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BUILDING RECORD AND SANITARY ENGINEER

VOLUME 56

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AUTHOR INDEX

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THE ENGINEERING RECORD,

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THE ENGINEERING RECORD

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Of this issue of THE ENGINEERING RECORD 16,000 copies are printed. Total circulation for 1907 to date 392,000 copies, an average of 14,519 copies per week.

TABLE OF LEADING ARTICLES.

New Views of the Cause of the Corrosion of Iron.

At the recent meeting of the American Society for Testing Materials, Dr. Allerton S. Cushman, of the United States Department of Agriculture, made the first public announcement of the very interesting investigations he has been carrying on for several years on the causes which underlie the corrosion of iron. A number of new points were brought out, among which the most startling are that oxygen plays only a secondary role in the rusting of iron and that the best preventatives of rust are to be found among the most effective oxidizing agents known, such as chromic acid and its salts. This view is so contrary to all previous conceptions that it is naturally received with some incredulity when first heard, yet those who are familiar with the investigations and conceptions upon which the new theory of corrosion is based are of the opinion that the evidence which has been brought forward is not only convincing but conclusive. Dr. Charles B. Dudley, whose conservatism in expressing opinions on theoretical subjects is well known, stated at the close of the presentation of Dr. Cushman's paper that he considered this work to be the most important contribution to a metallurgical problem that has been made in the last quarter century. The same opinion was expressed privately by others who are familiar with the work.

The fact that chromic acid and its salts act as inhibitors of rusting has been known for some time, but no explanation of the curious phenomenon has ever been offered heretofore nor has its application to practice ever been suggested. Dr. Cushman has made a special study of this problem, and although it remains to be seen what practical benefits may develop out of these new ideas, it is most gratifying to be able to state that if any patents are granted covering rust inhibitors they will be taken out in accordance with the practice of the Department of Agriculture, so that they will be free for all American citizens. The investigation was begun by Dr. Cushman as a part of his study of the corrosion of fence wire, in the interest of the farmer. A farmers' bulletin on this subject was published by the Department of Agriculture about two years ago. It is safe to say that the public benefit which is likely to follow these investigations is on a par with the important economical benefits which will probably be derived from the same author's researches on the decomposition of feldspathic rocks and their use as fertilizers. Both of these investigations, made in the interests of the people, demonstrate the great national benefit which is derived from the scientific research of our federal departments, conducted by specialists of the highest rank. It is to be hoped that Congress will not fail to appreciate the advisability if not the necessity for providing the funds to carry on work of this kind, the expenditure for which is so small in relation to the public benefit.

If a text-book is consulted for an explanation of the rusting of iron, it will be found that carbonic acid has heretofore been generally held responsible for the formation of rust. Iron is supposed to be attacked by carbonic acid, with the formation of carbonate, which is then acted on by water and the oxygen of the air to form the red hydroxide known as rust, the carbonic acid being again set free to take up its destructive work. According to this theory, in an atmosphere which did not, like that of this earth, contain about four one-hundredths of one per cent. of carbonic acid, the rusting of iron would be an unknown phenomenon. That this, as well as the peroxide hypothesis which has lately been developed in England, must be relegated to the dump pile of abandoned theories, seems to be conclusively shown by these latest researches.

According to the electro-chemical or electrolytic theory which Dr. Cushman upholds, the first attack on iron is not made by oxygen, even in the presence of water, but by hydrogen in the form of the hydrogen ion. According to the modern theory of solutions, many substances when dissolved in water are dissociated into ions, which may be regarded as atoms carrying static electrical charges. Water itself, even when pure, contains a certain proportion of hydrogen ions, and the presence of many impurities, especially those which are by nature acid, increases the hydrogen ions and thus the tendency to attack iron and carry on corrosion. The action is entirely electrolytic, being continually accompanied by an exchange of the electro-static relations between the iron and the attacking hydrogen. Such oxidizing agents as the chromate and bichromate of potash inhibit rusting by polarizing the iron to the condition of an oxygen electrode, thus preventing the approach or attack of the hydrogen ion. One of the most extraordinary points brought out is that this polarization effect is to some extent lasting. That is, to say, if iron is immersed or "pickled" in a concentrated solution of bichromate acid and is then washed and wiped, it is rendered passive, so that it resists electro-chemical attack whether this take the form of rust formation or the well-known plating out of copper which takes place if the chromated specimen is immersed in a dilute solution of copper sulphate. In short, the action which goes on when iron rusts is in every respect analagous to that which takes place when iron is immersed in a solution of a copper salt. In the later case, copper ions carrying positive electro-static charges are present, iron passes into solution and assumes the electro-static charge, while copper plates out and becomes visible. When iron rusts, iron passes into solution while hydrogen "plates out." Once in solution the oxygen of the air oxidizes the iron to the insoluble form of the red hydroxide known as rust. This electrolytic action can be shown taking place by the use of a special polar indicator which has been called "ferroxyl." It follows from this that anything that will inhibit electrolytic action will act the part of a rust preventative.

To what extent the various salts of chromic acid will come into use for the treatment of boiler feed waters and for "pickling" structural material will depend upon experiments carried out on a large scale. Dr. Cushman himself is emphatic in pointing out the necessity for care and conservativeness in approaching the practical application of these purely scientific investigations. One of the modern problems in boiler practice is the rapid corrosion of boiler tubes used in connection with turbine engines. The copper which is dissolved by the action of the setam jets impinging on the bronze blades of the turbine rapidly corrodes the iron in the boilers by the electrolytic action just described. Since

it has been found that the presence of bichromates in feed water will prevent this action, it seems as though the solution of this important problem has been discovered. The engineering world will eagerly await the detailed publication of Dr. Cushman's researches, as well as the results of the practical tests which are sure to follow.

Structural Lessons of the San Francisco Earthquake and Fire.

Although much has been already written regarding the conclusions to be drawn from the structural results of the San Francisco earthquake and fire, the excellent reports submitted to the United States Geological Survey regarding the subject of Prof Frank Soulé, Captain John Stephen Sewell, Corps of Engineers, U. S. A., and Mr. Richard L. Humphrey, structural expert of the Geological Survey, much of which was printed in The Engineering Record of June 15, are worthy of close consideration. These three engineers have made probably the most complete and thorough studies of the conditions resulting from the San Francisco catastrophe of all that have been reported. Furthermore they were completely unbiassed by any possible motives of self-interest, and their conclusions may therefore be regarded as based essentially upon the conditions as they found and interpreted them.

The first prominent conclusion to arrest the attention of the technical reader is the statement that the fireproofing in the city was, as a whole, defective, and, further, that it is practically impossible to construct any building which shall be entirely and absolutely fireproof in all respects. The latter dictum is not new nor unexpected, while the former statement finds so many exemplifications in every large city of this country that it was to be expected as a matter of course. Owners seem to fail completely to realize the imminent danger courted by cheap so-called fireproof methods. This feature of the old city is far too likely to be reproduced in the new, as it is constantly found in the majority of building operations in every large city. The authors of the reports mentioned recognize, however, that it is entirely feasible so to design buildings by a proper use of suitable materials as to make them so highly fire-resistant that they are to all practical purposes essentially fireproof.

A most important feature emphatically insisted upon by both Prof. Soulé and Captain Sewell is that the joints of columns with floors of all buildings shall be of the stiffest and strongest character. This is equally true of the steel-frame building and of the reinforced concrete structure. The former engineer speaks particularly of the steel-frame type of building whose adaptation to earthquake resistance as well as to fire resistance when properly protected with fireproofing material he comments upon in the most favorable terms. This also is what might be expected. The steel frame building, when properly designed, has in it all the elements of toughness and resistance to vibrations which could be desired, although such conflagrations as those of Baltimore and San Francisco have demonstrated in the most conclusive manner that the necessity of their being fireproofed is imperative. Captain Sewell states that "where reinforced concrete is used throughout, whether the building is very tall or not, great care should be taken with the design and execution of the connections between columns and members of the floor system. There should be heavy knee-braces for the connection of all girders and beams . . ." This, as The Engineering Record has frequently insisted upon editorially, is one of the most important features of concrete-steel design. It is interesting in this connection to observe that the building which will shortly become the future home of The Engineering Record is a reinforced concrete structure embodying among other advanced elements of design these essential features so strongly insisted upon by Captain Sewell. He lays down the fundamental proposition, although not in just these words, that the floors and columns of an earthquake-proof and fireproof reinforced concrete building should be actually continuous so as to secure the most rigid and unyielding structure attainable, and precisely these basic principles have governed the design of the building of the McGraw Realty Co., where the continuity of floors and columns has been secured throughout the entire structure by both the steel connections and the concrete. It is Captain Sewell's opinion that such a monolithic concrete-steel structure is secure against damage even by severe earthquakes, unless it should happen to lie across the actual slip. In fact, it is probable that unless such a slip were of considerable magnitude, the building would be but little damaged even under such circumstances.

It is not entirely clear why he should limit the extreme height of reinforced concrete buildings to 125 ft.; or again why he should state that the "bracing of a reinforced concrete building of any height" is a problem which "has not been solved as yet." It may be admitted at once that the great majority of buildings of this class do not show a satisfactory solution of that problem, but in such a reinforced concrete structure as the McGraw building it is quite reasonable to state that the problem has been completely solved throughout its height of nearly 150 ft. above the street. The type of columns employed in that building, involving every essential element of good design set forth by Captain Sewell, the steel portions of which are essentially continuous with the reinforcing steel of the floor girders and beams, attain most completely the element of rigid bracing which he so properly insists upon. As a matter of fact the general system used in the design of that building is capable of being adapted to any degree of rigid bracing and practically to any height to which it may be desirable to carry the structure.

One of the most essential lessons to be learned from the great conflagrations of the near past, which these experts insist upon with most commendable emphasis, is the imperative need of a greatly improved system of fireproofing, not only in the interior parts of the structure but especially for the exterior openings. It is well known, as they maintain, that many large buildings would have escaped an interior conflagration if the exterior openings had been properly guarded with suitable metal or metal-covered shutters or doors. Moreover, buildings of the steel frame or reinforced concrete type so fitted would frequently prove most effective fire stops, and an effective fire stop is practically the only real bar to the rapid extension of a great conflagration.

These three reports constitute the most valuable of the latest additions to the literature of earthquake-proof and fireproof building construction. They should be carefully studied by the building department of every large city and their recommendations should be heeded. The general principles which they set forth are sound and not the least of their services to modern building construction is the authoritative statement of the excellent part played by the few substantial reinforced concrete buildings exposed to the San Francisco fire.

It should be added, however, that fireproofing is largely a matter settled by the owner. Baltimore and San Francisco have shown the importance of good fireproofing, but owners too rarely are willing to pay for it.

Flood Prevention.

It is interesting to observe that last Spring's freshets and floods in a good many portions of the country have at last aroused communities exposed to injury from these occurrences to the advisability of taken measures to prevent them. It is not often that a single city is able to carry out a complete system of works for this purpose, and until co-operative measures can be arranged between several cities or under the direction of State commissions, it is useless to expect the best results. A good example of this is shown by the works constructed at Ithaca which were recently described in this journal; in order for them to be of maximum efficiency it is essential for various improvements to be undertaken by the State of New York in connection with its barge canal work. It is this interrelation of all parts of a waterway which produces such a complication in flood-prevention measures. Numerous communities have learned by bitter experience that works constructed for a short stretch of river may increase instead of diminish flood troubles, unless great care is taken to provide for carrying off the water below the improvement. Probably the unfortunate experience of many communities in constructing small and inadequate preventative works has been responsible for the general backward state of such undertakings in this country at the present time. Nevertheless the large flood loss which takes place almost every year has at last aroused public appreciation of the importance of the subject and has proved that it is sound business economy to spend a considerable sum of money in order to prevent such damages.

The methods to be followed in flood prevention are extremely varied, and anyone who will take the time to study the numerous works built in different parts of Europe will be impressed by the complexity of the problems and the necessity of regarding each one as an independent subject of investigation in order that not only the cause of the freshet but also its remedy may be ascertained. There is a prevalent opinion that forestry is a universal preventive of floods, but there are portions of Europe where works have been executed with successful results in which no reliance was placed on trees. Where a mountainous country has been stripped of its forests for some time and the rocky surface has been bared by rain, it is idle to expect more trees can be grown successfully. Other preventive measures must be taken in such districts, but national economy as well as the regulation of stream flow demand that forestry should be given a thorough trial where it stands any show of success. It is to be regretted that the bill for the establishment of forest reserves in the Appalachian and White Mountains, passed without dissent in the United States Senate at its last session, failed to pass the House, although it was unanimously recommended by the House Committee on Agriculture. This is one of the most important bills from the standpoint of flood prevention and forestry introduced for some years. The regions which it was proposed to set apart for forest reserves not only furnish the water supply for numerous communities and power plants but must also eventually supply valuable timber, and if they are not protected by federal legislation it is probable that their denudation and its attendant evils will continue. Fortunately the importance of this bill was thoroughly recognized by both branches of Congress and it is but reasonable to expect its passage at the next session, provided all who are interested in the subject, sufferers from floods, believers in the federal control of our important forests and users of water for power purposes and municipal supplies, take steps to urge their Congressmen to push for-

ward this bill as speedily as possible at the next session.

While the prevention of floods by protective measures on the watersheds from which the freshets come is a practicable measure for many districts, it is out of the question for places like Kansas City or New Orleans. The government has investigated the flood conditions at the former city and the probability of a recurrence of great damage there has been pointed out by a board of army engineers. These specialists have shown that just so long as the city encroaches on the natural waterway of the Kaw River, there will be danger of great damage. At New Orleans the situation is different. The city is guarded by a system of levees controlled by municipal officers, independently of the works executed elsewhere under the direction of the State Board of Engineers. These city levees were recently examined by order of the Governor of Louisiana and the engineers reported that out of thirteen miles of embankment on the left side of the river none is up to the State standard of 5 ft. above the flood mark of 1903. Moreover there are many places in this embankment which are declared to be unsafe and others that are unsatisfactory. On the other bank of the river the fourteen miles of municipal levees also present many features which are not what they should be. The results of the investigations seem to have aroused public appreciation of the dangers of the situation in New Orleans, and it is to be hoped that definite action will be taken before long to remedy the defects.

The Importance of Water Powers.

The Taylors Falls plant, which is described in this and the last issue of The Engineering Record, is a type of the hydraulic work of great economic importance now steadily under way. It is not at all sensational in capacity, voltage or distance of transmission, but it is a fine example of a well-planned and executed plant admirably constructed for economical and reliable service. Its most novel and interesting feature is the way in which the dam and power house are worked out together in massive concrete construction, giving a compact and convenient plant with the important feature of very short penstocks giving a most excellent opportunity for close regulation. The lesson it teaches is chiefly the economic one of the facility with which central stations can utilize water power anywhere within a radius of many miles to keep down the cost of electrical energy. At the present time electrical power transmission involves little of difficulty and is settling down to standard forms of practice. The voltage of 50,000 used in this Taylors Falls system would have been looked upon as rather hazardous even a few years ago. To-day it must be regarded as within the bounds of safe and conservative practice. In fact, one might almost say that 60,000 volts is now standard for large projects involving long transmissions, and 50,000 is certainly well within safe bounds.

The question of reliability which used so often to be raised with respect to long transmission has now been pretty thoroughly settled in the affirmative. It is true that lines sometimes break down, but with well-constructed duplicate circuits the chance of actual failure of service is not a frequent one. Against it must be set off the fact that the chance of failure of the motive power is considerably less with water than with steam. Something may now and then go wrong even with a hydraulic plant, but there are fewer chances for little things to cause a shut down than in a steam plant. It is a wise and far-sighted thing for a central station to develop hydraulic power for its own use and it nearly always pays from the start. Coal prices are upon the up grade and no return trains are running, so that what pays reasonably well now will be a splendid investment a few years hence. Plants like this at Taylors Falls are permanent. They are certain to give many years of valuable service, and there is little likelihood that the apparatus will go out of date for the purpose of its use. The distributing appliances may change and the receiving end of the plant go out of date, but there is small probability that the generating station will become materially less economical as time goes on. Dynamos and water wheels are unlikely to be materially improved in efficiency, and modern electrical machinery has a very long, useful life. As a matter of fact the first polyphase generators put into operation in this country some fourteen years ago are still in successful operation, and generators as built to-day are even more durable. It pays to do a thing a well, if at all, and plants built as thoroughly and planned as carefully as this one at Taylors Falls are likely to justify the wisdom of their constructor for many years to come. As time goes on more and more of the larger central stations are likely to do likewise. Few can find power so near at hand as in Minneapolis, but transmissions of a hundred miles or more are now as safe and practicable as those of twenty or thirty miles a few years ago, and are not to be feared.

THE PANAMA CANAL SITUATION seems to be unnecessarily troubling a number of people having access to the columns of daily papers. The latter have been manifestly misled lately concerning the management of affairs under the new commission and the feeling of its leading subordinates. It has even been stated that the chairman of the commission was dissatisfied and wished to be relieved from his duties. While The Engineering Record has no knowledge of the opinions of Lieutenant-General Goethals concerning his work, it is in a position to state positively that there is no such marked dissatisfaction with conditions among the technical employees of the commission as recent published reports would indicate. Wherever many thousand men are engaged on an undertaking which necessarily compels them to go without some of the comforts to which they have been accustomed elsewhere, a certain amount of grumbling and a few cases of positive discontent must be expected. Fortunately most discontented people went home before the present commissioners assumed office, and those who are now there are thoroughly alive to the importance of their work and to the credit that all will receive in due measure from participation in the undertaking. It is true that there was some apprehension in the engineering staff when military engineers were placed in control of the commission, but this disappeared as soon as the men had an opportunity of becoming acquainted with their new leaders. There will always be differences of opinion between those engaged on the work, which may lead in some cases to resignations, but there has never been a time when the force of canal builders felt more satisfied with their conditions than at present. Where work can be pushed it is going ahead energetically; where investigation is necessary in order to avoid mistakes, it is being made; and where the data for plans are complete, the designs are being pushed. There is no ground for any other statements.

THE NEW YORK RAPID TRANSIT RAILROAD COMMISSION has passed out of existence but it has left behind it a record of good work very well done. In the face of all kinds of opposition and in spite of the apathy of the public for some years it blazed the way for improved transportation facilities in Greater New York. It built one great subway line, it partly built others, and it left plans by which the transportation needs of the city can be met for a good many years to come. It went about its work with great shrewdness. The technical features of designing its proposed works were entrusted to an engineer, Mr. William Barclay Parsons, who had been engaged in studies of the city's transportation needs for some years before the organization of the commission. When the blight of politics settled on its work, the latter was quietly stopped until a time arrived when it could be carried on with a decent regard for the interests of the taxpayers. Instead of asking what terms would be acceptable to possible bidders the commission prepared its own requirements and at last succeeded in making a contract with responsible people, which was a good one in view of the novelty of the undertaking. The first subway was a thing untried; it was essential to make no false step at any stage of its history, and so the Commission necessarily moved slowly, and only after a full deliberation of the probable result of each proposed act. And on account of this deliberation and the self-sacrificing public spirit of the members of the Commission, there have been no mistakes to check the progress of rapid transit and the city is to-day in full possession of detailed information concerning every feature of the subject. The Engineering Record considers the abolition of the Board a great mistake, provided its members could be persuaded to continue in office, but it must be admitted that the transit work now pressing for early execution is so extensive and varied that it would probably unduly tax men of such large affairs as the commissioners who have retired.

THE PUBLIC SERVICE COMMISSIONS which will exercise supervision of the railway and lighting companies in the State of New York are made up of men of high standing. Some of them have taken an active interest in party politics, but none are "politicians." Most of them are lawyers, but business, manufacturing and engineering are also represented. Whether these men are capable of team work cannot be foretold; if they are not then the famous plan of controlling public utilities devised by Governor Hughes will come a tremendous cropper, for the commissions replaced by the two new ones did fair work. The new commissions undertake their duties with a great handicap, from the fact that the same kind of control in different parts of the State is vested in two independent bodies, each with powers of making rules and regulations to govern the companies under its jurisdiction. If the New York Central & Hudson River Railroad Co. has to obey one set of regulations until it comes down to the New York City line, and then must obey a different set of regulations, is there any likelihood that this complication cannot be utilized by the company to nullify effectively any regulations it does not like? While the apointment of two commissions with equal powers, one for the city and the other for the State outside the city, may have been a good political move to secure the adoption of the general principle of centralized State control of public utilities, it seems a pretty severe tax on human nature to expect the two commissions to agree, even on the most important features of their work. It is therefore reasonable to expect that before long the two bodies will be consolidated, and the work of the consolidated commission will be arranged so that everywhere in the State the supervision of public utilities contemplated by the spirit of the legislation will be uniform and effective. Such supervision is desirable, both technically and as respects rates, but The Engineering Record has no expectation that it can be exercised successfully by two independent bodies.

THE POWER PLANT OF THE NORFOLK & PORTSMOUTH TRACTION CO.

The new electrical generating station of the Norfolk & Portsmouth Traction Co., at Norfolk, Va., with a capacity of 10,500 kw., made up of a 1,500-kw. and three 3,000-kw., turbo-generator units, is thoroughly modern in all the details of its design. This station will furnish power to operate the street railways in Norfolk and Portsmouth and a number of electric railways running from those cities to resorts along the shore of the Atlantic Ocean and arms of the latter; the traffic between the Jamestown Exposition grounds and Norfolk will also be handled entirely by electric lines supplied with power from this station. The latter will also furnish power for electric lighting in Norfolk and the adjacent cities and for the brilliant electrical display at the Jamestown Exposition. The station occupies a rather prominent site in Norfolk on the bank of the Elizabeth River, a broad tidal stream connecting with Hampton Roads and the ocean. The station building exterior is designed in keeping with the surroundings, and although no attempt at elaborate architectural treatment has been made, the style of the architecture is expressive of the purpose for which the building is intended. The footings and substructure of the building are of concrete built on piles driven into the sandy soil of the site. The walls are of red brick and are surmounted by a concrete roof supported by steel trusses carried by columns in them. The building is 148 ft by 154 ft. 3 in. in plan, a brick wall dividing it into a boiler room 87 ft. 5 in. wide, and a turbine room 66 ft. 10 in. wide, both of which extend the full length of the building.

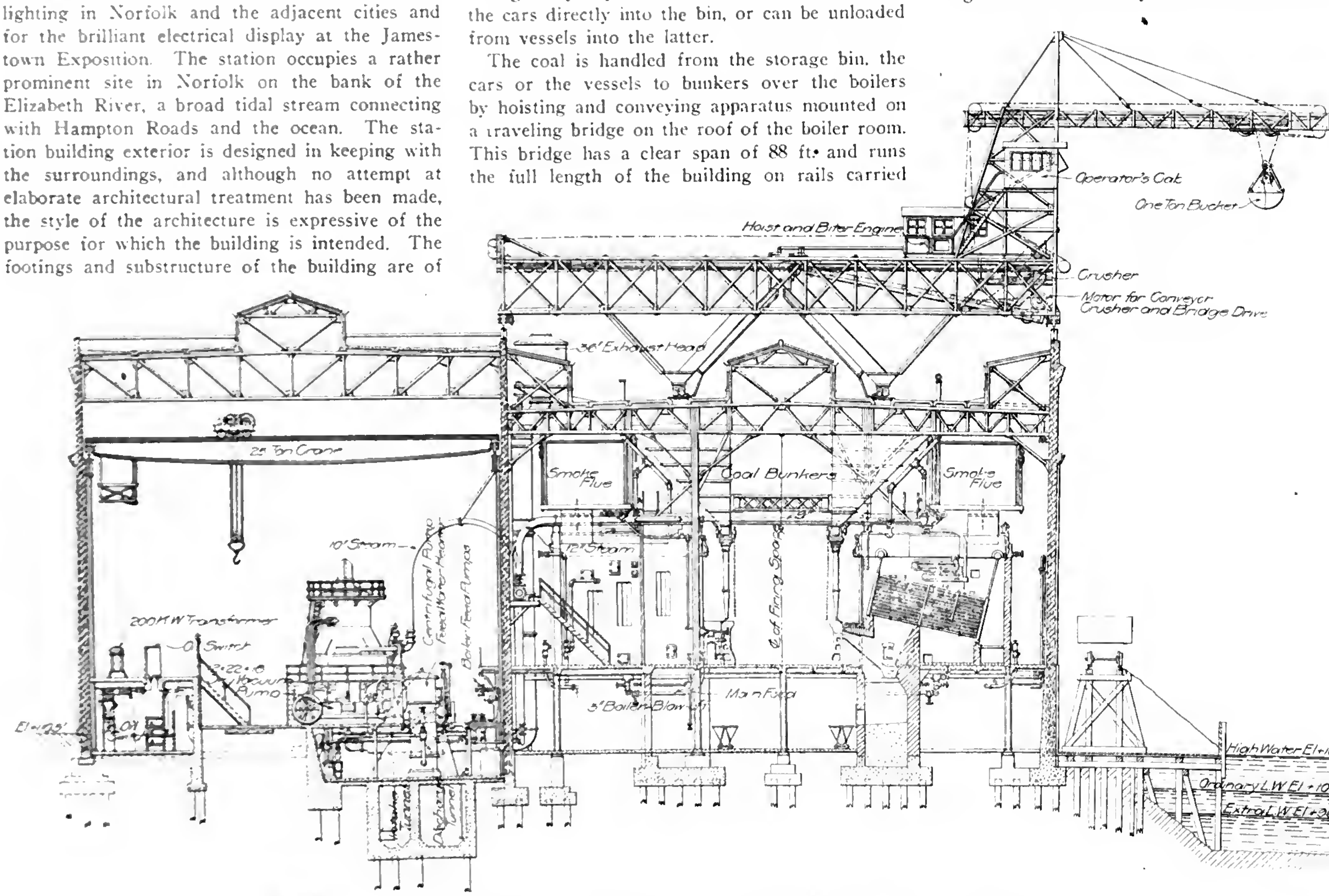
The boiler room is along the river side of the building and contains fourteen 500-h.-p. Babcock & Wilcox double drum water tube boilers. These boilers are set in batteries of two each, the batteries being in two rows, with six boilers in one row and eight in the second. The two rows face on a firing floor having a clear width of 15 ft. at the level of the boiler room floor, the fronts of the boilers in the two rows being 27 ft. apart. The space over the firing room floor is open and is surmounted by a monitor in the roof having side windows and skylights; a monitor with side windows and skylights also extends the length of the building along both sides of the roof over the boiler room. This arrangement of monitors produces good light and secures ventilation for all parts of the boiler room.

The coal supply for the boilers can be delivered in cars on a switch track on a trestle along the river side of the building, or by vessels in the river. An open storage bin, 26 ft. wide and with its outer side 5.5 ft. high, is built on piles directly under the trestle. This bin is against the side of the building, extending the full length of that side and along one end of the latter. The floor of the bin is at the extreme high-water level in the river, while the base of rail on the trestle is 14 ft. above that level so the bin has a large storage capacity. The coal is dumped from the cars directly into the bin, or can be unloaded from vessels into the latter.

The coal is handled from the storage bin, the cars or the vessels to bunkers over the boilers by hoisting and conveying apparatus mounted on a traveling bridge on the roof of the boiler room. This bridge has a clear span of 88 ft. and runs the full length of the building on rails carried by steel girders supported on columns in the building walls. The bridge carries a cantilever crane, an electrically-driven hoisting engine, an operator's cab and an electrically-driven coal crusher in a tower at the end next to the river. A traveling carriage is mounted on the crane, which extends out 42 ft. from the side of the building. The coal can be elevated from the cars on the trestle, from the storage bin, or from vessels moored along the dock on which the bin stands by a 1-ton clam-shell bucket swung by a hoisting cable from the traveling carriage.

The clam-shell bucket dumps into a hopper at the inner end of the crane. A chute leads from this hopper to the coal crusher immediately under it, the crusher discharging on a belt conveyor inclined upward toward the top of the traveling bridge and extending to the middle of the latter; the crusher may be by-passed and coal discharged from the hopper directly to the conveyor. Gates are arranged at the end of the conveyor so the latter will discharge at the middle of the bridge into either or both of two inclined chutes leading down to openings in the roof of the boiler room. These chutes are each fitted at the lower end with an undercut gate controlled from the operator's cab. Coal is supplied by these chutes to two rows of bunkers over the fronts of the boilers, each boiler having a separate bunker with a capacity of 95 tons. An opening in the roof, normally covered with a tight hatch, is provided over each of the bunkers, which are fed through these openings by the chutes on the traveling bridge. The bunkers are carried by steel columns in the fronts of the boiler settings and by the roof trusses. A vertical chute controlled at the top by a gate operated from the firing room floor feeds coal from each bunker to the charging hopper of the stoker immediately under it.

The ashes from each stoker are discharged into a tight chamber directly under the front of the boiler setting. A chute also leads into this chamber from back of the furnace bridge which is provided for conducting into the ash chamber the soot and fine ashes that collect back of the bridge. Two 24-in. gauge tracks are laid the length of the floor of the basement under the firing floor in the boiler room, one track in front of the ash chambers under each row of the boilers. The ashes are drawn out of these chambers through doors directly into 1-yd. dump cars running on these tracks. These cars are pushed out of the building by hand to low ground around the station on which the ashes will be dumped for filling.



Cross-Section of Norfolk Power Plant of the Norfolk & Portsmouth Traction Co.

The setting and arrangement of the boilers do not involve any unusual features. The boilers are designed to operate at 195 lb. pressure and are each equipped with superheaters capable of raising the temperature of the steam to 150° Fahr. above the temperature of saturated steam. Two brick stacks, 12.5 ft. in diameter and 200 ft. high above the boiler room floor, are built on separate

concrete footings at one end of the building, each stack serving one row of boilers. A smoke flue built of riveted steel plates extends through the entire length of the boiler room from each of the stacks and is swung over the rear of the boiler settings from the steel roof trusses. Each boiler is connected to one of the flues by a short vertical breeching.

Two pairs of 18x12x24-in. Atlantic type upright Dean Bros. feed-water pumps and two Alberger feed-water heaters, with 2,500 sq. ft. of heating surface each, are installed in the turbine room, one pair of pumps and one heater forming a set. The four main units in the turbine room are all operated condensing. A separate hot well is provided to receive the discharge from the condenser of each unit, an 8x12x12-in. Alberger vertical pump being installed at each of these wells to deliver the condensed steam to the feed-water heaters; these pumps may also discharge into the tunnel under the turbine room basement. Make-up water is supplied to the heaters from a connection with the city mains, and a second connection with those mains is provided so the heaters may be supplied entirely with cold water, if necessary. The steam-consuming units of the auxiliary equipment in the station discharge their exhaust steam into the feed-water heaters.

The boiler-feed pumps can draw either from the feed-water heaters, from a condenser discharge tunnel under the engine room, or from the city mains. Each pair of pumps supplies a separate system of feed-water piping for the boilers, the two systems being interconnected so any pump can supply either row of boilers. A 4-in. main feed-water header, hung from the ceiling of the basement under the boilerroom is provided for each row of boilers. These headers are supplied through a connection from both sets of pumps, each boiler having a connection with the header under its row. An auxiliary header is extended over each row of boilers, these two headers being interconnected and supplied independently from the feed pumps.

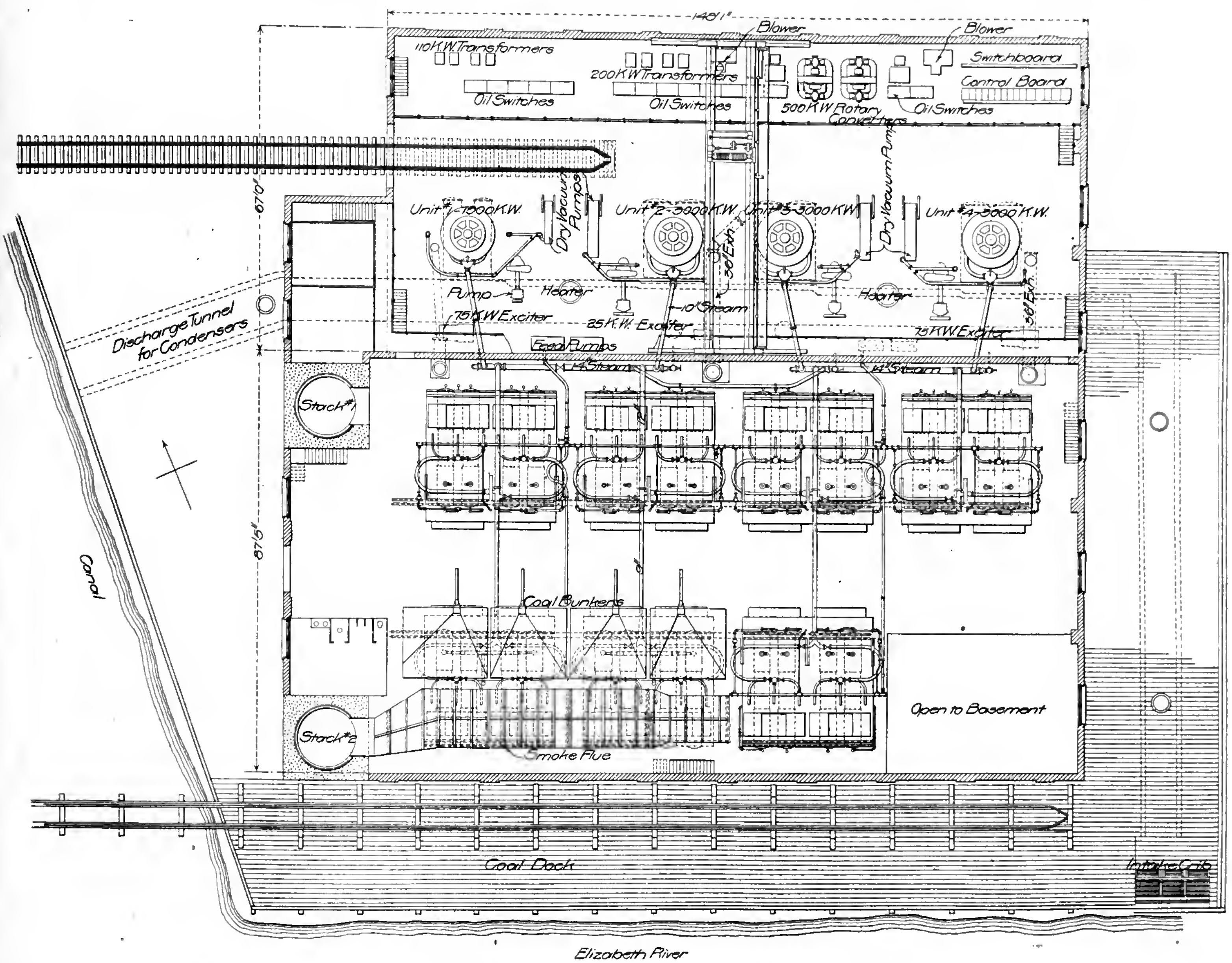
A 14-in. steam header in two sections is supported on the wall between the engine room and boiler room, the two sections being connected by an 8-in. loop. Two 12-in. branches are extended from each section of the steam header to connections with the first row of boilers and are then continued as 9-in. lines to the second row of boilers. The two drums of each boiler have a 6-in. connection with one of these branches, the connections each having a check and stop valve and an angle valve at the boiler, and a gate valve at the header.

Two of the main units in the turbine room are supplied from each of the two sections of the header, the latter having a valve at the middle by which either half of it may be operated independently. A line is extended into the turbine room basement from both ends of each section of the header to supply the auxiliaries in the turbine room, all of which are steam driven.

Extra heavy hydraulically-operated Crane gate valves are used on the steam headers and on the main connections from them. These valves are arranged to be operated from the basement of the boiler room. Water under pressure for operating the valves is obtained from connections to the supply lines leading from the feed-water pumps to the boilers, auxiliary connections also being provided. These connections are each controlled by a four-way cock, the controlling cocks being brought together in two groups on the wall of the boiler-room basement so the operator may close all of the valves on one section of the steam header and on the branches of the latter leading to the main units in the turbine room, without moving from the group of controlling valves. All the fittings and valve bodies on the main live steam connections are of cast-steel.

The four main units in the turbine room are in a single row, the 1,500-kw. unit being at the front end of the station. Between this unit and the first 3,000-kw. unit are the condenser equipments for these two units, one feed-water heater and a pair of feed pumps. The third and fourth units are arranged in a similar pair with their auxiliaries between them. The plans for the station contemplate that the building will be extended from the end which the fourth unit occupies.

The four main units have three-phase, 60-cycle, 11,000-volt, 10-pole alternating-current General Electric generators, which are each direct-connected to a Curtis turbine, and are operated at 720 r.p.m. The steam supply to these turbines is automatically controlled by an oil-operated governor in each case. The turbines all have base-condensers of the Alberger type, those on the 3,000-kw. units having 12,000 sq. ft. of



Plan of Norfolk Power Plant of the Norfolk & Portsmouth Traction Co.

surface, and the one on the 1,500 kw. unit having 6,000 sq. ft. of surface. Cooling water for these condensers is obtained from a large tunnel which connects with the river and extends the length of the building under the floor of turbine room basement. Three 20-in. Alberger volute centrifugal pumps, each direct-connected to a steam engine, are placed on the turbine room floor, one close to each of the large units, which deliver water from the intake tunnel to the condensers. A 10-in. Alberger volute centrifugal pump performs the same service for the condenser of the 1,500-kw. unit. After the circulating water has passed through the condensers it is discharged into a second tunnel, which parallels the intake tunnel and is also connected with the river, the two tunnel connections being at nearly diagonally opposite corners of the station site.

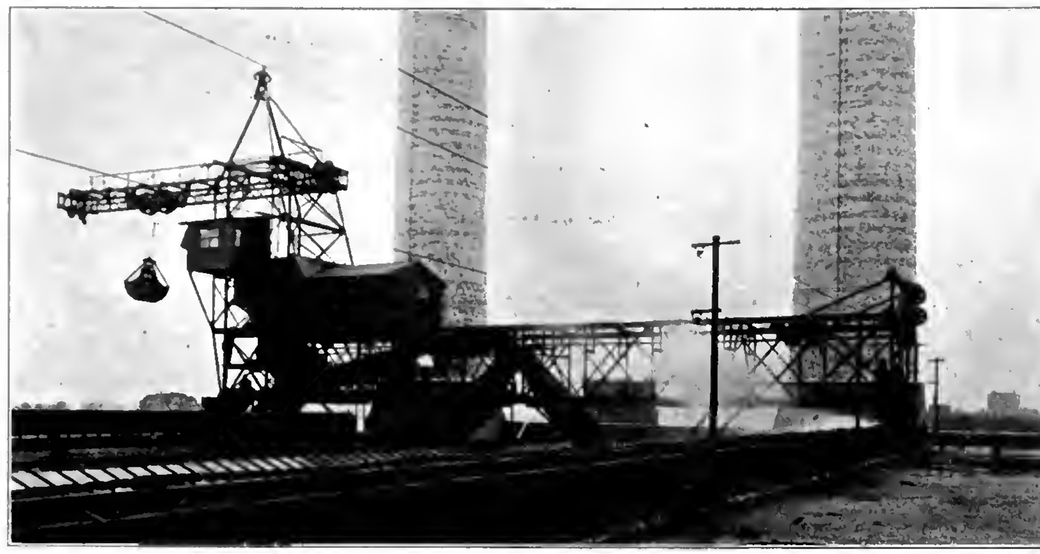
A 12x22x18-in. Alberger dry vacuum pump is used in connection with the condenser of each of the large units and an 8x20x12-in. Alberger dry vacuum pump serves the condenser of the 1,500-kw. unit. These pumps are on the floor of the turbine room, close to their respective units. Each condenser has an exhaust to the atmosphere through a riser extending above the roof of the boiler room. Each free exhaust outlet is fitted with a bronze mounted Davis turbine relief-valve, a 24-in. size for the 3,000-kw. and an 18-in. size for the 1,500-kw. unit.

The oil for the lubrication of the turbines and for the governors is supplied by four 9x5¼x3⅛x10-in. duplex, center-packed plunger Blake pumps of the differential type, one pair of these pumps supplying two turbines. These pumps take suction from a pipe supplied from the storage chamber of an oil filter in the basement, to which the oil from the bearings of the turbines is returned by gravity. The connections between the pumps and the bearings is arranged so either pump of a set may supply either turbine in each pair.

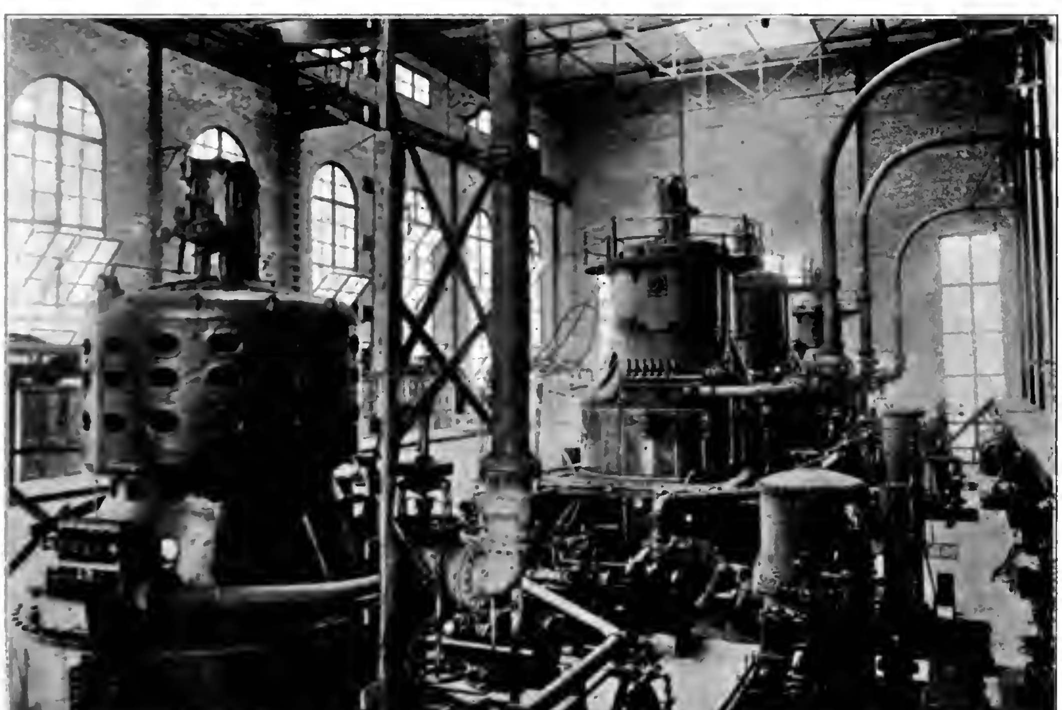
A 25-kw. and two 75-kw., 4 pole, 125-volt direct-current General Electric generators furnish excitation for the main generators. These exciters are each direct-connected to a horizontal Curtis steam turbine and operate at 2,400 r.p.m.

A part of the output of the alternating-current generators is transformed by two 500-kw. General Electric rotary converters in the engine room to direct current at 550 volts and is transmitted at that voltage for use on the street railway lines in the immediate vicinity. A large part of the remainder of the output is transmitted at 11,000 volts to sub-stations where it is transformed by rotary converters to direct current at 600 volts. The balance is stepped down to 2,300 volts alternating current and is used to supply lighting circuits.

The transformers, converters, control board, switchboard and so forth, are mounted on a concrete platform, 17 ft. 8 in. wide, which extends the length of the engine room, 8 ft. above the level of the floor of that room. The three cable leads from each main generator are carried under the engine floor in conduits to current transformers under the platform and then to motor-operated automatic 11,000-volt General Electric oil switches mounted on the platform. These switches are connected through disconnecting switches to three-phase buses in a brick compartment under the space enclosed by the platform and the wall in front of the latter. Each bus is in a separate section in this brick compartment. The buses are sectionalized at the middle by a 11,000-volt motor-operated oil switch, two generators being on each section. Three 11,000-volt feeder lines lead out of the station from each section of the bus-bars. Leads also extend from one section of the buses through disconnecting and oil switches to the primaries of two 550-kw., three-phase General Electric air-blast transformers mounted on the platform. The 11,000-volt current is stepped down to 420 volts by these transformers which deliver it to the rotary converters. The current used for lighting is stepped down to 2,300 volts by three 200-kw. and three 100-kw. single-phase delta-connected transformers, motor-operated oil switches and disconnecting switches being provided between the 11,000-volt buses and the transformers, and solenoid-operated oil switches and disconnecting switches between the transformers and the 2,300-volt buses.



Traveling Bridge of the Coal Handling Apparatus.



Interior of Turbine Room.

The oil switches, rheostats, field switches and the governors of the main generators and the switches for the 11,000-volt lines are operated by remote control switches on a switchbaord having 110 volts at the latter. This board has a panel for each generator, a tie panel for the 11,000-volt buses, a panel for each of the rotary converters, two transformer panels and six outgoing line panels.

The regulation of the auxiliary equipment, the direct-current side of the rotary transformers and 600-volt feeders, the local power and lighting circuits and so forth is controlled from a second switchboard. This board has two panels for Tirrill voltage regulators, a panel for each of three exciter units, a station lighting panel, four panels for 600-volt, direct-current feeder lines, two panels for the positive of the direct-current side of three rotary converters, a 600-volt panel for power supply around the station and three 2,300-volt feeder panels.

A switch track is extended into the engine room for a car length to expedite the delivery of heavy machinery. A 25-ton Niles-Bement-Pond traveling crane operated by three electric motors spans the turbine room and serves all parts of the latter, permitting of ready removal and installation of apparatus.

The station was designed and built under the direction of Sargent & Lundy, consulting mechanical and electrical engineers of Chicago. Messrs. J. B. McAfee, C. O. Emmons and E. C. Hathaway form an engineering committee in charge of the design and construction of the station for the Norfolk & Portsmouth Traction Co. The electrical equipment of the turbine room was furnished and installed by the General Electric Co.

AN EXHAUST STEAM TURBINE of the Rateau type at the Zollverein mine in the Essen coal district of Germany was found to require from 18.6 to 14.3 kg. of steam per kilowatt-hour when developing from 433 to 1,112 kw. The steam was supplied at 1.004 to 1.155 atmospheres absolute and the vacuum was 93.46 to 88.29 per cent. at the limits mentioned.

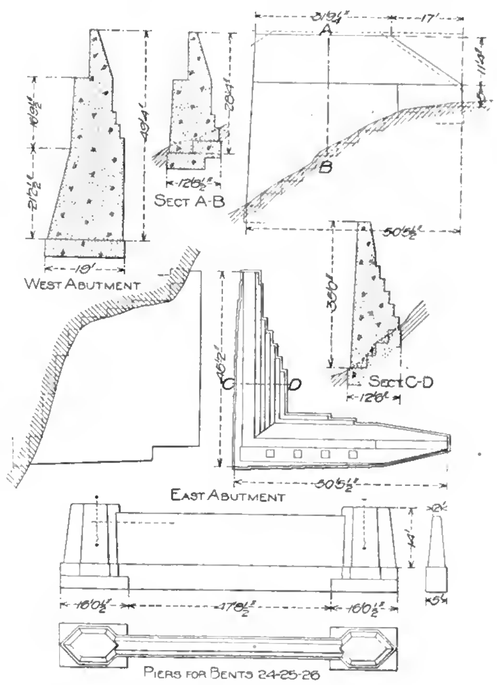
The Moodna Creek Viaduct, Erie R. R.

The Erie & Jersey R. R. now under construction is a 39-mile branch of the Erie system running from Highland Mills, N. Y., to Guymard, N. Y., and crossing the Moodna Creek valley on a tangent at a 2 per cent grade, on a steel viaduct 3,200 ft. long and 181.47 ft. above high water made of alternating 40 and 80-ft. plate girder spans supported by 40-ft. steel towers 120 ft. apart on centers. The substructure and towers are designed for a double-track superstructure but only enough girders for the single track will be erected at first, provision being made for the erection of the girders for the second track and for the reinforcement of the towers to carry the additional load at any future time without seriously increasing proportionate expense.

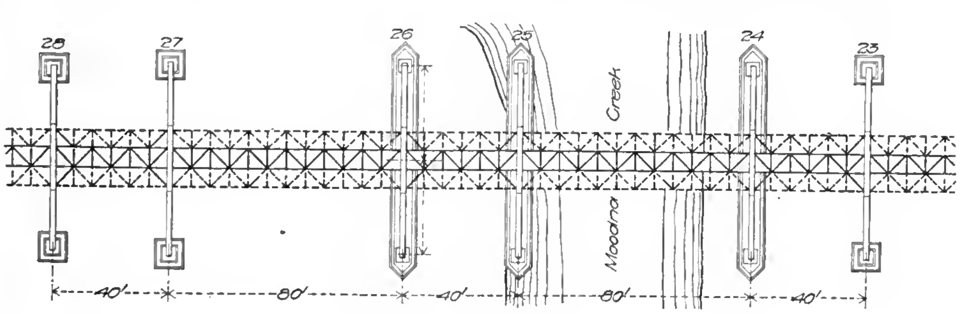
Careful estimates were made of the comparative cost of placing the reinforcement in the tower columns, now, and of deferring it until some future time, which showed that, calculating interest at 5 per cent., an economy will be effected if the reinforcement is deferred eight years or more.

The substructure is entirely of concrete without reinforcement and comprises two abutments, three intermediate piers and 98 separate pedestals for the tower columns. The footings were carried down from 5 to 10 ft. below the surface of the hard clay soil and were proportioned to load it to a maximum intensity of 5,000 to 6,000 lb. per square foot. At the west end the abutment 50 ft. high above the original surface of the ground is of the "pulpit" type without wings, and is 19 ft. wide at the base and 37 ft. long perpendicular to the bridge axis. The upper part is carried up 12 ft. above the bridge seat to form a back wall retaining the fill and the front and rear faces are battered and offset as indicated in the cross-section.

width of 11 to 12 ft. At the ends of the viaduct where the tower weights are a minimum the sides of the tops of the piers are reduced to 4½ ft. Where the distance from the base of the column to the surface of the ground is 5 ft. or less the height of the pedestal above the footing is 5 ft. In all other cases it is 8 ft. Each pier is provided with two vertical anchor bolts 2 in. in diameter and 10 or 12 ft. long, embedded in the masonry and projecting about 20 in. above its top. A shallow U-shaped bend is made in the bolt 2 ft. above the bottom, to prevent it from turning in the masonry and each end is provided with a nut and 6 in. of thread. The concrete was made 1:2½:5 with Atlas Portland cement



Details of Substructure.



Part Plan of Viaduct.

At the east end of the viaduct the surface of the ground slopes both longitudinally and transversely, and the abutment is L-shaped in plan with one long wing wall. The footings for both the wing wall and the face are built in offset horizontal courses on solid rock.

At the deepest part of the valley, where the viaduct crosses the Moodna Creek, three of the tower bents are located in or near the bed of the creek, and in order to protect their foundations from flood and drift and ice, the special hexagonal pedestals under both columns of each bent have sharp cut-waters up and down stream and are connected by a solid vertical wall 2 ft. thick at the top and 12 ft. with a base 5 ft. wide extending down to the bottom of the footings and made integral with them so as to form a long and solid pier approximately parallel to the creek, developing great longitudinal strength and preventing any driftwood or debris from lodging between the pedestals.

In all of the other tower bents each column has a separate and independent pyramidal pedestal 5 ft. square on top with battered sides, seated on two or three offset courses extended to a

and all exposed edges of piers, bridge seats and wing walls were rounded to a 3-in. radius.

The superstructure of the viaduct consists of twenty-seven 80-ft. spans and twenty-six 40-ft. spans supported on 52 transverse trestle bents, longitudinally braced together in pairs to make 26 towers, 40 ft. long, 19½ ft. wide at the top on centers, with the columns battered 1½ in. per ft. to a maximum width of about 65 ft. at the foot of the tallest towers. The towers are from about 35 to 180 ft. high and are divided into one to five stories with X-braced panels. Both columns of each bent are riveted at the top between the webs of a transverse box plate girder 10 ft. deep, with its top flange flush with the top flanges of the longitudinal girders. The upper panel has a uniform depth of 42 ft. in all bents except the single story ones, and the intermediate panels have a uniform depth of 30 ft. on centers, while the heights of the lower panels vary from 20 to 45 ft., according to the irregularities of the surface.

The columns have a 23½x26¼-in. open rectangular cross-section, made of two built-up channels having their webs parallel to the axis of the viaduct and their flanges turned inward and latticed. Wide rectangular plates riveted across the flanges of the columns project beyond the inner faces and form jaw plates receiving the field-riveted connections of the transverse struts and diagonal members. Each web has from end to end a double row of open rivet holes provided for the future connection of an I-shaped diaphragm perpendicular to them which will be made with 22x⅜-in. flange angles, and two 7x⅝-in. flange cover plates, field-riveted in the interior of the columns when it is decided to reinforce them in order to withstand the extra stresses from the added track. The cross-section of the column varies in the different stories, as indicated on the general elevation.

In the high bents the transverse width at the bottom is so great that the temperature movements make it necessary to provide a roller bearing, similar to that of an ordinary bridge truss, for the foot of one column, the opposite column being seated on a fixed pedestal. The horizontal transverse struts are built channels having their webs horizontal and their flanges turned inward and latticed. The X-braces are pairs of angles latticed together, one member being continuous in each panel and the other cut to clear it at their intersection and spliced and connected to it with two field-riveted flange cover plates. The longitudinal face of each tower is X-braced in panels corresponding with those of the transverse face but has no horizontal strut except one at the foot. The X-braces are uniform throughout, each consisting of two 12-in. channels with vertical webs and latticed flanges. One of them in each panel is continuous and the other is cut to clear and spliced across the intersection with web plates. The struts are field-riveted at the ends to pairs of vertical web-connection plates shop riveted to the columns.

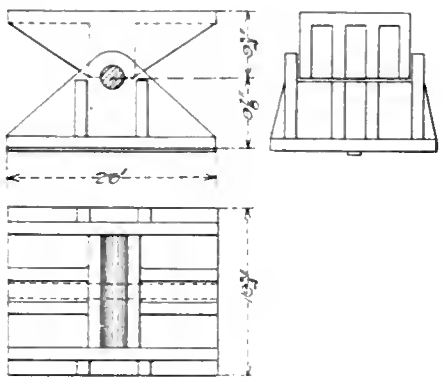
The single-track viaduct, as first erected, has two lines of longitudinal girders each 3 ft. 3 in. from the axis of the viaduct. Provision is made for adding two more duplicate lines of girders, each 6½ ft. beyond the original line, when it is decided to double-track the viaduct. The 40-ft. girders, about 5½ ft. deep over all, are all fixed at both ends where they are field-riveted to the transverse girders at the tops of the towers. The 80-ft. girders, 9 ft. deep, are similarly connected to the tower girders at the fixed ends. Expansion bearings are provided for the 80-ft. girders on both abutments and at one of every second span, making a series of portals at intervals of 240 ft. where they have sliding seats on planed bed plates. The transverse tower girders have deep web pockets to receive the sliding ends at the expansion points.

The upper ends of the top sections of the columns have very deep and wide flange cover plates, projecting a considerable distance from the inner face of the column, which in reality form the end sections of the webs of the transverse girders and are field-riveted to outside cover splices shop-riveted to the latter. This arrangement greatly simplifies the construction and facilitates the erection, allowing the location of all field-driven rivets in accessible positions. The center sections of the transverse girders are 13 ft. long and are shop-riveted complete to the webs and are connected by the top flange cover plates and by vertical longitudinal diaphragms in the planes of the longitudinal girders. The fixed and expansion end middle sections weigh 9,100 lb. and 13,800 lb. respectively, and are found to be easily handled and assembled in the field. The diaphragms are provided with manholes to make the interior of the header girders accessible for painters and inspectors after erection. The fixed ends of the longitudinal girders are field riveted to the webs of the transverse girders with 42 rivets each, driven from the outside with pneumatic hammers, sufficient space

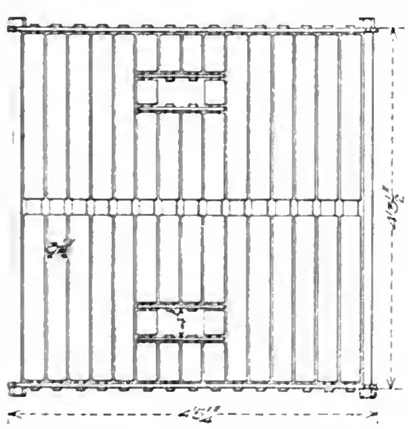
being provided betwen the webs to hold up against the heads of the rivets. The top flanges of adjacent longitudinal girders are connected across the transverse girders by cover plates field-riveted to all three girders except where they are bolted through slotted holes to the expansion ends of the sliding girders.

The longitudinal girders are braced together with transverse angle frames, top lateral struts and zig-zag angles, thus making horizontal wind trusses 6½ ft. deep on centers and 40 and 80 ft. long. In order to transmit the horizontal shear at the ends of the span to the tops of the tower columns without producing a bending moment in the transverse girders, the end transverse struts are spaced about 4½ ft. beyond the transverse girders and the lateral angles terminating there connect with horizontal knee-braced struts running directly to the column tops. These struts will be removed when the viaduct is double-tracked and an additional set of lateral bracing is put in on each side of the two center girders, as indicated by dotted lines on the plan diagram.

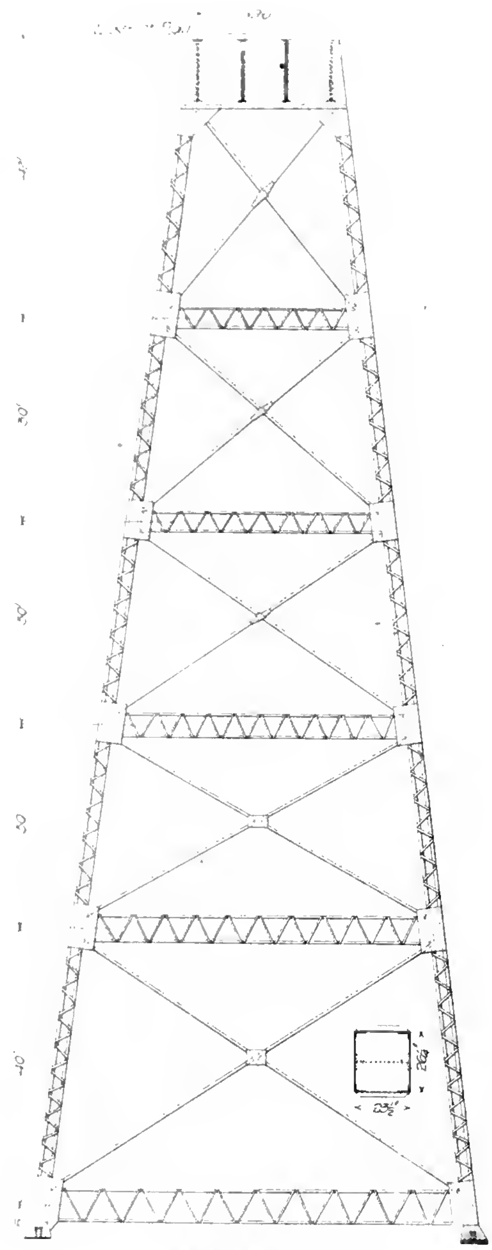
Cross ties 10 in. deep and 16 in. apart on centers are laid on the top flanges of the stringers, to which every fourth one is hook bolted at both ends. Every fourth tie is 10 ft. long with a projection beyond one side of the track to carry a 5-ft. sidewalk with 2x9-in. longitudinal plank 16 ft. long. The ends of the long ties carry a wooden lattice girder hand-rail 4 ft. deep with a 5x5-in. vertical posts 8 ft. apart securely bolted to the ends of the ties. The intermediate ties



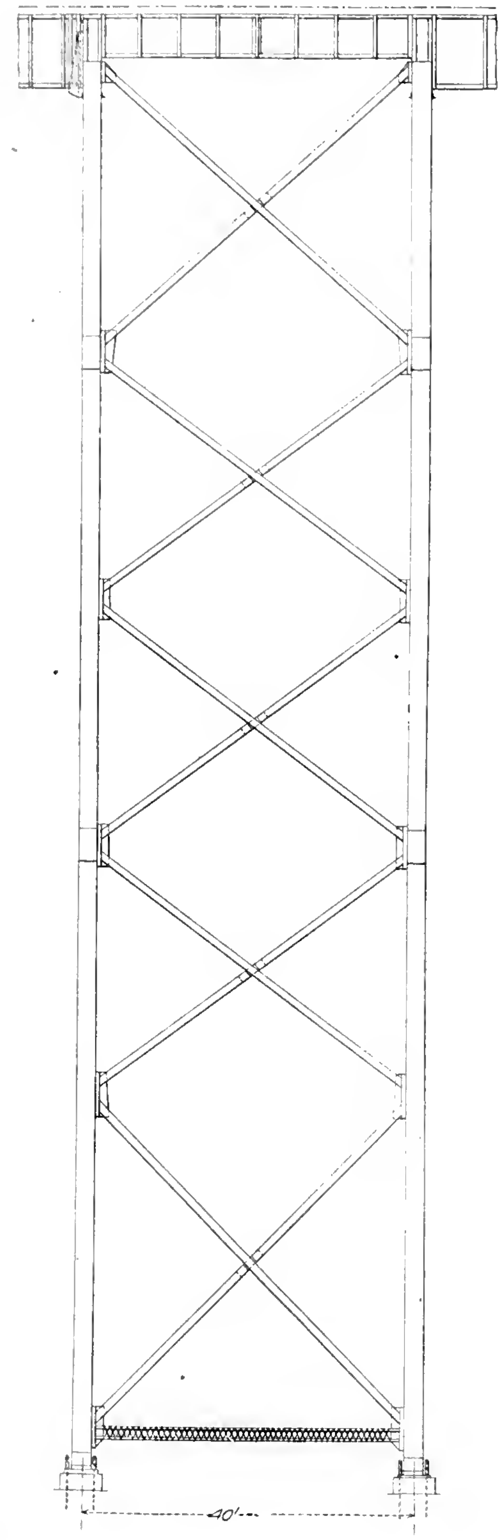
Abutment Expansion Bearing.



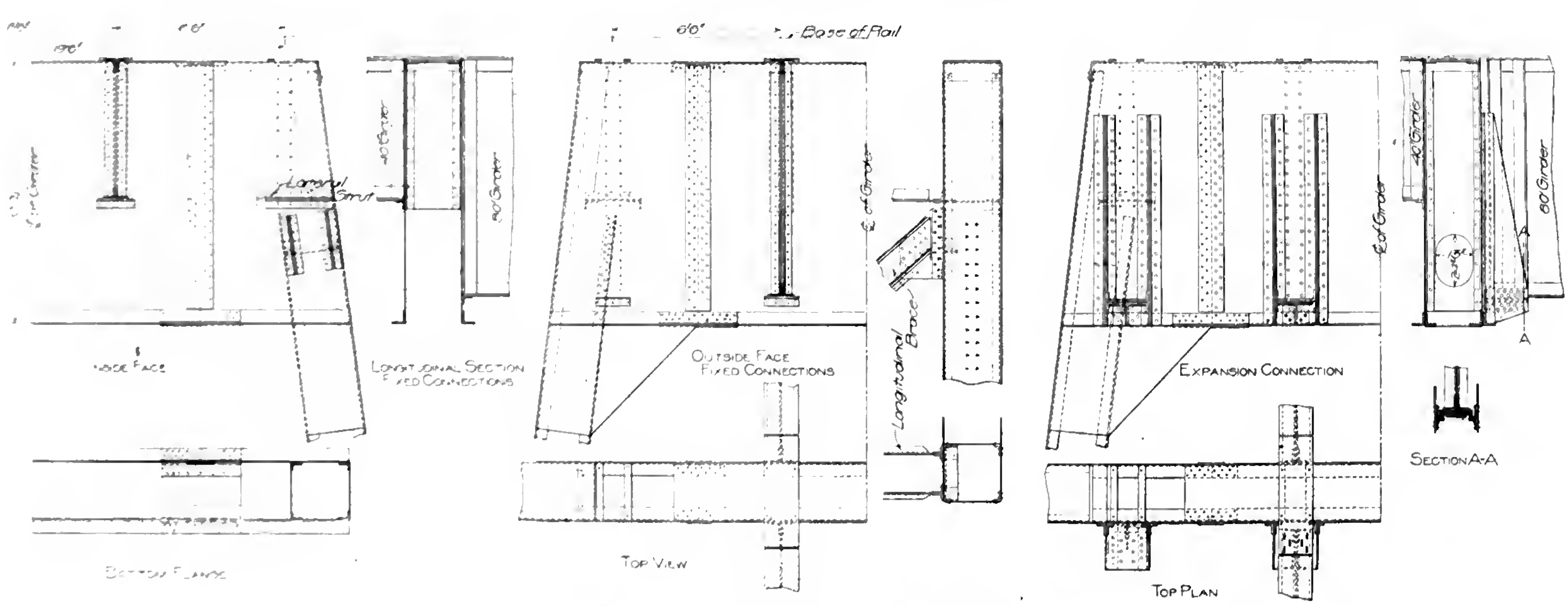
Rollers under Column.



Transverse Elevation.



Longitudinal Elevation.



Connections of Longitudinal and Transverse Girders.

are 10 ft. long and every other one is bolted to the 5x8-in. guard timbers. All high viaducts on the Erie Railroad have wooden hand rails as the appearance of their heavy lines is considered better than that of a lighter construction. An effort is always amde to accentuate the columns and the top line of the structure and to simplify the bracing, so that the main supporting elements may not be confused by a network of insignificant members.

The tower girders are 38 ft. 10½ in. long over all and their webs are two ⅜-in. plates 108 in. deep, shop-spliced with four rows of rivets in a pair of cover plates. The flanges are made of a pair of 6x6x⅝-in. angles and three 16½-in. cover plates, one of them full length. Pairs of 5x3½x⅜-in. angles with fillers divide the girders into 6½-ft. panels.

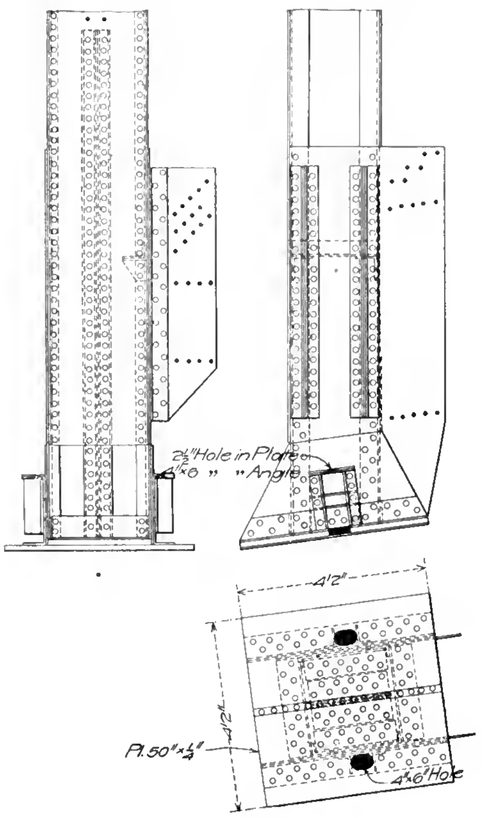
The transverse girders have 120x⅜-in. single-piece web plates 26¼ in. apart in the clear with 6x6x⅝-in. bottom flange angles. The 6x4x⅝-in. top flange angles have their horizontal flanges turned inward to clear the longitudinal girders and are shop-riveted to the 27x⅜-in. cover plates. At the ends of the fixed longitudinal girders the webs are connected by diaphragms 62½ in. deep in the planes of the longitudinal girder webs. At the expansion connections the diaphragms are extended to the full depth of the girder between flange angles, to reinforce thoroughly the pocket connections and are provided at the bottom with 18x24-in. manholes to give access to the center part for inspection, painting and riveting. The expansion bearing pockets are made of a pair of 20x⅝-in. vertical longitudinal plates 8 ft. long shop-riveted to the webs and having at the bottom an 18¾x20½-in. reinforced horizontal shelf plate with a planed upper surface to receive the lower flange of the longitudinal girder.

The feet of the tower columns have 4 ft. 2 in. x 3 ft. 9 in. base plates stiffened by vertical transverse flange plates and heavy connection angles, and provided with two 4x6-in. slotted holes just clear of the column faces. These holes receive the 2-in. anchor bolts that pass through pockets made by vertical distributing angles on the faces of the columns and through 2¼-in. holes in horizontal shelf angles fitted to the tops of the vertical angles and affording bearings for their nuts. The fixed column base plates are seated directly on the carefully dressed masonry, but the bases of the expansion columns are seated on nests of fifteen 3⅛-in. rollers 50 in. long with shoulder bearings in ordinary guide frames and center slots for guide ribs on the bottoms of the base plates and on the tops of the 50x50x1¼-in. bed plates. Four rollers in the center of each nest are made in three lengths each, with 4-in. spaces between the ends of adjacent sections of the same rollers to provide slots clearing the anchor bolts. The expansion ends of longitudinal girders have sliding bearings on all towers, but at the abutments they are provided with Standard cast-iron shoes and pedestals and the latter are seated on nests of eight 3⅜-in. rollers 22 in. long.

The superstructure contains about 4,042 tons of steel for the single track and 1,750 tons additional are required to transform it to a double-track structure.

In the present construction of the viaduct the two lines of longitudinal girders are spaced close together for a single track and are connected to the transverse or header girders near the centers of the latter. After the future double-tracking of the structure, the addition of the two outer lines of girders will very much increase the width of the roadway platform and extend it to the tops of the tower columns, thus directly transmitting to them the various horizontal stresses at track level. Meantime, in order to provide for the longitudinal traction stresses, the first panel point of each long span is braced with a heavy transverse cross strut and from its ends diagonal struts are run to the tops of the towers, as indicated in the general plan, thus directly connecting the main girders with the columns and providing for the transmission of the stresses through the tower bracing to the ground.

The Erie Railroad construction department is under Mr. J. M. Graham, vice-president, and Mr. Francis Lee Stuart, chief engineer, under whose direction the viaduct, including the foundations, was designed by Mr. Mason R. Strong, engineer of bridges and buildings, with the assistance of Mr. F. A. Howard, assistant engineer of bridges and buildings. The erection is being done by the bridge and building department under the charge of Mr. W. H. Wilkinson, inspector of bridges. The steelwork was fabricated by the McClintic-Marshall Construction Co.



Foot of Column.

Bituminous Preparations for protecting structural steel were strongly recommended by Mr. Bertram Blount at the British Engineering Conference last month. Natural bitumen is permanent but costly; coal tar boiled so that the coating shall be neither brittle nor sticky, is almost as durable and is cheap enough. Its use is limited by aesthetic considerations, but as these are chiefly based on convention, Mr. Blount believes that the engineer who insists on finishing a bridge with tar may be regarded as a poineer in the art of embellishment. Until that time bituminous materials can be freely used for all structures not too conspicuous. Where the work is exposed to boiler-gases, such as overhead bridges and station roofs, complete coating with a good layer of hot bitumen, he believes to have so much practical advantage over paint that no question of appearance should be permitted consideration. Whether paint or tar is used, the metal should be thoroughly cleaned from scale and rust immediately before the coating is applied. For structural steelwork, such as the frames of buildings or frame foundations, there is no preservative so good as lime or cement concrete, Mr. Blount said. It is essential that the concrete hould be dense and rich in cement, and that the cement or lime should be unexceptionable. Steel protected in this way need not first be cleaned from scale and rust.

Standard Test for Fireproof Floor Construction.

Reported by the Committee on Fireproofing Materials of the American Society for Testing Materials.

The test structure may be located at any place convenient to the applicant, where all the necessary facilities for properly conducting the test are provided. The test structure may be constructed of walls of any material not less than 12 in. thick, properly buttressed on all sides. The floor construction to be tested shall form the roof of the test structure. At a height of not less than 2 ft. 6 in., nor more than 3 ft. above the ground level, a metal grate, properly supported, shall be provided, covering the whole inside area of the building. In the walls below this grate level, draught openings shall be provided, as many as possible, furnishing openings with an aggregate area of not less than 1 sq. ft. for every 10 sq. ft. of grate surface. Means for temporarily closing these openings should be provided. In the wall, immediately above the grate level, a firing door, 3 ft. 6 in. by 5 ft. high, must be provided in the side of the building at right angles to the floor beams. A second door must be added when the span of the floor slab under test exceeds 10 ft.

Flues should be supplied at each of the corners, and oftener in case of a test structure exceeding 250 sq. ft. of grate surface, with sufficient opening to insure a proper draught, securely supported and disposed at the sides of the structure in such manner as not to rest on the floor under test. In no case should a flue area be less than 180 sq. in.

The horizontal dimensions of the test structure will depend upon the number and the span of the systems under consideration. The clear span of the floor beams is to be 14 ft. The distance between floor beams, or span of slab, may be varied according to the design of the system to be tested, and should be as near as possible to usual practice. The underside of the construction under test must be not less than 9 ft. 6 in. nor more than 10 ft. above the grate level.

The construction to be tested should be designed for a working load of 150 lb. per square foot, and no more. This load to be uniformly distributed without arching effect, and to be carried on the floor during the fire test. The floor may be tested as soon after construction as desired, but within forty days. Artificial drying will be allowed if desired. The floor is to be subjected to the continuous heat of a wood fire, averaging not less than 1,700° F. for four hours.

The heat obtained shall be measured by means of standard pyrometers, under the direction of an experienced person. The type of pyrometer is immaterial so long as its accuracy is secured by proper standardization. The heat should be measured at not less than two points when the main floor span is not more than 10 ft., and one additional point when it exceeds 10 ft. Temperature readings at each point are to be taken every three minutes. The heat determination shall be made at points directly beneath the floor so as to secure a fair average.

At the end of the heat test a stream of water shall be directed against the underside of the floor, discharged through a 1⅛-in. nozzle, under 60 lb. nozzle pressure, for ten minutes.

After the floor has sufficiently cooled the load on the same shall be increased to 600 lb. per square foot, uniformly distributed.

The test shall not be regarded as successful unless the following conditions are met: No fire or smoke shall pass through the floor during the fire test; the floor must safely sustain the loads prescribed; the permanent deflection must not exceed one-eighth inch for each foot of span in either slab or beam.

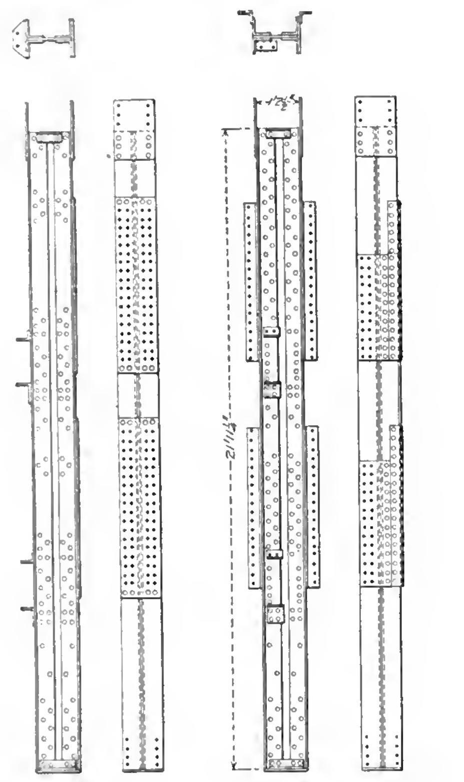
The Berger Building, Pittsburg.

The 60x90-ft., 15-story Berger Building at the corner of 14th Ave. and Grant St., Pittsburg, Pa., is an example of extremely simple and regular construction of a steel cage office building of moderate height. The plan is a parallelogram with the ends skewed 11⅛ inches on the long side. This difference is all concentrated in the end panels of the floor, so that the 12 intermediate panels are rectangular, and the six in the center of the building are all 15 ft. wide and 10 ft. long, the others varying from 15 ft. to 20 ft. 1½ in. From the basement to the fifteenth floor inclusive the beam framing is the same in each story, and is of the simplest possible description, consisting of single longitudinal and transverse I-beams on the center lines of the columns except for the wall girders which are riveted on the outer faces of the columns, and having no intermediate beams or girders whatever except in the two intermediate panels containing the elevator and stair-well. The main beam, therefore, supports the Johnson system floor arches, made with 6-in. blocks and a maximum span of 15 ft., and are proportioned for a dead load estimated at 65 lb. per square foot, and for a live load of 100 lb., on all but the roof, which is proportioned for dead and live loads of 65 lb. and 60 lb. per square foot respectively. The I-beams vary from 7 in. 15 lb. to 15 in. 60 lb., and in all cases are connected to the column with simple top and bottom horizontal flange angles.

The columns are made in two-story lengths, except in the upper section, which are three stories long. All wall columns are spliced 5½ ft. and all interior columns 11¾ in. above finished floor level. The first story is 16 ft. high and those above it are uniformly 11 ft., except the fifteenth story which is 16½ ft from the floor line to the highest point of the roof. This gives the roof a total height of 175 ft. above the first floor or 200 ft. above the sub-basement floor. All columns have an I-shaped cross-section made with two pairs of flange angles and a web plate. The lightest column section is made with four 5x3½x5/16-in. angles and a 14x5/16-in. web plate about 36½ ft. long and extends through the thirteenth, fourteenth and fifteenth stories and supports the main roof. The heaviest column section is proportioned for a static load of 554,000 lb. plus wind stress, and is made with four 6x6x¾-in. angles, one 14x¾-in. web plate and four 14x½-in. cover plates and is 30 ft. 9 in. long extending from the sub-basement floor to above the first floor. All of the other columns have a uniform length of 22 ft. and a cross-section varying between the limits already mentioned, but terminating in the basement and sub-basement stories with a uniform dimension of 12-in. flange and 14-in. web made with either 4x6 or 6x6-in. flange angles.

All columns have simple cast-iron pedestals 21 in. high seated on solid rock, except adjacent to the next building, where in order to bring them close to the party line the pedestals are seated on grillages of 10-in. I-beams 5 or 6 ft. long, which distribute the pressure longitudinally. The wall columns are enclosed in interior pilasters made by extensions of the brickwork. On the two street fronts two 10-in., 15-lb. fascia channels to support the metal cornice are carried about 2 ft and 3½ ft. beyond the centers of the wall columns by cantilever girders each of which consist of a pair of 10-in., 15-lb. channels back to back with a solid web gusset plate riveted between their inner ends to give connection to the face of the column.

The exterior walls are carried at every story by plate girders made with a 20¾-in. web plate and four 3½x3½-in. flange angles, both webs and angles varying slightly in thickness to correspond with the different surfaces. The lower outside flange angle is made full length, the other three flange angles of each girder are cut to clear the columns and the web plates are field riveted across the column flanges except in four cases where the corner columns have connection angles to receive the girders at right angles to their flanges. In all cases below the thirteenth floor the girder web is made in three sections with the short end pieces projecting from two to four feet above or below the top or bottom flanges of the girder to form gusset-plate knee-braces in the corners of the panels made between the columns and girders. The inclined edges of the knee brace plates are stiffened with pairs of 3x3-in. angles below the tenth floor in two sides of the building and below the third floor in the third side. Those of the fourth side on the 4th Ave. front not being stiffened at all. On the party side of the building the knee braces are placed on the under sides of the girders in the sub-basement, basement and first story. Otherwise they are throughout as above described. Exposed braces are carried across the court at the eighth and thirteenth floors and roof.



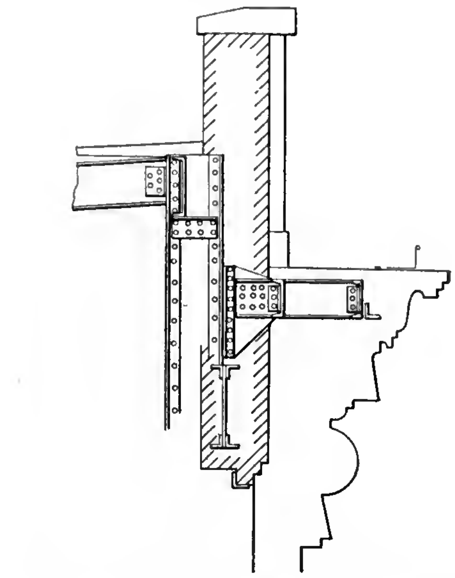
Column with Wind Bracing Connections.

The building contains about 950 tons of structural steel which was fabricated at the Ambridge plant of the American Bridge Co. Mr. S. S. Beman was the architect, and Mr. N. Ronneberg was the structural engineer.

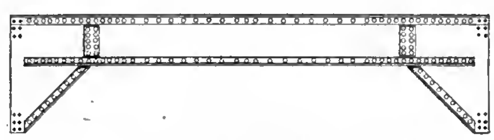
BITULITHIC PAVEMENTS may be laid in Iowa cities under a decision recently made by the Supreme Court of that State in Saunders v. Iowa City et al., 111 N. W. Rep., 529. The court rules that the bitulithic monopoly cannot be considered odious in the eye of the law. The field for the use of paving materials and methods is limited, the court considered, and if cities may not avail themselves of new discoveries in this line, little encouragement will be given to invention, and we must depend upon the cobblestones of our forefathers. If the material for a pavement selected in a legal way is wholly or partly patented, there cannot be absolutely free competition, and where that is impossible, the court decided, the Legislature never intended that improvements should cease or antiquated methods only be adopted.

Sampling Coal for Government Buildings.

The methods adopted by the Treasury Department in purchasing coal for use in federal buildings were described in the Engineering Record April 6 and formed the general subject of three papers read at the recent convention of the American Society for Testing Materials, as reported in the Current News Supplement of this journal on June 29. An important lesson of the experience gained to date in purchasing coal on the thermal unit and ash basis is the necessity of taking great care in sampling coal, so as to obtain a fair average. This was particularly shown in the paper presented to the convention by Messrs. J. A. Holmes and D. T. Randall, of the U. S. Geological Survey, based on three years' experience in comparing samples obtained in the mine and from cars. Two methods of



Support of Cornice and Parapet, Berger Building.



Wind Brace, Berger Building.

sampling have been tried. In one the sample is taken and impurities discarded in accordance with instructions to miners for separating foreign matter from the coal. This method, when checked by samples taken from coal shipped in cars under ordinary working conditions, shows that mine samples are usually considerably better than the actual delivery, due to the failure of the miner to fully carry out instructions. This difference may be indicated by comparison of the ash content of the coal in the two cases. The average results show for run-of-mine coal 30 per cent. more ash in the coal delivered than in the mine sample. The other method of mine sampling follows as nearly as possible the actual methods which the miners follow, regardless of what their instructions may be. By this method samples may be secured by an experienced inspector which correspond very closely with the car deliveries, but considerable time is required for observing the work of the miners in different parts of the mine, and the judgment of the inspector is depended upon to secure the result.

In both methods the following precautions are taken by the inspector to secure a correct sample. A vertical cut is made over the face of the coal and the cuttings are caught upon a waterproof blanket which is spread upon the floor of the mine. Impurities are rejected, in accordance either with the instructions or with the usual miners' practice, and after being crushed to ½-in

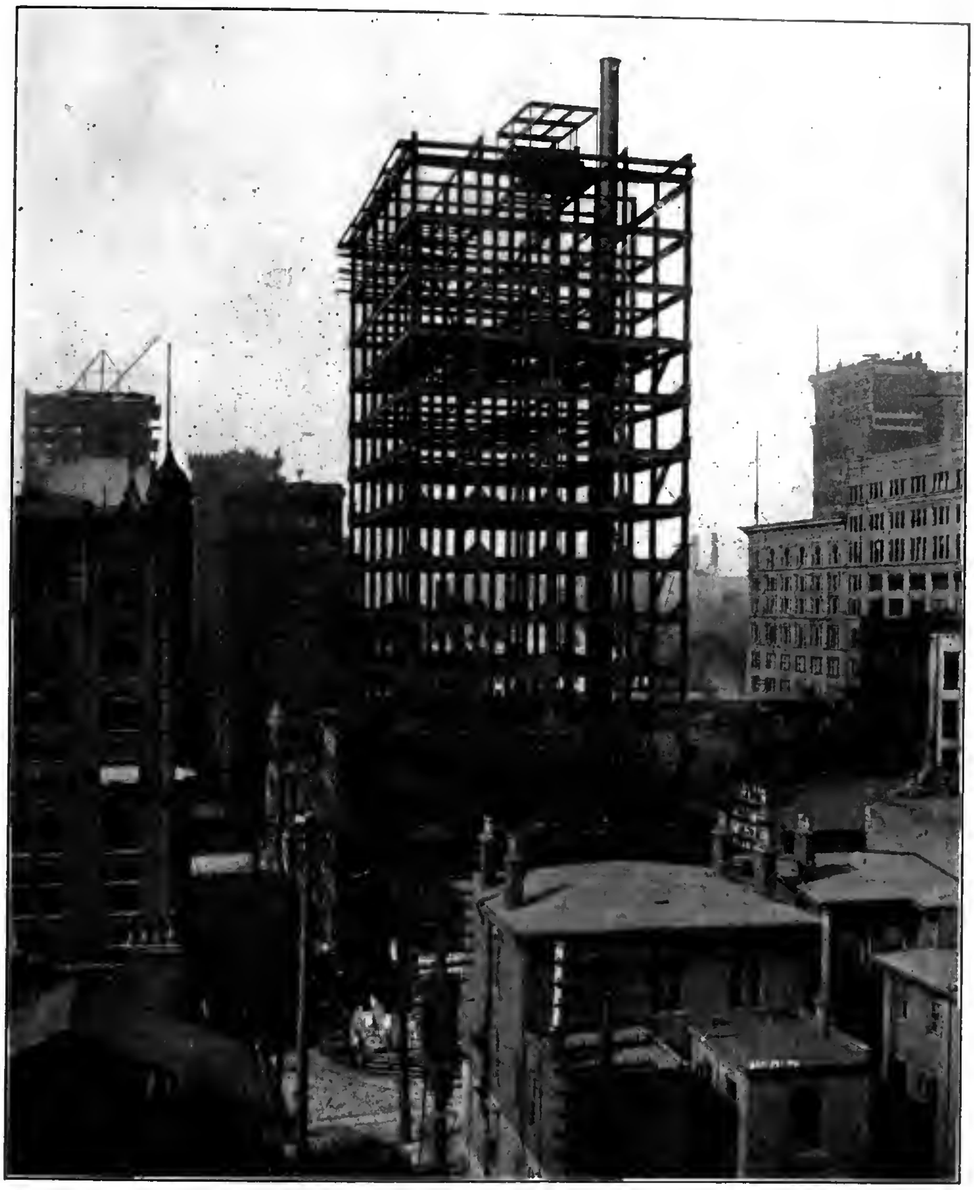
pieces or smaller, the coal is thoroughly mixed. It is then quartered down and the resulting sample is placed in a metal can holding about one quart and sealed air tight. All of this work is done in the mine where the sample is taken and as rapidly as possible to avoid loss of moisture. A full description of these methods and results may be found in the Geological Survey Bulletin No. 290.

Samples as usually furnished from mines are not to be depended upon as representing the coal which will be delivered. This difference is mainly due to failure of the miners to obey instructions regarding the rejection of impurities, to differences in the quality of the coal in different parts of the mine, and to the fact that different beds of coal are often mined at the same time and the output mixed. Lack of cars in mining and in preparation of coal for the market explains in a great measure the variation in the amount of ash in the coal delivered from the same mine at different times. In sections of the country where coal is washed variation in the quality may be considerable, due to the carelessness of the attendant in charge of the washery. The tendency with persons inexperienced in sampling is to select a sample much better than the average product. In many cases samples are taken by selecting a nice looking lump, breaking it down and shipping it in a cloth sack, thus allowing the moisture to evaporate. Such a sample, of course, represents the best coal in the mine and (unintentionally, in most cases) establishes a much higher value than can be commercially delivered.

The mine sample, if properly taken, does, however, establish the general character of the coal and indicates what may be expected under favorable circumstances.

During the past winter samples of coal from several of the Government buildings in Washington were secured by members of the Fuel-Testing Division of the Geological Survey and the analyses were made by the Chemical Laboratory conducted by this division under direction of Prof. N. W. Lord, of Ohio University. Samples were usually taken from the coal as it was being unloaded from the cars or from wagons. In the case of car deliveries it has been found that it is necessary to take small quantities from many parts of the car as it is being unloaded, in order to obtain a fair sample, for the reasons that the coal is often brought to the car from different parts of the mine, and in transit the heavier portions of the coal tend to settle to the bottom. The analysis of samples from the top and bottom of cars often show very considerable differences in the percentages of ash. In case coal is delivered to the buildings in wagons and stored in bins, it is preferred to obtain the sample by taking a small quantity from each load or at regular intervals as the wagons are being dumped into the bins. In cases of small deliveries of anthracite coal it has been found satisfactory to take samples from a number of points over the surface of the coal when it has been impossible to channel through the bin, which is preferred when practicable.

These samples vary from 100 to 500 lb., according to the amount of coal delivered. The coal is collected on shovels in such a manner as to represent the delivery as closely as possible, and is placed in closed cans, each holding about 60 lb., which are locked when filled. These samples are then sent to the laboratory crushing room in the Geological Survey Building and crushed in a small rotary crusher to ⅛-in. pieces or smaller. The crushed coal is automatically divided into quarters by passing through a special sampling tube designed by the chemical division. The resulting sample is further reduced by quartering until a quart sample is secured. Precaution is taken throughout the work to prevent loss of moisture.



Complete Steel Framework, Berger Building.

Waste Heat Boilers for Copper Smelting Furnaces.

An interesting smoke flue boiler installation has recently been made at the smelting plant of the Colusa-Parrot Mining & Smelting Co., at Butte, Mont., for the utilization of waste heat from the copper smelting furnaces. The installation follows in general lines the practice that has been customary in steel mills for the utilization of heat from reverberatory and similar furnaces, but in plants where chemical processes are involved, the difficulties attending the use of the smoke flue boilers have prevented its more general adoption. While in furnaces for heating metals for forging and working, the waste gases of combustion carry little soot and dust, where chemical processes like smelting and ore roasting are involved, such large amounts of dust and friable matter are carried over from the ore that considerable difficulty is usually experienced in the operation of the boiler, owing to the rapid accumulation of this flue dust on the boiler tubes, with consequent reduction of their heat-absorbing capacity. Especially in the case of copper smelting furnaces is this difficulty encountered, so that only boilers whose heating surfaces may be quickly and effectively cleaned while in operation, are adaptable, and those of the water-tube type with inclined tubes have been found in practice to be the more desirable. Moreover, this dust and friable matter carries a considerable quantity of metal, so that its recovery by deposition in any manner is both desirable and profitable.

There are three matte furnaces at the Colusa-Parrot smelters, each having chimney flues 32 x 45 in. in cross section, which were formerly connected directly into tall stacks. The furnaces are all of the reverberatory type, with 5x10-ft. grates, and are fired with coal, the waste gases formerly passing to the stacks at temperatures ranging from 1,500° to 2,000°. In the application of the waste-heat boilers to the furnaces, it was the desire so to arrange the flue gas connections that a by-pass might be secured for use in case it might be necessary to take the boilers out of service, and accordingly provisions were made for the boilers at the front corners of the furnace settings, on the opposite sides from the by-passes. The matte furnaces are located 51 ft. apart between centers, which allowed fully 24 ft. between the settings; at the front and above these spaces at one end substantial platforms 17 x 24 ft. in size were erected upon which the boilers are supported. The platforms are elevated about 7 ft. above the main floor level in order to bring the heating surfaces of the boilers at a convenient level above the flue gas connections. The platforms consist of four latticed posts under the corners of the boilers, upon which are carried 12-in. I-beams transversely, that support six 10-in. I-beams, 24 ft. in length, three under either side of each boiler. The platform is extended about 3½ ft. on all sides of the boiler and is fitted with a railing to form a working gallery.

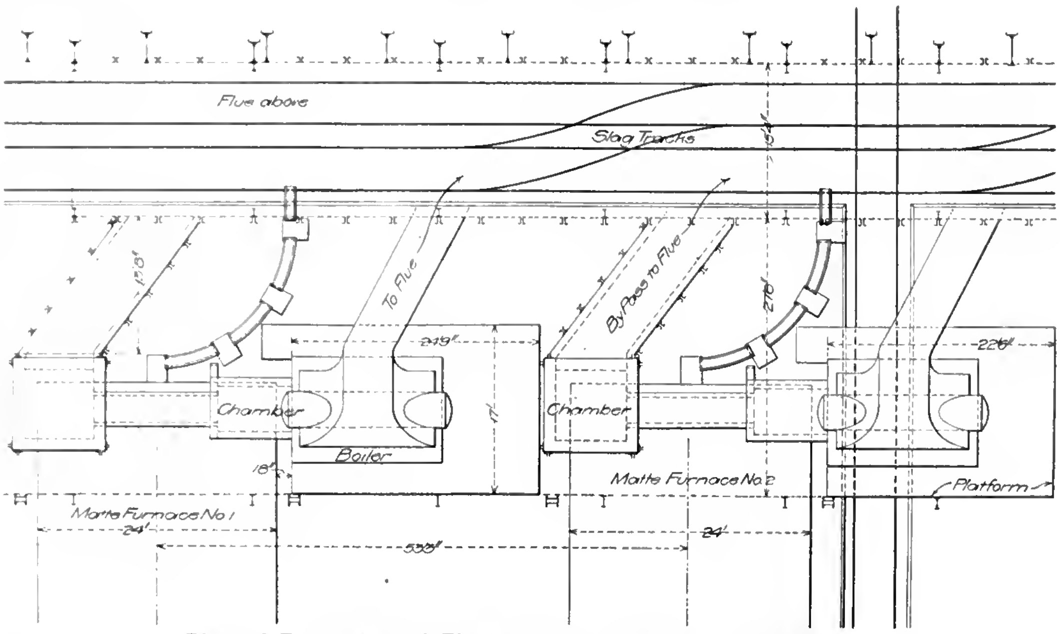
The details of arrangement of the flue connection to the boiler are shown in the accompanying drawing. From the furnace a flue outlet, 32 x 45

in. in section, is carried up directly to the combustion chamber of the boiler, directly above this is located the boiler. The course of the waste gases is from the furnace through the flue to the combustion chamber under the boiler and thence upward through the heating surface of the boiler and discharging through a special breeching which extends to a flue leading to a settling chamber and stack. The settling chamber is a brick duct, about 50 ft. wide x 19 ft. high inside and several hundred feet in length. The chimney is a circular brick stack, 352½ ft. in height, which is substantially built on a heavy slag foundation, the reinforcement of the latter being of steel rods and bars, around which the slag was poured while in molten state.

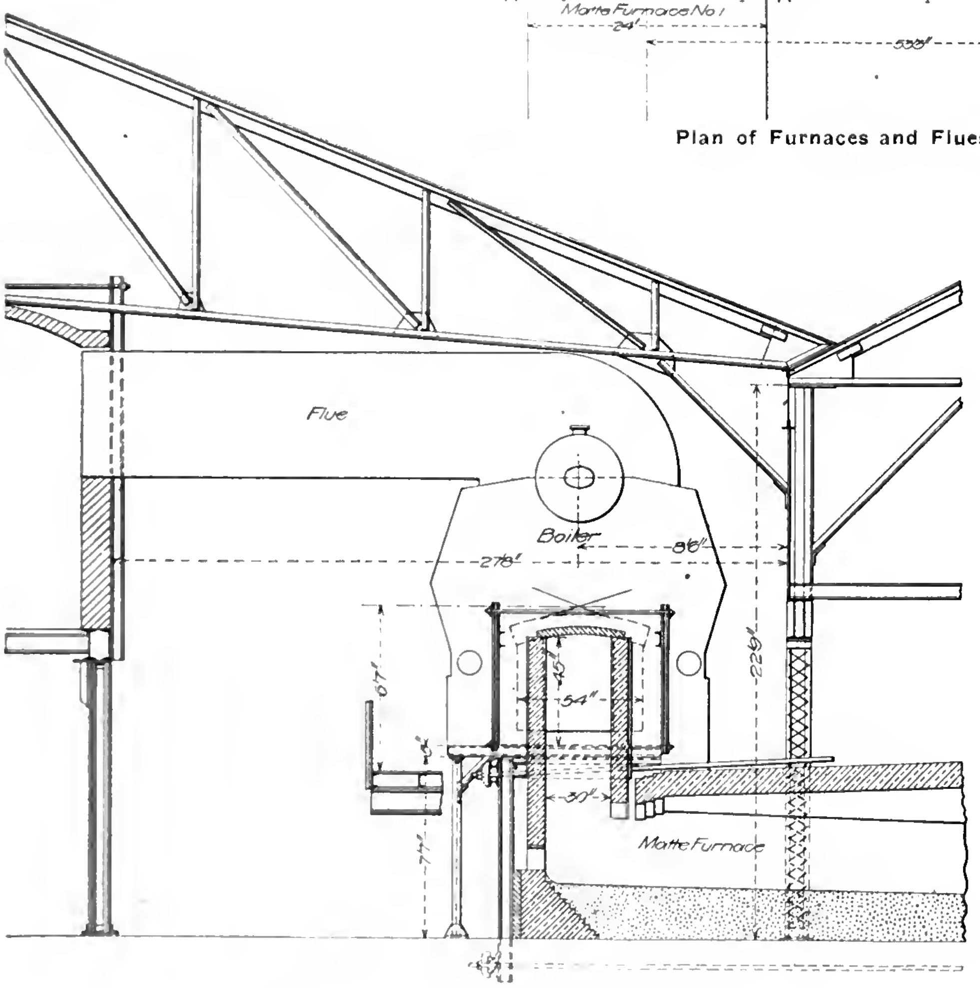
The boiler used with each Matte furnace is a 315-h.-p. unit of the Worthington type, built by the New York Safety Steam Power Co., which has a specially designed casing rendering it well adapted to this class of service. It embraces the usual Worthington construction, consisting of a centrally located horizontal steam drum with inclined banks of tubes, the steam drum being 42 in. in diameter by 20 ft. long. There are 61 sections of water tubes, each with eight full-length tubes and one shorter tube connecting with the lower side of the drum, making 549 tubes in all. The tubes are 3 in. in diameter and 10 ft. in length, the total heating surface presented in each boiler being 4,635 sq. ft. Apart from its size the boiler presents no unusual features with the exception of the casing, which is of special design to permit cleaning while in service, not only for the purpose of keeping the heating surface free from dust and matter deposited from the furnace, but also to enable this material to be reclaimed for return to the smelter.

The entire outer casing of the boiler, which is of the usual sheet metal construction, is formed of hinged doors, of which there are two on each end and six on either side, to facilitate the cleaning of the heating surfaces. The by-pass flues permit any boiler unit to be cut out of service at any time desired in order to enable this cleaning to be done, but the spaces between the tubes may be kept free from accumulations through slotted openings in the lower doors at both front and back, through which bars may be inserted. The slots are 2 x 10 in. in size, cut through the doors in line with the openings between the headers of the boiler, and are covered by small flap doors, hinged and held by buttons on the main doors. Each flap door covers only five of these openings, so that it will be seen that by opening but one of these doors at a time, the boiler may be cleaned while it is in operation without sensibly interfering with the draft. The operation of the cleaning bar through the slot openings keeps the boiler free from any deposit between the tubes vertically, while the side doors permit the introduction of a nozzle to blow the dust from the tubes horizontally.

In operation the waste heat boiler units have been very successful, it having been found that, with this arrangement of flue connections, there is no diminution in the capacity or economy of the matte furnaces, and sufficient steam is produced for the operation of the entire plant, without the use of the boilers that were formerly operated for steam production. While the waste gases formerly went to the stack at temperatures of from 1,500° to 2,000° Fahr. they are now discharged at a temperature of about 500°; in order to provide ample draft, a tall single stack was erected to replace the independent stacks that formerly served each of the furnaces separately. The boiler settings are also found effective as settling chambers, considerable amounts of the metal-bearing material carried over from the furnaces being reclaimed from the combustion chambers under the boilers, for return to the furnace or smelter.



Plan of Furnaces and Flues at the Colusa-Parrot Smelters.



Connection between Boiler and Furnace Flue.

Traction in the Detroit River Tunnel.

Traction in the Detroit River Tunnel now under construction will be conducted at first with six 100-ton direct-current locomotives of the swivel truck type, with geared motors. Each locomotive is designed to haul a 900-ton train up a 2 per cent. grade at a speed of 10 miles per hour. Current for operating the motors will be taken from a third rail by contact shoes. Power for the operation will be purchased from the Detroit Edison Co., and will be delivered at a substation at a potential of 4,400 volts and a frequency of 60 cycles. At the sub-station two 1,000-kw. synchronous motor-generator sets will be installed for supplying direct current to the third rail. The yards and approaches to the tunnel will be lighted by arc lamps while the tunnel itself will be lighted by incandescent lamps. Alternating currents from the main power supply at a frequency of 60 cycles will be used on the lighting circuits. For draining the tunnel there will be five sumps, each fitted with a pair of centrifugal pumps driven by induction motors. The sub-station will be provided with a regulating storage battery to carry the fluctuations of the load. The electrical equipment of the tunnel will be furnished by the General Electric Co.

A 22-Degree Curve on the Canadian Pacific Ry., between Golden and Field, B. C., known as Kicking Horse Pass curve, has recently been replaced by a new cut-off with maximum curvature of 8 deg., which involves a tunnel 693 ft. long. The old curve was on a detour line around a bend in the Kicking Horse River, which had been made necessary by the caving in of the old "Mud Tunnel" 20 years ago; the detour was 2,880 ft. long, 755 ft. of which was curved to a radius of 262 ft., so that no elevation of the outer rail was possible on account of "cornering" of passenger coaches. The cut-off shortens the line 1,192 ft.

The New Settling Basins and Other Improvements to the St. Louis, Mo., Water-Supply System.

The water supply for the city of St. Louis is drawn from the Mississippi River at the Chain of Rocks, 10 miles above the business section of the city. At this point a tunnel extends under the river to an intake tower in the channel of the latter, and is connected at the shore end to low-service pumps in a station building 500 ft. back from the edge of the river bank. These pumps deliver at present to a series of six large settling basins immediately downstream from the pumping station, the six basins having a combined capacity of 180,000,000 gal. From these basins the settled water flows by gravity through a horseshoe-shaped brick and masonry conduit, 11 ft. wide at the springing line of the arch and 9 ft. high, to two high-service pumping stations, known as the Baden Station and the Bissell's Point Station, which are approximately 4 and 7 miles, respectively, down the river from the low-service pumping station at the intake.

In order that the facilities for supplying and distributing water to the city should keep pace with the exceptionally rapid growth of the latter, additions to and extensions of the supply and distribution systems had become an immediate necessity. Two new settling basins at the Chain of Rocks, a 7-ft. steel pipe flow line paralleling the existing conduit from these reservoirs to the Baden high-service pumping station, and a storage reservoir at this station are the most important features of the additions and extensions to the supply system that have been undertaken. A large building containing storage space for the coagulants used in the clarification process employed in the settling basins, the machinery necessary in mixing these coagulants and applying them to the raw water, and a new high-service pumping station are among other improvements to that system that are to be put under construction soon.

The six existing settling basins are each 400 x 670 ft. in plan and are placed side by side, a masonry division wall separating the adjacent basins. The side walls of these basins are of stone masonry and their bottoms are concrete, embankments being placed around the walls. Under normal conditions of operation the raw water enters the upstream basin through four 3 x 3-ft. openings controlled by sluice gates. It flows from this basin over the dividing walls between the successive basins and is drawn into the brick and masonry conduit from the downstream one of the six basins, known as Basin No. 6. Supply and effluent connections are made, however, so the water may be admitted to or drawn from the various basins in practically any combination of the latter, in order to provide for cleaning and for emergencies of operation. The bottom of each of these basins is sloped from both sides to a trench along the longitudinal center line, to facilitate the removal of the sediment that is deposited from the raw river water. A 24-in. sewer outlet controlled by a gate valve in a gate house in the embankment extends from the end of this trench to the river, about 500 ft. distant.

The two new basins are being built between the existing basins and the river, covering together an area 400 ft. wide by 1,660 ft. long. They have reinforced concrete side and end walls backed by earth embankments, their bottoms being lined with 9 in. of concrete. The two basins are separated by a division wall, consisting of two reinforced concrete walls spaced apart and filled between with puddle, the total thickness of the walls and puddle being 9.5 ft. The bottom of each basin is sloped to two transverse trenches under which is laid a 30-in. sewer leading to the river. The basins are each 400 x 800 ft. in plan and have an average depth of about 21 ft., their combined capacity being 75,000,000 gal. The total capacity of the eight basins will be 255,000,000 gal., which is increased to 394,000,000 gal. when the new basin at the Baden station, four basins at Bissels Point Station and a distributing reservoir on Compton Hill in the city are considered. As the average daily consumption is approximately 72,000,000 gal., five and one-half days' storage capacity is provided.

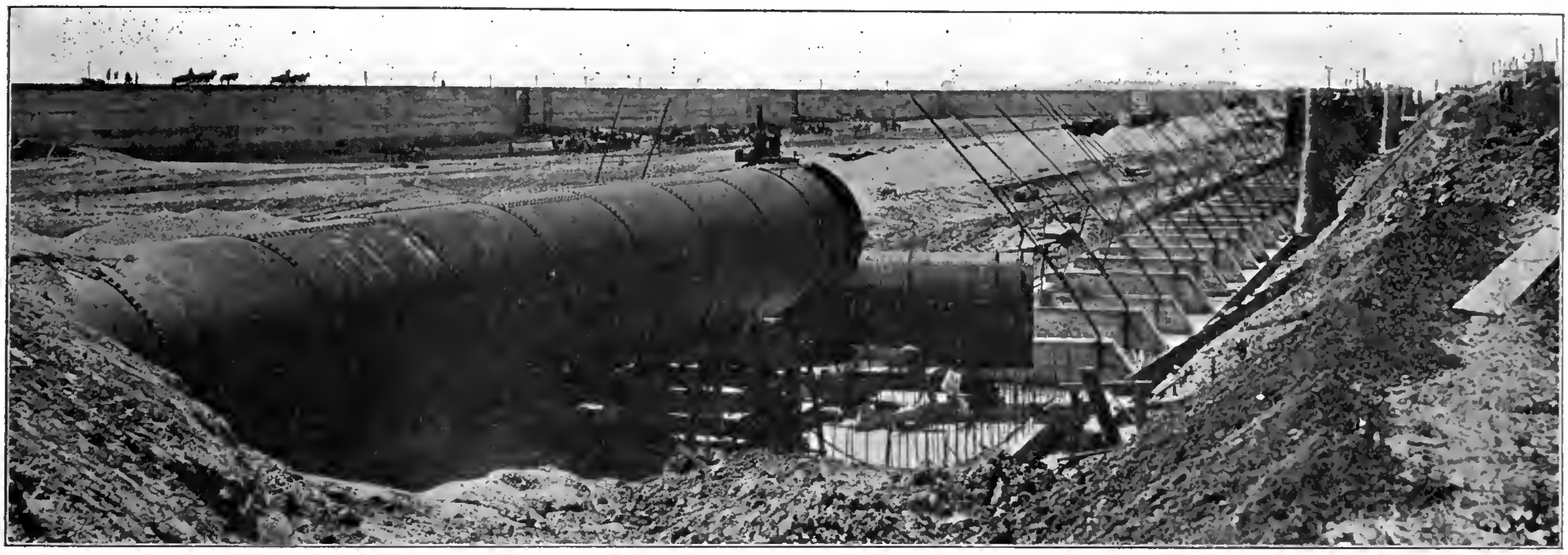
A by-pass consisting of a double 4x7-ft. reinforced concrete box conduit has been laid between the six existing and the two new basins in order that one or more of the eight basins may be cut out of service if desired; the two new basins are each connected with this conduit from which they may be supplied separately. The downstream one of the new basins, known as Basin No. 7, is connected with the downstream basin of the six existing ones, called Basin No. 6, so that water may be diverted from the former into the latter. The new basins are interconnected and have independent connections with the brick and masonry flow-line conduit leading to the high service pumping stations. Basin No. 7 also has a connection with a gate chamber from which the new 7-ft. steel flow line will be supplied.

The usual method of operation when the new basins are placed in service will be to pass the water through the existing basins in the normal manner, then through Basin No. 7, into Basin No. 8, and thence into the brick and masonry flow-line conduit, from which it may be diverted into the 7-ft. steel flow line at the south end of the system of basins. The various connections that have been provided, however, provide for a number of different combinations of the basins, making the sequence of operations entirely flexible. The connections between the various basins and between the latter and the by-pass and conduits are all controlled by sluice gates and valves. These gates and valves are placed in concrete gate chambers, built with the walls of the basins as their outer sides. The walls of the chambers are carried up to the tops of the basin walls and are to be covered with removable cast-iron floor plates.

A gate chamber at the inner downstream corner of Basin No. 7 is called Chamber No. 1. It contains two compartments, one 10 ft. square and the other 10x12 ft. in plan, which are separated by a 4-ft. concrete wall. The connection between Basin No. 6 and Basin No. 7 is a reinforced concrete conduit, having a 4 x 8-ft. rectangular cross-section. This conduit terminates in the larger compartment of chamber No. 1, 10.25 ft. above the bottom of the latter, in which it is controlled by a 4x8-ft. sluice gate. The outlet from this compartment is a two 4x4-ft opening in the opposite side of it, leading into the basin. A 6x7-ft. opening in one side of the other compartment of this chamber connects the latter with the basin, the opening being controlled by a sluice gate. The outlet from this chamber is a 7-ft. steel pipe which connects through the terminal conduit chamber nearby with the new 7-ft. flow line.

A connection from Basin No. 7 to the by-pass is made about midway in the side of that basin, terminating in a 10x15-ft. gate chamber known as Chamber No. 2. The connection with the by-pass is a double reinforced-concrete box conduit, each part of which is 5 ft. square in cross-section. The outlet from the chamber is a 6x7-ft. opening fitted with a sluice gate of that size.

The third one of the gate chambers, known as Chamber No. 3, is at the inner end of the dividing wall between Basins No. 7 and No. 8. This chamber has two compartments, each 10x13.5 ft. in plan, which are connected by an arched opening in the wall between them. A connection with the by-pass, of the same type and size as the one in Chamber No. 2, ends in one of these compartments and is controlled by two 5x5-ft. sluice gates. A 7-ft. steel pipe extends from the other compartment to the brick and masonry flow-line conduit, and is controlled by a 7-ft. circular sluice gate. A 6x7-ft. opening in one chamber connects the latter with one basin and the second basin is connected with the other compartment by an



General View of New Basins During Construction.

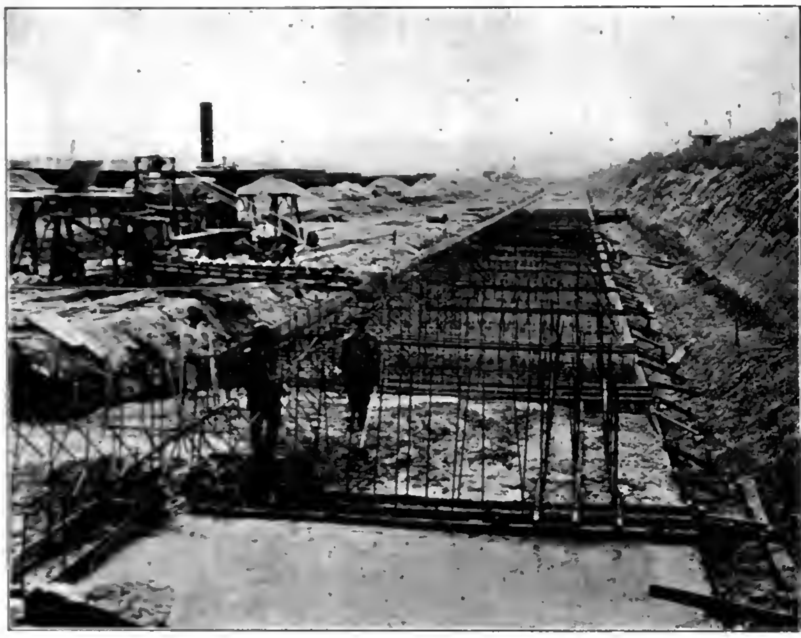
opening of the same size. With this arrangement the two basins may be connected, either or both basins may be supplied from the by-pass and either or both basins may discharge into the brick and masonry flow-line conduit through this conduit.

A fourth gate chamber, known as Chamber No. 4 and similar to Chamber No. 1, is placed at the inner upstream corner of Basin No. 8. This chamber has two independent compartments, one 10 x 10 ft. and the other 10 x 15 ft. in plan. A 7-ft. steel pipe line from the receiving chamber which supplies raw water to Basin No. 1 leads into the larger compartment, which also has a connection with the by-pass, of the same size and type of those already mentioned, and has a 6x7-ft. opening into the basin. The two supply connections are each controlled by gate valves. The smaller compartment has a 6x7-ft. opening connecting it with the basin and a 7-ft. steel pipe connection with the brick and masonry conduit, the opening into the basin from it being controlled by a sluice gate.

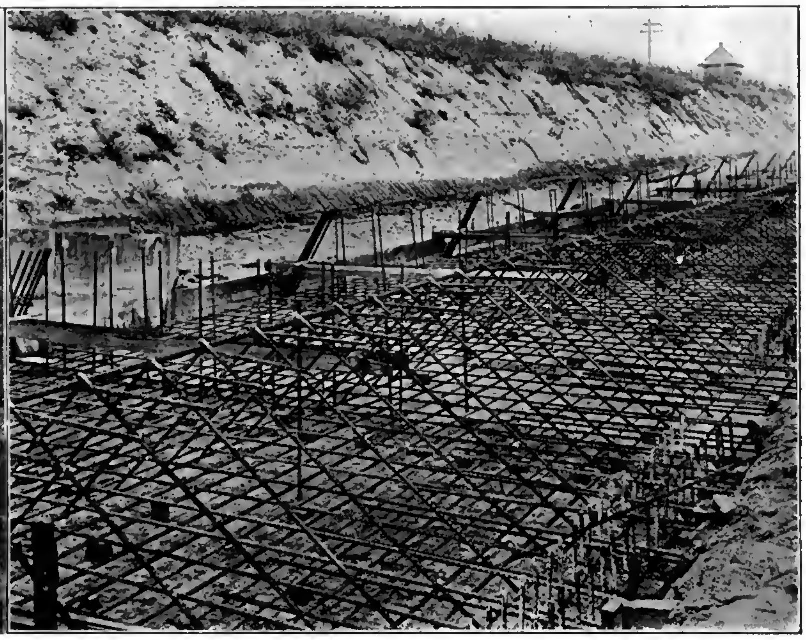
Three 30-in. cast-iron pipe lines are laid across each new basin under the floor, and at one side bottom is placed. The latter has a minimum thickness of 9 in. and is laid in 8x8-ft. blocks, the surface being troweled to a smooth finish. The blocks are separated to their full depth by ½-in. joints, which are filled with an asphalt cement filler. This filler is required to remain pliable at zero Fahr., and to have a melting point of not less than 210° Fahr. In addition to containing at least 92 per cent. pure bitumen it must be free from any coal tar products.

The footings of the reinforced concrete side walls of the basins are 25 ft. wide and 18 in. thick, the walls rising to a height of 22.5 to 24 ft. above them, depending on the elevation of the bottom of the basin at the point in question. The base of the wall proper is 2.5 ft. thick, the footing being stepped down to that width. The front face of the wall is vertical, but the rear face is battered slightly, the thickness at the top just below the coping being 18 in. The wall is designed as a buttressed retaining wall capable of resisting the forward overturning moment brought about by the fill against its rear face, as well as a backward overturning moment caused by the pressure of the water on point, 20 in. in diameter at the top and 20 ft. long. They were built by sinking two concentric steel shells together with an ordinary land pile driver having a 2,000-lb. hammer falling 5 ft.; then pulling the inner shell, which is collapsible and much the heavier, and filling the outer one with concrete. Each pile was reinforced with six ¾-in. corrugated bars. This method is controlled by the Raymond Concrete Pile Co. of Chicago, and has been described at length in this journal. The maximum load on the footing where these piles are used is about 2,800 lb. per square foot, the maximum load on the piles being 35 tons to a pile.

The details of the reinforcement of the footings, walls and buttresses are shown in one of the accompanying illustrations. Johnson corrugated bars are used in all cases where the concrete is reinforced in connection with the work on the basins, ¾-in. rods being employed chiefly in the footings, walls and buttresses. The footing is a horizontal beam 18 in. thick, which is designed to resist upward stresses, as well as the load brought on it. The walls and buttresses are thoroughly tied into the footing, and the



Concrete Mixing Plant Used on Footings of Walls.



Reinforcement Bars in Place for Wall Footings.

of the trenches in the latter. They replace the 24-in. vitrified pipe sewers which formerly served the existing basins. The trenches in the floors of the new basins are each connected with them at three places through 24-in. pipes having 24-in. non-rising steam valves placed in concrete chambers built in the trench. One of these connections is at the river side of the basins and the other two are at equal distances apart across the latter. A steel tower carrying a working platform above high-water level in the basin will be placed over each of the valve chambers not against the side wall in order that these valves may be operated from the stands when the basins are filled.

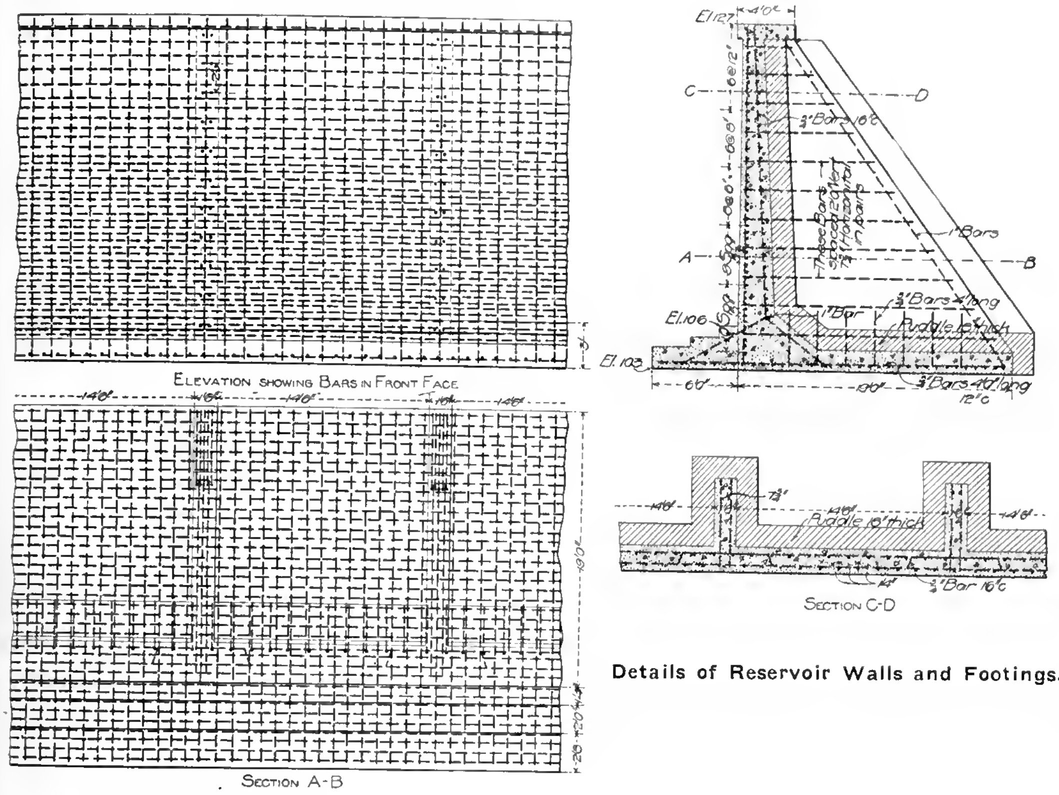
The site of the two new basins is a strip of the river bank from 725 to 825 ft. wide between the existing basins and the river. The greater part of the natural surface of this site is 2 to 5 ft. above high water. The basins are being built partially in cut and partially with embankments against the back faces of the concrete walls which form their sides. The greater part of the walls, however, is above the level of the natural surface.

The bottoms of the basins are being built almost entirely in excavation, a mixture of river silt and sand being uncovered over a large portion of their sites. A layer of puddle, having a minimum thickness of 18 in., is placed over the bottom of the excavation before the concrete its front face. The buttresses against the back face are placed 16 ft. apart on centers and are built continuously with the wall and footing, the latter extending at its full width for the full length of the wall. The walls are entirely without expansion joints, the reinforcement being designed to provide against cracks due to temperature changes. A continuous wall 1,600 ft. long is thus made on each side and one 400 ft. long at each end of the two basins. The wall on the river side has nearly all stood through three changes of seasons during the construction without having shown any cracks due to temperature.

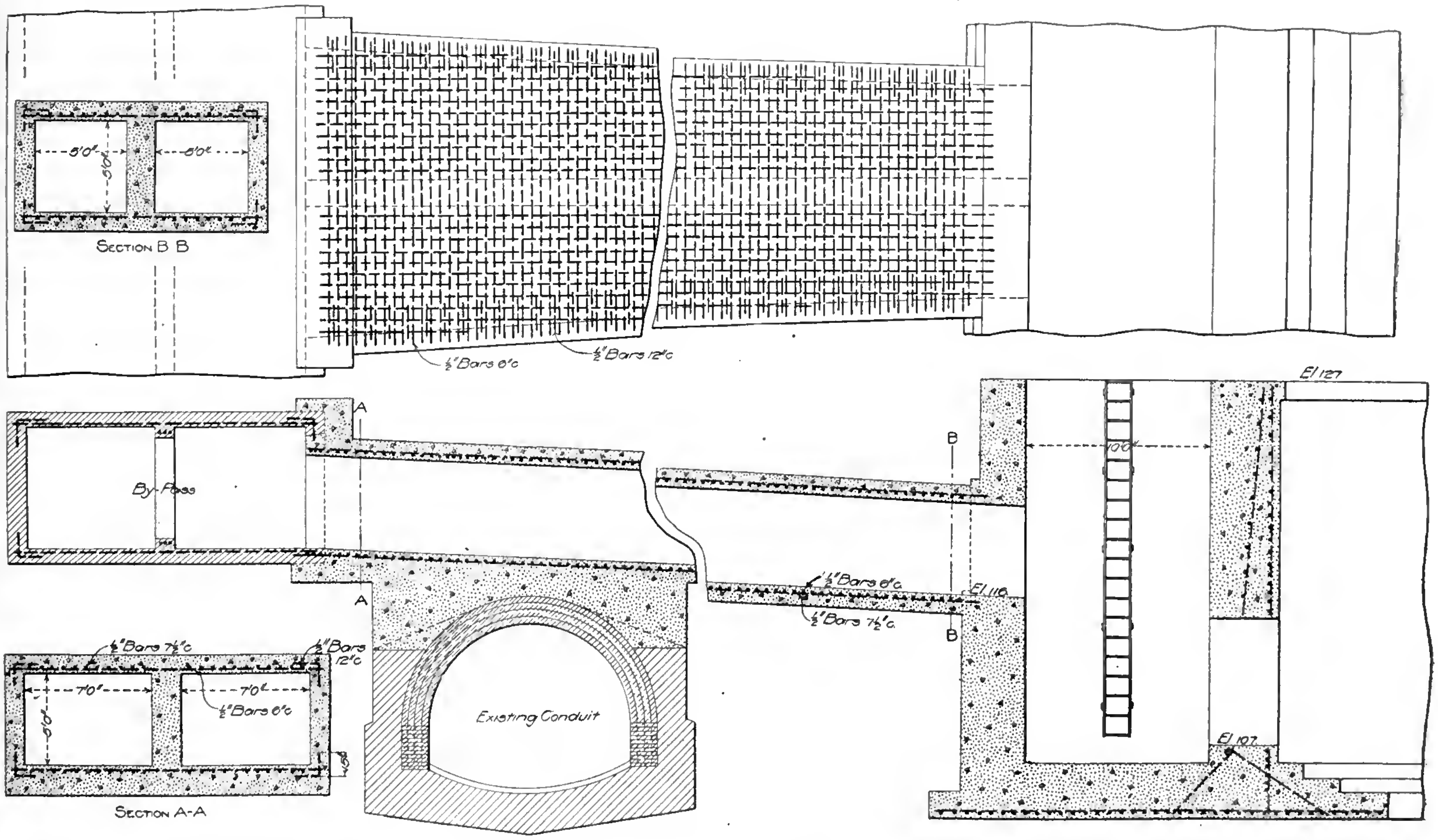
The soil of the site has sufficient sustaining capacity to carry the walls on the regular footings except at the outlets of the three sewers in each basin leading from the latter to the river. A heavy concrete wing wall is placed on both sides of these outlets and the excavation for the trench leading up to the outlets had to be carried considerably below the level of the remainder of the basin floor, with the result that extremely poor soil was encountered. In order to insure the stability of the walls on the poor soil at these outlets, a section of the wall footing about 64 ft. long is carried by seventy Raymond concrete piles at each outlet. The piles are placed in five rows of fourteen each, the rows being 5 ft. apart on centers, and the piles in the rows from 4 ft. 3 in. to 5 ft. 4 in. apart on centers. The piles are each 6 in. in diameter at the buttresses into the wall by reinforcement bars. The wall proper is designed as a continuous beam placed on edge, with the buttresses as points of support. The principal reinforcement is therefore laid horizontally and extends longitudinally near the faces of the wall. Shorter horizontal bars are also placed at the buttresses, as shown, to provide for the stresses set up at those points. Vertical bars are placed in the same plane as the horizontal bars in order to tie the wall together and to cause it to act as a uniform beam. The coping on the top of the wall is 12 in. thick and 4 ft. wide, and is reinforced sufficiently to carry its overhanging portion between the buttresses, and to prevent cracks.

Two classes of concrete are used in the construction of the basins and the various structures connected with them. One of these is specified to be made in the proportions of one part cement, three parts sand and six parts broken stone, by measurement, a barrel of cement being considered as 3 cu. ft., which actually produces a 1:2¼:4½ mixture, as proportions are ordinarily stated. The proportions of the other class, as specified, are one part cement, four parts sand and eight parts broken stone, or one part cement to nine parts of a mixture of sand and gravel, also by measurement, the barrel of cement again being considered 3 cu. ft. The 1:4:8 or 1:9 concrete is used for

lining the floors of the basins; in all other concrete construction the 1:3:6 mixture is employed. Red Ring Portland cement is used in all of the concrete, over 50,000 bbl. being required. This cement is subjected to tests approximately the same as the standard tests recommended by the American Society for Testing Materials. Clean, sharp river-channel sand, free from loam and dirt is required. Sound, clean limestone, crushed and screened, is used, the pieces ranging in size from those that would be retained on a ¼-in. screen to those which would pass a screen with 1½-in. meshes. The gravel used is dredged from the Meramec River, and is washed and screened before being delivered.



Details of Reservoir Walls and Footings.



Details of Typical Reinforced Concrete Conduit.

Construction of the Basins.—The Water Department of St. Louis operates an electric railway, 7 miles long, from the Bissells Point high-service pumping stations in the city to the low-service pumping station at the Chain of Rocks. This railroad connects with steam railroads in the city, and over it all of the supplies for the work are delivered by a steam locomotive owned by the city. The main railroad track traversed longitudinally the site of the two new basins and practically the first construction work done on the latter was to relocate this track on the river side of the site. Two side tracks from this main track were then laid the full length of the site from the upstream end of the latter, one adjacent to each longitudinal wall of the basins. The materials for the work can thus be delivered directly in cars to within 75 ft. of the point where they are to be used.

The first work that was done on the basins themselves was to excavate the trenches for the footings of the walls on the river side and the downstream end. These footings were then laid the length of the walls, which were built later, reinforcing bars and keyed recesses serving to tie the new concrete to the old, although the latter was also well cleaned before any fresh concrete was laid on it. Meanwhile, work was started on the footings for the walls on the other side and end of the basins, the footings for these walls being completed in time so the work on the walls resting on them could be carried forward without interruption when the first walls were finished.

As the top of the footings are in all cases at or below the natural ground level of the site, the concrete did not have to be elevated to them. On the other hand, since the footings contain a comparatively small amount of concrete per linear foot of wall a stationary central mixing plant from which the concrete could be delivered in cars, or by other means, to the position it was to occupy was impracticable. The requirements governing the method of constructing the wall proper, as will be described later, were also against the use of a central mixing plant. Two portable self-propelling concrete mixing and conveying outfits, built by the Drake Standard Machine Works, of Chicago, were accordingly designed for the work of the footings.

Each of these outfits consists of a standard Drake continuous mixer with its 20-h.-p. engine and boiler mounted on a four-wheel truck, which is fitted with a traction gear driven by the engine. A boom, 25 ft. long, carrying a 20-in. traveling belt conveyor is supported from the front end of this truck in such a position that the concrete is discharged on the belt directly from the mixer, and as the boom can be swung through an arc of 90 deg., concrete is delivered into the

footings from the mixer by the conveyor. The sand, gravel and cement for the concrete were delivered in barrows from storage piles and cars along the branch railroad tracks extending the length of the site, to the machines and elevated by super-hoppers into the mixer troughs. The mixing outfits were moved on 4x16-in. plank runways laid on the ground along the walls. Each of these mixing outfits could place on an average about 100 cu. yd. per 10-hr. day, with 25 men, allowing for delays, time of moving, and so forth.

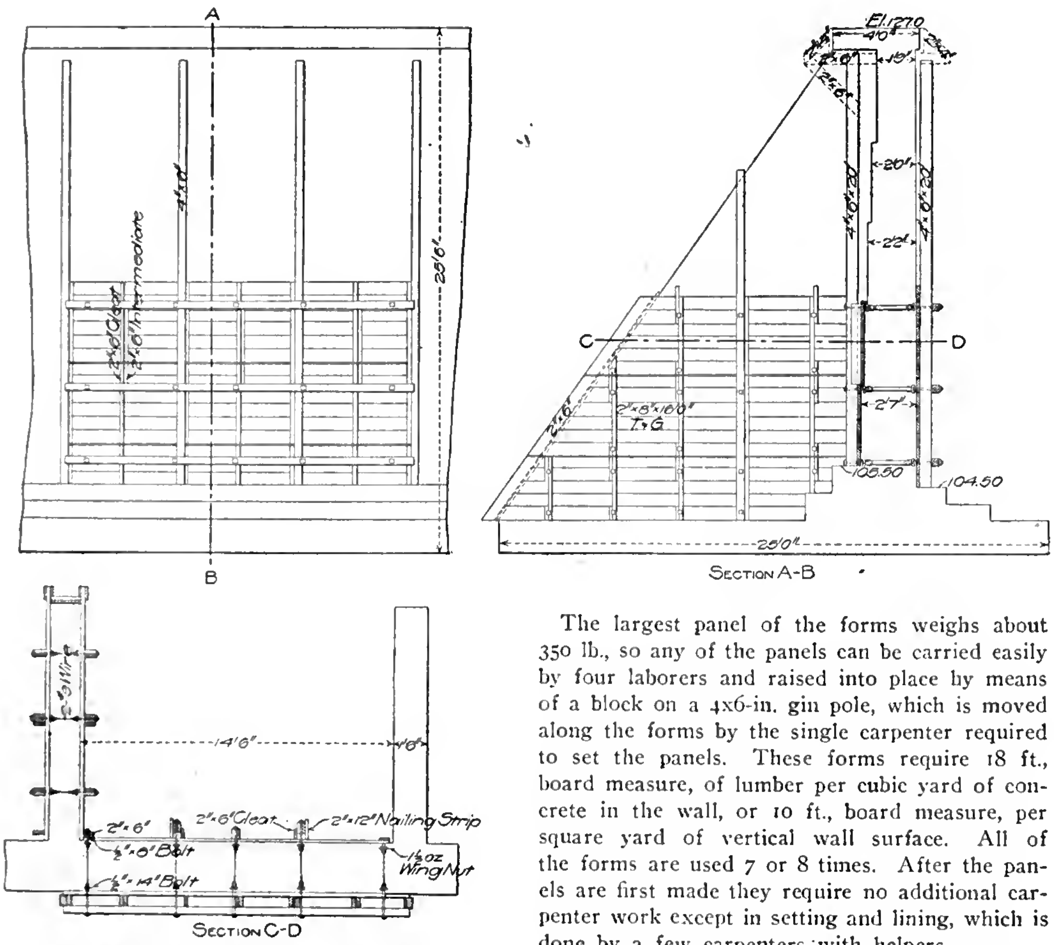
The type of the mixing outfit employed on the walls was governed entirely by the design of the walls, the manner in which they were required to be built, and the design of the forms. At the same time the design of the walls and buttress forms was controlled materially by the following considerations: The concrete was required to be placed in layers not exceeding 4 ft. in depth; provision had to be made in building the 4,920 linear feet of walls to permit the work to be stopped with keyed bulkheads, at the end of each day's work, in a form so narrow and so filled with reinforcing bars that a man could not work within it; and longitudinal reinforcing bars had to be placed after each layer of concrete had been laid.

The solid concrete wall with counterforts, forming a structure capable of resisting pressure from either face suggested the possibility of designing a hollow self-contained and self-sustaining timber wall, without bracing, for the forms. A form of this type was accordingly adopted, and is designed so it can be taken down in sections and erected again with a minimum amount of labor. In fact, in detailing the forms attention was devoted to minimizing the amount of lumber necessary by using the latter repeatedly, to the construction of sections of the forms of such size and weight that they could be placed and removed rapidly, and to simple methods of fastening and to the reduction of skilled union carpenter labor at 60 cents an hour as compared with unskilled helpers at 22½ cents per hour.

The lagging for these forms is made of 2x8-in. tongue and groove planks, faced on one side. This lagging is converted into panels, 3 ft. 2 in. to 4 ft. in height when placed vertically in position, and of different lengths, depending on the portions of the wall for which they are made. The panels on the front face of the wall are all uniformly 16 ft. long, extending from the center of one wall buttress to the center of the next; those for the back face of the wall are 14 ft. 2 in. in length extending from the forms for one buttress to those for the next; the panels of lagging for the buttresses have one beveled end and are gradually reduced in length from the bottom to the top of the buttresses to correspond with the slope on the back of the same. The planks forming each panel are cleated to 2x6-in. uprights, placed 30 in. apart on centers to prevent warping. The bottom panel of both the front and rear faces of the wall form rests on offsets in the footing of the wall. The remaining panels of the front face of the form are set on the lower panels later, but the succeeding panels of the rear face form each rest on a 2-in. offset in the back face of the wall. These offsets are spaced so their inner corners fall outside a line drawn to the batter proposed for the back face of the walls in the original design. The amount of concrete in the walls is thus increased only about 100 cu. yd. on all the walls by the change, while the saving attained in building the forms was very great. The panels of the front face of the forms are held in position by vertical 4x6-in. timbers, 20 ft. long, which are spaced four to a 16-ft. front panel. The rear face panels have two of these 4x6-in. uprights at the quarter points, their ends resting against the forms for the buttresses. The alignment of the front face forms is preserved by a horizontal 4x4-in. timber to each 4-ft. panel, these horizontal pieces being placed against and bolted to the 4x6-in. uprights.

The two faces of the forms are tied together by wires which are attached in such manner by means of bolts and wing nuts, that, as compared with the usual method of binding the wires around the uprights of the forms and cutting them when the latter are removed, only half the number of holes need be bored, the labor of wiring is diminished and wire is saved. At the same time, by turning up the bolts an even strain can be brought on all the wires holding a panel thus preventing the forms being broken out when the concrete is poured. The wires are held by ½-in. bolts, with ⅛x2¼-in. wrought-iron washers and ½-in. wing nuts. The bolts are placed through the uprights of the forms, the nuts being inside the latter. The bolts are placed in pairs, one bolt in the front face and the other in the rear, two No. 9 wires holding together the wing nuts on each pair of bolts. These wires are prepared in advance for the various lengths required at different heights of the wall. They have loops on their ends to fit over the wing nuts, these loops being made by holding the loose end of the wire in a vise and twisting the other end with a small rod so as to crimp both strands at the loop and prevent slipping. As shown in the accompanying sketch of the forms, intermediate 2x6-in. cleats are slipped along the cleats on the panels of the front face of the forms to reach the 4x4-in. longitudinal below the level to which the concrete has already been carried. These intermediate cleats reduce the number of wires and permit the upper wires of each panel to be raised so they can be reached from the top of the form, which method is required by the narrowness of the forms. When the forms are to be removed the bolts are screwed out of the wing nuts and the small holes resulting in the face of the concrete are filled with mortar. The walls are not given a mortar face, the only finishing done being to spade the concrete against the forms, but a good smooth surface is secured in this manner.

The walls and buttresses are carried up about 4 ft. at a time over a section 20 to 30 panels of the forms in length, depending on the working conditions. The 4x6-in. uprights of the forms are first set true to line and then the lowest panels of both faces of the forms are placed over the length of the wall in which concrete is to be laid in a continuous section. After the concrete has been filled in to the top of this lower panel for this length of wall, the next panels of both faces are placed over this length and a second longitudinal layer of the wall is built. The forms are thus erected and the walls built continuously in horizontal sections. These sections are selected of such length that work on the forms can be in progress on one end of this horizontal section while concrete is being placed at the other end of the section without interference.



Forms for Building Reservoir Walls.

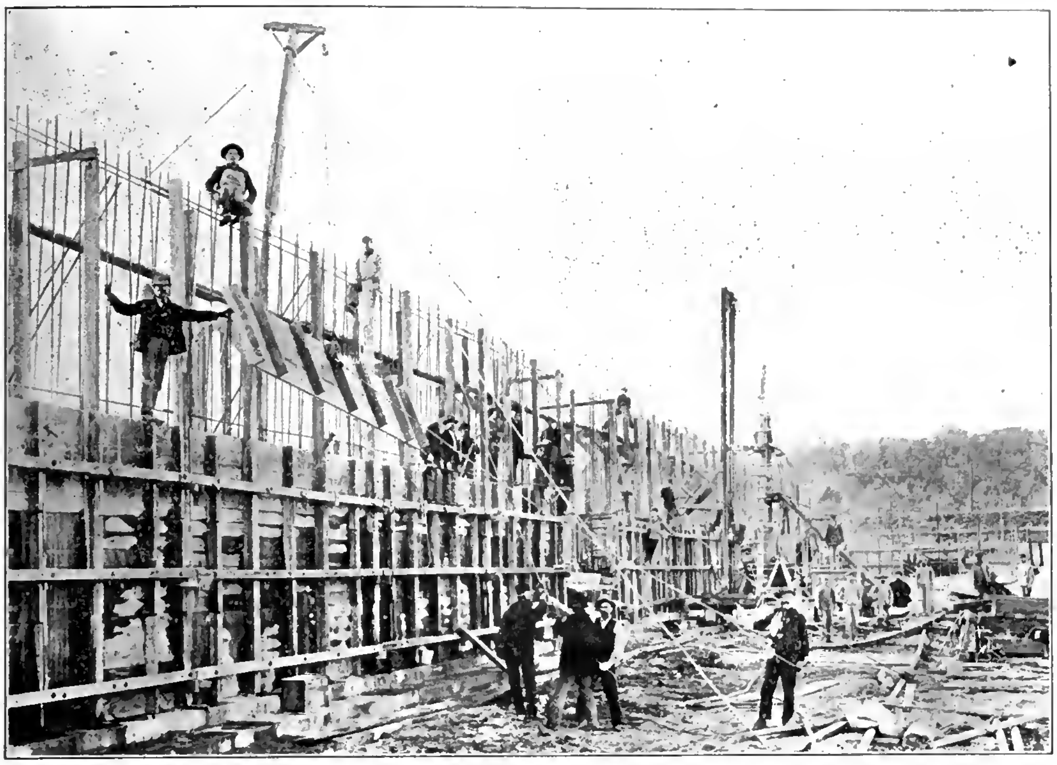
The largest panel of the forms weighs about 350 lb., so any of the panels can be carried easily by four laborers and raised into place by means of a block on a 4x6-in. gin pole, which is moved along the forms by the single carpenter required to set the panels. These forms require 18 ft., board measure, of lumber per cubic yard of concrete in the wall, or 10 ft., board measure, per square yard of vertical wall surface. All of the forms are used 7 or 8 times. After the panels are first made they require no additional carpenter work except in setting and lining, which is done by a few carpenters with helpers.

A portable concrete mixing and elevating outfit entirely different from those employed in building the footings is used in constructing the walls. This outfit consists of a 11 cu. ft. improved Chicago cubical mixer mounted, with a 20-h.p. electric motor which drives it on a platform carried by a truck having four flat-rim castor wheels running along planks laid on the bottom of the basin. This mixer is equipped with an automatic charging hopper, which is loaded, about 2 ft. above the level of the bottom of the basin, from wheelbarrows and holds one batch of materials for the mixer. The concrete is discharged from the mixer into a specially-arranged automatically-dumped hoisting bucket operating in a pair of vertical leads at the front of the platform on which the outfit is mounted. A chute, also operating in the leads carrying the hoisting bucket is set at the height at which concrete work is in progress, the concrete being dumped from the hoisting bucket through this chute into the forms. The machine is moved along the wall by a rope in a block and fall attached to an anchor at one end, and at the other to a winch head on the hoisting drum driven by the mixer motor.

As this outfit can be moved readily, and as

concrete can be placed by it at any height of the wall, it is particularly adapted to building the wall in the horizontal sections as required. Under these conditions an outfit can place on an average 80 cu. yd. of concrete in the wall and buttresses in a 10-hr. day.

The 230,000 cu. yd. of earth required to be excavated from the bottom of the basins was handled with New Era grading machines, drawn by 26-h.-p. traction engines, or by 12 mules, each, when the ground was soft. These graders loaded the excavated materials into three-horse contractors' dump wagons in which it was hauled through openings left in the walls and filled in behind the latter on the layer of puddle which had already been placed against the wall.

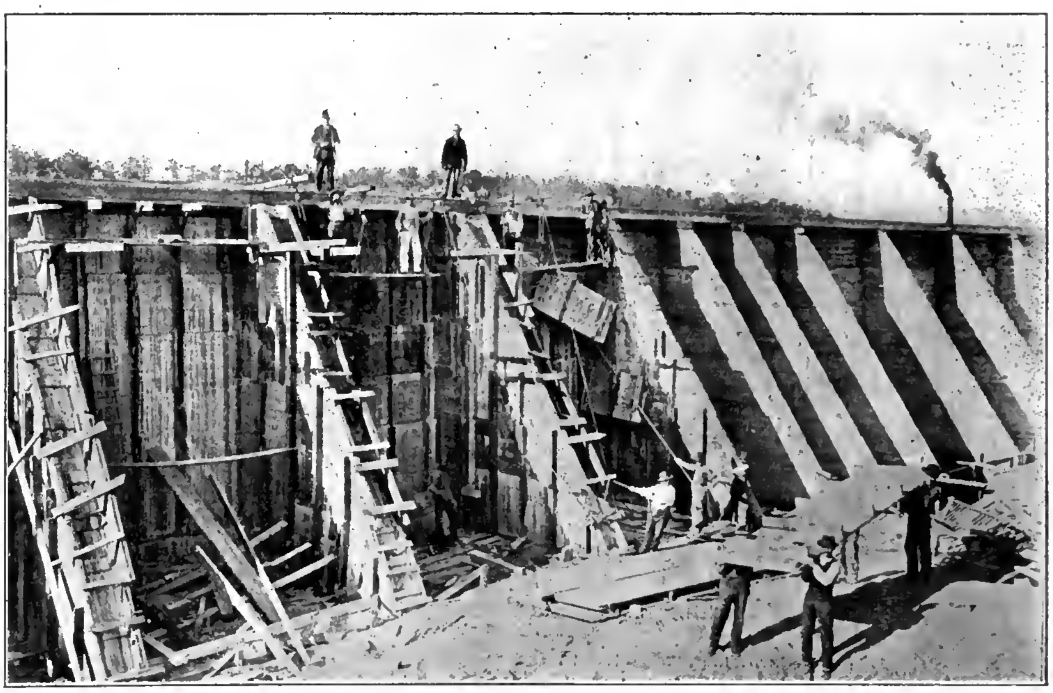


Concrete Mixing Outfit and Forms for Basin Walls.

Some puddle has been placed and the concrete lining laid over a portion of the bottom of the basins. The same concrete mixing outfits used in building the footings for the walls are being used in placing the concrete bottom lining. The bottom is laid in blocks 8x8 ft. in plan, and with ½-in. joints between them, as required. These blocks are placed continuously, ½x9-in. by 8-ft. iron plates forming the joints. These plates are greased with paraffin and tallow to aid in pulling them, the pulling being done with a light lever jack at each end.

The construction of the basins, according to the plans, requires approximately 50,000 cu. yd. of puddle under the concrete lining of the bottom and as backing for the walls. This puddle is made from a very excellent deposit of yellow clay excavated from the top of a high bluff back of the low-service pumping station, and about half a mile from the transverse dividing wall of the basins.

A very complete plant for excavating, mixing and delivering the puddle has been installed. A New Era elevating grading machine, drawn by a 26-h.-p. traction engine, is used in excavating the clay and loading it into three-horse bottom-dump contractors' wagons. The clay is hauled in these wagons to pug mills at the edge of the bluff. Three of these mills, 8 ft. long, and of the Freeze & Co. type are used as dry granulators into which the clay is dropped from the wagons through three traps in a platform over the mills. The granulators each feed the clay into one of the pug mills proper, which are 12 ft. long, where water is added in a fine spray. The wet mills discharge at the ends into 3-yd. dump cars on a 36-in. gauge track. This track has two branches just below the pug mills, which branches drop down the side of the bluff on a grade varying from 6 to 33 per cent. for a distance of 1,000 ft., part of this grade being on a trestle over a highway. The dump cars are operated on the incline in trains of three by a cable railway, the descending loaded cars assisting in pulling the empty ones to the top of the incline. The tracks at the bottom of the incline connect with tracks leading to the basins, the cars being handled in trains of 6 to 9 over 2½ per cent. grades by 9x14-in. locomotives running on 30-lb. rails.



Removing Forms from the Rear Face of the Basin Walls.

The cars in which the puddle is delivered are designed specially to handle this material. They are side-dumping and tilt to an angle of 55 deg. The bottom of each car extends out 1 ft. on each side farther than is usual in such cars, in order to cause the puddle to slide beyond the ends of the 6-ft. ties in the tracks. The bottoms of the cars are lined with No. 12 sheet steel to prevent the puddle from sticking. The cars were furnished by the Western Wheel Scraper Co., of Aurora, Ill., and have given satisfactory service in handling the wet, sticky puddle used on the work.

The puddle back of the basin walls is dumped into place from cars operated on a narrow-gauge track laid on top of the walls. These cars are hauled out on top of the walls in trains by the locomotive and dumped with no more difficulty than is experienced in dumping ordinary material in the same manner from cars of the usual type. The puddle for the bottom of the basins is hauled into the latter, on the narrow-gauge tracks, in the cars in which it is delivered and is dumped directly in place from these cars.

The construction of the two new basins and the improvements directly connected with them are about 60 per cent., completed, and it is believed they can be finished and placed in service by the end of 1907. The principal quantities of materials required in their construction are as follows: 230,000 cu. yd. of excavation; 49,700 cu. yd. of puddle; 40,150 cu. yd. of concrete; 17,000 ft. of ½-in., 1,103,000 ft. of ¾-in. and 35,000 ft. of 1-in. Johnson corrugated reinforcing bars; 4,100 ft. of permanent standard-gauge railroad track; and 3,050 ft. of sewers.

Mr. Ben C. Adkins, water commissioner, of St. Louis, has general supervision of the improvements which are being made by the water department. Mr. Edward E. Wall, assistant water commissioner, has charge of the engineering work for the department. Mr. Arthur I. Jacobs is engineer of the supply and purifying division of the water department in which division the improvements described are being made. The basins are being built by Messrs. Fruin & Colnon, general contractors of St. Louis, for whom Mr. A. P. Greensfelder is superintendent in charge of field operations at the Chain of Rocks.

Rail Corrugations were discussed at considerable length by Mr. Joseph A. Panton, in a paper before the Institution of Electrical Engineers, in which these corrugations are attributed to lateral play in weak trucks, the weakness being intensified by unsymmetrically driven axles. In the discussion of the paper, Mr. H. M. Sayers suggested that a considerable part of the trouble might be due to slipping of wheels on curves or when braked.

A New Impact Test.

A paper read before the American Society for Testing Materials by L. W. Page, director of the Office of Public Roads, Department of Agriculture.

The essential parts of this impact machine, like all others, are a hammer and an anvil. The nature of the work for which it is designed, however, has made it necessary to introduce a number of devices not before employed in impact tests.

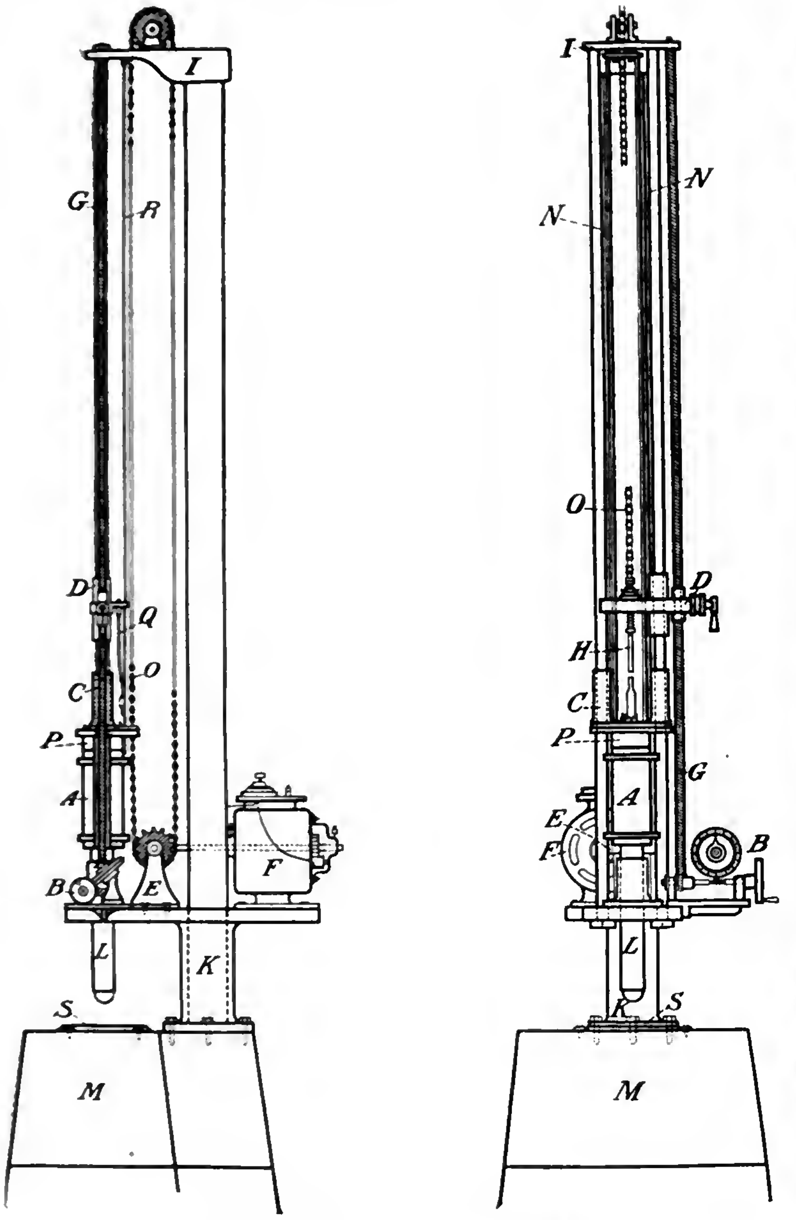
The main object of the test is to determine the relative toughness of road-building rocks. In the consideration of road materials toughness is understood to mean the power possessed by a material to resist fracture under impact. As the surface of a road is continually subjected to the pounding of traffic, it can be seen that toughness is an important property from the standpoint of the road builder. From the laboratory standpoint the problem is not altogether a simple one, and considerable difficulty has been found in designing a suitable test for measuring the degree to which a rock possesses this property. With homogeneous, structureless, brittle materials, resistance to impact may be due to a relatively low modulus of elasticity combined with high elastic limit. Provided a blow is delivered on such a material by a flat striking head with small local damage, toughness will be almost wholly due to elasticity. In this case there will be a critical energy of blow below which the specimen under test will not be broken by an indefinite number of blows, and in excess of which it will be broken by a single blow. The toughness of a road material in this instance will vary directly as the square of the elastic limit, which equals the ultimate strength, and inversely as the modulus of elasticity. In testing such materials under impact it is necessary to apply a number of blows of successively increasing energy and note the blow causing failure. The machine which I am about to describe involves this principle, and is the result of about fourteen years' work on the subject.

Instead of the hammer falling directly on the test piece it strikes an intervening plunger and the energy of the blow is conveyed through this plunger to the test piece. As comparative values are sought rather than physical constants, the end of the plunger bearing on the test piece is spherical in shape, thus rendering the energy of the blow splitting in its effect. At present we have in the laboratory of the office of public roads two of these machines, one having a 2-kg. hammer and a 50-kg. anvil, photographs of which are given here. This machine is used for making routine tests on the toughness of road-building rocks, and has a few special devices for this work. The other machine has a 10-kg. hammer and a 500-kg. anvil, and is used for larger tests, especially on paving blocks. A front and side elevation of this machine are also given. In describing this test I will confine my remarks entirely to the smaller machine, as it has all the essential parts of the other and a few improvements.

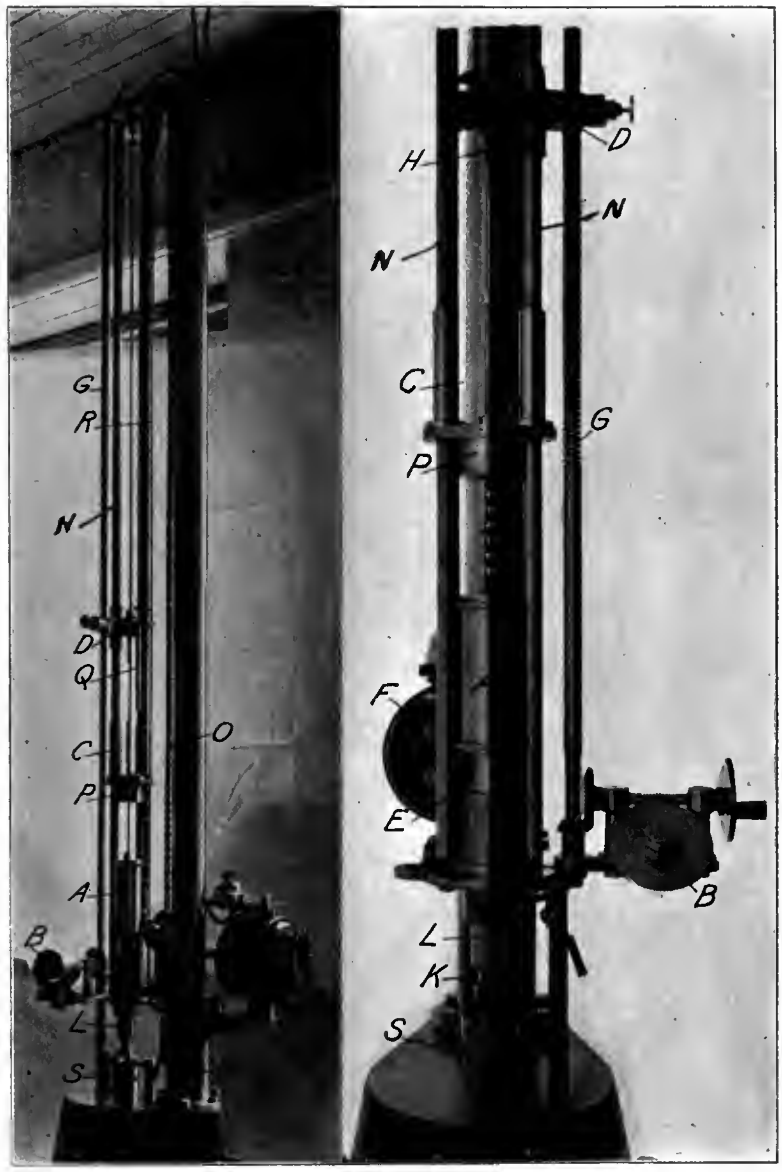
The test for toughness is made on 25x25 millimeter rock cylinders, which are cut with a core drill. It can be seen that the blow as delivered through a spherical end plunger approximates as nearly as practicable the blows of traffic; besides this, it has the further advantage of not requiring great exactness in getting the two bearing surfaces of the test piece parallel, as the entire load is applied at one point on the upper surface. The test piece is adjusted so that the center of its upper surface is tangent to the spherical end of the plunger, and the plunger is pressed firmly upon the test piece by a spring. The test piece is held on the anvil of the machine by a device which prevents its rebounding when a blow is struck by the hammer, and which keeps the test piece centered.

The hammer, which weighs 2 kg., is raised by a sprocket chain and released automatically by means of an electromagnet. The test consists of a 1-cm. fall of the hammer for the first blow, and an increased fall of 1 cm. for each succeeding blow until failure of the test piece occurs. The number of blows required to destroy the test piece is used to represent the toughness of a sample. The variation in results on the same material is very low; only in rare instances does a variation of more than one blow occur.

The machine consists of a 2-kg. hammer, *A*, which is guided by two vertical rods, *N*. The upper end of the hammer has a small cone set in it, which fits snugly into a concentric electromagnet, *P*, the latter being attached to the lower side of a crosshead, *C*, which slides freely on the guide rods, *N*. This crosshead is provided with a slot on its rear side through which a sprocket chain, *O*, passes. This sprocket chain is supported on two sprocket wheels which are attached to castings at the top, *I*, and near the base, *K*,



Large Machine for Impact Tests.



Small Machine for Impact Tests.

of the machine, which project sufficiently to support the guide rods, *N*, and other attachments. The lower sprocket wheel is directly connected by a worm gear to an electric motor, *F*, placed at the rear end of the lower casting, *K*. The sprocket chain is provided with two small lugs, which, when it is being driven by the motor, engage a spring bolt attachment, which projects inward on either side of the slot on the crosshead, *C*. This raises the crosshead until tripped by a rod, *O*, projecting downward from an upper crosshead, *D*. When this takes place the crosshead, *C*, which holds the electro-magnet falls until it comes in contact with the hammer, *A*. The electro-magnet, *P*, is supplied with current from the same circuit running the motor. The current is conveyed through two small conducting rods running parallel to the guide rods, both being insulated from the rest of the machine. The current passes from one of these conductor rods through a small carbon brush to a make and break attachment, *H*, on the upper crosshead, *D*, and thence down one of the guide rods through the electro-magnet back to the other conductor rod.

When the crosshead, *C*, is raised by the lugs on the sprocket chain and the current turned on the magnet, the hammer is lifted until the crosshead, C, comes in contact with the make and break, *H*, on the crosshead, *D*, and thus releases the hammer, which falls, striking a plunger, *L*. This plunger is made of armor-piercing steel which has the maximum temper at its lower end, which is spherical in shape. The test piece rests on a counter anvil, S, of hard steel, the plunger resting on its upper surface, which is tangent to it at its center point.

The upper crosshead, *D*, is raised through any desired height by means of the long revolving screw, *G*, which is geared at its lower end to a dial, *B*, on which the height of the make and break attachment, and, therefore, the height of the hammer drop may be read direct. By means of the revolving dial and screw the height of the crosshead may be adjusted by very close approximation to within 1 millimeter.

In order to prevent the crosshead, *C*, which holds the electro-magnet from striking too hard a blow on the hammer when falling a dash-pot was first used, but we have found that a few drops of cylinder oil on the lower end of the guide rods completely prevents this difficulty.

A point of interest in connection with this test is the fact that many of the test pieces are split into three pieces. Just why this takes place I am unable to explain.

The highest result yet obtained was on a sample of diabase from Pennsylvania. One test piece of this sample broke at a drop of 54 cm. Three months later another operator cut and tested another test piece, which broke at 58 cm. drop. The next highest result was on a fine grained sandstone from Virginia. One test piece broke at 49 cm. and the other at 50 cm. drop. I give these results only to show the small variation in results on the same materials. In rocks of low toughness there is generally no variation.

Several series of cement briquettes, of the same size as the rock cylinders, have been broken in this machine, with practically no variation in the results. It was necessary in these tests to use a ½-kg. hammer to give high numerical values to the results. This test has also been found most useful in grading asphalt surface mixtures. Some interesting penetration tests have also been made on wood paving blocks.

In concluding, I may state that a very interesting series of tests are at present being made to determine the detonating points of the high explosives. It has already been ascertained that more energy of blow is required to detonate nitroglycerine than a number of the other high explosives. It is very easy with this machine to determine the detonating point of an explosive at a given temperature within 1 cm. fall of the hammer. Nitroglycerine, for instance, detonates at 30 cm. drop at 29°, 31 cm. at 28°, 34 cm. at 24°, 35 cm. at 23°, 67 cm. at 11°, and 95 cm. at 8°.

Foundations of the American Bank Note Building, New York.

The new 66 x 44-ft. office building for the American Bank Note Co., New York City, will be a fireproof steel cage structure at the corner of Broad and Beaver Sts. Above the street level the floors are entirely unobstructed by columns and, together with the roof and walls, are carried on 16 steel wall columns. Eight of these columns in two opposite sides of the building have separate rectangular piers from 6½ to 7 ft. square. On a third side of the building the four columns are carried in two pairs, each on long, narrow piers, and on the fourth side, where the columns are located close to the wall of the adjacent building, they are supported on separate still smaller and narrower piers close to the footings of the old building. All of the piers are of concrete carried down by pneumatic caisson process through quicksand and some clay to a solid stratum of hardpan from 30 to 37 ft. below the curb. The column loads are distributed on the tops of all of the larger caissons by double grillages consisting of a lower tier of I-beams and an upper tier of pairs of channels riveted together back to back to give larger web sections than can be secured in I-beams of the same depth.

The self-supporting brick wall of an adjacent four-story building on one side of the lot was underpinned by seven 12-in. wrought-iron sectional pipes driven to hardpan by the Breuchaud method before the excavation was commenced. The pipes were received in 6-ft. lengths and were sunk in the usual manner with a hydraulic jet and a 50-ton hydraulic jack, reacting against the wall of the building. They were forced down to refusal against the hardpan, the interior was thoroughly washed and pumped out and filled with concrete, and the work was completed without entering the interior of the old building or causing any settlement or cracks in its wall.

The site was excavated by hand to a depth of about 11 ft. below the curb and the spoil was removed at first in wagons driven into the excavation and afterwards by derricks and buckets. The sides were retained by 2-in. tongue-and-groove sheet-piling braced by inclined struts as the excavation was carried down and afterwards left permanently in position and faced up on the inside with a concrete wall reinforced by steel rods ⅞ in. in diameter. Ground water was encountered at a depth of about 9 ft. below the curb and was drained by syphons to one of the caissons, which was left unfilled until the last to act as a sump and was emptied by a 4-in. centrifugal pump driven by an electric motor.

One one side of the lot a working platform at street level was built on falsework bents and on it was mounted a stiff-leg derrick with a 50-ft. boom of 15 tons capacity which commanded all portions of the lot and unloaded the caissons of a maximum weight of 7 tons from wagons in the street and delivered and set them in their required positions in the excavation. The derrick was operated by a 7 x 10-in. double drum Lidgerwood hoisting engine with independent boiler and sufficed to handle all materials involved in the construction of the substructure. Underneath the derrick platform were set two 10¼-in. class E Ingersoll-Sergeant air compressors and their receivers, and the remainder of the space there was utilized for storage and workshops.

The 8 regular piers were sunk with standard rectangular wooden caissons very simply constructed with 3-in. vertical sheeting with caulked joints, bolted to inside rectangular horizontal frames made of 4 x 12-in. planks spaced from 16 to 34 in. apart vertically in the clear. A deck of two crossed courses of 3-in. planks, 6 ft. in the clear above the cutting edge, is supported on the upper edge of one of the interior frames and another frame was bolted in contact with its upper surface. A steel airshaft 3 ft. in diameter was fitted to the deck and provided with the usual air-locks and connections. The lower horizontal frame was made of 6 x 10-in. timbers and being placed 6 in. in the clear above the cutting edge served to reinforce the latter which was formed simply by bevelling the lower ends of the wall sheeting which were not shod or otherwise strengthened. The vertical sheeting was made in 18-ft. lengths continuous over the working chamber and the cofferdam.

When this did not suffice, the cofferdam was extended by a separate 8-ft. section constructed in the same manner and connected to it by ¾-in. vertical bolts through the top frame of the lower section and the lower frame of the upper section which thus acted as flanges. The sheeting in the lower section extended about an inch above the upper edge of the upper cross frame and thus formed a socket to receive the lower edge of the lower frame in the upper section, the sheeting for it being cut short to correspond and bringing the joint over the solid timber of the lower cross frame in the upper section. Two of the caissons about 19 ft. long and 4 ft. wide were made in substantially the same manner except that the long side frames were braced by two sets of equidistant 3 x 10-in. horizontal transverse struts. The smallest caissons, 3 ft. 8-in. x 8 ft. 4 in. outside, were constructed substantially like the regular caissons except that in order to increase the clearance for the airshaft made with 5-ft. sections of 3-ft. cast-iron cylinders with inside flanges, sections about 2 ft. long were cut out of the center of each of the long sides of the inner horizontal frames and the remaining end pieces were spliced together with single 8 x ⅝-in. plates 46 in. long, thus increasing the effective width of the caisson nearly 6 in. The caissons were filled with 1:3:5 concrete made with Atlas Portland cement hand-mixed and completed in 25 days with an average force of about 90 men.

Kirby, Petit & Green were the architects. Mr. Chas. H. Nichols, consulting engineer, and the Hedden Construction Co. general contractor. The Bryson-Gamble Co., was the contractor for the sub-structure work above described.

THE PRESERVATION OF TIES by crude oil has been tried successfully by the Atchison, Topeka & Santa Fe Ry. In the fall of 1901 the company treated a few thoroughly seasoned New Mexico, Arizona and Texas pine ties with California crude oil containing about 75 per cent. asphaltum base, the remainder being light oils, the greater part of which vaporized when heated. The oil was heated to 180° Fahr. and forced into the wood under a pressure of 150 lb. per square inch, the ties taking up from 4 to 8 gal. each. They were placed in an experimental track on the Gulf, Colorado & Santa Fe Ry., where an untreated loblolly tie will not last over two years, and an untreated long leaf tie not over three years. The ties were examined by the Santa Fe officers after they had been in service four years and nine months and were found perfectly sound. Those that were sawed through or bored were found to be in excellent condition, and the spikes were not only as good as the day they were driven, but seemed to hold better than in untreated ties. The company has therefore decided to use oil for ties, and to continue creosoting for bridge timbers and piling.

Aqueduct Bridges on the Illinois and Mississippi Canal.—II.

By Fred W. Henens, M. Am. Soc. C. E., Junior U. S. Engineer.

Methods of Construction.—Aqueducts 1 and 9 were built entirely by hired labor, as were also the piers and abutments of Aqueducts 2 and 3, and the trunks, including the reinforced concrete linings, of all of the aqueducts.

The foundations of Aqueducts 2 and 3 were constructed by Cogan & Pound, contractors, and the foundations of Aqueducts 4 to 7, inclusive, were put under contract twice, it being finally necessary for the Government to complete the work by hired labor. The foundation of Aqueduct 8 and the piers and abutments of Aqueducts 4 to 8, inclusive, were constructed by Page & Shnable, contractors, of Chicago. The latter contract was completed during the season of 1906.

Unless otherwise stated, the methods of construction described were those used at Aqueduct 9. The methods used at Aqueduct 4 are typical of the work done on the Western Section and will be referred to frequently. Junior Engineers H. E. Reeves and A. O. Rowse were the resident engineers in charge of construction of Aqueducts 4 and 9, respectively.

Aqueduct 9 is located about 11 miles from Tampico, Ill., its nearest railroad station, and 24 miles from Rock Falls, Ill. A narrow-gauge railroad was previously constructed by the Government for riprapping the banks of the canal, and was later extended to the Aqueduct. All of the materials were received at Rock Falls, and transported to the aqueduct with a construction train. There is a siding from the Chicago, Burlington & Quincy Ry. on the canal right-of-way at Rock Falls.

Aqueduct 4 is located about 2 miles north and east of Mineral, Ill., which is a station of the Rock Island Ry.

The canal runs almost due south at Aqueduct 9, making an angle with Green River, such that during construction, an abutment and the upper end of one pier were on the south side of the river, two piers were entirely in the river, and an abutment and the lower end of one pier were on the north side of the river.

A cofferdam about 110 ft. long was built parallel to and about half way between the first and second piers, from the north, with a wing on the upstream side that returned to the river bank. In the same way a dam was built between the third and fourth piers with a wing on the downstream side that returned to the south bank, thus leaving a channel about 65 ft. wide for the passage of the river.

The coffer dams consisted of two lines of sheeting, 2 x 12-in. by 8 ft., placed 6 ft. apart, filled with a sandy loam, the only available material.

Each line of sheeting was supported by two 6 x 8-in. by 16 ft. horizontal waling timbers, placed about 4 ft. apart. Vertical 6 x 8-in. posts were placed outside at the ends and center of the wales, through which the coffer-dam was tied together at top and bottom with $\frac{5}{8}$-in. rods, 8 ft. 6 in. long.

After all of the work inside of the two enclosures, including the excavation for the channels, had been finished, the wings of the dams were removed and the ends of the main or longitudinal portions were connected with cross-dams, thus enclosing the second and third piers and forcing the water through the two side channels.

Twice it was necessary to flood the pit on account of high water. This was accomplished through a sluice or trough about a foot square, with a gate, constructed in the cofferdam about 2 ft. above the ordinary water line. The gate was kept closed until it was seen that the dam was in danger, when it was opened, allowing the pit to flood.

Owing to the sandy bottom of the river, the cofferdams were not entirely satisfactory. Twice the water went under the sheeting, doing no particular damage except to delay the work for a few days. On later work a pile coffer-dam was used.

Such a coffer-dam was constructed at Aqueduct 4 by driving a row of round piles 7 ft. apart, through the center of the creek between the second and third piers, to which was bolted 6 x 8-in. waling timbers.

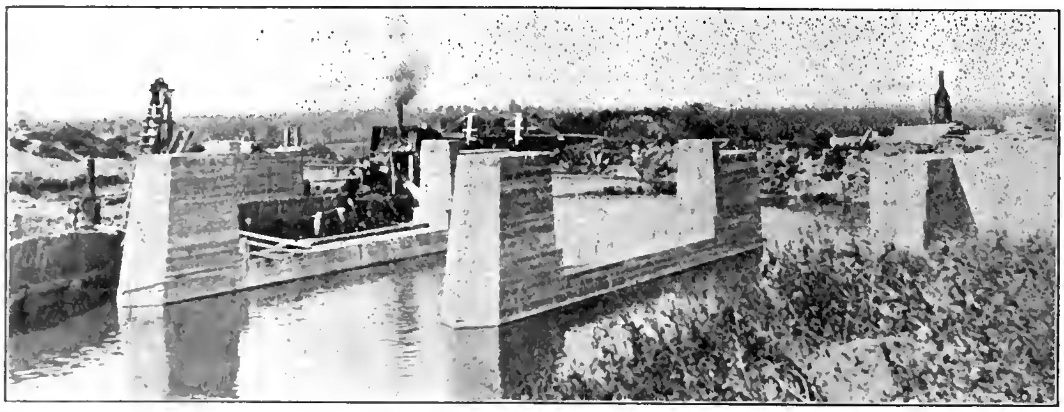
Triple-lap sheet piles made of 2 x 12-in. by 16-ft. lumber were driven about 8 or 9 ft. and spiked to the wales. At each end of the pit a similar dam was constructed across the channel, sluiceways being left on each side of the center coffer, which could be closed with planks when it was desired.

The materials excavated at Aqueduct 9 were sand and sandy peat with some clay. The work was done with teams and scrapers, except the sand in the middle section, which was excavated with a 6-in. sand pump. The materials were wasted between and back of the canal embankments, which had been previously built, the bottom grade of the canal being several feet above the natural surface of the ground.

At each aqueduct, channels were excavated across the canal right-of-way, being the full width between abutments except where it joined the original channel.

The first contract for excavation and building foundations for Aqueducts 4 to 7 inclusive on the Western Section, was dated March 20, 1902. The only work done at Aqueduct 4 under this contract, was the excavation of about 11,000 cu. yd. of materials.

The work was relet on Oct. 12, 1903, but no work was executed at Aqueduct 4 under this contract. When the United States began work by hired labor, in the spring of 1905, to complete these contracts, the pit was found to have from 7 to 9 ft., about 7,000 cu. yd., of silt deposited in it. This deposit stood at a slope of about 1 to 4, and was gummy and sticky, being exceedingly hard to dump from the cars.



Right-Hand End of Aqueduct No. 4.

Left-Hand End of Aqueduct No. 4.

The hired labor work was done with a $\frac{3}{4}$-yd. Page scraper bucket operated by a stiff-legged derrick mounted on a frame with a 12-h.-p. hoisting engine and vertical boiler, which furnished the power. The dredge was moved about on rollers.

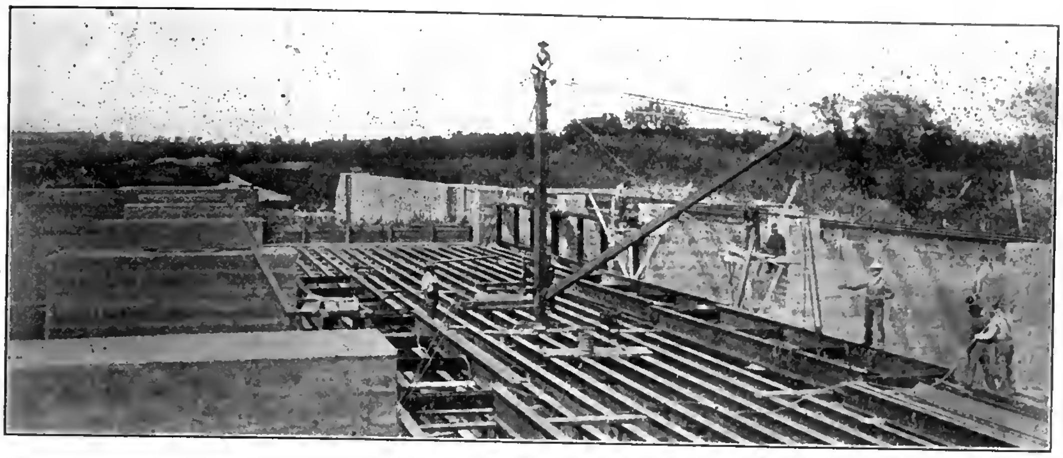
The excavated materials were dumped into $1\frac{1}{4}$-yd. dump cars, which were pulled to the top of the canal bank with a cable by a 15-h.-p. hoisting engine. The cars were operated in trains of three cars each. At the top of the embankment, the train was taken by a team and drawn down the canal where the materials were dumped back of the canal bank. A force consisting of 2 enginemen, 1 fireman, 1 team, 6 laborers, and a foreman, operated the plant. The output was about 15 cu. yd. per hour.

Both round and sheet piles were driven with a driver having a 2,000-lb. hammer, aided where necessary by a water jet. The round piles were about 16 ft. long and 12 to 16 in. in diameter at the large end, the average driven length at Aqueduct 4 being between 14 and 15 ft. A sheet pile was made of three pieces of $1\frac{1}{2}$-in. white oak 8 ft. long, fastened at the top and bottom with three 5 x $\frac{1}{4}$-in. boat spikes, making a tongue and groove $2\frac{1}{2}$-in. deep. The sheeting was driven about 7 ft. below the bottom of the foundation, and was imbedded about 6 in. in it. The round piles were cut off at grade, the longitudinal timbers placed and the spaces between timbers filled with concrete. The cross timbers were then laid and concrete filled between them.

At Aqueduct 4, the concrete was made with Utica natural cement, the proportions being 1 part cement, 2 of Mississippi River sand and 4 of crushed limestone from quarries at Moline, Ill. The concrete was mixed with a one-half yard Smith mixer, and dumped into the pit,

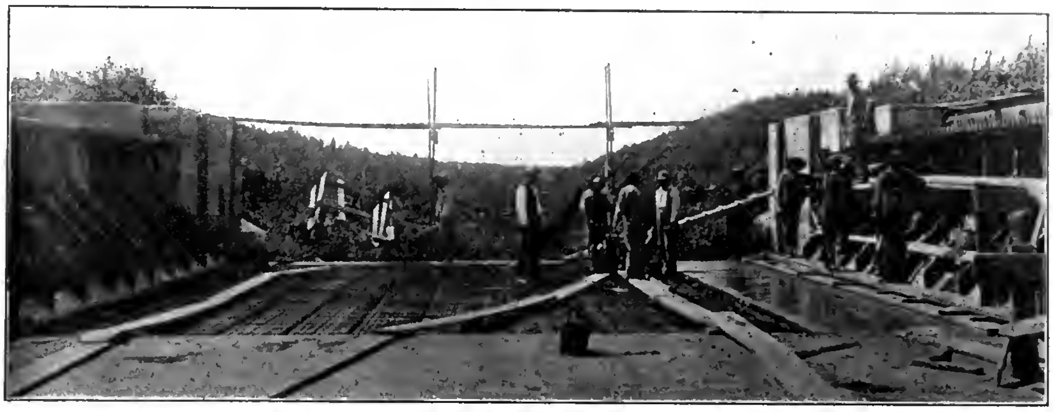
where it was distributed in the foundations with wheelbarrows. The materials were placed in the mixer with wheelbarrows.

At Aqueduct 9, Portland cement was used almost exclusively, most of it being the Marquette brand. The sand contained about 20 per cent. of pebbles and was obtained from excavations from the canal prism. The crushed rock was obtained from the Government crushing plant at Rock Falls, being screened to remove dust and rock too large to pass a 2-in. ring. The concrete in the foundation consisted of 1 cement, 3.5 sand, and 4.5 crushed rock, and was mixed with a half-yard Smith mixer as later described for piers and abutments.



Assembling Steel at Aqueduct No. 8.

The concrete materials for the piers and abutments of Aqueduct 9 were the same as for the foundations and were hauled to the site of the aqueduct in dump cars. The track was on top of the canal bank from which the cars were dumped on the outside of the bank, the slope being covered with a grass sod. Enough sand and crushed rock was delivered before any construction began to complete all of the concrete work. The materials were distributed along the bank for a distance of about 400 ft. An accompanying illustration shows the general layout of the mixing and hoisting plants.



Placing the Concrete Lining at Aqueduct No. 9.

A warehouse with a capacity for storing about 2,000 bbl. of cement was rebuilt about 1,500 ft. from the aqueduct and a shed was built over the track at the aqueduct site large enough to shelter a flat car loaded with cement. All cement was received in sacks.

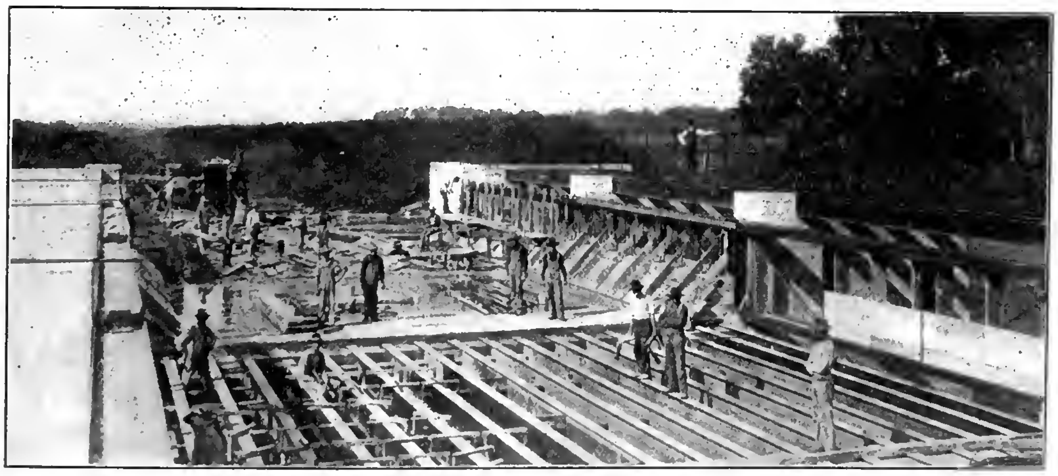
The concrete was mixed in a one-half yard Smith mixer mounted on a frame with an engine and vertical boiler, the concrete proportions being 1 cement, 3.5 sand and 4.5 crushed rock. The materials were loaded into a car, in which they were measured, the sand being placed in the bottom and the rock on top, with the cement sandwiched between. The car was designed and built for use on the concrete work on the canal. It consists of a wooden hopper lined with sheet steel, having a slide in the bottom for dumping, mounted on two pairs of trucks of 36-in. gauge. Its capacity is about 20 cu. ft. The car was pulled up an incline by a single horse to a platform above the mixer, where it was dumped through an extension chute into the machine and mixed.

The concrete was dumped from the mixer into one of the concrete cars described, which was pushed onto an elevator and hoisted to a trestle where it was pushed by two men to the form where the concrete was deposited. In order to provide a passageway for cars without using switches, a track just long enough to hold one concrete car was constructed, at the same elevation as, and on the opposite side of the elevator, from the track leading to the forms. Two cars were used for carrying the concrete, one car being at the mixer when the other was on the upper concrete track. The cage of the elevator would be left at the top, making a continuous track over the elevator, and the car from above would be run over it to the passageway. The cage would then descend, the car of concrete be placed thereon, and raised to the upper track. As soon as the loaded car was pushed off, the empty one was pulled on and lowered to the mixer, and the operation repeated. For every load of concrete taken to the forms, it was necessary to raise the cage twice. In this way, the elevator man also acted as switchman.

The mixer was placed about 50 ft. below the downstream end of the piers and a trestle was built from the elevator, which stood just in front of the mixer, to the forms, a track being laid on it extending from end to end of the several piers and abutments.

The forms were built with posts of 6 x 8-in. timbers and the lagging of 2 x 12-in. pine plank, surfaced on two sides. The posts were placed opposite on the two sides and 4 ft. between centers. They were tied together at the top about 2 ft. above the concrete with a 3 x 12-in. plank and at two intermediate points between top and bottom by ⅝-in. rods. Planks were spiked to the grillage timbers to catch the heels of the posts, and the upper tie carried the concrete track.

The piers were divided into two sections by a bulkhead at about the center of the forms. The abutments were built in six sections, the two parts of the breast wall being first, the canal retaining walls next, and the wing walls last.



Progress View during the Work of Lining Aqueduct No. 7.

The work was carried on by two shifts of 8 hours each. No special effort was made to complete the work as a monolithic structure, but at the close of work on the second shift, the concrete was leveled and tamped as nearly horizontal as possible. The masonry was not faced, the concrete being thrown up against the sides of the form, allowing the coarser parts to rebound, and the crushed rock was omitted from the last batches on top.

The piers and abutments at Aqueduct 4 were built with natural gravel and the Chicago AA brand of Portland cement. The specifications for cement were those formulated by a Board of Army Engineers and published as "Professional Papers No. 28, U. S. A."

The following extract is from the specifications for concrete, and proved to be quite effective:

"Abutments and piers of aqueduct bridges shall be built of Portland cement concrete so proportioned that there are no voids when compactly rammed, and shall contain on an average, for each section of wall, one and one-tenth barrels of Portland cement per cubic yard in place, including facings, copings, and bonding layers, as hereinafter described. In no case will a greater proportion of sand than three parts sand to one part cement be permitted to be used. In case the number of barrels in any piece of masonry falls below the average stated above, then the price per cubic yard shall be reduced in proportion to the reduction in amount of cement used. Prices of concrete will not be increased if greater

quantities of cement than specified above per cubic yard are used."

The gravel contained about 55 per cent. of pebbles and the proportions for concrete were made 1 cement to 5½ gravel.

The concrete was mixed in a 1¼-yd. Page mixer, an invention of Mr. J. W. Page, one of the contractors. It is an open drum batch mixer mounted on the end of a shaft inclined at an angle of 52 deg. with the vertical plane. It is operated by spur and bevel gearing by a 20-h.-p. two-cylinder vertical reversing engine. Its capacity is about 15 batches per hour.

A platform was built around the drum of the mixer, on which the cement was unloaded. The gravel (27 cu. ft.) was loaded into a 1¼-yd. side-dump car and pulled up an inclined track by a 20-h.-p. double-drum hoisting engine, onto the platform in front of the mixer, where it was dumped into the drum with five sacks (5 cu. ft.) of cement.

The concrete was dumped through a door in the side of the drum into a hopper concrete car with bottom dump, and hauled to the forms by a cable operated by the second drum of the hoisting engine previously mentioned. A small trestle was built from the mixer to the form and the concrete car was pulled up an incline, about 22 ft. long with a rise of about 10 ft., to a track on top of the form. This allowed the distribution of the concrete along the entire length of the pier or abutment.

The forms were built about the same as at Aqueduct 9. The form for the nose was built in two pieces, which were left intact when wrecking the forms. The short planks in the nose were beveled to fit the corners and were spiked to 6 x 8-in. posts. The two pieces of the nose forming were fastened together where they met by bolts through the posts. The posts were also supported by diagonal braces from the ground.

The concrete would be considered a wet mixture. All of the exposed surfaces were faced with a mortar of 1 cement to 2 Mississippi River sand, 1½ in. thick.

The piers were divided into two sections, each of which were built in one day.

The materials for the concrete lining for Aqueduct 9 were the same as used for the piers and abutments, although crushed rock was not used except for the concrete over the piers. Marquette Portland cement was used exclusively.

The same one-half yard Smith mixer was used for mixing the concrete, but with an entirely different set up. The mixer was placed at the bottom of the canal between the embankments, and a short track for a material car was constructed over it. Over this track and at a height sufficient to clear one of the concrete cars, a hopper having a capacity of 6 or 7 cu. yd. was built. The hopper was about 9 ft. square at the top and had a 12 x 18-in. cast-iron chute with steel slide in its bottom which was opened and closed by a lever. The hopper was placed adjacent to the track on the canal bank. The sand or gravel, which had been stored on the opposite side of the canal bank the previous year, was loaded into 3-yd. dump cars and hauled with the narrow gauge locomotive by a circuitous route to the hopper, where it was dumped. From here the gravel was dumped into the material car where it was measured and pushed by hand to and dumped into the mixer. The concrete was dumped from the mixer onto a platform, where it was shoveled into wheelbarrows and wheeled to the forms.

The ends of the floorbeams and trusses are embedded in concrete, 4 ft. wide and 18 in. thick, over which the joint in the lining between the adjacent bays is made. This joint was made by placing a piece of house siding between the two pieces of concrete when it was built, subsequently removing it and filling the joint with coal tar pitch. As just indicated, the lining for each span was built separately, the floor and those parts of the side up to the top of the triangular reinforcement being built one day and the balance of the sides later.

For the floor forming, 2 x 12-in. by 8-ft. pine planks were laid horizontally between, and were supported from, the flanges of the floorbeams by small horses or brackets.

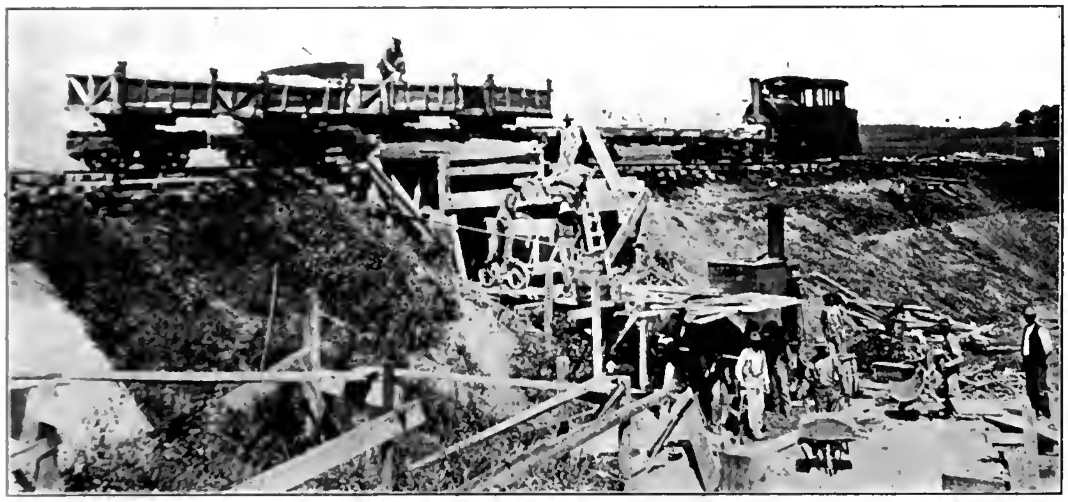
For the side forming, vertical posts were securely fastened between the two beams of the side truss every 4 ft., and 2-in. lagging nailed to them. To form the triangular portion, diagonal posts of 3 x 8-in. pine were nailed to the top of the vertical post, extending downward to the top of the floor lining, and were wired to the opposite side of the form. The lagging was placed under these diagonal posts as the concrete was deposited.

All of the reinforcing bars in the floor were laid in position and wired together the day before the concrete was deposited. At the same time, the vertical reinforcing bars for the sides were bent to a template and were wired at the top to a 2 x 4-in. strip. The horizontal bars were laid in position as the concrete was deposited.

Operations were begun on one of the sides, the first layer of concrete extending several feet beyond the side into the floor, on which a working platform was built. This consisted of three lines of 3 x 12-in. plank laid close together parallel to the side and on top of the fresh concrete with 2-in. strips laid crosswise thereon and a fourth plank carried on the strips.

A runway for filling the sides was supported from this plank. As the concrete was being deposited in the side, a second smaller gang of men kept the floor bond alive. This was done by placing a 2 x 4-in. strip on edge over the center of the floorbeam and depositing concrete between it and the concrete previously deposited with which it was bonded. The strips were 2 ft. 3 in. wide and extended the full length of one span of the aqueduct. When the first side had been completed to the top of the triangular section, the same operation was repeated on the other side, and a third small force kept the floor bond alive on that side. As soon as the second side had been completed, the entire force was concentrated on the floor.

Concrete Plant and Trestles at Aqueduct No. 9 in 1904.



Mixing Plant Used in 1905 for Lining Aqueduct No. 9.

The concrete was a wet mixture and was finished with a wooden float, no additional mortar being used.

At Aqueduct 4, 1.8 bbl. of Marquette Portland cement were used with 1 cu. yd. of bank gravel. The Smith concrete mixer was placed at the bottom of the canal with its hopper against the inside wall of the abutment. It was charged by one-horse dump carts from the top of the abutment walls.

The method of construction was practically the same as previously described. The concrete was deposited the middle of December, in freezing weather, the lowest temperature being 12° Fahr. The water for concrete was heated to about 130° Fahr., the exhaust steam from the mixer engine was discharged into the mixer, and the concrete was deposited at a temperature of 70° to 90° Fahr.

After the concrete was deposited, boards were laid on the fresh concrete to support carpenters' horses. Planks were placed between the horses, the entire area over the lining was covered with inch boards, and the space heated for about 48 hours with live steam.

The concrete deposited in freezing weather was apparently as good as any of that deposited in mild weather.

Each of the piers at Aqueduct 4 contain 191.5 cu. yd. of concrete and each abutment 350.5 cu. yd., a total of 1,467 cu. yd. There were 1,801 bbl. of Chicago AA cement used in the concrete besides 113 bbl. in the mortar for facing. The splay walls at the ends of the aqueduct contain 119.88 cu. yd. of concrete and required 159 bbl. of Chicago A A cement in their construction. The contract price for Portland cement concrete was

$7.07 per cubic yard. The total cost of the masonry, including splay walls, was $11,219.24.

The unit costs for materials and labor for the earthworks, foundations, piers and abutments at Aqueduct 9 amounted to 31 cents for 16,471 cu. yd. of excavation, 25.1 cents for 7,000 cu. yd. of back-filling, $5.92 for 632 round piles, $64.75 per thousand feet for 18,616 ft. B. M. of sheet piling, $38.81 per thousand feet for 40,050 ft. B. M. of grillage, $6.66 for 3,612 cu. yd. of concrete, and $3.70 per linear foot for cofferdams. In addition $1,645.15 was spent for engineering connected with these items, $1,663.85 for pumping and $1,485.92 for the emergency gates set in place. The unit costs for the superstructure, splay walls and lining at the same structure were 2.3 cents for 427,889 lb. of steel in the superstructure, $6.217 per yard for 206 cu. yd. of concrete in splay walls, $8.702 per yard for 329 cu. yd. of concrete in the lining and 2.32 cents for 30,924 lb. of reinforcing metal. The engineering cost $715.

The following is the scale of wages for the above work, 8 hours constituting a day: Overseers, $100 per month; locomotive enginemen, $90; pump enginemen, etc., $60; stokers, $60; watchmen, $45; teamsters with teams, $3.50 per day; capenters, $2.50; laborers, $1.75; waterboys, 60 cents.

The average cost of 35 spans of the reinforced concrete lining of the aqueducts is $756.87 per bay, and the average cost of the concrete is $9.48 per cu. yd.

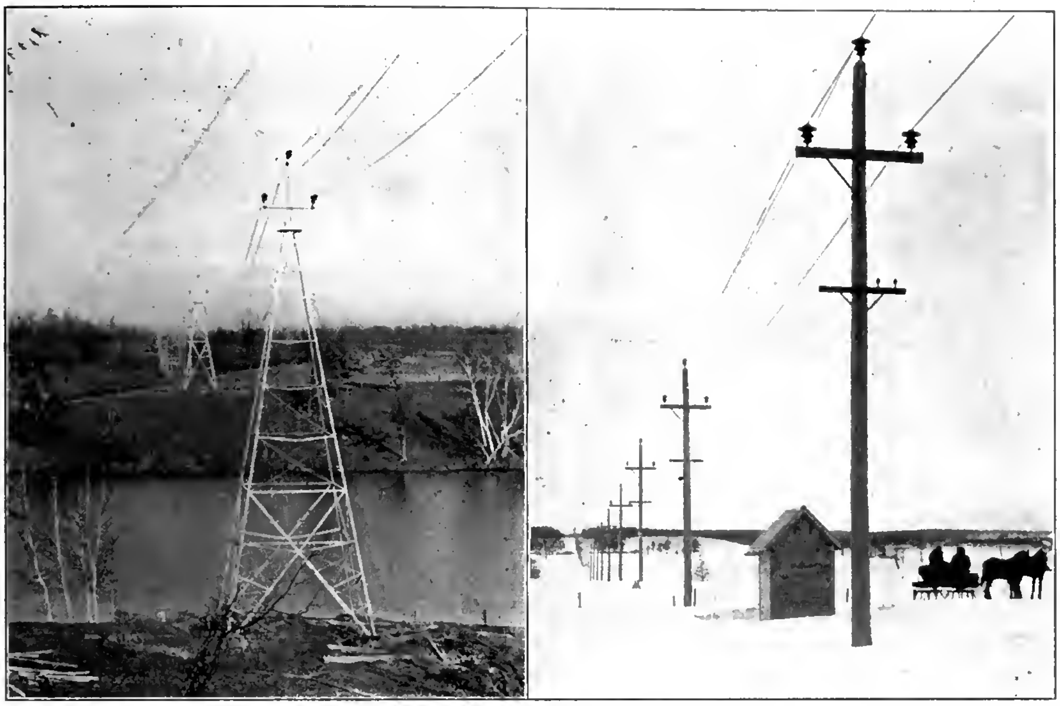
The work of construction of all work on the feeder and Western Section of the canal has been in charge of Assistant Engineer L. L. Wheeler, and that on the Eastern Section in charge of Assistant Engineer J. C. Long. Major W. L. Marshall, Major J. H. Willard, Major C. S. Riché, and Lieut-Col. W. H. Bixby, Corps of Engineers, U. S. A., have had supervision successively of the work in the district in which the canal is located.

My thanks are due Messrs. Wheeler, Rowse and Reeves for help in preparing this article.

A High-Voltage Third-Rail Interurban Line is under construction in California between Marysville and Nevada City and Auburn, using a protected under-running conductor rail on private right of way and overhead wire and pantagraph trolley in public streets. The operating voltage is 1,200 volts direct current.

The Taylor's Falls, Minn., Water Power Development.—II.

Transmission Line.—At present one transmission line has been built on private right-of-way from the power station to the step-down sub-station at the city limits of Minneapolis and St. Paul. The right-of-way is practically straight and in general is 60 ft. wide, being laid out for a pole line 10 ft. from each boundary line. The present line, which is 40.6 miles long, is of 4/0 semi-hard-drawn copper cable carried on wooden poles, with the exception of certain long spans across swamps, lakes or other obstructions where Aermotor steel towers are used. The standard pole of the transmission line is of Idaho cedar, 45 ft. long, carrying 5 x 7-in. cross-arm, 7 ft. 4 in. long, and a small cross-arm 7 ft. below for the telephone line. The transmission wires are carried on four-part porcelain insulators of special design, which are arranged on a 72-in. equilateral triangle with the apex at the top of the pole. The top insulator is cemented to a bracket pin swedged out of extra heavy 2-in. iron pipe, while the cross-arm insulators are carried on pins of the same material set into the arm in the usual manner. The cross-arms are bolted to the poles, braced with a single angle iron on one side and fitted with bolts through and on each side of each pin to hold the pin firmly and to prevent splitting of the arm. The standard span on pole construction is 140 ft., the spans on the tower construction reaching up to 600 ft.

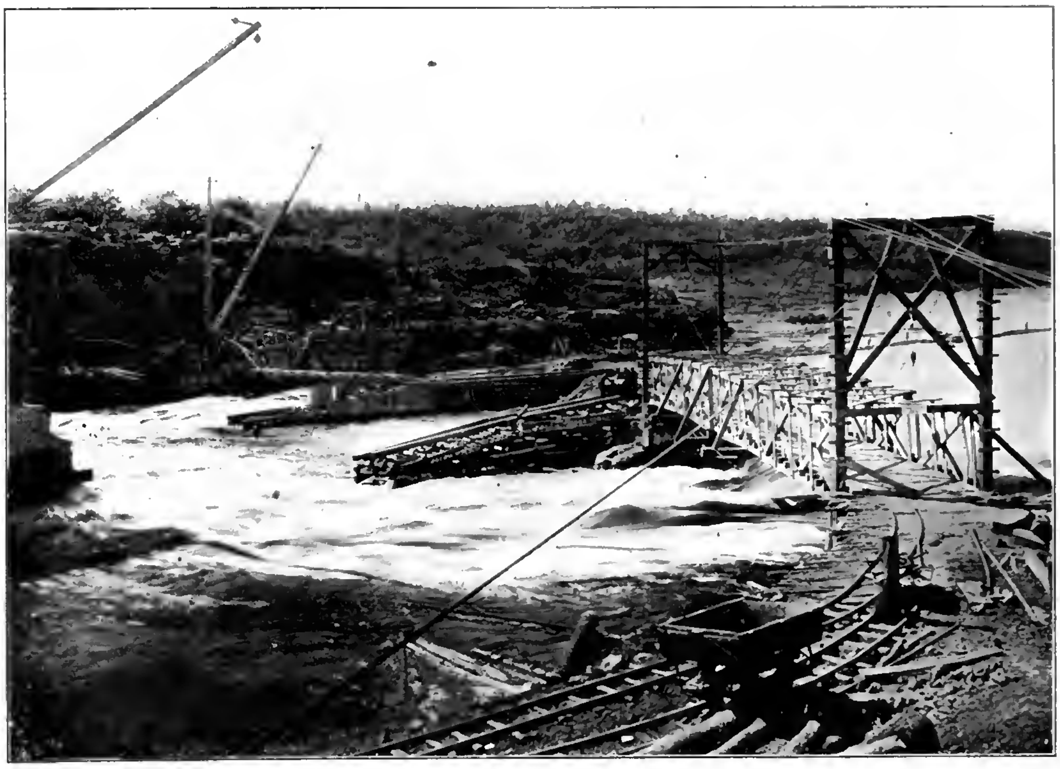


Two Typical Transmission Line Views, Taylor's Falls Development.

The telephone line consists of two No. 10 copper wires connecting permanent instruments at each power station and at a patrolmen's cottage at the centre of the line, and with temporary connections in booths arranged along the line for the use of the patrolmen. The telephone instruments and connections are all arranged with high insulation repeating coils to protect the attendants against possible shock from induction from the transmission line.

Owing to the prevalence of thunder storms over the middle portion of the transmission line, this part is protected by several different experimental constructions of overhead grounded wires, lightning rods on the poles and also on separate poles arranged alongside and reaching above the transmission line. The Westinghouse Co. standard low equivalent arresters are used to protect the station apparatus at both ends of the line and in addition three types of horn arresters and other special devices have been put up.

Main Step-Down Sub-Station.—The step-down sub-station is built of brick and steel with reinforced-concrete floors, and has a timber framework to support the wiring, which is open throughout. The building is divided into two rooms, one containing the transformers and the other the switchboard and wiring. The transformer room is screened off by a brick wall with a reinforced-concrete floor overhead. The entrances of present and future transmission lines are at one end of the building, while exits for three 13,000-volt outgoing lines are provided along each side. Three banks of transformers duplicating those at the power station are now installed with provision for three additional banks in future. These transformers are now connected for stepping down from 47,500 to 13,800 volts.



Cofferdam Used in Building Closing Section of Spillway.

Arrangement of Construction Plant for Taylor's Falls Station.

The wiring consists of two high-tension busses and two low-tension busses to be joined in the future in each case by a junction switch at the end of the building. The transformers and incoming and outgoing lines are controlled by Westinghouse oil switches mechanically connected to lever handles on the switchboard, which is arranged on the second floor across the building near the transmission line end. The oil insulated choke coils, instrument transformers and high-tension lightning arresters are arranged on a reinforced-concrete gallery at the end of the building and the arresters and oil switches controlling the outgoing lines are arranged on the second floor and gallery above. The transformers are provided with an oil treating system similar to the one at the power station. Water for cooling the transformers is pumped from a deep well and circulated by motor-driven turbine pumps and finally discharged over a cooling screen into an artificial pond outside the building. The cooling coils of each transformer are provided with Venturi meter tubes and gages to indicate the amount of cooling water used at all times and each gage is provided with electric contacts which ring an alarm and indicate by lamps in case the flow in any transformer falls below a given amount.

Construction.—The construction of the dam and power house was handled with considerable difficulty, owing to the swiftness and volume of the stream; the frequent changes in the stage of the river; the necessity of sluicing logs during the spring and summer months; the extreme toughness of the trap rock encountered in the excavation and the heavy flow of ice during the spring freshets.

The materials and equipment required in building the two structures, excepting the sand and stone used in the concrete, were brought in over a standard-gauge spur track about 1½ miles long, that was built especially for the purpose from the Minneapolis, St. Paul & Sault Ste. Marie R. R. This track extended from the end of that railroad at the village of St. Croix Falls on the Wisconsin side for about ¾ of a mile upstream to a switch back and from there back about ¾ of a mile downstream to the power house site. It ended about 150 ft. from the upstream side of the power house and was back about 250 ft. from the straight section of the spillway of the dam, parallel to the stream and 40 to 50 ft. above the bed of the latter.

The dam and power house were both built on the solid trap rock which underlies the entire site on the Wisconsin side of the river. The foundation of the power house was excavated out of this rock in the downstream side of the ledge through which the forebay canal was dug. The straight section of the dam at the power house and the downstream end of the spillway were built on this ledge after it had been stripped down below any fissures. The balance of the spillway was built on the trap rock which formed the bed of the stream after all loose rock and sand had been removed. The bear trap dam and log sluice on the Minnesota side of the river were also built in excavation made in the solid rock bank.

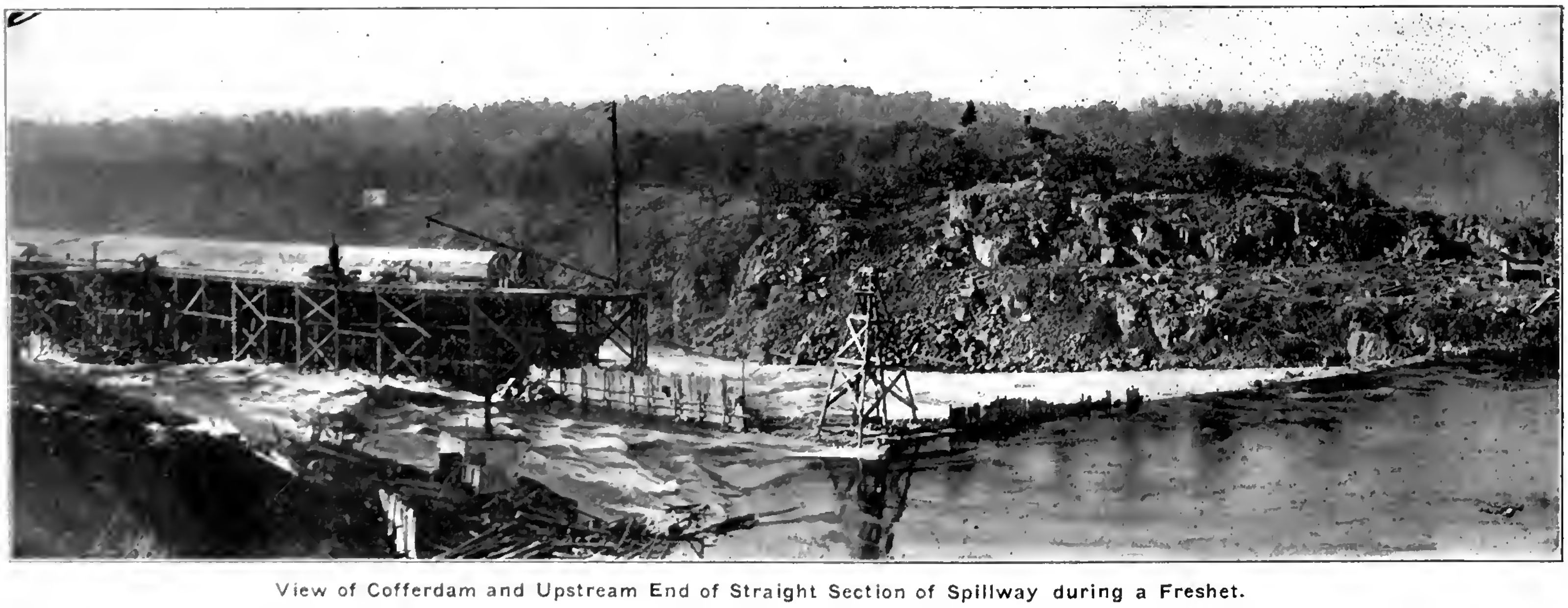
Concrete and Concrete Mixing Plants.—The mixture of concrete used for the greater part of the work was one part Atlas Portland cement, three parts sand and five parts broken stone. The sand was obtained from a bank 1,500 ft. from the site of the work. It was brought to the mixing plants in cars run by gravity on a track laid from the sand bank to the two mixing and crushing plants. After they had been dumped the cars were hauled back to the pit by horses.

The trap rock excavated from the canal and power house site was crushed to a size that would pass the meshes of a 2½-in. screen and then stored in bins to be used in the concrete. Large pieces of trap rock taken from the excavation, varying in size from those that could be handled by one man to those containing about one cubic yard, were placed in the green concrete of the dam and power house foundations. These pieces of rock were placed at least 1 ft. apart and 1 ft. from the surface.

A concrete mixing plant was set up beside the standard gauge spur track nearly in line with the junction of the curved and straight sections of the spillway and 150 ft. back from the latter at the top of a sharp drop in the river bank. This plant contained a 1-yd. Smith concrete mixer set on a platform about 4 ft. above the ground. Over this mixer were measuring hoppers for sand and stone, and above these the storage bins for those materials.

The rock was brought to the plant from the excavation on a narrow-gauge track which ran up an incline to the level of the crushers. It was first passed through a McCully gyratory crusher and then elevated to a 2½-in. mesh screen over the rock bin; all pieces that would not pass through this screen were returned to a No. 3 McCully crusher, which also delivered to the elevator. All rock that would pass through the screen fell into the storage bin for crushed stone.

The storage shed for cement was erected alongside the spur track; cement was delivered from this shed to the charging platform of the mixer on push cars. The straight section of the spillway was built from tracks on a temporary trestle about 15 ft. below the top of the dam. This trestle carried three tracks; one of standard gauge on the dam side, a 36-in. gauge next, and a 24-in. gauge on the outside, with extra rails



View of Cofferdam and Upstream End of Straight Section of Spillway during a Freshet.

provided in the outer tracks and arranged so that a 24-in. and a 36-in. gauge track were also made on that side. These tracks were connected with the mixer by a trestle which ran from it to the main trestle. The standard-gauge track carried two cars, each mounted with a guyed derrick having a 60-ft. boom. These derricks handled the rock excavated from the site of the dam; the forms for the concrete and the skips in which the concrete was delivered on the cars from the mixer.

What little coffer-dam work was necessary for this portion of the dam was done with gravel brought from an adjacent gravel bank. This section of the dam contained at the base three pairs of 9x12-ft. arched openings which were left to provide for the passage of the river while the closing section of the dam was being built.

After the work had been in progress for a few months a second crushing and mixing plant, a duplicate of the first, was erected on the river bank above the site of the power house and 300 ft. downstream from the first plant. A trestle connected this second plant with the main trestle along the dam.

The second portion of the dam crossing the bed of the river was a more serious proposition to construct than the first, owing to the liability of sudden and rapid changes in the stage of the stream. The cofferdam to turn the river while this portion of the dam was being built was constructed of log crib work, weighted down with rocks taken from the excavation. Sheet piling was placed on the upstream side of the crib work and gravel and clay were used to fill the interstices of the rock in the cribs. Large quantities of brush were also placed outside of the sheet piling and clay and gravel dumped over them, this method of construction being found very effective in the swift curent of the congested channel.

The concrete for this portion of the dam was brought to position in dump cars running on a track blocked up on top of the completed portion. An elevator brought the dump cars of concrete to position on this track from the lower level of the trestles running from the two mixing plants. From the dump cars the concrete was placed through chutes extended to the work from the end of the track. As the dam was completed the latter was gradually extended. This method of placing the concrete was found to be faster than the use of derricks, and gave excellent results.

The foundations of the power house were largely put in in the winter with the temperature at times as low as 20° below zero, Fahr. For this winter work one of the mixing plants was fitted up so that live steam could be run through the sand and rock bins and into the water tank. In very cold weather salt was also used in the water. The concrete thus made was found to be hot enough to get its initial set before it could freeze and the results obtained were uniform and excellent.

The concrete for the bear trap dam and sluiceway for logs was procured from a separate plant set up on the Minnesota side of the river. This plant consisted of a ½-yd. Smith mixer placed on the river bank immediately above the site of the work. Most of the concrete supplied by this mixer was put in position through a chute running directly from the latter to the point where concrete was being laid. In such portions of the work as could not be reached in this way the concrete was handled by a derrick set in the lower end of the sluiceway.

The dike on the Minnesota side of the river was built of gravel concrete on a stratum of hardpan and sandstone. A separate concrete mixing plant was installed for this work, using the same ½-yd. Smith mixer which was employed in the construction of the bear trap dam. A trestle ran from this mixer immediately above the dike and on this trestle the concrete was handled in dump cars from which it could be put directly in position. The sand and gravel were obtained from a bank near by which was connected with the plant by narrow-gauge tracks.

The plans for the Taylor's Falls development were prepared by Messrs. Stone & Webster, of Boston, Mass., and the construction work and installation of the machinery in the power house were executed under their direction. Messrs. Dean & Main, of Boston, were the consulting engineers in connection with the preparation of the plans for the hydraulic features of the development. Messrs. Loweth & Wolfe, of St. Paul, Minn., conducted the preliminary hydraulic investigation.

Gasoline Motor Service on the Union Pacific Ry.

An interesting innovation in railway passenger transportation in this country will be inaugurated next month, when, it is announced, the Union Pacific Ry. will place in service twelve gasoline rail-motor cars. The cars are intended for branch-line traffic, where the fast and frequent service required cannot be maintained by ordinary trains except at a loss.

The lastest type of these cars developed at the Omaha shops of the Union Pacific makes 60 miles an hour with a 200 h.-p. engine, reaches high speed within six car lengths, and can be stopped within 120 ft. With these advantages the cars can be put on a much faster schedule than is possible with the steam locomotive.

Outwardly the newest of the cars, which are built entirely of steel, resemble a turned-over racing yacht. The forward end tapers sharply, and the roof and rear are rounded off to reduce the air resistance and avoid the vacuum produced by a square car. Rounded windows give to the passengers a wide range of outlook, and increase the nautical appearance of the car.

In cold weather the cars are to be heated by hot water from the cylinder jacket. They are lighted by acetylene gas shining through opalescent panels.

For sanitary reasons the floors of the cars are built so that they can be thoroughly cleaned by flushing with hot water. The familiar system of ventilation has been replaced by roof ventilators which exhaust the inside air by suction, fresh air being taken in from the car roof in front. Vibration is reduced to a minimum by the way in which the motor is balanced.

The cost of operating the cars varies from ten to twenty cents a mile, according to the density of the traffic, but the records kept indicate that the rail-motor car will make possible great improvements in handling branch-line passenger traffic.

THE FREEZING PROCESS of sinking shafts has been successfully employed at a colliery at Seaham, England. At this place there is a deep bed of limestone under which is a 92-ft. stratum of water-bearing sand. The limestone also carries much water. Twenty-eight bore holes were marked off in a circle 30 ft. in diameter around the shafts and were sunk to a depth of 484 ft. Pipes were placed in these holes and connected with apparatus producing a circulation of brine, which formed an ice wall in 185 days. The sand was struck at a depth of 371 ft. after the freezing had been completed, and was found to be so hard as a result of the process that blasting was necessary in places. When the shaft had been sunk through the water-bearing materials, the ground was thawed by circulating warm brine through the freezing tubes.

The Quebec Bridge Superstructure Details.—II.

Vertical Bents on Main Piers—Pedestal.—The 166,000-lb. pedestal is seated on the bolster and is pin-connected to the foot of the main post. It is a 11x13-ft. frustum of a rectangular pyramid and is about 8 ft. high. The construction, although of a simple type corresponding with that of the ordinary pedestal for a bridge truss bearing, was rendered very difficult on account of the great thicknesses required for the different bearings, the necessity of securing perfect contact between the webs and base, the provision of satisfactory connections for such large stresses in oblique directions and the arrangement of details to avoid costly operation and make the shop work conform to regular standing. The construction, involving a great number of pieces, made it necessary to provide numerous plans, elevations and sections, to show their relative positions and the numerous dimensions and notes required for their proper construction. The shop drawings, at 1-in. scale cover all of a 39 x 130-in. sheet and occupied an expert draftsman seven months. It is therefore obvious that it is impossible within the limits of this description to fully show the drawings; so only enough typical plans and elevations are here given to show the general character of the construction and the great care and accuracy with which it was designed.

The base plate 3 in. thick is planed on both sides and is made with three pieces with a planed butt joint on the longitudinal center line of the pedestal. To it are riveted five vertical longitudinal webs bored for the 24-in. pin 7 ft. long, which receives in them a total bearing nearly 3½ ft. long, thus reducing the pressure on the metal to the allowed unit stress of 28,000 lbs. per sq. in. All of the webs are built up of 1-in. intermediate plates and 1⅛-in. outside plates, riveted together to make up the required thicknesses. The outside webs are made with 6 plates each and the intermediate webs with 10 plates each. In the outside webs all plates receive full holes, but in the intermediate webs the two outer plates on each side of each web terminate on the center line of the pin so that they only have half-hole bearings while the inner plates have full holes. The webs are connected to the base plates with special angle sections made by cutting off one flange of a 15-in. channel, thus leaving a vertical leg 15 in. long, through which 5 rows of rivets are placed while only a single row is driven through the comparatively narrow lower horizontal flange. The webs are stiffened and connected by five lines of transverse vertical diaphragms of different types according to the clearances required for the pins and connecting members. Each diaphragm is made with four 6 x 8-in. angles, two of them riveted back to back on the face of one diaphragm to form a T-bar section and the other two riveted to the opposite diaphragms with their outstanding flanges separated far enough to clear and engage the outstanding flanges of the first pair. The interlocking flanges are connected by bolts close together since the space does not permit driving rivets through them. The outer webs are located about 3½ ft. clear of the edges of the base plate and are provided on their outer faces with five heavy vertical transverse diaphragms in the plane of the interior diaphragms, which help distribute their load and stiffen the base plates to transmit the pressure uniformly over its entire surface. The inclined edges of all the diaphragms are stiffened with pairs of 6 x 8-in. flange angles. Most of the webs are single 1-in. plates, but in the two diaphragms nearest the center one the webs are

made of three thick plates and the two outer plates are bent at the inner edge to form flanges riveted to the main web instead of connecting angles. Angles with one long and one very narrow flange are made by cutting off one flange of a 10-in. channel and partly cutting off the other and are riveted to the inclined outer edges of the main web to receive cover plates put on to give them a neat finish and exclude water from the open joints.

The pedestal is provided with horizontal and inclined transverse connection plates forming pairs of jaws field riveted to the ends of the lower chord sections and bottom lateral members. As very heavy stresses are transmitted through these connections great care was taken in designing them; they were accurately fitted in the shop to large details accompanying the general drawing as shown in the sketch herewith reproduced. The pedestal is connected to the bolster by seventy-six 1⅛-in. vertical bolts. The spaces between the webs are closed as much as possible to exclude rain, snow and rubbish; drainage holes are provided in the upper transverse plates and in the lower edges of the outside cover plate to permit the melted snow and rain to escape as much as possible. The dimensions of the pedestal are so great that it was found impossible to ship it from the shop to the bridge site on an ordinary car or in an ordinary manner. It was therefore transported as noted in The Engineering Record of September 16, 1905, on a special steel car, built for the purpose with an unfloored frame-work of heavy girders, from which the pedestal was suspended by a heavy box girder passing through its pin hole and allowing it to be suspended with its lower edge 6 inches clear of the top of the rails.

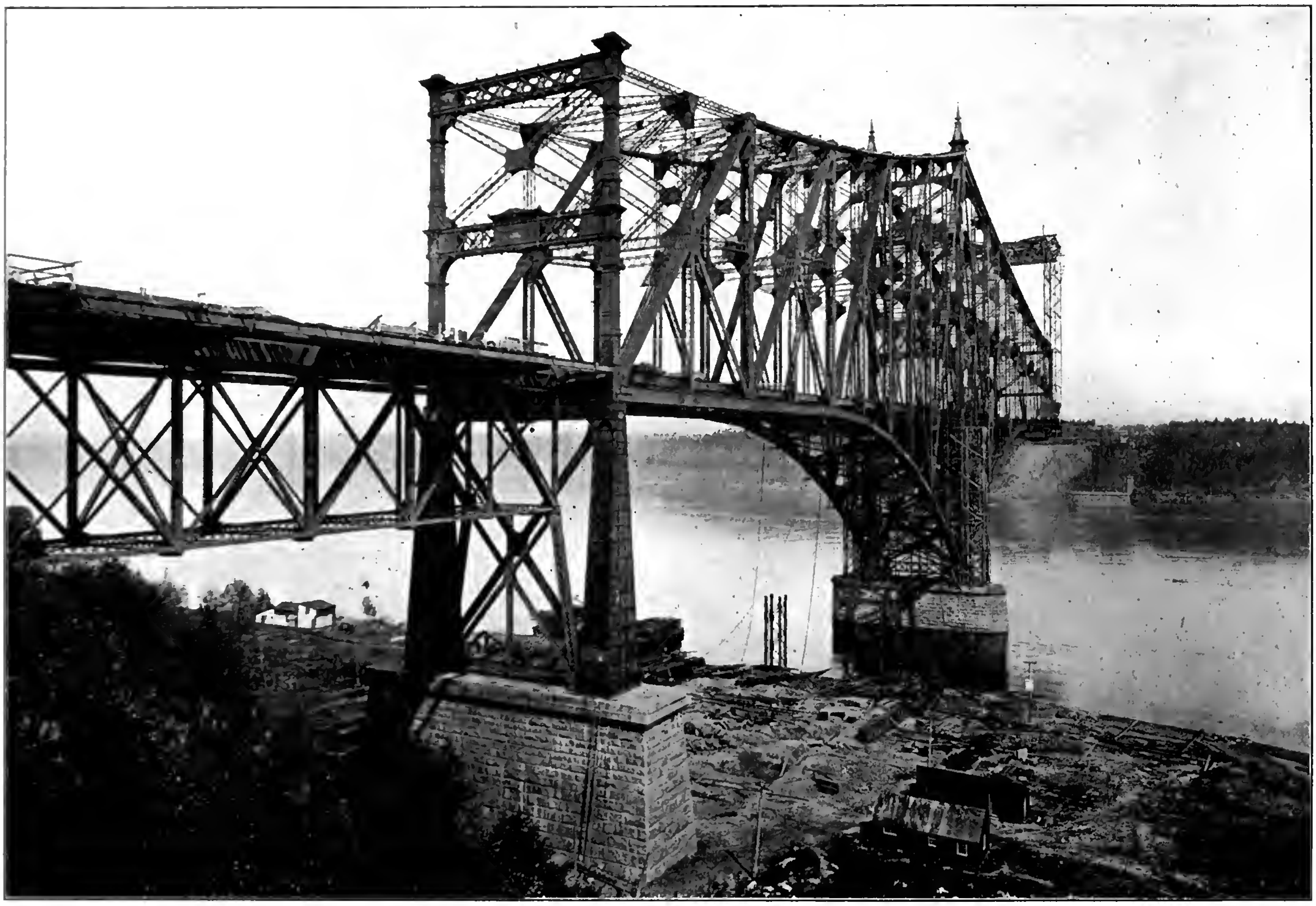
The vertical post is the most important single member connected to the pedestal and it has a special shoe riveted to the lower end with four vertical longitudinal webs engaging the 24-in. pin which locks it to the pedestal. The shoe is 9 ft. high and weighs 67,000 lbs. The 5½ x 10-ft. horizontal upper surface, corresponding to the base plate of the pedestal, is made with a single 1¼-in. plate, planed on both sides and secured by about 200 field rivets to the corresponding horizontal plates in the bottom of the lower section of the vertical posts. The four webs clear those of the pedestal and are each 6¾ in. thick, thus providing a combined bearing 27 in. long for the transmission of the 10,000,000 lb. stress in the post to the pedestal. Each web is built up of four ¾-in. plates, three plates being cut off on the center line of the pin so as to afford half-hole bearings and the fourth plate being extended to receive a full hole and thus lock the shoe to the pin. The webs are connected by four lines of inclined diaphragms, those between the outer pairs being made like those described for the pedestals with two pairs of engaging angles back to back riveted to their adjacent faces. The space between the inner webs is sufficient to enable their diaphragms to be made in the usual manner with a ¾-in. web plate and two pairs of 8x8x¾-in. flange angles. Between the flange angles the web plates are reinforced by pairs of ¾-in. cover plates, giving them a uniform thickness throughout of 2¼ in.

The shoe is provided, like the pedestal, with horizontal and inclined transverse plates perpendicular to its web which engage the upper flanges of the lower chord sections and are thoroughly field riveted to them. The connection plates are shop riveted to the outside webs and are reinforced in the center by heavy brackets with their lower ends faced to bearing against the plates.

The main lower chord pin which connects the pedestal and shoe is 24 in. in diameter, about 7 ft. long and weighs 10,000 lbs. It is doubtless the largest pin yet constructed for a bridge truss; it is made from open hearth steel of about 70,000 lbs. tensile strength, forged under a pressure of 5,000 tons; it has a hole 6 in. in diameter through its axis, through which a 1½-in. rod passes to connect and hold in position the steel discs covering the ends of the pins in lieu of nuts.

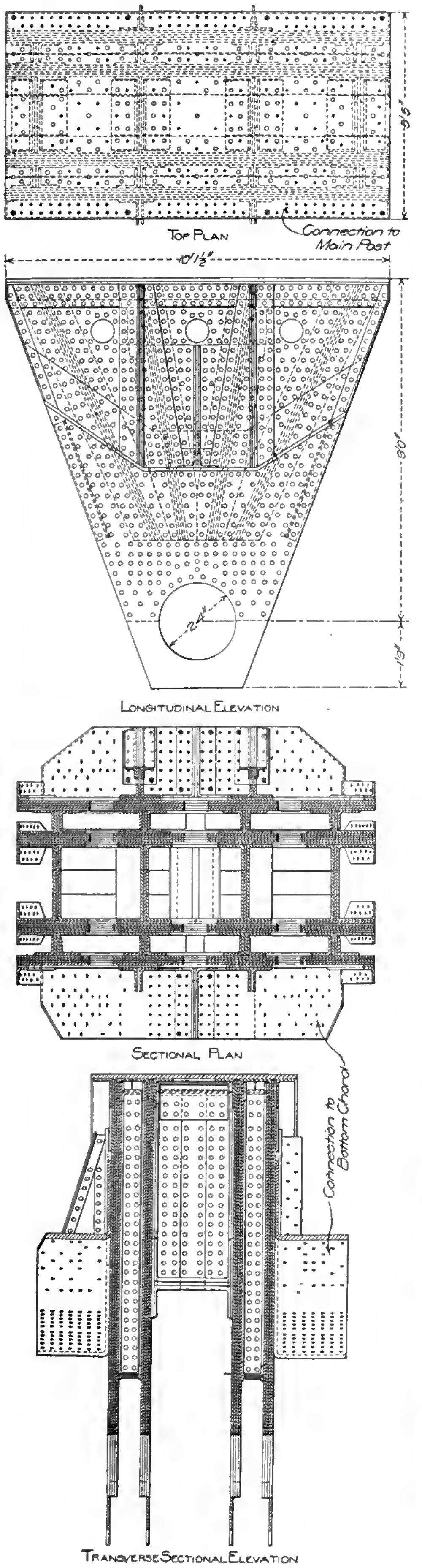
Between the outer webs of the shoe and pedestal it receives the webs of the short end sections of the lower chords which are reinforced to total thicknesses of 6¾ in. These are made with full-hole bearings in V-shaped special sections about 14 ft. long and weigh about 120,000 lbs. each; they were assembled with the shoe and the pedestal, independent of the main sections of the lower chords, which were spliced to them at convenience later. Notwithstanding the mass and rigidity of the members they were designed to fit together with clearances of only 11/16ths in. on the main pin; they were so truly dimensioned and the shop work was so accurately executed, that they were assembled without difficulty in the field. The diagonal members of the truss are theoretically connected to the short pin on which their center lines intersect, but for convenience they are made with separate connections, field riveted to the foot of the lower section of the vertical post.

The accompanying view of the bridge was made from a photograph taken June 12, and is the first picture published which shows the structure from this point, looking upstream, and including the approach span and the complete sub-



View of Approach Span, and of South Anchor and Cantilever Arms.

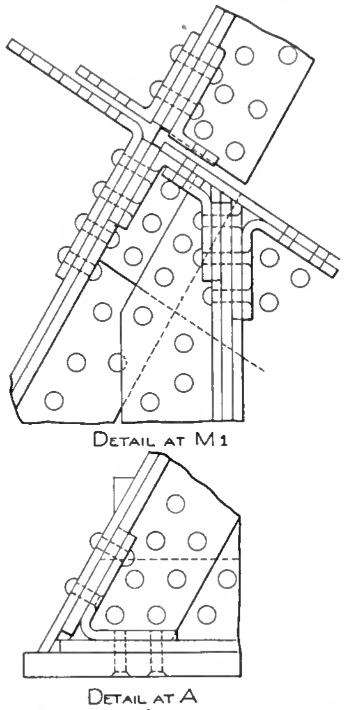
structure on both sides of the river. It shows the completed 600-ft. anchor arm and the 562½-ft. cantilever arm and gives an especially clear view of the south anchor pier and the riveted



Shoe for Main Post.

towers on it enclosing the vertical eyebars extending from the end pins to the anchorage platform enclosed in the base of the pier.

The falsework has all been removed except the bents on the main pier, outside the trusses, and the lower story of the last two bents on shore, and part of it can be faintly seen erected on the opposite shore, half a mile away, while a portion remains piled on the near shore ready for transportation to the other side. The temporary erection girders are still suspended from the extremity of the cantilever and the great traveler supported on them is being dismantled for re-erection on the opposite side of the river. All the principal members are in position in the anchor and cantilever arms and they are completed except for part of the field riveting, which is still in progress from scaffolds, almost imperceptible



Web and Base Plate Connections of Pedestal.

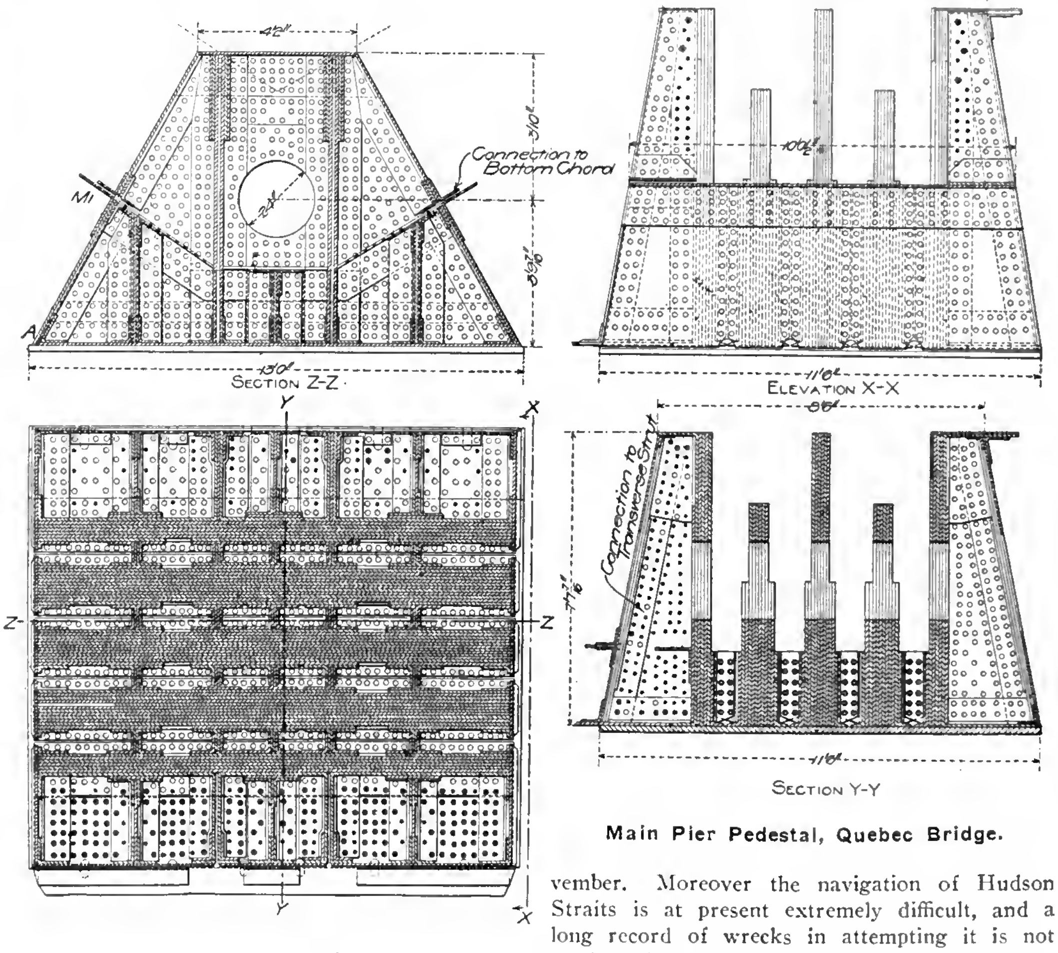
to the scale of the picture, which are suspended from different points of the lower chords and elsewhere.

All of the 3,202 eyebars have been completed, 23,000 tons of steel have been shipped to the site, 12,000 tons more are completed and held in storage at the bridge shops, and only about 3,000 tons more are yet to be riveted in the shops. The steel for the north half of the bridge is being stored in a yard established about 8 miles from the river, at the nearest point now accessible by railroad, where there has been installed an electric traveling crane and service tracks corresponding with those for the south side, described in The Engineering Record of March 4, 1905.

The railroad track is under construction from these yards to the bridge site, and as soon as it is completed the materials will be forwarded to the river and the north anchor arm, north cantilever and north half of the suspended span will be erected in the same manner as previously adopted for the corresponding south portions of the bridge. It is expected that this construction can be commenced early in 1908 and meantime a smaller overhead traveler will be built to run on the top chord and will, this summer, erect as a cantilever the south half of the 675-ft. suspended center span.

Hudson Bay Railway Projects.

Hudson Bay railway projects are now receiving a large amount of attention in the Dominion, and one of the charters for such a road has been secured by Mr. Hill, of the Great Northern system, who formerly ridiculed the project of constructing any line of this character. One of the Hudson Bay roads, the MacKenzie-Mann line, is already about a quarter completed. The great geographical advantage of the route is the shortness of the railroad haul to the ports on the Bay. Unfortunately the season of navigation in Hudson Bay is limited to the short period between the middle of June and the middle of November. Moreover the navigation of Hudson Straits is at present extremely difficult, and a long record of wrecks in attempting it is not particularly encouraging. Nevertheless it seems safe to say that the attention now being paid to the Hudson Bay route is bound to result in a great deal of more definite information concerning its practicability, and possibly before long such a line will be constructed. The Canadian Premier has advocated liberal subsidies to companies undertaking the work.



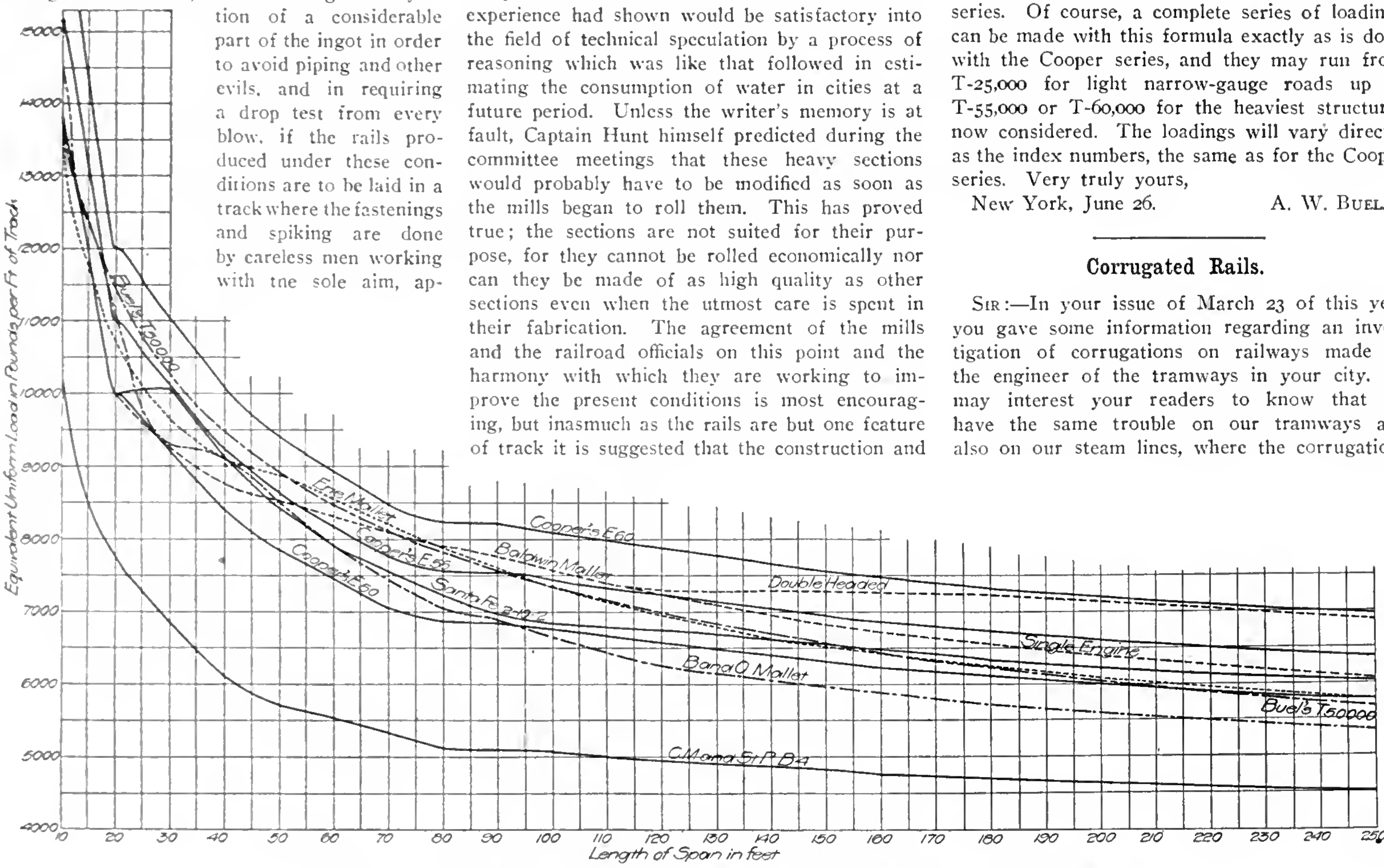
Main Pier Pedestal, Quebec Bridge.

Letters to the Editor.

RAILS AND TRACK.

Sir: Those who have followed the recent discussion concerning the quality of steel rails and at the same time have been in a position to know the manner in which rails are laid in some tracks probably will agree with the writer that the railway officials who are showing so much interest in improving the quality of the rails used on their line would do well to look at the same time into the way in which track construction and maintenance is carried on. Every one must agree that the precautions which seem likely to be taken to secure better rails, even at a considerably higher first cost, are so eminently in the line of an increase in safety as to deserve the heartiest support of stockholders and the traveling public. On the other hand, there seems to be some inconsistency in devising new sections, in demanding the rejection of a considerable part of the ingot in order to avoid piping and other evils, and in requiring a drop test from every blow, if the rails produced under these conditions are to be laid in a track where the fastenings and spiking are done by careless men working with tne sole aim, apparently, of getting the work completed just as fast as possible regardless of character. The brutality of the spiking is sometimes directly preventative of good track conditions. The punishment which rails received when laid improperly can be witnessed by any observant person during a ride of any length. It is generally possible to notice the action of the track under passing freight trains, even in a short ride of a few hours' duration, and after witnessing a few times the pounding of the rails and their vertical vibrations under heavy freight cars and under Pullmans, if one is fortune enough to have an opportunity to witness that, a most illuminating idea of certain track troubles and their cause can be formed. Unquestionably Mr. P. H. Dudley is entirely correct in his statement reported in your issue of last week that the average track on the New York Central lines is much stiffer than it was twenty years ago, owing to the use of heavier rail sections, but there are many lines in this country carrying very heavy trains which are not laid with rails of the New York Central weight and do not keep their roadbed up to such a high standard of maintenance.

These remarks are made without any intention of criticising the present apparent determination of the railway companies to purchase better rails even at an increased cost. There is every reason for improving the quality of rails, as was very well shown at the discussion of the American Society for Testing Materials at its recent convention. Very likely one reason that improvement in the quality of rails has not been more marked during recent years has been the adherence to the Am. Soc. C. E. standard sections for the heavier rails. Those sections were devised, as Captain Hunt pointed out at the convention mentioned, by a committee which had to work absolutely in the dark. Very likely Captain Hunt could have gone farther and stated that the sections were laid down by that committtee with the understanding that they would probably need material modification, and were a compromise or an extension of the sections which experience had shown would be satisfactory into the field of technical speculation by a process of reasoning which was like that followed in estimating the consumption of water in cities at a future period. Unless the writer's memory is at fault, Captain Hunt himself predicted during the committee meetings that these heavy sections would probably have to be modified as soon as the mills began to roll them. This has proved true; the sections are not suited for their purpose, for they cannot be rolled economically nor can they be made of as high quality as other sections even when the utmost care is spent in their fabrication. The agreement of the mills and the railroad officials on this point and the harmony with which they are working to improve the present conditions is most encouraging, but inasmuch as the rails are but one feature of track it is suggested that the construction and maintenance of the track itself might very properly be taken up with the same thoroughness at this time, so that by the time the mills are rolling better rails they will be used in a better manner. At the convention of the American Society for Testing Materials, one railroad officer stated that if the mills could not furnish a better quality of rails, unquestionably they would be subject to some kind of legislation; it is only reasonable to expect that probably the same kind of legislation might be directed at the railroads if they do not improve their track methods. X.



Graphical Comparison of Typical Engines with a Few Recent Heavy Engines.

BRIDGE LOADINGS.

Sir: The article on pages 712 and 713 of The Engineering Record of June 15, "A Comparison of E-50 Loading with Recent Heavy Locomotives," is very interesting and valuable. I have platted on the diagram on page 712, showing the graphical comparison of equivalent uniform loads from typical engines and a few recent heavy engines, another line (see accompanying diagram) showing the equivalent uniform load by my formula, using the index 50,000. This loading I have called T-50,000. The curve of the T-50,000 lies just slightly above all actual loads and above Cooper's E-55 for all spans between 18 ft. and 50 ft. For spans under 16 ft. it is very close to Cooper's E-50 and for spans over 50 ft., up to 250 ft., it crosses the Erie Mallet twice at a span length of about 100 ft., and again at a span length of about 170 ft., but for all spans between 50 ft. and 250 ft. it seems to follow the curve of the Erie Mallet single engine without departing from it more than 2 per cent.

This system of loading was presented at a discussion of the committee report of the American Railway Engineering and Maintenance of Way Association and published in the "Proceedings" of its Seventh Annual Convention, Volume VII, page 211.

I thnk that a mere inspection of the diagram with this line on it is sufficient to show the value of this loading, and that it seems to more nearly meet the actual loadings of to-day than the Cooper series. Of course, a complete series of loadings can be made with this formula exactly as is done with the Cooper series, and they may run from T-25,000 for light narrow-gauge roads up to T-55,000 or T-60,000 for the heaviest structures now considered. The loadings will vary directly as the index numbers, the same as for the Cooper series. Very truly yours,

New York, June 26. A. W. Buel.

Corrugated Rails.

Sir:—In your issue of March 23 of this year you gave some information regarding an investigation of corrugations on railways made by the engineer of the tramways in your city. It may interest your readers to know that we have the same trouble on our tramways and also on our steam lines, where the corrugations produce such a special sound that we call the rails on which they occur "roaring rails." The engineers of our North-Eastern Ry. have been paying considerable attention to the subject, but have been unable to discover the cause of the corrugations. An examination of many corrugated rails failed to show any connection between the corrugations and the composition of the metal or its fabrication, nor did the ballasting, grade and curvature of the track have any apparent influence. A number of rails, some roaring and some quiet, of the same character and from similar locations were subjected to physical tests and microscopic examination. Their hardness was ascertained by the Unwin knife-edge test, which showed that the roaring rails were harder than others, while tension tests showed that the metal at the high points of the roaring rails was stronger as well as harder than that in the low parts. The microscopic and chemical examinations gave no clue to the cause of the corrugations.

Trams.

London, June 11.

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TABLE OF LEADING ARTICLES.

Ethics, Law and Business Rules.

For a good many years the subject of engineering ethics has been discussed at meetings of technical societies. Until recently nothing came of this discussion, but a year ago the American Institute of Electrical Engineers turned over to a committee consisting of Dr. S. S. Wheeler, chairman; Dr. C. P. Steinmetz and Mr. H. W. Buck, the task of formulating such a code. At the recent convention of the Institute at Niagara Falls the committee reported a set of principles of professional conduct for the guidance of the electrical engineer, which is reprinted elsewhere in this issue. The committee reached the conclusion that it was impracticable at present to formulate an ethical code covering explicitly all the conditions which the electrical engineer may meet in his work, although it believed it to be desirable to record some of the principles which should be a guide, leaving it to him to make specific applications to his own work. The code was discussed at some length at the convention, but on account of constitutional limitations prohibiting any decisive action of a business nature affecting the Institute at a meeting for professional discussions of papers, no final decision regarding the report was reached. As the first attempt by a committee of a national engineering society to establish an ethical standard for its members, the report deserves a great deal of study.

In the first five paragraphs the code discusses certain general principles. It will be noticed, however, that there is no sharp line drawn between professional and business relations in this "general" section, although there is a fundamental distinction between the two. It goes without saying that whether a man be a consulting engineer or an employee on a salary, his relations with those about him may very properly be governed by the Golden Rule. Most people are content to acknowledge that that rule has never been equalled for comprehensive and concise statement; in fact, it was pointed out years ago at a meeting of the American Society of Civil Engineers that better compliance with it would remove the necessity of a code. There is always more or less difference of opinion, however, concerning the application of general rules to specific cases, and it is for this reason that a detailed code of ethics seems to be desired by a considerable number of engineers. In discussing the subject, however, they seem to forget there is such a thing as law in the land, and the legal relations between engineers and their employees or clients will always have to be established by courts and not by the resolutions of technical societies. The courts have many times indirectly drawn a distinction between the rules of conduct which should govern an employee and those which are binding on a professional man. The consulting engineer, like the lawyer, physician and architect, who claims to possess certain specialized knowledge which he places at the disposal of clients for a fee, has to regulate his conduct by legal rules different in some respects from those governing salaried employees. While all these rules are based on the elementary principles of complete justice to everyone, the engineer who works on a salary is essentially a subordinate and not an independent adviser retained for some special purpose. It has accordingly been considered necessary by many who have looked into the subject of professional ethics with considerable care that the first step in formulating any code should be to draw a distinction between professional and salaried men which would recognize the legal obligations of the two classes and thus avoid the pitfall of impracticability. This is shown in the code printed elsewhere in this issue, in the distinction drawn between the property rights of consulting and salaried engineers in their plans and data.

Among the principles enunciated in the code referred to is one that the electrical engineer should incline toward and not away from standards of all kinds. This seems to be rather out of place in a code of ethics, although it might be entirely appropriate in the regulations drawn up by a company for the guidance of its salaried employees. Just what relation exists between ethics and the adherence to or departure from standards it is difficult to understand. The Engineering Record has always held the opinion that an engineer should adopt standard plans and purchase standard machinery when it was to the interest of his employers or clients to do so, and that he should prepare special designs when the standards were not so suitable as special methods or appliances would be. It has been pointed out by many men on many occasions that the innovation of today is the standard of tomorrow, and that progress is only possible by departing from standards. This paragraph is specially referred to because it indicates a feature of the code which seems to be open to a certain amount of criticism, the attempt to include in a code of ethics a number of rules which have no ethical relations. The same criticism might be made of the attempt to incorporate in the code certain legal relations which the courts must settle in any controversies between engineers and their clients or employers. For example, it is stated that the electrical engineer may not accept commissions directly or indirectly from parties dealing with his principals nor be financially interested in inventions and apparatus unless the matter is understood by the principals, statements which are governed by judicial decisions and are discussed in legal text books. Again, it is pointed out that operating engineers should consider themselves responsible for defects in apparatus or dangerous conditions of operation and should bring them to the attention of their employers and urge remedial action. If the causes of the danger are not removed, they should withdraw, according to the code. It might be pointed out that this subject is fully covered in the law of negligence and of master and servant, which are the subjects of many text books.

The portions of the code relating strictly to ethics seem to be confined mainly to paragraphs 22 to 35 inclusive, on the relations of the electrical engineer to the general public and to the engineering fraternity. These paragraphs contain suggestions regarding several relations of the engineer that are not often considered. For example, it is stated that the engineer should not engage in controversies of a technical nature in the daily press with other engineers. As a general proposition this is a good rule to follow, since the specialist who endeavors to conduct a technical controversy in the newspapers is almost certain to suffer in the end from doing so. His audience does not know what he is talking about, most of the time, and he will suffer in comparison with an ignorant man who is able to use English vigorously in the enunciation of ideas which are worthless. But occasions may arise when it is desirable in the interest of the public for an engineer to combat what he knows to be erroneous statements of another engineer in the daily papers. On several occasions in recent years eminent civil egineers have accomplished not a little of good by letters to the newspapers pointing out the defects of plans for public works drawn up by other engineers who were not entirely familiar with the subject, but probably did the best they could. In the opinion of The Engineering Record, therefore, rule 23 of the code of ethics is not wholly advisable. Another rule in the code, No. 32, states that the electrical engineer should not take a position left by another electrical engineer without satisfying himself that the former had left it voluntarily or for proper reasons. This rule seems to be meaningless, for who is to decide what are "proper reasons"? In the case of engineers engaged on a salary to discharge specific duties, it is difficult to see just what ethical rule is involved outside of the customary business relations of employer and employee.

In making these critiicsms on the code, the intention is not to attempt to belittle the excellent work done by the committee. They deserve the thanks of all who are interested in improving the relations of engineers among themselves and with their principals. It is a good thing that such a proposed code has been drawn up by men of the high standing of the committee which prepared this statement, for something definite is presented for discussion. The familiarity of the members of the committee with the difficulties facing engineers connected with manufacturing corporations has doubtless led them to lay more stress on what may be termed ordinary business relations than a committee of civil engineers would be likely to do. This makes the proposed code particularly instructive to civil engineers, for it furnishes a new point of view from which to regard a subject they have long discussed. It is also interesting as an example of an attempt to combine ethical maxims with principles of law and rules of business conduct. In this respect it departs from legal and medical codes which have been suggested from time to time, and opens up a new field of discussion.

Unit Bids in Machine Installations.

In the preparation of quotations to present to a prospective purchaser of machinery, time is usually very valuable in the district office of a manufacturing company. Requests for quotations come in by telephone and telegraph to be later confirmed by letters, and generally the information is wanted at the earliest possible date. Such conditions tend toward the production of blanket rather than detailed unit bids, unless the latter are specifically requested. The advantages of having figures submitted on a unit basis are thus often missed.

Under present-day conditions the completion of engineering and industrial designs requires the use of as much comparative data on similar work as may be available. An installation will be better adapted to its specific service if the data of other comparable work is considered in connection with it, even though the detailed conditions may differ very broadly. If quotations are submitted in an itemized form allowing for a certain range in the size and number of machines selected, these figures will be extremely suggestive and valuable in making future estimates and checks, and will also permit minor modifications to be made in the specific design in hand without delaying the course of events to anything like the extent which obtains if a single blanket bid is required on each set of assumptions.

Thus, in the case of a factory which decides to equip all its important machine tools with individual electric motors, it is of great value to secure the price of each motor as well as the total cost of the installation. Even though the power estimates be made with great care, there often arise modifications of the original plans which necessitate new figures from the manufacturers at short notice. At the last moment the company decides to replace certain machine tools by new outfits of an improved type or to carry the individual drive plan farther than was originally intended. Again, there may be a contraction in the amount of new apparatus decided upon, resulting from an economical turn at a directors' meeting. Accurate estimation of probable cost must be prepared within a few minutes' time in many such instances, and if the quotations are prepared on the unit basis as well as on the basis of a lump sum, it is ordinarily a simple matter to modify the wiring and installation figures in the time available, so that prompt decisions may be reached. When different types of motors are at issue, as in weighing the merits of commutating pole and induction outfits for a given shop, the facility of reaching decisions with the minimum delay depends in no small degree upon the presence of figures for each individual motor in the submitted quotations. Doubtless it takes longer in the first place to secure such individualized prices, and in some instances they are of course not needed from any standpoint, but in the majority of instances where the equipment is at all varied or complex in character, it saves time in the end to secure unit bids. As time passes and machines depreciate and have to be replaced at different times a company never regrets knowing just what the original unit cost was.

The Contracts for the Ashokan Dams.

Bids for the large masonry dam and for the appertinent earth dams and dykes for the Ashokan reservoir have been advertised by the Board of Water Supply of New York to be opened on the sixth of August. These great works are designed to impound about 120 billion gallons in a reservoir twelve miles long, constituting the largest impounding reservoir yet undertaken for a public water supply. It is one of the main features of the additional water supply system for the City of New York, which is estimated to cost, when completed, about $160,000,000. A comparatively small contract has already been awarded for the construction of nine or ten miles of the main aqueduct north of Peekskill, but the award of the contract for these dams will mark an epoch, so to speak, in the progress of construction of this exceptional public work.

The main dam across Esopus Creek, a half mile below Bishop's Falls, is chiefly of masonry and is about 230 feet high above its foundation in the rock, forming the bed of the stream at the dam site. Although it is a masonry structure of unusual magnitude it does not surpass the new Croton dam either in total height, or mass of masonry, or total length, but it possesses certain features which give it a distinct character of its own. There are no serious foundation problems to be met and solved as far as may be judged by the results of the examinations which have been abundantly made, and are available for the information of all bidders.

The features which will impress both engineers and contractors at first sight are the provisions for a series of wells throughout the length of the main masonry structure, placed a few feet from its upstream face, for the purpose of draining away any seepage, and a number of joints through the structure enabling it to be built up in sections and at the same time affording provision for expansion and contraction. It is not the first time that the drainage of seepage water has been introduced in a masonry dam, although this particular method of making the provision has probably never before been introduced in so large a dam. The operation of such features of masonry construction will, doubtless, be observed with great interest after the completion of the work. Although there is not much diversity of opinion among engineers regardng either seepage through masonry or the movement of masonry masses when free to move under changes of temperature, but there probably would be a rather wide range of judgment as to the necessity of severing such masses in the one case, or the introduction of a cellular arrangement in the other. In any event it is at least progressive to anticipate the prevention of certain features of the actual performance as observed in nearly all high masonry dams so far built. The results of such experiences will add substantially to the accumulating sum of engineering knowledge of masonry structures of magnitude.

An examination of the specifications and form of contract shows that they have been prepared with scrupulous care, both as to the city's interest and as to a fair and just attitude toward the contractor. There have been certain features of administration of public works contracts in the City of New York, which redound neither to the credit of the city as a reasonable agent in dealing with its contractors, nor to its efficiency in a business capacity. Progress estimates are often most unreasonably delayed in payment, and final estimates are not infrequently held up for many months after the satisfactory completion of the work. The Engineering Record has commented pointedly upon these features of public works construction, which, by their injustice to experienced and competent contractors, enhance correspondingly contract costs, and tend toward serious delays in the completion of the works affected by them. It is a matter of gratification therefore to find that the initial contracts in the series of greatest public works ever yet undertaken for any city disclose a radical change for the better in these respects, without in any way failing to safeguard with equal efficiency, the interests of the city. Although the aggregate of the bonds required amounts to $1,000,000 in addition to a certified cheque for $250,000 to accompany the bid, the payment of progress estimates is made obligatory within thirty days of date, and the final estimate within forty days of date. This provision is as wise for the city as it is advantageous for the contractor. The prices bid by the latter under such circumstances need cover only the legitimate costs of doing the work. The city puts itself on record as a prompt paymaster, and if there are any delays beyond the periods named, the municipality binds itself to pay four and one-half per cent. interest on the amounts due, and to make those interest payments practically a part of the immediately succeeding progress estimates.

These essential features of the contract for the Ashokan dams are unique in the history of New York City municipal construction. They cannot fail to be attractive to a class of experienced contractors whom it is desirable to secure as constructors of these works. In spite of the fact that the recent attempts to sell bonds for the city have not been successful the credit of the city is excellent, and there is no reason to believe that it will ever be otherwise, at least within any ordinary period of time. It should, therefore, avail itself of its good financial standing and improve every advantage which that condition offers. By prompt payments to contractors who have executed their works in a satisfactory manner, the prices tendered for public works will be reduced to a minimum by relieving the bidders of an interest account which they would otherwise have to carry. The Board of Water Supply has done well in making this fundamental departure from bad precedents and worse practice. It is safe to predict that it will secure highly satsfactory returns in reasonable prices and efficient prosecution of work.

Promoting.

The opportunities which engineers have for discovering water powers, locating new lines of railways and utilizing various natural advantages which they discover in their work are so many that some surprise is occasionally expressed that they rarely take advantage of their chances of this nature. Probably the reason is to be found in their lack of information concerning the manner in which to promote an undertaking of this sort. The word "promoter" has a very bad sound in the ears of many people. It stands for a man who makes glittering promises which are never fulfilled, in their opinion, whereas the real promoter is one of the most useful men a community can have. Through his knowledge of local conditions and insight

into their capabilities he is able to suggest developments that are for the benefit of the district, and an honest promoter accordingly deserves local encouragement. It has been repeatedly noticed, however, that engineers do not seem to possess the faculty of stating their propositions of a new nature in such a form as to make them interesting to capitalists. They wrap the project up in all sorts of technical details which nobody but an engineer cares anything about and leave out the very essential facts which any man of business must have presented to him before he will even stop to consider a proposition. It is essential to have the technical details of any such enterprise worked out fairly well before the financial details can be stated, but it is the financial part of the proposition which is interesting to the capitalists, and unless that can be presented clearly, concisely and convincingly, he will not spend a moment's time in looking into it. These considerations indicate why it is that the successful launching of any enterprise makes a considerable expenditure of money necessary. People sometimes wonder why it is a capitalist takes no interest in the announcement that there is a water power capable of furnishing several thousand horse power within 15 or 20 miles of a large city. As a matter of fact there is no business interest to him in such knowledge. The time and money he would have to spend in investigating this statement can generally be made to yield a larger return if expended on his regular lines of business. Hence a good many people having knowledge of such opportunities for investment, who have presented them in a half-baked condition to capitalists, look upon the latter as extremely unprogressive and miserly men, when the fault really is due to the manner in which the propositions have been presented.

Before any proposition is likely to be of interest to capitalists it must be put on a business basis and this involves a great deal more than a mere rough estimate, made up some evening, of what it is likely can be realized from the resources to be developed if everything goes along happily. Take the case of a water power as an example. The mere existence of such a power is of no financial interest, as a rule. Unless the engineer and his friends have the money necessary to develop the power and construct the transmission lines to the nearest cities, then it is necessary to go to capitalists for financial help. In order to present the matter to them properly it is not only necessary to have a complete and conservative estimate of the cost of building all the works and of the immediate and probable future demand for power, but it is also necessary to have a completely organized company, with franchises, charter and options on all properties. Securing such evidences of good faith, which are necessary to enlist outside capital, involves the expenditure of considerable sums, and these it is absolutely necessary for the promoter and his friends to raise. Moreover, it rarely happens that the people who will underwrite a bond issue are willing to have any portion of the money they advance used for preliminary and prompting expenses. Although such expenditures are entirely legitimate and are to be considered as part of the capital necessarily embarked in the enterprise, it is essential that they should not be represented by anything more than a certain amount of stock in the enterprise. Failure to appreciate this view which is held by bankers and trust companies has been the rock on which a number of enterprises have been wrecked. People looking for help rather than giving it have to accept conditions as they are and cannot undertake to reform a money market condition which does not please them.

Large undertakings nowadays can be best brought to the attention of the public by an engineering promoter through one of the contracting-engineering companies which maintain banking departments. These companies do not undertake small enterprises, however, and the engineer who has a good thing in mind should do his best to interest local people in it before going to the large cities for capital. Moreover, it is necessary for him to arrange matters so that the capital which is advanced for preliminary expenses will be represented by stock, as before stated, for if any attempt is made to dispose of any part of a bond issue in return for money advanced for the purposes mentioned, the sale of the remaining bonds will be rendered practically impossible. Few people care to underwrite an issue of bonds unless the entire issue can be given to them, so that they can completely control the selling price. If this is not done and a few bonds are held by local people, circumstances may arise which will lead the latter to sacrifice some of these bonds for a low sum, thus establishing a price for them which will practically prohibit the underwriters from making any money on the bulk of the issue. It is also very necessary to have a thoroughly responsible lawyer pass upon every step of the proceedings, so that the validity of the bonds and the security of the investment in the undertaking shall be unquestioned. If a proposition has been investigated by engineers who are in good standing among capitalists, its proceedings are legally correct, and the undertaking has the backing of local bankers to the extent of their means, the project may be taken to the larger cities for final financial arrangements with some expectation of success.

Attention has been drawn to all these details because they emphasize the fact, which has been the wreck of a good many ambitions, that by the time all the work of launching a new enterprise has been carried through, the share of the promoter will have dwindled to a small percentage of the stock. This is a condition that must be recognized at the outset, for any promoter who seeks to retain control of an enterprise which he cannot finance is endeavoring to accomplish the impossible. All he can hope to do is to retain a reasonable share of the stock, so that, if his predictions come true under careful management, he will receive a reasonable return on the expenditure of time and money which he and his friends have made. Even this return must be foregone unless the original promoter takes care that all the preliminary steps of expert examination, incorporation, and preliminary organization are thoroughly well done and the local capitalists behind him are friendly and will use their good offices to prevent advantage being taken of him.

Notes and Comments.

THE THIRD-TRACKING of the elevated railways on Second and Third Aves., New York, has luckily been brought up again for discussion, owing to the fact that such matters will be hereafter under the charge of the Public Service Commission, and its policy on such subjects has not yet been determined. The Board of Rapid Transit Railroad Commissioners which went out of office last month was positively opposed to adding a third track on these elevated structures, and for this reason no improvement of transit facilities on the Second and Third Avenue lines was possible. As a matter of fact third tracks have been laid on parts of both of these lines, and are used for storing cars when the traffic is light. The additional trackage to make the complete third lines will not be very great and the need for it seems so strong that a good many people in New York who have to do much traveling during rush hours have felt that the additional tracks ought to be permitted. It is true that an elevated railroad is not a thing of beauty, but it is also true that the addition of a third track at places where it does not already exist would be such a great advantage to a large portion of the public that the slight additional obstruction to light which its presence would cause would be more than outweighed by the benefits to be derived from it. Since the elevated structures are already in position, it seems good public policy to allow them to be utilized to the maximum.

FRANCIS B. THURBER, who recently died in this city, was one of the valued advisers of The Engineering Record in its early days. The paper was established as a journal to spread a knowledge of sound sanitation. This included not only measures to improve plumbing in houses and the sewerage and water supply of cities, but also various important projects to insure purity in food products. His wide acquaintance with men in public life, his personal interest in the affairs of the city, and his knowledge of the measures necessary to prevent the injurious adulteration of food materials, made him a valued counselor, and placed The Engineering Record under obligations to him many times. In fact his willingness to devote a large part of his time to public affairs and to the interests of his friends resulted in his entrusting too much of his business to people unable to carry the responsibilities. The large business he built up was ruined through no fault of his, and at the age of fifty-seven he began life again as a lawyer, being admitted to the bar in 1899. His energy and independence, even when embarking on new work at an advanced age, won him the admiration of many who before had not fully appreciated his sterling qualities.

SEVERAL ROAD IMPROVEMENT projects have been abandoned this year on account of the great objection of the taxpayers to paying money for constructing roads that would attract automobiles. At South Kingstown, R. I., for example, where important improvements were proposed, the opinion of the town, as expressed at a meeting called to consider the matter, was that such good roads would be advisable if the inhabitants of the town could use them with comfort, which was formerly possible but was now out of the question, for the high speed at which automobiles were driven through the town put citizens using the roads in peril of their lives. In view of the strong agitation for highway betterments which is being conducted by motor car enthusiasts, it might be well for them to consider carefully these instances of the determination to postpone road improvements until some laws were passed and enforced which will prevent speeding in towns. It will be recalled that the same revulsion of feeling regarding highway improvements occurred during the last few years of the bicycle craze, when the noisy mobs of cyclists made themselves so obnoxious in many localities that the residents preferred to go without the benefit of better highways than to be overrun on holidays and Sundays with a class of people distinctly undesirable. While The Engineering Record has no sympathy with the attempts of some towns to levy tribute on every owner of a motor car who goes through the streets at a speed above a crawl, it is thoroughly convinced that highway improvements will be more and more retarded unless laws are passed and rigidly enforced which will prevent the fast speeding of cars through streets. The clouds of dust and the odor of gasoline they leave behind them are unpleasant enough without being accompanied by the danger of life and limb to driver and pedestrian. A further evidence of the same feeling is to be seen in the vigorous protest from all parts of the State of New Jersey against permitting the Vanderbilt Cup race to be held there.

THE FORTIETH ST. TRACK ELEVATION OF THE CHICAGO JUNCTION RY.

The Fortieth St. branch of the Chicago Junction Ry., in Chicago, extends from a connection at Forty-second St. and Lake Michigan with the eight tracks of the Illinois Central R. R., north to Fortieth St. and thence west in that street for approximately 2½ miles to the Union Stock Yards. The tracks of this branch cross twenty-six city streets and a number of railroad tracks, over which the trains of eight trunk-line railroads enter the city. The branch provides an entrance to the Union Stock Yards for the following railroads: Illinois Central; Michigan Central; Cleveland, Cincinnati, Chicago & St. Louis; Lake Shore & Michigan Southern; Chicago, Rock Island & Pacific; New York, Chicago & St. Louis; Erie; Wabash; Chicago, Indianapolis & Louisville, and the Pennsylvania. In addition to the heavy traffic carried over the tracks of this branch between the Union Stock Yards and the various railroads with which it connects, a number of industries in the vicinity of the Yards contribute a large volume of traffic to it.

According to the new arrangement of tracks the Chicago Junction Ry. will have one, and the South Side Elevated Ry. two tracks for about ¾ mile from the lake front. The single track of the former rises on a grade from the lake until it is high enough above the street at the crossing of the first street west from the lake to permit that street to pass under the track. The two tracks of the elevated railroad are carried on a steel structure in this distance and thence continue at the same grade as the single track of the steam railroad for nearly three-quarters of a mile to a point where they rise on an incline and connect with the three main-line tracks of the elevated railroad. The steel structure on which these three tracks are carried parallels the steam railroad from this connection for about a quarter of a mile and then turns to the north and crosses over that railroad. From the point where these main-line tracks turn to the north a double-track branch line from the elevated railroad is being built to the stock yards; the two tracks of this tracks of the Chicago Junction Ry. cross at right angles, a six-track elevation carrying the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific railroads four city blocks to the west of the point where the main line of the elevated turns to the north. Formerly, the tracks of the Chicago Junction Ry. passed under this elevation; with the new arrangement these tracks cross this elevation on a single-span double-track through Pratt truss bridge. The elevated railroad will be carried over the track elevation on a separate bridge at one side and above the Chicago Junction bridge. The three crossings are thus made at three different grades, the street passing under the original elevation carrying the Lake Shore and the Rock Island tracks, the Chicago Junction tracks on the bridge being above that elevation and the tracks of the elevated railroad still higher, and at one side. In both directions from this crossing of the original track elevation the tracks of the elevated railroad are carried on a steel structure which spans the tracks of the Chicago Junction Ry., between a row of columns along each side of the right of way of the latter.

The tracks of the Western Indiana R. R., a

Construction Work in Congested District.

Section Extending from a Street to an Alley.

This branch of the Chicago Junction Ry. was built at the grade of the streets many years ago when the district through which it passes was an outlying residence district. The area on both sides of the branch for over a mile back from the lake is now one of the most populous of the better residence sections of the south side of the city; to the west from this area the district traversed by the branch is also quite congested, but grades off from the residence section into factories and other industries. Many of the streets which the tracks of the branch cross carry important north and south street railway surface lines and on several of these streets there is a large volume of vehicular traffic.

In order to eliminate the numerous grade crossings of streets and of the various trunk-line railroads the tracks of the Fortieth St. branch are being elevated on a fill carried between heavy concrete retaining walls. The South Side Elevated R. R. is also building a double-track branch line which closely parallels the branch of the Chicago Junction Ry. from Lake Michigan to the Union Stock Yards. The location and erection of the steel structure for this elevated railroad, the narrow right-of-way in which the construction work had to be carried on, the heavy freight traffic that had to be handled over the tracks which were being raised, and the necessity for keeping the streets crossed by the branch open for service at all times, rendered this track eleva-

line are on an elevated steel structure which spans the tracks of the Chicago Junction Ry. for several blocks, and then parallels them at one side to a point near the yards.

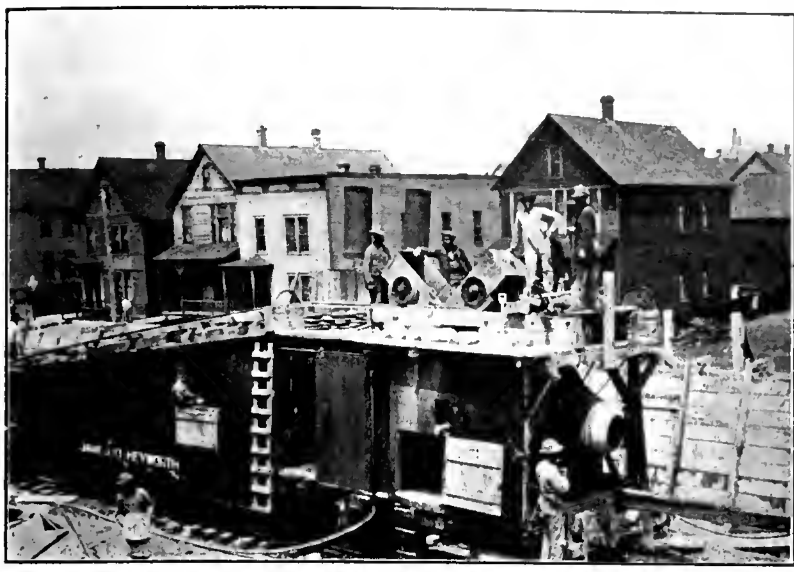
The Chicago Junction Ry. has two tracks for about a mile to the west from the point where the branch of the elevated railroad rises on the incline, and then three and finally several tracks just before entering the yards. In the entire distance from the lake to the yards the tracks are carried on a fill between two parallel gravity-section concrete retaining walls, the street crossings being made on through-plate-girder bridges having solid trough floors filled with concrete. These bridges are carried by concrete abutments and by a row of steel columns at each curb line.

The elevation has a nearly uniform width for three tracks from the lake to within a short distance of the yards, where it widens out to accommodate the extra tracks. From the first street crossing at the lake to the point where the two tracks of the branch of the elevated railroad rise to connect with those of the main line, the track elevation carries the single track of the steam railroad and the two elevated railroad tracl In this distance the city blocks are 400 to 550 ft. long, and as a 20-ft. alleyway is crossed on an overhead bridge between each two street crossings, the concrete retaining walls and the bridge abutments form a series of huge rectangular boxes half a city block in length.

terminal road on which several trunk lines enter the city, is also crossed at right angles by the tracks of the elevated railroad and of the Chicago Junction Ry. a short distance to the west from the crossing of the track elevation just mentioned. The elevation of the tracks of the Western Indiana R. R. to eliminate grade crossings has recently been completed at this point. The elevated railroad structure crosses over this elevation, while the Chicago Junction tracks drop down and pass under it at about street grade. The tracks of the latter rise again beyond this crossing and continue on an elevation into the Yards.

The grade of the tracks of the Chicago Junction Ry. at Halsted St., which is near the end of the present elevation, were formerly separated by carrying the street over the tracks on a three-span bridge with long fill approaches. This bridge has been removed, the 40,000 cu. yd. of material in the approaches to it are being taken out with steam shovels and the street will be carried under the track elevation. The elevation will be carried over this street on a bridge, the street being depressed somewhat to secure the necessary clearances.

The construction of the retaining walls for the track elevation and the placing of the fill between those walls have been carried forward in such order as the heavy traffic would permit.



Dump Car in Partial Dumping Position.

One Type of Concrete Plant for Walls.

before tracks were raised. A track, or tracks as the case might be, were then laid on a temporary pile trestle erected over the completed wall, traffic being diverted over this trestle while the other wall was under construction, and until the fill had been made. The great volume of traffic to be handled, particularly on the tracks west of the crossing of the Lake Shore and the Rock Island elevation, and local conditions necessitated much diversion from this method. In places the fill was carried up under traffic and the retaining walls built later, the sides of the fill being held meanwhile by a cribbing of ties.

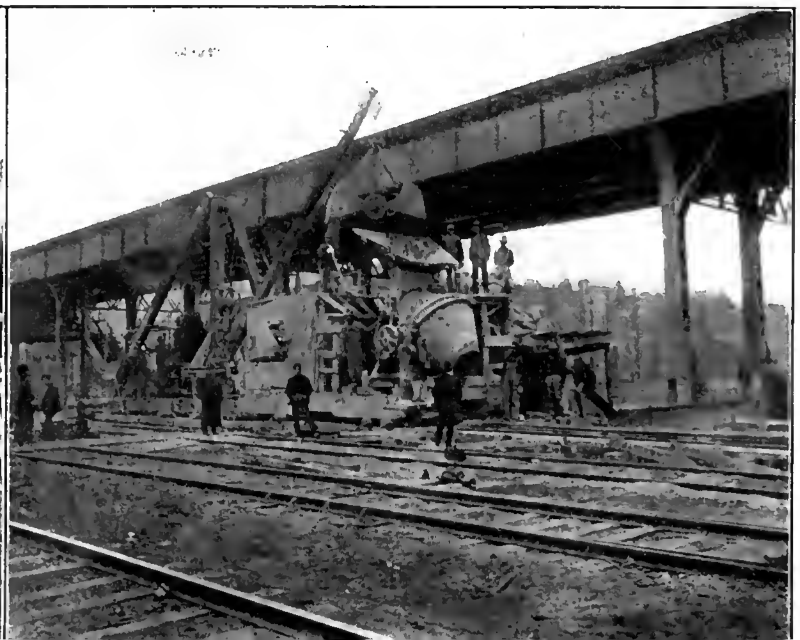
The portion of the elevated railroad structure which carried the three main-line tracks in the short-section where the latter parallel the tracks of the Chicago Junction Ry. had only two tracks and was partly over the site to be occupied by the elevation when operations were started on the latter. This structure was moved several feet to one side, raised 5 ft. and a third track added to it under traffic. A complete description of the manner in which this work was handled was published in The Engineering Record for March 3, 1906.

The excavation for the footings of the retaining walls for the track elevation was for the most part in sand or sandy loam which required the sides of the trenches to be sheeted closely in most of the work. The trenches were nearly all made with a Page scoop-bucket excavator, the sides of the trench being finished by hand. The sheeting was also driven by hand to prevent the loose soil sliding into the trenches.

A portable concrete mixing outfit specially adapted to the work was used in placing the footings. This outfit was mounted on a 12 x 24-ft. platform carried by three pairs of longitudinal 8 x 16-in. stringers. This platform ran on rollers on a runway laid on each side of the trench for the footing. A 30 cu. ft. Smith mixer carrying a charging hopper was mounted on the front end of the platform so concrete could be dumped from it into the footing. The engine driving the mixer was also carried by this platform and storage space for enough cement in sacks to keep the outfit in service was provided at one side of the platform. The concrete for the footings was made in the proportions of 1 part cement to 8 parts pit-run gravel. The latter was delivered from the pit in gondola cars from which it was unloaded directly into the charging hopper of the mixer by a 1-yd. clam-shell bucket handled by a stiff-leg derrick. This derrick and the hoisting engine operating it were mounted on a second portable platform which ran on rollers on the same runways that carried the mixer platform. It was placed immediately in the rear of the latter with which it was moved back and forth along the work. The normal output of this outfit was about 220 cu. yd. of concrete per 10-hr. day, with 22 men, wherever the traffic conditions permitted steady running.

Owing to the limited space available this mixing outfit was generally set up at the intersection of a wall and the street and retained in one position until the footings on that side of the elevation had been completed for a half a city block each way from it. The mixer discharged into 1-yd. dump cars on four-wheel trucks, these cars being operated by hand on a 30-in. gauge track on each side of the trench for the footing. If more space had been available, the outfit could have been made readily portable so it might be moved forward as the work progressed. As it was, the single service track on which gravel was delivered was the only part of the right-of-way occupied by the operations on the footings, and this track was open for traffic when the mixer was not in service.

Two types of concrete mixing outfits were employed in building the retaining walls above the footings. One of these is very similar to those which have been employed on much of the track elevation work in Chicago. In this outfit a Drake mixer was mounted on the front end of a 34-ft. car, and together with its engine was protected by a housing, having a tight roof. A charging hopper surrounded by a working platform was built over the mixer in the roof of this housing. The pit-run gravel used in the wall was delivered in gondola cars, which were placed in a string of three or four immediately back of the mixer car. Plank runways were laid along the top of each side of these cars, leading from the latter up to the charging platform over the mixer. The gravel was hauled to the latter from the cars on these runways in wheelbarrows. The cement was kept in a box car at the far end of the string of gravel cars and was also delivered to the mixer in wheelbarrows. The mixer discharged on a traveling conveyor belt



carried by a 30-ft. boom that could be swung through a radius of 90 deg. and could be raised and lowered at the end through 14 ft. The conveyor discharged the concrete into a bottom-dump hopper bucket attached to the end of the boom, this bucket preventing the gravel from being separated from the remainder of the concrete and also permitting the discharge of the concrete to be directed.

This outfit operated on a single track. It was moved forward or back by a cable attached to an anchor ahead and one in the rear of the string of cars, the cable winding around a drum driven by a set of gears on the deck of the mixer car. The engine driving these gears and the mixer engine were run by one man who also fired the two boilers which supplied steam to these engines.

The other outfit used on the walls, although embodying similar general features of arrangement and operation, was entirely different from this first outfit in several important particulars. This mixing outfit was mounted on a standard-gauge double-truck car, 40 ft. long at the sills. A 3⁄4-yd. Smith mixer and its engine were set at the front end of this car so the mixer could discharge into a bucket on a suspended platform just clearing the ground. A housing with a tight roof was built over the whole mixer car, a charging hopper being placed in this roof directly over the mixer. The gravel for concrete was delivered in gondola cars which were placed in a string of three to five in the rear of the mixer car; the cement was stored in sacks in a box car at the end of this string. A portable 30-in. gauge track was laid along each side of the tops of the gondola cars and extended up on the roof over the mixer car where the two tracks joined in a double-throw switch and were continued as a single track to the charging hopper of the mixer. The gravel and cement were delivered to the latter on these tracks in dump cars of a special type. The mixer discharged into a 3⁄4-yd. bottom-dump bucket in which the concrete was handled to place in the forms by a stiff-leg derrick mounted with its hoisting engine on a second car.

The great drawback to portable concrete mixing outfits of types similar to this one, such as have been employed so extensively on track elevation work in Chicago, has been the difficulty and expense of delivering the concrete materials from the cars to the mixer. The details of the portable tracks used in connection with this particular outfit were so carefully developed, however, and the design of the special dump car used on them was so well adapted to the work, that 8 to 10 men could deliver the cement and gravel to the mixer as fast as the latter could turn out concrete; from 20 to 22 men are generally required in delivering the materials in similar outfits of this kind when wheelbarrows on runways are employed for this purpose, and even with such a force difficulty is experienced in supplying the mixer rapidly enough during hot weather.

The rails of the two 30-in. tracks which were laid the length of the gondola cars in which the gravel was delivered are both attached in pairs toward the ends of 4 x 6-in. tie timbers, 11 ft. long, the timbers being spaced 5 to 6 ft. apart. These timbers are laid transversely on top of the cars so one 30-in. track comes directly over each side of the cars. The rails are attached to the timbers by a special form of fastener, which is clamped to tie plates on timbers by a U-bolt and can be drawn from the plate by pulling a small latch and without loosening any bolts. The tie plates being firmly fixed to the timbers, the latter can be laid on the cars and the rails attached to them at gauge by the fasteners very quickly. The two tracks are rarely dismantled, however, when once set up on a section of work, as they are light and can be lifted readily in sections. When the gravel has been unloaded from a string of gondola cars, the two 30-in. tracks are lifted from them and placed on another string of loaded gondola cars on an adjacent track, or if no other cars are available, or there is no parallel track, they are set on light wooden horses until more cars are brought in.

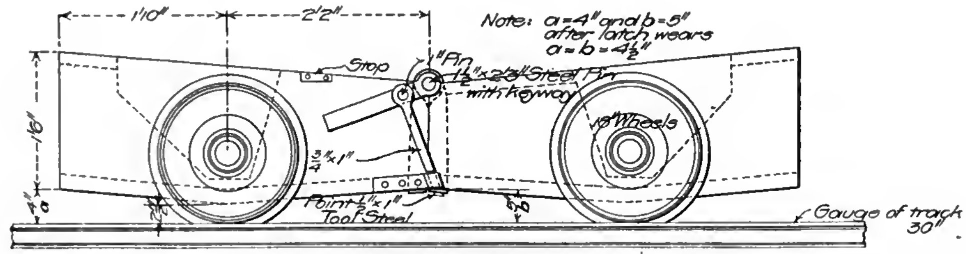
As the gondola cars vary considerably in height, a bracket has been devised to carry the ends of the 4 x 6-in. track timbers, which permits the tracks to be brought to grade over low cars without any difficulty whatever. Each of these brackets is an A-frame built of wooden strips, the legs of the frame being double with the two halves of each leg spaced apart in order that the legs can be placed astride the side of the gondola car. The top of the frame is built to carry one end of a 4 x 8-in. track timber. A row of holes is made in each double leg of the frame, so bolts may be placed in these holes and the frames set at different heights by changing the positions of these bolts, on which the frame rests.

A special dump car used on these tracks was designed and patented by Mr. O. E. Strehlow, the patent being controlled by Mr. James O. Heyworth, the general contractor for this track elevation. The details of this car are shown in an accompanying illustration. The car has a long, low body built of steel plates; this body is divided in half at its transverse center line, the two halves being attached together on each side by a hinge at the top. Each half is carried by a pair of 18-in. flanged wheels with dust-proof bearings which are attached to the side of the body. Each pair of wheels is placed slightly toward the center of the car from the center of gravity of the half which they carry, but when the car is loaded the center of gravity of each half of the body is toward the middle of the car from the wheels. The two halves of the body are held horizontally by a latch on each side of the body, these latches each being attached to the hinge on the side of the body they lock. A lever extending from this hinge carries a 3⁄4 x 1-in. latch strip which passes through a band attached to the lower edge of one half the body and also through a hole in a band on the bottom of the other half of the body.

The latch is loosened by pulling the lever and drawing the latch out of the hole in the band on the bottom. When both latches are unlocked the eccentric position of the wheels causes the center of the body to drop, the two halves of the body turning on the hinges so as to bring the ends of the body quickly together in an elevated horizontal position, thus discharging the contents along the bottoms of the halves, which are brought to a vertical position by the movement. The impact of the two halves coming together loosens the contents of the car and the body of the car is also shaped to facilitate the removal of the contents, the bottom, sides and top of both halves all converging toward the transverse center line. When the car is empty the center of gravity of each half is toward the end from the wheels so the car rights itself after it has dumped.

These cars are not any higher than an ordinary wheelbarrow and as they have a much lower center of gravity and greater wheel base than the latter, gravel can be shoveled into them with no danger of tipping and with greater speed. The cars each hold enough gravel for one charge of the mixer, but may be made any size desired. All parts of them have been made to stand the hard service to which they are subjected, with the result that two of these cars which have been in use for over a year are in practically as good condition as when new.

A double-drum friction hoist was placed on the roof over the mixer, and at the end of the track on which the dump cars were brought to the charging hopper of the latter. The shaft of this hoist was driven by a chain on a sprocket wheel on a shaft of the mixer engine. The cars were each drawn along the track and up to the charging hopper by a cable on one drum of this hoist. Two cars could thus supply materials to the mixer as fast as the latter could produce the concrete. The cement was delivered from the box car at the end of string to the platform around the charging hopper on top of the load of gravel in one of the dump cars.



Special Steel Dump Car.

A 3⁄4-yd. bottom-dump hopper-shape bucket into which the concrete was handled from the mixer to place was also designed specially for this work. The bottom was made in two overlapping halves, each of which was hinged to the sides of the bucket and was arranged on the lever that controlled the two so the amount of opening could be varied. With this bucket concrete could be placed in comparatively narrow wall forms without difficulty.

The entire outfit, including the material cars and the derrick car were moved in either direction along the track by a traction gear on the car carrying the concrete mixer. This gear was driven by a 24-h.-p. duplex marine engine on the car. The shaft of the engine carried a 12 x 22-in. pulley wheel with a 11½-in. paper friction face bearing against a 12 x 32-in. iron rim pulley wheel on a shaft geared to the traction gear. The latter drove a pair of 2-ft. grooved sheave wheels for 1-in. wire cable, these wheels being placed in tandem, 4 ft. 9 in. apart on centers. A 1-in. wire cable was wound six times around the pair of sheave wheels and attached at each end to an anchor in the track; by winding up on one end and paying out on the other end of this cable the entire outfit could be moved in either direction. The sheave wheels were swung below the frame of the car and the cable brought on them at the under side from both ends in order to avoid any downward pull on the car frame.

The design and arrangement of this gear gave the latter enough power to pull the mixer car and five loaded material cars up a 5 per cent. grade. Since much of the track on this elevation work was raised between streets with material from the excavation for the wall footings, it was a succession of humps and grades during the time the concrete work was in progress, so this strong tractive force was of much value in

moving the outfit along the wall as the concrete was carried ahead in horizontal layers. Furthermore, the placing of the gear below the floor and the general arrangement of the interior of the mixer car provided room for a coal storage space 8 ft. wide at one end of the car and ample space for the 42-in. vertical boilers which supplied steam to the two engines on the car.

Mr. J. B. Cox is chief engineer of the Chicago Junction Ry.; Mr. O. F. Cole is assistant engineer in direct charge of the Fortieth St. track elevation. The contract for the excavation, concrete, timber work, pile driving, street depressions and so forth on this track elevation was carried out by Mr. James O. Heyworth, general contractor, of Chicago; Mr. O. E. Strehlow, M. Am. Soc. C. E., associate of Mr. Heyworth, devised and directed the construction and operation of the various special plants which have been described. Mr. Wm. Eesley is general superintendent for Mr. Heyworth. The principal item of the contract was 150,000 cu. yd. of concrete, although the pile-driving, timber construction and street depressions also constituted large quantities of work.

THE COLLAPSE OF A BUILDING into the excavation for a large structure alongside it, which happened in Cincinnati on July 2, calls attention to the necessity of thoroughly shoring all adjoining buildings when a structure is torn down and they are left exposed. The brick building which fell at Cincinnati was four stories high, about 120 ft. deep, and 22 ft. on the street front. It had been shored in the usual manner, according to reports, and its fall was probably due to the weakening of the shores. This may have happened in two ways, judging from the information at hand concerning the condition of the work at the time of the accident. One cause may have been the blasting of a large mass of concrete in the cellar of the building which was being torn down, while the other cause may have been the loosening of the wedges at the feet of the shores by the workmen who were clearing away the débris in the bottom of the excavation, where a large mass of refuse building material had been allowed to collect and was then being removed. It is often seen in the work of demolishing buildings that the class of men employed do not possess sufficient intelligence to appreciate the importance of keeping shores firm.

The Quebec Bridge Superstructure Details.—III.

The Upper Part of the Center Posts.—A maximum stress of nearly 16,000,000 lbs. is transmitted from the top chord of the anchor arm to the top chord of the cantilever arm through the top of each main post. Stresses of about 3,500,000 lbs. are also brought to the same point by each of the two main diagonal members converging there; these forces produce a resulting vertical stress of 9,900,000 lbs. in the upper part of the post which is made separate from the main part of the post and special in order to better provide for the transmission and resolution of stresses. The different members theoretically intersect at a common point where their center lines meet, and where, in ordinary construction, a single pin would receive all the members.

In this case, however, there are thirty 16x2-in. I-bars in each panel of the top chord, making 60 in all besides 12 webs for pin-bearing in the main posts and two webs for the bearings of each of the inclined members, thus making a total of 76 large bearings to be assembled at this point. If these were all grouped on a single pin, it would be impossible to reduce the bending moments enough to avoid makiing the pin of great diameter, and its length would require to be over 20 ft., dimensions which are obviously impracticable. The connection was therefore designed as a special unit to unite the different groups of members at this point and is virtually a complicated multiple link provided with four 12-in. pins, each of which receives only the bearing for a single member and transmits its stress to the link which distributes it among the other members. The heavy reinforced vertical longitudinal plates required for the bearings of the pins are connected rigidly by transverse diaphragms and an elaborate construction is provided to distribute the combined stresses on the four webs of the main section of the post.

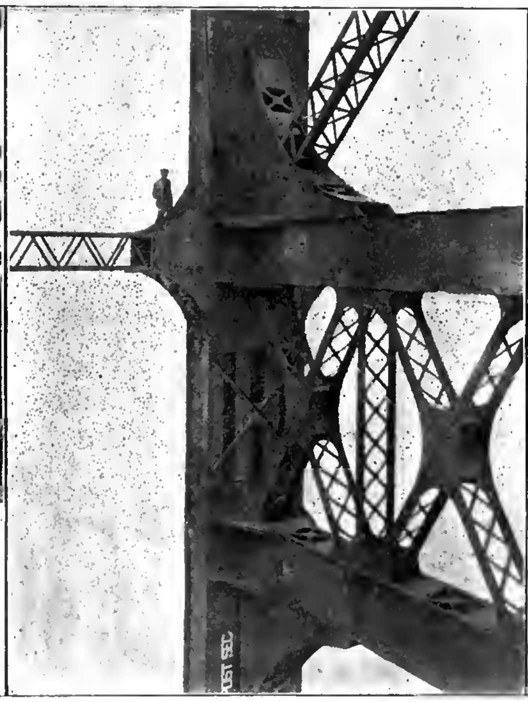
In order to limit the special construction to as small a member as possible, and to facilitate its assembling in the shop and particularly to reduce the dimensions to those conveniently handled in the boring and planing machines, this member was made entirely separate, as a cap, field connected to a horizontal bottom base plate in the top of the upper section of the main post. The cap is 10 ft. long parallel to the bridge axis, 9 ft. 8 in. wide at right angles to it, about 20 ft. high and weighs 230,000 lbs. The shop drawings for it include 19 main elevations and plans, besides several smaller sketches and details and entirely cover a 32-in.x12-ft. tracing which required the entire time of an expert draftsman for many months in its construction.

The cap has 12 longitudinal diaphragms or ribs connected by five vertical transverse diaphragms and, for convenience in manufacture and erection, it was made and shipped in three separate parts, assembled and bolted together on top of the main post. The two center ribs and the corresponding part of the horizontal base plate form one portion and the other two symmetrical portions each consist of five massive vertical longitudinal pin-bearing webs with their connected diaphragms and their base plates. Although nearly symmetrical about its longitudinal and transverse center line there are slight differences on the outer arm and cantilever arm sides which necessitate special construction throughout.

In order to make the pin bearings from 3 in. to 4 7-16 in. in thickness as required, the longitudinal webs of the ribs are made with plates 7/8 in. thick, reinforced on both sides with plates about 3/4 in. thick. Their upper portions serve as short horizontal ribs connected to the eye bars in the outer and cantilever arm and the special reinforcement for ribs which do not receive the outer members are double pairs of 1/2-in. and 9-16-in. plates 10 ft. long. The eye bar pins engage all ribs and the upper ends of the latter are stiffened and connected by transverse diaphragms each side of the pins, four in all. The lower pins, for the diagonal members, although extending completely through the cap, engage only two pairs of webs on each side, the other webs being cut away to give abundant clearance for these pins.

In order to clear the top chord eye-bars, all transverse diaphragms except that on the center line are omitted in the upper part of the cap. Below the eye-bars the webs are connected by four transverse diaphragms, one each side of the lower pin, and additional center diaphragms are provided between the pairs of ribs which afford bearing for the pins in the diagonal members. All diaphragms have I-shaped cross sections made by single web plates from 1/2 in. to 3/4 in. in thickness and four flange angles except the diaphragms on the center line between the outer webs which are made with double sets of vertical

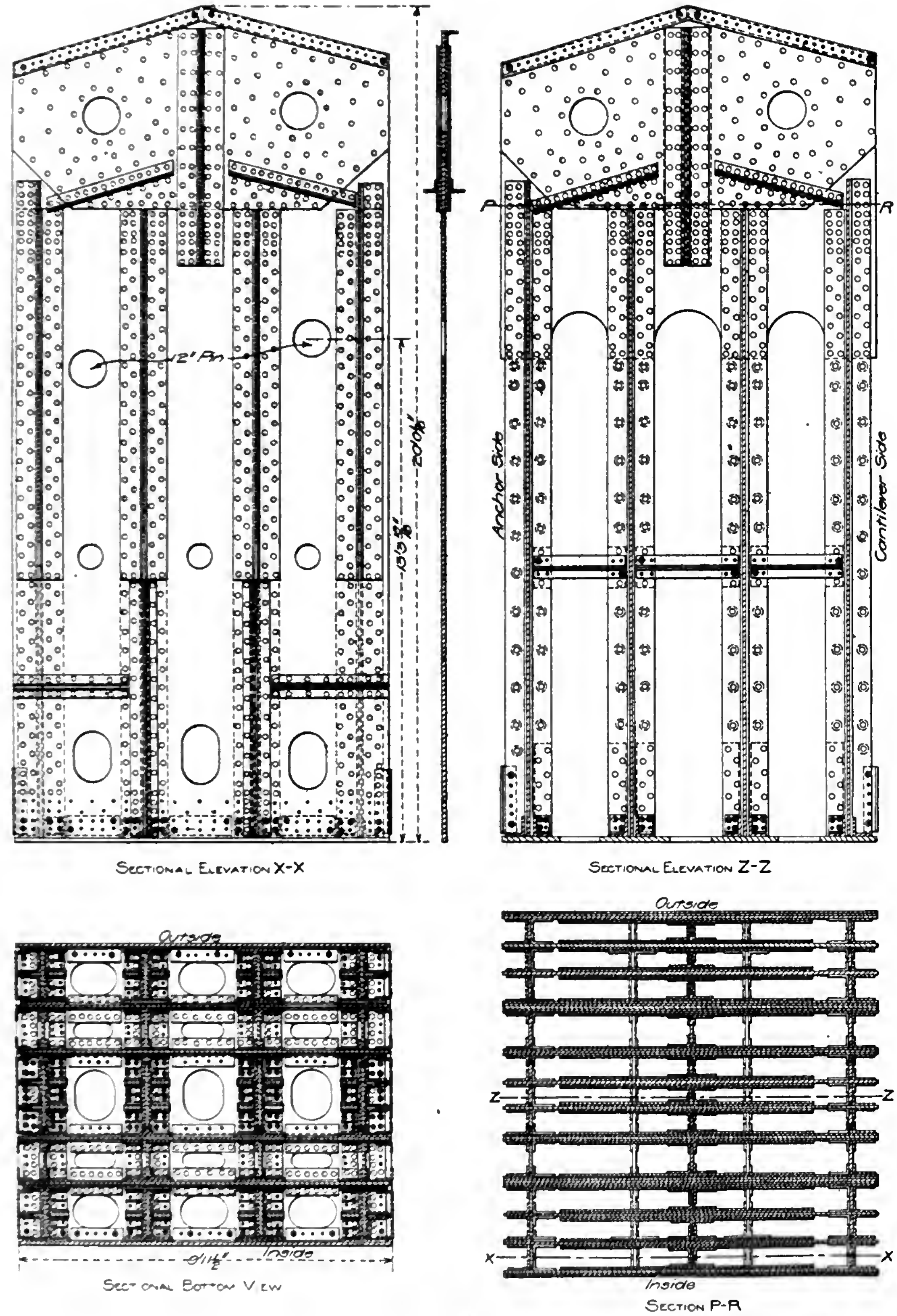
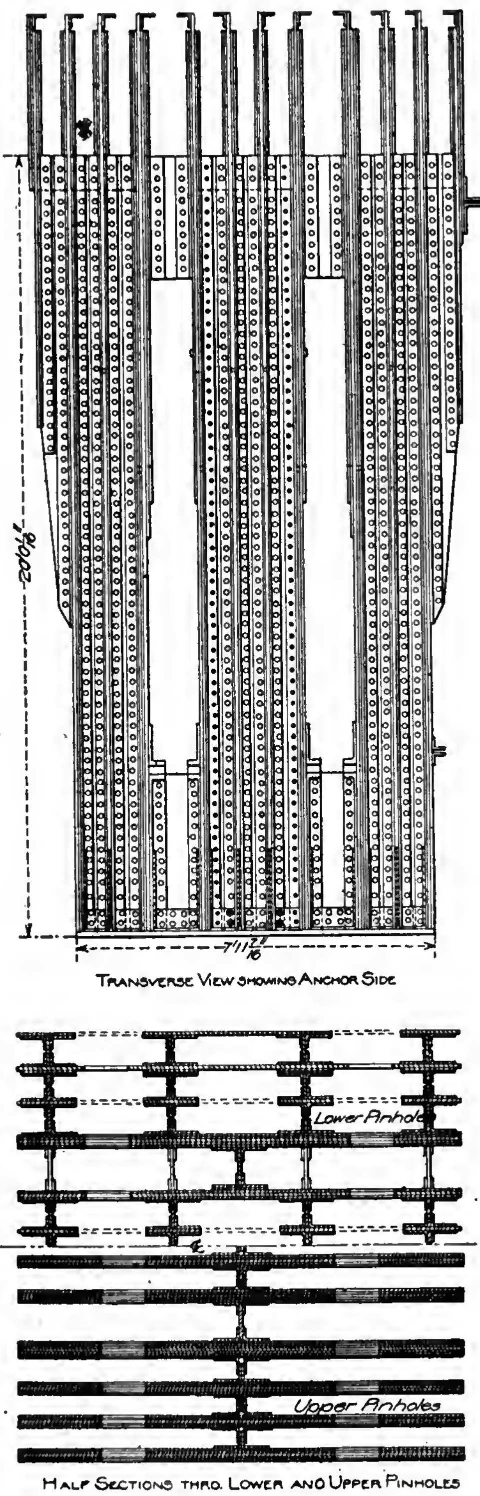
Top Transverse Strut over Pier.



Strut over Roadway at Pier.

Top Connections at Main Post.

angles back to back, forming T-shaped cross sections which engage each other and are riveted together through the outstanding flanges.. Rivets ⅞ in. in diameter are used wherever possible, but where there is not sufficient clearance to drive them and in the connections between the different sections of the cap and between the cap and the top of the post a large number of turned bolts are required and a number of hand holes are left to give access to them.

Details of Cap for Connections at Top of Main Post.

The two outside webs and four interior webs are slotted between transverse diaphragm connections from the bottom to a point nearly 13 ft. higher up and the edges thus left are braced near the center by double pairs of horizontal angles riveted together back to back. As all of the webs on the same side of the center lines differ, many separate elevations were required for the shop drawings and each of these was designated by the number of the rib and by a letter indicating which face of it was shown.

As the adjacent cantilever and anchor arm trusses are not duplicates the pin holes for their connection to the cap are not symmetrically arranged either with regard to each other or with regard to the center lines of the member, but are located at the vertices of a trapezium with sides from about 5 ft. to 6½ ft. in length. One hole was carefully laid out in the top with reference to the longitudinal and transverse axis of the post, and the other holes were located from it by triangulation, their centers being determined by the intersections of arcs struck with trammels from the center of the first pin hole.

The pin holes were first punched in the separate pieces to a diameter of about 10 in. and after assembling were bored and counter-bored in a vertical boring mill to a finished diameter of 12.03 in. for a 12 in. pin. The interior of the cap is closed as much as possible to the weather by means of inclined ¼-in. cover plates field riveted over the top, and by vertical transverse side plates riveted across the edges of the lower end of the longitudinal webs below their points of intersection with the diagonal members.

The main vertical post 315 ft. long on centers has in addition to the special top and bottom sections, five main sections with field riveted butt joints. Their lengths vary from 50 to 76 ft. and their maximum weight is over 100 tons. The total combined maximum stresses amount to 11,928,000 lbs., for which a cross sectional area of 526 sq. in. is provided by four webs which with their flanges and cover plates build up the 4x10-ft. rectangular section. The 48-in. web plates and the 8x6-in. flange angles are separately riveted together to form the I-beam elements of the posts and are connected by very long and thick batten plates, amounting almost to cover plates, on the flanges and by 6x3½x7-16-in. angles riveted transversely across the flanges to divide them into panels about 7 ft. long, each of which is X-braced by a pair of angles of the same dimensions, one of which is continuous and the other is cut to clear and spliced across the intersection with an 18x⅝-in. connection plate. Care is taken to fit the cut ends of the angle to close bearing against the flanges of the continuous X-brace angle.

The lower section of the post, 51 ft. 9½ in. long over all, is typical of the other sections and varies from them chiefly in the minor details of connections with the transverse bracing and with the top and bottom portions of the posts. The splice which is typical of the other splices in the same member has about 1,000 field driven rivets and is made with single cover plates on the flanges and with double cover plates on each side of each of the four ends. All of the splice plates are shop riveted to the lower section of the post and project beyond it, forming jaws to receive the field riveted lower ends of the webs of the section above. At the lower end of the post the 119½x¾-in. cover plates are about 18½ ft. long and have in the outer edges about 500 field driven rivets for the connection with the main inclined post. The lower ends of the webs are united both by their cover plates or battens and by two lines of vertical longitudinal shop riveted diaphragms which strengthen it and tend to distribute the load uniformly and stiffen the 65x1⅝-in. base plate 10 ft. long to which it is connected by horizontal flange angles. Very great care is taken to fit the lower edges of the main webs and diaphragms to accurate bearing on the base plate which is planed on both upper and lower surfaces and is connected to the horizontal upper plate of the pedestal by a large number of field driven rivets. Just above the base the cross section is divided into nine rectangles by the webs and diaphragms and just below the splice it is stiffened by angle frame horizontal X-braces.

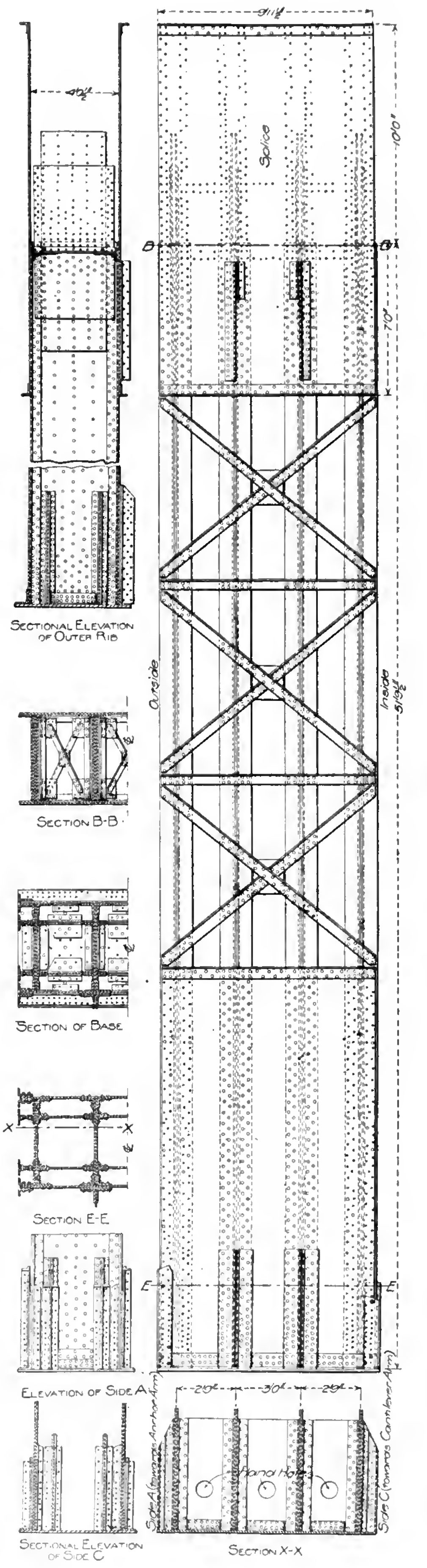
(To be Continued.)

A Gravity Water Supply at Montrose, Colo.

The town of Montrose in the western central part of Colorado formerly obtained its supply of water from the Umcompahgre River. During the summer months this stream is practically diverted for irrigation purposes before the waters reach Montrose, with the result that the only supply available from it in the late summer is that which returns to the river in the form of seepage. This seepage is highly impregnated with alkali and contains a large amount of organic matter. The water is consequently almost impossible to use for laundry or manufacturing purposes on account of the hardness, and during the time it was the source of the domestic supply several epidemics of typhoid fever occurred in Montrose.

The only other available supply that could be obtained was from the Cimarron River, which is 30 miles or more from Montrose, a high divide separating the latter from it. This river had been tapped, however, by an irrigation company, which operates a ditch carrying about 100 cu. ft. per second across the divide into the valley of the Uncompahgre River. At the top of the divide, known as Cerro Summit, a reservoir site covering about 19 acres was obtainable by the construction of a dam about 480 ft. long and 35 ft. in height. This site is at an elevation of approximately 7,800 ft. above sea level, the elevation at Montrose being 5,800 ft. The quality of the water delivered to the reservoir by the irrigating ditch is fairly good, but from the reservoir to Montrose the soil contains a large amount of salts, making it impossible to carry the water from the reservoir to the town through an open channel. The high rate of evaporation in the dry climate and at the high altitude also made an open ditch undesirable. As the distance from the reservoir to the town is about 14 miles, the method of conveying the water became a very serious one. On the basis of an estimate prepared, it seemed probable that the town could not raise sufficient funds to construct an iron pipe line. The nearby town of Delta had experimented under somewhat similar circumstances, with glazed tile pipe, with seriously disappointing results. Consequently, a wooden stave pipe conduit was adopted.

The contract for the construction of the dam,



Lower Section of Main Post.

a 10-in. wooden stave conduit, slightly over 14 miles in length, and about 10 miles of cast-iron distribution mains in Montrose was awarded to the American Water & Light Co. in the spring of 1905. These works have since been completed and the whole system is in satisfactory operation.

An earth fill dam having a puddle core wall was built to develop the reservoir site. This dam is 10 ft. wide and 480 ft. in length at the crest, 35 ft. in height, has a 1 on 3 slope on the upstream side and 1 on 2 slope on the downstream side. A low dam 320 ft. long at the crest and with the same slopes as the larger dam was also built across a saddle near one end of the latter. Both dams have their upstream slopes paved with 6 in. of gravel to the top, although an overflow prevents the water reaching a depth of over 30 ft. at the dam.

The puddle core wall of each dam was built in a trench carried 5 ft. below the natural surface. The core wall of the main dam is 10 ft. wide from the bottom of this trench to the natural ground surface, above which it has a batter of about 1 in. to the foot to its top, 32 ft. above the ground level. The ground rises from the center of the dam toward both ends. This rise was overcome in the core wall by cutting steps having 1-ft. risers and 5-ft. treads in the bottom of the core wall trench.

The outlet from the reservoir is a 4ft. circular screen chamber, 32 ft. high, built in the dam. The water may be drawn from the bottom of the reservoir, or from a point 11 ft. above the latter into this chamber, the outlet from which is an 8-in. cast-iron pipe laid in concrete to the downstream toe of the dam, where it connects with the wooden stave conduit.

As the reservoir is 2,000 ft. above the town, the pressure had to be reduced at intervals along the conduit. This reduction is obtained at each point by a special reducing valve placed in a small valve chamber. Whenever the difference in elevation reached 200 ft., one of these valves was inserted and the pressure reduced to that of the atmosphere so no section of the pipe stands under a greater hydraulic head than 200 ft. Ten of these valves and valve chambers were, therefore, installed. These chambers are 6x8 ft. in plan and have concrete bottoms and side walls 6 in. thick. A gate valve is placed on the conduit immediately inside the chamber and just beyond this valve is the one in which the pressure is reduced. The outlet from the chamber is through a 10-in. strainer on a free end of the conduit.

The pipe was all laid with a cover of at least 4 ft. in the trench. The latter was largely all made with a Buckeye traction ditching machine. For the first 6 miles from the reservoir the trench was blasted out of the rock in the side hills to a considerable extent. Most of the remaining 8 miles of the trench had to be made through cementing gravel, which could only be moved with a pick when taken out by hand. The ditching machine was very successfully and economically employed in all of the trench over this 8 miles, working over the rough places in the line without any difficulty. It was also used with good results in making the trenches for the distribution mains.

Some trouble was experienced at first in making the wooden stave conduit tight, owing chiefly to the fact that the wood had not been properly seasoned before it was delivered. The leaks were caulked after the line had been in use for some time, and at present the conduit is in good serviceable condition.

A HEAVY-CAPACITY CAR of unusual proportions has recently been built for the Bethlehem Steel Co. by the Philadelphia & Reading Ry. for the transportation of castings weighing 125 tons. This load is distributed on 32 wheels, grouped in four eight-wheel trucks. The load is carried in a "well," formed between two 6-ft. plate girders 67 ft. in length, which taper at the ends, and rest on center-plate frames of 26-in. plate girders, 20 ft. long, that are supported by two of the 8-wheel trucks. The "well" accommodates castings 5x24 ft. in size by 12 ft. 10 in. high, and the load is distributed over a total wheel base of 94¼ ft., of which but 12¾ ft. is rigid.

An Official Examination of the Battery Tunnel, New York.

Owing to numerous statements in the daily papers concerning the condition of the Battery tunnel between Manhattan and Brooklyn, Mayor McClellan instructed Mr. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, to make an examination of the work. This has been done in a thorough manner, everybody connected with the undertaking placing all information in their possession at the disposal of Mr. Lewis. As a result of his inspection of the tunnel and examination of the records of the engineers and contractors, he submitted last week an instructive report, from which the following notes have been taken:

Both cast-iron tubes have been completed for their entire distance. In the north tube the concrete lining and the ducts are practically complete from the Manhattan end to the lowest point, which is near the middle of the East River, where the tube leaves solid rock, while the bottom lining has been carried about to the point where the tube enters the reef of rock about 600 feet further east. There is nothing but the cast-iron shell from this reef to the Furman St. shaft, while from this shaft to the Brooklyn end of the tube the greater part of the concrete lining and some of the ducts are in place. The concrete track invert has been placed for the short distance between the Manhattan end and the Battery Park Shaft.

In the south tube the concrete lining, ducts and track invert are practically complete between the end of the tube and the cross tunnel at the lowest point, and the cross-ties are in position for the greater part of the distance. From here to the Furman St. shaft there is nothing but the cast-iron tube, while from Furman St. to the Brooklyn end of the tube the lining and ducts have been completed.

The portions of the tubes which have been built in rock are in excellent condition, and the work is so far advanced that tracks could be laid and this part of the tunnel made ready for operation in a very short time. Where soft material was encountered great difficulties were presented, and there were variations from grade and section which had to be corrected.

Variations from Theoretical Grade.—North Tube: Beginning at the Brooklyn end the bottom of the tube is about 4 inches below the theoretical grade, this variation decreasing toward the west to a point just east of Garden Place, where the tube suddenly rose to 9 in. above grade, then gradually approached true grade, crossed it about 100 ft. east of Hicks St., and 100 ft. west of Hicks St. dropped to 28 in. below grade, this being the greatest departure. Up to this point the tunnel is wholly or in part above water level. The true grade was recovered in the next one hundred feet, and from there to the bulkhead line the tube bottom was mostly above grade, the maximum distance being about 10½ in., while at one point it fell 9 in. below the grade. After crossing the bulkhead line the tube continued above the theoretical grade for over 500 ft., the maximum variation being seventeen inches. It then ran very closely to the true grade for about 500 ft., and within the next 100 ft. it reached a maximum of 18 in. below grade. For the remaining 200 ft. before the rock reef was reached, the grade line was somewhat irregular.

South Tube: The grade of this tube from its easterly end shows slight variations from the true grade, with a maximum of about 5 in. above and below, but after passing Hicks St. there is, as in the case of the north tube, a more noticeable departure, dropping to about 23 in. below the true grade, which, however, was quickly recovered and was closely followed to the bulkhead line, the maximum variations in this distance, which is about 900 ft., being 3 in. above and somewhat less below the true grade. In both tubes the maximum departure from grade occurred just west of Hicks St., or at the point where the tubes became wholly submerged. Work was in progress on both tubes at this point at the same time, namely, in May, 1904, so that in both cases was presented simultaneously the problem of passing from material which was dry or partly in water to a position wholly below the water level. Work on the north tube was continued, with the results as to grade already outlined, but in the south tube operations were suspended until November, 1904, and it is a significant fact that in the south tube the variations from grade and the deformation are much less noticeable, the maximum east of the bulkhead line being 3 in., and under the river section 6 in. As the material through which both tubes passed is precisely alike, the inference is that the contractors had gained a valuable experience in their work on the north tube which was used to good advantage on the other.

Settlement After Building.—From the Brooklyn end to points about 500 ft. west of the bulkhead line, both tubes rest upon coarse sand of excellent supporting power. From this point to the rock reef and between the reef and the rock through which the west end of the tunnel is driven they rest upon a very fine sand and river silt. The parts of the tubes resting upon this soft material have settled somewhat since they were put in position. Statements as to the time and causes of this settlement are conflicting It has been claimed that this settlement may have occurred gradually during some months after the tunnel was driven. The engineers of the Rapid Transit Railroad Commission and of the Rapid Transit Subway Construction Co. assured Mr. Lewis that the settlement, which reached a maximum of 12 in. in the north tube and 9 in. in the south tube, occurred when air pressure was reduced before the joints had been calked and the fine material coming into the tubes left spaces into which they settled. That this was what actually occurred appears probable from the fact that the contractors made an attempt to adjust the grades by opening the bottom of the tubes at high points in order that material might flow into them, thus causing them to settle to a uniform grade line, and it is said that in this they were partially successful. So far as Mr. Lewis could learn there has been no perceptible settlement during the past year.

Supporting Piles.—In order that further settlement may not occur either through inherent lack of supporting power of the soft material above referred to, or through any change in the character of the material may possibly be caused by the vibrations due to train movement, supporting piles are now being placed under those portions of both tubes which rest in this material. [This work has been described in detail in this journal.] In the space west of the rock reef these piles are being driven about every 35 ft. East of the reef and until the tubes reach coarse sand, the piles are placed about 50 ft. apart. These piles are in pairs, 7 ft. apart between centers, each pile consisting of a steel tube 20 in. in diameter filled with concrete and reinforced with steel rods and hoops. Each pair of piles supports a cradle made of concrete strongly reinforced with steel, this cradle being 11 ft. long and 5½ ft. wide, equivalent to three rings of the tunnel tube.

Under the north tube all of the supporting piles have been put in place east of the reef, and all but seven west of the reef. Under the south reef five pairs remain to be driven to the east and eight pairs to the west of the reef. There will be 63 pairs of these supporting piles, all of which will go to rock or hard pan, their length varying from 4 ft. to about 75 ft. This work is being done very rapidly, and will be completed in about three weeks.

Deformation of Tubes.—Flattening occurred in both tubes and was most noticeable where there were sharp changes in the grade lines. If a ring of the tunnel were to be tightly bolted together and placed in a vertical position, there would undoubtedly be a certain amount of flattening, which would be increased by any loosening of the bolts. This flattening or deformation is most noticeable in the land section, reaching its maximum as in the grade variation about where the tubes became entirely submerged where it was about 10 in. in the north and about 7 in. in the south tube. Between this point and the bulkhead the south tube, which followed the grade more closely, showed a maximum flattening of less than 4 in., and still less under the river.

Correction of Grade and Section.—Where the departure from grade and section has been sufficient to interfere with passage of trains or to endanger the integrity of the tubes, the plates have been removed and concrete, and in one case brick masonry, has been substituted, in some places for the roof, and in other places for the bottom above the water line, while under water new plates giving an elliptical section with the longer diameter vertical have been put in place of the old ones. This was a very difficult undertaking, but it has been successfully done by the use of novel and very ingenious methods. [These have been described in detail in this journal.]

Cracked and Broken Plates.—Much has been said about cracked and broken plates. By far the greatest number occurred on the Brooklyn land section of both tubes, where the material was coarse sand and gravel and where the tubes were wholly or in part above water, and, as in the case of the flattening, they are most noticeable where there are sharp changes from the true grade line. This would appear to indicate that the cracking of plates was not due to the inability of the tubes to retain their shape or to perform their proper functions after they were in position, but to the stresses to which they were subjected by the irregular course of the shield when it departed from the proper grade and the efforts to bring it back to grade after such departure. There are few cracked plates in the river section, especially in the south tube, and Mr. Lewis was informed that nearly if not quite all of the cracking occurred immediately behind the shield during the progress of the work. None of the cracked plates appear to be lacking in that part of the tubes east of the Furman St. shaft, although for about 600 ft. the tubes are entirely below mean high tide. In the portions which are still under air pressure Mr. Lewis could see no leaks either at the joints or from cracked plates, but some may develop when the air pressure is again removed. They can, however, be stopped as have been those east of Furman St.

The inability of the tubes to retain their shape and carry moving trains without leaks, settling and deformation, depends upon the character of the material in which they lie. This material, except for about 800 ft. east and about 600 ft. west of the rock reef, has ample supporting power. As to the very fine sand and river silt on both sides of the reef, there is a difference of opinion. Mr. Lewis examined a number of samples, most of which were taken from under the tubes when plates were removed for the purpose of sinking the supporting piles. Some of these samples are in water, while others are dry. The former appear to be nearly all very fine sand, while the latter have the appearance of a putty-like mud, although all contain a large amount of exceedingly fine sand. While some of the engineers who have this work in charge seem confident that the fine material on each side of the reef is capable of supporting the completed tubes with the moving trains, it is realized that the problem is a novel and difficult one; that tunnels are now being built beneath both the

Hudson and the East Rivers under conditions which have not been found elsewhere; that the tubes, if not otherwise supported, will settle if the underlying material flows into them; that in one of the Hudson River tunnels the original plans called for supporting piles, and that it is, therefore, prudent to insure against settlement by the supports now being put in place.

That the most unfavorable material encountered has considerable supporting power, there can be no doubt. Should this prove to be even less than was believed when it was decided to introduce the supporting piles, the number of these supports can be increased at any time.

Difficult Cofferdam Work on Decomposed Rocks.

A discussion of recent improvements in steel sheet piling elicited some reminiscences of difficult cofferdam work accomplished with heavy wooden sheet piles where troublesome conditions of an unusual character were overcome by simple expedients that are suggestive for similar work under other circumstances.

Several years ago a massive sea wall about 40 ft. high and 114 ft. long was built by the Department of Docks at the foot of East 116th St., on the Harlem River, New York City. The bank and river bed were of mud and miscellaneous fill and peat down to the surface of the characteristic gneiss rock which had an irregular surface sloping from about 15 to 34 ft. below high water level. The footings at both ends of the wall were close to those of buildings which it was dangerous to disturb, and the space at the south end was occupied by an old timber and stone filled crib which made excavations especially difficult. A sewer also crossed the site of the wall and was supported only on the earth and fill. A portion of the bottom at the south end had been badly broken up by dredging and the conditions were such that it was not considered practicable to build the wall with the standard large cast concrete blocks usually adopted by the Department of Docks in New York City. It was therefore decided to enclose the wall by a cofferdam and build it with concrete placed in moulds in open excavation.

A cofferdam about 114 ft. long and from 20 to 25 ft. wide inside, was therefore constructed with some difficulty with 6-in. splined wooden sheet piles driven to the surface of the rock which they penetrated about 1 in. When exposed it was found that the surface of the rock, apparently sound and hard, had been badly decomposed to a considerable depth, perhaps by the action of the peat, and that although firm and quite hard, it could be easily cut by a pick or shovel and when removed in small pieces could be crumbled to fine sand.

When the sheet piles were first driven it was sufficiently solid to afford bearing for them and exclude a large part of the water, but as the interior of the cofferdam was pumped out and the unbalanced pressure on the outside became large, the surface of the rock was rapidly cut out and water entered under the bottoms of the piles in very large quantities so that it soon became impossible to pump it all out and it was necessary to keep up an almost continual redriving of the piles, going around and around the cofferdam and forcing them down as fast as they were undermined.

In this way they were gradually sunk to sounder rock 1 or 2 ft. below the original surface and at the same time a large amount of good puddle clay was dumped around the outside of the cofferdam and protected the feet of the piles so that eventually the leaks ceased and the dam was made good everywhere except at the upper end where the surface of the rock was only about 10 ft. below low water level. Here a large boulder intersected the end of the cofferdam and stopped the sheet piles which brought up hard on top of it with their upper ends forming a curved line extending above the tops of adjacent piles and corresponding exactly with the profile of the boulder. The boulder was lodged in a fissure in the rock bottom, under which the water entered the cofferdam in a great volume.

Efforts were made to close the fissure with cement, concrete and sand, but it was very difficult to place them and it proved impossible to close it entirely, although the leak through it was somewhat diminished so that finally it could be controlled by the operation of one 8-in. and one 6-in. centrifugal pump and one 6-in. and one 3-in. pulsometer. When all of these were working to their full capacity the cofferdam could be emptied, but if any one of them was out of service for a short time the remainder could not control the leak and the cofferdam would be flooded.

Finally, an interior cofferdam of sand bags was built to partly enclose the end of the boulder, where it projected inside the cofferdam, and divert the leak at that point to the opposite side of the main cofferdam. Behind this protection a curved concrete wall about 3 ft. high was built forming a quadrant with one end abutting against the end wall of the cofferdam. In it there were placed two or three large drainage pipes and after the wall was completed the pipes were opened, allowing the flow from the leak to pass through them into the bottom of the main cofferdams while the temporary sand-bag cofferdam was removed and rebuilt on the other side of the boulder, diverting the flow from that portion of the cofferdam where it had previously been. Under its protection, an additional section of curved concrete wall was built connecting with the first quadrant and with it making a semi-circular curb 9 ft. in diameter, with both ends abutting against the end wall of the main cofferdams and entirely enclosing the boulder, fissure and leak. Six-inch outlet pipes were also built into the bottom of this part of the curb wall but were temporarily closed while the water from the leak flowed through those at the other side and was conducted to a large deep sump in the body of the wall in the middle of the cofferdam, which was maintained until the concrete covering the face of the rock was built up to its level when another sump was formed on the opposite side of the cofferdam.

The ends of the pipes leading to the first one were closed with wooden plugs and the sump itself filled up. The second sump received the flow from the leak through the other set of pipes and enabled the bottom to be kept sufficiently dry to permit concreting on the opposite side until the level of this sump was reached when the same operations were repeated, building successive sumps on both sides until finally the general level of the concrete was brought up to, the top of the curb enclosing the boulder and a wall was continued up to low water level after which, of course, it was easy to fill in with concrete over the boulder at low tide, thus completing the foundations. The work was done in successive halves on both sides of the cofferdam while the water was flowing violently over the opposite half. The sumps were large enough to maintain a constant body of water for the pump suction and enable the action of the centrifugal pumps to be graduated exactly to the required service, a requirement which could not have been filled had it been attempted to use the curb enclosing the boulder directly for a suction sump.

The work was completed and the wall finished in about 7 months under the direction of Mr. A. McC. Parker, assistant engineer.

The Big Cottonwood Conduit of the Salt Lake City Water Supply.

The water supply of Salt Lake City is secured from Utah Lake and a number of creeks in the mountains near the city. The flow of the creeks is conserved in reservoirs from which the water is fed to the city mains by large pipes and conduits. The latest extension, the Big Cottonwood conduit, leads the water from the creek of the same name to a reservoir previously built in Parley's Canyon. The construction of the conduit was started in September, 1905, completed during the latter part of last year, and put into service on Feb. 5, 1907. It is a reinforced concrete structure 38,167 ft., or about 7¼ miles long, and has a capacity of 32,000,000 gal. in 24 hr.

Two different sections have been used for the conduit, the one first adopted being rectangular and the second, which was substituted about 5 months after the work had started, has an arched instead of a flat roof. Both sections are 3½ ft. wide. The rectangular section is 4 ft. high with a depression of 2 in. at the center of the floor, the thickness of the latter being 8 in. at the side and 6 in. in the center. The side walls are 6 in. thick, and the flat roof from 4 to 6 in. according to the depth of cut in which the conduit was constructed. In the arched section the floor is the same as in the rectangular type, except that the corners were rounded to prevent the lodgment of impurities, but the side walls were increased to 8 in. in thickness and the roof to 6 in. at the center. The rise of the arch roof is 10.3 in. Of the total length of the conduit, about 27,000 ft. have the section last described.

The reinforcement consists of ⅜ and ½-in. twisted steel bars imbedded in the concrete in planes at right angles to the axis of the tunnel and spaced 6 to 9 in. on centers. In a number of places the conduit is built on piers above the level of the ground, and in such cases additional reinforcement is provided by rods laid longitudinally.

The inside of the conduit is plastered with a coat of cement grout composed of equal parts of cement and sand, and all exposed stretches of the conduit are covered with at least 2 ft. of earth. Blow-off valves with mud drums are provided at three convenient points along the line so as to allow the conduit to be drained for cleaning or in case of emergency.

In building the conduit, as soon as a sufficient length of line to be served economically by one concrete mixer had been graded, the forms for the bottom and walls were erected, and on them, supported by the bracing across the top, was laid a narrow-gauge track on which were operated the steel cars carrying the concrete. The mixing plants were located at suitable intervals in places which could be conveniently reached for delivering the materials and were installed immediately alongside of or over the line of the conduit so as to be able to discharge by gravity into the steel cars. Wooden forms were used exclusively on the work, the lagging for the inside of the conduit being of dressed and matched lumber.

The head of the conduit in Big Cottonwood Creek is in the concrete diversion dam which has been thrown across the canyon so as to create a storage reservoir. From this point it follows the side hills along the hydraulic gradient, through a rough country where considerable rock excavation was necessary, and finally empties into Parley's Canyon reservoir.

The cost of the conduit was $376,600 and about $23,000 more was expended on the dam and headworks and on the improvements to the Parley's Canyon reservoir. The work was done by contract by Mr. P. J. Moran under the supervision of Mr. Lewis C. Kelsey, city engineer.

Heavy Columns in the Metropolitan Tower, New York.

The great tower now under construction in this city for the home office building of the Metropolitan Life Insurance Company will be, as noted in recent articles in The Engineering Record, a 75x85-ft. rectangular steel cage structure with the unprecedented height of 608 ft. above the sidewalk and over 690 ft. above its foundation on the side lot. The exterior walls are of white marble lined with brick, and the floors are of concrete construction. As the lateral dimensions on the tower are equal to those of many tall office buildings and its height is fully three times as great, the static load alone is enormous, and when augmented by the loads from a wind pressure assumed at 30 lb. per square foot of the exposed surface of the tower, the combination results in stresses so large as to be almost or quite unprecedented in this class of construction and to require very special and interesting treatment in the design of the cross-section, details and connections of the principal columns.

The columns are arranged, as illustrated in The Engineering Record of February 9, in four transverse rows about 20 and 25 ft. apart. All of the 12-wall columns are connected by massive rigid sections of deep double girders and knee-braces forming a framework which substantially corresponds to heavy vertical trusses on each of the four faces of the tower, reaching from the foundation to the 38th floor where the roof commences. The corner columns thus receive double increments of wind loads, which give them, in the lower stories, maximum stresses of 7,500,000 lb. each.

The allowed unit stress reduced by the proper formula to nearly 14,000 lb. per square inch requires for these columns a cross-sectional area of 544 sq. in., which is provided as shown in the accompanying detail by twelve 8x8x1-in. flange angles and twenty 1-in. full length plates, two of them 44 in. wide; two, 38 in.; two 20-in.; eight, 14-in.; and six, 8-in. wide. The plates are so arranged as to form continuous webs projecting beyond the flange angles on two sides of the columns to provide connections for the wall girders and knee-braces and receive the wind stresses and distribute them throughout the columns without the use of detached plates, thus very much simplifying the column details and insuring direct and efficient transmission of stresses. A considerable economy is also effected by the almost entire absence of gussets, angles, etc., reducing the estimated weight of the columns to about 1,980 lb. per lin. ft., an amount scarcely in excess of that due to the effective cross-section. It is sufficient, however, to bring up the weight of a single one-story section to the very respectable amount of 26 tons.

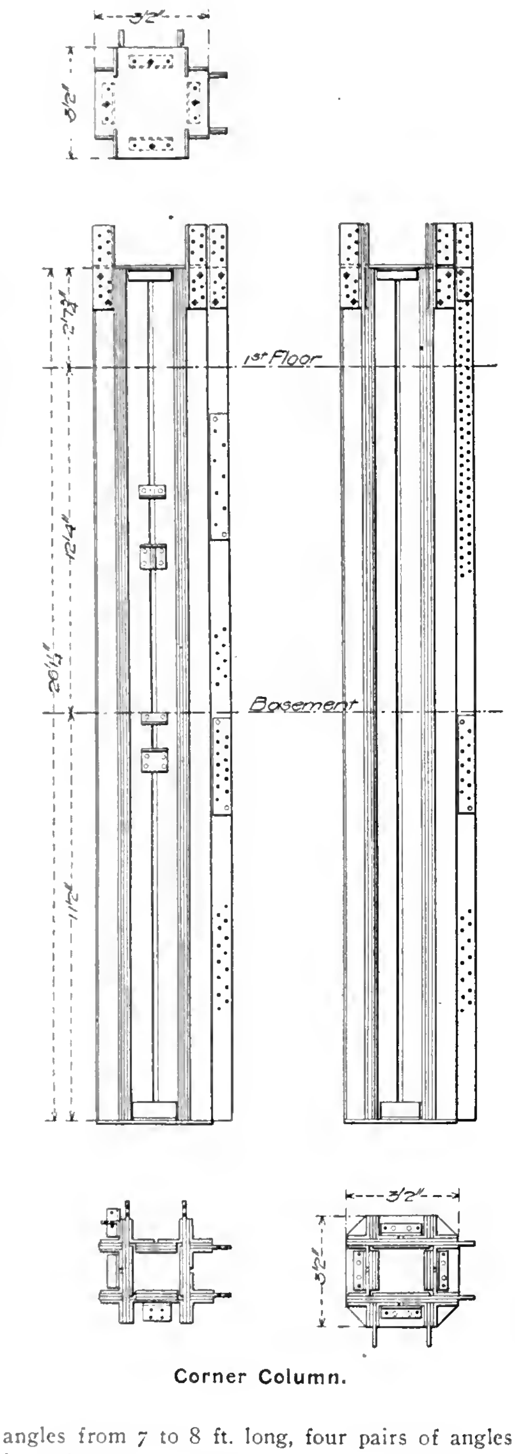
Each column has a 38x38-in. base plate 1-in. thick seated on a cast steel pedestal, 7 ft. sq. and 3 ft. high, which weighs about 11 tons and distributes the load through an I-beam grillage embedded in concrete on the solid rock. The upper end of the column has a horizontal cap plate 1¼ in. thick and receives the foot of the second-story column which is connected to it with eight ½-in. splice plates 5½ in. and 6½ in. in width which are field riveted to both members and serve only to maintain them in accurate alignment until they receive a portion of the dead load, which is, of course, entirely transmitted to the carefully milled butt joints.

The intermediate wall columns although receiving somewhat lighter wind loads carry heavier floor loads and thus require cross-sections only a little inferior to those of the corner columns. Columns 7 and 14 in the first and second stories are 38 ft. 3¼ in. long, have a cross-sectional area of 416 sq. in. and a total estimated weight of 57,493 lb., equal to about 1,500 lb. per lin. ft. They have an ordinary rectangular closed cross-section made with three webs and two cover plates, all of them heavily reinforced and built up with eight 6x4x1-in. flange angles, eight 22x1-in. web plates and six 28x1-in. cover plates, all full length. The connections for wall girders and knee braces are on opposite sides and instead of being formed by extensions of the continuous pieces forming the column sections are made with pairs of 8x6x½-in. angles and 6x6x½-in. angles from 7 to 8 ft. long, four pairs of angles in each set.

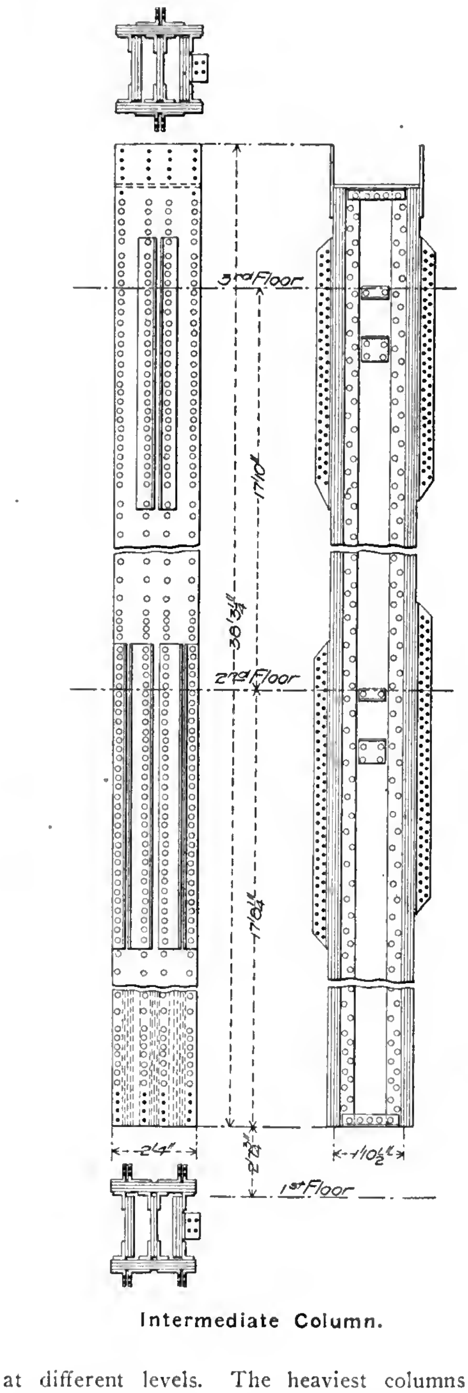
The columns have horizontal cap plates at the upper end and the splices are very simply made with pairs of short cover plates shop riveted to the upper ends of the lower sections of the columns and field riveted to the lower ends of the upper sections. The connections for each of the twin wall girders in the lower story are made with fifty-two 1-in. rivets in double shear. Sub-punching and reaming is permitted only in material less than ¾ in. thick, and as all of the principal parts of these columns are made from thicker materials the rivet holes are drilled from the solid metal, thus making an unusually large amount of shop work, but insuring very perfect work.

In the upper part of the tower the dimensions of the columns diminish to 42x42-in. at the fifth floor, 38x38-in. at the 12th floor, 36x36 in. at the 18th floor, 32x32 in. at the 20th floor, 19x29 in. at the 25th floor, 18x28 in. at the 28th floor, 20x24 in. at the 33rd floor, and 12 in. at the 37th floor. Most of them are shop riveted in two sections with an average length of 24 ft. above the 12th floor, below which the stories have heights of 13 to 20 ft.

The weights of even the lighter columns are therefore considerable, as is indicated on the special weight diagram provided for the erectors and showing the maximum loads to be hoisted



Corner Column.



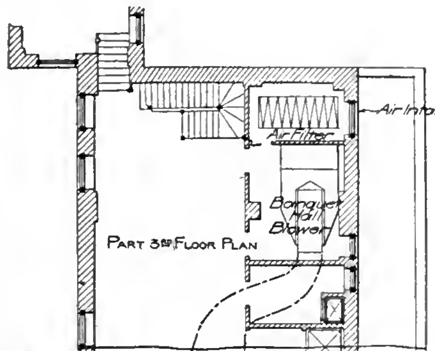
Intermediate Column.

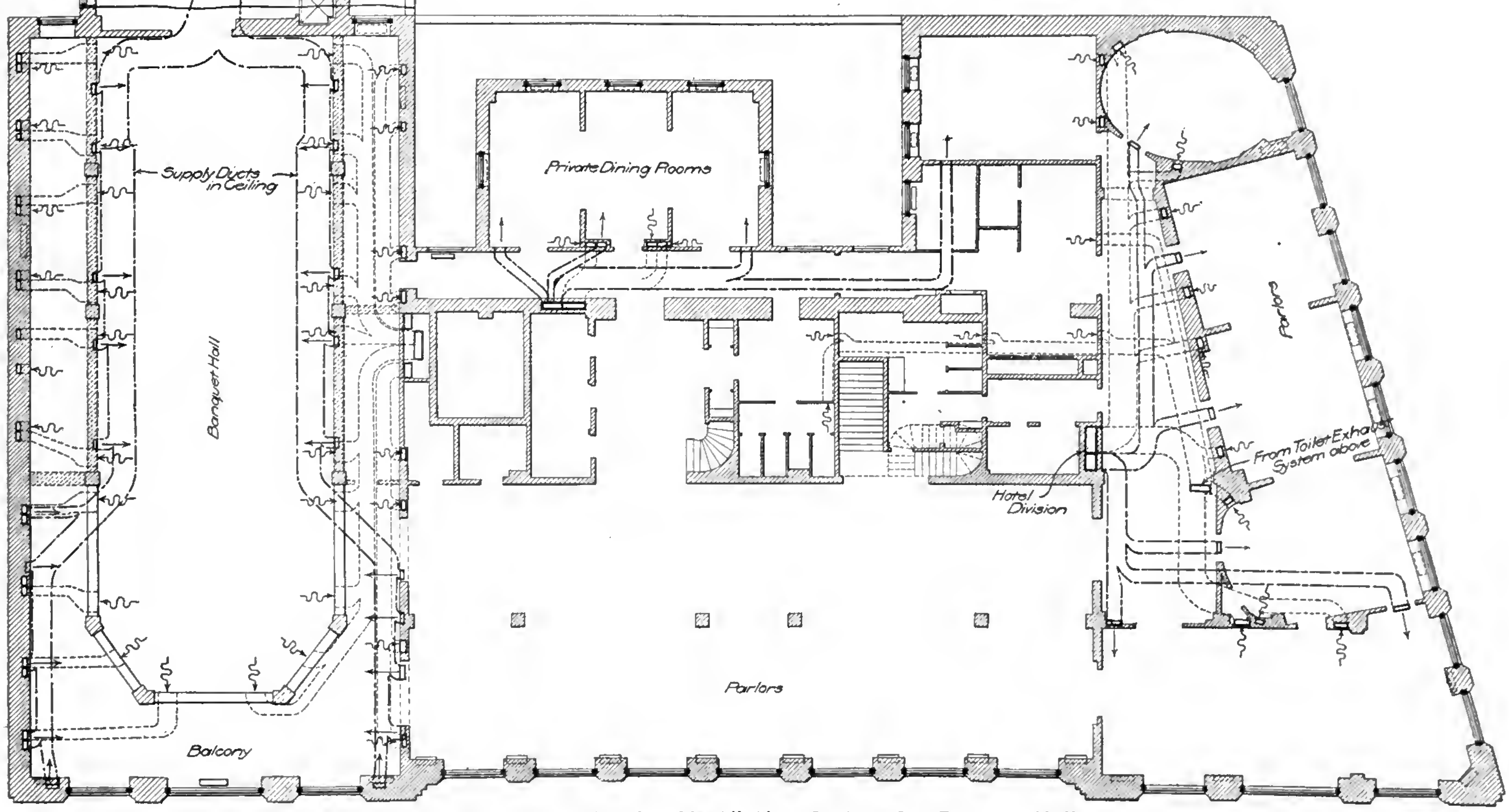
at different levels. The heaviest columns are at the 3rd floor and are 39 ft. long and weigh 29 tons each. At the first floor there are 25-ft. 25-ton columns; at the 12th floor, 151 ft. above the sidewalk, 29-ft. 19-ton columns; at the 19th floor, 14-ton columns, and 33rd floor, 48-ft. columns weighing 8 tons each, which have to be hoisted over 400 ft. above the sidewalk. There are besides a number of heavy girders including 48 plate girders 78 ft. long, weighing 11 tons each at a height of 441 ft. above the sidewalk and shorter 4½-ton girders 491 ft. high; the highest heavy pieces are the 24-in. I-beams 13 ft. long over 600 ft. above the sidewalk.

Mr. N. LeBrun & Sons are the architects, Purdy & Henderson the consulting engineers, and Post & McCord, the contractors for the fabrication and erection of the steel work.

Heating and Ventilating the Hotel Knickerbocker, New York City.

The Hotel Knickerbocker, which was opened to the public early in 1907, is the most recent and one of the finest appointed of the transient hotels in New York City. It is a 12-story fireproof structure occupying an irregular corner plot, fronting 110 ft. on Broadway, 180 ft. on 42d St., and extending through the block at the rear corner to 41st St., with 50 ft. frontage on the latter street. It has, on the main floor, the hotel lobby, cafe and dining room, on the second floor parlors, private dining rooms and a banquet hall, and guest rooms from the third to the eleventh floors inclusive, with employees' dormitories on the 12th floor and ventilating apparatus in pent houses on the roof. The basement is devoted to kitchen and serving rooms, and a grill room, while all mechanical apparatus is accommodated in a spacious sub-basement, which also contains storage rooms and the laundry. Both the basement and sub-basement extend under the sidewalk, except where this is prevented on the 42d St. side by the underground structure of the New York Subway.





Second Floor Plan Showing Ventilating System for Banquet Hall.

The mechanical equipment of this hotel is unuslly complete, embracing an extensive power plant with the usual service auxiliaries, and a very complete installation for the ventilation of the lower and sub-surface floors as well as all toilets and baths on upper floors. The particularly open location of the hotel facing directly on Times Square, with window exposure on practically all four sides, obviated the necessity of ventilation in the guests' rooms on the upper floors. All of the bath rooms that have not exterior windows are, however, fitted for exhaust ventilation, air being admitted to such rooms through louvres in the doors. On the second floor, however, there is a large banquet room, which, together with a number of smaller private dining rooms, are amply fitted for ventilation, both fresh air supply and exhaust, and similarly all the public rooms on the lower floors are well ventilated. The purpose of the ventilating equipment has been to provide ample changes of air throughout, for maximum conditions of occupancy in all of the public portions, while in the kitchen and heated machinery section, cool fresh air is supplied for the sole purpose of relieving the high temperatures that would otherwise render these departments uncomfortable. The ventilation in this building is made entirely independent of heating throughout, heating being accomplished by direct radiation operated with low pressure steam from the power plant.

The ventilation of this building is laid out in seven divisions, four of which are for the lower floors and the remaining three for the ventilation of the baths on the guest-room floors and auxiliary rooms. The four lower divisions include what is known as the hotel system, covering the grill room in the basement, the entire first floor and the parlors on the second floor; the banquet hall system; the kitchen and laundry system, and the engine room system. It was found advisable to separate the banquet hall system from that first mentioned, called the hotel system, owing to the fact that the banquet hall is used at infrequent intervals only, and when in use requires a comparatively large ventilating capacity. The kitchen and laundry and engine room systems are operated separately owing to the fact that in the former a considerable amount of air tempering is required under winter weather conditions while in the latter cold fresh air only is supplied at all times, there being no need for warming in the heated machinery section of the sub-basement. The fans for all of the systems for the four lower divisions are located in the sub-basement, with the exception of the supply fan for the banquet hall system which, for convenience of air intake and distribution connections, was located on the third floor. The toilet exhaust systems have disc exhaust fans located in the usual arrangement on the roof of the building and draw through vent flues which connect in the various sections of the building with the bath rooms and toilets to be ventilated.

The ventilation is generally applied in the public portions on the downward system, the fresh air being supplied through outlets near the ceiling in all cases, with exhaust through registers near the floor. The floor exhaust registers are, however, duplicated throughout by registers from the same flues at the ceiling line, to permit ceiling exhaust in warm weather or in special cases where it is desired to remove cigar smoke. In the hotel division the wall supply outlets are distributed at frequent intervals in the upper sidewalls in the main dining room, the cafe, the bar and the grille room. The exhaust registers, which are of the same size, are given corresponding locations to render the circulation positive. The lobby on the main floor and the large parlor on the second floor are, however, without ventilation connections, the entrances from out-of-doors and the numerous connections with the corridors and other adjacent rooms providing sufficient ventilation for all practical purposes. An extension of this system is made in portions of the second floor to a number of smaller parlors, private dining rooms and special rooms, to each of which there are individual supply and exhaust connections, as shown on the accompanying second floor plan; these connections are, it should be stated, independent of the toilet and locker room exhaust systems which are also shown on this plan, the latter being operated by a flue connection from one of the roof exhaust fans. The private dining rooms consist of a group of three connecting 11x20-ft. rooms fitted with independent supply and exhaust connections on the above arrangement, by which uniform rates of ventilation are insured in each under all conditions. The capacities of air supply and the exhaust apparatus which are provided for this hotel division are almost exactly

Fan Equipment in the Hotel Knickerbocker.

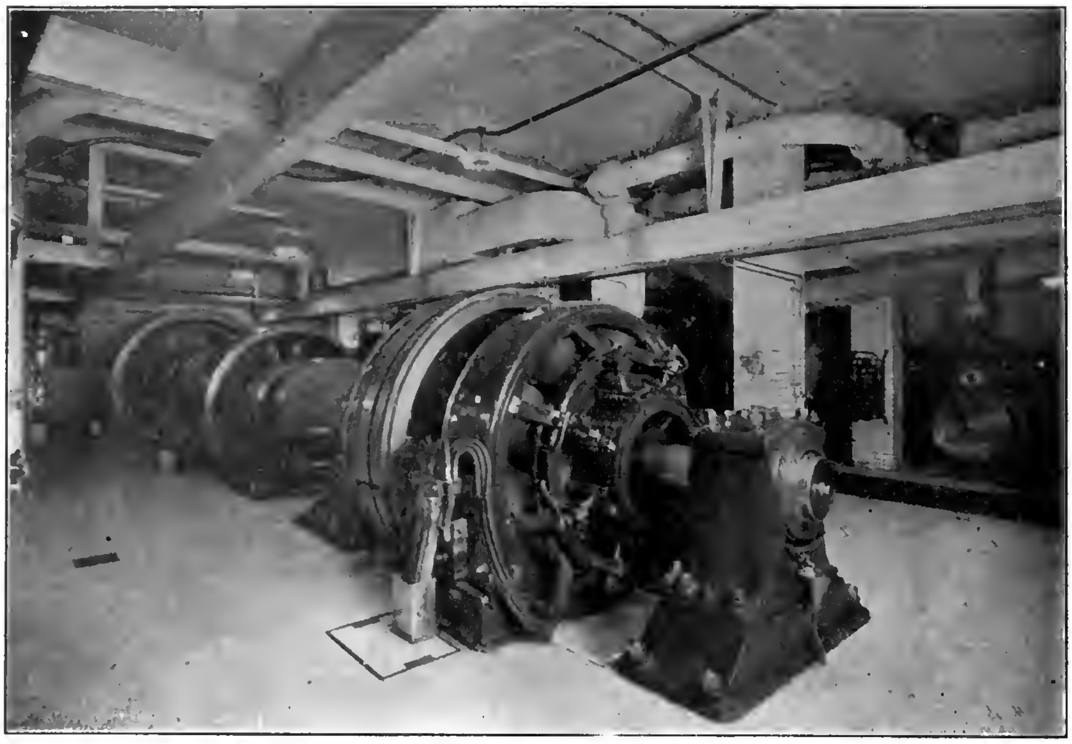
		Size of Fan.	Wheel Width.	Speed.	Capacity per Min.	Size of Motor, H.P.
Hotel division	Supply	9 ft.	5 ft.	130 r.p.m.	44,900 cu. ft.	18
	Exhaust	9 "	4½ "	130 "	40,400 "	15
Banquet hall division	Supply	5½ "	3 "	150 "	11,450 "	4
	Exhaust	7 "	4 "	150 "	26,000 "	8
Kitchen and laundry division	Supply	6½ "	3½ "	220 "	27,980 "	15
	Exhaust	9½ "	6 "	123 "	56,000 "	25
Engine room division	Supply	5½ "	3 "	213 "	16,200 "	7
	Exhaust	8 "	4 "	147 "	31,800 "	12
Bath room division	Exhaust	2—60 in.	....	300 "	48,000 "	4½
Annex	Exhaust	1—42 "	....	450 "	13,000 "	3

equal, the supply being a trifle in excess of that for exhaust.

The banquet hall is a room 47x93 ft. in plan, occupying the entire easterly end of the second and third floors. It has a balcony on the third floor level at the forward end, narrowing at the rear on this level to a width of 29 ft. for a distance of 57 ft. The arrangement of ventilation in this division consists of fresh air supply from 10 registers near the third floor ceiling line which are arranged as shown in the accompanying plan and exhaust connections at the edge of the gallery on the third floor level and also under the gallery in the sidewalls near the second floor level. The arrangements of registers were carefully studied for proper distribution of ventilation under extreme conditions of occupancy in the hall, it being made possible to remove air in large volumes at the balcony level and thus prevent the disagreeable accumulation of cigar smoke. The distributing ducts for the ceiling fresh air supply outlets are arranged above the main ceiling of the hall, connecting at the rear to the supply fan which is located on the third floor level. The exhaust registers are operated by independent duct connections to the sub-basement, where dampers are provided to enable either the top or bottom registers to be operated independently or together as required by conditions in the hall. For this hall, comparatively great ventilating capacity has been provided to permit of ample ventilation in times of extreme occupancy. The capacity of exhaust is also made considerably in excess of that for supply, the purpose being to cause a state of plenum inward and thus prevent the communication of cigar smoke or odors to the hall or corridors of the hotel.

The kitchen and laundry system involves the simple arrangement of supply and exhaust fans in the sub-basement with short direct connections to the kitchen directly above, and the laundry at the forward end of the sub-basement. The arrangements of supply and exhaust outlets in the kitchen follow the usual arrangement, consisting of numerous vent openings over the ranges, stock boilers, and other cooking utensils and cool fresh air outlets at the rear of the positions occupied by the cooks, to permit of a blast of cool air from the rear when at work. The bakery, pastry and dish-washing departments are also similarly equipped with ample ventilating connections, and owing to the heated condition of these departments all exhaust registers are located at the ceiling line. The ventilating connections in the laundry follow also this latter arrangement, the arrangement of connections differing principally in this department in that large gathering hoods are located over some of the mangles and other washing apparatus from which large volumes of steam are emitted; this tends to keep the laundry atmosphere clear and prevents the communication of steam to the corridors of the building. In this division the exhaust capacity is, of course, made considerably in excess of that for fresh air supply, for the purpose of creating a strong plenum inward, and thus preventing the communication of odors from either department into other portions of the building. Similar to this system in all its details is the engine room ventilating division, which involves fresh air supply and exhaust in all portions of the heated machinery section. The fresh air is supplied without tempering and the capacity of exhaust is also considerably greater than that for the fresh air supply for the same reason as in the case of the preceding division.

For exhaust ventilation from the baths and toilets on the guest floors there are two vent risers, each with groups of gathering ducts from the various rooms, which are located at the front and rear corners of the building on the 42d St. side. These systems are installed solely for the ventilation of baths and toilets which have no opening to outside air; such bath rooms as have outside windows are not thus equipped. The general arrangement is shown in the accompanying second floor plan, that in the front corner exhausting in general from nine bath rooms on each of the floors and that at the rear similarly from eight baths; the smaller flue shown in the central portion serves to exhaust from groups of two inside baths on each of the floors, as far down as the fourth floor, being connected at the top to the rear corner riser. These two larger vent flues are operated by 60-in. Howard & Morse disc fans which are located in pent houses on the roof and discharge directly to the atmosphere. These fans are vertically arranged for economy of space, and are each driven by a 4½-h.-p. round type vertical shaft Sprague electric motor. The third exhaust system consists of a 42-in. disc fan of similar make, direct driven by a 3-h.-p. round type Sprague vertical motor, which is located on the roof of the annex and exhausts from the servants' dining rooms and a number of auxiliary rooms in the annex.



Electrical Generating Units in Engine Room.

The fans operating the four ventilating divisions in the lower portion of the building, of which there are seven in the fan room in the basement and one on the third floor at the rear of the banquet hall, are all Sturtevant steel-plate centrifugal fans, which have been installed in the following sizes (see appended table for list of dimensions and capacities.) These fans have intake through a filter chamber with 8 x 10-ft. shaft connecting to a ventilation court on the 2nd floor level, the filters being of the usual zig-zag cheese cloth type, designed for low filtering velocities. The motors operating these fans are all of the type D Sprague direct-current motors which are equipped with variable speed starting boxes by means of which considerable changes of speed may be obtained. The motors are operated at 110 volts, each on separate power circuits from the switchboard. The duct connections are all of rectangular iron construction and are well arranged in the sub-basement for the complexity of equipment involved. They are heavily covered with asbestos air-cell coverings, protected with canvas sewed on.

The building is heated throughout by direct radiation, utilizing low pressure exhaust steam from the steam using machinery of the power plant with the Paul system of returns. Automatic temperature regulation is provided upon radiation in practically all of the public portions of the buildings, but that in the guests' rooms is fitted for hand control. The distribution of radiation follows the usual plan of units underneath window-sills in varying capacities to correspond with the amount of glass exposure to be counteracted and in all public and guest rooms, radiators are enclosed in recessed spaces with ornamental grilled fronts. Steam is supplied to the radiation on the one-pipe system through risers located in chases in the sidewall construction, which are fed by a distributing main on the sub-basement ceiling. The distributing main consists of a 12-in. line connecting with the muffler tank of the exhaust steam system of the power plant which extends to the front of the building reducing to 7 and 6 in. to supply the risers, and full size to the rear, supplying both risers and tempering coils of the fresh air supply fan systems in the fan room at the rear corner of the basement.

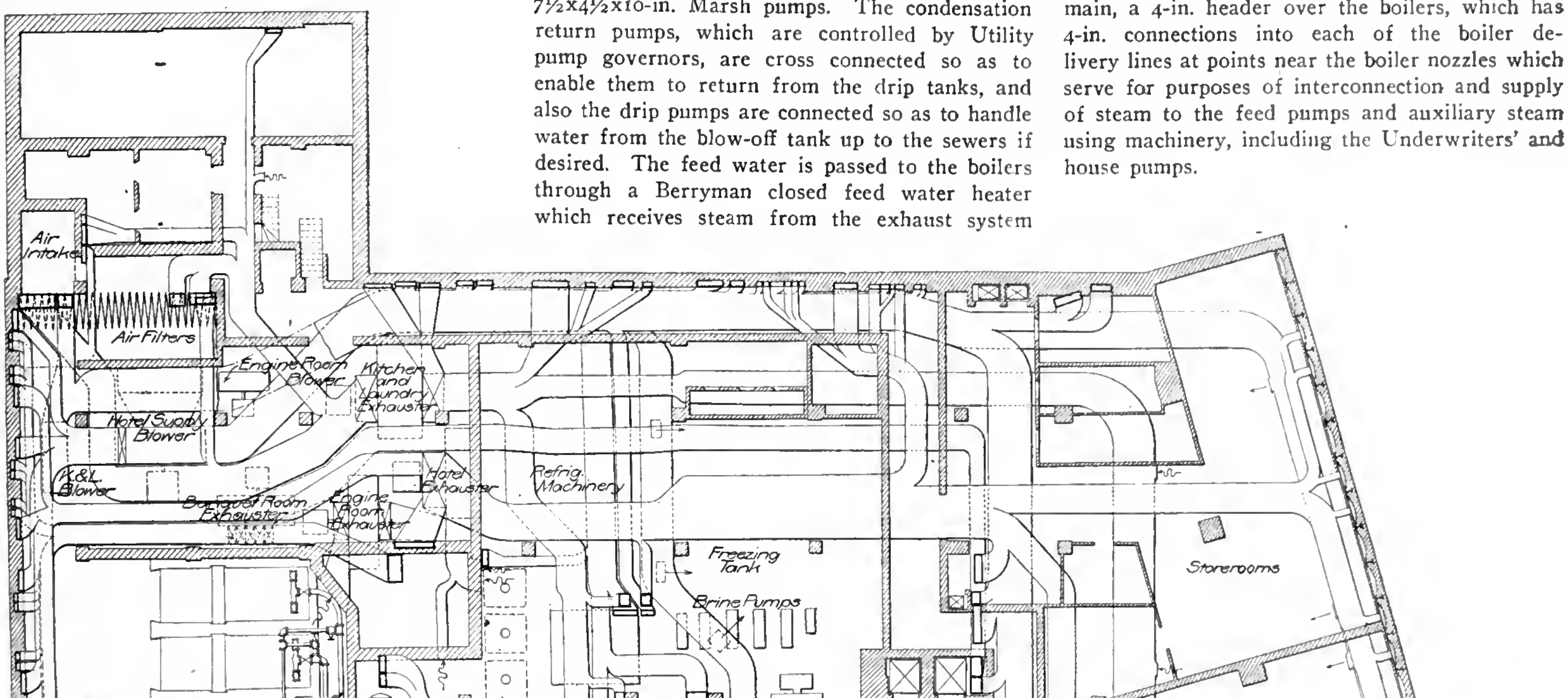
The power plant and mechanical equipment of the hotel occupies about two-thirds of the sub-basement space, the remaining third of the sub-basement at the Broadway end being devoted to a 60x70-ft. laundry and a number of store rooms for hotel supplies. The power plant section consists of a 43x60-ft. boiler room at the rear on the 42nd St. side with 12-ft. coal bunker extension under the sidewalk, a 40x60-ft. fan room

and in the central portion, the main engine and machinery room, which is 75 ft. in width and extends entirely across the building, a distance of 120 ft. Ample head-room is provided in practically all sections of the sub-basement for overhead piping and duct connections, that in the engine room permitting a traveling crane runway over the electric generating machinery for handling of parts. A feature of this mechanical plant installation is the care that has been given to the appearance of the interior, the floors being finished in tile throughout the machinery and laundry section, all piping and duct work being conveniently and orderly arranged and the interior attractively finished throughout.

trolley, installed by the Northern Engineering Co., of Detroit, Mich., the buckets having a capacity of 500 lb. each. The ashes are handled by the same trolley system, being delivered to a small ash hoist near the coal-bunker which raises the ashes in cans to the street level.

Boiler feeding is provided for by an equipment of eight pumps, flexibly arranged in four groups of duplicated units, four of which return condensation from the heating system, two of the remainder handling water from the high or low pressure drip tank and the two others for the make-up water from the city water supply. The condensation return pumps are 10x6x12-in. Marsh duplex steam pumps, while the other four are 7½x4½x10-in. Marsh pumps. The condensation return pumps, which are controlled by Utility pump governors, are cross connected so as to enable them to return from the drip tanks, and also the drip pumps are connected so as to handle water from the blow-off tank up to the sewers if desired. The feed water is passed to the boilers through a Berryman closed feed water heater which receives steam from the exhaust system

tion having a gate valve at the drum and a Bedford non-return stop valve at the boiler nozzle. The main delivery connections consist of a 9 and a 12-in. line to the engine room, the former supplying a 150-kw. and a 200-kw. generating unit and the latter a 250-kw. and a 300-kw. generating unit, all through Cochrane steam separators; an 8-in. line delivers steam to the elevator pumps, the refrigerating compressors, brine pumps, etc., a 3-in. line through a pressure reducing valve to the laundry and kitchens, and a 6-in. delivery line through a 6x12-in. reducing valve to the heating supply mains for make-up to supplement the exhaust steam in case of deficiency. There is in addition an auxiliary main, a 4-in. header over the boilers, which has 4-in. connections into each of the boiler delivery lines at points near the boiler nozzles which serve for purposes of interconnection and supply of steam to the feed pumps and auxiliary steam using machinery, including the Underwriters' and house pumps.



Details of Ventilating Equipment in Sub-Basement.

Steam is generated in an equipment of four Babcock & Wilcox water-tube boilers which have an aggregate capacity of 1,400 h.-p. These consist of two small units set in a single battery and two larger units each in single settings, the smaller units having 120 and the larger units 210 four-in. tubes 18 ft. in length. They each have 42-in. steam drums, 18 ft. in length for the smaller units and 14 ft. for the larger ones, and are designed for a working pressure of 125 lb. The settings are equipped with Thompson shaking grates for hand firing, the coal consumption under ordinary conditions of operation being about 28 tons per day. Coal is stored in a 200-ton bunker, under the sidewalk at the 42nd St. end of the boiler room, into which it is dumped directly from the street. The coal is handled to the furnaces by a bucket and chain industrial

of the plant and preheats the feed water to about 200° Fahr. The blow-off system involves a 4x8-ft. steel plate tank in the machinery room at the rear of the boiler fittings, to which 2-in. blow-off connections are made from the boilers. A Utility pump governor connected to this tank controls the blow-off pump to keep the tank half filled, discharging the blow-off from the boilers to the sewers as it accumulates.

The steam piping of the power plant embraces an unusual arrangement of individual connections from the boiler nozzles to a large steel plate drum or header on the engine room side of the division wall, from which drum the high pressure delivery connections are made. The drum is 30 in. in diameter by 15½ ft. long and has 6-in. connections to the smaller boiler units and 8-in. connections to the larger ones, each connec-

The electrical generating equipment consists of four Sprague multipolar engine-type generators direct-connected to Fleming four-valve engines. These units have been installed in a novel arrangement of sizes, their capacities being 150, 200, 250 and 300 kw. respectively, in order to permit of adjusting the generating capacity as close as possible to the current consumption in the hotel at all times. The units are located in an engine room of more than usual beauty, each being guarded by a 2-in. polished brass railing and the flywheel shrouded by a Russia iron casing. The room is spanned by a 10-ton hand-operated traveling crane supplied by the Northern Engineering Co. The engineer's office is located in a mezzanine gallery at the westerly side, from which position a clear view is had of the entire engine and machinery rooms.

The generators deliver current at 110 volts, direct current, the hotel being wired on the 2-wire system. The circuits are controlled on a large switchboard in front of the generators, which is divided into two sections for power and lighting service. All motors are operated on individual circuits from the power sections and on the lighting section, there are 42 feeders of capacity from 100 to 800 amperes. The average running load carried by the generating machinery is 3,000 amperes.

The elevator equipment of the hotel consists of 11 passenger elevators installed by the Standard Plunger Elevator Co., of New York, which are operated by three 18 and 28x13x24-in. American compound single cylinder pumps of the outside center packed plunger type. These units have each a capacity of 650 gal. of water per min. against a pressure of 160 lb., being installed in the three-unit layout to permit of one pump carrying the load when the service is light, and not requiring over two pumps under any circumstances, so that one unit is always held in reserve. There are three pressure tanks, consisting of 6x22-in. steel plate tanks suspended on the ceiling over the pumps, in which air space is maintained by a 10x8 and 4x12-in. two-stage Marsh air compressor. The elevator discharge tank has a capacity of 15,000 gal.

The refrigerating plant consists of two 45-ton and one 3-ton machines of the ammonia compressor type which were built by the York Mfg. Co. Either one of the 45-ton machines will handle the entire refrigeration duty in the hotel and the 3-ton machine is for very low temperatures for making ice-cream, etc. About 9 tons of ice is manufactured daily, and the total refrigerating duty averages about 45 tons per day. All cooling service in the hotel is operated by brine circulation, for which there are two services, one for the upper portion of the building and the other for the lower. The upper or high pressure circulation is operated by 7½x4½x10-in. single cylinder Marsh pump in duplicate while the low pressure service is operated by three 10x8x12-in. American pumps. A separate system is used for ice manufacturing, a 4x6x8-in. Marsh pump circulating the brine to the ice tank. Other auxiliary services operated include extensive vacuum sweeping and pneumatic tube systems, and an electrically operated printing establishment in the annex, in addition to which large amounts of live steam are used in the laundry and kitchen apparatus.

The mechanical plant of the hotel was designed by G. A. Suter & Co., New York, in consultation with Mr. Alfred R. Wolff, consulting engineer, New York. The steam generating, heating and ventilating equipment were installed by G. A. Suter & Co., the generating machinery by G. E. & A. L. Pennock, and the wiring by the Lord Electric Co., New York. The architects of the building were Trowbridge & Livingston.

Automatic Coaling Barges of the American elevator type have recently been introduced on the Mersey in England, five such barges of 1,300 tons capacity each being operated there. They are fitted with elevated bins, which are filled from the barge below by continuous bucket conveyors, on the principle of the floating grain elevators, and thence discharged through adjustable chutes into the coal bunkers of the steamers. The coal delivered is automatically weighed and each barge can deliver at the rate of 180 tons per hour. In a recent test 904 tons of coal were placed on board of one of the English war vessels in 4¾ hr. by two of these barges, although if a sufficient number of workmen had been available for trimming the coal in the bunkers, this could, it is said, have been accomplished in 3½ hr.

A Novel Moist Closet.

Read at the annual meeting of American Society for Testing Materials on June 22 by Mr. E. B. McCready, of the Lehigh Valley Testing Laboratory at Allentown, Pa.

A brief description of a moist closet—fully equal to a slate or soapstone closet—which may be made in any laboratory with a minimum of cost considering its character, may be of interest to some of the members of this society. The closet illustrated was made of "waste cement" left from a testing—all brands mixed—and several samples of natural sand from the same source. The cement was thoroughly mixed, as were the sand samples, so as to insure uniformity in color.

The mortar was mixed 1 to 2 and wet enough to be filled readily into and tamped down in a ⅝-in. space. The walls are 1¼ in. thick, except the center panels of the doors, which are only ½ in. thick. The walls are reinforced with ½-in. mesh galvanized wire netting.

The hinges in this closet were specially designed to be imbedded in the walls and doors. Of course, if desired, ordinary strap hinges can be used, except that they should not be of iron, and may be bolted to the doors and walls. The hinge shown is a little more expensive, but makes a better appearance.

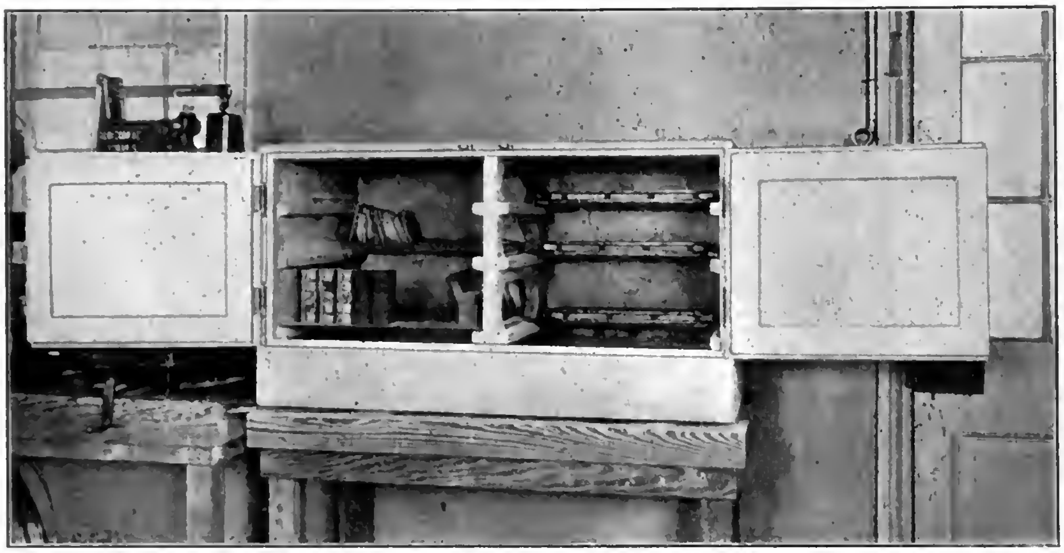
The dimensions of this closet are practically the same as those of the soapstone closet described by Mr. R. L. Humphrey and illustrated by Taylor & Thompson and others, but shape and size may be varied to suit the space to be occupied or the size of molds used. The necessary forms can readily be made by any carpenter and consist of an outside form or box, without top or bottom, and two inside forms or cores, which are simply boxes with tops, but no bottoms. As the closet is cast face or front down, the top of the forms means the back of the closet. When the forms are in position, there must be 1¼-in. clearance all around each core, top, bottom and sides.

The doors are cast first by filling in a frame of the proper dimensions, laid on a pane of glass or other flat surface which has been oiled. The hinges are placed by marks on the frame and secured to it by small brads before the mortar is filled in. The same form answers for the two doors by simply reversing the position of the hinges. If made like those illustrated, the hinges must be "right" and "left."

When hard enough to stand handling, the two doors are placed, in their proper relation, face down, on a flat surface and the outer box-form placed around them. The edges of the doors are covered with several thicknesses of oiled paper and the cement mortar filled in around them level with the doors, making the layer of mortar just 1¼ in. thick. The inside forms are immediately placed in position, open end down, and are supported by the doors, which are sufficiently hard. If correctly made, they will reach to withiin 1¼ in. of the top of the outer form and there will be an open space of 1¼ in. all around each core. The mortar is then filled in around and over these cores and smoothed off even with the top edge of the outer form; this top layer forming the back of the closet.

Of course, the placing of the reinforcement adds slightly to the detail of these operations. The doors and the back are filled in two layers with the wire placed between. The wire for the sides, in one piece, is placed in position and kept in the middle by strips of half-inch board which are moved along or taken out as the mortar is filled in.

The doors may be panelled and their weight reduced by placing in the frame, before and after filling a piece of plate glass, slate or even wood of the desired shape and thickness. These are removed after the mortar has hardened.



Interior of Moist Chamber of Reinforced Concrete.

The forms must be thoroughly shellaced and oiled before use. The cores must be put together with screws, entirely from the inside and exposed ends and edges slightly bevelled so that they may be removed after the cement has set.

The shelf cleats are provided for by longitudinal strips on the ends of the core boxes, in width equal to the distance desired between the cleats. The space between, when filled with mortar, makes the cleat.

The appearance of the closet may be enhanced by thoroughly moistening the green surface after the removal of the forces and sifting some neat cement lightly and evenly over the whole from a 50 or 80 mesh sieve.

This closet has been in use a little over a year and has given great satisfaction. It is water-tight and requires no felt lining to maintain a uniform degree of humidity. By actual repeated tests, we have found the percentage of saturation on the top shelf to be as high and often a little higher,—owing, perhaps, to a slight difference in temperature,—than at the surface of the water.

The Pavements of Berlin have a total area of 7,499,600 sq. yd., of which 4,521,000 sq. yd. are stone, 2,857,300 sq. yd. are asphalt and 120,-900 sq. yd. are wood, the remainder being slag, macadam and concrete. The stone blocks rest on an 8-in. bed of crushed stone and the asphalt on 8 in. of concrete. Natural asphalt 2 in. thick after compression is used.

The Hydro-Electric Plant of the Vancouver Power Co.

The Vancouver Power Co., Ltd., has for some years been operating a hydro-electric plant supplying current for electric lighting, street railways and commercial purposes in Vancouver, B. C., and the surrounding towns. The plant, which originally had a capacity of 9,000 h.-p., will eventually have a capacity of 30,000 to 40,000, the supply of water being ample for such a development. Measurements of the flow of three streams had been made for a number of years, but owing to the high cost of the first installation the work was not started for 10 years after the feasability of the project was determined. Construction was finally started in August, 1902, and current was first generated in December, 1903, though the plant was not completed until a year and a half later.

Early in 1902 a very careful examination was made of the water supplies which had been under observation, and as a result of the report rendered the plans which have since been executed were adopted. The scheme has been to build a dam across the outlet of Coquitlam Lake and bore a tunnel to Trout Lake, a distance of 12,775 ft., using the former lake for storage, and the latter as a balancing reservoir. The outlet of Trout Lake will likewise be closed with a dam, from which the pipe lines will lead to the power house, situated on an arm of the sea just above high tide.

The main source of supply, Coquitlam Lake, is a glacial lake having an area of 2,300 acres, situated 432 ft. above sea level. The drainage area is approximately 100 square miles, and the annual precipitation over it about 150 in. The smallest flow from the lake in thirteen years was 300 cu. ft. per second, and this continued for about fifteen days. Trout Lake is separated from Coquitlam by a mountain range, about 2½ miles across, rising 4,000 ft. above the lakes. The former lake is located 400 ft. above sea level, close to the north arm of Burrard Inlet, and 32 ft. lower than Coquitlam Lake. Its area is approximately 500 acres, and the storage capacity which can be drawn upon amounts to a depth of 16 ft. over this area. The attainment of very high peak loads is therefore possible without danger of a failure of the water supply.

The dam at the outlet of Coquitlam Lake is a rock-filled timber crib structure 113 ft. long, 14 ft. high, 12 ft. wide at the top and 50 ft. at the base. Below the dam is a very heavy timber apron, and on each side of the river below are two smaller aprons for protecting the abutments. This extensive protection was required because in flood periods large logs up to 6 and 8 ft. in diameter are brought down by the river. All the timbers are 12 in. square, drift-bolted together. The foundation of the dam rests on glacial hard pan over which was a stratum containing large boulders. A trench was dug in the hard pan along the upstream face of the dam and a double row of timber sheeting driven in the trench and spiked to the heavy timbers of the dam, the trench being then refilled and the material well rammed. The sheeting covering the dam consists of one thickness of 4-in. plank, over which is laid one thickness of 2-in. plank.

The tunnel connecting the two lakes is 12,775 ft. long, and has a normal section 9 x 9 ft., with rounded corners. The grade falls at the rate of 1 per cent. for the first 875 ft. from the Coquitlam portal, and from this point, where a drainage sump and pumping plant were located during construction, rises on a 0.02 per cent. grade for 5,600 ft. The last 6,300 ft. reaching to the Trout Lake portal is a down grade of 0.14 per cent. The tunnel intake in Coquitlam Lake consists of three submerged openings each 8 ft. square driven in the solid rock, and leading to a cross heading 30 ft. back from the lake, where the 9x9-ft. section starts. This cross heading is 10 ft. square and about 36 ft. long normal to the tunnel axis. The three openings are protected from driftwood and debris by two lines of rock-filled timber cribs, supporting screens, the tops of which are at the level of extreme high water. Sixty feet back from the tunnel portals are two gates for controlling the flow of water. Each gate is 9 ft. high by 4½ ft. wide, built of structural steel shapes, and carries brass rollers, which run on I-beams forming part of the framework of the water tight bulkhead. The gates are operated by screw stems and hand wheels, and are worked from an operating tunnel above the main tunnel. The mountain is syenite or quartz syenite with occasional dykes of diorite, the latter being particularly hard and tough. No timbering was required.

The dam across the outlet of Trout Lake is a solid concrete structure, 361 ft. long, 54 ft. high above the base, with a top width of 7 ft. and a width on the base of 35 ft. It contains 10,000 cu. yd. of material, putting stones and 1:2½:5½ concrete, the stone in the latter being crushed granite. The mixture on the face for 18 in. is somewhat richer in order to secure water tightness. The foundation for the dam is a very sound syenite.

The openings of the pipe lines leading to the power house are steel pipes built into the dam, the tops of the pipes being 22 ft. below the crest. There are ten 54-in. and two 24-in. pipes, each fitted with a special brass-roller gate-valve at the face of the dam with a separate screen for each pipe. The intake gate-valves work in guides bolted to the face of the dam, and are fitted with brass rollers, on which the thrust due to the water pressure comes. A circular ridge on the back of the gate is machined to make the seat and a corresponding seat is made on the gate frame, to which the pipes are riveted. The gear for operating the gate is a simple screw stem and hand wheel, and the gates though quite tight can be operated with ease by one man at all stages of the water.

The total length of the pipe line is 1,800 ft., of which the upper 800 ft. are of wooden-stave construction, 54 in. in diameter, and the remainder of riveted steel varying in thickness from 9/32 to 17/32 in. and in diameter from 48 to 42 in. The exciter pipes are of steel throughout their entire length, and are 24 in. in diameter at the upper end and 18 in. at the lower end. Each pipe is fitted with air valves at three different points, a relief valve at the lower end, and a stand pipe just below the dam. The pipes are laid in a trench and covered with the excavated material, the top layer being of fine material in which clover was sown. At the lower end where curves occur the pipes are anchored to concrete piers from 12 to 16 ft. apart.

The power house, 40 ft. wide and 160 ft. long, is situated on an arm of Burrard Inlet, just above high tide. The main units, of which three were installed when the plant was constructed, have a capacity of 3,000 h.-p. each, and consist of a 2,300-volt Westinghouse generator, with two Pelton water wheels, one on each side of the generator. The water for each unit will be supplied by a separate pipe, a Y being inserted near the unit to conduct the water to the two wheels of each set. The head of water is about 400 ft.

The current is transmitted to Vancouver, a distance of 16 miles, at 23,000 volts. At Barnet the transmission lines cross a navigable arm of the harbor, the distance between supports being 2,750 ft. and the height of the conductors above high tide 150 ft. For the crossing twelve 7-strand 9/16-in. plow-steel cables are used as conductors.

The surveying and construction of the plant were quite interesting. Owing to the steep, rocky slopes and perpendicular cliffs of the mountains separating the two lakes, it was found impracticable to carry the levels over the range, and four lines of levels were therefore run from one proposed tunnel portal to the other, around the end of the range, a distance of 25 miles, the results having a maximum variation of 0.23 ft. A Buff transit having a large, high-power telescope was used for the alignment. Four transit stations were established, of which two were on the mountain 3,200 ft. apart, one on the further shore of Coquitlam Lake, and one on the further shore of Trout Lake. These latter stations were placed across the lakes from the tunnel portals because the latter could not be seen from the points on the mountain.

The tunnel was driven simultaneously from both ends, and hand drilling was used for the first 4 months when the installation of compressor and haulage plants was completed. The construction plants were furnished by the power company, but the work was done by contract on the percentage basis, the contractor's profits being increased in proportion to the decrease in the cost per foot from bidders' prices, and an independent bonus being offered for speedy completion. A 36-in. gauge railway was run from tide water to the Trout Lake portal, the first section having a length of 1,800 ft. and a rise of 400 ft. This portion was operated by a Lidgerwood hoist having a pull of 2,000 lb. The rest of the road is level, and the hauling is done by an electric locomotive. The plants at the portals consisted of a boiler supplying steam to an Armington & Simms high-speed engine, a 60-kw. d. c. 550-volt generator, supplying current for lights, ventilating motors and locomotives, and a Leyner two-stage air compressor, having a capacity of 400 cu. ft. of free air per minute. For the transportation to the Coquitlam portal it was necessary to build 2 miles of new road through dense forest and swamp, and to rebuild 7 miles of old road and bridges.

The full section of the tunnel was blasted out without driving an advance heading or drift. As soon after a blast as possible drilling was commenced for the next shot, the miners standing on the muck of the last blast and putting in the upper holes first. The muckers meanwhile removed the debris and then covered the floor of the tunnel for 30 ft. back from the face with ¼-in. iron plates about 4 ft. square. The iron plates afforded a suitable shoveling surface and greatly facilitated the speed of mucking.

The air for the drills was carried from the receiver, which had a capacity of 100 cu. ft., through a 4-in. pipe for half a mile from the portal, and through a 3-in. pipe the remainder of the distance. The temporary connections to the drills were made with 2-in. pipe. To overcome the trouble due to wet air, short drops were placed in the air line at half-mile intervals, and drip cocks on the pockets were left "cracked" to expel the condensed moisture. Flanged unions were provided at 500-ft. intervals to facilitate repairs and all joints were made up with oil and graphite. A number of different types of drills were used on the work, all operating at a pressure of 100 lb. per square inch. Four drills were constantly on hand at each end, two being in use and the other two in reserve.

The spoil cars were of special design, 30 in. high above the rails, with a capacity of 2 cu. yd. The bodies are of steel and swing on a centre king-bolt, dumping out of one end and on either side of the track. Each car weighs 1,500 lb., and cost $130. A General Electric locomotive with two 10-h.-p., 500-volt motors having a draw-bar pull of 1,200 lb. was used at each end. Each locomotive readily handled two loaded cars on a 6 per cent. grade. They were worked at a speed of 4 to 6 miles per hour.

Ventilation of the headings was provided through a 12-in. galvanized iron pipe of No. 24

gauge. Forty-inch Sturtevant fans driven by 5-h.-p. motors were placed at intervals of 2,000 ft., working in series, each fan forcing the air to the next one in the line. The speed of the fans was between 1,300 and 1,400 r.p.m. and cleared the tunnel of smoke and gas in 45 min. after a blast. In addition to this provision a stream of compressed air was blown into the heading through a quarter-inch orifice. Several methods of lighting the tunnel were tried, but were abandoned in favor af candles, which best fulfilled the miners' requirements. Temperature readings showed a rise of 2° Fahr. for each 1,000-ft. advance, the maximum temperature of 60° being found near the middle of the tunnel, and 3,500 ft. below the surface.

The work was begun at the Coquitlam portal by driving a working tunnel 5 ft. above the elevation of high water in the lake so as to guard against flooding the heading. This tunnel sloped downward on a 6 per cent. grade to meet the main tunnel. Thirty feet from the portal a shaft was sunk in the floor of the working tunnel to a depth of 18 ft., the bottom of the finished tunnel. From this shaft a cross heading was run at right angles to the tunnel axis, and from it three 8x8-ft. headings were driven backward toward the lake. During construction about 10 ft. of rock was left in place in the three headings to guard against flooding.

In building the Trout Lake dam a temporary cofferdam was built about 100 ft. upstream, and from it a flume 600 ft. long carried the flow of the creek past the site of the permanent structure. The earth excavated from the site was hoisted in skips by a derrick, dumped into the flume, and sluiced away, 20,000 cu. yd. being removed in this manner. The bedrock on which the dam rests was prepared for a good bond with the concrete by drilling it with 6-in. holes, 3 ft. apart, which were loaded and fired, thus producing a rough surface. The sand used for the concrete in the dam was dredged from the sea bottom near the mouth of Fraser River, pumped into scows, and after being towed to the landing was dumped into cars and hauled to the site. The sand, though not coarse, was very clean and sharp. Four brands of Portland cement were used on the work, White Bros., Hercules, Condor and Alsen.

In building the pipe lines a narrow gauge track was installed in the pipe trench for its whole length and operated by a steam hoist, all the materials for the pipes being brought to their proper place by means of it.

The wooden stave pipes were built by the Excelsior Wooden Pipe Co., San Francisco, at a cost of about $4 per lineal foot. The steel pipes cost approximately $14.50 per lineal foot, for the pipe alone. The cost of the grading for the pipe lines, including trench excavation, and back filling was $25,400.

The contractors were Ironside, Rannie & Campbell for the tunnel; Pelton Water Wheel Co., water wheels; Vancouver Engineering Works, steel pipe lines and head gates; Canadian Rand Drill Co., drills; and the Westinghouse Electric & Manufacturing Co., electrical equipment. Mr. Wynn Meredith was the consulting engineer, and Mr. E. B. Hermon, from whose article in the Transactions of the Engineering Society, University of Toronto, these notes have been taken, and Mr. H. M. Burwell, engineers in charge of construction.

The New Custom House in New York is not only one of the best examples of architecture in the city but it also seems likely to become famous for being completed considerably under the appropriations, which were $4,965,000 in all. While it is not yet completed, it is believed that when all bills are settled it will have cost under $4,900,000.

Sinking a Shaft Through Quicksand by the Pneumatic Process.

A mine shaft which presented unusual difficulties in its construction has recently been sunk by the pneumatic method on the Mesaba Range, near Biwabik, Minn., for the Syracuse Mining Co., to open up a rich deposit of iron ore. The ore body is adjacent to and extends under a lake of considerable size and immediately on top of the deposit is 45 ft. of quicksand. Owing to the proximity of the lake the ground is saturated with water. The mining company, realizing that the sinking would be difficult, arranged to use a patented method of sinking open shafts through water-bearing material and work was begun in December, 1904. The method adopted involved the driving of a series of cofferdams inside each other, the size decreasing with the depth.

Wooden sheet piles 18 ft. long were driven down around two sets of walling timbers, and the excavation was started. Very slow progress was made, owing to the heavy inflow of water and sand. The second set of piles was started, but a bed of large bowlders was encountered and piles could not be forced down. By this time four No. 10 Cameron pumps could not handle the inflow of sand and water. After a four months' trial the mining company decided to stop all operations at this point and shift the location of the shaft about 200 ft. south, where the overburden is perhaps 50 ft. greater, but the chance of encountering bowlders was considered much less.

The permanent mining plant which had already been installed was accordingly moved at considerable expense up a steep hill to the new site. Here the company sunk a large timber shaft with its own force to the quicksand, about 50 ft., by the method commonly employed on the Mesaba Range. Rings of timber are suspended from the surface about 3 ft. apart. As the excavation proceeds 2x10-in. plank, 4 ft. long, are slipped in back of these timbers, forming a comparatively tight wall to keep out the soil. Each course of waling timbers, or "set", as it is locally called, is suspended from the set immediately above it by 1¼-in. bolts, the uppermost set being connected in a like manner to large round bearing timbers on the surface, spanning the excavation and carrying the weight of the shaft lining until the bottom is reached. As it was intended to drive steel sheet piling to the ledge through the quicksand, the shaft was accordingly made large enough to accommodate a steel sheet pile cofferdam at the bottom of and inside the timber lining.

Driving the steel sheet piling was begun in November, 1905, and continued until the following spring. The piles were driven by an ordinary derrick pile driver which rested on the timbers at the surface, a specially designed follower being used. A 3,000-lb. hammer was used and at one period of the work a water jet was also employed. The piles were very heavy in section and were driven very hard.

After the pile cofferdam was completed, a No. 10 Cameron pump was installed and the excavation started inside the steel piling, waling pieces and struts being introduced about every 3 ft. as the work progressed, to keep the piles in place. The excavating was accomplished without much difficulty to a point about 20 ft. below the top of the piles, but below this point it proceeded very slowly. After a few feet of material had been taken out the quicksand would suddenly begin to boil up from the bottom, a corresponding movement of the material on the outside of the shaft occurring at the same time. This badly distorted and cracked the shaft timbers.

It became evident that there was a bad leak or break in the steel sheet piling. Accordingly a crib of 10x10-in. timbers, 3 ft. high, was built at the bottom of the excavation inside the shaft, the intention being to load this crib and force it down till it overlapped the leak or break in the piling. It was hoped that the inflow could thus be checked. After the crib was forced down a few feet it stuck and very little was gained by the scheme. In the meantime each period of excavation was followed by an upward boiling of the quicksand at the bottom. The material around the outside of the shaft settled away, leaving the upper part of the lining exposed. Hay and straw were placed outside the shaft in the hope that at each settlement of the sand, this material would be carried down outside the steel piling and ultimately stop the leak.

At this stage it became necessary to support the timber shaft, which had broken away from the bearing timbers at the surface and was settling down and telescoping the steel cofferdam. This was accomplished by placing steel rails and timbers across the top of the cofferdam and under one of the sets of the timber shaft lining, allowing the latter to take a bearing on them. Pumping was then resumed, and pieces of sheet iron were forced down alongside the sheet piles in an effort to locate and stop the holes where the quicksand was entering the shaft. As a last resort grout was pumped down to the ledge through a 2-in. pipe, it being withdrawn and moved frequently. This was allowed time to harden and the excavation was resumed. After an advance of a few feet had been made, the sand and water broke in from the bottom and boiled up as usual. In August the mining company decided that the shaft could not be sunk by ordinary methods, and called on The Foundation Co., of New York City, who devised plans and contracted to put the shaft down to and far enough into the ledge to make a watertight joint with the rock.

Operations were resumed early in October, 1906. The new plan involved lining the upper or timber part of the old shaft with reinforced concrete, leaving a shaft 13 ft. 6 in. by 6 ft. 1 in. having two 4-ft. 6-in. by 6-ft. 1-in. hoisting compartments at each end, and one 6-ft. 1-in. by 3-ft. 6-in. compartment in the center for pipes and ladders. An air-tight concrete diaphragm fitted with an air shaft and lock was then to be built on the upper ends of the steel sheet piling so that the excavation and timbering below could be done under air pressure. Provision was to be made to suspend the entire weight of the timber lining from the diaphragm until a bearing was secured on the ledge. It was decided to pump out the shaft as low as it had been excavated, about 18 ft. below the tops of the steel sheet piles, and timber from that point up to where the concrete diaphragm was to be; then to construct the diaphragm and line the old timber shaft above with concrete up to the surface of the ground, at the same time replacing the timber bracing with two 6-in. concrete transverse partition walls, reinforced with horizontal ⅝-in. square rods in each side on 6-in. centers.

On account of the dangerous condition of the timber shaft and because it had been strengthened from time to time with cross braces, which left very little working room, this order of operations was found to be impracticable and it was decided that the old timber shaft must be made secure and safe first. Accordingly the weight of the shaft was transferred from the tops of the sheet piles to the surface of the ground by putting in some extra heavy 60-ft. bearing timbers across the top of the shaft at the surface and connecting the timber lining to them by twelve 1¼-in. bolts. The cross timbers and rails on which the lining formerly rested were then cut out, leaving the lining again suspended from the surface.

A 2-ft. space was then cleared of bracing and broken struts at the bottom of the timber shaft, and forms were started preparatory to placing the lining and division wall concrete. Great care had to be taken in cutting out and shifting the struts and braces to make room for the concrete, which was deposited in sections about 2 ft. thick. The timber in the shaft was cracking and moving a good deal of the time while this work was being done, and it was difficult to persuade men to stay in the shaft. A few of the crossbrace ends were embedded in concrete and after the concrete had set the braces were cut and the ends dug out, the resulting space being filled with concrete. Horizontal reinforcing rods 5/8-in. square were placed in the concrete lining on 12-in. centers. A 6x18-in. recess was left 1 ft. from the bottom of the side and end walls to engage the edges of the diaphragm. This work necessarily proceeded very slowly, temporary braces and jacks being used continually. The scarcity and poor quality of the labor available also tended to make the work go slowly. On Nov. 9, the concrete lining had reached a point 10 ft. from the top of the shaft and it was then considered to be in a perfectly safe condition.

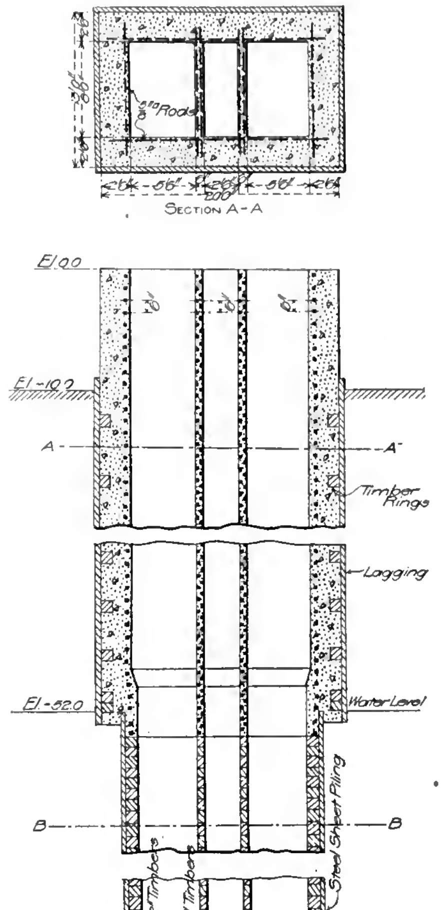
The shaft was then pumped out to the sand, about 18 ft. below the bottom of the proposed concrete diaphragm, and the work of lining the shaft from this point to the diaphragm with rings of 10x12-in. timbers was commenced. This was a difficult piece of work, for the bracing then in the shaft at this point had to be removed and solid timbering substituted. Each ring of timbers rested immediately on the one below it, the joints between the successive rings being well calked with oakum.

The rings were braced transversely by two solid walls of 6x12-in. timbers, each placed 1 ft. 9 in. from the center of the shaft, as shown in an accompanying illustration. These also served to divide the shaft into three compartments, a skidway at each end and a pipeway and ladderway in the center. In each of the four corners of the shaft a 3½x3½x½-in. angle was bolted to each set. These secured and braced the ends of the timbers in a very satisfactory manner.

The centering for the diaphragm was suspended by twelve 1¼-in. bolts from 12x12-in. timbers extending across the finished concrete walls of the shaft. The diaphragm was a 5-in. slab of concrete and was built into the keyway left when the concrete lining was built, as before mentioned. The slab was heavily reinforced both transversely and longitudinally with 1¼-in. steel bars placed on about 6-in. centers. Eight 1¼-in. steel bolts were built into the slab and after the concrete had set sufficiently, the weight of the timbering below the diaphragm, which was built on the sand bottom, was transferred to these bolts so the sand could be excavated below the timbers without danger of settlement. A section of 48-in. air shaft had also been built into the roof, and when the concrete had set this shaft was continued up in one of the hoisting compartments to a point 30 ft. above the diaphragm. A Moran air lock was then connected to the top of the air shaft and air was turned on Dec. 18, 1906.

The work of excavating the shaft and placing the timber lining inside the steel sheeting was carried on rapidly for 12 ft., though the old 3-ft. crib previously mentioned had to be cut out and sent to the surface. All the timber lining was lowered through the air lock and shaft from the surface, where it had previously been framed. As each stick was put in place it was suspended from the timber above it by 2¼x¾-in. iron straps 24 in. long fastened to each timber by two 7x¾-in. lag screws. After ten courses were suspended in this manner, an iron strap of the same dimensions, but long enough to engage ten sticks of timber instead of one, was fastened to the wall in the same manner and attached to the roof bolt, as an additional precaution.

Between the outside of the finished shaft and the steel sheet piling for the first 23 ft. there was a space of 3 to 6 in., which was filled with rich concrete. This had to be suspended from the diaphragm like the timbers, and had to be put in from the bottom instead of the top. However, the general line of the steel piling slanted toward the center of the shaft, and it was not long before the space enclosed by the piling was not any too large to receive the timber lining.



Sections of Mine Shaft.

Twelve feet down it was discovered that four of the sheet-piles had been deflected from their course by a boulder and, being driven further, had curled up inside the shaft in almost true circles, 4 to 6 ft. in diameter. These were cut off with pneumatic tools and sinking was resumed. On account of the large space left open for the escape of air, caused by cutting out these four piles, and the peculiar nature of the ground, great difficulty was experienced from this point down to the ledge. In a good many cases it was possible to put in place a set of timbers only by the aid of jacks and an air jet, owing to the difficulty in keeping down the water level.

As sinking progressed more steel sheet piles were encountered that had broken away from the general line of the piling and been forced into the shaft area. Some of them had to be cut several times as the excavating and timbering proceeded. In all 143 cuts were made in the steel sheet piles. This was slow work, as a good many of them had to be cut 14 in. below the surface of the sand and water to allow for placing the timbers. The work was further retarded by a fire caused by the flame of a miner's candle, and at another time by the breaking down of an air compressor, and it was not until March 12, 1907, that the ledge was reached.

It was the intention of the contractor to stop the shaft at the ore ledge and, after making a tight joint, turn it over to the mining company, but the ledge was found to be so badly broken up and seamy that it was finally decided to carry the excavation under air into the ledge. After going into the ledge 12 ft., it was thought best to stop further sinking under air pressure and finish the shaft in the open. Accordingly a tight joint was made with the ledge and air was taken off on May 10. The walls of the shaft were found to be tight and in good condition. Very little water came in, and that only in the center of the ledge.

The Syracuse Mining Co. was represented by Mr. C. H. Munger, general manager, and the work was done under the direction of Mr. F. W. Adgate, superintendent for The Foundation Company.

The Demolition of Masonry Arches.

The demolition of masonry arches over the double-track railway between St. Denis and Survilliers on the Northern Ry. of France, to permit four-tracking was recently done by an ingenuous method without interfering with traffic. The bridges were segmental arches with skewbacks below the track level thus giving a wide lateral clearance with a small vertical headway on each side of the tracks. In this space a timber falsework tower, triangular in transverse vertical elevation, was built on each side of the track with its upper surface closely fitted to the intrados of the arch. Slight cantilever projections adjacent to the tracks at the tops of these falseworks provided seats for a thin steel shield, put in position during the short intervals between trains and fitted closely to the masonry. This method was equivalent to reducing the span to a minimum and then closing it with a light steel arch which proved strong enough to sustain the masonry of the bridge above after the arch action ceased. The shield was only about 7 ft. wide and as the bridges were about 16 ft. wide it was necessary to move it twice for each bridge. The towers were accordingly seated on oak skids and first used to take down one end of the arch, then moved to the opposite and, after removing it, were replaced in the center and completed the demolition. The thickness of the steel shield was only about 2 in., leaving a clearance of scarcely more than 1 in. below it.

AN EXTRA ADHESION RAILWAY for mountain climbing has been built at Clermont-Ferrand, in France, which makes use of a double-headed rail mounted horizontally between the running rails, upon which horizontal flanged traction wheels underneath the cars bear for propulsion or braking. On the locomotives the horizontal wheels are geared to the main driving axles and adhesion is obtained by a pneumatically operated mechanism which forces them against the double-headed rail with a powerful toggle action. The locomotives weigh 33 tons and the pressure on the horizontal wheels may be caused to reach the equivalent of 50 tons, so that three coaches are hauled up grades ranging from 6 to 12 per cent. without difficulty. The line rises 3,566 ft. in its length of 46½ miles.

The Engineer as a Professional Man.

Extracts from the Annual Presidential Address before the American Society of Civil Engineers, Mexico Convention, July 8. By George H. Benzenberg.

The Constitution of our Society provides that the President shall deliver at the Annual Convention an address, presumably consisting of a general résumé of the most important work in progress and of whatever advance has been made in the engineering art during the past year. Such a statement, however, would be but a repetition of what is being currently presented by the various publications devoting their columns to engineering subjects. Through the perusal of these ably edited and carefully compiled periodicals, we are sufficiently enabled to keep fully abreast of the times, in a statistical and instructive way. It may not be inappropriate, however, to call your attention to the fact, that during no similar period in the history of engineering in this country have so many works of such gigantic magnitude, requiring the expenditure of such vast sums of money, been undertaken or entered upon as during the past year. Among these, the principal works, probably not over nine or ten in number, are all devoted to improving or enlarging present facilities for navigation, travel and commerce, or to providing new channels and new terminals for the accommodation of such, and involve the expenditure of nearly seven hundred millions of dollars, while nearly as large a sum is to be spent from public funds for the development or improvement of water supplies, the betterment of sanitary conditions, the reclamation of arid lands, and the construction or reconstruction of highways, bridges, and other public works for the health, relief, and convenience of man.

It is, however, not only the constantly increasing needs of commerce and transportation, and the comfort and welfare of the public at large, that engage the talent of the engineer. The prevailing tendency to acquire profit and benefit by the introduction of more economical processes of construction and manufacture, as well as by the reduction of wastes, makes it imperative to enlist his analytical and inventive skill and his trained and experienced judgment in almost every branch of human activity, and to secure his advice or approval in every important enterprise. Hence, everywhere, immense interests and ever-increasing responsibilities are being entrusted to the engineer by private as well as corporate organizations. So thoroughly has he been able to meet every expectation, to fulfill every obligation, and to demonstrate his ability to meet every emergency successfully, that his counsel is not only invariably sought in the line of design and construction, but very frequently also as to the possibility or probability of any undertaking becoming a profitable venture. It is in keeping with the world's practical grasping at every opportunity to profit by the knowledge of the highest and best exponents before entering upon or engaging in any great or important venture. These exponents, therefore, should not only be well informed, accomplished, and gifted in their calling, but they must also be the representative of the very best and highest type of that which is implied by American citizenship. Besides being designers and constructors of works for the upbuilding of commerce and every other industry, they should also, to come up to the standard of the profession, become foremost and eminent among their fellow men. The marked position of trust, influence, and eminence which the profession has attained so signally in the industrial world is undoubtedly due to the fact that engineering has become a science of the highest standard.

This progress has been particularly along the line which constitutes the very essence of engineering, and consists in establishing and advancing a thorough knowledge and understanding of the various properties of material, of the forces and latent energies of Nature, and of their economic and intelligent application to the needs and benefit of man. This present knowledge has been acquired by faithful and patient study, by close and careful investigation, by thorough and systematic experiments and tests, and by compiling and communicating the results by reports and publications, in order that the profession might have the full benefit of such research and continue the same for the information and benefit of its members.

Furthermore, the various engineering colleges and technical schools of to-day contain libraries whose shelves are stocked with treatises containing specific and valuable instruction in engineering, as well as with official reports on engineering work. They also possess complete laboratories, thus enabling the student in every branch of the profession to become at least somewhat familiar with the practical end of his study and to train his mind in the proper method of investigating and diagnosing the engineering problems which may present themselves. Moreover, every engineer of to-day, besides his collection of books of reference, keeps himself supplied with all the current literature and with every report and article published pertaining at least to that branch of engineering in which he is especially engaged, in order to remain well informed and abreast with the current conception, practice, and experience of the craft.

To promote and foster this service further, and to maintain the high standard of the profession among its members, as well as in the estimation of mankind, the profession in our country organized this Society, as well as many kindred associations relating to the different branches of professional work, for the advancement of the individual engineer.

To the younger generation of engineers a membership in this and kindred societies is of inestimable value, for it affords them the opportunity not only of participating in practical discussions, but also of having access to valuable documents, papers, drawings, and publications, containing a great mass of information which otherwise is not to be had, and which the earlier engineers did not possess. The present very rapid and remarkable growth in the membership of this Society demonstrates that this fact is now fully understood and appreciated.

It may be properly stated, therefore, that the present-day engineer largely owes whatever success he may have achieved, or reputable position he may occupy, primarily to the advantage which the profession has accorded him, through the close study and diligent research of others who have preceded him and have given the benefit of their learning and experience to the craft, and to which he in turn has likewise added his share for the benefit and welfare of others who may follow.

If this be true, and the engineer, because of this service and also the eminence of his profession, occupies to-day a higher position in the world and enjoys a standing and reputation which compares most favorably with that of any other profession, then the question very properly arises, what duty does he in return owe to the profession; what should be his attitude toward it and his brother engineer, and what position must he ever maintain before the community at large, in order to receive always the full confidence to which he and it should and must always be entitled? The query is a pertinent one, which no engineer should disregard or hesitate to answer.

With the prevailing and ever-increasing tendency of the present day to acquire wealth rapidly, many temptations are thrown in the way of the engineer. Individuals or corporations engaged in monopolizing natural or artificial advantages for selfish purposes, to the detriment of others, do not hesitate to seek the aid of the engineer in furthering their objects. They tempt him to close his eyes to questionable and reprehensible practices. The engineer who is the head of, or is employed in, a municipal or other government department, or who has charge of work executed under contract, is nearly always exposed to such temptation. Every kind of influence is brought to bear upon him to exercise the duties of his office for the benefit of some individual, party, or combination. It assumes every conceivable guise, and is frequently used in such an insidious manner that the unsuspicious mind is not aroused. How often has not the engineer on municipal work been importuned to place the inspection of such work in the hands of someone whose sole qualification consisted in nothing better than the possession of political influence, and who was expected to be not overscrupulous in carrying out the instructions of the engineer?

The element of loyalty to duty, of absolute faithfulness to every honorable engagement, which is not infrequently ignored in many professional and business enterprises, must ever be a distinguishing characteristic of every member of this profession. No matter what may be thought, said, or done in any other walk of life, that much, at least, the engineer owes to his calling, which through its combined achievements reflects credit and reputation upon the individual. The world must know that the engineer does not lend himself, his ingenuity, his skill, or his experience to aught but what is right, and that, having the privilege of declining, his acceptance of a commission means that he is not, knowingly, lending himself to any questionable undertaking, and that his sense of probity, his pride in his work, and his devotion to his profession rise above every other influence or consideration.

To his brother engineer he should always be fair minded and honorable. His sense of justice and equity will never allow him for one instant to forget that he himself is not infallible, that there is often more than one way of solving a problem, and that the work of the "other" may be capable of as good results, with as high economy, as his own solution; nor will he forget that his fellow engineer has the absolute and unqualified right to receive the same consideration he would himself expect. He will, with the innate spirit of a gentleman, honor and respect the opinion and judgment of his fellow engineer, if given in good faith, to the same extent that he values his own; for the argument and reasoning of the one may be as sincere and logical as that of the other, and may possibly be founded on as good or even better experience, the relative merits of which can only be determined by unbiased consideration. He should also recognize that the reputation of the individual is inseparably linked with that of the profession, that the honor and glory of one reflects upon the other, and that, therefore, by maintaining the standing and reputation of its members, he is but maintaining his own.

The respect and esteem which a community entertains toward any profession or its members is always in proportion to that which the members of such profession entertain toward one another.

Unfortunately, there are those who do not hesitate to presume upon the general confidence accorded by the community to any profession, and to exploit it or its reputation for purely personal profit and gain. In the other professions the law has been invoked to provide protection against the unauthorized acts and unpro-

fessional practices of members or individuals whose dealings and transactions tend to reflect discredit upon their several occupations. Happily, there has been no necessity for the enactment of any special statute to protect a community against imposition from the engineer or from one who claims to be a member of our profession, probably because his deeds and works speak for him, while his misdeeds advertise themselves with surprising rapidity.

The engineer is not infallible; he may make mistakes, and it would be remarkable indeed if he did not at some time err in his judgment; but, so long as he is conscientious, exercises every care, and exhausts all his resources in the performance of his obligations, it cannot be said that he is culpable or negligent in his duty. It is necessary, therefore, that he should always be circumspect and vigilant. That the engineer has recognized these obligations toward his profession is evidenced by his standing in the community to-day, and by the trust and confidence with which every material development has been committed into his hands.

Strength of Red and Yellow Douglas Fir Bridge Stringers.

The terms red and yellow fir are not thoroughly defined. By some, only close-grained, bright yellow sticks are designated yellow fir and all other sticks called red fir; while others call only close-grained sticks of a pronounced red color red fir and all other material yellow fir. Both red and yellow fir are secured from the same species, Douglas fir, and often from the same tree.

STRENGTH OF RED AND YELLOW DOUGLAS FIR BRIDGE STRINGERS.
(Yellow fir expressed in percentages of red fir.)

Kind of Fir.	Grade.	Number of Tests.	Rings per Inch.	Per Cent. Moisture.	Weight per cu. ft. As Tested.	Weight per cu. ft. Oven Dry.	Unit Fiber Stress at Elastic Limit.	Modulus of Rupture.	Modulus of Elasticity.
Red	Select	48	10.3	29.6	38.2 lb.	29.5 lb.	4,427 lb.	6,974 lb.	1,645,000
Yellow	Select	45*	17.5*	87.0	94.0	97.0	101	96	100,000
Red	Merch.	71	9.0	29.7	35.9	27.7	4,056	6,019	1,534,000
Yellow	Merch.	38*	16.4*	90.0	97.0	99.0	101	102	97,000
Red	Seconds	43	7.5	27.4	35.7	28.0	3,674	4,923	1,319,000
Yellow	Seconds	11*	14.5*	98.0	104.0	105.0	99	106	98,000

* Not expressed in per cent.

An analysis of the strength tests made by the Forest Service on Douglas fir bridge stringers is shown in the attached table. These stringers were graded according to the export grading rules of the Pacific Coast Lumber Manufacturers' Association, and in the table are grouped by grades. In classifying the stringers according to color all timbers of a reddish tinge were called red fir, and all of a yellowish tinge were called yellow fir. The rings per inch shown in the table indicate that yellow fir is of slower growth than red fir. It also ranges higher in grade. Of the 94 yellow fir stringers tested 47.8 per cent. were selects, 40.4 per cent. were merchantables, and 11.8 per cent. seconds. Of the 162 red fir stringers tested 29.8 per cent. were selects, 43.8 per cent. were merchantables, and 26.6 per cent. seconds, but, grade for grade, these tests show that there is practically no difference in the strength and stiffness of red and yellow fir in bridge sizes.

A CO_2 RECORDER has been constructed for furnace gas investigations by the Cambridge Scientific Instrument Co., which depends on the variation in pressures of waste gases when confined in a vessel with porous walls. Under such conditions the outside air diffuses into the vessel more rapidly than the furnace gas diffuses outward, and the pressure rises within the vessel. The rise depends upon the difference in specific gravity of the gas and the air, which enables the proportion of CO_2 to be measured.

Proposed Code of Ethics for Electrical Engineers.

Submitted by a special committee of the American Institute of Electrical Engineers at the Niagara Convention.

General Principles.—1. In both his professional and his business relations the electrical engineer should follow strictly the same ethical principles that are recognized in the social relations of every-day life. He should consider himself personally responsible for the character of the enterprises and the persons with which he is associated professionally.

2. Before entering into professional relations, it is therefore the duty of the electrical engineer to satisfy himself that the enterprises with which he connects himself are of a legitimate character. If, after becoming associated he finds them to be of a questionable nature he should sever his connection as soon as possible. It should not be considered an excuse that his connection extends only to legitimate engineering work.

3. An electrical engineer permitting the use of his name in any enterprise or exploitation becomes morally responsible for the character of the latter. He should therefore not allow the use of his name in connection with anything upon which he is not qualified by training and experience to exercise competent judgment.

4. The electrical engineer should take care that credit for engineering work is attributed to those who, as far as his knowledge of the matter goes, are the real authors of such work.

5. The electrical engineer should incline toward and not away from standards of all kinds, since standardization is peculiarly essential to the general progress of the profession. This applies to construction, measurement and expression, or nomenclature, as well as to conduct, or ethics. Even the tendency to give individuality by providing special construction may sometimes be avoided with advantage.

Relations of the Electrical Engineer to His Employer, Customer, or Client.—7. The electrical engineer should consider the protection of his client's interests as his first obligation, and therefore should avoid every act that would be contrary to this duty; if any other consideration such as professional obligations or restrictions interfere with his so acting, in accordance with the expectation of his client, he should inform him of the situation.

8. He can honorably accept compensation, financially or otherwise, from one side or party only, interested in the same matter. The electrical engineer, whether consulting, designing, or operating, may therefore not accept commissions, either directly or indirectly, from other parties dealing with his principals.

9. Electrical engineers in a position to decide on the use of inventions, apparatus, etc., should not be financially interested in their use, as by receiving a royalty, etc., unless the matter is clearly understood by the client.

10. Electrical engineers should not accept employment while financially interested in a rival concern except upon the express permission of both parties. An electrical engineer may be employed by more than one party, as in the case of a consulting engineer, when the interests of the parties do not conflict and it is understood, as is usual in such cases, that he is not expected to devote his entire time to the work of one party but is free to enter into other engagements. A consulting engineer permanently retained by a party should notify other prospective employers of this affiliation before entering into relations with them. A consulting engineer when not exclusively retained by one side may advise rival concerns, with the full knowledge of all of them and upon taking care that the interests of the parties do not conflict in the particular matter handled.

11. Operating engineers should consider themselves responsible for defects in apparatus or dangerous conditions of operation, should bring the same to the attention of their employers and urge remedial action. If the causes of the danger are not removed they should withdraw.

12. An electrical engineer should in general be considered directly responsible to his employer or client for the successful fulfilment of the work upon which he has been engaged and for its satisfactory performance as a whole. It should therefore be clearly understood at the outset just what the extent or the limitations of responsibility of the engineer are to be. Whether he has been employed merely as designer or whether he is retained to design and to superintend construction; whether to design only the chief features, or to pass as well upon all details of the apparatus that is to be installed. Attention should be directed to the fact that defects in the manufacture of material or apparatus is a matter distinct from the matters of design or installation. An engineer should not be held responsible for the unsatisfactory performance of a plant resulting from defective aparatus furnished, unless he has undertaken to include this subject.

Relations of the Electrical Engineer to the Ownership of the Records of His Work.—15. The following general principles should be recognized:

If in executing his work, the electrical engineer uses data or information which are not common and public property, but which he receives, directly or indirectly from his employer, or if the problem solved by the engineer is met in the pursuit of his work for his employer, and is not of such character that his attention would have been directed to it regardless of his relations to his employer, the products of his work, in the form of inventions, plans, designs, etc., are not his private property, but the property of his employer, though the engineer may be entitled to special remuneration for such inventions, etc.

16. If in the execution of the work the engineer uses only his own knowledge or data or information which are public property by prior publication, etc., and receives no engineering data from his employer or customer, except performance specifications, the results of the work, such as inventions, plans, designs, etc., are the private property of the engineer, and his employer or cusomer is entitled to their use only in the specified case.

17. All the work done by the engineer in the form of inventions, plans, designs, etc., which are outside of the field of engineering for which his employer has retained him, are the engineer's private property.

18. When an engineer or manufacturer builds apparatus from engineering designs supplied to him by his customer, the designs remain the property of the customer and should not be duplicated for other customers without express permission. When the engineer or manufacturer and his customer are jointly to work out designs and plans or develop inventions, a clear understanding should be arrived at before the beginning of the work regarding the proportionate

rights of the ownership in any inventions, designs, etc., that may result, since in such case both parties should be considered to have rights therein.

19. Any engineering data or information which an electrical engineer obtains, directly or indirectly, from his employer or customer, or which he creates as a result of such information, must be considered by the engineer as confidential; and while the engineer is justified in using such data or experience in his own practice as going towards his education, the publication thereof without express permission is improper, as is also its use in producing for other parties, work that is characteristic of the original customer or employer.

20. Designs, data, records and notes made during his engagement by an engineer employed under permanent engagement, and referring to his work, are his employer's property. The same matter in the case of a consulting electrical engineer are the property of the consulting engineer.

21. A customer, in buying apparatus, does not acquire any right in its design beyond the use in the apparatus purchased. A customer of a consulting engineer does not acquire any right to the plans made by the consulting engineer except for the specific case for which the apparatus was built or the plans made.

Relations of the Electrical Engineer to the General Public.—22. The electrical engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, spread the general knowledge of electrical engineering, and discourage wrong or exaggerated statements on engineering subjects published in the press or otherwise, especially if these statements are made for the purpose of, or may lead to inducing the public to participate in unworthy schemes.

23. Controversies on engineering questions, however, should never be carried on in the public press, but should be confined to the technical press and the engineering societies.

24. First publication of inventions or other engineering advances should not be made through the public press but rather through the technical press and the engineering societies.

25. The publications which an electrical engineer is justified in making through the public press should therefore be of a historical, educational, instructive or similar character and should not relate to controversies between engineers or on engineering questions, to new inventions, etc., nor contain technical criticisms of fellow engineers, and it should be considered unprofessional to give opinions without being fully informed on all the facts relating to the question, and on the purpose for which the opinion is asked, with a full statement of the conditions under which the opinion applies.

26. In giving expert testimony before judicial bodies, the electrical engineer should confine himself to brief and clear statements on engineering or historical facts. He should not give personal opinions without so expressly stating, and should avoid pleading on one side or the other.

Relations of the Electrical Engineer to the Engineering Fraternity.—30. The electrical engineer should take interest in and show due regard for the electrical engineering societies and the technical press.

31. He should assist his fellow engineers by exchange of general information, experience, instruction, etc.

32. He should not take a position left by another electrical engineer without satisfying himself that the former has left it voluntarily, or for proper reasons.

33. Where engineering work is in charge of an electrical engineer, no other electrical engineer should undertake the work except on request of or in co-operation with the electrical engineer who had charge of the work before, unless the latter's connection with it has already terminated.

34. An electrical engineer in responsible charge of work should not permit other engineers or non-technical persons to over-rule his electrical engineering decisions. If this is done and persisted in, he should as soon as is practicable withdraw.

35. In engineering work in charge of a board of engineers, the respective limitations of the authority of each should be decided at the outset, and each electrical engineer should give full and complete information on his part to the other engineers and insist on this being reciprocated.

Relations of the Electrical Engineer to the Standards of His Profession.—40. The title "electrician" should be applied to those having practical training sufficient to enable them to carry on intelligently certain classes of electrical work, such as the installation of electric lights, signaling systems, and the operation of small electric plants.

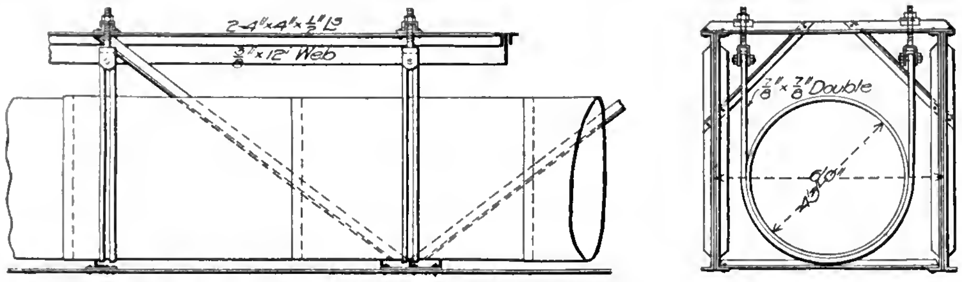
41. The title "electrical engineer" should be applied only to graduates from the electrical engineering school of universities of recognized standing, and such men as possess an equivalent knowledge of electrical engineering.

42. The title "consulting electrical engineer" should be applied only to those electrical engineers who possess such knowledge and experience in electrical engineering as would qualify them to full membership in the American Institute of Electrical Engineers.

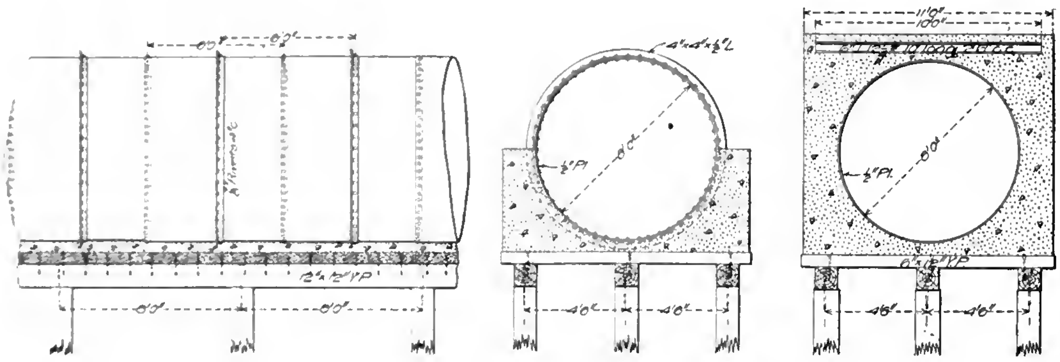
Large Riveted-Steel Sewers in Jersey City, N. J.

An 8-ft. riveted-steel storm-water sewer is now being built in 12th St., Jersey City, N. J., to serve a high 600-acre tract of thickly settled property known as the Hudson City section. The sewer has its origin in the Horseshoe Meadows below the Hudson City section and will extend eastward about 5,200 ft. to its outlet in the Hudson River. At the origin the invert is at El. 65 and at the outlet it is at El. 2, or 4.5 ft. below mean sea level. The average elevation of Hudson City is about 125. This district is at present drained by a 5½-ft. riveted-steel sewer, which is entirely inadequate to carry the storm flow.

Formerly during every severe rain storm cellars in Hudson City were flooded. This has been remedied by constructing a 5-ft. brick sewer through the section and connecting it with the steel pipe at El. 65. This has transferred the water from the residential section to the head of the steel pipe, where it is placed under pressure. The new sewer will also receive at its upper end the flow from cast-iron and steel pipe extensions of the old sewers, and is designed to operate under a maximum head of about 65 ft. It will receive no water from the meadows or neighboring low land.



Side and Sectional View of Pipe Bridge, Jersey City Sewers.



Concrete Reinforcement of Jersey City Riveted-Steel Sewers.

The pipe is made of ½-in. plates, 6 ft. 3 in. wide, and is delivered and laid in 18-ft. sections. All the seams are single-riveted, with 3-in. laps and ⅞-in. rivets 4 in. between centers. Around the pipe, midway between the successive circumferential seams, 4x4x½-in. stiffener angles are attached with ⅞-in. rivets on 6-in. centers. Each 18-ft. section is coated with refined asphaltum in the usual manner. The field riveting is done by hand.

Near the upper end of the new sewer it crosses the lands of the Erie R. R., passing under several tracks. Here and in the soft meadow land special support is secured by three lines of piles, spaced 5 ft. center to center longitudinally and 4 ft. 6 in. transversely. These carry three lines of 12x12-in. yellow pine stringers, spiked to the pile tops, and on these is laid a floor of 6x12-in. pine plank. Under the railroad tracks the angle stiffeners are omitted and the pipe is encased in concrete, as shown in an accompanying illustration, 6-in. 10¼-lb. I-beams spaced 2 ft. on centers being imbedded in the concrete over the pipe as additional reinforcement. In the railroad property where there are no tracks at present and in the soft land the angle stiffeners are used and the concrete casing is carried up to the elevation of the center line of the pipe, where a square shoulder is left on each side, on which the concrete and I-beam arch can be built up if needed later when more tracks are laid. The concrete is a 1:3:6 hand-made mixture of Vulcanite Portland cement, sand and crushed stone.

The pipe laying was begun at the upper end of the sewer and has proceeded about 1,100 ft. All the unloading and other handling of the pipe and all excavation and backfilling has been done with a Brown locomotive crane, equipped with a Haywood 1-yd. orange-peel bucket or with hooks and chains, as the work required. This crane is

operated on a standard-guage track laid along the street in the center of a 21½-ft. strip between the south curb and the south edge of the 8½-ft. trench, which is dug close to the north curb. The track extends to the switch tracks of the Erie R. R. The pipes, which weigh about 6 tons each, are delivered on flat cars, two 18-ft. sections being placed on each car. They are unloaded by the crane and piled two tiers high along both sides of the crane track with their axes perpendicular to the track. At times as many as 75 pipes have been at hand. When one is needed the crane runs back, picks up the pipe, carries it to its place and lowers it into the trench. The time required to do this, when the distance traveled does not exceed about 500 ft. each way, has sometimes been as low as twenty minutes.

In excavating the trench the top 4 ft. of soil is delivered into 2-yd. dump wagons and hauled away. The remainder of the material is delivered at once over the first length of pipe behind the crane so that there is seldom more than 50 ft. of trench exposed at one time. About 5 ft. below the unpaved street surface, where the trenching is now in progress, is hard pan in which there are many small boulders and some large ones. This has to be loosened with hand picks before the shovel can handle it and even then the bucket is never well filled and sometimes picks up only a very little. Nevertheless this method is cheaper than digging the trench by hand.

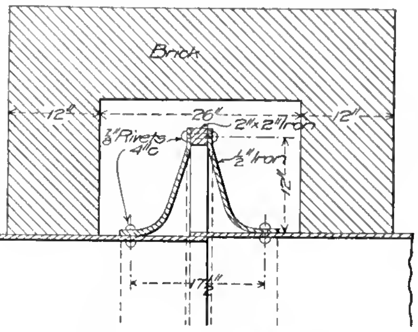
Two-inch yellow pine sheet piles are used. These have been driven with a 2¼-in. cylinder, 100-lb. McKiernan steam pile driver. This has proved too light to force the piles through the hard pan rapidly and a 3½-in. cylinder 600-lb. hammer of the same kind is to be substituted. To facilitate handling the hammer it is swung with a chain block and tackle from a four-legged tower about 18 ft. high, mounted on a small car which runs on a 30-in. track along the outside of the line of piling. The tower is formed by two braced A-frames, one on each side of the car, the one nearer the piles being vertical and the other inclined so that the four legs meet at the top. A platform is provided near the top of the tower on which the man hauling the hoisting tackle stands. The hammer operator stands on a lower platform. Steam is supplied to the hammer by a 40-h.-p. horizontal boiler, a line of 1-in. pipe with hose connections being laid between the rails of the crane track from the boiler to the hammer. This boiler is moved when necessary with the locomotive crane. In one instance it was swung across the track and carried about 300 ft. while under a steam pressure of about 40 lb.

While the pipe was being laid in the meadows a considerable quantity of water was encountered which was handled with an 8-in. Craft centrifugal pump. Later the quantity of water materially decreased and it is now collected in the pipe behind dams of bags of sand, three tiers thick, and pumped out with a 3-in. Maslin pulsometer, supplied with steam from the boiler that supplies the pile driver. When the water gains on the 3-in. pulsometer another is added. This second pulsometer is supplied with steam by a vertical 20-h.-p. Erie boiler mounted on a standard-gauge truck which can be run over the crane track to any point along the sewer. The truck is equipped with an A-frame and boom and tackle with which the pulsometer is lowered into the sewer through a manhole.

Manholes are placed at 500-ft. intervals and at similar intervals automatic duplex air taps and valves, made by the Eddy Valve Co. are installed. Expansion joints of the form shown in an accompanying illustration, are placed at 1,000-ft. intervals.

The sewage of the houses along Twelfth St. has been discharged in the past into a 3-ft. brick sewer built about 40 years ago, a part of which is being destroyed as the construction of the new sewer progresses. Eighteen-inch vitrified pipe lines will be substituted, placed close to the steel pipe one on each side.

A system of riveted-steel sewers of various sizes up to 8 ft., designed to relieve the present inadequate storm water sewerage system serving the Bergen district of Jersey City, has also been partly built. The conditions there are in many ways similar to those in the Hudson City district and the pipes and foundations in general are like those in Twelfth St. The 8-ft. sewer will operate under a head of about 35 ft. and its outlet will be in New York Bay. The construction of this system involved carrying the flow from a system of brick sewers over the Newark & New York R. R. on Jackson Ave. in a steel pipe line having an inside diameter of 4 ft. 5 in. The highway bridge over the railroad on Jackson Ave. is of the deck truss type and was originally designed for very light traffic. It has been reinforced from time to time with plate girders and trusses and now carries two street



Expansion Joint, Steel Sewer.

car tracks. The trusses and girders under the floor left no room for the pipe line, and because of this and the fact that the bridge is likely to be replaced before long, the pipe has been carried across by a through-truss bridge, the end bearings of which rest on the abutments of the highway bridge under the cantilevered sidewalk.

The trusses are of the riveted Pratt type, 6 ft. 4 in. deep. placed 6 ft. on centers and having a span of about 64 ft. divided into eight panels. Roller bearings are provided at one end. To facilitate easy adjustment of the structure and pipe to variations in length due to temperature, the pipe is hung at each panel point from the lateral struts with adjustable slings made of two lines of ⅞-in. square steel rods, as shown in the illustration.

The designs for sewers and bridges were prepared by Mr. Charles A. Van Keuren, chief engineer of the Board of Street and Water Commissioners, of Jersey City, under whose general supervision the construction work has been carried on. Work on the relief sewer for the Bergen section was suspended last summer owing to a disagreement with the New Jersey Central R. R., under whose tracks the sewer must pass, and the contractor, the B. M. & J. F. Shanley Co., was relieved of the contract and paid for the material on hand. Mr. P. Connelly is the general contractor for the Twelfth St. sewer, Mr. W. A. Connelly, superintendent, and Mr. O. C. Stringham, engineer in charge. The steel pipe is supplied by the Thos. C. Basshor Co., Baltimore, Md.

THE WATER UNACCOUNTED FOR at Yonkers, N. Y., where practically all service pipes are metered, was 51.37 per cent. of the quantity supplied in 1906, as indicated by plunger displacement estimates. This is about the usual discrepancy between plunger and meter readings.

Some Effects of the Recent Earthquake in Jamaica upon Railway Structures.

By J. Monk Fletcher, Assoc. M. Am. Soc. C. E.

The earthquake which occurred in Jamaica on Jan. 14 of this year and destroyed its chief city, Kingston, caused comparatively little damage outside that city. The damage was confined to a strip about 30 miles wide, running across the island from southwest to northeast. It seems probable that the centre of the disturbance was somewhere at sea opposite and not very far from Kingston, but it is certain that this principal shock and the many smaller ones which followed were felt to a greater extent in Kingston than at any other place on the island.

The almost complete destruction of the city was, however, largely the result of the unsuitability of the buildings for withstanding earthquake shocks of magnitude. The general offices, locomotive shed and stores of the railway were of brickwork in lime mortar, built upon a foundation of earth, and were wrecked or very badly injured as regards the upper stories, and severely shaken and cracked in the lower stories.

A clock tower of brickwork about 80 ft. high collapsed and fell upon one of the locomotive shops, damaging it considerably. The freight store, which is a wooden building supported upon brick pillars, was almost uninjured, though nearly shaken from the supporting pillars, which were badly cracked and in some cases twisted bodily upon the vertical axis, being broken at about ground level or just above.

Outside Kingston upon the railway the damage done was not great, and was confined almost entirely to brickwork structures. One station building of brickwork was wrecked and several others more or less severely damaged. Lime mortar had been used in the construction of the buildings damaged.

The more important structures, such as bridges, viaducts and tunnels, remained intact. The abutment and piers of bridges are nearly all of concrete without reinforcement and with the exception of a little spalling under the seat of girders, show no signs of the very severe strains to which they were subjected. Viaducts of concrete, without reinforcement, are uninjured as are 20 to 30-ft. span concrete arch bridges under and over the track.

The tunnels are, where necessary, lined with concrete and in some cases show slight cracks, commencing near the junction of the invert with the side wall and extending vertically about 6 ft. The cracks are superficial and do not weaken the structure appreciably. One tunnel has a brick in cement mortar arch 13½ in. thick and this shows absolutely no signs of injury, although the side walls, which are of concrete, have slight cracks as mentioned above.

Concrete retaining walls without reinforcement withstood the shock well and were not damaged. A concrete sea protective wall, which had been completed only 2 weeks, suffered no damage. The wall is carried below sea level 5 ft. and rests partly upon hard blue clay and partly upon igneous rock and extends 16 ft. above sea level. It is built of 1:3:6 Portland cement concrete below and 1:4:8 Portland cement concrete above sea level, clean sea sand being used for the mortar. Hard limestone broken to 2½-in. gauge by hand labor was used for the aggregate. The wall is 8 ft. thick at the base and up to sea level, after which it is battened and stepped to a thickness of 1½ ft. at the top. No reinforcement is used.

Retaining walls of dry rubble masonry were, in some cases, damaged seriously, but where particularly well constructed no injury was done. Rubble masonry walls in 1:4 or 1:5 cement and sand mortar were uninjured.

The effects of the earthquake upon the track were very marked where the embankment crossed swampy land or land which was at or near sea level, the setlement in some cases being as much as 12 in. in 3 ft. At these places the track was also thrown very badly out of alignment. Many small landslips occurred, blocking the track temporarily.

Considering the magnitude of the earthquake shock and the large amount of damage done in Kingston, it is remarkable that so little damage was done to the railway. Traffic was maintained without any break and many extra trains were run for the purpose of carrying the homeless people from the stricken city to their friends in the country parts, thus helping the authorities to bring order out of chaos.

Erection of a Short Bridge by Long Span Methods.

The Smallheath Bridge, at Birmingham, England, carries a very heavy highway traffic and includes one 120-ft. and one 145-ft. riveted pony truss span about 17 ft. in the clean above the surface of the ground. The space under the 145-ft. span is entirely, and that under the 120-ft. span is mostly, occupied by a large number of tracks of the Great Western Ry., which have a very heavy traffic during week days and part of Sunday. To avoid obstructing the tracks, the trusses, 42 ft. apart, are supported on very heavy vertical steel columns instead of masonry piers, and to avoid interfering with the traffic a special method of erecting was developed which, although sometimes used for very long, high, or difficult erection, is rather costly and elaborate.

The vertical pier columns were erected and long transverse girders were seated on them, overhanging them several feet at each end. A transverse timber trestle bent was built between the tracks in the middle of the long span and on it and on the transverse girders were supported four lines of longitudinal girders, one line at each side of each main truss. These were very heavy lattice girders of special construction, tapered from 5 ft. deep in the middle to 2½ ft. at the ends, where they had solid ½-in. web plates. The flanges were 20 in. wide and the web diagonals were 6-in. flats. A solid floor of 14x14-in. transverse timbers and longitudinal planks was laid on these girders and on it the span was erected and riveted. After its completion timber cribbing was built to the ends of the girders and received their weight when the cambre blocking was removed. The erection platform being thus released was removed and the 360-ft. span was gradually lowered about 7 ft. to its bearing by hydraulic jacks.

The bridge is of the ordinary English type with massive riveted construction and buckle plate floors. The details are not of special interest except for the fact that the main truss diagonals have approximately I-shape unbalanced cross-sections with a web plate and single flange angles, the latter reinforced with a wide and a narrow cover plate. The ends of the girders have pin bearings in cast steel shoes and pedestals which at the expansion ends are seated on sets of segmental rollers submerged in tanks filled with special non-evaporating oil to above the tops of the rollers, thus protecting the under surface of the pedestal base. The 32x40-in. vertical pier columns are made with closed cross sections having four longitudinal and four transverse webs with 24 flange angles and have extended cap and base plates stiffened with gussets. The bases are secured by anchor bolts 10½ ft. long to reaction beams embedded in the masonry foundation. The design and erection of this bridge was fully described in recent issues of "Engineering," of London.

The Construction of the Seligman Building, New York.

The 11-story Seligman building, New York, occupies the whole of an irregular lot, having an area of about 5,400 sq. ft., and a front of about 100 ft. on William St., 90 ft. on South William St. and 50 ft. on Stone St. The building is of fireprof steel frame construction with brick walls and stone facing in fronts. The lower floor is chiefly occupied by a very large and handsome bank room, two stories in height finished with Italian marble. The upper floors are devoted to offices and each have about 5,000 sq. ft. of rentable area. The exterior walls 28 in. thick at the base are self-supporting up to the 9th floor, where they are 16 in. thick, and above that are carried entirely by steel girders from the wall columns.

The removal of the old building that formerly occupied the site was commenced about the 1st of May, 1906, the debris was removed and the site was excavated to ground water level at a depth of about 8 ft. below the curb. From the bottom of the pit concrete foundation piers were carried down to solid rock from about 43 to 47 ft. below the curb by the pneumatic caisson process. The foundations for the wall columns were made continuous, forming a solid concrete wall 6 ft. thick and from 30 to 40 ft. high, which encloses the four sides of the lot and is designed, as in several other buildings described from time to time in these columns, to form a sort of dam resisting the heavy outward pressure and excluding ground water from the deep cellar excavated within it.

This dam was constructed in consecutive separate sections up to about 26 ft. long by the pneumatic caisson process. Each caisson consisted simply of a working chamber about 6 ft. wide and 6 ft. high inside, and from 20 to 26 ft. in length. The walls were made with solid horizontal courses of planed timbers sheeted and calked and the long sides were braced by transverse horizontal struts. They were built at the contractor's yard, delivered complete on trucks and set in position where required in the bottom of the pit by four large mast and boom derricks seated so as to command the entire area of the lot and the adjacent street and handle the caissons directly from the trucks to the required positions.

The tops of the caissons were covered temporarily with light roof boards above which molds were built, and in them were cast slabs of rich concrete. Collapsible steel air shafts were set in these slabs and the molds were extended above them by successive sections of detachable paneled courses with exterior horizontal frames of angle iron which were filled with concrete until the pier had been constructed to full height, clear above the bottom of the pit.

The caissons were put under air pressure, workmen entered them and excavated, and the great weight of concrete in position aided their rapid sinking to hard pan through very wet quicksand, gravel and numerous boulders, many of them of such large dimensions that they had to be blasted to clear the cutting edge of the caisson. One such was 10 ft. long, 6 ft. wide and 6 ft. deep and extended entirely across the caisson transversely. The cutting edge of the caisson was usually stopped near the upper surface of the hardpan and the excavation was continued below it from 4 to 8 ft. to the regular surface of the solid rock which was cleared off and received the concrete with which the caissons and air shaft spaces were filled after the steel air shafts were removed.

Caissons for Wall Columns.

The caissons were sunk with clear spaces of about 12 in. between adjacent ends, and in order to bond them together and close the intervening spaces, semi-octagonal wells about 3½ ft. in diameter were cored out of the concrete in the center of the end face of each caisson. The outer faces of these wells were closed with horizontal plans and after both adjacent caissons had been sunk, the planks were removed and the space between them was excavated, the well thus formed being enclosed on both sides by horizontal boards connecting the adjacent caissons as the excavation proceeded.

The well was carried down with the original diameter to a depth of about 4 ft. and a short section of steel air shaft was embedded in it and filled with concrete. An air lock was connected to it, pressure was put on and a man entered and continued the excavation of the well with a reduced diameter down to the top of the working chamber below which point there was not room to admit him between the caissons and the excavation was made as best might be with a post hole digger. When the excavation was complete it was filled with concrete placed under pressure and forming a heavy key binding both caissons together and tightly closing that joint of the dam. The construction of the caissons and the method of sinking and connecting them was substantially the same as that illustrated in the description of the foundation for the Trust Company of America Building, located near the

Seligman Building and executed by the same contractors, which was published in The Engineering Record of October 27, 1906.

The 12 caissons were sunk and air pressure was removed from the last one in exactly 30 days. A sump was dug and steam pumps installed to drain the area enclosed by the wall caissons, and it was excavated by hand to a depth of 26 ft. below the curb, the spoil being loaded in steel buckets and delivered by the derricks to wagons in the street. As the dam proved efficient to exclude most of the ground water, no difficulty was encountered in carrying the concrete foundations for the interior columns down to solid rock by means of seven open rectangular wooden cofferdams. These were made complete at the contractor's yards where they were built in 8-ft. courses, each side consisting of a single panel of vertical 3-in. planks bolted to horizontal transverse timbers. These panels were assembled at the site with the ends of the inside horizontal pieces overlapping and bolted together to form transverse frames connecting the structure and receiving the cross braces. They were sunk by open excavation and loading, and like the pneumatic caissons, were filled with 1:3:5 Alpha Portland cement concrete mixed in a Ransome machine.

Besides the foundations for the interior columns a 16x16-ft. concrete pier was sunk in the same manner to solid rock to support the large steel vault. The sub-structure work involved the excavation of about 8,000 yd. of material and the construction of 2,000 yd. of concrete. The mechanical installation included two 100-h.-p. steam boilers, one 80-h.-p. Ingersoll-Rand and one 80-h.-p. McKiernan air compressor and the usual equipment of hoisting engines, pumps, counter-weight iron and ordinary tools. The work was done with an average force of about 100 men working day and night.

A 12-ton derrick with a 70-ft. mast and 65-ft. boom was installed near the center of the lot, guyed with six lines and operated by a Mundy hoisting engine permanently located in Stone St. With this all the steel work was unloaded from wagons, swung to place, and erected, usually at a single operation. The column loads on the wall piers were distributed over them by grillage I-beams carefully leveled with shims and bedded in grout. The upper flanges of these I-beams, having been adjusted as nearly as possible in the same horizontal planes for each group, were carefully dressed and filed until a uniform bearing was secured and a hot pressed steel plate 1 in. thick was bolted on top which received the cast-iron pedestal for these wall columns. The pedestals of interior columns were grouted on the carefully cut surfaces of granite capstones about 2 ft. thick. Great care was taken to make the pedestals exactly level and to locate them precisely, and all adjustments were carefully checked with transit and level.

All columns are made with rectangular closed cross sections of standard type and were built in two-story lengths having a maximum weight of 5 or 6 tons. There are in the first story and basement 25 columns, some of which support three twin girders over the banking room which carry four additional intermediate lines of columns in the ten upper stories and provide for a large unobstructed floor space in the first story. These girders are much the heaviest pieces of steel in the building and one of them about 35 ft. long weighs about 15 tons and was handled by the derrick boom unshipped and used in a vertical position as a gin pole, secured by six guy lines each adjustable by a hand tackle. The girder was lifted with a 10-part tackle made with ¾-in. steel rope rove through a number of separate sheaves and single and double blocks combined together to provide for the required number of parts. The structural steel in the building weighs about 1,000 tons, and its erection was commenced on Sept. 15 and finished Dec. 15, with an average force of about 25 men.

Erection of Steel Framework.

The weight and the reach of the derrick was so great that the erection stresses transmitted from it to the steel framework were larger than usual and special provision was made to stiffen the structure to receive them before the completion of the masonry walls and floors gave it final stability. The panels between the floor beams and columns in each longitudinal row were X-braced with ¾-in. wire ropes extending across three stories and provided with sleeve nut adjustments. Each double panel thus braced was also stiffened by a single 6x6-in. diagonal timber wedged at the foot against the wall columns and serving as a kicking piece. The columns in the transverse rows were similarly X-braced with wire ropes made from 1⅛-in. guys crossing two panels horizontally and three panels vertically. This system left one panel vacant at one side of the building and was completed without the use of the kicking pieces used in the other systems. When the erection was commenced the systems of bracing were carried up continuously several stories above the ground and afterwards the diagonals were removed from the lower stories and added to the upper ones as the erection progressed. This method was followed not only to clear the masonry but because after the walls and floors were built they lent additional stability to the framework and rendered the bracing unnecessary.

An Ingersoll-Rand air compressor driven by a General Electric dynamo was installed on the first floor and provided air pressure for the field riveting. A 3-in. vertical main was carried from its receiver to the roof and was provided at every third story only with an outlet from which connections were made to flexible tubes by which Chicago and Boyer hammers were operated by three rivet gangs. It was at first intended to utilize one of the steam pipe risers for this pneumatic service, but finally a special pipe was put in rather than wait for the steam pipe to be installed.

The floors and roof are of Roebling cinder concrete construction 4 in. thick and comprise about 65,000 sq. ft. of surface. Their construction was urged forward as rapidly as possible and they were usually kept within two stories of the setting of the beam tiers. The exterior walls contain about 1,200,000 red brick and were built from movable scaffolds suspended by long steel cables from drums carried at the upper story of the building. They were moved almost continuously and permitted the brick-layers to work to the best advantage without interruption.

The wall on all street fronts is faced up to the first floor with polished Crotch Island granite and above that with Bloomington limestone, about 35,000 cu. ft. of which was used. This was unloaded from the street by three boom derricks operated by steam hoisting engines and was stored in large quantities on the working platform 15 ft. wide which extended around three sides of the building over the sidewalk. The stone was set with hand power breast derricks located in every panel between columns, and every block was anchored to the brick work or to the steel framework with from one to three steel anchors, most of them galvanized and with extra large cross section. The work was done by an average force of about 20 men who completed it in about three months.

Mr. Francis H. Kimball and Mr. Julian Clarence Levi were the associated architects, Messrs. Weiskopf & Stern were the consulting engineers for the structural work. Mr. J. S. Griggs and Mr. J. B. Holbrook were the engineers for the mechanical and electrical installation. The Geo. A. Fuller Co. was the general contractor and erected the steel work and the brick masonry. The Foundation Co. was the sub-contractor for the substructure, Mr. W. H. McWhirter, Astoria, L. I., was the contractor for the limestone, which was set by McWilliam Bros. The National Fire-Proofing Co. furnished the hollow terra-cotta partitions, McNulty Bros. were the contractors for the plastering, Herts Bros. for the mahogany trim, the Wells & Newton Co. for the plumbing, and the Marine Engine & Machinery Co. for the plunger elevators, the L. H. Prentice Co. for the steam heating, ventilating and the mechanical equipment; the General Electric Co. for two turbines for the electric lighting plant, the L. K. Comstock Co. for the electric wiring, the Traitel Marble Co. for all marble, and the Waterproofing Co. for the hydrolithic finish of the cellar and pavements.

The Supervision of Construction of the New York State Highways.

The methods of making surveys and plans for highway improvements which are described in the manual issued some months ago by the State Engineering Department of New York have been outlined in recent issues of this journal. These articles have not taken up the supervision of construction, which is covered by other regulations prescribing the following procedures:

Engineers assigned to construction duty are held responsible for the construction of the road in accordance with the plans and specifications, from which no deviation is permitted without the consent of the division engineer. Engineers and their assistants do not leave the road during working hours without the consent of the Division Engineer, unless it be upon some business connected with the work.

Immediately upon assuming charge of a contract the engineer carefully checks the levels and measurements for the entire length of the road and marks on the adjacent fences, telegraph poles or other permanent objects in white lead paint each full station number, where this may be done without damage to private property. If the even station does not come opposite the permanent object the plus station is marked. If discrepancies are found to exist in levels or distance notice of them is sent at once to the division engineer.

The grade and alignment are given according to the following rule: "Set stakes on each side of the highway at every station, or more often if necessary, and near the fences or other permanent objects, where they are not liable to be disturbed. Prepare two small note books in ink, giving the horizontal distance from each stake to the center line of the macadam, and the vertical distance from the top of each stake to the crown of the finished macadam. After these note books are checked one shall be retained by the engineer in charge and the other shall be given to the foreman in charge of the grading, so that he may set his own intermediate grade stakes. At times when the engineers are not needed elsewhere these intermediate stakes shall be set by them."

If, to secure better results, any work in addition to that provided by the plans is thought necessary or advisable by the engineer in charge, a careful plan and estimate of the cost of such extra work is prepared and the whole matter submitted as soon as possible to the Division Engineer.

Engineers are expected to observe carefully the drainage of the entire road, especially during or after heavy rainstorms, and any changes in location or size of culverts or ditches that are considered advantageous are brought at once to the attention of the Division Engineer. Attempts are made during wet seasons to discover all soft and poorly drained portions of the road and if, in the opinion of the engineer, these places are not properly provided for in the plan, the Division Engineer is promptly notified.

No engineer is allowed to give any advice to contractors as to whether or not they can safely take their road rollers or other equipment over bridges. The contractors must assume all risks for such crossings.

Forming Subgrade.—In forming the subgrade for the macadam, stakes are set every 50 ft., or more often if necessary, along the line of the edge of the macadam and the finished grade marked on them. The proper form is given to the subgrade by a string stretched longitudinally between stakes, and by a template conforming to the desired cross-section of the subgrade. The elevation of the subgrade is checked before any stone is laid.

Before any subgrade is prepared for the macadam, all embankment and excavation is made for the full width of roadway. On embankment the portion outside the macadam is thoroughly rolled and consolidated before the trench for the macadam is formed. In excavation, all drainage ditches are excavated before placing the macadam, in order to drain the work thoroughly during the construction.

Care is taken to give the subgrade a sufficient amount of crown, so that after the road is rolled and completed it will have the full crown shown on the plans. This result is best obtained, according to the Department's experience, by raising the center of the subgrade 2 in. or more to allow for settling while the stone is being rolled, leaving the sides as indicated on the plans. If the contractor objects to this method, he is informed that, if the finished road has not the desired crown, it will have to be supplied with additional macadam. This precaution is specially needed on a yielding or plastic soil, likely to flatten under the action of the roller or the traffic.

The result to be obtained, when forming the subgrade, is a firm and solid foundation upon which to place the macadam, one that will not weave under the action of the roller, and on which the stone may be bound and locked together.

When unstable material is of too great an extent to be entirely removed, the facts are reported to the Division Engineer, with a detailed description of the extent of the trouble, and with suggestions as to its proper treatment.

On the clay soil frequently encountered in New York State it is considered absolutely essential that the subgrade be so formed as to prevent the clay working into the interstices of the stone during the rolling of the macadam. The Department states that this can best and most economically be accomplished by placing a layer of gravel upon the clay subsoil, if a bank can be found within hauling distance. A layer of ¾-in. stone or screenings will often give satisfactory results, where no other material is available, and in the more unstable places a layer of field stone, varying in size, with the larger at the bottom, may be used.

During dry weather a subgrade of clay may be firm and hard, but immediately upon being wet it may become very soft. The sprinkling and puddling of the macadam often causes the latter condition, and hence the necessity of providing against the clay working into the macadam.

On sandy soil, rolling has little effect and is continued only long enough to settle the subgrade in place. If the sand is very fine, or is quicksand, a layer of gravel is considered the best treatment possible and will usually give as firm a subgrade as is desired.

Culverts.—Masonry design may be substituted for concrete design at the option of the contractor, the height of parapet above the top of cover being the same in all cases, 9 in.

In setting culverts of minimum length, where the channel is practically level, a fall of about 3 in. is allowed in the culvert and the shape of the shoulders of the road is varied slightly to bring the slope lines to the proper places. Where a culvert is under more than the minimum amount of embankment, either at one end or at both ends, the culvert is lengthened beyond the minimum length instead of raising the parapet and wings to hold the slope. It is not necessary in any case for the elevations of the tops of parapets to be the same, for if so placed, the one on the down-stream side usually appears higher than the other.

Quarries.—If a quarry, after being developed, contains layers of slate, shale, thin layers of soft stone or undesirable stone of any kind, the contractor is required to select from the general run only such stone as will comply with the requirements of the specifications and contract.

If, in the opinion of the engineer, the quarry should be discontinued as a source of supply, the contractor is directed to suspend immediately and a report is sent at once to the Division Engineer.

Field Stone.—Where "local stone" is permitted by the contract and the contractor proposes to use field stone rather than stone from quarries, the following directions are made binding:

"The stone must be selected from the general run of stone found in the fields and stone walls or fences; those used shall be hard, durable and of compact texture, and all disintegrated stone, as well as soft sandstone, shale and slate, must be rejected. Where the field stones are of the flat variety, the minimum thickness allowable for use is 2 in., and where the stones are round cobbles, the minimum diameter allowable is 5 in. unless otherwise ordered by Division Engineer. It will, therefore, be seen that old walls or fences can not be cleaned up entirely in crushing for macadam. When the quantity of harder stone is insufficient for the whole road the softer stone may, if of approved quality, be crushed and used for the lower course. This must not be allowed without the approval of the Division Engineer in each case."

Crushing.—The engineer in charge is required to note frequently the working of the crusher, in connection with the inspection of the crushed stone. If the product seems to run smaller than the screen should give, it may be due to the section of the screen being too short, or the screen may turn too fast, or it may have too great an inclination. The bins are often allowed to get too full and stone from one bin will run over into another. The specifications requirements regarding crushed stone are rigidly enforced.

Courses.—The thickness of the courses of stone are regulated by the use of several hardwood blocks, laid on the subgrade or on the next lower course, as the stone is being spread. These blocks will be one and one-third the required thickness of the course to be formed and the loose stone must be spread to the full height of the blocks.

Spreading Screenings.—The contractor is not allowed to haul heavy loads of screenings over the stone which has been placed, until the latter has been sufficiently filled and rolled to prevent its being displaced by so doing.

Where it is impossible to drive along the side of the macadam and spread the screenings directly from the wagon the contractor must dump sufficient screenings along the shoulder before the stone has been spread and rolled.

Rolling and Finishing Macadam.—In the preliminary rolling of both courses the large wheel of the roller is required to lap out on to the shoulder about 8 in., and after traveling the length of the portion to be rolled, the roller should cross over and return in the same manner on the other side. Crossing from one side to the other on unrolled portions is strongly opposed by the Department.

The rolling of the bottom course is continued until the stone are firmly locked together and do not weave to any extent ahead of the roller, or are not moved by the action of the feet in walking over the macadam.

Where the top-course stone must be hauled over the bottom course, the latter is well filled and rolled to sustain the travel.

No more water is used on the bottom course than is necessary in preparing it to sustain the travel of hauling the top course over it, without cutting or raveling. In most cases the desired result is obtained by dry rolling.

Where the subgrade is of clay, special care is taken not to soften it by the application of too much water, and in the final rolling the stone is not saturated but sprinkled just sufficiently to wet it without reaching the subgrade. It is then rolled several times and left until the next day, and this operation repeated from day to day until the desired result is obtained.

Under no circumstances is any driving allowed over the stone after the screenings have been spread, until the section has been given the first puddle. If the top-course stone is delivered faster than it can be rolled and puddled, it is spread and filled, but is not driven on until puddled and rolled.

It is seldom feasible to get any portion of the road thoroughly filled and puddled at the first operation. If, after the greater portion of the surface is filled with "grout," the road is left for several days to partially dry out, and then is again rolled and more screenings added, the final result can be obtained with less rolling and wetting than if attempted at one operation. Any depressions or hollows developed during rolling or puddling are filled with stone of the same size as the course being treated, thoroughly incorporated with the course before proceeding.

Sections of the road are opened to travel as soon as completed in dry weather, but in wet weather, when the travel brings on mud, the road is not opened in short sections, thus reducing to a minimum the number of places where mud is carried on to the road.

Guard-Rail.—In setting guard-rail the distance from the center of the road to the face of the posts is equal to one-half the width of the road-surfacing, plus two-thirds the width of the shoulder. Exceptions to this rule are made in setting short stretches of rail over culverts and in setting the end posts of all stretches. At culverts where only 24 ft. of guard-rail is used, the face of the middle panel is at the inside face of the parapet.

The end posts of all stretches of guard-rail are set at a distance of one-half the width of roadway from the center of the road and the entire top rail is a uniform distance above the center of the road. In setting the top rail a uniform side slope of 3 in. in 6 in. is used instead of allowing a 3-in. slope regardless of the width of the top of post. A guide for sawing the tops of the posts, similar to that used by carpenters in sawing miter joints, is the simplest method of securing this result.

Inspection.—There is constant inspection of all work and materials during the entire time the construction is in progress and the following rules are given especial attention:

"The thickness of each course of stone must be constantly watched by the engineer, or one of his assistants, during the entire time of spreading.

"The mixing of all mortar and concrete must be constantly watched to insure proper proportions and methods. In placing concrete it is very important to have the forms securely braced, so as to prevent any movement or misplacement. Masonry or concrete laid in warm weather should be protected from the sun by covering with burlap, grass or other satisfactory material, and kept damp until it has thoroughly set.

"Sand used for mortar or concrete must be carefully inspected, and if found to contain an injurious amount of foreign matter, it must be washed before using. Washing should be done by stirring the sand in running water.

"Paving must be watched to insure proper size and shape of stone and form of ditch. Care shall be taken to have the edge of the paving nearest the macadam slightly lower than the material of the shoulder, otherwise the paving will cause the water to follow along its edge, forming a ditch in the shoulder and tending to undermine the paving.

"Paving across drives or highways must be so formed that vehicles can pass over it without danger or inconvenience.

Cement.—No cement is used until it has been tested and accepted. Samples of cement are placed in paper bags, furnished by the Cement Testing Laboratory, Department of State Engineer, Albany, to which the samples are sent immediately after taking. The Laboratory is notified by standard notification cards when each package is forwarded, and a card is also enclosed in each package.

The contractor is informed that the cement he proposes to use on the work must be furnished with a view of being held for the 28-day test, as prescribed in the standard specifications, for only those showing very satisfactory tests are allowed to pass on the seven-day tests.

The contractor must provide a dry place, protected from the elements, for storing cement, and each shipment and each car lot must be kept separate, to enable the removal of any one lot in case of its rejection without causing the removal of a larger quantity.

Samples are taken by the engineer, or his representative, promptly on delivery, from every tenth barrel, or from the equivalent of the tenth barrel when packed in sacks. Each sample is taken to include cement from the surface to the center of the package sampled.

Each barrel or bag sampled is numbered consecutively throughout the progress of the work and its sample is marked in the same manner with the same number.

Results of tests are furnished in ten days from the seven-day test, and in thirty days from the 28-day test, but no cement is used until a notice of acceptance has been received from the Division Engineer. Any cement which has been rejected by the Department, because of failure to stand the required tests, is immediately removed at the expense of the contractor, under the general direction and in the presence of the engineer in charge.

Final Note Books.—For the purpose of making monthly and final estimates and for permanent record after the work is completed, all quantities, except as noted below, are recorded as the work progresses in standard note books furnished by the Division Engineer. Separate headings are made for each item of work, and under each heading is given the station or stations at or between which the item was used and the amount used in each case. If the item were used in a structure reference is made to the page in the book where the structure is shown, as described below. The following data must be given:

"Clearing and Grubbing: Give station, width of cutting and number of acres.

"Excavation or Embankment: Give the contract amount and show by stations any additions or deductions from this amount.

"Macadam: Give the contract amount and show by stations width, thickness and amount of any additions or deductions.

"Concrete: Give the station and nature of each structure, with amount in each, and refer to page where details may be found.

"Masonry: Same as concrete.

"Riprap, Telford Base, Paving and Cobble Gutter: Give station, width, thickness and amounts. If paving is at a culvert, refer to page where details may be found.

"Flagging and Expanded Metal: Give amounts by station and refer to page where details of structure may be found.

"Pipe: Give station, kind, size and length. If in a culvert, give page where details may be found.

"Steel, Cast Iron and Timber: Give stations, amounts and page where details of structure may be found.

"Guard, Bridge and Pipe-Rail: Give stations and side of road on which rail is used.

"Guide-Boards and Road-Signs: Give station and side of road where each post was erected and inscription on each."

Drawings to approximate scale of each structure are shown, with all dimensions and computations and a list of all items and amounts in each structure. When the work is completed, a general summary of all items is made in the back of the book and a final account compiled. This account shows the exact quantity of every item used in the construction of the road.

All final notes are entered neatly and legibly in ink in such a manner that they can be easily interpreted after the work is completed. The final note books are kept as a part of the permanent records of the office of each Division Engineer.

Acceptance.—After the completion of a road and before notifying the Deputy State Engineer of its completion, the Division Engineer has a profile of the center of the road made by a reliable employee not engaged upon the construction of the road. This profile is plotted upon the original working profile or upon a set of original blue prints in such a manner that it may readily be compared with the original profile and a written certification as to its correctness is placed on it by the engineer making it. In like manner an occasional cross-section is made at the places of the heavier cuts and fills. These data are presented for the inspection of the Deputy State Engineer when making his final inspection of the road.

Book Notes.

It has doubtless been a matter of surprise to a good many engineers that there has been no general book on the subject of clay and its products written in this country. While considerable information is available in the publications of the national and state geological surveys, it is not of a comprehensive character and these reports are often difficult to obtain. Accordingly Prof. Heinrich Ries has prepared a useful book in his "Clays; their Occurrence, Properties and Uses," which furnishes in compact form information that could only be obtained by prolonged search and correspondence before the book appeared. The author is particularly well qualified for his task, as he has investigated clays for a number of geological surveys and has made a special study of them in his laboratory at Cornell University. In the first chapter he describes the origin of clays and explains the various classifications of them that have been proposed. In doing this he carefully points out that a great deal must still be learned before our knowledge will be in a satisfactory condition, and in many parts of the country a great deal of investigation of clay beds may still be profitably carried on. In the second chapter the chemical properties of clay are discussed and the effect of various constituents is explained. The author rejects the common statement that all clays contain kaolinite, and points out that chemical analysis alone is unable to determine definitely what are the mineral constituents of clay. Attention is also called to the effect of certain minerals, such as titanic oxide, on the properties of clay of technical importance. The physical properties of clay are taken up in the third chapter, and it is interesting to observe that in respect to the most important of them, plasticity, the author takes a broader conception than that usually held, defining plasticity as the "property which many bodies possess of changing form under pressure, without rupturing, which form they retain when the pressure ceases, it being understood that the amount of pressure required and the degree of deformation possible will vary with the

material. The available information concerning the causes of the physical properties is reviewed and criticized and the changes in the properties due to manufacturing processes are explained. The fourth chapter is an attempt to classify clays from a manufacturing point of view, something which ceramic specialists seem to regard as unadvisable although it is but natural that people looking into the industry for the first time or desirous of ascertaining if a given clay can be used for some purpose should urge the necessity of something of the sort. The chapter also contains a section explaining the general methods followed in manufacturing different classes of clay products. No attempt is made to go into details or to give directions for producing any given class of material, and it is not unlikely that in making general statements the author has occasionally not cared to indicate the exceptions to them. This portion of the book is a useful introduction to a more detailed knowledge of the manufacture of brick, terra cotta, pipe and pottery, when its limitations are borne in mind. The remainder of the volume is a description of the extent and nature of the clay deposits in different States. (New York, John Wiley & Sons. $5.00).

Letters to the Editor.

AN UNUSUAL BRIDGE WRECK.

SIR:—The accompanying picture may interest some of your readers, as it shows a wreck of an unusual nature on the Nashville, Chattanooga & St. Louis Ry. near Lookout Mountain. In the background of the picture is the new road that the Southern Ry. is building between Chattanooga and Stevenson, Ala., where it will connect with the present line of the Southern Ry. to Memphis. The tunnel through Lookout Mountain is just to the right of the picture. Just to the left of the picture is a high hill, the face of which had to be cut off in order to get the approach to the tunnel. This hill is nearly all earth excavation, and is being removed by steam shovels after being loosened by blasting. The bridge which was wrecked is a two-span structure across Chattanooga Creek.

About 3 o'clock on the afternoon of May 16, a blast went off in the earth excavation just mentioned. Whether this was premature or intentional I do not know; the man who set it off disappeared and has not been seen since. A mass of earth from the blast struck the bridge just as a freight train was entering it and wrecked it, dropping eleven cars through, as shown. This was a Southern Ry. train running to Chattanooga. Just to the river side of the picture the Nashville, Chattanooga & St. Louis Ry. was building a trestle across Chattanooga Creek to connect its line around Lookout Mt. with a freight yard which it is constructing on the Chattanooga side of the stream. Rubbish from the blast struck a pile driver on this work, killing a couple of men. In all seven lives were lost as a result of the blast, and a few houses on the hillside were damaged.

The tracks of the Nashville, Chattanooga & St. Louis Ry. at this place are also used by the Alabama Great Southern Ry. and by the Memphis division of the Southern Ry. All traffic was suspended, but passengers were transferred around the wreck. The trestle connecting with the freight yard was completed and the first train was run across it about 10 o'clock on the evening of May 18. The wreckage was then cleaned up and a temporary trestle put in, and the old bridge put in service again on May 23.

I do not know just why this blast did so much damage, but the most plausible explanation seems to be about as follows It is said that about 275 bbl. of powder were used in the blast. It is claimed that instead of the powder going to the bottom of the hole it caught about half way down and lodged there, with disastrous results when it was set off. C. E.

Wreck at Lookout Mountain Tunnel.

UNIFORM CONTRACTS FOR GOVERNMENT WORK.

SIR: By direction of the President, a committee has been appointed from the various executive departments in Washington to prepare uniform contracts for use by the Government. The committee consists of Mr. J. S. Wetmore, of the Supervising Architect's office, Pay Inspector J. S. Carpenter, of the Bureau of Supplies and Accounts of the Navy, Mr. Maurice Bien, of the Reclamation Service, and Messrs. W. W. Warwick and John Mason Brown of the office of the Comptroller of the Treasury. The committee is singularly well constituted to represent all phases of this question in Government work. The contracts with which Mr. Wetmore is directly concerned are contracts for architectural work. Mr. Bien is especially acquainted with engineering contracts, having had charge of the preparation of the forms of contract in use in the Reclamation Service, and Pay Inspector Carpenter in his official duties is necessarily concerned with the purchase of supplies and materials of every sort for the Naval service. The representatives of the Comptroller's office are both of them lawyers of ability, who have dealt especially with the construction of the various provisions of public contracts now in use. Mr. Warwick is chief law clerk in the Comptroller's office and Mr. Brown is the author of a brief but valuable work on the law of contracts, which has been very extensively purchased by the government.

They are to take into consideration the forms of government contracts for all purposes. These may roughly be divided into two classes, contracts for the purchase of supplies and material, including all classes of machinery, and contracts for the construction of the numerous public works in which the United States is engaged, including river and harbor improvements, irrigation projects, public buildings of all classes and wharves and docks.

It is found upon investigation that the forms used in the different departments vary widely, having been modified from time to time by the heads of different departments as conditions arose. The attention of government officers has been of late directed to the fact that the general use in government contracts of provisions vesting a very wide discretion in the government engineer or superintendent and provisions bearing with special severity upon the contractor, while nominally to the advantage of the government, have operated greatly to its disadvantage.

Contractors of wide experience who have large demands upon them for their services prefer to work under contracts which are drawn with a due regard to fairness upon each side. When specifications disclose that the contractor is placed at the mercy of the other party and is subject to the exercise of an uncontrolled discretion, he is not inclined to bid under such specifications. The government has failed to receive bids from many contractors of high reputation because they did not like the conditions under which the work is to be done. Then, too, a contractor who understands the conditions of government work under these severe restrictions, finds it necessary to add an emergency percentage for the risk which these require of him. Consequently, the bids upon government work, when made by contractors of experience in it, have often been considerably higher than their bids upon private work of the same kind. It is common to hear successful contractors say, either that they will not take Government work at all or that if they do take it, they will take it only upon their own terms. The result of this is to the disadvantage of the Government, both in paying higher prices and in losing the benefit of the work of many of the best-equipped contractors in the country.

Much of this difficulty can be avoided by the adoption of a form of contract which will be satisfactory both to contractors and to the government. It is understood that the committee will take ample time for deliberation and discussion on this subject, in the hope of creating better conditions so far as the fault lies in the present forms of contracts. The Committee of the American Public Works Association appointed to prepare a uniform contract for engineering work, of which Mr. G. O. Tenney, of Richmond, is chairman, has placed itself in communication with this official committee and will present to it the result of its labors in the draft of a uniform contract.

Yours truly, OBSERVER.

HYDRAULIC RAMS driven by artesian wells are used in the lower Potomac valley and along Chesapeake Bay. The well pressure is ample to furnish supplies at the shore but does not serve the higher banks, so the artesian flow is used to run rams for the high service.

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TABLE OF LEADING ARTICLES.

The Enforcement of Specifications.

The presidential address of Dr. Charles B. Dudley before the American Society for Testing Materials, published in The Engineering Record of June 29, is suggestive of many important questions which arise in the execution of engineering works of magnitude. Dr. Dudley's observations naturally bear chiefly upon the quality of materials to be delivered to the consumer. His life work, although thorough and most extended, has been devoted with highly excellent results largely to investigations regarding the quality of a great range of materials used by the Pennsylvania Railroad Co., and yet his treatment of the subject as a whole is applicable in essence to the broad field of engineering construction as well as to engineering materials, the former in general terms including the latter. As indicated by him the necessity of inspection in order to secure the enforcement of specifications does not in the slightest degree, as a matter of fact, reflect upon the integrity or the motives or the capacity of the producer of materials or of the contractor who undertakes to build great engineering works. The conditions under which materials are produced or work performed are of almost limitless variety, and it is to the real interest of the producer and the contractor as well as to the engineer and owner to secure in every part of it excellence of material as well as efficiency in structural procedures. Further than this, it is one of the duties of the engineer to supply to his client an authoritative certification that the latter has obtained precisely what he has contracted to receive. It is not an uncommon experience where there is a suitable and reasonable co-operation between engineer and contractor to attain enhanced economy for the contractor as well as improved quality of material and work for the owner. One of the most common instances of this kind, although many might be cited, was the result of the cement inspection in connection with the construction of the Rapid Transit Subway in New York City. The engineering inspection of the cement was carried on in connection with that of the manufacturers to the marked mutual advantage of both parties concerned, and what was accomplished there has many times been accomplished elsewhere and will be again.

Although it cannot be denied that the enforcement of specifications in many engineering works has led to sharp friction between engineers and contractors or producers, it can be said almost without exception that had there been a reasonable attitude of each party in interest to the other with even a moderate amount of tact on the part of the engineer, even such difficulties would largely, if not entirely, have disappeared. It is excessively difficult, in fact practically impossible, for any engineer, however experienced and highly qualified he may be to set forth correctly all the important conditions affecting both the quality of the materials and the character of procedures required in connection with the prosecution of an engineering work of unusual magnitude. The natural conditions affecting such work are never identical in any two cases and seldom nearly so. These differences of natural conditions which occur in the development of field and other structural procedures are so marked in passing from one work to another that, however scrupulously careful the fundamental features of construction are specified, it is simply impossible to anticipate all the exigencies that may arise and hence to formulate specifications which may not need modifications in the interests of both the client and contractor. Under such circumstances it is the part of the engineer to consider well to what extent he shall hold to the literal requirements of the specifications. It is his first duty to secure every excellence of material and structural procedure which the specifications call for: on these points there must be no concession and no reasonable contractor either desires or expects it. There may be, however, a wide legitimate range in opinion as to the ways and means of securing the essential ends set forth in the specifications and therein lies the necessity for the exercise of judicial functions by the engineer. It is precisely in this part of the work that unnecessary and even inexcusable friction so frequently arises between engineer and contractor. Even though specific procedures are prescribed for the accomplishment of certain portions of the work, if either the contractor or the engineer can independently or in co-operation devise more effective procedures for the attainment of the necessary ends, the mere letter of the specifications should not stand in the way of obtaining such an advantage. It matters little whether the contractor will save expense by such a procedure or not. It is his legitimate object to increase his profits if he can do so without prejudice to the quality of the work or materials. No engineer goes beyond a reasonable and proper concession in considering a proposition of this character from a contractor if he constantly keeps in mind the real purpose of his specifications and yields nothing which prejudices either the quality of material or efficiency of the work.

The specifications form a part of the contract which is essentially no less important than those parts which secure payment for the work done. In fact, it may be stated that the specifications form the real substance of the contract, the other portions being incidental although essential, and clearly the engineer cannot properly consent to any modification which militates against the real spirit of the agreement; nor should a contractor be permitted any modifications of procedures, or modifications in the supplying of the materials, which are not absolutely in harmony with the same spirit of the specifications. Neither of these observations, however, prevents to the slightest degree any reasonable modifications necessitated by conditions developed in the progress of the work and not originally anticipated. Such exigencies frequently cannot be met in a reasonable manner under a drastic, literal interpretation of contract conditions. It then becomes the duty of the engineer to exercise broadly his proper functions so as to relieve situations which might otherwise be unreasonable or even intolerable; and thus secure, in the completed work, precisely what was really contemplated by the specifications. It is only the part of wisdom to make specifications sufficiently elastic to permit such an enforcement which, while guarding the interests of the client, is also consistent with the highest efficiency in the contract operations and amenable to any exigencies of natural conditions that may arise.

The Street Lighting Situation.

Indications are very plain that within a short time city engineers and electricians and others who represent the public interest will be hard up against some new and revolutionary propositions in street lighting. At its recent convention the National Electric Light Association adopted a series of specifications for street lighting which are of very grave import and of which the association itself has probably hardly grasped the full significance. The specifications, printed on page 71 of this issue, on their face look somewhat crude, but nevertheless innocent. In point of fact, the cloven hoof of ill-disguised commercialism protrudes from their raiment. This journal gladly acquits the committee that framed them of wilful guile as a whole, yet it certainly has managed to draw up a document that will lend itself readily to ends which its authors would hardly care to stand for were they plainly expressed. With malice toward none and charity toward all, this journal feels compelled to let the cat out of the bag and to show the dangerous issues that lurk in these mild-mannered specifications.

To go back a little, street arc lighting up to

about the year 1898 was carried on to all intents and purposes exclusively by means of the familiar open arcs, of two general patterns, one taking about 9.6 amperes at 45 to 50 volts at the arc, the other about 6.8 amperes at the same pressure. The former was known to the trade as the 2,000 c.-p. or "full" arc, the latter as the 1200 c.-p. or "half" arc. Now, these candle-power ratings were a commercial fiction. The "full" arc gave a maximum candle-power of roughly 1,200 when operating normally, throwing it about 45 degrees below the horizontal, while the "half" arc gave somewhat more than half this light under the same qualifications. Both lights were subject to considerable fluctuations and were weak in rays near the horizontal, so that they gave excellent light near the lamp, but rather poor light at a couple of hundred feet away.

In 1898, the enclosed direct-current arc pushed its way to the front. This was usually a 6.6 ampere arc taking about 72 volts. This gave a smaller maximum than the old full arc, but a more even distribution and a steadier light. It required trimming only infrequently and therefore saved much in carbons and labor, but required to be run from arc machines similar to those already in use, which were rather inefficient. The new light was a pretty effective substitute for the old, lamp for lamp, and took about the same energy. In 1894, the National Electric Light Association, to simplify the situation, agreed to consider the then standard open arc to be of 2,000 nominal candle-power when it took 450 watts at the arc and the usual lamps construed this rating rather liberally. On the new lamps the wattage was liberal enough but the lower current density in the arc lowered the light to an extent that was not compensated by the higher voltage, and the chief gain was in steadiness and better distribution. The old wattage rating was tacitly retained. Had the matter stopped here disputes would have been few, but almost at once the alternating-current series arc at 6.6 amperes appeared, taking only about 410 watts at the arc. Now, alternating-current arcs are intrinsically considerably less efficient light producers than direct-current arcs and this alternating-current lamp was, in spite of a still further improved distribution, decidedly a less effective illuminant than the 450-watt arcs, open or enclosed.

Its gain to the station was considerable, both in trimming and in the substitution of very efficient transformers for rather inefficient arc machines, and therefore, by hook and by crook, it was pushed rapidly into use. Incidentally, it was a good thing for the manufacturers, since the stations had to secure a new equipment. It was not a bad light this 6.6 ampere alternating-current lamp gave, and when sold for what it was and not as an equivalent of the old "full" arc, nobody was the loser. Most contracts specified the lamp fully and fairly and the price was made satisfactory to the users. But later came a somewhat insidious tendency to push this lamp as an equivalent of the full arc, and here the trouble began. This attempt received a severe setback in the Colorado Springs decision of last winter, but at the recent convention, the National Electric Light Association attempted by a rider upon its committee report to resolve that three quarts make a gallon by extending its old 450 watt rating to cover alternating-current lamps. Now a "standard" alternating-current series lamp pushed to 450 watts by raising the current or voltage a little is distinctly inferior for the purposes of its use to the direct-current lamp of similar wattage. Look out for it! There is an alternating-current lamp, taking [illegible] amperes and [illegible] 500 watts which is up [illegible] of pow[illegible] were [illegible] the direct-current lamp, [illegible]w, to side-step the difficulties of this situation, the committee resolved that instead of a watt or candle-power specification, street lighting should be sold by illumination, saying very truly that illumination is the end of street lighting and hence should be ultimately the goods delivered. Unhappily, illumination on the street is measured only with very great difficulty, so that it will produce unlimited litigation as the subject of contracts, while wattage or standard candle-power can be measured with relative ease.

Had the committee stopped here it would simply have endorsed a logical but somewhat impracticable method. It went on, however, to specify that the lamps should be rated solely by the light given at a distance of not less than 200 feet, that is, by the light given nearly horizontally, utterly irrespective of the perhaps very brilliant results over three-quarters of an acre or so of ground nearer the lamp. Right here, kitty pops out. A new form of arc, the so-called luminous arc, has been devised and is being introduced, which throws its maximum light very near the horizontal. It is highly efficient and, if measured in the way proposed by the committee, will enable an illumination specification at 200 feet distance to be met at an expenditure of little more than half the energy of the usual arcs, at the cost, however, of the brilliant effects produced by common arcs at shorter distances.

The luminous arc has many good qualities and will surely make a place for itself, but let it be sold for just what it is, and not by means of a disingenuous method of comparison. The luminous arc gives a capital distribution for street purposes, but one can ill afford to ignore the light given within 200 feet, since only within that distance of any commercial arc yet produced does the illumination rise to a value that is of much use for seeing purposes. The German Association of Lighting Engineers rates arcs on their mean lower hemispherical candle-power, thus taking full account of the total flux of light available on the street. This plan perhaps overvalues light close to the lamp but it is far fairer than that proposed by the National Electric Light Association's committee and is not open to the objection of deliberately favoring a particular form of lamp at the expense of all others. When a proposition for changing the street lighting system arises it is up to those who guard the public interests to see that they are not persuaded to pay for light which they do not get. If highly efficient lamps are available they should be so freely used as to raise the general average of illumination instead of lowering it.

Building a New City.

The industrial city which the United States Steel Corporation is building at Gary, Ind., to provide homes for the employees of the immense new steel mills under construction at that place, is being developed according to a broad general plan of greater scope than heretofore attempted for such a community in this country, if not in the world. The new steel plant will have 12,000 to 15,000 employees soon after it is started. The Steel Corporation also controls seven miles of water-front on Lake Michigan, extending from Gary to Indiana Harbor, which it is expected will be occupied almost entirely comparatively soon by the plants of the subsidiary companies or by those of allied industries. As a matter of fact, the American Car & Foundry Company has already decided to erect a plant in the vicinity of Gary which will give employment to about 3,000 men. Mill towns in this country, in which no outside interests are centered, have a general population of about five to each mill worker. On this basis, the population of Gary ought to be in the neighborhood of 75,000 within two years. The plans for the new town contemplate, however, that latter will be the residential center for the great industrial district which is certain to be developed at the lower end of Lake Michigan on account of the possibility of shipping iron ore by water from the mines around Lake Superior directly to the furnaces, and by the short haul from the extensive coal fields in Illinois and Indiana.

An idea of the scope of the municipal improvements and public service systems for this community, which it is expected will have an important part in the development of the new industrial district, may be obtained from a description published elsewhere in this issue of The Engineering Record. From this description it is evident that the best of modern engineering practice has been applied in the design and construction of these improvements and service systems. Many interesting and novel questions arise in planning and building such a city as Gary, and it might be considered that in this case the opportunity would be presented for improved and original methods of providing for urban population. At the same time, when the arrangements which have been developed for the benefit of existing communities are investigated, it is apparent that they cannot be varied to any appreciable degree without occasioning unreasonable cost, unexpected inconvenience, or the creation of new and undesirable conditions. The adoption of numerous innovations in the arrangement of different features of the public service systems at Gary has been practicable, nevertheless, and advantage has been taken of these possibilities in the work that has been done.

The expense of all the improvements which have been undertaken is borne entirely by the Steel Corporation and is added to the cost of the business and residence lots. These lots are sold subject to reasonable building restrictions that are designed to regulate the character of the city and of different districts in it. Contrary to the general conception, the Steel Corporation will exercise no further paternalism over Gary, which will not differ in its government from any existing city incorporated under the laws of Indiana, except that it is to be finished before being occupied. The outcome of providing such a complete, modern and substantial city as is being built under these conditions by the Steel Corporation for its employees will be of no small degree of interest. The undertaking is practically certain to be successful, nevertheless, because it should be borne in mind that before the new steel plant and other industrial plants which may locate in its vicinity can compete for labor, or for skilled labor, at least, with industries in settled communities a satisfactory place of residence must be provided in the practically barren sand wastes of northern Indiana.

Notes and Comments.

A BUILDING PARTIALLY COLLAPSED in San Francisco early this month, but up to the present time there have been no indications of a massing of technical experts and photographers to describe and illustrate every detail of the design and of the wreckage, although a number of men were hurt. Possibly, the fact that the structure was steel rather than reinforced concrete may be an explanation of the lack of interest shown in the accident by esteemed contemporaries. Just why they have spasms over similar insignificant accidents with reinforced concrete and disregard them when other building materials are concerned is a puzzling conundrum. The accident in this case was apparently due to the removal of bracing before enough rivets were driven; something likely to happen with any kind of construction when work is being driven at high speed and rigid

inspection is not maintained. Every builder knows the danger and tries to avoid it, but foremen will occasionally take the risk of loosening up supports too early and a collapse sometimes occurs. It hardly seems likely that deep technical sermons will be preached on this accident or the use of steel on the Pacific Coast will be at all affected by it, but had it been a concrete floor that dropped what a fine stir it would have made in the trade press.

THE POSTPONEMENT OF ROAD IMPROVEMENTS owing to the unwillingness of those paying for them to have their lives endangered by automobile scorchers was briefly mentioned last week. The subject is one that deserves a good deal of attention. The most destructive user of macadamized roads is unquestionably the automobile, and the time is fast approaching when some method of making the owners of motor cars pay a fair proportion of the maintenance expenses for highways will have to be rigidly enforced. The reasonable use of the roads by automobiles is a distinctly legitimate matter, but their unreasonable use is something entirely different. There is some difference of opinion between road engineers concerning the effect on highways of cars when running at high and at low speeds. Some engineers consider that a speed of 25 miles per hour or less does not work much injury, while others hold that the rate of speed of the car makes very little difference. It goes without saying, however, that a car habitually run at high speed covers so much more ground that it is more destructive than one which is run a shorter distance owing to its lower power, and on this account there is some justification for the tendency to tax cars according to their horse power rating.

THE JUMP IN VALUATION of real estate wanted for public improvements is one of the interesting features connected with the prosecution of any large undertaking involving the condemnation of land. The taxpayers of the city of New York have become accustomed to such large payments for property needed for the public works that the enormous prices they are sometimes forced to pay do not arouse the general condemnation they should. The Board of Water Supply has evidently felt that the expenses for land connected with its works for bringing water from the Catskill Mountains will be so high anyway that every flagrant case of hold-up should be made public. Accordingly, one of the New York papers last week published an illustrated description of some property belonging to a man named Le Vino, situated on the line of the proposed Croton Aqueduct, for which the sum of $545,000 is asked. It is claimed that this property includes a railway, a valuable medicinal spring with improvements connected with it, and a natural park. All these things are shown by photographs to be mere fakes and the man is now the laughing stock of everybody who takes any interest in public affairs. It is to be hoped that such a course will be followed with every other flagrant attempt to extort ridiculously large sums from the city in connection with the new water works. There is nothing so much disliked by the man trying to pry open the public treasury as publicity, and the Board of Water Supply should continue its course of giving out illustrated information regarding these extraordinary properties for which enormous sums are demanded by their owners.

THE BROKEN STONE INDUSTRY seems likely to develop before long in a way that will surprise a good many people. A good bank of building sand has long been recognized as a valuable asset, but it will not be long before a ledge of rock suitable for concrete and highway work will be equally prized. A few far-sighted people have already bought quarries and erected plants for crushing rock for sale as a commercial product, but the present price of broken stone in the vicinity of many cities indicates that more plants can be constructed without materially affecting the market. Any attempt to get out rock economically from most of the little beds developed for small pieces of work is entirely out of the question. The cost of quarrying and breaking the stone is quite high and the expense of transporting it to its place of use is generally equally high, so that it is often the case that a contractor can purchase broken stone from a large crushing plant many miles distant cheaper than he can obtain it from some small ledge in the vicinity. At present most contractors and dealers in broken stone zealously guard the cost of such material, but it is well established that the expense of quarrying and crushing stone is extremely low when the work is done according to a carefully arranged plan and with plant designed be somebody who appreciates not only the special conditions of rock breaking on a large scale, but also the importance of such items of expense as interest charges, depreciation and the like. It is reasonable to say that some of the neglected ledges in the more populated sections of the country will become as valuable assets as the undeveloped water powers which have but recently begun to attract attention.

THE BOARD OF EXPERTS appointed by the Interstate Commerce Commission to investigate the value of safety devices on railways is thoroughly well qualified for its task. At the present time such devices, especially signal systems, are so closely associated with various commercial interests that independent investigations are very much needed. There is no question about the value of most of these appliances, but there is considerable lack of definite information concerning their field of satisfactory usefulness. There is also much misinformation floating about concerning just what safety appliances can accomplish. Oftentimes, after an accident, there is a strong feeling manifested in newspapers that sufficient or proper safety appliances were not at hand, whereas railway men will generally acknowledge in private conversation that the trouble was due to some employee's carelessness. This misapprehension has sometimes been unquestionably increased by attacks on the railroad where the accident occurred by men who have probably had their passes cut off in the past and wish to get even. The way in which newspapers hail them as experts seems to be some recompense for the fact that they no longer travel for nothing on roads where their transportation was formerly furnished free. The work of the Board of Experts is consequently of deep interest to the traveling public, and it is to be hoped that the Board will issue progress reports from time to time so that a knowledge of what it is doing may be had. Such investigations will clear up the uncertainty regarding about only three-tenths of the railroad accidents, and it would be a very good thing indeed if more railroad systems than the Harriman lines were to adopt the method of publicity regarding accidents which Mr. Kruttschnitt recently announced. On that system it is held that personal responsibility for accidents, whether officers or laborers, should be known to the public. It has been determined that there must be a closer observance of rules and greater respect for danger signals than is now obtained from employees. The method of accomplishing this which the officers of the company have adopted is to give the widest publicity to every accident. It will be recalled that this view was expressed in a signed editorial by Mr. Joseph Ramsay, Jr., published in The Engineering Record two years ago. Mr. Ramsay pointed out that until it is possible to secure laws which will make railway employees legally responsible for accidents due to their negligence or carelessness, it is hardly posible to insure much greater safety to travelers than is now afforded. So long as train crews can not be punished for accidents due to their carelessness, it is not worth while to expect any very great increase in safety from mechanical appliances except on roads which have not yet adopted them to the extent their traffic warrants.

A NEW EDUCATIONAL SCHEME called a co-operative course in engineering has been established under the direction of Prof. Herman Schneider, dean of the College of Engineering at the University of Cincinnati. It is a six-year course, during which the students work alternate weeks in local shops throughout the scholastic year and full time in the summer. They have a week's vacation at Christmas and two or three weeks during the summer. The practical work at the shop is stated to be as carefully planned as the theoretical work at the university, and the students are paid about $2,000 for this work during the six years. The students who take the electrical course and work at the shops of the Bullock Electric Co. spend the first year in the foundry, the next year and a half in the machine shop, the next two years in the graduate-apprentice course, and the subsequent time in the drafting room and sales office. The aim of the course is, according to Prof. Schneider's paper before the Society for the Promotion of Engineering Education, not to make a so-called "pure" engineer, but to make an engineer able to take an important position in commercial work. The course is the result of an investigation which showed that a great majority of engineering graduates are employed in commercial production, whereas the present college courses were considered to contemplate only "pure engineering." The advantages claimed for this new educational course are that the extra two years give the student plenty of time to assimilate the theory he learns under the direction of his professors, the shop work has a valuable effect on the application of the theoretical studies he has carried through, the work is a change for the student and valuable as physical exercise, the student gains a knowledge of phases of the labor problem which he cannot obtain except by working in shops, and, finally, he learns to appreciate the importance of time in all commercial work. The course is an interesting innovation and the results of it will be followed with much curiosity, particularly if it is carried forward long enough so that the future careers of the graduates from it can be studied. In one sense, it is a return to some of the ideas which were firmly held when technical colleges were established in this country, for the attention given to shop practice is out of proportion to what is considered desirable in most colleges. If the object of a technical school is to turn out shop superintendents and managers, then it is safe to say that the course is likely to prove successful, for only those fitted by temperament and ability are likely to take its full six years of work. On the other hand it may be questioned whether so much shop practice is of any value to a good many engineers, for it seems to be pretty well established by experience that excellent designing engineers may be trained in the drafting rooms of establishments from students who have never had shop practice. It is safe to say that not one architect in a hundred can do a good job of plastering, yet all are perfectly competent to prepare the specifications and the drawings for such work. Probably very few of the best designers of electrical machinery at the present time have the ability to themselves execute their designs in a shop.

THE MUNICIPAL WORKS OF GARY, IND.

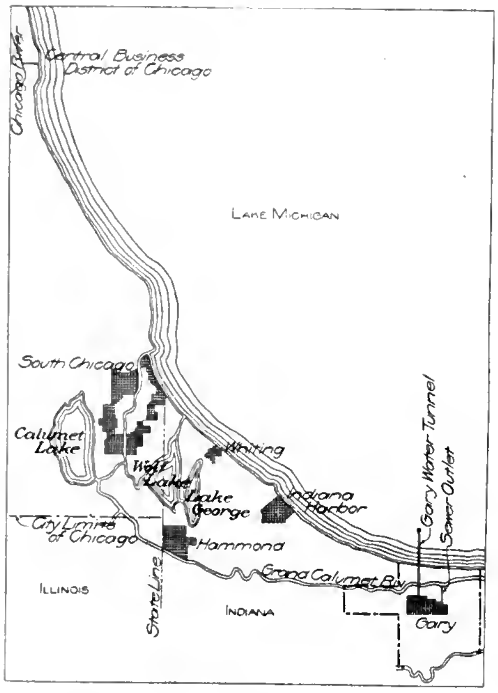
The city which is being built in connection with the new plant of the United States Steel Corporation at Gary, Ind., will have on the whole what are believed to be the most complete and extensive municipal improvements and public service systems that have ever been provided for a new community. The new steel plant will occupy a site about one mile square on the shore of Lake Michigan at the extreme southern end of the latter. 26 miles from the central business section of Chicago, and 12 miles from the South Chicago plant of the United Steel Corporation. This corporation owns seven miles of water front extending along the lake to the west from Gary to Indiana Harbor, the ultimate plan being to establish on this property the plants of allied industries, as well as those of subsidiary companies of the steel corporation. In fact, at least one large independent manufacturing plant employing 3,000 operatives has already been located in the immediate vicinity of Gary, the American Car & Foundry Co. having decided to erect such a plant.

The city of Gary is entirely distinct from the new steel plant, both in regard to location and ownership. The site is immediately in the rear of the steel plant, a sluggish stream, called the Grand Calumet River, separating them. The land on which the city is built, and, in fact, all of the land in that vicinity consists of pure lake sand, which lies in a series of alternate ridges and hollows, roughly parallel to the shore line of the lake. The tops of the ridges are 25 to 45 ft. above the water level of the lake, the general elevation of the hollows being 12 to 20 ft. above that level. The land was originally covered with a scanty growth of vegetation and small oak trees, for, except in some of the hollows, soil was almost entirely lacking.

The construction on such a site of a city which would provide a desirable place of residence for the families of the large number of mill operatives to be employed in the new plant, involved a great expense for preliminary grading before any municipal improvements could be made or public service systems installed. It was imperatively necessary, nevertheless, to afford homes for the 12,000 to 15,000 employees which will be required from the start in the new steel plant alone, and for the population which is expected to be drawn to the city by other industries in the vicinity. In fact, since these various industries will have to compete for workmen with settled communities in which all conveniences are available, the new city had to be a desirable and attractive place in which to live.

The town site was purchased in the first place by the steel corporation, by which it was divided according to what is considered to be the most satisfactory arrangement for an industrial town. Although the topography of the site of the city was very irregular, uniform grades for the streets and alleys were adopted, the streets varying from 19 to 25 ft. above lake level, with the grades of the building lots still higher, so that contrary to the general conception the new town is well above the lake. The adoption of these uniform grades necessitated several million cubic yards of sand to be moved to reduce the sand dunes and to fill the hollows and the waterways of the small sluggish creeks which traversed the site. As little of the sand had to be moved any distance, the grading has all been done with dump cars and horses, and with clam-shell buckets handled by traveling stiff-leg derricks with long booms.

The streets of the city are laid out on the gridiron system. A principal business street, 100 ft. wide, called Broadway, extends due south from a bridge which forms the entrance to the steel works through the center of the first subdivision of lots that has been made; a second business street, 80 ft. wide, called Fifth Ave., intersects this 100-ft. street at right angles near the middle of the subdivision. The lots on both these streets are 25 ft. wide and all face at the rear on an alley, 30 ft. wide. As all other streets in the subdivision are reserved for residences, the business houses will be concentrated on these two streets, the intersection of which is being made the commercial center of the city by the erection of large permanent business buildings, frame buildings being prohibited on these two streets. The residence streets are all uniformly 60 ft. wide, with alleys 20 ft. wide between each two streets. The blocks in the residence districts are 270x450 ft. and 270x630



Map Showing Location of Gary.

ft. in plan, making the depth of the lots 125 ft., when the 20-ft. alleys are considered, the width of the lots being 25 or 30 ft. Space has been reserved in these districts for two recreation parks, one on each side of Broadway, the two being separated about ¼ mile. One of these parks covers an area of four city blocks, and the other an area of two blocks.

Unlike many other similar communities which have been started in the vicinity of large industries in this country, the greater part of the lots along the two business streets in Gary were offered for sale with quite strict requirements, which are calculated to prevent any land-jobbing schemes and to produce a desirable business district, free from the objections so common to such districts in factory towns. The corporation reserved the balance of the lots on these streets, however, including a number of the more desirable business sites, and is erecting on them modern, substantial brick and stone buildings for banks, hotels, a theater, and so forth. The residence districts, on the other hand, being entirely reserved for homes for the employees of the steel corporation, will be free from business concerns of every kind. The houses, which are being erected by the corporation for its employees vary in cost from $2,000 to $15,000 each, and will be sold to the employees at cost. About 500 such houses are now under construction, one company having contracts for over $5,000,000 worth of these dwellings. A noticeable feature of these houses is that over fifty different designs were employed, but as no two houses in the same locality have the same treatment, the architecture of all is apparently different. The lots on the residence streets are wide enough and the houses are far enough back from the sidewalk line to present the appearance of a first-class suburban town. Cheaper homes and large boarding houses for the day laborers are also being erected in one section of the city, but the restrictions governing the erection and maintenance of these structures are such as to bring them far above the average.

Street Pavements.—The two principal business streets, Broadway and Fifth Ave., are paved with concrete; the remainder of the streets of the present subdivision are being paved with macadam. The concrete pavement on Broadway is 66 ft. wide between curbs and is flanked on each side by a concrete sidewalk, 17 ft, in width, which extends to the building line. The pavement is omitted for a width of 20 ft. along the longitudinal center line of the street to provide for the track structure of a double-track street railway which is to be built the length of the street. A concrete curb, 6 in. wide at the top, 12 in. wide at the base and 18 in. high, is placed along each side of this space for the car tracks, the front face of these curbs being vertical so the track structure will be entirely independent of the pavement. Fifth Ave. is being paved with concrete to a width of 46 ft. between curbs.

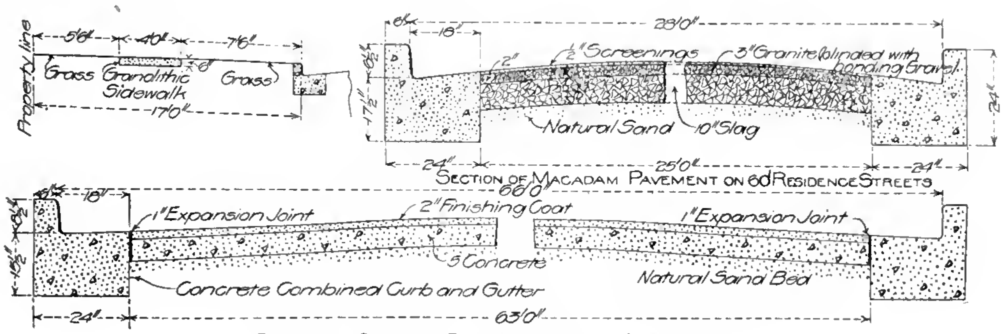
The concrete pavement which is being laid on these two business streets of the city has a total thickness of 7 in., made up of a 5-in. base course of 1:2:4 concrete covered with a finishing coat of about 5:7 mortar. The base consists of 1 part Universal Portland cement, 2 parts coarse sand and 4 parts crushed limestone ranging in size from ½-in. to 1-in. pieces. The finishing coat consists of 5 parts Universal Portland cement to 7 parts red granite screenings. The surface of this finishing coat is marked into 4½x9-in. blocks by grooves, ½ in. wide and ½ in. deep, this marking extending transversely across the pavement. Joints, 1 in. wide, which extend entirely through the pavement are placed across the street, 75 ft. apart, to allow for expansion and contraction, these joints being filled with asphalt mastic.

A combined concrete curb and gutter is placed along each side of the pavement, a 1-in. joint being left between the edge of the pavement and the curb and gutter. A true joint is placed in the curb every 6 ft. and a joint extends through both curb and gutter every 24 ft. Where the sidewalks extend out to the curb a 1-in. joint is made between them and the curb. The curbs are formed into steps at the street intersections, and at the corners special joints are provided in the curbs to prevent the latter being displaced or cracked. The street grades are arranged to carry the drainage to the center of the blocks, thus avoiding a high step at the street crossings.

The natural bed of sand on which the pavements are laid is merely leveled to conform to the grade of the pavement and the base course of concrete is laid directly on this natural sand bed. The concrete in most of the pavement that has been laid was mixed by hand, but a concrete mixer is used for the work that is now in progress. The finishing coat is laid immediately following the placing of the base course, in order to insure a bond between the two. The marking of the finishing coat is done before the latter has taken an initial set. This marking is done by men working on a traveling bridge which spans the pavement and runs on wheels on the gutters. Four men have marked as high as 6,000 sq. ft. in a day when working from this trestle.

In all, nearly three miles of the concrete pavements are being laid. The pavement on a portion of Broadway over 3,000 ft. long was laid last season; Fifth Ave. is now being paved for a length of nearly 1½ miles. The paving is being done by the Rudolph S. Blome Co., of Chicago, and is very similar to a large amount of such work which has been done by this company. Descriptions of some of these concrete pavements in Chicago built in this manner were printed in The Engineering Record for June 9, 1906.

The 60-ft. residence streets of the city are being paved with macadam to a width of 28 ft. between curbs, thus leaving a space, 17 ft. wide, between the curb and the lot line. This space is divided into a 7.5-ft. parking next to the curb, then a 4-ft. granolithic sidewalk, with a 5.5-ft. grass plot between the latter and the lot line.



SECTION OF MACADAM PAVEMENT ON 60' RESIDENCE STREETS

SECTION OF CONCRETE PAVEMENT ON 100 FT. BUSINESS STREETS

Sections of Street Pavements in Gary.

The macadam pavement is laid on a layer of slag which is 6 in. thick at the curbs and 10 in. thick at the center of the pavement. This slag is laid directly on the natural sand, and over it is placed a layer of 1-in. crushed granite varying in thickness from 3 in. at the crown of the pavement to 2 in. at the gutter. The voids in this layer of granite are filled with cementing gravel, the whole layer being thoroughly rolled and sprinkled as it is laid. A finishing course of ½-in, red granite screenings is spread over the surface to fill the voids which may appear in the macadam with use. The granite was chosen for the macadam instead of limestone on account of the glare from the latter, although the granite is much more expensive in this section.

Water-Works.—The water supply for the city is to be derived from Lake Michigan through an intake crib submerged in 40 ft. of water at a point 1½ miles from the present shore line. This intake is 12 miles southeast from the mouth of the Calumet River at South Chicago, which is the nearest considerable source of pollution. The water will be conveyed from the intake crib to a pumping station in the city through a 6-ft. tunnel 3 miles long. This tunnel will be driven 95 ft. below the level of the lake, in the hard clay which underlies the latter and the site of the city at that depth. Three shafts will penetrate to the tunnel, one connecting it with the intake crib; one on the shore of the lake, in which gates will be set to control the supply; and one at the pumping station, 1½ miles inland. The capacity of this tunnel is about 80,000,000 gal., and as the municipal water works are entirely distinct from the water-supply system of the steel plant, it will provide an ample supply for a population of over 300,000.

The two land shafts for the tunnel have to be driven through 50 ft. of fine sand and 40 ft. of clay. One of these shafts has already been sunk by the contractor for the construction of the tunnel, the Great Lakes Dredge & Dock Co., of Chicago, and work will be started at once on the tunnel bore.

The water-works pumping station will be placed at one corner of the larger city park. It will be constructed of heavy masonry according to a design that will render it an ornament to the park. The water will be drawn from the intake tunnel by large centrifugal pumps which will lift it to a water tower, 125 ft. high. This tower will be built of steel and masonry, conforming in architectural design with the surroundings. The pumps will be driven by electric motors supplied by a large electrical generating station in the steel mills, the original source of power being gas engines operating on waste gases from the blast furnaces. The combined capacity of the pumps will be about 20,000,000 gals., the plant being so arranged that under ordinary conditions water will be furnished at a pressure of 50 lb. per square inch, while in case of fire the pressure can be increased to 100 lb. per square inch.

Well-Point Pumping Outfit in a Sewer Trench.

The distribution system of mains is of seamless wrought-iron pipe, with unions forming the joints. The distribution system for the present subdivision is now completed and is arranged to supply every lot in this area. The gridiron system of mains was adopted, the different districts being cross-connected by large feeder lines, controlled by valves, which are so arranged that a broken pipe may be isolated quickly without interfering with the general distribution. The mains have an aggregate length of 22 miles, varying in size from the minimum of 6 in. for residence sections, to 30-in. for the main feeder lines. In order to avoid the necessity for tearing up the streets to make repairs or connections, the distribution mains are all placed in the alleys. The fire hydrants are, on the other hand, all located just inside the curb line of the streets, each city block being provided with four hydrants, one at the middle of each of its four sides. These hydrants are connected to the distribution mains in the alleys by pipes extending through the lots, so the pavement does not have to be crossed to reach them.

The whole water-works system has been designed so provision may easily be made for a supply for a considerable addition to the population and to the size of the city. The capacity of the pumping station may be increased readily and large feeder pipes radiate from the station to the borders of the present subdivision, in order that water may be furnished to additional subdivisions from this station.

The distribution mains were all laid to a depth of 5 ft. below the established grades. The irregular character of the site required a large amount of grading to be done in the alleys before the pipes could be laid. Grading and pipe laying were started in October last, and were carried on simultaneously during the winter, the work being now practically completed. As the grading was all in the fine sand, the pipe laying could follow it quite closely where necessary. Where the pipes were laid across low places in which the grade was to be raised they were placed on small wooden bents pending the filling of the low areas with sand.

The intake tunnel will require some time to complete, so a temporary water supply is obtained from six 6-in. wells driven in the sand at the northwest corner of the present subdivision, in a locality isolated from swamps and all sources of pollution. These wells are all connected to one suction main which is extended into a temporary pumping station. This station contains a belt-driven centrifugal pump which will supply the distribution mains until the intake tunnel and the permanent pumping station have been completed; additional pumps will be installed in this temporary station, if required.

Sewerage System.—The ridges and hollows which make up the site of the city were so formed that the natural drainage was poor, the greater part of the rainfall being obliged to escape by percolation through the underlying 40 to 50 ft. of sand over the hard clay. The direction of ground water flow is toward the Grand Calumet River, which flows westward along the northern boundary of the town site, parallel with and about 1 mile from the shore of Lake Michigan, the river

emptying into the lake at a point some 12 miles to the northwest at South Chicago. The flow in this river is very sluggish, its water level varying only slightly from the level of Lake Michigan. The reduction of the sand dunes to the uniform grades of the streets and alleys and the construction of an adequate sewerage system has entirely changed the natural surface conditions, and to a very considerable extent the ground-water level as well.

The sewerage system is designed according to the combined plan. Provision has been made for substantial growth in the areas on three sides of the present subdivision of two square miles, the steel plant being on the third side. The drainage of the present subdivision is carried to the Grand Calumet River by a 96-in. reinforced concrete sewer, which is sufficiently large to provide an outlet for a system for at least twice the area at present improved. An outline plan has also been made for draining 5 additional square miles through separate outlets. Several small sloughs in the hollows, which formerly carried considerable water at certain seasons, extended from the east to the west through the area that is being sewered and discharged into a small creek, called Gibson's Run, which emptied into the river at a point nearly a mile downstream from the outlet of the 96-in. outfall sewer. These sloughs are all being filled, and the water from them will be taken directly to the 96-in. outfall by a 72-in. sewer instead of passing through the improved area to reach the river through the small creek.

From the junction of the 96-in. and 72-in. sewers a main sewer extends to the east and one to the west, these main sewers reducing from 5 ft. to 24 in. in diameter. The lateral sewers vary from a minimum of 10 in .to 30 in. in diameter. All sewers 24 in. or more in diameter are built of brick, except the main outfall. The smaller sewers are vitrified tile with cement mortar joints. The depth of the sewers ranges from 9 to 23 ft., the deepest sewer being placed in the business districts, or in localities which are likely to become business districts in the future. The lateral sewers are all placed at right angles to these mains, all the main and lateral sewers being placed in the alleys for the same reason the water pipes were so located. The gas pipes are also placed in the alleys, the sewers being at the middle of the alley with the water pipes 5 ft. from one lot line and the gas pipes, 5 ft. from the other. All house connections are made through the rear of the lots. Where catch basins in the street come at the middle of the side of a block parallel with laterals they are connected through the lots to the lateral sewer in the alley, one connection serving two basins. The only sewer connection under the street pavement is thus the single pipes from the catch basins on the far side of the street.

Until the town attains considerable size it is quite possible that the flow in the river, augmented by the large volume of pure water which will be discharged from the steel plant will give sufficient dilution to render inoffensive the discharge of raw sewage into the river. The entire sewerage system has been designed, however, with a view to the purification of the sewage as soon as conditions warrant it. The location of the purification works has not been determined beyond certain limits. At the same time these limits are such that the invert of the main outlet sewer can be constructed on a slight down grade away from the river so the dry weather flow will not reach the river, but will be pumped to the purification works from a sump some distance back from the outlet. During flood flows, though, this arrangement will not interfere with a free discharge into the river. The purification works will consist of septic tanks, followed by percolating filters.

Construction of the Sewerage System.—The natural conditions existing in the area to be drained have occasioned no small amount of difficulty in the construction of the sewers. The ground-water level was originally very nearly the same as that of a large portion of the surface of the land, although the sand dunes rose 15 to 20 ft. above it. Part of the first work done last season after the completion of main outfall sewer was to excavate a trench along the site of one of the main sewers, in order to drain the water from the hollows in the central part of the city and to lower the ground-water level. This trench was dug with a clam-shell bucket handled by a traveling stiff-leg derrick. It was carried to a depth of 15 to 28 ft. below the surface, the botom 4 to 5 ft. being finished by hand and very closely and heavily sheeted to hold back the fine sand through which the excavation was made; the top of the trench was also made as much as 50 ft. wide through the highest sand dunes. This trench had much to do with lowering the ground-water level, and with draining the central part of the town site, but the fine, loose sand on the surface of the ground drifted into the sheeted portion of it to such an extent that the lower part of it had to be partially excavated again before the sewer could be built.

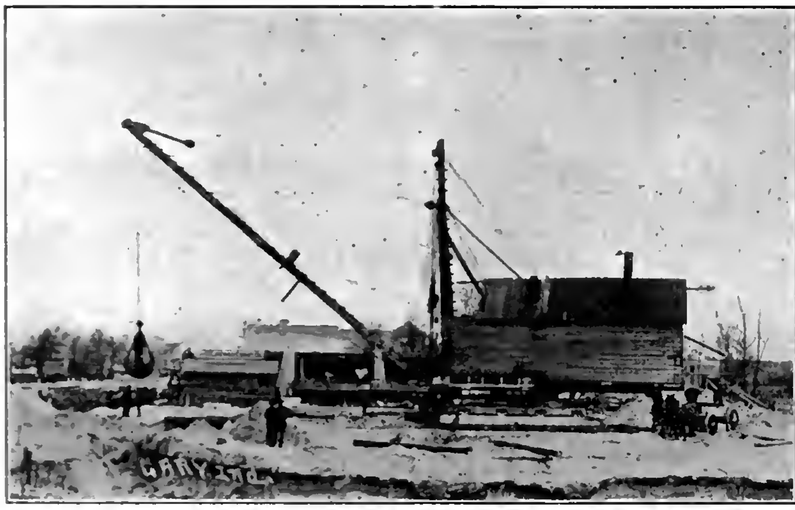
All of the sewer trenches have to be very closely sheeted, and pumping has to be carried on continuously in the vicinity of the pipe laying. Messrs. Green & Sons, of Appleton, Wis., the contractors for laying the water pipe and the lateral sewers, have used a system of well-point strainers in connection with portable pumping outfits, which have proved especially valuable in keeping the trenches entirely free from water even where the ground-water level is practically at the surface of the fine sand. The trenches in which these outfits have been used vary from 2 to 4 ft. in width, and hav depths of 9 to 15 ft. They are in all cases closely sheeted, the sheeting generally being driven after the excavation has been opened to a depth of 2 ft. or more, unless the trench is at a point where the ground-water level is too near the surface.

The portable pumping outfits each consist of a triplex pump, belt-driven by a gasoline engine, the pump and its engine being mounted on a platform carried by the running gear of an ordinary wagon. One of these outfits is placed at the side of the trench where pipe laying is in progress. The pump has a twin 6-in. suction, each branch of which is attached to one of two 6-iin. pipes placed horizontally in the trench, one along each side. These pipes are in 20-ft. lengths, which are connected together by flanged joints. Every 2.5 or 3 ft. a 2-in. connection is made to these 6-in. pipes, each of these connections having two short flexible pieces of 1½-in. hose attached to them. A 1½-in. pipe carrying at its lower end a 1½-in. well-point strainer is attached to each of the hose couplings, the strainer being driven into the sand until it is below the grade of the sewer. The trench is generally opened in sections 60 to 100 ft. long, that is from the point where the excavation is just starting to the place where back filling can be done. In this way it has been found that the pump can remove the water so effectually through the strainers that the work is carried on entirely free from water in the trench, although much trouble is occasioned from water when the latter is drawn from the surface only.

The pumping outfit can be left at one place until 100 ft. of trench has been completed, as the 20-ft. lengths of 6-in. pipe are each fitted with a valve so those at the end where back-filling is being done can be cut off and carried forward to the point where the excavation is just starting. The siamese connections on these pipes are also each provided with a valve so any two strainers may be cut out of service. The well points are jetted down into the sand without any difficulty, and have been used repeatedly with scarcely no damage to them.

The water-works and sewerage systems were designed and are being constructed under the supervision of Messrs. John W. Alvord and Charles E. Burdick, sanitary and hydraulic engineers of Chicago. The main sewer, including about 3 miles of the deepest and most difficult work, is being constructed by the Nash, Dowdle Co., of Chicago.

Gas Plant.—A water-gas plant, with ample capacity to meet the demands to be expected from a city of 75,000, is being built. This plant and the system of distribution mains connected with



Traveling Excavator for Grading.

Type of Business Building.

it are modern in every particular. The main building of the plant, now practically completed, is at the north side of the city on the bank of the Calumet River. It is 63x141 ft. in plan and is built of red pressed brick, with sawed Bedford sandstone trimmings and a book tile roof, the latter being carried by structural-steel trusses.

Two gas-generating plants, each with a capacity of 300,000 cu. ft. daily, are being installed in the building by the Western Gas Construction Co., of Fort Wayne, Ind. In these generators live steam is passed through a bed of incandescent coke in which it is decomposed; oil is then admitted through a carburetor, the mixture passing to a superheater, where it is fixed in permanent form. The gas passes from the superheater through a scrubber, where the tar, ammonia and other impurities are removed, thence to a condenser to reduce the temperature, and finally through four 12x16x5-ft. Lloyd purifiers containing oxide of iron to absorb the sulphur impurities. The finished gas flows through an 84-in. American meter into a 250,000 cu. ft. double-lift steel gas holder in an above ground steel tank, a 10,000 cu. ft. relief holder also being provided.


Water Mains before Grading.


View in Residence Section.

The coke is dumped from the cars in which it is deliverd into a hopper under a track along one side of the building. The coke feeds by gravity from this hopper into a crusher which delivers to a bucket conveyor that elevates the crushed coke to a steel bunker over the generators, the latter being fed by gravity. The ashes from the generators are also removed by this conveyor. Two 75-h.-p. O'Brien boilers supply steam for use in the generators, for the mechanical equipment of the plant and for heating the building.

The distribution system of mains consists appromixately of 17 miles of steel pipe ranging in size from 4 in. to 12 in. The same difficulties encountered in laying the water-works mains had to be overcome in the construction of the gas distribution system. The freedom from danger of settlement in the sand in which the pipe is laid permit very accurate grades to be maintained, thus securing effective drainage for the system with a small number of drainage outlets. The pipes are all coated with asphaltum before being laid. As each section of the system is completed and before the pipe is covered it is tested at a pressure of 40 lb. per square inch, all leaks being carefully caulked. House connections are made to the lateral pipes in the alleys, with heavy saddles clamped to the street mains, thus obviating the necessity for cutting the pipe and inserting the usual tees.

The gas plant was designed by H. M. Byllesby & Co., of Chicago, and is being built under the supervision of that company, which will also direct the operation of the plant after it has been placed in service.

Electric Lighting System.—The present intention is to secure power for electric lighting from a large generating station in the steel plant. A distributing system of wires extending to all parts of the town will be provided, however, and current for power as well as for lighting will be available.

Miscellaneous.—The town site being entirely sand which contains no soil, except in a few places, it will be necessary to provide soil before grass or trees of any size can be grown. The valley of the Grand Calumet River in the vicinity contains a large amount of vegetable loam and black soil which can be brought to the land and distributed at a low cost. When the other improvements have been more nearly completed this work will be undertaken and a general endeavor will be made to cover the whole site with sufficient soil to produce good grass and trees.

The time consumed in building these comprehensive municipal improvements and public service systems, and in fact, the city itself has been remarkably short. Ground was broken for the first time in August of last year, when the paving work and grading was commenced. The construction of the water works distribution system, the gas plant, and many of the dwellings was started about the first of last November, but work on the sewerage system was not well under way until January of this year. The immense amount of grading required, involving several million cubic yards of sand to be moved, has been largely completed; the paving that has been undertaken will be finished soon; over 17 miles of the water distribution mains are laid and are being supplied with water from the temporary pumping station, pending the completion of the intake tunnel and permanent station; the gas plant and distribution mains will be ready for service before the end of the summer; the most difficult portions of the sewerage system are finished and work is progressing rapidly on the lateral sewers, and a large majority of the dwellings are nearly ready for occupancy, while a number of permanent business buildings are completed and occupied.

All of the municipal improvements that are being made at Gary will be paid for at the start by the steel corporation and are charged pro rata to the land, the charge being paid by the purchaser when the land is bought. When the improvements are all completed the steel corporation will relinquish all control of the property that has been sold, the restrictions in the deeds covering the sale of property, the unusually complete public service systems that are provided and other municipal improvements that have been made, being expected to preserve the character of the city well above that of the average mill town.

The population that may be expected in Gary in the near future has been variously estimated. Conservatively, it may be taken to reach 75,000 to 90,000 in five years. The new steel plant will employ 12,000 to 15,000 men, and the new plant of the American Car & Foundry Co., 3,000 more. The population of industrial towns in this country averages about five persons to each mill worker; based on this average, a population of 75,000 is evidently certain. The location of allied industries in this vicinity within comparatively short periods, and the expressed intention of the United States Steel Corporation to make its plant at Gary the one in which the expansion for western business, at least will be handled, give good ground to believe that the permanent and extensive improvements which have been undertaken to found a city of the better class under such adverse conditions are justified.

The construction of the new steel plant is being directed by Mr. G. G. Thorp, vice-president of the Indiana Steel Co. Mr. A. B. Neumann is chief engineer and Mr. W. P. Gleason, general superintendent, of that company. The town of Gary is being developed by an independent company under the general supervision of Mr. Thorp.

A Sand Roadbed has recently been constructed by the Atlantic City & Ocean City R. R. to carry its electric line over a long stretch of salt marsh. A number of highways have been built in this neighborhood by confining a sand fill between lines of plank attached to posts, and this roadbed follows the same general plan. Two rows of posts are driven, one on each side of the 48-ft. roadbed, with their tops level with the surface. The inner face of each row carries planking for a depth of 5 ft. below the tops of the posts, leaving an open space of variable depth between the bottom course of plank and the top of the meadow. Sand is filled into the space between the rows of posts up to their top, as before stated, some of it running out at the bottom below the planking. Outside the row of posts on each side of roadbed, sand is filled in at its natural slope until it is within 2 ft. of the top of the posts; this fill acts to prevent the confined sand from slipping sidewise under the planking and allowing the track to settle.

Standard Sand for Cement Work.

An investigation of sands for cement work has been made at the Iowa State College, Ames, Iowa, by Mr. M. J. Reinhart, to ascertain what the best sand should be like and how ordinary sands can be improved by screening or by adding the proper material to give the resulting mixture the least percentage of voids. From the account of the investigations presented by Mr. Reinhart before the convention of the Iowa Cement Users' Association these notes have been taken.

The sand used in the experiments was bank sand of exceptionally good quality, comparatively coarse and largely free from earthy materials and having about 30 per cent. of voids. All that failed to pass a No. 2 sieve was rejected. This was about 3 per cent. of the original sand and it was the grades from this size down that were used in making the mixtures.

The screens used in separating the sand into the various sizes were as follows. The No. 2, or two meshes per lineal inch, the No. 4, or four meshes per lineal inch, the No. 8, No. 16, No. 30 and the No. 50 screens. With the above screens a given amount of material was divided into the six graded sizes as follows: That which passed the No. 2 and was retained on the No. 4: passed the No. 4 and was retained on the No. 8; passed No. 8 and was retained on the No. 16; passed No. 16 and was retained on No. 30; passed No. 30 and was retained on No. 50; and finally that which passed the No. 50 sieve. In each case the per cent. of the whole was determined by weight and the voids in each separate part determined.

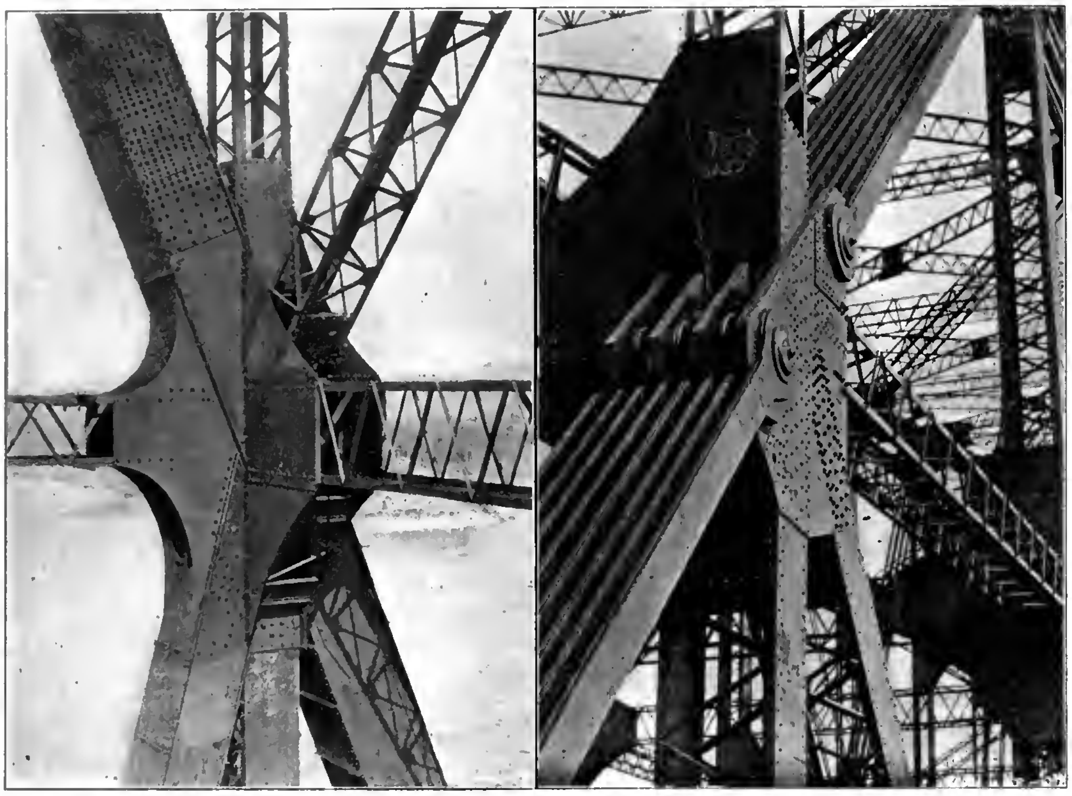
In determining the voids the following method was used: A cylindrical vessel holding about a pint was carefully filled with sand up to a horizontal line around the jar, and settled somewhat by shaking and tapping the sides of the vessel, but not tamped, and then weighed. The vessel was then emptied and a certain amount of water poured in, approximately equal in volume to the voids ÷ total weight of water × 100 per cent. carefully put back into the jar and water enough removed or added to cause it to stand just to the level of the line around the glass. The difference in weight between the vessel filled with sand and water, and the weight of the vessel and sand alone is the weight of the water required to fill the voids of the sand. Next the weight of the water required to fill the vessel up to the horizontal line was determined and by the following expression the percentage of voids was calculated: (Weight of water required to fill the voids ÷ Total weight of water) × 100 per cent. = percentage or voids. In all cases two determinations were made and the average taken.

Next, a properly graded sand was attempted, by putting the right amount of each grade of sand into the mixture. The weight of a certain amount of the coarsest material was found, and to it was added just enough of the next size to fill the voids. This gave a material made up of particles or pebbles which passed the ½-in. mesh screen and were retained on the ⅛-in. sieve. The voids of the large size was 44.2 per cent. of the small size 42.4 per cent., and of the mixture 38.0 per cent. To the mixture was then added enough of the third size to fill the voids, and so on down to the finest material, which passed the No. 50 sieve. The table shows the weight and voids of each material and mixture. The final mixture contained 24.4 per cent. of voids, a reduction in voids of nearly 19 per cent. as compared with the 30 per cent. of voids in the natural sand. This was the second mixture tried, the other by adding an excess of fine material each time gave a slightly larger per cent. of voids.

Next a mixture that would be practicable for improving sand was tried, on which by one screening of the sand the voids could be materially reduced. It is a generally known fact that if to ordinary sand fine pebbles as an aggregate be added a stronger mortar can be made from the sand, if mixed in a given proportion. So it was decided to add to the ordinary sand a certain amount of aggregate which passed a No. 2 sieve and was retained on a No. 16 sieve. To determine the correct proportion to add, a

PROPERLY GRADED SAND.

Kind		Percentage	Quantity in Mixture				
			Separate		Combined		P.C. of
Passed.	Retained on.	Voids.	lb.	oz.	lb.	oz.	Total.
No. 2	No. 4	44.2	3	2.	..	..	22.9
No. 4	No. 8	42.4	1	6.1	..	..	10.2
No. 2	No. 8	38.0	..	..	4	8.1	..
No. 8	No. 16	43.4	1	11.4	..	..	12.6
No. 2	No. 16	33.5	..	..	6	3.5	..
No. 16	No. 30	38.7	2	1.4	..	..	15.5
No. 2	No. 30	28.9	..	..	8	5	..
No. 30	No. 50	38.1	2	6.4	..	..	17.6
No. 2	No. 50	26.9	..	..	10	11.4	..
No. 50	......	35.5	2	14.1	..	..	21.2
No. 2	......	24.4	..	..	13	9.5	..



Main Diagonal Intersections, Quebec Bridge.

determination was made to find the per cent. of aggregate larger than that which passed a No. 16 sieve as well as the voids of the aggregate.

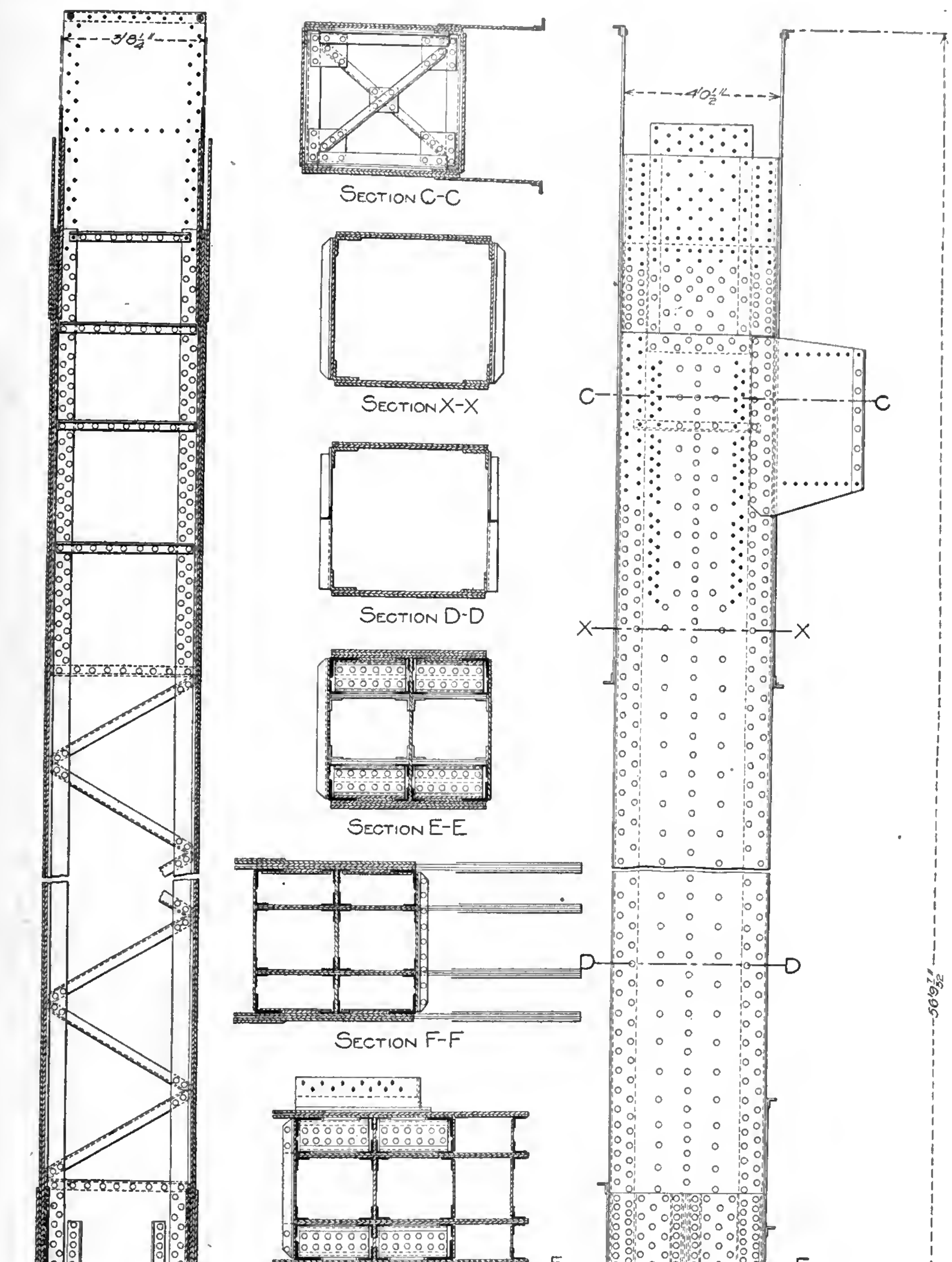
It was found that 34 per cent. stopped on the No. 16 screen and that this material had 34.2 per cent. voids. Starting thus with a given amount of this coarse material (16 lbs.), the proper amount of natural sand to add in order to just fill the voids was calculated thus: Let $x =$ the amount of coarse material or aggregate in the sand. Let $y =$ the total weight of sand. Then $(16-x) \times 0.34 = y-x$, and $x = 0.342\ y$. Solving, $y = 10$ lb. In other words, to 10 lb. of sand was added 16 lb. of the coarser material, and this mixture contained 25 per cent. of voids, a reduction in voids of nearly 17 per cent. By the same method of determination the proper amount of aggregate to add to any sand or gravel might be determined.

In order to show the comparative strengths of mortars made from the three sands, the natural, the properly graded mixture, and the mixture improved by one screening only, tests were made, both for tension and compression. The specimens tested were ordinary briquettes for tensile strength and 6-in. cubes for compressive strength.

The mortars used in the tension briquettes were all 1:3 mixtures and the compression blocks were all made of 1:4 mortars. Three briquettes of each class were tested after seven days and six others were reserved, three to be tested at three months and three at one year. One compression block of each mixture was broken when seven days old and two others made at the same time and from the same mortars will be crushed when three months and one year old, respectively The mortar in which natural sand was used showed an average tensile strength of 367 lb. per square inch and a compressive strength of 1,889 lb. The mortar made with sand improved by one screening developed a strength per square inch in tension of 397 lb. (average) and in compression crushed under 2,611 lb. per square inch. The specimens made with properly proportioned sand showed an average tensile strength of 403 lb. and a compressive strength of 2,139 lb. The values developed in tension were quite consistent.

The results show the value of having the graded materials in a mixture of sand, and the fine material in the proper proportion to fill the voids in the larger aggregate. This was not a concrete but a mortar of about the consistency for cement blocks, tile, posts, etc. In the natural sand there was a deficiency of both the coarse and fine material, while in the other mechanical mixtures this fault had been largely overcome. In the former, mixed in a proportion of 1 to 4 the cement was insufficient to fill the voids, while in the latter case it was just sufficient, and hence the results.

EROSION OF STEAM FITTINGS by water in the steam was recently demonstrated by a test made by Mr. James F. Hobart. Two ¾-in. pipes were used, one known to carry water with the steam and the other dry steam. A flange union was put in each line and between each pair of flanges a diaphragm of thin sheet iron was inserted, pierced by a ⅛-in. hole in the center. Steam was then allowed to pass through both pipes for 6 hr. a day for 6 weeks. At the end of the time the unions were taken apart and the diaphragms removed. The hole in the disk exposed to dry steam was unaltered but that in the disk exposed to wet steam had been worn away so much that it resembled a key-hole.



Lower Part of Intermediate Post 4.

The Quebec Bridge Superstructure Details; Part IV.

Upper Part of Vertical Post 4.—Intermediate vertical post 4, adjacent to the main post, is the largest of the vertical posts in the anchor arm truss and was shipped in two separate sections successively erected and connected by a field riveted splice 2 ft. above the center point of the completed member. The dead load stresses are uniform throughout the member, but the wind load stresses vary in the upper and lower parts, being somewhat greater in the former where the total maximum stress is 3,620,000 and is provided for with a gross sectional area of 174.3 sq. in. The total length of the post is 224 ft. from center to center of chords and the normal section is a 3-ft. 8-in. x 4-ft. rectangle.

The upper section of the post has a total length of 94 ft. over all and weighs about 92,000 lb. It is made of two built channels 4 ft. deep with their flanges turned in and latticed with angle bars in the spaces not covered by continuous flange plates. The channels are made with double 48x11/16-in. web plates 79 ft. 7 in. long riveted together and with pairs of 8x6x13/16-in. flange angles about 89½ ft. long, with double rows of rivets at about 6-in. pitch in each flange. Additional section is secured by a full-length 7x¾-in. flat riveted between the web plate and each flange angle. The joint between the upper and lower portions of this member is made with four flange and web cover plates, having in each end about two hundred ⅞-in. field-driven rivets.

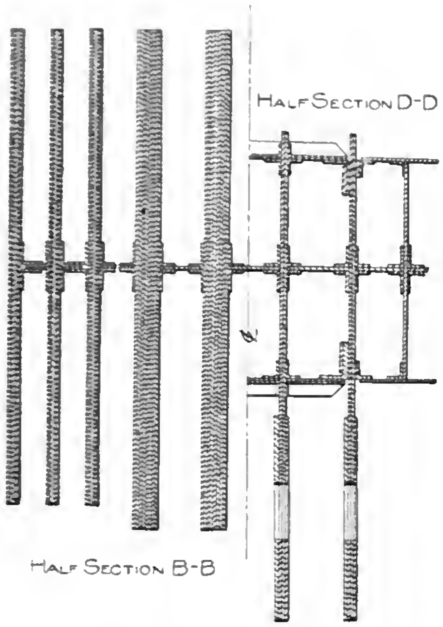
Just above the splice the sides of the posts are stiffened and the rectangular cross-section is maintained by an interior transverse horizontal diaphragm made with a rectangular angle iron frame-work having intersecting diagonals shop riveted to the web plates and flange angles. About 33 ft. above the splice both flanges of the post are covered with a 50x½-in. plate 20 ft. long with one edge projecting beyond the flange angle to provide for the field riveted connection to the transverse bracing. The flange plates are stiffened with exterior 3x3-in. horizontal angles 3½ ft. apart and, completing the closed cross-section at this point, serve to distribute the transverse stresses uniformly between both main webs of the post.

The upper end of the post is connected on one side to 28-in. and on the other side to 30-in. top chord eye-bars, which, as already explained, in order to reduce the size of the pin and promote ease of fabrication and erection are connected to it with separate pins 14 in. in diameter, while a third pin 12 in. in diameter is provided for the connection of the diagonal member. For the proper packing of the chord pins each of them requires ten different bearings in separate longitudinal webs, the four center ones also providing bearing for the pin of the diagonal member.

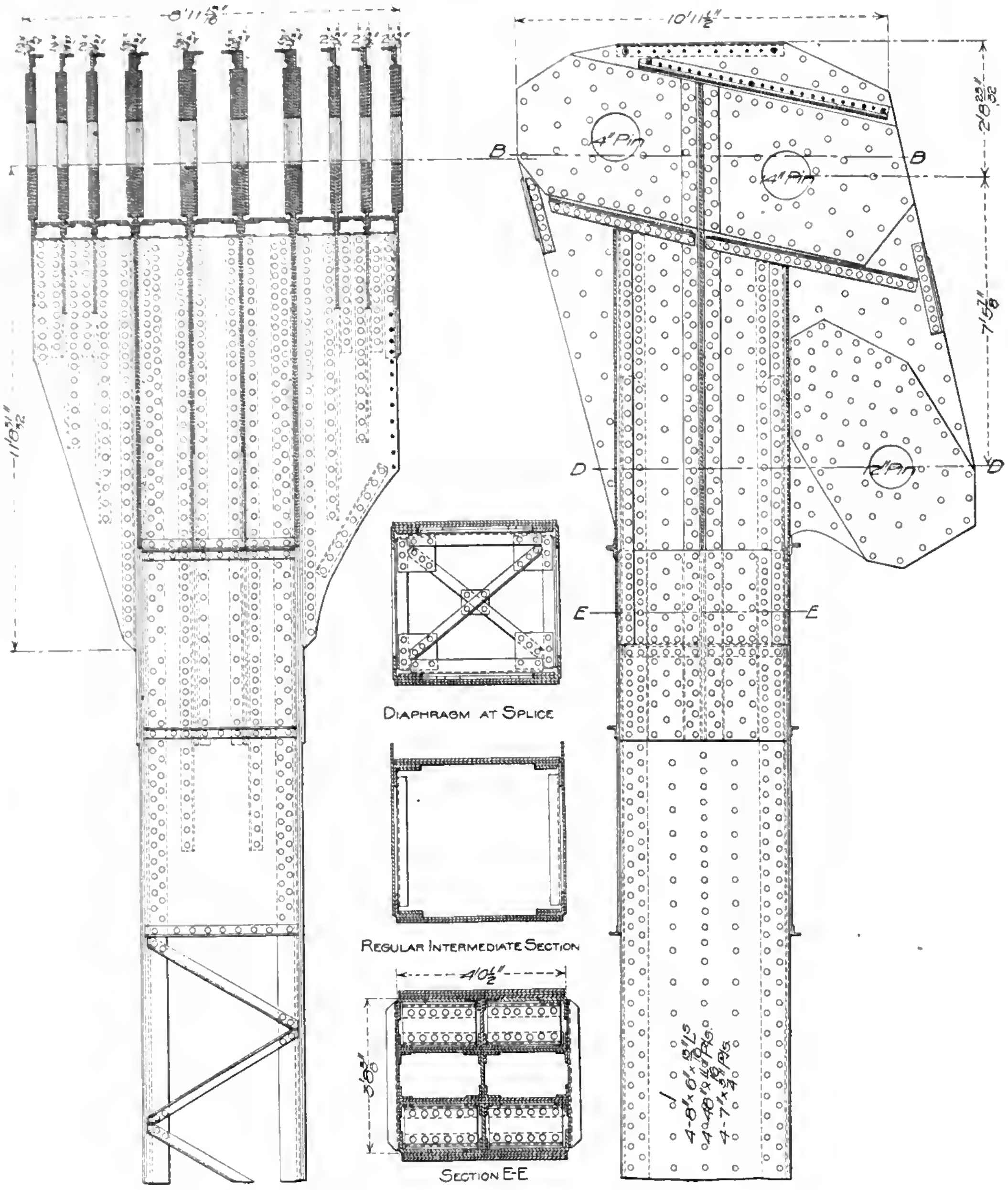
To give clearance for the large eye-bar heads and other members converging at this point and to provide for a sufficient length of pin it was necessary to materially increase the dimensions of the post in both horizontal directions. This was accomplished by building up a series of longitudinal plates parallel to the web plates of the built channels and projecting beyond them on both sides. The upper end of the post web was connected by a single center transverse diaphragm projecting beyond their extremities to the end of the post and connecting them with the auxiliary web. Its construction virtually makes a 9 x 9-ft. cap about 17 ft. long, shop riveted to the main body of the post and integral with it. The longitudinal webs are reinforced to a maximum thickness of 5¾ in. by full-length side pieces riveted to them and serving as ribs to connect the opposite panels of eye-bars. Four of these webs are continuous at the foot of the

cap and receive the pins through the upper ends are exterior to the regular cross section of the flange plates. The remaining six webs post and engage the top chord eye-bars only. Wherever possible, the different pieces are riveted together but in some cases the connections have so little clearance that they have to be made with turned bolts, which are inserted through hand holes provided for that purpose. The lower part of the post is 50 ft. 9 in. long over all and weighs 75,000 lb.

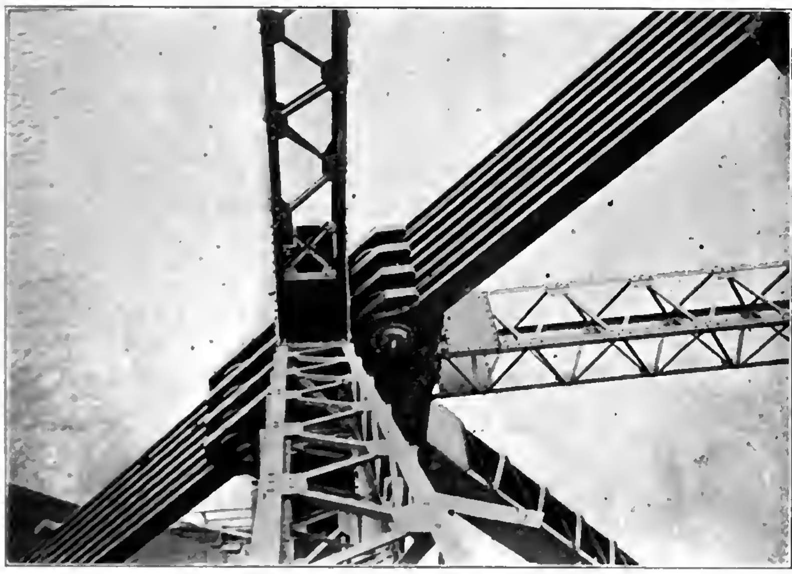
The stress in different parts of the post varies on account of the different increments from the transverse bracing. The total maximum static and wind load stresses are 3,208,000 lb. for which there is a cross-sectional area of about 163 sq. in., diminished slightly from that of the upper part of the post by the omission of the 7-in. reinforcement flats under the flange angles. At both ends the flanges are covered with wide



Sections, Upper Part of Post.



Upper Part of Intermediate Post 4.



Intersections of Main Diagonal and Sub-Vertical.

Intersection of Top Chord and Vertical Post.

plates completing the closed rectangular sections everywhere except for a distance of 22½ ft. in the middle of the post where the flanges are latticed by zig-zag 3 x 3-in. angles. The flange and web cover plates in the splice are shop riveted to this section of the post and project beyond it to form double jaws receiving the web and flange plates of the next upper section, through which they are connected with about 220 field rivets. The angles are continuous through the full length of the post, but the web plates are cut about 18 ft. short of the lower end, where they are replaced by much wider plates projecting beyond both flanges to provide for the field riveted connection to the diagonal strut and the pin connection to the main digonal. These plates are about 9 ft. wide and have on one side about 150 holes for ⅞-in. field rivets to the inclined members. On the opposite side two parallel plates are riveted in and connected to the outer plates with diaphragms stiffening them to distribute the stresses from four bearings for each 12-in. pin. The 12-in. lower chord pin also takes bearings in the four web plates which are connected below with diaphragms made by pairs of 8 x 8-in. angles with flanges engaged.

(To be Continued.)

Pumping Water by Producer Gas Plant at St. Stephen, N. B.

Abridgement of a paper presented at the convention of the American Water-Works Association by Mr. F. A. Barbour.

St. Stephen is on the St. Croix River, which at this point forms the boundary of New Brunswick and Maine. On the opposite side of the river is Calais and upstream a short distance, are Milltown, Me., and Milltown, N. B. For twenty years these communities have been supplied with water taken from the river by the Maine Water Co. Increasing pollution of the stream had given rise to dissatisfaction with the water and on the expiration of the twenty-year contract St. Stephen determined to establish municipal works. Many surface supplies were investigated but in all cases the water was found to be so impregnated with vegetable coloring matter as to be unfit for use. Attention was then turned to ground water supplies. The first wells yielded only a limited amount, but finally water was found in large quantities. A test of several weeks' duration in the driest period of a dry year developed a supply of more than 2,000,000 gal. per twenty-four hours from a test well 6x8 ft. in horizontal dimensions and 13 ft. deep. The normal ground water level at this point of supply is 150 ft. above the principal streets in the town, thus greatly reducing the necessary pump lift. The Canadian Pacific Ry. runs within a few hundred feet, permitting economical construction of side track. It was accordingly determined to construct an open well, 20 ft. deep and 30 ft. in diameter, and to erect a pumping station at this point, lifting the water into a concrete reservoir situated on a hill some 1,500 ft. to one side of the main pipe line to town.

Up to the time the work was ready for receiving tenders the water company looked upon the municipal investigation as merely a piece of strategy to obtain better rates in a further contract but when fully convinced that an economical supply had been found and realizing that their present source must be abandoned, negotiations were begun by the company to obtain from St. Stephen the water required to supply the adjoining towns on the river. Since such an arrangement greatly reduced the cost of water per gallon this proposition was accepted by the authorities of St. Stephen, and it was finally agreed to furnish water at $24 per million gallons by Venturi meter measurement. The total daily quantity thus made necessary will run from 1,200,000 to 1,600,000 gal. Incidentally, it may be stated that with an actual pump lift of 135 ft. into the reservoir a pressure of 80 lb. at the hydrants when drawing ten standard fire streams, will be maintained in the principal streets of the town.

Steam, gas producers and electric power merited consideration for pumping. Electricity to compete in the pumping of water, especially where the transmission line is relatively long and a relay engine of some type is necessary for emergency use, must be obtained at less than three-quarters of a cent per kilowatt-hour. This could not be done at St. Stephen and the choice, therefore, narrowed to steam and gas producer plants. In relative reliability Mr. Barbour believes there is very little difference between these types of plants; in point of attendance there would be but little difference in the ordinary water-works station. The actual labor in handling the fuel is much less in such plants and the attendant has more time for other work. While the operation of producer plants is simple, it is more difficult at the present time to obtain attendants who appreciate the requirements and are in sympathy with this type of apparatus than in the case of steam plants. An engineer who has long been running steam engines if put in charge of a producer plant is apt to be prejudiced.

Believing that the choice at St. Stephen rested on the relative economy in first cost and cost of fuel, bids were asked on both steam and gas plants—the propositions to be based on two complete units, each of 1,800,000 gal. capacity in 24 hours and the bidder to name a guaranteed duty.

In order that the bids might express the actual relative value to the town, as far as possible, it was required that the duty should be based on the total coal used in a three days' test, engines to run eight hours and fires to be banked sixteen hours—all coal used in banking and all standby losses to be charged against the plant. Such a test is absolutely necessary in producer work, as no reliable results can be obtained in short runs and in steam plants, where boilers are included, the average ten-hour test is often very misleading. In the latter case if the run is started and stopped without drawing the fires the difference in amount of combustible on grates at start and stop, as manipulated by a clever fireman, will frequently involve an error of from 5 to 6 per cent. in the duty obtained. In producer work it is much more difficult to estimate the relative amount of combustible in the producer at any one time, and the period of the test run must therefore be extended long enough to eliminate, so far as possible, the personal equation and reduce the percentage of error. In power plants of different types the relative fuel consumption during hours of banking is most important. In the average high duty steam pumping plant running 8 to 10 hours and banking the remainder of the day, as observed by the writer, the coal used in banking will run from 20 to 30 per cent. of the total coal used or from 0.4 to 0.6 lb. per nominal boiler horse-power of banking. Such plants in actual operation usually develop a duty in hours of running equal to from 80 to 90 per cent. of that developed in a 10 to 12-hour duty test and, including banking, usually develop a station duty from 60 to 70 per cent. of the test duty. The short run test does not always develop he relative commercial or station economy of steam installations and in a comparison of steam and producer plants the standby losses must be taken into consideration. It is claimed that gas generators can be banked with less than one-tenth pound of coal per horse-power hour of banking.

Proposals were received on two steam plants and three gas producer plants. The first costs of the steam plants varied from 60 to 80 per cent. of that of the gas plants, but the duties guaranteed were more than correspondingly reduced. On the basis of using pea anthracite in producer and Nova Scotia bituminous coal for steam work, both at $5.00 per ton, there was no doubt but that the producer plants were much the cheaper proposition.

Some of the gas propositions were based on the use of centrifugal pumps, connected to the engine by silent chains, but the reduced efficiency, as estimated by the bidder, more than made up for the less cost of this type as compared with triplex power pumps. Apparently an efficiency of 60 per cent. was estimated in the case of centrifugal pumps and 70 per cent. with triplex pumps.

The proposition accepted included two Pintsch suction gas producers with necessary accessories, two 4-cycle single cylinder engines, and two double acting, triplex power pumps, each of 1,250 gal. capacity per minute. The contractors guaranteed a duty of 115,000,000 ft.-lb. per 100 lb. of pea anthracite coal having a thermal value of 13,000 B.t.u.'s per pound, with not to exceed 10 per cent. ash nor 8 per cent. volatile matters nor 2 per cent. sulphur.

The generators, which have each a rated capacity of 125 h.-p., are constructed of boiler iron, 12 ft. 9 in. high and 4 ft. 3 in. outside diameter, lined with fire brick and the space between fire brick and shell filled with mineral wool. The fuel is fed through a double-closing shotpouch hopper. This hopper is mounted on a cast-iron plate which is pivoted on a vertical pin and can slide on another cast-iron plate which is bolted to the outer lid of the producer. The lower plate has an aperture which leads to a conical fuel magazine in the upper part of the generator. This sliding lid, with ground joint surfaces, serves to permit of charging the generator with fuel without allowing the escape of gas or inrush of air.

The grates are of the so-called shaking basket type, especially adapted for the pea anthracite coal which this producer is to use. Large cast-iron doors with ground joint surfaces are placed above and below the grate on the two opposite sides of the producer, rendering the fireplace and ash pit readily accessible. A cast-iron pipe extends vertically from the ash pit into a concrete sump in the floor below the generator, which is kept filled with water and thus provides a water seal. In this way the ashes can be discharged through the ash door or through the water seal.

The gas after leaving the generator passes through the vaporizer, which is a cast-iron shell containing a number of vertical tubes, the space around the tubes holding water and the gas passing through the tubes on their way to the scrubber. The steam formed in the vaporizer is led through piping provided with the necessary valves to a steam jet, where it is mixed with air and led under the grate through the water seal pipe. This latter arrangement insures the air being admitted at the centre of the grate, resulting in an even distribution through the overlying mass of fuel.

The steam jet works under a pressure of less than 1½ lb. per square inch and is designed to secure a constant and uniform mixture of air and steam in excess of the requirements under any varying load conditions, the excess steam being carried away through a galvanized iron pipe to the outside of the building.

The lower part of the vaporizer is formed by a casting having openings leading to the scrubber and one to the relief pipe, which serves as a chimney during the hours when the engines are not taking gas from the generator. A cast-iron wall divides this lower portion of the vaporizer along a vertical line, extending from the top of this section of the vaporizer toward the bottom in such a way as to form, by the admission of water, a seal which, when the engine is stopped and the relief pipe open, prevents gas from the vaporizer entering the scrubber. The manipulation of this water seal is effected by valves provided in the piping.

The scrubbers are made of boiler iron 12 ft. 8 in. high and 3 ft. 2 in. outside diameter and contain a removable grate for the support of the coke. The gas enters the bottom and leaves at the top, coming in contact in its passage through the scrubber, with water which is admitted to a sprinkler system attached to the scrubber cover. After passing the scrubber the gas is led by a vertical pipe to a cleaning pot, which serves to collect large particles of moisture which may have been carried over by the gas, and thence to the cleaner, which is a circular boiler iron shell, 5 ft. 6 in. in diameter and 32 in. high, fitted with two wooden trays, supporting layers of sawdust through which, by baffles, the gas is forced to pass vertically downward. The provision of this ample capacity in scrubber and cleaner is believed to be a valuable insurance against the passing over to the engines of dust and tar products, which lead to the minor difficulties in operation sometimes attributed to the use of this type of plant.

Each producer is equipped with a gauge board with water gauges showing the vacuum in the different parts of the apparatus. The piping is so arranged that either engine can be operated from either producer.

For blowing the producer when starting an air jet is provided, the air being taken from the compressor used for starting the engine.

The engines are 4-cycle, horizontal single cylinder, with one fly-wheel and outer bearing, with shaft extended to receive friction clutch by which the engines are connected to the pumps. The engines are nominally of 115 h.-p. and are designed to operate at 150 r. p. m.

The engine has a combination, starting, blow-off and relief valve. The valve proper consists of a casing containing three poppet valves, dividing the casing into three chambers. When starting, the levers that operate these three valves are brought into contact with an auxiliary cam by means of a special hand lever. The engine having been barred into position and the hand lever thrown to the starting point, compressed air is admitted into the cylinder, resulting in the piston, crank-shaft, lay-shaft and auxiliary cam moving, until by the action of this cam, the compressed air valve closes. On the return stroke of the piston the valve leading into the cylinder opens and also the valve into the vent pipe, thus allowing the compressed air to escape. This operation is repeated automatically until the engine starts to fire. The operation of blowing off while the engine is running, to remove impurities and excessive oil from the cylinder, is accomplished by throwing the hand lever in an opposite direction from that necessary for starting; the result being that the valve between the cylinder and vent pipe is open during a certain part of the explosion stroke.

Gas and air are admitted to the cylinder head valve chamber through a cast-iron pipe, divided by partition into two conduits, one for the gas and the other for the air, with provision for controlling the amount of gas and air in order to obtain the desired mixture. The air is taken through piping from above the roof of the building.

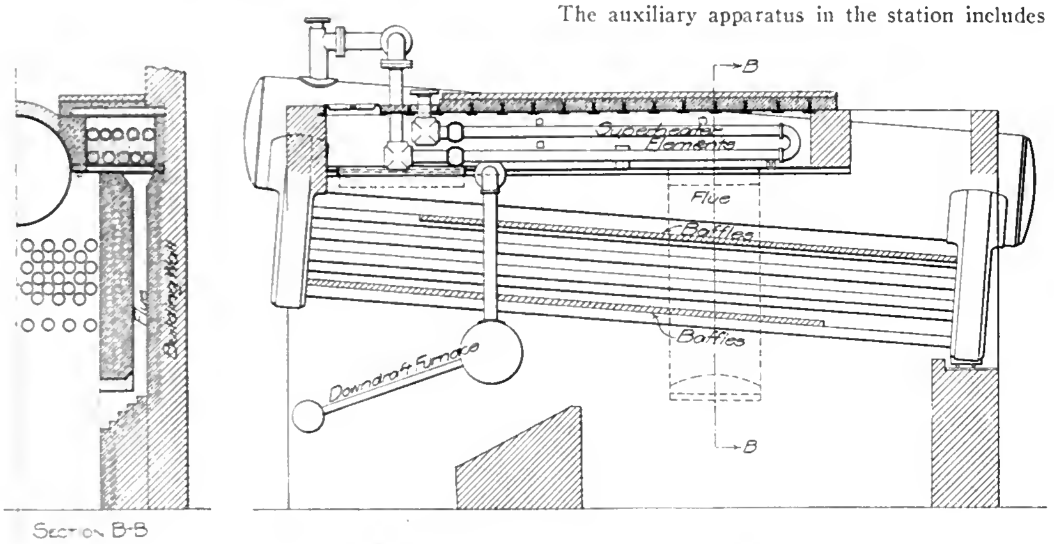
The exhaust gases are carried through one length of water cooled pipe and then through a non-jacketed cast-iron pipe to a combined muffler and heater below the floor of the engine room, from which they are carried to an exhaust funnel above the roof. The muffler and heater is a double walled cast-iron cylinder, with a section of tubes inserted between two headers, the gases passing through the pipes which are surrounded by water. By this muffler it is proposed to provide the necessary hot water for heating the building.

The engines are larger than necessary for the economical operation of the pumps, the size being determined by the intention of the authorities to employ these engines in the future development of electric current for lighting. The engines are connected with the pumps by means of a heavy duty friction clutch.

The pumps are of the ordinary triplex, four-stand, double acting type, geared to run 32 r. p. m. Rawhide pinions keyed to the shaft extending from the clutch, transmit the motion of the engine to the gears of pumps. The pump cylinder is 13 in. in diameter and the stroke 12 in. The two pumps have a common suction pipe, 18 in. in diameter, leading from the well with individual suction pipes 14 in. in diameter. The discharge pipes are 12 in. in diameter and connect with 14 in. force main leading to the reservoir. Check valves are provided in the discharge of each pump and also straightway valves in the discharge and suction pipes, thus permitting the entire isolation of either unit. Relief valves, with outlets piped into the suction, are also provided.

The auxiliary apparatus in the station includes an air compressor, driven by a Pelton wheel with water taken from the pressure main and returned to the well. The compressed air is piped to two receivers erected on the producer platform, each 32 in. in diameter and 6 ft. high. Compressed air is also employed in two stationary air-lifts, provided to raise or lower the exhaust valve of the engines. These lifts are attached to the engine foundations and facilitate any repairs or inspection of the exhaust valve or its mechanism.

The station building is of red brick and includes the engine-room, generator room and coal-shed. Above the engine room and connected with it by an iron spiral stairway is the office and bath-room. The generator room has a concrete platform, 11 ft. above the floor, and at the same elevation as the floor of coal-shed, thus permitting all coal to be transferred from the point of storage to the producers without lifting. A railroad siding permits the coal to be shovelled directly from the cars through the roof of the coal-shed. Care has been taken in the producer room to use concrete or brick throughout, both in walls and floors. Windows are provided in the wall between producer room and engine room so that the operation of the engine may be observed by the attendant, either when on the ground floor or the charging platform.



Arrangement of Boiler Setting in Flour Mill.

Electric Towing was tried on July 13 on the canal of the Lehigh Coal & Navigation Co. at Mauch Chunk, Pa. A narrow-gauge track was laid along the towpath and on it a 10-ton electric motor truck was operated. This was connected by a hawser with a canal boat and dragged the latter satisfactorily.

The Power Plant of a Small Flour Mill.

The power plant of the 400-bbl. mill of the Washington, Mo., Flour Mill Co. is an example of the economies which can be secured in a well-designed power installation of small capacity. The original power plant of this mill contained an 18x42-in. Corliss engine, operating non-condensing at 70 r.p.m., to which steam was supplied by two 48-in. by 20-ft. return tubular boilers. The latter had 33 sq. ft. of grate surface, or 1 sq. ft. to each 33 sq. ft. of heating surface, and were operated at approximately 100 lb. steam pressure. Under these conditions, on an average 43.5 lb. of coal were required to each barrel of flour that was produced by the mill. As this coal consumption was excessive, plans for reconstructing the power plant were made and carried out.

The two return tubular boilers were replaced by a single 100-h. p. O'Brien water tube boiler, having 1,003 sq. ft. of heating surface and 18.34 sq. ft. of grate surface. This boiler was equipped with an O'Brien down draft furnace, the upper grates of which consist of a row of 2-in. boiler tubes, inclined upward at a pitch of 4 in. to the foot, and attached at the front and rear to water drums connected with the main drum of the boiler. The latter is also equipped with a Foster superheater which is placed at the level of the drum of the boiler in a compartment at one side of the latter. A flue leading to this compartment is built in the side of the boiler setting and opens in the furnace just back of the arch. A part of the hottest gases are thus diverted through the compartment and over the superheater, which produces steam at about 100 degrees Fahr. above the temperature of saturated steam. The gases from the superheater pass out of the rear end of the compartment for the latter and mingle with those which have come up through the tubes of the boiler.

The cylinder of the original engine was replaced by a 12-in. high-pressure and a 24-in. low-pressure cylinder, making the engine a tamdem-compound machine, which is operated condensing. A Wheeler jet condenser served by a wet-and-dry vacuum pump was also installed, and a natural-draft cooling tower with a capacity of 2,700 lb. of water an hour was erected on the roof of the building, as the water supply is limited.

Tests made since the reconstructed plant was placed in service determined that on the average only 19.6 lb. of coal of the same quality previously used are required to produce a barrel of flour, or a saving of 120 per cent., as compared with the original plant.

The plant was reconstructed under the direction of Mr. William H. Bryan, consulting engineer, of St. Louis.

An Insulating Joint to prevent electrolysis has been used in the 6-in. water service pipe that enters the power station of the Cleveland Electric Ry. It consists of a large wooden washer bolted between special castings forming adjoining ends of the service. Each casting has an 11-in. flange with eight ¾-in. holes by which it is attached to the service pipe and a 13½-in. flange with a dished face and eight 1⅛-in. holes to form the insulating joint. The wooden washer is a piece of hard maple boiled in paraffine and having a ¼-in. boss on each side, which fits into the recess in the face of the flange of the casting. The bolts at the joint pass through rubber hose and their nuts press on large fiber washers.

It may be added that there is a difference of opinion among engineers regarding the usefulness of any insulating joint. Fortunately, the engineering department of the Metropolitan Water and Sewerage Board of Boston has been carrying on investigations as to their value which will furnish definite information.

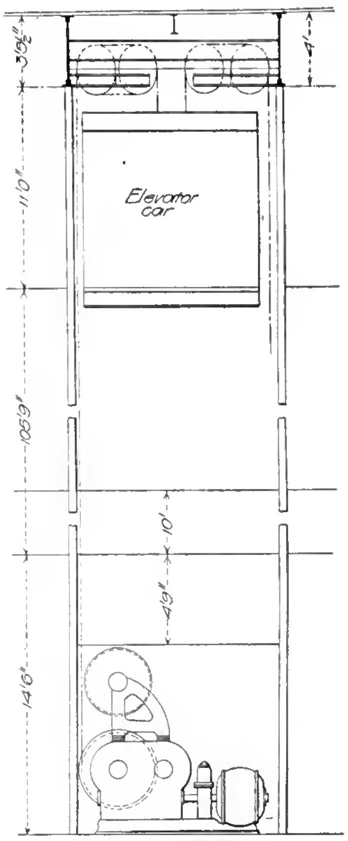
The Elevator and Escalator Equipment of the New York Subway.

In the construction of the New York Subway the topographical irregularities of the upper portion of Manhattan Island caused considerable differences in elevation between the track grade and the surface of the ground at certain points, notably at Manhattan St., 167th St., and 181st St. on the Broadway Division, and at Mott Ave. on the Bronx Division. At 167th St., 181st St. and Mott Ave., the tracks are 100 ft. or more below the street surface, which renders access to the stations by stairways extremely difficult. At Manhattan St., on the other hand, the line is carried on a viaduct with a station at its centre where the grade of tracks is some 50 ft. above the street level. Electric elevators of large capacity have been installed in pairs at each of these three underground stations, and a duplex escalator at the viaduct station.

The electric elevator was selected so that the machine, as well as also the escalator, might be operated by direct current from the subway. As it is necessary to handle large crowds during rush hours, large elevator cars were required, necessitating special elevator machines and other mechanical features. The six machines have the largest capacity of any electric passenger machines installed in this country by the Otis Elevator Co., and are equalled in size only by the machines recently installed in new stations of the London Underground system. The cars are all 8¾ x 11½ ft., with a capacity of 8,000 lb. A load of 73 men and boys has been safely carried in one of the cars in a period of heavy traffic. Owing to this extremely heavy load, machines of the duplex type were installed, consisting of two large multipolar motors, mounted side by side on a single base plate to drive the hoisting drum through tandem worm-gear drives of the type usual in the Otis machine.

The installation of the equipments at 167th and 181st Sts. was attended with considerable difficulty owing to the location of these stations under sidewalks, with stair entrances at the street line, which prevented the projection of any structure above the street level to house the overhead gear. Furthermore, as it was desirable to have the upper landing as high as possible in the elevator shaft, it was necessary to minimize the space occupied by the overhead sheaves and supporting beams, which resulted in the location of the machines at the base of the shaft. Special overhead work was accordingly designed, which is particularly compact for the capacity for which it is designed. The upper landings in the shaft are within 14 ft. of the underside of the sidewalk vault light at 167th St., and within 15 ft. at 181st St., so that, with the total height of elevator cage of 9 ft., but 5 and 6 ft. overhead clearances, respectively, are obtained at the two stations. The supporting beams for the overhead sheaves were accordingly located 3½ and 4 ft. under the sidewalk vault lights, giving total clearances over the uppermost sheaves of 5 in. Details of the sheave supports are indicated in an accompanying illustration. The 30-in. sheaves carrying six ⅝-in. cables from both the counter-balance weights and the machines to the car are supported by two 15-in., 42-lb. I-beams, between which and two outer 12-in., 31½-lb. I-beams, are supported two auxiliary sets of 30-in. sheaves, each carrying two ⅝-in. cables from the machine drum direct to the counterweights. Owing to the width of the car and the limited overhead clearance, the use of single sheaves to pass the cables from the counterweights and the elevator machine to the car was prevented, necessitating the four 30-in. sheaves instead, two over the center of the car, one over the machine drum and one over the counterweight guides. The bearings for all sheaves except those over the center of the car, rest upon short 6-in. channels separated from the I-beams by 8-in. spacers, with flanges riveted to those of the lower channels and the I-beams. The large six-cable sheaves are so confined by adjacent beam supports that journal box bearings of the usual type were impossible, and the sheaves are accordingly arranged to turn on large 4-in. shafts or spindles passed through the large I-beams.

The cars of the 167th and 181st St. elevators are steel cages 8¾ x 11½ ft. outside measurement, designed for operation between corner guides in a hatchway, 10 x 11¾ ft. in size. The cases are of ornamental iron work, enclosed at the top and sides, and the floors are finished with interlocking rubber tiling. Each car has openings with folding gates at either end, and there is a 5-ft. double folding gate on both sides of the shaft at every landing, in order to facilitate the handling of crowds, for which purpose ample corridor spaces have been provided at every landing. The guides for all electric machines are 4x6-in. posts of yellow pine, bolted to 10-in. channels supported on the steel work of the shaft.



Elevator Mechanism.

The elevator machines at 167th and 181st Sts. stations are at the foot of the shaft in cellars with 10½ ft. clear head-room under the shaft pit for cars at the lower landing, but for the Mott Ave. station, the location was such that an overhead station building was permissible, allowing the elevator to travel up to street level with ample room for the overhead sheaves and supports. The building was accordingly arranged to accommodate the machines in the space above the shaft, the shafts themselves therefore extending but the necessary 4 ft. below the lower landing level. The machines used in this station are identical with those at 167th and 181st Sts., but the details of supporting structural work and arrangement of overhead sheaves is different. The cars are here 8½ x 12 ft. in size, traveling in a 9¼x13-ft. hatchway, over which the elevator machines are supported on four 18-in. I-beams spanning the hatch lengthwise. In order to prevent interference with the support beams, the guide posts on these cars are arranged at the side in the usual manner, the posts being here also of 4x6-in. yellow pine fastened to 10-in. vertical channels. The drums of these machines are so located that overhead sheaves are eliminated, except for the counter-balance weights, the car cables passing vertically downward from the inner face of the drum to the car fastenings, while those from the drum to the counterweights pass over sheaves at the rear to the counterweight slides. The cables extending directly from the counterbalance weights to the cars are carried by sheaves over the counterweight slides and an upper sheave mounted above the drum so as to clear the drum cables.

The elevator machines are all of the duplex tandem worm-gear type, equipped with two four-pole compound wound motors designed for operation on 500-volt current from the railroad propulsion system. The motors are specially designed with compound windings for rapid acceleration and the gear of the drive is proportioned for a car travel of 250 ft. per minute under all conditions of loading. The vibrating sheaves above the drum of the 167th and 181st St. machines automatically traverse in guiding the cable off the drum, the conditions of clearances and manner of running the cable permitting this to be done there without difficulty. The machines are all controlled from the cars by the latest type of magnet controller of the Otis Elevator Co., with duplicate control switches on either side of the car for convenience of operation from either doorway, and switch panels near the machines on which are mounted the solenoid switches, resistances and connections. These controllers have the usual features for utilization of the increasing counter electro-motive force of the motors, in starting, to cut out gradually the armature resistance and finally the series-field coils, by means of a series of magnets while retarding magnets are similarly used for slowing down. Special features of the control as applied to these cars are gate contacts by which the machine cannot be started until all gates in the elevator and hatchways are closed, the control circuits being made through contacts on all gates arranged in series, so that if any gate is left open the control circuit cannot be closed and the machines started. The machines are all equipped with the safety car switches, the slack cable switches, the limit switches and governors which are usual in electric machine installations.

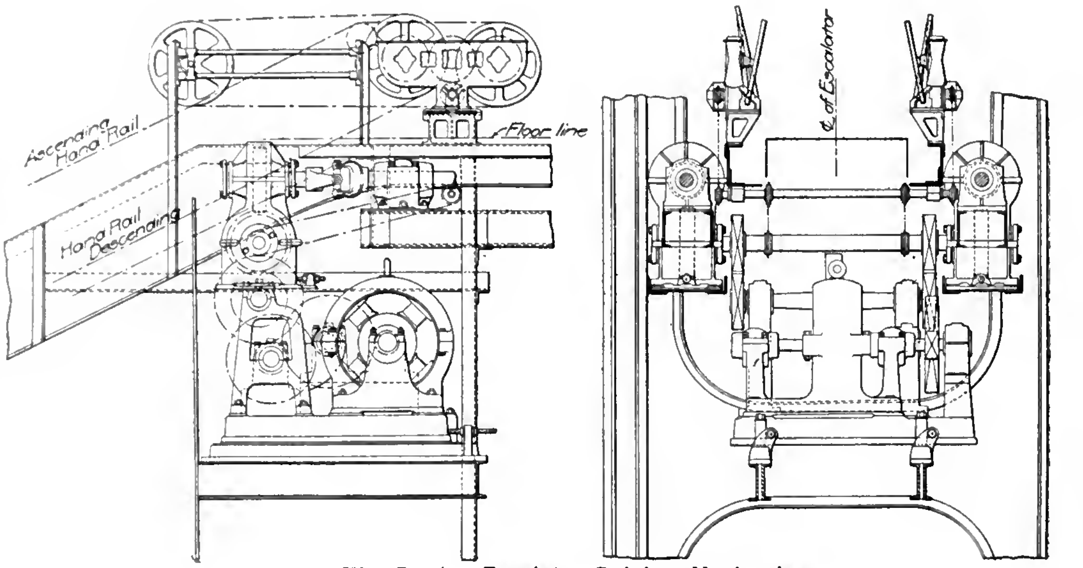
The escalator installed at the Manhattan St. station is a moving stair of the traveling flight type, similar in general construction to those installed at the 23rd and 33rd St. stations of the Manhattan Ry., in New York, but differs in that it is of the duplex type, the flights being reversible and made to serve for both ascending and descending travel. As the station platforms are some 50 ft. above the street level, and it is necessary to elevate the passengers a distance of 33 ft. to a cross passage connecting both uptown and downtown platforms, it was desirable that the elevating mechanism be made available for travel in either direction. This was accomplished by the use of the one position treads of the Otis escalator construction which travel in an endless chain through both the up and down runways, offset arrangements at both top and bottom landings preventing interference of the returning flight with the loading and unloading landings as shown in the accompanying elevation detail of the escalator runways.

The general arrangement of the escalator involves an up-travel flight, 74 ft. long and a down-travel flight 80 ft. in length, including a 6-ft. level landing, midway in the run, to serve as an eye rest to the passengers looking down from the upper end of the long flight. The loading and unloading divisions are level, those for loading at both upper and lower levels being about 8 ft. in length, while those for unloading at both levels are approximately 15 ft. in length. The de-

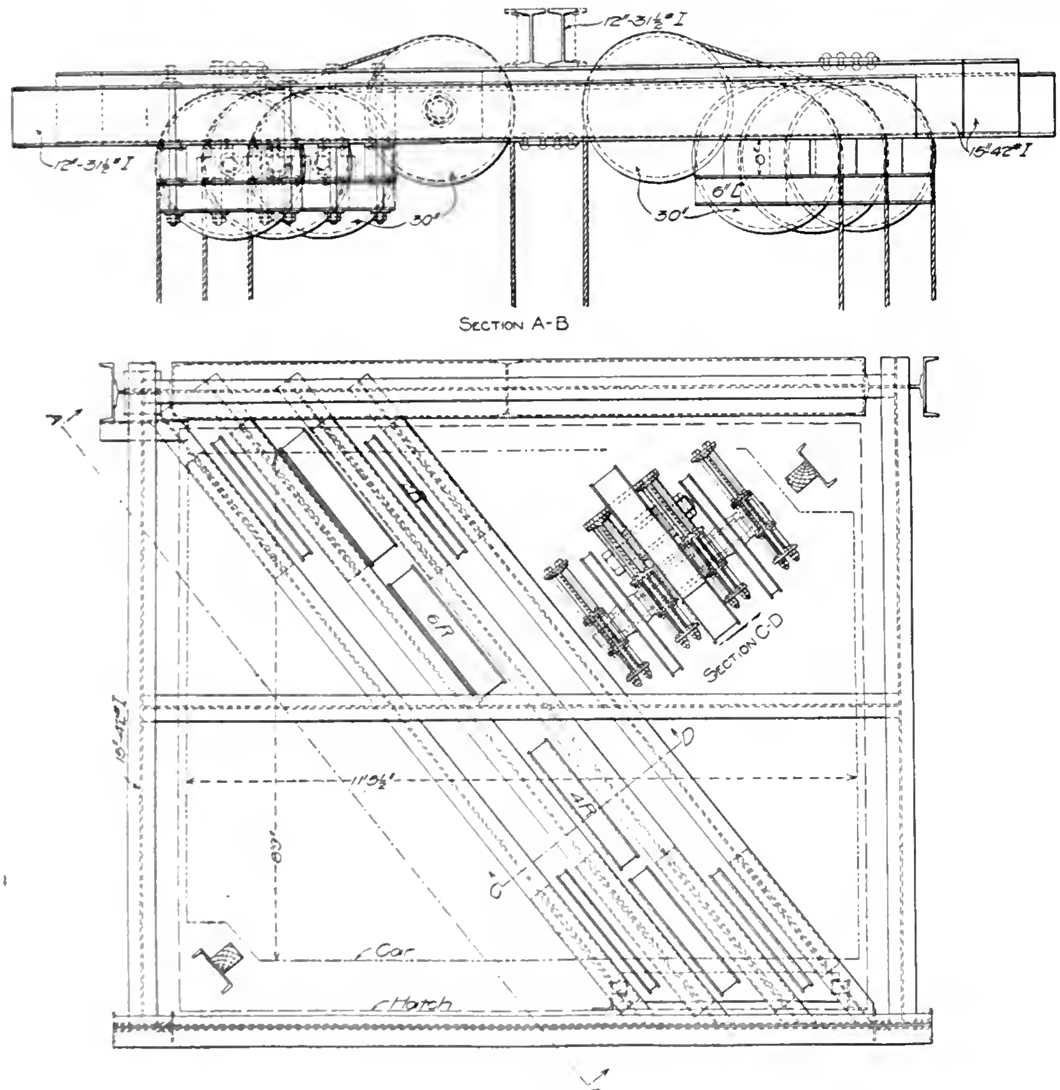
tail of arrangement of the unloading division with oblique wainscot rail follows the usual escalator practice. Moving hand-rails are also provided on both ascending and descending flights, which travel at the same speed as the stair flights.

The escalator is driven by an intersecting mechanism which applies the driving force equally to both ascending and descending flights at upper points on the stairway run. It consists of a 60 h.-p. Otis motor mounted under the upper landing at the top of the ascending flight and arranged to drive through three gearing reductions, the shaft carrying the sprockets meshing in the flight driving chain. This gear is supplemented by a similar sprocket driving shaft under the loading landing at the top of the descending flight at the rear, which is connected to the ascending flight sprocket shaft by two 5-in. longitudinal steel shafts which are connected to the sprocket shafts at either end through spiral gearing. By this arrangement, the driving force, which amounts to an average power consumption of 25 h. p. is effectually equalized between the two halves of the endless chain of stair flights and the duty imposed on the sprocket and chain at either driving point lessened by approximately one-half. The driving gears are, however, both designed for ample strength to carry the entire driving strain if this should become necessary in case of emergency. The 5-in. interconnecting shafts between the two driving gears are of considerable length, approximately 35 ft., and in order to provide for possible deflections of the viaduct on which the mechanisms are supported, each shaft is connected to its spiral gear at either end through a universal joint. In practice it is found that the structure deflects under certain conditions sufficiently to throw the shaft out of alignment by as much as one inch. The spiral gears of the drive are entirely enclosed and fitted with an oil bath for lubrication and protection from dirt and dust. To the sprocket driving shafts of either flight there is connected by a chain drive a supplementary hand-rail driving mechanism of the endless cable type with rubber-covered hand grips. The rail for either flight is driven over pulleys carried in the upper surface of the banister and moves at a speed corresponding to that of the stair flight, returning within the boxing underneath the banister. Three sheaves above the driving mechanism for either flight carries the hand-rail, and by a turn around a third adjustable sheave provision is made for taking up slack in the cable.

The important feature of the escalator is its large carrying capacity. The flights are of unusually large size, each step being 18 in. in width by 4 ft. long, so that under conditions of maximum loading, three persons might be accommodated on each step. From actual practice it is found that under conditions of rush-hour travel an average of 2½ persons are carried per step continuously for considerable periods of time.



The Duplex Escalator Driving Mechanism.



Special Overhead Construction for Subway Elevators.

With the normal speed of operation, of approximately 4,000 steps passing a landing per hour, the maximum carrying capacity of the escalator is, as determined by the average of 2½ persons per step, 10,000 persons per hour, for both the ascending and descending runs, making the total capacity of the station 20,000 per hour, as guaranteed by the builders. This is, moreover, accomplished by a continuous uni-directional movement of the apparatus and devoid of stopping and accelerations of the driving motor, as in the case of the usual elevator apparatus. While the escalator occupies more space than an ordinary elevator installation, it requires far less than that necessary for an elevator equipment of equal capacity and its advantage over the latter is obvious in view of the maximum carrying capacity of each of the above elevators at the above mentioned stations of approximately 1,000 persons per hour. An interesting feature of the escalator installation is the effect upon travel at that station. Aside from the fact of the general novelty of the escalator as a means of elevator travel, it has been found from studies of the actual station records of the subway operating company that the escalator station is one of the most popular stations on the line, and that a most decided preference is shown to it over other nearby stations of the subway and elevated lines in the city. In the hot summer months when the travel by way of all-stair stations decrease by from 10 to 15 per cent. over that of other times in the year, the travel at the escalator station remains constant or even above normal. The escalator at this station is operated constantly throughout the day and evening, and is shut down only from one o'clock to five o'clock in the morning of each day.

PLUGGED CROSS-TIES have been used with marked success in large numbers by Chief Engineer Fredericia, of the Danish State Ry. A plain 1½-in. cylindrical creosoted plug of beech or birch is driven tight in a 1⅓-in. hole bored in the tie and the spike is driven in a hole bored in this plug. Worn-out ties plugged in this way have been found to give good service, as the rail seems to be held down with exceptional firmness and deterioration due to the pounding of loose rails is prevented.

Suggested Specifications for Street Lighting.

Report to the National Electric Light Association by a Committee consisting of Dudley Farrand, Chairman, A. E. Kennelly, Charles P. Steinmetz, Louis A. Ferguson and Paul Spencer. Comments on the report are given in the editorial pages of this issue.

In the year 1894 a committee of experts, appointed by the Association to consider the rating of arc lamps, reported at the seventeenth convention, then in session at Washington, a preamble and resolution which was adopted as follows:

"Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligations of the producer of electricity for illuminating purposes to the consumer thereof, be it

"Resolved, That in the opinion of this convention what is ordinarily known as a 2,000-c.-p. arc lamp is one requiring on the average 450 watts for its maintenance, the measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc. In case such resistance is used, it must be excluded in the measurement of the voltage."

The rating of arc lamps on the basis of energy consumed, as set forth in the resolution, was then and would now be satisfactory as an equitable means of determining either a proper rate of charge or illuminating value for street arc lighting furnished by a company to a municipality, under the same conditions, but at the time of the adoption of this resolution there was in use in the United States no type of arc lamp other than the open arc, which, although of many makes and designs, gave approximately the same illuminating power for a given amount of energy. Wherever the rating adopted by the committee in 1894 has been employed in connection with open-arc lamps of the general type then in use, little or no difficulty has been experienced in the adjustment of differences arising from the interpretations of contracts.

During the very year in which this rating was adopted, however, the commercial introduction of enclosed-arc lamps began, and within the past ten or twelve years the gradual displacement of open-arc by enclosed-arc lamps has taken place. The manufacture of open-arc lamps has practically ceased as a result of their inability to compete with the enclosed type, and manufacturers have devoted themselves almost exclusively to the latter unit quite recently. During the past four or five years there have been placed upon the market a number of distinct new types of lamps, which have been known by the general designation of "flaming carbon" or "luminous arc" lamps, some of which originated from American ideas, while others were imported.

The characteristics of the various lamps mentioned, taken either individually or grouped in classes, are so widely at variance in performance in the ratio between light produced and energy expended that the difficulties experienced by operating companies are greater now than they were in 1894, and the preamble then adopted is equally applicable to-day by reason of the introduction of these new devices.

In addition to the new types of arc lamps, there have also been placed on the market and are now offered for sale certain kinds of mercury-vapor or vacuum-tube lamps, which can be used for street lighting, as well as a considerable number of new incandescent lamps constructed of some form of metallized filament. Quite a number of the latter are already in use, with every prospect of their general introduction within a reasonable time.

Any attempt to compare the illuminating value of these latest forms of lamps, which are or may be used for street lighting, on the basis of energy consumed, is not only futile, but would be ruinous to the contracting company, for while the so-called high-efficiency lamps operate on a lesser expenditure of energy, they also give a larger volume of light. No reason can be given why a contractor should be penalized for giving more light than contracted for, after having made considerable investment for that purpose, simply because the number of watts consumed is less, notwithstanding that other items of expense and renewals may be considerably increased.

Your committee, after a most careful consideration of the difficulties to be met and for the purpose of establishing a definite basis, assumed: That, inasmuch as the lighting of streets by contract is a matter of illumination produced rather than of apparatus employed, the terms used in specifications should be in terms of illumination and not of energy consumed; that the individual lamp of each class should be the unit of number charged for; and that the average illuminating power of each unit should be comparable with and have a value equal to a known standard at proper relative distance.

The following report is submitted as the best provisional solution of the problem of street lamp specification that the unsatisfactory existing state of the science and art of outdoor photometry permits.

The committee considers that street-lighting lamps should not be rated in candle-power under contract specifications; because unless qualified as to the space distribution of the candle-power, such rating may be entirely misleading. The lamp may, by suitable reflectors, be made to possess a large candle-power in some particular direction or zone, and yet be very ineffective as a practical street illuminant. Consequently, the committee considers that the rating of street lamps in contract specifications should be in terms of the mean normal illumination cast at a considerable distance from the lamp, along the street which it illumines, i. e., the mean illumination thrown by the lamp upon a plane surface at a considerable distance from the lamp and supported perpendicularly to the rays.

The following specifications are drawn to cover the ordinary conditions of street lighting, and are recommended to replace previous specifications, such as those appearing in the Report of the Committee on Rating of Arc Lamps of the National Electric Light Association at the meeting of 1894, a copy of which is reported above:

(1) Under ordinary conditions of street arc lighting, with lamps spaced 200 to 600 ft. apart, specifications for street lamps should define the mean illumination thrown by the individual lamp, in position in the street, as measured at the height of the observers' eye and perpendicular to the rays, at some point not less than 200 ft. nor more than 300 ft. distant, along a level street, from a position immediately below the lamp, with all extraneous light screened off and with no reflection from surrounding objects not forming part of the lamp equipment.

The reason for leaving the horizontal distance flexible along the street within the range between 200 and 300 ft., is that a definitely specified distance such as 250 ft. might be unsuitable for the purpose of the measurement.

Within the horizontal distance in excess of 200 ft., the distance correction for the height of the lamp above the observer's eye is ordinarily unimportant.

(2) When using smaller units of light, such as series incandescent lamps spaced shorter distances apart, a correspondingly shorter distance from the lamp could be chosen in measuring the illumination.

(3) The lamp contracted for should give a mean normal illumination at the test point (selected as in Sections 1 and 2) not less than the illumination given by the stationary standard incandescent lamp of 16 c.-p. at 1/x of the distance. The said standard incandescent lamp should be a standardized seasoned lamp having a determined candle-power in a fixed direction.

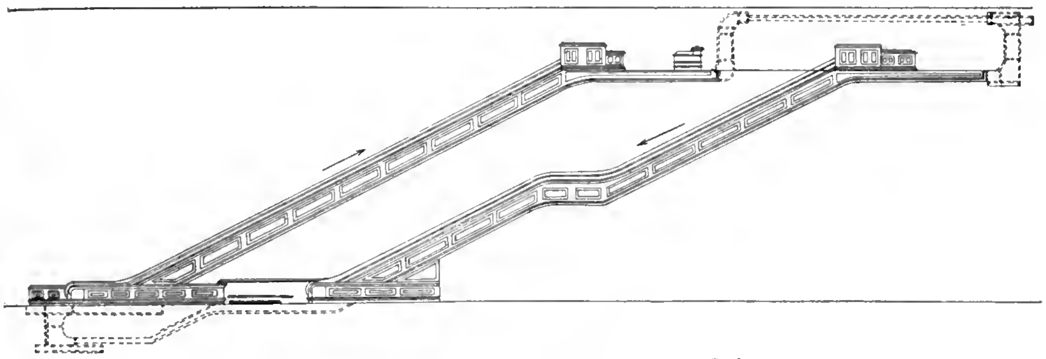
(4) When the lamp tested fluctuates in intensity, a number of observations of the maximum normal illumination should be made at a distance of not less than 200 ft. horizontally from beneath the lamp, and the average of these measurements should be taken as the average maximum illumination. A similar number of observations of the minimum normal illumination should be made, the average of which should be taken as the average minimum illumination. The arithmetical mean of the said average maximum and minimum illuminations should be taken as the mean normal illumination called for in Section 1.

(a) When a reading-distance instrument is used for measuring the mean normal illumination at specified horizontal range, the average of a number of maximum distances at which a certain size of print can be distinguished may be called the average maximum distance, and the average of a similar number of minimum distances the average minimum distance. From these, the mean distance at which an illumination is cast normally, sufficient for distinguishing that size of print, can be determined. This mean distance must lie within the 200-300 ft. horizontal range specified in Section 1. In most cases the arithmetical mean of the average maximum and average minimum distances may be taken as the said mean distance with an accuracy sufficient for practical purposes. The illumination needed for distinguishing the size of print may be determined for each particular observer from measurements of the reading distance with the standard incandescent lamp referred to in Section 3.

(b) When a portable photometer is used at a fixed horizontal distance, such as 250 ft., the mean normal illumination of a fluctuating lamp may be obtained by taking the average of not less than 50 observations at intervals of not less than one-half minute.

(5) A reasonable number of lamps covered by the contract should be tested.

(6) For measuring the mean normal illumination of a lamp, comparison with the standard incandescent lamp may be made either with a



Scheme of the Duplex Escalator on the Subway.

suitable portable photometer or with a reading-distance instrument, such as the so-called "luminometer."

(7) The unobstructed mean normal illumination must not be less at shorter distances than at the point of test.

(8) An approximate list of the mean normal illuminations thrown by street lamps of standard manufacture, at horizontal distances within the 200-300-ft. range, hung approximately 20 ft. above the level of the observer's eye, is given in the following table: (Data from which table is to be prepared are not yet completed. Table will be furnished later.)

Your committee during the consideration of this subject invited to its meetings and sought the advice and assistance of a number of the most prominent illuminating engineers and are lamp experts, and in that connection hereby expresses its appreciation for services rendered by Dr. Clayton H. Sharpe, Mr. Caryl D. Haskins, Mr. Frank Conrad, Mr. Carl Hering, Mr. Louis B. Marks and L. D. Howard Gilmour, and especially to Mr. W. D'A. Ryan for the quantity of data furnished to the committee for its use and the large amount of labor performed in the collection of additional data required in the preparation of the schedules.

Swamp Drainage on the catchment area of the Wachusett reservoir of the Metropolitan water-works has been resumed. As a rule, the ditches cut for the purpose have a board bottom 1 ft. wide, with 4 x 4-in. triangular wood strips rabbeted at the square corner to the edges of the board. The board is nailed to 2 x 4-in. cross pieces 2 ft. long and about 3 ft. apart, laid on the bottom of the excavation. The triangular strips make wooden sides to the ditch 3 in. high and serve as a footing for the stone paving on the slopes of the ditch. As the bottom of the excavation for the ditches is generally in water and the material is very soft, it is necessary to use some form of board bottom in order to preserve the grade of the ditch and afford a support for the slope paving, and the form of the bottom used facilitates cleaning the ditches. Where the ditches have steep grades and the ground is more firm, the bottom is also paved with stone; where the ground is stony, no paving is used. This type of ditch construction has been very successful in earlier swamp drainage operations in the Wachusett basin, resulting in a marked reduction in the color of the water

The Nine-Mile Power Station of the Spokane & Inland Empire Railway.

By H. Cole Estep.

Twelve miles below the city of Spokane, Wash., on the Spokane River, the Spokane & Inland Empire Railway Co. is constructing its new 15,000 kw. hydro-electric station, as described in this journal on March 2. The work of construction, which has been in progress since August, 1906, is now about half completed, and is in many ways in its most interesting stage. After several delays on account of floods and high water, the subaqueous work has been completed. To obviate as much as possible further delays caused by a rising river, a rather novel method of construction has been adopted.

The river is 250 ft. wide at this point, and the power house, which is built, as is usual in such cases, against the back wall of the dam, extends out to mid-stream, the generator room being 127 ft. long by 20 ft. wide.

The method of construction adopted consists in building the power-house half of the dam first, the foundation work being subaqueous. Then while the other half of the dam is being constructed, the river is diverted through temporary openings left in the base of the power-house dam for that purpose. When the whole structure is completed these temporary openings will be sealed.

To accomplish this the upstream face of the dam at the elevation of the generator room floor is left open, the upper part being supported by heavy cross walls located between each of the four generating sets. Between these cross walls are left four 20 x 30-ft. openings. I-beams bedded firmly in the cement at the top and bottom, spaced 12 in. apart, are placed vertically in these openings, forming a grid. When the power-house is completed and the coffer-dam thrown across the east half of the stream, the water will pour down through this grid and find its exit through temporary openings in the dam floor. After the east half of the dam is completed this grid will be sealed by driving sheet piling between the I-beams. This rather novel design has already proved its efficiency and will materially reduce the time and cost of construction.

The dam is being very thoroughly and substantially reinforced. The lower courses are tied together and stiffened by diagonal rods 20 ft. long, made of 1¼-in. twisted steel squares. The reinforcement of the upper courses consists of 20-ft., 1¼-in. twisted steel squares, laid in horizontal courses 2 ft. apart and tied together by short rods of ¾-in. twisted stock.

No penstocks are used, the wheel chambers being constantly under full head. The water is controlled by ordinary vertical lift gates located at the face of the dam. From each turbine the water is carried away by two draft tubes, each 8 ft. 6 in. in diameter.

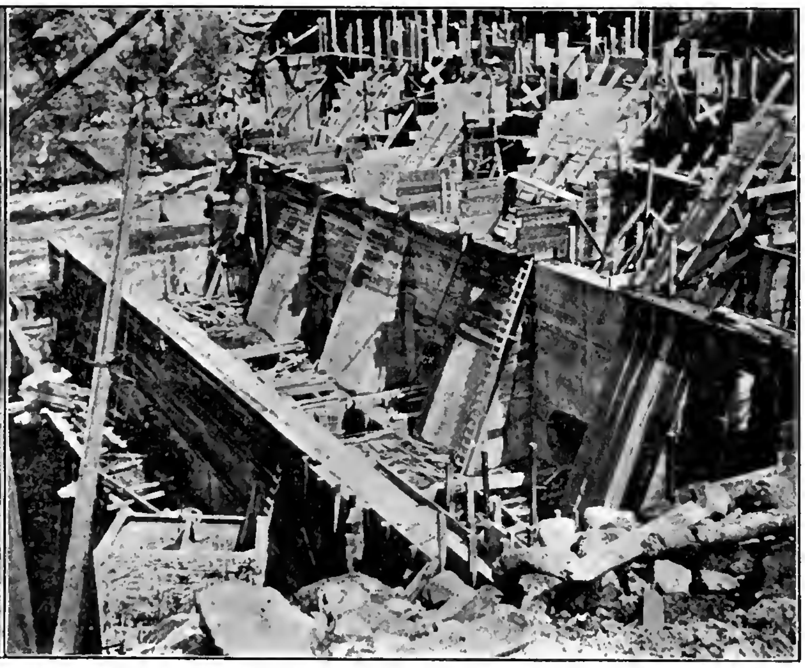
A feature of the design of the dam is the hatchway provided for gaining access to each wheel chamber. This chamber, ordinarily under full head of water, is located between the sealed grid, mentioned above, and the main wall of the dam. At the top of the chamber the dam wall forms a corner, and in this corner, swung 45 deg. to the vertical, is fitted the 16 x 16-ft. hatchway. The hatchway itself, made of channel iron and reinforced concrete, is supported against the upward water pressure by removable girders. In one of the accompanying photographs the location of the hatchways is indicated by white crosses.

The plant will operate under a head of 60 ft. The flow of the river varies from 25,000 to 1,400 second-feet, the normal flow being bout 6,000 second-feet. The river canyon is deep and wide enough to provide sufficient pond area to enable the plant to develop 15,000 kw. continuously. Two 3,750-kw., three-phase, star-connected Westinghouse alternators are to be installed immediately; one more is to follow before the end of the year, while eventually the plant will contain four 3,750-kw. machines. Each generator is to be driven by a 6,000-h.p., direct-connected, horizontal, parallel-flow turbine.

The switchboard gallery is located at one end of the generator room. Remote control will be used throughout, the main oil switches being each located in a separate fireproof compartment at the rear of the switchboard gallery.

Each generator is supplied with its own 3,750-kw. 2,300-60,000 volt, oil-cooled, three-phase Westinghouse transformer. The transformers are located in fireproof pits situated adjacent to the generators along the back wall of the dam. The generator room crane is used to handle the transformers. This brings out another of the features of the design. On account of the hatchways leading to the turbines, the transformers and the generators can be placed under the same crane runway; every part of the machinery is thus made exceptionally accessible, served by one main crane and can be moved rapidly and economically.

Sand Pit and Gravel Sluice.



Dam under Construction, Nine-Mile Station.

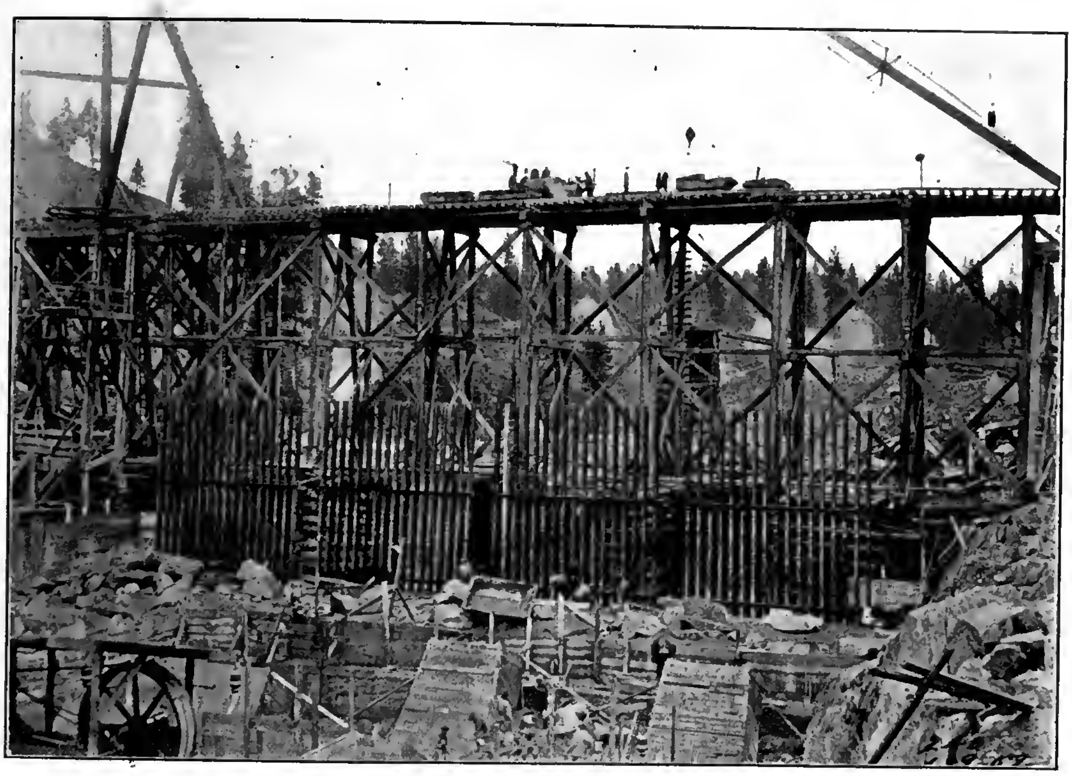
One of the causes contributing to the economical construction of this plant is the exceptionally fortunate location of the sand and gravel pit. At the site of the dam on the east bank of the river is found the finest natural deposit of sand and gravel that could be desired. The here rises about 300 ft. above the river. The concrete mixing plant, in which are installed two steam-driven Smith mixers, is located on the hillside about 100 ft. above the river. From this point to within 100 ft. of the top of the cliff is situated a bed of fine, pure sand. The sand is transferred to the hoppers of the mixing plant in small, horse-drawn tramcars. Above the sand bed and extending to the top of the cliff is a deposit of clean gravel. The gravel is sluiced down to the concrete mixers by the common method used in hydraulic mining. On its way down the boulders are removed and diverted to a stone-crusher. By virtue of this natural gravity system of transportation and the close proximity of the material, the concrete at the spout of the mixers costs 13 cents per cubic yard, exclusive of the cost of the cement.

Except at prohibitive cost, the plant is inaccessible by rail. All the heavy machinery will have to be transported over the county road. Although the road is steep and crooked in places, the machinery can be moved in this way cheaper than by building a costly railroad spur.

The location is twelve miles from the center of distribution at Spokane and the electricity will be transmitted at 60,000 volts over this distance. The pole line is now completed and is being used temporarily for the transmission of electricity from Spokane for light and power purposes at the plant under construction. The transmission line follows the county road most of the way and is not on a private right-of-way.

The energy generated at the Nine-mile station will be used for commercial and street station purposes in Spokane and also for power on the extensive electric railway system of the Spokane & Inland Co., which operates 200 miles of standard gauge electric railway traversing the Inland Empire district of eastern Washington.

Messrs. Sanderson & Porter, of New York, are the contractors in charge of the construction of the Nine Mile Power Station. Mr. W. F. Zimmerman, of Spokane, representing the Inland Empire System, is the consulting engineer.



I-Beam Grid, Nine-Mile Station.

Carrying Capacity of Reinforced Concrete Floor Construction.

By Messrs. A. E. Lindall and G. R. Heckle.

Many causes contribute to the diversity of opinion among engineers regarding the design and load-carrying capacity of floor panels, the principal ones being the variation in strength of material and class of workmanship, but more particularly the tests that are published with a view of exploiting the merits of a particular system, which tests are frequently executed in such a manner as to give entirely false impressions regarding the strength of the structure. It is a common practice to test a portion, or a strip of floor panel a few feet wide and judge from the load thus carried, the load which the whole panel could carry; or pile up bags of cement, sand or gravel and call each bag in height 100 lbs. per square foot, whereas the load averages more nearly 50 per cent. of this amount—that is to say, a pile ten or twelve bags in height will give about 600 lbs. per square foot of area. Materials such as pig iron, brick, pig lead, and so forth, unless special provision is made, may be suspected of carrying a portion of their load to the supports, by interior arching action.

The situation outlined is unfortunate, in so far that those who are interested, instead of being instructed are unconsciously misled, and until a great number of experiments have been made, placing the whole subject of reinforced concrete on a solid foundation of experimental data, this phase of the matter is really serious.

In justice to all who have made floor tests, it must be said that it is difficult to eliminate many inaccuracies. Laboratory apparatus can seldom be obtained; the heavy loads required to test to destruction full-sized floor panels can be secured in practice only by the piling up of a large number of comparatively small loads, probably giving a very fair uniform load, but uncertain, nevertheless, as regards its exact amount and point of application.

It is hoped that the following record of a test on a full-sized panel will be found generally interesting and useful, although subject to most of the criticism noted above.

The panel was built near the Intercity Viaduct, Kansas City, Mo., because the reinforced-concrete viaduct floor was under construction, and the convenience in securing material and labor very greatly reduced the cost of the panel. The foundation, however, was very poor, and the precaution that was taken to spread the footings under the corner posts was not sufficient to avoid serious settlement, and even cracks in the panel, as will be noted later.

The general plan and arrangement of reinforcement are shown in an accompanying illustration. The corner posts were made rather heavy for two reasons—to give as much continuity to the girders as possible, there being no surrounding panels as is the case in buildings, and to distribute the load on the foundation.

The reinforcement was corrugated high-carbon bars. The concrete was made of one part of Iola Portland cement, two parts Missouri River sand and five parts crushed limestone graded from ¼ in. to 1 in. in size.

The concrete was placed during cold weather in February and protected with manure—or in other words, subjected to the same unfavorable conditions that may obtain in practice. Tests were made sixty days later, on April 11, 12 and 13.

The slab was tested first, and in order to avoid loading the beams and girders they were blocked up, the idea being that the slab should be tested

Table 1, Total Loads and Deflections.

Slab.			Beam.		
Total Load.	Load per sq. ft.	Deflection.	Total Load.	Load per sq. ft.	Deflection.
lb.	lb.	in.	lb.	lb.	in.
40,000	220	⅛	132,200	367	3/16
60,000	330	¼	138,600	385	¼
105,000	580	⅜	154,800	430	5/16
113,000	630	⅝	171,200	470	⅜
118,000	655	¾	182,500	510	7/16
135,000	750	1	193,800	540	⅝
155,400	865	1⅛	205,100	570	¾
162,000	900	1¼	220,120	611	1

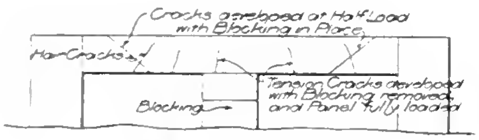
to practical destruction without injuring the beams, and then test the beams, blocking up the girders, and finally the girders. For loading material, cement sacks were filled with sand and twenty-five of these were weighed, the average weight being found to be about 113 lbs. per sack. This weight was then used to calculate the total weight by counting the number of sacks placed on the panel. The sacks were so placed as to load the area included between the center lines of the beams and girders, this area being 10x18 ft. in plan, or 180 sq. ft. To avoid arching action, a space was left between the piles in the center of the panel, as shown in one of the illustrations. Deflections were read in the middle of the panel, by means of a multiplying device, level readings were also made on the north corner posts. When the panel was only half loaded settlement began, cracking the outside beam on the north side, the cracks extending diagonally upwards toward the supports, or in the reverse direction to the ordinary diagonal tension cracks, the nature of these cracks being shown in an accompanying sketch. The total load, load per square foot, and the deflection in the middle of the panel are given in Table 1. Correction in the deflection had to be made because of the settlement, and this makes the deflection readings uncertain by perhaps as much as ⅛ in. An attempt to show by a curve the general relation between the load per square foot and deflection has been made in the accompanying diagrams, in which the deviation of some of the points from the average curve is probably due to causes enumerated above. At a load of 750 lbs., the loading was discontinued for the day, and an examination was made, which failed to show any cracks. The next morning, however, fine cracks about 3 ft. long were found in the under side of the slab, at right angles to the reinforcement, showing that the deformation had increased beyond that

which the concrete could stand. Settlement became so troublesome that it was thought best to measure deflections from a string stretched from the under side of the girders: this would have been done in the first place only that it made it impossible to use the multiplying device. By the addition of another 100 lbs. per square foot the deflection increased 1/8 in., and by adding sufficient to make the total 900 per square foot, or the addition of about 40 lbs. per square foot more, increased the deflection another 1/8 in. As the deflection was rapidly increasing, and the cracks in the under side becoming more numerous and distinct, it appeared probable that the ultimate strength had about been reached.

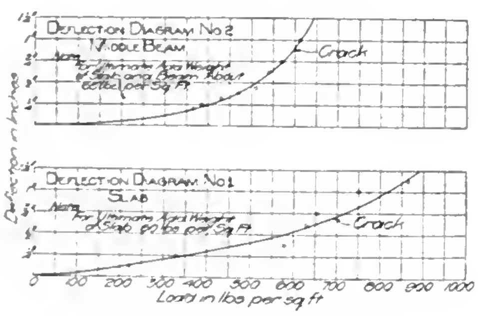
One of the photographs shows the load at 900 lbs. per square foot over one full panel of the slab, which is one-half of the total floor panel, and gives a good idea of the amount of load required to produce 900 lbs. per square foot.

In arranging the test for the middle beam, part of the load was entirely removed from the panel and the balance distributed over the total area of 20x18 ft., or 300 sq. ft. The blocking was removed and a deflection of 3-16 in. noted, the total load being 132,200 lbs., or about 367 lbs. per square foot. Before the blocking was removed it was noticed that the beam, as well as the outside one previously noted, had a fine diagonal crack extending upwards toward the girder, probably due to unequal settlement, because upon removal of the blocking the cracks closed a trifle; in any event, it seemed to exert little influence on the strength of the beam, as it behaved in the ordinary manner upon the addition of load.

Referring again to deflection diagram No. 2



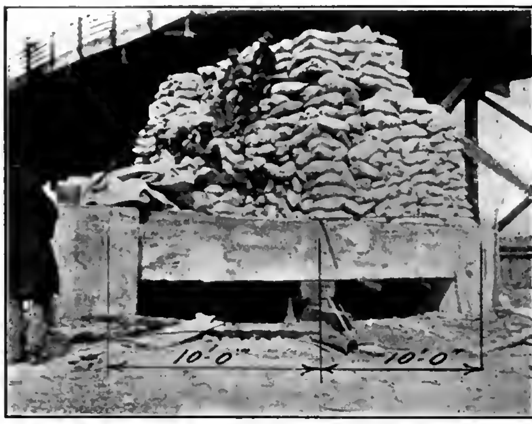
Cracks In Outer Beam.



Load-Deflection Diagrams.

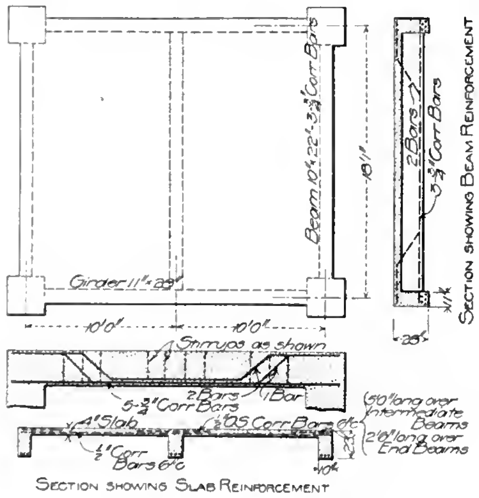
the relation between deflection and load per square foot can be seen. In this case the points noted agree very closely with the average curve. As the deflections were all noted with reference to the girders, the influence of the settlement was eliminated. At a load of 385 lbs. per square foot, two fine cracks appeared near the middle of the beam on the side adjacent to the slab previously loaded with 900 lbs. per square foot. These cracks extended less than 2 in. on the bottom from the edge of the beam, and showed no further development until a load of 430 lbs. per square foot, when cracks were found to extend entirely across the bottom of the beam. At 470 lbs. a fine crack appeared across the upper corner of the beam at the west end, intersecting the slab at about 12 in. from the end of the beam, and the girder the same distance down. The loading was continued with increasing deflections as shown on the curve until 611 lbs. per square foot was reached. The beam was allowed to stand over night with this load, and the deflection increased 1/8 in.; the cracks at this stage were about 1-16 in. wide at the bottom.

About 24,300 lbs. of the load was then taken off the two outside beams and placed directly over the central beam, with a space in the middle to prevent arching of the load. This left a uniformly distributed load of 544 lbs. per square foot over the entire panel; the 24,300 lbs. directly over the beam would be equivalent to 135 lbs. more, or a total of about 680 lbs. per square foot. If to this is added 60 lbs. per square foot for the floor and beams, the ultimate load at which the beam failed was approximately 740 lbs. per square foot. The failure took place along the crack previously noted as running across the upper corner of the beam. With the dropping of this beam, the slab sheared off at right angles to the beam for a distance of about 3 ft. on each side, about 24 in. from the girders, and the lower inside edge of the girder was broken off, exposing the bars in the bottom for a distance of nearly 3 ft.



Uniform Load of 900 Lb.

Loading to Prevent Arching.



Details of Reinforcement.

In order to obtain a full loading of the west girder, a false work was erected by making a cribbing of ties about 10 ft. from the girder and spanning the distance between the ties and the girder with old rails. The distance from the bearing points of the rails on the ties to the center of the girder was 9 ft. 6 in.

With 154,800 lbs. uniform load on the main panel and 50,000 lbs. uniform load on the false work, making the actual load on the girder 102,300 lbs., fine cracks appeared in the middle of the girder on each side of the center extending about one-half the distance to the bottom of the slab, the deflection being 1/8 in. On the failure of the center beam as previously noted, the inside edge of the girder was broken off at the center, exposing the bars, and a horizontal crack was formed in the outside face about 12 in. from the bottom and about 3 ft. long.

Approximately 219,200 lbs. were then placed directly over the girder, none of the load being outside of the center of the spans of the false work and the main panel, and a space being left across the middle of the girder to prevent arching. This load caused a 1/2 in. deflection in the girder, but no further cracks appeared. Estimating three-fourths of the total load as carried by the girder under test, the load on the girder represented a panel of 360 sq. ft. loaded 620 lbs. per square foot, and the total moment in the girder was approximately 5,740,000 inch pounds, using the formula 1-10 wl, in which w is the weight and l the length. This load was allowed to remain on the girder over the next day, or about 40 hours. The deflection was then found to have increased to 3/4 in. and the cracks to have increased to about 1-16 in. at the widest point. The foundation had settled at one corner about 10 in. and at the other corners about 7 in., making any further loading impracticable.

It may be worthy of note that the floor slab and beam were designed to carry 600 lbs. per square foot ultimate load, and the girder about 85 per cent. of this load. These loads include the weight of the structure. On this basis, the slab carried more than 50 per cent., the beam 23 per cent., and the girder, at the time the test was discontinued, 13 per cent. above the computed breaking load.

One or two points seem evident from the foregoing—that formulas frequently prescribed in building laws, such as 1-8 wl, 1-10 wl, or even 1-12 wl, do not even approximately represent the carrying capacity of floor slabs. This also applies to the formulas in which strips are assumed to carry loads in two directions at right angles to each other, because such formulas will show that about 90 per cent. of the load is carried in the short direction when one side is twice as long as the other. The assumption that a floor panel is an arch—a groined arch, perhaps seems unsound in view of the small rise that is possible in a 4-in. slab with a 10-ft. span, as well as the decidedly large deflection noted in the center. The opinion has frequently been expressed that little if any reinforcement is required in a floor panel, because of the restrained condition of the edges. While future investigation may reveal the desirability of radical changes in the method now employed in reinforcing floor panels, the writers wish to state most emphatically that a large portion of the under side of the panel tested was under very heavy tensile stress, made evident by the number of small cracks that appeared at right angles to bars, and the flaking of the concrete as the load approached the ultimate. Beams and girders, when incorporated in floor construction, agree very well with computed strength if computations are based on 1-12 wl—in fact there seems to be a comfortable margin of strength above this, which to a certain extent will take care of uncertainties in workmanship. Beams in end panels, where incorporated and made monolithic with exterior girders, have nearly the same strength as in interior panels. Floor slabs, while stronger than computed by the ordinary beam formulas, cannot be loaded indefinitely with "no appreciable deflection."

The Upper Grays Dam, Consolidated Water Co., Utica, N. Y.

The following notes refer to a dam built under somewhat unusual conditions as to foundation and equally unusual requirements as to future extension. It is owned by the Consolidated Water Co., of Utica, N. Y., and is to provide additional storage for the water supply of that city. Investigation on the part of the company developed a good storage reservoir but with the severe drawback that the only available site for a dam was underlaid with foundations of clay, without either hardpan, gravel or ledge in sight. The clay was of a good quality and fairly tempered with sand. The difficulties of building on this foundation, however, were so great that it was tentatively abandoned and a new site selected where the foundations were adequate, but at a sacrifice of a large portion of the reservoir capacity.

At this stage the owners invited the Ambursen Hydraulic Construction Co., of Boston, Mass., to consider with them the situation and submit a design for a dam to be built on the clay foundation. They furthermore stipulated that the present height of the dam must be 30 ft. but with provision for future extension to a height of 40 ft., when additional storage should be required. This latter condition by itself was fatal to a solid dam on account of the cost of the 30-ft. dam being practically equal to the full cost of the 40-ft. dam when completed, assuming it was built at one time.

The borings indicated that the foundations could safely be trusted to support a working load of 1¼ tons per square foot with the clay confined against spreading. A broad floor was therefore laid out of such dimensions that the total load of the full-height dam under flood would be represented by a distributed pressure of 1.2 tons per square foot. The floor of course was amply reinforced in all directions and was pierced with a number of weep holes to relieve any upward pressure which might occur from accidental seepage and hillside springs.

Cut-off walls of reinforced-concrete were sunk in trenches at both the upper and lower edges of the dam, the former one being carried down 8 to 10 ft. until they intersected a bed of fairly good hardpan. The general arrangement is shown in the cross-section.

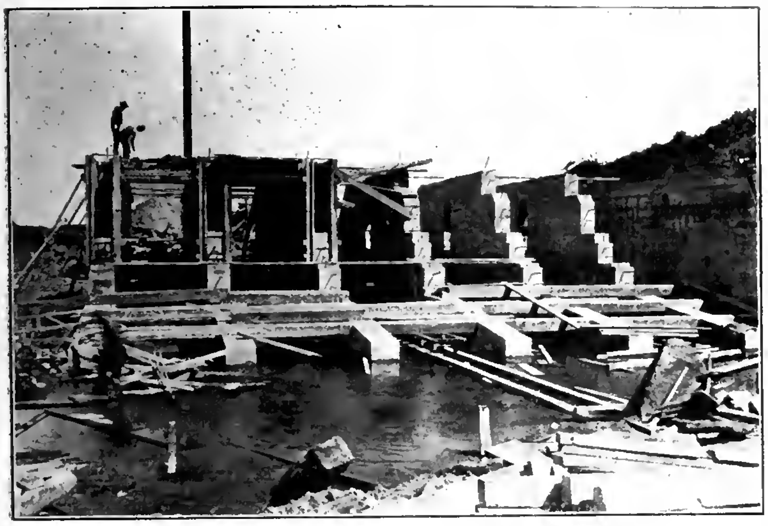
On this floor heavy buttresses were carried up, the downstream edges of which were stepped off as shown, with corrugated steel rolls left projecting from the vertical face of the steps so as to secure an ultimate bond with the extension when finally built.

The deck was carried up of a thickness proportioned, of course, to the ultimate height of 40 ft. plus flood, and finished with a temporary crest at the 30-ft. grade. Purlin timbers were then bolted to the nosings of the steps and on them was spiked a temporary apron of plank which served to carry over the ice and logs and at the same time protect the projecting rods from injury.

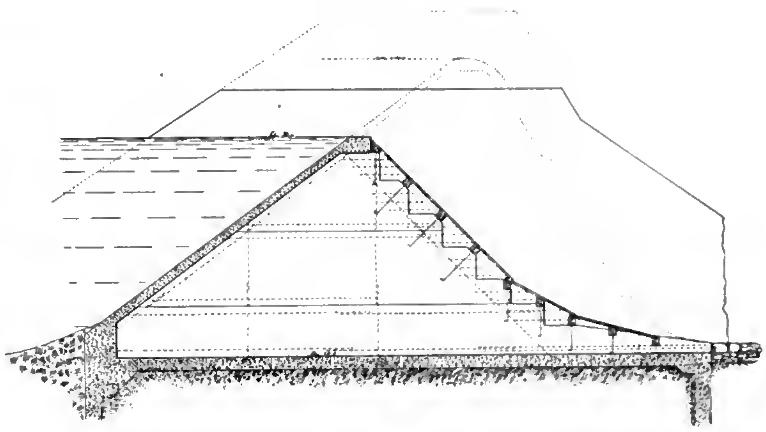
The bed of the river below the dam was paved for 30 ft. with a heavy body of boulders grouted together and finished to a cement surface.

The interior of the dam between the buttresses was fitted up for three measuring weirs, which enables the water supply to be carefully gauged and controlled.

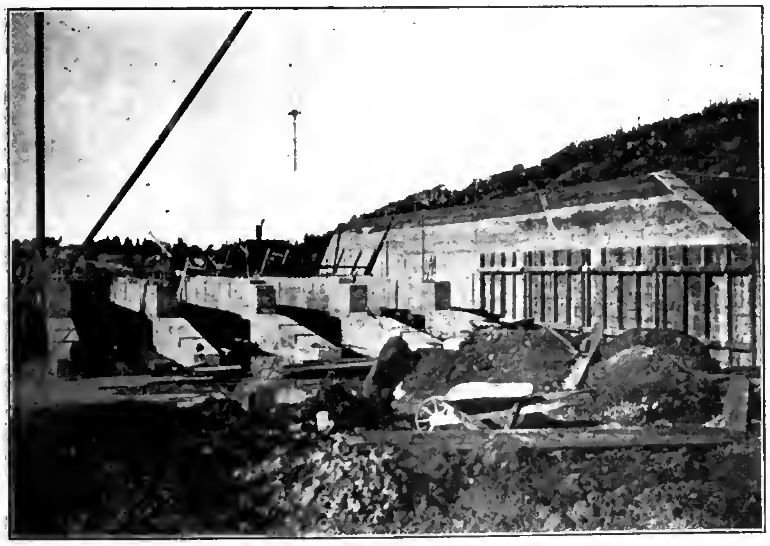
When the dam is raised to the full height of 40 ft., the temporary plank apron will be removed and used as forms. The latter will then be bolted up to each side of the present buttresses and filled with concrete, with a bond secured by means of the projecting rods. The final deck and full apron will then be laid in concrete, as shown by the dotted lines, which represent the dam as finally completed. It should be noted, however, that the additional 10 ft. section is self-stable and would be permanent even if there were no mechanical connection between it and the lower section. The use of the junction rods is obvious and cheap and is at least a satisfaction to the mind if of no very marked utility.



Buttresses of Dam.



Section of Upper Grays Dam.



First Lift of Buttresses.

Part of Deck in Place.

The dam was finished last fall and has been in successful service for some six months. This construction opens up new possibilities both in respect to dams on soft foundations and in respect to providing for future increase of height.

Two Building Collapses recently occurred in Philadelphia which were probably due to careless or negligent building methods. On July 13, while a gang of Italian and negro workmen were tearing down an old brick building four stories high, the floors collapsed and a number of men were injured, some fatally. The collapse was caused by overloading the second floor with brick from the third and fourth stories. The other accident occurred on July 10, and was the collapse of an incomplete reinforced concrete building on account of the premature removal of the forms, before the concrete had hardened. Several lives were lost.

Completion of Grade Rectification in the Battery Tunnel, New York.

The rectification of the minor irregularities in the alignment of the twin tubes of the Battery tunnel has now been completed. As described in several previous articles, these irregularities were of a secondary nature, due to divergencies in the movement of the heavy tunnel shield through soft material and were corrected by comparatively small elevations or depressions of the roof and invert so as to cut out the summits of the line of divergence and distribute the deviation over a longer grade, providing for smooth track and preserving the minimum clearance of 8 in. for the cars.

All of the work has been done in soft, wet sand or quicksand and has substantially consisted of removing some of the original arch or invert segments and replacing them with concrete or cast-iron construction, changing the cross-section of the tunnel from a circle to an egg shape. Only a small part of the work was done under atmospheric pressure but for nearly all of it pneumatic pressure was necessary, which of course added to the delay and expense involved. The depression of the invert consisted simply of removing the old segments and rebuilding the lining to the required new dimensions and was done piecemeal with little difficulty.

Where it was necessary to raise the roof, it was at first intended merely to cut through the old lining at about the springing line and replace the upper portion of it with new cast-iron segments providing for an elongated vertical axis and giving the required additional headroom. This did not involve any change of the invert in these parts of the tunnel, and operations were commenced as described in The Engineering Record of March 2, 1905, by the construction of interior timbering which afforded a jacking platform over a clear roadway in the lower part of the tunnel. Special powerful hydraulic jacks were inserted between horizontal distributing and reaction beams on the falsework and fillers fitted to the arch segments. After unbolting and disconnecting the segments on longitudinal horizontal lines, they were jacked 2 or 3 ft. vertically upward into the sand above the tunnel roof, the sand being partly removed to facilitate their displacement by "bleeding" through holes cut for that purpose in the segment webs.

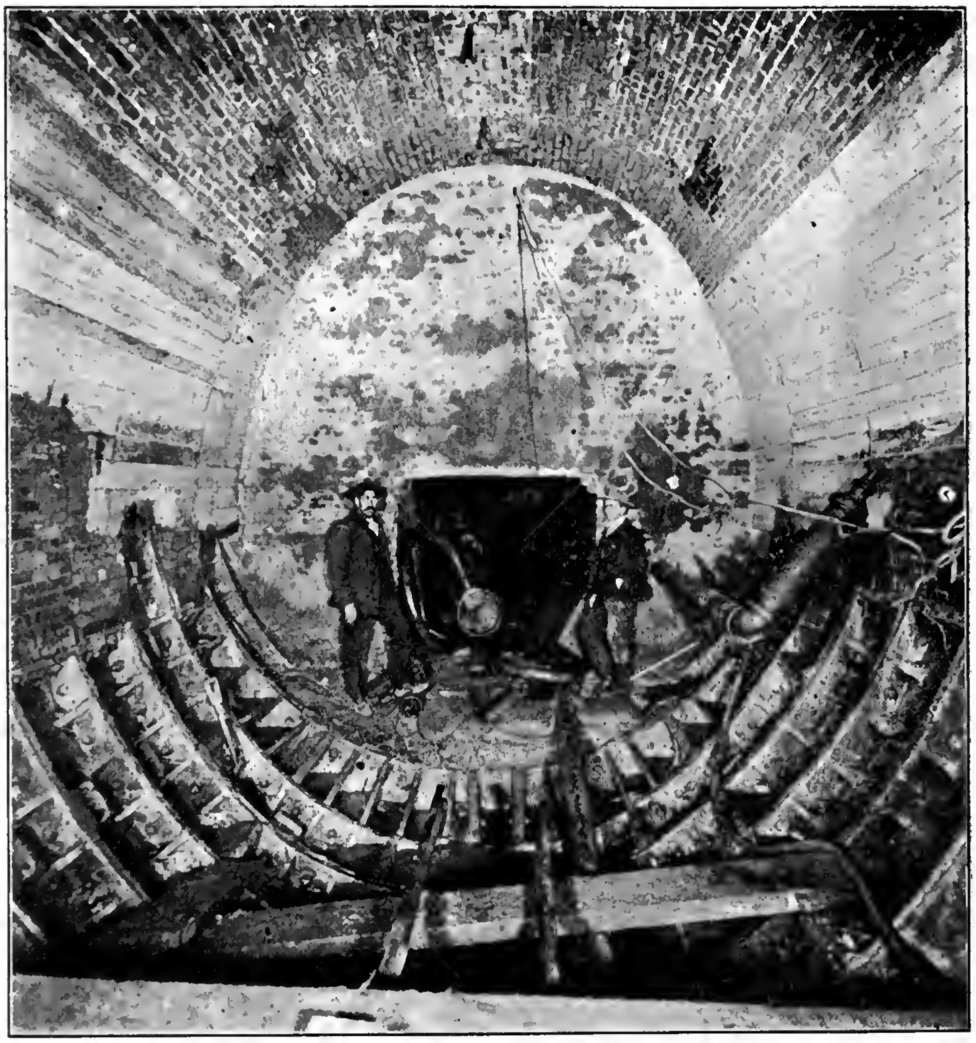
The jacks were removed and the segments temporarily supported by radial shores seated on transverse timber arches inside the tunnel and affording clearance for passage and operations there. On each side of the roof segments thus elevated, lines of thin vertical steel sheeting were driven to exclude the sand and retain the surface exposed between the separated portions of the lining. As the ground water line approached nearly to the lower edge of the sheeting and as that point was considerably above the bottom of the new tunnel lining, the question of removing the remaining segments on the sides of the tunnel and retaining the sand there while the new structure was built, became a very serious one.

It was at first proposed to drive poling boards nearly vertical on both sides of the excavation and as far as practicable from the tunnel axis, so as to enclose the new work, and then endeavor to drain the space between them and the tunnel lining by pumping so as to make it possible to remove the reamining sections of the old segments and construct the new work under atmospheric pressure, being prepared, however, to furnish pneumatic pressure if necessary.

Eventually, this plan was somewhat modified and the work was finally executed, as indicated in the accompanying cross-section, by jacking out the segments on both sides of the tunnel in exactly the same manner as the roof segments had been jacked out; before this was done, however, poling boards inclined somewhat from the horizontal were driven under the lower edges of the roof segments to support the earth there and the vertical sheeting was removed. The segments were then jacked out until their upper ends were nearly in contact with the lower ends of the poling boards, where they were maintained in position by radial shores wedged against the segments and reacting against the arch timbering or bracing in the tunnels. The surface of the earth exposed at the lower ends of the side segments was nearly horizontal, so that no difficulty was experienced in making it stable. During this operation the ground water level was lowered by drawing the water into the lower portion of the tube through several well points, so that it was not found necessary to provide a pneumatic pressure to exclude the water.

A new lining about up to the haunches was then built with concrete, reinforced by three curved 1-in. square bars for every 22-in. ring. This concrete enclosed the upper segments of the old lining and extended about 1½ ft. above them or 4 ft. above the springing line, where it was finished with a radial surface acting as a skewback to receive the 4-ring brick arch roof, which was built on it in preference to continuing the construction with concrete, because the brickwork could be more easily handled in the tunnel and required less time for setting after it was laid, thus considrably expediting the work. The space between the adjacent ends of the displaced segments and those which remained undisturbed in the lower part of the lining was carefully filled with concrete, sealing it against the earth and water pressure, and the remainder of the space between the displaced old segments and the new lining was carefully backfilled with solid brickwork. Care was taken to have the upper ends of the reinforcement rods project about 6 in. beyond the surface of the concrete lining to bond the latter thoroughly with the brick roof arch. The work progressed rapidly and steadily and when completed presented a very neat and satisfactory appearance.

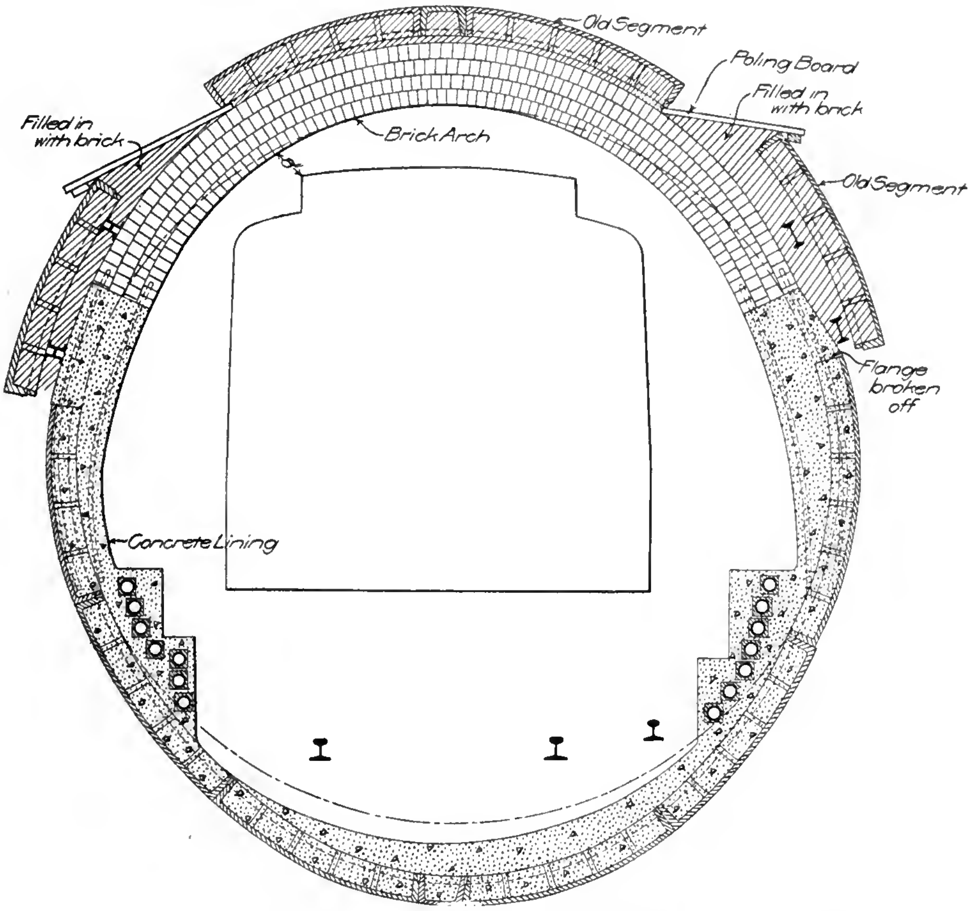
The reconstruction of about 210 lin. ft. of roof arch and 2,676 ft. of invert in both tubes was commenced in April, 1906, and was completed in June, 1907, with an average daily force of about sixteen men for each tube at a fraction of the outlay which it was conservatively estimated would be required for doing the same work by means of a shield built around the old tunnel. The latter method was considered to involve great difficulties in the construction and operation of the shield and serious doubts were entertained as to its practicability. Its control was believed to be a difficult and delicate matter, subject to the same difficulties encountered in the original construction which would, it was expected, be considerably augmented under the new conditions. That the work has been carried on so rapidly and successfully and at such a small comparative cost demonstrate a high degree of skill and ability in the engineers and contractors and must be a source of great satisfaction to all concerned. The work was designed and executed under the approval of the Rapid Transit Railway Commissioners, Mr. Geo. S. Rice, chief engineer, and Mr. Frederick Noble, division engineer. The general contractor was the Rapid Transit Subway Construction Co., Mr. Geo. H. Pegram, chief engineer, the details being designed and executed by Cranford & McNamee, Mr. J. C. Meem, chief engineer, and Mr. W. I. Aims, consulting engineer.



View of Portion of Rectified Tunnel.

Cold Twisted Steel Rods for Concrete Reinforcement.

Although a great deal has been written concerning reinforced concrete comparatively little has been published regarding the steel used as



One Method of Rectifying Battery Tunnel.

reinforcement. The subject was brought up at the recent meeting of the American Society for Testing Materials by Mr. Jesse J. Shuman, chief inspector of the testing department of the Jones & Laughlin Steel Co., in a paper that called forth considerable discussion in which diametrically opposite opinions were expressed by reinforced concrete specialists. Mr. Shuman's paper read as follows:

When a bar is twisted by a machine of the usual type it does not change in length; in fact one end is inserted loosely into the revolving die and there is no tendency to pull out. Hence the central fiber alone is unchanged in length and strength, and the great increase in the strength of the bar is an average of values that are widely different. Moreover, the size of the square has a direct bearing on this average; a point that is commonly neglected in specifications.

If square bars of any size be twisted until they have made one complete turn in 9 times the dimension of a side (pitch = 9), the metal on the corners is stretched about 11.5 per cent. as determined by formulas for helices. The areas of squares, however, vary with the squares of their sides, so that in a small bar the average stretch is greater than in a large bar, and the increase in strength is correspondingly greater. This is amply illustrated by laboratory results in any series of tests in which the size varies, and it should be recognized as a normal manifestation.

The moment the twisting machine has created a permanent set in the fiber, the steel has begun to increase in strength, in the same manner as higher yield-point and ultimate strength are set up in a bar when it is slightly stretched in a testing machine. As the twisting proceeds the yield-point ascends more rapidly than the ultimate strength. There is a point, however, at which the maximum strength of the bar is reached, and beyond which it is reduced somewhat before the bar twists apart.

The interesting behavior of half-inch squares of three widely different grades is shown in Table 1. It would clearly be a mistake to specify a number of turns approaching the maximum strength of the steel, for the internal strains in such a bar are already nearly enough to destroy it; yet it is not uncommon for engineers to do this very thing. In Mr. Shuman's opinion the number of turns should be about half the number at which the steel is at its maximum strength, and in the ordinary soft Bessemer product this means one complete twist in 8 to 10 times the size of the bar; in other words, the pitch of the twist should be 8 to 10 for Bessemer steel of about 60,000 lb. tensile strength. Basic open-hearth squares of similar grade should have a pitch of 5 to 7 in order to have their best properties developed. If carbons higher than ordinary structural grades are insisted upon, a proportionate concession must be made in the number of twists.

Excellent results have been obtained with both Bessemer and open-hearth steels of a wide range of carbons. It seems reasonable, however, that the grades that have been found to be best adapted to structural work would also be most reliable for reinforced concrete. Bessemer steels containing carbons up to 0.30 or 0.40 per cent. can be twisted successfully, and are very high in tensile properties, but they have the same brittlenes that constitutes the strongest argument against the various hot-rolled and hot-twisted concrete bars. The latter must be high in carbon in order to yield an elastic limit that even approaches that of the soft steel cold-twisted square rods. Surely the lowest yield-point in Table 2, in which are shown results on soft Bessemer bars, is high enough to suit the most exacting requirements.

On low-phosphorous steel the effect of twisting is not as marked as on Bessemer steel, the behavior in this respect being quite similar to that of the same steel when cold-rolled or cold-drawn. The lower results are readily raised, however, by carrying the twisting process further. Table 3 shows what can be expected of basic open-hearth bars of 55,000 to 65,000 lb. tensile strength twisted an appropriate number of turns.

Manifestly it would be a poor plan to use open-hearth steel softer than the tests shown in this table, but it would be both safe and advantageous to use steel up to about 0.35 per cent. carbon, with phosphorus under 0.04 per cent.

Inasmuch as the function of a reinforcing bar

View of Jacking Platform, Battery Tunnel.

is performed inside the elastic limit, the elastic limit is the feature of highest importance from the engineer's standpoint. It is here that the cold-twisted square excels all hot-finished sections, in Mr. Shuman's opinion, and must always continue to do so, for its elastic limit of 60, 70, and even 80 thousand pounds permits the use of less steel for the same service than can be guaranteed by its competitors.

In the testing laboratory it is necessary to take unusual pains to observe the yield-point, commonly called elastic limit, for the reason that the beam of the machine does not always drop when the point is reached at which permanent deformation begins. The machine should be run not faster than 5/8 in. per minute, and in the absence of an autographic device a pair of dividers should be held on the specimen until the yield-point is observed.

Specifications for cold-twisted bars should be consistent with the behavior of steel of known quality, and should recognize the empirical laws peculiar to the material. Thus, to summarize and add to points made in this paper, the following suggestions are offered by Mr. Shuman as a broad foundation for specifications.

1. Process. Specify whether open-hearth or Bessemer steel is to be used, or either. Open-hearth steel should contain less than 0.04 per cent phosphorus for basic and 0.06 per cent. for acid steel.

TABLE 1. EXPERIMENTS WITH ½-IN. TWISTED SQUARES, SHOWING THE EFFECT OF INCREASING NUMBER OF TWISTS.

Grade.	Turns per Foot.	Yield-point, lbs. per sq. in. Plain.	Yield-point Twisted.	Yield-point Increase Per cent.	Ultimate Strength. Lbs. per sq. in. Plain.	Ultimate Twisted.	Increase Per cent.	Elongation in 8 in. Per cent. Plain.	Elongation Twisted.	Reduction of area. Per cent. Plain.	Reduction Twisted.	Elastic Ratio. Plain.	Elastic Ratio. Twisted.
Soft Bess.	3	41,600	65,600	57.7	60,400	83,200	37.7	28.25	10.0	64.0	49.6	68.9	78.8
"	4¾	39,200	72,400	84.7	60,000	89,600	49.3	28.75	5.75	63.4	31.2	65.3	80.8
"	5	41,600	84,800	103.8	60,800	92,000	51.3	30.5	6.25	65.8	36.0	68.4	92.2
"	5¼	40,800	84,000	105.9	60,400	90,000	49.0	30.0	7.5	64.6	40.0	67.6	93.3
"	5⅞	40,000	80,800	102.0	60,800	88,800	46.0	27.5	3.75	60.9	25.2	65.8	91.0
Bess. .25 Carb.	3	48,800	83,600	71.3	74,000	96,000	29.7	25.0	8.0	53.8	48.9	65.9	87.1
"	4½	51,200	83,200	62.5	75,200	99,200	31.9	25.0	4.5	51.0	46.7	68.1	83.9
"	4⅞	52,800	88,800	68.2	75,200	104,000	38.3	24.0	4.0	54.4	44.5	70.2	85.4
"	5	51,200	84,200	64.4	75,600	102,000	34.9	22.5	5.75	50.3	44.5	67.7	82.6
"	5½	53,200	84,200	58.3	75,200	100,800	34.0	23.0	6.0	51.0	28.6	70.7	83.5
Soft O.H.	3	31,200	46,000	47.4	46,400	64,000	37.9	33.0	8.0	74.0	70.8	67.2	71.9
"	5	31,200	60,800	94.9	47,200	68,000	44.1	32.5	5.75	68.7	59.0	66.1	89.4
"	7	31,200	68,800	120.5	46,000	76,000	65.2	37.5	6.75	73.0	67.0	67.8	90.5
"	9	31,200	67,200	115.4	47,200	71,200	50.8	34.0	5.0	74.5	28.6	66.1	94.4

Note: Bars of each grade twisted off when given more turns than here shown. The "elastic ratio" is the ratio between yield-point and ultimate strength.

TABLE 2. TESTS ON PLAIN AND COLD-TWISTED STEEL BARS, SOFT BESSEMER STEEL.

Size Inches.	Turns per Foot.	Yield-point. Lbs. per sq. in. Plain.	Yield-point Twisted.	Yield-point Increase. Per cent.	Ultimate Strength. Lbs. per sq. in. Plain.	Ultimate Twisted.	Increase. Per cent.	Elongation in 8 in. Per cent. Plain.	Elongation Twisted.	Reduction of area. Per cent. Plain.	Reduction Twisted.	Elastic Ratio. Plain.	Elastic Ratio. Twisted.
¼x¼	4	36,800	80,000	117.4	65,600	92,800	41.5	19.5	8.0	64.0	53.8	56.1	86.2
¼x¼	4	38,400	78,400	104.2	68,800	91,200	32.5	17.5	7.5	64.0	56.5	55.8	86.0
⅜x⅜	3½	39,130	71,160	81.8	61,180	85,380	39.5	26.0	10.0	67.8	55.5	63.9	83.3
⅜x⅜	3½	39,830	72,560	82.2	62,330	85,380	37.3	28.0	12.0	62.4	60.8	63.9	85.0
½x½	3	41,600	65,600	57.7	60,400	83,200	37.7	28.25	10.0	64.0	49.6	68.9	78.8
½x½	3	38,600	66,000	71.0	63,100	91,200	44.5	27.75	10.0	61.7	48.1	61.2	72.4
⅝x⅝	2¼	40,020	73,860	84.5	63,100	85,560	35.6	26.0	9.5	63.8	55.6	63.4	86.3
⅝x⅝	2¼	40,940	74,180	81.2	64,640	84,960	31.5	28.0	11.0	61.2	56.7	63.3	87.3
¾x¾	1½	40,340	74,680	85.1	60,450	80,860	33.8	30.0	13.5	64.0	55.5	66.7	92.4
¾x¾	1½	39,120	72,720	85.9	60,080	81,060	34.9	31.0	14.0	62.4	58.1	65.1	89.6
⅞x⅞	1¼	39,380	71,340	81.2	59,460	77,960	31.1	34.0	13.75	59.2	58.5	66.2	91.5
⅞x⅞	1¼	39,640	68,700	73.3	59,200	75,980	28.3	34.0	10.0	61.1	56.3	67.0	90.4
1x1	1	36,000	66,000	83.3	61,000	73,900	24.4	32.0	6.5	59.6	43.0	59.0	89.3
1x1	1	37,400	67,500	80.5	61,000	74,000	21.3	33.0	9.0	56.7	53.1	61.3	91.2
1⅛x1⅛	⅞	37,550	61,640	64.1	58,820	70,680	20.2	30.0	12.5	60.1	49.3	63.8	87.2
1⅛x1⅛	⅞	38,330	63,100	64.6	58,820	70,580	20.0	31.0	12.5	56.6	50.6	65.0	89.4
1¼x1¼	¾	39,530	61,100	54.5	61,420	78,950	28.5	30.0	12.0	47.5	36.0	64.3	77.4
1¼x1¼	¾	38,251	62,510	63.4	61,300	79,270	29.3	30.0	6.0	45.2	31.5	62.3	78.8

TABLE 3. TESTS ON PLAIN AND COLD-TWISTED STEEL BARS, OPEN-HEARTH OF 55-65,000 LBS. TENSILE STRENGTH.

Size Inches.	Turns per Foot.	Yield-point. Lbs. per sq. in. Plain.	Yield-point Twisted.	Yield-point Increase. Per cent.	Ultimate Strength. Lbs. per sq. in. Plain.	Ultimate Twisted.	Increase. Per cent.	Elongation in 8 in. Per cent. Plain.	Elongation Twisted.	Reduction of area. Per cent. Plain.	Reduction Twisted.	Elastic Ratio. Plain.	Elastic Ratio. Twisted.
½x½	5	38,000	58,000	52.6	61,200	92,000	50.3	27.25	5.25	64.0	11.6	62.1	63.0
½x½	5	37,600	60,000	59.6	60,400	91,200	51.0	28.75	5.25	65.2	31.5	62.2	65.8
⅝x⅝	3½	34,130	60,000	75.8	58,660	75,450	28.6	27.5	6.25	62.5	55.2	58.2	79.5
⅝x⅝	3½	34,880	58,480	67.7	58,220	76,060	30.6	31.25	8.0	61.1	53.7	59.9	76.9
¾x¾	2½	31,170	52,800	69.4	57,020	69,670	22.2	31.0	7.5	61.2	46.5	54.7	75.8
¾x¾	2½	34,370	55,770	62.3	57,050	69,300	21.5	28.75	7.5	59.7	44.8	60.3	80.5
⅞x⅞	2	35,660	65,960	85.0	60,740	78,110	28.6	30.0	6.5	60.5	27.6	58.7	84.4
⅞x⅞	2	35,000	60,870	73.9	59,430	71,580	20.4	29.0	8.25	50.3	45.7	58.9	85.0
1x1	1¾	33,120	57,920	74.9	57,430	67,480	17.5	31.0	9.0	52.5	43.1	57.7	85.8
1x1	1¾	33,360	54,350	62.9	59,060	72,300	22.4	30.75	6.0	54.0	26.8	56.5	75.2
1⅛x1⅛	1½	38,560	66,140	71.5	68,760	82,560	21.5	32.5	7.75	49.3	14.8	56.0	80.1
1⅛x1⅛	1½	32,350	57,290	77.1	56,150	72,570	29.2	32.25	5.25	60.7	14.6	57.6	78.9
1¼x1¼	1½	33,740	62,230	84.4	55,550	68,890	24.0	30.0	7.75	46.7	30.7	60.7	90.3
1¼x1¼	1½	32,950	57,140	73.4	55,810	73,340	31.4	32.0	6.25	52.0	24.6	59.0	77.9

2. Carbon. This should usually be left to the discretion of the manufacturer, who insists that when carbon limits are named the tensile requirements should be left open.

3. Elastic Limit. For squares ½ in. and smaller, this should be at least 65,000 lb.; for squares ⅝ in. to 1 in. at least 60,000 lb., and for squares 1⅛ in. and larger at least 55,000 lb. Manufacturers can generally guarantee minima values somewhat higher than these, but the above would be a reasonable specification.

4. Ultimate Strength. To be recorded.

5. Elongation. At least 5 per cent. in 8 inches, or 12 per cent in 2 inches.

6. Reduction of Area. To be recorded.

7. Bend. Bars to bend cold around a pin twice their size without distress.

8. Number of Turns. For Bessemer steel, one complete turn in 8 to 10 times the size of the square; for open-hearth steel, in 5 to 7 times the size.

9. Number of Test Pieces. One tension test specimen and one for bending test for each melt used in each size.

10. Inspection. All tests governing the acceptance of material to be made at manufacturer's works. Inspector to have access to the bars prior to shipment, but the manufacturer is not relieved thereby from responsibility for unsatisfactory material. In this connection it may be stated that each bar is thoroughly cleaned by the twisting process, and that each piece is in a large measure tested at the same time, as no imperfect bar will stand the cold-twisting process.

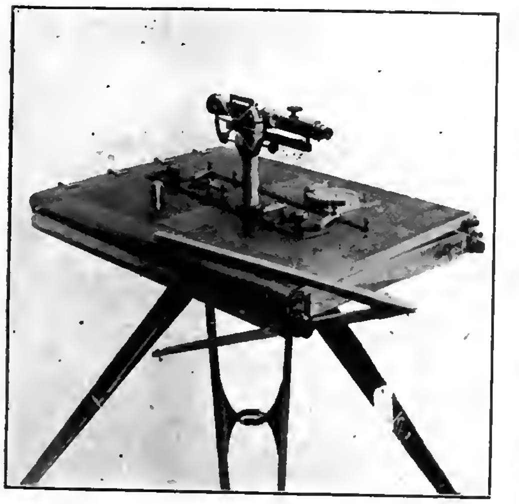
In the discussion of the paper, some of those taking part urged that no distinction should be allowed between specifications for structural steel and those for reinforcement steel. Mr. H. H. Quimby stated that all the steel for reinforced concrete work done under the direction of the Bureau of Surveys of Philadelphia was purchased under the same requirements as governed the steel for bridges and buildings. He was strongly of the opinion, however, that it was not advisable to specify properties of steel bars both straight and twisted, for it was enough to test them in one or the other form. Other engineers stated that there was every reason for departing from the requirements for structural steel in purchasing reinforcing steel. The properties required in structural steel are largely necessary on account of the hard treatment received by the steel during its fabrication into the members used in bridges and buildings. Reinforcement steel is not subject to any such severe treatment and on that account, it is claimed, the specifications governing it need not be the same as for structural steel. Mr. T. L. Condon, who was among those who expressed such opinions, stated that for many years he was an advocate of strich requirements for structural steel. When he first employed reinforced concrete he held that the same grade of metal should be employed in that work. After a longer experience in the design and execution of reinforced concrete he became convinced that the treatment of steel for reinforcement and the work required of it varied so widely from steel structural work that the differences should be recognized in specifications.

SUBMERGED ROCK BREAKING with a Lobnitz chiseling machine is now in progress at the harbor works of Blyth. About 150,000 cu. yd. of rock were taken out by drilling and blasting before two of these machines and two 700-ton hopper dredges were put in service, and on this account a comparison of the cost of the two methods of working is possible. At the recent engineering conference of the Institution of Civil Engineers Mr. J. W. Sandeman stated that each chiseler consists of a steel barge carrying shear-legs from which is suspended a steel ram weighing 15 tons. It is about 45 ft. long and 17 to 18 in. in diameter, and its conical point can be renewed. The latter is tempered so as to have a hard center with a soft exterior, which enables a sharp point to be preserved. The ram falls from a height of 8 ft. and an average of 8 or 9 blows is sufficient to penetrate the sandstone rock, which is of variable character, about 3 ft., sufficient to permit it being dredged to a depth of 2½ ft. One machine working day and night and allowing for all stoppages averages about 900 cu yd. of rock broken per week at a cost of 8.8d. per cubic yard. Adding various contingencies and expenses for repairs not included in the figure mentioned, the total cost is about 14.5d. Drilling and blasting the rock cost about 3s. per cubic yard and left it in a somewhat less favorable shape for removal than the rock broken by a chiseling machine. The blasted rock cost 3s. 2.2d. per cubic yard to dredge, while the broken rock left by a Lobnitz machine cost but 2s. 9.1d. to dredge. Summarizing all the figures it was found that the rock breaker made a saving of 2s, 2.6d per cubic yard.

The Topographical Survey of Staten Island.

The preparation of a topographical map of each borough of New York is required by the city charter. The work of preparing such a map of the Borough of Richmond was begun in August, 1902, five men being put in the field at that time. Since then the working force has been steadily increased until there are now about 120 men employed. This Borough, otherwise known as Staten Island, is triangular in general form, its area being 57¼ square miles. It has a maximum width and length of 7 and 14 miles, respectively. The island is very hilly, the highest points being about 400 ft. above sea level. Trees and brush cover a great part of the surface and numerous small streams divide it into a large number of small watersheds. Though some portions are thickly settled, the total population is only about 77,000, or 1,350 per square mile. The unusual conditions existing in the Borough have resulted in the adoption of methods which differ from those ordinarily employed for topographical surveys.

The primary purpose of the topographical survey is to secure data for planning a street system, but the information is also valuable in planning drainage and sewerage systems and most other public improvements. As in the other New York boroughs, the work of primary triangulation is to be done by the United States Coast and Geodetic Survey. As a preliminary measure a reconnaissance of the island was made by the topographical division of the engineer corps of the Borough and 43 stations have been selected and a map prepared showing their intervisibility. The stations include sixteen towers, four lighthouses, twelve public buildings and eleven other buildings, mostly residences. The base line is about 1¾ miles long.



Improved Plane Table.

Portable Tower.

As it was necessary to carry on the survey before points of control could be determined by tringulation, it was important to measure the primary traverses very carefully. It was soon found that the common 50-ft. spring-balance chain used horizontally was not satisfactory, because of the many steep grades and the extreme care necessary to secure accurate results. A system of measurement along the slope was therefore devised which depends on the plumb bob only at the ends of a measured line. A standardized 100-ft. steel tape is used, a 16-lb. pull being applied with a spring balance and the temperature taken as usual. Solid steel tripods, with a spread of about 2½ ft. and a height of about 2 ft., are used, on which to mark successive tape lengths, the elevation of the tripod heads being obtained with a wye level and proper corrections made for inclination and temperature. The tape is suspended between the end marks without intermediate support. Duplicate measurements are made, which must agree within 0.01 ft. × (0.00003 × the distance in feet), or the line is remeasured, which is rarely necessary. With a party of six a line can be run in this manner faster than with the 50-ft. spring-balance chain and the cost is about the same.

The traverses, which are limited to about 10,000 ft. in perimeter, are made as nearly square as practicable and usually close within about 1 in 30,000. The ten or more traverses in a section are adjusted together, commencing with the one having the largest error of closure, so that the maximum error in a section is made as small as possible. The sections are adjusted systematically one to another so that all errors are limited in amount and properly distributed. A single system of co-ordinates is thus obtained. The traverse work is built up in a compact body extending outward from the first adjusted section and is kept in advance of the work of filling in the detailed topography. Marble monuments, 4 in. square and 30 to 40 in. long, are generally used to mark important traverse points.

Level circuits for establishing bench marks are run with wye levels, forward and backward in closed circuits of about the same size as the primary traverses. A number of level circuits are adjusted together in the same manner as the traverse circuits. Bench marks are selected in pairs so that the elevation of any bench mark may be checked by another nearby. The bench leveling is kept in advance of the work of detailed topography and both field work and adjustments are carried forward as the survey proceeds.

In thickly settled districts the work of filling in detailed topography is done with the transit and the contours are traced by the wye level and located with the tape. Outside the thickly built-up districts the location of all instrument stations, monuments, property lines, buildings, and the like, is determined by the transit in advance of the contour work. The contours, which are traced with a wye level, and the other topographical details are then located by the stadia, using either the plane table or transit.

When the survey was begun, the transit and stadia method was generally used, the computations and mapping being done in the office, and the maps then taken into the field and checked. So many of the stadia traverses had to be rerun to close within the assigned limit of error, that it was soon found more economical to tape and level over all instrument stations and depend on the stadia method only for determining points about a station fixed by the transit, tape and wye level. A fault of this method is that too much depends on the judgment of the rodman in selecting points and when errors of reading occur, it is difficult to detect them.

The unsatisfactory results secured by the transit and stadia method and the fact that draftsmen could not be obtained to plot the survey promptly, led to the design of a special plane table shown in an accompanying illustration. This instrument is designed to accommodate the 27 x 40-in. Whatman's "Double Elephant" sheets on which the survey is plotted. Under each of the longer edges of the 22 x 28-in. board is a 2-in. roller with a ratchet with which the sheet can be drawn tight, a special clamp being used to hold the entire edge of the sheet to the rollers. The alidade is equipped with a 20-in. parallel ruler, which makes it unnecessary to give attention to the position of the ruler edge in taking a shot. The under side of the ruler and base plate is covered with white celluloid, which does not soil the paper like a brass surface. The telescope is of the inverting type, as are all those used on the work. It can be turned completely through a vertical circle and the vertical scale is equipped with a floating vernier. The sector-shaped swinging drawer turns on a pivot and can be opened and closed with little risk of disturbing the instrument.

The contours are traced with a wye level and plotted at once on the plane table sheet, the distances being determined by the stadia. Rods 12 to 18 ft. long are used and the telescope is kept in a practically level position. The contours are traced across all streets and streams and all features of any importance are shown. The map is thus available for use as soon as taken off the table. The traced contours represent the topography much more accurately than those drawn by interpolation and are much superior for grade studies. The instrumentman can at any time compare the map and the ground and errors or omissions are almost impossible. While tracing contours is somewhat more expensive than taking isolated elevations by the stadia, when the cost of computations and the inaccuracy of interpolation are considered the balance is largely in favor of the tracing method. The location of contours, on ground of average slope, requires a more accurate determination of the elevation of the selected points than of their horizontal position. The tracing method thus gives increased precision where it is most needed, while the reverse may be said of the transit and stadia method.

In open country, where the maximum slopes do not in general exceed 5 per cent., a party consisting of a plane table man, levelman and two rodmen can cover about 8 acres per day. When the country is rougher or wooded the area covered is less, about 5 acres being the minimum. In wooded country 2,600 ft. of contour line per day is considered good progress, and in open country a mile per day is about the average.

The field parties work every clear day during the year. During the winter they are kept in the wooded districts as much as possible and in the summer when the foliage is heavy they work in the open. To facilitate the work where brush is thick, a portable tower has been devised on which both plane table and level may be set up. With the tower a very long rod is used and the contours can thus be traced without clearing off the brush. The platform is 8 ft. above the ground and is 9x6 ft. It is made in two sections, each 3x9 ft., so that it may be more readily carried about. The posts are 4x4 in., the braces 2x1 in., the platform stringers 2x4 in., and the floor 1-in. matched flooring. Bolts with thumb nuts are used to fasten the various parts together.

In connection with the transit and stadia work two portable field offices have been used in which the plotting can be comfortably done in all weathers, close to the field party. These offices, which were described and illustrated in The Engineering Record of Dec. 19, 1903, are sub-

stantially built of wood, with glass windows and awnings and are mounted on a spring wagon gear. The climate of Staten Island, while it is seldom too severe for field work, is so changeable that such shelters are very valuable.

The survey is plotted 27x40-in. sheets to a scale of 50 ft. to the inch. The contours are shown at intervals of 2 ft. below El. 50 and at 5-ft. intervals above. All important topographical features are shown and all transit lines and measurements to locate buildings, monuments, and property lines are given. This scale, while somewhat larger than that usually employed on such work, has proved very satisfactory for mapping thickly built-up districts. The plotting can be done with less strain on the eyes than with a smaller scale, and any errors due to inaccuracy or shrinkage of paper are diminished in magnitude. The cost of the survey depends mainly on the accuracy and amount of detail obtained, and when these remain the same the cost is not increased materially by the use of the larger scale. The least accurate part of the survey is the location of contours and topographical details by stadia measurements. With the telescopes used, which were specially designed for stadia determinations, these measurements are correct to within about 1 ft. in 400, and as the longest sights are not over 600 ft. the maximum error of location of a contour does not exceed 1½ ft. If the map is to represent the contours as accurately as the survey warrants, a scale large enough to show errors of this magnitude is required. These maps have proved very satisfactory in preparing detailed plans for streets, drains and sewers.

Though the field sheets are well adapted for the study of details they are on too large a scale for many purposes, particularly for the study of a general street system involving the consideration of a large area at one time. It was decided that for such purposes a scale of 150 ft. to an inch would be most satisfactory, since a large area could thus be shown on a sheet of practicable size, which is necessary in comprehensive planning, and at the same time the topography could be represented with proper accuracy. At first the usual method of reduction with the precision pantagraph was used, but this proved so inaccurate and expensive, particularly when much detail was required, that resort was had to photography. Photographic prints of topographical sheets can be copied by means of a stylus and carbon paper if only one copy is needed, but when a number of copies of each large-scale map are required they can be obtained best by photolithography, by which all the details of the original field sheets are reproduced accurately and economically.

The lithographic sheets are made the same size as the field sheets and nine of the latter are required to make one of the former. The field sheets have to be carefully matched in order that the junction of the separate sheets will not be apparent, and lines and letters have to be made of proper strength. Negatives, 8⅓x12⅔ in., are first taken of each field sheet. Prints from these negatives are then made on photolithographic transfer paper and these prints are then carefully trimmed, mounted, matched and pasted together upon a large sheet of paper. This built-up transfer is then put down in the usual manner on the lithographic stone, from which as many copies are printed as are desired. The maps of the Borough of Richmond have been printed in editions of 400. On account of the number of processes involved and wetting and stretching of the paper, care is required to preserve the accuracy of the scale, but the error need not exceed 1 in 500. These lithographs fully meet the requirements for maps on which to project street layouts and similar studies, as they contain all the data on the field sheets.

About 764 27x40-in. topographical sheets will be required to map the entire borough. Of these, 245, covering much of the most thickly settled portions, are either completed or in progress. Since the survey was begun the work has been done under the direction of Mr. George W. Tuttle, engineer in charge, and Mr. Louis L. Tribus, consulting engineer and Commissioner of Public Works. The improved plane table was designed by Mr. Edward M. Law, assistant engineer. Nine of these instruments are now in use, all of which were supplied by the Keuffel & Esser Co., New York.

MAINTENANCE-OF-WAY WORK has a direct influence on the cost of repairs to electric railway equipment, according to Mr. W. R. W. Griffin, of the Rochester & Eastern Rapid Ry. In 1905, the second year of operation of that road, $11.20 per thousand car-miles was spent for maintenance of way, $14.52 for maintenance of cars and $5.20 for maintenance of electrical equipment. In 1906, $15 per thousand car-miles was spent on maintenance of way, $10.77 for maintenance of cars and $5.42 for maintenance of electrical equipment. This saving of $1.01 per thousand car-miles in the total maintenance charge (after eliminating expenses for painting and damaged car bodies) is attributed to the better condition of the track during 1906.

The White-Souther Endurance-Test Specimen.

A paper read before the convention of the American Society for Testing Materials by Henry Souther.

For certain classes of work, I believe that an endurance test is the best measure of the value of any given material for any given purpose.

Back in the days when the bicycle was most popular this fact was forced upon me, and I rigged up in my laboratory many forms of endurance test. I not only used test specimens as such, but I tested by endurance methods many structures, as, for example, assembled wheels, assembled bicycle frames and forks, and bicycle cranks. All of these tests answered the problems for which they were contrived with the greatest finality. I did not hesitate to make recommendations based upon the results obtained; they were conclusive.

The one possible exception to this statement refers to the endurance-testing machine for test specimens. I took for my model the kind of machine used at the Watertown Arsenal, with which I was familiar. Much experience has been gained with that machine, and a great many results were available in the government records; so I hoped it would answer every purpose. The results obtained with it were not as consistent as they should have been, although, as I have already stated, much good work was done and definite results obtained, upon which to base recommendations.

TABLE 1. RESULTS OF ENDURANCE TESTS OF STEELS WITH FIBER STRESS OF 53,600 LB.

C.	P.	Mn.	S.	Si.	Ni.	Cr.	E. L. sq. in., lbs.	M. S. sq. in., lbs.	Red. of Area, Per cent.	Elong. in 2 in., Per cent.	Endurance End No. 1.	Endurance End No. 2.	Remarks.
.40	.037	.63	.033	....	....	....	59,800	81,800	51.8	30.5	19,300	Jumped and bent	Natural condition.
.47	.049	1.14	.043	....	....	....	75,900	113,400	56.3	28.5	156,600	Taken out	do.
.25	.008	.59	.007	....	3.49	....	55,400	79,800	61.8	29.5	33,500	75,400	do.
.30	.059	.62	.012	....	3.63	....	61,300	90,800	46.8	23.5	165,000	435,000	do.
.35	.013	1.82	Trace	.609	2.02	....	....	176,800	35.0	11.5	108,301,900	108,301,900	Annealed at 1150° F. Did not break.
.287	.035	.62	.027	....	....	....	157,200	178,200	32.9	12.5	615,100	636,600	Natural condition.
.267	.043	.41	.063	....	.722	....	111,400	140,400	57.5	20.0	100,000,000	100,000,000	do. Did not break.
.385	.017	.40	.019	....	1.75	1.02	76,500	104,000	50.5	21.5	65,100	76,500	do.
.33	.014	1.66	.002	.766	1.18	1.17	66,300	89,300	66.8	29.0	3,900	4,200	do. Both ends bent.
.385	.017	.40	.019	....	1.18	1.17	84,600	109,200	57.4	18.5	609,300	1,492,800	Quenched at 1500° F. Annealed at 1050° F.
.894	.015	.31	Trace	....	....	....	77,500	135,700	21.8	8.0	70,500	135,700	Natural.
.894	.015	.31	Trace	....	....	....	70,300	131,800	18.4	6.0	56,100	17,000,000	Quenched at 1500° F. Annealed at 1050° F.
.656	.013	.39	.029	....	....	....	53,800	84,200	57.4	28.0	23,000	27,500	As received (Krupp).
.656	.013	.39	.029	....	....	....	81,700	155,300	51.0	19.0	89,700	188,700	Quenched at 1500° F. Annealed at 1050° F.
.405	.035	1.05	.027	.160	....	....	95,300	113,500	58.8	21.0	168,500	416,400	As received (Krupp).
.405	.035	1.05	.027	.160	....	....	129,500	143,500	52.3	16.0	147,700	205,700	Quenched at 1500° F. Annealed at 1050° F.
.313	.083	1.04	.039	.450	.57	.92	92,900	115,[illegible]00	55.1	22.0	1,040,100	11,044,000	As received (Krupp).
.313	.083	1.04	.039	.450	.57	.92	143,900	157,800	44.4	15.0	4,755,900	Taken out	Quenched at 1500° F. Annealed at 1050° F.

TABLE 2. ENDURANCE TESTS OF MANGANESE BRONZE.

Sample.	Cu.	Sn.	Pb.	Fe.	Zn.	Red. of Area.	Elong. in 2 in.	Sample.	E. L. sq. in.	M. S. sq. in.	Load.	Fiber Stress.	Endurance. No. 1 End.	Endurance. No. 2 End.
Gov. Stand. Casting Bronze....	59.47	0.71	0.18	1.60	38.04	25.1	26.0	36830	46,200	80,600	35	12,350	1,793,000	1,793,000
											75	26,500	1,220,100	1,904,300, broke
Rolled Rod....................	.....	0.71	....	....	.....	23.6	22.5	36831	55,200	72,500	35	12,350	1,572,100	1,572,100
											75	26,500	9,993,500	12,153,800 No. 1 broke
											100	35,300	....	3,710,800 No. 2 broke.
Rivet Stock....................	.....	0.71	....	....	.....	65.1	42.0	36832	38,500	64,100	75	26,500	10,078,700	10,078,700
											100	35,300	536,400	1,011,800, broke

Mechanical difficulties developed with it, due to its construction. The construction consisted of what amounts to a lathe bed with head and tail stocks 33 in. apart, and provided with universal joints, so as to permit the bending of the specimen, the load being applied at the middle supported upon some form of bearing, either roller or plain journal.

The specimen was objectionable, it being very difficult and expensive to make so long a one and get it exactly right. Owing to its length, it vibrated to a greater or less degree; the vibration, differing in different tests, put upon the specimen different, and immeasurable stresses Also, at the point of application of the load, more or less heat developed and to a greater or less extent must have influenced the test, because the heating came at the point of greatest bending moment. High speeds with this form of specimen were out of the question, because of the heating, and something like five or six hundred revolutions per minute seemed to be the upper limit. All this criticism is not with the idea of detracting from the value of the work

done at Watertown, because I believe it has been very valuable, but simply to show my starting point in the evolution of an endurance machine.

With all these facts in mind, Mr. Maunsel White and myself devised a test specimen which seems to do away with all the objections mentioned without introducing others of serious moment.

This specimen, measuring about 13 in. over all, is a comparatively cheap one to prepare; also, as it is large at its center, there is little trouble in the lathe due to bending. It is, therefore, quite easy to make accurate to size and straight. It is a double-ended specimen, which makes it possible to obtain definite results, even though there may be a flaw or other defect in one end. This double-ended specimen also gives check results in case both ends are sound. I feel that the higher of the two results is the proper one to accept, inasmuch as it is the highest measure of the efficiency of the material under test, and no material can endure beyond its capacity.

The specimen is supported at the center portion on large ball bearings, and may be rotated at very high speeds. No heat is produced, at least no great amount of heat, and, even if it were, the center portion being larger than the ends, it would matter little. There is no wear of any kind on the specimen, the loads being applied at the ends, not at the point of greatest bending moment. The critical points of the specimen are, of course, the fillets, coming at the point of greatest bending moment. These must be accurate to shape and perfectly machined; slight flaws or defects at this point are serious.

I append herewith a table of characteristic results obtained without going into exact details. This series of tests was undertaken to get a ground work for suitable comparison. For example, the first specimen may be classed as high grade machine steel. It will be noted that the elastic limit was about 60,000 lb. per square inch, as shown by the tensile test. My idea was to break this quickly, and I therefore loaded it with a fiber stress of 53,600 lb. per square inch and quick results were obtained, as expected. I then went forward with high grade material, one after another, variously treated, the heating being carefully done in an electric furnace in connection with a pyrometer. There are some exceptions to this, in that some of the specimens were tested as received.

The results obtained show the tremendous possibility in the use and adoption of high grade materials. The tests also show that in order that the endurance test may not be too prolonged and therefore not practicable, it must be conducted in such a way as to give quicker results than some of those given. For example, it is practically out of the question for a manufacturer to wait for a machine to run one hundred million revolutions, or probably ten weeks, running night and day at 1,300 r. p. m. Consequently, I have adopted lately an increasing fiber stress; for example, starting the test at 50,000 lb. fiber stress, and, if the specimen endures for ten million revolutions, increase it to 60,000 lb.; and after the next ten million increase it to 70,000 lb., and so on until rupture occurs. It is still possible to compare the behavior of various steels and to show the results graphically. The test is, consequently, more useful because more valuable.

A higher number of revolutions than adopted for our tests may be used with this machine, if considered desirable, but I feel that 1,300 r. p. m., more or less, is a practical number. For example, the crank shaft of an automobile rotates at that speed, and there are many rotating parts in the manufacturing industries that are near that speed. Were a very much higher number to be adopted certain unknown elements might be introduced into the test that would render the results questionable, as being a test carried on under abnormal conditions.

For any manufacturer whose product goes into machinery subjected to dynamic loads, such a test ought to be extremely valuable. Further, the heat treatment of steel and the great benefits derived from it are rapidly being appreciated and increasingly used by all manufacturers. Such a test is a measure of the benefit due to heat treatment. Moreover, I have found that certain clients in talking about the increased strength of new alloys and heat treating in general, have said—Oh! yes; of course there is a great increase in strength and apparent toughness and good qualities in general, but how about the capacity of the metals in such a condition to resist shock?" I believe that this test does show the capacity of metals to resist shock, whether of impact nature or alternate stress.

In the table of results given will be found a number of aluminum and bronze specimens which are very instructive.

TABLE 3. ENDURANCE TESTS OF ALUMINUM.

Mn.	Cu.	Zn.	At.	Spec. Grav.	M. S. sq. in.	Fiber Stress.	Endurance No. 1.	Endurance No. 2.	
0.11	7.84	0.00	92.05	2.86	*16,000	16,600	558,600	816,500	Broke
Trace	0.34	16.24	83.42	2.97	*25,000	"	1,550,400	1,618,300	"
.....	3.20	26.72	70.08	3.23	32,000	"	1,613,900	477,600	"
.....	6.80	22.78	70.42	3.22	....	"	3,438,400	435,500	"
.....	8.20	22.44	69.36	3.24	20,000	"	12,038,500	815,600	"
.....	3.00	27.00	70.00	3.30	*30,000	"	5,415,000	257,300	"
.....	....	27.00	.....	....	....	"	3,029,900	543,000	"
....	....	27.00	.....	....	....	"	2,513,300	707,200	"

*Estimated from other specimens.

We are just beginning to get at the results of tests on vanadium steels. The few we have that are trustworthy show a considerable benefit under the endurance test, but I do not like to put them on record, for there are certain features of the treatment unknown to me. We also had the misfortune to have our pyrometer go wrong in connection with the treatment of several specimens, and the results are, therefore, worthless. To generalize, however, it is my impression that vanadium will add to the endurance of any given steel if present in quantities aproximating 0.25 per cent. The increased endurance seems to be at least four to one, but in view of the above lack of knowledge on my part as to all the conditions, I do not wish to commit myself fully.

A Pile Pointing Machine.

A pile pointing machine has recently been built in England for the use of Messrs. E. Robinson & Sons, contractors for the Rotterdam harbor works. Its purpose is to taper the end of fir piles 20 in. square, leaving them 5 in. in diameter at the point and extending the taper back about 4 ft. Illustrations of the machine in "Engineering" show that the pile is clamped rigidly in a horizontal position, and a conical shaving head, with a knife on its inner surface like the old-fashioned pencil-pointing device, is then pushed against the end of the pile. The cone containing the knife is driven by a belt and the whole cutting head is gradually forced forward by a screw in the same way that the tool-holder of a lathe is traversed. The machine is stated to point a pile in about 15 min., leaving it in a condition ready to receive the iron shoe used at these works.

THE FIRST RAILROAD IN MOROCCO, Africa, was opened some months ago. It was built by a German company to haul stone from a quarry to tide-water and is only about 1¼ miles long.

Book Notes.

The Bureau of the Census, of the Department of Commerce and Labor, has issued a bulletin containing some instructive figures of the condition of the electrical industry in 1905. The author, Mr. T. Commerford Martin, has succeeded in investing the dry statistical data of an ordinary census report with deep interest by his explanation of the changes in the electrical art which are the underlying cause of the numerical developments in the classes of apparatus for which figures are given. The report is, in fact, a well-written and authoritative summary of progress in electrical engineering during the five years ending Dec. 31, 1904.

It is pretty well recognized now that in preparing a textbook on certain engineering subjects for class room use it is advisable to abandon some of the conditions which would govern the writing of a treatise for specialists. The requirements of teaching and the knowledge possessed by students when they take up a subject must be considered in determining the sequence of the topics in a school book, and the author's ability as an instructor is often revealed by the departures he makes in a text-book from the order of presentation of topics which would be followed in a treatise. These reflections are suggested by the excellent "Steam-Engine and other Heat Motors" by Prof. W. H. P. Creighton, which is a model text-book. It is highly gratifying to observe that the author has had the courage to compress the subject of thermodynamics into the space it really should occupy in an engineering text-book, and has taken into account the desirability of assuming that, by the time the student is able to take up the steam engine, he has already acquired in other classes and by association with upper classmen enough knowledge to warrant introducing the vital subject of indicator cards before the principles of thermodynamics are discussed. This is one of the many indications in the book of the author's knowledge of the needs of students as well as his thorough acquaintance with his subject. The latter is shown on every page in the concise yet clear manner in which the matter is presented and in the excellent choice of numerical examples, selected so as to make the student grasp all aspects of a topic instead of very limited portions of it, like most exercises in text-books. It is also shown in the presentation of a subject in all its complexity at the outset, and the deduction of the more simple cases from the general case, a procedure that is far better from a teaching point of view than the reverse one. In short, the book is one calculated to make the student think logically, to interest him in his work, and to respect what knowledge he possesses at the outset of his study. The contents of the volume are well indicated by the chapter headings: Review of elementary principles and general view of steam engine plant; Steam engine indicator and its calibration; Curves and the work of expansion; Zeuner and Bilgram valve diagrams and design of plain slide valves; Measuring the effects of heat; Measuring the effects of heat on water and steam; Measurements of heat losses; Entropy; Condensers and air pumps; Small auxiliaries; Multiple-expansion engines; Revolution control; Steam variation control; Steam engine tests; Superheated steam and steam turbines; Gas engines and gas producers; Boiling in a vacuum; Refrigeration; Appendix of useful tables and physical data. These subjects are presented with a nice appreciation of their relative importance and of the distinction between what is appropriate for a class in engineering and one in physics, and the volume as a whole is a particularly important contribution to our list of engineering text-books. (New York, John Wiley & Sons, $5.00).

Letters to the Editor.

EJECTOR PRACTICE.

SIR:—Regarding the inquiry in your issue of June 15 concerning the use of ejectors for delivering water against pressure, I think it is worth while to notice that in this year's "La Technique Sanitaire" there was a description of a successful arrangement of this kind made by Koerting Bros., of Hanover, Germany. The purpose of this arrangement was to force the water from a low-service reservoir into a pipe system when the latter is operating under the high fire pressure furnished directly by the pumps. The accompanying diagrams indicate the position of the apparatus. In the first diagram, for everyday service, the low pressure is directly from the reservoir, as shown. In the second diagram, showing the conditions during fire service, the high pressure from the fire pumps passes directly to the mains, the low-pressure reservoir being cut off by the valve, as indicated. Water from this reservoir is taken into the pipe line, however, through the ejector, which is thus in use under the conditions mentioned by your correspondent.

Yours truly, BORIS N. SIMIN.
Moscow, Russia.

ANCHORING BRIDGE SPANS.

SIR: May I put a few words in your columns about the anchoring of bridges against a vertical lift. Nearly all standard specifications provide that "all spans shall be anchored against moving sideways or lifting vertically" but how many of our modern bridges are securely held against a vertical pull is problematical. I do not refer to the design but to the setting of the anchor bolts at the time of erection.

Is the hole in the masonry drilled large enough to allow the cement fronting to find its way to the bottom to surround the anchor bolt thoroughly and efficiently and provide for the performance of its full duty? Of what use to drill a hole and stick a bolt 16 in. into the masonry and so small the fronting can penetrate but 4 or 5 in. and even then perhaps does not surround the bolt? Such a bolt may be good for moving sideways, but what about the emergency when the uplift comes?

In the ordinary proceedings for erecting a bridge the anchor bolts are put in last or any old time on the fixed end and the expansion end must be left till the span is swung. On both ends, therefore, the holes are drilled through the bed plate castings and their size is governed by the holes in these castings. When these holes are barely large enough to admit the bolts, which is often the case, we get the same condition down into the masonry.

If the bolts cannot be set before the span is erected, the writer's experience for best results has been as follows: Drill the hole as large as the casting will permit and at least an inch deeper than the bottom of the fixed bolt, unless it be with a split wedge end. Mix the fronting of neat cement or cement and sand to a good flowing consistency and fill the empty hole about one half full. Now let or drive in the bolt to its proper depth and if sufficient grouting has been poured into the hole it will overflow at the top.

The hole is now entirely filled, the anchor bolt is entirely surrounded and, when set, the writer believes, a better and more efficient anchorage can be secured than by the usual method of pouring in the grouting after the bolt is driven.

The co-operation of the masonry can then in emergency be depended upon and the bolt can perform the duty for which it was designed.

Very truly yours, H. N. PECK.
TUXPAN, JALISCO, MEX.

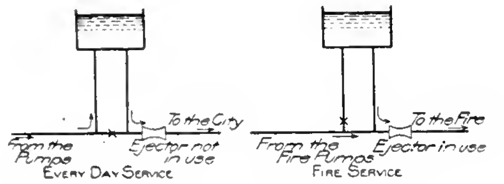
CHROMIC ACID AS A RUST INHIBITOR.

SIR:—I notice in your article on "New views of the cause of the corrision of iron" in yours of July 6th that you state as follows:

"The fact that chromic acid and its salts act as inhibitors of rusting has been known for some time, but no explanation of the curious phenomenon has ever been offered heretofore nor has its application to practice ever been suggested. Dr. Cushman has made a special study of this problem, and although it remains to be seen what practical benefits may develop out of these new ideas, it is most gratifying to be able to state that if any patents are granted covering rust inhibitors they will be taken out in accordance with the practice of the Department of Agriculture, so that they will be free for all American citizens."

From this it is evident that you have not seen the report made by the Committee of Tests of the Master Car and Locomotive Painters' Association, submitted by them at their last annual meeting in 1906 in which they state as follows:

"Steel Plate Exhibit No. 269 represents a small plate of steel exposed to the weather for twenty-



A French Ejector Application.

eight months, after having been treated with an exploited chromic acid rust-neutralizing process, the powerful black staining chromic acid preparation being knife applied over the entire surface, half of which was then coated with an especially furnished graphite and oil mixed paint.

"The Committee suggests a critical examination of this exhibit, which, it judges, shows that all up-to-date attempts at chemically oxidizing a steel surface against future corrosion have been attended with failure, such as is indicated by this badly under corroded plate so treated, but you will also please note that the single coat of honest graphite paint is still a protective coating, notwithstanding the hard task of holding its ground against this most powerful acid, said to be soluble only in water, which if true, would fully account for its apparent failure as a corrosive preventative."

Judging from the above and from our own researches, I do not believe that chromic acid can be used with any success as a protection against corrosion in metal surfaces.

Yours truly, FRANK P. CHEESMAN.

CABLE AND HOLLOW ROD DRILLS FOR BLAST HOLES.

SIR:—With reference to a letter from Mr. W. T. Kershner, of Hell Gate, Montana, published in your issue of June 1, 1907 (page 665), describing "a competitive test" of a Keystone cable drill and a Cyclone hollow-rod drill on a blast hole proposition of the Winston Bros. Co. at Hell Gate, we have the following correction to make:

The statement that "the drills were operated by the makers" is at least partly in error, as the Keystone Driller Co. had no representative or employe at the scene of operations either before or during the "test." Mr. R. H. Horrell, who operated the cable drill, is a competent driller but has been in no way connected with the Keystone Driller Co. Mr. Horrell was favorably impressed however, with the work of the cable drill, and we have the following report from him under date of May 16, on this subject:

"On April 8 I arrived at Missoula, Mont., being to report to Winston Bros. Co., to set up and operate the machines that were shipped there along in January, which were a long time on the road, on account of the heavy traffic west of St. Paul.

"Upon arriving there, I found that they had also ordered a Cyclone machine, which arrived a couple of days afterward, being put in competition with the Keystone machine. Only one machine was set up and operated for the time being. We commenced practically at the same time with both machines, the Cyclone people having a practical driller on the ground to operate the machine in drilling blast holes for the cut, which is to be 150 ft. wide and 125 ft. in depth.

"The material is taken out 20 ft. at a time, and hence the holes do not run over about 20 ft. in depth, the rock in most cases being exceedingly hard.

"During the time of being there we operated one machine, and in nineteen days we drilled 1,200 ft., which included the moves from place to place, while the Cyclone in the same length of time drilled 800 ft. In part of the time at this work, the work was in cleaning out holes that were sprung, and on this class of work we were set side by side with the Cyclone machine, starting at the same time. The Keystone succeeded in cleaning out fourteen holes to the Cyclone's six, in one day. This will give you an idea of the work being done by the two machines. The Cyclone people had an A No. 1 practical man on their outfit and it was pushed to the limit.

"In the amount of drilling that was done their rope was entirely worn off in drilling 800 ft., while in the amount of drilling that was done with the Keystone machine, there was no change made in the rope and the part that was used is still good for a number of feet yet. The superintendent and also Winston Bros. seem very well pleased and satisfied that the Keystone is far ahead of the Cyclone machine."

Yours truly, R. H. HORRELL.

Parts of Mr. Kershner's letter, such as this, "the best day's work for each drill was 73 ft. in 10 hours for the rod machine and 71 ft. in 12 hours for the cable machine" cannot but be misleading. Referring to a letter from Mr. W. O. Winston, of Winston Bros., to Mr. Horrell, on the subject of this test, the fact is found to be that the Keystone cable drill averaged 51 ft. per day, whereas the Cyclone rod machine averaged but 46½ ft. per day. Furthermore, the 5-in. cable drill hole was made at a cost of 23 cents per foot, while the 3-in. hole cost 23¼ cents per foot.

We append Mr. Winston's letter, which may be regarded as an unbiased report of the "test."

"Your letter to Mr. Young at Hell Gate has been referred to us for reply.

"As you are aware, we were not personally on the ground, and therefore do not feel that we can accurately gauge the merits of the two machines, Keystone and Cyclone. Our records show that the holes drilled by the Cyclone cost 23¼ cents per foot, and those drilled by the Keystone cost 23 cents per foot. The Cyclone averaged 46½ ft. per day, and the Keystone 51 ft. per day. The holes drilled by the Keystone were 5 in. in diameter and those by the Cyclone 3 in. in diameter.

"We are very well satisfied with both machines, and can say that we consider the Keystone certainly as good a machine for contractor's use as the Cyclone. In some cases the Cyclone, being light, might have some advantage. In other cases, the Keystone will be the better machine to have."

Yours very truly, KEYSTONE DRILLER CO.
New York, July 8.

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TABLE OF LEADING ARTICLES.

A New Code of Reinforced Concrete Rules.

Elsewhere in this issue will be found the full report of the joint committee of British architectural and building associations and government bureaus, which has been working for many months to adopt a code of rules for the design and construction of reinforced concrete works. This report is both interesting and important as emanating, primarily, from an institution of architects since it indicates that the Royal Institute of British Architects, the prime mover in the organization of the committee, is of opinion that reinforced concrete is to be recognized as an accepted material for general structural purposes. The report embodies a fairly complete set of general rules to govern the use of reinforced concrete without limitation in regard to the classes of buildings to which it may be applied. In other words, if there is any such limitation in the mind of this body of architects and builders, the limitation is neither set forth nor even mentioned in the report. It is fair to assume, therefore, that the committee intended no such limitation, especially in view of the fact that some of the regulations recommended for the design of reinforced columns apply to buildings of any number of stories in height. This is of interest, for the reason that some American architects are still averse to more than a limited application of reinforced concrete to building construction.

The report sets forth certain provisions which govern the design and construction of this class of work in substantial accord with similar provisions in force in the larger cities of this country, although some features are perhaps less extended and vary to some extent from corresponding provisions of American practice. The opening paragraph, however, is one which every engineer or other interested agent will indorse without qualification, viz: That the use of reinforced concrete has now become so general "in building and engineering construction, that a general agreement on the essential requirements of good work is desirable." If there is any one feature of reinforced concrete work imperatively needed at present in this country it is a body of uniform regulations designed to secure an excellent quality of well-built structures and so avoid the accidents which have been due to ignorance and indifference to suitable structural procedures. Reinforced concrete work needs, first, competent engineering design, and then intelligence and effective supervision to secure good materials and well considered structural processes. The accidents in reinforced concrete work which have taken place during the past two or three years in the United States and have thrown doubt upon the attainable excellence of this class of work are without any other cause than ignorance, incompetence or some sinister reason. Reinforced concrete is precisely like any other excellent building material in that it must be made and put in place under suitable specifications supplemented by competent design and supervision. One of the most commendable characteristics of the report of the committee is the recognition of these simple fundamental principles.

The proposals and specifications as to materials, as well as the practical instructions for actual fabrication of work, are all, in the main, well considered and adapted to secure the ends desired, although a few minor matters will, it is probable, be modified, by more extended experience. In this category is the provision that "work should not be carried on when the temperature is below 34 degrees Fahr." Experience during the unusually severe weather of last winter in New York city in constructing some of the heaviest and best reinforced concrete work ever built demonstrated conclusively that simple and effective measures for the protection of reinforced concrete during fabrication, including the use of enclosing canvas and salamanders, make it perfectly practicable to carry on this class of construction with the best results, with little or no interruption during the severest weather of a New York winter. It is also probable that further directions and provisions for the centers, or forms, and for their use will be set forth after more extended experience; to secure reduced expense, ease of removal and re erection and general efficiency in this part of the work.

That division of the report relating to methods of calculation is especially worthy of commendation, although here also there seems to be some lack of recognition of what has been done in the United States in reinforced concrete construction. Within the past year the ratio of the coefficients of elasticity of steel and concrete has often been taken as fifteen rather than twelve, which is frequently employed here. The usual neglect of the tensile resistance of concrete is recommended and the straight-line law of the variation of intensity of stress in the concrete beam is adopted rather than any law, such as the parabolic represented by a curve. While the curved relation is used by a good many engineers, the general belief seems to be that the straight-line relation is as good for all practical purposes as the other, and is more easy to use. It is an open question, however, which can be definitely settled only when more experimental results are available than we now have, and even then the choice will probably be governed largely by the temperament of the individual engineer, as is the case to-day with the Gordon and straight-line column formulas.

The methods of calculation, relating to columns, appear to be set forth without knowledge of the most advanced reinforced concrete column design. The Considère type of column alone is considered, with its extremely light longitudinal rods which are considered by some engineers to be actual elements of weakness, although this weakness is supposed to be cured, by the wire or other banding. This column can never be satisfactory for use in the highest buildings. The type of column used in the McGraw building in New York, with its self-supporting steel column enveloping the concrete, is admirably adapted to any height of building whatever, and to the strongest and best possible connections for floor beams and girders. Such a column fully justifies 750 pounds per square inch on the concrete instead of 500 pounds stated in the report.

In spite of a few secondary considerations of this character, the report as a whole is well calculated to secure satisfactory results in this field of construction, wherever its recommendations are efficiently enforced.

State Ownership of Water Powers.

The Fuller bill recently signed by Gov. Hughes is likely to have an important bearing on the great unused water-powers of the Adirondack regions, for under this measure the State Water Supply Commission is empowered to collect full information regarding the water powers of the State and to devise plans for their development under State ownership and control.

The Adirondack region has many possibilities in the way of hydraulic development, and already several projects have been put on foot for the construction of power transmission plants in that region. Were these simply projects relating merely to the utilization of the streams in the ordinary way, probably they would have attracted little attention and would not have aroused any sentiment in favor of State control. In point of fact, the greatest possibilities in the Adirondacks are believed to lie in large developments with elaborate storage systems requiring very extensive hydraulic works and, possibly the diversion of considerable streams. Under these circumstances, the public may be deeply concerned in the projects and a safeguarding of the public interest becomes doubly necessary. It is certainly necessary to develop the hydraulic

resources of the State to the fullest and so develop them that the best result possible shall be produced. To this end the proposed critical examination of the resources of the Adirondacks is a necessary preliminary. With the data once fully in hand it will be possible to carry out the utilization of the powers on a consistent plan and to the fullest extent.

Just how far actual development by the State will prove practicable or desirable it is impossible now to tell. It is possible that the State could successfully carry out the hydraulic work and lease the developed powers to transmission companies which would undertake the work of distribution, or the powers might be leased in their crude state with a provision by which the lessee should carry out the development in accordance with the lines laid out by the State. It is unlikely that the State would wish to undertake the full development and distribution, or that it would be desirable for it so to do. That these vast water powers are steadily assuming greater and greater importance is true, and the increasing cost of fuel will make them even more necessary in the future, so it is highly desirable that those which now remain unutilized should be developed in a systematic way. The aggregate result under a state power that can obtain from any system of water-courses depends in a large measure upon the skill with which the hydraulic work is planned, and if planned on a large scale after thorough investigation the final result will be vastly more satisfactory than if the development is carried on piece-meal by independent organizations.

The Engineering Record therefore believes that the fundamental principle of the Fuller bill is a thoroughly good one, and while it would dislike to see the State embark on public enterprises of an intricate character, it is certain that the State and its people will profit from a careful and intelligent exploitation of these water privileges. If it proceeds somewhat slowly, so much the better, for each year increases the resources of power transmission and renders development on a large scale and with a broad view of the future, the easier.

The Subjugation of the Ludlow Reservoir.

For many years the water of the Ludlow reservoir at Springfield, Mass., has had a most notorious reputation. It has been the subject of many investigations and its evil character has been laid bare in all American books on water supply which make any claim to thoroughness. The reservoir has stood forth from others as an unequaled cultivator of odors that rival the aroma of a fertilizer plant on a hot, moist day. The Water Board of Springfield has never enjoyed the distinction which ownership of this famous basin thrust upon them, and so, from time to time, they have asked various engineers and biologists how to make the reservoir behave as it was intended to. The Board has been accumulating this advice for many years, and has received all kinds of suggestions, ranking from physicking the water with germicides to treatment by repeated filtration. In the counsel of many lies wisdom, we are told, but the counsel in this case was too varied for the Board to sift, and so it eventually placed the burden on Messrs. Hazen and Whipple, the New York consulting engineering firm, which was engaged in preparing plans for an additional water supply for the city. A temporary additional supply was greatly needed pending the completion of the new works, which would not occur for several years, and the engineers naturally turned at once to the Ludlow supply, which is objectionable only on account of its offensive character at certain seasons. They have fortunately been able to construct works which have rendered this water suitable for city uses, and their success is a real engineering achievement.

The Ludlow reservoir was made by building two dams across valleys, thereby flooding a peat swamp with water to an average depth of perhaps 12 ft. A considerable proportion of the watershed is swampy. Ever since it was put in service thirty years ago the water has suffered during the summer from growths of micro-organisms. Anabæna has been the most abundant and best known of these, but probably many others have contributed to the tastes and odors, which have made this reservoir the most notorious in this respect of any reservoir in the United States. Possibly some reservoirs are occasionally more malodorous, but they are by no means so well known as this, which has generally been considered as the worst chronic offender in the country. The experiments that had been made on the purification of this water were all based on the use of continuous filtration, with aeration at different stages of the process. Two such filtrations in the experiments had sufficed entirely to remove the tastes and odors. One filtration with suitable aeration had usually sufficed to do this, but had proved wholly incapable of treating the water when the growths of organisms were at their height.

The idea suggested itself that, as the organic matter in the water was in a readily decomposable state and chemically was much like the organic matter in sewage, the system of purification which had given the best results in purifying sewage in Massachusetts might also be applicable to this water. The temporary plant designed was, therefore, in all its essential features, a sewage purification plant, in other words, intermittent filtration through coarse sand was used. By this method of filtration the water is aerated, not only before and after filtration, but during the whole process. The whole filtering material is drained once each day and its pores become filled with air, and this air, which is only partially displaced when the water is applied to the sand, serves to effect an additional aeration in the sand itself while the filtration is taking place.

It was expected when the plant was built that the quality of the water would be materially improved by it. It was not expected that complete removal of tastes and odors would be secured when the growths in the reservoir were strongest. At the same time it was recognized that the results to be obtained were more or less uncertain, for the process had never been adequately tested in treating a water of this character. The plant was put in service July 6, 1906, and served to remove the tastes and odors fully during that summer, although the growths in the raw water, for some reason, were not as great during this period as they had frequently been in previous years. The season of 1907 opened with a growth of uroglena as strong as had been previously observed in the reservoir, and this was immediately followed by a strong growth of anabæna, the most troublesome of all the organisms that have grown in this reservoir. Up to the present time the tastes and odors have been removed in an entirely satisfactory manner. The accomplishment of this result is probably due fully as much to the care and intelligence with which the filter has been operated by Mr. E. E. Lochridge, engineer of the Water Board, as to its design. Certainly the remarkable results that have been obtained could not have been secured with anything but the most skillful supervision. In connection with the removal of the tastes and odors there is a striking reduction of color which is most interesting. This reduction in color seems to be due to the coagulating effect of the iron, which is present in the ferrous state in the reservoir water at the times of growths and is precipitated by the aeration and filtration of the water, thereby accomplishing results which certainly could not be reached were it not for the iron.

The cost of the filter complete was about $50,000. It should be stated, however, that many parts were built in a temporary way and without reserve, and that it would not be possible to build a permanent plant of this type, with duplicate parts, for this sum. The quantity of water treated is 10,000,000 or 12,000,000 gal. per day. The Ludlow reservoir is able to supply this amount in a wet year or an average year, but would be quite incapable of maintaining the present rate of draft in a dry year; and for this reason the additional works now authorized would be necessary, even though the treatment of the Ludlow reservoir should prove in all respects to be feasible.

This experience teaches an important lesson, for it shows very clearly the practical value of the knowledge of the characteristics of water and the methods of purifying it which have been acquired by those who have been makilng a specialty of the subject. The progress of late has been extraordinary, and uncertainty concerning the nature and cause of many phenomena has given way to reasonably complete knowledge. But it is important to bear in mind that this increasing knowledge brings complications with it and is difficult to apply. The Water Board that attempts to determine how to improve the quality of a supply from what information it can gather from books will be very sorry that it assumed the role of a specialist, while the superintendent who carries out works for water purification without securing the advice of competent experts is not likely to obtain the best possible results at the minimum of expense. The purification of water and sewage are not simple problems, but are complicated by many conditions of different degrees of importance, which only specialists can appraise accurately.

Notes and Comments.

The Architectoral Development of Suburban Property will be investigated by a committee of the Royal Institute of British Architects consisting of Mr. T. E. Collcutt, president, Sir Aston Webb and Messrs. John Belcher, Paul Waterhouse, John W. Simpson, W. E. Riley, Leonard Stokes, Reginald Bromfield, and Prof. Beresford Pike. The purpose of the committee is to suggest lines on which a scheme can be prepared for the expansion of suburbs of large towns on a rational plan. This is a topic of much importance in the neighborhood of many large American cities, where the rate of growth is even faster than it is in the vicinity of European cities. Many suburbs suffer from a lack of proper planning when they were first started or before they began to develop rapidly. It is often considered that the control of the growth of a suburb is impracticable, but experience indicates that where attention is paid to the prospective development of transportation facilities and to the fitness of a locality for the homes of people of different classes, it is possible to guide the development quite closely. Just what lines the committee of the Royal Institute will follow is now unknown, but it goes without saying that all suggestions from a body of such eminent architects will prove valuable, although they may be impracticable for many suburbs. Too many committees of a somewhat similar nature have seen fit to recommend schemes of development which cannot be adopted on account of their costly nature or lack of fitness for the community for which they were intended.

AN ANOMALOUS ROAD SITUATION exists between Newark and Jersey City, respectively, the sixteenth and seventeenth cities of the United States in population, which are about 7 miles apart. Newark is noted for the great variety of its manufactures and has a heavy trade with most places in the vicinity. Jersey City, on the Hudson River water front, is also a manufacturing place, and the relations between the two cities would naturally be quite close. They are separated, however, by a stretch of marsh, and although several railways have been built across it, there are but two roads connecting the two cities, and both are in such a condition that travel over them is an unpleasant task. One of these roads is a plank affair, which may have been in fair condition years ago but now has its planks so loose that they are positively dangerous. A line of trolley cars runs along this road and their presence does not by any means improve the character of the highway. The other road is an alleged macadam affair, but its condition is such that nobody uses it who can avoid doing so. The importance of the lack of good roads in this district is so great that before long their improvement will undoubtedly be undertaken. At the present time the meadow land is regarded as the future site of many large industrial establishments, and a number of them have already been erected on its borders, notably the large plant of the International Pump Co. Many people are interested in developing this territory, in a general way, but it seems to be overlooked by most of them that until roads are constructed across it which are fit for use by both light and heavy teams, it will hardly be practical to get many industries to settle in the vicinity. But with good roads connecting Newark and Jersey City, and with water front facilities such as can be readily furnished, it does not seem improbable that the dreams of a great industrial center on the Jersey meadows will be at least partially fulfilled.

THE PHILADELPHIA FILTRATION CONTRACTS held by the McNichol firm have probably attracted more attention than any contracts for public work in this country for some time, owing to the attempt of the authorities of Philadelphia to have them annulled on the ground of fraud. A few years ago all sorts of assertions were made concerning the character of the work and the favoritism shown to this firm. When work was stopped a large sum was due the contractors as deferred payments, and after heated controversy and an unsuccessful attempt to show that a former chief of the bureau of filtration was negligent in the discharge of his duties, or worse, the whole matter was finally left to an arbitrator. On July 22 the latter decided that the city was indebted to the firm for more than $2,000,000 and the sum awarded was immediately paid over by the city to the contractors. The arbitrator also found that while one of the members of the firm was a member of the city councils he received about $51,000 as his part of the profit on the contracts, and this sum the arbitrator has directed him to return to the city. It is fortunate that the matter has at last been settled, for the controversy has resulted in great delay in the completion of much needed works for the purification and extension of the Philadelphia water supply. During the progress of the construction, the work was visited by many engineers, and this journal has yet to learn from any of them that the character of the work was not fully up to the average of good municipal construction. It is true, however, that the contracts were generally taken at a very high figure, as such work goes, and it is possible that better prices might have been attained had some of the conditions attending the award of the contract been different. So far as the engineering work and the actual construction are concerned, however, it is hardly probable that were the work to be placed under contract to-day, with all the knowledge gained in the interim, the workmanship would have been much different or the prices much lower.

THE SMOKE NUISANCE was the subject of a very important recent decision by the New York Court of Appeals in McCarty *v.* Natural Carbonic Gas Co., 81 N. E. Rep., 549. The question the court has to decide was: in a country district suitable for country homes, does the use of soft coal in a factory so situated that thick black smoke therefrom, great in volume and dense in quality, envelops and discolors a neighboring dwelling house, causing much discomfort and some financial loss to the occupants, constitute a nuisance, when such use of soft coal is not necessary for the practical running of the plant and is not a reasonable use of the manufacturer's property? The court decided that while the defendant's business was lawful and not of itself a nuisance, it was a nuisance as conducted, although a neighboring plant where anthracite coal was burned was not one. It was therefore ordered that the company must either burn hard coal or make such alterations in its plant that soft coal can be burned without causing offense. This opinion is particularly important because it does not refer to a smoky plant in a city, but to one in the country, where the house of the plaintiff is 840 ft. distant. It therefore establishes the rule throughout the entire State that no boiler plant may be so conducted as to be a nuisance without being subject to a permanent injunction until it is rendered practically smokeless. Whether it is a nuisance or not must be determined from all the facts in each case, and this is likely to cause considerable controversy, but the decision as a whole is nevertheless of much technical importance. It is fortunate that the upper court did not uphold the decision of the trial court, which forbade the use of soft coal under all conditions. The time is at hand when soft coal must be used far more extensively than at present, for the supplies of anthracite are running short except from collieries which it is expensive to work. There is no reason why soft coal should not be used except the practically universal lack of knowledge of American people concerning the way to burn it without producing dense smoke. It is sometimes said that smoke is inevitable where soft coal is used; the complete ignorance shown by those who make such a statement can be readily demonstrated by a visit to any large European city, where soft coal will be found in general use but without causing any greater obscurity of the atmosphere than in New York City to-day.

A WHOLLY UNJUST REQUIREMENT is contained in the proposed terms of the contracts for some of the New York Barge Canal improvements, which, it is safe to say, the eminent lawyer who is now Governor of the State would alter immediately if it were brought to his attention. Section 29 of the proposed contract for some improvements now being advertised reads as follows: "The State Engineer shall between the first and fifteenth days of each month make and file with the Superintendent of Public Works an estimate of the amount, character and quality of the work done and of material which has been actually put in place in accordance with the terms and conditions of this contract during the preceding month and compute the value thereof. The Superintendent of Public Works *may* within fifteen days thereafter, at his office in the City of Albany, N. Y., pay to the contractor from the money which shall have been appropriated for that purpose a sum not to exceed ninety per cent. of the value of the work performed and material furnished as so certified by the Engineer—retaining not less than ten per cent thereof until the contract shall have been completed and approved by the State Engineer and Superintendent of Public Works." Attention is called to the use of the word "may," as it makes the contract a mere gamble and possibly destroys its legality for want of consideration. As the clause now stands, whether or not the contractor gets his money depends on the whim of the Superintendent of Public Works, as there is no law to compel him to pay, nor any contract provision, and only a suit in equity, assuming one to be possible, would give the contractor relief from an official who was disposed to withhold money from a contractor until the latter had seen the right people. This journal does not believe that any of the people now in office would make any improper use of this peculiar wording of Section 29, but it is very strongly of the opinion that no contractor is justified in signing a contract involving large sums of money which does not protect him in the very vital matter of payments in a better manner than that above quoted. There has been so much scandal and so much wrangling over canal work in New York, that such a palpable opportunity for graft as this clause offers should be immediately done away with.

THE STRENGTH OF A DUMP CART is something few people have ever had an occasion to determine carefully, and for this reason some tests made by Prof. W. K. Hatt, in the laboratory of Purdue University are decidedly interesting. They were made on a stock cart built by the Troy Wagon Works Co., and rated at a safe capacity of 4½ tons. The purpose of the tests was to show just what resistance could be expected from such a cart under the most adverse conditions of loading. The first test was made by filling the body with sand and applying a heavy load on top of it with a testing machine. Failure did not occur until 36¼ tons had been applied, at which point the body gave way, but the running gear was uninjured; this is equivalent to a factor of safety of about 8½. The second test was to show the resistance of the rear wheels to the strain brought on them when the wagon rests on a side hill parallel to the slope, the latter being just below the inclination, 31 deg., which will cause the fully loaded cart to overturn. The theoretical force acting at right angles to the wheel rim under such conditions is 2,680 lb., while the test showed that the wheel had a resistance of 5,500 lb. to such a load, equivalent to a factor of safety of a little over 2. Inasmuch as no teamster ever drives a loaded wagon on a side slope as steep as this, it is evident that the actual factor of safety is largely in excess of that mentioned. The third test was to ascertain the resistance of the rear wheels to the strain that occurs when the wheel is caught in a rut and the horses attempt to turn it out of this rut. Prof. Hatt figured that theoretically the maximum strain which would be produced under such conditions was about 7,600 ft.-lb., while the wheel which was tested developed a resistance equivalent to 13,080 ft.-lb. This gives a factor of safety of 1¾, but as it will rarely happen that a single wheel is caught in a rut and has to withstand the whole wrenching of turning out, it seems likely that the actual factor is considerably higher. The fourth test was to determine the strength of the rear axles under actual load conditions, which was found to be 31,000 lb. Full details of the tests and results are given in a little pamphlet issued by the builders of the carts, and are instructive as showing the real strength of such wagons. They also show how the modern testing laboratory can be utilized to furnish definite information concerning appliances that, until recently, were considered to be beyond the range of experimental examination.

THE KINNICKINNIC RIVER FLUSHING TUNNEL AND PUMPING STATION, MILWAUKEE, WIS.

The Kinnickinnic River in Milwaukee, Wis., rises about 10 miles southwest of the central part of the city and empties into the Milwaukee River at a point half a mile from the mouth of that stream in Lake Michigan. The mouth of the Milwaukee River is a little to the south of the central business district of the city, the river running northwesterly for nearly half a mile from its mouth, and then turning to the north, which general direction it follows to beyond the outskirts of the city. The original portion of the city, and what is now its most congested sections, lies between the lake and the Milwaukee River, and to the west of the latter. The area along the Kinnickinnic River just south of the central business district is largely covered with factories, while farther out are residence sections, which are comparatively new. The Menominee River flows east and west through the city and also joins the Milwaukee River at the point where the latter turns to the north. The land on both sides of the Menominee River is fully occupied from its junction with the Milwaukee River to the city limits, a distance of about two miles, with factories and coal and steamship docks.

The sewerage system of Milwaukee is on the combined plan, practically all the sewers having their outlets in one of the three rivers. All three streams have comparatively small watersheds, which are of such nature that during dry weather the flow in them is slight. The Milwaukee River has an average width of 200 ft. and a depth of 20 ft. for about 3 miles from its mouth; the Kinnickinnic River is also 200 ft. wide and 20 ft. deep for nearly 2 miles from its mouth, and its channel is being dredged to that cross-section for one-half mile farther. The large cross-section of the Milwaukee River, the small volume of water flowing in it during eight to ten months of the year and the great amount of sewage tributary to it, long ago rendered the stream very offensive for all but two or three months in the year. In order to relieve the situation, a 12-ft. tunnel, 2,500 ft. long, was built in 1888 from an intake on the shore of Lake Michigan to the river at a point just downstream from a dam which is about 1½ miles south of the northern limits of the city. All of the sewage above the dam is intercepted and carried below the mouth of the tunnel. A 14-ft. screw-pump, placed in this tunnel near the lake, gives a head of 3 ft. to the water in the tunnel, which is sufficient to cause a large enough flow through the tunnel from the lake to flush the river. This pump is driven by a vertical tandem-compound steam engine in a pumping staiton near the lake. The water supplied through this flushing tunnel has kept the river in good condition at all times since it was placed in service over 19 years ago.

When the Milwaukee River flushing tunnel and pumping station were built, the areas along the Kinnickinnic River were sparsely covered with buildings, and the old channel of the latter river had not been dredged to its present cross-section. Since then these areas have become quite congested and the river has been widened, with the result that the pollution of the stream has been greatly increased and the nuisance caused by this pollution has been correspondingly aggravated, until in the last few years some means of relieving the situation became an imperative necessity. A flushing tunnel, 12 ft. in diameter and 7,182 ft. long has accordingly been built from Lake Michigan to a point on the river, 2½ miles from the mouth of the latter. A pump similar to the one in the Milwaukee River tunnel was placed in this tunnel at the river, and is driven by an engine in a pumping station built over the outlet end of the tunnel. The river will be dredged to the standard width of 200 ft. and depth of 20 ft. from the lake to this pumping station, and as it is only 20 to 30 ft. wide above the station no trouble from pollution in this portion of it is anticipated.

The intake at the lake, from which the tunnel starts, consists of two parallel, rock-filled pile piers which are 60 ft. apart and extend 385 ft. into the lake from the shore line, the channel between the piers having been dredged to a depth of 16 ft. As practically all heavy storms on the lake and most of the floating ice come from the northeast the intake has been built to provide against any difficulties which may arise from this condition. The pier on the south side extends 300 ft. from the shore line, an opening 75 ft. wide being left between it and the end of the intake; the pier on the north side is carried 75 ft. farther out, and has a section, 80 ft. long, at right angles to it at the end, which section is across the end of the intake channel and protects the opening along the south side of the intake. The corner between the end and north side piers is reinforced with a diagonal pier on the inside and is riprapped on the outside with heavy stone for a width of 32 ft. along the end and for 50 ft. from the corner along the side. The two parallel side piers converge at the inshore end, and in a distance of 85 ft. from the shore line the space between them is reduced to a width of 12 ft. A short length of concrete conduit connects the end of the intake with the tunnel proper, the cross-section of this concrete conduit being changed from square to circular from the outer to the inner end fo it.

The piers of the intake consist of two rows of round piles which are 10 ft. apart, outside to outside of rows. The piles in the outer row of each pier are 18 in., and those in the inner row 36 in. apart on centers. The two rows of piles in each pier are tied together at the water line by 1¼-in. rods spaced 3 ft. apart, these rods being anchored to 8x12-in. waling timbers. A row of 2x12-in. triple-lap sheeting is driven along the inside of each row of piling to hold the stone filling in place. The piers are also floored over 5 ft. above the water level.

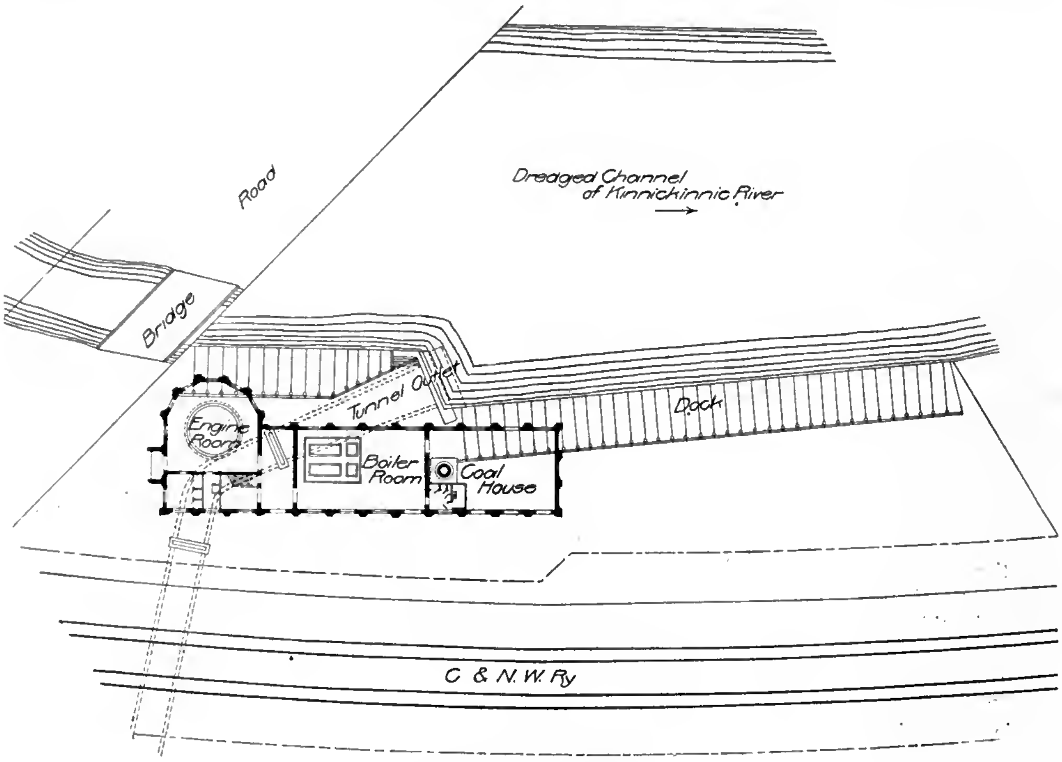
Floating debris and ice will be prevented from entering the tunnel through the intake by a heavy iron rack across the latter near the mouth of the tunnel. This rack is 37½ ft. across the face and is built in sections each 5 ft. wide and 19½ ft. high, the top of the rack extending 2 ft. above the water level. Each section consists of a ¾x6-in. plate frame having vertical 1-in. rods spaced 4 in. apart on centers between these plates. These sections slide in 8-in. I-beams placed vertically, so they can be removed and repaired readily.

The tunnel was built under city streets for almost its entire length. The invert of the tunnel is 16 ft. below Milwaukee city datum, which is approximately the average water level in Lake Michigan, at the inlet end, and 20 ft. below that level at the outlet end in the river. The excavation was all carried on in tunnel, with the exception of a short length of about 450 ft. where an old creek valley was crossed in open trench. The cover over the top of the tunnel varies from 5 to 80 ft. The tunneling was handled from six shafts, and on the whole, no difficulties were encountered while it was in progress, as the work was practically all through clay, or sandy clay, which for the most part could be shored with light timbering. Quicksand was encountered for a short stretch, however, and some trouble was occasioned in building this section of the tunnel.

The tunnel is lined with four rings of Milwaukee sewer brick laid in Milwaukee Portland cement mortar. Manholes for entering the tunnel are provided at each end of the latter. A 12-ft. cast-iron sluice gate is placed in the tunnel at the inlet end. A gate of the same size and type is also placed in the tunnel on each side of the pump at the river.

The pumping station was located at the river end of the tunnel instead of at the lake end, as is the pumping station for the Milwaukee River tunnel because a better site could be had at the river. The station is immediately along the bank of the river, between the latter and the Madison division of the Chicago & Northwestern Ry. and faces on a public highway, so the best of transportation facilities are available.

The building has a concrete substructure carrying a red brick superstructure trimmed with Bedford sandstone. The roof of the building is of 4-in. concrete slab, reinforced with expanded metal and carried by steel trusses resting on the side walls. The concrete slabs are covered



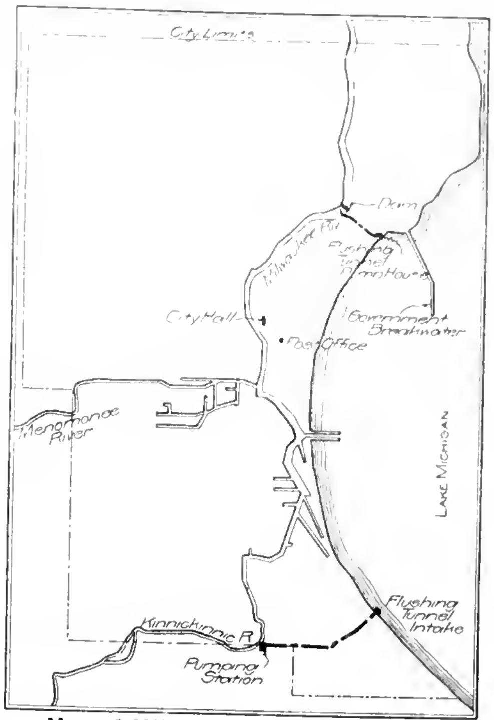
Plan of Pumping Station.

by green interlocking terra-cotta tile, which are laid in roofers' cement and have a glazed surface finish.

The general arrangement of the station and its surroundings is shown in an accompanying illustration. The station building is 34x165 ft. in plan in the clear, the front end being made wider to accommodate the engine which drives the pumps in the tunnel. The building is divided into an engine room, an engineer's office and storage room at the front, then a repair shop, boiler room and coal storage room, in order.

The screw pump and the engine which drives it are of the same type and generally the same arrangement as the pump and engine of the Milwaukee River flushing tunnel. The pump has a wheel 12.5 ft. in diameter made up with six impeller blades attached to a 12-in. shaft. This wheel revolves in a casing set in the tunnel lining. A cone, 6 ft. in diameter at the base, is placed concentric with the wheel on the side from which water approaches the latter and directs the flow on the blades. A second casing placed just beyond the wheel contains stationary deflector blades which reduce the swirling motion given to the water by the wheel.

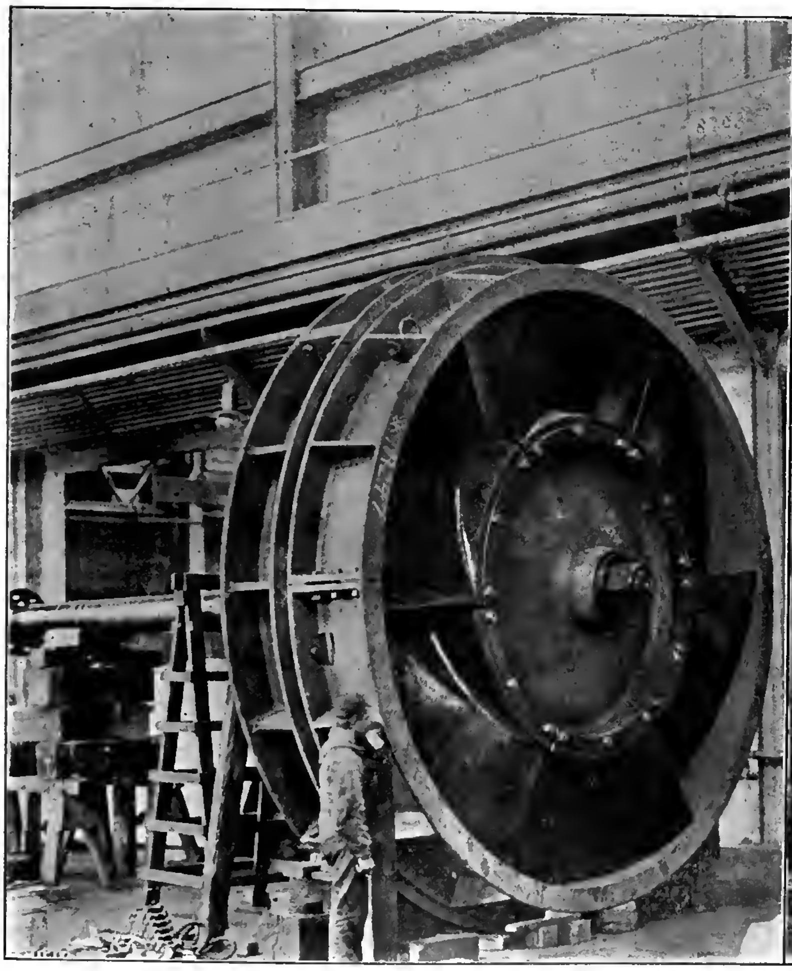
The 12-in. shaft on which the wheel is mounted is carried by an outboard bearing in the center

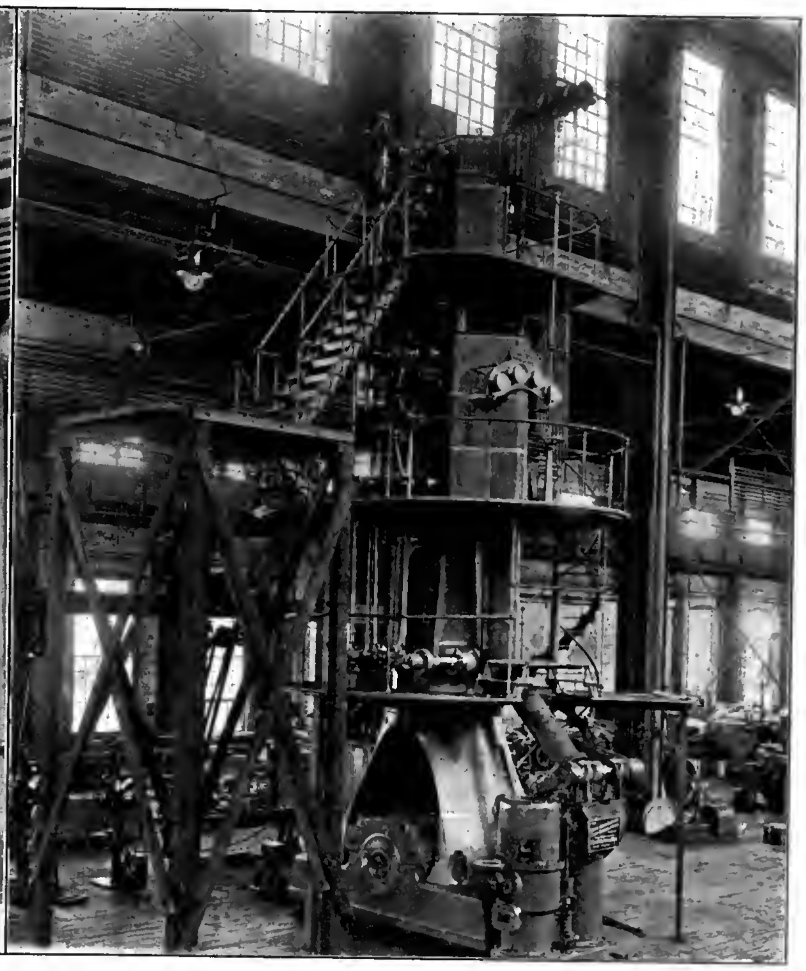


Map of Milwaukee Showing Tunnel.

the lake. These valves are all of the same general design. The two at the pumping station were built by the Coffin Valve Co., and the third by the Wm. Bayley Co. The valve disks are cast-iron. They carry on both sides at their circumference, a turned and planed brass ring, each of which seats against a brass ring carried by the valve box. A 2-in. pipe extends from the surface to a connection in the valve box so the sediment may be flushed out of the bottom of the latter. Each disk has two 3-in. steel stems, one on each side, which rise in channels in the sides of the valve chamber. These stems are each geared to a worm on a horizontal shaft on an operating stand over the chamber. This shaft is fitted with a windlass crank at each end and will be turned by hand, as experience with the original flushing tunnel has shown that the gates are rarely moved. 2.5-ft. sluice gate operated from the surface through a non-rising stem is placed on each of the large valve disks, and is used to equalize the pressure on both sides of the latter.

The station was designed and built under the direction of Mr. Chas. J. Poetsch, M. Am. Soc. C. E., city engineer of Milwaukee. Mr. B. W. Perrigo, assistant city engineer, was immediately in charge of the design and construction. The pump and engine in the station were built


Wheel of 12.5-Ft. Screw Pump.


Pump Engine Set Up in Shop.

of the second casing, where it is supported by the reflector blades. The pull on the shaft is taken up by a thrust bearing of the marine type, which is placed inside the engine pit. The shaft is 32 ft. long and extends through a stuffing box in the side of the engine pit and is direct-connected to the crank disk of the engine.

The engine is of the vertical tandem-compound condensing type with a Corliss valve gear, and is practically a marine engine without the reversing gear. It has sufficient capacity when supplied with steam at 140 lb. pressure, and running at 55 r.p.m., to drive the pump so the latter will raise 30,000 cu. ft. of water per minute against a head of 3½ ft. The pump for the jet condenser, which is supplied with water from the tunnel, and all other auxiliaries are driven by rocker arms attached to the cross-head of the engine.

Steam is supplied by two 72-in. by 18-ft. return tubular boilers equipped with Hawley down-draft furnaces and Foster superheaters. The furnaces are connected to a Custodis radial brick stack, 135 ft. high. The superheaters supply steam to the engine at a temperature of 100° Fahr. above that of saturated steam.

A 25-kw. direct-current generator direct-connected to a De Laval steam turbine furnishes power for lighting.

The large sluice gate valves on each side of the pump permit the latter to be shut off from the river and from the tunnel. The valve at the lake also permits the tunnel to be shut off from by the Allis-Chalmers Co., of Milwaukee, the Edward P. Allis Co., one of the constituent companies of the Allis-Chalmers Co., having built the pump and engine for the pumping station of the Milwaukee River flushing tunnel.

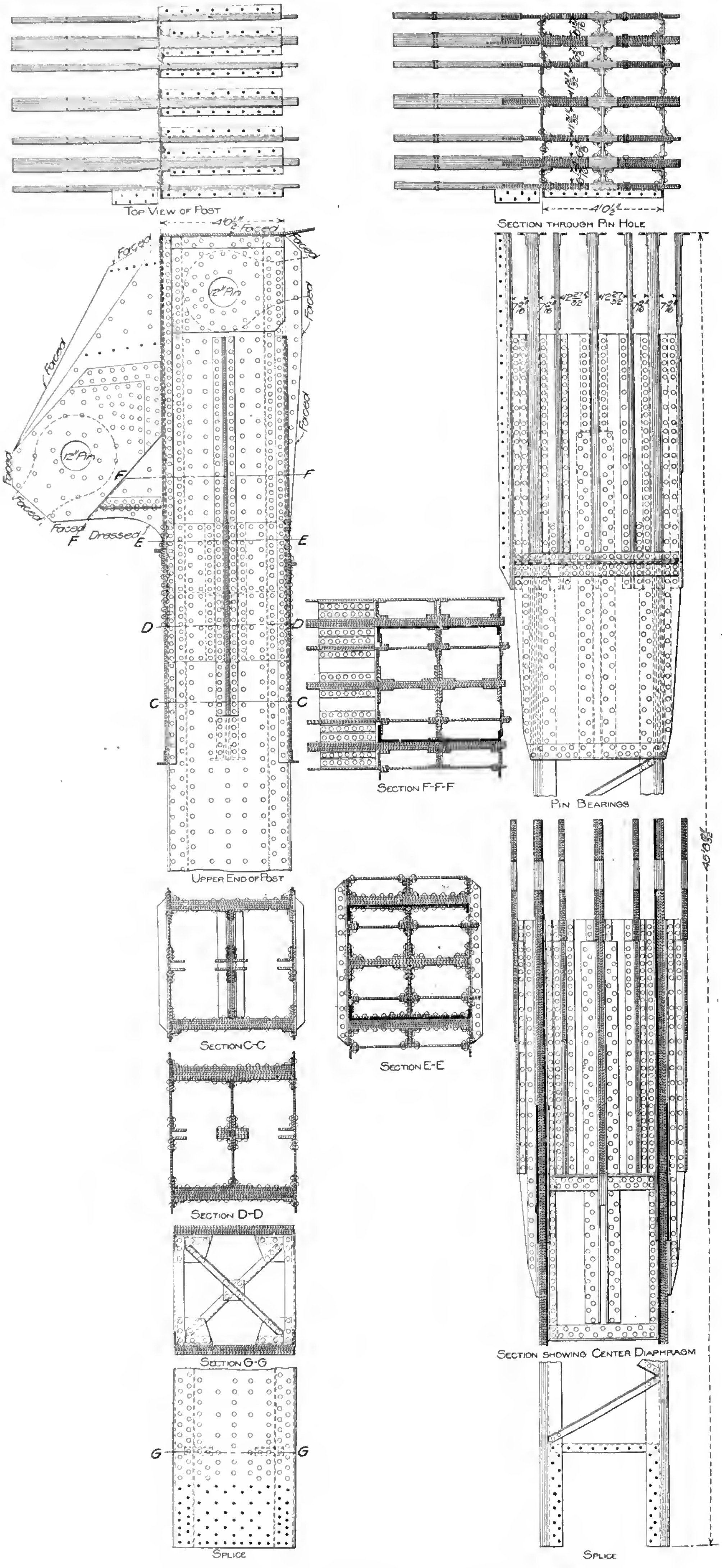
Fire-Killed Timber is being used more extensively each year in the West for railroad ties, and where tried in the same track with ties cut green, has been found to be as good as the latter. Despite the fact that dead timber is often regarded as unsound there are many tracts of it, killed by fire 15 or 20 years ago, that are still sound. The strength is not impaired, and the durability is often increased. The Forest Service is selling such timber on its reserve.

Widening Blackfriars Bridge, London.

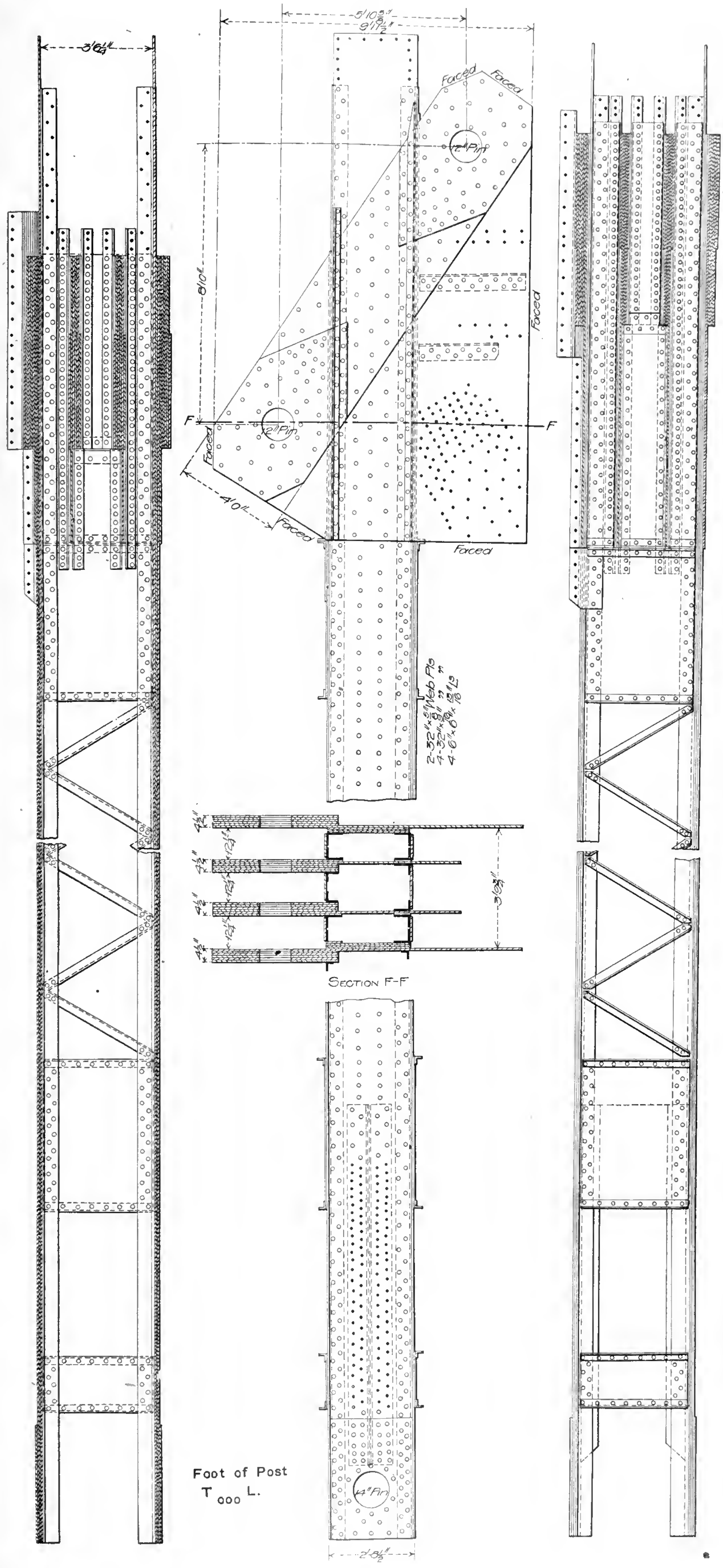
Improvements estimated to cost about $1,000,000 are now in progress on the Blackfriars Bridge across the Thames, at London, and include the extension of the upstream ends of the piers and abutments to receive three new lines of steel arch ribs 10 ft. apart increasing the width of the superstructure to 105 ft., which will make it the widest bridge across the Thames. Pile platforms at a level of about 5 ft. above high water have been built to enclose the upstream ends of the piers and to support during construction the steel caissons and cofferdams in which the extensions of the substructure will be built by the pneumatic process. On these platforms the permanent steel caissons are riveted up complete to a total height of about 13 ft., after which each of them is suspended from four overhead hydraulic jacks seated at the ends of two pairs of steel girders supported on timber trestles. Brackets bolted to the caissons are pin-connected to the lower ends of suspension links, each of which is formed of alternate single and double flat steel bars 10 ft. long, pin-connected together for convenience in the insertion of additional lengths as the caisson descends. The upper length passes through the hollow plunger of the hydraulic jack and engages a pin bearing on the saddle of the jack. The slotted pin holes in the links are 12 in. apart to correspond with the stroke of the jack. As the caisson descends, the successive courses of the steel cofferdam above it are built on, the shoe concreted, the caisson lowered to rest on the bottom of the river and the overhead girders and jacks removed. Air pressure will then be admitted and the caisson excavated to the required depth of about 27 ft. below low water, where it will be concreted and grouted and will be subjected to a test load before the superstructure is built on it.

Wooden cofferdams puddled with clay will be built to enclose the adjacent ends of the new caissons and of the old piers, enabling the end walls of the caissons and the adjacent masonry in the old piers to be removed and allowing the new masonry to be bonded with the old and additionally secured by a pair of steel trusses built into the masonry and serving to carry the skew-backs for the new arch ribs. Riveting and other work will be done by pneumatic tools operated by air from electrically driven compressors and all hoisting engines will also be driven by electricity. The parliamentary plans were prepared by the late Sir Benjamin Baker and the work is in charge of Mr. Basil Mott and Mr. E. M. Wood. Sir Wm. Arrol & Co. are the general contractors and, according to "Engineering," the work is to be completed in three years with a penalty of $100 a day for all time in excess and an equal bonus to be given for time saved.

Technical Clubs among the employes of large engineering offices are among the most useful means of keeping men interested in their work and acquainted with the problems that arise in other departments than their own. They are generally encouraged by the officers of such companies on account of this good influence. The last to be organized is the Engineers' and Constructors' Club, which has been formed among the staff of Dodge & Day. Its object is to discuss subjects relating to engineering and construction, and to give all members the benefit of the experience gained by each in his particular line of work. During recent meetings papers have been presented and discussed on civil engineering preliminaries for an interurban trolley, electric welding, gas producers and internal combustion engines, and concrete piling, the discussions showing much interest in the subjects.



Upper Part of Vertical Post, UP_1 L, Quebec Bridge.



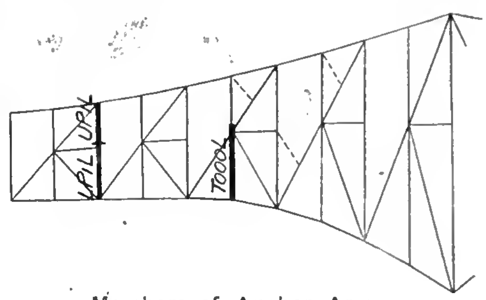
Foot of Post T 000 L.

The Quebec Bridge Superstructure Details; Part V.

Vertical Post P_1.—The dimensions and stresses of the vertical posts change rapidly toward the ends of the anchor arms. They are typical in post P_1, about 114 ft. long over all, which has a cross-section of 370 in. to provide for a uniform maximum stress of 5,365,000 lb. throughout. It is nearly 4 ft. sq. and has a rectangular cross-section made of two built channels 4 ft. deep. Each channel is made with five plates riveted together to make a solid web 3 3/16 in. thick and two 8x6x13/16-in. flange angles turned inward with their flanges latticed except at the ends of the posts with 3x3-in. diagonal angles.

The upper part of the post is 45 ft. 8 in. long over all and weighs about 120,000 lb. It differs from the upper part of post P4, in that it only has one pin for the top chord bars, all of which from both panels interlock on the same center line. The outside webs and three additional interior webs, making seven in all, are provided for the bearings of the top chord pins and are extended on one side to afford a connection for the diagonal eye bars which also have a 12-in. pin taking bearing in all seven webs. The webs are connected by a center transverse diaphragm and by two side diaphragms in the planes of the flange angles of the post.

The regular 4-ft. web plates are cut short and are extended to the upper ends of the post by



Members of Anchor Arm.

special wide plates about 12 ft. long which are shop riveted to the continuous flange angles. The plates are reinforced to give pin bearings from 1¼ in. to 2⅞ in. long, and like the webs in the other similar members of the bridge they were assembled and shop riveted separately to form independent ribs with I-shaped cross-sections which were then shop riveted between the transverse plates of diaphragms and the pin holes were bored and counterbored to templates. A horizontal cover plate is bolted across the top of the post to exclude snow and rain.

The lower part of post P_1 is 68 ft. 7½ in. long over all, and weighs about 150,000 lb. The cross-section is the same as that of the upper part and its bottom chord and diagonal connections closely resemble those described in a previous article for foot of post P4, but have much smaller dimensions. The main ribs and intermediate ribs are reinforced to total thicknesses of 5½ in., giving a combined length of bearing of 22 in. for the diagonal eye-bar pin. The holes for the chord pin bearing in the same webs are bored at a point where they are less heavily reinforced and have thicknesses of only 2⅞ in. and 3¼ in.

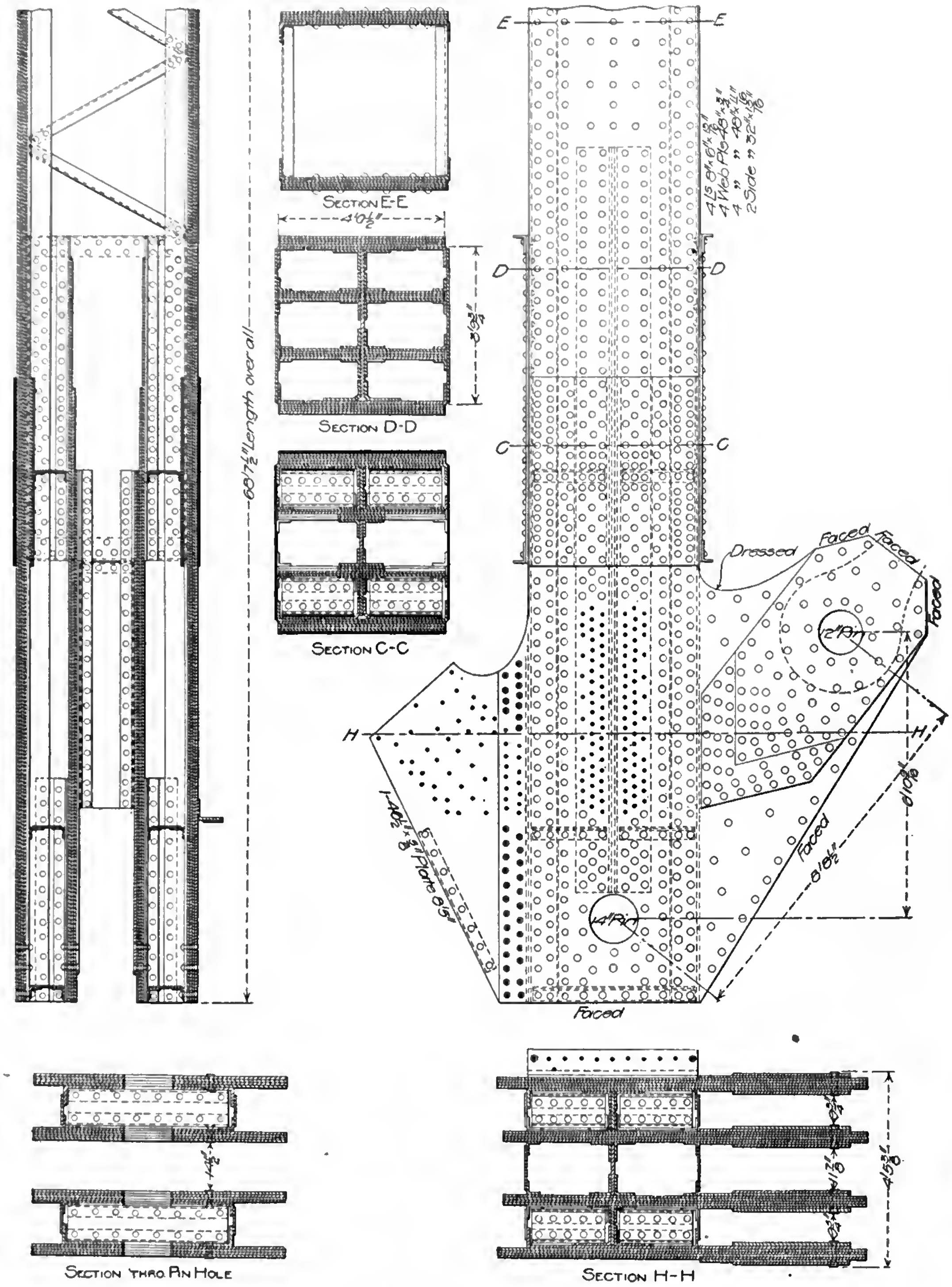
The center transverse diaphragm clears the upper flange of the lower chord and beyond it the two pairs of outside webs project in the spaces between the lower chord webs and are themselves stiffened by I-shaped diaphragms to make double jaws interlocking with the lower chord. The wide outer web plates are spliced to the regular 4-ft. web plates of the post channels with inside and outside shop-riveted cover plates, and the upper ends of the two inner web plates is coincident with the center of the splice and is stiffened

by two horizontal transverse diaphragms. The center vertical transverse diaphragm is shop riveted between the post webs and extends about 8 ft. above the center of the web splices and nearly 13 ft. below it to he end of the post, but is slotted for a depth of 4½ ft. at the bottom to clear the center rib of the bottom chord.

The sub-verticals at intermediate panel points of the truss are compression members made in two or more sections each with riveted splices and pin connections to the top and bottom chords. A fair example is the post marked T000 between vertical posts 2 and 3 at about the middle part of the anchor arm. This member has a total stress of 58,000 lb. in the upper part and 1,307,000 lb. in the lower part, which is 72 ft. long over all, weighs 92,000 lb.; the upper and lower parts are each shipped separate and complete from the shop and field riveted at the splice just above the intersecting diagonal.

Like the main vertical posts this member has a rectangular cross-section made with two built channels having their flanges turned inward and latticed. Each channel has a total thickness of 1⅞ in. and is made with three 32-in. web plates riveted together, and two 6x6x13/16-in. flange angles. At the lower ends there are two 31x½-in. flange plates nearly 5 ft. long, which produce a

Foot of Post, Quebec Bridge.



Foot of Vertical Post, L P₁ L, Quebec Bridge.

closed rectangular cross-section and have a center transverse I-shaped diaphragm to make a rigid connection between the two webs and stiffen them to receive the floor beam connection on the inner face of the post which is made with 110 ⅞-in. field-driven rivets. The webs project beyond this diaphragm to form jaws engaging the lower chord pin betwen the center and outside webs of the chord.

Just below its upper end this part of the post intersects the main diagonal member of the panel which consists of sixteen eye-bars made in two lengths and connected at this point. The large number of heavy pieces meeting here would require a long pin and develop difficult packing besides throwing the bars somewhat out of alignment if all were assembled on the same pin. To avoid this two pins are provided through opposite ends of a series of four oblique plates forming short links riveted to the post at the point of intersection so as to provide for the pins in opposite ends outside of the post flanges.

These links are riveted to the post webs and to two intermediate diaphragms, thus forming four longitudinal webs similar to those already described for the upper ends of the main vertical post. On one side of the post the two outer web plates are extended below the connections for the upper eye-bar pins to form jaws for the sub-diagonal strut connected at this point with 198 ⅞-in. field-driven rivets. The eye-bar connections are reinforced to have thickness of 4½ in. thus giving a total length of bearing of 14 in. for the 12-in. pins. At the upper end there are somewhat thinner pin plates, reducing the total length of bearing there to 12¼ in. On the side adjacent to the sub-diagonal the ribs are also stiffened by two horizontal transverse diaphragms about 2 ft. apart at the point where one end of a light horizontal strut is riveted between the outside ribs.

(To be continued.)

An Australian Irrigation Project.

The barren jack dam is the leading feature of a great irrigation undertaking for which plans have been prepared by Mr. L. A. B. Wade, principal engineer for rivers, water supply and drainage of New South Wales. It is to be constructed across the Murrumbidgee River, at a place where the catchment area is about 5,000 sq. miles. The dam will be 232 ft. high from foundation to coping, the latter 12 ft. above the maximum water level, and 910 ft. long, being curved upstream with a radius of 940½ ft. The cross section, according to "Engineering," is that suggested by Major Tulloch. The width of the base at the deepest place is 160 ft. The lower faces on both sides rise vertically for 20 ft. and the thickness of the dam then decreases rapidly to 145 ft. Then the upstream face has a batter of 1 in 20 and the downstream face 1 horizontal to 1½ vertical up to a point 60 ft. below the coping. Above this level the upstream face is vertical and the downstream face is curved, the width at the coping being 18 ft. The reservoir impounded by this dam will hold 33,380,000,000 cu. ft. The dam is to act merely as a regulating structure, and the impounded water will be let out through outlets in the body of the dam into the river-bed, down which it will flow for about 220 miles to a large weir so located that the water impounded by it can be discharged by gravity to the 6,500,000 acres to be irrigated. The water will be distributed over the land by a very extensive system of canals and ditches controlled by head gates.

Sewage-Disposal by Biological Processes.

Presented to the Engineering Conference of the Institution of Civil Engineers by John Duncan Watson.

An absolutely essential feature of a good scheme of sewage-purification should be an efficient method of eliminating solids without nuisance. At Birmingham this is done by mechanical precipitation and septic treatment. The elimination and removal of grit, etc. (50 per cent. water), costs 5*d*. per cubic yard. The elimination and removal of sludge (90 per cent. water) costs one-third of a penny per cubic yard. (Both figures are exclusive of the capital cost of tanks, etc.)

No matter by what method the tank-liquor is prepared for oxidation and nitrification on a biological filter, it is desirable that it should be rendered as free from suspended matter as possible. It is possible to reduce the suspended solids in septic liquor from 29.1 to 6.1 parts per 100,000 for the sum of 2*s*. per million gallons treated.

The tank capable of effecting the above result had the Dortmund tank for its prototype, but it is essentially different, both as regards principle of construction and form.

The Birmingham tank is pyramidal in shape, with vertical walls rising to the surface in the form of a square. The sewage is made to enter the tank by a submerged pipe, the downward velocity being 1 to 2 ft. per second. As it emerges from the mouth of the pipe, it spreads out laterally and ascends to the square portion of the tank at a gradually decreasing velocity, the average velocity throughout being 7 ft. per hour. As this velocity approximates to the falling velocity of the particles in suspension, the tendency is for the latter to separate out and collect in that region of the tank between the mouth of the inflow pipe and the apex or bottom of the pyramid. The sludge-pipe terminates in a sump at the bottom, and whenever the pipe is opened by operating the sluice-valve, the sewage affluent ceases to ascend, or it may even become a downward flow precipitating the suspended matter towards the mouth of the sludge-pipe. The sludge or irreducible residuum of the septic process in this tank amounts to 1.027 tons of dry solid matter per million (imperial) gallons treated, and may be removed and buried for 8*d*. per million gallons, a figure that includes sludge main and labor, but excludes rent of land. The cost of an installation of the tanks of a sufficient capacity to effect the necessary reduction of suspended matter amounts to £520 per acre of bed supplied.

A biological filter should be constructed, whenever possible, on the percolation principle; it should rest on a concrete floor laid with an inclination towards an effluent-channel. Before the surface hardens it is advisable to lay thereon an aerating tile or false floor capable of sustaining the medium. The chief purpose of the aerating tile is to allow the free exit from the bed of all matter in suspension, whether due to disintegration or imperfect washing of medium, and to admit of the natural evacuations of the bed itself, such as colloidal matter, hydrated oxide of iron, sand, living and dead bodies of organisms, etc.; but the aerating floor also—as its name implies—provides for a free passage of air from end to end of the bed.

A percolation bed should be a permanent structure that requires no renewal, and little or no displacement of medium for cleansing purposes, and this can be obtained only by the employment of good rock or other equally durable material. The qualities next in desirability are roughness of surface, and pieces that approximate to cubes, so to prevent the particles from uniting too closely. Observe those conditions, and almost any medium will answer the purpose of providing a habitat for the bacteria. The accompanying table shows that no merit attaches to medium substance *per se*, and the beds which I am now constructing contain various kinds of stone (including gravel) and hard slag from different places, mixed together indiscriminately.

It must be admitted that the smaller the medium the more perfect the effluent depth for depth, but there are other and more important considerations than to obtain a perfect effluent. A perfect effluent is not an ideal one; the ideal is to obtain by natural means an effluent which will not putrefy, and which will continue to improve when it is discharged into a stream: this, when a strong sewage has to be purified, can be done for little more than half the cost by adopting large instead of small medium. Compare bay 7 with bay 6 of bed No. 5 on the table accompanying this note, and it will be seen that bay 7 (small) was at work for only one-half of its time, whereas bay 6 was at work 94 per cent. of the full time. The cost of purifying one million (imperial) gallons was £3 7*s*. 3*d*. against £1 12*s*. 8*d*. in favor of bay No. 6.

No doubt the purification obtained was greater in the case of bay No. 7, but what of that when both effluents were non-putrescent?

It cannot be too often reiterated that what may be a suitable medium for one sewage may be quite unsuitable for another. The character of the effluent desired, the depth of the percolation bed, the quantity of sewage to be dealt witl the periods of rest necessary, and the faciliti for removing suspended solids, all have a di and reciprocal bearing on the selection of most suitable size for media.

One of the most important questions t sider is the best way to distribute sewa the surface of a bed, and it will pro admitted that the ideal to be aimed imitation of rainfall. The fixed spray

up the liquid other method distribute an this respect tributor, w or travel

Upper Section of a Vertical Post on Car; Quebec Bridge.

BIRMINGHAM, TAME AND REA DISTRICT DRAINAGE BOARD'S SEWAGE WORKS.

Bed.	Date when Bed Brought into Use.	Volume Treated During 1906.	Rate per Square Yd. per Day Whilst Working.	Proportion of Time Bed Was Working, Resting and Idle, Due to General Causes. (Unity taken as 8,736 Hours.) Working.	Idle. Resting and Aerating.	Idle. Distributor out of Order.	Idle. General Causes.	Mech. Effi'y of Bed Without Regard to Deg. of Purification Calculated on 170 Imp. Gal. per Sq. Yd. per Day for 364 Days per Year. Per Cent.	Capital Cost of Beds.	Cost of Treatme Gal., Includi Separat A Capital Cost.
		Gallons.	Gallons.						£	£ s. d.
A	Aug., 1903	34,419,215	109.9	0.693	0.062	0.176	0.069	43	2,149	3 2 4
B	May, 1904	41,907,212	112.7	0.876	.....	0.081	0.043	87	1,730	2 1 2
C	Feb., 1904	41,909,171	154.6	0.621	0.021	0.287	0.071	56	2,764	3 5 7
D	Oct., 1904	59,982,617	167.4	0.840	.....	0.121	0.039	83	2,481	2 1
E	April, 1904	137,389,645	169.3	0.935	0.025	.....	0.040	92	3,108	1 2
No. 4	Jan., 1906	236,940,249	144.0	0.956	.....	.....	0.044	79	6,216	1 6
No. 5 (Bays 1-6)	Sep., 1905.	216,216,247	160.4	0.944	0.017	.....	0.039	90	5,328	1
No. 5 (Bay 7)	May, 1906	11,012,306	139.1	0.526	0.422	.....	0.052	84	978	2
No. 6	June, 1905	259,218,438	160.6	0.932	0.029	.....	0.039	87	6,216	1
No. 7	May, 1905	265,987,358	163.8	0.929	0.031	.....	0.040	89	6,216	
No. 8	Oct., 1904	261,979,793	166.3	0.894	0.068	.....	0.038	88	6,216	

the other hand, it is much cheaper, e.g., spray jets cost (initial outlay) £500 per acre against anything between £1,000 and £4,000 required to install moving distributors, and reference to column 4 will show how much time may be wasted owing to the repairs required by a mechanical apparatus. Now if it could be shown that the moving distributors were instrumental in producing better results, I should be the last to disparage the use of the traveling distributor on large works; but it cannot. Compare the results from bed D, which is served by a Candy distributor, with fixed spray jets on bed No. 6. In both cases the medium is nearly similar in size, the only difference being that bed D is 7 ft. deep, and bed No. 6, 6 ft. deep. The results show a purification of 83.6 in the case of bed D, against 80.4 in the case of bed No. 6, both non-putrescent effluents.

For a considerable time I have been suspicious of crystalline effluents, fearing that they would some day result in serious chokage in the bed itself. I have, therefore, encouraged effluents that contained as much or more suspended matter than was present in the sewage when applied to the surface, and as this represented from 7 to 8 parts per 100,000 of dry solid matter, it became necessary to arrest the solids before discharging them into the river. This was done by the Birmingham separator, constructed as already described. The cost is *1s. 4½d.* per million (imperial) gallons treated; pumping silt and digging it into land, costs *6d.* per million gallons more.

The accompanying table contains facts culled from weekly reports prepared for my own information and guidance; in it and others of like nature ample justification will be found for inculcating caution in estimating the amount of strong sewage which an acre-bed 6 ft. in depth is capable of purifying. On an installation of 20 acres of such beds at Birmingham, not more than 15,000,000 (imperial) gallons of dry-weather flow can be efficiently purified; with an occasional augmentation of a like quantity for a very short period. Again, the table shows that the adoption of fine medium, although capable of producing a slightly better effluent than large medium, is too costly to become popular; and lastly, the fixed spray jet for large works has not, so far, been seriously rivalled by the traveling distributor either for circular or rectangular beds.

A LARGE GAS ENGINE rated at 1,650 h.-p. at 107 r. p. m. when using furnace gas of 80 B. t. u. has recently been completed by the Wm. Tod Co., for the Ohio works of the Carnegie Steel Co. The unit consists of a pair of two-cylinder tandem four-cycle engines connected by an operating platform at the level of the axes of the cylinders. The latter are 30 in. in diameter and have a stroke of 42 in. They are held together by tie rods and are so mounted that they are remarkably free to expand and contract. The valve gear is driven by eccentrics, one for the inlet and exhaust valves of each end of each cylinder. Mushroom inlet valves are used, mounted on top of the cylinders, and the exhaust valves are at the bottom and readily accessible from the space below the operating platform. The main valve is opened by a rolling lever and seated by a spring. The mixing and governor valves are in the upper part of the valve bonnet and the former may be controlled individually or together by hand. A fly-ball governor is provided for each pair of tandem cylinders and the two governors are connected for ordinary operation although they may be disconnected if either half of the engine is to be used independently. Make and break ignition with 90-volt direct current is employed. The engine weighs 900,000 lb., and occupies a space of 27 x 60 ft.

The Municipal Ownership Investigation for the National Civic Federation.

The Commission on Public Ownership and Operation of the National Civic Federation has completed its work, and abstracts of its special reports are now being given out from time to time. Labor conditions and the character of the gas, water and electric service rendered by public and private plants are covered by the official reviews that have been made public up to the present. The Commission appointed a committee of investigation of 21 members, which engaged in turn a staff of engineers, accountants and statisticians to examine thoroughly every undertaking in this country and Great Britain which was visited by the committee. These experts were so chosen that, in each examination made, both sides of the municipal ownership question were represented. Thus, one engineer, accountant or statistician approached the subject under consideration favorably disposed toward municipalization, while his colleague began his task holding views in opposition to that principle.

Labor Conditions.—The labor conditions under private and public ownership are discussed by Prof. John R. Commons, of the University of Wisconsin, and Mr. J. W. Sullivan, editor of the "Clothing Trades Bulletin." Starting with the same information gathered by the experts as a basis for argument, the former reaches the conclusion that corruption under municipal control is no greater than under private ownership, while the latter makes caustic reference to political rottenness which he declares to be evident in Syracuse, Allegheny and Wheeling.

According to Prof. Commons, the investigations have shown that "the strongest safeguard for a manager against the pressure of outside recommendations is the recognition of organized labor within his department. Wherever we have found a class of employees organized and dealt with as such through their representatives we have found those positions exempt from politics. This follows from the nature of labor organization, which cannot survive if individuals are given preference on political, religious, personal or any other grounds than the character of the work they do. Even in the politically honeycombed municipal undertaking at Allegheny, the union of electrical workers stopped the practice of paying assessments by its members for political campaigns. The success of the civil system of Chicago is owing more than anything else to the fact that organized labor has one of the three members on each examining board. The manager of the Manchester tramways ascribes his freedom from interference by individual councillors to his recognition of the union that holds 90 per cent. of his motormen and conductors."

The minimum payment for common labor by the private companies in the United States, except in Atlanta, is lower than that of the cities investigated, and the hours of labor are longer. The laborers employed by the municipalities are in all cases citizens, but most private companies employ foreigners when colored labor is unavailable.

Mr. Sullivan sums up his observations with the conclusion that in all but the most poorly paid forms of labor, and for tramway employees, municipalization has not raised the wages or improved working conditions of the employees above conditions in the private undertakings. With respect to "common, unorganized labor," however, the investigators found a difference somewhat favorable to British municipal employees. The report cites two causes for this condition; first, that the municipal laborer is a picked man, and second, that this class of labor is capable of exerting on city councils a combined pressure which obtains for them better terms than the employing councillors accord to the men they hire in their private capacity for similar work. "No street car undertaking in Great Britain has ever been a 'private' enterprise in the sense in which the word is applied in this country," says Mr. Sullivan. "The twenty-one years' term of the franchise, the veto of company petitions by village authorities, the enormous cost of Parliamentary powers and local assents, and various other restrictions non-existent in the United States, shackle and impoverish British tramway company management and consequently forbid an intelligent investigator to employ British example to illustrate possibilities in America through change from private to municipal ownership. British tramways have always been semi-municipal. As by the terms of their franchises all English tramway undertakings may be taken over by the municipalities, directors manage their properties with that end in view. Compared with the remarkable changes for the better in wages and hours in the American street car industry under companies, the best of the British municipal labor improvements seem hardly more than trivial."

American Water and Lighting Plants.—The reports of the investigating staff for water and lighting plants have been reviewed by Vice-Pres. Walton Clark, of the United Gas Improvement Co.; Pres. Charles L. Edgar, of the Edison Electric & Illuminating Co., of Boston; Pres. Frank Parsons, of the National Public Ownership League, and Supt. Edward W. Bemis, of the Cleveland water-works. The experts examined the public gas works at Wheeling, W. Va., Richmond, Va., Holyoke and Westfield, Mass.; the private gas plants at Atlanta, Ga., Norfolk, Va., Philadelphia, Pa., and Fitchburg and Beverly, Mass.; the municipal water works at Cleveland, Ohio, Chicago, Ill., and Syracuse, N. Y.; the private water-works at New Haven, Conn., and Indianapolis, Ind.; the public electric light and power plants at Chicago, Ill., Allegheny, Pa., South Norwalk, Conn., Detroit, Mich., and Danvers, Holyoke, Westfield, Marblehead, Peabody, Taunton, Chicopee and North Attleboro, Mass.; and the private lighting plants at Northampton, Fitchburg, Salem, Beverly, Gardner, Abington and Attleboro, Mass.

The Wheeling gas plant is severely criticized by Messrs. Clark and Edgar, while the plants at Norfolk and Atlanta are considered satisfactory. They say: "If we consider together the price the Wheeling consumer pays for gas and the character of the service rendered, we may not doubt that he gets less of net result per dollar expended than does the gas consumer in Atlanta or Norfolk. Low and varying pressure, uncertain candle power, influenced at times by a dash of natural gas (at Wheeling), will bring troubles to studying children that, while not factors in financial calculations, has a proper place in this inquiry. Wheeling's gas plant is not an important factor in the well-being of Wheeling's citizens. What with fast meters, charges for service and meter setting, absence of any gratuitous work, the admixture of 15-cent, 8-candle power natural gas, insufficient and irregular pressure, and general inefficiency in the complaint department, Wheeling gas is a dear commodity at any price. Our experts found nothing to praise in Wheeling's service and little to criticise in the service of the companies at Norfolk and Atlanta."

Mr. Bemis, on the contrary, holds up the Wheeling plant as an example of what may be accomplished by a municipality, even under unfavorable political conditions. Despite its admitted defects, he says, the Wheeling experiment has been a financial success, and has been "the pioneer throughout the United States in low charges." He does not agree with Mr. Edgar and Mr. Clark as to the value of the free instal-

lation by the private companies at Atlanta and Norfolk, saying on this point: "The gas sold in Wheeling during the sixteen months ending with May 1, 1905, was 162,515,200 feet. The difference between the price charged at Wheeling, 75 cents, and at Norfolk and Atlanta, $1.00. or 25 cents multiplied by these sales, would be $40,628.80. In other words, the saving to the consumer in the price of gas in less than one year will cover all the difference between the free services and the meter setting from the curb to the house in Atlanta and Norfolk, and the cost of the same at Wheeling."

There is the same difference of opinion concerning the Philadelphia gas works. Messrs. Edgar and Clark quote Dr. L. S. Rowe as authority for the statement that the quality of the gas supplied has been improved by the company now operating the service, and that through the rental paid, the city has received for eight years an average profit of $491,674 annually, while for the last few years under city operation there was a loss of $245,398 per year. The private company, however, charges no more than did the city, but supplies better gas. "The Commission's records," say Messrs. Edgar and Clark, "indicate a high degree of efficiency in the company operation of the Philadelphia gas works, and kindly and liberal treatment of employees. On these latter points Dr. Rowe speaks as follows: 'As has been shown (under municipal management), there were abuses in almost every branch of the operation. The purchase of coal and the residual product were each under the control of favored individuals; the wages account was padded with incompetents, the friends of men prominent in city politics. It is unquestioned that there were leaks in the management of the gas works at other points than the distributing system; it is true that the labor account was debauched, and it is certain that in the purchase and sales departments there were influences at work which worked harm to the city's interests. But the loss through such sources was inconsiderable when compared with those inflicted by councils by the senseless blocking of the way to improvement in cutting off the appropriations for modernizing the plant. During the entire period of municipal operation the officers in charge were engaged in a losing fight to preserve the works from ruin. There never was a time during the entire period of responsible control when it could truly be said that the works were in an efficient condition.'"

Prof. Parsons claims that the experience at Philadelphia is of no value in settling the problem of municipal ownership. "It does not appear," he says, "that Philadelphia ever had real public ownership of the gas works. She had government ownership of gas works. But government ownership is not public ownership unless the people own the government. Philadelphia had the paper title to the gas works, but the people did not own or control them because they did not own the city government. The councils were full of the agents and allies of the private street railway, telephone, gas and electric light interests and they purposely mismanaged the gas works, allowed them to be filled with supernumeraries and let them get out of repair by refusing year after year to appropriate, even out of the receipts of the plant itself, the money necessary to keep it in order, so that they might have an apparently good excuse for executing a lease of the works to themselves. Philadelphia did not have real public ownership of gas, but one of the worst forms of private ownership—ownership by political grafters, in the pay of corporations, but masquerading as public servants."

With regard to water-works. Messrs. Edgar and Clark summarize the reports of the experts regarding the quality of the supplies in the cities previously mentioned as follows: "This phase of the question may be summarized with the statement that while the natural conditions in the different cities call for different methods of treatment, it is evident that the two companies examined were more solicitous regarding the purity of the water supply, and adopted more thorough means for insuring the same than did the three municipalities who ran their own water department. The conclusion drawn as a result of our investigation into the quality of the water is that the water supplied by the two companies is good, sanitary water; that its quality is much better than the water supplied in Chicago, somewhat better than the water supplied in Cleveland and quite as good as the water supplied at Syracuse. The latter place is blest with water from a source which, down to the date of this report, has remained pure without any special expense or effort on the part of the water department. It seems that the citizen obtains the cheapest water in Cleveland, while New Haven is the second cheapest. At Indianapolis the poor man gets water fairly cheap, but the cost increases rapidly as the class of dwelling improves. At both Chicago and Syracuse the poor man pays a high price for water.

Mr. Bemis, on the other hand, quotes the following typhoid fever death rates as proving municipalities are furnishing good water, as the lowest rates are in cities with public plants:

	New Haven.	Indianapolis.	Chicago.	Syracuse.	Cleveland.
1905	42.8	30.2	16.5	7.1	14.9
1906	52.0	34.2	18.1	9.2	20.2
Aver.	47.4	32.2	17.3	13.2	17.6

In reviewing the charges for water, he states that the rates are more favorable to the consumer with municipal plants, and particularly commends the low meter rates at Cleveland. He also declares that in spite of great reductions of rates in Syracuse on going from private to municipal ownership, and the phenomenally low charges for all residence consumers under the present meter system in Cleveland and the moderate charges also in Chicago, the financial results of municipal ownership, from the standpoint of the community and the taxpayer, are far better in the three municipal plants than in the case of the two private companies studied.

The municipal electric plants are criticized in various adverse ways by Messrs. Clark and Edgar. They state that the municipal lighting department of Chicago is run at an annual loss of $11.07 per lamp, although the city claims it makes a profit; that the character of the South Norwalk plant is such that the current costs 20 per cent. too much; that the Detroit plant is old and incapable of expansion, and the Allegheny plant is poorly designed, inefficient and expensive to operate. Mr. Bemis, on the other hand, states that the South Norwalk plant is one of the most successful in the world, and the Chicago plant is furnishing light at a lower cost than a private company would charge for similar service. Detroit, he considers the most successful plant after South Norwalk. Allegheny, he claims, has saved enough to pay for her plant out of the difference between her operating expenses and the $96 a year Pittsburg paid for similar arc lights prior to 1906.

Municipal Ownership in Great Britain.—The investigations made by the experts sent to study municipal ownership in Great Britain have been reviewed by Mr. Milo R. Maltbie, a member of the Public Utilities Commission, of New York City, and by Messrs. Clark and Edgar. Mr. Maltbie declares that, of the plants examined, those operated by municipalities gave in almost every instance a superior service at a lower cost than the private works. He does not consider actual ownership and operation to be necessary for the success of the municipal ownership idea; the power of a city to operate a public service undertaking has been as effective as actual operation in some cases. The same expert reports are held by Messrs. Clark and Edgar to prove that municipal ownership is productive of many and serious ills with little or no compensating good. They see various present difficulties which can only be met by electing municipal officers who will protect the people against injustice.

The gas plants examined by the Investigating Committee of the Commission were those conducted by the municipalities of Birmingham, Glasgow, Manchester and Leicester, and by private companies at Sheffield, the Newcastle and Gateshead Company, and the South Metropolitan Company of London. On the important subject of maintenance of plants, etc., Mr. Maltbie says that during last year every municipality set aside out of earnings a larger total to maintain or extend the plant or wipe out indebtedness than did any private company. As to the price of gas to the consumer, Mr. Maltbie points out that the private company at Sheffield is able to buy good gas and coke-making coal at a lower price than any other company or municipality and finds a market for its coke at its very door in which it receives more per ton than any other undertaking save one: and that it sold its by-products for more than the cost of its coal, oil and other supplies, making profit thereon of 2.13d. per thousand cubic feet of gas sold. No other undertaking was so fortunate, and a comparison as regards prices and costs between Sheffield and any other plant not so well situated would be misleading and unfair.

Mr. Edgar and Mr. Clark open their comments on the British gas situation by pointing out that the private companies supply gas at lower prices than do the municipalities. Thus, the relatively small cities of Newcastle and Sheffield get cheaper gas from private companies than do the larger cities of Manchester, Birmingham or Glasgow. The difference in cost per ton of coal does not explain this difference in the selling price of gas, according to the reviewers, who find that the greater efficiency in management and in energy in selling the by-products has much to do with the lower prices. The service given the consumer by the private companies is declared to be superior to that given by the cities, although it is pointed out that the investigation of the candle power of the light supplied was incomplete in the municipal plants because of the declination of the authorities to permit the experts to make full examination.

"The whole question of the quality of the product of the municipalities is in doubt," say the reviewers. "The members of the Commission and the experts who are familiar with gas and photometry see no escape from the conclusion that the above facts show that the service of the municipalities is not what it is claimed, that the municipalities are unwilling to have the actual quality of their service determined by independent and competent authorities, and that the gas supplied by private companies is much superior in candle power to that supplied by municipalities.

"In the year covered by this investigation, if, in the city of Birmingham, the Newcastle price of gas had prevailed, the consumers would have been £262,600 better off: if the Sheffield price had prevailed, the Birmingham gas consumers would have saved £350,000. The amount paid by the Birmingham gas undertaking into the common good was £69,813. So it seems that this city is playing a losing game with its municipal plant; it is mulcting its gas consumers from £250,000 to £350,000 a year in order that it may help out the municipal treasury with a paltry £70,000.

"In the case of Manchester, if the Newcastle price had prevailed, the gas consumers would

have saved £47,500; at Sheffield's price they would have saved £111,300. The amount contributed to the city treasury by the gas business was £60,000.

"In the case of Leicester, at Newcastle's price, the consumers would have saved £65,200, while if Sheffield's price had obtained they would have saved £90,500. The amount contributed by the gas business to the common good was £43,400."

A Problem in Underpinning.

The Mount Royal pumping station in Baltimore is one of the handsomest water-works stations in the country. It was designed for three 17,500,000-gal. Worthington horizontal triple-expansion engines and four batteries of two 200-h.-p. water-tube boilers, and has been a source of much pride to the city. It was recently asserted that the walls at a corner of the engine-room were insecure and underpinning operations have been commenced to strengthen their foundations. In an article in this journal on March 24, 1900, the following statement was made concerning the foundations: "After the site had been selected, test pits were driven at a number of points within the proposed limits of the station and bed-rock was found uniformly at a depth of 30 to 35 ft. To carry the walls, circular concrete piers from 4½ to 12 ft. in diameter were built up at intervals from the rock to about the height of the basement floor, and the spaces between the piers spanned with masonry arches springing from the piers as abutments. . . . As a large storm sewer runs through the site directly underneath the buildings, considerable trouble and ingenuity were required to locate the foundations so as not to strike this sewer, and at the same time properly distribute the weight of the superstructure and permit of the desired architectural effect."

The wall of the engine-room cracked somewhat in one corner and this was asserted to be due to failure to carry all the piers to bed-rock. The architect of the building, Mr. Henry Brauns, stated that the cracks need cause no apprehension, but the mayor determined to underpin the walls. Since the work was begun, Mr. Brauns made a strong protest against its character in a letter to the mayor, and submitted with it a report on the methods, written by Mr. Richard C. Sandlass, chief engineer and general manager of the Chesapeake Iron Works of Baltimore. This report discusses underpinning work from a point of view rarely mentioned in print, as will be seen from the following extracts from it. It was based on measurements made at a time when two of the needles, Marked 4 and 5 in the accompanying diagrams, were not in position, but openings cut in the wall showed their location.

The needle marked 1, consisting of three 18-in. 55-lb. I-beams 29 ft. long between centers of bearings has to support, Mr. Sandlass says, a concentrated load of 179,610 lb. arising out of one-half of the weight on pier 41 and one-half of the weight on pier 42, as shown in the diagrams. This load causes a stress of 56,400 lb. per square inch of section in these beams, and is very close to their ultimate strength. This is aggravated by the fact that the beams incline about 1 in. in 1 ft.

Needle 2, consisting of two 20-in. 65-lb. I-beams 22 ft. long between centers of bearings has to support two concentrated loads, one arising out of the reaction of needle 1, which is 108,386 lb., the other from one-half load on pier 41, which is 89,805 lb. This load produces a stress of 33,090 lb. per square inch of section in these beams, which is about the elastic limit of the material.

Needle 3, consisting of two 18-in. 55-lb. beams 13 ft. long between centers of bearings, receives a concentrated load arising out of one quarter of the weight on pier 23, equal to 56,400 lb., which causes a tensile stress of 7,895 lb. per square inch of section in both of the beams.

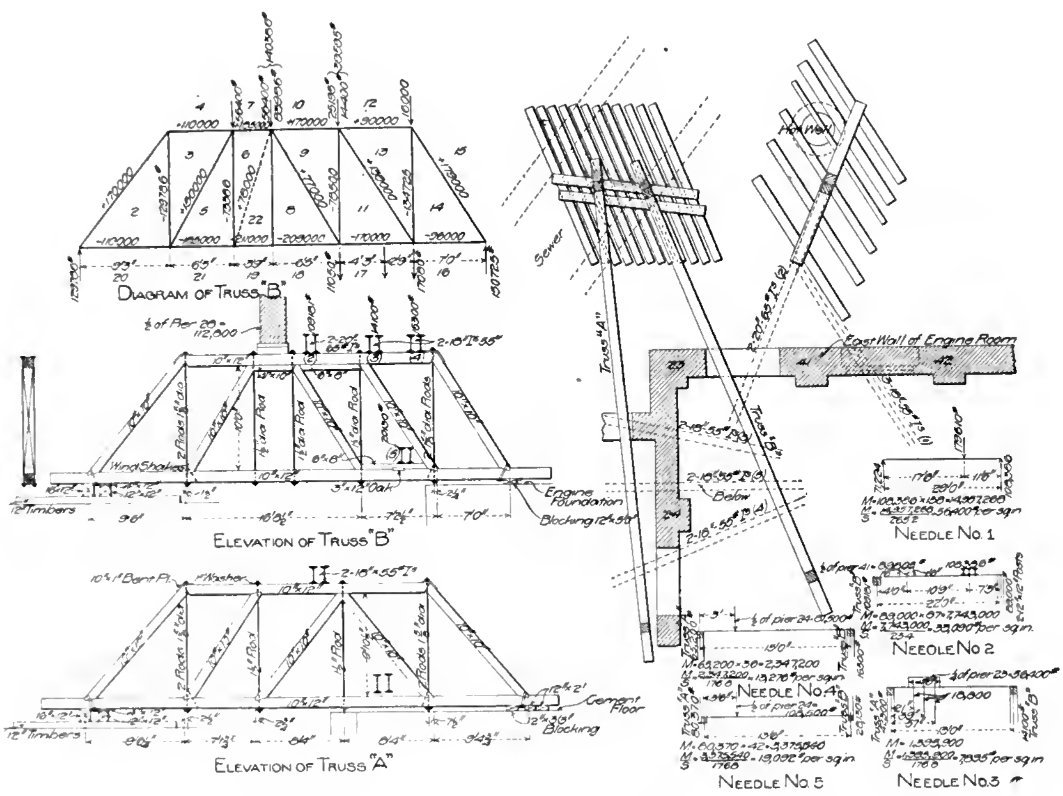
Needle 4, which was not in position at the time of the examination, consisting of two 18-in. 55-lb. I-beams 15 ft. long between centers of bearings receives a load of one-half of the weight on pier 24, equal to 81,500 lb., which causes a tensile stress of 13,276 lb. per square inch of section.

Needle 5, which was not in position at the time of the examination, receives a load of 10,500 lb., arising out of one-half of the load on pier 24, and two 18-in. 55-lb. beams would be sufficient in this case, as there is a stress of 19,092 lb. per square inch of section arising from this load.

Truss B receives a total load of 280,511 lb. distributed over four panel points in the top chord and two panel points in bottom chord, arising out of the reactions of needles 2, 3, 4 and 5 and from one-half of load on pier 23. The end asmuch as member 14-13 consisting of two rods 1⅝-in. in diameter not upset, each having a net area of 1½ sq. in., receive a total stress of 44,908 lb. per square inch. The net area of 1½ sq. in. of rod is assumed at the root of the thread.

Member 9-11 consisting of one rod 1½-in. in diameter, having a net area of 1.35 sq. in., receives a total tensile strain of 78,500 lb. This, however, divided by the net area gives a stress per sq. in. of 57,810 in. The reaction of 109,181 lb. of needle 2 causes a compression in the top chord, crosswise, of 873 lb. per square inch and is mostly on one edge of the top chord only, inasmuch as this needle has a slight incline. The ultimate resistance to compression crosswise of Georgia yellow pine is about 1,260 lb. per square inch, which would leave but little margin for safety.

The timber foundation under the east end of trusses B and A consists of one 12 x 16-in. timber, one 12 x 12-in. and one 4 x 12-in. laid flat,



Underpinning Employed at Mount Royal Pumping Station.

post 14-15, of 10 x 10-in. Georgia yellow pine, 14 ft. 6 in. long between chords, with an area of 100 sq. in., receives a compressive strain of 179,000 lb., which is equal to 1,790 lb. per square inch. The ultimate strength of a post this length, about 5,757 lb. per square inch, divided by 1,790 lb., gives a safety factor of 3.2.

Bottom chord number 8-18, consisting of 10 x 12-in. Georgia yellow pine, having a net area of 102 sq. in., receives a tensile strain of 209,000 lb., or 2,049 lb. per square inch. Bottom chord 11-77, being 10 x 12-in. Georgian yellow pine, having a net area of 105 sq. in., receives a tensile strain of 170,000 lb., and a moment of 563,640 in.-lb., arising out of the reaction of needle 5. This causes a tensile stress of 4,210 lb. per square inch. This gives a safety factor of three, assuming the ultimate resistance of the timber to tension as 12,600 lb. per square inch. While all these stresses in wood members of the truss referred to are in excess of those usually assumed in good engineering practice, Mr. Sandlass states, especially in view of the fact that the timber used is not of the very best, the wooden portion of the truss will probably carry the loads that come on it now with a small margin.

The unit stresses in the steel rods of the trusses, however, are considered by him to be so excessive as to endanger the construction, in-

and distributes the reaction of both trusses over twelve timbers 6 x 8-in., 8 x 8-in., 8 x 12-in. about 16 ft. long aggregating about 205 sq. ft. The total reaction of truss A being about 87,000 lb. and truss A 130,000 lb. makes a total of 217,000 lb. and this divided by the area of the timber gives a total load of 1,058 lb. per square foot on the ground. While this is not considered by Mr. Sandlass to be excessive on firm or even bad ground, he does not regard this foundation as absolutely safe because it is immediately above a large sewer.

The foregoing calculations are based on loads figured from the architect's drawings, but Mr. Sandlass reduced all crane, roof and floor loads by half in order to eliminate live loads in the calculations. This, while not exactly conservative, would with proper safeguards be permissible in this case, he believes. All wall loads assumed in the calculations do not include the weight of the wall from the engine room floor to the concrete foundations, except in the case of needle 5. If the full wall loads are ultimately carried by the trusses the strain in the different members will be proportionately increased. Truss B is not considered by Mr. Sandlass as a perfect system inasmuch as it should have another brace 6-22, indicated in the diagram by a dotted line, in order to develop the full capacity of the truss.

Power Plant of the West Street Building, New York City.

The West St. Building is a 23-story, steel-cage structure recently completed on West St., on the Hudson River front, in New York City. It is intended solely for office purposes, to which all floors above the basement are devoted. It occupies an irregular plot about 120 x 160 ft. in extreme dimensions, with the West St. front parallel to and about 300 ft. distant from the Hudson River bulkhead line. Interesting structural features of the building and of the substructure, necessitated by the proximity to the water front, were described in an article in The Engineering Record for Dec. 29, 1906.

It is a large building, rising to a total height of about 300 ft. above the sidewalk level, and having about 1,200 sq. ft. on each of its 23 floors, or a total of nearly 275,000 sq. ft. of floor space in the entire building, exclusive of the basement. The upper office floors can be arranged for subdivision into a maximum of 20 offices, if required, there being about 300 office groups in the entire building as it is now sub-divided, an average of about 12 suites to every floor. Accordingly an extensive mechanical plant was necessitated for the operation of the building, which includes not only the elevator and heating service, but also electric current for both lighting and power purposes. Besides this the usual auxiliary services have been provided for, including a vacuum outfit for office cleaning purposes.

Owing to the sub-structure conditions encountered in the construction of the building, very limited basement space could be provided, the difficulties in excavation rendering a minimum of sub-surface space advisable. Accordingly there is only a single basement with its floor level 11½ ft. below the main floor of the building, with the exception of a section in the southerly central portion where the floor was depressed some 7 ft. further, to provide ample head-room for the boiler equipment. The greater part of the basement is below ground-water level, so that the cellar floor and all the walls were carefully waterproofed to prevent leakage. Provisions have, however, been made to provide for the removal of any leakage that might possibly occur, consisting of a series of sub-floor drains which discharge through a 6-in. vertical cast-iron pipe into a deep central sump pit which has been provided for the natural drainage within the basement due to the leakage from piping systems and other causes. This pipe connection will normally be closed, but in case of unexpected leakage through the foundations at any place, it may be connected to a pump and water thus pumped from beneath the foundation and floors to keep the basement dry. This was installed as an emergency provision, however, and it is not expected that it will be needed under ordinary conditions.

About two-thirds of the basement is devoted to the mechanical equipment, that under the front portion and under the West St. sidewalk being used as store rooms for the offices and salesrooms on the main floor front. The space is divided into a 40x60-ft. boiler room in the south central portion of the basement, with a coal bunker under the Albany St. sidewalk; at the rear of this, a 30x85-ft. engine and dynamo room; a 15x50-ft. space in the center for the elevator mechanism and operating valves, and the large irregularly-shaped space in the northeasterly corner, 80 x 90 ft. in extent, in which are located the elevator pumps and tanks, the miscellaneous pumping equipment and other auxiliary apparatus. The head-room in the basement is very limited, averaging but 9½ ft. in the greater part, except in the boiler room which is depressed 7 ft. lower, giving 16½ ft. clear head-room to accommodate the overhead flue and piping connections. All inside drainage in the basement is accordingly directed to the boiler room in which there is at one corner a sump pit containing a 3x4-ft. cylindrical steel tank from which drainage can be removed by the sump pump. The interior of the pump and machinery sections is attractively finished, the ceilings and walls being plastered with an asbestos finish and the floors laid with tile. Very little daylight lighting is available, however, except at the outer edges of the basement where lighting is had through sidewalk lights.

For the generation of steam, four 250-h.-p. Keeler water-tube boilers have been installed. They are set in two batteries of two each between building columns in the boiler room, giving a total boiler capacity of 1,000 h.-p., while there is also space available for the addition of two more units of equal size. A 7-ft. space was left at the rear of the settings for the breeching and blow-off connections, while at the front there is a 12-ft. firing floor, in which an industrial track of 24-in. gauge is laid for the handling of coal and ashes. The former is, as above noted, stored in the bunker space underneath the Albany St. sidewalk, which is 10 ft. in width and extends from the boiler room to the West St. front. The floor of the bunker is depressed to the level of the boiler room floor alongside of that room, but to the west of the latter it was, for foundation construction reasons, raised to the level of the basement. The bunker is filled by dumping through sidewalk coal holes on the Albany St. side, and has a total capacity of over 200 tons. The narrow-gauge track extends into and through the lower portion of the bunker on which the charging cars are filled by shoveling, while in the raised portion at the front, there is a short section of the narrow-gauge track on which runs a 500-lb. dumping car into which coal may be shoveled and wheeled to the front for dumping into the charging cars on the lower track. There are two steel charging cars of one-half ton capacity, and a branch of the narrow gauge track permits them to be run around to the ash lift at the rear of the bunker for handling ashes in cans up to the sidewalk for removal. The products of combustion are removed from the furnaces through a 4½x5½-ft. breeching on the ceiling at the rear of the settings, which connects in the pump room with an elliptical steel stack rising above the roof line, to a level about 350 ft. above the grates.

The boilers are of the horizontal inclined tube type built by E. Keeler Co., Williamsport, Pa. They each have 124 4-in. tubes 18 ft. in length, which are arranged in 14 rows, each 9 tubes high. The steam drums are 48 in. in diameter by 20½ ft. long, to which the forged steel tube headers are directly attached, the total heating surface presented by each unit being 2,500 sq. ft. The boiler units are hung in steel frames, enclosed in substantial brick settings with brickwork arched over the steam drums, and are fitted with Ajax shaking grates of 52 sq. ft. grate area for hand firing. Owing to the arrangement of settings necessitated by lack of space horizontal baffles were required between tubes instead of the usual vertical arrangement. The boilers deliver steam at 150 lb. pressure and recent calorimeter tests at the plant indicate less than 0.99 per cent. of moisture. Each boiler has a 2½-in. blow-off connection from the rear tube header to a 3-in. blow-off line at the rear of the boilers which discharges into a blow-off tank, with cooling coil at the rear of the boiler room. This tank, being below the sewer level, is emptied by a duplex steam pump of 40 gal. capacity, which is under the control of a float mechanism adjusted to maintain the tank always partly filled. The boilers are fed by both injectors and pumps, each boiler having an independent injector, which draws from the city water connection and may be used for feeding or boiler testing, as desired. There are three pumps used for boiler feeding, each of which is a brass-fitted, outside-packed Platt Iron Works duplex pump of the double plunger type, having a capacity of 40,000 lb. of water per hour at 50 strokes per minute. Two of them, having 6x4x6-in. cylinders, are located at the rear of the boilers and connected to return condensation from the heating system, while the third, an 8x5x10-in. pump, is on the side of the settings and draws from city water connections or from the feed water heater, all delivering through a 3-in. feed line to the boiler fronts. The principal source of feed will be condensation returned from the heating system which is delivered to a 3x6-ft. condensation surge tank at the rear of the boilers and pumped thence by the condensation pumps under control of a pump governor through the feed main to the boilers. The feed heater is an exhaust muffler and separator tank, which is connected in the exhaust steam main and serves both as an oil separator and feed water heater. It is located in the pump room near the corner of the boiler room, and is 5 ft. in diameter by 9½ ft. long, being connected directly into the exhaust steam main with by-pass.

The high pressure steam piping departs from usual practice in that the mains are not in duplicate, the system consisting of a 12-in. header in the engine room adjacent to the boiler room wall, which has 7-in. supply connections from each of the boiler units and 5-in. delivery connections to the generator engines, a 3-in. live steam make-up connection to the heating system and an 8-in. delivery line to the steam pumping units in the pump room. All of the high-pressure piping is of extra heavy wrought-iron pipe with long-radius bends, the boiler branches having gate valves at the header and stop and check valves at the boiler nozzles. All of the high-pressure piping is run on the ceiling and is covered with 2-in. of magnesia covering, canvas jacketed, while the low-pressure piping from the engines and steam pump exhaust connections is carried in trenches to the muffler tank. The trenches extend to all engine cylinders and to all of the pumps, and are for the greater part 18 in. in depth, ranging from 20 to 36 in. in width. The low-pressure system consists of two divisions, one of which is a 12-in. line to the engine room and the other a 12-in. line to the pump room, the two joining into a 16-in. connection to the muffler tank, in the boiler room. The engine room division has 8-in. valve connections to each of the generating units and a 6-in. branch extending into the boiler room to receive the exhaust of the condensation sump and boiler feed pumps. The pump room exhaust main has 3 and 6-in. branches to a number of small auxiliary pumps and a 10-in. extension which serves the large and small elevator pumping units and the jack pump. From the muffler tank outlet, a 16-in. low-pressure riser is carried up to the roof of the building to connect with the overhead distributing mains of the heating system and thence through a back-pressure valve to the roof exhaust head. Condensation is dripped from all of the high-pressure piping by the Holly gravity return system, while for the low-pressure piping connections, there are two drip systems, one for the clean drip and the other for the oily drip; the former consists of all bleeder and drip connections from low-pressure piping, engine exhaust valves and other points where clean condensation water will be obtained, while the unclean drip system consists of the cylinder cock connections, the oil drip chambers, and the like. The clean drips are returned to the feed water heater and the condensation surge tank in the boiler room to be delivered to the boilers, while the unclean drips are discharged into the boiler room sump for delivery to the sewer.

With the original considerations of design, the electrical generating plant was laid out for a total capacity of 800 kw. to provide for a very heavy lighting load occasioned by some special illumination which was planned for a large tower on the roof of the building. Subsequently the tower feature and its illumination were temporarily abandoned and a total generating capacity of but 550 kw. provided, although space has been arranged for an additional 200-kw. unit to be installed at any later period desired. The present capacity is divided into two 200 and one 150-kw. units, so that with the addition of the possible future 200 kw. unit, the total generating capacity would be increased to 750 kw. The generating units consist of Western Electric slow-speed, engine-type generators which are direct connected to Fitchburg four-valve compound engines, which operate non-condensing. The engines are of the heavy-duty, side-crank type with Tangye frames and have the usual Fitchburg valve gear with double eccentrics for independent operation of admission and exhaust valves and giving results approaching very closely to that of the Corliss valve gear. The governors are of the centrifugal shaft type providing for a long range of cut-off and regulate within 1½ per cent. The two larger units have 16 and 24x26-in. cylinders and when operating at 150 r.p.m. and 125-lb. steam pressure have a capacity of 320 h.-p. The small unit has 14 and 22x20-in. cylinders and operates at 200 r.p.m., at which it has a rating of 225 h.-p.

A feature of the engine installation is the use of particularly massive engine foundations with sand cushions to prevent possible communication of vibration from the generating units to the building. All three of the engines are carried on a single large block of monolithic concrete, 3¾ ft. in maximum depth, which, it is calculated, will absorb initially the motion of the reciprocating parts of the engine. Between the concrete block and the underlying earth and also the adjacent building column footings, a continuous sand cushion is provided, which effectually maintains the position of the block yet insulates it mechanically from any part of the building. The sand cushion is made 6 in. in thickness in all horizontal planes and 3 in. in thickness between the edges of the block and the adjoining building foundations. The block is continuous longitudinally under the engine cylinders, being cut into at the fly-wheel ends only, in order to straddle building columns which are encountered. The engine equipment was installed complete by E. H. Ludeman & Co., New York.

The generators are multipolar direct-current generators wound for 125 volts, and arranged to operate on the two-wire systems for which the building is wired. They are compound wound, the over-compounding amounting to 5 per cent., with a variable shunt so as to allow maintaining the voltage constant automatically from no load to full load. They are so rated as to permit of operation at 33⅓ per cent. overload for two hr. duration without excessive heating. The generator and electrical distribution circuits are controlled on a 9-panel marble switchboard at the northerly end of the engine room, which consists of four generator panels, one totalizing panel and three lighting and one power panels. The panels have the usual equipment of instruments and switches, the total panel having wattmeters for both power and lighting services, a tie switch and ground detector equipment. There are 20 circuits controlling the lighting of the building and 15 circuits controlling the power circuits to the various motors, every motor in the building service being operated on an independent circuit for direct control from the switchboard. The generators and switchboards were built and installed by the Western Electric Co., New York, general contractors for the electrical installation.

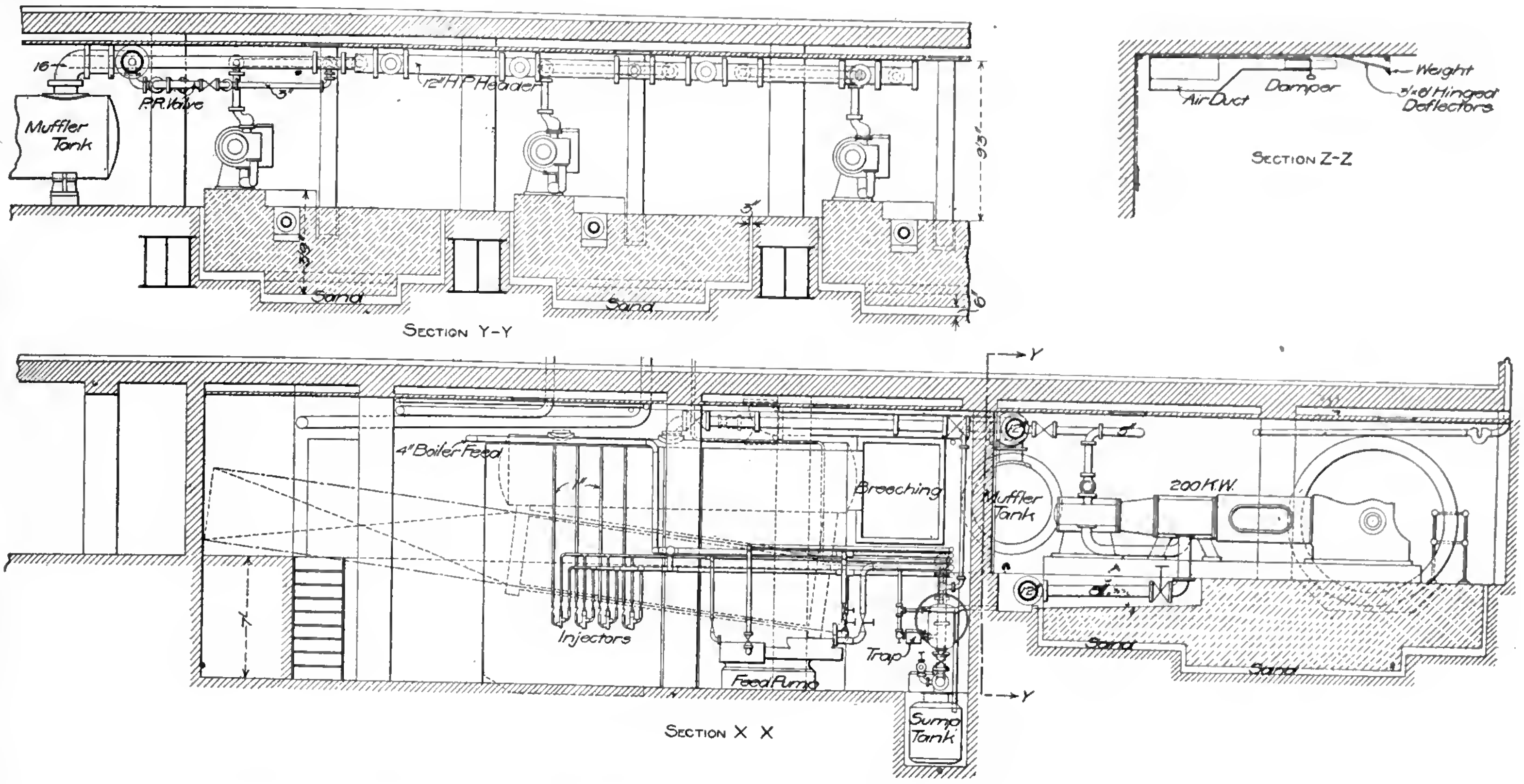
The heating system of the building involves direct radiation throughout, operated with low pressure exhaust steam from the power plant, there being no mechanical ventilation provided for, except in the heated machinery sections of the basement. The radiation is proportioned in the usual manner to maintain the temperature of the interior to 70° Fahr. in all conditions of weather, the radiators being located under window-sills for direct counteraction of the glass exposure. Owing to the large amount of exterior exposure of the building and the open unsheltered position of the building itself, a large amount of radiation was necessary. Over 52,260 sq. ft. of radiation are installed on the main and upper floors of the building, which is an average of 2,270 sq. ft. on each of the 23 floors. Cast-iron Peerless radiators have been installed throughout, which are of the 4-column type, 23 in. high, on the main floor; in all corridors and elevator halls of the 2-column type, 39 in. high, while in all of the offices from the second to the twenty-third floors inclusive, they are of the 2-column type, 26 in. high, for location under window sills. A feature of the distribution of radiation is the location of individual radiator units under each of the outside windows, no matter how the office spaces are at present sub-divided; with this method the radiation is evenly and thoroughly distributed throughout all parts of the building and thus no future re-arrangements of office partitions will necessitate the changing or addition of radiators in any part of the building, as is usually the case in office building alterations.

The radiation is supplied with steam on the one-pipe system with the Paul system of air-piping for positive circulation. The heating supply mains embrace an overhead distribution system to which down-feed risers are connected, the latter being connected at their lower ends in the basement to return gathering mains which deliver the condensation to the surge tank in the boiler room for return to the boilers. The heating supply system originates in the 16-in. exhaust steam riser which leads from the muffler tank in the pump room up to the roof of the building through the elevator shaft, and ends in a back-pressure valve and exhaust head at the roof line. At the 21st story level, a 16-in. branch connection is made from this riser to a series of distribution mains under the floor, which connect with and deliver steam to each of the entire group of 32 down-feed risers. This distribution system consists of a 12-in. line extending longitudinally through the building in either direction from the 16-in. connection, and supplying branches along the outer walls which taper in size as connections to the risers are taken off. These risers drop down from the supply connections as 3½ and 4-in. lines, tapering as connections are made to radiators, at the fifteenth floor to 3 and 3½ in., at the eleventh floor to 2½ and 3 in., and at the fourth to sixth floors down to 2-in. lines, which are carried through at that size to the basement return gathering mains. Twenty-two of the risers are carried above the twenty-first floor for the supply of radiation in certain portions of the twenty-second and twenty-third floors as 2-in. lines. Owing to the height of the building the expansion of these risers introduced a troublesome factor. It is provided for by the anchorage of all of the risers to the building construction at six points, namely, the fourth, seventh, tenth, fourteenth, seventeenth and twentieth floors, between which points slip expansion joints are inserted; the latter occur at five points, namely, above the fifth, eighth, twelfth, fifteenth and eighteenth floors, and consist of Crane iron-body expansion joints with brass sleeves.

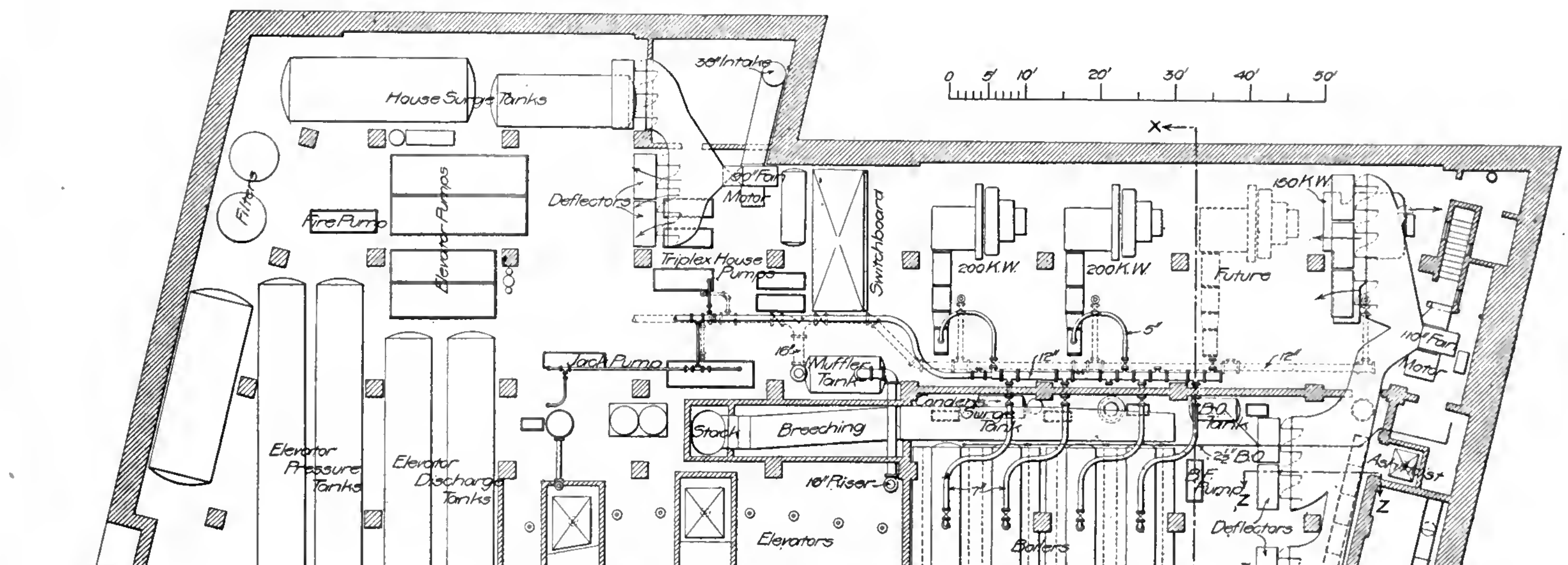
The riser lines are, of course, all dripped directly into the condensation gathering mains in the basement with which the risers connect at the base. The return gathering system consists of a series of 3-in. lines which connect with the various branches from the risers and pitch sharply toward the condensation surge tank for proper drainage. Owing to the extreme distance of supply from the muffler tank in the basement to the lower floor radiators, by way of the twenty-first story distributing main, a dry equalizer system has been installed in the basement connecting the muffler tank and the lower end of practically all of the riser lines. This system consists of a 6-in. main extending from the muffler tank and parallel to the return gathering mains, which has 2-in. connections into the majority of the risers at points above the first floor level. These connections are so made as not to drain condensation from the risers, but to supply only such a limited amount of steam to them as may be necessary to equalize their lower ends against drop in pressure which might occur in case of heavy consumption of the low pressure steam.

Ventilation is, as above stated, provided only in the heated machinery sections of the basement, where it is desired to moderate the temperature for comfort of the workmen. Communication of heat to the main floor is prevented by an asbestos ceiling finish in all machinery sections of the basement consisting of 1½ in. of asbestos plaster on wire lath, over a 1½-in. air space. The basement ventilation is accomplished by separate ventilating equipments installed for both the boiler and engine rooms, and the pump room, which are arranged to deliver untempered fresh air in either case. They are installed of sufficient capacity to change the air in the rooms served approximately twenty-five to thirty times per hour. The blowers are conveniently located, as shown in the basement plan, near outer walls, for in-take connections, that for the pump and machinery room under the lighting and ventilation court at the rear of the building, to which a 38-in. intake duct is carried up from the fan intake. The engine and boiler room system is conveniently located adjoining a stairway entrance from the Albany St. sidewalk into the engine room, so that the fan has a short direct connection from its intake to the open stair-well. The fans are 90 and 110-in. steel plate centrifugal fans of the full-housed peripheral-discharge type, built by the American Blower Co., and are driven by Western Electric motors of 12 and 25 h.-p. respectively, which operate on the power and lighting circuits of the building. The systems are each fitted with a novel arrangement of deflectors for directing the blast from the outlet registers in any direction desired for the comfort of the workmen. These consist of both horizontal and vertical vanes, the vertical vanes being butterfly dampers located directly in the duct outlet openings and may thus serve as dampers for adjusting the volume of flow, or to control the direction of the flow, in a horizontal plane; the horizontal deflectors are 36-in by 6-ft. galvanized iron sheets mounted on steel frames which are hinged to the ceiling in front of the register outlets and arranged for adjustment of position by cords passing over pulleys to the outer edge and controlled from the adjoining side-wall. The latter permit the blast to be diffused generally into the room or directed toward the floor close to the register outlets, while the butterfly dampers allow the air to be blown forward directly into the room, spread to the sides or partially closed off.

The elevator equipment of this building consists of nine passenger elevators and two sidewalk lifts, which are all of the plunger type installed by the Standard Plunger Elevator Co., New York. Five of the passenger elevators have travels from the first to the twentieth floors, a rise of 245 ft., two from the first to the twenty-



Sections through Boiler and Engine Rooms, West St. Building.



Plan of the Mechanical Plant of the West St. Building, New York City.

third stories, a rise of 285 ft., one from the basement to the twentieth story, a rise of 256 ft., and the other from the basement to the twenty-third story, a rise of 296 ft. These are all operated by a 6⅞-in. plungers, working in 10-in. cylinders and with a hydraulic operating pressure of 180 lbs. per square inch, have a maximum capacity of 2,500 lb. each, or 1,500 lb. each at the maximum speed of travel of 600 ft. per min. A sidewalk lift on the West St. side of the building and the passenger elevator rising from the basement to the twenty-third story are fitted for operation with extra pressure for lifting safes and extra heavy weights; when operated by the jack pump for this purpose, they have a maximum lifting capacity of 8,000 lb. at a speed of travel of 50 ft. per minute. The other sidewalk elevator is an ash lift which rises from the boiler room floor to the Albany St. sidewalk for the purpose of communication with the boiler room and the removal of ashes.

The elevator plant is operated by a novel equipment of compound and triple expansion duplex pumps which provide in an interesting manner for emergency operation and reserve. There are two pumps, the larger unit a triple-expansion pumping engine with 15 and 24 and 36 steam cylinders, and a 14½-in. water cylinder, all with 24-in. stroke, while the other unit is a compound pump, having 16 and 26 in. steam cylinders, and 14½-in. water cylinder with 24-in. stroke. The pumps, although of duplex construction, are built with separable valve gear in both the compound

and triple expansion units, and have independent steam and water connections throughout, so that in case it is desired to operate at reduced capacity, either unit may be sub-divided into one-half of its total capacity and either side operated while the other is shut down. It is estimated that this arrangement has saved the installation of an extra pump, as there are thus provided four independent units, although under normal operating conditions they will be operated as two. For regular service the large triple expansion unit will be used, although while either side of this unit is under repairs, the other side and the smaller unit may be utilized as necessary. The pumping plant as thus installed is figured to be capable of operating the passenger elevators and sidewalk lifts when running on a schedule of a round trip every two minutes, for the passenger elevators, allowing five of them to go up at the same time, and a round trip of the sidewalk elevators every three minutes. The elevator tank equipment consists of two pressure tanks and two tanks for discharge, all of which are cylindrical steel tanks horiontally arranged in the front portion of the pump room, the two pressure tanks having each a capacity of 12,000 gal. and the discharge tanks a capacity of 10,000 gal. Air pressure for maintaining the necessary air space in the pressure tanks is furnished by two Westinghouse locomotive-type steam air pumps. The Jack pump is a 9x4½x10-in. duplex pressure pump which has independent piping connections to the sidewalk lift and the passenger elevator rising from the basement to the twenty-third floor. The entire pumping equipment was supplied by the Platt Iron Works Co.

For cleaning and renovating purposes a vacuum sweeping system was installed as a permanent part of mechanical equipment, embracing steam ejectors and dust separators in the basement with suction lines extending to all upper floors, the equipment having been installed by the American Air Cleaning Co., New York. This apparatus is located in the central portion of the pump room, and from the separators, a 3-in. vacuum line extends to either side of the building to connect with the two 3-in. vacuum risers in the corridors. These risers are conveniently placed for reaching any of the offices and at each floor there is a 1¼-in. branch connection ending in a 1-in. air cock attachment for the sweeper hose.

The architect of the building was Mr. Cass Gilbert, New York City, and it was built by the John Pierce Co., general contractors. The power plant, heating and ventilating and entire mechanical equipment was designed by Mr. Burt S. Harrison, consulting engineer, New York.

A DRY-DOCK, 1,050 ft. long and 114 ft. wide at the coping will be built at San Francisco by the San Francisco Dry Dock Co., from the plans of Mr. Howard C. Holmes.

Notes on Water Purification at St. Louis.

Abstract of a paper read before the American Water Works Association by Mr. W. F. Monfort, Chemist of the St. Louis Water Department.

The necessity of coagulation in purification of turbid waters of high color, such as occurs in many of our Western rivers, is generally recognized. It has been thought that the interest in the matter of coagulation and sedimentation as an essential part of any method of purifying such waters, whether in connection with, or apart from filtration by slow-sand or mechanical filters, will justify the presentation before this association of a brief statement of chemical and bacterial results for the past year at one of the larger plants, treating daily an average of 70,000,000 gal. of a water whose average turbidity is above 1,200, whose color is above 40, and of an alkalinity equivalent to 135 parts per million of calcium carbonate, using lime and iron sulphate as coagulants, without the use of filters.

The low-service pumping station and coagulating plant of the St. Louis water works system are located in the extreme northern part of the city at a point on the Mississippi River, about five miles below the mouth of Missouri. From this intake tower in the stream some 1,500 ft. from shore, the supply flows through a tunnel to a well or uptake shaft beneath the coagulant house, where it receives its charge of iron sulphate, thence through the inshore tunnel to the wet well. At this point it is freed from ice, when necessary, by bucket conveyors. From the wet well, the water with its charge of iron sulphate is lifted by the low-service pumps to the distributing well, where the charge of milk of lime from the coagulant house is delivered by centrifugal pumps. It then flows by gravity to a series of six uncovered sedimentation basins, 670 x 400 x 14 ft. (average depth), having a working capacity of about 24,000,000 gal. The weirs between the successive basins are 610 ft. long. A conduit runs on either side of the system of basins, allowing filling and drawing from any basin at will; in practice the end basins alone are used for filling. From the drawing conduit, the treated and settled water passes by a conduit 7 miles long to the most southerly high-service pumping station at Bissell's Point, where there are four smaller storage basins, and the clear well. From the latter as also from a basin connected with the conduit at an intermediate point three miles above, the high-service pumps deliver the water to storage reservoirs and to the mains.

TABLE 1. VARIATIONS IN RAW WATER. PARTS PER MILLION.

	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Turbidity.												
Maximum	2100	1200	3600	3600	1800	2400	1500	900	500	2400	1500	1500
Minimum	180	180	1050	1350	1200	900	500	400	275	400	120	700
Average	1358	975	2856	2261	1455	1398	866	702	375	1019	481	1183
Suspended Solids.												
Maximum	1645	1078	5301	4577	1769	1633	1191	944	496	3678	2537	2380
Minimum	394	122	842	1032	692	568	412	362	139	249	146	733
Average	1096	691	3417	2182	1164	947	691	592	264	1110	661	1444
Color.												
Maximum	51	51	41	41	45	41	41	71	70	65	70	70
Minimum	35	31	31	31	31	25	31	35	35	30	35	30
Average	52	38	33	36	35	34	35	52	57	49	49	45
Alkalinity.												
Maximum	127	148	146	129	139	143	176	175	172	167	176	152
Minimum	90	94	126	118	120	120	119	154	160	63	90	106
Average	110	134	134	123	129	136	147	163	167	107	145	133
Coefficient of Fineness.												
Maximum	0.914	1.41	1.606	1.272	0.983	0.907	1.007	1.203	1.102	2.415	2.024	1.602
Minimum	0.606	0.559	0.802	0.765	0.563	0.555	0.654	0.603	0.657	0.83	0.85	0.966
Average	0.827	0.708	1.17	0.963	0.80	0.677	0.798	0.844	0.836	1.33	1.37	1.22

TABLE 3. REDUCTIONS THROUGH THE BASINS.

	River.	Weir 1	Weir 2	Weir 3	Weir 4	Weir 5	Weir 6	Tap.
Suspended solids..............................	1444	14.2	12.1	8.35	7.1	5.8	5.46	2.56
Color	45.3	13.6	13.	13.	12.	11.6	10.8	10.8
Alkalinity	133.	51.1	48.6	47.	46.	45.	44.5	41.
Bacteria per ccm..............................	57029	933	....	501	....	106	.....	42

The raw water partakes very largely of the character of the Missouri River water, being ordinarily so much higher in turbidity than the Mississippi above the confluence of the rivers that the line of demarcation between the two waters is plainly noticeable. As showing the variable character of the water, Diagrams Nos. 1, 2 and 3 are introduced, giving in graphic form the maxima and average for each month of the past year of a few prominent characteristics.

Fluctuations in turbidity of 2,000 or more parts per million occur in April, June, July, September and January; the difference between maxima and minima is less than 1,000 in May, November, December and March. The maximum turbidities for June and July were 3,600, for September and January 2,400, with a minimum of 120 for February. The year's average was 1,248 parts per million.

Fluctuations in suspended solids as determined by weighing are even greater than those of turbidity, being above 3,000 for June, July and January, about 2,000 for February and March and less than 1,000 for four months, May, October, November and December. The maximum of the year falls in June 5,300 parts per million or almost 31 grains per gallon, while for January it was 3,678 or 21 grains per gallon. The year's minimum was 122 parts per million or 7 grains per gallon. The monthly average follows generally the curves of maxima and minima. The year's average was 1,205 parts per million or about 70 grains per gallon.

The wide variation in the character of the suspended matter is shown in Diagram No. 2. From a minimum fineness of 0.555 in September to a maximum of 2.415 in January, with the year's average at 0.953, slightly less than the standard fineness. The peaks of June (1.6) and January (2.4) mark flood stage, with consequently coarser material transported.

The minimum alkalinity of the year, 63 parts per million, occurs in January flood water, when the variation was more than 100 parts per million. Otherwise the monthly variations lie within smaller limits of 10 to 80 parts per million. The average for the other months runs from 107 to 167 parts per million. The color range is from 25 to 71 with a yearly average of 43.

Diagram No. 4 shows two typical cases of fluctuation in character of the river water, the curves of this diagram having been plotted from the data in Table 2. From January 17 to 24 the river rose 11.5 ft., with a corresponding rise in turbidity from 400 to 2,500 parts per million, and a decline in alkalinity from 137 to a minimum on the 23rd of 63 parts per million. The dissolved solids declined from 255 to 138, color fluctuated irregularly, but remained high throughout. This is typical of a seasonable flood. It was on January 19 that the coefficient of fineness reached 2.4.

TABLE 2. TYPICAL FLUCTUATIONS IN CHARACTER OF RIVER WATER.

1907.	Gauge.	Turbidity.	Color.	Alkalinity.	Dissolved Solids.
Jan. 17	85.8	400	45	137	255
18	88.4	600	60	120	220
19	90.3	1000	60	107	192
20	94.0	1500	60	104	...
21	96.7	1800	65	80	138
22	97.1	2400	55	65	141
23	97.3	2400	55	63	142
24	96.9	2100	45	68	155
May 27	86.2	750	50	127	219
28	86.9	600	35	130	238
29	87.0	1500	50	130	221

The other case occurred in May, 1907, and is typical of the Missouri habit of cutting a new channel suddenly. Accompanying a rise of 0.1 ft. comes an increase of turbidity from 600 to 1,500 parts per million, while the dissolved solids, alkalinity and color waver slightly but independently of the turbidity. Cases less marked than this latter one have been of constant occurrence througout the year, wherein the shifting of the channel of the Missouri and of the Mississippi just below their confluence, has caused similar wide and sudden fluctuations.

It has been stated already that in the St. Louis plant the removal of suspended matter is accomplished without appeal to filters. On passing to the first or filling basin in the series of six previously mentioned, the coagulated

water from the distributing wells carries its natural sediment and added coagulum. Sedimentation is so rapid that before the first basin is traversed the water is very largely clarified. The turbidity is reduced to about 15 parts per million on leaving the first basin; most of the suspended matter is fairly coarse at the first weir, and drops out in passing the succeeding basins, so that at the third weir the turbidity approximates 12, at the fifth 10 or less. It will be understood that the suspended matter in the earlier basins is too coarse for accurate determination by optical methods. Direct weighing of the suspended matter show results which are tabulated with other data in Table 3.

The figures given are monthly averages for March, 1907. The daily data for the same period vary but slightly from the averages. In the accompanying diagram, No. 5, these data have been reduced to a percentage basis, save the color, which is platted in parts per million.

Accompanying a reduction of suspended matter to less than 2 per cent., the bacterial reduction through the basins goes with almost even progress. When it is remembered that a portion of the suspended matter carried over the weirs is adventitious, produced by the softening reaction, and not bacteria laden, as is the original river sediment, it will not be surprising that the sudden decline in the solids has accomplished the removal of so large a percentage of bacteria. Most of the original sediment and the coagulum fall out in the first half of the first basin, leaving the deposit heaviest about the filling gates.

Basin No. 1 was put into commission January 8 and the March data plotted show results in the third month of use. It must be stated, however, that the sewer of the filling basin is opened daily without interrupting its use, to allow the lighter accumulated flock and sediment to flow out.

The March averages plotted in Diagram No. 5 are representative of the best working of the system and of the best results attained. During the period January 8 to March 30 the average removals were almost as satisfactory, as shown in Table 4.

TABLE 4. AVERAGE BACTERIAL REMOVAL—PER CENT.

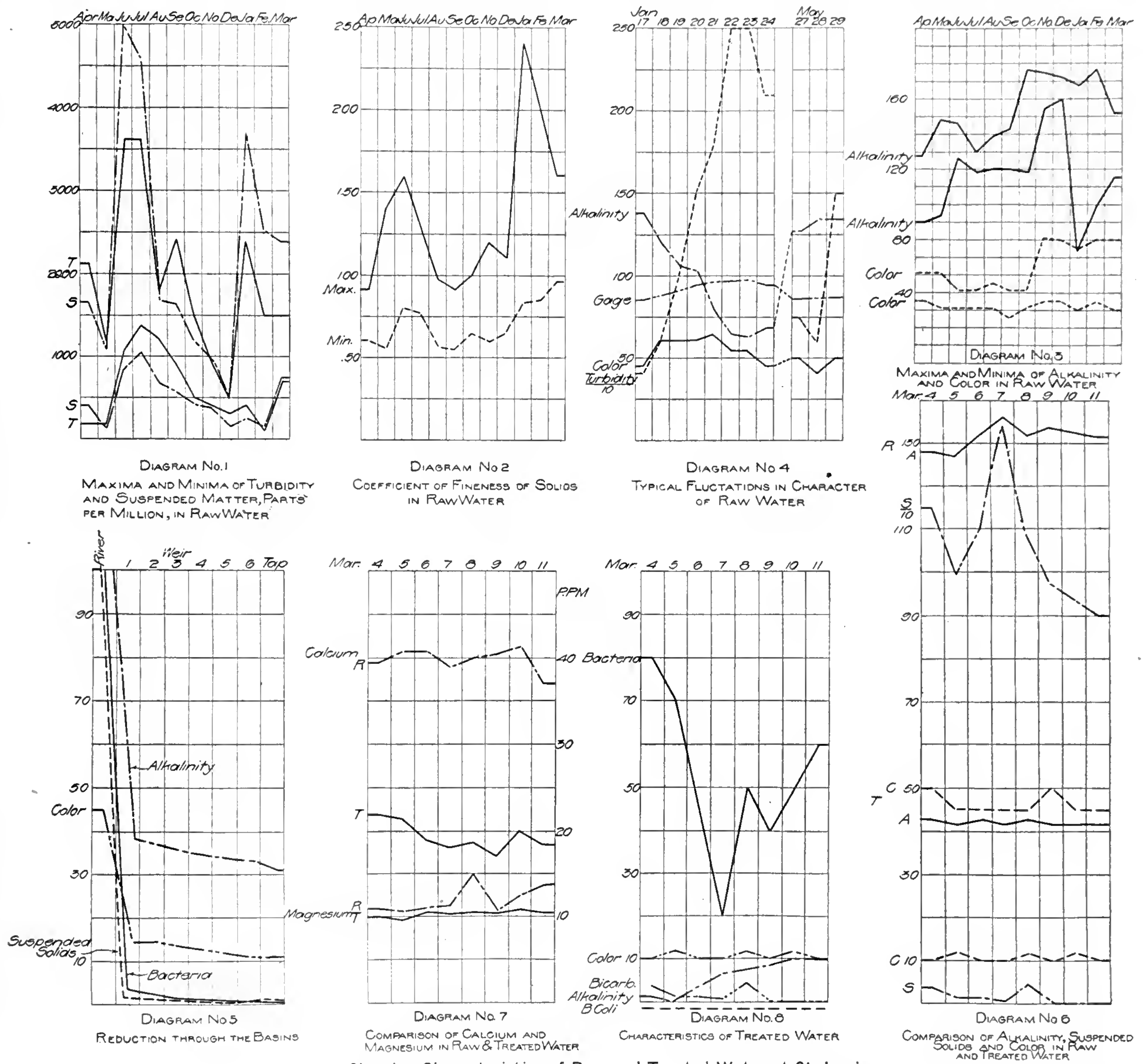
	Basin 1.	3.	5.	Tap.
Jan., 1907	93.7	96.	97.4	98.87
Feb.	95.9	98.4	99.0	98.8
Mar.	96.1	99.1	99.8	99.88

As typical of results through the year a period in March, showing the character and extent of the changes in the raw water effected by the treatment, was selected for presentation here. The results obtained during this period are given in Tables 5 and 6, and are shown graphically in Diagrams Nos. 6, 7 and 8.

Consideration of the Diagram No. 8, makes it evident that there is no necessity for carrying caustic alkalinity through the basins to secure satisfactory bacterial removals. Not only was the tap water free from caustic during the period under consideration (March 4-11), but no caustic appeared in any samples on passing weirs 1, 3 and 5, save on the 9th and 11th of March. This conclusion finds further support by consideration of daily data for the entire month, as well as the longer period, January to March. It appears, further, that removal of colon bacillus is likewise not dependent upon the presence of free lime through the basins, since tests for coli were negative throughout the week represented by Diagram No. 8, and also throughout the month.

TABLE 6. AVERAGES OF RAW AND TREATED WATER—MARCH 4-11, 1907.

	Raw.	Treated.
Alkalinity	132 p.p.m.	42 p.p.m.
Susp. solids..................	1079 "	1.7 "
Color	46 "	10.7 "
Calcium	40 "	19.4 "
Magnesium	12.1 "	10.5 "
Bacteria	94000 "	50 "



Diagrams Showing Characteristics of Raw and Treated Water at St. Louis.

TABLE 5. COMPARISON OF RAW AND TREATED WATER.

1907. Mar.	Suspended Solids. R	Suspended Solids. T	Color. R	Color. T	Alkalinity. R	Alkalinity. T	Calcium. R	Calcium. T	Magnesium. R	Magnesium. T	Bicarb. Alka'ty. T	Bacteria. R	Bacteria. T	Bacteria. Per cent. Removal.	Coli.
4	1146	4.0	50	10	128	43	39.9	22.0	11.1	10.0	1	166,000	80	99.94	...
5	991	1.0	45	12	127	42	40.8	21.5	10.7	9.7	0	149,000	70	99.99	...
6	1103	1.0	45	10	132	43	40.9	19.3	11.1	10.7	3	95,500	40	99.9	...
7	1343	0.8	45	10	136	42	39.2	18.4	12.5	10.3	6	105,100	20	99.99	...
8	1087	4.8	45	12	132	43	40.0	18.8	15.	10.7	7	48,750	50	99.9	...
9	972	0.0	50	10	134	42	40.5	17.0	11.1	10.7	8	59,000	40	99.9	...
10	....	...	45	12	133	42	41.5	20.2	12.5	11.1	10	......	..	....	...
11	903	0.0	45	10	133	42	37.0	18.6	13.6	10.7	10	34,800	60	99.8	...

The averages given for this period differ but slightly from the averages for the year, save in the extent of the removal of the magnesium, and in the actual number of bacteria per cubic centimeter, which are unusually low.

The raw and treated water at Bissells' Point (the Southerly high-service station) for the year averaged as follows:

	River.	Treated Water.
Suspended solids	1,188	3.8
Color	43	10.7
Alkalinity	135	49.
Calcium	42.3	22.8
Magnesium	13.1	4.5

being a reduction of the calcium to 54 per cent. and of magnesium to 57 per cent. of the original content of the raw water. In the river water there is approximately 0.05 parts per million dissolved iron; in the treated water 0.02 parts per million dissolved iron, while the total iron content of the water from the clear well varies from 0.1 to 0.25 parts per million. Most of this is in the form of ferric hydroxide adherent to or absorbed by fine suspended siliceous matter and is in large part carried down with it in the after reactions, which are still incomplete in the clear well.

The color reduction has not been pushed below an average of ten because the popular appreciation of colorless water has not yet developed beyond this point in the scale.

With reference to the matter of cost, it may be said that on an average 2.13 grains of iron and 7.39 grains of lime have been used and the following is the detailed cost per million gallons of water treated:

Iron, $1.442; lime, $2.454; making a total chemical cost of $3.896; labor, $0.579; power, $0.064; improvements, $0.021; repair, $0.063; producing a total cost of treatment $4.623 per million gallons treated. The waste of water due to the daily flushing out of loose sediment from this filling basin, together with that used in flushing out the accumulated deposit when the basins are cleaned is approximately 2 per cent. of the amount pumped.

Some members of the association may be interested in a method for continuous slacking of lime for water treatment which has been introduced at St. Louis during the past year as a result of an investigation carried on by the writer—based upon the heat of hydration of lime, and the increase in efficiency of the milk of lime produced by hot slaking.

Prior to this year the method of slaking used at St. Louis since the installation of the plant was as follows: Cooling water from an auxiliary condenser was heated to 120° Fahr. by live steam, and the water thus used for slaking, giving a maximum temperature in the tanks of about 180°. During part of the past year a higher initial temperature (approximately 160° Fahr.) was maintained for the hot-water supply, and a temperature of 200° or more in the slaking tanks, since it appeared that using the same lime in like slaking tanks with only the difference in the initial temperature of the water, the efficiency of the effluent from a tank in which a temperature of 200° Fahr., or more, prevailed was 15 per cent. greater than when a temperature of 165 to 170° Fahr. prevailed. In other words, a serious loss in efficiency was caused by the low temperature of the water used. The accompanying Table 7 shows results of several series of comparative experiments, the same lot of lime being used throughout the experiments of each series.

TABLE 7. RESULTS OF COMPARATIVE EXPERIMENTS TO DETERMINE EFFECT OF WARM SLAKING WATER.

Series.	Tank.	Initial Temperature of Water. Deg. Fahr.	Maximum Temperature of Suspension. Deg. Fahr.	Efficiency. Per cent.
A	1	110	156	70.3
	1	120	171.3	78.13
	4	122	156	72.85
	3	172	202	83.65
B	4	127	165	66.04
	3	165	200	81.25
C	4	117	153.5	79.35
	3	172	208	94.6

For several months a device has been in use which heats the hydrant water supplied for slaking by utilizing the heat developed in the slaking process.

The effluent milk of lime from the slaking tank flows through a circular steel tank. A coil of 2-in. copper pipe is submerged in this latter tank, the contents of which are agitated by paddles on a vertical shaft. The hydrant water passes through this coil to a head tank, its temperature being raised during the passage from 60 to 70° Fahr. above the initial temperature of the cold water. From the head tank the hot water flows through adjustable orifices to the slaking tanks, where a temperature of 200° Fahr., or more, has been maintained by the heat of hydration. In a long series of observations these are representative temperatures:

Cold Water.	Head Tank.	Lime Tank. No. 1	Lime Tank. No. 2.	Heater Tank.
51	118	204	200	134
51	118	206	203	136
51	114	206	204	135

The apparatus has been successfully operated since February, and in a slightly modified form is incorporated in the plans of the new coagulating plant for which bids have been recently received. The suspension used is adapted to the individual tanks. Two of the slaking tanks now in use have short pipes carrying the effluent to the heater tank. These have their water supply adjusted so that the milk of lime has one pound of lime in 3½ lb. of water. In two others having longer effluent pipes of 6 and 8 ft., respectively, a suspension of 1 to 3¾ is maintained. Inasmuch as it is necessary to cool the milk of lime before it passes the centrifugal pumps, the amount of water needed for this purpose is actually reduced, making the process economical from every point of view. The estimated saving over heating the water by live steam is nearly $3,000 per year.

The residue left in the slaking tanks after sixteen hours continuous operation is reduced to less than 1 per cent., where formerly 3 per cent. was a minimum. There is thus a further economy of time and labor in its removal.

THE NATAL GOVERNMENT RAILWAYS in 1906 operated 880 miles of line, the earnings from which amounted to $10,443 per mile, and the return after paying for operation and maintenance, $3,412.80 per mile. The gross earnings per train mile were $1.905. The new lines constructed during the year brought the total mileage of the system to 1,024 miles, most of which is of the standard gauge of the colony, 3½ ft., the remaining mileage being 2 ft. gauge. Most of the rail is 61-lb., though 313 miles are laid with 78-lb. rail.

Reinforced Concrete Abutments on the Atlanta, Birmingham & Atlantic R. R.

The bridges of the Atlanta, Birmingham & Atlantic R. R., which has now over 300 miles of line under construction, are of two general types; semi-circular concrete arches up to 30 ft. in diameter, and for larger openings steel bridges on plain concrete piers and reinforced-concrete abutments. The resident engineer on each ten miles of line determines the waterway required for each bridge, either by making a survey of the run-off area and calculating the required waterway by Talbot's formula, or by measuring at the site the stream section below the high-water line.

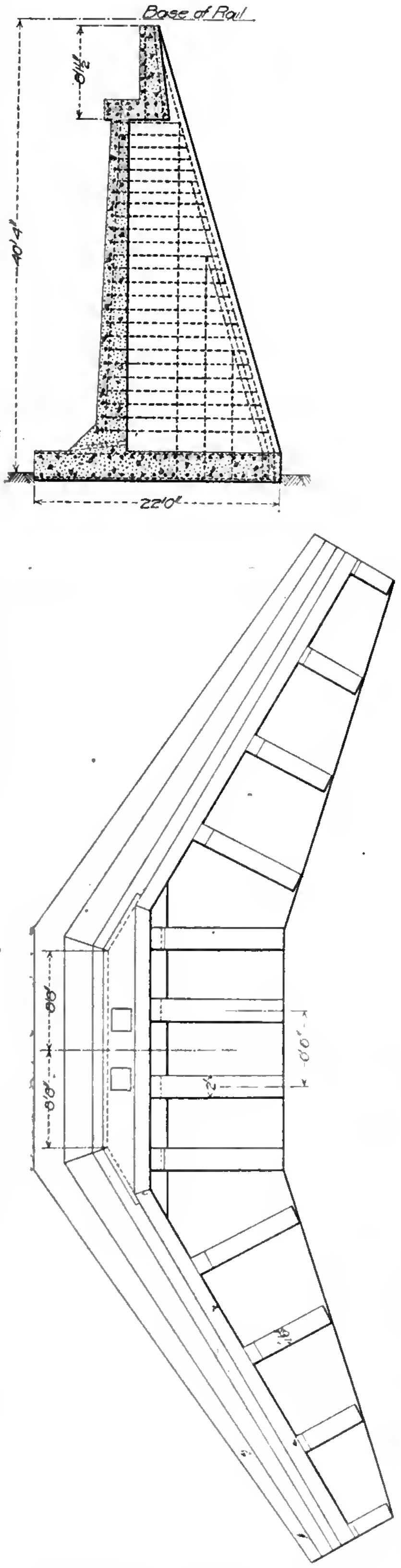
All bridges on the line are founded either on rock or piles. The footings are started 1 ft. below the pile tops and are carried up to 4 in. above the top before any reinforcing bars are used, thus forming a 16-in. cap of plain concrete, in which the piles are imbedded 1 ft.

The abutments are provided with counterforts as shown in the accompanying illustration of a plan and cross-section of a typical structure. According to Mr. S. L. Morrow, office engineer of the road, from whose paper published by the Engineering Association of the South, these notes have been taken, the ratio of base to height, in abutments of this character, must be 0.5 to 0.55 in order to make the resultant of the external forces intersect the middle third of the base. In calculating the pressure due to the backing, the engineers of the Atlanta, Birmingham & Atlantic use Rankine's formula: $P = \frac{1}{6} wh^2$ where P = the total pressure on the back of the wall applied at the lower 1-3 point, w = the weight of the backing, and h = the height of the wall.

Th reinforcement in the counterforts is, according to Mr. Morrow, of great importance, since the bars in the back take practically all the bending moment. The bending moment is calculated at the base and at points one-third and two-thirds down from the top. Assuming that the horizontal pressure is one-third the vertical for any fraction of h down from the top, the resultant will be $w\ h^2$; where w is the weight of the earth, the bending moment will be $p\ h \div 3$, or $w\ h^3 \div 18$. Assuming w to equal 100 lb. per cubic foot of earth, the moment is $5.5\ h^3$.

Considering the buttress, together with the front wall, as a T beam, and using as its effective depth the distance from the center of the rear bars to the inner face of the front wall, and supposing the buttresses to be spaced 10 ft. apart, the bending moment for a depth of 14 ft., down from the top will be $M = 5\frac{1}{2} \times 14^3 \times 10 = 190920$ lb. Supposing the effective depth of the beam at 14 ft. down to be 4 ft., then 2.3 sq. in. of reinforcement will be required, using a unit stress of 16,000 lb. for the steel. In addition to the above, the horizontal components of the live load and the dead load, due to the reaction of the bridge on the abutment, must be added to the bending moment. The live load is assumed at 1,000 lb. per square foot, and the re-150,920 ft. lb. Supposing the effective depth of the cific case. The above calculations are repeated for the other depths below the surface and the sectional area of steel for each point obtained. The bars should be placed well in the rear of the counterfort and the bottom ends of them hooked over the horizontal bars near the bottom of the footing course. The steel is calculated to carry the entire overturning moment because the concrete is placed in the forms in horizontal courses, and may have planes of cleavage at the points where one day's work joins another. Main counterforts are placed under each bridge bearing or point of concentrated loading. The parapet walls and face walls are treated as slabs supported by the counterforts.

The bridge seat proper receives no direct load, since the main buttresses are designed to carry the entire weight of the bridge, but it carries a portion of the overturning moment from the parapet wall and this is taken care of by lateral reinforcement. The bridge seats are heavy enough to transfer the load to the buttresses if the girders should become displaced through accident.



Reinforced Concrete Abutment.

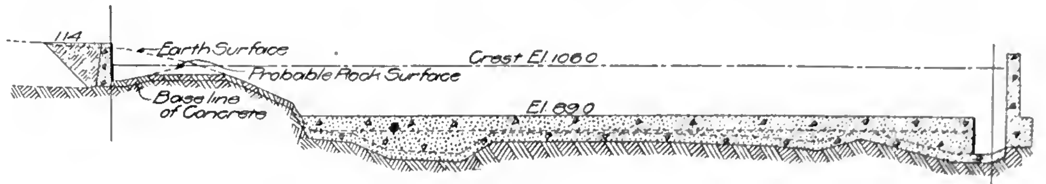
The footing course is considered as a beam supported by the counterforts. The pressure is greatest near the toe and gradually decreases until it becomes a minus quantity at the back of the abutment. The footing course near the front of the abutment is therefore heavily reinforced, and the reinforcement is decreased as the back of the footing course is approached. The sketch given herewith shows the dimensions and proportions of one of the typical abutments.

Hydraulic Development at West Buxton, Me.

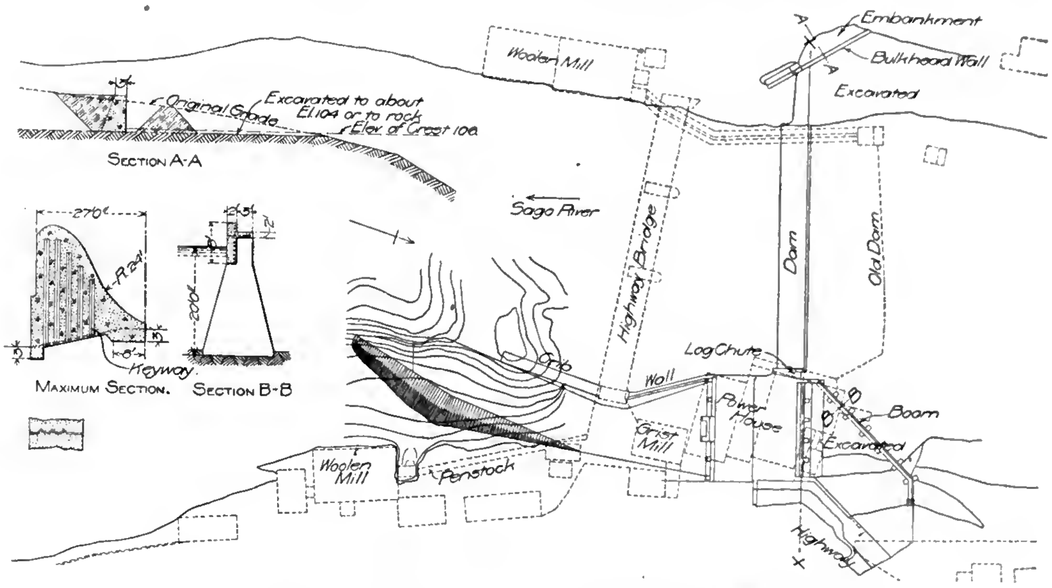
There is now being installed at West Buxton, about 20 miles west of Portland, Me., a 3,000-kw. plant for the transmission of a 3-phase, 60-cycle, 30,000 volt current to the Electric Lighting Co., at Portland. It will be operated by hydraulic power developed in the Saco River and involves the construction of a dam about 300 ft. long, 33 ft. in extreme height and 28 ft. in width at the base, a 100 x 100-ft. power house, a 40 x 100-ft. dynamo house, with four 750-kw. units, turbines and other machinery required, a 150-ft. boom, a log-chute, and a 50 x 300-ft. tail race.

At the site the river has a width of 350 ft. an average depth of 3 ft., and a velocity of about 6 ft. per sec. at ordinary stages of the water. A 4-span highway bridge formerly crossed the river about 100 ft. below the present dam and slightly oblique to it, a crib dam crossed the river about 50 ft. above it and connected at the east end with an old grist mill and other buildings which occupied the site of the power house.

The dam is approximately perpendicular to the shore line and has a standard cross section with curved crest and ogee face downstream, a vertical face upstream, and a depressed footing or cut-off wall at both the up and downstream longitudinal edges of the foundation. The west end of the dam makes an oblique angle with a concrete abutting wall which it intersects and with which it is integral, the footings of this wall are carried down to rock and it has a maximum height of 10 ft. with a top width of 3 ft. It extends about 100 ft. upstream from the dam to intersections with the maximum flow lines of the impounded water and is carried up to a height of 8 ft. above the crest of the dam, thus concentrating all flow over the crest of the dam and protecting the bank on the downstream side. The wall was built in an open cut with 1:1 slopes and was back filled on the shore side, the river side being left unfilled and excavated near the dam to a depth of 3 ft. below the crest. At the opposite end of the dam a sluice 11 ft. wide and 2 ft. deep below the crest is built to afford



Section X-X. Longitudinal Profile of Dam.



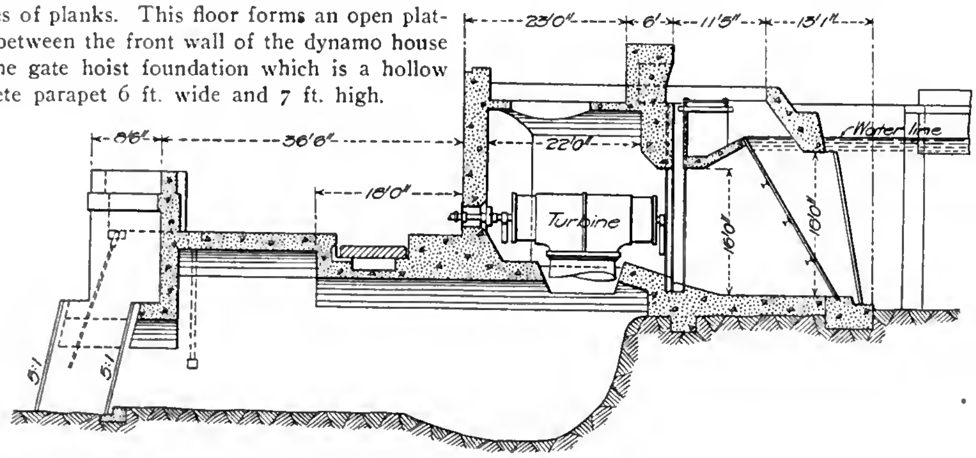
Location of Dam and Power House, with Sections.

General View of Dam and Power House.

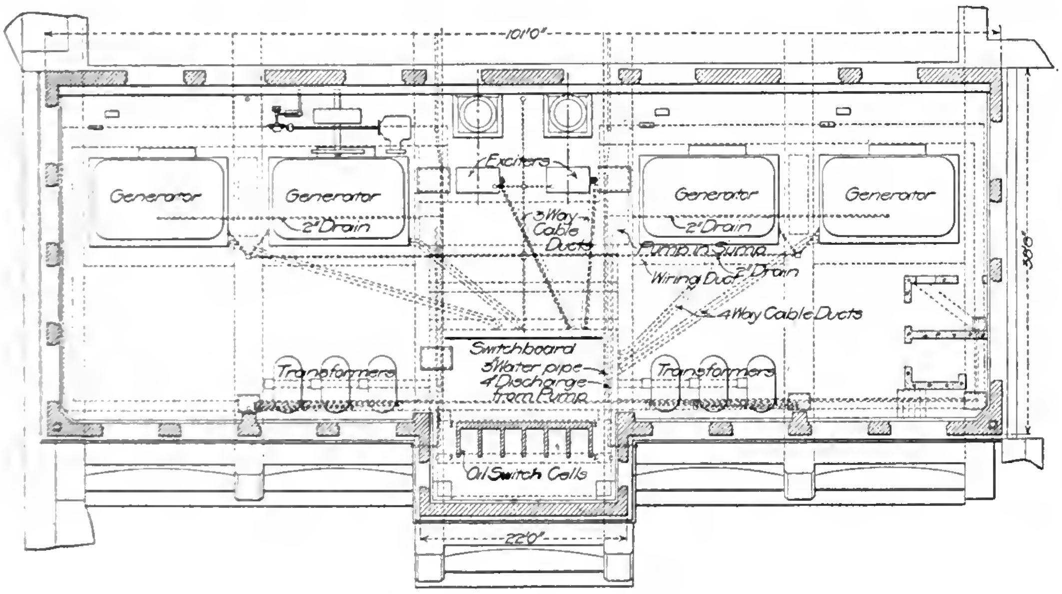
a runway chute for logs and slopes rapidly downward to a point about 10 ft. beyond the lower face of the dam where it is below water level. The sluice is integral on the river side with the dam and on the shore side with the outer wall of the power house foundations. Normally, the sluice is opened and the water discharged through it somewhat reduces the depth on the crest of the dam, but provision is made for closing it if necessary by stop planks fitting recesses in the side walls near the upper end.

The power house foundations are of concrete up to a level 75 ft. above the dynamo floor, above which the structure is entirely of brick and steel except on the side towards the turbine chambers, which are separated from the dynamo room by a concrete wall extending 8 ft. above the crest. The floor of the dynamo room is 13 ft. below the crest of the dam and in order to provide for a possible flood such as was caused by an ice gorge eight years ago, the windows and doors are 7½ ft. above the floor and the walls are made reasonably tight up to that height. Water is admitted to the turbine chambers through five rectangular 16 x 16-ft. openings between the four longitudinal interior foundation walls which are extended about 23 ft. beyond the intake gate to form piers with slightly inclined cut waters and a concrete foundation on the solid rock 22 ft. below the crest of the dam. The piers support on their upstream faces a continuous reinforced concrete girder with an irregular cross section about 8 ft. deep and 7 ft. wide, having its lower surface 2 ft. below the crest of the dam to form a sort of boom to intercept any floating material and also a support for needles for closing any penstock above the gates, as well as making foundations for a future house over gates, hoists and screens. A depressed walk 2½ ft. wide and 3 ft. above the crest of the dam provides a platform from which it is easy to push the débris along the face of the boom and from which needles may be placed. About 7 ft. in the clear downstream from this girder there is a second thin horizontal girder supported on the piers and extending across the full width of the power house. It has a horizontal and inclined surface forming the bottom and one side of a trough opening into the log chute. The downstream side of the trough is vertical and is formed by horizontal planks separating it from the gates. The upstream edge of the trough is at the level of the dam crest and forms a support for the inclined rack bars 23 ft. 3 in. long and 2 in. apart on centers. The feet of these bars take bearings on a concrete footing and they are intermediately supported by three lines of equidistant horizontal I-beams. A timber platform is carried by transverse I-beams 4 ft. above the top of the trough and permits an attendant easily to float the ice which may accumulate against the masonry or rack over the edge of the trough and thence push it or allow the current in the trough to carry it down to the log sluice.

The floor of the turbine room is made with massive concrete arches without reinforcement which are 2.5 ft. thick at the crown and are carried by the 3-ft. longitudinal interior walls in the plane of the outside piers above mentioned. The tops of these walls are pitched both ways from the centers to the springing line so as to give radial surfaces for the skewback bearings. The footings of these walls are carried down 39 ft. below the crest of the dam or 1 ft. below the level of the main excavation. The roof over the turbine room is similar in construction to its floor, but the arches are only 1 ft. thick at the crown and are pierceced over the centers of the turbines with large circular holes closed with doors made with two crossed courses of planks. This floor forms an open platform between the front wall of the dynamo house and the gate hoist foundation which is a hollow concrete parapet 6 ft. wide and 7 ft. high.



Section through Forebay and Tailrace.



Plan of Power House.

The entire area of the dynamo room is commanded by a traveling crane of 34½ ft. span, and 15-tons capacity, with its rails 5 ft. clear of the lower ends of the 20-in. roof beams 7 ft. 8 in. apart on centers which are pitched about 1 in 36 and carry a continuous 4-in. slab of concrete, reinforced by No. 10 expanded metal with 3-in. meshes and covered with tar and gravel.

The intakes are closed by vertical wooden gates made with 4-in. horizontal planks with pairs of 8 x 10-in. vertical lifting beams bolted, keyed and X-braced to them and provided with cast-iron racks engaging pinions operated by hand from the deck above. Many logs are run down the river and are diverted from the power house by the main boom which extends from the log sluice to the river bank at a point about 110 ft. upstream, thus making an angle of about 45 deg. with the face of the power house and facilitating the movement of logs and other drifting material to the sluice. It is a horizontal concrete girder with a T-shaped cross section 8 ft. deep and 5 ft. wide with vertical and horizontal webs respectively 2 ft. and 1 ft. in thickness. The vertical web is reinforced by 19 rods with areas of 1 sq. in. spaced 5 in. apart lapped 2 ft. at joints and located 2 in. from the downstream face of the beam. The horizontal web is reinforced by six bars each with an area of .62 sq. in. spaced 6 in. apart, lapped 13 in. at joints and located 2 in. above its lower surface and forms a walk. The booms are supported on concrete piers, 4 ft. thick, with both sides battered 4:1 and nearly 23 ft. apart on centers. The girder is made continuous with three-panel lengths and butt joints for expansion on the center line of the center pier, the river abutment, and the last pier at the shore side.

The existing dam over 100 years old was made with cribs filled with stone and although in excellent preservation was so leaky that all the silt and sediment had washed through it from the pond above. It was made tight with sand bags put in place by divers and the crest was raised 5 ft. with flash boards supported on triangular wooden frames, the west end being torn out to take the flow. A low earth dam or dyke sheeted on the lower side, was built nearly across the river below the site of the new dam and the river diverted to a channel near the west bank by a cofferdam 200 ft. long on the east side of the channel parallel to the shore line and connecting the old dam and the dike below. It was made with timber cribs, 15 ft. high, 12 ft. long and 16 ft. wide floated to place, filled with sand and sheeted with 3-in. tongue and groove vertical planks. The area between the dams was drained and kept dry with a single pulsometer and a 6-in. steam pump. The surface of the granite rock was found smooth and regular, but on account of the deep seams it contained was excavated with steam drills and dynamite to a depth of 4 to 8 ft. for the footings of the new dam.

A concrete platform 33 ft. above the river bottom was built on falsework trestle bents at the level of the highway on the east bank of the river. Stone from the excavation was broken in a Gates crusher and stored in a 1,000-yd. pile on the opposite side of the road from the plaftorm, where sand and gravel were also delivered by wagons. Cement was stored in adjacent buildings and all of the material was delivered by wheel-barrows to the center of the platform where they were measured and chuted through trap doors to two Smith mixers under the platform which delivered the concrete to 1-yd. bottom dump steel buckets on flat cars on a 2-ft. track on a service platform about 400 ft. long and 16 ft. above the bottom of the river. The concrete was delivered to six guyed derricks with 5-ton, 60-ft. booms which commanded the entire length of the dam and handled the forms and all ma-

terials. They were operated by Lidgerwood double drum engines and handled a maximum of about 200 yd. of concrete daily.

The concreting was carried on without interruption during the coldest weather and when the temperature was as low as minus 47°. The only precautions taken were to mix the concrete with hot water and to soak the broken stone in a hot water tank large enough for two 1-yd. skips and heated by exhaust steam from the steam engine and live steam from the hoisting engine boilers. Although the sand was used cold, the concrete was so hot when first mixed that sometimes the men could scarcely walk in it with rubber boots. It was covered at night with tarpaulins and in the morning was found still moist and unfrozen.

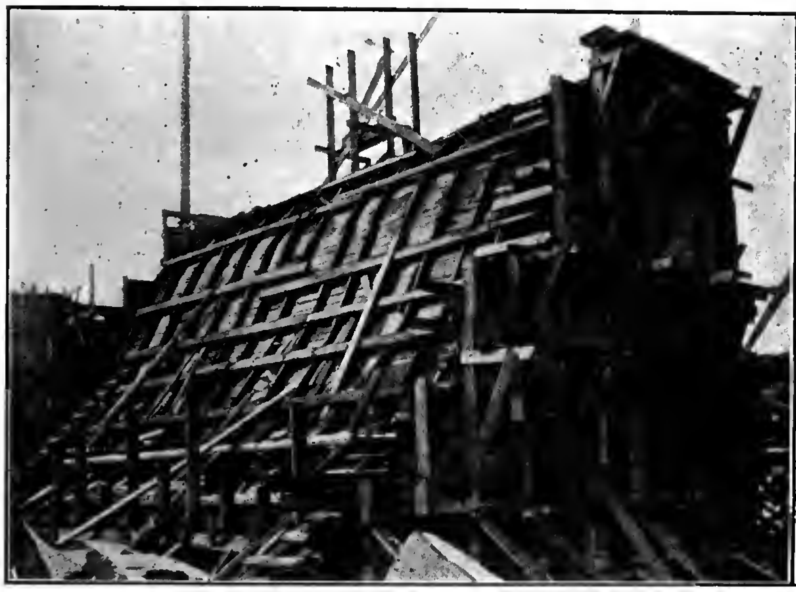
The dam was made in alternate sections 40 ft. long, bonded together with four vertical triangular 12x12-in. keys 18 in. apart in the clear. They terminated 2 ft. below the upper surface of the dam.

Derrick stones up to 1 yd. in volume were bedded in the concrete and formed about 30 per cent. of its mass. Care was taken in filling the molds to complete a horizontal course over the whole surface each day, a requirement which necessitated the men sometimes working from 12 to 14 hr.; corresponding heights of from 3 to 8 ft. a day were secured according to whether the work was at the base or the top of the dam. Successive courses were bonded together by large stones imbedded in the surface so as to project half-way above the top of the lower course and tooth with the upper course. The forms were built of 2-in. square edged dressed pine planks and were not interchangeable, being knocked down as each one was stripped and rebuilt for the next.

The contract was awarded Aug. 20, 1906, and work at the site was commenced Sept. 1, and has been carried on continuously ever since and the concrete work is now completed with the exception of two 40-ft. sections of the dam at the waste channel. Conditions have been favorable and low water has prevailed except during the spring freshet, when the discharge amounted to about 12,000 cu. ft. per second. The principal quantities include 150,000 ft. board measure of lumber in the forms, 25,000 cu. yd. of excavation, and 11,000 yd. of concrete made with Atlas and Vulcanite Portland cement. About 400 men were employed on the work during the fall, until it was seen that it would be impossible to complete the dam before the ice went out in the spring, and at Christmas the force was reduced to 200 men and maintained at that figure during the winter. J. G. White & Co. are the contractors, Mr. A. S. Crane, chief hydraulic engineer, and Mr. C. H. Nichols, superintendent of construction.

The Loring N. Farnum Co. are subcontractors for the dam and power house.

The turbines are supplied by the S. Morgan Smith Co.; the electrical apparatus by the General Elec. Co., and the water wheel governors by the Lombard-Replogle Co.



Mould for One Section of Dam.

Offsets and Recesses for Bonding Sections.

Power Plant of a Paper Mill.

What electricity will do in improving conditions in paper production is well shown in the new works of the Willamette Pulp & Paper Co., at Oregon City. The company's first mill was built at a 25-ft. fall in the Willamette River. The location was not particularly good for manufacturing and since the development of electric power transmission and shop operation it has become possible to build the new mill 1,000 ft. from the falls and drive it by motors receiving current from a turbine-driven unit at the old mill. In this way it has become possible to develop 750 h.-p. additional at the falls and to use it at the most advantageous site. The turbine is rated at 1,000 h.-p. and was built by the Platt Iron Works; it is direct-connected to a 600-kw., 3-phase, 600-volt General Electric generator, and power is transmitted directly at the generator voltage. The machinery in the mill is driven mainly on the group system by induction motors. A 200-h.-p. motor drives a 12 x 13-in. chipper, a chip separator, a saw-dust conveyor and a chip elevator. A 200-h.-p. motor drives three pumps and four beaters; owing to the large starting effort required for the beaters, a friction clutch is inserted in the line shaft so that the motor can come up to speed without load and then take the load gradually by means of the clutch. A 100-h.-p. motor drives two chest agitators and three pumps, and another motor of equal rating runs the Jordan engine. A 50-h.-p. motor drives four wet machines and three Decker machines. Motor operation is not used with the 152-in. paper machine, since the drying cylinders require a large amount of steam for warming purposes and a 650-h.-p. non-condensing engine furnishes the most economical operation, as the exhaust can be used for warming.

A HORIZONTAL EXPANSION JOINT has been provided between the top of the Wachusett dam and the granolithic surfacing above it, which averages $5\frac{1}{2}$ in. in thickness. This was done by covering the top of the dam with powdered mica, which prevented the adhesion of the two surfaces. The granolithic pavement is in squares about 9 ft. 9 in. on a side, with ½-in. joints filled with asphaltum.

Report of the British Joint Committee on Reinforced Concrete.

In October, 1905, the Royal Institute of British Architects invited a number of leading organizations and government departments interested in reinforced concrete to appoint representatives on a joint committee to draw up rules for the guidance of architects for the use of reinforced concrete. Up to that time, there had been no authoritative rules prepared in the country, owing to the practical prohibition of reinforced concrete for complete buildings by the ordinary building regulations. Only railway and dock companies and other bodies exempt from these restrictions had been able to avail themselves of this method of construction. The committee was made up of the following members: Royal Institute of British Architects, Sir Henry Tanner, chairman, Messrs. T. Walmisley, William Dunn, Max Clarke and H. D. Searles-Wood; District Surveyors' Association, Messrs. Thomas H. Watson and E. D. Drury; Institute of Builders, Messrs. B. I. Greenwood and Frank May; Municipal and County Engineers' Association, Messrs. A. E. Collins and J. W. Cockrill; War Office, Col. C. B. Mayne, vice-chairman, and Major E. M. Paul; Admiralty, Mr. C. H. Colson; special members, Prof. W. C. Unwin, vice-chairman, Mr. Charles F. Marsh and Col. F. Winn. The aim of this committee was to produce a good working guide, laying down the necessary conditions and stating safe rules for a proper disposition of the parts of a reinforced concrete structure. Previously every specialist in the country made his own rules and the margin of safety was occasionally cut too fine. In preparing its rules, the committee endeavored to avoid giving any preference to patented systems and materials, and confined itself to stating principles for all kinds of structures reinforced with ordinary bars. The report reads as follows:

1. Reinforced concrete is used so much in building and engineering construction that a general agreement on the essential requirements of good work is desirable. The proposals which follow are intended to embody these essentials, and to apply generally to all systems of reinforcement.

Good workmanship and materials are essential in reinforced concrete. With these and good design structures of this kind appear to be trustworthy. It is essential that the workmen employed should be skilled in this class of construction. Very careful superintendence is required during the execution of the work in regard to—

(a) The quality, testing and mixing of the materials.

(*b*) The sizes and positions of the reinforcements.

(*c*) The construction and removal of centering.

(*d*) The laying of the material in place and the thorough punning of the concrete to ensure solidity and freedom from voids.

If the metal skeleton be properly coated with cement, and the concrete be solid and free from voids, there is no reason to fear decay of the reinforcement in concrete of stone, gravel, cinder, coke-breeze, etc., made with clean, fresh water.

2. The By-Laws regulating building in this country require external walls to be in brick, or stone, or concrete of certain specified thicknesses. In some places it is in the power of the local authorities to permit a reduced thickness of concrete when it is strengthened by metal; in other districts no such power has been retained. We are of opinion that all By-Laws should be so altered as to expressly include reinforced concrete amongst the recognized forms of construction.

A section should be added to the By-Laws declaring that when it is desired to erect buildings in reinforced concrete complete drawings showing all details of construction and the sizes and positions of reinforcing bars, a specification of the materials to be used and proportions of the concrete, and the necesary calculations of strength based on the rules contained in this report, signed by the person or persons responsible for the design and execution of the work, shall be lodged with the local authority.

3. (*a*) Floors, walls and other constructions in steel and concrete formed of incombustible matetials prevent the spread of fire in varying degrees according to the composition of the concrete, the thickness of the parts, and the amount of cover given to the metal.

(*b*) Experiment and actual experience of fires show that concrete in which limestone is used for the aggregate is disintegrated, crumbles and loses coherence when subjected to very fierce fires, and that concretes of gravel or sandstones also suffer, but in a rather less degree. The smaller the aggregate the less the injury. The metal reinforcement in such cases generally retains the mass in position, but the strength of the part is so much diminished that it must be renewed. Concrete in which coke-breeze, cinders or slag forms the aggregate is only superficially injured, does not lose its strength, and in general may be repaired. Concrete of broken brick suffers more than cinder concrete and less than gravel or stone concrete.

(*c*) The material to be used in any given case should be governed by the amount of fire resistance required as well as by the cheapness of, or the facility of procuring, the aggregate.

(*d*) Rigidly attached web members, loose stirrups, bent-up rods, or similar means of connecting the metal in the lower or tension sides of beams or floor slabs (which sides suffer most injury in case of fire) with the upper or compression sides of beams or slabs not usually injured are very desirable.

(*e*) For main beams a covering of 1½ to 2 in. of concrete over the metal reinforcement appears from experience in actual fires to afford ample protection to the structural parts. In floor slabs the cover required may be reduced to 1 in. All angles should be rounded or splayed to prevent spalling off under heat.

(*f*) More perfect protection to the structure is required under very high temperature, and in the most severe conditions it is desirable to cover the concrete structure with fire-resisting plastering which may be easily renewed. Columns may be covered with coke-breeze concrete, terra-cotta, or other fire-resisting facing.

Materials.—4. Only Portland cement complying with the requirements of the specification adopted by the British Engineering Standards Committee should be employed; in general the slow-setting quality should be used. Every lot of cement delivered should be tested, and in addition the tests for soundness and time of setting, which can be made without expensive apparatus, should be applied frequently during construction. The cement should be delivered on the works in bags or barrels bearing the maker's name and the weight of the cement contained.

5. The sand should be composed of hard grains of various sizes up to particles which will pass a quarter-inch square mesh, but of which at least 75 per cent. should pass ⅛-in. square mesh. Fine sand alone is not so suitable, but the finer the sand the greater is the quantity of cement required for equal strength of mortar. It should be clean and free from ligneous, organic or earthy matter. The value of a sand cannot always be judged from its appearance, and tests of the mortar prepared with the cement and the sand proposed should always be made. Washing sand does not always improve it, as the finer particles which may be of value to the compactness and solidity of the mortar are carried away in the process.

6. The aggregate, consisting of gravel, hard stone, or other suitable material, should be clean and angular, varied in size as much as possible between the limits of size allowed for the work. In all cases material which passes a sieve of a ¼-in. square mesh should be reckoned as sand. the maximum allowable size is usually ¾ in. The maximum limit must always be such that the aggregate can pass between the reinforcing bars and between these and the centering. The sand should be separated from the gravel or broken stone by screening before the materials are measured.

7. In all cases the proportions of the cement, sand and aggregate should be separately specified in volumes.

As the strength and durability of reinforced concrete structures depend mostly on the concrete being properly proportioned, it is desirable that in all important cases tests should be made as described herein with the actual materials that will be used in the work before the detailed designs for the work are prepared.

In no case should less dry cement be added to the sand when dry than will suffice to fill its interstices, but subject to that the proportions of the sand and cement should be settled with reference to the strength required, and the volume of mortar produced by the admixture of sand and cement in the proportions arranged should be ascertained.

The interstices in the aggregate should be measured and at least sufficient mortar allowed to each volume of aggregate to fill the interstices and leave at least 10 per cent. surplus.

For ordinary work a proportion of one part cement to two parts sand will be found to give a strong, practically watertight mortar, but where special watertightness or strength is required the proportion of cement must be increased.

The amount of cement added to the aggregate should be determined on the work by weight. The weight of a cubic foot of cement for the purpose of proportioning the amount of cement to be added may be taken at 90 lbs.

8. The metal used should be steel having the following qualities:—

(*a*) An ultimate strength of not less than 60,000 lb. per square inch.

(*b*) An elastic limit of not less than 50 per cent., or more than 60 per cent. of the ultimate.

(*c*) An elongation of not less than 22 per cent. in the lengths stated below.

(*d*) It must stand bending cold 180° to a diameter of the thickness of pieces tested without fracture on outside of bent portion.

In the case of round bars the elongation should not be less than 22 per cent., measured on a gauge-length of eight diameters. In the case of bars over one inch in diameter the elongation may be measured on a gauge-length of four diameters, and should then be not less than 27 per cent. For other sectional material the tensile and elongation tests should be those prescribed in the British Standard Specification for Structural Steel.

Before use in the work the metal must be clean and free from scale or loose rust. It should not be oiled or painted, but a wash of thick Portland cement grout is desirable.

Welding should in general be forbidden; if it is found necessary, it should be at points where the metal is least stressed, and it should never be allowed without the special sanction of the architect or engineer responsible for the design.

The reinforcement ought to be placed and kept exactly in the positions marked on the drawings, and, apart from any consideration of fire resistance, ought not to be nearer the surface of the concrete at any point than 1 in. in beams and ½ in. in floor slabs or other thin structures.

9. In all cases the concrete should be mixed in small batches and in accurate proportions, and should be laid as rapidly as possible.

When the materials are mixed by hand they are to be turned over and thoroughly mixed on a clean platform until the color of the cement is uniformly distributed over the aggregate.

Whenever practicable the concrete should be mixed by machinery.

10. The thickness of loose concrete that is to be punned should not exceed 3 in. before punning, especially in the vicinity of the reinforcing metal. Special care is to be taken to ensure perfect contact between the concrete and the reinforcement, and the punning to be continued till the concrete is thoroughly consolidated. Each section of concreting should be as far as possible completed in one operation; when this is impracticable, and work has to be recommenced on a recently laid surface, it is necessary to wet the surface; and where it has hardened it must be hacked off, swept clean, and covered with cement grout. Work should not be carried on when the temperature is below 34° Fahr. The concrete when laid should be protected from the action of frost, and shielded against too rapid drying from exposure to the sun's rays or winds, and kept well wetted. All shaking and jarring must be avoided. The efficiency of the structure depends chiefly on the care with which the laying is done.

The amount of water to be added depends on the temperature at the time of mixing, the materials, and the state of these, and other factors, and no recommendation has therefore been made. Sea-water should not be used.

11. The centering must be of such dimensions, and so constructed, as to remain rigid and unyielding during the laying and punning of the concrete. It must be so arranged as to permit of easing and removal without jarring the concrete. Provision should be made wherever practicable for splaying or rounding the angles of the concrete. Timber when used for centering may be advantageously limewashed before the concrete is deposited.

12. The time during which the centres should remain up depends on various circumstances, such as the dimensions or thickness of the parts of the work, the amount of water used in mixing, the state of the weather during laying and setting, etc., and must be left to the judgment of the person responsible for the work. The casing for columns, for the sides of beams, and for the soffits of floor slabs not more than 4 ft. span must not be removed under eight days; soffits of beams and of floors of greater span should remain up for at least fourteen days, and for large span arches for at least twenty-eight days. The centering of floors in buildings which are not loaded for some time after the removal of

same may be removed in a short time; the centering for structures which are to be used as soon as completed must remain in place much longer. If frost occurs during setting, the time should be increased by the duration of the frost.

13. Before the detailed designs for an important work are prepared, and during the execution of such a work, test pieces of concrete should be made from the cement, sand and aggregate to be used in the work, mixed in the proportions specified. These pieces should be either cubes of not less than 4 in. each way, or cylinders not less than 4 in. diameter, and of a length not less than the diameter. They should be prepared in moulds, and punned as described for the work. Not less than four cubes or cylinders should be used for each test, which should be made twenty-eight days after moulding. The pieces should be tested by compression, the load being slowly and uniformly applied. The average of the results should be taken as the strength of the concrete for the purposes of calculation, and in the case of concrete made in proportions of 1 cement, 2 sand, 4 hard stone, the strength should not be less than 2,400 lb. per square inch.

Loading tests on the structure itself should not be made until at least two months have elapsed since the laying of the concrete. The test load should not exceed one and a half times the accidental load. Consideration must also be given to the action of the adjoining parts of the structure in cases of partial loading. In no case should any test load be allowed which would cause the stress in any part of the reinforcement to exceed two-thirds of that at which the steel reaches its elastic limit.

Methods of Calculation.—1. In designing any structure there must be taken into account:—

(*a*) The weight of the structure.

(*b*) Any other permanent load, such as flooring, plaster, etc.

(*c*) The accidental load. By "accidental" load is meant the imposed load additional to the weight of the structure for which the structure is calculated.

(*d*) In some cases also an allowance for vibration and shock.

Of all probable distributions of the load, that is to be assumed in calculation which will cause the greatest straining action.

The weight of the concrete and steel structure may be taken at 150 lb. per cubic foot.

In structures subjected to very varying loads and more or less vibration and shock, as, for instance, the floors of public halls, factories, or workshops, the allowance for shock may be taken equal to half the accidental load.. In structures subjected to considerable vibration and shock, such as floors carrying machinery, the roofs of vaults under passage ways and courtyards, the allowance for shock may be taken equal to the accidental load.

In the case of columns or piers in buildings, which support three or more floors, the load at different levels may be estimated in this way. For the part of the roof or top floor supported, the full accidental load assumed for the floor and roof is to be taken. For the next floor below the top floor 10 per cent. less than the accidental load assumed for that floor. For the next floor 20 per cent. less, and so on to the floor at which the reduction amounts to 50 per cent. of the assumed load on the floor. For all lower floors the accidental load on the columns may be taken at 50 per cent. of the loads assumed in calculating those floors.

2. Spans may be taken as follows: For beams the distance from centre to centre of bearings. For slabs supported at the ends, the clear span + the thickness of slab. For slabs continuous over more than one span the distance from centre to centre of beams.

3. In the most ordinary case of a uniformly distributed load of w lbs. per inch run of span the bending moments will be as follows:

(*a*) Beam or slab simply supported at the ends. Greatest bending moment at centre of span of l inches is equal to $w\ l^2/8$ inch-lbs.

(*b*) Beam continuous over several spans, or encastré or fixed in direction at each end. The greatest bending moments are at the ends of the span, and the beam should be reinforced at its upper side near the ends. If continuity can be perfectly relied on, the bending moment at the centre of the span is $w\ l^2/24$, and that over the supports — $w\ l^2/12$. If the continuity is in any way imperfect, the bending moment at the centre will in general be greater, and that at the supports less, but the case is a very indefinite one. It appears desirable that generally in building construction the centre bending moment should not be taken less than $w\ l^2/12$. The bending moment at the ends depends greatly on the fixedness of the ends in level and direction. When continuity and fixing of the ends, whether perfect or imperfect, is allowed for in determining the bending moment near the middle of the span, the beam or slab must be designed and reinforced to resist the corresponding bending moments at the ends. When the load is not uniformly distributed the bending moments must be calculated on the ordinary statical principles.

4 The internal stresses are determined, as in the case of a homogeneous beam, on these approximate assumptions:

(*a*) The coefficient of elasticity in compression of stone or gravel concrete, not weaker than 1:2:4, is treated as constant and taken at one-fifteenth of the coefficient of elasticity of steel: Coefficient for concrete = E_c = 2,000,000 lb. per square inch; coefficient for steel = E_s = 30,000,000 lb.; $E_s \div E_c = 15$. It follows that at any given distance from the neutral axis, the stress per square inch on steel will be fifteen times as great as on concrete.

(*b*) The resistance of concrete to tension is neglected, and the steel reinforcement is assumed to carry all the tension.

(*c*) The stress on the steel reinforcement is taken as uniform on a cross-section, and that on the concrete as uniformly varying.

5. If the concrete is of such a quality that its crushing strength is 2,400 to 3,000 lb. per square inch after twenty-eight days, and the steel has a tenacity of not less than 60,000 lb. per square inch, the following stresses may be allowed:

Concrete, in compression in beams subjected to bending, 600 lb. per square inch; concrete in columns under simple compression, 500 lb. per square inch; concrete in shear in beams, 60 lb. per square inch; adhesion of concrete to metal, 100 lb. per square inch; steel in tension, 15,000 to 17,000 lb. per square inch.

It is desirable that the reinforcing rods should be so designed that the adhesion is sufficient to resist the shear between the metal and concrete. Precautions should in every case be taken by splitting or bending the rod ends, or otherwise to provide additional security against the sliding of the rods in the concrete.

When the proportions of the concrete differ from those stated above the stress in compression allowed in beams may be taken at one-fourth, and that in columns at one-fifth of the crushing stress of cubes of the concrete of sufficient size at twenty-eight days after gauging. If stronger steel is used than that stated above, the allowable tensile stress may be taken at one-half the stress at the yield point of the steel.

Let b be the width and d the effective depth of the beam in inches.

$A = bd$ the area of cross-section.

$m = E_s/E_c$ the ratio of the coefficients of elasticity of steel and concrete.

M = bending moment at the section considered, in inch-pound units.

t = tensile stress in metal in pounds per square inch.

c = compressive stress in concrete per square inch.

z = distance of resultant thrust in concrete from compressed edge of beam in inches.

kd = distance of neutral axis from compressed edge in inches.

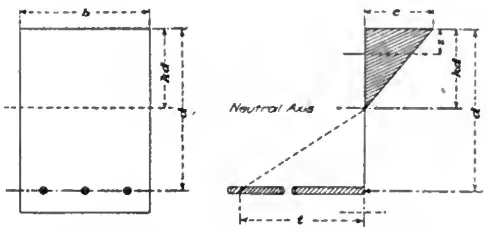
$A_c = kbd$ = area of concrete in compression in square inches.

A_t = area of metal in tension in square inches.

$p = A_t/bd$ the ratio of section of metal to section of concrete.

l = span in inches.

w = load per inch run of span.



(*a*) *Beams of Rectangular Section with Single Reinforcement.*—In a homogeneous beam the stresses are proportional to the distances from the neutral axis. In a discrete beam, such as a beam of concrete and steel, on account of the greater rigidity of steel, at a given distance from the neutral axis the stress in the steel will be m times as great as in concrete. Hence—

$$\frac{mc}{t} = \frac{kd}{d\,(1 - k)} = \frac{k}{1 - k}$$

But equating the total tension and compression

$$\tfrac{1}{2}\,cbkd = pbdt$$
$$ck = 2pt.$$

Replacing c in terms of t

$$k^2 \div m\,(1 - k) = 2p$$
$$k = \sqrt{(p^2m^2 + 2pm)} - pm.$$

Thus for $m = 15$

p = 0.007, 0.010, 0.015, 0.020.

k = 0.365, 0.417, 0.483, 0.530.

That is, the neutral axis is lower as the amount of reinforcement is greater, and passes the half depth for 2 per cent. of reinforcement.

The distance of the resultant thrust from the compressed edge is $z = \tfrac{1}{3}kd$.

Equating the moments of resistance to the bending moment,

$$M = A_t t\,(d - \tfrac{1}{3}kd) = \tfrac{1}{2}A_c c\,(d - \tfrac{1}{3}kd)$$

$$t = \frac{M}{A_t d\,(1 - \tfrac{1}{3}k)} = \frac{M}{pbd^2\,(1 - \tfrac{1}{3}k)}$$

$$c = \frac{2M}{A_c d\,(1 - \tfrac{1}{3}k)} = \frac{2M}{kbd^2\,(1 - \tfrac{1}{3}k)}$$

The shearing stresses and tensions near the ends of the beam are usually resisted by stirrups or inclined steel bars, and it is always desirable to bend upwards near the supports one or more of the reinforcing bars when the reduced bending moments at the ends permit of so doing. Stirrups or rigidly attached web members or inclined bars should be provided in all cases where the average shearing stress on a vertical section of the beam exceeds 60 lb. per square inch of the section. A theoretical determination of the section required for these would be very difficult. If the simple case is taken of a uniformly loaded beam, supported at the ends with horizontal steel tension bars not bent up at the ends, the adhesion between concrete and steel which is required may be found thus: The difference of tension in 1-ft. length of bars at the end of the span will be the tangential force between steel and concrete in

that distance. The bending moment at the end is 0, and at 1 ft. from the end $6w\ (l - 12)$ inch-pounds, where w is the load per inch run. Hence the increment of tension between the end and 1 ft. from the end is

$$6w\ (l - 12) \div d\ (1 - \tfrac{1}{3}\ k) \text{ lb.}$$

If Ψ is the total perimeter of the reinforcing bars, the adhesion stress is $w\ (l - 12) \div 2\ \Psi\ d\ (1 - \tfrac{1}{3}\ k)$ lb. per square inch.

(b) *Beams of T Section with Single Reinforcement.*—In designing T beams where the upper flange forms a floor the thickness d_1 of this wall first be ascertained by considering the part between two ribs as a slab, having its own reinforcing bars transverse to the rib. The whole of this cannot in general be considered to form part of the upper flanges of the T beams. The width b_1 of the upper flange may be assumed to be not greater than one-third the span of the beams, or than three-fourths of the distance from centre to centre of the reinforced ribs. There is no satisfactory theoretical determination of the precise amount of the floor slab acting with the web. The depth d should then be determined with reference to the stiffness required in the floor. In general d is from one-twelfth to one-eighteenth of the span.

Two cases arise according as the thickness of flange is greater or less than kd, the distance from the neutral axis to the compressed edge. In the former case (d_1 greater than kd) the rules under (a) apply if b_1 is substituted for b, and $A = b_1d_1 + b\ (d - d_1)$ for bd. The equations then become

$$mc \div t = k \div (1 - k)$$

$$k = \sqrt{\left(\frac{2pAm}{b_1d} + \frac{p^2A^2m^2}{b_1^2d^2}\right)} - \frac{pAm}{b_1d}$$

$$= \sqrt{\left(\frac{2A_tm}{b_1d} + \frac{A_t^2m^2}{b_1^2d^2}\right)} - \frac{A_tm}{b_1d}$$

$$z = \tfrac{1}{3}kd$$

$$t = \frac{M}{A_td(1 - \tfrac{1}{3}k)} = \frac{M}{pAd(1 - \tfrac{1}{3}k)}$$

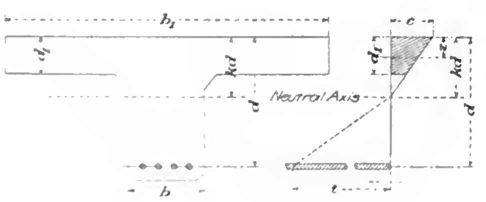
$$c = \frac{2M}{A_cd(1 - \tfrac{1}{3}k)} = \frac{2M}{kb_1d(1 - \tfrac{1}{3}k)}$$

where $pA = A_t$ the section of reinforcement. The increment of tension in 1 ft. length at the end of the beam and the adhesion stress is the same as in (a).

When d_1 is less than kd the small compression in the web between d_1 and kd may be neglected.

Let, as before, the whole area of section $= A = b_1d_1 + b(d - d_1)$, and pA be the area of reinforcement.

$$mc \div t = k \div (1 - k).$$



The mean compressive stress on the flange is

$$\tfrac{1}{2}\left\{c + c\frac{kd - d_1}{kd}\right\} = \frac{c}{2}\ \frac{2kd - d_1}{kd}.$$

Equating the total tension and compression,

$$A_tt = pAt = \tfrac{1}{2}b_1d_1c\ (2kd - d_1) \div kd$$

$$kd = \frac{b_1d_1^2 + 2pAmd}{2b_1d_1 + 2pAm} = \frac{b_1d_1^2 + 2A_tmd}{2b_1d_1 + 2A_tm}.$$

$$\text{But } z = \frac{d_1}{3}\ \frac{3kd - 2d_1}{2kd - d_1}$$

Equating the moments

$$M = A_tt(d - z) = pAt\ (d - z) = \tfrac{1}{2}b_1d_1c\ (2kd - d_1)\ (d - z) \div kd$$

$$t = M \div pA(d - z)$$

$$c = 2Mkd \div b_1d_1\ (2kd - d_1)\ (d - z).$$

It may be useful also to point out that the area of reinforcement for a given value of c/t is

$$A = pA = \frac{c}{t}\ \frac{b_1d_1\ (2kd - d_1)}{2kd}.$$

(c) *Slabs Supported on More Than Two Sides.*—It does not appear that there is either a satisfactory theory or trustworthy experiments from which the strength of rectangular slabs supported or fixed on all four edges can be determined.

(a) *Short Columns Axially Loaded.*—The reinforcement of columns should in general amount to at least 0.8 per cent. of the gross cross-section. The liability to bending of the longitudinal reinforcing bars greatly weakens the column, and should be prevented by steel binding bars. Some theoretical considerations would indicate that cross-binding is required at points not further apart than twenty-four times the least lateral dimension of the reinforcing rods. But further experiment shows that still closer cross-binding, or, better, spiral binding, greatly increases the strength of the column.

(M. Considère recommends that the distance between the coils of the spiral should not exceed from 1/10 to 1/7 of the diameter of the spiral. In the case of piles subjected to longitudinal shock in driving there are special reasons for decreasing the distance between the cross-binding near the ends.)

If the load is strictly axial the stress is uniform on cross-sections. Let A_c be the cross-section of the column (including the reinforcement), and A the equivalent section as defined below, a the section of logitudinal reinforcing bars, P the load on the column in pounds. Let c be the stress on the concrete, and t that on the steel, the ratio of the coefficients of elasticity being m.

$$c = \frac{P}{A_c + (m - 1)a} = \frac{P}{A}$$

$$t = \frac{mP}{A_c + (m - 1)a} = \frac{mP}{A}.$$

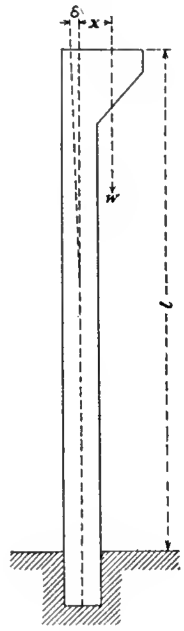
It appears that c may be taken $=$ 500 lb. per square inch, t = 7,500 lb. per square inch, and $E_s/E_c = m = 15$.

When the stress on the concrete is not greater than 500 lb. per square inch, lateral bending of the column as a whole is not to be feared if the ratio of length to the least lateral dimension is not greater than 18.

(b) *Columns Eccentrically Loaded.*—If a column initially straight is loaded eccentrically, as when a beam rests on a bracket attached to the column, it may be regarded as fixed at the base and free at the loaded end. Then it must bend in the plane passing through the load, the deflection at the top being δ. Let x be the eccentricity of the load measured from the centre of the column when straight. Then the bending moment at the base of the column is $W\ (\delta + x)$. But it is known that δ will be small compared with x, provided that W is small compared with $2EI/l^2$, and this will be the case in such conditions as are likely to occur in designing concrete columns. Then the bending moment may be taken as Wx, and the stress at the base of the column, treating it as homogeneous, will be

$$f = W\left\{\frac{1}{A} \mp \frac{x}{Z}\right\}$$

very nearly, where A is the whole section of the



column and Z the modulus of the section relatively to an axis through the centre of gravity and at right angles to the plane of bending.

In dealing with reinforced columns which are not nomogenous, it is convenient to substitute for the actual section of the column what may be termed the equivalent section, or section of concrete equivalent in resistance to the actual column. If A_c is the area of section of the column (including the area of reinforcement) and a is the area of reinforcement, then the equivalent section is

$$A = A_c + (m - 1)a.$$

If h is the depth of the section in the plane of bending, the moment of inertia relatively to the neutral axis can be expressed in the form $I = nAh^2$, and the section modulus in the form $Z = 2nAh$.

It is desirable in columns that there should be no tension, and generally when the vertical load is considerable there is none. Cases in which the eccentricity is so great that there is tension must be treated by the methods applicable to beams if it is made a condition that the steel carries all the tension. In the following cases it is assumed that there is no tension.

Case I.—Column of Circular Section, Reinforcements Symmetrical and Equidistant from the Neutral Axis. Let m be the ratio E_s/E_c of the coefficients of elasticity of steel and concrete, A_c the cross section of the column in square inches, a the area of reinforcement in square inches, h the diameter of the column, h_t the distance between the reinforcing bars perpendicular to the neutral axis. Then the equivalent section is

$$A = A_c + (m - 1)a$$

and the modulus of the section is

$$Z = \tfrac{1}{8}A_ch + \tfrac{1}{2}\ (m - 1)a\ h_t^2 \div h$$

The stress at the edges of the section can then be calculated by the general equation

$$f = W\left\{\frac{1}{A} \mp \frac{x}{Z}\right\}$$

where x is the eccentricity of the load in inches and W the load in pounds. The greater value of f must not exceed the safe stress stated above.

Case II.—Rectangular Section with Reinforcement Symmetrical and Equidistant from the Neutral Axis. Using the same notation as in the

last case, h being now the depth of the section in the plane of bending, the section modulus is

$$Z = \tfrac{1}{6}Ach + \tfrac{1}{2}\ (m - 1)a\ h_t^2 \div h$$

and the stresses are given by the same equation as in the previous case.

Case III.—Column of Circular Section with Reinforcing Bars arranged in a Circle.—Using the same notation as in Case I, h_t being the diameter of the circle of reinforcing bars, the section modulus is

$$Z = \tfrac{1}{8}\ A\ h + \tfrac{1}{4}\ (m - 1)a\ h_t^2 \div h,$$

and the stresses are given by the same equation as in Case I.

(*c*) *Long Columns axially Loaded.*—For columns more than 18 diameters in length there is risk of lateral buckling of the column as a whole. The strength of such columns would be best calculated by Gordon's formula, but there are no experiments on long columns by which to test the values of the constants for a concrete or concrete and steel column. There does not seem, however, to be any probability of serious error if the total load is reduced in a proportion inferred from Gordon's formula to allow for the risk of buckling

Let, as before, A_c = the section of the column in inches; a = the reinforcement. Then $A = A_c + (m - 1)a$ is the equivalent section. Let n be the constant in the equation, $I = nAh^2$, and h the least transverse dimension of the column.

Then for a column fixed in direction at both ends, Gordon's formula is

$$W/Af = 1 \div (1 + l^2/cnh^2) = 1 \div (1 + K)$$

so that the column will carry less than a short column of the same dimensions in the ratio of $1 + K$ to 1, or, in other words, the column will be safe if calculated as a short column, not for the actual load, W, but for a load $(1 + K)W$.

The constant c has not been determined experimentally for reinforced long columns. But its probable value is $c = 4\pi^2\ E_c/f$,

where f is the ultimate crushing stress. Putting E_c = 2,000,000 and f = 2,500, then c = 32,000. Looking at the well-understood uncertainty of the rules for long columns, very exact calculation is useless.

VALUES OF $1 + K$ FOR THREE VALUES OF n.

l/h	Case I. $n = 0.098$	Case II. $n = 0.075$	Case III. $n = 0.0646$
20	1.13	1.17	1.19
25	1.20	1.26	1.30
30	1.29	1.38	1.44

The differences of $1 + K$ for considerable differences of n are not very great.

In the case of columns fixed at one end and rounded or unfixed at the other, $2K$ must be substituted for K. If the column is rounded at both ends, $4K$ must be substituted for K.

Rock Breaking on the Suez Canal.

Rock breaking on the Suez Canal has been done since 1902 with Lobnitz chiseling machines having 13-ton rams. The average height of fall of these rams is from 5 to 10 ft. On the average 132 blows are delivered per hour of effective rock breaking, but as the passage of ships through the canal requires the rock-breaking barge to be drawn aside 30 per cent. of the time, the actual work of the barge is 83 blows per hour of work paid to the crew. The average thickness of the rock bed shattered is 2 ft. 7½ in., and it requires about 5.4 blows per cubic yard to shatter the rock. There is a considerable range in the cost of the work, but it averages 1s. 4.1d. per cubic yard, exclusive of general charges. This does not include the cost of dredging the rock. Similar machines are being used on canal work in western New York.

The Rectification of an Auditorium Roof.

The pitched wooden roof of an auditorium is carried by five 80-ft. Howe trusses 7 ft. deep and 12 ft. apart on centers which also carry the light suspended ceiling. The top chords are made with 1-in. boards spiked together and the bottom chord is made with 2-in. and 4-in. planks. Pairs of vertical screw ended rods divide the trusses into eight 10-ft. panels which are X-braced with solid diagonals abutting at the ends on wooden angle blocks of the usual type. In the many years since the trusses were built they have sagged and shrunk until the deflection at the center panels was about 6 in., which, of course, threw the roof and ceiling badly out of alignment and induced stresses in the walls and framework which it was thought desirable to relieve.

The trusses were sound and otherwise in good condition and it was determined to adjust them without removing or destroying the roof or ceiling. The latter is attached to the trusses with scarcely any clearance below their bottom chords and the height was so great and the working space so small that the job presented many difficulties.

The plan finally adopted was simply to support each truss simultaneously at two intermediate panel points and from them to jack it up to the required height and adjust the vertical rods and diagonals at that elevation so as to retain permanently the camber, after the temporary supports were removed. The roof trusses are parallel with the proscenium arch and their lower chords are all in the same horizontal plane about 59 ft. above the auditorium floor. It was decided to support each truss at the third panel point from each end where a false-work tower 8 ft. square was built up to the bottom chord. These towers were 20 ft. apart on centers and 30 ft. from each end of the truss which projected beyond them like cantilevers. Each tower was made with four 4x8-in. vertical posts with butt joints with scabs spiked on both sides. Each face was divided into panels about 10 ft. high and X-braced between them with 2x6-in. boards nailed on. All of the ten towers are braced together by continuous horizontal struts and by occasional diagonal braces.

Three of the roof trusses in the rear of the auditorium are over the wide sloping floor of the upper gallery. The fourth truss is partly over this floor and partly over the main auditorium floor and the fifth truss is wholly over the orchestra circle at a clear height of nearly 60 ft. above the main floor. The two towers which support it are seated directly on the main floor and the latter is reinforced to carry them by temporary transverse beams under the cellar ceiling and supported on vertical shores and sills set in the cellar. A third similar parallel transverse beam is placed in the cellar to support the legs on one side of the towers for the second truss, which are also carried down to the main floor. The rear legs of the same towers are, however, supported on the balcony where they are carried through the floor and are seated on the tops of the girders just above the heads of the cast-iron columns. Part of the posts of the towers for the three rear trusses are seated in the same manner on the floor beams over the gallery columns and the remainder are seated on horizontal transverse sills supported at the front end by posts from these columns and at the rear end on longitudinal sills distributing their load over the upper foyer floor at the top of the gallery. In this way each of the shorter towers are terraced up over the inclined floor of the gallery and solid well-braced footings are in every case provided for them. The entire roof load is thus transferred to forty 4x8-in. posts which are well braced and are sufficient to carry several times the greatest loads that can possibly be imposed on them here.

The posts of each tower are capped by two 8x8-in. transverse timbers carrying in the center another pair of 8x8-in. longitudinal timbers on which are supported two pairs of short 8x8-in transverse sills close together. On each pair of upper sills there is seated an ordinary 3-in. cast-iron jack screw with a capacity of 5 tons. Space is left between the sills for the screw to move up and down and its head engages a bearing plate on a short cross timber set under the bottom chords of the roof truss. The jack screws are placed close together on opposite sides of the panel points and the four screws for each truss are simultaneously operated to raise the truss about 8 in., thus giving it a permanent camber of about 2 in. It is estimated that the total load on the 20 jack screws used for the five trusses is only about 20,000 lb., so that a very large margin of safety is provided to allow for irregularity in loading or settlement.

About 18,000 ft. of timber, board measure, has been used for the falsework and the difficulty of bringing it in and erecting it in the confined spaces without injuring the interior has been the principal trouble thus far encountered.

Book Notes.

The Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, has issued two bulletins containing information of general interest. The first, on concrete bridges, was written by Mr. George S. Webster, chief engineer of the Bureau of Surveys, Philadelphia, and describes certain features of the work of this class now being done under his direction. The second pamphlet contains two articles; the first, by Mr. H. L. Weber, is on concrete roadways, and the second, by Mr. Walter E. Hassam, is on cement concrete roads. Mr. Weber first laid concrete pavements in Richmond, Ind., in 1896, and sixteen such pieces of work have been done in that city up to the present time. The article explains the important points to be considered in laying these pavements and gives complete specifications for them. In the second article, the author explains the method of laying the pavement that bears his name and gives a number of suggestions of a practical nature concerning it. The bulletins can be obtained on application to the association.

The National Fire Protection Association has issued the "Proceedings" of its eleventh annual meeting, held last May, in a well-illustrated book of 415 pages. The Association has for its object the improvement of methods of fire protection, and its work is largely of an engineering and architectural nature. It is unusually interesting for two reasons; the first is that upon its recommendations are based in a large degree the rates we must pay for insurance on buildings of all sorts, and the second is that the members of the Association discuss the designs of buildings from a point of view that rarely receives the attention it should. Owing to the amount of information collected by the Association and its affiliated societies concerning the cause and progress of fires in all sorts of buildings, it is able to discuss fire resistance with the aid of information that others do not have. As a result, many of the requirements made by insurance interests seem unnecessarily severe; indeed, it is probably true that they are too burdensome on the intelligent and conscientious contractor and yet fail to hold down the scamp who intends to do crooked work if he possibly can. A perusal of this interesting volume will show, however, that the members of the Association are approaching the problems set before them in a spirit of fairness to all, and when

they make severe requirements it is because experience indicates that there is danger. The volume contains information of much value to architects of all types of buildings and to the managers of large industrial establishments who desire to know what is going on in the way of improvement to standard fire-protection apparatus. The volume is published by the secretary of the Association, whose office is at 382 Ohio St., Chicago.

Messrs. Wynkoop Kiersted, consulting engineer, and W. D. Hubbard, of the engineering staff of the Board of Water Supply of New York, have written a volume on "Water Works Management and Maintenance," which will be of value in the offices of all water works departments, public or private, particularly in the Mississippi Valley. Nearly half of the book is a discussion of ground and river supplies and the methods of developing and purifying them, a subject which has received particular attention from Mr. Kiersted for many years and in which he has had unusual success with novel methods and plants. These two chapters give in considerable detail the results of his experience with some of these plants and contain notes regarding the clarification and purification attained by simple coagulation and sedimentation which are particularly valuable. There is a chapter explaining the types and uses of pumping engines and one on impounded supplies in this part of the book; the latter chapter contains the statement that unless the benefits of stripping a reservoir site are liable to be impaired by deposits washed into the reservoir by freshets it is considered advisable to expend funds for the purpose of removing objectionable material from the bottom and sides of an impounding reservoir. Inasmuch as this subject of stripping is one of the most important in water works design at the present time, it might be well in the next edition of the book to embody the substance of the report on stripping made by Messrs. Hazen and Fuller to the Board of Water Supply of New York. The second part of the book is on the maintenance and operation of water works plants. It explains the methods of keeping records, making connections, metering, the prevention of electrolysis, the maintenance of the quality of the supply, the reduction of water waste, the management of repair work, accounting, and other subjects of a similar nature connected with the routine work of a water works office. The book closes with a section on franchises, water rates and depreciation. These are questions that arise mainly in the dealings of private water companies with municipalities, and are becoming of more and more importance on account of the trend of sentiment toward municipal ownership. The senior author has been engaged on many cases in which these subjects were discussed thoroughly and the notes on them which he gives in the book are particularly important in consequence. (New York, John Wiley & Sons, $4.00).

An excellent book on "American Electric Railway Practice" has recently been prepared by Mr. Albert B. Herrick, consulting engineer, and Mr. Edward C. Boynton, general manager of the Orange County Traction Co., for the purpose of bringing together in convenient form a considerable amount of practical information relating to the construction, operation and maintenance of electric railways. No attempt has been made to describe the older types of apparatus or abandoned methods of operation, and as a result the book is an unusually valuable source of information for anybody interested in the subject. While a considerable part of the volume relates to technical subjects, these have been discussed with the idea of showing the "state of the art" rather than the theory. Probably no railway officer will agree with everything in the book, but it contains so much information gathered from the columns of the "Street Railway Journal" and the authors' experience that it will doubtless be of help to all in suggesting improvements in management. The investor in street railway securities who wishes to know something about the details of electric traction properties will find the book particularly useful. The first two chapters are devoted to preliminary estimates and the field engineering methods of interurban railways, and it is interesting to notice that the authors have taken a number of hints from accepted steam railway methods in their discussion of parts of these topics. The location of the power house is next taken up, but no attempt is made to describe power house construction, since that subject is well covered in other books and its introduction here would lead to a great increase in the size of the volume without appreciable increase in its value to most readers. The chapter on the overhead circuit that comes next is a long one, and explains this costly part of an electric railway installation in a manner particularly interesting to steam railway engineers, who generally fail to appreciate its extreme significance. Two chapters follow on train despatching, signals, time tables and schedules, which show, that the time is approaching on many electric roads when the complicated schedules of the steam roads will have to be adopted in order to keep traffic moving in accordance with a predetermined plan. The importance of rolling stock is explained in one of the longest chapters in the book, which describes in considerable detail the construction and uses of different types of cars and trucks and gives illustrations of the electric equipment and the wiring. The remaining chapters are on shop design and the maintenance of track, overhead lines and equipment, and various details of the management of men and the collection of fares. (New York, McGraw Publishing Co., $3.00).

Letters to the Editor.

Responsibility for Building Collapses.

Sir.—The numerous collapses of all kinds of buildings that are taking place throughout the country, particularly buildings that are either being constructed or are in course of demolition, ought to result in a more careful consideration of the responsibility for such accidents. When anything of this sort happens, all those concerned stand in a circle and point to the man on the left as the guilty party. There are generally so many of these interested parties and the actual responsibility of each for any part of the work is so indefinite that nobody is punished. This is decidedly wrong, for the killing and maiming of people through careless disregard of safe rules of building is becoming altogether too frequent in our large cities. I do not wish to hold up foreign practice as a model in all respects for American cities, but it is certainly true that the rules of the Prussian government regarding buildings are so complete and so thoroughly enforced that anybody inclined to take chances which endanger life rarely does so, knowing that he will certainly be punished if he does, not with a light fine only but with imprisonment. The building police regulations fix the responsibility of the architect and the contractor and their assistants, and if anything goes wrong there is no question about who shall be punished. Consequently the men who are responsible for the safety of the work really take pains to see that it is safe, except in rare cases, when they invariably are made to suffer for their neglect. The theory is that it is wise to allow builders and contractors full scope of their skill, but their work must conform with the building regulations, and if any accident results from a failure to comply with these regulations, they must bear the penalties for their neglect. It seems to me that American cities are trying too much to pass on the details of plans of proposed structures and are not giving enough attention to defining the responsibilities of those engaged in building operations.

Very truly yours,

Observer.

The Operation of Water and Sewage Purification Plants.

Sir.—Will you allow me to suggest through your columns that a number of American cities are showing a poor appreciation of their responsibilities in health matters to their people in the way they operate the plants for sewage and water purification that have been built by them at considerable expense. Some time ago I had an opportunity of visiting a number of plants in the Central States and found that most of them were without proper supervision and a few were allowed to run without any supervision at all, except such as could be given by an ignorant laborer. I have also seen a number of water purification plants that needed careful attention, owing to the fluctuations in the character of the water or the large amount of sedment in it, run by rule of thumb in such a way that they could not be of much use.

It seems to me that the engineers who design such plants do not lay enough stress as a rule on the importance of operating the plants properly. When the authorities of a city take over a sewage disposal plant, they generally have the opinion that it is something which is important but rather offensive as a scene of daily work, so that good men will not take it up, and accordingly adopt a scale of wages for the attendants which is not enough to secure competent men. In a little while something goes wrong, the neighbors raise a cry, and the authorities are so disgusted with the result of the large initial expenditure for the works that they leave them to shift for themselves. Probably a little competent attention and cleaning up would bring the plant to rights again, but it will probably never get it unless there is a powerful State Board of Health to force the city to act or the people in the neighborhood of the works take the matter into the courts.

Most consulting engineers do not need to be told that the average city looks upon their modest charges for professional services as very high, for there is still a lurking impression that the only difference between the engineer who dwells in a large office and the engineer who looks after a steam plant in a shop is in their respective incomes. It is hard enough in most cases to collect reasonable fees for mere designs, yet public health would be much advanced if the designers of water and sewage purification plants strongly urged their clients to turn the operation of these plants, for a period of two to five years at least, over to them at a fixed annual compensation, they to furnish all attendants. Such plants require expert supervision when first started up more than at any other time, and by giving them this supervision the experts will be able to train local assistants so thoroughly that at a later date, when the operation of the plant under local conditions is fully understood, the management will be reduced to a minimum as respects cost.

Yours truly,

Sanitarian.

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TABLE OF LEADING ARTICLES.

Bridge Loops and Passenger Traffic Between Manhattan and Brooklyn.

One of the most complicated and troublesome questions to come before the Public Service Commission of New York is that of the passenger traffic between the boroughs of Manhattan and Brooklyn, and its bearing in some respects upon the increase of elevated railroad facilities in the former borough along the existing lines and the proposed loop between the Manhattan terminals of the Brooklyn and Williamsburgh bridges. The disgraceful and uncivilized daily crush at the Manhattan end of the Brooklyn bridge and the much discussed increased capacity of that terminal and of the bridge itself have already been subjects of the most vigorous and sometimes even fantastic consideration for a number of years. Several commissions and numerous self-appointed agents for the best solution of this important problem have put on record their conclusions, and the city has spent a considerable sum in testing at least one project. The last commission appointed by the Commissioner of Bridges reported at the end of 1906 a comprehensive plan, which has at least the merit of ultimate relief as complete as any that can be hoped for, and temporary relief to an extent limited only by the present train and structural capacity of the Brooklyn bridge.

It is altogether probable that whatever measures of relief may be perfected, it will scarcely be possible to install them before the demands of the situation will exceed their capacity. Nevertheless the present conditions are absolutely intolerable and in seeking for effective means for their cure it is essential that the broadest possible views of all elements of the problem shall be taken. There have been laid down with much persistence and emphasis by interested parties certain assumed general principles to control the solution of these difficult problems and to fix the conditions which may either govern them or result from them. The Public Service Commission will do well to recognize the fundamental differences which may exist between plans or propositions loudly advocated, frequently by representatives of semi-civic bodies, of one idea only, and those calculated to lead to the real relief of the public. What is imperatively demanded for the situation is an effective means for transporting people quickly and comfortably between the boroughs of Manhattan and Brooklyn so far as the East River bridges and the connecting lines are concerned and not the enforcement of some thesis strenuously enunciated in behalf of some impracticable proposition.

One of the most emphatic statements made in connection with the solution of this problem in its relation to the East River bridges is that there must be no addition whatever to the present elevated railroad facilities of the borough of Manhattan and consequently that there must be no elevated loop constructed between the Manhattan terminals of the Brooklyn and Williamsburgh bridges. It may be perfectly proper to assume the general principle that there should be no more elevated railroads constructed on Manhattan Island. The Engineering Record is inclined to take that view of the matter, and public sentiment probably strongly favors it; at the same time that is a long way from ruling out the construction of additional express tracks under proper conditions on the Second and Third Avenue elevated lines or even the construction of an elevated loop through streets well adapted to that purpose between the two bridges named. Elevated railways in the city of New York have given a measure of relief to its people impossible to have been secured in any other way, and they are there to stay. They will continue to render that service for an indefinite period in the future. It would be irrational and thoroughly absurd to take the position that while they have rendered, and will continue to render, such service they shall not be permitted so to develop their capacity as to greatly increase that service to the comfort and convenience of the community.

The Subway system of rapid transit certainly has extraordinary advantages, but it does not possess them all. An elevated loop between the Williamsburgh and Brooklyn bridges on the Manhattan side can be built much more quickly than a subway and when it is borne in mind that the Brooklyn bridge must be reconstructed with far greater capacity than at present, as soon as diversion of traffic to the Manhattan bridge will permit, it becomes highly probable that both subway and elevated loops will be required for the enormously increased traffic of the future, especially as both terminals afford ample facilities for the two classes of connections. It is petulantly idle and hypercritical to object that such loop connections give relief only to the rapid transit companies in handling their cars. That is precisely the kind of relief which they ought to have, for it constitutes one of the most important elements in efficient transportation. The masses of people whose comfort and convenience depend upon the best possible means of inter-borough rapid transit cannot be more effectively served than by such terminal and connecting facilities between the East River bridges and the adjacent transit systems, as will afford those systems the highest attainable efficiency in handling their cars. This is the very pith and essence of this great problem of rapid and comfortable transit to which the Public Service Commission must give its best thought and not be governed by the academic advocates of any one idea.

Accident Records in Equipment Maintenance.

The maintenance of engineering equipment includes some of the most interesting problems in the field of industrial technology. The reduction of repair costs to the lowest amounts consistent with safe and reliable service is always before the maintenance department as a desirable condition to meet, and the invention of labor and time-saving devices and methods always contributes towards this end if the quality of the work is not sacrificed in the meanwhile. As equipment is developed from year to year to satisfy varying specifications, it is always of importance to measure the effect of changes in design upon the total cost and facility of repairs and renewals, and in this connection the temporary or permanent failures of the machinery in service deserve careful and detailed study. Gradual deterioration of wearing parts is easily followed in most cases, for modern equipment is designed with accessibility as one of the important requirements to be met; but the study of sudden failures or accidents is much more difficult and often neglected by operating companies in comparison with the attention paid to current repairs and their contributory causes.

Serious accidents involving legal complications are generally analyzed at considerable length by executive and technical officers of industrial organizations, but even this work is apt to be carried out in a haphazard manner if the principal energies of the staff are occupied in replacing damaged equipment as quickly as possible in order to establish the normal rate of production again. Obviously, the return to normal conditions is usually the most important task after personal injuries are cared for, supposing that these appear in an accident, but it is well not to overlook the value of notes upon the conditions taken as soon as possible after the equipment goes wrong. In the operation of a modern street railway there is a wise appreciation on the part of the management of securing the fullest particulars of the smallest and most insignificant accidents as well as those of undisputed importance. Of course, the avoidance of damages through unjust claims on the part of the public is the main reason why street railway em-

ployees are, on large systems, provided with blank forms on which the minute details of each casualty are to be recorded, but apart from their legal aspect, such reports are often helpful in throwing light upon the performance of the equipment and suggestive of changes in design to avoid similar accidents in the future. In an industrial or power plant the use of blanks bearing upon probable accidents is seldom feasible to anything like the extent which obtains in street railway service, for in the latter work the range of accidents is limited to the car and its vicinity and certain general forms can be applied to practically every case. At the same time, reports on accidents to engineering equiment in general by technical employees to their executives can be made valuable analyses of weak spots in the apparatus if care is taken to make them up on the strength of full notes of the condition before, during and after the trouble occurs. Literary excellence in such reports is not the point—what is needed is a full memorandum of the conditions mentally noted, but seldom recorded in the haste of setting things to rights.

In the stress of emergencies there is often no time to make the notes of conditions, and no engineer with heavy responsibility can be expected to sit down and prepare a report on either major or minor accidents until all that is possible has been done to restore the original rate of production. Too often, however, the necessary notes are not made until some of the details at first clear have become uncertain. The value of all emergency notes lies in their accuracy in detail, however conflicting the data may appear at first. The smaller accidents are likely to be as suggestive of desirable improvements in equipment as casualties costing considerable sums to repair and offset.

The Civic Federation Investigation of Municipal Ownership.

The abstracts of reports made by members of the committee of the National Civic Federation appointed to examine public and private management of public service undertakings in this country and abroad, printed in this journal last week, must have seemed to some readers as partaking of the nature of a technical imitation of Joe Miller's joke book. An examination of the same data has led one set of critics to declare that municipal ownership is a failure and the other set to assert equally strongly that it is a complete success. It is hardly necessary to say that those who found muncipal ownership to be a success were well-known advocates of it, while the advocates of private ownership were gentlemen engaged in the management of public service corporations. Each party doubtless felt called upon to stick to the source of its bread and butter, even in cases of reasonable doubt. It seems a pity, however, that they could not agree somewhat, and thus make their statements carry some weight with the public, which must look upon the critical reports given out by the Federation's secretary as mere ex-parte statements, to be regarded merely as utterances of interested parties. The entirely divergent opinions which were stated in the abstracts printed last week show how futile it is to expect that those who are out-and-out advocates of municipal or private ownership under all conditions may ever reach conclusions at all harmonious.

The costly investigations conducted by the Federation must not be judged, however, by the statements of the partisan reviewers of the reports which were outlined last week. The main committee has been able to reach a number of highly important conclusions from the information collected by its investigators, and its report, signed by all members of the committee save Mr. Walton Clark, is of more than usual value and a contribution of particular interest at the present time. The committee which signs the report is made up of representatives of all classes of professions and trades. It represents all political parties and every shade of belief in municipal ownership or antagonism to it. Accordingly the practical unanimity with which certain important conclusions were reached in a gratifying indication that the work which has been carried on may be of some definite help in reconciling the present discordant views held on the subject. The conclusions reached are as follows: First, public utilities, whether in public or private hands, are best conducted under a system of legalized and regulated monopoly; second, public utilities in which the sanitary motive largely enters should be operated by the public; third, the success of municipal operation of public utilities depends upon the existence in the city of a high capacity for municipal government; fourth, the franchise grants to private corporations should be terminable after a fixed period, and meanwhile subject to purchase at a fair value; fifth, municipalities should have the power to enter the field of municipal ownership upon popular vote under reasonable regulation; sixth, private companies operating public utilities should be subject to public regulation and examination under a system of uniform records and accounts and of full publicity. Messrs. Chas. L. Edgar, of the Boston Edison Electric & Illuminating Co., and Mr. Walton Clark, of the United Gas Improvement Co., refused to concur in the second and fifth conclusions, and the reasoning upon which they are based.

For the successful municipal operation of a public service undertaking, the committee's investigations indicate, according to a report given out this week, that provision must be made for compliance with the following conditions: First, an executive manager with full responsibility, holding his position during good behavior, must be in charge; second, political influence and personal favoritism must be excluded from the management of the undertaking; third, the finances of the undertaking must be separate from those of the rest of the city; fourth, the necessary bond issue for revenue-producing utilities must be exempt from the debt limit law, and should be a first charge upon the property and revenues of the undertaking. These conclusions go practically to the root of the whole subject of the successful municipal ownership. At the present time there is little attraction to a man of even third and fourth rate calibre as a technical executive to enter municipal service. Except in a few cities where municipal affairs have been administered for many years on a business-like basis, the executive head of any department is likely to be chosen for political rather than business reasons. The fact that he often makes a good executive is due to the fact that, to a certain extent, political skill calls for much the same kind of ability that business success does. Wherever technical matters are involved, however, as they always are in public service departments, the politician fails to be a satisfactory executive head. Moreover there is hardly a municipal department in the country which is free from the blighting burden of financial mismanagement. It seems to be the fate of municipalities to have their financial affairs conducted in such a manner that a business man who for the first time becomes acquainted with them is horrified. The average public service department conducted by city officials, in case it is revenue-producing, has to pay all its surplus into the public treasury. This is a financial crime of the first order, since the earnings of such a department are diverted from the consumers, who may be but a small fracton of the total population, for the benefit of the whole body of taxpayers. Every competent business man who has ever investigated and reported on municipal financial methods is a strong critic of this almost universal practice, yet it seems impracticable to uproot it from its firm hold. As a result, it is not only impossible to reduce rates for the benefit of the consumers who are paying for the service, but it is even impracticable in many cases to pay out of the earnings of the department the sums necessary for repairs and extensions.

Beyond question this subiect of municipal ownership is fast becoming one of the most important in the country. It deserves particularly careful attention for two reasons, the first being that it affords a popular method of appealing to prejudice followed by political demagogues; and, second, there is a feeling among a good many students of governmental methods that the American system of control by popular vote is likely to receive its most severe test in dealing with such a subject. In Germany, where paternalism has always been a feature of government and those who are engaged in municipal service are highly respected, municipal executive offices attract a very fine class of men. There are a good many people, believers in municipal ownership as a theory, who nevertheless hold that the Anglo-Saxon temperament, modified by a mixture of characteristics from the lower classes of all Europe, is unfitted for the municipal management of undertakings so directly affecting all the people as street railways, electric lights, markets, water-works, and the like. Just how far this pessimism is warranted seems to be uncertain at the present time. There are some cities in the country, notably in Massachusetts, where the State regulation of public utilities is very strict, in which the municipal management of public lighting has been a marked success. Moreover, the State control of the extension of railways and other public services by private corporations has prevented unnecessary duplication of facilities, and has practically created for existing companies the monopoly of their business which the committee so strongly and properly considers essential for the successful administration of any public service, whether under municipal or private control. As the matter stands to-day, The Engineering Record believes that a fair statement of conditions is that in some cities it would be extremely dangerous to place all public services under municipal control, and turn over to politicians the direction of their vast body of employees. On the other hand, there are cities where such public service operations might properly be conducted by the city authorities, for the standard of municipal business methods is a high one.

The Water-Works Situation at Atlanta.

The situation of the water-works of Atlanta, Ga., during the past month has been an interesting one, particularly to those who believe that the successful administration of municipal departments depends upon divided control. Without going into the detail of all the troubles, it may be stated in brief that the water supply has at times been deficient in quantity and poor in quality. As a rule it is excellent and the trouble naturally aroused serious protest from the consumers. The affairs of the water department are under the charge of a general manager, a water board and the city council, the measure of responsibility of each being something which apparently few people know anything about. The manager of the department, Colonel Park Woodward, is one of the best known superintendents of such works in the country. The development of the plant and its effective service have been under his special care for years, and that he has served the city well is thoroughly well recognized among water-works men. Probably some members of the city government do not understand how carefully all details of water-works affairs are watched by those interested in them in other

cities. Some of these critics, among insurance interests particularly, have a very good reason for keeping closely in touch with water-works management throughout the country and have special facilities for comparing the results obtained in different cities. These people naturally rubbed their eyes when an attempt was recently made to shove on the shoulders of Colonel Woodward the responsibility for the recent troubles with the Atlanta supply. They have known considerably better, apparently, than a good many people in the city that the situation at Atlanta was such that, unless the recommendations repeatedly made by the manager of the works were carried out, the consumers would be subjected eventually to serious inconvenience. Now that the inevitable has happened, although its coming was foretold in the reports of the general manager of the works, the shuffling haste with which those responsible for the mud in what little water was supplied to Atlanta recently, endeavored to fasten the blame for the trouble on the shoulders of others was just a bit ludicrous.

As a city develops and its population increases there is an increased demand for water as well, a fact so self-evident that it is surprising it is overlooked so often by city fathers. It certainly was overlooked or neglected in Atlanta for a good many years. In 1902, Colonel Woodward sent a special report to the water board in which the necessity for various improvements, including an additional water main from the river which is the source of the supply to the reservoir, was very strongly stated. In each subsequent annual report he also called attention to the matter, and the president of the water board drew the attention of the city council during the same time to the subject and urged that money be appropriated to carry out the work. Owing to the lack of this main the city finally was supplied with very poor water, and a few months ago, practically five years after the construction of the main had been strongly urged by the manager of the water department, money for the work was finally appropriated.

The pumping capacity of the water department is short. There are two 10,000,000-gal. pumps and one 15,000,000-gal. pump available for use. During the day it is necessary to run one of the 10,000,000-gal. pumps and the 15,000,000-gal. pump. If the larger one should break down, the two smaller pumps could not give the necessary pressure for fire and domestic service. The situation was brought to the attention of the city council and some of the members of that body recognized its gravity and endeavored to secure a new pumping engine as quickly as possible. Bids for such an engine were opened early last May, when it was discovered that the son-in-law of one of the councilmen had put in a tender for a centrifugal pump driven by a steam turbine. This was a new combination and at the request of the bidder offering it, Mr. D. H. Maury, of Peoria, was retained to investigate the merits of the proposition. This engineer is known to look with favor on centrifugal pumping machinery, nevertheless he rejected the proposition on the ground that the combination was an experiment and it would be hazardous for Atlanta to make it. His report was discussed and he was again retained to investigate the matter, but further examination convinced him that the proposition was not one adapted for the situation in Atlanta. The party making the bid finally suggested that it would be desirable for a committee of the council to visit Brooklyn, where there was such a pumping unit in service, but it was found that the unit was not ready for operation and the trip was called off. Whether a new pumping engine has yet been ordered, this journal cannot state, but the long delay in placing the order is a thing that deserves considerable study by those who urge that the successful management of a water department by public officials demands divided responsibility.

A recent report by the engineering department of Atlanta on the water-works situation is pertinent. It was the duty of this committee to investigate the cause of the muddy water recently and it recommended the construction of settling basins at the river side, where the water could be partially clarified before it was pumped into the main reservoir. This recommendation was satisfactory to the authorities in charge of the water-works and the general manager was asked why it should not be adopted. He very promptly called attention to the fact that two years ago he suggested the necessity of such works. Apparently this suggestion had been entirely overlooked and, like a good many other recommendations of importance made by water-works superintendents in other cities, it was allowed to lapse into the limbo of forgotten things. It is merely one of many details which go to show that there is no inherent virtue in municipal ownership which makes it practicable for several different parties to have control of the same undertaking, and that the sooner such departments are placed in the charge of a technically competent administrator, the better will be the service the public receives. There is no reason why the water board of Atlanta should not be in complete control of the water-works under its charge, receiving enough compensation for its water to enable it to be financially independent of the city council, just as if the service were rendered by a private water company. Under such a plan the works could be conducted in a business-like manner, and there would be a better chance of improvements being made when necessary to avoid troubles like those that have recently occurred.

Notes and Comments.

THE ENORMOUS COVERED RESERVOIR which is under construction at Honor Oak, Camberwell, for the Metropolitan Water Board of London, contains a number of unusual features in the design of the walls. The reservoir will contain about 70,000,000 gal., and is divided by two intersecting interior walls into four basins, with a gatehouse for all the basins at the intersection. Here the connections are so arranged that each basin can be operated independently of the others. A part of the reservoir is an excavation, and here the walls are arched in plan, while the outside walls elsewhere are of ordinary section for retaining walls. The central walls are also arched in plan, 6 ft. thick at the center of each bay and 10 ft. at the heavy brick buttresses which separate the bays. These buttresses are likewise used along the outer walls, and are carried up to form part of the roof supports. The floor is made of inverted arches, supporting at the high points brickwork piers 14 ft. high, which carry the jack arches for the drum vaulting of the roof. The brick used in the work were made from the clay excavated from the site.

THE GAS SITUATION in Hamilton, Ohio, concerning which editorial mention was made in the issue of this journal for June 22, has undergone further change. The city council has passed an ordinance granting a franchise to the Columbia Gas & Electric Co. to furnish natural gas to the city for a term of 25 years. The company is to lease the mains of the moribund municipal plant, maintain them, and make necessary extensions, the rental being stated as $5,750 per year. Natural gas is to be supplied by Jan. 1, 1908, the price to be 30 cents per thousand, or 60 cents per thousand for manufactured gas, should the natural gas supply fail. Meanwhile the plant of the Hamilton Gas & Electric Co., which supplies all the gas now used in the town, has suffered considerable damage from a tornado, which on July 6 demolished the condensing house at its by-product coke-oven works, and put this division of the plant temporarily out of operation. The supply of gas, however, has been kept up with but a few hours' intermission, an auxiliary water gas plant being brought into service. It is expected that repairs to the coke oven plant will be completed, it is stated, within ninety days from the time of the accident, and operations will then be resumed as usual.

THE COST OF ANTHRACITE COAL is bound to rise steadily and for this reason the expense of operating boiler plants with such fuel in order to avoid the production of smoke is sure to rise with equal steadiness. This assertion has been made a number of times in this journal, and has generally aroused a protest from engineers who hold that the increased cost of hard coal is simply due to a combination of the producers. A few facts based on the experience at a colliery at Pittston, Pa., are worth considering in connection with this subject. The shaft reached a coal seam 10 to 12 ft. thick at a depth of 175 ft., and here coal could be taken out at the rate of 15 tons per miner per day. After this seam was worked out, the shaft was carried down to a second, about 6 ft. thick; then to a third, about 6 ft. thick, and finally to a fourth, only 3 ft. 10 in. thick and 270 ft. below the surface, where one miner can produce but 5 tons per day. Under the present conditions it is necessary to employ three times as many miners to get out the same amount of coal as originally, and also a much larger number of timber men, drivers, runners and masons. It has been necessary to more than double the ventilating equipment and to increase many times the force of men employed in keeping the ventilating system in working condition. The amount of water to be removed has increased from 300 to 3,500 gal. per minute. The wages of the miners have been raised and they are now paid for both coal and rock removed, while formerly they were paid solely for the coal. This list of increased expenses could be made much longer, but enough has been stated to indicate why it is true that the working of the anthracite fields is more expensive now than formerly.

A RIVER POLLUTION DECISION was recently made by the Massachusetts Supreme Judicial Court in Parker v. American Woolen Co., 81 N. E. Rep., 468, which merits attention. The court decides that there is no question about the right of each riparian owner to use the stream in a reasonable manner, according to the usages and wants of the community, which will not interfere with a similar use by the riparian owners above and below him. Many of the uses which properly may be made of the water of a natural stream by an upper riparian owner will have some tendency to defile the water, and it is inevitable for controversy to arise concerning what is permissible contamination. The court rules that no riparian owner has the right to use the waters of a natural stream for such purposes or in such a way as will materially injure it for the use of a lower riparian owner, or to add to it substances which will make it unfit for use. Owing to the self-purification which takes place in streams the law will not prevent the discharge of every small amount of polluting substance into the water, although this may be prevented by statute. The court also makes the important ruling that the plaintiff is entitled to an injunction restraining the pollution of the stream, even though this pollution does not now interfere with any use he is making of its waters. The court accordingly ordered a decree to be entered enjoining the defendant "from emptying or discharging or permitting to be emptied or discharged into the brook upon its premises above the plaintiff's premises any acids, soaps, compounds of soaps, or of iron, chemicals, scouring, dye stuffs, sewage or any objectionable substances whatever, in quantities that noticeably or appreciably affect the purity of the waters when they reach the plaintiff's premises, or render them materially less fit for drinking, domestic or other uses at that point than they are when they enter the de-

THE WEST NEEBISH CHANNEL OF THE ST. MARY'S RIVER.—I.

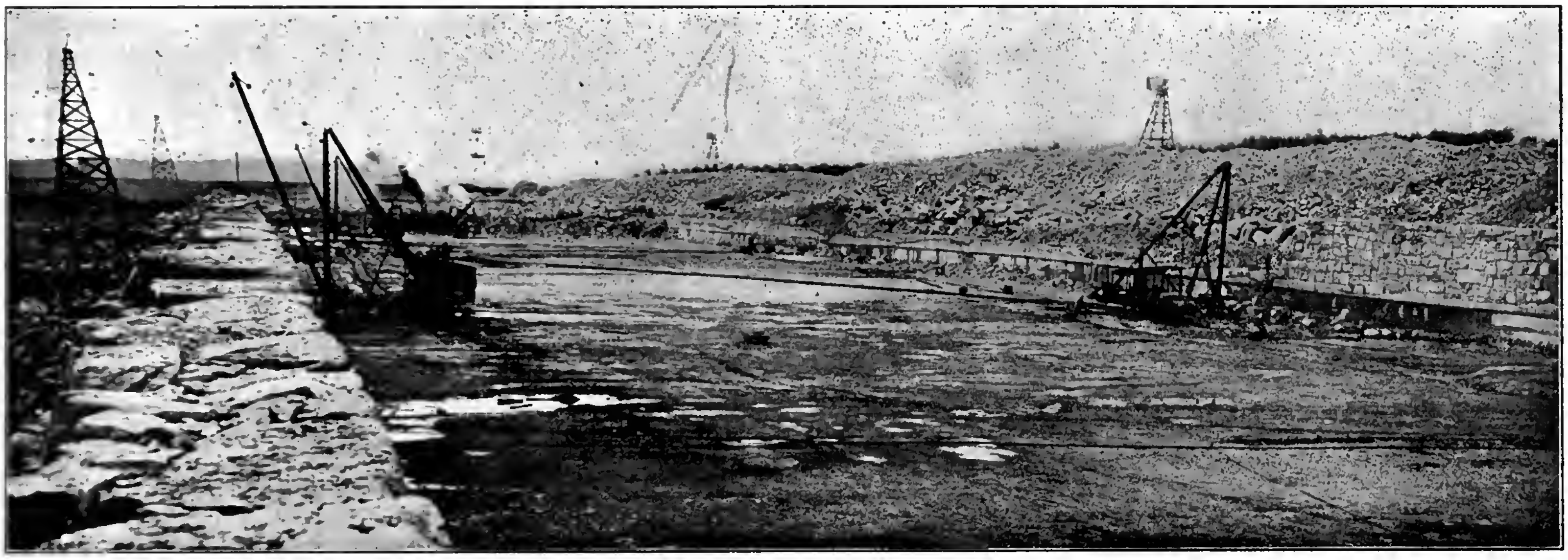
The improvement of the West Neebish channel of the St. Mary's River, which connects Lake Superior and Lake Huron, was undertaken several years ago by the United States Government and has approached a stage of completion indicating that under normal conditions this extensive work will be finished before navigation closes this fall, or at the latest by the opening of navigation next spring. One of the most serious handicaps to the great volume of traffic passing through this river between Lake Superior and the other Great Lakes will then be relieved. Originally, up-bound vessels plying the St. Mary's River were obliged, after leaving the head of Mud Lake, which is some twenty miles in a direct line from Lake Superior, to pass to the east of Neebish Island and thence follow a long circuitous route around Sugar Island through Lake George and Little Lake George to reach the locks at the Sault Ste. Marie Rapids in the River. The channel along the east side of Neebish Island was improved several years ago to provide a minimum depth of 21 ft. at the mean stage of water in the river. About the same time a channel with a minimum depth of 21 ft. was excavated between the upper end of Neebish Island and the lower end of Sugar Island; this channel was continued on up the river to deep water in Hay Lake, about 10 miles below the locks at Sault Ste. Marie. The new channel thus formed, generally called the Middle Neebish, greatly shortened the sailing distance between Neebish Island and the locks and is used by traffic practically to the exclusion of the old channel, the great fleet of large ore and grain-carrying vessels which pass through the river being included in this traffic.

At the same time the hazards presented to traffic by the Middle Neebish Channel became a serious menace to that traffic long before the latter reached its present tonnage, which during the average open navigation season of 143 days is greater than that of any other inland waterway in the world, having reached a total of over 51,500,000 tons in 1906. Several sharp turns in the Middle Neebish channel, the greater part of which is artificial, are the most dangerous features offered to the safe passage of vessels through it. In the first place the approach to them from one direction cannot be seen from the approach from the opposite direction, owing to the height of the wooded intervening land. On the other hand, the five to six-mile current in the river at this point requires the down-bound vessels to maintain a speed of eight to twelve miles an hour in order to obtain steerageway. Since the larger loaded ore and grain vessels, many of which are over 550 ft. in length and draw in the neighborhood of 19 ft. of water, form the principal portion of the down-bound traffic, it is evident that they cannot be controlled readily at the turns in the channel. Furthermore, the upbound traffic consists mostly of the same large vessels, which generally return to Lake Superior loaded with coal.

The menace offered by these turns and the conditions surrounding them has thus greatly hindered traffic at all times, and has resuled in numerous serious collisions. The extreme care that is observed in navigating this channel, frequently necessitating a vessel to lie at the mouth of the St. Mary's River during the night in order to make the channel by daylight, has, however, reduced the number of accidents to a minimum. To avoid these delays, the schedules of vessels are arranged, when possible, so the channel will be reached during the duy. A large number of vessels, nevertheless, make a night passage through the St. Mary's River, rather than wait for daylight.

The West Neebish Channel is being excavated to relieve the present situation. It will provide a shorter and straighter course than the Middle Neebish Channel, with fewer turns, all of which can be navigated safely, and will have a minimum depth of 22 ft. below extreme low water. It connects the lower end of Hay Lake with the upper end of Mud Lake, passing between the west side of Neebish Island and the mainland, and has a total length of approximately 13.5 miles. The upper and lower reaches of this channel extending, respectively from Hay Lake to the West Neebish Rapids of the St. Mary's River and from those rapids to Mud Lake were excavated in sand, clay and mud and are finished. The remaining section of the channel, extending through the rapids, with a total length of about 2.5 miles, forms the most difficult part of the whole project, as it has to be excavated almost entirely in solid rock. This section is now rapidly approaching completion, however, the expectation being that, with reasonable success, it will be done before December 1st. After the opening of the new channel on the west side of Neebish Island, the Middle Neebish Channel will be deepened to the same depth of 22 ft. at extreme low water. Downbound traffic will be diverted through the West Neebish Channel after the improvements are finished and upbound traffic will continue to use the Middle Neebish Channel, making a double sailing course in the most difficult part of St. Mary's River, and a practically double course from Lake Superior to Lake Huron.

The new channel has a minimum width of 300 ft., and a clear swept depth of 22 ft. at the lowest stage of the water in the river. The upper reach, extending from Hay Lake to the rock section through the rapids, has a total length of approximately six miles, with only one slight turn. The water along the site of this part of the channel varied from 3 to 5 ft. in depth before excavation was started; the excavation was made through mud and sand with large dipper dredges, the excavated materials being loaded on scows, in which they were hauled to shallow water along the shore line and dumped. The lower reach of the new channel in a distance of some two miles between the downstream end of the rock section and the original river channel had 22 ft. or more water, so no work was required in this length. From the lower end of this natural deep channel to Mud Lake a new channel, approximately three miles long, was dug through the sand, clay and mud which formed the bed of the river. This three-mile section has only one turn, and its channel is widened at this turn to permit easy navigation, as is done at all turns in artificial channels. This section of the channel was also made with dipper dredges from which the material was carried on scows to dumping grounds.



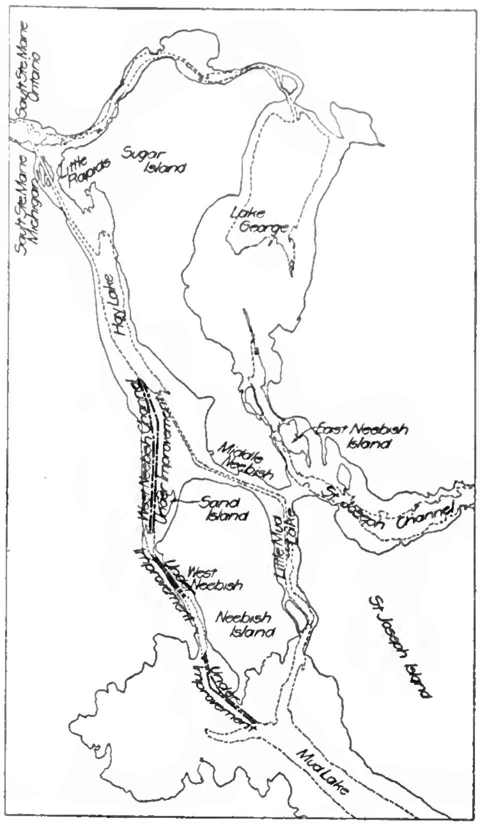
Upstream End of Canal Showing Two 1,000-Foot Cableways.

The water in the West Neebish Rapids of the St. Mary's River through which the rock section had to be built, varied from a few inches to several feet in depth and had a current with a velocity of 4 to 7 miles an hour. The bed of the river was a solid ledge of hard Niagara limestone for 8,600 ft. of the 13,300-ft. section included in the contract for this work. This limestone ledge was covered with scattered boulders, varying from small stones to those containing 2 cu. yd. or more. The specifications under which the contract for this work was awarded required that cofferdams should be constructed which would unwater these rapids over a length of about 6,000 ft. of the channel; and that the remainder of the work could be done by dredges. These conditions were changed, however, to permit the construction of cofferdams which would unwater a length of 8,800 ft. of the river through the rapids, the remainder of the work to be done by dredging.

The contract for the construction of the 2.5-mile section of the channel through the West Neebish Rapids was awarded to MacArthur Bros. Co., of Chicago, on April 7, 1904. This

company built the large cofferdams required to unwater the portion of the excavation to be done in the dry, and then sub-let that portion of the work, involving approximately 1,700,000 cu. yd. of rock excavation to Messrs. Grant, Smith & Co., of Chicago, of which company Mr. C. H. Locher, associate partner, is manager in charge of the work, and Mr. G. P. Locher is superintendent. The contract for the portion of the excavation to be done outside of the cofferdam with dredges was let to Edward Bros., of Sault Ste. Marie. A preliminary description of the work on this rock section was printed in The Engineering Record for March 2, 1906.

Construction Plant and Methods.—The first work of the construction was to build two temporary cofferdams about midway between the two main cofferdams. These temporary dams were about 1,000 ft. apart at the site of the channel and extended across the river from the mainland to the island, varying in direction to suit the contours of the river bed. They were built in 2 to 7 ft. of water flowing 3 to 6 miles an hour. The construction of these dams stopped the flow of water in the West Neebish Channel of the river, so the main cofferdams could be built in still water, and also laid bare a part of the site of the channel about 1,000 ft. long. In building these temporary dams, which varied from 4 to 10 ft. in height, broken stone and rock were dumped from scows on the line of the dams until the force of the current was



The West Neebish Channel.

ice. The rock that had been taken from the portion of the channel on which work was already in progress was hauled on sleds on the ice to a point over the part of the dam already built. This haul was from 4,000 to 4,500 ft., and as much as three cords of stone were carried on a sled at a load. A channel was cut through the ice over the dams in order that the stone could be dumped on top of the bank already built. This dumping was done in such manner as to form a small bank along each side of the top of this base. When these two parallel banks had been carried up to the water surface in this manner, the space between them was filled with sandy clay which contained a considerable quantity of gravel and small boulders, taken from a borrow pit on the mainland. After the space between the two small banks of rock on each side of the top of the lower section of the dam had been filled with the material from the borrow pit the same material was used to top out the dam to its full height of 6 ft. above the water level. The material was hauled from the borrow pit to the dam in boxes on sleds and dumped into place through the ice. After the dam was about finished, a narrow-gauge light railway was laid the full length of it and extended to the borrow pit in order to have it available in an emergency. This dam was completed in April, 1905, and the last part of the area between the two main cofferdams was unwatered soon after.

Only one accident of any moment occurred to

Upstream End of Excavation, Showing Part of Upstream Main Cofferdam and Compressor Plant.

broken and the rock-fill carried above the water. Sandy clay was then brought in and dumped on the upstream side of these rock embankments in order to silt up the openings in the latter and produce water tight dams. The dams were completed in July, 1904, after which the water was immediately pumped out of the area enclosed between them and work started on the rock excavation. Two of the four cableways which have been employed in the construction of the rock section of the channel had been installed meanwhile and were placed in service to hoist the excavated material out of the cut and convey it to spoil banks along the channel.

Main Cofferdams.—The two main cofferdams which unwater the 8,600-ft. section of the work that is being excavated in the dry, are structures of unusual magnitude. The upstream dam is L-shaped, and is built in water from 2 to 18 ft. deep; the stem of the ell extends from the mainland across the river at right angles to the channel for 1,200 ft., the leg of the ell continuing down-stream 700 ft. from the outer end of the stem to the shore of the island, making the total length of the dam 1,900 ft. This cofferdam has a minimum width of 8 ft. at its top, which is 7 ft. above the water, and has side slopes on the water side of about 1 on 1½, and of about 1 on 2 on the other side. The other main cofferdam is 8,600 ft. downstream from this one. It has a total length of 2,600 ft., and in plan is arched slightly downstream against the water on that side of it. This cofferdam was built in water from nothing to 26 ft. deep; it has a minimum width of 12 ft. at the top, which is 6 ft. above the water; its side on the water side is built on an average slope of 1 on 2, and the one the other side of 1 on 2½.

The construction of the upstream main cofferdam was started soon after the current of the river had been broken by the temporary dams. Sandy clay and mud excavated by the dredges at work on the adjacent sections of the channel were brought to the site in bottom-dump scows and deposited in place. When the banks thus formed had been carried up until the bottom-dump scows would operate no longer, the materials were loaded on flat deck scows, and handled from these to place in the embankment by a clam-shell bucket on a derrick scow. The final trimming and finishing of the portion of the dam above the water was done with wheelbarrows and by hand. This dam was finished November 1, 1904, after which the water covering the area between it and the upstream temporary dam was pumped out.

The downstream main cofferdam was also built from scows up to within 5 to 6 ft. of the water surface, with materials excavated by the dredges. Soon after this part of the work was finished in the fall of 1904 the river froze over, and the cofferdam was completed through the either of the two main cofferdams after they were built. In February, 1905, the upper part of a 250-ft. length of the leg of the upstream dam, near the shore where the dam section was light became detached from the remainder of that dam and was carried over into the area which had been unwatered, with the result that that area was flooded. The cause of this accident has never been certainly determined. It is believed, however, to have been brought about by the formation of a line of cleavage in the dam by freezing, followed by a change in the river level which lifted the detached portion and floated it away. This break was soon repaired and since then an open channel maintained in the ice on the water outside the dam has avoided further similar difficulty. This channel was kept open by simply piling brush on it and covering this brush with loose snow; the top and slopes of the dams were also covered with brush to collect snow which prevents freezing and the formation of cleavage planes. Although temperatures of 20° below zero, Fahr., are common in the locality where the work is in progress, this simple expedient forms a line of separation between the main body of the ice and that attached to the slopes of the dam.

Pumping Plants.—The quantity of water which leaks through the cofferdams is very slight when compered with the great length and height of these dams. At the same time, a large amount

t pumping capacity was required to remove the water which covered the area enclosed by the dams. The total capacity of the pumps installed is about 40,000,000 gal. per 24 hours. This capacity is required only a small portion of the year, however, but is all necessary in the spring when the snow is melting, or during excessive rains. A berm ditch on each side of the river, extending the full length of the work on the island side and two-thirds the length on the mainland side, diverts the drainage from the land into the river and prevents it reaching the area between the cofferdams. A 12-in. centrifugal pump on the upstream cofferdam handles the principal part of the water in that end of the area enclosed. Two 6-in. reciprocating pumps in this end of the channel cut are capable of removing the water from the latter. Two centrifugal pumps, one a 12-in. and the other a double section 18-in. are installed in a pump house on the downstream main cofferdam to pump the water from that end of the work. Two reciprocating pumps, an 8-in. and a 12-in., are placed in a house on the edge of the channel cut, about midway between the main cofferdams, and pump from the cut into a flume leading to one of the berm ditches. A 12-in. centrifugal pump in a house on the opposite side of the channel near this point is also used while the snow is melting and during heavy rains. The water in the downstream end of the channel cut is removed by three 8-in. reciprocating pumps.

General Features of Construction Plant.—The controlling feature of the extensive construction plant which has been installed by Messrs. Grant, Smith & Co., is the adaptability and arrangement of the various parts of this plant to be operated day and night, six days a week, throughout the year. The long and extremely cold winters of the locality in which the work is being carried on required unusually careful precautions in the choice of the equipment to be installed. At the same time, the continued low temperature of the long winters, the large amount of snow-fall which occurs and the great quantity of ice that forms in a work of this character interfered seriously with the progress of the construction. In fact, it is believed that the cost of handling work during the winter months has been 25 per cent. greater than it is during the remainder of the year.

An idea of the climatic conditions in this locality may be obtained from the records of the station of the United States Weather Bureau at Sault Ste Marie. The mean average temperature throughout the year for a long series of years, as given by those records was 39° Fahr. During four months of the year, December, January, February and March, the average monthly temperature for the same series of years was considerably below 32° Fahr., with frequent temperatures as low as 25° below zero, Fahr. Ice forms on open water six months in the average year, reaching a thickness of 30 in., or more during the winter. Added to these conditions some snow falls nearly every day in the winter and the annual snowfall is quite heavy, the ground generally being covered with from two to three feet of snow during the winter. Notwithstanding these extreme climatic conditions the construction work has been handled day and night, practically without interruption, except for Sundays, since its inception. During 1906 the government engineers credited the contractor with 290 working days and nights, without including seven holidays on which work was in progress. This record does not mean, either, that part of a day was counted as a full one, because all of the men are provided with rubber clothing, so work is rarely stopped by rain or snow, the rock bottom of the cut always providing a good working foundation.

The various equipment and plant connected with the work is operated, with a few exceptions, on air furnished from a central compressor plant. Air-driven rock drills are employed in making the large number of blast holes in which the channel cut is excavated. The loosened rock is loaded into large skips by steam shovels, the skips being hoisted out of the cut, conveyed to spoil banks along the side of the channel and dumped in these banks by long-span cableways with traveling head and tail towers. All of this equipment was selected largely on account of its adaptability to work continuously under the trying climatic conditions, which become particularly strenuous at night during the winter.

Compressor Plant.—The equipment in the central compressor plant is as complete as that in most permanent plants of this kind, and was installed with as great care. The plant may, in fact, be considered a permanent one, since it has been operated continuously for over three years. It is in a tight frame building, 40x108 ft. in plan, which is divided by a transverse partition wall into a boiler room and an engine room. The boiler room contains three 200-h.-p. Erie City sectional water-tube boilers placed in brick settings on concrete footings. These boilers are operated at 150 lb. pressure and are each served by an 80-ft. stack. They are supplied with feed-water by either of two Snow boiler-feed pumps, which draw from a Kelly-Berryman feed-water heater. This heater operates on exhaust steam from the auxiliary units in the plant.

The engine room contains two cross-compound two-stage Rand compressors; one of these has 40 and 23-in. air cylinders and a 48-in. stroke, producing a capacity of 4,527 cu. ft. of free air a minute at 90 lb. pressure; the other machine has 17 and 30-in. air cylinders and a 30-in. stroke and produces 1,900 cu. ft. of free air a minute at 90 lb. pressure. The larger compressor is driven by a cross-compound 700-h.-p. Newburg Corliss engine, and the smaller one by a cross-compound 325 h.-p. Hamilton Corliss engine. These engines are operated condensing, each of them being equipped with a Dean jet condenser. Circulating water for the condensers is supplied by any one of three pumps in the basement of the engine room. These pumps also supply water to the feed-water heater from the condenser hot well, or from the river.

All of the various units in the plant are on heavy concrete foundations, which were built with special care. The bed plates of the two main units are placed directly on the concrete, without any cap stones. No trouble from vibration of the engines or compressors has ever been experienced, however, although both compressors are in service 23 hr. a day for at least six days a week.

The compressors deliver to an air receiver, 4 ft. in diameter and 18 ft. long, just outside the building, from which air is piped to various parts of the work. An 8-in. pipe line, 6,000 ft. in length, extends along the main-land bank of the

General View of the Construction Work in Progress, Viewed from Upstream End.

river, and is continued an additional 2,000 ft. as a 6-in. line. This 8,000-ft. line is provided with several L-shape vertical joints to provide for expansion and contraction. The line is also laid to drain to drip cocks placed at convenient intervals, in order that the condensation may be removed readily. A second receiver of the same size as the first is placed on the 8-in. line 3,650 ft. from the compressor plant, to provide for sudden demands for air. Taps are made in the main line so branches can be carried to the various plants at any point along the work. A 6-in. main line is also laid to opposite side of the work to deliver air to the engines of two cableways on that side. In all, 35,000 ft. of pipe is required to convey air from the central plant to the different parts of the work. This large amount of pipe is entirely exposed to the weather, but the whole air distributing system has been operated during the coldest weather. Reheaters have to be used on all air-consuming units, however, and in the winter fires are maintained at different points along the supply lines to prevent the water of condensation from freezing and stopping the pipes.

(To be Continued.)

A NEW RAILROAD STATION designed for handling a large number of people in a short time was completed at East Pittsburg by the Pennsylvania R. R. last spring. It is located at the shops of the Westinghouse Electric and Manufacturing Co., and separated from the latter by Turtle Creek. During the rush hours the railroad carries between 5,000 and 6,000 people, mostly employees of the various Westinghouse companies, who live in Pittsburg and its suburbs. The platforms of the new station have in consequence been made especially wide, and since the passengers as a rule have but a few minutes to wait, the station building has been made small, but the main platforms have been covered throughout their length. The passenger trains are operated on four tracks, the two outside ones being devoted to local trains, which carry the bulk of the traffic. The main platforms are on the outside of these local tracks, and an island platform is located between the express tracks. A bridge over the creek leads to the north local platform, from which stairways descend to a subway leading under the tracks to the other platforms. A masonry retaining wall about 30 ft high forms the bank of Turtle Creek, and in order to get the desired width of platform the station building was built out beyond the face of the wall, overhanging the creek 8 ft. and resting on cantilever I beams.

The Hydro-Electric Plant of the Huronian Co.

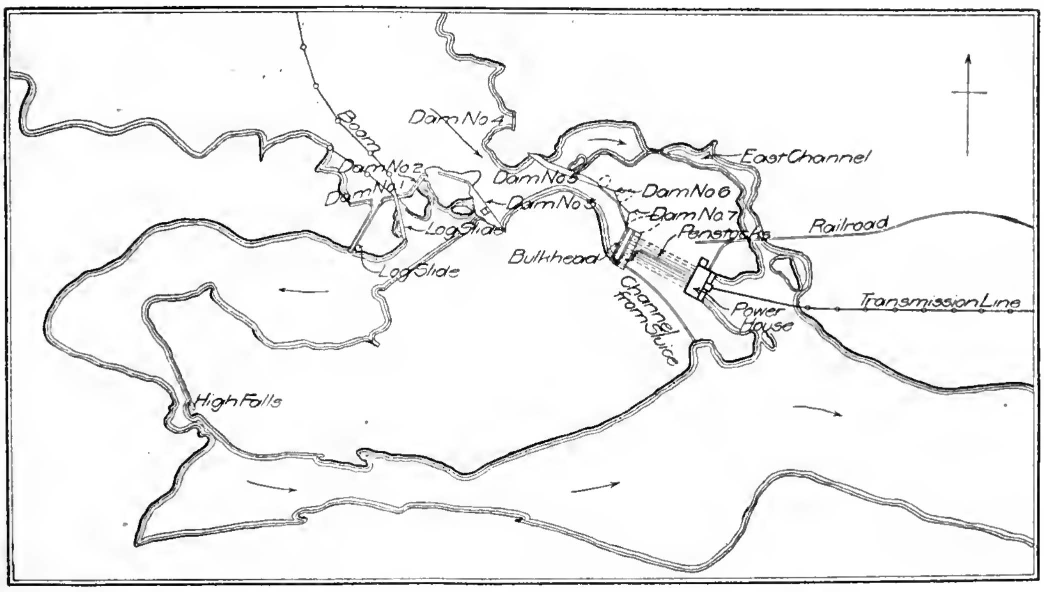
The Canadian Copper Co. operates numerous nickel and copper mines, in the Sudbury District of Ontario, Canada, all of which are located on a strip about 28 miles long and not far from the Soo Branch of the Canadian Pacific Ry. The high cost of coal for operating these mines and the smelting plant which is located at Copper Cliff, resulted in the organization of the Huronian Co., in order to acquire the property known as High Falls, on the Spanish River about 28 miles west of Sudbury, and in the spring of 1904 work was begun upon the development of this water power. The plant is located in western Ontario, north of the Georgian Bay.

The Spanish River above High Falls drains an area of 2,150 square miles, over which the annual average rainfall does not exceed 30 in. The minimum gauged discharge from the river is 1,600 cu. ft. per second, which occurred during a season when the average rainfall did not exceed 24 in. Owing, however, to the nature of the covering of the watershed and to the numerous lakes in the upper reaches, the minimum flow is high, being 0.71 cu. ft. per second per square mile.

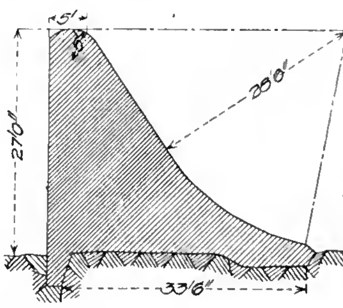
Above High Falls for a distance of 6 miles the river is a succession of rapids, and it was considered necessary that these should be drowned so as to prevent the formation of frazil, and also to form as much of a reservoir as possible. For these reasons the river level above the falls was raised 18 ft., thus providing a storage basin about 6 miles long and increasing the head from 67 to 85 ft. Immediately above the falls are many rocky islands which break the stream into several channels and finally at the falls themselves an island divides the river into two channels which unite again a short distance below the falls.

On account of the number of small channels between these rocky islands, quite an extensive system of dams was necessary. Three of these were needed to close the west channel, two to close the east channel and two others, joining on to the bulkhead, form the forebay. As the river is much used for lumbering purposes and as large numbers of logs come down each year, provision for their passage was made in dams 1 and 2 by means of a chute to which the logs are guided by a system of booms in the upper river. In order to insure a constant flow over these two dams the other dam in the western channel, No. 3, was made 18 in. higher than the overflow dam in the other or eastern channel. Sluices have been built in two of the dams at an elevation 11 ft. below the bottom of the forebay so that by opening them the water can be lowered if necessary, so as to allow of repairs to the racks and bulkhead. These sluices are also intended to be used to relieve the overflow at high water and are accessible by bridges from the shore end of the dam.

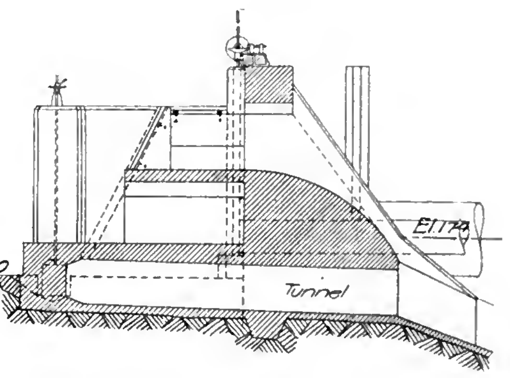
The first work in the actual development was



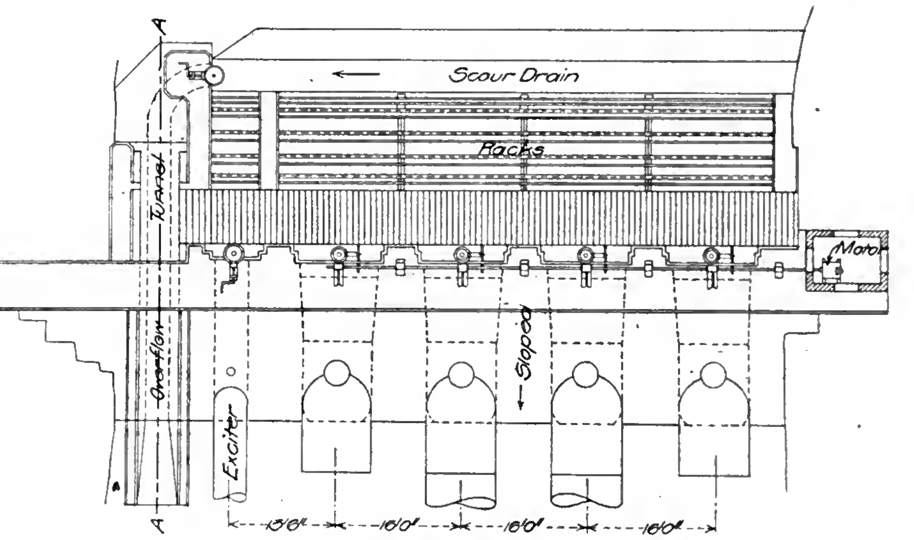
Plan Showing Dams and Power House, Huronian Company.



DAM No.3



SECTION A-A



Dam, Bulkhead and Penstock Inlets.

the construction of the dams, and this was started in September, 1904. The preliminary work had been begun in the Spring of the same year and consisted of the construction of a spur from the Canadian Pacific Ry., and the erection of buildings for housing the workmen and storing material. Dams 1, 2 and 4 were started first and work on them was carried on continuously to completion notwithstanding the severe Winter of 1904 and 1905. About the same time the concrete foundations of the power house were built up above the level of high water so as to avoid delay in the following spring. A log slide and two temporary openings were left in dams 1 and 2, so as to pass the water when it became necessary to stop the flow in the east channel of the river. The latter channel was then closed up by a crib cofferdam against the head of 32 ft. of water. The plan of this cofferdam was in the form of a letter V, each leg abutting on the rocky bank and projecting outward and up-stream. The ends of these legs were finished square leaving a key-shaped space between the channel ends. Accurate measurements were made of this space and a crib of these dimensions was built up-stream, loaded and then lowered with heavy tackle to within a short distance of the proposed location. Its construction was continued until it sank within a few inches of the bottom of the river, and its position was then carefully adjusted so that the current would carry it into the opening between the ends of the two legs. When this had been done the tackle securing it were quickly slacked and the crib slid in place and closed the cofferdam. The face of the entire structure was then double-sheeted and made as tight as the bottom formation would allow and the flow of the river was diverted to the openings in dams 1 and 2. The power house is located on the down-stream side of High Falls Island and in order to carry the water to it a forebay was blasted on the island and enclosed by the bulkhead and dams 6 and 7.

All of the dams are founded on solid rock, ample trenches being cut for anchorages, both in the foundation and in the end walls. The rock was carefully cleaned of all dust and dirt and cement sprinkled dry over the bottom. Over this was placed a layer of 1:3 mortar having a minimum depth of 4 in., and the regular concreting begun. The concrete mixture was 1:3:5 well mixed and deposited very wet. Larger stones were freely used, some measuring over 2 cu. yd., and were placed so that none of them were closer than 9 in. to the face of the work, nor nearer to each other than 12 in. All of them were carefully washed and scrubbed before placing, carefully bedded and so disposed as to form as effective a bond as possible.

Although a large part of the concrete both in the dams and power house foundations was dug in winter with the temperature varying from a few degrees below freezing to 15° below zero (Fahr.), no difficulty was found in securing good concrete work, the only precaution taken being to heat the water by turning a ¾-in. steam pipe into the water barrel supplying the mixer, and during the mixing to use a jet of live steam in the mixer, keeping the cylinders closed by wooden coverings. No attempt was made to heat the sand or stone. In all the winter work care was taken to use only cement which would attain its initial set in not more than 65 min., and the results obtained have been absolutely satisfactory. Even the thin walls used in the sub-station and the blowing engine house were constructed in the winter without impairing the quality of the work.

The dams vary somewhat in height according to the elevations of the rock foundations but are all in the neighborhood of 27 to 30 ft. They vary in length from less than 100 to about 300 ft. in length. The front face in all cases is vertical while the back face in the spilling sections has a ogee curve, and in the remainder of the work a sloped profile having two different ratios.

The steelwork supporting the racks and the entrance cones of the penstocks is built into the bulkhead wall, being carefully bedded and covered with wet mortar. The inlet for the exciter penstocks is separated from the main unit inlet by a concrete pier, and is placed to one side of the four intakes instead of in the center, its usual position. Since the exciter units are placed in the center of the power house with the main units on either side of them the exciter penstock was curved, back of the bulkhead, and carried over the main unit pipes into its relative position in the power house. The bulkhead was housed in so as to protect the operators in severe winter weather. The gates are of steel and may be operated by hand or by a direct current motor driven from the exciters.

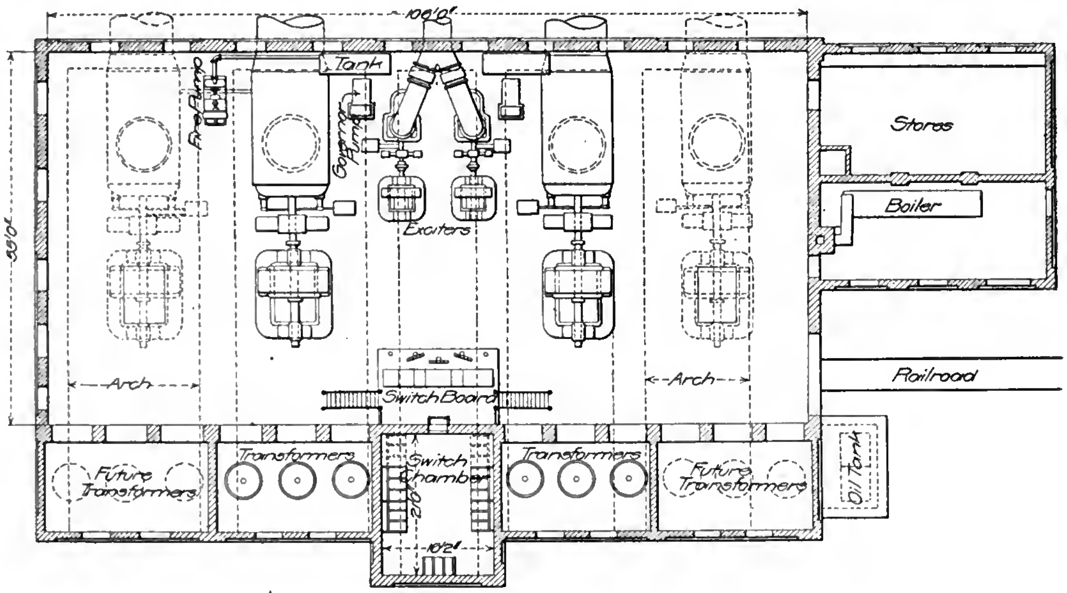
The entrance cones of the penstocks are 10 ft. in diameter at the upper end in the front face of the bulkhead wall and 9 ft. in diameter at the back face. From this point a diameter of 9 ft. is maintained to the wheel cases. The tubes are of steel plate resting on concrete saddles, spaced 18 ft. on centers, equal to two diameters of the penstock, and are anchored in the center of their length, an expansion joint being provided in each tube near the bulkhead wall and also one near the power house. To prevent the formation of ice in the penstocks they are covered with a wooden structure made as nearly air-tight as possible, an arrangement that is quite effective. Such protection is quite necessary in a plant operating in this locality where the temperature sometimes reaches 45° Fahr. The maximum speed of water in the penstocks at full overload is 7.2 ft. per second. Air pipes of ample capacity protected from freezing are provided at the upper end of the penstocks.

The power house is carried on five arches running the entire width of the building, one being beneath each of the main units and the fifth beneath the exciters. The foundations were carried down to rock which dipped to the north and east at a depth of about 30 ft. below the floor level of the building. The overlying material was soft clay and quicksand which gave a good deal of trouble in excavating, though the low temperature at which most of the work was done tended rather to facilitate than retard progress as every opportunity was given the frost to penetrate the earth beyond the limits of the excavation, thus rendering the standing wall secure and enabling the excavation to be carried down about plumb.

The floor arrangement of the power house provides for two exciters in the middle of the room each capable of serving four generators. Both of them are furnished with water from one penstock and each is provided with a hydraulically operated gate valve. The power units, of which there will eventually be four, are arranged two on each side of the exciters. The switchboard is in the center of the building, in front of the exciters, and back of it is the tower in which the high-tension switches are housed. On either side of the latter are the transformer compartments separated from the main room by steel doors. A railway track leads into the power house and an overhead crane commands all the machinery, the transformers being mounted on trucks so that they can be pushed forward under the crane.

The main turbine wheels are designed for a maximum of 3,550 h.-p., and are connected with 2,000-kw. generators, the wheels thus having a capacity sufficient for operating the generators at 33 per cent. overload. The effective head is 85 ft. and the speed 375 r. p. m. The wheels are of the horizontal shaft type and are enclosed in steel cases, which are split horizontally so as to give quick access to the moving parts in case repairs are necessary. There are two wheels to a unit, each 34 in. in diameter. The runners are of bronze. The thrust bearing which is of the marine type, is located between the wheel case and the generator. The bronze gates are of wicket type being as nearly as possible balanced and are operated by a governor of the Sturgess type. The exciter turbines are similar in design to the main units and are also controlled by Sturgess governors. All of the governors are electrically controlled so that the operator on duty at the controlling desk can start up any or all of the machines. The total full load capacity of the plant is 8,000 kw. The exciters each have a capacity of 200 kw. and are operated at 550 r. p. m.

In testing the generators already installed the loads were obtained by connecting one generator up as a motor, reversed in the direction of rotation, and operating it from the other machine running as a generator. Both machines for the purpose of the test were brought up to full excitation and switched together before starting. The gates on the generator wheel being opened up gradually, both machines came up to speed, the motor, of course, driving its wheel in the opposite direction to normal rotation. When both machines were at full speed the gates on the wheels connected to the motor were gradually opened, thus obtaining practically a water brake load. It was possible by this scheme to get any load required and also to reach any power factor by over or under exciting the synchronous motor, thus determining the regulation of the generators at any power factor. This scheme



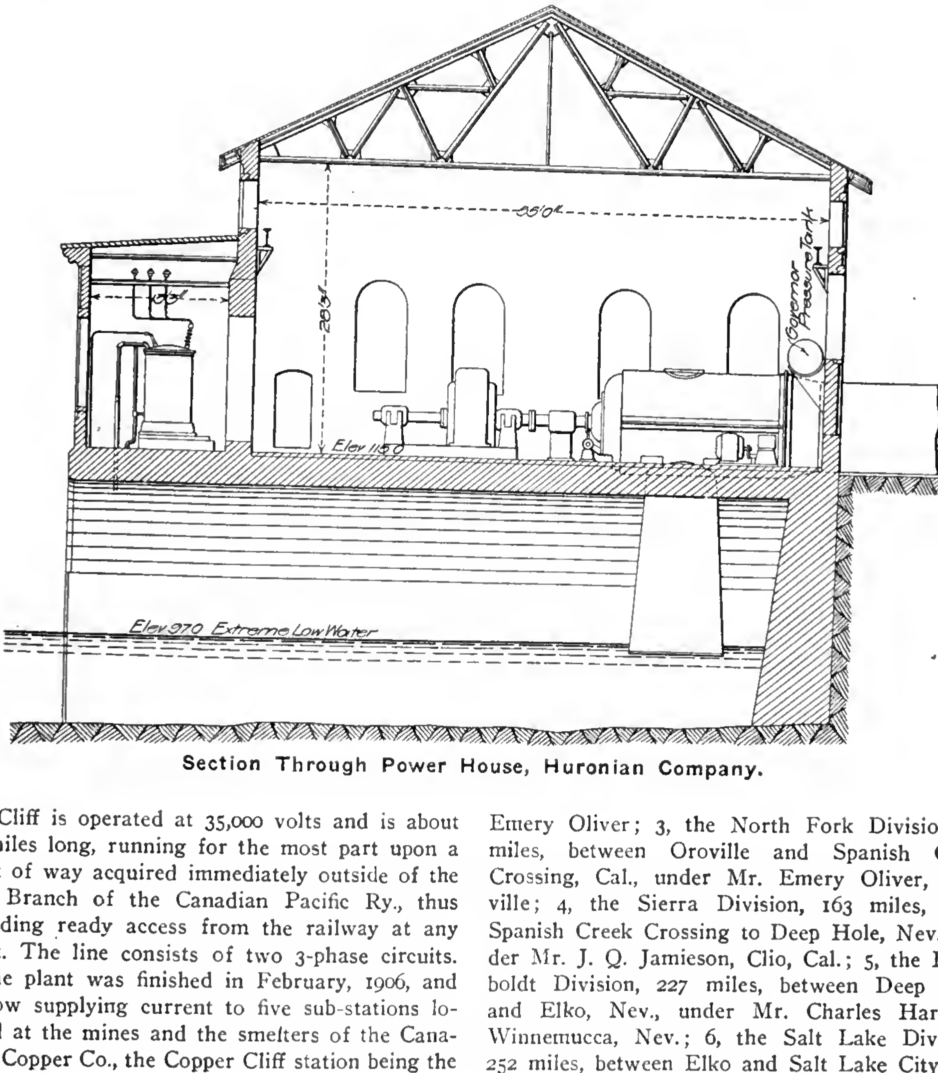
Plan of Power House, Huronian Company.

proves decidedly superior to a water rheostat load which gives only a fixed power factor.

The marble bench board from which the operation of the station is controlled in every particular, including the speeding of the water wheels, was placed on a gallery to give the operator a clear view of the power station and also of the switching apparatus in the tower back of the board. The main switches and all connections between the main units, transformers and transmission lines are distantly controlled so that the only voltages on the bench board are those from the exciter and the operating voltages from the switch control. In other words nothing higher than 125 volts is admitted to the main power station except within the generators themselves which have no exposed parts and the current from which is carried by cables in ducts to the low voltage chamber in the switch tower.

There is a group of three transformers to each main unit, each group being housed separately. The transmission line from High Falls to Copper Cliff is operated at 35,000 volts and is about 29 miles long, running for the most part upon a right of way acquired immediately outside of the Soo Branch of the Canadian Pacific Ry., thus affording ready access from the railway at any point. The line consists of two 3-phase circuits.

The plant was finished in February, 1906, and is now supplying current to five sub-stations located at the mines and the smelters of the Canadian Copper Co., the Copper Cliff station being the farthest from High Falls. The plant was designed by Messrs. Ross & Holgate, consulting engineers of Montreal, Canada, and described by them in a paper before the Canadian Society of Civil Engineers, from which this article has been taken.



Section Through Power House, Huronian Company.

A Curtis Turbine Test was made by the engineers of the Boston Edison Co. on Jan. 29 of this year, the machine being one of 5,000 kw. rating. Under the normal operating conditions the test showed a steam economy of 13.586 lb. of steam per kilowatt-hour. On Feb. 25 of this year one of the four 8,000-kw. turbines at the Fiske St. station of the Chicago Edison Co. was unofficially tested under regular operating conditions, and showed a steam economy of less than 13 lb. per kilowatt-hour. This test, moreover, showed the remarkable result that from 5,000 to 14,000 kw. output the steam consumption varied less than 1 lb. per kilowatt-hour.

The Engineering Organization of the Western Pacific Railway Company.

By George P. Low.

The Western Pacific Ry. is now being constructed from Salt Lake City to San Francisco, its engineering and construction department being under the direction of Virgil G. Bogue, first vice-president and chief engineer of the company. That the construction work may be handled to the best advantage, the line has been divided into six sections in charge of division engineers with headquarters as follows: 1, The San Francisco Division of 93 miles, between San Francisco and Stockton, in charge of Mr. John T. Williams, Oakland, Cal.; 2, the Sacramento Division, 113 miles, between Stockton and Oroville, Cal., subdivided into two sections, the first of 87 miles, between Stockton and Yuba River, under Mr. John T. Williams, and the second of 26 miles, between Yuba River and Oroville, under Mr. Emery Oliver; 3, the North Fork Division, 76 miles, between Oroville and Spanish Creek Crossing, Cal., under Mr. Emery Oliver, Oroville; 4, the Sierra Division, 163 miles, from Spanish Creek Crossing to Deep Hole, Nev., under Mr. J. Q. Jamieson, Clio, Cal.; 5, the Humboldt Division, 227 miles, between Deep Hole and Elko, Nev., under Mr. Charles Harlowe, Winnemucca, Nev.; 6, the Salt Lake Division, 252 miles, between Elko and Salt Lake City, under Mr. T. J. Wyche, Salt Lake City.

The North Fork Division is one of the heaviest pieces of railway building ever undertaken, and it is the purpose of this article to describe the engineering organization under which its construction by The Utah Construction Co., of Ogden, Utah, is being directed. For practically the entire length of the division, the route of the railroad follows up the tortuous canyon of the Feather River, first along the main stream to the junction of its North and Middle forks, which is at a point about 7½ miles by way of the grade northeast of Oroville, thence along the North Fork for 57 miles to its confluence with the East Branch of the North Fork which it follows for approximately 17 miles. It then enters the canyons of Spanish and Spring Garden Creeks respectively and, leaving them by tunneling through the main ridge, reaches the Middle Fork of the Feather River, which it follows through Sierra Valley until reaching Beckwourth Pass.

The North Fork Division is divided into residencies, each about five miles in length, each being in charge of a resident engineer who reports to an assistant engineer. The latter has direction of the engineering work on two or more residencies through various resident engineers, and is responsible to the division engineer. In some cases the work of the engineers is so arranged that assistant engineers are given two instrument men with parties working from the same camp, the men being rated as resident engineers only when they are in charge of a camp. Resident engineers are usually allowed a party consisting of a leveler, chainman, rodman, stakeman, axeman and a cook, but assistant engineers have authority to increase or reduce the number of assistants employed. Where a camp is maintained by the company, expenditures for board elsewhere are discouraged, but when assistant or resident engineers do not wish to board at the company camps, upon application to the division engineer they are allowed $25 per month for board in lieu of subsistence, with proper deduction from this amount for meals which may be taken in company camps. Engineers are not allowed to board their wives and families at company camps, although occasional meals to them are not prohibted.

Assistant engineers are given general supervision of the work to which they are assigned and are responsible for its proper execution. They receive such reports from the resident engineers as are necessary, and these reports, after being consolidated and approved, are forwarded to the division engineer. Assistant engineers are furnished with an advance account with which to defray current expenses which cannot be vouchered. All time rolls, bills of material and estimates made out by resident engineers are sent to the assistant engineers, but to save time weekly progress reports and requisitions for camp supplies are generally sent to the division engineer direct.

Assistant engineers are instructed to give as much personal attention to the details of construction work, where supervision is assigned to them, as is possible, and they are required to assist and direct the resident engineers in every way necessary, as they are held responsible for the proper execution of the work of the resident engineers and their assistants. When necessary, assistant engineers accompany their force reports with letters to the division engineer calling attention to any lack of energy on the part of the contractors or to any disposition to slight or neglect work.

Diaries are furnished to assistant and resident engineers in which all special data pertaining to the work are kept, such as dates of beginning and completing special structures, notes on classified materials, the manner in which contractors handle various kinds of materials and the like. The condition of the weather is also noted, and where camps are convenient to the river, gauges are established and readings taken during floods, these readings being turned in with the final records. The engineers are required to furnish all necessary assistance and information to inspectors detailed to look after special structures and to work in harmony with all other engineers and their assistants. As friction between employees is prejudicial to the company's interests, it is not tolerated.

The following reports are required by the division engineer:

Progress Report.—Every Sunday the resident engineer mails to the division engineer a progress report giving any and all information pertinent to the work which he has in charge.

Contractors' Force Report.—On the 8th, 15th, 22d and last days of each month, assistant engi-

neers are required to make up from data received from resident engineers, a report of the forces of every character employed by the contractors. These forces are counted at least once a day by a time-keeper, who is checked by the assistant and resident engineers as they go over the work from time to time.

Financial Estimates.—Data for financial estimates are compiled and forwarded early enough in the month so that approximately the amount of money necessary to meet pay rolls and vouchers can be provided and forwarded to the division engineers before the last day of the month.

Property Reports.—A complete inventory of all company property in charge of assistant and resident engineers is made in duplicate and forwarded to the division engineer on the last day of each month, and engineers in charge of such property are held responsible for its safe-keeping and care. All camp equipage and instruments received during the month from all sources are entered in the property reports, and reports are also made of the date chiefs of party leave the service or are transferred, and certified to by both outgoing and incoming engineers. If it should happen that the incoming engineer is not present when the outgoing engineer leaves, then the report is signed by the employee temporarily in charge. The new appointee, when assuming charge, also signs it, with any necessary endorsement, and then forwards it to the division engineer.

Time Rolls.—In making out time rolls, the blanks furnished must account for each day worked, as well as for the month's aggregate. In figuring for fractional parts of a month the valuation for a day's labor is figured to the nearest five cents. If time certificates have been issued, the number of the certificate is entered in the proper column opposite the name on the roll. The number of time voucher is also entered by the division engineer or the assistant engineer issuing it. Engineers certifying to time certificates and time vouchers are held responsible for the correctness of the same and their proper notation on the time rolls. Time certificates are not issued unless the employee is leaving the company's service, but when doing so after the rolls have been sent to the division engineer, suitable identification certificates are furnished.

In transferring a man from one party to another, a letter is written by the transferring engineer to the receiving engineer indicating the last day on which time is allowed. In addition to this, a letter of advice is sent to the division engineer's office with the same information, and any failure to do so imposes the penalty of any resultant loss to the company on the party at fault.

Itemized Statements.—The division engineer cautions his subordinates to be systematic in the keeping of accounts, and to call for bills from dealers a few days before the end of the month so they can have these accounts rendered promptly. The practice of having bills sent to the division engineer's office weeks or even days after they should be, is discouraged. Bills for which discount for cash can be obtained are called for when the purchase is made and are sent in at once. All bills must be in duplicate; one being in copying ink or copying pencil. They must show the amount of purchase, the unit price, and calculations checked to the nearest five cents. They are then certified by the resident engineers and forward to the division engineer either preceding or accompanying the subsistence report for the month in which incurred. Receipts are not dated after the last day of the month to which they belong. Board bills must show the name of each man and the dates on or between which the board was furnished. The rate per day or week is also shown, as well as the work upon which the party was engaged during the time. All payments made to contractors are vouchered, and under no circumstances paid directly or entered on pay rolls.

Requisitions.—Where engineering camps are reached by team, the resident engineer, on or about the 20th of the month, makes out a requisition for such supplies as are necessary to last during the following month. The supplies so requisitioned are sent to the storekeeper, after approval by the division engineer. These requisitions do not include farm products, which can be bought near the camp, and standard packages only are sent by the storekeeper, even if a single package will last several months.

Subsistence Report.—This report is made up monthly by the chief of each engineering party subsisted by the company immediately after all bills for supplies furnished during the month have been certified and submitted through the proper channels. An inventory of food supplies on hand after the last meal at the end of the month is taken and entered at actual cost. After deducting this inventory from the total debit, the difference shows the total cost of meals furnished. An accurate account of the total number of meals furnished during the month is kept and the debit divided by this number shows the average cost per meal. A copy of the summary for all camps for the month is sent to the resident engineers that they may see the relative cost of meals at the different camps and correct any waste or extravagance.

Estimates.—The estimates rendered are of two kinds: main contractors' estimates and sub-contractors' estimates, both of which are made out in ink. The main estimates are sent so that they will be received by the division engineer not later than the third day of each month. All the section numbers of the work in charge of any assistant engineer are shown on the sheets in consecutive order, with the limiting stations for each, even if work is being done in but one section; the idea for so doing being to have each quantity which is estimated appear in its proper place in the sheet each month, thus providing the utmost facility in comparing and checking. If only the second page of the estimate sheet shows quantities, the headings on both pages are filled in and both sides are signed by the assistant engineer. Inasmuch as all of the route of the line within the North Fork Division traverses a section of the mountains never before covered by a wagon road, it has been necessary for the company to build one to enable the contractors to carry in materials and supplies. Where work on this wagon road is being carried on adjacent to the line of the railroad, the section numbers corresponding to the main line are shown so as to indicate the portion of the line to which the wagon road is opposite; but, conversely, the station numbers of the wagon road are independent of those of the railroad.

Sub-contractors' estimates are also prepared in duplicate and sent to the division engineer with the main contractors' estimates. They show the work done by The Utah Construction Company as well as by the sub-contractors, and the estimates divide at the section limits in order that they may be checked against the main estimate sheets. The sub-contractors' estimate sheets are complete statements of all work done and are handed to The Utah Construction Co. for its use in settling with its sub-contractors. Station men are not shown thereon.

In estimating quantitites for the monthly estimate, the nearest even 10 cu. yds. is taken when the unit price is $1.00 or less per cubic yard, and fractions of a unit are not used for any material for which the unit price is less than $5.00 per cubic yard. Material for which $5.00 or more is paid per unit is carried out to the nearest hundredths of a unit.

Extra Work.—Any work that it is possible to measure, or which can be covered by the specifications at the contract price, must be shown on the estimate sheets, but when it is necessary to have any extra work done by the contractor's forces, it is carefully looked over and, if sufficient in amount, a time-keeper is kept on the work all the time. A force of half-a-dozen men employed on extra work is considered to be sufficient to justify keeping a time-keeper.

Bills for extra work are made out by the contractor in duplicate and, when approved by the assistant engineer, are sent to the division engineer. These bills are sent in with the estimate at the end of the month in which the work was done, and are not allowed to run along until it is necessary to include more than one month's work on the bill. If the bills, as made out by the contractor, are not in proper form, the engineer in charge must make up the bills, using the contractor's bills as memoranda, the latter being attached to the respective bills and both being sent to the division engineer. All bills rendered by the contractor for extra work which, for some reason, have been disallowed, are sent to the division engineer with a letter giving particulars and the reason for rejection. Bills for extra work show the dates on which the work was done, the number of days work, the rate per day, and the stations between which the work was done, also the distribution and account to which it is to be charged. If in doubt as to the account to which it should be charged, the engineer makes a brief statement on the face of the bill showing of what the work consisted.

Progress Profiles.—These are made on plate "A" profile paper, showing all possible information with reference to the progress of the work. To begin with, the profile shows the ground line, grade line, grade elevation, rate of grade, and alignment. Where revisions of the center line are made, the elevations are shown in dotted lines with new alignment and grades. As the work progresses, the amount of excavation moved and embankment placed are shown in color in their proper places, different colors being used for the respective months. All surfaces are tinted uniformly by mixing enough color at one time to cover all surfaces. The space to be occupied by bridges is left blank until such time as work begins upon them, when the average depth to which piles are driven is shown, and mud sills of framed bents, by short, heavy lines. The stations at each end of the bridge, culverts in place, retaining walls and cribs are shown, care being exercised to color only the portions upon which work has actually been done because of the fact that these profiles are checked with engineers' force reports and estimates. Where the face of a cut is being worked but the center line is not reached, a strip along the ground line proportionate with the amount of work actually done is shown, and where a cut is entirely taken out except for trimming slopes and finishing a small strip is left above the grade line to show that the work is not entirely completed. Fills are not shown completed to grade unless they are of full width.

Standard Progress Drawings.—The division engineer requires that the reports of subordinate engineers shall be uniform in character, and to facilitate the compilation of them in such uniformity, sample sheets in colors are issued to assistant and resident engineers in exemplification of methods to be followed in making calculations and reports upon excavations, fills, grades, tunnels, and, in brief, all features of the work. Excavations, for instance, are classified under three heads, namely: 1, Solid rock, which includes all rock found in ledges or masses of more than one cubic yard and which, in the judgment of the engineer, can be removed only by blasting; 2, loose rock, which includes all bowlders and detached masses of rock measuring more than one cubic foot and less than one cubic yard

in bulk, also all slate, hard shale, soft sandstone, disintegrated rock and soapstone that can be removed without blasting, and such hardpan, gravel and bowlder deposits of such consistency as to prevent being ploughed with a ten-inch grading plough behind a team of six horses; 3, common excavation, including all materials not classified as loose or solid rock.

In the sample cross section furnished to the men, solid rock is outlined in brown, loose rock in green and common excavation in yellow, the sectional areas of each being shown with the dimensions from which the calculations are made. Preparatory to making these sections, of course, the work is cross-sectioned, the quantities are calculated and the results then placed on profiles in order to determine where the cuts are to be hauled and where it is safe to borrow, putting doubtful borrow off until the cuts are out. Waste and borrow are not allowed where they will be detrimental to the completed road, and when allowed the borrowed material is not estimated, but any overhaul which might become due had the cuts been hauled, is estimated.

All classified excavation material is measured, and percentages are resorted to only when conditions preclude actual measurements, but solid rock is always actually measured, the results being positively shown. In cross-sectioning the work sections are taken at every station, and wherever any breaks occur in the center or side lines of the excavation, grade points are set on either side of the roadbed where it enters the cut, taking cross sections to each point. The distance out from the center is marked on all grade points and the full station number is given on the back of every cross section stake. On curves, the cross sections are not more than 50 ft. apart.

All work of every character, including ditches, changes of channels, width of clearing, and culvert and trestle excavations, is staked out. As fast as the work is cross-sectioned, the notes are copied into a record book and the original is sent to the chief engineer's office. The cross sections of the work are platted on cross section paper, all figures being put on and classified materials shown in colors as above detailed. The method of average end areas is used in determining quantities.

Construction.—All excavations for retaining walls, cribs, or masonry structures are sunk to a solid foundation, which must receive the approval of the assistant engineer before the structure is started. Where practicable and within the limit of haul, material excavated from foundation pits is placed in embankments in order to reduce borrow quantities accordingly. All loose or dangerous rocks are removed from rock bluffs beyond the regular excavations before commencing to grade the cuts opposite them, this work being paid for by force account.

Embankments are made so as to be full 16 ft. in width after they have become thoroughly settled, and to secure this result, shrinkage is provided for by adding to their height or width as follows: Casting or wheelbarrow work in earth, 12 to 15 per cent.; cars in earth, 10 to 12 per cent.; cars in gravel, or fine rock, 5 to 10 per cent.; wagon work, 7 per cent; scraper work, 5 per cent, and rock fills, 3 per cent. The contractor is informed of the amount of shrinkage which he will be required to put on before he completes roughing-in the embankment. Where the embankments are short or are side fills so that the profile grade must be maintained, the shrinkage is provided for by widening the embankment from the slope stakes up, the shrinkage being made up in the ballast wherever necessary.

The contractor is required to bear the cost of the entire excavation and removal expenses, including loading, unloading, transportation and deposit, provided the haul does not exceed 600 ft.; for excess of this haul, he is paid an additional price per cubic yard per 100 ft. up to the limit of 2,000 ft., or an overhaul of 1,400 ft. All overhaul in excess of the last distance is subject to additional compensation for the additional distance.

Mass Diagrams.—To secure uniformity in estimating overhaul on excavated material, mass diagrams are used in accordance with a sample form. These are made on plate "A" profile paper, laid out to the horizontal scale of 200 to 400 ft. to the inch, the vertical scale being 200 to 2,000 cu. yds. to the inch. In the sample diagram given the men, one cubic yard of solid rock is taken as equal to 1.6 cubic yards in embankment, but the amount of swell or shrinkage is determined on the ground by observation, the points between which cuts and fills actually balance and the ratio of shrinkage or swell determined being noted. It is found that earth placed in embankments under the blows of horses' hoofs usually shrinks so that 100 cu. yds. of cut will make about 90 cu. yds. of fill, and that rock taken from cuts usually swells 50 or 60 per cent. The quantities used are taken from the cross section notes as they appear in the record book, but when cut and fill both occur within the limits of a station, only the net quantity is used. As shrinkage and expansion affect the distances but not the yardage hauled, the latter is always measured and estimated in excavation.

In making the overhaul diagram, the total yardage, both in cuts and in fills, both ways from grade points is summed up to the various cross section stations within the limits of haul. These stations are platted on a horizontal line to the scale chosen. The total yardage from the grade point to each station is then platted vertically at that station to the yardage scale chosen and connecting lines are drawn. Then a straight edge is moved upward until it measures between the cut and fill lines the proper yardage above 600 ft., at which points horizontal lines are ruled in and the quantities picked off on the vertical scale.

The haul diagrams from which final estimates are made are turned in with the final cross section notes and become a part of the permanent records. The haul is estimated separately for each cut and is paid for on the section from which the excavation is made. A record of the work is kept in ink in a special book provided for the purpose. It shows the station, ground and grade, elevation, cross section, areas, cubic yards, and classification. Surface elevations are shown across bridge openings so that all the necessary information for making a profile may be included. The cross-sections of solid rock or other classified material that can be shown by cross section notes, also all measurements of borrow pits, foundation pits, clearing or riprap, are shown at the end of each section. The measurement for side ditches are given in the remark column, as well as the quantity placed, with the cut to which it belongs. Each section is kept complete by itself and shows at the end a summary of all the quantities for which payments are to be made. The final estimates are made from these summaries. Diagrams for the overhaul from each cut, showing the estimated amount of overhaul for which payment must be made, are attached, as are also diagrams of all special structures, such as cribs, retaining walls, bridge piers, and the like, and bills of material for all culverts with the station at which they were constructed.

Another typical instruction sheet describes in outline the methods to be followed in computing and reporting upon the excavation areas of standard tunnels, as well as of determining the quantities of material necessary for their proper lining. In reality, this sample sheet presents a 63 ft. length of the 806-ft. tunnel known as Tunnel No. 4, which pierces Cape Horn, on the Feather River, about 2½ miles above Oroville. In it the neat section is outlined in red; its enlargement necessary to admit timbering is represented in the space included between red and yellow lines; the overbreakage consequent upon this enlargement is included between yellow and black lines, while the dry packing includes all packing material which is placed by hand outside between the lining or lagging and the line of overbreakage.

Organization Chart.—An organization chart has been prepared, primarily for the information and guidance of clerical forces, which has proved to be of such general utility that its form has been almost universally adopted by the division engineers of the system. In it the engineering organization of the North Fork Division, so far as officials are concerned, is shown at the left, with Mr. Oliver as division engineer; Messrs. H. P. Gradon, A. C. Koogle, Geo. S. Kopp, W. F. Webb, J. A. Hutchinson and A. H. Thomas as assistant engineers, and Messrs. J. F. Miller, C. E. Zeigler, J. R. Howell, W. A. Rowe, C. C. Derby, H. V. Klippel, R. C. Clifford, B. B. Boyd, W. W. Joliffe, R. L. Bryant, and John Tarish as resident engineers. The chart shows the rank of each engineer on the division, with the residencies or residency, or stations to which he is assigned. In the next column appears the numbers of the surveying stations along the route, opposite which are the respective mile posts as surveyed from San Francisco, and between these columns is a double line indicating the wagon road and its bridges, its finished portion being colored red. Following the mile post figures, is a column showing the locations of the various tunnels with their designating numbers and comparative lengths, after which is a line indicating the railroad as sectioned off by contracts, the work opened up by the main contractor and each sub-contractor being given a distinctive color. The scope of each of the four main contracts into which the construction of the North Fork Division has been divided is then shown on the chart, following which the boundary line of the two counties traversed is indicated. Geographical names of points, bars, creeks, etc., occupy the ensuing column, which is followed by a line on which is delineated the rate of grade for the finished road. The locations of water tanks and fuel oil stations are projected from this grade line by means of open circles and black discs respectively. For convenience, the various residencies are again shown, as is the line of the road on which are located the various bridges, tunnels and sidings, with specific information concerning each. The river with its tributaries, the locations of steel bridges and river crossings, together with an indication of the particular side of the river upon which the road runs, are shown with precision. Finally, the width of the right of way at every point is indicated, as is the name of the owner from whom each particular piece of right of way was purchased.

THE SEWAGE PUMPING ENGINES at the Ward St. station of the Metropolitan works at Boston are each rated at 50,000,000 gal. daily capacity against a head of about 40 ft. They are of the Allis-Chalmers vertical triple-expansion type, with standard steam ends. Each engine has three single-acting outside-packed plungers, and six suction and six delivery valve chambers. In each chamber there are 36 specially designed valves of the flap type, with rubber and canvas seats bolted to brass plates. They are hinged and swing on manganese bronze hinge bolts. A modification of the barometric type of condenser, adapted for using sewage for cooling, is used, the passages through it being larger than those employed with clear water in order to avoid any clogging of them.

The Slipping Resistance of Steel and Brass in Concrete.

By H. Burchartz, Gross-Lichterfelde.

Numerous authors have reported on the adhesive strength or the slipping resistance of iron in concrete, for instance Bauschinger, de Tedesco, Mörsch, Féret and von Bach. Dr. O. Meyer has recently made tests relating to this subject and reports on the results of his tests in the "Oesterr. Wochenschrift für den oeffentlichen Baudienst" substantially as follows:

The objects of the tests in question were: (*a*) Dependence of the slipping resistance of the metal rod in concrete on the condition of surface of the rods embedded in the concrete. (*b*) Relation between the slipping resistance and the kind of material of the reinforcement, whether steel or brass. (*c*) Relation between the slipping resistance and the composition of concrete. (*d*) Influence of the form of the rods on the slipping resistance, 1, when the rod was bent to a hook, and 2, when the rod was split to a fork.

All concrete test-pieces were of prismatic shape and square section measuring 20x20x30 cm. or 8x8x12 in. The rods were placed in the specimens in a longitudinal direction, the embedded length amounting to 20 cm. or 8 in.; the ends of the rods were turned off to a 2½-cm. conical shape, so that the tangential adhesion to the concrete was only fully acting on a length of 17½ cm., or 7 in. When calculating the slipping resistance, the cylindrical part of the rod only was considered, for the influence of the cone can hardly be determined numerically in a suitable manner. For this reason the calculated specific slipping resistance may be taken a little too high.

With the rods bent to a hook at the ends the reinforcement was only about 17½ cm., 7 in., in the concrete, and with those shaped like a fork, the end of the fork was found in this length. It is natural that the values for slipping resistance which were found with these latter tests did not at all correspond with the pure adhesive strength, but can merely be used for comparison with the values found with straight bars. Those values are correct standards, however, which indicate the strain per square inch of the sectional surface of the round rods. The latter figures were calculated in order to get the ratio of load to the tensile and breaking strength of the steel.

The materials used in preparing the specimens were: (*a*) Portland cement purchased without knowledge of the origin, but of a quality already approved for concrete buildings; (*b*) Pit-sand with grains passing a sieve with 4-mm. meshes; (*c*) Gravel from the Danube with grains passing a sieve with 10-mm. meshes; (*d*) Round steel bars; (*e*) Yellow metal with a tensile strength of about 30 kg. per square millimeter, and 14 per cent. extension when breaking; (*f*) well water.

The materials were mixed in parts by weight and the mixtures gauged with 10 per cent. of water.

The concrete samples were tamped with the rod in a vertical position.

The specimens in Table 1 were made on November 10, 1900, at about 90° C., the samples of Table 2 on March 29, 1901, at about 6° C. for air and water. The test-pieces were kept dry and for about a month in a shop and then until testing in a laboratory.

The average results of Table 1 are given in Table 3 and the quotient of the average figures of the slipping resistance of rods with rolling skin and with finished surface are also calculated; it fluctuates between 1.5 and 4.8 so that the rough round steel in comparison with the finished one with smoothed surface shows the slipping resistance to be 1½ to 5 times greater.

This result is in good accordance with that obtained by von Bach, who says in "Baumaterialienkunde," 1905: "If the prismatic shape of the rod embedded in concrete is perfect, the slipping resistance depends on the condition of the surface, and if the prismatic shape changes the same is also true. With turned and smoothed rods the slipping resistance is half of that determined for rods with rolling skin." Our differences are therefore still greater. The average of the proportionate values is 2.7 with our tests. The difference in question seems to be generally greater with small steel bars than with large ones; with mixtures of 1:4 and 1:6 the result is, with 12-mm. iron, 2.3 and 3.4 compared with 1.5 and 1.7 with 25-mm. bars.

The strength of concrete seems to influence the slipping resistance, for the richer mixtures of concrete give greater values than the poor ones. It must be borne in mind that the values obtained with 25-mm. steel bars for a 1:6 mixture do not seem to be entirely free from objection, as several test-pieces were already damaged before the test. Even if the results with this mixture are excluded the relation seems to remain true. In the case of the steel bars with the rolling skin left on them, the slipping resistances are, with decreasing richness of the mixture, 697, 514, 426 lbs. per square inch, respectively, for 25-mm. steel bars, while the 12-mm. bars show a decrease from 900 to 740 lbs. per square inch.

The same difference may also be perceived with finished material, though not with the same clearness. These observations are somewhat in contradiction with those made by von Bach, who says: "Alterations in the proportion of the admixture of sand within certain limits do not considerably influence the slipping resistance."

The influence of the thickness of rod has not been distinctly indicated by our tests. Of course the smaller round rods gave more favorable results than the larger ones; but it is the contrary with yellow metal. The observations made with steel contradict those made by von Bach, who found that the slipping resistance decreases with the decrease of thickness of rod. On the other hand, von Bach's remark that with finished rods there are smaller differences, agrees with our results. Yellow metal seems to have greater slipping resistances than steel, which is no doubt due to the softness of the material. This would allow the surface to be roughened more easily and consequently a greater resistance against slipping would result. The finished yellow metal (brass) and steel rods showed equally smooth surfaces at the portion not covered by concrete, so that the finish of the two could be called uniform.

The figures of practical value obtained with the steel bars with rolling skin show on the average a slipping resistance of 651 lb. per square inch; i. e., a value which is somewhat higher than that indicated by Bauschinger. The tests with steel bars bent to a hook and those shaped like a fork showed that the loads required to draw out these rods, are far greater than with straight steel bars with rolling skin. In all cases the concrete body cracked before the rods could be drawn out. With all steel rods the the loads measured, which should properly be called the breaking or bursting loads of the concrete, are so high that, referred to the unit of section of the respective steel bars, they fluctuate between the stretching and breaking load of the steel; in most cases they approach more the latter. The 25-mm. bars form the only exception, which is due to the fact that the surface and section of the rod are as the bases to the squares, the result of which is, with the constant specific resistance, a decrease of the load referred to the section.

The bars split to a fork gave higher figures than those bent to a hook, which result is explained by the fact that the hook-shaped bars when under tension exert only a bursting action on the concrete, whereas the fork also presses the concrete between its two poles thus reducing somewhat the bursting action.

TABLE 1.—RESULTS OF ADHESION TESTS WITH STEEL AND BRASS RODS IN CONCRETE.

	Rod			Adhesion per sq. in.			
Mixture.	Material.	Diameter.	Surface.	Age.	Maximum.	Average.	Tension in Rod.
1:1:2	Steel	1 in.	Smoothed	3m. 24d.	62 lb.	......	1,732 lb. per sq. in.
1:1:2	Steel	1 in.	Smoothed	4m. 13d.	229 lb.	146 lb.	6,362 lb. per sq. in.
1:1:2	Steel	1 in.	Skin	3m. 25d.	616 lb.	......	17,182 lb. per sq. in.
1:1:2	Steel	1 in.	Skin	4m. 2d.	798 lb.	707 lb.	22,294 lb. per sq. in.
1:2:2	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	325 lb.	......	18,886 lb. per sq. in.
1:2:2	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	460 lb.	393 lb.	26,838 lb. per sq. in.
1:2:2	Steel	7/16 in.	Skin	4y. 7m. 2d.	879 lb.	......	*50,836 lb. per sq. in.
1:2:2	Steel	7/16 in.	Skin	4y. 7m. 2d.	920 lb.	900 lb.	53,250 lb. per sq. in.
1:2:2	Steel	1 in.	Smoothed	4y. 7m. 2d.	322 lb.	......	8,974 lb. per sq. in.
1:2:2	Steel	1 in.	Smoothed	4y. 7m. 2d.	359 lb.	341 lb.	10,039 lb. per sq. in.
1:2:2	Steel	1 in.	Skin	4y. 7m. 2d.	518 lb.	......	14,484 lb. per sq. in.
1:2:2	Steel	1 in.	Skin	4m. 16d.	508 lb.	513 lb.	14,172 lb. per sq. in.
1:2:4	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	251 lb.	......	14,768 lb. per sq. in.
1:2:4	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	224 lb.	......	13,078 lb. per sq. in.
1:2:4	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	159 lb.	......	9,301 lb. per sq. in.
1:2:4	Steel	7/16 in.	Smoothed	4y. 7m. 2d.	159 lb.	......	9,344 lb. per sq. in.
1:2:4	Steel	7/16 in.	Smoothed	4y. 7m. 3d.	284 lb.	216 lb.	16,614 lb. per sq. in.
1:2:4	Steel	7/16 in.	Skin	4y. 7m. 3d.	777 lb.	......	44,020 lb. per sq. in.
1:2:4	Steel	7/16 in.	Skin	4y. 7m. 3d.	797 lb.	......	59,782 lb. per sq. in.
1:2:4	Steel	7/16 in.	Skin	4y. 7m. 3d.	531 lb.	......	31,098 lb. per sq. in.
1:2:4	Steel	7/16 in.	Skin	4y. 7m. 3d.	848 lb.	......	48,564 lb. per sq. in.
1:2:4	Steel	7/16 in.	Skin	4y. 7m. 3d.	448 lb.	740 lb.	44,730 lb. per sq. in.
1:2:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	73 lb.	......	†2,031 lb. per sq. in.
1:2:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	193 lb.	......	5,382 lb. per sq. in.
1:2:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	119 lb.	......	3,323 lb. per sq. in.
1:2:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	183 lb.	......	5,126 lb. per sq. in.
1:2:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	97 lb.	133 lb.	2,684 lb. per sq. in.
1:2:4	Steel	1 in.	Skin	4y. 7m. 3d.	182 lb.	......	†5,069 lb. per sq. in.
1:2:4	Steel	1 in.	Skin	4y. 7m. 3d.	244 lb.	......	6,802 lb. per sq. in.
1:2:4	Steel	1 in.	Skin	4y. 7m. 3d.	308 lb.	......	.....
1:2:4	Steel	1 in.	Skin	4y. 7m. 3d.	175 lb.	227 lb.	4,927 lb. per sq. in.
1:2:4	Brass	7/16 in.	Smoothed	4y. 7m. 3d.	229 lb.	......	13,320 lb. per sq. in.
1:2:4	Brass	7/16 in.	Smoothed	4y. 7m. 3d.	295 lb.	......	17,040 lb. per sq. in.
1:2:4	Brass	7/16 in.	Smoothed	4y. 7m. 3d.	230 lb.	251 lb.	13,447 lb. per sq. in.
1:2:4	Brass	1 in.	Smoothed	4y. 7m. 3d.	338 lb.	......	9,358 lb. per sq. in.
1:2:4	Brass	1 in.	Smoothed	4y. 7m. 3d.	388 lb.	......	10,906 lb. per sq. in.
1:2:4	Brass	1 in.	Smoothed	4y. 7m. 3d.	500 lb.	409 lb.	13,944 lb. per sq. in.
1:4:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	182 lb.	......	5,084 lb. per sq. in.
1:4:4	Steel	1 in.	Smoothed	4y. 7m. 3d.	173 lb.	178 lb.	4,828 lb. per sq. in.
1:4:4	Steel	1 in.	Skin	4y. 7m. 3d.	471 lb.	......	13,391 lb. per sq. in.
1:4:4	Steel	1 in.	Skin	4y. 7m. 3d.	379 lb.	425 lb.	10,764 lb. per sq. in.

*Concrete cracked and steel stretched. †Crack in concrete, which was plastered with cement. In the text the mixture of 1 part cement, 1 part sand and 1 part gravel is termed a 1:3 mixture, the 1:2:2 proportions a 1:5 mixture, the 1:2:4 proportions a 1:6 mixture and the 1:4:4 proportions a 1:8 mixture.

TABLE 2.—TESTS WITH BENT AND FORKED RODS.

	Rod		Resistance, tons.		Tension in
Mixture.	Diameter.	Shape.	Individual.	Aver.	rod, lb. per sq. in.
1:4	⅝ in.	Hook	6.96	....	55,806a
1:6	⅝ in.	Hook	5.22	6.09	41,890a
1:3	⅝ in.	Fork	7.05	....	55,948b
1:4	⅝ in.	Fork	6.94	....	55,096b
1:6	⅝ in.	Fork	6.96	6.98	55,806b
1:3	1 3/16 in.	Hook	8.65	....	39,902a
1:4	1 3/16 in.	Hook	8.67	....	40.044a
1:6	1 3/16 in.	Hook	8.65	8.66	39,476a
1:3	1 3/16 in.	Fork	12.0	....	55,948a
1:4	1 3/16 in.	Fork	10.1	....	46,576a
1:6	1 3/16 in.	Fork	7.78	9.96	35,500a
1:3	1 in.	Hook	11.1	....	32,092a
1:4	1 in.	Hook	8.01	....	23,146a
1:6	1 in.	Hook	5.79	8.30	16,898a
1:3	1 in.	Fork	7.34	....	21,158a
1:6	1 in.	Fork	15.70	7.68	45,440a

a, Sample burst. *b*, Rod broken and loose; sample uninjured.

TABLE 3.—AVERAGE RESULTS FROM TABLE 1.

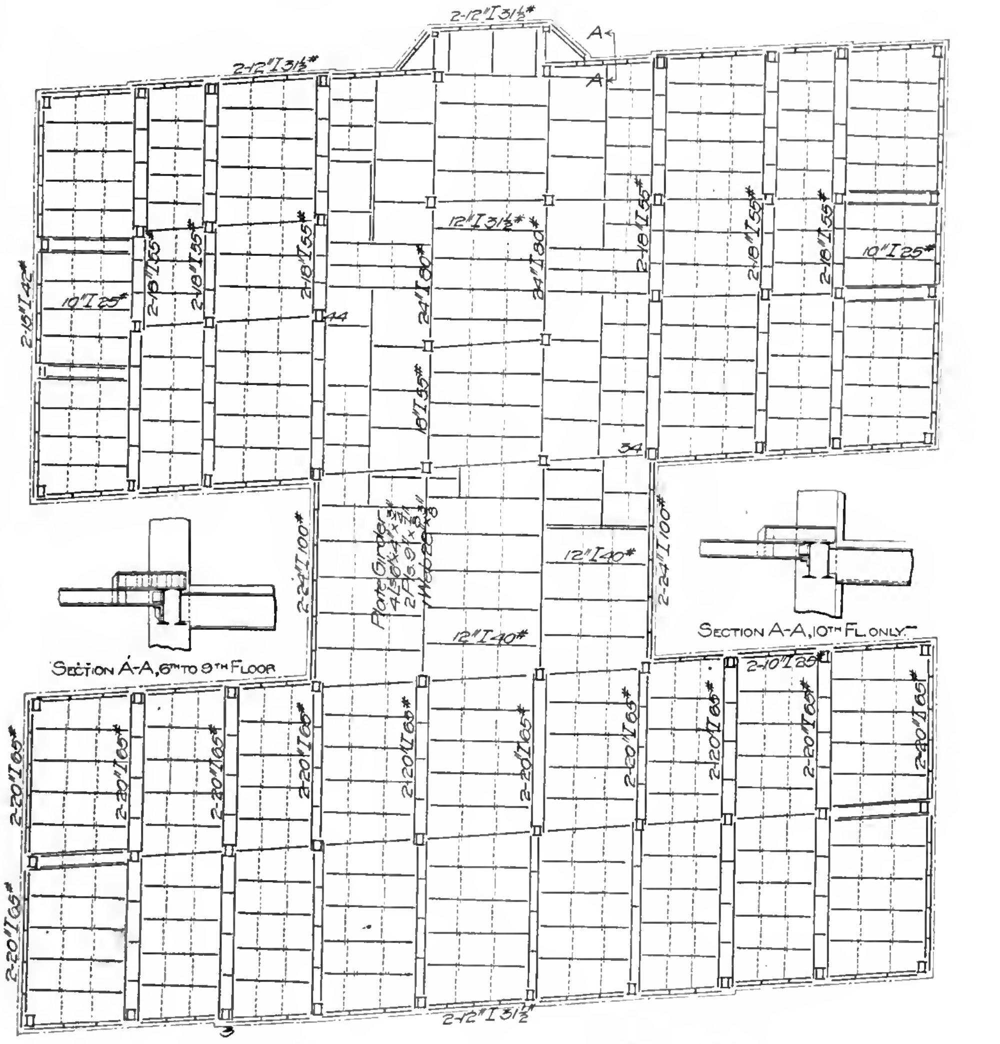
		Resistance per sq. in.		Ratio,
Mixture.	Rod.	I—Smoothed.	II—Skin.	I÷II.
1:3	1 in.	146	707	4.8
1:4	7/16 in.	393	900	2.3
1:4	1 in.	341	514	1.5
1:6	7/16 in.	216	740	3.4
1:6	1 in.	133	227	1.7
1.8	1 in.	178	425	2.3
		Average Unit Resistance Smooth Rods.		
		Steel.	Brass.	
1:6	7/16 in.	216 lb.	251 lb.	
1:6	1 in.	133 lb.	409 lb.	

The Hudson Companies' Building, New York.

The terminal station of the Hudson & Manhattan R. R. Co., occupies two city blocks in the congested down-town financial district of New York City, extending from Cortlandt to Fulton Sts., on Church St. It is the terminus of two tunnels under the Hudson River, affording connections with the terminals in New Jersey of the Pennsylvania, the Erie and the Lackawanna R. R., and of all the trolley lines in Jersey City and Hoboken, the passengers from which can enter the subway and elevated lines in New York directly from this station. The station proper has extreme dimensions of about 210x435 ft. and is constructed entirely below the surface of the street in an excavation about 76 ft. deep to the floor of the sub-station.

The massive concrete foundation walls are carried down by the pneumatic caisson process to solid rock at maximum and average depths of about 95 ft. and 80 ft. below the curb and serve to support not only the station but the terminal buildings 275 ft. 9 in. high from the curb to the top of the main roof and 304 ft. high to the tops of the towers. All footings for the interior columns are carried by the same process to rock or hard pan. Below the street, the construction is uninterrupted across the line of Dey St., but above street level it is divided into two large 21-story structures, used as independent office buildings, one on each side of Dey St., which are harmonious in appearance and of the same type of construction and will be operated under the same management and by the same equipment of mechanical installation. The massive sub-structure below street level was separately designed and constructed and may be considered as an independent base on which the fire-proof steel cage superstructures of the terminal buildings will be erected similar to ordinary office buildings.

The two 21-story steel cage fire-proof buildings have brick walls, faced up to the 5th floor with polished granite and Indiana limestone and trimmed above that level to the 16th floor with terra cotta. Above the 16th floor the entire facade is of terra cotta ashlar with brick backing. Together they will contain about 25,000 tons of structural steel, fabricated at the Pencoyd and Trenton plants of the American Bridge Co., about 5,000 tons of terra cotta furnished by the Atlantic Terra Cotta Co., and about 15,000,000 W. A. U. red brick. The floors will generally be reinforced concrete slabs with cinder concrete fill and yellow pine finish. All steel will be enclosed in terra cotta tile, brick or concrete and all wood-work will be fire-proofed. Metal sash and window frames and wire glass will be treely used. The approximate weight of the combined superstructures including the estimated live load is about 165,000 tons.



Typical Beam Plan, 6th to 10th Floors Inclusive.

The dead and live loads per square foot of floor surface are as follows: In the Cortlandt Building dead 85, live 75, total 160 and total roof load 150. In the Fulton Building, dead 95, live 105, total 200 and total roof load 150. Total first and lower mezzanine floor load, both buildings, 250. Stairs and runways, total load both buildings, 270 lb. per square foot. Wind stresses are computed for a uniform pressure of 30 lb. per square foot on the entire exposed vertical surface of the building and the columns loads are calculated with the 5 per cent. allowance taken off from the maximum floor loads at each of the upper floors in accordance with the New York building laws. The maximum unit stress in columns is 13,000 lb. and the minimum stress is about 11,500 lb. The maximum column load is 1,700 tons and the corresponding maximum cross section is 268 sq. in. Above the second floor all columns are made in two-story lengths and the heaviest section of a column in the building from basement to concourse floor weighs about 25 tons. The heaviest girder is in the concourse floor and weighs about 20 tons.

The 213x170-ft. Cortlandt Building, bounded by Cortlandt, Church and Dey Sts., is H-shaped in plan with two symmetrical 32x76-ft. light courts separating wings of 57 ft. and 78 ft. width respectively, which are joined by a connecting structure 65 ft. wide. It contains about 26,000 sq. ft. of rentable area on each of the upper floors. The 156x154-ft. Fulton building is bounded by Fulton, Church and Dey Sts., and is of similar construction with two 48x32-ft. light courts and has about 18,000 sq. ft. of rentable area on each floor. Both buildings are substantially alike and in general symmetrical, but owing to the lack of exact perpendicularity of the intersecting streets on which they are built, none of the angles are right angles and as all of the streets have different grades, great complications in the design and details of the steel work were unavoidable. These, however, related chiefly to the details of connections and are disregarded in the following descriptions.

In the Fulton Building, the first tier of beams in the superstructure is that provided for the pipe gallery at a level of about 13 ft. above the concourse floor and about 8 ft. below the intersection of the Dey and Church St. curb, which has been assumed as datum for all levels referred to in this article. The pipe gallery forms a platform from about 8 to 18 ft. wide extending around two sides of the building under Church and Dey Streets with a floor carried by 6, 12 and 18-in. I-beams supported at one end on the concrete foundation piers and at the other end on beams and channel girders carried by the columns. The main stairway at Dey Street and an inclined runway at Fulton Street, provide entrance and exit respectively from street level to concourse. The concrete slabs of the runway floor are carried on I-beams inclined 1:12½ and supported by plate girders.

In order to provide proper clearance for trains passing through the station, several of the columns have been spaced at wider intervals, below the concurse floor than in the superstructure This arrangement necessitates the employment of heavy triple distributing girders in the Concourse floor to support the 22 upper stories. Some of these girders are supported at one end by distributing and grillage beams on top of the wall column caissons; all of them are encased in concrete and have concrete filling in the interstices between their webs.

The floor designated as the "Lower Mezzanine" is mainly at the street level. It covers the entire area of the building west of the stairway and runway, and is intermediate between the concourse and first floors.

The first floor covers the entire area of the building except where runway and main stairway emerge and a few bays where a greater story height was desirable. East of the runway it is in general at the street level. West of the runway the first floor is intermediate between the lower mezzanine and the second floor, and contains the main elevator hall. In general the above remarks regarding pipe gallery, runway and stairway, lower mezzanine floor and first floor of the Fulton Building, apply also to the Cortlandt Building.

Dey Street roadway between curb lines, including a back fill of about 5 ft., the pavements and the constant traffic of heavily loaded trucks and wagons, is carried on a system of plate girders and I-beams, which form a skeleton platform about 180 ft. long, and about 27 ft. wide, supported on 14 2-story columns, about 18-ft. apart,

in longitudinal rows parallel to the wall columns in both buildings.

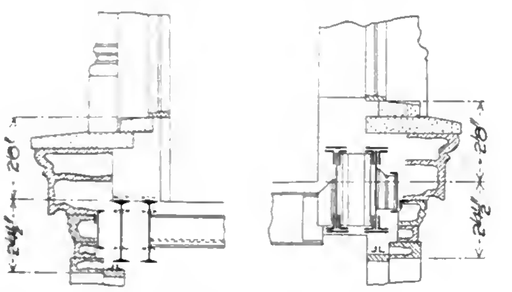
The platform is proportioned for a total load of 1400 lb. per square foot and in the widest panels has 24-in. 90-lb. I-beams about 4 ft. apart, 17 ft. 10 in. long that are web connected to plate girders and carry concrete arches about 18 in. thick.

Two lines of longitudinal girders outside of the ones just described form supports for a portion of the roadway, the sidewalks and several lines of heavy pipes, and are connected to transverse girders. The latter are connected directly to the main columns at one end and to the short columns and main longitudinal girders under Dey Street at the other end. This arrangement keeps the sizes of the girders within reasonable dimensions and provides for the distribution of a part of the weight of the street betwen the street columns and the building columns without involving oblique connections, notwithstanding the fact that the spacing of the columns is irregular and that those in the buildings are not in many cases in the same lines as those in the street.

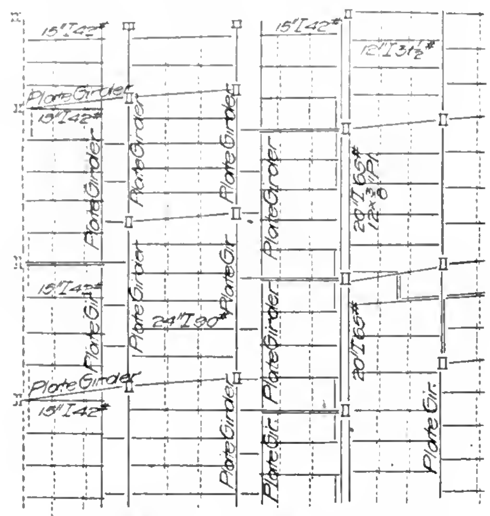
In the building the floor construction is complete and the 12-in. and 15-in. I-beams are carried directly from the columns and on 24-in. I-beam girders or plate girders. The grade of Dey St., the different levels in the floors, and the irregularity necessitated by the wide stair-ways and their framing of these floors is therefore special in that particular and in a few other minor details, otherwise it corresponds in general to the framing of the 6th, 7th, 8th, 9th and 10th floors, which varies from those above up to the 18th story only in minor details around the bay windows, walls and elevator shafts. In all of these floors the girders are in most cases pairs of 18-in. 55-lb. or 20-in. 65-lb. I-beams symmetrically arranged to give balanced loads on the columns, although where the latter are out of alignment, the variation is provided for in a number of cases by continuing girders of adjacent spans across the opposite faces of the columns and making the other girders of each pair engage the sides of the columns as shown in the diagram.

Above the 13th floor the bay windows disappear and all of the exterior walls carried on pairs of I-beams from 9 to 24 in. deep. The 18th floor framing is special, chiefly in the wall girders which provide for a heavy projecting belt course carried by I-beams or plate girders as indicated in the spandrel sections. In the upper stories of the beams and girders are reinforced by the milled upper ends of vertical distributing angles which transmit the girder loads to the columns.

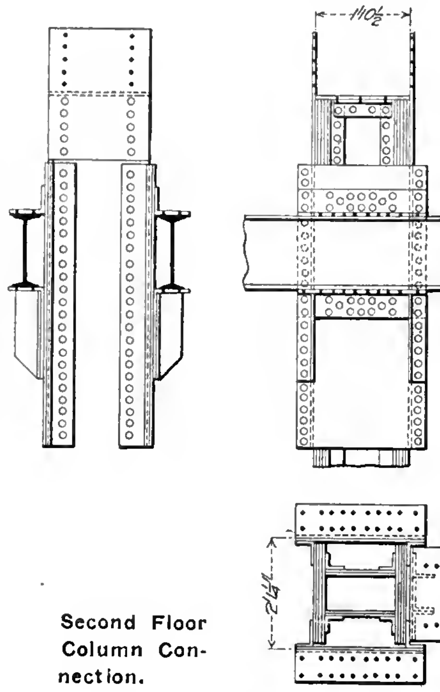
In order to avoid wind braces which would obstruct the panels between wall columns and floor beams or would interfere with the requirements of the architectural design, special provision was made to connect both upper and lower flanges of all beams and girders to horizontal angles shop riveted to the columns and thus provide a moment of stiffness equal or somewhat superior to the depth of the girder and insuring a considerable degree of stiffness in the frame work independent of the wall masonry. This construction together with the great mass and inertia derived from the weight and dimensions of the building is considered ample to provide



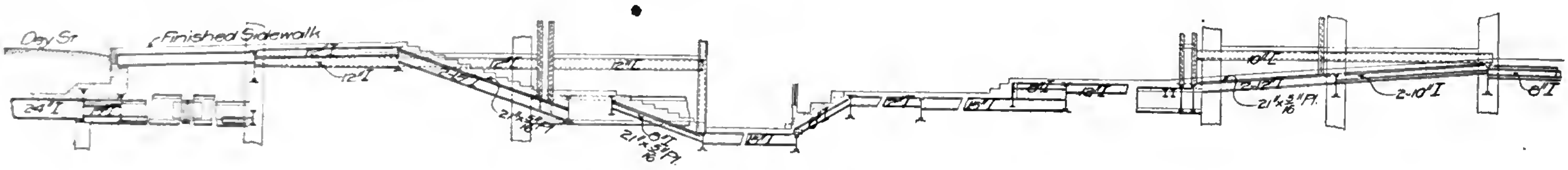
Spandrel Details.



Beams and Girders under Dey St.



Second Floor Column Connection.



Section of Lower Mezzanine Floor Parallel to Church Street.

landings make the framing of this tier very complicated.

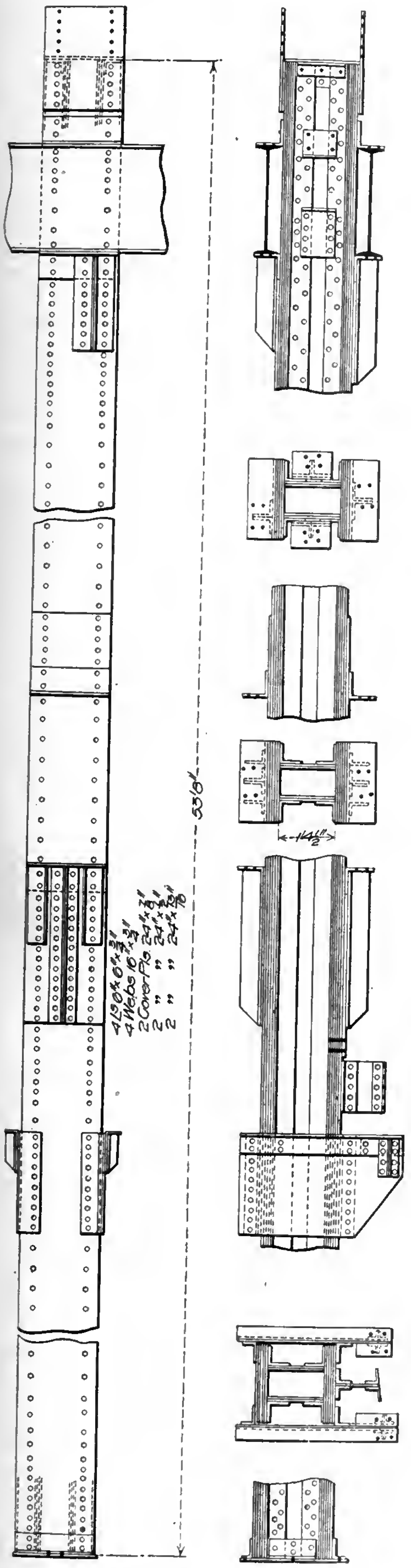
There are in the lower mezzanine floor of Fulton Building, 58 different girders, of 30 different patterns from 24½ to 40½ in. deep. The web plates are from ¾-in. to ⅞-in. thick and in some cases are made with double 9/16-in. plates. All flanges are made with 6x6 or with 6x4-in. angles reinforced in many cases with 14x¾-in. cover plates. The girders have reactions of from 40,000 to 285,000 lb.

The location of columns and girders in the first floor corresponds essentially with the location in the upper floors, but the floor loads are so heavy that special provision is required for them and the 12 and 15-in. I-beams are carried in most instances by plate girders of which there are 3 types, nearly all of them 30½ in. deep with 6x6-in. flange angles. Owing to the irregularity of the column spacing and the diverging of the column rows there are many offsets in the lines of girders and I-beams and their connections are in many cases necessarily eccentric and irregular. Except on the rear side and in the light courts the outer walls are carried on pairs of 15, 20 and 24-in. I-beams. The full size light courts are open to the street at both ends of the building, but at the 2d, 3d and 4th floors the beam tiers are extended across the courts covering the entire rectangle enclosed by the outer walls of the building. The the Fulton building there are 70 main columns from 12 to 36 ft. apart in longitudinal and transverse rows. All of them, up to the 8th floor, have standard rectangular closed cross sections made with web and cover plates and four angles. At the 8th floor the construction changes to rolled channels diminishing from 15 in., to 10 in. in the attic where the minimum size has 12x⅜-in. cover plates. The web plates of the built channels are 16 in. wide in all cases and have cover plates, increasing from 20 in. at the 7th floor to 24 in. in the lower story. All columns have reinforced shelf angles which carry the beams and girders, and are spliced 24 in. above the floor line with horizontal connection angles, a horizontal diaphragm, and a pair of short cover plates, the latter shop riveted to the top of one column and field riveted to the bottom of the succeeding column.

I-beam girders parallel to the column webs are connected by special shelf angles, plates and vertical angles riveted to the cover plates. Those at right angles to the webs are usually riveted to the east and west girders with short connection angles. Girders offset beyond the faces of the columns are carried on projecting cantilever plates properly stiffened. Deep plate girders are additionally connected to the columns and stiffened by auxiliary diaphragms shop riveted to the columns and field riveted to the webs of the girders. The shelf angles which receive the bottom flanges for all wind stresses. The heaviest column in the building is the lower section of No. 44 in the Cortlandt St. Building, which carries 1,700 tons. It is made with four 16x¾-in. web plates, two 24x⅞-in. two 24x½ and two 24x13/16-in. full length cover plates, besides two half-length 24x⅞-in. cover plates and four 6x6x¾-in. flange angles. It is 53 ft. 8 in. long and weighs about 900 lb. per lineal foot. Another very heavy column is in the basement section of No. 34 of the Fulton Building, which carries two deep plate girders in the sub-structure of the building besides the heavy loads from the upper stories. It has four 6x6x¾-in. flange angles, six 16x½ and ⅝-in. web plates and eight 24x¾ and ⅞-in. cover plates.

Column 3 between the concourse and the 2nd floor is typical of the upper story columns and the accompanying details show the numerous field rivets through the girder planes and the column connections to provide for the wind stress. The section of column 34 between the concourse and 2nd floors is made with 4x4x¾-in. flange angles, two 16x¾-in. web plates, four 24x11/16-in., and four 24x⅝-in. cover plates, is about 40 ft. long and weighs about 700 lb. per lineal foot. The connections at the upper ends are typical for those of beams and girders throughout the floor and are designed for a maximum stress of 7,500 lb. per square inch on the field driven rivets.

Messrs. Clinton & Russell are the architects. Mr. James Dougan, engineer. Messrs. Jacobs & Davies are the engineers for the Hudson Co. The design of the steel work was completed by Purdy



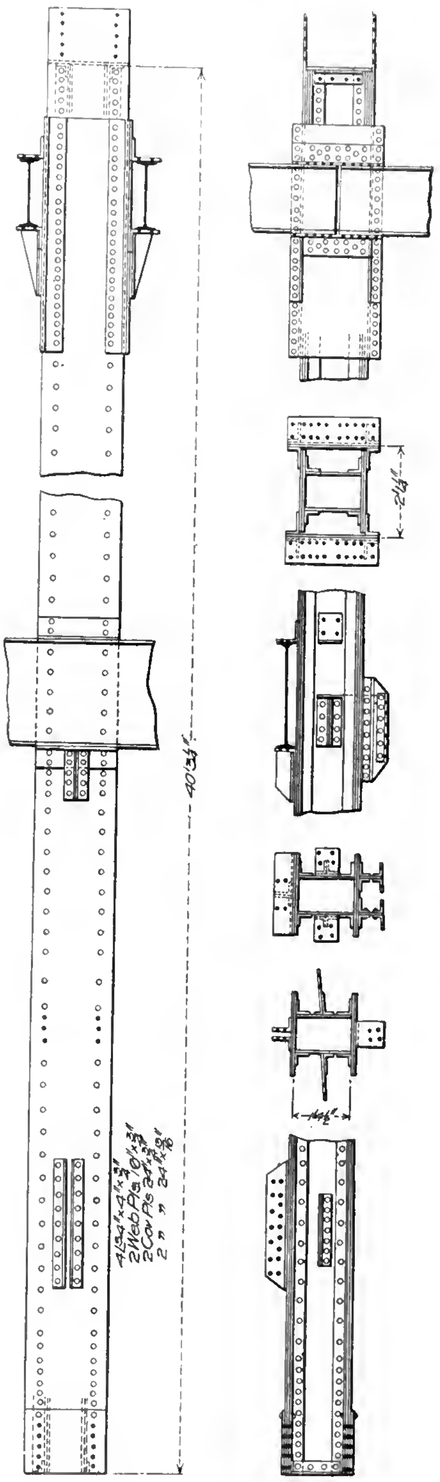
Column 44 A.

& Henderson, consulting engineers, under the supervision of the architect's engineer. The Geo. A. Fuller Co. is the general contractor and the steel work is furnished by the American Bridge Co.

WEED DESTRUCTION by the use of salt water from Great Salt Lake is being tried by the Oregon Short Line.

A Study of a Ground-Water Supply.

In connection with an investigation of the sources of water supply for Muscatine, Ia., Mr. Wynkoop Kiersted, of Kansas City, who was retained by the city as consulting engineer, prepared a report, which, while it deals with a special problem, is of value to those who have to secure water supplies from gravel strata. Muscatine Island is several miles in width. Its surface is in general above high water and undulates slightly in a direction perpendicular to the course of the Mississippi River. The surface slopes permit little run-off of storm water, hence the rainfall, not evaporated or absorbed by vegeta-



Column 3 A, Hudson Co. Building.

tion, reaches the river by flowing through a gravelly substratum. The surface soil is light and porous and readily permits the passage of water.

About 2½ miles below the business portion of Muscatine nine wells were sunk into the gravel down to bed rock or some other impervious material. These were on a line perpendicular to the course of the river. The well nearest the river, termed No. 1, was about 300 ft. from the bank and the others were at distances of 100, 200, 350, 500, 700, 1,000, 1,500 and 3,000 ft. from No. 1, and were numbered consecutively from 2 to 9. No. 1 was 8 in. in diameter, 2, 8 and 9 were 5 in. and the others 2 in. The depth of the wells below the ground surface varied from 46.0 to 57.25 ft. and averaged about 49.5 ft. and the variation in the elevation of the top of the wells was from 115.65 to 120.69, with an averge of 117.82, datum being approximately 100 ft. below low water of the river. The strata through which the wells passed were practically the same in every case and about as follows: 3 ft. of sandy top soil; 5 ft. of clay; 10 ft. of red sand and fine gravel; 10 ft. of coarse gravel; 15 ft. of coarse sand and gravel; 6 ft. of gravelly sand; 2 ft. of sand and coarse gravel; 5 ft. of blue clay; 3 ft. of shaley clay; 6 ft. of sand rock.

A series of observations, taken at intervals of one to five days and extending over a period of nearly two months, was made of the static level of the ground water in the wells and at the same time the stages of the river and the rainfall were noted. During the month of August and the first half of September the river fluctuations were small and there was a correspondingly stable condition of the ground water surface as shown in the wells. The average slope of the surface of the ground water toward the river during this period was 0.8 ft. in 1,000 ft., clearly indicating an under flow toward the river. From Sept. 13 to 21 the river rose a little over 2 ft. and a rise of 2.1 ft. in well No. 1 resulted. A corresponding rise occurred in the other wells, gradually decreasing as the distance from the river increased, until at well No. 9 the rise was only 0.3 ft. The slope of the ground water surface toward the river, though considerably reduced, was still evident, showing that the river water was not flowing into the gravel beds but simply acting as a dam and causing the ground water in the beds to rise and fill the wedge of gravel included between the water table of Sept. 13 and that of Sept. 21. In order for this to happen it was necessary for the water in the gravel to advance toward the river as well as to rise. This advance was estimated by Mr. Kiersted to be at the rate of at least 2½ ft. per day, and it necessarily occurred throughout the entire depth of the gravel bed, about 43.5 ft.

From Sept. 21 to 27 the river rose over 4 ft. and the slope of the ground water surface was completely reversed, so that on Sept. 30 it sloped inland at the rate of 1.13 ft. per 1,000. It was computed that from Sept. 27 to 30 the river water advanced into the gravel beds at the rate of 4.63 ft. per day. From Sept. 27 to Oct. 9 the water table maintained an average slope inland of 0.84 ft. per 1,000 and the computed average rate of advance of the river water for the same period is 2.3 ft. per day. In the accompanying table the results of the computations, involving slope and velocity of flow, are given, v, i and k being the symbols used in the Dupuit formula, $v = k\,i$, where v = velocity in feet per day, i = fall of ground water surface in a given distance divided by that distance, and k = a factor depending on the porosity of material through which the underflow passes.

RESULTS OF UNDERFLOW COMPUTATIONS.

Interval	v	i	k
Sept. 13 to 21.......	2.5	0.0005	5000
Sept. 20 to 21.......	1.55	0.000273	5680
Sept. 27 to 30.......	4.63	0.00113	4100

The average value of k is nearly 5,000, or the average rate of travel of the underflow of Muscatine Island per day is five times the fall of the ground water per 1,000 ft., indicating a very porous sub-soil.

To secure further information concerning the porosity and continuity of the gravel deposits

a pumping test was run at well No. 1, during which readings of the ground water level were taken at the nine wells. The water discharged from the pump was conveyed directly to the river in a wooden trough. The quantity of water pumped was only roughly estimated since it would have been of little use in determining the value of the beds as a source of water supply. A 6-in. centrifugal pump, operated at the rate of about 1½ million gallons per 24 hours, was used. The test was begun in the morning of Sept. 21 and continued for 125½ hours. Between the mornings of Sept. 21 and 26 the river rose over 3 ft. and notwithstanding the steady operation of the pump the level in the wells showed a simultaneous rise. The zone affected by the pumping seemed to extend about 700 ft. from No. 1. The conclusion drawn was that the gravel beds under that part of the island where the wells were driven are practically continuous and so porous as to be favorable for the operation of tubular wells.

The method of development of the gravel beds as a source of water supply depends on the rainfall, the catchment area, the rate of water consumption, the available velocity of ground water flow up to a limit safe for efficient filtration, the depth of the water-bearing gravels, and, it might be said, upon the permissible rate of infiltration from the river were it not for the possible choking of the beds with particles of silt. Although the river will always contribute somewhat to the flow of ground water, the rainfall upon the catchment area is usually considered the main reliance of a ground water supply. At the same time, there should be a large capacity for permanent storage in the gravel bed. The water stored above the low-water mark of the river is an uncertain quantity. If the average stage of the river is low the amount of water in the gravel beds above the low-water line will be small and vice versa. Below the low-water level the beds are sure to be always saturated and will yield water as long as the river and rainfall replenish it.

The amount of rainfall which is available in the run-off by underflow is a larger percentage of the total rainfall in a year of excessive or average precipitation than it is in a year of low precipitation, ranging approximately 50, 45 and 35 per cent., respectively, according to Mr. Kiersted. Taking 45 per cent. of the rainfall for an average year gives 17 in. per year or 813,500 gal. per day per square mile, as the available rainfall at Muscatine. The catchment area supplying the underflow will be on both sides of a line of development and may extend a mile or more on either side of it. For a development having a total width of 2 miles the daily yield per lineal foot is 308 gal. and the velocity 235 ft. per day. When the total width is 3 miles the quantities are 462 gal. and 3.52 ft., and when the development is 4 miles wide 616 and 4.7 are the corresponding daily yield and velocity. The length of the development is not necessarily the same as the length of the constructed work because, as shown by the pumping test, the affected zone may extend upwards of 700 ft. beyond the actual construction.

The computed velocities of ground water flow are based on an available depth of saturated gravel of 35 ft. and an available void space of 25 per cent. of the bulk of the gravel.

Mr. Kiersted recommended that, at Muscatine, the development should be laid out approximately parallel to the river and far enough back from it to insure thorough filtration, probably about 650 to 800 ft. from the bank. The development should be extended enough to insure a slow average rate of percolation. Either the gallery or tubular well system is reported to be feasible at Muscatine, but wells are recommended.

The Reconstruction of the East St. Louis & Suburban Ry. Power Station.

The power station of the East St. Louis & Suburban Railway in East St. Louis, Ill., was built in 1902, with an electrical generating equipment, capable of producing 3,100 kw. Since then this equipment has been augmented from time to time to supply increasing demands for power, and early in 1906 an 80 ft. addition, containing two 1,000 kw. engine-driven generators and 2,000 h. p. in boilers was erected at one end of the original building, the rearrangement of the interior of the latter having been commenced prior to the installation of other new generators.

The original station was built to supply power for the street railway lines in East St. Louis and interburan electric lines in the vicinity of that city. The station building is of brick and is divided by a brick wall into a boiler room, 52 ft. 5 in. wide and 280 ft. long, and a generator room, 56 ft. 9 in. in width and 262 ft. in length. The generator room originally contained two 750 kw. three-phase 25-cycle 13,200 volt alternating current General Electric generators, each direct-connected to a 1,150 h.p. non-condensing St. Louis Iron & Machine Co. Corliss engine; a 1,600 kw. 575-volt direct-current General Electric generator direct-connected to a 2,500 h. p. twin non-condensing Fulton Iron Works' engine, and the necessary auxiliary machines and switch boards. Soon after the station was completed demands were made for power at different voltages from that of the current generated by the units installed, and at present current is being supplied from the station for the following purposes: 575-volt direct-current for street railway service; 500-volt direct-current, over nongrounded double-wire circuits, for power; 2,300-volt 3-phase 60-cycle alternating current for commercial lighting and power; 13,200 volt 3-phase 25-cycle alternating current, which is transmitted to six railway substations and in these transformed to direct current at 550 volts. The power supplied by the original generators was utilized as it came from the latter, transformed to alternating current, or employed to drive motor-generator sets producing current at the desired voltages.

Steam for driving the units in the generator room was furnished by twenty 250 h. p. Heine water-tube boilers. These boilers were set in batteries of four each and were equipped with Green automatic traveling-chain-grate stokers, 12 ft. wide, one grate serving each pair of boilers. Coal was fed to the stokers from elevated bunkers supplied by a gravity overlapping-bucket conveyor that delivered from a hopper under a switch track along one end of the building. Eight additional 250 h. p. Heine water-tube boilers in two batteries have been installed in the addition to the boiler room, and the settings of the existing boilers are being reconstructed. The coal handling equipment will be retained and the new boilers will have grates of the same general design as the existing ones.

When the non-condensing engines driving the three original generating units were purchased they were to be installed in a power house at coal mines about eight miles east of the city, but when the city railway and lighting plants in East St. Louis were acquired by the interests which were erecting the power house, this proposed site of the station was abandoned and the latter was built at the edge of the city. At that time coal could be delivered to the station over the company's tracks from the mines at such a low figure that the non-condensing engines were installed at the new site. Since then the price of coal has increased considerably in the territory in which the station is located, so that in adding

Fans, Stacks and Fan Engine House.

to and re-arranging the station, provisions have been made for utilizing the exhaust steam from these non-condensing engines by passing it through low-pressure turbines.

Two new 1,000 kw. engine-driven units have also just been installed, and are designed to operate condensing. In addition to these engine-driven units, two turbo-generator units, one of 800 kw. and the other of 1,000 kw. capacity which operate on exhaust steam, and a 500 kw. link steam turbo-generator have been added to the equipment.

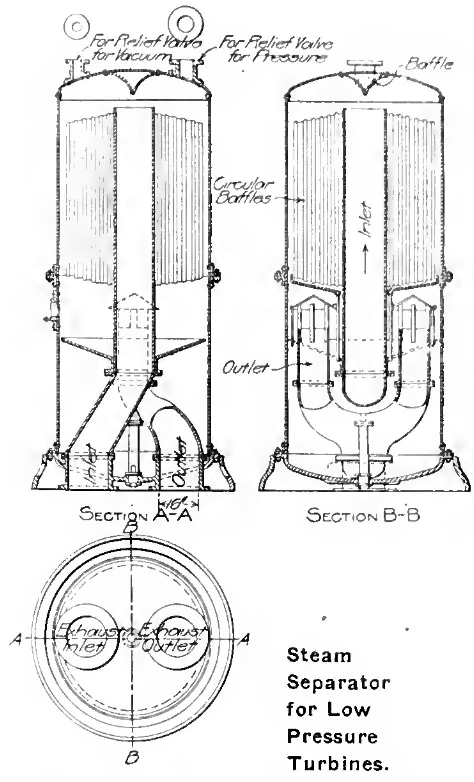
The site on which the station is built afforded such poor foundations that brick smoke stacks could not be erected at a reasonable cost, so five steel stacks, each 6 ft. in diameter and 180 ft. high, were built. These stacks were once partially wrecked by one of the windstorms to which the territory is subject. When the addition to the station was determined on, it was decided to equip the boiler room with an induced draft installation which would provide for the entire plant and to abandon and remove the stacks. This induced-draft apparatus taking care as it does of 7,000 h. p. in boilers, is of unusually large size, and is being built at the same time the other reconstruction work is in progress.

The exhaust steam from the engines driving the 1,600 kw. and the two 750 kw. units is utilized in the low pressure turbines operating on steam at 1-lb. gauge pressure; these turbines are operated

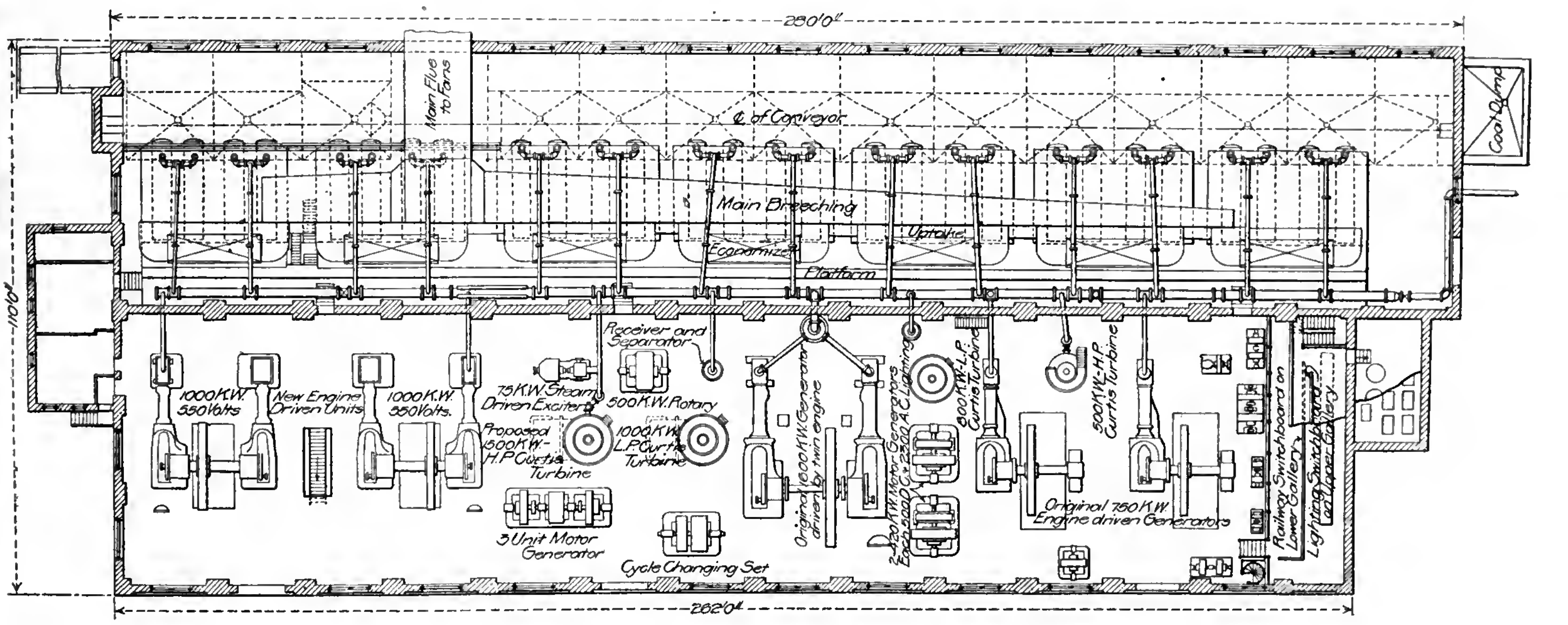
condensing, and as about 27 in. of vacuum are obtained, normally, the turbines operate at approximately 14 lb. pressure. An exhaust main 30 in. in diameter is placed in the basement of the engine room and extends the length of the building on the side next to the boiler room. The exhausts of the various reciprocating units are connected to this main and the low-pressure turbines are supplied from it. An 800 kw. 25-cycle 13,200-volt three-phase alternating-current General Electric generator, direct-connected to a vertical low-pressure self-governing Curtis turbine, is placed between the engine of the 1,600-kw. unit and the engine of one of the 750-kw. units, as shown on the accompanying plan. This turbine is supplied with steam from the exhaust main and can be operated independently on the exhaust from the engines of the two 750-kw. units. A 1,000-kw. 60-cycle 2,300-volt alternating-current General Electric three-phase generator, direct-connected to a vertical low-pressure self-governing Curtis turbine, is placed on the opposite side of the 1,600-kw. unit. The turbine of this unit is also connected with the exhaust main, and it is arranged so it can be supplied with exhaust steam from any of the five reciprocating engines. Both of these turbines also have live-steam connections through reducing valves from the main steam header of the station.

The engines driving the two 1,000-kw. units which have recently been installed are equipped with a single Wheeler surface condenser having 3,000 sq. ft. of area; space is also provided for a second condenser of the same size for these two units. One or both of the latter can be operated non-condensing, however, when the exhaust from the three non-condensing units is not sufficient to supply power for the low-pressure turbines.

A specially-designed separator is placed in the connection between the exhaust main and each of the low-pressure turbines, in order to remove the oil and water from the exhaust steam as fully as possible, and to act as a reservoir so that a steady steam pressure may be maintained. The details of these separators are shown in an accompanying illustration. Each separator is inclosed in a cylindrical steel shell, 5 ft. in diameter and about 12 ft. high, which stands on a base on the floor of the generator room. A 16-in. inlet connection from the exhaust main enters this shell at the bottom and extends nearly to the top of the latter, with which it is concentric. The steam is discharged from this inlet against a curved baffle plate in the top of the shell, which baffle directs it downward through a series of cylindrical baffle plates placed concentric with the inlet pipe. These plates retain the impurities and deposit them on an annular diaphragm which is drained to the outside through a blow-off pipe. The steam passes through a narrow space between the outer edge of this diaphragm and the shell of the separator, and then through twin 12-in. outlets into the connection leading to the turbine. The tops of these outlets are capped to prevent any impurities entering with the steam.



Steam Separator for Low Pressure Turbines.



Plan of East St. Louis & Suburban Railway Co. Power Station.

Connections are made to the separators which will maintain the pressure in the latter, between certain limits, automatically. A relief valve which will prevent the pressure in the separator rising above a pre-determined amount is placed on a connection in the top of the separator. A second relief valve which will prevent a vacuum occurring in the separator is also placed on a connection in the top of the separator. Live steam may be supplied to the separator through an inlet in the side of the latter.

A 500-kw. 60-cycle 2,300-volt alternating-current General Electric generator direct-connected to a vertical Curtis turbine has also been erected, and space for a 1,500-kw. 25-cycle 13,200-volt alternating-current General Electric generator, direct-connected to a vertical Curtis turbine has been reserved in the generator room of the station. These units both operate on steam at about 150 lb. pressure. The 500-kw. unit furnishes power for a commercial lighting and power circuit; the 1,500-kw. unit will supply power for transmission to the street railway sub-stations.

The high and low-pressure turbines are each equipped with a surface condenser. These and the surface condenser for the engines of the two 1,000-kw. units are also supplied with cooling water from the same source, namely, six large cooling towers.

Two of these cooling towers are of the Alberger sprinkler type and the other four are of the Wheeler trough type. The six towers are in a row along one side of the building, each one being on a separate footing. They are built of steel plates and are 19 ft. in diameter to a height of 33 ft. and then 10 ft. in diameter to the top of the tower, 60 ft. above the footing. The cooling water is drawn from the base of each tower, circulated through the condensers and forced back to the top of the towers by centrifugal pumps in the basement of the generator room of the station. A pump is provided for each condenser, each pump being direct-connected to a motor. The two sprinkler-type towers are each equipped with two 8-ft. fans while the four trough-type towers each have two 10-ft. fans. Each pair of fans is connected through a shaft to a motor in the generator room of the station. Each tower is connected to a supply pipe from the city main, these connections being fitted with valves by which the make-up water is supplied automatically.

The condensed steam is pumped from the condensers to a 6x17.5x5-ft. closed hot-water tank in the basement of the boiler room. This tank is arranged with vertical baffles, placed 1 ft. apart, which are open alternately at the top and bottom of the tank. The water is admitted at one end of this tank and passes in a circuitous up-and-down route around the baffles to reach an outlet at the opposite end. The oil and other floating impurities are thus caused to rise to the surface between the alternate pairs of baffles, which alternate baffles are attached to the top of the tank. A blow-off pipe is placed in each of these spaces for removing the impurities from the surface of the water.

The induced-draft system which will replace the stacks that now serve the boilers has a main breeching extending the length of the row of boilers over the tops of the latter and connecting

in a space between the old and new boilers to a main flue leading to a fan house that has been built on a separate footing at the side of the main building. Two fans, having impellers 20 ft. in diameter and 10 ft. wide are placed along the side of this house, in steel-plate volutes 32 ft. in diameter.

Each of the batteries of two boilers has been equipped with a Green economizer, which is placed over the boiler setting in a by-pass between the boilers and the main breeching, the various economizers being a part of the induced-draft system. The different main parts of the latter have been designed to provide for draft for an eventual installation of six additional boilers, or twenty in all, sufficient for expansion for a considerable time.

The breechings, flues and connections have all been designed so that any part of the induced-draft system may be cut out of service without interfering with the operation of the other parts. The connection between each boiler furnace and the main breeching is fitted with a damper that is operated by hand from the firing floor in front of the boiler, so the amount of draft in each furnace can easily be regulated separately from the others. The by-pass in which the economizer for each battery of boilers is placed is connected at both ends with the main breeching. These two connections can be shut off either separately, or together by dampers, while a balanced damper in the main breeching at each economizer by-pass permits all the gases to be diverted through the latter if desired.

The main breeching over the boilers increases in size at a uniform rate to a cross-section of 10.5x12 ft. at the main flue. The latter is 14x14 ft. in cross-section for its full length from the junction of the breechings to the connections leading to the volutes of the fans in the house at the side of the building. The breechings and flue are suspended from the roof trusses of the building, while the economizers are carried by a steel frame in the boiler settings. In all cases ⅜-in. plates reinforced with channels and angles were used for the ducts carrying the waste gases from the furnaces to the fans. The limited head room over the boilers makes the installation of the ducts particularly difficult and necessitated the rearrangement of the piping connections by which the steam is led off from the boilers.

Engines which drive the fans are placed in the brick fan house outside of the power station building. Two smoke boxes, 11 ft. wide, are placed along the side of this house, one at each side of the end of the main flue leading from the boiler room and to these the volutes of the fans are connected. Dampers make it possible to cut each of these boxes out of service separately.

The two 20-ft. fans which furnish draft for the system are driven by two 12x30-in. Fulton Corliss engines in the fan house. Each fan is on the end of a shaft direct-connected to one of these engines, a double water-cooled bearing, each part of which is 48 in. long, being placed between the fan and the engine which drives it. The fans will normally be run at 80 r.p.m., but are designed to operate at from 70 to 150 r.p.m., depending on the amount of draft desired and on local conditions. Each fan is served by a self-supporting steel stack 10.5 ft. in diameter and 70 ft. high above the footing, which is integral with those of the fan house.

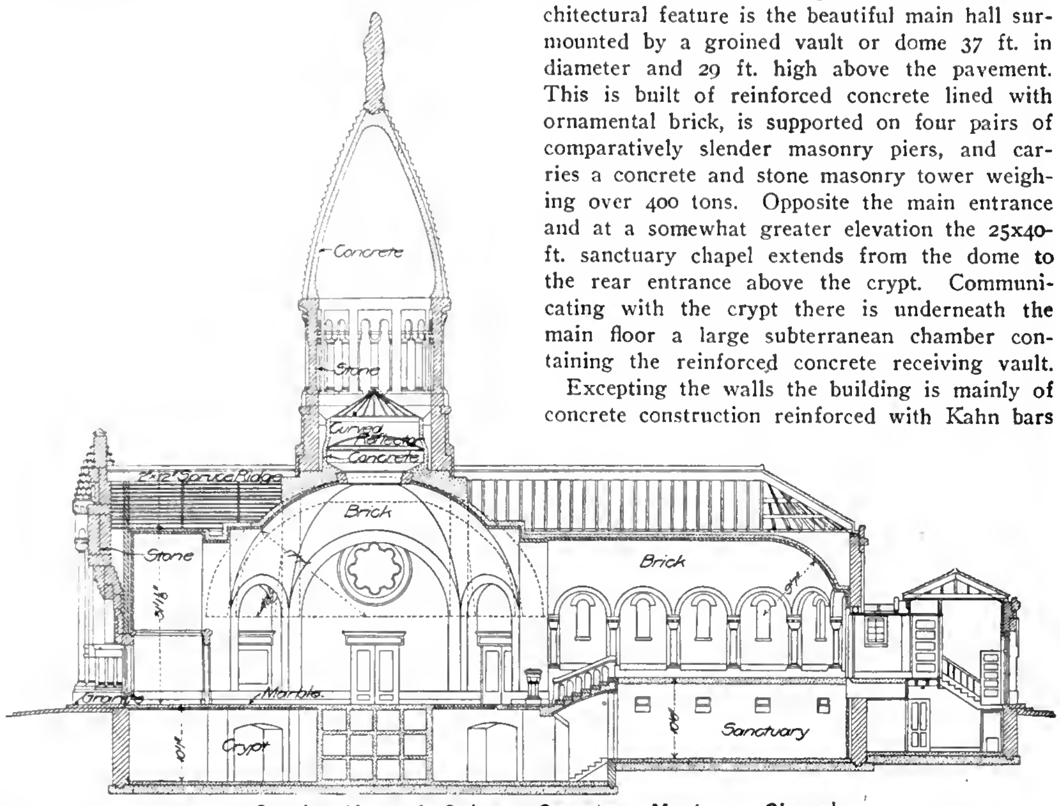
The additions to and the rearrangement of the power station are being made under the direction of Messrs. Lichter and Jens, consulting engineers, of St. Louis, who prepared the plans for and supervised the construction of the original station.

Combined Forced and Natural Draft Cooling Towers.

The Calvary Cemetery Mortuary Chapel.

The Mortuary Chapel now being completed in Calvary Cemetery, New York, at a total cost of about $200,000, is a 64x124 ft. structure about 32 ft. high to the top of the main roof and 92 ft. to the top of the tower, which is surmounted by a 5-ton stone figure 10 ft. high. The general elevation and the symmetrical plan are indicated by the vertical longitudinal sections and by the foundation diagram. The central architectural feature is the beautiful main hall surmounted by a groined vault or dome 37 ft. in diameter and 29 ft. high above the pavement. This is built of reinforced concrete lined with ornamental brick, is supported on four pairs of comparatively slender masonry piers, and carries a concrete and stone masonry tower weighing over 400 tons. Opposite the main entrance and at a somewhat greater elevation the 25x40-ft. sanctuary chapel extends from the dome to the rear entrance above the crypt. Communicating with the crypt there is underneath the main floor a large subterranean chamber containing the reinforced concrete receiving vault.

Excepting the walls the building is mainly of concrete construction reinforced with Kahn bars



Section through Calvary Cemetery Mortuary Chapel.

which make monolithic construction for all floors, roofs and dome. The walls are faced on the exterior with Indiana limestone above a granite base and the interior of the superstructure is faced with light brick and pink Minnesota sandstone. The main floor is paved with marble and that of the crypt and subterranean receiving chamber has a granolithic surface on a bed of cinder concrete. The doors and windows have stone lintels and the dome has at the crown a cut stone curb about 6 ft. in diameter, covered with a concave skylight of ornamental stained glass. Above the skylight there is a curved Frink reflector and a conical skylight roof at the base of the open colonade forming the lower part of the tower.

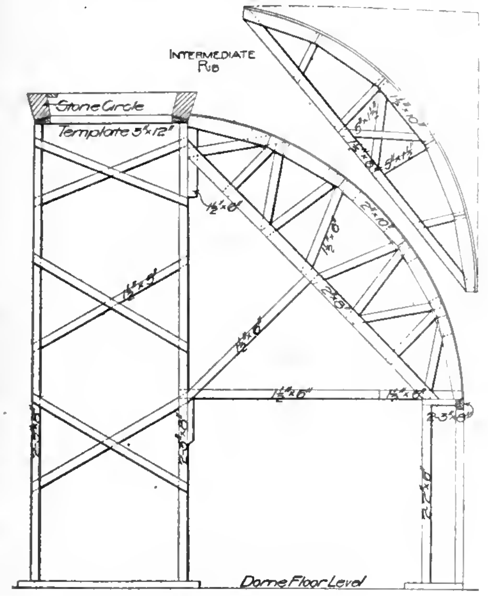
The vaulted roof over the chapel is a full centered arch surmounted by an exterior shell of timber framework covered with Celladon tile to give the Gothic appearance required for the exterior elevation. The foundations for the wall have continuous footings. Those for the 8 piers carrying the dome and tower are isolated. The dome piers are virtually segments of an octagonal ring taken at the vertices and their footings, 26 in. thick, are reinforced by cross layers of ¾-in. Kahn bars 12 in. apart on centers and 4 in. clear of the lower surface of the pier. The footings for the main walls are of the same thickness and are reinforced with single transverse bars of the same size. Under the crypt the footings are only 12 in. thick and are reinforced by 1½-in. transverse bars.

The reinforced concrete dome construction consists essentially of two pairs of arches at right angles to each other supported on piers. The tops of the piers are connected in pairs to arches of 9 ft. diameter of intrados and four 1x3-in. vertical anchor bars project above the

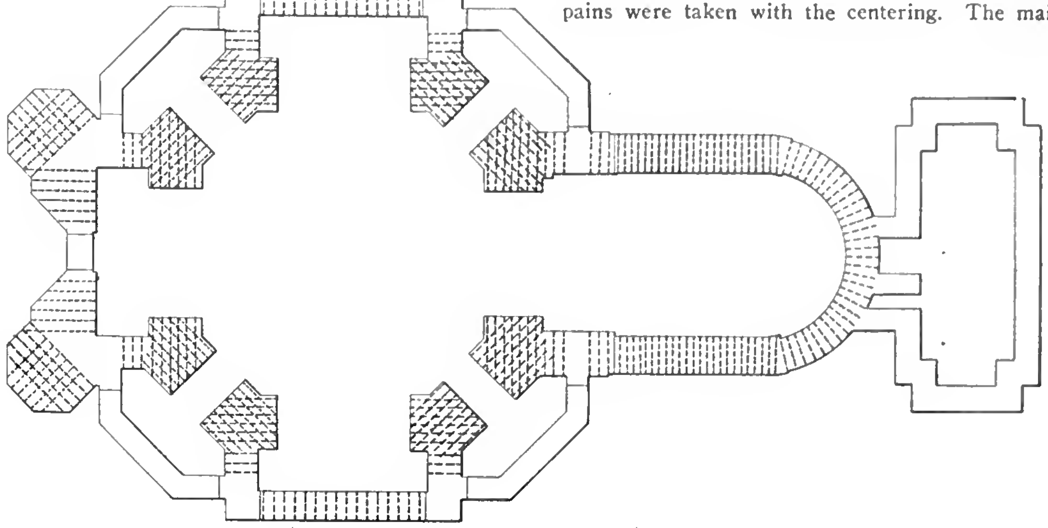
top of each to secure the arches which were built separately after the completion of the piers. The thickness of the arches diminishes from 3 ft. on a horizontal line at the base to 2 ft. at tion details and have offset footings on the upper side to receive the stone masonry of the tower.

The arches and groins of the 4-in. brick lining for the domes spring from so many points of intersection with the piers that the stability of by Morse anchors to the monolithic concrete dome above, from which it is actually suspended, although in construction the concrete dome was built on the brick arch.

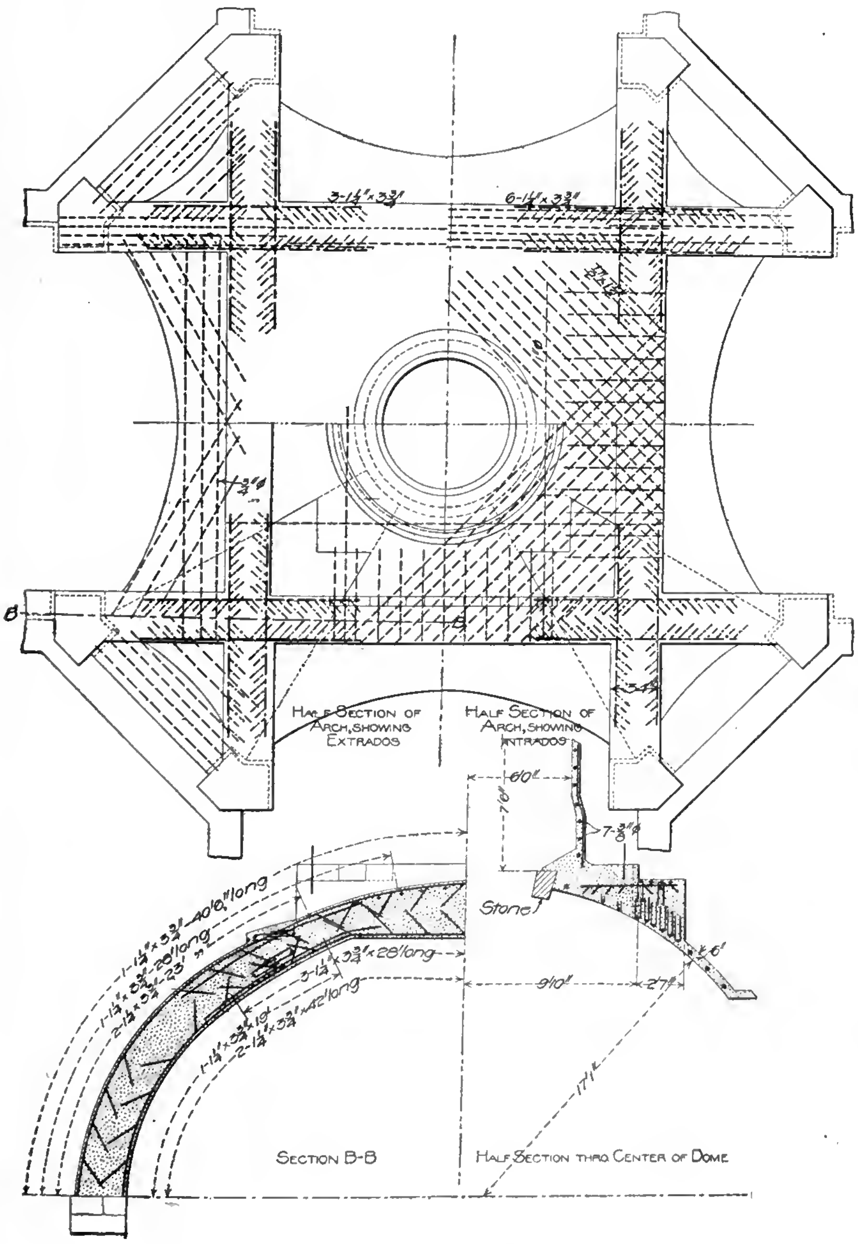
In order to support the compound structure during erection and to provide for extreme accuracy of the complicated curved surfaces, great pains were taken with the centering. The main



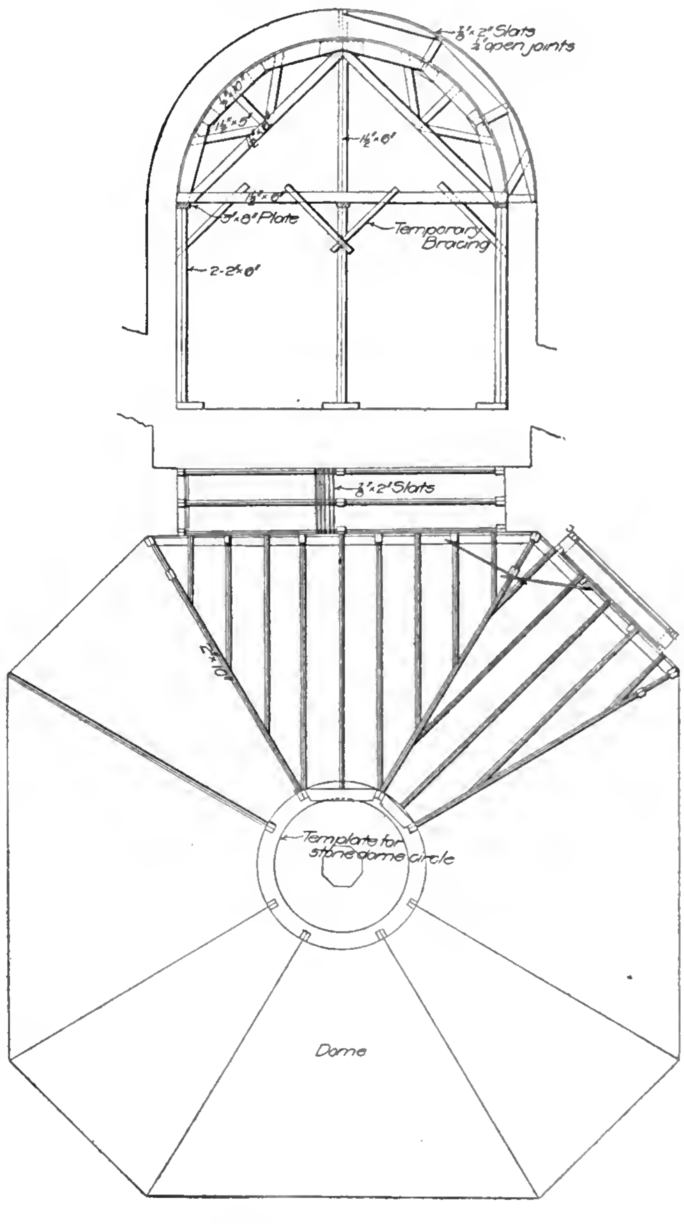
Falsework for Dome.



Plan of Chapel Showing Footing Reinforcement.



Reinforcement of the Dome.



Dome Falsework and Arch Centering.

the haunches where the thickness is a minimum at the intersection with the curves and horizontal intrados. They are reinforced with crossed layers of radial and horizontal bars near the intrados and extrados, as shown in the cross section the latter is very much decreased and the concentrated thrust would be so great that unless other supports were provided for them than is given by the skewbacks stability could not be secured. The brick lining is therefore connected framework was built with 8 radial sections or sectors symmetrical about their center line and symmetrically arranged alternately in pairs corresponding with the long and short side of the octagon formed by the piers. Vertical posts con-

sisting of pairs of 2x6-in. timbers were placed in the openings between the piers and in a circle under the crown of the arch. The former carried centering for the relieving arches and the latter carried segmental caps fitting the intrados of the dome. The ends of the caps and centers were connected by radial trussed ribs, like hip rafters, into which were framed transverse scarf boards at right angles to the separate elements of the dome arches and afforded support for the lagging which was very carefully cut and laid. The radial ribs were in reality wooden trusses with curved top chords made from the scarf boards and with 2x8-in. straight inclined bottom chords connected to them with 6x½-in. zig-zag web members spliced to both chords. The intermediate ribs were of similar construction but lighter and were proportioned to be supported at both ends without intermediate columns.

In order to make the courses of the brickwork exact and their alignment perfect, a full-sized quarter section model or negative of the intrados of the dome was made of plaster paris on which the courses of the brick work were marked and then transferred to the lagging. Every brick in the lining was applied to it and was cut and rubbed in two directions, namely, concave on the exposed face, concave on the lower bed, and convex on the upper bed so that the brick would be truly horizontal when laid. This work was done with great care and resulted in such precision that all of the lines are perfectly regular and no imperfections can be observed in the finished work. It is believed that this method of constructing brick work and suspending it from reinforced concrete above has never before been followed in this country, and so far as shown only once recorded abroad.

After the completion of the brick lining, forms were built above it and in them the concrete arches were made. After they were set the thin interior concrete walls for the sides of the lantern frame were built continuous with the dome concrete. Later the stone masonry walls for the base of the tower were laid in the usual manner on a footing provided by the offset upper surface of the dome, the concrete columns of the colonnade were set on it. Finally the reinforced concrete shell of the top of the tower 18½ ft. in diameter and 24 ft. high were built on it with sectional inside and outside wooden forms of ordinary construction. This concrete shell is reinforced by 12 horizontal rings of 1-in. round iron and by curved bars in vertical radial planes. The latter are made in two varying lengths. The base of the structure is reinforced by a ring of 6x6x⅜-in. angle iron secured to the sub-structure by eight 1¼-in. vertical anchor bolts through its horizontal flange. The vertical flange of this angle is bolted to the flattened lower ends of the radial reinforcement bars.

The stairway descending to the crypt is made with an inclined slab of solid reinforced concrete 12 in. in minimum thickness and provided on the upper surface with triangular offsets to engage the rectangular solid marble steps placed on it. The vaults in the crypt are contained in a monolithic rectangular concrete structure 14 ft. 4 in. wide, 17 ft. 8 in. long and 10 ft. high with horizontal and vertical partition slabs dividing it into 24 compartments each 30 in. square. The main walls are 8 in. thick and are reinforced with Kahn bars, all the partition slabs are reinforced with ⅜-in. round bars.

Mr. Raymond F. Almirall is the architect and P. J. Carlin Construction Co. is the general contractor. The reinforced concrete work was designed under the supervision of Mr. John Hawksworth, assistant engineer of the architect, by the Trussed Concrete Steel Co., Detroit, Mr. B. J. Greenhood, engineer, and was constructed by the Concrete Steel & Tile Construction Co., Detroit.

The New Water Supply of Mexico.

Heretofore the water supply for Mexico City has been of rather limited quantity and poor quality, but there is now in an advanced stage of construction a new system which will remove both objections. The new system comprises works for taking the water of several springs, a conduit to convey the water to the limits, receiving and distributing reservoirs, pumping plants, and a new system of distributing pipes in the city.

The new supply comes from four different groups of large springs at La Noria, Nativitas, Santa Cruz and San Luis, situated along the southwestern shore of Lake Xochimilco.

This lake is one of the ancient and historically interesting bodies of water in the valley of Mexico and lies on the southerly side of the city, the springs being from 20 to 30 kilometers from the reservoirs, which are located on high ground about 10 kilometers from the center of the city near to and westerly from Chapultepec.

The valley of Mexico, in which the city lies, is a great basin 7,000 ft. above sea level and entirely surrounded by high mountains. Of the latter, the Ajusco Mountains lie to the south of Lake Xochimilco, and their formation is so porous and their capacity for absorption so great that they appear to yield the underground flow from which the springs mentioned, as well as many others on the south side of the valley or basin, are supplied.

The water, as it comes from the springs, is as clear as crystal, and, analyses show it to be of a high degree of purity.

The four groups of springs yield a total of 700 gal. per second. The new works are designed to take and deliver 562.5 gal. per second, or 48,600,000 gal. per day. The population of Mexico City is about 400,000, from which it appears that the new supply provides about 125 gal. per capita.

To collect the water, reinforced concrete wells or caissons of rectangular and octagonal forms, with necessary partition walls, openings and valves, are sunk into and around the springs to depths of 20 to 30 ft. and with horizontal dimensions from 10 to 30 ft. The pumps are located in or over these wells.

To convey the water from the source of supply to the distributing reservoirs west of Chapultepec, a reinforced concrete conduit to have a total length of 30 kilometers (18.75 miles) is under construction. It runs across the level valley with a hydraulic grade of 0.0003. Its cross-section is oval, the maximum horizontal and vertical diameters being about 6.60 ft. The invert is flat, while the crown is, approximately, a parabola.

Along the conduit and spaced 333 meters apart, open concrete stand pipes about 20 ft. high and about 30 in. in diameter are built on the conduit with a manhole in the top of the latter on either side of the stand pipe, and a gate in the conduit between the standpipe and the manhole on the upstream side. The bases and tops of the stand pipes are handsomely finished in cut stone trimming.

The conduit will work under a normal head of 5 to 10 ft. Its shell above the invert is about 5 in. thick and the entire section is reinforced by expanded metal. The concrete is a 1:3:3 mixture, using Portland cement. Owing to the level country, the conduit has a covering of earth rarely exceeding 3 ft. except in approaching the reservoirs. It is laid but a few feet below and approximately parallel to the hydraulic grade.

The conduit terminates near and about 50 meters below the receiving and distributing reservoirs. As previously stated, the latter are situated westerly from the city and Chapultepec and adjacent to the west end of Chapultepec Park. The reservoirs are four in number and are at an elevation of 50 meters (164 ft.) above the streets of the city. Each one is circular and 100 meters in diameter and deep enough to hold 50,000 cubic meters, the combined capacity being equal to 30 hours' supply for the entire city.

For a depth of about 10 ft. the circular wall of the reservoirs is vertical, and from there to the bottom it slopes 1 on 1. The bottom is covered with a heavy floor of concrete. Each reservoir is covered with a heavy concrete roof of girders and slabs carried on concrete columns set on circles concentric around the central octagonal chamber about 18 ft. in diameter, which rises from the bottom to the roof of the reservoirs and terminates in an ornamental tower about 10 ft. in diameter above the roof.

This chamber has openings in each face inside the reservoir and is connected to a central gate chamber centrally located outside the reservoirs by a concrete tunnel having a diameter of 1.5 meters. The only office of this large central chamber in the center of each reservoir appears to be to permit the flow into and out of the reservoir, there being no gates or other means of control in it.

The roofs of the reservoirs are approximately level with the ground and, when finished, the reservoirs will be covered with earth and sodded, it being the intention to grade the reservoir site and convert it into an extension of Chapultepec Park.

Outside of and conveniently located near the reservoirs, one large controlling gate chamber, surmounted above ground by an ornamental tower, will be constructed. The tunnels above described will run from each reservoir to this chamber and deliver the water to it for distribution to the city.

All concrete in this construction is very heavily reinforced in all directions by Johnson bars, and the dimensions of the concrete are heavier than theoretical requirements dictate. The mixture is 1:3:3.

From the controlling gate chamber 60-in. cast-iron pipes will lead to the city and an entirely new network of pipes for the latter will be laid. This part of the work is not yet under way.

At each of the four groups of springs and wells the water must be lifted from 6 to 12 meters to get it into the conduit and give it necessary head. At the terminus of the conduit at the reservoirs, the lift will be 50 meters to get the water into the latter.

Single stage centrifugal pumps will be used for all this work, there being two 24-in. pumps at each of the four groups of wells, and one plant of three pumps at the reservoirs and having a capacity equal to the sum of the other four. These pumps are being constructed by I. P. Morris Co., Philadelphia, and will be run by electric power. The lift of 50 meters in single stage appears abnormal for this class of pump, but the data are taken from the official statement of the Water Works Board of Mexico City. Handsome stone buildings will house the pumps.

The work as a whole, which is being carried out in an admirable, permanent character, was designed and is being directed by Sr. Manuel Marroquin y Rivera, Chief Engineer to the Board.

IMPROVEMENTS IN MANILA HARBOR and the Pasig River, which were completed during the past year, cost $4,483,000. The work consisted in dredging channels and constructing breakwaters, and has resulted in making the harbor the safest in the Orient. Two covered steel and concrete docks, one measuring 600 by 70 ft. and the other 650 by 110 ft., are now being built. The mud dredged from the harbor and the river has been pumped to shore, and used in filling in along the water front, at the points recommended by Mr. D. H. Burnham, who visited the islands some years ago in order to plan broad improvements for Manila.

The Effect of Stress on the Corrosion of Iron.

It is doubtless known to a number of readers of this journal that Prof. William H. Walker and Mr. Colby Dill have been conducting some important investigations of the effect of stress on the corrosion of iron at the research laboratory of technical chemistry at the Massachusetts Institute of Technology. They presented a paper on the subject at the recent convention of the American Electrochemical Society, and were on the program for a similar paper before the convention of the American Society for Testing Materials, which was unfortunately read by title only. The substance of the information they have made public in these papers is an important contribution to our knowledge of the corrosion of iron. The authors consider that a definite relation exists between electromotive force and corrosion, and that the corrosion of iron in water depends essentially upon three factors, the electrolytic solution pressure of the iron, the electrolytic solution pressure of hydrogen, and the condition of surface of the iron or metal in contact with the iron, in so far as it affects the ease with which molecular hydrogen may be liberated on it. In an experiment, the last two factors may be held practically constant, and the electromotive force of the system made to depend for the greater part on the solution pressure of the iron. In the paper read before the American Electrochemical Society, the authors deal with a single one of the conditions which affect the electromotive force of iron, the effect of stress on the metal. The particular problem investigated was the determination of the sign and magnitude of the potential changes caused by straining a piece of iron, particularly below the elastic limit.

The magnitude of the increase of potential which one would expect to be produced can be easily computed on the assumption that the energy stored in the specimen below the elastic limit is available as potential. Some very pure Swedish charcoal iron was tested in the usual manner to determine the modulus of elasticity and the elastic limit. From these data the maximum amount of work which it is possible to do on 1 cu. in. of soft iron by stretching it to its elastic limit was calculated to be 5.16 in.-lb., which is equal to 5.83 joules. One cubic inch of soft iron weighs approximately 126 grams, the specific gravity being 1.7. The work done in joules per equivalent is therefore 1.30, and the change in elctromotive force which would be expected is 1.30 joules divided by 96,540 coulombs, or 0.0000134 volt. The magnitude of this change is, therefore, very small; its direction should be positive, because it is the manifestation of energy stored up in the metal.

The paper gives the results of experimental measurements by the Poggendorf method, using a cadmium cell as standard electromotive force. The specimens of iron tested were made from two lots of exceptionally pure Swedish charcoal iron. One lot was hard-drawn wire about 0.25 in. in diameter, and the other was bar iron about 0.5 in. in diameter. The bars were cut in lengths of about 18 in., and the central portion reduced in a lathe for a distance of about 1 in. until a zone of bright new metal was exposed. This band was smoothed in the lathe first with a file and finally with emery cloth. With the exception of a narrow zone about 0.25 in. wide at the middle, the bars were covered with several waterproof coatings of ordinary shellac to insulate the metal from the solution except at the desired point.

The cell consisted of a central tube about 3 in. long and 1 in. internal diameter, open at both ends. To this were bound by means of adhesive tape three smaller tubes of the same length closed at the bottom. The bottom of the central tube was closed by a rubber stopper, carefully cleaned, through which the iron part projected, so that the reduced portion came at the middle of the tube. The central tube containing the specimen was filled with ferrous sulphate and then the three outer tubes were filled, one with ferrous sulphate and two with potassium chloride. All four tubes were then connected by syphons. The syphon of the normal calomel electrode dipped into the last potassium chloride tube. These precautions were successful in preventing the diffusion of the $FeSo_4$ into the tube containing the normal electrode. The $FeSo_4$ solution was protected from air by a layer of paraffine oil carefully washed to remove traces of alkali or acid. The loads were applied with a testing machine operated by hand, as a power machine rendered potential measurements out of the question.

Tests were made with a large number of pieces of iron which were subjected to increasing stress up to the breaking point; a typical test was as follows: The stress was applied uniformly and gradually increased. The potential dropped simultaneously very slowly until at a stress of about 31,000 lb. per square inch of original section, the electromotive force had decreased 0.9 millivolts. When the machine was stopped at this point the beam of the machine sagged. When stress was again applied the potential rose suddenly 3.9 millivolts, and when the machine was stopped it dropped to its former value in 15 seconds, then sank more slowly to a minimum and then started slowly to rise again. When load was put on a second time the character of the change was similar to the first, there being first a sharp rise of electromotive force while the load was increasing, followed by an abrupt fall when the machine was stopped, then a slower fall, then a rise to a constant value. The magnitude of the sudden rise depended upon the rate at which the stress was applied. The final value after fracture was about 8 millivolts higher than the initial value.

The cause of the abnormal rise observed at high stresses was next investigated. Change in temperature suggested itself as the most probable cause, although iron under these conditions has shown itself to have a negative temperature coefficient. In order to duplicate as nearly as possible the thermal conditions which obtain in the iron electrode, a device was used whereby there was a continual flow of heat from the electrode to the solution. A hole about 1/8 in. in diameter was drilled throughout the length of one of the electrodes. The upper end was joined by a rubber tube to a reservoir directly above, holding about 2 liters. A copper-nickel thermopile was soldered to the surface of the electrode where it was in contact with the liquid. The copper, nickel and solder were insulated from the solution by means of shellac. Hot water was placed in the reservoir and allowed to flow down through the electrode, the rate being regulated by a screw pinchcock. The test showed that a rise in temperature produced a decided decrease of electromotive force. The experiment was repeated with additional precautions and entirely concordant results were obtained.

If the sudden rise in potential above the elastic limit is caused by temperature changes in the electrode, then, since iron has a negative temperature coefficient, the specimen must cool off as the breaking load is approached. Such a phenomenon, though highly improbable, is perhaps conceivable. Experiment showed, however, that there is a continuous rise in temperature from the elastic limit to the breaking load. The rise in temperature in this test was determined by means of the copper-nickel thermopile previously used.

An experiment was also made with normal ferric chloride as electrolyte to see if this change in potential below the elastic limit also occurred. The specimen was prepared in identically the same manner as the previous ones. Soon after immersion in ferric chloride it became coated with bubbles of hydrogen and the surface lost its metallic lustre and grew black. The potential rose rapidly during the first and second days. On the third and fourth days the potential was not measured. On the fifth day it had risen from 0.5279 to 0.6638 volt and was very constant. Scraping the specimen by means of a sharp wire produced a decrease of 0.0031 volt. On the sixth day the bar was pulled nearly to fracture. The potential decreased gradually 0.0006 volt from 1,200 to 32,600 lb. (yield point), per square inch. Here the potential rose as in all previous cases, but the subsequent behaviour was irregular. This experiment confirmed the previous ones with ferrous sulphate as electrolyte.

If there is any permanent difference in electromotive force between a strained and an unstrained piece of metal, it should be apparent in the case of hard-drawn wire when compared with the same wire annealed. A number of specimens of steel wire in its strained condition were obtained and portions of each specimen carefully annealed in a vacuum. In almost every case a difference of potential was observed between the annealed and unannealed specimen; but further investigation showed that as great, and frequently greater, differences existed between the different portions of the same wire, both in the strained and the annealed condition.

The results of the experiments are summarized by the authors of the paper as follows:

1. The magnitude of the potential changes suffered by soft iron when tested in a tension machine below the elastic limit is exceedingly small. In the majority of cases it was less than 0.0001 volt. The maximum change was 0.0004 volt.

2. The change, when great enough to be measured, was negative, *i. e.*, the strained metal had a slightly lower potential than the same metal unstrained.

3. Somewhere above the elastic limit the potential rises suddenly several hundredths of a volt. The magnitude of the increase depends on the rate of straining and ceases abruptly when the straining ceases.

4. Measurements on specimens under tortional stress give results similar to those obtained from tension tests.

5. Out of a considerable number of specimens strained to breaking, the potential of six reached a constant value shortly after fracture. The difference between the initial and final potentials varied from —0.00019 to +0.0077 volt, and the single potential of unstrained metal was found to be 0.156 volt.

Electrolysis of Pipes.

Electrolysis of pipes is receiving careful attention from the Metropolitan Water & Sewerage Board of Massachusetts, which states in its last annual report that the districts in which such damage occurs seem to be extending. In general, the injury has not proceeded so far as to require immediate repairs, but the examinations show that the corrosive action is advancing. The pipe lines crossing Chelsea Creek between Chelsea and East Boston were found to be particularly subject to disturbance, and at one point it was found that a hole had been eaten through a pipe. The examinations were made over the greater part of the system, records being made of the conditions for future use in caring for the mains. Efforts are being made to devise means of checking the action of the current, and as an experiment insulating joints have been inserted at several points in Cambridge.

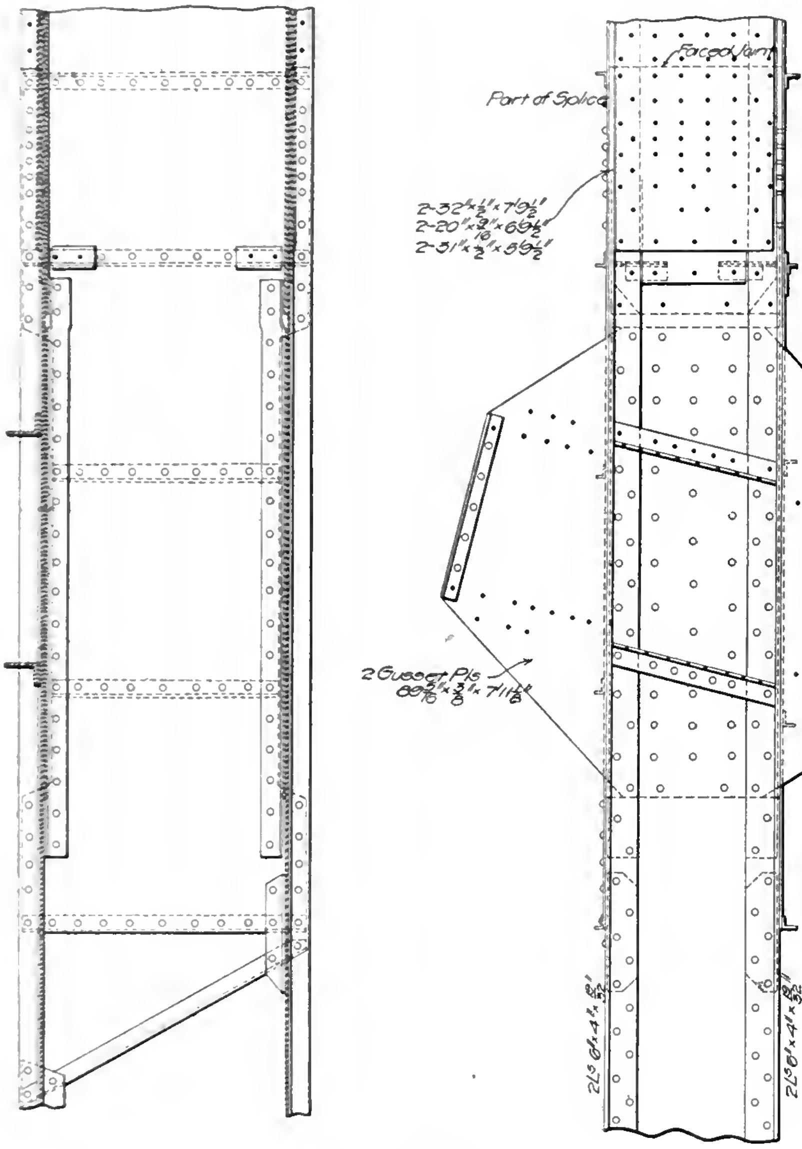
The Quebec Bridge Superstructure Details; Part VI.

Diagonal Members.—The main diagonal in the panel at the river end of the anchor span is a pin-connected strut 273 ft. long on centers and weighs 268,000 lbs. It has a 38½x48½-in. rectangular cross section and was shipped and erected in four pieces with field riveted web and flange cover plate splices. At the lower end it has a cross section of 158.4 sq. in. gross, or 144.15 in. net proportioned for a total maximum static stress of 1,312,000 lb. tension or 554,000 lb., compression and a wind stress of 1,990,000 lb. in either tension or compression. At the upper end the gross and net cross sections are respectively 226.9 and 208.9 sq. in. proportioned for maximum stresses, of 1,123,000 lb. static, and 2,350,000 lb. wind pressure in tension or 1,046,000 lb. static, and 2,350,000 lb. wind in compression.

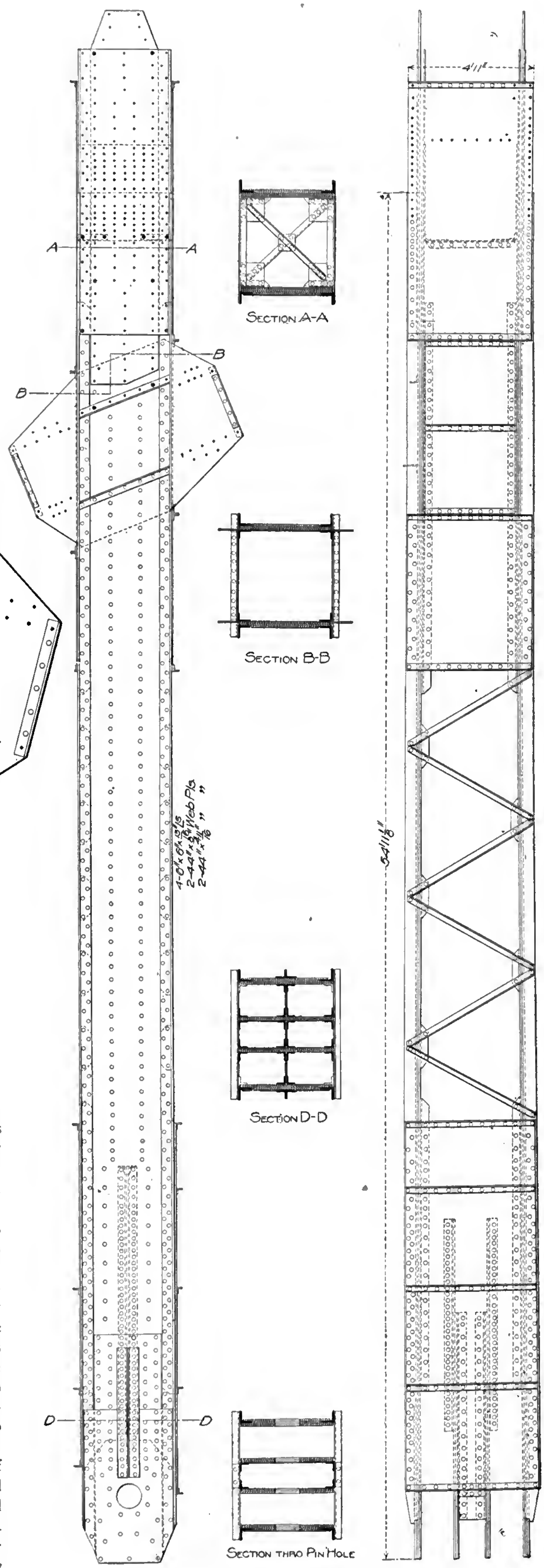
The lower section of the member is about 55 ft. long over all and weighs 66,000 lb. It is made with two built channels having their flanges turned outward and latticed with 3x3-in. angles each of which has one rivet at each end through the channel flange and a second rivet through an auxiliary connection angle riveted to the inside of the channel web. The channels are each made with one ¾-in. and one 11/16-in. plates 44 in. wide and two 6x6x13/16-in. flange angles at the lower end. Additional pin bearing is providing by two intermediate webs about 13½ ft. long riveted between a center transverse diaphragm about 8½ ft. long and two flange cover plates.

For about 19½ ft. at the upper end of this section of the strut the cross section is closed by flange cover plates ½-in. thick, riveted on in three lengths and stiffened with transverse angles. The center lengths of these cover plates are 43 in. wide and 7 ft. 2½ in long and do not engage the flanges of the post channels, but are riveted on each long end to connection angles riveted in their turn to the webs of the post channels, thus connecting the latter rigidly together and still allowing transverse jaw plates to be riveted across their inner faces and project beyond both flanges to receive the field driven connections of the horizontal strut which intersects the diagonal strut at this point. The splice between this section of the strut and the adjacent one is made with long multiple cover plates on the webs and single cover plates on the flanges which were shipped bolted in position with 10 shop rivets driven and finally connected with 1,100 steel field driven ⅞-in. rivets.

The next upper section of the strut is 87½ ft. long and weighs 80,000 lbs. with field riveted splices at both ends. Near the upper end a pair of 111x¾-in. wing plates 17 ft. 11 in. long are riveted to the backs of the channels and pro-



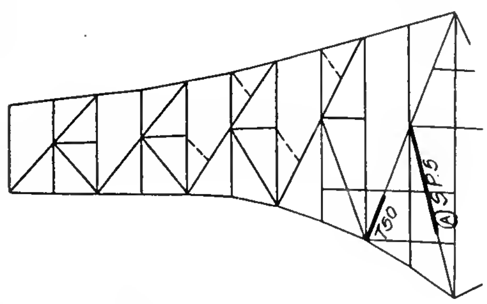
Part of Diagonal A S P_5.



Lower of Main Diagonal T_{50}.

ject 67 in. beyond the flange on one side to form jaws for the field riveted connection of a sub-vertical, sub-diagonal and horizontal strut intersecting the main member at this point. The sub-vertical is continuous and passes between the webs of the diagonal strut to which it is field riveted. The outer edges of the plates are stiffened and connected by a diaphragm 7 ft. 9½ in. long field riveted in position after the connection has been made to the vertical post. During shipment the wing plates were additionally secured by thorough bracing and wedging with sub-units. The webs and flanges are stiffened and set in accurate position so as to maintain the rectangular cross section by interior X-braced frames or diagonals made up with angles such as are used for similar purposes in the outer vertical and sub-vertical posts.

The sub-diagonal strut in the river-end panel of the anchor arm has a riveted connection at both ends and is 195 ft. long over all with a total weight of 63,000 lbs. It is proportioned with a cross sectional area of 59.52 sq. in. designed for a total maximum static and wind pressure of 1,201,000 lb. It is made in three sections spliced together with inside and outside field riveted web cover plates. It is made with two built channels having a 32x9/16-in. web and two 6x4x19/32-in. flange angles turned outward and latticed with 3x3-in. angle bars each having two rivets at each



Anchor Arm, Quebec Bridge.

end, one rivet being directly through connection plates interposed between the lattice bars and the channel flanges. A pair of 8½x⅜-in. x 8-ft. gusset plates are riveted to the backs of the channel webs at the intersection of this strut with a horizontal strut and project beyond both flanges to form jaws field riveted to the latter. Between these jaws the channel webs of each column are connected by transverse diaphragms in the planes of the flange angles cut to clear the latter and the jaw plates, and riveted to short connection angles on the inner faces of the jaw plates. At this point the flanges of the channels are connected by a pair of 54-⅜-in. batten plates about 10½ ft. long stiffened by transverse angles and cut to clear the projecting wing plates to which, however, they are connected by inside angles riveted through them to the webs of the main channel.

(To be Continued.)

A Ganz Steam Motor Car is being tested by the Erie R. R. The car is divided into a motor compartment, a baggage-room, smoking-room, and general passenger compartment.. It is 58 ft. long, weighs 45 tons and has seats for 50 passengers. The motive power consists of two compound inclosed steam motors of 60 h.-p. each, with cylinders 4.7 and 6.7 in. in diameter, and 5½ in. stroke. The steam generator is 42 in. in diameter and 5 ft. high, and produces superheated steam at 270 lb. pressure. Anthracite coal is used for fuel. The speed of the car is 40 miles per hour on level track. The car is being used in regular service out of the Jersey City terminal of the Erie. Cars of this general type have been used in Europe, and a western road sometime ago secured one for experimental purposes.

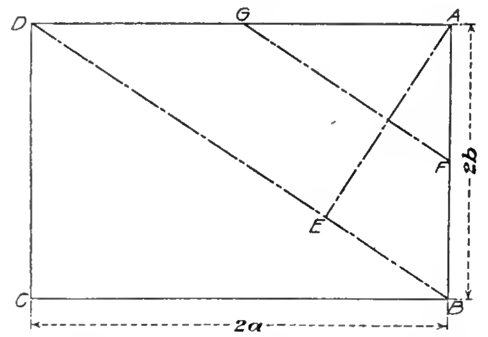
Notes on Reinforced Concrete Designing.

Accompanying the report of the Joint Committee on Reinforced Concrete, which was printed in this journal on July 27, were a number of appendices explaining the reasons for certain requirements suggested by the Committee. As these are of general interest in connection with the report, a number of them are reproduced below.

Bach's Slab Theory.—The first appendix was a discussion of Bach's theory of the resistance of flat slabs supported on all edges and uniformly loaded. It was written by Prof. A. C. Unwin and reads as follows:

The experiments of Professor Bach show that a flat square slab supported all round fractures along a diagonal, and the greatest stress is therefore on the diagonal section. It is the same apparently with rectangular slabs, though the evidence is not quite so clear. But if a diagonal fracture is assumed a very simple theory gives the stress.

Let the figure represent a rectangular slab with sides $2a$ and $2b$ in inches. Let the diagonal $B\ D = d$; the thickness of the slab $= h$; the perpendicular on the diagonal $A\ E = c$; draw $F\ G$ bisecting the sides and let p be the load per square inch. Consider the left-hand half of the rectangle. The total load on it is $2pab$ acting



at the centre of gravity of $A\ B\ D$ or at $c/3$ from the diagonal. Whatever the distribution of the reactions of the supports, from symmetry, the reaction on $A\ B$ must act at the centre F of $A\ B$ and the reaction on $A\ D$ must act at the centre G of $A\ D$. Hence the resultant of the reactions on $A\ B$, $A\ D = 2pab$ must act at some point on the line $F\ G$ or at a distance $c/2$ from the diagonal. Hence the bending moment on the diagonal section is

$$M = 2pab\left(\frac{c}{2} - \frac{c}{3}\right) = \frac{pabc}{3},$$

the stress at the diagonal section is

$$f = \frac{6M}{dh^2} = 2p\frac{abc}{dh^2}.$$

But $cd = 4ab$,

$$d^2 = 4a^2 + 4b^2,$$

$$f = 2p\frac{a^2}{a^2+b^2}\frac{b^2}{h^2}.$$

The following form of the equation is convenient:

$$f = \tfrac{1}{2}\frac{\left(\frac{a}{b}\right)^2}{\left\{1+\left(\frac{a}{b}\right)^2\right\}\frac{a}{b}}\frac{W}{h^2}.$$

Where W is the total load on the slab:

a/b	1	1.5	2
f	$0.25\ W/h^2$	$0.23\ W/h^2$	$0.2W/h^2$

It would seem that if Bach's formula is to be used in calculating slabs, the reinforcing rods should be perpendicular to the diagonals of the rectangle.

Comparison of Slab Formulas.—The second appendix gives a comparison of the results obtained from the use of various rules for the strength of flat rectangular slabs supported on all edges and uniformly loaded. It was written by Mr. William Dunn and reads as follows:

The theories of Professor Grashof and of Professor Rankine assume that the maximum bending stress on the slab is at the centre, where there are two principal stresses on planes normal to each other, these planes coinciding with the major and minor axes of the slab.

The stress on the plane formed by the major axis of the slab (which is the greater of the two principal stresses) may be found in a simple manner as follows:

Let the length of the slab $= a$, and the breadth $= b$ (where a is equal to or greater than b).

Calculate the bending moment on the slab (disregarding the end supports) as a beam supported or fixed at the sides only, of a span b under the total load on the slab. Multiply this bending moment by the factor s in the following table,

When $\frac{a}{b} =$	Grashof's and Rankine's Rule. $s = \frac{a^4}{a^4+b^4}$	Grashof's and Rankine's Rule. $r = \frac{b^4}{a^4+b^4}$	French Government Rule. $s = \frac{1}{1+2\,b^4/a^4}$	French Government Rule. $r = \frac{1}{1+2\,a^4/b^4}$
1.0	0.50	0.50	0.33	0.33
1.5	0.83	0.16	0.71	0.09
2.0	0.94	0.05	0.89	0.03

to allow for the effect of the end supports. The result is the actual bending moment on the long axis of the slab.

The stress on the section formed by the long axis of the slab is found in the usual way by equating this actual bending moment to the moment of resistance of that section.

Similarly the stress on the plane formed by the minor axis of the slab is found by assuming the slab supported or fixed at the ends (disregarding the effect of the side supports), calculating the bending moment as if the slab were a beam of span a under the total load on the slab. Reduce the bending moment so found by the factor r in the table above, and the result is the actual bending moment on the short axis of the slab.

The stress on the section formed by that axis is found as before by equating this moment to the moment of resistance of that section.

The reasoning by which we find the factors s and r is not entirely satisfactory, and other writers give other values. In the Instructions issued by the French Government to the bridge and highway engineers, with the report of the Ministerial Commission on Reinforced Concrete, the factors adopted give a greater importance to the effects of the third and fourth supports. The values of s and r, according to that report, are also given in the table above.

The maximum stresses on the sections as found by the foregoing rules when the slab is supported but not fixed all round are given in the table below, W being the total load uniformly distributed over the slab, h its thickness, and f the minimum stress due to bending.

When $\frac{a}{b} =$	Values of f according to Grashof and Rankine. On L'g Axis.	Values of f according to Grashof and Rankine. On Sh't Axis.	Values of f according to French Government Rule. On L'g Axis	Values of f according to French Government Rule. On Sh't Axis.
1.0	$0.375\ W/h^2$	$0.375\ W/h^2$	$0.250\ W/h^2$	$0.250\ W/h^2$
1.5	$0.416\ W/h^2$	$0.183\ W/h^2$	$0.361\ W/h^2$	$0.101\ W/h^2$
2.0	$0.352\ W/h^2$	$0.088\ W/h^2$	$0.333\ W/h^2$	$0.045\ W/h^2$

These results may be more readily compared by the diagram.

It is implicitly assumed in the foregoing that the strength to resist bending is the same in both directions, so that the reinforcements longitudinal and transverse should be of equal area and at the same depth from the compressed face; they should

be placed parallel to both the ends and sides.

The stresses found by Bach's formula are also plotted on the diagram.

Moments of Inertia.—Prof. Unwin contributed the third appendix, on the moment of inertia of

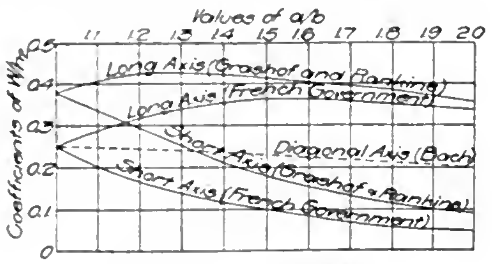


Diagram of Stresses.

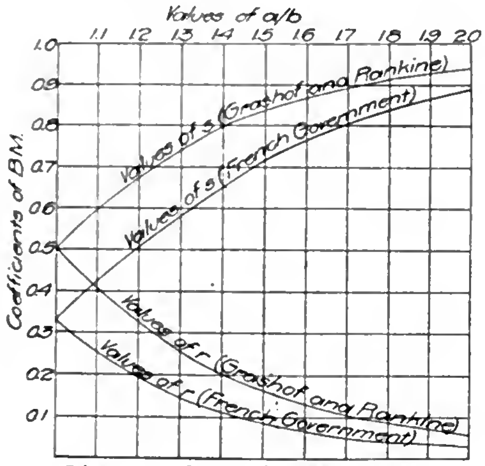


Diagram of Bending Moments.

reinforced concrete, which reads as follows:

If m is the ratio E_s/E_c of the coefficients of elasticity of steel and concrete, then an area A_t of steel is equivalent to resistance to mA_t of concrete. If A_c is the area of a section (including the area of reinforcing bars), and a the area of the reinforcing bars, then the section is equivalent to a section of area $A = A_c + (m - 1)a$ of concrete only. This will be called the equivalent section.

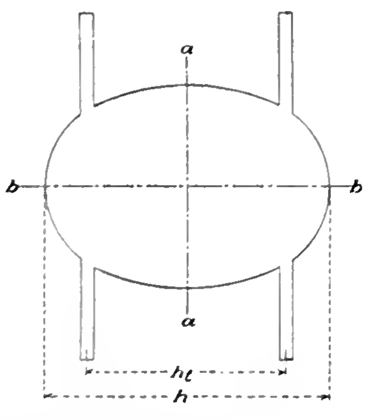
The moment of inertia of a section about its neutral axis can always be put in the form

$$I = nAh^2,$$

where h is the depth at right angles to the neu-axis and n is a constant depending on the form of the section. Thus for a rectangular section $I = {}^1/_{12}\ Ah^2$, and for a circular section $I = {}^1/_{16}\ Ah^2$.

In dealing with reinforced sections, it is convenient in many cases to express the moment of inertia in terms of the equivalent area. The equivalent area is found by adding to the actual area of the section portions of a total area $(m - 1)a$ at the same distance from the neutral axis as the reinforcing bars.

The figure shows a section for which $b\ b$ is the plane of bending, and $a\ a$ the neutral axis pass-



ing through the centre of gravity of the section. The reinforcing bars are supposed symmetrical to the neutral axis. The projecting parts of total area $(m - 1)a$ are the concrete areas equivalent to the steel. If I_c is the moment of inertia of the section without reinforcing bars, the moment of inertia with reinforcing bars is

$$I = I_c + {}^1\!/_4\ (m - 1)ah_t^2.$$

Thus for a rectangular section

$$I = {}^1/_{12}A_ch^2 + {}^1\!/_4\ (m - 1)ah_t^2,$$

and the modulus of the section is

$$Z = {}^1\!/_6A_ch + {}^1\!/_2(m - 1)a\frac{h_t^2}{h}.$$

For a circular section

$$I = {}^1/_{16}A_ch^2 + {}^1\!/_4\ (m - 1)ah_t^2,$$

and the section modulus is

$$Z = {}^1\!/_8A_ch + {}^1\!/_2(m - 1)a\frac{h_t^2}{h}.$$

Example 1, Rectangular Section.—Let $m = 15$, $a = 0.01A_c$, and $h_t = 0.9h$. The equivalent area is $A = A_c + (m - 1)a = A_c + 14a = 1.14A_c$.

$$I = {}^1/_{12}\ A_ch^2 + \frac{14 \times 0.81}{4 \times 100}\ A_ch^2$$
$$= 0.1117A_ch^2$$
$$\text{But } A_c = 0.877A$$
$$I = 0.098Ah^2$$
$$Z = 0.196Ah.$$

In this case in the general expression $I = nAh^2$, $n = 0.098$ when A is the equivalent section.

Example 2, Circular Section.—Let $m = 15$, $a = 0.01A_c$, and $h_t = 0.8h$. The area of the equivalent section is $1.14A_c$, as before.

$$I = {}^1/_{16}A_ch^2 + {}^1\!/_4 \times 14 \times .01A_c \times .64h^2$$
$$= 0.0849\ A_ch^2.$$

$$\text{But } A_c = 0.877A.$$
$$I = 0.0745Ah^2.$$
$$Z = 0.149Ah.$$

Example 3, Circular Section with Reinforcing Bars arranged in a Circle.—The reinforcing bars are nearly equivalent to a ring of steel of the same total area. Let $m = 15$, $a = 0.01A_c$, and let the diameter of the circle of reinforcing bars be $h_t = 0.8h$. The equivalent section is $A = 1.14A_c$, as before.

$$I = {}^1/_{16}\ A_ch^2 + \frac{m - 1}{8}\ ah^2t.$$
$$= 0.0625\ A_ch^2 + 1.75 \times .01A \times .64h^2$$
$$= 0.0737A_ch^2$$
$$= 0.0646Ah^2$$
$$Z = 0.1292Ah.$$

It will be seen that if the value of n in the equation $I = nAh^2$ for simple circular and rectangular sections, and the reinforced sections are compared, the results are as follows:

	Simple Sections.	Reinforced Sections.
Case I	$^1/_{12} = 0.0833$	0.098
Case II	$^1/_{16} = 0.0625$	0.0745
Case III	$^1/_{16} = 0.0625$	0.0646

The differences are not very great, so that while the value of n can always be found exactly when necessary for any proportion of reinforcement, there are cases such as that of columns where the value of n does not much affect the result, and where, from the nature of the calculation, great accuracy is impossible—for which a value of n can be assumed without any practically important error.

Ratio of Moduli of Elasticity.—The fourth appendix, on the ratio of the moduli of elasticity of steel and concrete, was written by Mr. Dunn, and reads as follows:

In the foregoing recommendations, as in the Prussian Government and various other foreign rules, the value of E_s/E_c for concrete of the kind usually employed, of hard stone or gravel mixed 1:2:4, is put at 15.

In reality, it varies with the age of the concrete, the proportions and nature of the materials, the stress at which it is taken, etc. As determined from tests of full-sized columns of concrete, with longitudinal reinforcement only and without transverse binding, it varied from a maximum of 10 at working loads to 15 to 21 at ultimate loads. For cinder concrete of 1:2:4 or 1:3:6 it varied from about 12 at working loads to 26 to 48 at ultimate loads.

This factor E_s/E_c is employed to determined the position of the neutral axis in beams, and it is found that while a variation between 10 and 15 makes no very great difference in the result, a value of 15 fixes the position of that axis nearest to the position found by experiment in singly reinforced beams. In fact, the formula given herein for the position of the neutral axis with $E_s/E_c = 15$ gives a result which agrees well with observed values in beam tests.

As mentioned above, it does not agree so well with the tests on columns: it gives too great an importance to the metal reinforcements, which becomes more noticeable when the percentage of reinforcement is considerable. But these tests were made on columns with longitudinal reinforcement only and without transverse binding, which latter adds greatly to the strength. This binding is explicitly required in the Prussian Government and other proposals where E_s/E_c is taken at 15; and that figure may be taken as making allowance in some degree for it.

We have no satisfactory determination of the increase in strength due to the transverse reinforcement, whether in single bindings or a continuous spiral.

In the Report of the French Commission on Reinforced Concrete, it is stated that where the concrete has spiral binding or transverse or oblique reinforcements, so disposed as to resist swelling under thrust, the safe loads may be increased in some measure, but not in any case to more than $^6/_{10}$ of the crushing strength as determined from tests on cubes of 20 cm. sides at the age of 90 days.

In the explanatory circular accompanying that report the value to be given to E_s/E_c is discussed, and its theoretic value is put at about 10. It is stated, however, that it is preferable to regard that coefficient as the result of experiences on pieces with longitudinal and transverse reinforcements, and not as representing the ratios found from concrete and metal separately. It is to be taken as varying from 8 when the longitudinal reinforcements have a diameter equal to one-tenth of the least dimension of the piece and the bindings are spaced at a distance equal to that least dimension in the direction of the length; up to 15 when the longitudinal bars are one-twentieth of the least dimension and the bindings are spaced one-third of that distance apart. In both cases the bindings are to be near the outer face of the concrete.

Again, it is stated in the circular that it is desirable to encourage the proper use of the metal in both longitudinal and transverse directions. While an exact determination of the increase of strength due to the transverse reinforcement would be difficult, the investigations of the Commission enable it to be admitted, in default of something better, that it is found by multiplying the resistance to crushing of the concrete by a coefficient.

$$1 + m^1V^1/V,$$

V^1 being the volume of the transverse or oblique reinforcement, and V the volume of the concrete, m^1 being a variable coefficient depending on the efficiency of the union between the longitudinal bars. When the union is made by bindings in the usual way, m^1 varies from 8 when these bindings are spaced at a distance equal to the least transverse dimension of the piece to 15 when spaced at one-third that dimension.

When spiral binding is used m^1 varies from 15 to 32, the lower value being taken when the pitch of the spiral is two-fifths of the least transverse dimension, and the higher when the spacing is one-fifth of the dimension under a pressure of 50 kilos per square centimeter, or one-eighth of the dimension under a pressure of 100 kilos per square centimeter.

In no case should the working stress exceed six-tenths of the resistance to crushing as determined on cubes, as before mentioned.

Filtration Experiments at Washington.

The water purification experiments conducted under the direction of Major Spencer Cosby, Corps of Engineers, at Washington, were described at some length in this journal on May 25. They were made with three systems of treatment: A, a rapid sand filter and a slow sand filter; B, a Maignen scrubber and a slow sand filter; C, a settling and coagulating basin and a slow sand filter. In a report recently submitted to the Chief of Engineers by Major Cosby, it is stated that no combination of filters has been found which satisfactorily clarified the Potomac water. "While the preliminary filters remove the greater part of the suspended matter," he says, "and leave comparatively very little work for the slow sand filters to do, the grains of mud remaining in the water after the first filtration are so exceedingly small that they are not entirely removed by either a second or third filtration. In order to arrest these fine grains a layer of very finely powdered animal charcoal was applied to the surface of the slow sand filter of system B, but without any apparent success. The results from system C (the modified slow sand system) show, however, that it has so far been successful in keeping the water free at all times of turbidity by the occasional use of a coagulant and subsequent filtration. The experience thus far gained with this system indicates that it will be found to be the most practical method of clarifying the Potomac water at a reasonable cost, and at the same time utilizing the plant already installed. The bulk of the mud is not only removed by coagulation, but the small amount which remains is so changed in character that it can readily be removed by filtration. It also tends to form a sticky gelatinous mass on the top of the filter sand which assists in arresting particles of mud in the applied water for several days after the use of the coagulant has ceased." The experiments were undertaken in order to find the best means of removing the turbidity which sometimes occurs in times of flood.

The Construction of the Dam of the Nevada-California Power Co.

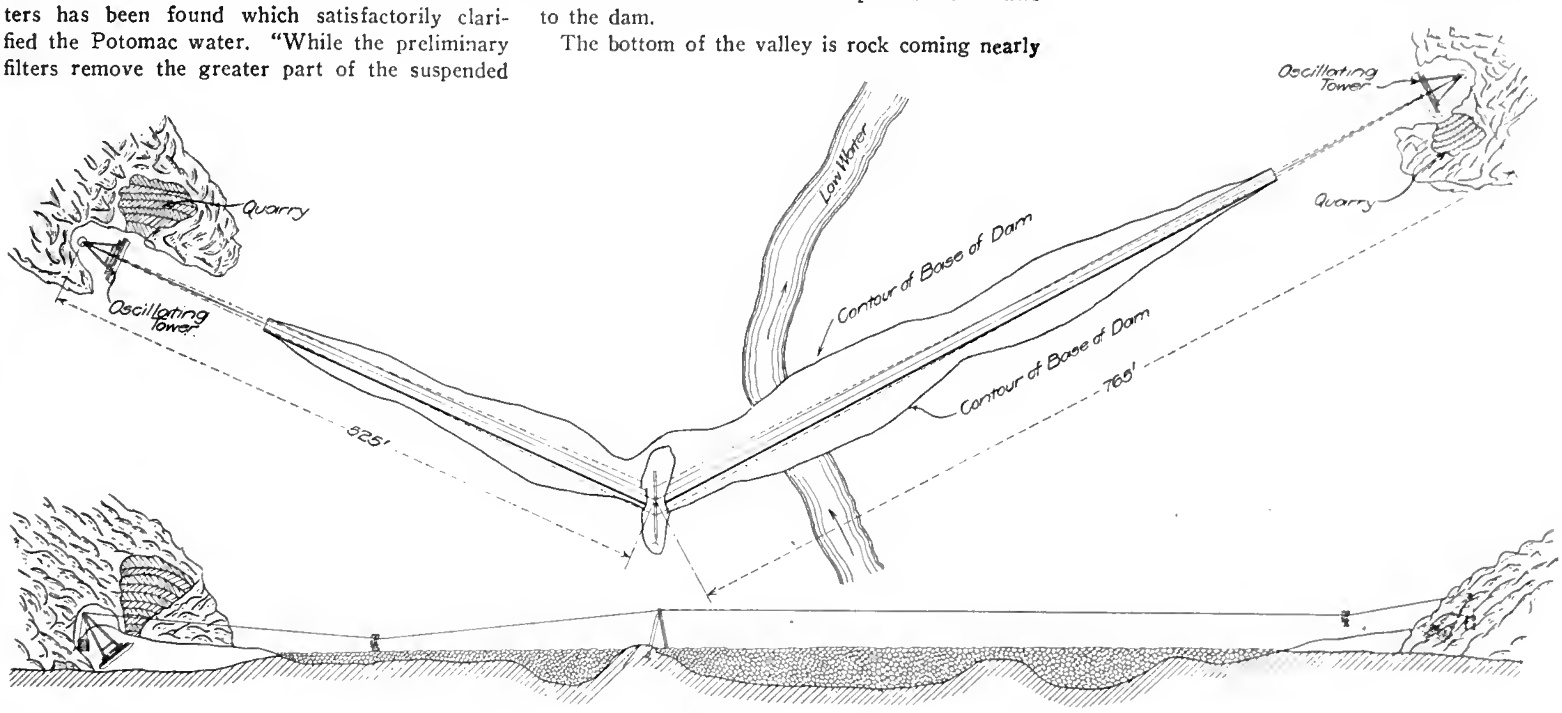
A dam about 1,300 ft. long and 75 ft. high is now under construction by the Nevada-California Power Co., across a narrow valley at a high altitude in the Sierra Nevada Mountains to impound water for supply and power development purposes. It was at first intended to build the dam of stone masonry laid in cement mortar or of concrete, and derricks and other appliances were shipped to Laws, Cal., on a narrow-gauge railway at a cost of 6 cents per pound freight from New York. From this point to the dam site, a distance of about 18 miles, it is necessary to haul all materials by wagon over a very steep, rough road at a cost of $80 per ton. This made the transportation of appliances and materials so costly that the design and method of construction had to be radically changed, and it is now proposed to build the dam entirely of loose rock puddled on the upper side, quarrying it at the site, and handle it by a cable crane system so light that its installation will require the minimum amount of materials to be transported from Laws to the dam.

The bottom of the valley is rock coming nearly or quite to the surface of the ground and rising near the middle of a valley in a ridge extending a little above the crest of the dam and forming a center abutment where the two straight portions of the dam intersect in an angle of about 140 deg. pointing up-stream as indicated in the general plan. On one side of the ridge the dam is about 350 ft. long, 55 ft. wide at the base and 30 ft. high. On the other side it is about 570 ft. long, 75 ft. wide at the base and 35 ft. in maximum height. The crest of the dam has a uniform width of 10 ft.

The axes of the dam produced one or two hundred ft. beyond each end, intersect the faces of steep cliffs of solid rock rising many hundred feet above the crest of the dam. In these cliffs natural recesses occur at the right places to enable them to be utilized for the location of the end towers for the cable crane in positions thoroughly protected from operations in the quarries which will be commenced on the face of the cliff between the recesses and the ends of the dam. In these quarries, carried up to any convenient height above the cable crane, the rock will fall by gravity as blasted to the foot of the cable crane and can be delivered and deposited by it in the required position in the dam, thus obviating the use of all derricks or tracks and reducing the handling of material.

The two-span, cable crane system has been designed and built by the Balanced Cable Crane Co., New York, Mr. W. F. Brothers, president. The plant installed has a single Victor cable 2 in. in diameter with a capacity for a 5-ton load and a breaking strength of 200 tons. It is 1,290 ft. long, and is attached at both ends to oscillating traveling shears which gives it sufficient transverse movement to enable it to command the full width of the dam. It is divided into spans of 525 anad 765 ft. by a telescopic pivoted strut set on the rock at the intersection of the two sides of the dam. The strut bisects the angle between the axes of the dam and is inclined from the vertical toward the stress in the cable and is secured by a tackle anchored to the solid rock. Each tower is inclined away from the center of the dam so as to exert a constant tension on the cable, and has suspended from its apex a 40-ton counterweight exerting a constant tension on the cable and capable of sufficient vertical motion to allow the top of the tower to revolve through an arc sufficient to permit the adjustment of the angle to the position of the load and maintain a constant tension in the cable. These conditions being similar on both sides of the center support the whole system remains in equilibrium while both spans act independently. Both towers are seated on single-track rails perpendicular to the axis of the cable, and when it is necessary to move either one the other can be adjusted until the counterweight is seated with bearing on the solid ground. In the 526-ft. span the deflection due to weight of cable and to maximum load are respectively 2.41 and 23.26 ft. In the 765-ft. span the corresponding deflection was 6.19 and 39.54 ft., the maximum cable tension in both spans being 42 tons.

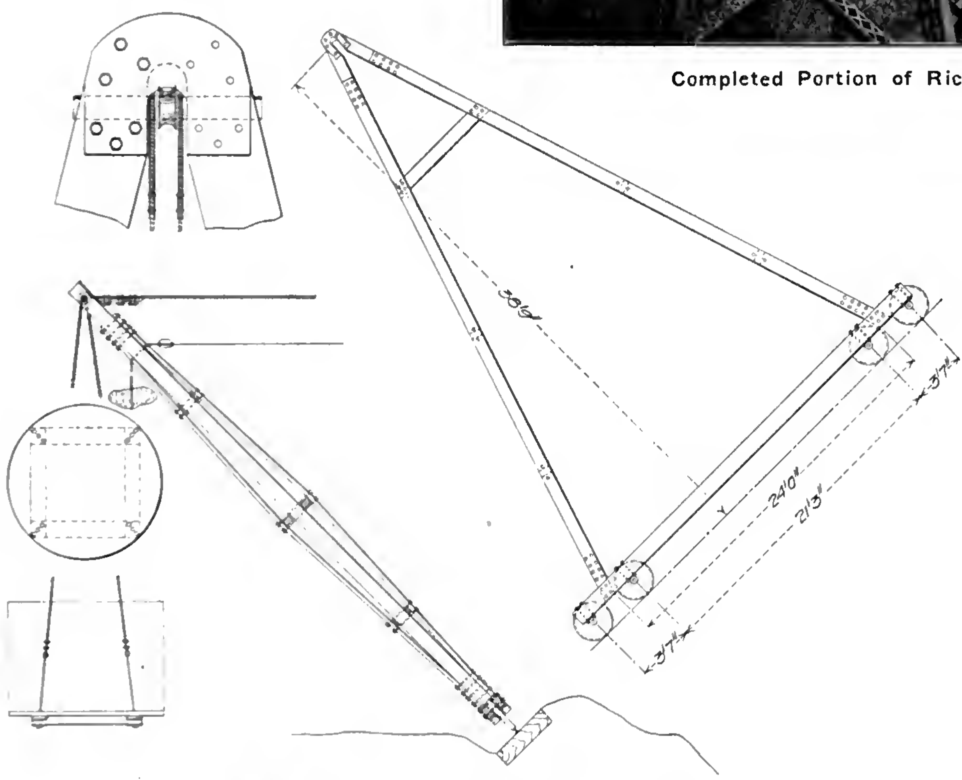
Each of the duplicate towers consists of a triangular wooden frame about 39 ft. high and 31 ft. wide over all, made with single 10x10-in. legs trussed with 10x3-in. planks and with a single 6x12-in. sill. There are four 24-in. wheels with their single flanges set alternately on opposite sides of the rail. The tops of the posts are bolted together through a pair of ⅜-in. plates and have a horizontal transverse pin receiving the clamped loop-eye of the main cable and the bights of two suspender ropes for the counterweight platform. The platform, 10 ft. in diameter, is made of 3-in. planks and is loaded with 40 tons of rubble masonry or concrete. Below it a cushion 2 or 3 ft. deep of soft earth is provided where it can be lowered down to bearing in case it is necessary to temporarily seat it



Two Span Continuous Cable Crane, Nevada-California Dam.

on the ground. The single 80-lb. rails are spiked to short ties perpendicular to the main inclination of the tower.

The hoist carriage is suspended from two deeply grooved wheels with teeth cut in their flanges which mesh with a pinion on a horizontal axle, which, at its outer end, is propelled, released or gripped by the action of a single lever controlling it through friction clutches which directly engage the motor. The pinion can be reversed to propel the carriage in either direction and it is traversed, held stationary or allowed to coast by different positions of the same lever. Each of the two hoist ropes is double with its bight wound on a separate drum and the loose ends provided with clevises for attachment to the bucket or skip. Each drum is supported on four sets of ball-bearings with steel racers about 15 in. in diameter and 5/8-in. hardened steel balls. The hoisting apparatus is controlled by a single lever and clutches much like those for traversing the carriage, and it is so arranged that either drum can be disengaged and run, stopped or overhauled independently of the other, thus enabling the operator to revolve a skip about its horizontal axis to dump it or to operate a clam-shell bucket. The motor shaft is vertically midway between the belt-driven traversing and hoisting pulleys, which run constantly. The 40 h.-p. motor can be run in either direction and normally drive both hoisting and traversing shafts, but can be disengaged instantly from either in order to concentrate all the power on the other if required. The hoisting apparatus is rated at 40 h.-p. and can develop a maximum of 60 h.-p. The speed of operation is 80 ft. per minute for hoisting a 5-ton load and 1,500 ft. per minute for traversing. There is a



Oscillating Tower, Nevada-California Dam.

duplicate carriage on each cable and each carriage has a suspended enclosed cab for the operator who is in entire control of hoisting, traversing and dumping. A 50 h.-p. General Electric dynamo, driven by a 75 h.-p. engine, furnishes the current which is transmitted through a trolley wire attached to both towers and provided at each end with an adjustable counterweight.

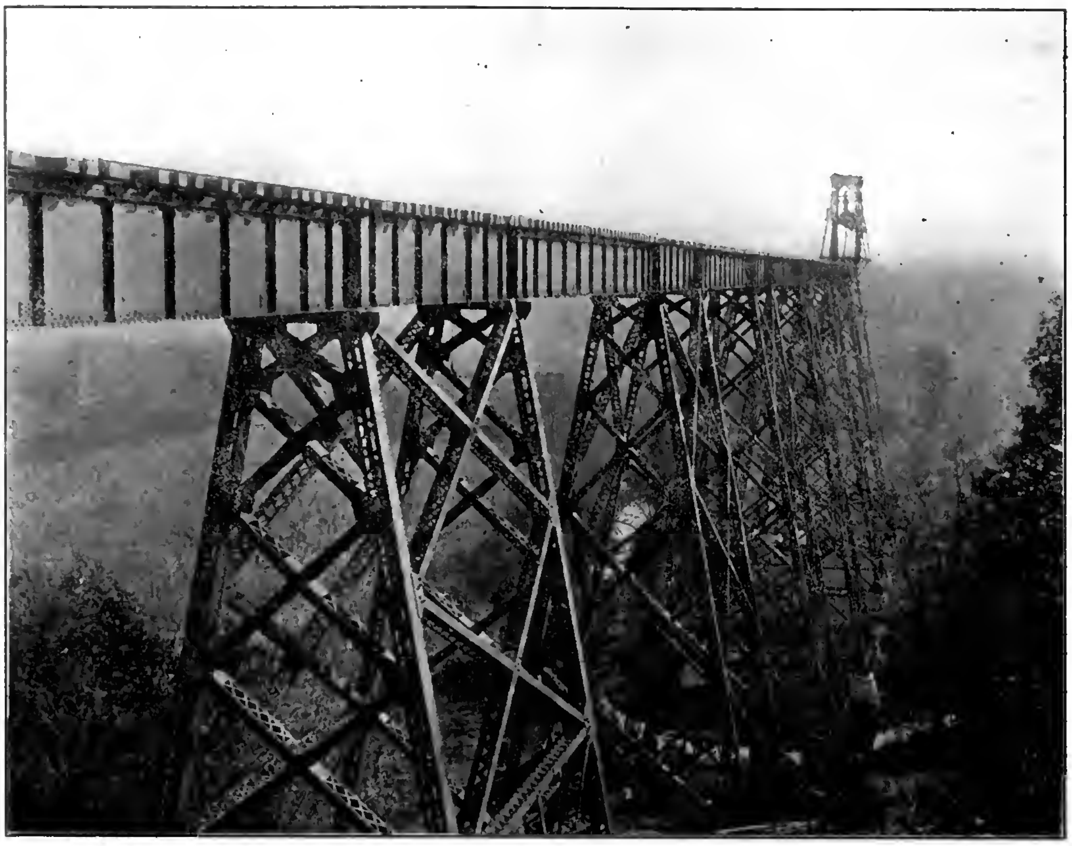
The surface of the rock is being stripped and a concrete foundation prepared for the sluice pipe intended to provide for the dry weather flow through the dam while the latter is under construction. It is expected that the quarry blasts will deliver the broken rocks so close to the cable crane at both ends of the dam that a large proportion of it can be chained in massive pieces and delivered to the required position at an average cost of about 25 cents per yard. This is on the assumption that 1,000 cu. yds. per day can be handled by a small force of laborers at 50 cents each per hour.

Messrs. Manifold & Poole, Los Angeles, Cal., are the engineers of the power plant.

The Specific Heat of Superheated Steam has been under investigation for some six years by Mr. A. R. Dodge, and at the recent meeting of the American Society of Mechanical Engineers he presented a paper describing his methods and summarizing his conclusions. He believes that at constant pressure the specific heat is constant for all ranges of temperature investigated, although it increases with increasing pressure according to the equation $c = 0.4754 + 0.00031\ p$.

Richland Creek Viaduct, Indianapolis Southern Railway.

A single-track viaduct of the Indianapolis Southern Ry. crosses Richland Creek, 7 miles from Bloomfield, Ind., with a steel superstructure 132 ft. in maximum height and 2,215 ft. in length. It has alternate 40 and 75-ft. plate girder spans,



Completed Portion of Richland Creek Viaduct and Traveler.

supported on eighteen 40-ft. towers, besides two 50-ft. spans at one end and two 60-ft. spans at the other end supported on single rocker bents next to the abutment. The girders have a uniform depth of 7 ft. and are spaced 8 ft. apart transversely and connected by the usual vertical transverse sway-brace frames and by zig-zag lateral angles in the planes of the top and bottom flanges.

Each tower is made with two vertical bents 40 ft. apart longitudinally, each vertical bent being composed of two columns battered 2¼ :20 with open rectangular cross-sections made with two built channels composed of pairs of 4x4-in. angles and 21-in. web plates latticed on flanges. The thicknesses of the angles and plates are the same in each column section and vary from 3/8 to 5/8 in.

The longitudinal faces of the columns are divided into two, three or four panels and the transverse faces into four, five or six panels, according to height, and both longitudinal and transverse panels are X-braced with struts, all of which are made with pairs of 10-in., 20-lb. channels latticed, with double 2½x3/8-in. bars. There are no horizontal struts except at the top and bottom of the transverse faces of the columns and where, both bent of the tower being of the same height, the longitudinal struts connecting the feet of the post in both bents happen to be horizontal. All bottom longitudinal and transverse struts are supported at their center point by suspenders made with four angles reaching to the intersection of the diagonals in the panel above.

The feet of opposite diagonal columns in each tower have expansion bearings with a 3/8-in. phosphor bronze plate sliding on a 7/8-in. steel masonry plate. The other columns have fixed bearings on 1¼-in. steel masonry plates. There

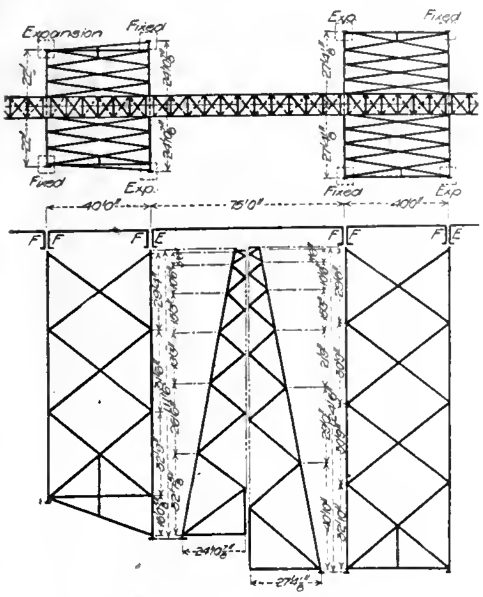
are no transverse girders and the tops of the columns have horizontal cap plates directly receiving the ends of the longitudinal girders with expansion bearings at one end of each 75-ft. span. Cross ties are laid on the top flanges of the longitudinal girders to receive a track on a tangent and at 5 per cent. grade.

The structure was designed for Cooper's E-50 live load and unit stresses of 15,000 lb. and 19,000 lb. were allowed in tension reduced by the impact formula, $I = LL \times \frac{LL}{DL + LL}$.

The maximum unit stresses in compression were

$$\frac{15000}{1 + \frac{l^2}{13500r^2}} \text{ and } \frac{19000}{1 + \frac{l^2}{13500r^2}}$$

and a maximum of 9,000 lb. per square inch was allowed for shear. Unit values for shop-driven rivets were 11,000 lb. shear and 22,000 lb. bearing, and for field-driven rivets 8,800 lb. shear and 17,600-lb. bearing.



Towers and Connecting Span.

The superstructure contains 2,017 tons of steel fabricated at he Detroit plant of the American Bridge Co., of New York and erected, as described in The Engineering Record of February 23, 1907, by the Strobel Steel Construction Co., of Chicago. The design and construction was under the direction of Mr. R. E. Gaut, enginer of bridges of the Illinois Central R. R. Co.

A New Use of Tar.

A new use of tar is reported from East Palestine, Ohio, where a mason erecting a number of brick houses ran short of black mortar color and was unable to get a new supply in the time at his disposal. Accordingly he tried a little partially refined tar, and had no difficulty in getting the right color for the mortar for pointing and beading between the bricks. Fearing defects from this material, the mason watched the houses very carefully, and recently reported that after a lapse of several years he found the color as strong as ever.

Water-Power Developments are being investigated in the southern part of Sweden for furnishing power to operate the State Railways in that part of the country. Estimates have been made which show that five waterfalls which can be developed for about $16,000,000, will furnish sufficient power.

Special Methods of Shaft-Sinking.

A paper read before the Engineering Conference of the Institution of Civil Engineers by Henry Louis.

Under the head of special methods of shaft-sinking, I propose to consider the methods that have to be resorted to when ordinary methods cannot be applied economically on account of an excessive influx of water. Such complications are mostly confined to coal-mining, and arise but rarely in metalliferous-mining, mineral deposits usually lying in the older, less heavily-watered rocks. Year by year, as the coal-seams available within the area of the exposed coal-fields are more extensively drawn upon, it becomes increasingly necessary to sink down to the so-called concealed coal measures, overlain by more recent formations, many of which carry vast quantities of water.

It is a question what quantity of water may be regarded as necessarily involving the use of special methods. The largest amount that I know to have been sunk through successfully was at Horden Colliery, where 9,250 imp. gal. of water per minute at a depth of 540 ft. were dealt with. But in many cases far less than this amount has proved an insuperable obstacle to sinking in an ordinary way. It is possible that in the future ordinary methods of sinking may be found applicable in cases in which they have heretofore been considered impracticable, by the use of suspended tubbings, as introduced by Messrs. Haniel and Lueg of Dusseldorf, a system which has never been tried in this country, although it has been used with much success in several deep sinkings on the Continent.

The special methods to be used will differ, according as the water-bearing strata to be traversed are firm or running ground. In the former case the Kind-Chaudron method is mostly resorted to. This system was first employed about the year 1854, since when about eighty shafts have been sunk by it, of which five have been in this country. A pair of shafts were put down by it in 1876 at the Cannock and Huntington Colliery in Staffordshire, but the operation failed through the breaking away of the ground at the moss-box in each shaft. Sinkings by this method were also commenced, almost simultaneously, in 1877 at the Whitburn Collieries, and were completely successful. Finally, the shaft of the Consolidated Kent Collieries Corporation, Limited, was sunk by this method at Dover in 1904-5. A depth of 1,095 ft. had been reached by ordinary methods of sinking, and there still remained some 90 ft. of Oolitic and Liassic rocks to sink through in order to reach the coal-measures. This was done by the Kind-Chaudron method, and a column of tubbing 1,120 ft. high was put in. The modern continental practice in such cases is not to put in a column of tubbing the full depth of the shaft, but to lower a length of tubbing corresponding only with the depth bored out, and fitted with a false cover as well as a false bottom, the economy being obvious.

Mr. Riemer, one of the leading German authorities on sinking, considers that it will not be possible to execute sinkings by the ordinary Kind-Chaudron method at depths exceeding 2,000 ft. because it would be impracticable to handle cylinders thick enough to withstand the pressure corresponding to that depth, the limit of thickness according to him being about 5 in. Various proposals for modifying the method, so as to render it available at these great depths, have been put forward by Mr. Riemer and Mr. Tomson, but have not yet been put into practice.

When the ground to be sunk through is running as well as water-bearing, the Kind-Chaudron method is no longer applicable. In such cases three groups of methods are recognized, namely (1) driving down annular sheet-piling, (2) forcing down continuous cylinders of brickwork or iron, and (3) the Poetsch freezing process. Annular piling is the oldest method, and is only applicable when the stratum of soft ground to be passed through is not very thick, and is comparatively near the surface. As the piling is usually in lengths of 15 ft. to 20 ft., and as each new ring of piles has to be driven inside the one above, it follows that the original diameter must be taken very much greater than the finished diameter of the shaft. The method is not often seen now, but a good modern example may be quoted, namely, the recent sinking (September, 1906) at Bowburn Colliery, Co. Durham.

It may be here suggested that ferro-concrete sheet-piling might be used. Piles of this material, 60 ft. in length, have been driven, and it has also been found practicable to add fresh lengths to the top of piles already driven, and thus to get down to almost any desired depth. Furthermore, the adjacent sides of ferro-concrete piles can be grooved, and when the piles are down, cement can be run into the spaces thus left, making the piling practically water-tight. As far as I know, this system has never been tried for shaft-sinking, but there appears to be no reason why it should not be perfectly successful.

The method of sinking continuous cylinders, and excavating the ground from inside them, has only been used in this country for moderate depths. There have been several good examples of shallow sinkings by it in Scotland, where sand, mud and silt on the seashore have been sunk through for depths of about 100 ft., the sinkings at Musselburgh (1901-2), and at Bridgeness (1878), being cases in point. In a more recent sinking of a pair of shafts at Ardeer (1905), about 80 ft. of silt had to be traversed, and a similar process was adopted, using, however, the somewhat antiquated device of the air-lock (first used by Triger in 1839) for the actual excavation, the men working in compressed air at the bottom of the cylinder. Modern practice seems generally to favor the use of some form of dredge for excavating the material from the inside of the cylinder.

This principle has reached its greatest development in Germany, where it has been extensively used for sinking down to firm ground through the overlying thick masses of superficial deposits. The modern practice consists in sinking a cylinder, usually of masonry, built upon a massive iron cutting shoe, until skin-friction prevents its further descent. Tie-bolts, attached to the cutting shoe, are built into the brickwork, and by means of these a heavy iron anchor-ring is secured to the upper part of the shaft. A cylinder of iron is then built up beside the first cylinder, and is forced down by powerful hydraulic presses, which work against the anchor-ring. The ground inside the cylinder is excavated by some form of dredge, grab-dredges, bucket-dredges, bag-dredges, and the air lift all having been made use of.

The freezing method was devised by F. H. Poetsch in the year 1883. Although originally intended for sinking through wet quicksands, it has also been applied to sinking in solid but broken strata, carrying much water. Although it had been used repeatedly with success in both France and Germany, the first applications of this method in Britain have been comparatively recent, and have all been confined to the Durham coal-field. The first example was the sinking of a pair of shafts at Washington in 1902.

Freezing was subsequently employed in two very difficult sinkings at Eastington and at Dawdon. At the former place the operation was a failure; the yellow sands here are exceptionally thick, namely, over 100 ft.; they lie at 465 ft. beneath the surface; the water is brackish, and the water-level is affected by tidal movements. At the neighboring colliery of Dawdon, however, the operations, commenced about the same time, were perfectly successful.

Another very interesting sinking by this method

is now in progress at the famous Wearmouth Collieries, originally sunk in 1826. It is now proposed to sink a new shaft close to the site of the old ones. If this were done by the ordinary method, the necessary pumping would relieve the tubbing in the old shafts of the hydrostatic pressure under which it now stands, and when this pressure comes on again, which it would do as soon as the new shaft were tubbed off, the old tubbing would in all probability be destroyed. Hence it has been decided to use the freezing method, which does away with the need of pumping, and therefore does not affect the hydrostatic level of the district.

Finally, reference may be made to a method that has only been used once or twice in the North of France, namely, the forcing of cement slurry through boreholes into soft, fissured strata, and thus forming a wall of concrete within which sinking can be performed; this method was used successfully a few years ago at the Lens Collieries.

Book Notes.

An attractive 26-page pamphlet has just been issued giving a brief description of the general design and construction of the Quebec bridge now under construction across the St. Lawrence River at an estimated cost of about $4,000,000. It gives a very concise resumé of the principal data for the 1,800-ft. channel span, notes the character and magnitude of its members, and describes the large concrete and granite piers. It is illustrated by 12 pages of photo-engravings including progress pictures at different stages of the construction of the south anchor and cantilever arms, the steel false-work, the 1,000-ton steel traveler, and the storage yard at the site. The pictures also include special operations of erection, such as the simultaneous hoisting of 160-ton groups of top chord eye-bars for both trusses, and the driving of 12-in. chord pins nearly 400 ft. above water level. The electrical installations from which all power used in erection is provided and the principal machines and tools used for the erection, most of which are special, are also described or illustrated, thus outlining some of the most important points connected with the building of the bridge. (D. R. Kinloch and N. R. McLure, New Liverpool, P. Q., Canada, 35 cents).

A pamphlet full of useful information to the experienced roadbuilder as well as the young engineer has been issued under the title of "The Construction of Macadam Roads," by the Office of Public Roads of the Department of Agriculture. It is written by Mr. A. B. Fletcher, secretary of the Massachusetts Highway Commission, and gives in some detail what is generally considered the best practice in macadam road construction in the Northeastern States, particularly that followed on the Massachusetts roads. It is particularly useful on account of the detailed information it contains respecting the amounts of materials and the average costs of executing different classes of work. The author is careful to point out that direct comparisons of average costs of roads in one locality with those in another are not likely to be of value, for the reason that the conditions in the two localities are rarely even approximately alike. Even the costs of broken stone surfacings, which at first thought might be considered comparable, often lead to wrong conclusions. The data are often interesting, nevertheless, and when used carefully furnish suggestions that are likely to result in some improvements in the methods followed at places where costs run high. The importance of making allowances for different local conditions is shown by the following extract from the pamphlet: "Road officials in New Jersey are advised to use 2,461 tons of broken stone, exclusive of screenings, to the mile of road 15 ft. wide and 6 in. thick, after thorough rolling. The screenings needed are estimated to weigh 407 tons to the mile, making a total weight of 2,868 tons. Trap rock is used almost exclusively in New Jersey. In Massachusetts in 1906 the 6-in. to 4-in. roads, average depth 5 in., built of trap rock and 15 ft. wide, averaged 2,810 tons to the mile, including the screenings. It would appear from these figures that in Massachusetts nearly as much stone is used in building the 5-in. roads as is required in New Jersey for 6-in. work." In addition to the general description of road-building which the pamphlet contains, it has extracts from specifications used in constructing State-aid roads in Massachusetts, New Jersey, New York, Connecticut, Pennsylvania and Maryland, and reproductions of the drawings of standard structures adopted by the Massachusetts Commission.

Letters to the Editor.

BRICK-BATS FOR CONCRETE AGGREGATE.

Sir:—Do you consider concrete made of brickbats any good for the foundations for a tower of a water-works system, the tower to be of steel and 100 feet high? Do you not think that in time the brick-bats will crumble and allow the tower to settle? CITY CLERK.

This question is asked so many times that the answer is probably worth printing, as a matter of record. The following notes are taken directly from Mr. L. C. Sabin's "Cement and Concrete," which is the standard American authority on the subject. Fragments of brick and other burnt clay products give good results up to the limit of the strength of the pieces, but this limit is not high. Four beams mixed 1:2:5.8 and tested at the age of eleven months showed an average modulus of rupture of 302 lb., the supports being 4 ft. apart, while two beams of the same composition but made with soft limestone shavings from a stone planer showed an average modulus of 413 lb. Eight beams of brick-bat concrete mixed 1:2:5.8 and tested in 20-in. spans at the age of about two years showed an average modulus of 397 lb., while four beams of the same composition and age, tested under like conditions, made with soft limestone shavings, showed a modulus of 604 lb. It will be seen that the strength obtained with broken brick is considerably lower than that obtained with soft limestone. Had a poorer mortar been used, the brick would, doubtless, have given a better comparative result, since with 1:2 mortar, the brick were not strong enough in themselves to utilize the full adhesive strength of the mortar.

The preceding notes from Mr. Sabin's book state the case so clearly that it is only necessary to emphasize the importance of his assertion concerning the effect of the quality of the brick-bats on the concrete made with them. There is such a great difference in brick that it is out of the question to state in a general way whether brickbats should be permitted in the foundations of a water tower. Some brick are dense and hard enough to be perfectly safe, provided the unit pressures imposed on the concrete are not excessive, while other brick are unfitted for such use. In this connection it might be stated that a concrete footing for a water tower in a Southern city, which cracked so as to endanger the structure, was made with brick-bats and the cracking was attributed to their use.

REINFORCEMENT STEEL.

Sir:—I note that in your abstract of the paper submitted by Mr. Shuman at the annual meeting of the American Society for Testing Materials, relative to specifications for steel used in the reinforcement of concrete, you neglected any referNce to the discussion which was offered by the writer at the time the paper was submitted, and as two out of the three parties whose discussion you quote in your issue of the July 20 are directly interested in the manufacture and sale of the material discussed, you may not consider it unfair to refer to some of the statements made by those not so connected. I am, therefore, enclosing a copy of the discussion which was offered at that time, which, though slightly revised, gives in substance what was stated verbally at the meeting of the American Society for Testing Materials. You are at liberty to use this as you see fit, but I do not think that your paper should favor the tendency which exists, to make it appear that almost any kind of material is good enough for the reinforcement of concrete.

Yours truly,
J. B. FRENCH.

MR. FRENCH:—The reading of this paper prompts me to say that as far as my knowledge goes the steel that goes into reinforced concrete is not being tested, and that the purchasers that use it know very little about its properties or quality, and Mr. Shuman being here, he can probably tell us what information he is able to give to purchasers in regard to the physical and chemical properties of the material that is furnished by the company with which he is connected.

It is known that old Bessemer rails are being bought up, twisted hot and furnished to reinforced concrete users, and the people that twist this material cold claim that the hot twisted material is very unreliable, because the phosphorus is excessive, and that it is liable to break and crack in using. Having myself insisted on cold-twisted material, made tests of it and failed to make it bend more than 45° without breaking off short, I have been forced to think that the claims in favor of the cold-twisted material (made from Bessemer stock) may sometimes be very misleading.

If we go back to the manufacturer and ask him for the best information he can furnish us in regard to Bessemer steel that is put into rods for cold-twisting, he gives us what he calls an average analysis. We are not able to find out the extremes between which the results vary, but must be satisfied with the "average." If we try to go a little further and find out how often analyses are made, we are told that an analysis every three or four blows is all that can be furnished.

As far as the statement goes that these average analysis or these analysis of occasional heats or blows represent uniform conditions,— I know, as a matter of fact, from check analyses that have been made within the last two or three months, that we found as high as 13 and 14 points of phosphorus in samples taken from material represented to show less than 10 points, and we have found bars that break before being bent 90°.

I think that in view of the many important uses to which reinforced concrete is now being put, and the failures, many of them involving the loss of human life, which often result from the use of bad material, that steel for the reinforcement of concrete should be as carefully specified, inspected and tested as is considered necessary for structural steel used in bridges and buildings, and if this view is correct, Bessemer steel will be excluded from use in reinforced concrete structures exactly as is already done in the case of important structures built entirely of steel.

SEVENTY-NINE REINFORCED CONCRETE BUILDINGS have been erected or are now under construction in San Francisco, according to Mr. Wm. Ham. Hall. One is a ten-story structure and sixteen are over six stories. Fourteen are stores, thirteen are office buildings, ten are warehouses, six are factories, and two are power stations.

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DATE ON WRAPPER indicates the month at the end of which subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

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TABLE OF LEADING ARTICLES.

An Engineering Potpourri.

Attention is called to the proposed municipal engineering board described in a letter published elsewhere in this issue. The fantastic originality of the suggestion is equalled only by its bright promise of endless confusion. Evidently the engineering work in the city referred to is already so foot-loose and free from direction by a central authority that its further reduction to a state of impotence is not a difficult matter. The situation stated by the writer of the letter has evidently arisen from the exigencies of practical politics. In the multitude of official boards there is multiplication of jobs for all the cohorts of great and small leaders, and consequently in a city where politics is a thrifty business it is customary to see each public works department more or less independent, its affairs being directed by a distinct board which appoints its employees and is responsible only to the mayor. It is usually a wretchedly inefficient system, so far as economical and effective technical management of the different public works is concerned. The various boards fight between themselves for patronage and appropriations, and instead of helping each other as occasion arises, generally do their best to prevent progress. It sometimes happens that for financial or other reasons it becomes necessary for a city to place a certain kind of work in charge of some special board. If this is not done the work cannot be carried out, and a board organized under such circumstances has a real reason for existence. Every condition in ordinary municipal affairs points, however, to the importance of placing all engineering work under the charge of a single city engineer, as has been done for years with marked success in Boston, where the city engineer, as the technical adviser on all engineering matters, directs the work of all the department engineers and harmonizes their differences. His most important function, however, lies in acting as a buffer between the heads of the various engineering departments and the city legislative and administrative officers. The heads of departments are thus free from all annoyance, and the mayor, councilmen and others become accustomed to applying to a single man for the engineering information they require. It is a great deal better in any organization for the work of one general kind to be under a single head, who alone is authorized to say anything about it. This has been demonstrated repeatedly in business affairs, in the management of large railway and manufacturing companies, and in a number of important cities, and consequently only the demands of politics can account for such an organization as is stated to exist in the city mentioned by the writer of the letter.

There are few engineers who have the breadth of view qualifying them to direct the technical affairs of a large city. The average engineering specialist is rarely so qualified, for by training and inclination he is accustomed to regard certain branches in which he is particularly interested as of greater importance than they probably are and is equally inclined to underrate the importance of other branches. Moreover, it is generally the case that a specialist has been so thoroughly concerned with technical matters that he has neglected the business side of engineering. He is an excellent man to give advice regarding details of his specialty, but this is no reason for putting him in a position to criticize the works of other engineers engaged in different lines. In such a municipal organization as that mentioned in the letter, there is bound to be more or less departmental jealousy, and this feeling of dissatisfaction between the politicians directing the different boards will be reflected by their engineering assistants. On account of this jealousy, it is not at all unlikely that excellent engineering suggestions by the technical head of some department would be voted down by the majority of the proposed board of engineers, owing to mere spite. Theoretically, this should not occur, of course, but those who are familiar with the feeling that sometimes exists between different departments of large organizations, public and private, will recognize in the proposed plan an element of danger of the sort indicated.

The writer of the letter suggests that the engineers who form such a board and undertake to criticize work of their associates, of which they know little or nothing, are guilty of unprofessional conduct. This raises a point concerning which there will be marked differences of opinion. If such an engineering board could be organized and its members were to work together harmoniously, criticisms from ignorant or from semi-ignorant members regarding certain projects could not be looked upon as unprofessional but rather as inquiries for purposes of information alone. It hardly seems probable that any engineer would undertake of his own volition to vote against plans prepared by somebody who knows more about the subject than he does. But if jealousy arises, either personal or departmental, it is evident that all hope of efficient progress in any engineering branch will be completely lost. The contrast, therefore, between a properly organized engineering department with a city engineer at the head of the whole force and such a board of probably discordant members as is suggested in the letter, is strongly marked. Even assuming that each member of that board is an expert, it is probable that sooner or later he will feel the necessity of consulting with other specialists concerning some parts of his work. The suggestion that he should refer such matters to the people associated with him on the board, who are less well informed about them than he is, instead of to competent consulting engineers, is a ridiculous attempt to save money in trifles by risking enormous losses in large works.

Comparing Estimates with Construction Costs.

Few duties are more instructive in engineering practice than the comparison of estimates with the actual construction expenses relentlessly added by each day's progress from the beginning to the completion of the work in hand. The task is sure to be a pleasant one if the totals fall below the anticipated amounts, but in so many instances changed conditions or inaccurate forecasts modify the results expected or secured, that an engineer would be more than human if he did not feel the temptation to postpone the rigid comparison of early figures with late experience. In actual work it is almost always necessary to explain increases in grand totals to the financial powers back of the enterprise, but this is not the point at issue. The question which ought to be faced fairly and squarely is, how the results in detail check with the detailed estimates, and what are the causes of discrepancies.

If field notes are kept with sufficient care in explanation of unexpected changes in working conditions the problem ought to be a simple one. Presumably the original estimates and the contract prices will be properly filed at headquarters. When a job diary is posted from day to day with records of all important decisions of the supervisory engineers, agreements modified by consultation with contractors, delays in shipments, unforeseen obstacles in excavation and the like, the comparison of estimates and costs becomes an easy task, as far as explaining discrepancies is concerned. Errors of judgment are liable to occur in the most carefully prepared estimates, and the detection of these by stripping off all other uncertainties in comparison is the most valuable aid toward more accurate judgments in future work. It is decidedly worth while to know the unit costs of every large enterprise and most small construction jobs, even at the expense of a certain amount of clerical work, which at times proves irksome. It is not enough to apprehend the probable limits of a prospective cost range. Excavation, stripping of land, pole erection, blasting, fills and many other constructional

activities all vary in unit costs according to conditions, and it is unquestionably valuable to be able to estimate such work with reasonable accuracy as checked by previous jobs.

If it is important for the engineer to verify his estimates with the actual results in cost details, it is equally essential for the client to appreciate that perfectly legitimate reasons may occur to change the original figures without in the least impairing the reputation of the engineer himself. When a client does not possess the mental breadth to realize the effect of conditions which could not have been foreseen, nothing is to be gained by volunteering explanations of why detailed items varied so widely in the actual costs, while the totals were close to those secured in the work. It is a personal matter for the engineer to determine, of course, how far it may be wise to offer explanations of this kind. Times are when they are asked for and appreciated when presented, but whether they are called for or not, every far-sighted engineer will check up the figures in the privacy of his office and will realize the immense importance of full memoranda as the job progresses.

The Improvements in the St. Mary's River.

The improvement of the West Neebish channel of the St. Mary's River, which is described at length in this and the preceding issue of The Engineering Record, affects a greater total tonnage of shipping than any other similar work that has been undertaken in recent years by the general government. The traffic between Lake Superior and the other Great Lakes has increased at a truly remarkable rate in recent years, the net total of this traffic being nearly 52,000,000 tons in 1906, as compared with a net aggregate of approximately 19,000,000 tons in 1897. This rate of increase has been particularly great since the opening of the iron mines in the Messabe Range at the head of Lake Superior, although the traffic in coal, general merchandise, grain and grain products is proportionately as much heavier each year, due to the rapid development of the vast agricultural region tributary to Lake Superior. Furthermore, it may certainly be expected that the present rate of increase will be maintained, and probably given considerable acceleration during the next few years as the scope of various enterprises at the head of the lakes is broadened and as new industries now under construction in that locality are placed in operation.

The narrow tortuous course of the St. Mary's River, through which this great volume of traffic is required to pass in leaving or in entering Lake Superior, and the rapids in that river, have necessitated some exceedingly broad and expensive improvements. These have been carried on as rapidly as practicable, but, in general, have never kept pace with the increase in traffic sufficiently to permit vessels of the most desirable sizes to be used. The work that has been done at the rapids consists of a lock on the Canadian side and two locks on the American side, together with approaches to these locks. The latter passed 22,155 vessels in the season of 1906, and during June of this year 3,134 vessels were locked through them. While they are capable at present of handling this great traffic, at the existing rate of increase their capacity will soon be entirely inadequate. Plans for a third lock on the American side have been made, and the construction of this lock will be started within a year, but it can scarcely be finished before the traffic becomes greater than can be passed satisfactorily through the existing locks.

The work that has been done in the past in improving the channels of the St. Mary's River below the locks is briefly outlined, and the work now under way on those channels is taken up in detail, in the description to which reference has been made. From this description it is evident that the opening of the West Neebish channel will practically complete such work in the river below the locks until the depth of water in various other channels and harbors of the Great Lakes is increased. Even at that time the improvements which will then be required in the St. Mary's River can readily be carried on without interfering with traffic. The most desirable feature of this new channel on the west side of Neebish Island, however, is that after it is in use a practically double sailing course will be available from the locks at the head of the river to the mouth of the latter in Lake Huron. That is to say, where two channels do not exist the single channel is either naturally wide enough or has been widened and deepened so the upbound and the downbound traffic may be separated entirely. The downbound traffic going with the swift current of fthe river will then be allowed to take the right-hand course, including the straighter route offered by the West Neebish channel, while the upbound traffic will use the more crooked route around the east side of Neebish Island. The value to the heavy traffic in the river of the double sailing course thus made possible by the completion of the West Neebish channel can scarcely be overestimated, and the opening of the latter will certainly be followed by a greatly increased traffic tonnage through St. Mary's River, due as much to the possibility of operating the existing vessels to greater seasonal capacities as to the addition of new vessels to service.

The Superstructure of the Quebec Bridge.

Unusual interest attaches to the articles now appearing in The Engineering Record describing fully the principal details of the Quebec 1,800 ft. cantilever. A detailed account of the structural work of a large steel bridge, or other similar work, is not at the present time, generally speaking, a matter to which it is worth while to call special attention, but the Quebec cantilever is the longest span steel bridge of any type yet constructed, and the arrangements of its details are necessarily unusual in order to meet the extraordinary stress conditions existing in such a great structure. It is sufficiently remarkable to have the main column between the anchor and cantilever arms 315 ft. long, but when it is borne in mind that such a member may have to carry a total load of 10,000,000 lb. or more, chiefly conveyed to it by pins at its upper end, it is easy to realize that provision must be made for extraordinary conditions.

Before giving attention particularly to the main details of this structure, it is worth while to consider some of the principle features of its design. It is now well established that it is in general economical to make the length of the suspended span about one half of the main cantilever opening. In long spans, however, conditions resulting from the erection of a long cantilever arm may render it judicious to decrease the length of the suspended span, and in the present instance it was made three-eighths instead of one-half of the 1,800 ft. opening. It is probable that there would be economy of material with the greater length, but the difficulties of design and manufacture in making provision for the correspondingly increased erection stresses might easily balance or overbalance any small saving of material.

It is interesting to observe that the width of the structure between centers of trusses, 67 ft., is practically one twenty-seventh of the main cantilever span. This width of structure insures a lateral stiffness essentially equivalent to that of a simply supported truss span of the same length and loading, whose transverse width between centers of trusses is one-eighthteenth of the span length. This measure of lateral stability for a cantilever span was first established in connection with the design of the Red Rock cantilever, a structure also built by the Phœnix Bridge Co.

The system of web bracing for this great cantilever structure, 315 ft. deep over the main piers, is a single system with subdivided main panels making the subdivided panel length 56.25 ft. The plan of subdivision makes the secondary members compression and is similar to that used in many of the longer spans designed and built by the Phœnix Bridge Co. It secures a most effective web system in which no ambiguity or statical indetermination exists. Only one serious question arises with this arrangement, and that is, why the entire shear of the cantilever and anchor arms is carried to the top of the great center post, instead of transmitting it down to the bottom of the same post by an inclined compression member meeting the top chord two panel lengths from the top of the center post. The comparatively small depth of truss at the extremities of the anchor and cantilever arms gives an economical angle of inclination to the inclined web members of those portions of the trusses, but the angle becomes far less economical as the main center post is approached.

The massive character of the individual members and of their details can scarcely be realized, even with the comprehensive description given in The Engineering Record, except by those familiar with the corresponding members and details of some of the largest ordinary spans yet constructed. It is obvious that a suitable arrangement of the details at the intersection points of the chords and web members, has been reached only after the most careful consideration of all the ends to be obtained in the design. Central intersections in such a great structure are absolutely essential for the elimination of objectionable secondary stresses, and they could only be secured by a massiveness of details which is unprecedented in bridge construction. The system used can be properly called pin-connected and yet so much extraordinarily massive riveted work is found that an advocate of riveted joints could claim that the trusses are built as much on the riveted type as pin-connected, if not more so. As a matter of fact, the plans show the trusses to be an admirable developement of both pin and riveted work to meet the exigencies of this particular structure. They further conclusively demonstrate that the single web system may be successfully applied in a highly satisfactory manner to the longest span of truss work yet contemplated.

The Quebec Bridge, therefore, is a most interesting exhibition of modern structural design of the most advanced type, in its application to a railway bridge structure of a span so great that it was a question whether the stiffened suspension system should not be employed. The degree of excellence to which shop work of this class has been developed is effectively shown by the fact that these great bridge members were never assembled after fabrication in the shop until they were placed in the actual structure with complete accuracy. This is in marked contrast to the system of construction of the Forth Bridge, for which shops were actually equipped and put in com-

mission at the bridge site in order to accomplish the fabrication, as it were, of each member in its actual place in the completed structure.

Notes and Comments.

THE HELL GATE BRIDGE PLANS for the Pennsylvania R. R. structure connecting Long Island and the Borough of the Bronx have been rejected by the Municipal Art Commission of New York. . This structure as planned was illustrated in The Engineering Record of June 1, and in a later issue it was stated that the Art Commission might request a modification of the architectural treatment. In its report the Commission states that it is quite ready to accept the judgment of the designing engineer on all engineering or structural questions, but the attempt to give decoration to the towers and to the bases of the towers is considered unsatisfactory from an artistic point of view. The report reads: "Your committee cannot approve these decorative features as they would have been ready to approve a strictly utilitarian construction, or, better still, a scheme of ornamentation which would seem to them artistic and appropriate. They, therefore, recommend disapproval of the plans without prejudice to their re-submission with a different treatment of the towers and their bases." In this connection it might be added that the "Builder," the leading British architectural journal, has also found fault with the architectural treatment of the structure.

AN ELECTROLYSIS CONTROVERSY of considerable interest recently took place before a committee of the British House of Commons, which was listening to arguments for and against a bill introduced in favor of the North Metropolitan Electric Supply Co. The Metropolitan Water Board insisted that this bill should in no way exempt the company from responsibility for causing injury to underground conduits and other structures by electrolysis. The electric company produced experts who testified that there was absolutely no danger of electrolysis from works such as the company proposed to construct. The committee finally decided that, this being the case, there was no reason why the Metropolitan Water Board should not be protected in the manner it wished and accordingly inserted the clause desired. It is understood that, in spite of the electric company's assertion that it would cause no harm, the presence of this clause is a source of considerable annoyance. It seems unfortunate that British electrical corporations continue to fight attempts to get a better knowledge of electrolysis and the methods of providing a protection against it. In Germany the contrary is the case. There the Association of Gas and Water Engineers, which has been carrying on an investigation of electrolysis for many years, has been joined by the Association of Industrial Electrical Engineers and the Association of Tram and Light Railway Proprietors, in a joint committee to carry on the researches begun by the society first named. There is no attempt made in Germany to ridicule the effects of stray electric currents, but, on the contrary, the companies responsible for these wandering currents acknowledge their obligations and are doing their best to remedy the troubles. Such a course has been followed in a number of American cities, but up to the present time it has not found favor in Great Britain.

THE SMOKELESS COMBUSTION EXPERIMENTS with Illinois coal which Prof. L. P. Breckenridge is conducting at the Engineering Experiment Station of the University of Illinois have attracted so much attention that the following notes concerning them will probably be of interest to many readers. The tests were begun with a Heine water-tube boiler of 210-h.p. having a Green chain grate stoker and induced draft in the furnace. The lower tubes of the boiler have been covered for two-thirds of their length with a special tile, making a roof in the furnace. Over a hundred tests have been made with soft coal, each of 8 to 10 hr. duration. With this setting no smoke has been caused during the operation of the boiler after the fires were once well started. A series of tests is now in progress with two types of heating boilers, using anthracite and bituminous coal, coke and briquettes. In all tests the technologic branch of the United States Geological Survey is co-operating. Prof. Breckenridge is of the impression that the smoke nuisance will be cured mainly by using mechanical stokers suited to the local coals, but the stoker must be combined with the proper furnace details to fit the coal used. Uniformity in the size of coal will be of material help. Where hand firing is adopted, careful firing, which is unusual, will cut down the smoke at least one-half. Details of the experiments and a complete description of several boiler settings which have operated without smoke for more than two years will be printed in a bulletin of the Engineering Experiment Station to appear arly this Fall.

PUBLIC IMPROVEMENTS in the Boston Metropolitan District are to be investigated by a commission consisting of three members appointed by the governor and two by the mayor, these men to be "skilled in finance, commerce, industry, transportation, real estate matters, architecture, engineering, civic administration and law," according to the law authorizing the appointment of the commission. The commission is authorized to investigate the advisability of any works in the district which, in its opinion, will tend to the convenience of the people, the development of local business, the beautifying of the district, or its improvement as a place of residence. It may also consider the establishment of intercommunicating highways between the cities and towns of the district, the control of traffic, the location of docks and terminals and other matters of this nature. The members of the commission, among whom Mr. Desmond Fitzgerald is included, serve without pay, but the commission may spend any sum up to $25,000 for clerical and other services. It will be noticed that the commission is essentially one of investigation, its powers in this direction being limitless, whereas it has no authority to execute anything. The appointment of the commission is particularly interesting in view of the somewhat similar action recently taken by the Local Government Board of Great Britain, and the appointment of a committee by the Royal Institute of British Architects to report on the æsthetic development of suburban tracts. It is becoming evident in all large cities that the time has been reached when a careful planning of the development of all outlying districts is important, not only from an engineering point of view, but also for the best commercial and artistic growth of the suburbs. This is a matter to which Mr. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, has several times called attention in his official reports.

INJURIES TO WORKMEN engaged in rock excavation by the explosion of charges which have not been fired properly, occur so often that it is rather surprising contractors do not instruct their foremen to use the utmost care to prevent such accidents. The law governing these occurrences in most States was stated lately by the Minnesota Supreme Court in the case of Carlson v. James Forrestal Co., 112 N. W. Rep., 626. In this case the general foreman in charge of the work of excavation for the foundations of a building directed a blasting crew to go to another part of the foundation. He directed a certain workman, the plaintiff in the case, to clear the ice and snow out of a hole which had been drilled in the rock by other men, and this workman was injured by the explosion of a charge of dynamite left there unexploded when a group of holes had been fired electrically. In this case the company itself was not considered negligent in its manner of conducting the blasting, or in allowing the work to get into the condition which existed. Nevertheless, as a matter of law, the general foreman was a vice-principal, charged with an absolute duty to exercise proper care to provide a reasonably safe place for the men to work. The jury found that the foreman did not exercise such care in making a reasonable examination to ascertain if all of the charges had been exploded, and the accident was the proximate result of this negligence. Under such circumstances, the court rules, the defendant was responsible for the injury to the workmen, and it affirmed the verdict of $8,000 which he received in the trial court. This is practically the decision rendered in so many States that it may be accepted as practically universal throughout the country, and indicates that some general rules might very properly be drawn up for the guidance of foremen in charge of blasting operations and cleaning up after explosions.

THE DRAINAGE WORKS of New Orleans from time to time arouse more or less criticism from residents of that city, which seems to be based on the supposition that a drainage system can accomplish the impossible. Few cities are situated like New Orleans. The surface water which has to be handled there accumulates during and after heavy rainfalls in very large amounts, unless means exist for conveying it away rapidly. The drainage system has been constructed for the latter purpose, and where it operates under the conditions which were assumed to govern the work when the plans were prepared, it gives complete satisfaction. It goes without saying, however, that if the inlets to the drainage canals are allowed to become clogged with trash and refuse, the water which accumulates in the gutters cannot enter the inlets at the proper rate, and consequently must flow over the surface of the street until some better escape for it is found. This occurs from time to time in the city and gives rise to complaints that the drainage works are inadequate for their purpose. The contrary is really the case, for the trouble is due to failure to keep the streets and gutters clean. This is no fault of the Street Cleaning Department, for it has less than $200,000 to spend annually for the purpose, which is less than a quarter of the sum really needed for the removal of dirt and rubbish in a fairly satisfactory manner, particularly in view of the fact that in some parts of New Orleans it has long been customary to throw refuse directly into the streets. Complaint has occasionally been made, also, that the drainage works were not of the highest type, and that some of the open canals should be lined and roofed. Lining and covering are certainly desirable improvements, but in view of the financial condition of the city it was unquestionably good public policy to carry out the construction in the manner that has been pursued. There has been trouble in some parts of the city due to flooding of streets, but relief from this situation will come much more quickly if the people will keep trash out of the streets and avoid such public criticisms of the Sewerage and Water Board as tend to increase the difficulty of selling bonds for continuing the improvements.

THE KERN RIVER NO. 1 POWER PLANT OF THE EDISON ELECTRIC CO., LOS ANGELES; PART I.

By C. W. Whitney.

The Pacific Coast, California in particular, has won a goodly amount of renown in engineering circles because of its many note-worthy hydro-electric power plants and its long-distance transmission systems. Going back 14 years to the noted historical work at Redlands and Pomona, practically all the improvements in hydraulic design in connection with high-head plants that have stood the test of time and which mark the best practice of to-day have been evolved in connection with the California water power plants. Substantially the same may be said regarding transmission work; and, although the record for highest voltage has been surpassed quite recently in Michigan, the Golden State still operates successfully the longest lines on the continent.

With this excellent record of pioneer work, and with many modern efficient plants now in continuous operation, it is interesting to note the improvements or innovations incorporated in the design of any new plant. The Edison Electric Co., of Los Angeles, has just completed and placed in operation a station on Kern River, which, while not surpassing any previous records of high head utilized or length of transmission, does employ in its construction many distinguishing features, some of which are distinct departures from previous practice.

In capacity, the Kern River No. 1 power plant equals the rated capacity, 20,000 kw., of the largest impulse wheel plant previously in operation and in overload capacity surpasses it. Its gravity conduit, constructed almost entirely of tunnels excavated through the mountains, is the most permanent and costly hydraulic waterway in the country. The pressure main driven in the form of a tunnel down the mountain slope is probably the most unique feature of the installation and is a decided innovation in power plant construction. The water wheels embody new features in the design of buckets, nozzles and governors. In the electrical details of the station is incorporated the most modern apparatus. The transmission line is at present operated at 60,000 volts and will be raised later to 75,000. The length of transmission, 117 miles, is exceeded in but few instances and the steel towers and insulators are of special design.

Considered in its entirety, or as to its several conspicuous component parts individually, the Kern River No. 1 station typifies the latest modern practice in hydro-electric power plant design and makes timely the following descriptive data. A general description of the plant while it was under construction was given in The Engineering Record of March 18, 1905, and in the issues of February 25 and March 11 of the same year the other plants of this company were discussed.

General Description.—The Kern River is the southernmost large tributary of the San Joaquin River and has its head in the snow-covered slopes of Mt. Whitney, and neighboring peaks of the Sierra Nevada Mts. Water for the plant is diverted at a point ½ mile below Democrat Springs in Kern County and about 14 miles up the river from the mouth of the canyon. An hydraulic conduit consisting almost entirely of a series of tunnels approximately 9 miles in length conveys the water through the mountains on the south side of the river to a forebay at a point about 900 ft. above the river and about 2 miles from the mouth of the canyon where the plant of the Power, Transit and Light Co., of Bakersfield, is located. From the forebay the force main is carried down to the power house in an inclined tunnel.

The power house is located on the bank of the river directly opposite the intake for the Bakersfield plant, and at an elevation of about 20 ft. above the ordinary high water level of the stream at that point. The tail race of the station is designed to deliver the water to the river immediately above the diversion point of the Bakersfield plant. The transmission line is carried down the Kern Canyon and across country to Los Angeles, 117 miles distant.

Diverting Dam.—The dam which is built to divert the water from the Kern River into the hydraulic conduits is placed on bed rock and is carried up to a point 1.25 ft. above the flow line in the tunnel conduit, thus insuring a constant supply as long as the reservoir created by the dam is kept filled. In excavating for the dam, bed rock was found to exist at varying depths, the deepest portions being at the south end at about 35 ft. below the stream bed. A cofferdam was built to divert the river during the construction and while the fill overlying the bed rock was excavated. Trenches were then cut in the bed rock and holes bored in which steel bars were driven in two rows across the canyon. The first layers of concrete were placed on the bed rock and secured to it by means of the trenches and the steel bars. Cyclopean concrete was the material of construction, the rock used being the granite found in the canyon. Many of the rocks were of large size, some weighing several tons each. About 1,500 cu. yds. of material was placed in the foundation, and 3,500 cu. yds. in the dam proper.

The form of the dam is the overflow type as shown in the accompanying illustration. Its length on the crest is 203.56 ft. and its height above ordinary water level in the river about 20 ft. At the base in the widest part it is 52.81 ft. wide. The crest has a small angle with the horizontal and is 7 ft. in width. The crest and lower face were designed so as to give a true hydraulic curve to the water overflowing and to attain this end the top 15 ft. of the face was built with a batter of 1 to 1 so as to allow an air space under the water. The theory of the design is that air will enter this space under the water from the ends of the dam and that enough will be carried down with the water to form an air cushion. With 2 or 3 ft. of water flowing over the dam a very smooth surface is presented. Below the 45 deg. batter the down-stream face has a radius of 100 ft. The up-stream face has a batter of ¾ of an inch to a foot.

Headworks.—The head or diversion works of the gravity conduit consist of an enlarged or widened section of the intake tunnel with controlling gates operated by means of hydraulic cylinders. In order to prevent contraction as the water enters and to afford sufficient screen area to admit the water, the tunnel is widened out at the entrance to 16 ft. 6 in. The screens or grizzlies are made of slanting bars and extend both in front and on the side of the controlling gate. The bars are ½x3 in. and are spaced on edge 3 in. between centers by means of 2¼-in. thimbles, the thimble rods being 4 ft. apart. The screen is 20 ft. long on the slant and 8 ft. high and is supported on 4-in. cast iron pillars. Behind the screen and just above the gate is a 10-ft. platform on to which can be raked any detritus caught by the screen. The grade at the entrance of the tunnel is increased above the normal so as to excellerate the water from its state of rest above the intake to normal velocity in the tunnel below.

Another important feature of the head works is the drainage or sluicing tunnel, 365 ft. in length, that is driven through bed rock below the intake at the south end of the dam, penetrating to the bottom of the reservoir above the diverting dam. A heavy grizzly built of 70-lb. T-rails protects the entrance of this tunnel and behind are two gates operated by hydraulic cylinders, by means of which the tunnel can be closed or opened as desired. The drainage tunnel was first used to divert the water from above the site of the dam during its construction to the river at a point some distance below the headworks. Its permanent purpose will be to sluice out at such intervals as may be necessary, any accumulation of silt collecting in the reservoir above the dam. The gates of this drainage tunnel are constructed for operation under pressure varying from 35 to 45 ft., depending on the quantity of water flowing over the dam, the hydraulic cylinders for the gate being designed to move them under a head of 20 ft. of water over the dam, should a flood of this magnitude ever occur.

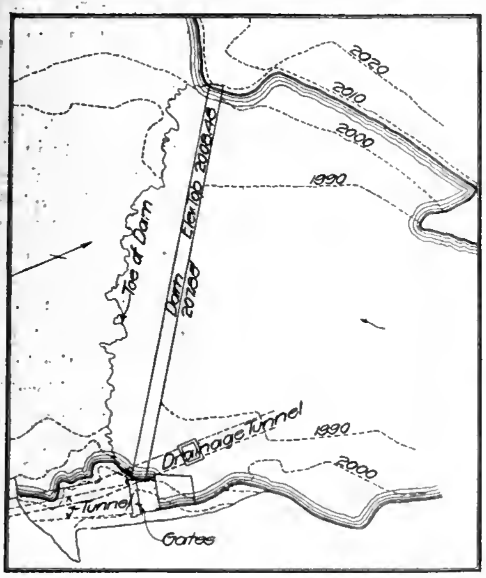
Kern River No. 1 Power Plant.

Each of the gate openings is 8 ft. 10¼ in. high and 3 ft. 8 in. wide, the side frames being of cast-iron and the sill a 10x10¾-in. redwood timber. The gates are built up of 5/16-in. steel plates and 6-in. 15-lb. I-beams, the sides being formed of 12-in. I-beams. There are two cast-iron hydraulic cylinders installed for each gate. The set for the east gate is mounted on top of the concrete operating shaft, the west set being placed directly below as there was not sufficient lateral space to place them both on the same level. The lower cylinders are placed 38 ft. 8 in. above the cylinder gate and operate the latter by lifting rods 26 ft. long. The upper cylinders operate their gate by means of 40-ft. rods. These lifting rods

are 4½ in. in diameter and are made of wrought iron encased in brass tubing to prevent rusting. The gates are guided at each side by 4 bronze rollers 3 in. in diameter. In order to equalize the pull of the two cylinders on each gate there are installed two racks 10 ft. long and 6 in. wide into which mesh two 12-in. pinions mounted on the top of the gate.

The gates for the intake tunnel are similarly constructed. The hydraulic cylinders both for the intake gate and the sluice gates in the drainage tunnel are operated by means of oil pressure supplied by gravity from a tank on the bank. The oil discharged from the cylinders is pumped up to this tank by a triplex pump, electrically driven, a sufficiently powerful hand-pump being installed for emergency use.

Tunnels.—The hydraulic conduit of the plant is noteworthy by reason of its being the most permanent construction of its character in the country. The Edison Electric Co., after its 14 years practical experience with the construction and operation of hydraulic electric power plants, has profited by the knowledge gained of the different forms of conduit used, such as timber flumes, earthen ditches, concrete-lined ditches, cement pipe and tunnels, and for its Kern River work determined that the most efficient and in the long run economical construction would be a system of concrete-lined tunnels. The expense of driving the



Dam and Tunnel Intake.

tunnels was a large item, but it is warranted in this instance because of the large quantity of water handled and by reason of its permanency and the fact that it will be subject to practically no depreciation losses and but little expense from maintenance. Another important feature of the tunnel construction is that there will be practically no evaporation loss from the conduit. As the evaporation from the natural stream is estimated to be from 15 to 20 per cent. in the summer months, this factor will be an important one during periods of minimum flow. Another advantage of the closed conduit is that no leaves, sticks or other debris can enter the water after it leaves the headworks.

Between the intake and the forebay there are 19 tunnels forming approximately eight units of gravity conduit. The tunnels vary in length from 496.3 to 4,373.7 ft., five of them being over 3,000 ft. long, five between 2,000 and 3,000 ft., and four between 1,000 and 2,000 ft. Their combined length is 42,910.5 ft. They are numbered from the intake down, tunnel No. 1 being the intake tunnel, the entrance to which has already been described.

The tunnels were excavated in the rough to be 9 ft. in width and 7½ ft. from the bottom to the springing line of the arch, and 9 ft. in height in the center. Afterwards they were lined with concrete 6 to 10 in. thick on each side and the floor paved with 3 in. of concrete, the net section thus obtained being 8 ft. in width and 7 ft. in height. The entire surface of the side and the floor were covered with a cement mortar plaster ¼ in. thick, composed of 1 part of cement to 2 parts of sand. At the corners of the walls and floor a curve with a 3-in. radius was formed in order to prevent wear at that point and also to smooth up the flow of water.

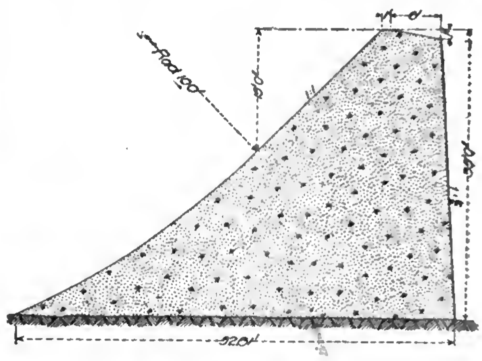
The section of tunnel adopted is not the most favorable to give the highest velocity on a minimum slope, but it is the most advantageous for the purpose, as by making a wider tunnel greater difficulties would have been encountered with the roof of the tunnel where it passed through a loose or shattered formation. The grade of the tunnel is 7.92 ft. per mile, it being intended that the water should be carried at a depth of 6½ ft. The cross sectional area of the stream is therefore 52 sq. ft., the wetted perimeter 21 ft. and the mean hydraulic radius 2.5.

Waste Flume from Forebay.

Assuming the coefficient of roughness to be 0.012 in Kutter's formula, the conduit has a discharge capacity of approximately 470 cu. ft. per second. Judging by experiments made on other tunnels constructed for the Edison Electric Co., and elsewhere, it is likely that the coefficient will not be far from 0.012 for this size of conduit. As is well known, the coefficient of roughness in the Kutter formula should vary somewhat with the mean hydraulic radius and from previous experiments for a hydraulic radius of 2½ and cement plaster as above stated, it will be about 0.012. Observations made during the first day the water was turned into the conduit would indicate that the coefficient would be even less than that value. In places where the tunnels pass through seams and shattered formations or "blocky" ground, they had to be arched overhead in order to support the roof, the concrete at the center of the arch being 12 to 18 in. thick. Less than 15 per cent. of the length of the tunnel required such overhead arching. Where this was necessary it was placed by using a template, with lagging overhead, the concrete being thrown back and tamped into place above the lagging. In excavating through this blocky ground timbering was necessary, the standard bent being formed of 6x8-in. sets spaced 4 ft. centers and holding the rock back by 3-in. plank. In such sections the timber was left in position and completely covered by concrete. The concrete at the sides was tamped into place behind boards supported by vertical forms. Wherever large cavities had been blasted out in driving the tunnels, these were built with rip-rap, the interstices of which were filled with sand and gravel. The same method was pursued above the concrete in the arches. Consequently there are no cavities existing between the bed rock and the concrete lining in the tunnels.

In several places springs were encountered and as the pressure that would be created by stopping them up might be disastrous to the tunnel lining, vents were installed through which the water can flow into the tunnel. These vents consist of sections of pipe from ¾ to 3 in. in diameter and 6 to 8 in. long, set in the floor or wall and left open at both ends. The spring water being under higher pressure than that flowing in the tunnel, continues to flow into the tunnel and thus relieve it of any strain.

The excavation of each of the 19 tunnels was carried on from both ends, thus dividing the work up among 38 headings. The work was principally done by pneumatic drills with 3¼-in. cylinders. Some hand work was done in opening up approaches and adits and where loose formation was encountered. The ardinary progress in driving with pneumatic drills was 5 ft. for a 10-hr. shift, using 2 machines in the face. This varied considerably, however, as the number of holes required for breaking the ground varied from 10 to 24. The depth of the holes usually employed was as follows: cut-ins, 8 to 9 ft.; lifters, 6 to 7 ft.; breast holes 6 to 7 ft.; back holes, 5 to 6 ft. The amount of powder consumed also varied according to the formation, so that no stated quantity per round of holes can be relied upon.



Diversion Dam.

In the toughest rock encountered it was sometimes found necessary to reload the holes the second time in order to break the ground, the first blast blowing out the rock only at the upper end of the hole.

The pneumatic drills were supplied with compressed air by means of 3 and 4-in. steel casings laid from the six construction camps located at suitable points along the canyon between the power house and the intake. Ventilation was provided by means of motor-driven Root reversible blowers located at the tunnel or adit openings and connected with the working faces by means of galvanized iron stove pipe. The company carried on all the tunneled excavation work itself, the only contract work being that for teaming, the supply of provisions, and feeding the men. By this method the company has been able to secure construction data which will be invaluable to it in carrying on similar work in the future and in the consideration of contract work. The only contract work done on the tunnels was the concrete lining. This was done by Glass & Fischer, of Los Angeles and Redlands, this firm also contracting for the boarding houses.

Standard and Colton brands of Portland cement, supplied by the two California mills, were used throughout for the concrete, the mixture

being in the proportion of 1:3:5. For the sand and aggregate the granite excavated from the tunnels was used. The rock was crushed to 1½ and 2 in. size, and for the sand it was crushed and rolled so as to pass through a 60 screen. Gates gyratory and Blake jaw crushers and Buchanan 10-in. rolls were employed. As no adequate water supplies were available along the route of the conduit, the water necessary for mixing the concrete had to be pumped up from the river, Rumsey duplex pumps being employed for that purpose. For mixing one Smith and two Ransome mixers were used. The men were worked on two 9-hr. shifts, illumination being furnished by a construction power plant to be mentioned later. A total of 110,000 ft. of lumber was used in the forms for the concrete work.

After the tracks had been removed from the lower tunnels and when the roads from the upper camps were impassable because of heavy rains and snow, two automobile wagons were purchased and proved indispensable in carrying cement and other supplies through the finished tunnels from camp 1 to the upper tunnel. These machines were of the Lambert friction drive type and were equipped with 20-h. p. gasoline motors. The wheels were fitted with heavy hard rubber tires. About 7,000 bags of cement were thus transferred from camp 1, an average distance of 5½ miles. In all about 1,000,000 lbs. of freight was carried by the two machines. Even the steel rails for the construction track were carried out in the automobiles. With light loads a speed of about 18 miles an hour could be made, precautions being taken at curves which were indicated by white signal flags.

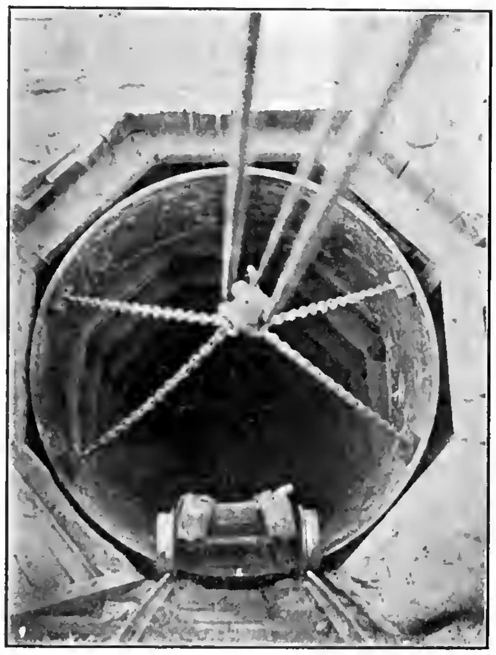
After the tunnels were completed 2-wheeled hand-carts with rubber tired wheels were used for carrying cement and light tools for such finishing and repair work as was necessary. They were also brought into service in stringing the telephone line that is carried throughout the entire tunnel, connecting the power house with the diversion works at the dam. The two galvanized iron wires of this telephone line are carried on inverted T-shaped brackets about 10 in. from the roof of the tunnel. The brackets are formed of ¾-in. pipe with porcelain insulators bolted on each end of the horizontal arm. The vertical pipe is secured in the holes of the rock or cement by wooden plugs.

Timber Flumes.—The tunnel work was planned so as to avoid wherever possible flumes for spanning the side ravines encountered along the line. However, in order to maintain a good alignment and make the line as short as possible, a few exceptions had to be made to this rule. Some of these ravines leading down to the main canyon and crossing the line of the conduit were on such a flat slope that should the tunnel be constructed under the ravine the necessary adits would have been very long. This not only would have increased the cost materially, but also would have added to the length of the line, and the time required to do the work. At such points where there was no danger from falling rocks the ravines were spanned with flumes. There are six of these flumes, the longest being 1,029.6 ft. long and the others vary in length from 49.9 to 167½ ft. All except No. 3, which is built of reinforced concrete with a steel frame, are constructed of timber. They are placed on concrete foundations and are designed with a factor of safety sufficient to make their life from 30 to 40 years. The framework for supporting the flume box is of Oregon pine, being so designed and distributed that no part of the timber comes in contact with the earth or is exposed to the drip should the flume at any point spring a leak. In this way the life of the Oregon pine will be great, as it is invariably kept dry and free from contact with the soil.

The flume box is built up of 3x12-in. redwood planks obtained from butt ends of Sequoia Semper Virens, grown in swamp lands west of the Coast Range in northern California. The grade of this lumber is perfectly clear, and its quality is such that its life should not be less than 40 years. The edges of all planks were bevelled so as to give a ¼-in. opening on the inside of the joints which is caulked with ship chandler's oakum. The bottom seams were covered with hot asphaltum and 1x6-in. redwood battens nailed down over them. On the sides of these flumes a specially designed batten is used. This batten is of 1x6-in. redwood, the upper half being cut away on a curve, permitting asphaltum to be poured between the batten and the side of the flume. At the corners of the flumes a quarter round strip is nailed.

The design of the flume above described has been thoroughly tested and even if it should stand dry for months in the hottest weather, the designers state that it may be again filled with water without having any perceptible leakage.

In some of the flumes where streams are crossed that are apt to carry considerable water in winter, span flumes are constructed. One of



Lowering 90-Inch Pipe Down Shaft.

these span flumes has a length of 32 ft., built with a 10x12-in. timber frame and resting on 12x12-in. beams. In connecting the wooden flume with the portal of a tunnel, a construction of a special nature was used, which offers two points of contact between the wood and the concrete and a well between the two, from which the water may be pumped out and any leaks repaired should these ever occur between the wood and the concrete.

Steel Concrete Flume.—The flume between tunnels 6 and 7 across Laird Canyon, is constructed of structural steel and concrete. The whole structure is carried on 15-in. steel I-beams set 8 ft. 10 in. apart and supported by concrete piers. These longitudinal girders carry 9-in. steel I-beams laid transversely 4 ft. center to center and on them is erected a framework of structural steel for the sides and bottom of the flume. Two layers of expanded metal of 1½ and 3-in. mesh are used in connection with this framework, and being filled with concrete form the plates enclosing the frame. This concrete construction is also reinforced on the floor by twisted ½-in. rods. The outside and inside of the flumes were then plastered, making the thickness of the reinforced concrete sides and bottom 4 in.

This type of flume or conduit had never been tried before, but in this case has proven a decided success and while it costs more than a wooden flume it has the advantage of being as permanent as the tunnels themselves.

Concrete Conduits.—In the lengths of tunnels and flumes forming the gravity conduit enumerated above no account is taken of the concrete conduits which connect some of the tunnels with the flumes. There were places along the line where the tunnel emerged at the foot of a steep incline in such a manner that the flume if constructed on the grade would be threatened by land-slides or boulders rolling down the side of the mountain. These places were spanned by means of concrete conduits, the interior of which have the same cross-section and slope as the tunnels themselves. The walls are made heavy and reinforced with steel and an arch overhead, the arch being covered with a cushion of earthen material to receive the impact of anything rolling or sliding down the hill and passing over the conduit. There are eight of these conduits having an aggregate length of 503½ ft., and with the exception of a very short one vary in length from 31.6 to 121.6 ft.

Forebay.—A terminal equalizing reservoir of some size at the end of the gravity conduit and feeding the pressure main would have been desirable in connection with the project. However, the slope of Mt. Breckenridge, where the lower end of tunnel 19 emerges above the power house, is approximately on a 45-deg. angle, making it impossible to excavate any large area for a tunnel reservoir or forebay. It was necessary, however, to have a small basin for regulating the flow in the force main and for this purpose a chamber 30x42 ft. was excavated to a depth of about 8 ft. below the grade of the supply tunnel. Inside of this and over the mouth of the force main were erected controlling gates and screens through which the water passes into the force main. The walls of the forebay were made of concrete in the form of retaining walls where they were enclosed in the excavation and on the lower side where they were unsupported were made sufficiently heavy to withstand the pressure of the water on the inside. As the formation where the construction is located is somewhat shattered the concrete work was heavily reinforced and the floor paved with 3 ft. of concrete. At the back these walls were extended up to a considerable height to prevent material caving from the mountain above from dropping into the forebay.

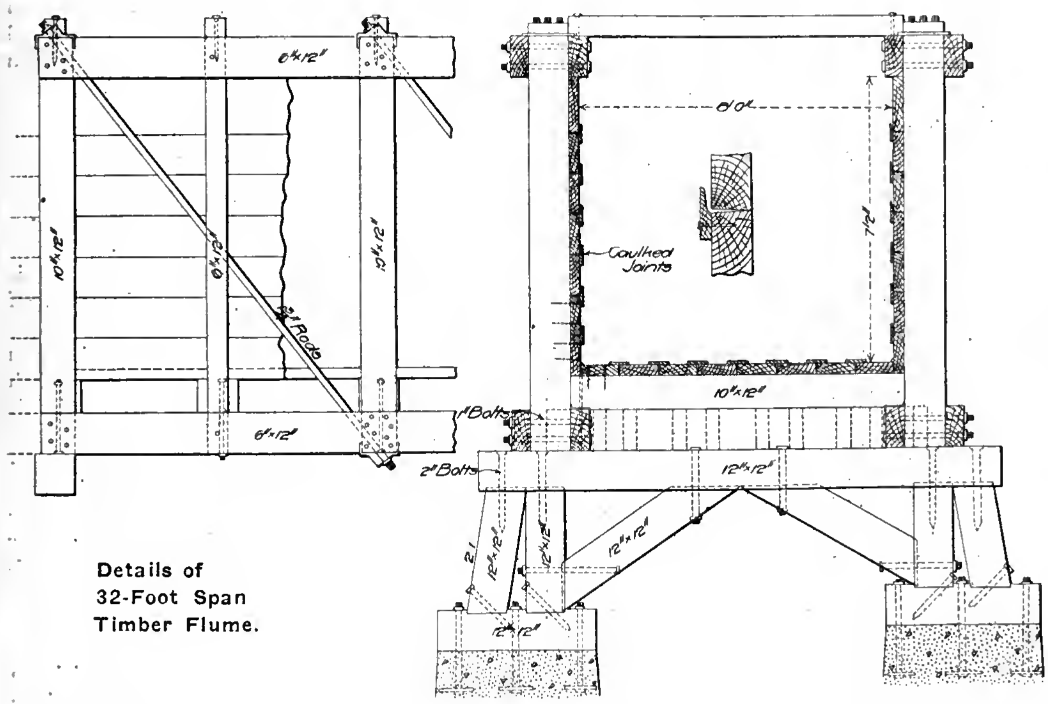
On one side is a spill-way 9 ft. above the floor of the forebay, and consisting of five 6-ft. 10-in. openings over which the water flows into the waste flume when it is desired to divert part or all the tunnel flow from the pressure main. The height of this spill-way can be controlled by means of flash boards which may be inserted and removed as required, according to the quantity of water carried through the tunnels. The extreme height of the spill-way is 3 ft. A 24-in. gate valve is set at each end of the spill-way for sluicing into the waste flume.

The force main starts from the bottom of the forebay, thus making it possible to have the water enter it from opposite directions. This construction tends to prevent the formation of eddies or a whirl-pool at the entrance.

The controlling gates have an opening of 6 ft. 2 in. high and 10 ft. wide and are built up of 4x12-in. timbers on two vertical 6-in. steel I-beams. They are raised by means of hand-operating gearing through four sets of gears working in two racks, 7 in. wide with 3-in. pitch, mounted on the front of each gate. Behind the gate and inclined upward toward each other are two heavy grizzles. These are formed of 3½x½-in. iron straps, spaced 3 in. on centers by thimbles of 2½-in. wrought iron pipe, the rows of thimbles being set 1 ft. apart. Each screen is 11 ft. 6 in. long and is set on an angle with its top supported by a 4-in. steel I-beam. These two beams are 3½ ft. apart, the space between forming a walk.

Waste Flume.—The forebay is constructed so that when the water is diverted from the force main it passes over the spill-way automatically into the waste conduit extending down the moun-

tain side to the river. This conduit is of concrete at the upper end where it is on a comparatively flat grade, the section being 8 ft. wide and 8 ft. 6 in. high. The water is discharged into a redwood flume 20 ft. wide that carries it down the steep slope of the hill. As the slope is about 45 deg., only soft wood, it was believed, would stand the wear due to the high velocity. The spill-way flume is 1,200 ft. long and discharges into the Kern River about 600 ft. above the power station. It rests on 4x6-in. stringers bolted to 3x3x3/8-in. anchor plates embedded in concrete footings. These footings are spaced 8 ft. apart and are securely set, although they are not carried down to bed rock in all cases. The cross-beams of the flume are 4x6-in. timbers 26 ft. 6 in. long. The side posts are 4 in. square and are carried up 3 ft. 3 in., being secured at the bottom by angle plates. They are set 4 ft. center to center and are angle braced by 4x4's, bolted at both ends by 1/2-in. bolts. For lining the flume 2x12-in. redwood planks were used, the joints in the floor being calked and covered by 1x6-in. battens. Quarter rounds were nailed in the corners as in the other flumes. The side lining, which is carried up 3 ft. high, is battened and caulked in the same manner as already described for the smaller flumes.



Details of 32-Foot Span Timber Flume.

Pressure Mains.—The greatest innovation in the entire plant is the pressure main, the construction of which has been along new lines and in decided contradistinction to the customary practice of laying a steel pipe on the surface of the mountain slope or merely burying it sufficiently to cover it for protection against freezing or expansion and contraction such as might be caused by a wide range of temperature changes. The pressure main constructed on Kern River consists of a tunnel approximately 1,700 ft. long driven through the mountains on an incline and lined with steel varying in thickness from 3/16 to 1½ in. This tunnel begins at the bottom of the forebay and is carried down at an angle of approximately 45 deg. and turning into the horizontal section emerges at the lower end on a level with the floor of the power station. There are 3 vertical curves in the tunnel. The upper one forms an angle of 7 deg., 260 ft. from the forebay floor and turns the pipe from a grade of 130.32 per cent. to a grade of 101.35 per cent. The second curve 32.5 ft. lower down has an angle of 5 deg. and turns the pipe into a grade of 84.93 per cent. on which it is carried 994.24 to the last vertical curve. The latter has an angle of 40 deg., and from its lower end the pipe is carried along horizontally to the power house, the total length of the main being 1,697 ft.

The pressure main is finished to give it an inside diameter of 7 ft. 6 in. At the top a taper 20 ft. long and 10 ft. in diameter at the forebay entrance terminates in the regular 7½ ft. diameter of the completed tunnel tube. This diameter of 7½ ft. is maintained throughout the inclined tunnel and on the horizontal beyond vertical curve No. 3 for a distance of 167.39 ft. At this point 1,454.44 ft. from the forebay, the force main emerges from the solid rock and is carried to the portal a distance of 243 ft. through a detrital deposit lying between the mountain and the power house site. Where the tunnel emerges from the solid rock a 20-ft. taper was installed, reducing the diameter of the main from 7½ to 5¼ ft., at which diameter the pipe is carried to the branch piping at the power house.

The inclined part of the pressure main and the portion of the horizontal section that is carried through solid rock were finished by installing a steel lining built up of plates 3/16-in. thick for the incline and 3/8 in. thick for the horizontal, riveted together to form a cylindrical pipe 7½ ft. in internal diameter. The tunnel itself was driven in approximately circular form and 9 ft. in diameter. The steel pipe was centered in the tunnel, being installed in 10-ft. sections and the space between the outside of the steel lining and the bed rock was thoroughly filled with a mixture of 1:3:3 concrete. The work of installing this lining was begun at the lower end in the horizontal section where the pipe is tapered down to a diameter of 5¼ ft. At this point the 20-ft. taper already mentioned was placed. It consisted of 1 3/8-in. steel plates riveted together with butt straps. The taper was placed back in the solid rock and around it was constructed a heavy bulk-head of concrete which was anchored into the bed rock by means of steel rods driven into the sides.

From this point the installation of the light steel lining with concrete back-fill as already stated progressed from the bottom to the top of the tunnel terminating at the reinforced concrete taper that connects with the floor of the forebay. The rock formation through which the force main tunnel was driven is not of the best kind, being very much fractured and broken. It was necessary to timber the greater part of the shaft or incline when it was excavated, and these timbers had to be removed before the steel lining was installed. The timbers were removed ahead of the steel work, the bed cleaned off and the concrete tamped into place without difficulty. At a point about 120 ft. below the top, the men in charge removed some timbers without bracing the bents above. This precipitated a cave-in of the shaft and several men lost their lives, one man being imprisoned for two weeks, after which time he was rescued in good condition. In retimbering the caved portion octagon steel sets of 7-in. 15-lb. I-beams were used, these sets being left in place when the concrete was filled in behind the steel lining.

The lower end of the pressure main, below the taper reducing the diameter to 5¼ ft., was made of 1 3/8-in. steel plates sufficiently heavy to withstand the static pressure without any external support. No concrete was placed around this pipe, and the tunnel was merely left in its original condition with the timber set to support the ground overhead.

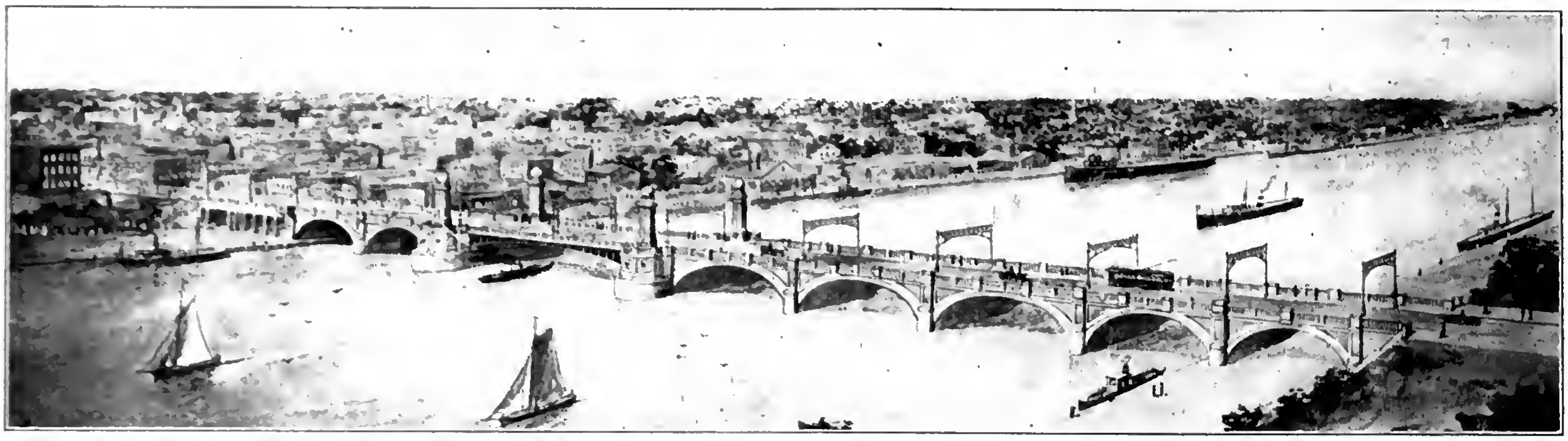
At a point 215 ft. above the power house, a man-hole was placed in the inclined tunnel for convenience in inspecting and for use in case any repair work was necessary. The regular 3/16-in. steel lining was replaced at this point by a section of 1½ in. pipe 30 ft. long.

The steel pipe was shipped to Camp No. 1 at the power house from San Francisco in 5-ft. lengths, 5 sections being nested together for shipment. The outside section was riveted complete on its two longitudinal seams but the 4 inner sections were riveted on one seam only, so as to allow for the nesting. At the camp the pipe was riveted into 10-ft. lengths and hoisted by means of an aerial tram to the forebay site at the upper end of the pressure tunnel. There the sections were secured to a dolly car and lowered by means of a hoist to the point where they were riveted together. This car consisted of a truck at each end of the pipe sections, the latter being hung from two timbers that passed through the pipe and rested on the axles of the truck, as shown in one of the illustrations.

All the piping in the pressure tunnels which is constructed of steel plates of ½-in. thickness and under is made up with standard lap joints, double riveted on the longitudinal seams and single riveted on round seams. All pipe on the work over ½ in. in thickness is made up of butt-strapped joints throughout with triple riveting on each side of the longitudinal seams and double riveting on each side of the round seams.

After the steel lining was completed an inspection of it revealed the fact that there were several places along the bottom of the pipe where voids had been formed in the concrete backing. These voids which were revealed by tapping were caused mainly by the difficulty experienced in tamping the concrete thoroughly around the steel lining. These steel sections were 10 ft. in length and in a few places where large irregular rock excavation occurred at the bottom of a section with but a 9-in. space at the top for handling the tamping bars, some voids were naturally formed because of the insufficient tamping.

Whenever these voids occurred, the pipe was tapped and liquid cement forced until the hole was filled. The apparatus designed on the spot to accomplish this work was an ingenius one. A section of 3-in. steel tube 20 in. long was fitted at the bottom with a cap that would fit the hole drilled in the steel lining. Liquid cement was poured into the void by means of this pipe, which had a capacity of about an ordinary pail. When no more cement would run in there was fitted in the pipe a screw with a plunger at the lower end and a crank at the outer end. By means of this device the cement was forced into the void under pressure until it would hold no more. The pump was then removed and the hole in the lining was stopped up by an ordinary flush pipe plug. There were 116 of these voids tapped and filled through the lining, although but three of them were of any size.



The Proposed Cherry Street Bridge across the Maumee River at Toledo.

A number of the voids required but a pint of the liquid cement, the quantity used varying up to the largest for which ten buckets of the slush was necessary. The slush used was a liquid mixture of Portland cement and sand. The work was carried on from a dolly car fitted with bevelled wheels and lowered down from the top by a steel cable. About 15 days were necessary to complete this special work. After all the voids were filled the entire pipe was painted with asphaltum, the same dolly car being used for the purpose.

Although the design of the pressure main has been criticised by some it is believed that the structure will stand criticism and will prove to be permanent and for that reason economical. The steel lining has a low factor of safety, being only heavy enough to keep its form and resist the internal pressure, while all external pressure is taken up by the concrete back filling, which backed by the rock itself also resists the internal pressures. Being entirely underground and some distance from the surface no trouble will be experienced by reason of expansion and contraction due to temperature changes. The anchorage is a mountain itself so no disastrous effects could result to the pressure main from any water ram that might be caused by improper handling of the water wheels or gate valves.

Branch Piping.—At the lower end of the pressure main was constructed the header pipe made of steel plates, varying in thickness from 1⅜ to ¾ in. at the outer end, and consisting of the following lengths and diameters:

PIPES FOR HEADER.

Length.	Size of Pipe.
33.5 ft.	4¾ ft.
23.0 "	4¼ "
21.0 "	3¾ "
11.5 "	3 "
16.7 "	2⅓ "

These diameters were graduated to maintain as nearly uniform velocity as possible after withdrawing the water for the various branches to supply the water wheel units in the power house. In reducing the force main at the various branch pipes to meet the diameters given, the following taper pipes were employed:

TAPERS FOR HEADER.

Length.					
20 ft.—	Tapering	from	7½	to 5¼	ft.
10 ft.—	"	"	5¼	to 4¾	ft.
10 ft.—	"	"	4¾	to 4¼	ft.
10 ft.—	"	"	4¼	to 3¾	ft.
10 ft.—	"	"	3¾	to 3	ft.
10 ft.—	"	"	3	to 2⅓	ft.

The branches from the force main were taken off by means of a Y on the header pipe and laid out in curved form entering the power house at right angles to the rear well. There is one branch 28 in. inside diameter 50 ft. long, made of ¾ in. plate, for each of the eight water wheels and a 10-in. inside diameter branch pipe for each of the two exciters.

At the end of the last section of the force main is a 28-in. gate valve which discharges into the river. It is proposed to attach to this pipe an experimental nozzle for the purpose of testing nozzle tips, needle valves and similar apparatus and it is expected from such tests data will be obtained regarding the flow of water under varying conditions. In each of the branch pipes leading from the force main to the water wheels are installed two 28-in. gate valves, one outside of the power house and the other inside. The former is intended solely for the purpose of closing off the branch pipe in case of any repairs to the gate or piping. The outside gates are arranged only for hand drive, while those inside of the power house are equipped for operation either by hand or by electric motors as will be mentioned later. The Risdon Iron & Locomotive Works, San Francisco, furnished the steel lining for the pressure main, the branch piping and header, and the gate valves.

(To be Continued.)

The Cherry Street Bridge, Toledo.

The acompanying illustration shows the general appearance of a bridge designed early this year by the Osborn Engineering Company, of Cleveland, for the Cherry Street crossing over the Maumee River at Toledo. The total length of this bridge over all is 1,184 ft., and the width of the river between the established dock line is 900.1 ft. The roadway for which provision has been made is 52 ft. wide and there are two sidewalks of 9 ft. each, making the total width 70 ft. The draw span is of the simple trunnion bascule type, resting on piers 40 ft. wide, and has a clear opening of 200 ft. The masonry arches have various spans, three of them 108 ft., and the others from 66½ to 100 ft.

THE BRUSH CREEK VIADUCT on the Alabama extension of the Illinois Central R. R., is a structure 1,231 ft. long and having a maximum height of 171 ft. 2 in. from the masonry footings to the base of the rail. The total weight of the structure is 1,943 tons. The structure consists of ten 75 ft. deck plate girder spans, nine towers with 40 ft. deck plate girder spans, and two 60 ft. deck plate girder approaches.

View of Erie Canal Break, Looking West.

View of Erie Canal Break, Looking South.

The Syracuse Break in the Erie Canal.

An unusual accident happened to the Erie Canal at Syracuse, N. Y., on July 30. The Onondaga Creek flows under the canal at this place through three stone culverts about 175 ft. long. The west and middle culverts have 25 1/3 ft. span, 6 3/4 ft. rise and abutment walls about 6 ft. high. The arch stones are 2 ft. in depth at the crown, increasing to 2½ ft. at the springing lines. The east culvert is about half the size of the others. The arch of the west culvert probably failed first, under the brick wall of a flour mill, which pitched into the canal. The break extended some 50 ft into the canal, and the stone retaining wall along the south side of the canal caved in for a distance of about 100 ft. The bottom of the canal was washed out 10 to 20 ft. deep for a distance of 150 ft. The general appearance of the canal after the accident is shown in the accompanying illustrations.

At the present writing it is impossible to state just what was the cause of the accident, for the wall of the Amos mill, the wreckage of two canal boats and a great mass of debris cover the ruins of the masonry. It is conjectured by some local engineers that water from the tailrace of the Amos mill, which entered the creek in close proximity to the culvert, probably undermined the foundations and was the direct cause of the accident. It is expected that repairs will be completed in the course of a fortnight.

View of Canal Break, Looking Southeast.

View of Canal Break, Looking East.

A Rapid Ore Car Unloader has recently been installed on the Duluth ore docks of the Duluth, Missabe & Northern R. R., to replace manual labor in breaking up or dislodging the ore in bottom-dumping ore cars when discharging into storage pockets. A traveling crane spans the unloading tracks above the pockets, the cross traveling trolley of which carries vertically adjustable racks of blades which may be forced down into the load of ore in a car with a pressure of 8 tons. Then by the longitudinal movement of the bridge, the blades may act as a sweep to clear the car of contents from either end to the hopper. All three movements of the crane are electrically operated so that the blades may be rapidly spotted over any car on any of the unloading tracks. These machines operate continuously in all conditions of weather and unload the cars at the rate of one car per minute, each machine replacing a large number of men and enabling the work to be carried on continuously throughout the 24 hr.

Tests of Concrete Columns.

A paper read before the American Society for Testing Materials by Arthur N. Talbot, professor of municipal and sanitary engineering and in charge of theoretical and applied mechanics, University of Illinois.

Before taking up a discussion of the recent experiments, I desire to modify a statement made in a discussion of this subject at a meeting of the Society a year ago, since the form of the printed discussion may be misleading. The remark was made that in the tests of reinforced concrete columns made at the University of Illinois there was indication that the steel buckled before the ultimate strength of the columns was reached. Further study of the tests shows that the steel did not buckle or reach its elastic limit until after the load taken by the concrete had reached its maximum, although in a few instances the load sustained by the column when the rods buckled, was equal to or a little greater than the load when the concrete was seen to be taking its maximum stress. Fig. 1 gives the stress-deformation diagram for one of the columns. The line marked "Line for steel" represents the stress in the steel as though distributed over the full area of the column, based on the observed deformation in the column and a modulus of elasticity of 30,000,000 lb. per square inch for the steel, under the assumption that the concrete and steel act together. The line marked "Line for concrete alone" was found by setting down the line for concrete and steel (*i. e.*, for the column as a whole) an amount equal to that given by the "Line for steel." The line for concrete obtained in this way corresponds closely with the line obtained in tests of plain concrete columns. This diagram gives a convenient method of comparing the stress taken by the steel with that taken by the concrete, if we assume that the stress in the steel is proportional to the shortening of the column. The ratio between the unit stress taken by the steel and that taken by the concrete at any stage of the loading of the column, based on the above assumption, for the column tested, is shown in Fig. 2. The average value for this ratio at the beginning of loading is 13; at three-quarters of the maximum load (corresponding to one-half the ultimate shortening) it becomes 18, and at the maximum load 26. The extreme range of this ratio for the individual columns is considerable. It may be also added that in these tests the strength of unreinforced columns was considerably less than the strength of 12-in. cubes made at the same time. A more complete discussion of these tests may be found in a bulletin of the Engineering Experiment Station of the University of Illinois.

Passing now to the tests which have recently been made at the University of Illinois, it should be stated that only a summary of the results will be given here and that a more thorough study of the tests will be made later. The tests include three classes of columns: (1) plain or unreinforced concrete columns, (2) columns reinforced with circular hoops or bands, and (3) columns reinforced with wire in the form of spirals or helices.

The concrete used, unless otherwise stated, was composed of one part of Portland cement, two parts of sand, and four parts of broken stone, by loose volume. A detailed description of the materials and of the method of mixing will not be given here. The columns were fabricated in galvanized iron forms. The concrete was a wet mixture, wet enough to allow stirring or churning in the forms. The forms remained in place for ten days. The columns were built on cast-iron base plates, and an upper base plate was embedded in plaster of paris on the top of the column a few days before the test. The average age at test was about 60 days. The columns were circular, 12 in. in diameter and 10 ft. long. A few were made 9 in. in diameter. In order not to complicate the analysis of strength, the hoops and spirals were barely covered at the surface of the column, the thickness outside the hooping being generally less than ¼ in. The area of the column was taken to be equal to the area corresponding to the diameter of the hooping. The circular bands used for hoops were 1 in. wide and of three thicknesses, No. 8, No. 12, and No. 16 gauge. The yield-point of this material was about 48,000 lb. per square inch. The hoops were electric welded. Tests of the hoops usually showed failure outside of the weld. In the few cases where failure occurred at the weld the breaking load was beyond the elastic limit of the steel. Generally the hoops were spaced 2 in. apart, center to center, although in some columns the spacing was 3 and 4 in. The spirals were No. 7 wire and ¼-in. wire. Ordinary black wire and high-carbon steel wire of both sizes were used. Considerable difference was found in the elastic limit of the high-carbon material; the smaller size gave about 60,000 lb. per square inch, and the larger size 110,000 lb. for the yield-point. For the black wire the yield-point for the No. 7 was 38,000 lb. and for the ¼-in., 54,000 lb. No longitudinal reinforcement was used. The thin longitudinal spacing bars used to hold the hooping in place were not considered in the calculations. In the statement of amount of reinforcement the percentage is based upon the volume of the hooping and the volume of the concrete core; or what is

the same thing. upon the area of the hooping considered to be uniformly distributed over the length of the column and the area of the concrete core.

The plain concrete columns gave results similar to those tested a year ago, both in the ultimate strength and in the character of the stress-deformation diagram. The strength of the 1:2:4 columns averaged about 1620 lb. per square inch, with a range of variation of 30 per cent. on either side of this. The stress-deformation diagrams approximate a parabola, but the total shortening at failure was somewhat less than that given in the 1906 tests. Fig. 3 gives a diagram for one of the columns. An interesting feature of these tests was the determination of the lateral deformation or enlargement of the column. The measurement of this expansion is extremely difficult, and this work is of an experimental nature and the results are not to be considered final. Further study of the data will be required to interpret them fully. It seems, however, that the value of Poisson's ratio found from these tests is generally less than that given in text-books. This is particularly true for the smaller loads. The ratio increases rather suddenly somewhat before the maximum strength of the column is reached. The line at the left of Fig. 3 gives the amount of the lateral unit-deformation. From a hasty study of the results it would appear that Poisson's ratio averages 0.1 or somewhat more, for the lower loads, and that near the maximum load this ratio rapidly increases to 0.25 or 0.3.

Fig. 4 gives the strength of columns made with different mixtures of concrete. The abscissas give the proportion of cement in terms of the weight of the sand and stone used. The results given are the average of two to five test columns. The diagram brings out the effect of adding cement in giving strength to concrete columns.

The general phenomena of the tests of hooped columns are as follows. The early part of the test is much the same as for plain concrete columns. At a load equal to that which would cause failure in a plain concrete column or a little above, the concrete over the spacing bars begins to scale, and this is soon followed with a scaling and shelling off of the surface of the column over the hoops everywhere. With added increments of load the amount of shortening increases rapidly and the column correspondingly expands or bulges laterally. The lateral deflection of the column from a straight line begins to be apparent just before the maximum load carried by the column is reached, and it rapidly increases after the maximum load is passed, forming a curve having the characteristics of the figure shown in text-books for columns with fixed ends. The columns finally bent out of line, in some cases as much as 4 or 5 in., the load finally carried being only a small proportion of the maximum.

Fig. 5 shows the stress-deformation diagram for a column reinforced with circular hoops and may be considered to be characteristic. In this and in the other columns, the load carried when the column had shortened an amount equal to that which plain columns exhibit at failure corresponded to the maximum load of plain concrete columns. If the line beyond the elbow (approximately straight) is produced to the vertical axis or axes of ordinates, the load there indicated agrees closely with the maximum strength of plain concrete. The diagram indicates that up to the load where a plain concrete column would fail, the shortening and the lateral deformation correspond closely with those obtained for plain concrete columns, and but a small stress is developed in the hoops. The line at the left of the figure gives the lateral unit-deformation. Beyond the critical point referred to, the longitudinal deformation or shortening increases rapidly with an increase of load, and the lateral deformation increases correspondingly. The total amount of shortening is considerable, in this column being nine times as much at the maximum load as may be expected in a plain concrete column at its maximum load. The maximum strength of the columns occurs when the bands have been stretched to their yield-point. Beyond this point the deformations increased rapidly, but the load falls off Fig. 6 gives a view of one of these columns after the outside scale has fallen off and some time after the maximum load has been applied.

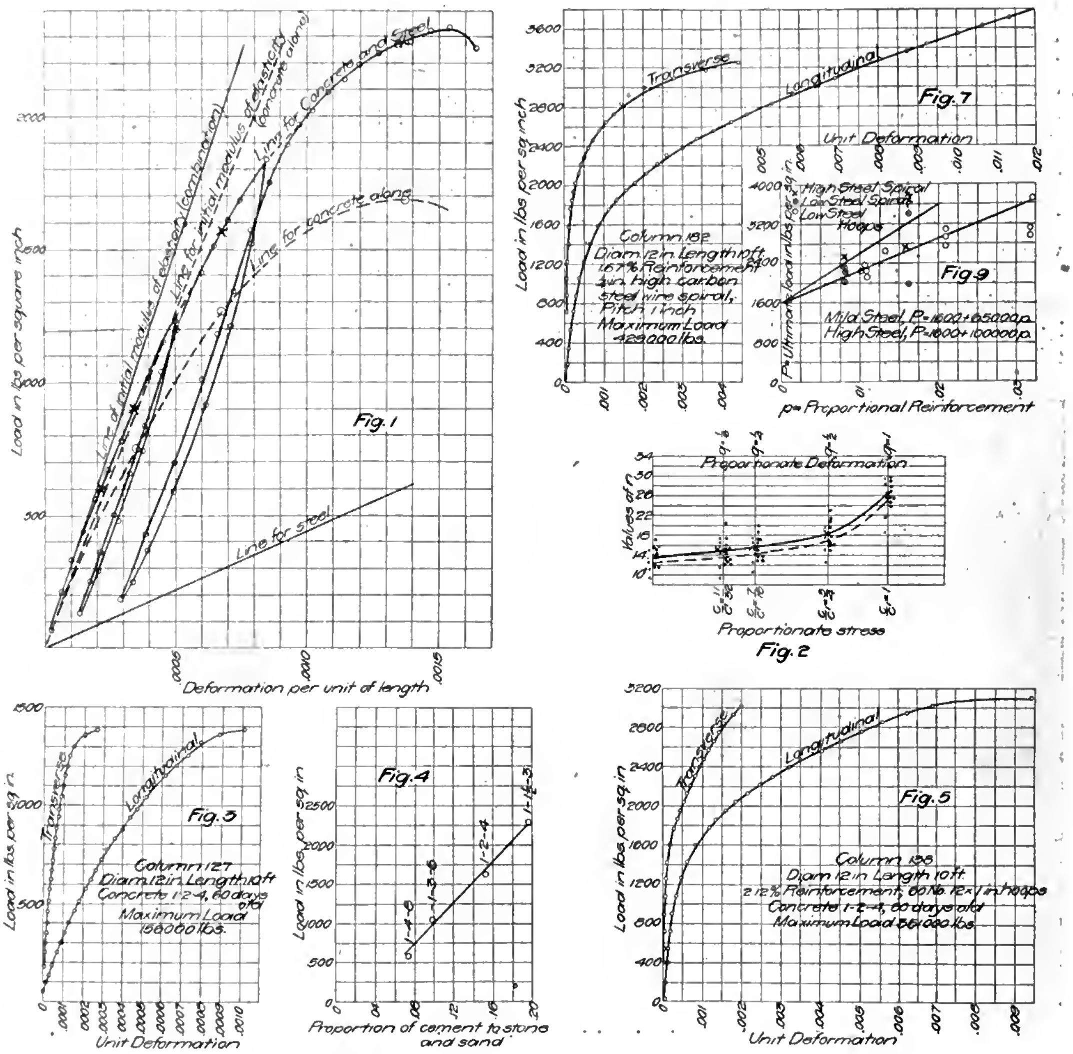


Fig. 1, Stress-Deformation Diagram for Column with Longitudinal Reinforcement. Fig. 2, Ratio of Stress in Steel to Stress in Concrete. Fig. 3, Stress-Deformation Diagram for Concrete Column. Fig. 4, Effect of Mixture on Strength of Concrete Column. Fig. 5, Stress-Deformation Diagram for Hooped Column. Fig. 7, Stress-Deformation Diagram for Column with Spiral Reinforcement. Fig. 9, Strength of Hooped Columns.

Fig. 7 gives the stress-deformation diagram for a column reinforced with high-carbon wire. The early part of the diagram is similar to that already described. The total amount of shortening is greater, as may be expected from the higher elastic limit of the reinforcing. The total shortening at the maximum was 13 times what may be expected in a plain concrete column at the time of failure. The lateral deformation curve shown at the left of the figure cannot be compared with the former one since the instruments were placed on the concrete between the wires and, as would be expected, the lateral swelling at these points is greater than for the reinforcement itself. Fig. 8 gives a view of one of these spirals after the maximum load had been applied.

The results indicate that the strength of the columns is dependent upon the strength of the concrete mixture, the amount of the hooping reinforcement, and the yield point of the reinforcing. In other words, the additional strength over that of plain concrete columns is a function of the amount and strength of the reinforcing. In Fig. 9 are plotted the strength of the hooped columns, and the amount of hooping. The lower line may be considered to represent the strength of the columns with mild steel hooping. Its equation is $P=1{,}600+65{,}000p$, where p is the ratio of the hooping to the concrete core. The upper line is for hooping, having a higher elastic limit. Its equation is $P=1{,}600+100{,}000p$. The columns reinforced with wire having a yielding-point of 110,000 lb. per square inch, gave a still higher strength and, of course, a greater amount of shortening. Equations of the same general nature may be derived from the results of other experiments on hooped columns. The first term represents the strength of plain concrete columns. These equations are given tentatively as expressing the results of these experiments.

It may be of interest to note the relation which exists between the load or longitudinal pressure on the column and the lateral pressure which may be considered to act on the hypothesis of hydrostatic pressure to give the deformation of the mild steel bands. Such of these tests as have been studied indicate that this hypothetical lateral pressure amounts to about 0.35 of the longitudinal pressure acting in excess of the strength of the plain concrete. Comparing the effect of hooping with the additional strength given by longitudinal reinforcement with concrete of the same character (counting in the

latter case that the stress in the steel at the ultimate load is twenty-five times as great in intensity as the stress in the concrete), it appears that the additional strength produced by a given amount of reinforcing material is from two to four times as great for the hooped columns as for columns with longitudinal reinforcement. Attention should be called to the fact that since the shortening in a hooped column at the maximum load is several times as great as in a column with longitudinal reinforcement at the yield-point of the steel, the effect of combining longitudinal reinforcement and spiral hooping is uncertain.

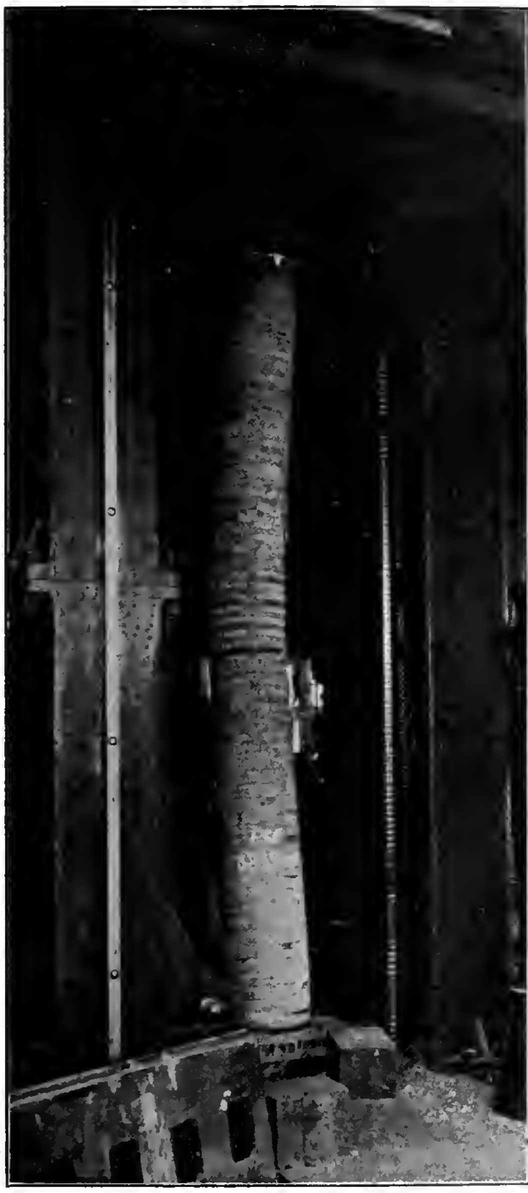


Fig. 6. Hooped Column.

Fig. 8. Helical-Wound Column.

An experiment of some interest was made by first loading a hooped column and then stripping the wire from it and testing the naked column. This column was loaded to 2000 lb. per square inch, and showed a unit shortening of 0.0036. The load was released and a set of 0.0025 was found. A load of 2000 lb. per square inch was again applied (the unit-shortening becoming 0.0041) and then released. The spiral was then stripped from the column without taking it from the machine and the naked column failed at 1080 lb. per square inch. As the indications of the stress-deformation diagram are that the plain concrete would have held 1200 lb. per square inch on the first application of the load it may be considered that the concrete sustained 90 per cent. of its original strength. The hooped column itself might have held 2200 or 2400 lb. per square inch. A test was made with a column eccentrically loaded. It was found that the hooped column acted as would be expected of a homogeneous column under the same conditions. This may have a bearing upon the explanation of the action of such columns. An analysis based on hydrostatic pressure would require that the internal pressure be distributed uniformly over the column, and hence only concentric loading would be allowable.

The writer feels that there is much yet to be learned about hooped concrete, and he has already had to give up several preconceived notions of the action of restrained concrete. As experimental work which helps to clear up uncertainties may be of advantage to the engineering public, the writer presents this matter without waiting for a complete study of the data, and gives the following tentatively as observations on these tests.

1. Poisson's ratio for concrete in compression is a variable quantity, increasing considerably just before the ultimate failure of the concrete. A value of 0.1, or somewhat more, may be tentatively given for the lower loads, and 0.25 to 0.3 near the crushing load. This concrete set in air.

2. In hooped columns the hoops do not come into action to any great extent before a load equivalent to the ultimate strength of plain concrete, or a little below, is reached. The longitudinal deformation and lateral deformation of the concrete are not modified by the hooping to any great extent before this load is reached.

3. Beyond this point both the longitudinal deformation and the lateral deformation are approximately proportional to the added load. The ratio of lateral to longitudinal deformation is more nearly constant, and in these experiments the ultimate strength of the column is controlled by the elastic limit of the hooping.

4. The total amount of shortening before failure occurred was very great, averaging something like 8 or 10 times that for plain concrete columns, and 60 times that at the ordinary working stress in plain concrete. The longitudinal shortening is, say, 8 times that of mild steel at its elastic limit. Cracking and peeling of the concrete appear at loads corresponding to the ordinary ultimate strength of concrete.

5. The excessive amount of shortening before failure affects the problem of combining hooping and longitudinal reinforcement very unfavorably, if the stresses are to be kept within the elastic limit of the latter.

6. The lateral deflection of hooped columns is large and may affect the ultimate strength which is available for the column. For continued application of stress beyond the maximum load, the column deflects enormously. Scaling of surface of concrete and lateral deflections are warning signs given well before danger of failure exists.

7. The concrete itself retains a considerable element of its strength even after it has shortened in a hooped state four or five times as much as would produce failure in unhooped concrete columns.

8. Columns of richer and leaner concrete exhibited phenomena of similar characteristics, the hoop stress becoming effective at the ultimate strength of unhooped concrete.

9. Hoops of high elastic limit steel give greater strength than of mild steel, but the increased amount of shortening necessary to develop the full strength of the column is an undesirable feature.

10. One experiment indicates that hooped columns will resist eccentric stresses in somewhat the same way as will other material.

11. Light hooping offers security against sudden failures and unevenness of concretes, and will enable higher working stresses to be used. In combination with rich concretes and longitudinal reinforcement, using low stresses in the hoops, i. e., basing the strength upon an assumed ultimate strength but little beyond the average ultimate strength of plain concrete) a satisfactory column may be made. It is suggested that a column of this character may be designed in such a way that the longitudinal reinforcement may carry the load during construction and still not be overstressed later for the additional stress which goes with the concrete, provided the basal point for the column strength is somewhat below the ultimate strength for plain concrete.

12. Heavy hooping gives added strength, but in utilizing the full strength of such columns the column shortens unduly, deflects laterally, and will strain longitudinal reinforcement many times beyond the deformation which exists at the elastic limit of the metal. It may be applicable where a large limit of safety is desired, or where large variations in shortening are unobjectionable, as where the structure is articulated. So far as ultimate strength is concerned, hooping adds two to four times as much strength to the column as does an equal amount of longitudinal reinforcement.

A Heavy Rainfall, 1.85 in. in 25 min. and 2.78 in. in an hour occurred in Baltimore on July 18. On July 12, 1903, 2.78 in. fell in 35 min., the record precipitation for the city. The heaviest storms recorded in the United States are 11.5 in. at Campo, Cal., in one hour; 8.8 in. in one hour at Palmetto, Nev., and 6.9 in. in 55 min. at Tridelphia, W. Va.

The Fall of an Arch of the Berlin City Railway.

The accident to an arch of the Berlin City Railway described in the following notes is considered by "Beton und Eisen," from which the information is taken, as a complete proof of the unreliability of the tensile strength of masonry, for the high character of the construction of this viaduct is well known. The fallen arch differs from the others only in the fact that the latter have the rough brickwork exposed. Owing to its location it was considerably ornamented, as were a few other spans adjoining it. The fallen portion shows an interesting view of the structural character of the arch. The brickwork of the latter is about 2 ft. thick and below it a large hollow space exists, the lower side of which was formed by the ornamental work, which did not have the same shape as the main arch. In order to give it the necessary support a wire cloth with coarse mesh was employed. The space between the brickwork and the ornamental surface amounted in some places to as much as a couple of yards. The piece that fell from the arch came from the neighborhood of the abutment and in falling badly injured the decorative arch below. It was a triangular mass of masonry weighing about 3 tons, the sides measuring from 6 to 10 ft. The smooth bed of concrete over the masonry shows a yawning diagonal crack, opening as much as 6 in. at the widest point, which apparently existed for considerable time. Below it the masonry was smeared with oil and tar, which apparently had gradually worked down for a long time from the ballast above. It is considered possible that eventually water and oil forced their way down into the pores of the masonry and that the adhesion of the joints was thus gradually destroyed.

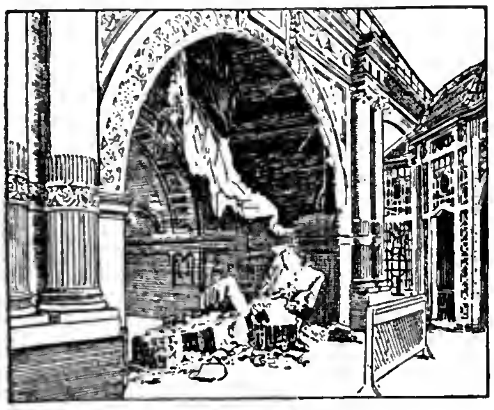
Opinions concerning the cause of the accident are very divided. It is reported that an investigating committee found that one of the foundations had sunk about 1¼ in. In other quarters it is believed that in consequence of the continued vibration due to the passing trains cracks were caused in the masonry which were not observed on account of the decorations hiding them from the eye. Part of the damage has also been attributed to the very severe winter. The moisture entering into small cracks of the main arch might have been frozen on account of the severe cold and thereby caused heavy stresses.

It is not to be overlooked, according to the journal from which these notes are taken, that the falling of so large a block of masonry would not have been possible had the disturbing forces not been great enough to overcome the shearing strength of the masonry and the friction due to the horizontal pressures. Nevertheless it is possible that the assumptions made in the course of the computations of the arch may not have been entirely fulfilled by the actual construction, and that during the setting of the masonry a part of the arch became pressed together very little or not at all, since in this work there was no provision made for a general uniform division of the loading over the individual arches. Under such conditions, if a few cracks destroying the shearing resistance arose, they would be sufficient to allow the mass thus separated to fall.

An Improved Arrangement of Service pipes has recently been adopted by Mr. Frank E. Merrill, water commissioner of Somerville, Mass. Instead of laying numerous small pipes across the street, one for each house, the method is now employed of laying one pipe 1½ in. in diameter from the street main to the sidewalk, and then extending smaller branches from this service pipe up and down the sidewalk to the various houses. Where the conditions are favorable a brick chamber is constructed in the sidewalk so that the main service gate and all the branch gates and connections can be reached.

Dust Prevention in the Boston District.

Dust prevention and road destruction in and about Boston have been receiving the attention of the Massachusetts Highway Commission, the Metropolitan Park Commission and the Boston Park Commission, and so many experiments are being made on a large scale that before long it is reasonable to expect some valuable information will be obtained. The work is particularly interesting on account of the extensive use of automobiles in the Boston district, and the consequent destructive travel on most of the good roads in that vicinity. One of the most thorough tests is being made by the Metropolitan Park Commission on the Revere Beach Parkway. A portion of this well-known roadway was treated with tarvia last year and another portion has been similarly treated this year. The procession of motor cars along this parkway is a close one at certain times of every pleasant day, and the effect of the treatment in preventing dust and the destruction of the road is consequently being determined with unusual thoroughness. In places the roadway which was treated last year has gone to pieces, raveling out somewhat like an ordinary



Damaged Arch at Berlin.

broken-stone road in very dry and windy weather; the surface shows a considerable quantity of loosened stones, but even there the road is practically dustless. The latter condition has been obtained without any watering, which shows the value of such applications in preventing dust, and indicates that while the first cost of an application may be large, the saving due to the omission of watering may largely counterbalance the expense of applying the tarvia.

It is believed that these badly worn places are due to the effect of the heavy motor car travel, but there are other places where holes occur which are believed to be due to the presence of too much clay or loam in the binding material used in making the road or to the application of the tarvia when the roadbed contained considerable moisture. In this connection it might be stated that there is a marked difference between the methods of applying tar preparations in the vicinity of Boston and the methods which are considered most satisfactory in France. In France never more than a thin coat of grit, amounting to little more than a mere sprinkling, is applied to the treated roadway, while about Boston a heavy coat of screenings seems to be considered necessary. This and some other differences in methods result in an average cost of about 12 cents per square yard for tarring some of the Massachusetts roads as compared with about 3 cents in France.

While tarvia has been used extensively, other preparations are being employed and some of them have already had considerable use. An experience with one of these, a preparation of Kentucky oil, in which some asphalt is dissolved at Revere Beach indicates that where the surroundings of the road have to be kept as clean as practicable, it is necessary to take special precautions to prevent their staining from the spreading of the preparation beyond the surfaces to which it is applied. In this particular case concrete gutters had been constructed and great care was taken to prevent the liquid from reaching them. This liquid leaves the roadway almost black, and an attempt was consequently made to keep any of it from the light gray gutters. This was successfully done while the material was being applied, but during the night following its application a rain occurred which washed some of it into the gutters, which were badly stained in consequence, thereby injuring one of the particularly attractive features of the roadway. An attempt will be made to restore the appearance of these gutters by cleaning. Another interesting experiment with this preparation of Kentucky oil and asphalt is being made by the Metropolitan Park Commission in Watertown, where a long stretch of gravel road is being treated with it. If a gravel road can be made more durable and its dust reduced by such an application, the result will be decidedly important, particularly in those districts where good road gravel is abundant and broken stone is costly.

The State Highway Commission is proceeding in a conservative way to test the various methods of reducing the wear on roads, and expects to spend about $20,000 this year in the work. For the present its experiments are confined to the use of tarvia, as it seems to give a more durable surface than other preparations which the Commission has observed in service; while the latter may be successful in laying dust, the Commission desires to obtain some material which will actually improve the surface of the road or at least reduce the rate of its deterioration. An interesting fact which has been brought out by the experience to date is that the application of preventatives of dust and wear to a new road is of little value. The surface of the new road is open and until it has been subjected to enough traffic to become consolidated and to permit the cementing action of the materials to form a compact mass, the application of tarvia and other preparations seems to be of little use.

Right-of-Way Areas.

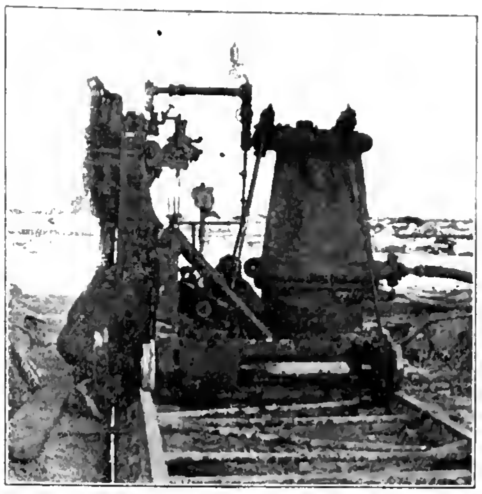
Rights-of-way of various widths are readily reduced to acreages by means of the following table, compiled for use by the engineers of the Western Pacific Railway Co. The acreages are for rights-of-way 100 ft. long and of the widths respectively stated; thus: a right of way 100 ft. wide and 1 mile long contains 1.21 acres ($0.229568 \times 52.8 = 1.21+$.) Logarithms of the respective areas as well as the acreage of 1 square foot and its logarithm are also given. Areas may be readily figured by the use of the slide rule in conjunction with the table:

Right of Way Width.	Area in Acres.	Logarithm.
10 feet	.022957	8.3609113
50	.114784	9.0598813
60	.137741	9.1390633
100	.229568	9.3609113
120	.275482	9.4400932
148.5	.340908	9.5326371
150	.344352	9.5370026
180	.413222	9.6161834
200	.459136	9.6619413
1 sq. ft. =	0.0000229568	—5.3609113

A Vitrified Clay Water Main 12 in. in diameter and 3 miles long has been constructed at Hobart, Okla., under the direction of the U. S. Geological Survey. It is made of double-strength pipe and is subjected to a maximum head of 14 lb. The joints were calked with oakum and run with a mixture of both pure and crude asphalt and petroleum.

The West Neebish Channel of the St. Mary's River.—II.

Rock Excavating and Handling.—The depth of the rock cutting varies from nothing at each end of the 8,600-ft. cut to as much as 27 ft. at the middle of the latter, with an average depth of 15 to 16 ft. The rock has mostly all been taken out in two lifts, the faces being worked the full width of the cut. Four steam shovels and four cableways have been used, one shovel to each cableway. Generally, the shovels have been worked in pairs, one shovel removing the top lift, and being followed by the other working on the second lift. The work has been handled in two lifts in this manner, in order that the sides of the cut could be made vertical with channeling machines. Four of these machines have been used, two Sullivan and two Ingersoll-Sergeant, all of which are capable of cutting to a depth of 14 ft. The specification provided payment for the removal of the sides of the excavation to a slope of 1 on 1, but stipulated that the contractor would be paid for all excavation out to these slopes, if the sides of the cut were channeled, which has been done accordingly.

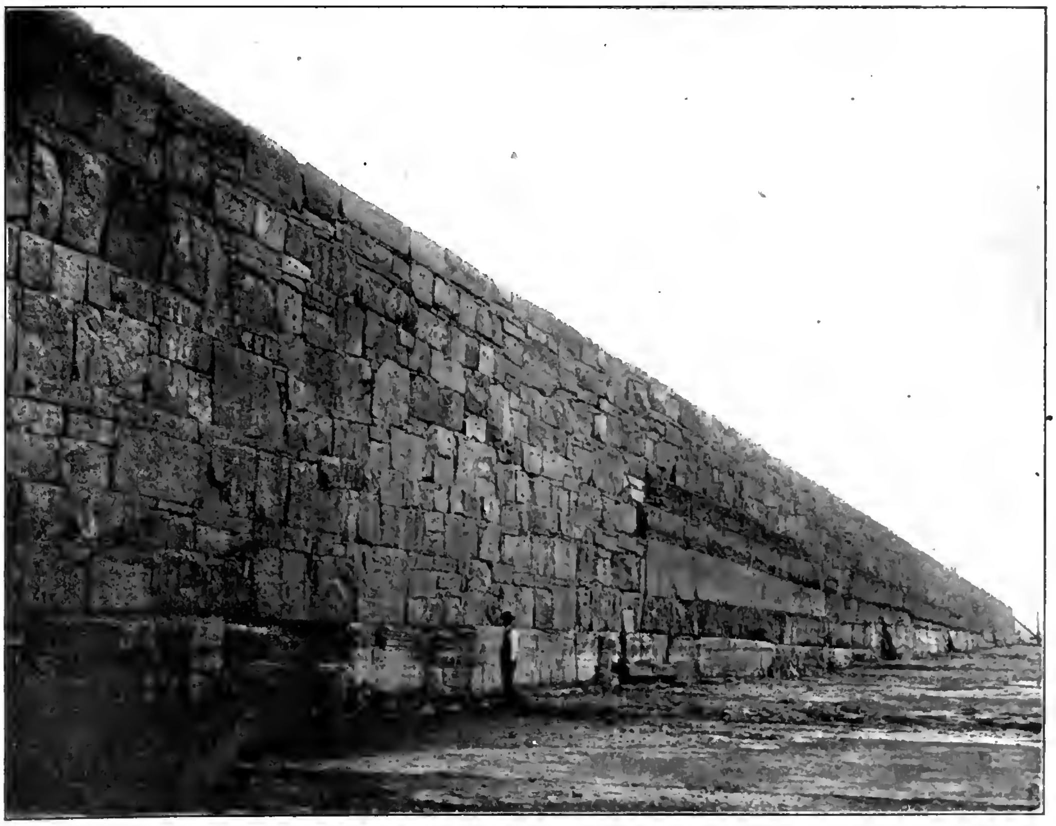


One of the Channelers.

General View of River Improvement at Rock Section.

The holes for the blasts necessary to break up the hard rock are made with 3¼-in. Rand drills, 30 of which are installed. The holes are made in two or three rows, depending on the character of the rock and other circumstances. Owing to the nature of the rock, the blast holes have to be placed at the four corners of 4 x 6-ft. or 5 x 5-ft. squares, making the cost of blasting very high. Half of the face of the cut is shot at a time, in order that the drills may be working on one half while the shovel is removing the muck from the other half. Dynamite is used for blasting, which is done almost entirely in the daytime.

The four steam shovels used in loading the loosened rock into the cableway skips are specially adapted to working in the cut. They are Model 60 Marion shovels, each with a 26-ft. boom carrying a 2½-yd. bucket. Each shovel is equipped with a traction gear which is capable of propelling it on wheels with 30-in. tires, without track, the same as the Model 20 shovel made by the same company is propelled. The driving gear is attached to the front wheels, the 10-in. steel axle of which is fixed, the steering being done with the hind wheels, which are on a pivoted axle. The shovels move on the rock bottom of the cut back and forth along the face without difficulty and can make a complete turn to start work in the opposite direction in 15 to 18 minutes. At rare intervals the shovels become stalled on rough bottom, or toward the ends of the cut where the rock runs out. The fall blocks of the cableway serving the shovel are then fastened to the front or the rear end of the latter, which can thus be helped along over the bad spot without any trouble.



Part of the Heavy Walls along a Portion of the Channel.

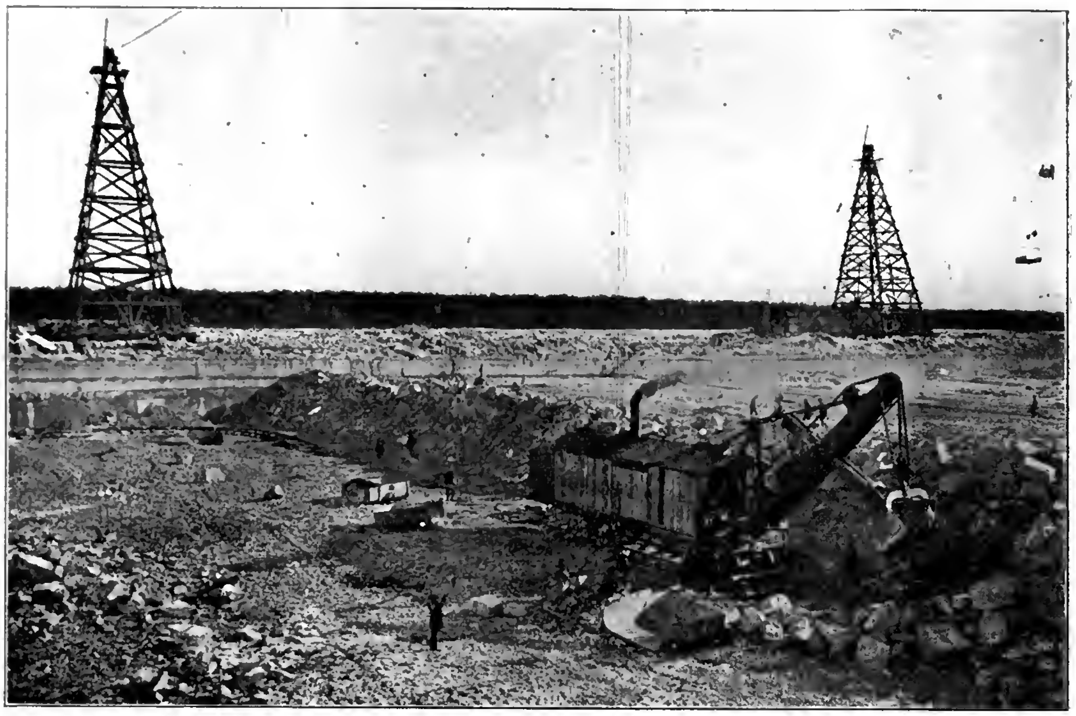
The boilers of the shovels are all supplied with water from a pump in the plant midway on the cut which houses the boilers supplying steam to the 8-in. and 12-in. reciprocating pumps in that plant. A 2-in. exposed pipe line, extending to both ends of the work from this plant has been able to supply water to the shovels and to hoisting engines for the derricks that are installed during the coldest weather by a method of operation which has been developed since the work was started. A 5,000-gal. circular wooden tank is placed in the boiler room of the plant and is heated during cold weather by the exhaust steam from the 8-in. and 12-in. pumps. Either of the two pumps on the supply line to the shovels and derricks draws from this tank, the steam exhaust of the pump in service being turned into the suction pipe of its water end. The temperature of the water is thus raised to about 100° Fahr., by the exhaust from the three pumps, so it does not fall below the freezing point before reaching the shovels and derricks even during the most extreme weather, due to a method of operation that has been adopted. When a shovel engineer needs water he can ring an electric signal bell in the pump house. The pump is then started and run until the engineer signals again, when it is shut down. The water left in the pipe leading to the shovel is then immediately blown out under a pressure of 90 lb., with air from the compressor supply line, and the pipe closed until water is required again. Arrangements were made to use steam to thaw the pipes after the water has been drawn from them, but the steam has never been necessary, as the distributing pipes are free from ice at all times.

An interesting condition developed in connection with the operation of the air line used to blow out these 2-in. water supply pipes. Shortly after the 2-in. air line for blowing the water pipes was installed it became difficult to maintain the usual pressure in the main air lines. Investigations determined that, on the average, the 2-in. water supply pipes required air about 7

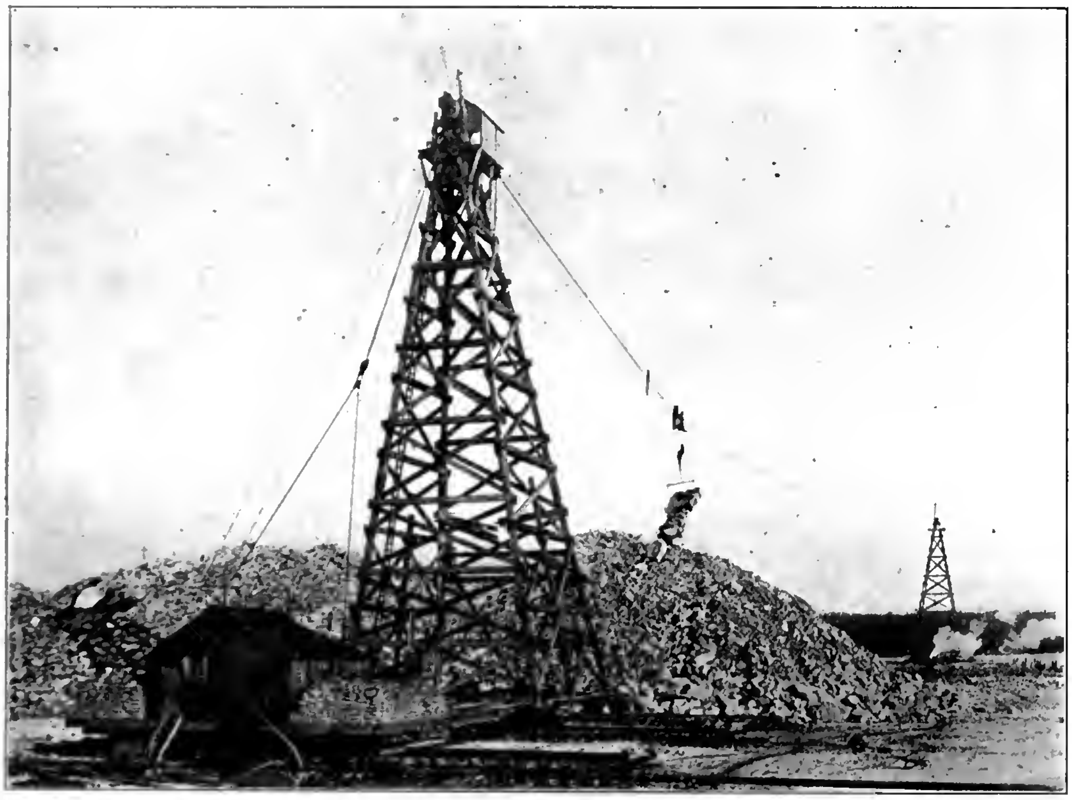
hr. out of the 24 hr., so a large amount of air was thus consumed. A plate with a ¼-in. circular hole was then placed in the 2-in. air supply line to the pump, in order that no air might be wasted. The result was that the pressure in the main air lines was at once restored, although the water could be blown out of the supply line as efficiently as before.

The four cableways are worked in two pairs, one pair operating from a point near the middle of the cut to the downstream end of the latter, and the other pair from the middle to the upstream end. The specifications were written with the idea that the channel may eventually be widened on the east, or island side. Accordingly, the material from the excavation can be dumped in the river adjacent to the improved channel, so long as the spoil banks within 300 ft. of the east side of the latter are not higher than the top of the retaining wall along that side of the cut. On the west side of the channel, the spoil banks are permitted to come within 50 ft. of the cut and the space between them and the latter can be filled to the level of the top of the wall. Owing to the nature of the river bed and bank on the west side of the cut for about 3,600 ft. from the upstream cofferdam, head towers for traveling cableways could not be operated with any degree of safety or satisfaction. The ground on the island side of the upper end of channel was satisfactory for the operation of the head tower, however, so cableways long enough to span the 300-ft. channel cut, the 300-ft. berm along the latter and sufficient space for spoil banks between the edge of this berm and the head towers had to be installed. At the downstream end of the channel conditions were much more favorable for the operation of head towers on the mainland side of the river, permitting shorter-span cableways to be installed.

The four cableways were made by the Lidgerwood Mfg. Co.; the two upstream ones have spans of 1,100 ft. each and the two downstream ones, spans of 800 ft. each. The capacity of the cableways is probably best illustrated by the loads which they have carried regularly in service. The stone which is being removed from the cut is very dense, weighing about 4,600 lb. to the yard; pieces of this stone containing 6 to 8 cu. yd. have been lifted out of the excavation, however, and conveyed to the spoil banks without any apparent difficulty. The head and tail towers are all mounted on trucks traveling on rails parallel with the cut. These towers have a clear height of 103 ft. above the base of rail, each pair of towers containing 85,000 ft., board measure, of timber. The front end of each tower of the 1,100-ft. span cableways is carried by seven pairs of wheels, three pair in a group under each corner and one pair on the center line. Seven more pair of wheels are placed under the rear legs of the tower and are spaced the same as those at the front end of the latter. Three lines of rails laid under the counterweight end of the tower platform carry eight pairs of wheels, staggered alternately so each outer rail of the three carries four wheels and the middle one eight. As compared with the usual arrangement of wheels for a cableway tower, in this case an extra pair is added under each leg of the tower and a pair under the middle of each side of the tower platform. The great load on the wheels and rails is thus distributed in such a way that bending of the rails is prevented. The tracks can therefore be kept up and the towers can be moved much more easily than if fewer wheels had been used. The towers for the 800-ft. span cableways are the same as those just described except they have five pairs of wheels in a row where the others have seven. A 50-h.-p. moving engine is provided on each tower.



Steam Shovel Loading Cableway Skip.



One of the Cableways and Its Spoil Bank.

Each cableway is operated by a double 12¼ x 15-in. engine driving a 59-in. hoisting drum, all in a house on the head tower. This engine gives the carriage a hoisting speed of 250 ft. and a traveling speed of 1,200 ft. a minute. The section of the hoisting drums carrying the endless cable line is covered in each case with a rim of boiler plate steel which wears much better than the regular material in the drum and can be replaced readily when worn. The carriage of each cable is equipped with an extra block, and an increased diameter section is added to the hoisting drum of the engine, so the skips can be dumped in the air by the hoisting engineer. This aerial dumping device was invented by Mr. Locher during the progress of the work on the Chicago Drainage Canal, and is the one which has been in general use since then.

A 2¼-in. lock-bar cable, made by the Trenton Iron Works, is used on the main cable in each machine. The repairs to the lock-bar cables have been very much simplified since the inception of the work, until now all minor repairs and some rather extensive ones are made without lowering the cable. When a strand breaks the ends at the break are lapped about ½ in. and are filed down on a bevel to form a flat joint, as nearly as possible. This is wrapped with fine brass wire, then covered with a little borax and heated to the welding point with a blow torch. The brazed joint is then filed down to the same cross section as the remainder of the strand, in order that the latter may be driven back into place. In case the ends at a break are not long enough to lap, a piece is cut out of the strand and another piece long enough to lap is welded in its place. Small steel clamps with tightening screws are placed around the cable to hold the loosened strands in position

while the repairs are being made and to assist in replacing the mended strands.

The repairs to the cables and cableway carriages are greatly facilitated by small cabins erected over the ends of the cables at the head towers. During the extremely low temperatures which occur in the winter it would be practically impossible to make repairs on these towers, 100 ft. or more above the ground without some such protection, and even with the latter men are often frost-bitten.

The skips used in connection with the cableways have a capacity of 6 cu. yd. each. They are built of heavy steel plates, but the extremely hard rock which is handled into them with the steam shovels breaks and bends them very quickly, 35 of these skips having been used in this work.

Retaining walls varying from 5 to 20 ft. in height and having a minimum top width of 5 ft., are built along both sides of the channel for a length of 5,000 ft. The tops of the walls are 6 ft. above extreme low water, the walls being built as a guide to traffic. They have been built of large stones taken from the cut, many of these stones containing 2 to 6 cu. yd. The limestone through which the channel cut is being made is quite evenly stratified and breaks out in regularly shaped pieces. At points where the stone occurred in particularly uniform strata, areas were reserved from the general excavation in order that the rock might be quarried carefully out of these areas for use in the walls. Four stiff-leg derricks operated by steam-driven hoisting engines, are used in handling the stone in these small quarries and in building the wall. With the exception of these four hoisting engines, the steam shovels and three pumping plants, all of the equipment on the work is operated on air from the central compressor plant.

The work within the cofferdams is now rapidly approaching completion. The rock cut is finished up to within a short distance from each end, the excavation having been carried to and below the required grade, and the bottom finished as the work progressed. The excavation had to be carried below the grade in places in this manner in order that the steam shovels could follow the plane of the inclined strata which occur in the rock. The retaining walls along this cut are practically done. A small amount of earth excavation between each end of the rock cut and the main cofferdam will be taken out with the steam shovels and conveyed to the spoil banks by the cableways. When this is finished and the work has been cleaned up it is planned to admit the water into the area enclosed by the cofferdams very slowly to prevent any of the loose material being washed into the channel. The portion of the cofferdams across the channel and the small portion of the channel in earth between the ends of the rock cut and the cofferdams will then be removed with a dredge.

The progress that has been made in executing this work is well worthy of notice. As has been mentioned the first work was started early in the summer of 1904, but it was early in the summer of 1905 before the whole area enclosed by the cofferdams was unwatered. Therefore, practically all of the work will be done in two and one-half years; at the same time, it should be borne in mind that the time limit on the work does not expire until Aug. 18, 1908, or in other words, the contract will be completed nearly a year ahead of time.

The quantities of materials handled by the plant installed also merit attention. During the month of June, last, the four cableways and four steam shovels handled approximately 86,000 cu. yd. of rock, or an average of 21,500 cu. yd. to each shovel and cableway. The output for July will be approximately the same amount. The monthly output since the four shovels and four cableways have been installed has ranged in the neighborhood of 65,000 cu. yd. In this connection it is interesting to observe that the ouput of the cableways used most sucessfully in rock cuts on the Chicago Drainage Canal ranged in the vicinity of 8,000 cu. yd. a month when operated an eleven-hour day shift. At the same time, the rock in that work was much more easily blasted and was not so hard on plant as is the rock which has been encountered in this contract.

Sixty-five Ton Shovel and Six-Yard Skips.

Another significant feature of the operations on this work is that the number of skips of stone handled at night by the cableways is about the same as the number handled in the day time. This condition may probably be attributed to two principal causes, the lighting and the efficient method of inspection and repairs which is followed. The method of inspection and repairs is also largely responsible for the maintenance of operations so successfully during the winter.

The lighting in the field is done with portable Kitson gasoline lamps, enough of which are used so all operations can be carried on without interference. The blasting is practically all done during the day, but when any blasting has to be done at night the lamps can very readily be moved out of range.

The method of inspection and repairs that is followed is very thorough. In the first place, the whole work is so far isolated from a base of supplies that a very large amount of extra parts and materials for repairs are kept on hand constantly. For instance, an extra steam shovel dipper, a dipper arm, one of the heavy traction gears and shaft, and so forth, are always ready for use. The small parts of the various machines are also kept in quantities in a supply house, the total quantity of extras and repairs on hand representing about $20,000. The parts of each machine which are most liable to need replacing, such as the cableway sheave wheels and the like, are kept at the machine in order to save the delay necessary to bring extras from the supply house. A blacksmith and machine shop in which most repairs can be made is also provided. The second feature of this maintenance system is the inspection method followed. A mechanic and helper are placed in charge of each two cableways, the carriages of which are carefully inspected at meal hours, or at other times when they are brought to the head towers. Any necessary repairs are made then, if possible, but if it is impracticable, they are delayed until a more favorable time. The steam shovels are also under the constant supervision of a mechanic, whose sole duty is to go over the shovels daily in an endeavor to find any defective parts. That this unusually close system of inspection has proved profitable, is evident from the rapid progress which has been made.

The supplies for the three camps which the contractor built and maintained on the mainland at the work are brought from Sault Ste. Marie by boat during the open navigation season, and over land in sleighs the balance of the year. Coal to operate the various plants and for the camps is delivered entirely by boat, enough being brought in each summer to last through the winter. Thus far, in the neighborhood of 40,000 tons of coal has been used. The majority of this has been required in the compressor plant. A road was built through the dense timber along the river by the contractor and such coal as is used at points where delivery is not made by boat is hauled along this road in wagons.

The improvement of the West Neebish Channel is being carried on under the direction of Col. Chas. E. L. B. Davis, Corps of Engineers, U. S. A. Mr. L. C. Sabin is assistant engineer, Corps of Engineers, U. S. A., with headquarters at Sault Ste. Marie, Mich., and has charge of all construction and administration of the nagivation in the St. Mary's River. Mr. Sutton Van Pelt is in immediate charge of the work under Mr. Sabin. Mr. A. S. Robinson is local manager of the Sault Ste. Marie office of the MacArthur Bros. Co.

The New Warehouse of the Newark Warehouse Company.

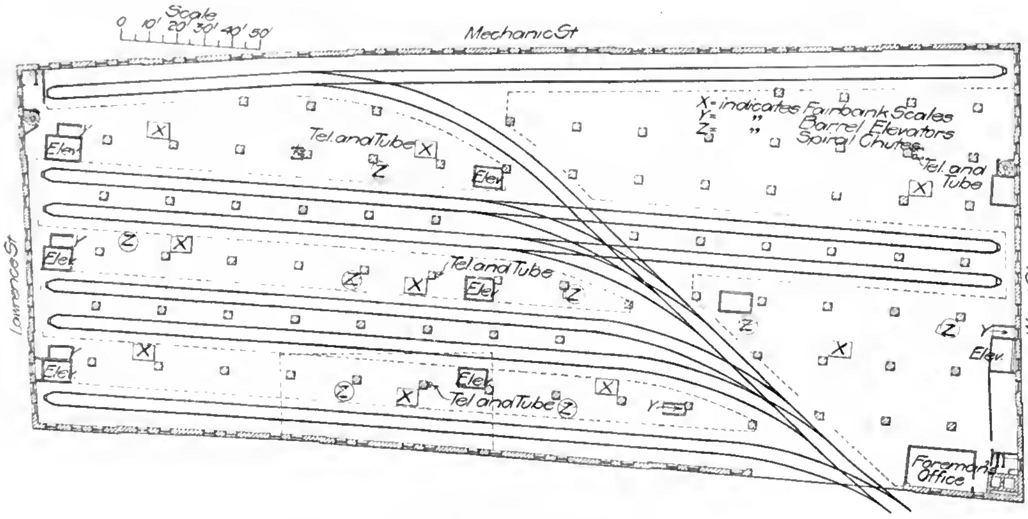
The Newark Warehouse Co. has just completed a large 6-story fireproof building in Newark, N. J., which presents some interesting features of warehouse design, many of them due to the peculiar local conditions in Newark. The building will be used by the Central R. R. of N. J. to accommodate its local freight business and this fact combined with the scarcity of available property and the elevation of the tracks of the railroad through the city caused the adoption of a design differing widely from those customary for terminal facilities. At the same time the building offers a safe and convenient storage for freight which is not taken promptly by the consignee and thus allows the release of cars and their prompt return to service. The building, therefore, combines the facilities of a freight delivery and receiving terminal and of a general storage warehouse.

These facts made the method of managing the building an important consideration which was finally worked out so that the entire structure with its contents is under the control of the warehouse company. The tariff covering the storage charges varies according to the class of merchandise and is double the rate for the first month, and single rate thereafter, the double charge covering the cost of handling the freight to and from storage. The question of insuring a building of this character together with its valuable contents is also a matter which received careful consideration. The building was constructed and equipped with fire protection apparatus to meet the requirements of the Associated Mutual Fire Insurance Companies with the result that they have written the insurance not only on the building but have taken a blanket policy on its contents.

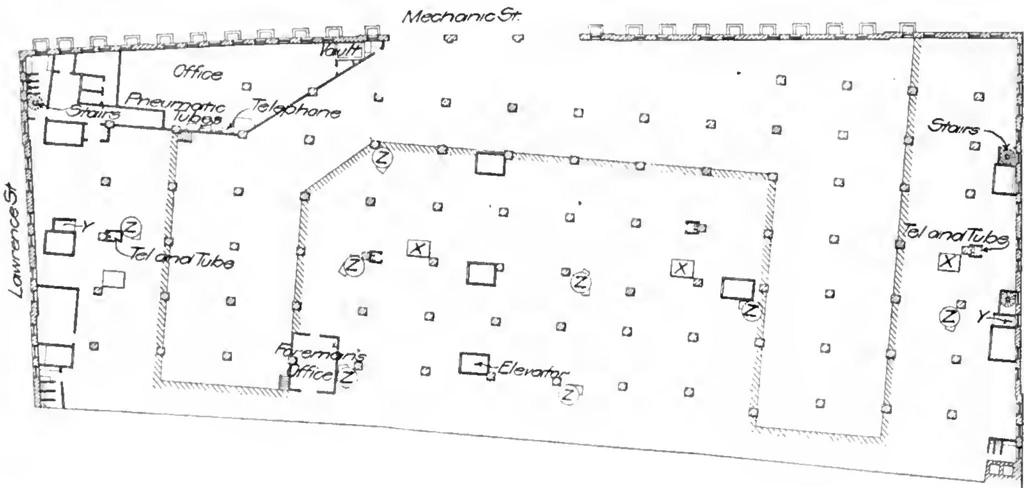
The building is situated on Mechanic St., between Ward and Lawrence Sts., extending back to the property of the Central R. R. of N. J. It is 360 ft. long with a width varying from 130 ft. on Lawrence St., to 165 ft. on Ward St., and has a storage capacity of about 1,200 carloads of freight. It is a steel frame structure with reinforced concrete walls and floors, containing 7 floors in all, the first devoted to teaming, the second to the freight tracks and the basement and the four top floors to storage. The fact that the tracks of the railroad are elevated through the city made it advisable from the first to unload the cars on the second floor and this immediately required provisions for lowering large quantities of freight to the teaming floor as well as a skillful arrangement of tracks inside the warehouse to allow of the unloading of as many cars as possible at the same time. The transfer of large quantities of freight between the first and second and the storage floors further emphasized the need of rapid and adequate elevator facilities.

The use of the ordinary platform elevator was considered not only expensive but very slow and it was therefore decided to put in spiral conveyors suitable for lowering packages in the form of barrels, boxes or bags of a limited size. These spiral chutes though used to a limited extent in some department stores have not, so far as is known, been applied to the handling of large quantities of miscellaneous freight. They are 8 in number, 5 with single and 3 with double spirals, all made by the Otis Elevator Co. They are constructed of sheet steel enclosed in cylinders 7 ft. in diameter. Three of them extend from the top to the first floor, one from the 6th to the 2nd, two from the 2nd to the basement, five from the 2nd to the 1st floor. The reason for the principal connection between the 1st and 2nd floors is that the majority of freight passing through the warehouse will be direct from the cars to the teams. The conveyor extending from the 6th to the 2nd floor is for freight which may come from the storage floors to be reloaded into cars. The discharge openings of these conveyors are permanently fixed at certain floors but packages can be placed in them at any of the floors which they reach. They are adapted for any packages no matter how small up to a maximum of 36 in. square and 4 ft. long. Their carrying capacity is only limited by the rapidity with which the packages can be put in at the top or taken away at the bottom.

There are 5 electrially-driven barrel elevators installed by the Link Belt Engineering Co., two running from the basement to the top floor and three from the 2nd to the top floor, having carriers about 8 ft. apart attached to an endless chain. They are adapted for either sacks, barrels or boxes and have an almost unlimited capacity, it being possible to raise a carload of flour to any of the floors in half an hour or less. They can be run in either direction, so that the packages can be lowered as well as elevated by them, but the probability is that practically all the freight which they raise will be lowered by the spiral conveyors. Automatic trips are installed at each floor and when once set discharge the elevator without further attention. When the elevators are used for raising packages, special arms are attached to the frames of the elevator shafts and on these arms are placed the packages to be carried up by the elevator. The carriers come up between these arms and pick up the packages. In case the elevators are used for lowering freight the packages are placed on the carriers by hand and caught by the arms just referred to on the floors where they are to be discharged. Special skids or platforms are used to aid the safe delivery from the elevators. The nine platform freight elevators are of the direct-connected electric type made by the A. B. See Electric Elevator Co., and have a carrying capacity of 6,000 lb., with platforms either 7 x 10 ft., or 8 x 12 ft. in size. One elevator runs from the 1st to the top floor, two from the 1st to the 2nd floor and the other 6 from the basement to the top floor. They will be used for large packages which cannot be handled by the barrel elevators or the spiral conveyors.



Plan of Second or Track Floor.



Plan of First or Teaming Floor.

The design of the 2nd floor of the building influenced to a large extent the arrangement of the other floors. As seen by the accompanying sketch the cars are brought inside the building and unloaded from 6 parallel tracks to platforms which are raised to the level of the car floor. The ends of the tracks toward Lawrence St., are intended particularly for inbound freight and at the Ward St. end for outbound freight, which may be reloaded in the cars from the different storage floors. The cars on the tracks at the Lawrence St. end of the building can be handled by a switch engine, but those placed on the tracks toward Ward St. will be handled by ropes running to an electrically-driven capstan. The capacity of all the tracks is about 45 cars.

The location of the elevators and spiral chutes was arranged so as to afford the greatest facility for handling the freight as it came from the cars, whether intended for immediate delivery to the teams on the first floor or for storage in the rooms above. The platforms on both the first and second floors are provided with Fairbanks automatic scales, nine on the second, and four on the first floor to afford a convenient means for weighing the freight.

The first floor is devoted to the delivery of freight to teams, and to the main office which is located at the corner of Mechanic and Lawrence Sts. The large platform in the center is intended for freight coming direct from the cars and the two end platforms for the freight com-

ing from storage, but in case of emergency either or both of the two end platforms can be used for freight going direct from the cars to the teams.

The entire operation of the warehouse is controlled from the office by a private telephone system with stations on all the platforms of the first and second floors and at the center of the storage floors. The system also connects with the lines of the Central R. R. of N. J., reaching all outlying points in the railroad yards, and with the public telephone system of the city of Newark. On the platforms the telephones are placed in the small offices which have been provided for the clerks looking after the freight. In addition to controlling the operation of the warehouse by means of the private telephone system, there has been installed a pneumatic tube system which affords means of sending orders or receipts from the office to any point in the warehouse. The telephone and the tube systems together will afford a quick and positive means of communication between the office and the various sections of the building and will thus greatly expedite the handling of the business. The pneumatic tube system was installed by the Lamson Consolidated Store Service Co.

The basement is divided into 13 sections, 10 of which are devoted to storage and are intended for such stocks as it is desired to keep cool and in a uniform temperature. One of the remaining sections contains a reservoir for supplying the fire pumps and the other the engine and boiler room. The latter contains a heating boiler for warming certain sections of the building and a reserve space wherein can be placed a turbine generator if it is ever desired to make the building independent of outside sources for electric current. A twin stack has been put in the building so that a ventilating equipment can be installed in the basement should that ever become necessary, one of the flues being reserved for this purpose. The fire pumps and air compressors are also located in this section of the building.

The third, fourth, fifth and sixth stories are divided transversely into 5 large storage compartments reached by 7 platform and 5 barrel elevators and 3 spiral chutes. In addition, at each end of the storage floors, there is a large open space around the elevators which can be used temporarily for freight that has not been allotted regular storage space. The floors are divided into about 100 sections each, by having numbers painted on the beams overhead to indicate the sections, these divisions permitting a record to be kept of the definite location of any merchandise which may be stored in the building. The carrying capacity of each floor is also plainly marked at each section. The elevators and chutes are lettered and numbered and at each opening of the spiral conveyors the floor at which the packages will be discharged is shown by a number.

The partitions between the compartments are of hollow tile double-celled blocks 8 in. thick, and the stairways and elevator shafts are enclosed with tile blocks 4 in. thick, laid in Portland cement mortar. The doors between the compartments are standard tin-covered fire doors, made of 3 thicknesses of 1-in. white pine boards, hung on an inclined rail, with a standard automatic fusible fastening allowing the door to close in case of fire. Similar doors are used for the barrel elevators and stairways. The doors for the platform elevators were made by the Automatic Door and Gate Co., and are self-closing whenever the elevator leaves the floor and can be opened only from the elevator side except on the first story. The windows have metal frames and sash, glazed with wire glass, with an automatic fusible attachment making them self-closing in case of fire.

New Warehouse of the Newark Warehouse Company.

The building is equipped throughout with the dry system of sprinklers installed by the General Fire Extinguisher Co. In this system numerous air valves throughout the lower stories of the building cut off the water from the sprinkler heads, thus leaving the pipes and headers charged with air, which is released by fire, acting on the sprinkler heads, permitting the discharge of water from the heads. The system can be supplied from three independent sources, thus guaranteeing against failure of any one or two of the supplies. Water can be obtained from the high pressure service of the city of Newark, maintaining a pressure of 140 lb. to the square inch, from two hemispherical-bottom tanks, furnished by the Chicago Bridge and Iron Works, of 30,000 gal. capacity each, carried 25 ft. above the roof of the building, or from two 750-gal.-per-minute electrically-driven centrifugal pumps drawing on a 150,000-gal. reservoir in the basement of the building. The pumps were furnished by the Fales & Jenks Co., Pawtucket, R. I., and were designed to meet the requirements of the Mutual Insurance Companies. The three independent water supplies are connected to a header located near the pumps on the Ward St. side of the building and by a system of valves any of the sources can be used at will. There are also stand pipes on each floor, with connections for 2½ in. hose, which can be used in case of necessity, but the main reliance is upon the automatic action of the sprinkler system. The power for operating the fire pumps as well as for the elevators and lighting is supplied by the Public Service Corporation and is distributed from a switchboard located in the engine room.

Except for the office on the first floor, the toilet and air valve rooms, and a 60 x 75-ft. section on each of the four upper floors, the building will not be heated.

The building is equipped with the Eco-Magneto clock system with stations at different points to insure the proper patrol by the watchman, and fire-alarm stations connected with the headquarters of the Newark fire department will also be installed throughout the building. These excellent fire protective measures have resulted in insuring the building and its contents at a very low premium with the Mutual Companies.

Construction.—On the south side of the warehouse is the freight yard of the Central R. R. of N. J., elevated above the street about 25 ft. at Ward St., and about 12 ft. at Lawrence St., the embankment being held up by a retaining wall running the entire length of the building. This wall had to be underpinned for a depth varying from 12 ft. at the low end to 25 ft. at the high end before the excavation of the building could be started. The material used for underpinning was concrete put in in short sections, thus avoiding any shoring or bracing. It had to be done with great care as the tracks next to the wall were constantly in use.

The retaining wall was utilized as a foundation for the enclosing walls of the building above the second story, but not for the support of the steel structure, the foundations for the columns being entirely independent of the retaining wall. The latter had a considerable batter which necessitated cutting chases into the wall so as to set the outside columns out far enough to permit the enclosing walls to rest on top of the retaining walls. The cutting of these chases was slow and expensive and after various methods had been tried it was found that the most efficient was by the use of air drills. The chases varied from about 3 ft. deep at the bottom to nothing at the top.

Borings made at the site showed that the natural ground was sand with slight indications of quick-sand. The spread of the grillage beams as at first planned allowed for a load of 4 tons per square foot on the soil and to avoid any risk of settlement the foundations were made a continuous plate of reinforced concrete extending the entire area of the building, and projecting from 6 to 8 ft. beyond the center lines of the outside columns. This plate was 15 in. thick, made with Vulcanite Portland cement, reinforced with extra heavy expanded metal and on it was placed the grillage beams carrying the cast-steel pedestals of the columns. Both the grillage beams and the pedestals were enclosed in concrete.

The steel work of the building carries the entire live load and is unusually heavy. The floor of the second story, which carries the tracks, was designed under the specifications for railroad bridges of the Central R. R. of N. J.,

taking as the load the heaviest type of switch engine, the remainder of the track being filled with cars having a capacity of 80,000 lb. each. In addition the usual live and dead loads are allowed for on the platforms adjacent to the tracks. The lay-out of this floor compelled the omission of certain columns above the first story and the span of the track entrance doors necessitated unusually heavy girders. The steel in the structure weighs over 7,000 tons, was furnished by the American Bridge Co., and erected by the Pittsburg Construction Co.

The building was first designed to have the enclosing walls above the street of brick with stone trimmings, but labor conditions arose in Newark which necessitated changing to reinforced concrete. The walls are independent of the steel work and are carried down to the concrete plate for a foundation. They are embellished to an unusual extent for concrete work with rustications, mouldings, dentils, and cornices, which have resulted in giving the building a very finished appearance.

The reinforcement of the walls consists of expanded metal supplied by the Expanded Metal Engineering Co., and of ¾-in. rods laid horizontally about 4 ft. apart, overlapping at the ends, with special reinforcement in front of the columns. The concrete in the walls is very dense and there have been no indications of moisture working through. The concrete was a 1:2:4 mixture, using Cow Bay washed sand and ¾-in. trap rock, mixed with Atlas Portland cement. Particular care was taken in the selection of the sand and stone so as to insure getting perfectly clean and uniform material.

The walls are 20 in. thick to the second story, 16 in. thick to the third story, and 12 in. from there up to the top, the parapet walls above the roof being 3 ft. high. The mouldings forming the horizontal lines, such as belt courses, cornices, were carefully levelled, great pains being taken to secure true lines for the concrete work. The cornice has a projection of about 3 ft. from the face of the walls and required very heavy construction for the support of the forms. After the forms were removed from the walls the latter were refinished by applying a very thin 1:2 mortar so as to thoroughly fill all voids, and then rubbed, leaving no thickness to the finish. This has proved very satisfactory and there is no indication of chipping or flaking and no cracks have developed.

The floors above the basement are of reinforced concrete, 6 in. thick for a live load of 300 lb. to the square foot, and 8 in. thick for a live load of 500 lb. to the square foot, the reinforcement being extra heavy expanded metal. They are made of the same proportions of concrete as the walls and finished with 1 in. of cement mortar applied at the same time that the concrete was laid. The surface has been treated with a special material imported from Germany which has made it hard and durable and done away with the dust which usually arises from cement floors. The roof is a 4-in. concrete slab of the same proportion as the floors, covered with a 5-ply felt and gravel roof. The water caught in the gutters is carried to cast-iron pipes carried inside the building with a steam pipe alongside of them so as to prevent freezing in winter.

On the second floor the rails for the tracks rest directly on the 7/16-in. steel floor plates, which are supported by I-beams about 16 in. apart. The rails are fastened with bolts and clip washers, the hole in the plate being made water-tight by a heavy felt washer. After the rails were laid, the joints in the plates, which in all cases came over the I-beams, were carefully cleaned out and run full of a specially prepared coal tar pitch, and the entire surface of the plates was coated with a prepared asphalt paint, making the floor water-tight. The ends of the tracks are protected by Ellis bumpers. The roadway on the first floor is made of rock asphalt blocks with a special asphalt coating or cushion about ⅜ in. thick, this coating being of such a consistency as to afford a firm footing for the horses. The pavement was laid by the Neuchatel Asphalt Co. An oak wheel guard is laid in front of the platforms, with an oak buffer fastened to the upper edge to protect the latter from the wheels of the wagons backing in. The basement floor rests upon the fill, which was put in over the concrete plate, forming the foundation, after the grillage beams and column bases were set.

The columns throughout the building are encased in stone concrete having a minimum thickness of 3 in. outside the steel work. For a height of 4 ft. above the floor they are protected by a steel plate guard, filled with concrete, with an additional cast-iron wheel guard around columns in the driveway of the first floor.

The concrete for the building was all mixed in two 1-yd. electrically-driven Smith mixers located in the basement of the building. A temporary track was laid on the steel work of the second floor and the crushed stone was brought in on cars and dumped into large bins built on the steel work of the first floor. The sand was delivered by carts on the first floor and dumped into a hopper from which it was elevated by a bucket conveyor to bins adjoining those for the stone. The cement was received in cars brought in on the temporary tracks and lowered by a chute to a storehouse on the first floor. The sand and cement were discharged by gravity into measuring bins and the cement and water were added as the material passed into the mixers. This reduced the labor of handling the material to a minimum.

Concrete was raised to the different floors by a contractors' platform elevator driven by a steam hoisting engine. The concrete was discharged by the mixers into specially designed carts having a capacity of 6 cu. ft., consisting of a bucket swung between two high spider wheels. They were easily handled by one man and when raised to the floor on which the concrete was needed were run onto plank runways laid on the steel work and wheeled to the point where the concrete was being placed. The use of these carts required the erection of some extra scaffolding, but that was fully paid for by the increased capacity of the carts over wheelbarrows.

The concrete was put in in sections, generally from the top of the windows to the sill of the windows above, and then the piers between the windows were put up. Where the height was too great for these sections to be put in in one operation, work was stopped and levelled off at the height of one of the V-shaped horizontal joints. In the top surface of each section steel dowels were embedded in the concrete, sticking up about 5 in. with an inverted V projection to prevent any water which might be driven into the horizontal joints, from passing to the inside face of the walls. Vertical expansion joints were provided about once in 50 ft., finished with a V-shaped joint on the outside or concealed in the angles formed by the offsets of the outside walls. The concrete was placed in the forms for the walls by being dumped into a sheet iron hopper, attached to the bottom of which was a telescope canvas chute, the lower part of which was kept just above the concrete already deposited

Track or Second Floor of the Warehouse.

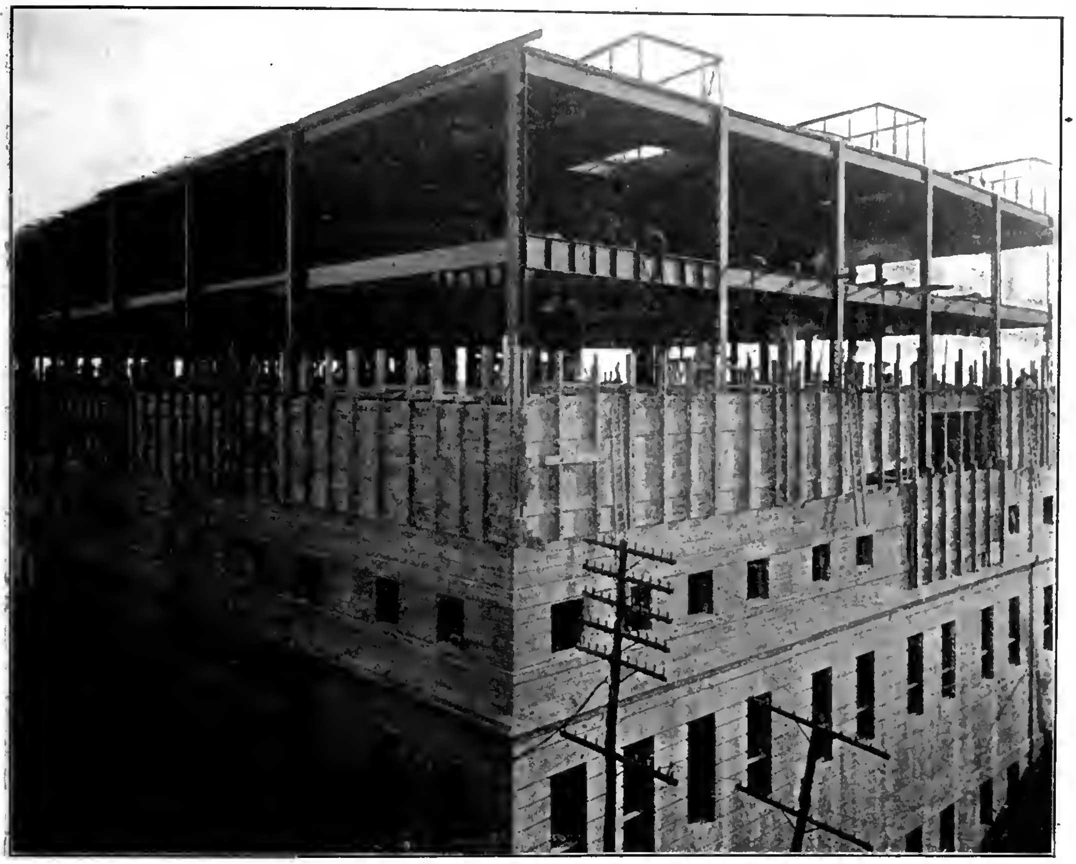
This prevented any splashing as the concrete was placed in the forms and aided materially in getting a good surface. The forms were not coated with any special materials to prevent the concrete from sticking to the boards any more than to keep the wood thoroughly wet before the concrete was put in. The concrete was in a very plastic state and was thoroughly spaded to remove all air bubbles and to push back the stone from the fact of the wall.

The building being of skeleton steel construction, permitted of attaching the forms to the steel frame in such a manner as to absolutely insure stability and accuracy. On each tier of beams outriggers were placed which were securely fastened to the beams by special steel clips which were easily removed. To these outriggers the uprights or studding were bolted and the plank forms were attached to the studding in sections, the outside of the form in many cases being used several times without being taken apart. The inside section, however, had to be practically rebuilt each time the form was raised.

The ⅝-in. bolts which held the forms together were passed through moulded concrete blocks about 4 in. square which had been prepared beforehand and allowed to season. The blocks were of the same length as the thickness of the walls, and the hole being ¾ in. in diameter allowed the bolts to be readily withdrawn

when the forms were struck. They were moulded into the walls and when the forms were removed the holes were filled with cement mortar.

The delay in erecting the steel work, due to the strike of the iron workers last year, prevented the enclosing walls being built before the cold weather set in last fall and when the steel work was finally completed the novel experiment was tried of putting on the roof before any of the floors were constructed. After the roof was made watertight the centering which was built for the reinforced concrete of the roof was lowered to the floor below and there formed the centering for the sixth floor. This was repeated from floor to floor and reduced the cost of removing the centering to a minimum. This procedure had the added advantage of preventing the drip from the floors as the concrete was laid from injuring the floors below as would have been the case if they had been laid from the bottom going up. The enclosing walls were carried up and connected with the roof before the severe cold weather of January. The windows were then closed and the work on the floors continued by the use of salamanders throughout the winter, no damage being done by the frost.



Method of Constructing Walls with Shutter Forms.

The building was designed and constructed under the general direction of Mr. Jos. O. Osgood, engineer of the Newark Warehouse Co., by the John W. Ferguson Co., Paterson, N. J., and New York City. Mr. Wm. Verbaarschot was the superintendent for the contractor and Mr. A. W. Smith represented the Newark Warehouse Co.

Heavy Galvanized Sheets are in use on the Northern Pacific Ry. for the decks of wooden bridges to guard against fire, as the burning of timber bridges is mainly due to hot cinders from the ash pans of locomotives. Galvanized sheets are put on in 8-ft. lengths with copper rivets, the rails being laid on top of the sheets and spiked through. Bolts for the bridge timbers are also passed through the sheets and at the ends of the bridge decks the sheets are flashed under the first tie of the road bed on either end and no part of the framework is exposed.

The Massachusetts Position Regarding Pollution of Streams by Mill Wastes.

The brief note in this journal on Aug. 3, concerning the decision of the Massachusetts Supreme Judicial Court in Parker v. American Woolen Co. has interested so many readers that the text of the court's statements regarding stream pollution are reproduced below without change.

It is difficult, if not impossible, to reconcile all the decisions which have been made upon the question of the right of riparian proprietors to use the waters of streams flowing through or along their lands. This is a common right, and each must exercise it with all due regard to the rights of others, and each must submit to that degree of inconvenience and hardship in the exercise of his rights which results from the existence of like rights in others. In such cases, each proprietor is entitled to use the stream in such reasonable manner, according to the usages and wants of the community, as will not be inconsistent with a like use by other proprietors above and below him. Cary v. Daniels, 8 Metc. 466, 41 Am. Dec. 532; Thurber v. Martin, 2 Gray, 394, 61 Am. Dec. 468; Gould v. Boston Duck Co. 13 Gray, 442. Many of the decisions relied upon by the defendant are instances of the application of this rule. Pitts v. Lancaster Mills, 13 Metc. 156; Springfield v. Harris, 4 Allen, 494, 81 Am. Dec. 715; Jones v. Portsmouth Aqueduct, 62 N. H. 488; Snow v. Parsons, 28 Vt. 459, 67 Am. Dec. 723; O'Riley v. McChesney, 49 N. Y. 672.

Cases in which the proprietors of sawmills have been allowed to throw sawdust and similar refuse into the streams frequently for the reason that the mills practically could not be run unless this was allowed to a reasonable extent, generally have been put upon the same ground. Haskins v. Haskins, 9 Gray, 390; Hayes v. Waldron, 44 N. H. 580, 84 Am. Dec. 105; Jacobs v. Allard, 42 Vt. 303, 1 Am. Rep. 331; Canfield v. Andrew, 54 Vt. 1, 41 Am. Rep. 828; Prentice v. Geiger, 74 N. Y. 341. But permission to do this has been refused where it was found to make the water impure and unfit for drinking and domestic purposes. Lewis v. Stein, 16 Ala. 214, 50 Am. Dec. 177. And the tendency of the later decisions is to restrict somewhat the liberality of the original rule. Lockwood Co. v. Lawrence, 77 Me. 297, 52 Am. Rep. 763; Canfield v. Andrew, 54 Vt. 1, 41 Am. Rep. 828; Red River Roller Mills v. Wright, 30 Minn. 249, 15 N. W. 167, 44 Am. Rep. 194. And in Canfield v. Andrew, supra, the court is careful to say in its opinion that no one is allowed to deposit any substance in a running stream that will pollute its waters to the injury of a lower riparian proprietor.

It is of course true that many of the uses which properly may be made of the water of a natural stream by the upper riparian proprietors will be likely to tend somewhat to defile the water. Sprague v. Dorr, 185 Mass. 10, 69 N. E. 344. Its use for watering cattle and for the irrigation of fertilized land, or for bathing or other domestic purposes, will have directly that tendency. Water cannot be made to pass through the propelling machinery of a mill without becoming more or less impure; nor can the water be made available for any manufacturing use without some incidental deterioration of its quality. Surface drainage into the stream will become more and more injurious to the condition of the water as population along its banks grows denser. No one has the right to complain of injury to the quality of the water coming from any of these causes. Wells, J., in Merrifield v. Worcester, 10 Mass. 216, 219, 14 Am. Rep. 592. The natural flow of surface drainage from occupied land or from streets, though much increased by the adoption of newer systems, so as materially to injure the water of a brook into which it runs, will afford no cause of action to a lower riparian proprietor. Bainard v. Newton, 154 Mass. 255, 27 N. E. 995. Perhaps the decision in Pennsylvania Coal Co. v. Sanderson, 113 Pa. 126, 6 Atl. 453, 57 Am. Rep. 445, can be justified upon the ground that the injury there complained of resulted in reality from the water pumped from the plaintiff's mine having drained over the surface of the ground into the brook; upon which reason indeed it is partly rested in the opinion of the court. See Crossley v. Lightowler, L. R. 2 Ch. 478.

We regard it however as settled that no riparian proprietor has the right to use the waters of a natural stream for such purposes or in such a manner as will materially corrupt it to the substantial injury of a lower proprietor, or to cast or discharge into it noxious and deleterious substances which will tend to defile the water and make it unfit for use. This was the doctrine laid down in Wood v. Ward, 3 Exch. 748. It has been maintained in the English courts. Mason v. Hill, 5 B. & A. 1; Pennington v. Brinsop Hall Coal Co., L. R. 20 Eq. 769, 772. It is affirmed in our own decisions. In Merrifield v. Lombard, 13 Allen, 16, 90 Am. Dec. 172, it appeared that by the mode in which the defendant had conducted his business a large quantity of poisonous and corrosive substances was permitted to run into a stream, which defiled and corrupted the water to such an extent that the machinery in the plaintiff's mill, lower down on the same stream, was corroded and his use of the water for proper purposes was impaired and prevented; and the defendant was enjoined from continuing so to act, and the court said: "We know of no rule or principle of law by which such a mode of appropriation of a running stream, in the absence of any proof of a paramount right or title, can be justified or excused as against a riparian owner of land on the same stream below." In Dwight Printing Co. v. Boston, 122 Mass. 583, it was held that a riparian owner has no right, in the absence of express

grant or prescription, to use the waters of a stream for dyeing or printing woolen or cotton cloths in such a way as to pollute the water and render it unfit for drinking purposes.

The same doctrine has been incidentally affirmed in other decisions of this court. Washburn & Moen Manuf. Co v. Worcester, 153 Mass. 494, 497, 27 N. E. 664; Walker Ice Co. v. American Steel & Wire Co., 185 Mass. 463, 471, 70 N. E. 937; New England Cotton Co. v. Laurel Lake Mills, 190 Mass. 48, 52, 76 N. E. 231. There is nothing inconsistent with it in Harris v. Mackintosh, 133 Mass. 228. It has been repeatedly and strongly declared in other states. "Riparian proprietors, mill owners or others have no right to render the water of a stream unwholesome or offensive." Richmond Manuf. Co. v. Atlantic De Laine Co., 10 R. I. 106, 14 Am. Rep. 658; Silver Spring Bleaching Co. v. Wanskuck Co. 13 R. I 611 (in which the court said: "The right of every owner of land bordering on a stream to the use of the water is well settled; and the fact that he also owns a mill does not lessen his rights. * * * And he has a right to have the water pass his land in its natural, pure state"); Bradley v. Warner, 21 R. I. 36, 41 Atl. 564; Holsman v. Boiling Spring Bleaching Co. 14 N. J. Eq. 335; Chapman v. Rochester, 110 N. Y. 273, 18 N. E. 88, 1 R. A. 296, 6 Am. St. Rep. 366; Middlestadt v. Waupaca Starch & Potato Co., 93 Wis. 1, 66 N. W. 713. In all these cases, it was held that the right of the lower riparian proprietor to the free use and enjoyment of the water of a natural stream extended as well to its quality as to its quantity. And see the cases cited in Gould on Waters, § 219; Wood on Nuisances, 427 et seq; Angell on Water Courses, § 136 et seq. The right to use the stream to carry away mere waste matter in a reasonable manner and to a reasonable extent is not so to be extended as to include a right to discharge into the stream noxious and deleterious matter to such an extent as sensibly and materially to foul the water and destroy its purity and fitness to be used by others.

It is true of course that there is in any large body of water a purifying principle which will, either by ordinary sedimentary deposit or by chemical change, obviate the evil effects which otherwise would arise from the deposit therein of some limited amount of noxious matter. Accordingly it is not for every small deposit of such matter that the law will give a remedy. This was the case in Brookline v. Mackintosh, 133 Mass. 215. There doubtless must be a material and sensible deterioration of the quality of the water; and this was recognized in the rulings made by the single justice. So in Townsend v. Bell, 167 N. Y. 462, 60 N. E. 757, it was found as a fact that the defendant's use of the stream did not render its waters unfit for manufacturing, mechanical or domestic purposes. Merrifield v. Worcester, 110 Mass. 216, 14 Am. Rep. 592, was decided on the doctrine that a city is not to be held in damages for having adopted an improper sewerage system.

Nor can we doubt that the plaintiff is entitled to an injunction to restrain the defendant from continuing to pollute the stream, in order to prevent it from gaining a prescriptive right, even though such pollution does not interfere with any use of the water which the plaintiff is now making. Crossley v. Lightowler. L. R. 3 Eq. 279; Pennington v Brinsop Hall Coal Co., L. R. 20 Eq. 769, 772; Brookline v. Mackintosh, 133 Mass. 215, 224. And it follows from what we have already said that the plaintiff is entitled to an injunction which will restrain the defendant from discharging into the stream any noxious or offensive substances to such an amount or in such a quantity as to affect noticeably or appreciably the purity of the water when it reaches the plaintiff's premises so as to render it materially less fit for drinking or for other uses than it was when it entered the defendant's premises. Simpson v. Hoddinott, 1 C. B. (N. S.) 590; Merrifield v. Lombard, 13 Allen, 16, 90 Am. Dec. 172; Richmond Manuf. Co. v. Atlantic De Laine Co., 10 R. I. 106, 14 Am. Rep. 658; Holsman v. Boiling Spring Bleaching Co., 14 N. J. Eq. 335. The court can fix no standard of reasonable use which will be more favorable to the defendant, or restrict any farther the terms of the injunction to be issued. The defendant must at its peril see that it does not overpass this limit.

Nor can an injunction properly be refused on the ground of the magnitude of the defendant's interests and the importance of its business. Some stress was laid upon this consideration in Pennsylvania Coal Co. v. Sanderson, 113 Pa. 126, 6 Atl. 453, 57 Am. Rep. 445; but the case was decided on other grounds. The same argument was urgently pressed to no purpose in the somewhat similar cases of Lockwood Co. v. Lawrence, 77 Me. 297, 52 Am. Rep. 763, Silver Spring Bleaching Co. v. Wanskuck Co., 13 R. I. 611, and Holsman v. Boiling Spring Bleaching Co., 14 N. J. Eq. 335. And here, as in the case last cited, the effect of the injunction will not be to stop the defendant's works or to interfere with its manufacturing industry, but simply to restrain it from discharging offensive matter into the stream and thereby polluting the waters which flow through the plaintiff's land. Here, as in that case, it does not appear that the offensive matter cannot readily and at small expense be otherwise disposed of; if a system of filtration or other purification is necessary, the expense of this should not be thrown upon the plaintiff. Richmond Manuf. Co. v. Atlantic De Laine Co., 10 R. I. 106, 14 Am. Rep. 658. Nor is it material that other causes have contributed to the pollution of the stream. This does not excuse the defendant for its wrongdoing. Crossley v. Lightowler, L. R. 3 Eq. 279. This is the principle of Corey v. Havener, 182 Mass. 250, 65 N. E. 69, and Ouliglan v. Butler, 189 Mass. 288, 293, 75 N. E. 726. Nor is this a case in which the defendant is simply discharging noxious matter into an already polluted stream. It is expressly found by the master that the water when it reaches the defendant's premises "is good, clean, clear brook water, fit for any kind of manufacture or for domestic use."

TRACING CLOTH makes a good window shade in drafting rooms where the sunlight from an unshaded window is too strong. It is also useful in shading electric lights.

Experiments With a Jewell Filter at the Posen Water Works.

By E. A. Gieseler, C. E.

Posen is a city of about 140,000 inhabitants, and the capital of the German province of the same name. It is an important fortress and for this reason it is imperative that the sources of its water supply should be located within the fortified lines.

The present supply is drawn from wells bored into the top layer of sand down to the underlying clay, which is reached at a depth of from 7 to 15 meters. This water, the so-called "Eichwald" water, is practically sterile, but contains a great deal of iron. It is conducted through a length of about 4,000 meters of 450-mm. syphons to the works in the city. There the water is aerated and filtered through slow sand filters. After having passed through these it is quite clear, and in every way satisfactory for household use.

This present daily supply of about 18,000 cub. met. is not sufficient for the growing needs of the city. Two ways are open to obtain an increase. The first one consists in a more exhaustive utilization of the present sources of supply by boring additional wells and by pumping instead of syphoning. The second way open for an increase of supply consists in the utilization of water which is also found within the fortified lines in abundant quantities at a depth of from 100 to 150 meters over a stratum of brown coal and which rises in the bored wells above the surface of the soil. From its contact with the coal this so-called "Herzog" water is of a deep brown color (about 1,000 degrees, according to the platinum-cobalt standard), but it is practially sterile, clear, without odor and taste and does not contain any objectionable substances. If it were not for its deep brown color, it would probably be fit for household use in its natural state.

TABLE 1.—ANALYSES OF EICHWALD AND HERZOG WATERS AND A MIXTURE OF EQUAL PARTS OF EACH.

	Eichwald.	Herzog.	Mixture.
Clearness	Clear	Clear	Turbid, but clear when filtered
Color (Plat. Cob. standard)	30° to 40°	1000°	600°
Smell	Slightly H_2S	Slightly peaty	Slightly peaty
Taste	Strong iron	None	None when filtered
Reaction	Weak alkaline	Alkaline	Weak alkaline
Suspended matter—			
Total	0	0	80 unfiltered
Loss on ignition	....	0	56 "
Residue on ignition	....	0	24 "
Residue on evaporation—			
Total	464	645	462 filtered
Loss on ignition	68	164	64 "
Residue on ignition	396	481	398 "
Chlorine	18	178	98 "
Ammonia	0.7	2.6	Trace "
Nitrates	0	0	0 "
Nitrites	0	0	0 "
Iron, Fe_2O_3	18	0.9	Trace "
Manganese, Mn_2O_3	1.7	0	0 "
Lime, CaO	123	61	70 "
Magnesia, MgO	21	20	16 "
Silicic acid, SiO_2	28	6	12 "
Sulphuric acid, SO_3	39	31	33 "
Phosphoric acid, P_2O_5	Trace	Trace	0 "
Oxygen, O	0	0	0 "
Carbonic acid—			
Free	16		.... "
Half free	94	46	.... "
Combined	94		.... "
Temporary hardness	12.3	6.6	6.2 "
Permanent hardness	2.9	2.4	2.5 "
Organic carbon	....	29	.... "
Permanganate of potassium consumed	24	246	12 "
Bacteria per c.cm	20 to 70	1 to 4	.... "

Laboratory experiments have shown that when a mixture is made of Herzog and Eichwald water in certain proportions, then the color of the former and the iron of the latter are precipitated without any previous aeration being required. After removing the flocculent precipitate of this mixed water by filtration, a perfectly clear and sterile potable water is obtained. The coagulating action of the two waters on each other takes place very rapidly when both are fresh from the soil, while when they are not fresh from the soil a certain period of subsidence is required, the length of which seems in a measure to depend on the time elapsed be-

tween pumping and mixing the two waters. A paper has been published on the subject by Prof. Dr. Wernicke and Dr. Weldert in "Mitteilungen aus der Koeniglichen Pruefungsanstalt fuer Wasserversorgung und Abwaesserbeseitigung, Heft 8, 1907." From this paper the analysis of the two waters given in Table 1 has been taken.

The remarkable result obtained by mixing the two waters is ascribed by Professor Wernicke and Dr. Weldert to the action of the iron in the Eichwald water on the humic substances contained in a very finely divided state in the Herzog water. I quote again from the above mentioned paper as follows:

"Tests made for the purpose of determining the nature of the substance causing the brown color of the Herzog water have shown that this substance is not held in solution, but in colloidal solution, because in the first place the colloid becomes pectenised when heated to the boiing point, and, secondly, because, as is apparent from the following table, it does not diffuse through parchment:

Duration in Hours of Dialysis Test.	Chlorine mg. per Liter.	Permanganate of Potassium Consumed.
0	174	228
48	119	226
120	64	222

"Further tests have shown that the amount of colloid is about 60 mg. per liter when dried at a temperature of 110° C. The analysis of this residue has rendered the following result: Organic carbon, 7 per cent.; nitrogen, 3 per cent.; residue on ignition, 22; loss on ignition, 78 per cent.

"The residue on ignition, besides a small quantity of iron, consists principally of lime respectively magnesia and silicic acid . . . . The mixture of one part Herzog and one part Eichwald water, when filtered immediately after mixing, renders a clear effluent of a slightly yellowish color (7 to 12 degrees) and free of iron . . .

. . . The mixing of the two waters was tested in various proportions and it was found that the best proportion was between the limits of three parts Eichwald water to from two to seven parts Herzog water, in other words that 1 liter of the Eichwald subsoil water containing iron would remove the color of from 0.6 to 2.1 liters of the brown Herzog subsoil water and at the same time be freed of the iron contained in it. On the basis of these figures we can compute that 1 mgr. of iron precipitates from 2.2 mgr. to 7.0 mgr. of the brown coloring substance.

"Professor Wernicke's tests had shown that besides the proportion in which the two waters are mixed, the age of the water containing iron (the Eichwald water) was likewise of importance, in other words that the time elapsing between the taking of the Eichwald water from the well and the mixing of the two waters exerted an influence on the reaction. The brown deep subsoil water was indifferent in this respect. It found that the longer the Eichwald water was kept without special care being exercised, the slower the reaction would be. After all iron of the Eichwald water had been precipitated as hydroxide no reaction at all would occur.

"This is of importance as regards the theoretical explanation of the reaction. It corroborates Professor Wernicke's opinion that the precipitation of the brown color is caused by the iron contained in the Eichwald water, but only by such iron which is held in solution."

In view of these remarkable laboratory results it was decided to conduct experiments with a filter furnished by the Jewell Export Filter Co. with a view to demonstrating whether and under what conditions of subsidence and coagulation the Herzog water alone or a mixture of it and the Eichwald water could be made potable on a large scale, or, failing that, whether rapid filtration would deal as successfully with the aerated Eichwald water as the present slow sand filter does.

The experiments were made with a plant consisting of a 4-ft. Jewell filter, two subsidence tanks and a chemical apparatus, all of which were arranged in the usual way. The two subsidence tanks had an aggregate capacity of 18 cu. m., but this capacity was later on increased by the addition of further tanks.

Table 2.—Experiments with Jewell Filter at Posen.

No. of Test.	Rate of Filtration in 24 Hrs., Meters.	Duration of Subsidence.	$Al_2(SO_4)_3$ gr. per cbm.	Satisfactory Effluent per m² Filter Area During 1 Run.
		Mixed water with sulphate of alumina.		
1	120	2 hrs. 50 m.	55	38 cub. met.
6	120	4 hrs. 26 m.	30	25 " "
7	120	4 hrs. 26 m.	31	18 " "
8	120	4 hrs. 26 m.	31	18 " "
9	120	4 hrs. 26 m.	31	20 " "
10	120	4 hrs. 26 m.	52	27½ " "
2	93	4 hrs. 00 m.	107	*a*47 " "
3	93	4 hrs. 00 m.	88	53 " "
4	93	4 hrs. 00 m.	50	*a*23 " "
12	93	5 hrs. 40 m.	60	56½ " "
13	93	5 hrs. 40 m.	30	46½ " "
5	60	5 hrs. 40 m.	50	81 " "
		Herzog water with sulphote of alumino.		
14	120	2 hrs. 50 m.	52	33 cub. met.
15	120	2 hrs. 50 m.	68	48 " "
		Mixed water without sulphate.		
16	120	4 hrs. 26 m.	0	12½ cub. met.
17	120	4 hrs. 26 m.	0	12½ " "
18	93	20 hrs. 00 m.	0	*b*43 " "
19	93	20 hrs. 00 m.	0	15½ " "
20	62	8 hrs. 36 m.	0	46 " "
21	62	8 hrs. 36 m.	0	*c*49 " "
22	62	19 hrs. 00 m.	0	44 " "
23	45½	13 hrs. 00 m.	0	68½ " "
24	32½	12 hrs. 15 m.	0	*b*80 " "
25	32½	12 hrs. 15 m.	0	60 " "
26	32½	12 hrs. 15 m.	0	65 " "
27	32½	17 hrs. 00 m.	0	*b*150 " "
28	32½	17 hrs. 00 m.	0	100 " "
29	32½	37 hrs. 00 m.	0	*b*130 " "
30	32½	56 hrs. 30 m.	0	*d*194 " "
31	32½	56 hrs. 30 m.	0	*d*114 " "
32	16¾	24 hrs. 00 m.	0	94 " "
33	11.8	34 hrs. 00 m.	0	126 " "
		Eichwald water without sulphate.		
34	93.4	3 hrs. 45 m.	0	*e*643 cub. met.
35	120	1 hr. 30 m.	0	*f*379 " "
36	120	1 hr. 30 m.	0	548 " "
37	120	1 hr. 30 m.	0	461 " "

a, Test not concluded.
b, With preliminary filter.
c, Milk of lime was poured on filter.
d, With preliminary filter; effluent good until end.
e, Effluent contained 0.1 mg. of iron; color of effluent, 7 to 12.
f, Effluent free from iron.

Experiments were commenced on Aug. 1, 1906. and were concluded on March 31, 1907. They included the treatment of mixed Herzog and Eichwald water alone without the use of sulphate of alumina and the treatment of Eichwald water alone without the use of sulphate of alumina.

It may be stated generally that the results obtained with the water containing iron were entirely satisfactory in regard to the quality of the effluent as well as in regard to the length of runs and the percentage of wash water required. The experiments with Herzog water were likewise successful so far as the removal of color was concerned, but they were not as sucessful as the one previously mentioned, either in regard to length of run and quantity of effluent furnished during one run, nor in regard to the percentage of wash water required. It was found, especially when using high rates of filtration, that the color would penetrate the filter bed after a comparatively short time. The results obtained are given in the appended tables, from which the conditions may be seen under which each individual test was made and how much water was satisfactorily clarified per square meter of filter bed during one run under such conditions. The limit of satisfactory clarification (removal of color) has been assumed at 15 degrees of the platinum-cobalt standard.

We will first consider the tests during which sulphate of alumina was applied, a summary of which is given in Table 2. No great difference was apparent in the action of sulphate of alumina on the pure Herzog water and on the mixed water. From a consideration of the figures of both tables we arrive by means of interpolation at the results given in Table 3, regarding the amount of water that can be satisfactorily clarified during one filter run:

Table 3.—Amount of Satisfactory Effluent Obtained per Square Meter of Filter Area During One Run. Mixed Water with Application of $Al_2(SO_4)_3$.

Rate of Filtration, Meters in 24 Hours.	When Applying per Cubic Meter— 30 gr. $Al_2(SO_4)_3$.	50 gr. $Al_2(SO_4)_3$.
120	20 cub. met.	30 cub. met.
110	28 " "	38 " "
100	36 " "	47 " "
90	45 " "	55 " "
80	53 " "	63 " "
70	61 " "	72 " "
60	70 " "	80 " "

It is clear at once from Table 3 that the high rates of filtration as well as the very low ones are practically out of question, because in the former case the filter runs are too short and in the latter case the required area of filter beds is too great. A rate of filtration of 80 meters when 30 grammes of sulphate of alumina are applied and a rate of filtration of 90 meters when 50 grammes of sulphate of alumina are applied, seem, however, to meet the practical requirements. In view of the considerable hardness of the raw water, there is not the slightest objection against the application of such quantities of sulphate of alumina.

When a rate of filtration of 80 meters is assumed with 30 grammes of sulphate of alumina being applied and a duration of subsidence of about 4 hours, then two daily washings would be sufficient and the amount of wash water used would not exceed 5 per cent. of the effluent. The existing slow sand filter bed in which the proposed rapid filter plant is to be accommodated affords space for fourteen 21-ft. Jewell filters, which with the rate mentioned above would furnish 36,000 cub. met.

During all these tests, the end of the run was brought about by the penetrating through the filter bed of the color, long before the loss of head had reached its highest limit. There is, therefore, no doubt that, if finer sand was to be used than that employed during the experiments, it would be possible to increase the velocity of filtration without at the same time increasing the dose of sulphate of alumina and the number of washings required.

We now have to consider the clarifying of the mixed water without the application of sulphate of alumina. A summary of the results obtained is given in Table 2. Six of these tests have been made with the aid of a preliminary filter and have yielded good results. For instance, with a rate of filtration of 93 meters, a sedimentation of 20 hours and the use of a preliminary filter, 43 cu. met. were obtained per square meter of filtering area in one filter run. A rate of filtration of 80 meters would therefore appear to be practicable and only require two washings in 24 hours. But the quantity of the wash water would certainly be great, as not only the filter proper but also the preliminary filter would have to be washed. Again, the space required for the entire plant would be very large. The tests made without the use of a preliminary filter are numbered 16, 17 19, 20, 22, 23, 25, 26, 28, 32 and 33. Their results have been produced graphically by laying off on the axis of abscissae the rates of filtration and on the ordinates the quantities of clarified water obtained per square meter during one filter run. The points thus obtained could be joined without any considerable deviation by a continuous curve and from this curve the figures of Table 4 have been obtained. This table contains a source of errors, inasmuch as the duration of sedimentation has not been considered.

It varied between $4\frac{1}{2}$ and 34 hours, but for the rates which practically come into question, namely those of about 60 meters, the average duration of sedimentation has been about 14 hours (tests Nos. 20 and 22).

Table 4.—Amount of Satisfactory Effluent Obtained per Square Meter of Filter Area During One Run. Mixed Water Without Application of $Al_2(SO_4)_3$.

With a filtration-rate of 100 met............	17 cub. met.
With a filtration-rate of 90 met............	22 " "
With a filtration-rate of 80 met............	28 " "
With a filtration-rate of 70 met............	35 " "
With a filtration-rate of 60 met............	43 " "
With a filtration-rate of 50 met............	53 " "
With a filtration-rate of 40 met............	65 " "
With a filtration-rate of 30 met............	79 " "

It is seen that when a rate of filtration of 60 meters and a sedimentation of 14 hours are employed the mixed water can be clarified under conditions that are admissible in practice. Two washings in 24 hours would be sufficient and the above mentioned plant of fourteen 21-ft. filters would supply a daily quantity of 27,000 cub. met. But it would be necessary to construct subsidence basins of very considerable size, and it should also be mentioned that the removal of color in none of these tests was as satisfactory as when sulphate of alumina was applied.

We now have to consider the tests which were made with the Eichwald water alone, without the use of sulphate of alumina. These tests were made with a rate of filtration of 93.4 meter and a subsidence of 3 hours 45 minutes, and again with a rate of filtration of 120 meter and a subsidence of $1\frac{1}{2}$ hour, the raw water being aerated before filtration. In both cases the result was excellent. According to the Royal Hygienic Institute at Posen the effluent was free from iron. At the same time the color was removed almost totally and even towards the close of each run it amount to only 12 degrees. In all cases the filter could be operated until the loss of head had arrived at its highest limit. With the rate of 93.4 meter a quantity of 643 cub. met. were filtered in one run and with the rate of 120 meters an average quantity of 461 cub met. was filtered in one run, as shown in Table 2. The amount of wash water used was considerably less than 2 per cent. of the effluent in both cases.

We may deduce from these results that the rate of filtration for this water may be considerably still more, when coarser sand is used in the filter bed. It is certain that a rate of 140 meters in 24 hours, with two hours of sedimentation, can be successfully employed and that then one daily washing will be perfectly sufficient, the amount of wash water used remaining below 3 per cent. With this rate of filtration the above mentioned plant of fourteen 21-ft. filters would have a daily capacity of 63,000 cub. met.

Table 5.—Sizes of Filter Plants Required at Posen for Different Methods of Supply and a Daily Capacity of 45,000 Cub. Meter.

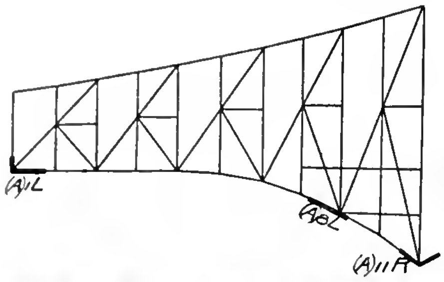
	Rate of Filtration in 24 Hrs.	No. of 21' Filters.	Capacity of Subsidence Required.	Dimensions of Filter House.	Total Area, Including Subsidence.
A	60 m.	24	26,300 cu. m.	93x19 m.	10,500 sq. m.
B	80	18	7,500	77x19	4,000
C	140	10	3,750	38x19	2,000

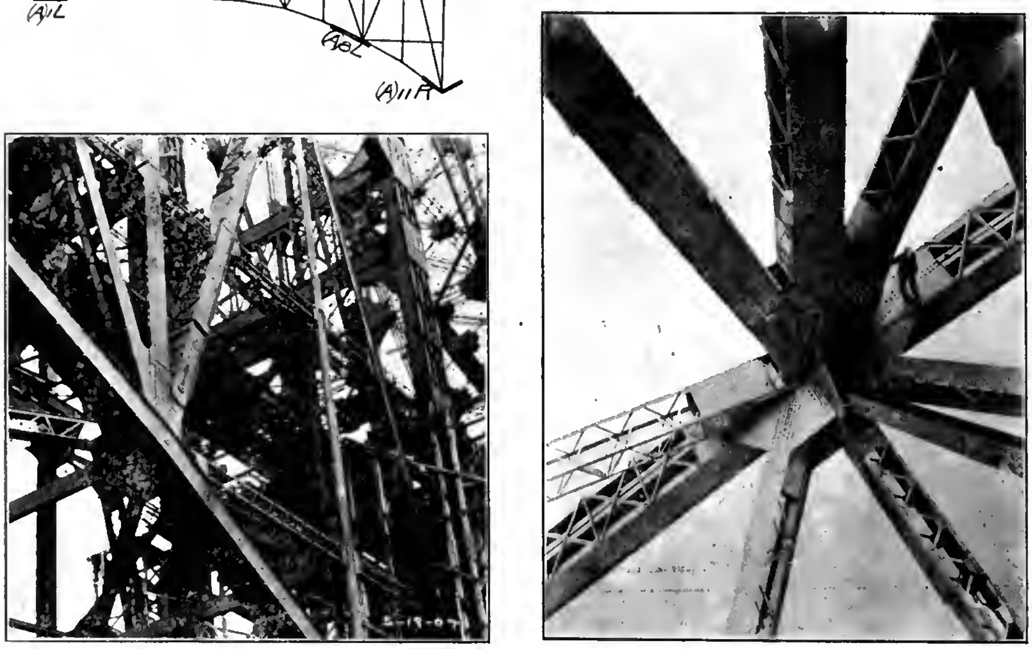
As stated in the above, the following three methods have been tested to obtain the necessary increase of potable water for Posen: (A), the clarifying of mixed water with application of sulphate of alumina; (B), the clarifying of mixed water without application of sulphate of alumina; (C), the clarifying of the water containing iron without the application of sulphate of alumina. The tests have shown that under certain conditions of subsidence and of rate of filtration all these three methods can be employed in practice, and we find that for a daily capacity of 45,000 cub. met. the size of plant required in each of the three cases is that given in Table 5.

Notes on Tar Macadam.

A paper read at the annual meeting of the Association of Municipal and County Engineers by C. F. Wike, City Surveyor, Sheffield.

These notes are not intended as an argument in favor of better roads. Discussion of road-making problems has recently been so thorough, and the demand for an improvement is so general, that road engineers need now only consider how the desired improvement is to be effected, and how paid for. The necessity has chiefly come about through the rapid development of motor traffic. Those interested in motors disclaim responsibility for the present dust nuisance and blame the roads, upon which, they say, motor vehicles have no more destructive effect than horse traffic. This, however, will





Second Bottom Chord Panel Point from Main Pier, Quebec Bridge.

scarcely be admitted by those engineers who have charge of the roads. In the opinion of the writer, the additional wear caused by self-propelled vehicles, and particularly by those fitted with non-slip devices, is considerable. Whether such vehicles ought to pay a larger contribution towards the upkeep of the highways is a question which undoubtedly will have to be fought out and settled.

One effect of the new traffic will be an extension of the paved roads leading out of the towns, and possibly a development in the direction of cheap paving. Another result will be that, where the amount of traffic and rateable value does not warrant the expense of paving, some other construction of road involving the least amount of dust will have to be adopted.

Where paving is too expensive, perhaps the best material for minimizing dust is tar macadam, which is by no means a recent introduction, it having been adopted in some of the Northern and Midland towns for at least thirty or forty years. In Sheffield it has certainly been laid nearly forty years, and it is with regard to what has been done in this direction that the following detailed observations are offered.

At present there are 392 miles of roads, of which 241 miles are macadam roads; about 151 miles of the latter are repairable by the Highway Authorities, and of these, nearly 10 per cent. are laid with tar macadam. The proportion may seem small, but the reason for this at once brings us face to face with one of the difficulties in the general adoption of tar macadam roads.

Many of the roads in the writer's charge have steep gradients, and no one who has had experience of tar macadam will suggest that it is a desirable material for hills. Up to the present a gradient of 1 in 20 has been considered sufficiently steep, and perhaps other engineers will be good enough to give their experience as to laying tar macadam on steeper gradients.

At one time most of this work was let by contract, and this is still the case to a liimted extent but about five years ago a plant was constructed by the corporation at an approximate cost of £1,000, consisting of sheds, iron-plated floors, with flues beneath for drying the broken stone, and heating apparatus for the tar compound. During the last three years the quantity of tar macadam prepared has averaged 2,300 tons per annum, in addition to 900 tons of tarred chippings for footpaths.

The specifications to which the tar macadam is made is as follows:

First Coat.—About 2 in. in thickness of limestone "dark" in color, and of approved quality, sound, hard and free from spar, and equal to sample. The stone to be broken uniformly to a $2\frac{1}{4}$-in. gauge.

Second Coat.—About $1\frac{1}{4}$ in. in thickness, of best slag, of sound, uniform material, free from honeycomb and dirt, from approved works, all equal to sample. The slag to be broken uniformly to a $1\frac{3}{4}$-in. gauge.

Third Coat.—About $\frac{3}{4}$ in. in thickness of slag shingle to a $\frac{3}{4}$ in. and $\frac{1}{2}$ in. gauge in equal proportions, free of dust, of the quality specified for the second coat, and eqaul to sample. The total thickness of the tarred material, after being rolled with the steam roller, to be 4 in., and the top of its surface to be $\frac{3}{4}$ in. above the level of the channels.

After rolling the roadway is to be covered with a dressing coat of granite chips ($\frac{1}{2}$ in. dust out) of approved quality and thickness, as may be ordered, and again rolled.

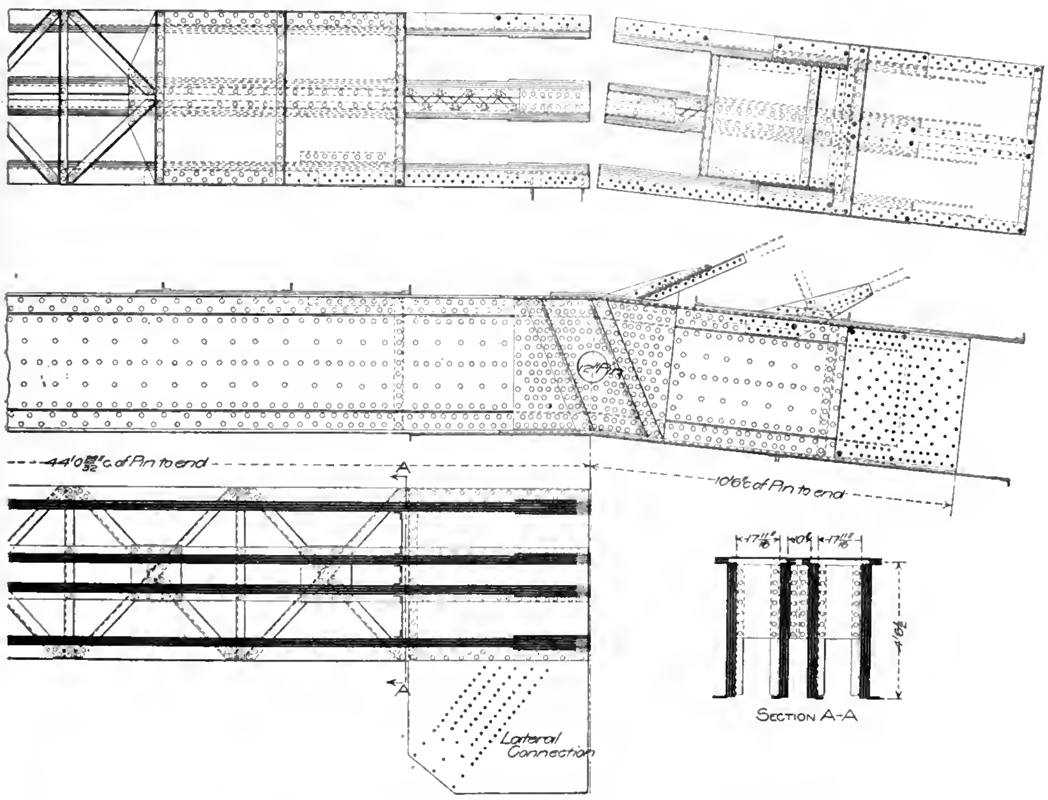
The whole of the limestone and slag must be thoroughly well dried on hot plates; a mixture of pitch and tar must then be boiled in the following proportion: For the first and second coats 90 imp. gal. tar and 125 lb. of pitch; and after boiling for two hours, 17 imp. gal. of the mixture must be mixed with 30 cwt. of the broken limestone and $1\frac{3}{4}$ in. slag.

For the third coat 14 imp. gal. of the above

mixture, after boiling, to be added to each cubic yard of shingle.

The limestone and slag to be perfectly dry and warm at the time of mixing, and the whole thoroughly turned over, so that every part of the surface of the stones will receive a coating of the mixture. The above-mentioned proportions may vary according to the quality of the pitch and the strength of the tar. The prepared limestone and slag is then to be put in separate heaps, and left a sufficient time to toughen before being laid. After it has been properly toughened and freshened with a further quantity of pitch and tar (if considered requisite), it is then to be spread on the foundation in layers as specified.

The cost of slag and limestone tar macadam is about the same. If of the best quality, probably slag is the better material, and in certain instances, it has been used for all three coats. The difficulty, however, is to get it sufficiently uniform and free from lime and other constituents which render it liable to early disintegration.



Intermediate Section of Lower Chord A_8L, Anchor Arm.

This is one of its disadvantages as compared with limestone, which can be obtained of uniform hardness, and, as the use of tar macadam increases, so will the difficulty of getting sufficient slag of suitable quality increase.

Granite has not hitherto been looked upon as a suitable material for tar macadam, on account of its want of absorption. It was laid by the writer nearly twenty years ago in several streets, but for the reason given, was not a success. It has recently been laid in some districts with tarred chips for binding, and similar work is in preparation in Sheffield. If the necessary adherence could be obtained, granite would, on account of its better wearing qualities, be more economical than either limestone or slag, and perhaps, with modern methods of retarring roads at frequent intervals, the old difficulty may be got over.

With regard to the cost of tar macadam roads compared with dry granite macadam, the initial cost is about the same, about *2s. 3d. to 2s. 6d.* per super. yard, exclusive of foundation, the extra expense of tarring being balanced by the fact that a cheaper material is used than the granite macadam usually employed for important main roads, when these are not paved. Statistics have been prepared with regard to a typical suburban road, taking a considerable amount of traffic, and the annual charge (including initial cost) for a period of fourteen years has averaged about *4d.* per square yard; this is for a fairly flat road. In another case—a road with light traffic—the average has been a little less than *2½d.* per square yard.

If the best results are to be obtained, it is very advisable that, after the first laying, tar macadam should be kept in thorough repair, and for many years it has been the practice to tar paint the surface at intervals of three or four years, or as soon as roughness begins to show. This has been done not so much with the idea of laying the dust as to prolong the life of the tar macadam.

At present a considerable mileage of dry macadam road is being tar sprayed, and, so far as can be seen at present, it will be practicable to apply this system to gradients steeper than those upon which tar macadam has been laid. Nevertheless, there must be a limit to the gradients upon which tar can, in any form, safely be employed, as it is a material very susceptible to heat, and slippery in hot weather.

To sum up the writer's experience, tar macadam is a very suitable and economical material for many situations, and its use is bound to increase, but it has its restrictions, the principal one being that it cannot safely be used for roads with a considerable gradient. So far, the materials used have been inferior in durability to granite or whinstone, and therefore it has not been suitable for macadam roads with the heaviest traffic. The great advantages are the comparative absence of dust, and the quietness. Tar macadam roads are also economical in the matter of cleansing. The introduction of tar-spraying apparatus has materially helped to minimize the dust nuisance, and it is through the application of tar, in one form or another, that the nearest approach to a dustless road must be looked for, where paving (which, after all, creates the least dust) cannot be used.

THE TREES ALONG STREETS in East Orange, N. J., are under a Shade Tree Commission, of which Mr. Alfred P. Boller is president. It plants and prunes trees, carries out measures to destroy insect pests, and repairs injured trees.

The Quebec Bridge Superstructure Details.—Part VII.

Anchor Arm Bottom Chords.—The bottom chords of the anchor arm trusses form chords of parabolic curves with 500-ft. span and 112 ft. rise, divided into ten panels of a uniform horizontal projection of 50 ft., which, at the river end where the inclination is nearly 45 deg., gives a maximum length of about 68 ft. on centers. All vertical and sub-vertical posts are connected to the lower chords with 12-in. pins and the connections of the diagonal members of the trusses are made through the lower ends of the vertical posts so that they are not directly attached to the chord members.

The bottom chords have a uniform rectangular cross section 4 ft. 6 in. deep and 5 ft. 7½ in. wide, made with four built channels with the thicknesses of their webs and the sizes of their flange angles varied to correspond with the total cross-sectional areas of 301 to 776 sq. in. The top flange angles on the two inner channels are turned inward. All other flange angles are turned outward. The flanges are connected by ½-in. batten plates at the splices and between them are divided into panels about 5 ft. long by transverse 3x3-in. angles. Each panel is X-braced with 3x3-in. lattice bar angles having two rivets in each end. On the top flange both of these angles are continuous, one of them having its vertical flange cut to clear the other. They are riveted together at the intersection and have one rivet in each flange of the chord channels. Batten plates are riveted across the lower flanges of the inner channels of the chords where the lattice angles intersect them and serve as splices for one of the latter, which is cut to clear the other, running continuously across it and secured with four rivets. At panel points the lower bottom plates project beyond the inner face of the chord to form, with parallel plates field riveted through the upper flanges opposite them, jaw plates for the field riveted connection of the lateral struts and diagonals.

As the chords change direction at panel points they are cut through there, and have at these places radial butt-joints spliced with shop-riveted web cover plates one on each side of the outside webs and one on the outside only of each of the inside webs. In order to facilitate erection the field riveted splices between the bottom chord sections are made at points 10½ ft. beyond the panel points on the river side. This arrangement enables all members to be connected at any given panel point without assembling the lower chord section for the next panel.

The eighth panel from the anchorage of the bottom chord is typical of the intermediate panels in the anchor arm truss, is 54½ ft. long over all and weighs 164,000 lbs. It has a maximum stress of 15,079,000 lb., and a gross cross sectional area of 767 sq. in. Each channel is made with three 54x13-16-in. and one 37¾x13-16-in. web plates riveted together with five lines of rivets exclusive of two lines in the vertical flange of each of the two 8x6x15-16-in. flange angles. The ends of the chords are stiffened in the field splices by vertical diaphragms and the field splices are made with 1-in. rivets through the webs of the outer channels and 1-in. turned-bolts through the webs of the inner channels which are inaccessible for field riveting. The open holes enclosed by hexagons, in the drawings, indicate shipping bolts.

The bottom chord in the river end panels of the anchor arm truss is 39 ft., 2⅞-in. long over all and weighs 120,000 lbs. It has a maximum stress of 16,129,000 lb. and a cross sectional area of 842 sq. in. The outer ribs are each made with two 54x15/16 in. web plates, two 46x15/16-in. side plates and two 8x3½x15/16-in. flange angles. The inner ribs are each made with three 54x15/16-in.

web plates, one 37¾x15/16-in. side plates, and two 8x6x15/16-in. flange angles. This section of the chord is special in that it has no pin connection, the connection to the main vertical post over the center pier being made with a riveted splice to the short section engaging the pedestal at this point.

The bottom chord section in the shore end panel of the anchor arm truss is special on account of the connections for the inclined end bars and the vertical portal post and the provisions made for the group of vertical anchorage bars connecting it to the reaction platform in the bottom of the pier. This section is 43 ft., 1⅛-in. long over all and weighs 119,000 lb. Its maximum stress of 4,950,000 lb. is less than that of any other section of the bottom chord and is provided for by a cross sectional area of 301 sq. in. The ribs are each made with a single 54x15/16-in. web plate and two 8x6x15/16-in. angles and are divided into 4½-ft. panels by inside vertical 3x3-in. stiffener angles. The river end of this cross section is like those of the other pieces except that the splice is made on the shore side of the pin. At the shore end the flange angles terminate about 2 ft. from the panel point and the webs project 2 ft. beyond it and are bored for a 10½-in. pin engaging the vertical anchorage eyebars. A slot 1 in. wide and 4½ ft. long is cut through all of the webs on the center line about 6 ft. clear of the panel point to receive a 53x¾-in. horizontal diaphragm plate about 5 ft., 2 in. long, which is connected by a pair of horizontal angles to each of the webs and affords connection for two intermediate vertical webs. The main webs are spliced about 10½ ft. from the end of the chord to short end sections 120 in. wide and 15 in. thick, which, with the two intermediate diaphragms of similar shape, provide 6 wings or jaws, engaging the foot of the inclined end bars with the 12-in. pin on heavily reinforced bearings. The plates extend beyond the pin hole to the end of the chord and above it are connected and stiffned by two sets of transverse diaphragm plates, thus making a massive rectangular pillar field riveted to the double end floor beam and receiving from it the heavy lateral stresses which are transmitted to the masonry pier.

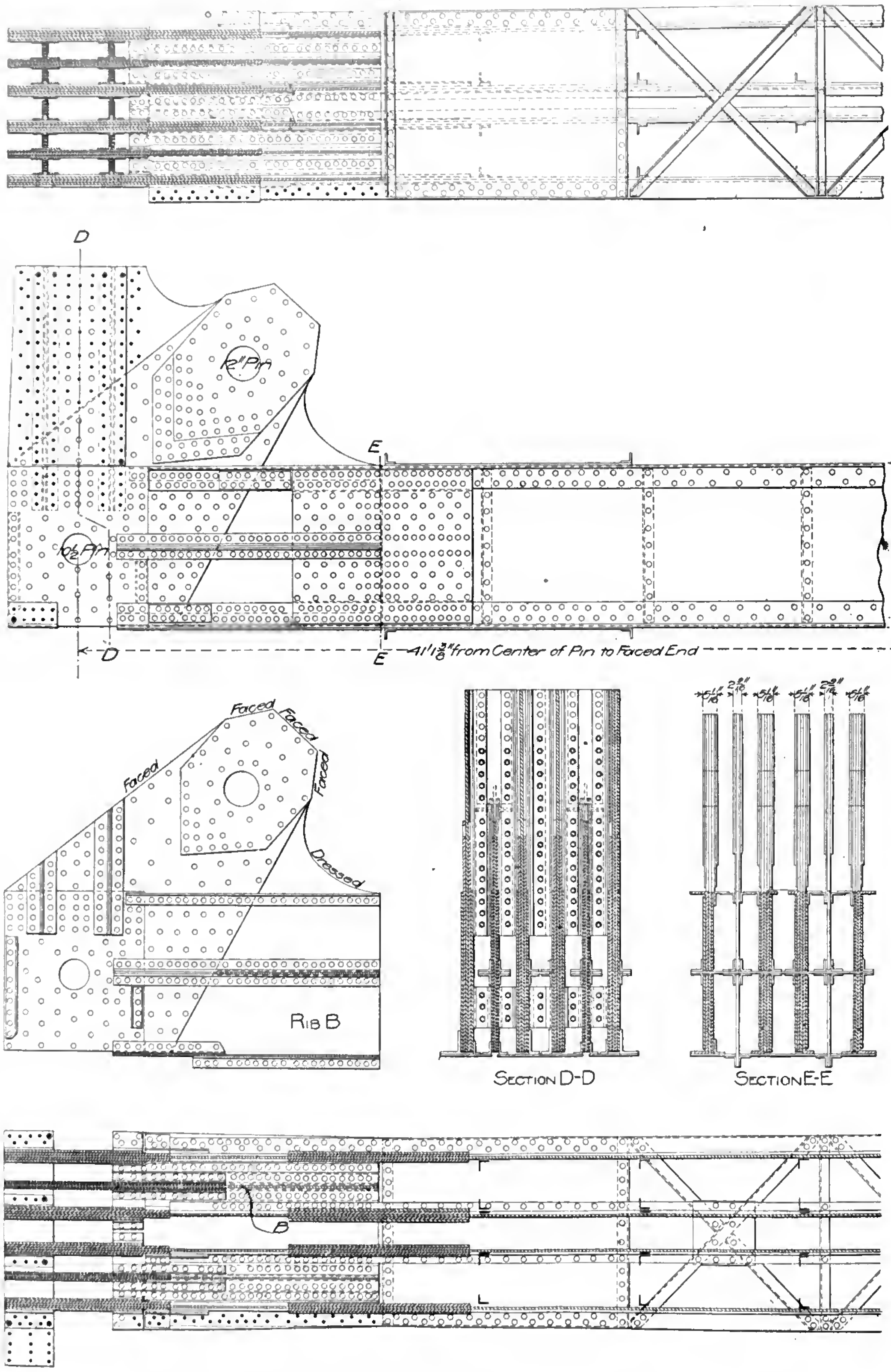
The bottom chords in the anchor and cantilever arm are connected together over the river pier by a special V-shaped section about 23 ft. long and 9 ft. high over all exclusive of end splice plates, which weighs about 40 tons and was riveted up complete in the shop and shipped as a single piece. It has 4 massive webs corresponding with those of the chord sections and is bored at the intersection of the center lines of the two wings, to engage the 24-in. pin through the foot of the main post. The webs interlock with those of the shoe and pedestal and provide full hole bearings of an aggregate length of 15 in. The ribs are made in halves with vertical butt joints on the center lines, each half rib has 4 full-length 15/16-in. web plates and two 6x8x15/16-in. flange angles. The halves of each web are spliced together by two cover plates on each side which are continuous across the center line and are bored with full pin holes.

The webs are connected on each side of the pin by three sets of oblique solid plate diaphragm, one of them parallel and one perpendicular to the axis of the chord and the third one making an angle of about 30 deg with it. Except near the vertex, the flanges are connected by top and bottom cover plates with open holes to match those in the inclined plates shop riveted to the shoe and pedestal with which they are field riveted or bolted. Four lateral connection plates with maximum dimensions of 117¾x½x120 in. are shipped loose and are field riveted to the top and bottom flanges as indicated in the general plan and elevation to receive the main bottom lateral members. The outer edges of these wide plates are stiffened by single 6x4-in. angles.

(To be Continued.)

Open Tank Timber Treatment.

The open tank treatment of timber is rapidly gaining favor, according to the Forest Service of the Department of Agriculture. The reason for this is that the appliances necessary for the treatment can be readily transported from place to place and are comparatively inexpensive, whereas the retorts and other apparatus required for the treatment of timber by the older methods are expensive and permanent. Hence, preserving plants have been located at lumber centers as a rule, where a large business might be expected, and the transportation charges to and from the treating plant have been quite heavy. The equipment for open-tank treatment, consisting of an open tank warmed either by steam coils or by a fire below, is so simple and low in cost that it is within reach of small companies and contractors. Moreover, it is so portable that it can be taken into the heart of the forest if necessary. An advantage claimed for the process is that it can be applied effectively to parts of timbers which are particularly subject to rapid decay, such as butts of fence posts and telephone poles, without wasting preservatives on other parts. It is also applicable to the treatment of mine props, cross-ties, piles, shingles, and small timbers of loblolly pine, black and tupelo gum. Western yellow pine, lodgepole pine and similar kinds of wood. According to the Forest Service, fairly good results have also been obtained in treating arborvitae, chestnut and red oak, but the experiments thus far made do not warrant the application of the method to the treatment of piles and ties of such woods. While the open-tank treatment does not ordinarily secure so deep a penetration of the chemicals as is secured by the pressure retort method, it is considered sufficient to protect timber for many purposes.



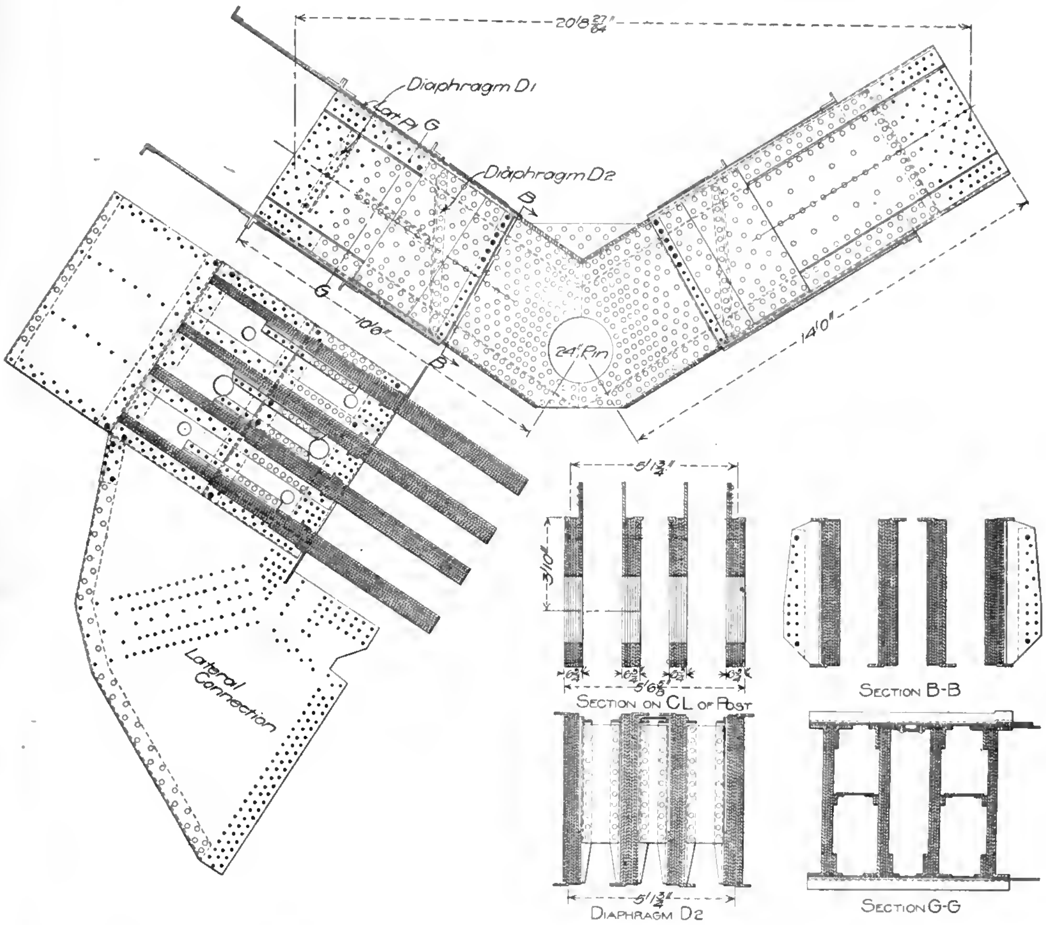
Lower Chord A₁ L at Shore End, Anchor Span, Quebec Bridge.

The Concrete Pier at Newlyn Harbor, England

The Newlyn south pier or breakwater, 25 ft. wide on top and 707 ft. long, is built of concrete on solid rock in water of a maximum depth of 14 ft. The concrete was cast in 15-ft. sections in molds made of shutters, placed by divers, on vertical transverse falsework bents. Each bent had a center vertical post and two side posts battered respectively 1:8 and 1:12 to correspond with the inclined faces of the pier. The posts were single 10x10-in. timbers about 40 ft. long, with their lower ends seated in shallow pits excavated in the surface of the bed rock and loaded with sufficient kentledge to overcome their buoyancy. In each transverse bent the posts were connected by horizontal struts bolted across them at just about low water level and at the top. The two upper panels thus formed were X-braced with single 6x6-in. angles and the entire bent considered as a single panel was X-braced with chains reaching from top to bottom of the posts and adjusted by turnbuckles. Similar adjustable transverse guys in the planes of the bents were attached to the tops of the outside posts and were anchored by a weight on the bottom of the bay. The bents were anchored by a weight on the bottom of the bay. The bents were X-braced longitudinally by adjustable chains.

Before each batter post was sunk one end of a long longitudinal angle was bolted to it, and after it was in position the other end was bolted to the adjacent bent by a bolt with an eye head, which was easily turned by a diver inserting a cross-bar into its eye. Greased eye-bolts also projected through the inclined posts into the interior of the mold, and were easily removed by divers after the concrete was in positon. The shutters or sides of the molds were made in sectional panels, the lower ones having cast-iron cutting edges which not only served to sink them but penetrated into the shallow layer of sand overlying the surface of the rock. These panels were provided with outside vertical cleats projecting above the upper edge and serving as guides to receive the lower edges of the successive upper panels, which were sunk to position by saddle castings afterwards hoisted to the surface by means of lines. The shutter panels were placed and the surface of the rock cleaned by divers, who also leveled off the concrete deposited under water. Up to low-water level the concrete was made 1:8 with large granite stones embedded in it, but was faced with 3 ft. of 1:4 concrete. The upper part of the pier was made with 1:10 concrete with a facing 12 in. thick. The work was executed with hand derricks and cost about $150 per lineal foot.

Subsequently another pier 40 ft. wide and 1,025 ft. long was built with two parallel concrete face walls chained together at distances of 100 ft., and filled between with rubble. As this pier was nearly all built above low-water level, ordinary molds were used for the concrete and no difficulty was encountered in its construction. A third pier, 890 ft. long, in water 14 ft. deep, was built with 10-ton molded blocks of 1:6 concrete lowered by an overhead gantry on a concrete bed made by divers. Mr. J. C. Inglis was the engineer, and Messrs. Hill & Lester, of London and Plymouth, were the contractors. The details of the work were described in a recent issue of "Engineering," London.



Section of Lower Chord over Pier A11 R Connecting Arms, Quebec Bridge.

THE DECOMPOSITION OF CEMENT in sea water is the subject of a valuable monograph by Henry Le Chatelier, in the "Annales des Ponts et Chaussées." His investigations led him to the conclusion that all hydraulic cements are decomposed by sea water, but at very unequal rates. This decomposition is slower as the content of alumina is lower and as the hydraulic index is higher. Quick-setting cements with high sulphate of lime and a high hydraulic index give very satisfactory results. The addition of pozzolana produces a considerable increase in the resistance. A dense mortar seems to be most essential to ensure the preservation of concrete in sea water. On this account, independently of all chemical action, the addition of pozzolana is important as increasing the density of the mortar.

Book Notes.

About five years ago an investigation of allowable pressures on foundations was made by Dr. E. L. Corthell in connection with harbor works in South America. He sent a circular letter to about 300 engineers in different countries, asking them to send him notes of actual pressures and attending settlements, if any, that had come under their observation. About one-tenth of those to whom these letters were sent replied, and from them voluminous tables giving facts regarding 178 works were compiled. This material was worked up as a paper for the Institution of Civil Engineers, which printed a very brief abstract of it about a year ago. The information in the paper would thus be practically lost for useful purposes, since but very few engineers have access to the unpublished manuscripts in the records of the Institution, had not Dr. Corthell arranged for the publication of the paper in full for general sale. In this way a quantity of valuable information relating to the pressures actually imposed on deep foundations is now available, and will unquestionably prove of much value to those engaged in foundation work of any sort. The paper is entitled "Allowable Pressures on Deep Foundations," and is sold in this country at $1.25, with the imprint of John Wiley & Sons, New York.

A few weeks ago attention was called in this journal to some studies made by Dr. A. S. Cushman, assistant director, Office of Public Roads, throwing much light on the nature of the corrosion of iron. A great deal of comment has been made on this announcement, and naturally enough some of these criticisms have been unwarranted on account of their proceeding from incomplete knowledge of just what Dr. Cushman has personally claimed regarding his studies. It is accordingly gratifying to state that the Office of Public Roads has issued for free distribution a monograph on the subject, written by Dr. Cushman, and containing all the information it is considered advisable to give out concerning his work at present, together with a resume of work done by others along the same line. It will be seen that the author draws attention to the investigations of Dr. Whitney, Dr. Walker and others, and it is probable that had the similar theory advanced by Mr. Freeland Howe, Jr., in a trade publication some time ago been available in scientific journals it would have similarly been noticed, although it does not appear to have been founded on experimental evidence. Dr. Cushman does not claim that no other man has ever understood the fundamental reactions upon which the rusting of iron depends, but merely states that he had to work the subject out for himself, for the available literature was unsatisfactory. The investigation was started in connection with investigations of the corrosion of fence wire requested by farmers in letters to the Agricultural Department and opens up an important possibility of using sheet iron for culverts on some classes of roads. The pamphlet explains the carbonic acid and the peroxide theories of the corrosion of iron and the reasons for considering them unsatisfactory and then outlines the electrolytic theory. Methods of stimulating and inhibiting the corrosion of iron are then explained, and the action of hydrogen peroxide on iron is discussed at some length. There is an interesting account of experimental work demonstrating electrolytic action, and the pamphlet closes with an account of some practial work done in applying the theory to prevent rusting. On account of the great interest shown in the subject, the pamphlet must be regarded as one of the most important issued by the department of Agriculture for some time.

Letters to the Editor.

A System of Structurally Reinforced Concrete.

Sir: In view of the regrettable accidents to reinforced concrete buildings at Rochester, Philadelphia and other places, it is a pertinent question whether it is not possible to make the designs of such a character that they may be "foolproof;" so that if foreign substances are accidentally introduced, or a batch of bad concrete escapes the inspector's notice, or an ignorant workman knocks out some props while the foreman's back is turned, the structure will not suddenly collapse. Such a design the writer here shows and he has been assured by several eminent engineers that it possesses features of merit.

As will be seen by the accompanying drawing, a structural steel column is utilized and for the bottom reinforcing metal of the girders and beams a pair of angles are used. These are connected to the column by means of diagonal shear bars and at intervals along the angles other shear bars, with their ends curved over to give adhesion to the concrete, are spaced as needed for the requirements of shear. These shear bars are securely connected to the angle by means of bolts and, being inclined, the shear or diagonal tension is transmitted by them directly to the bottom reinforcing angles. The beam acts like a Warren truss, the steel shear bars resisting the diagonal tension and the concrete the diagonal compression. To transmit the horizontal component of this latter to the reinforcing angles, rounds are introduced through the angles of the girders, and these together with the bolt heads and nuts and the adhesion of the concrete to the steel will amply provide for the development of all the tensile stresses in the bottom reinforcing angles.

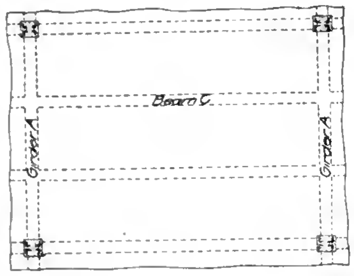
Where the beam intersects the girder a pair of light angles are placed near the top of the concrete to provide for the negative moment and prevent cracking over the girder. Several of the shear bars adjoining the girder are connected to these top angles for the purpose of developing their strength. While in the present design the girders are figured as if they were non-continuous, it might be permissible to figure them as being continuous.

A comparison of costs of this system of construction and for the standard steel cage system reveals a saving of about 10 cents per square foot of floor or about 37 per cent. for this typical floor panel. Some of the advantages of this system of reinforced concrete construction are as follows:

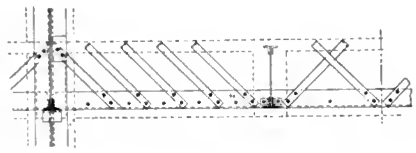
By providing a structural steel column and making a connection thereto by seating the bottom reinforcing angle on a shelf and running a diagonal bar from the angle up to the column and securely fastening the other bars to the angle, it is possible to thoroughly reinforce the beam for diagonal tension or shear, and it gives enough strength to the beam even when the concrete is green or of a poor mixture or weakened by the presence of foreign matter to guard against sudden collapse. If the forms are removed after only a few hours, the result would probably be either the concrete would crumble and drop to the next floor in small fragments not large enough to make their impact injurious or else the concrete would hold together and although perhaps it would sag perceptibly, it could not give way in a sudden manner. The angles securely tied to the column would by virtue of their tensile strength keep the structure from a sudden collapse and if the concrete had any compressive strength at all the shear bars would be brought into action, fulfilling the function of providing for the diagonal tensile stresses and by virtue of their being securely fastened to the bottom reinforcing bars, the structure would act as a whole as above stated in a manner similar to a Warren truss.

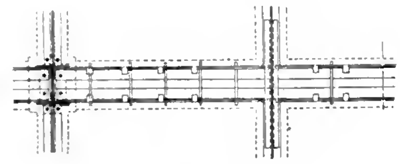
By bolting on the shear bars they may be spaced as required, the spacing being ascertained in a manner similar to that of finding the pitch of rivets in the flange of a plate girder; that is, the shear at any point is divided by the value of one bar and the quotient represents the number of bars that should be in a length equal to the effective depth of the beam. This is a distinct advantage over the method of having the shear bars a uniform length, size and spacing, or of having rods bent up at the ends of the beam only and making no provision for the intermediate shear.

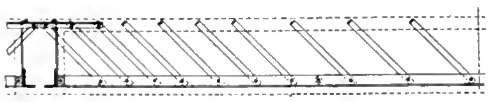
In buildings of four stories or more in height it is usually necessary in order to keep the size of interior columns down to moderate dimensions



Typical Floor Panel-Plan


One Half of Girder A


Plan of One Half of Girder A


One Half of Beam C

Structurally Reinforced Concrete.

to use a core of structural steel up to within one or two stories of the roof, and in Philadelphia when this is done the building laws require this core to be designed to carry the whole load. Hence, for a building of this height or more the cost of columns would be little more for the system here described than for a rod system. As for the cost of the beam and girder reinforcing, the angles would be shipped punched in one leg only and the shear bars bent at one end and punched in the other, so that the cost of the fabricated material should be quite low, say about 2.7 cents per pound in the east f. o. b. cars and for large jobs a portable punch might be used and the cost materially reduced below the above mentioned figure, perhaps to 2¼ cents per pound. It would seem therefore that the cost of the reinforcing material might be considerably lower than the most of the patented assembled rod systems now in the market.

By using angles and shear bars as shown there is no danger of the reinforcement being displaced by depositing of the concrete, and an inspector could tell at a glance if all the material required was in place.

By using this system, concrete construction could be safely applied to buildings of twenty stories or more in height, for the connection between the concrete beams and girders and the structural columns, being rigid, could be designed to provide for wind pressure or earthquake. It also would be well adapted for use in subway work where it is necessary to use steel columns to keep their dimensions down to a minimum.

The writer feeling that there is a wide field for the above described invention and believing that reinforced concrete construction must eventually come to some such system has protected the salient features of the above by letters patent.

Winfield W. Conard.

Norristown, Pa.

A Proposed Municipal Engineering Board.

Sir: Will you assist one of your readers by advice or comment to form an opinion in the following matter:

A certain city has a number of engineers at the heads of its different departments. For instance, there is a city engineer, who has charge of paving, etc.; a hydraulic engineer, who has charge of the water department; an electrical engineer, who has charge of electric subways, conduits, etc.; a harbor engineer, who has charge of the work around the water front; and a park engineer, who has charge of the engineering work in the park department; also a superintendent of street cleaning. These men are selected, in theory, at least, for the special ability each is supposed to have for his particular work.

It is proposed to form a board of engineers of the above departmental heads, and that this board of municipal engineers, as a whole, form a board of consulting engineers for the members of the city government. In the case of criticism of the plans of any one of these engineers, this board will pass an opinion on such plans, and thus determine for the lay members of the city government the justice of the criticism mentioned. If approved by the mayor, this board may correct or change the plans of the departmental heads to meet the ideas of the mayor and this board as a whole. It is stated that, under this idea, the city may be saved the fees of experts that might otherwise be called in.

Let us assume that within the sphere of his duties, each departmental head is an expert. Waiving the question as to whether the advice of an electrical engineer would be valuable on a question of piling, or whether the opinion of the street cleaning commissioner be worth anything on questions concerning the details of water supply, the question arises in the mind of your inquirer as to whether or not these engineers, joining in such a board and responding to requests for advice on subjects in which they may be inexpert, are doing themselves and their profession justice.

We hear a great deal of complaint, from time to time, regarding the small salaries paid members of the engineering profession. Your paper has several times suggested that the blame for this might frequently be laid at the doors of the individual members of the profession, and that a proper appreciation of his duties, responsibilities and ethics would do much toward placing the engineer and the profession in such a light before the general public as would result in the latter willingly paying a competent engineer a proper compensation for his work.

Should an engineer, no matter how thoroughly familiar with one specialty, allow himself to be placed in a position of advising or criticising the specialty of another and in which he is not thoroughly posted? Will your other readers interested, out of the breadth of their experience, help to clear up the mind of your inquirer by a frank statement of opinion?

Very truly yours, Specialist.

[This plan is about the worst example of executive confusion The Engineering Record has heard suggested. It is discussed in the editorial pages of this issue.]

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TABLE OF LEADING ARTICLES.

Electric Locomotives on Mountain Grades.

Engineers are so accustomed to the high cost of operation, the dangers, the delays and limitations inherent in the operation of mountain divisions of railroads with steam locomotives, that these things have come to be looked upon as essentially inseparable from mountain railroading. Until the trial of the Mallet compound locomotive, with its tremendous weight on drivers and correspondingly increased drawbar pull, it had been necessary to break up long trains at heavy grades and operate each of the sections with two or more steam locomotives of the largest capacity. The Mallet compound has done much to improve conditions where a large drawbar pull and great horse-power capacity are required, but the results thus far obtained in its operation still leave much to be desired, especially in view of the improvements in operating methods which seem to be possible with the adoption of the electric locomotive.

Electric operation on mountain grades appears to offer many advantages of greater importance than a generally admitted small saving in the expense of fuel, though this in itself may prove a most attractive feature under certain conditions and in certain localities. Admitting that electric power produced in hydroelectric stations costs less per ton-mile hauled than coal inefficiently burned under the abnormal overload conditions obtaining in steam locomotive operation on mountain grades, this item in itself will seldom show a sufficient return on the capital required for electrification to make it attractive to the steam railroad management.

It is a well known fact that the figures given in annual reports for locomotive maintenance running from six to ten cents per locomotive-mile do not apply to those locomotives operating under heavy grade conditions, and a maintenance charge ranging from ten to eighteen cents per locomotive-mile is not uncommon in this class of work. It is contended that the electric locomotive can perform the same service with a much less maintenance charge than is required in steam locomotive operation; while the 50,000-mile endurance run of the New York Central locomotive extended but a year, it showed a maintenance charge of less than one and one-half cents per locomotive-mile, and it is probable, according to electrical specialists, that an electric locomotive properly proportioned for service can be maintained for much less than a steam locomotive performing the same service. Just what the gain will be in this direction is not apparent from operating figures, and it will be interesting to see results from the New York Central electric zone after electric locomotives have been in service operation for a year or more. The saving in the maintenance charge of locomotives is reflected more generally than merely in labor and material for necessary repairs, as a low maintenance account means great reliability, and freedom from breakdowns and delays, so that if all expenses due to failure of locomotives in service were charged directly to maintenance of locomotives this item would assume formidable proportions. Hence, a saving in this item is of far-reaching importance and should prove a valuable asset to the electric locomotive on heavy-grade work, where the conditions of operation are very exacting as regards performance of the motive power.

The great advantages offered by the introduction of the electric locomotive seem to lie more in the direction of increasing the tonnage capacity of the single track, commonly met with on heavy grade divisions, and the general reduction in cost per ton-mile resulting from the handling of heavier trains at higher speeds with a certainty of operation not shared to an equal extent by the steam locomotive. Where the capacity of the electric motor is properly proportioned to the work which it has to do, there is no doubt of its being a highly efficient and extremely reliable piece of apparatus, requiring little or no attention, only periodic inspection, and with complete independence of the round houses, coaling towers, water tanks, and ash pits, required for the frequent repairs and grooming of the steam locomotive. This freedom of action and reliability must be reflected in a greatly increased daily mileage, a lower crew expense, and a considerable curtailment of the false mileage common to steam locomotive operation.

The electric locomotive is merely a transforming or converting piece of apparatus and can draw an unlimited supply from its distant stationary power house; hence its output is limited only by mechanical considerations, and the result is a type of locomotive capable of delivering an enormous power if designed to do so. Its motive power can be sub-divided into several motor units without loss in efficiency or increase in dead weight, thus permitting a construction which can utilize the entire weight of the locomotive upon the drivers and still keep within the recognized limits of weight upon each driving axle. Not only can the motive power in one locomotive structure be divided to suit the convenience of construction, but two or more locomotives can be coupled together and operated by a single motorman in the cab of the leading locomotive. While the steam locomotive, and especially the larger types as represented by the Mallet compound, is seriously handicapped by the difficulty and expense of stoking, the electric locomotive can be operated in groups of two or more by a single operator who has under his complete control the 2,000 or 3,000 h.p. concentrated in each of the several locomotives of the group. The possibilities opened up in this direction are enormous.

A steam locomotive is considered large when its boiler is capable of sustaining an output of from 1,500 to 2,000 i. h.p. The electric locomotive, on the other hand, as represented by the 3,400 type now operating on the New York Central, can give a sustained output of 2,200 h.p. rated with ample margin of overload in excess of this. It should be well understood also, that this 2,200 h.p. output of the motors is obtained with a total weight of something less than 100 tons, of which 68 tons is upon the drivers, and this locomotive was designed for a specified duty and does not in any way represent the maximum possibilities of electric locomotive construction.

It seems entirely practicable to construct an electric locomotive or a group of electric locomotives capable of delivering any drawbar pull permitted by the strength of the drawheads, and,. moreover, this drawbar pull can be delivered at any speed desired, in this respect far exceeding the possibilities of steam locomotive construction. This means that instead of operating trains downgrade at a maximum speed of from 25 to 30 miles an hour and up grade at a maximum speed of from 6 to 12 miles per hour, it is possible with electric locomotives to operate at any speed up grade that is consistent with the alignment of the track. In other words, the same schedule speed can be maintained up grade and down grade, thus greatly facilitating the movement of trains on heavy grade sections and vastly increasing the tonnage of the tracks.

Air brake equipments on all cars have contributed towards increasing the size of trains and safety in operation on mountain grade sections, but such operation is still handicapped by the limitations and dangers attending the holding of a heavy train on a downgrade of long extent. As the electric locomotive is a convertible piece of apparatus, changing electricity into mechanical power and vice versa with equal efficiency, it offers a means of relieving the air brake entirely or in part, and performing the functions of braking by returning electricity to the line. Elimination of air-brake shoe troubles and overheated tires, will be appreciated by steam railroad operators as soon as this valuable feature of the electric locomotive becomes well understood, and aside from the economic value of electric braking, it offers much towards the safety of carrying passenger trains over mountain grade sections.

This is peculiarly an age of engineering struggle and the battle between high-power guns and armor plate is equally reflected in railroading between the constructors of locomotives and the builders of roadbeds. The electrical engineers seem to have available a type of locomotive which can use existing roadbeds without subjecting them to additional burdens, at the same time ensuring material economies over steam locomotive operation. The initial step towards electrifying mountain divisions has already been taken by the Great Northern Ry. in equipping its Cascade Tunnel, and larger projects are under careful consideration by other roads, and will probably result in more electrified heavy-grade sections in the near future.

The Cambridge Bridge Over the Charles River.

The recent dedication of the Cambridge Bridge between Cambridge St., Boston, and Main St., Cambridge, which has been under construction for several years, is an event highly gratifying to those who believe that bridge work in this country is capable of a much higher artistic development than is generally permitted by those paying for the structures. The Cambridge Bridge has been in charge of a commission consisting of Dr. E. D. Leavitt and the mayors of the two cities it connects. To the public spirit of Dr. Leavitt is largely due the success of the commission's work, for through his influence it was determined at the outset that this bridge should not be a mere utilitarian structure, spanning the river between these two cities with a minimum expense for steel and masonry, but should be a structure worthy of the importance of the site and an ornament to the great parkways which have already been partly developed along the banks of the Charles River, and eventually will extend along both banks for a distance of over twenty miles, forming a water park of the first rank. The technical features of the work were assigned to Mr. Wm. Jackson, city engineer of Boston, and Mr. E. M. Wheelwright, the well-known Boston architect. The assistant engineer was the late John E. Cheney, who took a deep interest in it and left the imprint of his skill as a designer in all the structural details, some of which have already been illustrated in this journal.

Before any plans were prepared, Messrs. Jackson and Wheelwright visited Europe to become thoroughly familiar with the bridges in the important cities across the Atlantic. It may be recalled that The Engineering Record printed some years ago a series of large engravings from some fifty of the most interesting of the photographs these gentlemen gathered during their tour of inspection. It might be stated that before making this journey, Mr. Jackson had no preconceived ideas regarding the type of structure to be employed, although he was naturally enough glad to have an opportunity to design a bridge in which the question of dollars was relegated to a minor position as compared with artistic merit and harmony with surroundings. Mr. Wheelwright, on the other hand, visited Europe with the expectation of learning that stone arches were the only true solution of such a problem as that presented in this structure. After critically examining the important bridges of the Continent, it was apparent, however, that it was practicable to build steel structures possessing all elements of structural beauty, and that masonry not only had been forced from its old position as the leading material for artistic bridge-work, but had even been compelled to give way to steel for structures of the highest aesthetic rank under certain conditions. This fact was particularly evident from a study of the bridges in Dresden, illustrations of which were among those included in the series already referred to.

While the first suggestions for the bridge were being developed, the commission found it necessary to secure permission to build a structure without a draw span. At first it was believed that such a draw could be introduced without spoiling the effect of the structure as a whole, and it was proposed to make the central feature an artificial island with a channel cut through it at the draw. It was found impossible, however, to design a bridge having a draw span which would be satisfactory artistically and, accordingly the Massachusetts legislature was petioned to authorize the construction of a bridge without a draw, crossing the channel at a height sufficient to furnish a clear headroom of 26 ft. above mean high water at the central spans. This gives a sufficient height to allow tugs and vessels without masts to pass, and as there is no business to speak of above the bridge it was felt that the injury which might arise to a few riparian owners through the closing of the river navigation to larger vessels was more than counterbalanced by the gain in the character of the bridge. Unfortunately the War Department refused to agree to this opinion, and it was necessary to secure the passage of a bill in Congress and its approval by President McKinley in order to permit the construction of a drawless bridge. Two years were occupied in these legislative proceedings, but it was absolutely essential to carry them through in order to enable the engineer and architect to reach the best possible result, which alone would be acceptable in the case of the Cambridge Bridge.

Before the final design was adopted, about fifty carefully worked out studies had been made. Each of these was prepared to show the effect of some change in spans, piers, grades or points of structural emphasis, and every suggestion having any merit, structurally or artistically, was thoroughly discussed before decision was reached concerning it. It was learned early in this investigation that the best effect would be obtained by laying emphasis on the central portion of the bridge, increasing gradually the length of the arches from the shore to the center of the bridge and making the piers successively heavier as the central channel was reached. The length of the bridge between abutments is 1,767½ ft., and it has eleven spans, each of twelve steel ribs, varying from 101½ to 188½ ft. The height of the bridge at the center is about 48½ ft. above low water. The main effect of the structure is produced by the use of two large central piers, each having a foundation 201 ft. long by 67 ft. wide; these piers have ornamental stone towers rising to a height of 40 ft. above the roadway, and smaller stone towers have been built at the end of each abutment. In designing the masonry of these piers the purpose was to obtain the happiest possible expression of monumental dignity and not to keep the number of cubic yards down to the minimum consistent with strength. As a result, these great piers completely overshadow the masonry structures used on other bridges across the Charles River and demonstrate in a most striking manner the possibilities of stone masonry combined with structural steel for the expression of graceful strength. They also call attention to the fact that the bridge crosses the boundary line of two important cities.

Attention is particularly called to this structure because it is one that should be visited by all engineers and architects who have an opportunity to inspect the structure. It is the result of the most careful and painstaking attempt yet carried through to completion in this country to build a bridge which is artistically as well as structurally in perfect harmony with its position and with its purpose. Dr. Leavitt and Messrs. Jackson and Wheelwright are to be congratulated on the success of their work, which stands forth as one of the few really satisfactory American bridges from every point of view.

Large Reinforced Concrete Syphons.

The beginning of the construction of the Catskill Aqueduct for the additional water supply of the City of New York obviously brings into prominence many serious questions of design of the main features of the work. Among these important problems of design there is probably none requiring more serious consideration than that bearing upon the proper construction of syphons under the deep valleys crossed by the aqueduct line. The most evident forms of construction, those which most easily suggest themselves, are deep tunnels and riveted steel pipes. The deep tunnels are naturally carried to such depths as to pierce bedrock under the lowest points of the geologic valley crossed. This frequently necessitates the construction of shafts several hundred feet deep with the base of the tunnel carried still deeper. These pressure tunnels can usually be lined with comparative economy so as to make them actually or practically water-tight, and they serve their purpose admirably as structures if an excessive amount of water be not encountered in their construction. They need, however, provision for being pumped out at proper intervals for examination, cleaning and repairs, if necessary, all of which at such great depths involves inconvenience and expense.

The riveted steel pipe, on the other hand, aside from questions of relative cost, lies near the surface of the ground and is depressed to no greater depth than is necessary for suitable covering and protection. It is therefore subjected to a relatively low pressure no greater than the minimum required by the topographic features of the valley. This is a great advantage and reduces some important parts of care and maintenance, but it is offset by the perishable character of the metal, which can scarcely be completely protected against all corrosion. It is clear that the riveted steel pipe would be more suitable for a short syphon than a long one where the cost of shafts would be distributed over a comparatively long high pressure tunnel.

The obvious advantages of surface construction, or in some places of a type of aqueduct suitable to be carried across a valley on a masonry or other bridge structure, and, furthermore, of a more permanent character than that of a steel pipe gives much interest to the recent construction of a reinforced concrete syphon forming part of an irrigation canal in Spain, as described in "Le Genie Civil." This syphon has a length of about 3,200 ft., and consists of two tubes each 12.5 ft. in diameter. It may be contended, strictly speaking, that these tubes are mortar-lined and concrete coated steel pipe rather than reinforced concrete, and the contention would at least be reasonable, for each tube consists of a riveted steel pipe ⅛ inch thick reinforced on its exterior with steel ties. These steel pipes are coated with six inches of concrete on their exterior which encloses and imbeds the reinforcing ties. The interior of the pipe is lined with seven-eighths inch of mortar. The steel pipe is continuous throughout the length of the syphon, being fitted with expansion joints and thus affording a continuous water stop.

This is an interesting structure, especially in view of the large diameter of the tubes, at the same time it does not afford opportunity for learning much about what reinforced concrete would do in such a structure. A continuous steel

pipe of such a diameter lined with a thin interior layer of mortar and covered with but six inches of concrete is practically a series of comparatively thin cylindrical laminations. While water tightness is secured, it is at the cost of unity of the materials composing the syphon. It will be exceedingly difficult if not impossible to prevent the thin interior layers of mortar from cracking sufficiently to permit the water to come into contact with the steel, resulting in serious corrosion. In such a structure there is complete failure to secure that intimate and inter-structural combination which constitutes one of the most excellent features of reinforced concrete and without which failure of detail is invited.

The obvious reason for not using reinforced concrete for syphon tubes, aside from any matters of cost, is the lack of water-tightness of ordinary concrete. There has been, however, much advance made in securing this quality, so necessary for the purpose under consideration. Concrete sufficiently water-tight for aqueduct purposes, up to heads of sixty feet or more, has already been made, and experimental investigations indicate that it may be feasible to reach far greater heads. The maximum head on the Spanish syphon is eighty-five feet and there should be no serious difficulty in constructing a true reinforced concrete tube to meet the requirements of such conditions, nor would it be difficult to provide effectively against expansion and contraction with longitudinal steel.

Recent investigations have resulted encouragingly for the early attainment of concrete practically impermeable to water up to heads far beyond any hitherto considered. The intimate combination of the concrete and steel enables a sufficient mass to be used to eliminate any prejudicial effects of fine cracks. A properly designed and constructed reinforced concrete syphon would be as permanently enduring as any other first class masonry, and with all the advantages of complete accessibility, convenience and low cost of care and maintenance.

The Value of Small Drawings.

So much has been said about the value of small drawings in construction work that the subject would not be referred to at this time if evidence was not constantly proving the laxity of many companies in keeping their drawing office practice up-to-date, and their failure to realize that in probably half of all cases drawings for field use not larger than 11x14 in. are better than anything bigger. It should be needless to go over all the arguments against the custom of making single drawings for construction work big enough to convert into a suit of clothes. Sometimes, of course, a map must be drawn on so small a scale that the territory cannot be shown on less than 6 to 10 sq. ft. of paper, but if employers stopped to figure the cost of making large drawings and large prints, let alone the difficulty of filing them compactly, it is safe to say that fewer of those productions would be bulking big in the expensive office spaces of large cities.

An album of small drawings, multiplied as to details, is infinitely more convenient than several huge rolls in which details and general relations are all jumbled together. It can be kept up-to-date much easier, and at less expense. The cost of blue prints is not a negligible quantity under city conditions. Proper rotation and numbering, with suitable cross-references in the drawing index, are all that are needed to maintain the usefulness of the small data sheet. The picture plans required by non-technical clients and boards of directors can just as well be made on an 8 by 10 or 11x14 in. sheet in the majority of cases.

Obviously it costs money to keep drawings up-to-date, but it costs more in the long run to fail to do this. A prominent firm of engineers recently undertook the re-modelling of a power plant, and the expense for the new foundations was greatly increased on account of the fact that absolutely no record or definite knowledge existed as to the character of the foundation and soil under the plant. The knowledge was obtained finally, of course, by test borings and a long series of tabulations of data, but the expense to the client company was far beyond the cost of maintaining the necessary simple plans in the first place. It is poor policy for a company to be in such a hurry to start its plant that no time can be found to keep the proper records of the character of the construction, and the changes put in effect beyond the original design. From a hasty point of view the money expended on drawings and data in very large engineering undertakings by Federal, State or railroad authorities seems at times needlessly great, but a great system rarely gets through its first operating year without being benefitted in money saved far above the cost of the drawings and data, if the latter have only been kept up-to-date. Particularly in electrical work is there a field for the use of schematic diagrams in which on small sheets stripped of all superfluities, three phase circuits, for example, are shown by single lines, and apparatus by simple symbols. The value of drawings to an operating man is in direct proportion to their straightforward freedom from all draughting complications.

Notes and Comments.

The Rain-Water Run-off from populous districts is one of the most important subjects that the designers of sewerage systems have to consider. In spite of the attention that has been paid to it, surprisingly few absolutely definite data are available and for this reason the sanitary section of the Boston Society of Civil Engineers has appointed a committee to consider the whole subject. The committee is particularly desirous of collecting all records regarding it and engineers throughout the country who have information on the subject are requested to send it to Mr. Harrison P. Eddy, 14 Beacon St., Boston, who is the secretary of the committee. At the present time nothing is so necessary as the compilation and study of available data, and for this reason engineers will do well to assist the committee with whatever information they may possess, since the committee's work is done for the benefit of the whole profession.

A Gas Engine Test lasting two weeks was recently run at the works of the J. P. Eustis Mfg. Co., of Boston, by Messrs. P. R. Nichols and R. F. Knight, of the Massachusetts Institute of Technology. The test was made on a 55-h.p. engine direct-connected to a 30-kw. direct-current generator. The engine was of the vertical, twin cylinder, four-cycle type, the governing being effected by varying the richness of the explosive mixture. Cooling water was circulated by a motor-driven centrifugal pump and the engine was started by compressed air stored in two tanks which were kept filled by an air pump driven by a small motor. The gas used by the engine was taken from the street mains and averaged about 590 B. t. u. per cubic foot. During the two weeks' run, the total kilowatt-hours were 3,146, and the total gas used 92,900 cu. ft.; 31.9 kw. hr. were used in driving the pump, leaving 3,114 kw.-hr. as the net energy delivered during the run. At 70 cents per 1,000 cu. ft., the gas cost 2.09 cents per kw.-hr., the oil cost 0.029 cent, the labor at 2 hr. per day cost 0.193 cent, and the interest and depreciation, reckoned at 15 per cent. on $3,000, amounted to 0.555 cent, making the total cost of energy 2.87 cents per kilowatt-hour.

The Refuse Destructor and electric station described in The Engineering Record of Nov. 11, 1905, which was built by the City of New York to utilize the refuse of a portion of the Borough of Manhattan, has proved an unprofitable venture, so far as the generation of electricity is concerned. The current has been used for public bridge lighting, costing the Department of Water Supply, Gas and Electricity about $50,000 a year, while the local lighting company would do the same work for about half this sum. The trouble with the lighting end of the undertaking seems to have been that city refuse is a very uneven fuel, and the operation of the plant as an electric generating station is much more difficult than will be its operation as a refuse destructor simply. It is not unlikely that small amounts of current for various purposes will be furnished from it to the immediate vicinity, but it is not believed that any extensive system of public lighting can be safely undertaken.

Foundation Troubles at the Mt. Royal pumping station of the Baltimore water works are now being investigated and seem to be due to an unusual condition. One corner of the building has been underpinned and the pier which supported it has been laid bare by sinking a pit some 30 ft. deep. The concrete was found to be in a bad condition and the rock on which the pier rested was also somewhat decomposed. The earth in the vicinity was very warm and moist, and an examination showed that the concrete hot well had been leaking considerably. In addition to the presence of this hot water in the cinder fill which formed the site of this part of the building, return currents from the belt line tunnel of the Baltimore & Ohio R. R. were detected. It is understood that the condition of the concrete is not unlike that described by Mr. A. A. Knudson, in a paper read last winter before the American Institution of Electrical Engineers, concerning the electrolysis of steel embedded in concrete. The conditions at Baltimore are so unsual that when the examination is completed it is to be hoped that all the facts will be made public.

A Trade Catalogue Library has been established by the Technology Department of the Carnegie Library at Pittsburg, and an attempt is being made there to collect business pamphlets covering the entire engineering field These publications will be given a prominent place on the shelves, carefully catalogued under both firm name and subject, and made accessible to the public. A similar collection made at a Brooklyn library some time ago proved not only of value to the people using the library but also of service to the publishers of the catalogues. It goes without saying that a practically complete collection of trade publications in a library in a manufactoring city like Pittsburg has a reference value exceptionally high, and for this reason it is believed that manufacturers of supplies for engineers, architects and contractors will find it decidedly to their advantage to send their publications to Mr. H. W. Craver, who is in charge of the Technology Department of the Library at Pittsburg. The formation of such a collection in the public library of each manufacturing city is something that may very properly be investigated by its librarian. The time has gone by when the trade publication is merely a collection of claims for some product, stated without much regard for truth and published without regard to typographical appearance.

THE CONTRACTOR'S PLANT AND METHODS ON THE HARBOR WORK AT GARY, IND.

The construction of a harbor for the new plant of the United States Steel Corporation at Gary, Ind., is one of the most difficult and extensive of the engineering works required in building that plant. The site of the latter is at the extreme south end of Lake Michigan, 12 miles from the South Chicago plant of the steel corporation, and 20 miles from the central business district of Chicago, where an area of about one square mile, with a frontage of over a mile along the shore of the lake, has been provided. This area is covered with fine lake sand to a depth of from 40 to 60 ft. from the surface, which before construction started was formed by a series of alternate ridges and hollows parallel with the shore line. The ridges rose 15 to 40 ft. above the water in the lake, while the general elevation of the depression between them was about 10 ft. above that level. The Grand Calumet River, a sluggish stream that heads in swamps to the east of the site, extends along the rear side of the latter, parallel to the lake, into which it empties at South Chicago, 12 miles away. From South Chicago entirely around the lower end of the lake the shore line is a low, flat and practically unbroken sandy beach. This characteristic shore line existed at the site of the new plant, where the established minimum of 22 ft. in channel construction on the Great Lakes is not reached in the lake until about 2,000 ft. off shore.

General Arrangement of Harbor.—The provision of proper and sufficient harbor and docking facilities for the great number of the largest boats on the Great Lakes which will ply between the new plant and the terminals of the iron-mine railroads on Lake Superior, was rendered a project of unusual magnitude by these natural conditions. A slip, 250 ft. wide, approximately a mile in length and with a minimum depth of 22 ft. of water, is being built at right angles to the shore line to secure the necessary wharfage and habor room. This slip extends 2,000 ft. off-shore to the 22-ft. depth in the lake and 3,000 ft. inland. It is being closely lined along both sides with sheet piling to hold the sand in place, and will be dredged to the required depth.

The furnaces and stoves of the steel plant will be in single row along the west side of the slip, at a distance of about 750 ft. from the latter. Large traveling unloading machines will operate the length of the dock on that side and will convey the iron ore from the vessels to storage piles between the slip and the furnaces. These storage piles will be spanned by traveling bridges carrying grab buckets, which will handle the ore to stock piles or to cars for charging the furnaces, the general arrangement being the same as in several existing plants of the steel corporation.

The pier along the west side of the slip from the shore line to the inner end of the slip a distance of 3,000 ft., will have a concrete dock wall carried by heavy pile foundations. This wall extends from 3 ft. below Chicago city datum, the later being on an average about 2 ft below the lake level at Gary, to 10 ft. above that datum. It is 15 ft. wide at the bottom, has a vertical front face and is stepped on the rear face to a width of 5 ft. at the top. This wall rests on three longitudinal rows of piles spaced 6 ft. apart on centers, the piles in the rows being 3 ft. apart on centers. The piles in this portion of the pier are all at least 34 ft. long and are driven to at least 30 ft. below Chicago datum. The two outer rows are tied together at intervals of 6 ft. with heavy iron rods; the outer row on the slip side are also anchored by rods, 44 ft. long, at intervals of 6 ft., to a waling on a fourth row of piles under the footing for the unloader tracks. Immediately inside of the outer row of piles is a row of triple-lap Wakefield sheet piling. This piling consists of 3x12-in. Oregon fir in 34-ft. lengths and is driven to a penetration of at least 30 ft. The outer row of round piles are under the toe of the dock wall and are cut off at the level of the bottom of the latter, 3 ft. below the Chicago datum, and are capped with a 12x12-in oak timber. The other two rows of piles and the row of sheet piling are left with their tops protruding as they are driven and are imbedded in the lower part of the concrete wall.

The off-shore 2,000 ft. of the pier along the west side of the slip is a rock-filled timber and pile pier. For the first 600 ft. from the shore line this crib consists of two rows of closely-spaced, heavy, round timber piles with a minimum length of 45 ft. The rows are 12 ft. apart on centers and are tied together with two horizontal rows of iron rods attached to oak walings on the piles. A row of triple-lap Wakefield sheet-piling, consisting of 3x12-in. Oregon fir planks, 44 ft. long, is driven immediately outside of the row of round piles on the slip side. This sheet piling is protected by a third row of round piles, which are spaced 6 ft. apart on centers; these piles are capped with a 12x12-in. oak timber and are tied together near the top with a 12x12-in. oak waling piece, which also acts as a fender for the pier. The various rows of piles in the latter are driven to within about 12 ft. of the average water level in this section outside the natural shore line. The space between the two rows of closely driven piles is filled with broken stone from the natural bed of the lake to the top of the pier.

Beyond the 600 ft. of pier 12-ft. in width on this side of the slipe, is 700 ft. that is 18 ft. wide and beyond that 700 ft. that is 24 ft. wide. The construction of these wider sections is the same as that of the 12-ft section. At the outer end of this pier and the west side of the slip a rock-filled timber and pile pier, 2,000 ft. in length and 24 ft. wide, will be built to the west in the lake at right angles to the slip. This pier will be of the same construction as the off-shore portion of the pier along the west side of the slip, with the exception that the row of triple-lap sheet piling will be omitted in it. The space enclosed by the pier along the west side of the slip and by this outer pier was formerly covered with upwards of 22 ft. of water, but will be filled with sand to a height of 3 to 18 ft. above the water level and on this made ground will be erected a part of the steel plant.

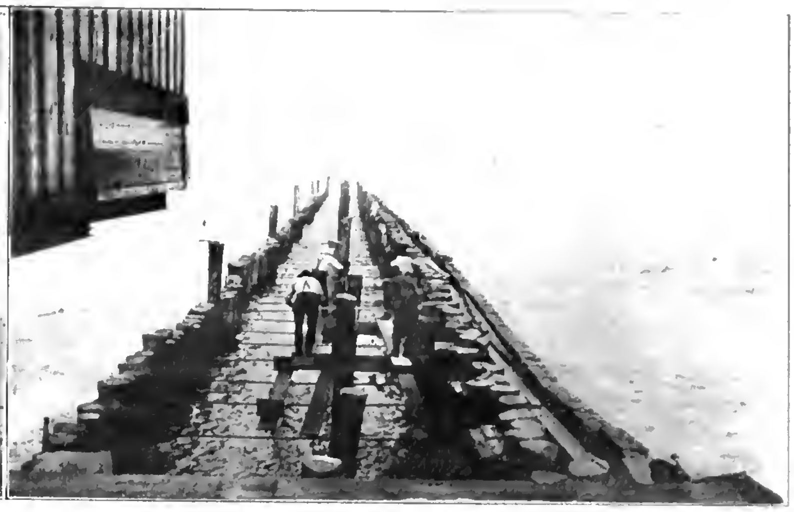
No dockage facilities will be provided along the east side of the slip, for the present. From 500 ft. off shore to the inner end of the slip, in a length of 3,500 ft., a row of triple-lap Wakefield sheet-piling, consisting of 3x12-in. Oregon fir planks, 44 ft. long, is driven as a lining to retain the sand. This sheeting is protected on the outer side by a row of heavy round piles, driven 6 ft. apart on centers, which are capped on top and are held together by a 12x12-in. oak waling piece along the side that also serves as a fender. The second 500 ft. off-shore of the lining on this side of the slip consists of a pier 12 ft. wide and of the same construction as the pier of that width on the west side; the next 300 ft. is 18 ft. and the remainder 24 ft. in width, all of the same construction as the pier of the same width on the west side. At the outer end of this pier, a return pier 24 ft. wide, is to extend 1,000 ft. to the east in the lake at right angles to the slip, and together with the pier along the east side of the latter will enclose an area of made ground, where the lake was originally as much as 22 ft. deep.

Section of Channel Showing Character of Sand.

Construction of Harbor.—The low, flat beach and the location of the site of the harbor at the south end of the lake, where it is exposed to the full force of the extremely severe northeast storms which sweep the latter, rendered the early construction work on the harbor particularly hazardous. The sand dunes that formed the site of the inshore portion of the slip rose 15 to 30 ft. above the level of the lake and were only sparsely covered with scraggly oak trees and scanty vegetation. The sand in which the slip has to be excavated is extremely fine, clean and free from pockets of gravel or loam. Although not exactly quicksand, it flows so freely when wet that it is confined with difficulty, and, in fact, is almost as hard to hold when dry.

Construction on the harbor was commenced in July, 1906, when the contractor for this work,

Off-Shore Piers under Construction.



Piles for Off-Shore Rock-Filled Pier.

the Great Lakes Dredge & Dock Co. of Chicago, excavated into the site of the slip from the lake with a hydraulic dredge. The piling for a 600-ft. length of the pier on the west side of the slip, extending into the lake from the shore line, were then driven with a land driver running on the finished work. A 500-ft. length of the pier on the east side, also extending into the lake from the shore line was built about the same time. A breakwater consisting of two rows of piles driven close together, the rows being about 12 ft. apart and filled between with rock, was then thrown about half way across the slip at the end of 600-ft. length of pier on the west side. It was expected that floating equipment could work readily in the temporary harbor thus formed. The unsually large number of heavy northeast storms which occurred during the past winter and spring, however, greatly interfered with the progress of the dredging and pile driving. In fact, at times the floating drivers and the dredge were in much danger from the high surf that prevailed on the flat beach and carried into the temporary harbor without much reduction in force. In order that the floating equipment could be better protected, the breakwater across the slip was extended 40 ft. farther and a short breakwater built into the slip from the completed portion of the east pier, this second breakwater being far enough toward the shore from the first so an entrance from the lake was provided between the two. With this final temporary harbor arrangement the floating equipment can work on the off-shore pier construction during good weather and on the piers of the inshore section of the slip when the lake is rough.

After the preliminary dredging had been done with a 15-in. hydraulic dredge and the temporary harbor finished, the hydraulic dredge New York was brought in and is being used to handle the excavation of the slip. This dredge has an all steel hull which has a 40-ft. beam, is 110 ft. long, over-all, and 12 ft. deep. The superstructure is also entirely of steel, so the dredge is practically fireproof, and, as a matter of fact, is believed to be the only dredge of this type on the Great Lakes that is so constructed. The suction pipe for the pump of the dredge is swung from a 36 ft. A-frame with a 65-ft. boom at the forward end of the hull, which permits this pipe to be lowered to 35 ft. below the water surface. In the fine loose sand in which the dredge is at present operating no cutter is necessary. The dredge is provided with a 6-ft. cutter, however, which is operated by a 250-h.p. motor driven by current generated by a dynamo in the engine room.

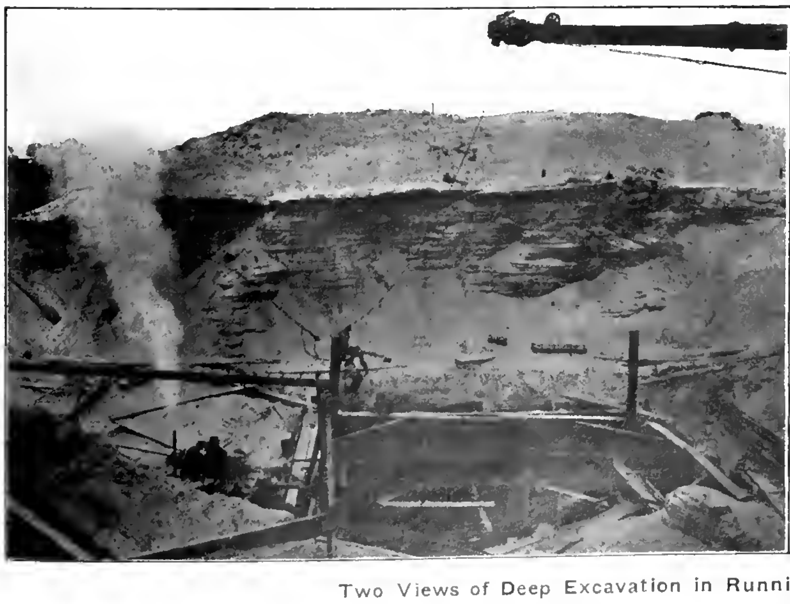
The dredge is equipped with a special centrifugal pump having a 24-in. suction and a 24-in. discharge. This pump is driven at 300 r.p.m. by a 17x30x42x30-in. triple-expansion marine engine. Steam is supplied to this engine and to the other steam consuming units by two 13x13-ft. Scotch marine boilers operating at 170 lb. pressure.

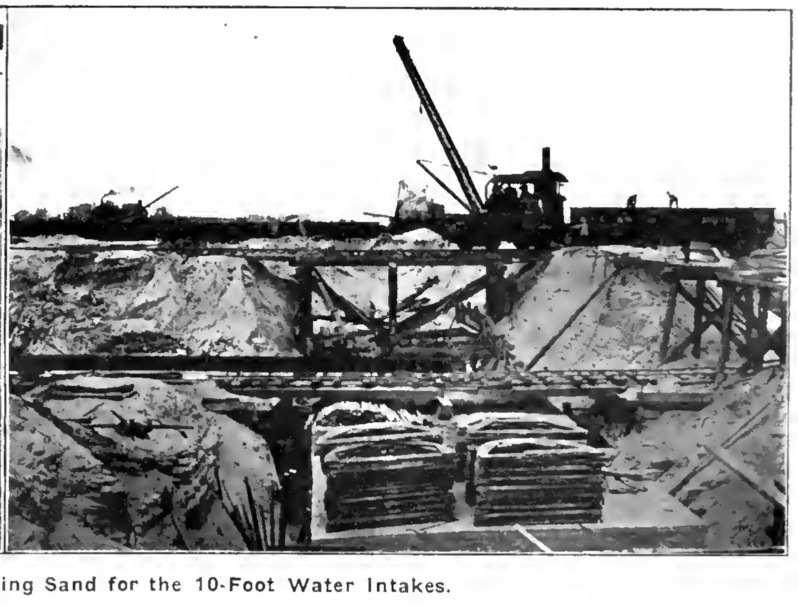
Two shifts are employed on the dredge in the present operations so that pumping may be carried on continuously. Quarters are provided on board for 40 men, 36 men being required to run the dredge.

The 24-in. pipe line that extends from the dredge to the point where the sand is being deposited for filling is carried on the water by pontoons consisting of hollow 24-in. cylinders built of boiler plates. These cylinders are made watertight and are built in lengths of 10 to 80 ft., depending on their location. They are used in pairs, one on each side of the pipe, the latter being swung from timbers attached to them. The pipe line is provided with flexible joints at intervals in order that bends may be made in the line without difficulty. The sand thus far has been pumped as much as 1,100 ft. from the dredge, the maximum distance to be reached by pumping being about 3,000 ft.

The preliminary plans covering the harbor construction estimated the excavation for the slip to require the removal of approximately 2,000,000 cu. yd. of material. Although under ordinary circumstances the dredge handles 8,000 to 12,,000 cu. yd. in 24 hr., when working on the excavation for the inshore section of the slip the roots of the small oak trees interfere to considerable extent with the operation of the pump. Small roots, 1-2 to 1 1-2 in. in diameter, are found to extend as much as 30 ft. from the surface to reach the water in the thick stratum of sand which makes up the site, fine shoots branching from these tap roots in the vicinity of the water. These fine roots cannot be kept out of the pump, but collect in the latter in considerable quantities and have to be removed.

The excavation for the slip is made somewhat wider at the water level than is required for the slip itself, in order to facilitate the construction of the piers. In all, over 16,000 round piles and 5,000,000 ft., board measure, of lumber will be used in the piers. The piles and the sheet piling are all being driven with the assistance of hydraulic jets. With the exception of the short length of each pier in which the piles were driven by land drivers, the work





Two Views of Deep Excavation in Running Sand for the 10-Foot Water Intakes.

is handled by four floating pile-driver outfits. Each of these outfits is equipped with a pump for operating a hydraulic jet at a pressure of up to 150 lb. per square inch. The sand in which the driving is done is of such nature that the jet can be put down first to loosen sand, and the pile or sheeting then dropped into this hole. A drop hammer in the leads of each outfit serves to carry the pile down into the loosened hole, and, if necessary, to hold it there momentarily until the sand has flowed back sufficiently to prevent it from floating, the nature of the sand being such as to remain very loose when stirred up under water.

The piles and timber for the dock work are mostly delivered on two switch tracks which extend the length of the land section of the slip parallel to and on the east side of the latter. The sheet piling is assembled on this side of the slip, dropped into the water and floated to place. The round piles for the east pier are also floated to place at present from storage piles along the east side. A standard-gauge track is laid the length of the west pier as it progresses in order that the piles and stone filling for that pier may be delivered on it. A track is also being laid on the off-shore section of the east pier to facilitate the delivery of material there.

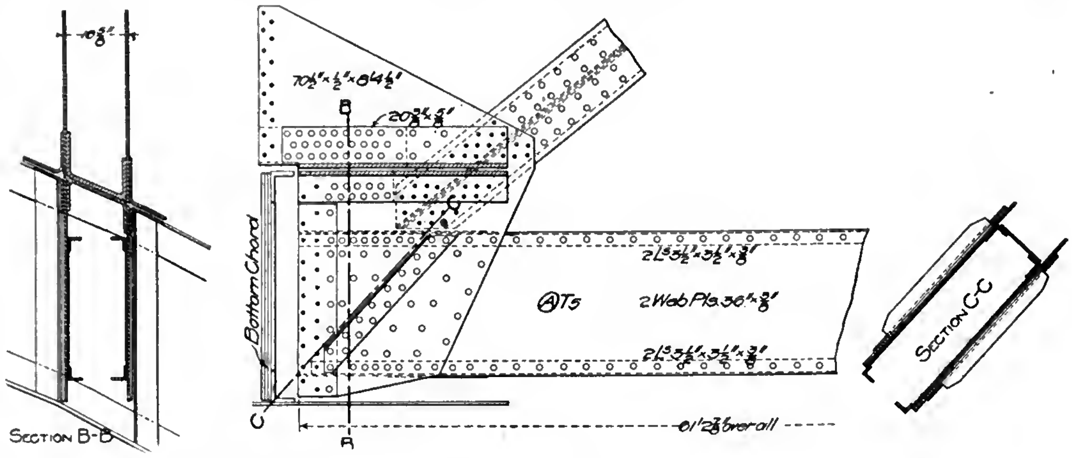
The concrete for the dock wall along the west side of the inshore portion of the slip is made in a mixing plant set up along the site of the wall and adjacent to a service track. A Drake continuous mixer is placed in a tower under storage bins for the concrete materials. The latter have heretofore been handled from cars on the service tracks to the bins in wheel barrows, but arrangements are being made to use a turntable A-frame derrick with a 1½-yd. clamshell bucket for this service. The mixer discharges into 1-yd. Koppel dump cars, which are pushed to place by hand on narrow gauge tracks laid on top of the wall forms.

Construction of Water Intakes.—The Great Lakes Dredge & Dock Co. also has the contract for building a pair of water intake conduits, each 10 ft. in diameter, which extend from an inlet in the concrete dock wall of the slip to a pumping station in the steel works, 750 ft. from the slip. The inverts of these two conduits are 25 to 26 ft. below the water level in the sand and 35 to 50 ft. below the surface, making their construction particularly difficult. The wide and deep excavation in the fine running sand required in building these conduits has been carried forward, successfully, however, by methods specially adapted to the work. The excavation is opened in lengths of 60 to 80 ft., the full width of the trench, a 1½-yd. McMyler clamshell bucket handled by a turntable A-frame derrick with a 65-ft. boom being used to remove the sand.

The sides of the excavation are lined with close horizontal sheeting as the sand is removed, until the water level is reached. A series of well-point strainers are then jetted down around the sides of the excavation to about the grade of the inverts of the conduits. These well-points range from 1½-in. to 2½-in. in diameter and are attached to pieces of wrought-iron pipe, which are threaded at the top and are screwed into 6-in. or 8-in. pipes laid horizontally around the sides of the excavation. These mains serve as suction pipes for several pumps set up around the excavation. Four to eight pumps are used in drawing water through this drainage system while excavating below the water line is in progress. This arrangement for keeping water out of the excavation has been so successful that the sand inside the limits of the suction mains is kept practically dry as long as desired, and the portion of the excavation below the water line does not require sheeting. The construction of the conduits is also carried on in the dry 25 to 26 ft. below the water level.

The concrete for the conduits, of which about 8 cu. yd. to the linear foot of the latter is required, is made in a Smith mixer set upon a platform on wheels running on a track laid along one side of the top of the excavation. Materials are supplied to the mixer from storage piles along a service track, or from cars on the track, by the clam-shell bucket handled by the turntable A-frame derrick. The mixer discharges into chutes which feed the concrete directly into place, the average output being about 120 cu. yd. a day when the outfit is in operation.

The construction of footings for the pumping station in which the two conduits terminate also involved deep excavations in the fine sand. The pumping station building is 45x153 ft. in plan.



Bottom Strut Connection in Floorbeam Truss, Quebec Bridge.

Part of the Work along the Site of the Ore Unloading Bridges.

The conduits end in a pump suction chamber, 8.5 ft. wide and 127 ft. long, the bottom of which is 25 ft. below Chicago city datum, or about 26.5 to 27 ft. below the lake level A 5-ft. layer of concrete was placed in the bottom of this chamber to insure against upward hydrostatic pressure. The pumping station provides room along one side of the top of the suction chamber for seven turbine pumps direct-connected to motors. A heavy base of concrete has been provided for these motor-pump sets, this base being carried down to about 20 ft. below the water level. The side walls of the building are carried by concrete footings 4 ft. thick which surround the suction chamber and pump base.

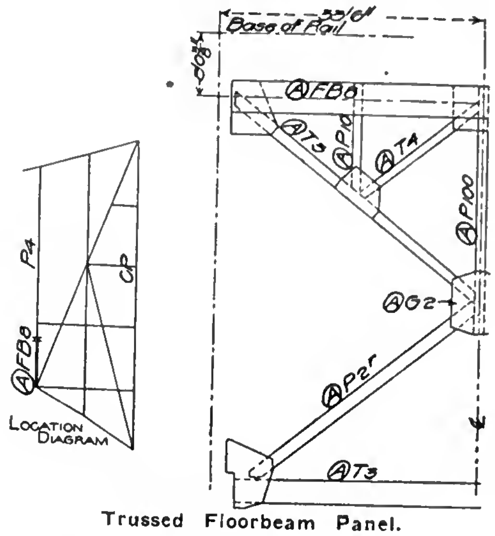
The wide and deep excavation in the sand for these heavy concrete footings was handled before the well-point pumping outfits had been adopted, heavy close sheeting and a large amount of pumping being required before the work was finished. The concrete was made in the same Smith mixer that is now being used on the conduits, over 6,000 cu. yd. being required.

The Great Lakes Dredge & Dock Co., the contractor for the harbor work and the intake conduits has the following plant now in operation: The 24-in hydraulic dredge New York; a land and four floating pile-driver outfits; four derrick scows; several flat scows; two standard-gauge turntable locomotive cranes; the A-frame turntable derrick; a light locomotive and train of dump cars; a large tug and various other equipment such as pumps, concrete mixers, air compressors and so forth. At present between 300 and 400 men are employed in the construction of these two portions of the new steel plant. They are housed and fed in model quarters by the contractor, on a cash co-operative basis.

The new steel plant was designed and is being constructed under the direction of Mr. G. G. Thorp, vice-president of the Indiana Steel Co., Mr. A. B. Neumann is chief engineer, and Mr. W. P. Gleason is superintendent of that company. The operations of the Great Lakes Dredge & Dock Co. are directed by Mr. T. C. Lutz, vice-president and general manager. Mr. John R. Williams is superintendent in immediate charge of the work at Gary.

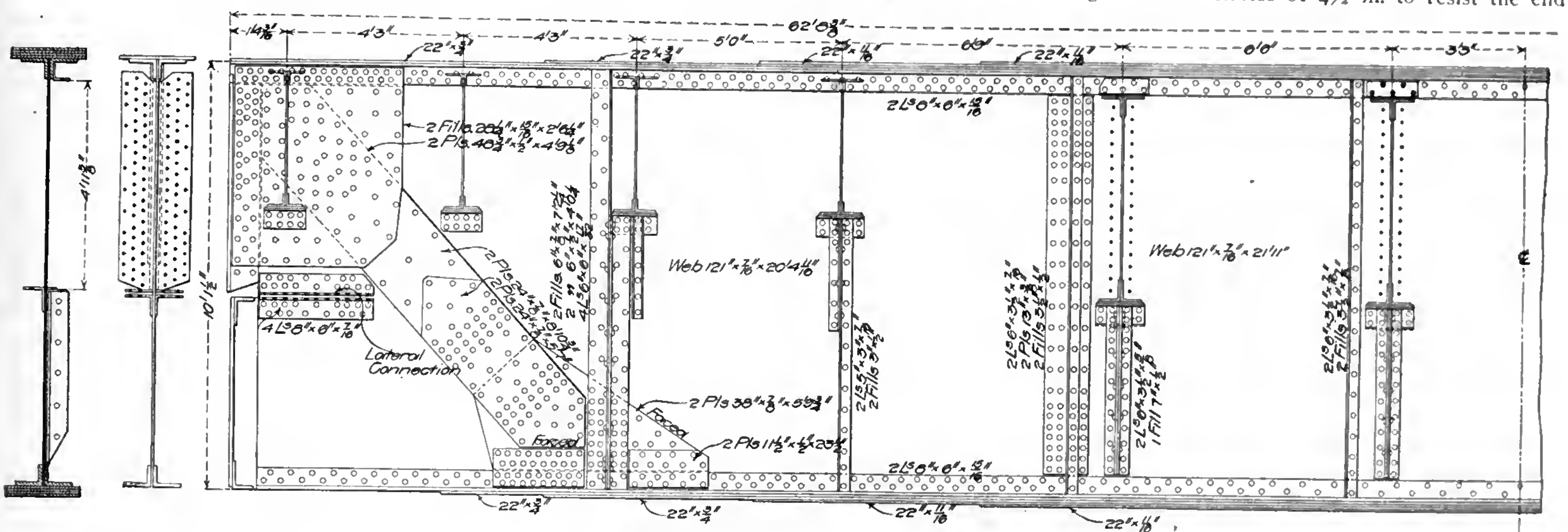
The Quebec Bridge Superstructure Details.—Part VIII.

Floor System.—The floor platform projects 5 ft. 3 in. beyond the centers of the trusses giving it a total width of 72 ft. 3 in. and provides for a live load consisting of two 140-ton locomotives on each track 6½ ft. from the axis of the bridge and for a continuous line of electric cars 30 ft. long, weighing 56,000 lb. each, 19 ft. each side of the bridge axis; and for a dead load of 6,200 lb. per lin. ft. due to floor construction alone. The railroad tracks are enclosed by vertical screens 7 ft. 4 in. high and the 17-ft. spaces between them and the truss clearances are floored with 4-in. diagonal planks spiked to 6x8-in. transverse joists, 18 in. apart on centers. Sidewalk platforms 5 ft. 1½ in. wide in the clear extend through the trusses beyond the outer edges of the roadway platforms and are protected by well-braced lattice girder hand-rails 4 ft. high. They have a flooring of 2-in. transverse planks elevated 6 in. above the top of the roadway planks and are carried by longitudinal timbers laid across the cantilever ends of transverse joists 7½ ft. apart.

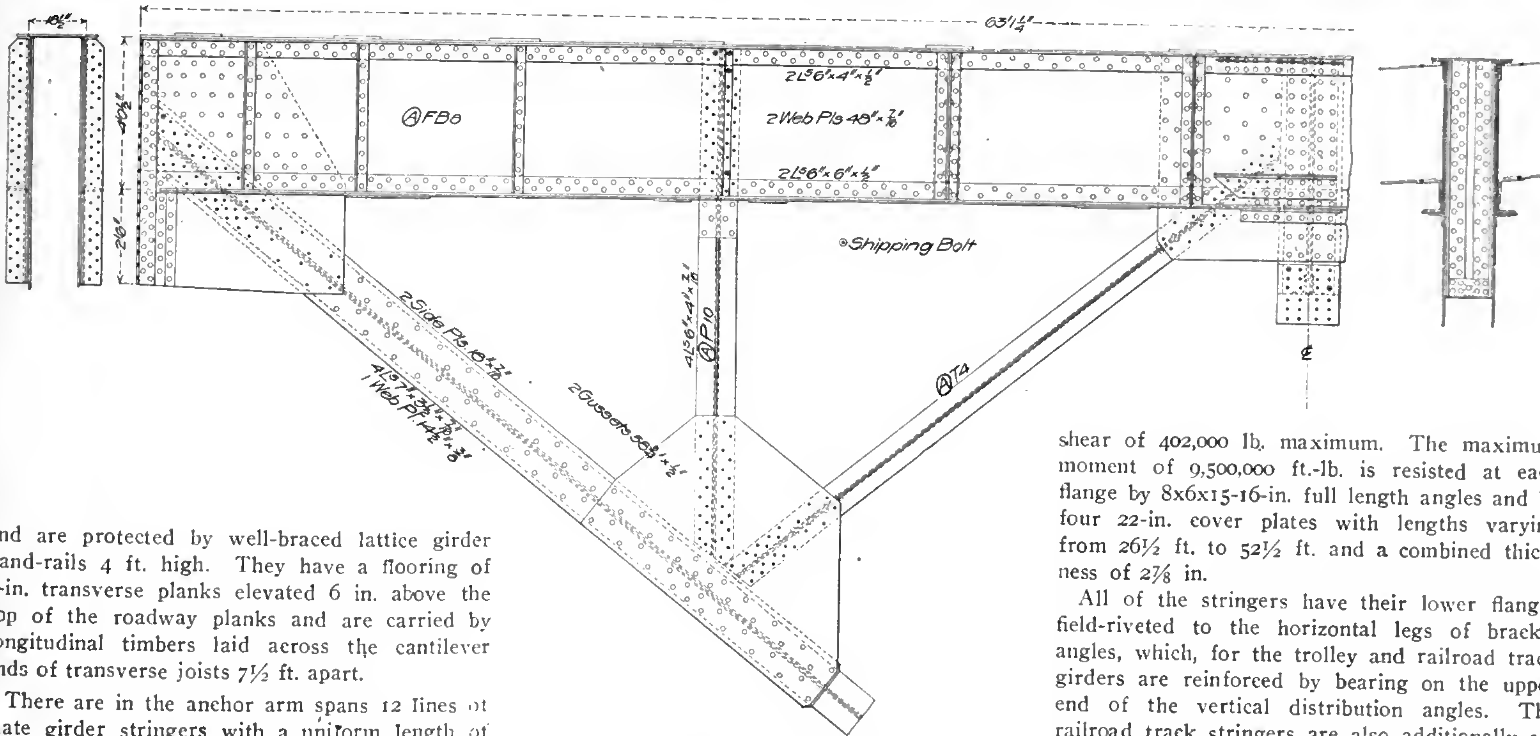


Trussed Floorbeam Panel.

the floor beam webs and provision is made for transmitting the lower flange stresses at an angle of 45 deg., to this point, through wide diagonal reinforcement plates riveted to the web plates in the sub-panels of the floor beams. These plates are thoroughly spliced to the bottom flange angles and although the latter are continued horizontally through the ends of the floor beam webs for the sake of stiffening them, the effect is substantially that of bending the flange angles up to the ends of the floor beams at this point. The floor beams at P1 and P2 resemble those at the adjacent intermediate panel points and have 7-16-in. web plates 10 ft. deep made in three sections, spliced together with four vertical rows of rivets to two 13x⅜-in. cover plates. The end is reinforced and already described by four diagonal 24x⅞-in. plates, and by two outside 48¾x½-in. plates in the upper corners, making a total thickness of 4½ in. to resist the end shear of 402,000 lb. maximum. The maximum moment of 9,500,000 ft.-lb. is resisted at each flange by 8x6x15-16-in. full length angles and by four 22-in. cover plates with lengths varying from 26½ ft. to 52½ ft. and a combined thickness of 2⅞ in.



Regular Floorbeam.



Half of Upper Part of Trussed Floorbeam.

There are in the anchor arm spans 12 lines of plate girder stringers with a uniform length of 50 ft., web connected to the floor beams with their top flanges just clearing the upper surface of the floor beam flanges. The four lines of railroad track stringers are 58 in. deep and are spaced 3 ft. 3 in. and 6 ft. 9 in. from the bridge axis. The 8 lines of roadway stringers 38 in. deep are spaced 5 ft. apart under the trolley tracks and 4 ft. 3 in. apart outside of them. The track, as well as the roadway stringers, are braced in the usual way with zigzag top and bottom flange lateral angles and transverse frames.

In the shore end panels of the anchor arm the lower chord is nearly horizontal and does not fall clear below the floor system; the deep, plate-girder floorbeams are therefore made in several cases to engage both the lower chord and the vertical posts, web-connected in the usual manner to the latter, notched slightly in the lower corner to clear the former and have their lower flanges flush with the lower flanges of the lower chord connected to them through the lateral connection plates. The effective connection is, however, made on the upper half of

All of the stringers have their lower flanges field-riveted to the horizontal legs of bracket angles, which, for the trolley and railroad track girders are reinforced by bearing on the upper end of the vertical distribution angles. The railroad track stringers are also additionally secured by top flange horizontal angle connections and by 30 field-driven rivets through vertical web-connection angles at each end. Each end of the floorbeam is connected to the vertical post by 106 field-driven rivets in six vertical rows of holes reamed to iron templates. The floorbeams weigh about 30 tons each and are shipped complete from the shop and handled in erection by special swiveling attachments which enable them to be delivered to the bridge parallel to its axis and to be revolved 90 deg. after being lifted from the cars by the overhang tackles, which swing them to position.

At post P3, where the bottom chord is clear of the lower flanges of the floorbeam, the latter is a simple plate girder 121 in. deep with webs and flanges like those already described for the end floorbeams except that the ends are not fitted around the lower chords and are set square and riveted to the vertical post through their full depth, the connection being made with a pair of 6x8x¾-in. vertical angles, having two rows of rivets to each flange. The lower flanges of the stringers are seated on and riveted to the top flange of the floorbeam.

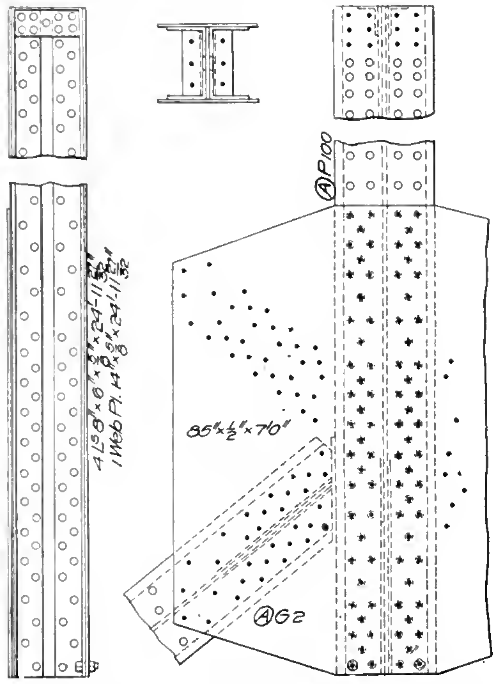
Near the river end of the anchor arm and the shore end of the cantilever arm the floorbeams virtually form the top chords of triangular trusses of which the bottom chords are formed by the main diagonals of the transverse braces below the floor. The floorbeams proper here consist of a box girder with two 48x7-16-in. full-length web plates, four 6x4x1½-in. flange angles, one full-length 26x1½-in. top flange cover plate and two full-length 7x1½-in. bottom flange cover plates. The stringers make butt joints on the center line of the top flange, where they are seated on riveted transverse plates. Pairs of 66x½-in. vertical gusset plates are riveted to the insides of the webs at the ends and centers of the girders and project below the lower flanges to form jaws receiving the field riveted connections of the diagonals and of the center vertical posts.

The upper ends of the intermediate vertical posts are inserted between the girder webs and are field riveted directly to them. The ends of the floorbeams have pairs of vertical connection angles 6½ ft. long, field riveted to the faces of the vertical posts or hangers. The main diagonals of the transverse bracing, which form the lower chords of the trussed floorbeams, have I-shaped cross section made with a 14½x⅜-in. web plate two pairs of 7x3½x5-16-in. flange angles and two 18x7-16-in. flange cover plates. They intersect at the center of the panel, where they are cut to clear the vertical post supporting the floorbeam at its center point, and are connected to it and spliced together by a pair of 85x½-in. flange cover plate, 7 ft. 10 in. long.

The lower ends of the main diagonals are connected to the feet of posts P4 with pairs of 70½x½ vertical gusset plates field riveted to the flanges of the vertical post and shop riveted on the outside of the web plate of the lower horizontal transverse strut, the ends are notched to clear the lower chord and they are connected above the strut with an oblique diaphragm made with a pair of plates back to back transferring the lateral stresses from the X-brace members in adjacent panels which are connected to corresponding double bent plates on both faces. The lower lateral strut has a rectangular cross section made with two vertical 26x⅜-in. side plates and four 3½x⅜-in. angles latticed top and bottom.

(To be Continued.)

Ventilation of Tunnel Workings during the Euston extension of the City & South London Ry. received the careful attention of the engineers and contractors, who commissioned Mr. Harvey Collingridge to make periodical examinations of the air at short intervals. Whenever these showed that the working conditions were not up to the standard deemed necessary, immediate steps were taken to remedy matters by exhausting the foul air and supplying fresh. As the impurity in the air at the working face generally was two or three times as much as in the body of the tunnel, a little distance back, it was found necessary to keep the point of air discharge close up to the shield. It sometimes happened, also, that foul air collected at other points in the tunnel workings, and accordingly the whole line of the construction was kept under observation.



Center Connection of Trussed Panel, Quebec Bridge.

Electric Operation on New Haven Line.

The recent beginning of regular electric operation of passenger trains of the New Haven R. R., running into New York was an engineering event of unusual importance, although trial and training runs had previously been made so often that there was no question about the success of the new system. This company was one of the earliest pioneers in the field of heavy electric traction, and operated six short branch lines in commercial service by electricity for a number of years. Three of them, aggregating 33 miles in length, were equipped for overhead contact, and three of them, aggregating 39½ miles in length, for third rail contact. All these lines were equipped with 500-volt, continuous current motors. The third rail was rather primitive in design and without protective devices, and so many injuries and fatalities followed its use that the company abandoned all third rail operation in Connecticut in consequence and returned to the use of steam locomotives. Improvements over the method it adopted formerly are now available, but it is safe to say that this unfortunate experience was one of the leading factors which determined the company to adopt the single-phase method of propulsion on its line. This selection of single phase after the New York Central authorities had chosen continuous current locomotives to haul trains into the same terminal station has aroused considerable interest, and on this account it is desirable at the outset to explain just why the choice was made, this explanation being based on information furnished by Vice-President McHenry, of the New York, New Haven & Hartford R. R.

Had the company been limited in its inquiry to the equipment of the terminal section leading into New York City, which is now electrically operated, considerations of expediency would doubtless have led it to select continuous current motors taking current from a third rail. The company, however, recognized the great importance of its decision upon future extensions of electric service to other parts of its system, and its final decision was accordingly based upon a study of the road as a whole rather than upon the solution of the New York terminal problem only. Its main problem, therefore, was the selection of a system of electric transmission best adapted to its condition, combining in the greatest measure efficiency, flexibility, simplicity and lowest first cost.

In the case of the New Haven road this problem was rather unusual for reasons which will appear at a glance at any map of its system. The latter comprises a net-work of lines which makes the transmission problem one to be worked out for areas rather than for lineal distances, reversing ordinary conditions. Under such circumstances the economic radius corresponding to any initial potential will be considerably extended and the practical value of high potential transmission will be much increased. The company finally adopted the single-phase system for a number of reasons. The efficiency which it showed was 95 per cent. between the bus bars in the power house and the collectors on the cars, whereas the customary continuous current motor system has an efficiency of but 75 per cent. The flexibility of the continuous or combination system is impaired by the limited radius of the low tension distribution, requiring sub-stations at frequent intervals, and still further by the limitations imposed by the use of a conductor rail. The position and height of this rail regarding the track rail must be rigidly maintained, while the overhead conductor used with the single phase system may vary 8 ft. in height and 4 ft. horizontally without causing inconvenience. It was also believed that the cost of the single phase installation would be much less than that of a continuous current system, although it is too early to furnish positive comparisons of cost of construction and operation at the present time.

The selection of the frequency and voltage of the transmission system was a decidedly interesting problem. The choice of frequency was practically fixed by the manufacturing companies at 15 or 25 cycles. The lower frequency afforded a material reduction in weight, size and cost of motors, a reduction in conductor losses and induction disturbances, together with an increase in the power factor of the motors. On the contrary its adoption would have materially impaired the commercial value of the system as a whole, in preventing its extension for many other uses incidental to railway operation. The standard power and railway frequency in general use is 25 cycles, and as the New Haven company already owned a number of power houses generating current at this frequency for trolley roads and, in addition, had equipped many of its shops with 25 cycle motors, the adoption of 15 cycles would have required the abandonment of a large amount of standard apparatus or the use of costly and inefficient frequency changes. The lighting of buildings was an important factor, also, for 25 cycles is the lowest frequency at which carbon filament lamps in general use can be satisfactorily operated. It was also considered desirable to provide for operation in parallel with the 25-cycle generators already adopted by the New York Central R. R. Accordingly the practical effect of a change from 25 to 15 cycle apparatus on the New Haven system would be substantially equivalent to a break in gauge and under existing conditions it was decided that the practical commercial value of the higher frequency outweighed the more theoretically merits of the lower one.

In the final selection of apparatus another interesting consideration was the determination of the generating and transmission electromotive force of the system. It was believed at first that the best results would be obtained by transmitting power at the highest initial voltage for which generators could be safely designed, about 22,000 volts, sub-stations being provided at suitable intervals for supplying current at 3,000-6,000 volts to secondary circuits. As the two motors in each electric locomotive truck are permanently connected in series, current must be supplied to them at 560 volts through the trans-

former which is a part of the locomotive's equipment. It was finally ascertained, however, that great simplicity would result from cutting out entirely the intermediate sub-stations and line transformers and reducing the initial electromotive force to 11,000 volts, raising the ratio of the locomotive transformer to correspond. This change has caused a reduction in capital and operating cost and an increase in electrcial efficiency which is most gratifying.

Before passing to some of the details of the equipment of the New York, New Haven & Hartford electrified line, attention may properly be called to a few statements given out by Mr. McHenry concerning the commercial aspects of electric traction. His investigations led him to believe that under favorable conditions there may be a sufficient saving in electric as compared with steam operation to pay interest and other fixed charges on the additional construction due to electrification and still leave a satisfactory margin to apply to dividends. Under general conditions, however, he believes it is altogether improbable that the direct saving resulting from the simple substitution of electric for steam power will be sufficient to justify the additional investment and financial risk.

In changing the method of motive power on existing railways, the conditions are by no means so simple as in the construction of new lines, for in the former case a great amount of capital already invested must be sacrificed and the problems of adaptation to existing conditions are particularly severe. The transition stage in bridging over the gap between steam and electric operation is both expensive and difficult, as the change affects train lighting and heating, telegraph and telephone service, signaling and track maintenance. To secure the fullest economy it is necessary to extend the new service over the whole length of the existing engine stage, and to include both passenger and freight trains, and in this connection it is interesting to note that in the case of the New Haven Co., the passenger train mileage forms so large a proportion of the whole that no additional generating and transmission capacity will be needed when electric traction is extended to freight service.

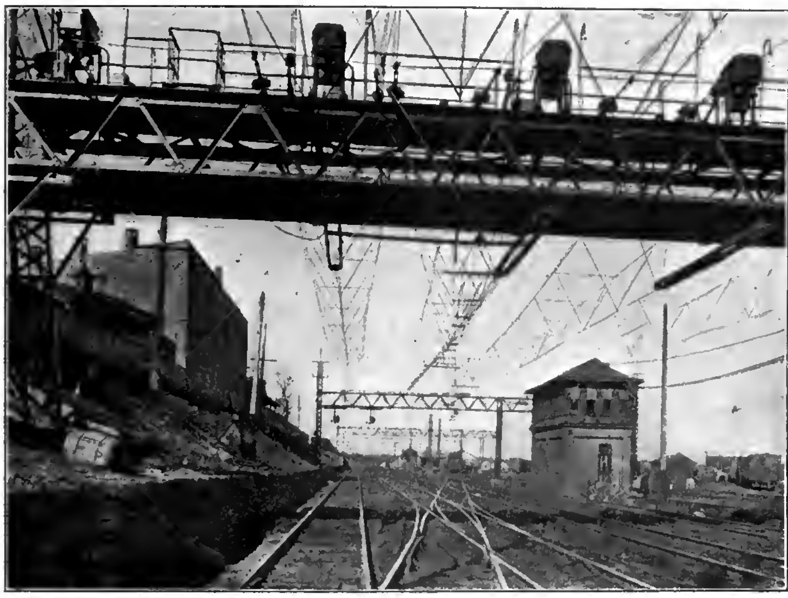
Mr. McHenry believes that the application of electric traction to heavy railway service will probably be governed by more important considerations than its mere relative cost as a motive power under similar conditions. In steam service the weight and speed of trains are limited by the horse-power capacity of the locomotive which generates its own power, and there are but few locomotives which can generate sufficient steam to utilize their full cylinder tractive power at speeds in excess of 12 miles an hour. Consequently any increase of speed beyond certain limits can only be attained by sacrificing train tonnage in a corresponding degree. A division of the train mile cost by the lesser number of tons increases the ton-mile proportionately. The high cost of fast freight service is principally due to this effect of a diminishing divisor, while it would seem that electric traction should permit high speed without sacrificing commercial tonnage, as, with a relatively unlimited source of power at command, the maximum draw-bar pull permitted by the motor design may be maintained at all speeds. The commercial value of high speed in freight and passenger service is so great that the prospect of escaping the present penalties accompanying reduced train capacity becomes doubly interesting.

Hardly less important is the opportunity afforded at the opposite end of the scale, for the economical operation of trains of minimum capacity. The train capacity cannot be reduced, without loss, below the point where the earnings equal the train-mile cost and if this cost cannot be reduced proportionately with reduced capacity, the inferior limit of capacity may be uneconomically large. In steam service the irreducible elements entering into the train-mile cost are so large that it is rarely possible to operate trains earning less than 40 to 50 cents per mile. On the other hand, electric service permits an extreme reduction of the train length to single car units, costing to operate but 10 to 15 cents per car mile. Hence the frequency of service may be increased and rates reduced, which in turn will react upon the volume of traffic, with a final result of increasing both gross and net earning. It may therefore be claimed for electric traction, in Mr. McHenry's opinion, that it will extend the limits of profitable operation of high speed heavy trains and also of light trains of low capacity.

A series of elaborate articles on all details of the electrical installation on the New Haven road is now appearing in the "Street Railway Journal," to which the reader is referred for complete official information in greater minuteness than is elsewhere available. The following notes are intended to give merely a general idea of the equipment.

The power plant is on the main line of the road on the bank of Mianus River, about one mile from Long Island Sound, and was designed and built by Westinghouse, Church, Kerr & Co. Coal can be delivered either by water or rail and an unlimited amount of salt water for condensing purposes is available from the river. By the erection of a dam about a mile upstream from the station, plenty of excellent boiler feed water has been obtained. The station is interesting as an example of plain-faced concrete blocks, made with crushed gneiss obtained in the excavation for the basement and condenser water flumes. In the boiler room the columns are steel, but all others are concrete. The runways for the traveling crane are of reinforced concrete. The boiler room is 160x110 ft., and the turbine room is 60x112 ft., the switchboard occupying a space 25x110 ft.

The current is supplied by three 3,000-kw. Westinghouse Parsons steam turbines and room is left for a fourth similar unit. The generators are wound for 3-phase current, but arranged to deliver both 3-phase and single-phase current. Their design was one of the most important technical problems of the entire undertaking. The former is required for delivery to the New York Central system to compensate for the energy required to operate the New Haven trains over the New York Central lines.



Overhead Lines at Cross-over.

Intermediate Bridge with Signals.

A separate condensing outfit is provided for each turbine, consisting of an Alberger 3-phase counter-current surface condenser, a 2-stage dry air pump, a centrifugal circulating pump direct-connected to a Westinghouse engine and a Monitor hotwell pump, the speed of which is automatically controlled by a float.

Condensing water is furnished by a single flume constructed of timber with a lining of creosoted lumber, from the intake at the face of the dock to the shore line, and of concrete for the remainder of its length. A similar discharge flume parallels the intake flume under the turbine room, and then diverges from it to the river. Each condenser is installed directly underneath the corresponding turbine and over the discharge flume, while the circulating pumps are located over the intake flume, thus making all connections as short as possible. The pipes leading from the condenser to the discharge flume have a submerged discharge, thus decreasing the head under which the circulation pumps work. To prevent electrolysis of the brass condenser tubes, a motor-generator set has been installed with suitable controlling apparatus maintaining in each condenser a counter electromotive force slightly in excess of the electromotive force due to the galvanic action and the stray currents.

Steam is furnished by twelve 525-h.p. Babcock & Wilcox water-tube boilers, set in batteries of

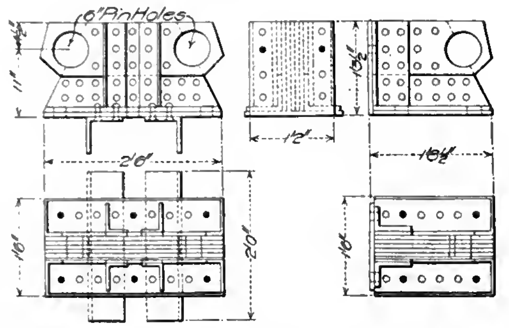
two each and arranged with eight boilers on one side and four on the other, separated by a 21-ft. firing floor. Provision is made for four additional boilers and to take care of the fourth turbo-generator which may be installed later. The boilers have Roney mechanical stokers and Babcock & Wilcox superheaters to deliver steam at 200 lb. pressure and 125° superheat. The boiler settings are completely enclosed in an external steel casing to render them impervious to air leakage. There are three Green fuel economizers.

Water is pumped at the dam at Mianus by means of two single acting vertical triplex pumps driven by 3-phase motors. One of these is able to supply the plant when it is running non-condensing and the other to supply all the fresh water needed when running condensing. Both pumps are operated by current from the power station. The water is forced through a 10-in. main to a circular reinforced concrete reservoir holding 600,000 gal., just outside the power house. From it the make-up water flows by gravity to two 13,000-gal. feed water tanks in the basement of the boiler room, which also receives the discharge from the hotwell pumps. The water is then drawn from these tanks by the pumps and delivered through the feed water heaters and economizers into the boilers. An auxiliary supply may also be obtained from a main of the Greenwich Water Co.

Coal received by water is unloaded from the barges by a clam-shell bucket which raises it into a hopper of 15 tons capacity at a height of 55 ft. above the dock. From the hopper it drops by gravity into a crusher and from the latter drops into steel cars in which it is weighed. The cars are drawn by cable up an inclined single-track railway of 13 per cent. grade into the top of the boiler room. There the coal is discharged into a hopper, whence it is delivered to two flight conveyors running the length of the boiler room. Openings in the bottom of the conveyors discharge coal through spouts to the stoker hoppers of the boilers. The flight conveyors have a capacity in excess of the coal required for the boilers and the surplus fuel is discharged at the further end of the boiler room into a storage bin below the boiler floor. Coal received by rail is dumped directly through a chute into this bin. When the boilers are supplied from this bin, the coal is discharged from it by gravity into a crusher, thence into a bucket conveyor in a tunnel below the bin, by which it is delivered to the flight conveyors above the boilers, and thence through the chute to the stoker hoppers. The ashes are dropped by gravity from the dumping grates of the stokers into chutes leading to cars running on tracks in the basement. These cars at present carry the ashes for use as a filling of the low ground in the neighborhood of the station.

A steam main is carried over the boilers on each side of the boiler house, each of the two mains crossing over to the opposite side at the center of the boiler room; provision is made for cross-connecting these two mains. From the boiler room the mains extend through the partition wall into the turbine room, thence downward into the basement where they connect to a header under the floor. A separate main is provided for the steam-driven auxiliaries, which are all designed to use superheated steam.

The main cables from each generator are run up to the switchboard gallery and thence through circuit breakers down to the high-tension busses under the gallery. One bus supplies the 3-phase current to the Port Morris feeders and the other principally single-phase currents for the New Haven locomotives. When a bus section, or the entire bus is used for supplying single-phase propulsion current, one leg is grounded directly to the track rails of the right-of-way through suitable switches; another leg supplies the outgoing feeders, which are run in duplicate, connecting directly to the trolley and forming the complete single-phase circuit; the third leg of this bus is also connected to a feeder carried along the right-of-way to supply power for local purposes, and completing the 3-phase circuit along the line.



Skewback Hinge Pedestals, Plate Girder Arch.

The locomotives used for hauling the trains were designed jointly by the engineers of the Westinghouse Electric & Mfg. Co., the Baldwin Locomotive Co. and the New York, New Haven & Hartford R. R. Co. They have two 4-wheel trucks, spaced 14½ ft. apart between centers, each truck having four 62-in. driving wheels. The motors, one for each axle, are of the gearless type and the methods of suspending them and transmitting the torque to the drivers are unusual. The armature winding is of a well-known direct current type, but is closed on itself and indirectly connected to the commutator through preventive leads, which are a feature of the Westinghouse design of single-phase motors. These leads serve the same function as the preventive coil used in alternating current work when passing from one tap to another of a transformer. The two armatures on each truck, with their corresponding compensating field coils, are joined permanently in series and operated at all times as a unit. For direct-current work, the two motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating current work the two units are operated separately from the secondaries of the step-down transformers at variable voltage, so that they are practically joined and parallel at all times. The locomotives may be controlled from either end by a master controller. On the New Haven portion of the line, current is taken from the overhead trolley line by means of a pantagraph collector, while on the New York Central portion of the route provision is made for a lower overhead direct current pantagraph trolley and third rail shoes. The locomotive measures 36 ft. 4 in. over the bumpers and weighs approximately 85 tons. It is capable of handling a 200-ton train in local service on a schedule speed of 26 miles per hour, with stops averaging 2 miles apart, making in such service a maximum speed of about 45 miles. It can also handle a 250-ton train on through service with a maximum speed of about 60 miles per hour. With heavier trains it is planned to couple two or more locomotives together and operate them in multiple. Details of the locomotive were explained at considerable length in The Engineering Record of March 24, 1906.

The overhead construction is shown in the accompanying illustrations. It is carried by supporting bridges of various lengths, accommodating 4 to 12 lines without intervening posts between tracks, and by heavier anchor bridges of which details have already been published in this journal. The main conductors are paralleled by two auxiliary feeder wires, for feeding around any section that may be cut out of service, and provision is made for two power feeders connected to the third phase of the generating system, and, on top of each post, for a three-phase circuit. The bridges are uniformly 300 ft. apart, and on sharp curves guy poles and pull-over wires are used to give the necessary curvature at intermediate points.

100-Foot Plate Girder Arch Spans over Carnegie Lake.

Snails in the Water Mains of some districts in Chicago have been causing considerable trouble. Evidently these snails originally entered from the lake and are now living in those pipes, which have only a small flow through them. In many cases service pipes have been stopped up by the shells, which have become tightly wedged inside them. These service pipes have been pumped out by force pumps and the main flushed through fire hydrants. In this way a large number of the shells have been removed. Blow-off branches to the sewers and screens on the mains will be tried as remedies.

A Plate Girder Highway Arch Bridge.

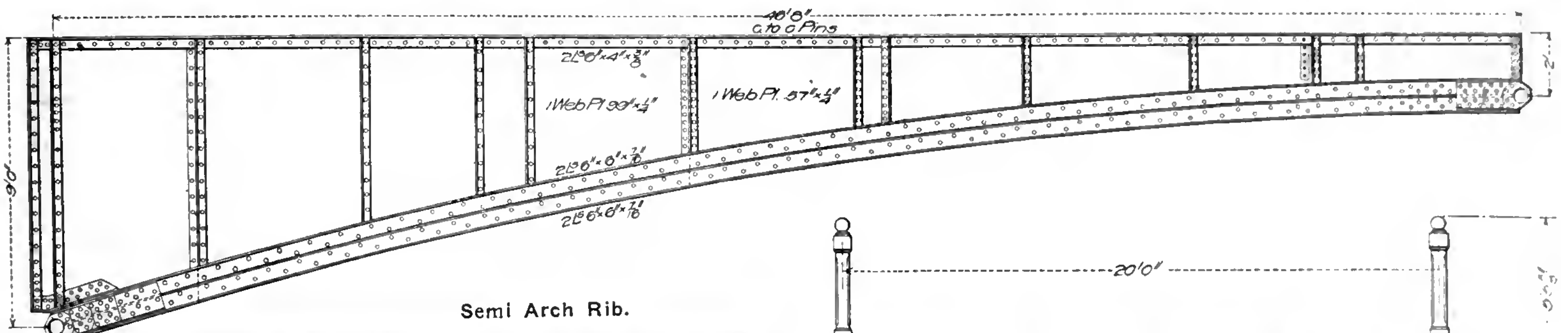
Harrison St., in Princeton, N. J., is carried across Carnegie Lake at a height of about 14 ft. above water level on a bridge of four three-hinge plate girder arch spans of 93 ft. 4 in. Several alternative designs for the superstructure were considered, and estimates were made for ordinary plate girders and for lattice girders, but the arches were adopted on account of the increased headway secured by their use, for the minimum elevation, and because of the much more attractive apeparance presented by them. The weight, although somewhat less than for ordinary plate girders is a little larger than for lattice girders of the same span.

The spans are duplicate and are independent of each other except that the pedestals on the three intermediate piers are continuous. Each span has two 3-hinge arch ribs 20 ft. apart on centers which have a rise of 7 ft. from the skewback pins and a depth of 2 ft. at the crown and 9 ft. at the skewbacks. Each semi-arch rib was shop riveted complete, forming a single unit about 47 ft. long and weighing about 9,500 lb. 26 in. deep are web connected to the arch ribs with their top flanges under the top flanges of the ribs. They carry three lines of 12-in. I-beam stringers with shelf and web connections and support the continuous reinforced concrete floor slabs which also rest on the top flanges of the arch ribs and project a few inches beyond them. The slab is made with 1:2:4 concrete reinforced with a single layer of No. 10 expanded metal of 3-in. mesh. It has a uniform depth of 6 in. except over the stringers where it has a 1-in. extension to rest on their top flanges and at both edges where it is integral with the curbs in which the hand rail cast-iron posts are firmly embedded. The slab is covered with macadam, crowned to a thickness of 5 in. on the center line.

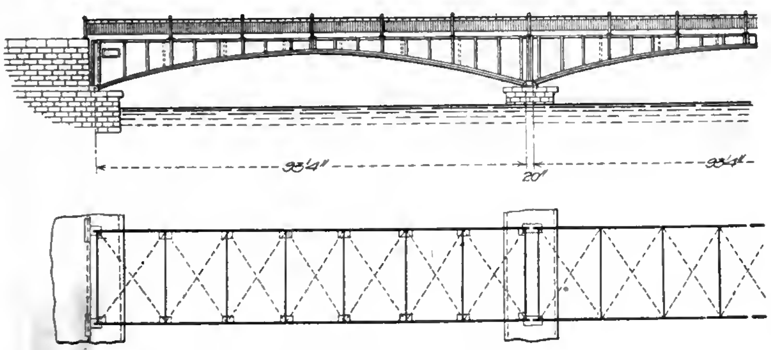
The skewback pins engage half holes in single-web pedestals which, on the intermediate piers, are symmetrical about the center line and receive both adjacent spans, to which they are locked by single projecting reinforcement plates with full holes. A pair of 6 x 6 x 5/8-in. angles 2 ft. long are riveted across the base plate with their vertical legs projecting downward and embedded of 17,000 lb. in tension and 10,000 lb. shear on web plates. The dead load per lin. ft. consists of 800 lb. of steel and 2,200 lb. of floor, while the live load is calculated at 100 lb. per square foot or for a 15-ton road roller.

When the bridge was erected there was no water under it except a small creek between two of the piers. Two ginpoles were set up on the dry lake bottom and erected the semi-arch ribs, holding them in position until connected and braced to be self-supporting and stable. All materials were delivered by wagons at the feet of the piers and hoisted by the gin poles or by hand.

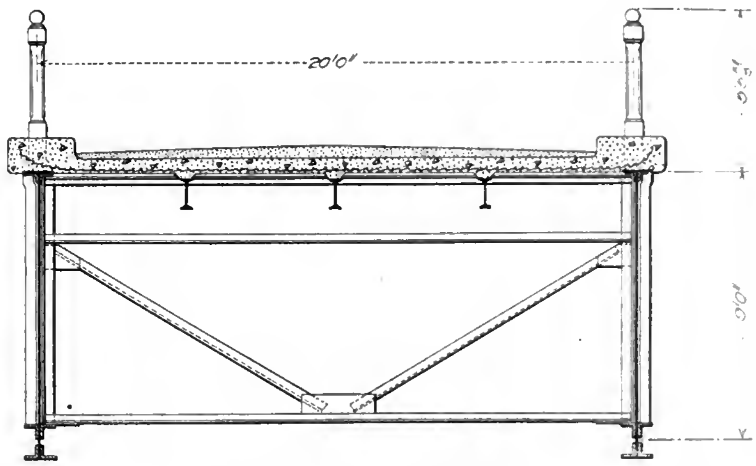
The bridge was designed by the American Bridge Co., and was fabricated in its Trenton plant. The United Construction Co., Albany, N. Y., was the contractor for the erection of the superstructure.



Semi Arch Rib.



Three-Hinge Arch Span.



Cross Section at Crown of Arch.

It really corresponds to a spandrel braced arch truss in which the effective member is the curved lower chord which is the segment of a parabola. It has an H-shaped cross section with a uniform area built up with four 6 x 6 x 7/16-in. full length flange angles and a 1/4-in. web plate which, forming the spandrel bracing, projects beyond the lower chord to the horizontal upper flange of the arch rib which is made with two 6 x 4 x 3/8-in. angles.

The web is spliced by double vertical rows of rivets through pairs of 6 x 3/8-in. cover plates and is divided into panels about 5 1/4 ft. long by pairs of 3 x 3-in. vertical web stiffener angles. The arch rib is reinforced at both ends by pairs of pin plates to give the required bearing for the 6-in. skewback pins and the 5-in. crown pins. The bearings are made with half holes, except that the outside reinforcement plate is continued far enough beyond the end of the rib to receive a full hole and lock it to the pin.

The arch ribs are connected at both ends and at six equidistant intermediate points by lower horizontal struts and vertical transverse X-bracing of the ordinary type made with single light angles riveted to vertical web stiffener angles adjacent to those at the regular panel points. The panels between have X-brace lateral angles in the plane of the lower flange. The plate girder floor beams

in the concrete so as to develop considerable resistance to any unbalanced horizontal thrust which might temporarily occur during erection or from very irregular loading. Since the horizontal component of the reaction is greater than the vertical component, the pedestals at the abutment ends of the bridge, which receive only one skewback hinge each, are made with both vertical and horizontal bearing plates and the former engages the outer flanges of a grillage of three 6-in. I-beams 4 ft. long embedded horizontally in the concrete abutment.

The thickness of the floor slab is increased at the ends to 7 in. and rests and slides freely on a seat moulded in the top of the abutment back wall with its surface and that of the floor slabs thoroughly painted with hot asphalt to prevent adhesion and to facilitate longitudinal motion. The roadway is protected by neat fences in the planes of the arch ribs which have at panel points cast-iron posts carrying the 2 x 3/8-in. top and bottom bars, 33 in. apart, the 3/4-in. square vertical bars 5 1/4 in. apart and a top rail made of a 3 1/2-in. pipe, with a horizontal 2-in. channel, flanges up, riveted to it.

The bridge is made of railway bridge grade open hearth steel corresponding to the requirements of the manufacturer's standard specifications and proportioned for maximum unit stresses

The Protection of Concrete and Iron.

The protection of concrete and iron exposed to the portion of the water of Frankfort, Germany, drawn from driven wells is necessary on account of the large amount of oxygen and free acids in the supply. These have a destructive effect on iron and other metals, the iron undergoing a softening change which continues to such a point that it can finally be cut with a knife. The concrete walls of a large reservoir having a dense surface coat of cement mortar were also attacked by this water, and the department accordingly undertook an elaborate series of investigations to determine the degree of protection against such action afforded by various compounds on the market. After experimenting for some time, none was found sufficiently resisting to this peculiar water, but Dr. Carl Roth, the chemist engaged on the investigation, devised a compound which gave much more satisfaction, lasting without apparent injury long after other substances had completely failed. The success of this compound has led to its being placed on the market under the name of "Inertol" by Mr. Paul Lechler, of Stuttgart. The concrete is best rubbed off with felt disks rather than steel trowels, and must be perfectly dry and preferably warmed before the inertol is applied. The latter should be given an opportunity to dry thoroughly before water is allowed to come in contact with it, for otherwise the water will acquire the odor of carbolic acid and consequently be spoiled for drinking purposes.

A Low-Cost Concrete Railway Culvert.

In line with the policy of the Nashville, Chattanooga & St. Louis Ry. to fill all trestles instead of rebuilding them, whenever possible to construct culverts for the waterway required, it was decided in 1905 to fill Trestle 55.7 on the Nashville Division.

This trestle, known as Yellow Bank trestle, has a total length of 922 ft., with the track at an elevation of 76 ft. above the valley. There is no stream under the trestle except during the wet season, when a large volumne of water passes through. After making a survey of the drainage area above the trestle to determine the size of waterway required, a 12-ft. full-centered concrete arch culvert, with 6-ft. side walls, was decided upon as being ample, and plans were prepared for the same.

In designing the plant for building the culvert, advantage was taken of the height of track above the valley, so that as nearly as possible all material moved by gravity from the cars in which it was shipped until finally placed in position in the wall. Slag and sand were shipped in drop-bottom cars and unloaded into bins constructed in the trestle. These bins were built with hopper bottoms, ending in chutes that led to a wheeling platform, which occupied the space between two of the tresle bents and extended over a concrete mixer placed just outside of the trestle. A cement house was erected alongside the trestle, level with and adjoining the platform. An inclined chute led up from the opposite end of the cement house to an unloading platform at track level, so that the cement, which was shipped in sacks, could be handled directly from the cars to the chute, and thence by gravity into the house.

The sand and slag were fed by gravity into wheelbarrows through gates controlled by levers to regulate the amount taken, and were then dumped into a hopper directly above the mixer. Two men wheeled slag to the mixer, one man wheeled sand, and one man wheeled cement. With the mixer in operation these men had to load the barrows and make a round trip, including dumping the load into the hopper, in about one minute's time. The maximum wheeling distance from the chute to the hopper was 23 ft.

A water supply was secured by sinking a well in the drainage channel just below the trestle, the water from this well being pumped by means of a gasoline engine into a tank placed on the trestle. From the tank a continuous stream of water was fed into the mixer through a flexible connection, a valve so regulating the flow that the necessary amount was delivered in the time required to mix a batch.

A drop-bottom car of 1 cu. yd. capacity, running on 30-in. gauge tram tracks, conveyed all concrete from the mixer to the wall. The hinged bottom doors of this car were held closed with a latch, which was withdrawn by means of a lever at the side of the car to dump the load. After dumping, the bottom doors closed automatically, and were latched by the lever above referred to.

A trestle spanning the entire culvert was constructed out of old car sills, with the deck at a sufficient height to clear the top of the arch when completed, and longitudinal tracks were built on the same directly above each wall. This arrangement permitted dumping the concrete into its final position in the wall without rehandling. Two small turntables connected the longitudinal tracks with a cross track that extended to the mixer. Three men were required to handle the car, and they made the round trip when going to the extreme end of the culvert in about 3 min., the mixer in the meantime discharging into a small hopper, which discharged into the car upon its return.

In order to provide expansion joints, the culvert was built in three sections, both walls of a section being brought up together. After reaching a point 2 ft. above the spring line, one of the tracks was removed and the other shifted to a position directly above the center of the arch, so as to reduce the handling of concrete to a minimum.

The concrete consisted of a 1:3:6 mixture, slag and stone being used as the aggregate. It was intended to use slag exclusively, but delays in shipment of the same necessitated substituting stone for about one-third of the work.

All excavating for the foundation, unloading of material, mixing and placing of the concrete, was done by one of the regular concrete forces of the railway, consisting of four white men and thirteen negroes, the rate of pay being as follows: 1 foreman, $3.50; 1 mason, $3.50; 1 carpenter, $2.25; 1 blacksmith, $2.05; 5 laborers, $1.20; 8 laborers, $1.10; a total of $26.10 per day. Usually this gang builds the forms as well as doing all other work; but owing to the size of the culvert and the haste to complete concreting before cold weather, the forms, arch centering, bins, tram trestle, and working platforms were erected by a bridge crew of white men, whose pay ranged from $1.75 to $2.25 per day. This slightly increased the cost of building forms, but secured rapid construction of the culvert.

The concrete gang moved to the work on Sept. 12, excavated 853 cu. yd. of earth, unloaded the material for and mixed and placed 1,217 cu. yd. of concrete, removed the forms and bins, loaded all timber used in construction, and moved away on November 9. During this time they lost three days on account of rain and closed down one day for lack of material.

The mixer was in operation 194 hours, and mixed 7,702 batches, or at the rate of one batch every 87 sec. during the entire time it was in operation. During the last ten days it mixed a batch every 78 sec. while running. The best short record made was 291 batches in 5 hours, being one batch every 63 sec., or at the rate of 58 batches, equal to 9.2 cu. yd. of concrete in place per hour. This is about equal to the capacity of the machine, one-half minute being required to mix the concrete, and at least that much time in charging and discharging it.

A No. 5 Chicago improved cube mixer, operated by a Bates & Edmunds Motor Co. gasoline engine, was used, and gave satisfaction; but a larger size would have been more economical, as all cement had to be measured, the amount required for each batch being two-thirds of a sack. This measuring required one additional man.

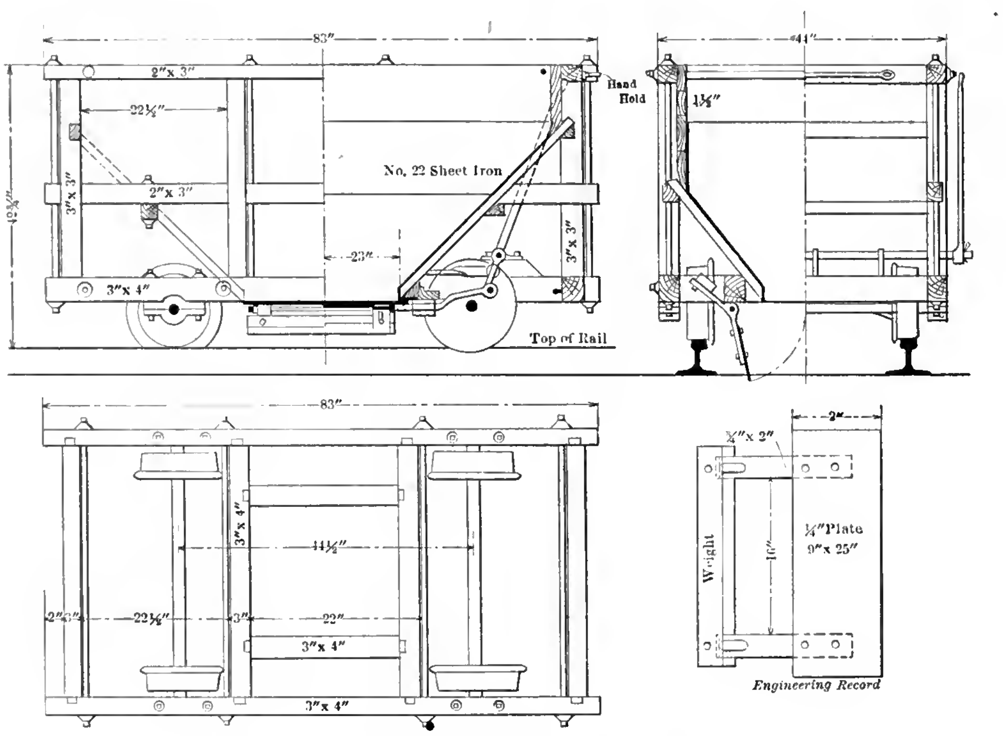
Another objectionable feature of the small machine is the size of the charging hopper, which causes a tendency to choke if the entire contents of a wheelbarrow are dumped into it instantaneously. To the cost of one man required to keep the hopper open should be added the delay in charging the mixer, which materially reduces the daily output of the same.

A comparison of the cost of this culvert with those of culverts on the same road built under quite similar conditions shows a large saving both in the labor and material items, the saving in the latter case being due to the use of slag. The concrete amounts to 1,217 cu. yd. and cost on an average $4.32 per yard, as against $5.88 per yard for the next lowest cost culvert which contained 406 cu. yd. of concrete, and $6.27 per yd. for a culvert containing 986 yards. The cost of the labor for the Yellow Bank culvert was $1.64 per cubic yard, for the second culvert $2.97, and for the third $2.97. These costs include excavation, mixing and placing concrete, building and removing the forms, and the back filling.

The cost of the concrete alone including forms, material, and labor of unloading, mixing and placing was $3.71 per cubic yard for the Yellow Bank culvert, $5.16 for the second one, and $4.96 for the third, the labor items in these amounts being respectively $1.08, $2.11 and $1.67 per cubic yard of concrete.

The reduction in labor cost was due largely to the use of a mechanical mixer, although the large yardage and the economical methods of handling material were factors in bringing about the reduction. The total cost of the culvert was $5,258.13.

The account of the work here given was presented in a paper by Mr. W. H. Whorley to the Engineering Association of the South.



Concrete Car Used on Nashville, Chattanooga & St. Louis Ry.

The Kern River No. 1 Power Plant of the Edison Electric Co., Los Angeles.—Part II.

By C. W. Whitney.

Power House.—The pressure tunnel emerges from the side of Mt. Breckenridge at an elevation above the sea level of 1061.95 ft. Directly in front of this point and slightly up-stream there was a boulder-covered wash protected by a bend of the river and bordered by a large mass of bed rock standing at the edge of the main channel of the river. This space was chosen as the power house site. The intake of the Power Transit & Light Co., of Bakersfield, is directly across the river and it is necessary to discharge the water from the wheels in such a direction and at such an elevation that it will flow by gravity into their intake.

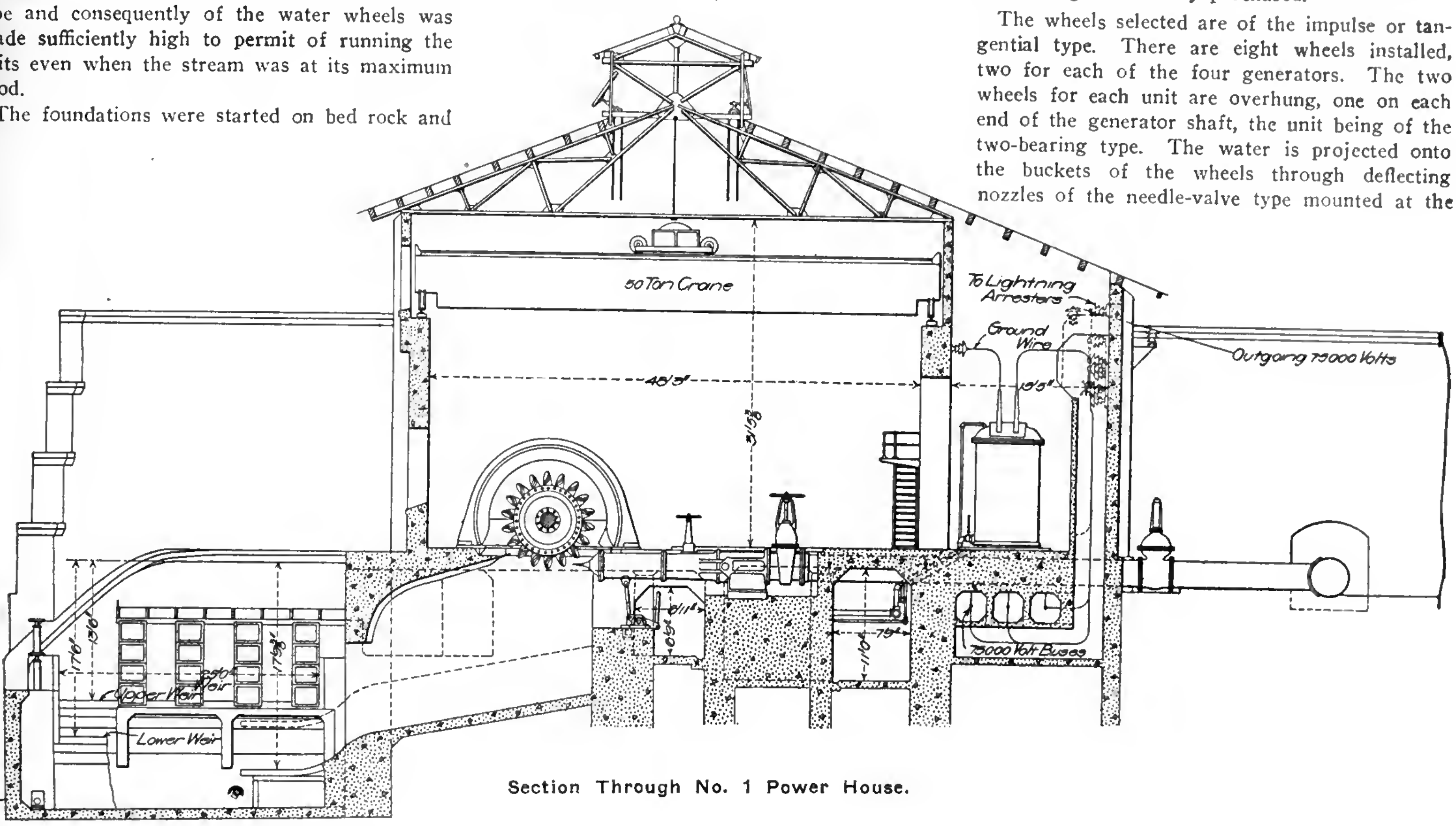
The Kern River is subject at times to very considerable floods and the elevation of the header pipe and consequently of the water wheels was made sufficiently high to permit of running the units even when the stream was at its maximum flood.

The foundations were started on bed rock and cemented boulders, low enough to avoid any possibility of the power house being undercut by floods and were carried up as walls in such a manner that no important machinery rested on floors placed on backfill. All spaces between these walls except those which could not be utilized on account of their falling so low as to be subject to flood, were filled in with compact backfill from other portions of the work.

The available area was so crowded that it was necessary to make a deep excavation in the hillside to accommodate the inner or eastern end of the building. The débris from the cut and from the tail-races was wasted on the south side of the building as a dump upon which the header and branch piping from the pressure mains were placed. On the north side of the station the spoil bank filled in a triangular area of the flat wash, raising its entire area above maximum high water and producing a bulkhead which will protect the power house from any possible flood.

The foundations proper are of monolithic concrete. The rock and part of the sand for the aggregate were secured by crushing granite boulders excavated from the site, as well as a large amount of rock which was lying on the pressure tunnel dump. Additional sand was secured for a time from various small bars in the river adjacent to the power house. These were, however, covered by exceptionally high water early in the year and after that time all necessary make-up sand was hauled from the mouth of the canyon about 2½ miles distant.

The upper part of the machine foundations carries a small amount of reinforcement. The large block of masonry back of each water-wheel deflector is heavily reinforced and tied into the main foundation blocks. The crane rail arches for the interior wall are reinforced concrete beams, with the exception of the long span above the switchboard, which contains an I-beam girder. By reason of the length of the building and the importance of the work no account was taken in its construction of the additional strength resulting from the continuity of the beams, the bridging effect of the crane rail, and its cushioning timbers, nor was any allowance made for the 12-in. curtain walls which fill in in places below this beam. The north wall, however, is a 12-in. curtain wall reinforced with heavy pilasters and this contains only sufficient reinforcement to render it reasonably secure against shock and vibration. The south wall of the building is of a cellular construction for about two-thirds of its height in order to provide wiring ducts for the 60,000 volt wiring connections. This wall also contains only nominal reinforcement. Between this wall and the interior crane wall, a space 15 ft. wide, a series of transverse partitions break up the area into transformer, switch and switch-board rooms. The transformer rooms are open up to the crane beam to permit of wheeling the transformers out under the main crane. The crane rail columns are not highly stressed and have no hooping whatever. A 50-ton electric traveling crane with a 50-ft. span, built by Maris Bros., serves the entire machine room. The switch-board space carries a deck 8 ft. 6 in. above the main floor level upon which the control board is mounted.



Section Through No. 1 Power House.

The roof of the building is of galvanized iron laid on wooden purlins, which are carried on steel roof trusses of 52 ft. 1 in. clear span. The internal length of the machine room is 164 ft. and its clear width 66 ft. 6 in. The generating units are located along the north side of the station 78 ft. from the center of the pressure header.

Water Wheels.—At the time tunnel work on the Kern River No. 1 plant was commenced five years ago, no plant of its size had been constructed for impulse wheel work. Units exceeding 2,000 kw. in output were extremely rare and for a long time it was supposed that 2,500 kw. units would be selected for this station. When, however, specifications were issued many larger units were in successful operation and prices were requested on machines of 4,000 and 5,000 kw. normal output. No difficulty was anticipated nor was any experienced in securing generators of this size. Considerable attention was given to the water-wheel equipment. Some manufacturers were willing to undertake the building of wheels having an output of 10,000 h.p. each from a single nozzle, but the large size required and the extremely crowded placing of the buckets rendered necessary if the unit was to be of reasonable dimensions, seemed to the officials to indicate that such a construction would be less efficient than the arrangement finally purchased.

The wheels selected are of the impulse or tangential type. There are eight wheels installed, two for each of the four generators. The two wheels for each unit are overhung, one on each end of the generator shaft, the unit being of the two-bearing type. The water is projected onto the buckets of the wheels through deflecting nozzles of the needle-valve type mounted at the end of the 28-in. branch pipe. By means of these deflecting nozzles and needle valves the discharge from the tip of each nozzle can be accurately regulated without altering the form of the jet to any appreciable extent. The wheels are designed to run at 250 r.p.m., and the two wheels on each unit are guaranteed to deliver 10,750 h.p. to the generator shaft.

The nozzles are provided with hand-adjustable needles and are arranged to be deflected by the governor automatically, or by the latter's hand-regulating device. By deflecting the jet, instead of regulating its discharge by adjusting the needle with the governor, it is possible to secure a constant velocity of water in the pipe line, as well as a constant discharge of water into the tail-race, even when the plant is operating with heavy fluctuations of the commercial load.

The nozzles are of the best quality of cast steel. Special attention may here be called to the design, which has a number of new features. Each nozzle consists of two Y pipes, flanged together in such a way that the whole nozzle has a diamond or bifurcated shape. The up-stream end of the nozzle forms the movable part of the knuckle or ball joint, and the down-stream end carries the nozzle tip. By making the nozzle diamond-shaped, the following advantages are claimed by the manufacturers:

1. The center of the jet corresponds to the center of the inlet pipe, therefore any reaction from the jet upon the needle and nozzle is not eccentric. This is of importance with deflecting nozzles, where any variable reaction upon the governor should be avoided.

2. As the two branches of the Y join at an ample distance from the nozzle tip, the water has time to gather concentrically around the needle under an absolutely uniform pressure. The result is that the jet leaves the nozzle tip at a high velocity and without disturbance.

3. Due to the fact that the jet leaves the nozzle tip uniformly, the needle is axially balanced and not subject to any vibration.

4. The needle stem, not being subject to any bending, need not be made slender and flexible, but is made of very substantial form. The end of the stem projecting through the front Y pipe is of smaller diameter than the stem. The differential room thus formed can be put under adjustable water pressure. This pressure tends to close the needle and puts all pins and links of the connection to the hand adjustment under slight pressure in the closing direction. By this any rattling of the needle is prevented.

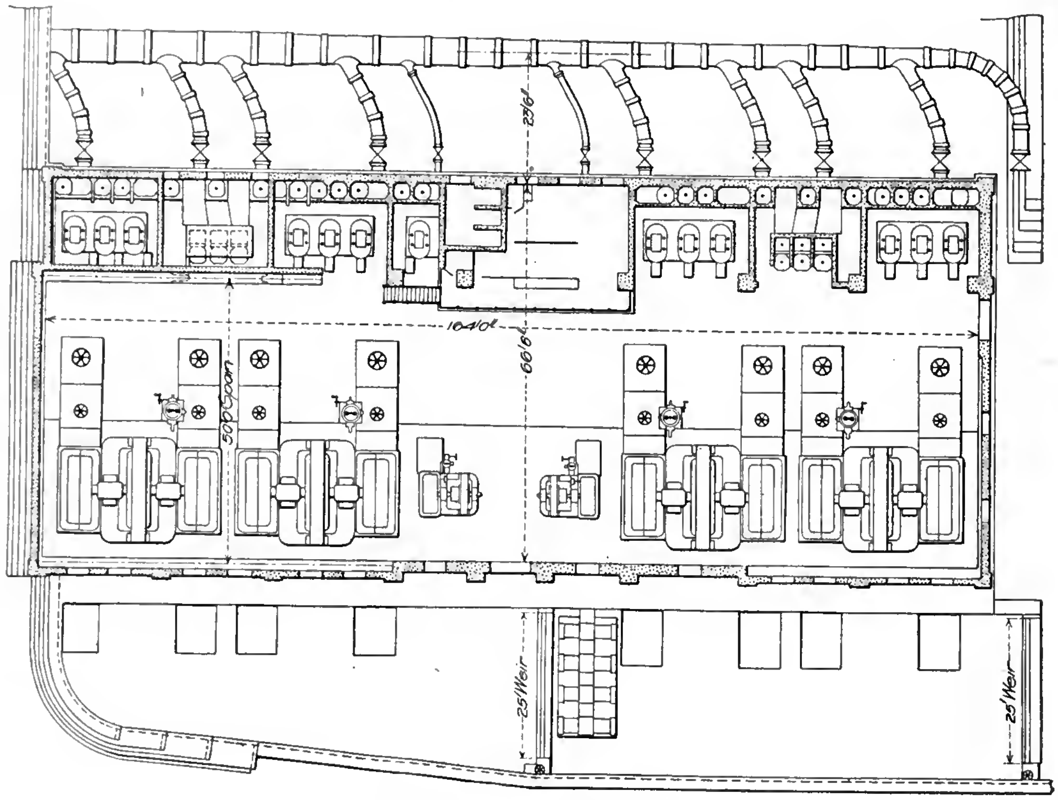
The up-stream end of the nozzle, forming the movable part of the ball joint, is hooked into the stationary part, or swivel head. This swivel head is heavily bolted to the concrete foundation, as it has to take up the full pressure of 375,000 lb., tending to pull the nozzle away downstream. This pressure is taken up by two steel trunnion pins carefully fitted into their bearings and provided with suitable lubrication.

The nozzles are equipped with needles for adjusting the size of the stream by hand. For convenience in construction and to permit of balancing them for back-thrust the needles are straight backed, running through a guide-sleeve of their full diameter into a balancing chamber supplied with water from the pressure side. The needle then reduces to a stem and passes through a second stuffing box beyond which the control links are attached. The needles are topedo shaped, being 8 ft. long 12 in. in diameter at their maximum and 8½ in. in diameter at the stem. The tip is about 25 in. long and is carried down to a blunt point on straight lines. The needle is operated by means of a hand wheel on the main floor, the wheel-stand also supporting a pressure gauge connecting with the nozzle and the two pipes connecting the two sides of the nozzle body with the balancing chamber of the needle. Each nozzle throws a jet 7⅜ in. in diameter at full opening. Part of the nozzle tips are of cast steel. Some cast iron tips have, however, been supplied, and it is expected that they will wear as satisfactorily as the steel ones.

Each of the revolving elements of the wheel is 9 ft. 8 in. in diameter and consists of a cast-steel rim to which are bolted 18 bronze buckets. These buckets are 27½ in. wide and are not radically different in form from modern buckets used elsewhere on the Pacific Coast, being in general of an ellipsoidal shape with a straight front wall and a dividing wedge that dips down toward the front of the bucket. The housings of the wheels are of cast-iron with graceful lines, and where the shaft enters are fitted with compound baffle plates or water guards to prevent water escaping from the housing. The sides of the housing have extensions into the wheel pit of removable steel plates, which protect the concrete walls against the impact of the discharging water.

The mechanical and hydraulic design of these wheels was carefully checked by the engineers of the Edison Electric Co., before the manufacturers were allowed to proceed with their construction. The combined moment of inertia of the revolving element in the two water wheels and generators of each unit is WR^2=1,800,000 lb.-ft.², by means of which regulation at 100 per cent. load variations is obtained within less than 8 per cent. when the units are carrying 50 per cent. overload and within less than 5⅓ per cent. variation of speed when running at normal load. The efficiency guarantee requires that the water wheel proper shall develop an efficiency at rated loads of 82½ per cent., which guarantee is to be substantiated by tests conducted by the company. For sudden changes of load, amounting to 25 per cent., 50 per cent. and 100 per cent. it is guaranteed that the speed variations will not exceed 1.7 per cent., 3.5 per cent. and 7.8 per cent. respectively.

There are two exciter units, each being of the two bearing type, with an impulse water wheel on one end and a heavy fly-wheel designed to give the units close regulation on the other end of the shaft. The exciter wheels are operated from stationary needle nozzles, the needles being of the same straight form used on the main wheels.



Plan of No. 1 Power House.

Regulation is obtained by governors which operate stream deflectors that are pulled up into the stream from below as the load on the unit decreases, thus deflecting a part or all of the stream into the tail-race. The exciter wheels are of a construction similar to the large wheels, having 20 bronze buckets 9⅜ in. wide bolted to the rim of the runner.

Governors.—Each turbine with its respective governor forms an independent unit. Although the available operating water pressure of 370 lb. from the force main is ample to operate governors, it was preferred to substitute oil governors. The governors are not fed from a central system, but each is absolutely self-contained. The oil pressure is 125 lb.

Special attention was paid to the safe operation of the units, avoiding from the beginning any tendency to run away. For this purpose the arrangement of the generator, as well as the exciter governor was made in such a manner that the jets will be automatically deflected from the buckets whenever the oil pressure in the governor should fail.

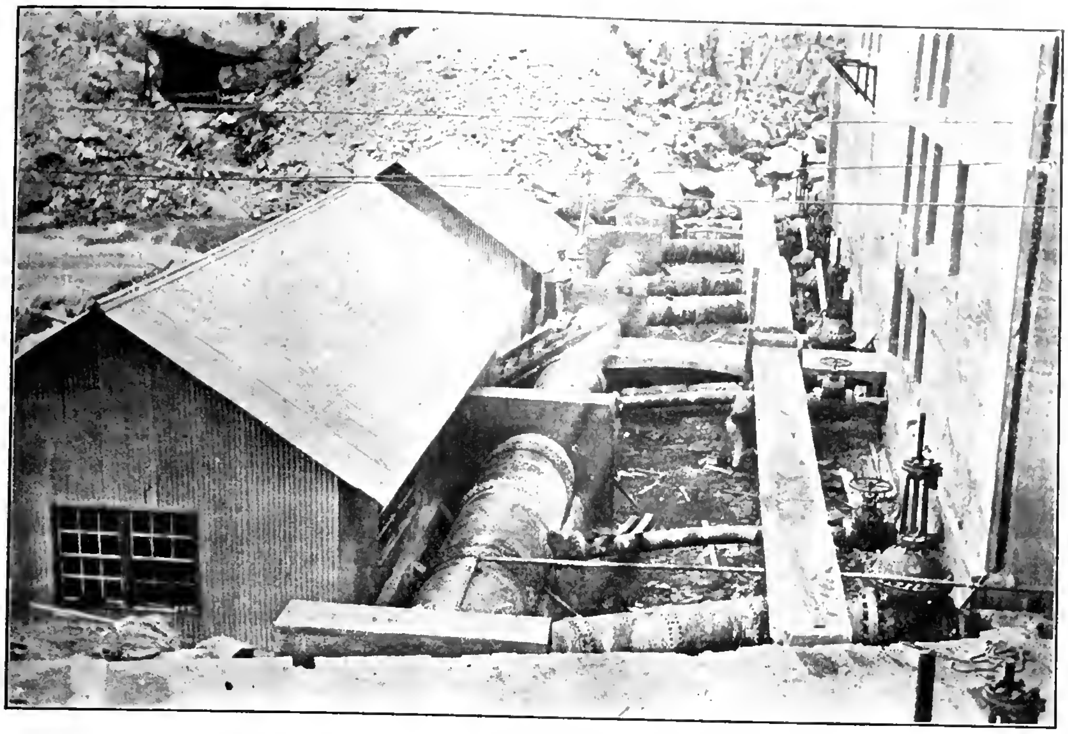
The weight of the two deflecting nozzles for each unit is partly carried by a hydraulic balancing piston placed midway between the nozzles, which receives water pressure directly from the force main. The governor arm connects by means of a link to a common rock shaft, which in turn actuates the two nozzles by means of rocker arms. These shafts are below the main floor and are accessible through a longitudinal alley or tunnel 5 ft. wide, and having a clear head room of 6 ft. 9 in. The governors are driven by a Morse silent-running chain driven from their respective wheel shafts.

The main casing contains the main operating cylinder with piston and mechanical hand-regulating device. The oil pump is attached to the casing and immersed in the oil reservoir. It is of the rotary type. The main pump shaft also carries the bevel gear which drives the fly balls operating the pilot valve over the regulating lever. The pilot valve is self-contained between opposing pressures, and any reaction upon the fly balls is eliminated. It is evident that this is a principal condition for exact regulation. The pilot valve distributes the oil pressure in the regulating cylinder. The motion of the regulating piston is reversedly transmitted to the regulating valve by means of a combined compensation. The leverage of this compensation is adjustable, so that the governor may be set to any change of speed between no load and full load, from 16 per cent. to absolutely constant speed.

The governors are equipped with four regulating devices which can be used at any time: 1. Mechanical hand regulation (without oil pressure). 2. Automatic regulation with fly balls. 3. Hand regulation with oil pressure (fly balls disconnected by a clutch coupling inserted between pump shaft and fly ball shaft). 4. Hand regulation with oil pressure and electric motor operated from the switchboard. (Synchronizing attachment.)

The exciter governors are of similar design, except that they are not provided for electric hand regulation. All the water wheel equipment mentioned above was supplied by the Allis-Chalmers Company.

The Lombard Governor Co. has furnished for the plant one of its type N governors for operating one of the main units and a type Q governor for one of the exciters. The governors are of the vertical oil pressure type and the order includes the necessary reservoirs, pumps, and similar equipment. The Edison Electric Co. has used Lombard governors in its other hydro-electric plants and is desirous of determining the relative

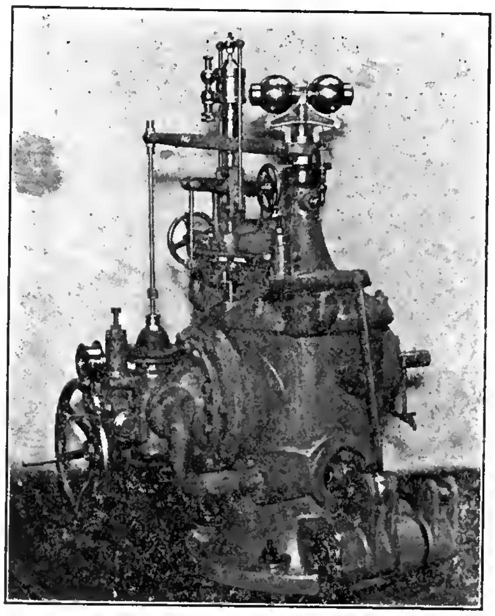


Pressure Header and Branch Piping at No. 1 Power House.

performance of the two types of governors in the new plant.

Tailrace.—Another feature of the water-wheel installation deserves mention on account of its novelty. As already mentioned, the regulation of the wheels is effected by a governor which deflects the jets of the two nozzles. The needles are adjusted by hand and are usually set to that maximum size of jet which will be sufficient to develop the maximum peak loads expected for that period of setting of the needles. In other words, there is always a maximum amount of water leaving the nozzles. The governor adjusts the deflecting nozzles in such a way that only as much water is directed upon the buckets as is needed for the load for the time being. The balance discharges below the buckets into the tailrace. Each jet has a maximum diameter of 7⅜ in. and leaves the nozzle tip at a velocity exceeding 225 ft. per second. It was necessary to provide means of receiving this tremendous power and deflecting the jet into the tailrace in such a way that its impact would not be detrimental to the structure against which it is directed.

The arrangement designed consists of a pair of heavy deflector plates onto which the jet is diverted. These plates are curved as shown in the elevation of the power house, their design being such as to turn the water through two right angles before it is allowed to pass into the tail race, thus reducing the force of the water so that it can do no damage. The upper of these plates consists of a channel heavily ribbed and bolted to the concrete foundation. The channel at its upper end is slightly more inclined than the deflected jet. Thus the jet strikes the bottom of the channel at a small angle, and therefore tends to spread and fill the section. The channel gradually widens and the jet is consequently offered a larger resistance area. The lower part of the channel is curved and at its end the jet discharges almost perpendicularly downward. The bottom plate is *S* shaped, its upper end being flush with the bottom of the wheel pit, the lower end practically level. The jet strikes the bottom plate almost in the turn of the *S* and under a small angle. Thus the jet is again forced to spread and follow the base of the bottom plate. The deflectors are lined with removable steel plates wherever the surfaces are exposed to the flow of the deflected jet, being held in position by lag screws. The plates are 7 ft. wide and the lower one projects out into the tailrace 8 ft.



Allis-Chalmers Exciter Governor.

The wheel races are lined with steel on both sides and fitted with steel back plates just back of the nozzle tips to keep the splash water out of the shaft alley.

The tailrace is 29 ft. wide and extends the length of the power house. It is fitted with two 25-ft. steel plate weirs, the lower weir at the end of the tail race being 4 ft. below the level of the upper weir, which has its crest 13 ft. 6 in. below the line of the nozzles.

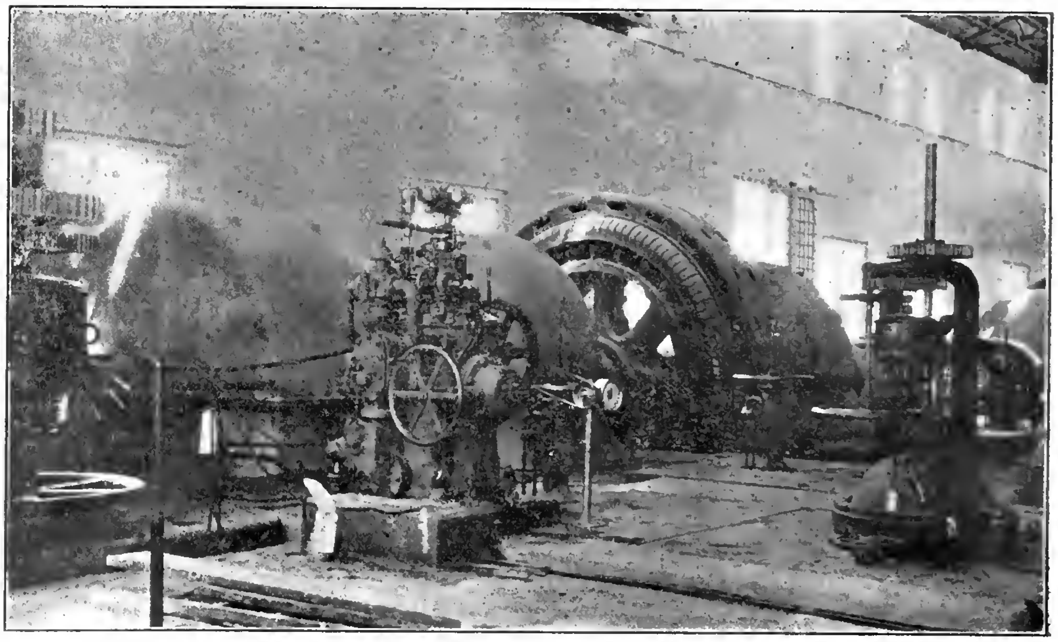
The water wheel branch pipes enter the power house at the south side and after passing across the transformer rooms and before joining the nozzle bases connect to 28 in. cast-steel gate valves. These valves are of a special design and are each operated from the control switchboard by a 1.2-h.p. 120-volt Allis-Chalmers motor. These motors are mounted vertically and operate at 460 r.p.m. It requires 7½ min. to open or close a valve by means of the motor. All of the gate valves are equipped with 4 in. by-passes.

In the machine room of the power house is installed a Dibble reservoir gate equipped with an indicating dial and a registering chart for measuring the water in the forebay.

Capacity of the Plant.—The normal rated capacity of the Kern River No. 1 power plant is 20,000 kw., or 26,667 electrical horse power. The machinery is all tested to operate under 50 per cent. overload for peak load service, thus making the ultimate capacity of the installation 30,000 kw., or 40,000 electrical horse power.

Generators and Electrical Equipment.—The main generators are of the standard General Electric A. T. B. type, form S, and have a rated capacity of 50,000 kw. The stationary armature is bar wound for 2,300 volts 3-phase 50-cycles. The main units are each carried on two 16x48-in. babbitted bearings, each fitted with six oil rings for flooding them with oil from the cellars contained in their pedestals. In the pedestals the oil is cooled by means of water coils built into them. Each bearing also has in its lower portion a number of small openings which are connected to a triplex motor-driven pump capable of circulating the lubricating oil under a pressure of 1,000 lb. to the square inch. The generator shaft is flared out at each end to form a flange to which is bolted the wheel disc. The shaft is also enlarged at the center to carry the cast-steel pole rim and spider. This latter is a single casting weighing 26 tons. The pole pieces are wedged to the exterior of this rim.

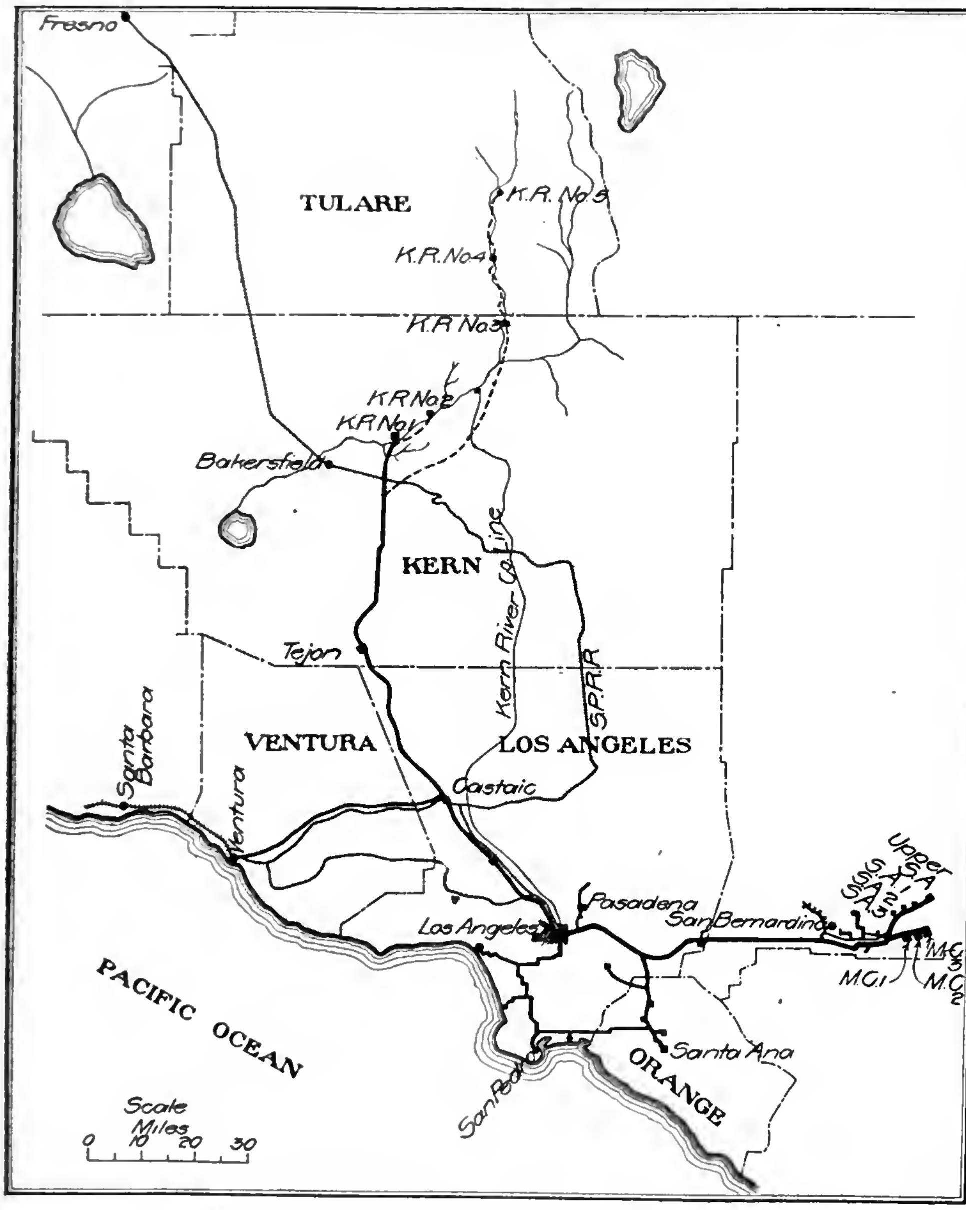
The exciter units are standard 225 kw. direct current machines generating at 125 volts, running at 430 r.p.m. and having ordinary self-adjusting



Unit No. 2, Governor and Top of Motor-Operated Gate Valve.

bearings. Sufficient space has been left between the two exciters to permit the installation of a large induction motor at some future time should it be found necessary. This motor would be designed for good speed regulation and arranged so that it could be connected by means of a pair of clutches to either of the exciters.

The station contains thirteen 50-cycle, 1,667 kw. oil-filled shell-type oil-circulated transformers in boiler iron cases. These transformers are grouped in 4 banks of 3 each with 1 pair to receive energy at 2,300 volts delta from the generators and to supply it to the line at 75,000 volts Y. Taps are also provided for the intermediate voltages of 56,250 and 37,500. These transformers instead of having internal water cooling coils are so built that when the oil is supplied to them under a slight pressure it will automatically distribute itself throughout their windings and return by gravity to the waste pipe. The piping and connections for this circulation are placed in the basement of the power house in a tunnel 7 ft. 9 in. wide and 11 ft. high, extending the length of the building.



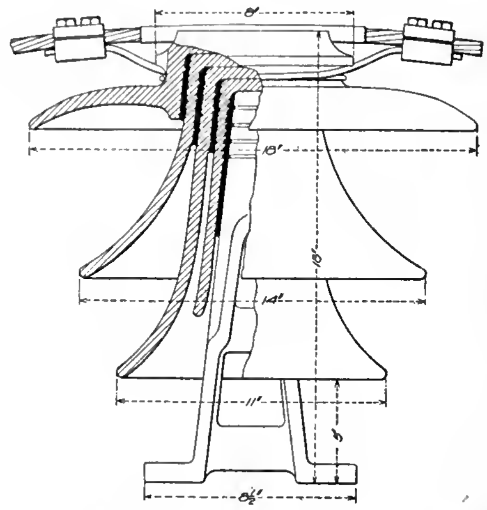
Map Showing Power Plants and Transmission Lines.

The oil coming from the transformers enters a receiving drum from which it is drawn by two 5-in. centrifugal pumps, motor-driven by 15-h.p. variable-speed shunt-wound direct-current motors. Either pump can supply the entire equipment of transformers in an emergency. These pumps force the oil through a set of boiler tube coolers, set over the tail-race and consisting of a series of 2-in. pipes, 10 ft. long, made up in four sections containing 1,008 tubes and having a total area of 4,500 sq. ft. Only two of these sections are at present installed. From these cooling coils the oil returns to the pressure line which supplies the transformers. As the system is under pressure from the time the oil enters the pump, any leakage will be outward and there will be no possibility of the water leaking into the oil, as is the case where the water coils under pressure are placed in oil filled transformers. Another advantage of this system is that the cost of installation is somewhat less than for a similar installation using water cooling. Water for the cooling section is by-passed from one or both of the exciter tail-races into a flume built across the top of the coolers.

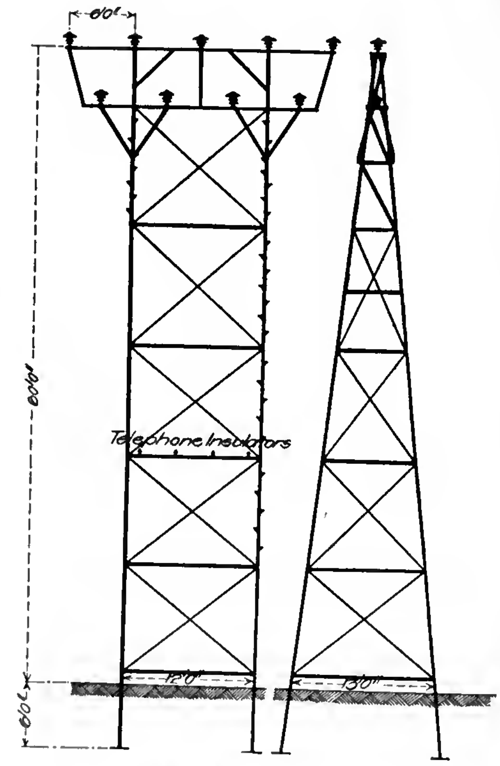
The generator leads pass through ducts under the station floor to the generator switches and thence to the low tension side of the transformer bank. The station is equipped in such a manner that in case of necessity any generator can be transferred to any single transformer bank or in case of absolute necessity run in multiples with some other generator on a single transformer bank, or if desired the entire station can be tied together and operated as a single unit.

The transformer banks connect on their high-tension sides to knife blade switches to a single bus bar from which the two outgoing transmission circuits are tapped off. The 2,300 volt oil switches are installed in concrete cells with concrete barrier walls and tops. The disconnecting switches for them are also separated by barrier walls where possible. The 75,000 volt oil switches are not only installed in concrete cells in accordance with standard practice but are each of them enclosed in a separate concrete room containing no additional apparatus except lightning arresters.

The control switchboard is mounted on a gallery overlooking the machine room. It is built of black slate and is a combination bench and panel board consisting of nine divisions. One of the panels controls the station auxiliaries, two of them the exciter circuits, four the generator units, one the auxiliary feeder and the remaining panel is at present left blank. These panels are equipped with the necessary meters and switches. The bench of the switchboard has controlling switches with red and green signal lamps for each



Insulator for 60,000-Volt Line.



Transmission Line Tower.

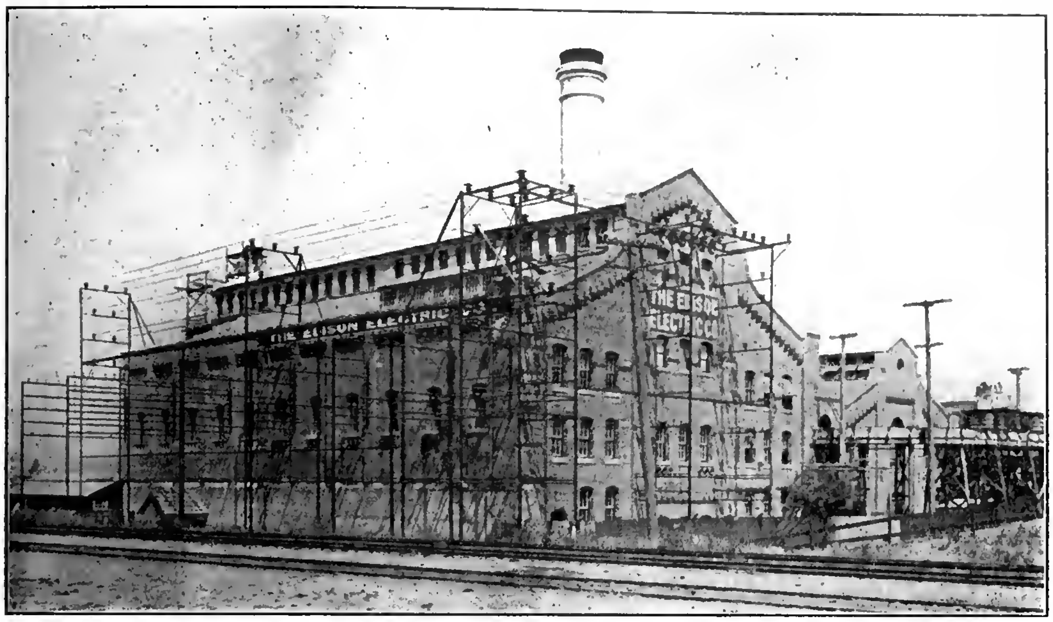
of the four generators, and control switches are also provided for the feeder switches, the bus sections and the outgoing line switches.

All the electrical equipment in the station including generators, exciters, transformers, oil switches and switchboards were supplied by the General Electric Co.

The high tension wiring is run in 4-ft. square ducts throughout. The lightning arresters are of the General Electric Co.'s multiplex type, consisting of alternate carbon spark gaps and resistance. They are mounted in concrete wall cells and are so completely isolated from each other by the intervening main line ducts that an arc starting on any single arrester could not by any possibility be transferred to any second bank. The leads after passing the choke coils and taps for the lightning arresters pass out of the south

wall of the building through rectangular openings located immediately below the eaves. From the eaves of the building, the leads converge onto the first tower of the transmission line.

The transmission voltage now used is 60,000, but 75,000 volts will be substituted later. The transmission line, 117 miles long, is carried on galvanized steel towers ranging from 30 to 60 ft. high. They are made of galvanized angles, bolted with galvanized bolts and held in shape by means of tension rods. All portions of the tower are figured to be safe under a wind pressure of 30 lb. per square foot on the tower and on the wire of a 700-ft. span. The towers will also withstand absolute failure of any single wire even though none of the resulting strain in transmitted to adjacent wires. They were furnished by the U. S. Wind Engine & Pump Co., Batavia, Ill.



Los Angeles No. 3 Receiving Station.

The transmission line is designed to consist of 3 circuits with the wiring spaced symmetrically on 6-ft. centers. The wire is 7-strand, 4/0 hard drawn copper havihg an elastic limit exceeding 35,000 lb., and an ultimate strength of 62,400 lb. It was furnished by J. A. Roebling's Sons Co., National Conduit & Cable Co., and the American Electrical Works. About two and a half million pounds of cable were used on the line.

The insulators used on the transmission line are the largest yet made for commercial transmission purposes. They are 18 in. high and 8 in. in diameter at the grooved top. The top section is 18 in. in diameter and the two lower petticoats are respectively 14 in. and 11 in. in diameter. The specifications for the insulators call for a guarantee of a 100,000-volt test from the groove to the pin for half an hour under a precipitation of 1 in. in 5 min. at an angle of 30 deg. from the vertical. The assembled insulator was required to stand under a wet test a potential of 150,000 volts for 30 sec., and the separate parts are guaranteed to stand a voltage 25 per cent. in excess of the normal proportion of over voltage test.

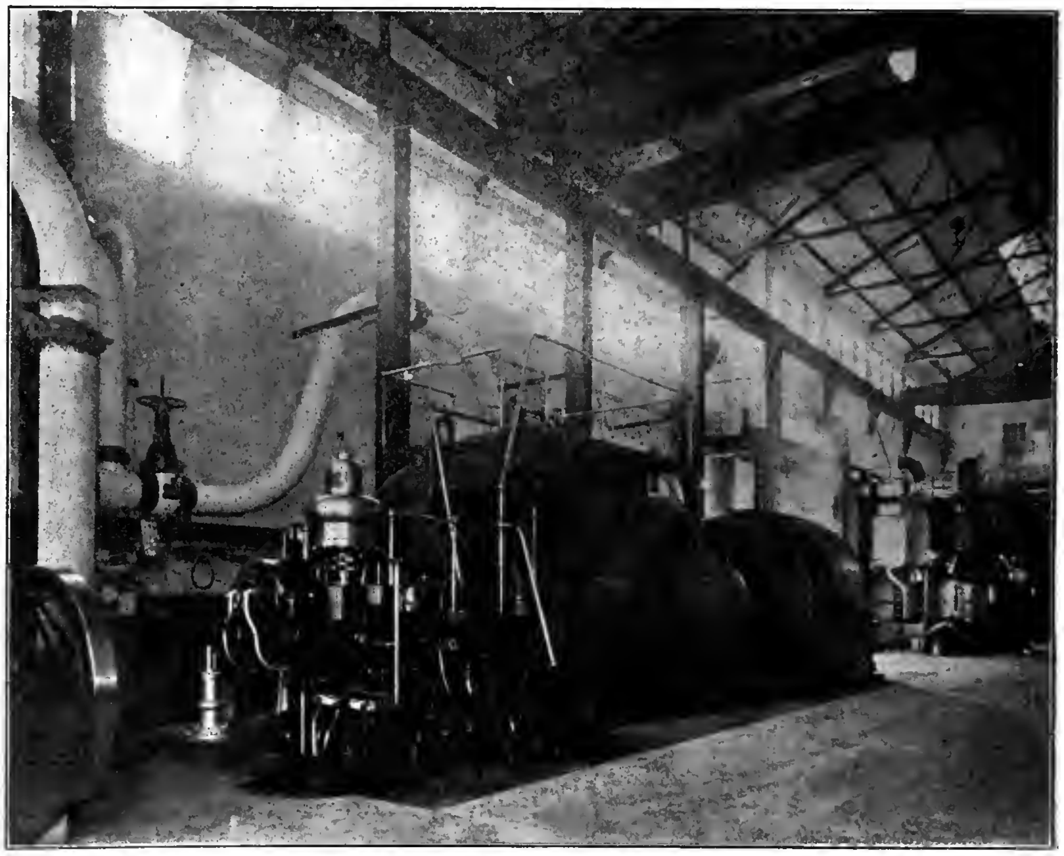
A telephone circuit is carried the entire length of the transmission line, being supported on the towers about 20 ft. above the ground. Between towers the wires are held up by wooden poles, 2 poles being necessary between towers for an average 700-ft. span. Switching stations are located on the transmission line at Tejon, Castaic and San Fernando, the latter two also containing transformer sub-stations.

Construction.—The first preliminary survey for location of the plant was made in the Spring of 1901. After that time it became necessary to obtain rights-of-way across private property and the Sierra forest reserve which required more than one year. The final location survey began in the summer of 1902, and construction was commenced near the close of that year. Continuous construction work was prosecuted vigorously during 1903, but in 1904 was slackened up owing to the fact that the company had two other power plants to construct at that time. During that year, however, the work was prosecuted on some of the longest tunnels, there being about four tunnel faces kept in operation the whole year. In the early part of 1905 work was again resumed with vigor and prosecuted until finally completed about May 10, 1907.

A construction plant generating 300 kw. at normal capacity was installed for furnishing the power used in driving tunnels, mixing concrete, transporting material and similar construction work. This plant was located at Frenchtown, or Camp 5, power being developed by means of a flume about 800 ft. in length which supplies water under 40-ft. head to McCormick reaction turbines each operating one 150-kw., 2,300 volt generator. This plant furnished all the energy required while the work was in progress and was only abandoned after the completion of the main plant. It frequently and for long periods operated at 50 per cent. overload. From the construction plant, power was transmitted at 10,000 volts to all parts of the work over a temporary transmission line, the power being used not only for the construction work, but for lighting both in the tunnels and in the camp quarters occupied by the men.

For driving the tunnels compressed air was generated by electrical power, transmitted from the construction plant, and was piped into the various tunnels for operating the pneumatic drills. The ventilating blowers for supplying fresh air at the face of the tunnel and for removing the fumes after a blast were also operated by electric motors. In the construction of the diverting a dam a complete system of cableways designed by the company's engineers was installed by means of which material was transported and placed in position in the dam. In the construction of the power house the handling of materials as well as the crushing of rock and mixing of concrete was carried on by means of equipment operated by electric motors. The hoisting engines for the aerial tramways used at Camp No. 1 and other camps for hoisting material to the tunnels were also operated by electric motors.

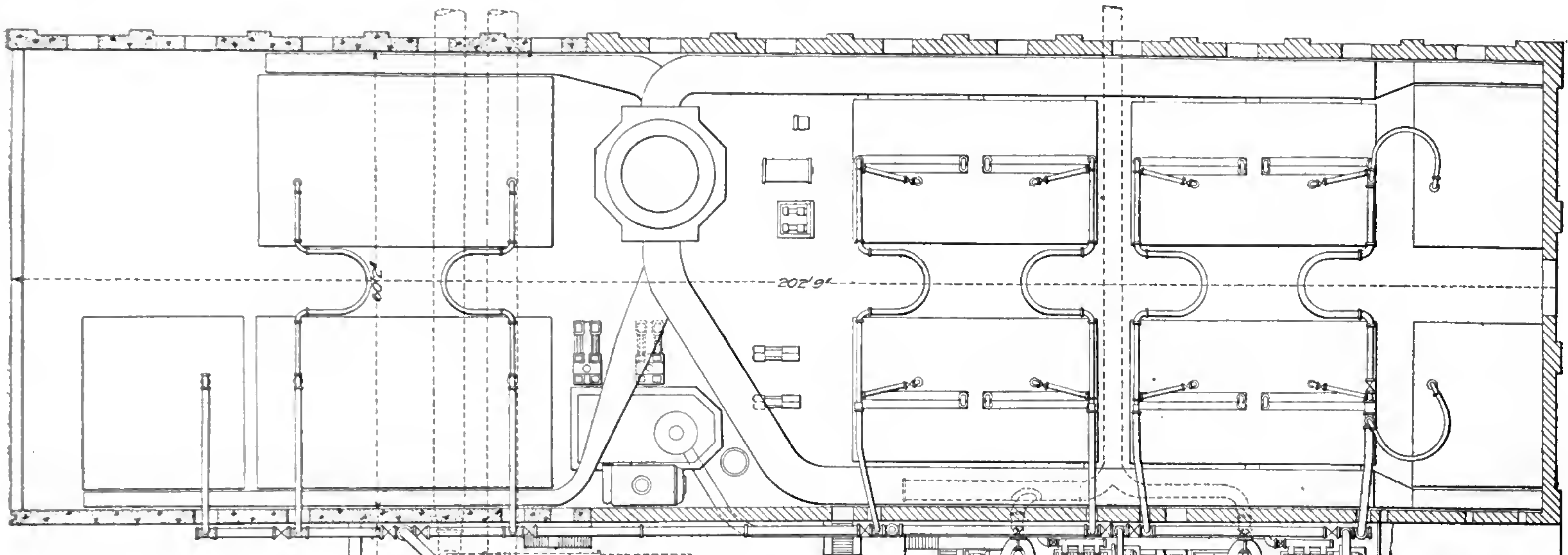
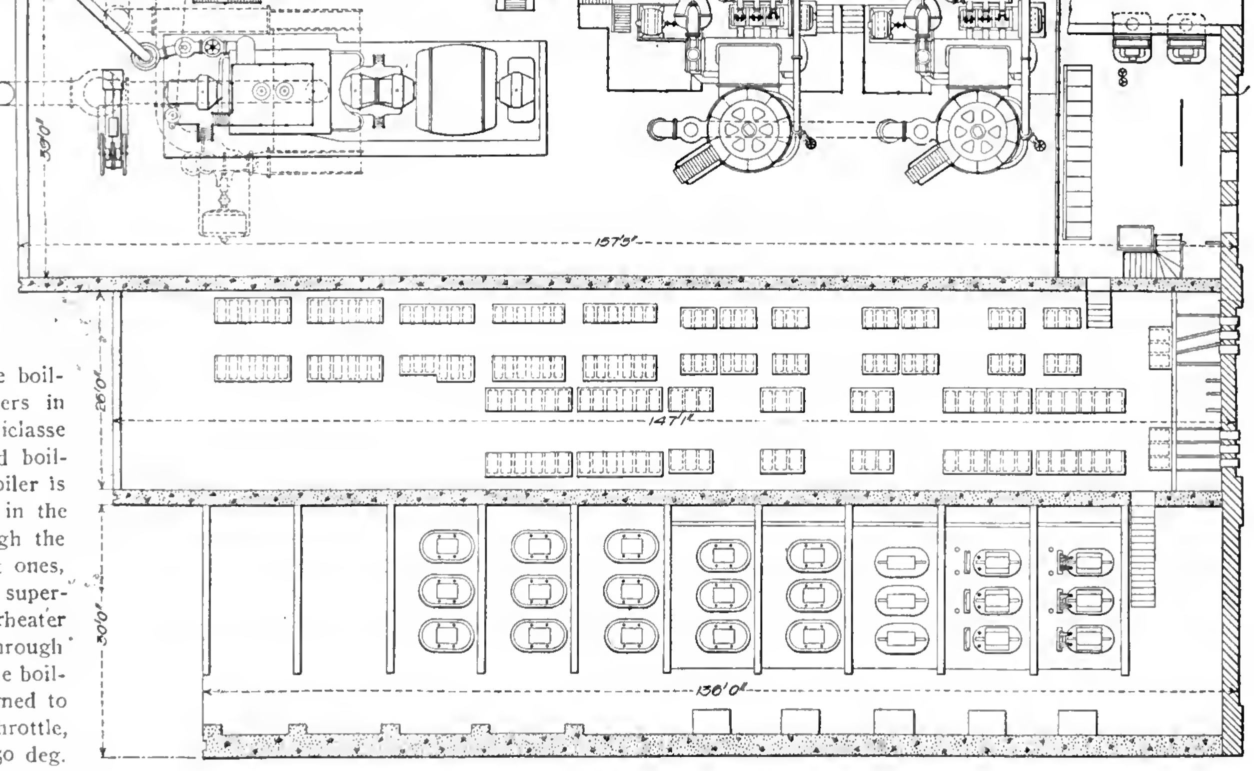
The station was placed in operation under the direction of Mr. H. H. Sinclair, one of the vice-presidents of the company. Water was first turned into the tunnels on May 11th, when it was wasted out at the Starr Creek flume. On the following day about 300 miner's inches of water were turned into the entire tunnel, the first water being carried through the pressure mains and sluiced out of the ends of the power house header into the river. On May 13, full prsssure, 380 lb., was placed on the plant and the first unit and one of the exciter units started up. After a few days of necessary drying out on May 19th, power was first put on the line from the station end and 2,500 kw. transmitted to Los Angeles. The first



Westinghouse-Parsons 7,500 Kw. Turbo-Alternator in Receiving Station.

unit has been operating continuously since that date, and the other three units will be started up as soon as their installation is completed, some of the machinery having been delayed in transit.

Los Angeles Receiving Station.—The transmission lines from the new plant terminate at the steam and transformer station known as Los Angeles No. 3, which receives, transforms and distributes to the local sub-stations power received from the company's water power plants at Santa Ana River, Mill Creek, Lytle Creek and Kern River and also contains a large steam auxiliary plant to supplement the water-generated power.

Plan of Los Angeles No. 3 Receiving Station.

In the steam end of this plant there was installed in 1903 two 2,000-kw. 2,300-volt Curtis turba-alternators with 4,000 h.p. of Sterling boilers in units of 500 h.p. each. When it became necessary to order an extension for the plant in 1905 larger size apparatus was determined upon throughout. An additional 5,250 h.p. of boilers in 750-h.p. units were installed. These boilers were fitted with superheaters in the middle drum instead of Niclasse superheaters as used in the old boilers. The construction of the boiler is such that cold water entering in the back drums passes down through the back tubes up through the front ones, across into one end of the superheater drum, through the superheater tubes to the other end, and out through the super-heated steam line. The boilers in the old plant were designed to give 125 deg. superheat at the throttle, while the new ones produced 150 deg. The new boilers have heavy drums and are fitted in every way to carry 175 lb. pressure, although the plant is now operated with 165 lb. at the boiler.

The turbine installation in the new plant consists of a single 6,000 kw. Westinghouse-Parsons turbo alternator with Worthington condensing equipment. The steam end is of the Westinghouse standard construction receiving steam through an intermittent valve. This steam before reaching the machine passes through a separator, an automatic butterfly valve and a hand-operated throttle valve. The unit is 4-stage single-flow and is operated at 27½ to 28-in. vacuum. Thus far loads up to 10,000 kw. have been carried on the machine without any indication of its maxmum load being approached. The by-pass throttle does not open until 9,000-kw. load is reached under normal steam and vacuum conditions.

Steam from the exhaust end of the turbine passes to the atmosphere during warming up through an automatic release valve. After the machine is up to speed, 750 r. p. m., the steam is condensed into a 24,000-sq.-ft. condenser and the water of condensation returns to the hotwell by a 2-stage motor-driven centrifugal pump. The vacuum space is cleared of entrained air by means of a steam-driven dry vacuum pump. Forty-nine second feet of condensing water are forced through the condenser by means of a 30-in. volute centrifugal pump direct connected to a 450-h.p. induction motor, driven from the 2,300-volt main.

Circulating water leaving the condenser passes beneath the boiler room in a steel lined concrete duct to the edge of the cooling tower where it rises through a steel pipe to the top of the tower. The new portion of the tower installed for the Westinghouse unit is 73x150 ft. in floor plan and the water has a clear fall of 27 ft. This gives a tower area of 6,100 cu. ft. per second foot of water and with a humidity of 58 per cent, and a wind velocity of 6 miles per hour the water temperature is reduced from 102 deg. to 85 deg. Fahr. The tower framing consists of 4x4-in. posts, 2x4-in. intermediates, 1x2-in. horizontals and 1x3-in. bracing. The main flume is carried on 6x6-in. posts and is itself built of 1½-in. redwood. The distribution troughs are galvanized iron of rectangular cross section with round holes punched in their bottoms. Their headers are also galvanized iron with wooden sliding gates. Strips 18-in. wide of galvanized iron mesh screen are placed at 3-ft. intervals through the depth of the tower. The reservoir is of concrete 6 ft. deep and 12 ft. wider than the tower. Water passes from it into the concrete suction pipes through close-set grizzles. Its flow can be shut off when necessary by a 38-in. iron motor-driven gate placed in the engine room basement.

The Westinghouse turbo-alternator unit was put in service in October, 1906, and has been run ever since without any shut-down due to the turbine and without any serious shut-down whatever. The preliminary acceptance test gave results materially better than the manufacturers' guarantee.

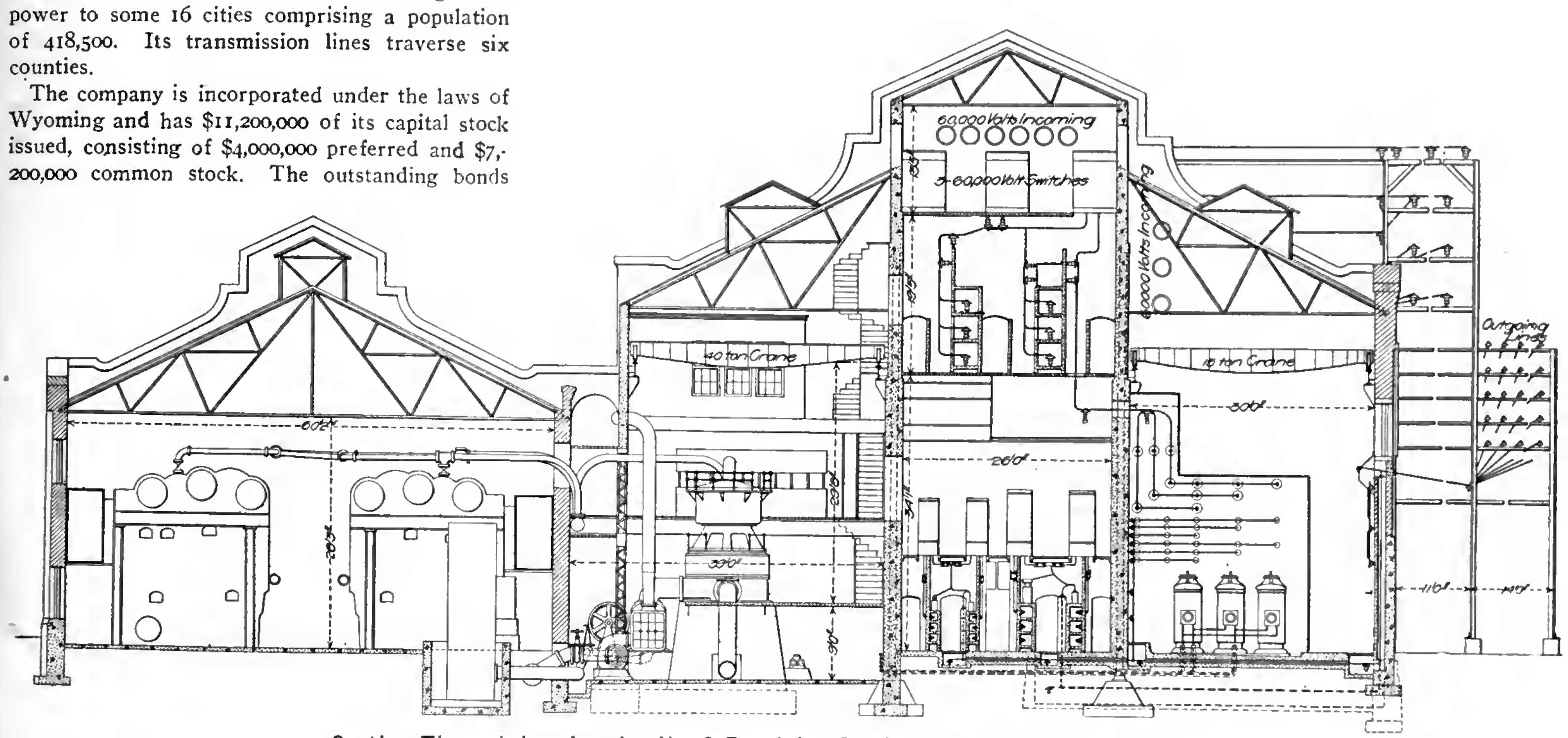
Extent of the Company's System.—In addition to the Kern River No. 1 Plant the Edison Electric Co., controls sites for four other plants on the Kern River, all of them above the plant just completed. They cover the entire length of the river 160 miles from the mouth of the canyon to the head works with the exception of the plant of the Power, Transit & Light Co., at the mouth, and the Kern River Company's plant about 30 miles above. The four additional plants will have a total capacity of 46,600 kw., and will be developed as the demand for power arises. The next plant to be constructed will be Kern River No. 2, the power house for which will be located immediately above the intake of the No. 1 plant.

Its diversion works will be 15 miles above, just below the Kern River Company's station. With the 317-ft. net head which will be available, this plant will develop a total of 11,600 h. p. with 400 second feet of water. Some work has already been done on this plant and the construction will soon be pushed ahead actively. In addition to the Kern River power locations which the company owns in entirety, it has a 2/3 interest in five excellent power sites on the Kings River, where 95,000 kw. can be developed.

The company is now operating 7 plants, including the one described in this article. The 6 earlier plants have a total capacity of 8,700 kw., the steam generating plant a capacity of 14,075 kw.; and it is expected that the Kern River plant will be able to deliver in Los Angeles a maximum of 23,000 kw. Thus far the company's maximum peak load has been about 20,000 kw. Judging by past experience it is probable that the new power will be contracted for as fast as it is available. The company now supplies current for light and power to some 16 cities comprising a population of 418,500. Its transmission lines traverse six counties.

The company is incorporated under the laws of Wyoming and has $11,200,000 of its capital stock issued, consisting of $4,000,000 preferred and $7,200,000 common stock. The outstanding bonds and debentures of the company amount to $10,895,000. The officers of the company are: President, John B. Miller, Pasadena; Vice-presidents, Henry Fisher, Redlands, Wm. R. Staats, Los Angeles, H. H. Sinclair, Pasadena, John W. Edminson, Los Angeles; Secretary, R. H. Ballard, Los Angeles; Treasurer, W. L. Percey, Pasadena; General Manager, A. L. Selig, Los Angeles.

The construction of the Kern River No. 1 Power Plant was prosecuted under the general supervision of Mr. H. H. Sinclair, vice-president of the company who originally located the power site on the Kern River and on most of the other streams whose power supplies are controlled by the company. The hydraulic features of the Kern River work including the dams, gravity tunnels, pressure tunnels and many of the details of the water wheel equipment were designed under the supervision of Mr. F. C. Finkle, chief hydraulic engineer and now consulting engineer for the company. Mr. F. E. Miller, as superintendent of power development, had charge of, and at times direct supervision over the construction work. The electrical details were looked after by Mr. Ralph Bennett, and Mr. R. J. C. Wood. Mr. G. E. Decker represented the company in the installation of the machinery. Mr. John Taylor formerly chief operator at the Santa Ana No. 1 plant has been placed in charge of the operation of the new plant. To these gentlemen the writer is indebted for many courtesies, for the furnishing of the drawings and much of the data which have made this article possible.



Section Through Los Angeles No. 3 Receiving Station of the Edison Electric Co.

The Tarring of Highways.

The increased attention which is being devoted in the United States to allaying the dust nuisance on our highways and to decreasing their disintegration under motor traffic makes a report which has recently appeared in the "Annales des Ponts et Chausses," by the secretary of a commission appointed by the French Minister of Public Works to consider this subject, of much interest.

The report classifies the various processes which have been employed, disregarding sprinkling with pure water, into four classes: 1, Surface tarring, either hot or cold; 2, treatment with petroleum oil or similar processes; 3, sprinkling with water to which various substances have been added; 4, several processes which cannot be included in the preceding classes.

Tarring.—After a historical note upon the subject, showing that the tarring of roads only reached any extent in 1902, the author describes the two methods which are in use to-day, the one cold, by thinning the tar with 10 per cent. of heavy or dead oil so that it can be absorbed, and the other by applying the tar hot. It is shown that in order to obtain satisfactory results it is necessary to allow the tar to soak into the road as long as possible before admitting traffic, and that if the absorption is not complete a light application of sand, or of the dust which has been originally swept from the road should be applied.

The conditions to be realized in order to meet with success are as follows:

1. To operate upon a road recently put in order, well rounded and sufficiently drained. Tar lasts much less time upon a flat surface, while from one which is moist at the time of spreading it scales off and disappears rapidly.

2. To carefully clean the street from the dust and filth which cover it and to expose the mosaic of stone in a way that will permit the layer of tar to penetrate into the road and, so to speak, anchor itself there thoroughly.

3. To operate only in dry weather and, if possible, only in hot weather.

4. To spread the tar in such a manner that it covers the entire surface without lack of continuity.

5. To let the tar dry out sufficiently, so that the wheels of vehicles will not pick it up nor skin off the coating.

From the information obtained through inquiries of various engineers by the Commission the report draws certain conclusions in regard to work done in summer as compared with that done in autumn and winter.

Summer Work.—There is a complete agreement that tarring, when done in the summer, is always satisfactory. Dust is suppressed, or at least notably diminished, and damage to the roadway is largely checked. These results are dependent upon the nature and the intensity of the traffic, the exposure of the road, the quality of the material of which it is constructed, as well as the manner of application, whether hot or cold.

The protection of the roadway upon routes travelled by motor vehicles is particularly striking.

Autumn and Winter Work.—Experimenters are of different opinions in regard to tarring done in autumn and winter. All agree that it lasts well upon rounded streets of good exposure, subjected to not too heavy traffic. As one or the other of these conditions is not fulfilled, the superficial coating of tar disappears at the end of a longer or shorter time, and it is rare that it lasts to the end of winter, at least on the crown of the road. Very often, if traffic is heavy, it has disappeared at the beginning of winter.

The tar, moreover, in the act of disappearing during bad weather, produces a very disagreeable mud, and one which is much more abundant than that from roads which have not been tarred. The majority of experimenters are agreed that with roads carrying a heavy and active traffic, as much as 600 to 700 collars, this result is, without doubt, to be expected. According to a minority, on the contrary, but who include the highest authorities, the diminution of the mud is quite sensible in winter, even on moist sections of road and those subjected to a heavy circulation.

These differences seem to pertain to the nature of the macadam and to the material of which it is composed. It is difficult to discover, from the answers to the questions, why this is so, as the replies do not give the details in

regard to the manner and care with which the tarring has been carried out.

It is beyond doubt that as long as the coating of tar lasts the roadway is guaranteed to a great extent against disintegration, but it must be remembered that the coating is a superficial one and not entirely continuous. The stone pierces it in many places and the exposed particles are worn down under traffic. The coating, on account of its plasticity, again covers these and other projections appear. There is always a certain wearing away of the stone by percussion or lateral friction, notwithstanding the bituminous material which supports them. It appears, then, that the tarred road is not entirely shielded from disintegration. If the coating of tar resolves itself into mud this mud retains water more easily, is more mobile and the road goes to pieces more readily. The general impression of all experimenters is, however, that tarring prolongs the life of the road; to what degree this takes place the observers are not agreed and do not dare give any definite value.

Tar Employed Per Square Yard.—This will depend upon the porosity of the road and the judgment of the operator. The first essential condition is that the tar shall cover the surface entirely. Upon a very absorbent surface, as one composed of dry silicious rocks thoroughly compacted, one would necessarily employ more tar than on a smooth and less permeable roadway of porphyry. In the same way a street which has been tarred the year before calls for less than one which is being treated for the first time. The minimum quantity is, then, a function of the state of the road, but in any case not less than 2 lbs. per square yard should be used. This amount can be increased according to the judgment of the operator. In the experiments made in France it has varied between 1.6 and 1.8 to 8.0 lbs. per square yard, with a mean in the neighborhood of 3.0 lbs. Experience has shown that it is advisable to avoid too thick a coat, which might prove slippery and provoke the formation of mud in winter. It seems that 4.0 lb. per square yard should be regarded as a maximum, beyond which it is not advisable to go. This means something less than one-half of a gallon.

Penetration.—The penetration of the tar into the surface should be carefully looked into to determine that the coating is well anchored. In well-conducted work the penetration should reach easily 1.25 to 1.6 in.

Effect of Temperature and Grade.—Frost does not seem to have any injurious effects upon tarred roads, in spite of the fears that have been entertained in regard to it. Excessive heat may soften it and even render it slippery. This is, however, rare, and is generally due to poor execution of the work and insufficient penetration.

One generally hesitates to tar a road having a grade of over 3 per cent., and a recent experiment at Aix-les-Bains on a 5 per cent. grade seems to demonstrate this.

Effect of Water.—Summer rain is favorable to tarred roads, as it cleans them, drying rapidly, and does not contribute to their disintegration. The washing of such streets with quantities of water, as in the manner carried out in cities, has the same effect. It is necessary, however, not to abuse this custom, especially on streets of heavy traffic, for the enemy of tar is persistent humidity.

Cost.—The cost depends on: 1, the quantity of material employed; 2, the price of this material; 3, the system of spreading adopted and the capacity of the plant.

An application of 3 lbs. of tar at a price of $10 per ton should not cost for material more than 1.3 to 1.5 cents per square yard. Labor for heating, spreading and sanding costs in France in the neighborhood of 1 cent per square yard. The Commission considers that the entire cost of tarring in France is, in the mean, between 2 and 3 cents per square yard, this, of course, for the first treatment. Subsequent treatment will cost less.

Methods of Treatment.—Tarring with hot tar, without any addition, is the method most frequently employed. A mixture of ordinary tar with 10 per cent. of dead oil has been practiced upon a considerable scale in various departments, especially at Havre, while some experiments have been conducted in Paris and in the Department of the Rhone. As far as can be judged, the two systems are identical in their results in both summer and winter, but in point of view of execution of the work the cold method does away with many inconveniences and the necessity for heating. The apparatus is less costly, the spreading is much facilitated, since no attention must be given to the temperature of the material, while the presence of dead oil has a happy drying effect. As a matter of economy the cost of heating is compensated by the greater cost of the heavy dead oil. Whether one system or another is to be adopted will depend upon local conditions. The use of crude tar without anything to make it more liquid is not to be recommended. It penetrates but a small distance into the roadway, especially in winter, remains upon the surface and dries badly.

Certain patented materials containing special driers, process Rimini, Pulveranto, d'Auch, Lassailly and Vinsonneau, are still in the experimental stage, as are particular methods of application, such as heating the tar after it has been placed upon the surface. More will have to be known of the success of these processes before they will be adopted in America.

Oiling Roads.—California seems to be recognized in the report as initiating the method of laying dust by oiling roads with a suitable oil. As no oil similar to the California petroleum is available abroad, mazout, the residuum from the distillation of Russian petroleum, has been used in France.

The report of the Commission gives few data in regard to the results obtained, but states that the difficulty with the use of this material is the high tax, $18 per ton, to which it is liable.

Sprinkling with Water Containing Other Materials.—The report considers the sprinkling of roads with solutions of deliquescent salts, and with mixtures of water and oil, such as westrumite and various other patented products. The results with these materials are in any case only temporary and last at the most for fifteen days and do not seem to be favorably regarded.

The Rio das Lages Hydro-Electric Station of the Rio Janeiro Tramway, Light & Power Co., is being constructed rapidly and before the end of the year it is expected that six generators will be in place. The falls supplying the power are 56 miles from the city, and a concrete dam has been constructed at their crest, which is 115 ft. high and 92 ft. thick at the base. From this reservoir water passes through a series of steel pipes about 6,000 ft. long to distribution receivers immediately above the power house. From the receivers six 36-in. pipes about 1,900 ft. long, are carried down to the six turbines. The receivers are about 900 ft. above the power station and the pipes leading to the turbines are on a steep grade. The total head when the reservoir is full is about 1,030 ft. from the level of the spillway on the dams to the nozzles of the turbines. Each of the six main wheels will develop about 9,000 h.-p., and will drive a three-phase, 50-cycle, 6,000-volt generator. It is proposed to step up the voltage of the current to 80,000 volts for transmission to Rio Janeiro.

Mechanical Equipment of the New City Hall at Newark, N. J.—I.

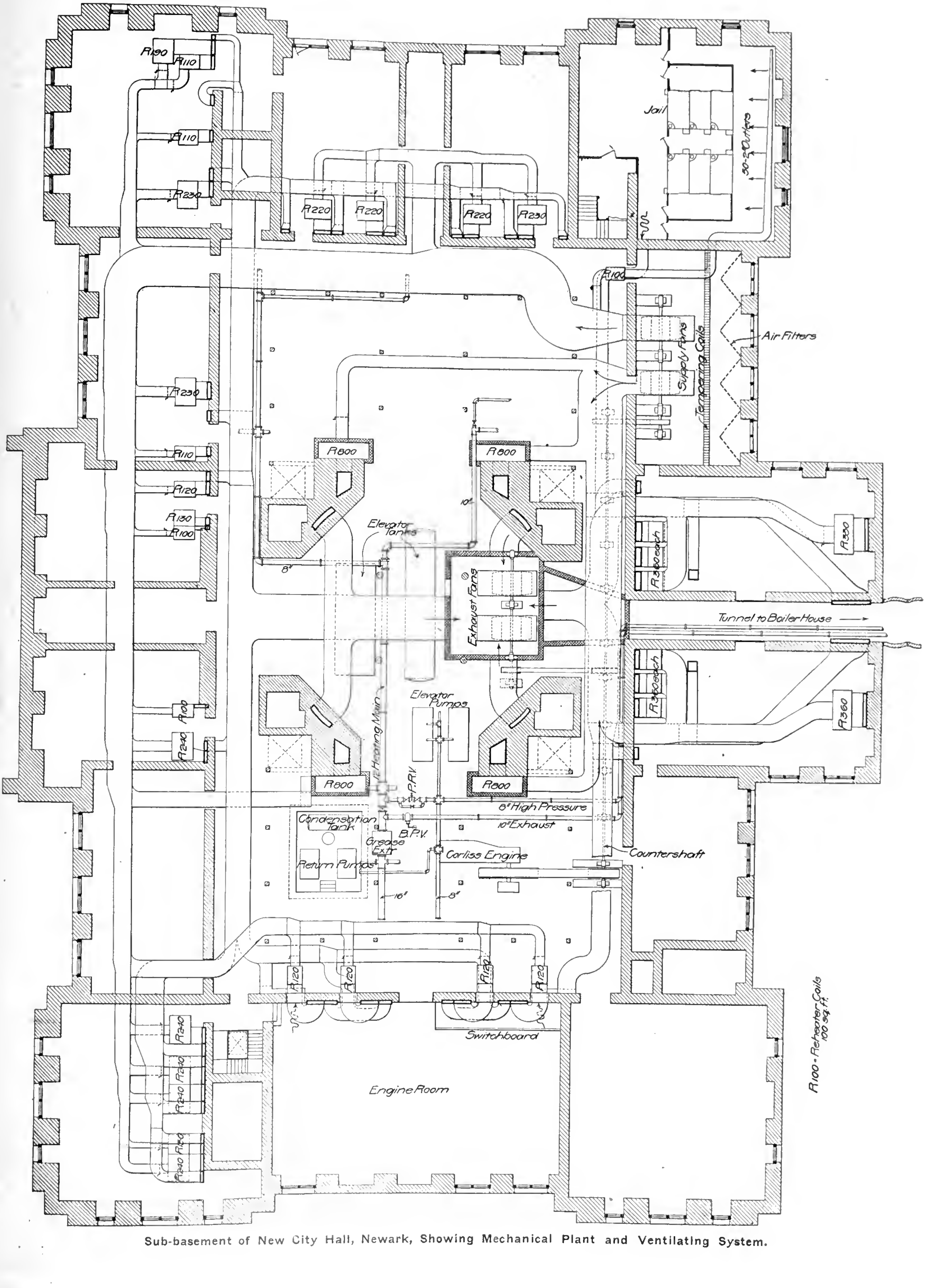
The City of Newark, N. J., has recently occupied an attractive new building for its municipal departments and offices which has a novel interior arrangement and an unusual heating and ventilating equipment. It has four stories and a basement and is surmounted by a central dome rising 135 ft. above street level. The structure is 175x240 ft. in plan and has an 83x152 ft. interior court surrounded by balconies forming the corridors of the various floors. In the center of this court is the structural work supporting the dome and elevator shafts, which has a most pleasing architectural treatment.

Current for lighting and a limited amount of power is purchased from the local public lighting company, but provisions have been made for a complete generating plant if it should be desired in the future. Provision has been made for ample ventilation of all rooms which are to be publicly occupied to any extent and also systems of exhaust from all toilet rooms. The heat and discomfort attendant upon a boiler plant in the basement of the building is avoided by having an independent boiler house at the rear of the grounds, with tunnel for steam and piping connections. This auxiliary building houses, however, only the boilers, the remainder of the mechanical equipment being installed in the sub-basement of the main building.

The general arrangment of the mechanical plant is shown in the accompanying plan of the sub-basement. The greater portion of the equipment is accommodated in the central portion under the interior court, the elevator equipment and exhaust fans occupying the circular portion under the dome, while a number of condensation tanks, pumps and piping, together with the engine which drives the ventilating equipment, are in the westerly portion of this area. The spaces surrounding this central area are for the greater part utilized as store rooms for the city departments, with the exception of that under the easterly wing which is occupied by the tunnel and a large amount of duct work for the fresh air supply system, and 21x44-ft. space adjoining this which contains the air intake and filter chamber, and the fresh air fans. A 35x60-ft. room at the westerly end of the sub-basement is reserved for possible future use as an engine room, and now contains the distribution switchboard for the electric lighting and power service, which has been so arranged that the addition of the necessary switch-board equipment for generating machinery will not be difficult.

The boiler house is 45x65 ft. in size and situated 50 ft. to the rear of the main building. This building has its floor 7 ft. below sidewalk level, and is connected with the main building by a brick tunnel 8 ft. square and 14 ft. under the surface, the tunnel entering slightly below the level of the sub-basement floor, which is 10 ft. below the sidewalk level. At the boiler house end, piping connections are carried up through a vertical shaft which rises to the roof in the corner of this building as a ventilation shaft.

Boilers.—Steam is furnished by three horizontal return tubular boilers in a single setting at one end of the boiler house facing a 35-ft. space in front, about 30 ft. wide, which serves both as firing floor and fuel storage. There is a 4-ft. space at the rear of the settings for access to blow-off connections and dampers, and 12 ft. at one side, provides for blow-off tanks and auxiliaries and also the addition of a fourth boiler unit if future demands for power should require. A convenient drive-way from the street facilitates the handling of coal, wagons being dumped directly through the large doorway at



Sub-basement of New City Hall, Newark, Showing Mechanical Plant and Ventilating System.

the front into the storage space, where fully 100 tons can be stored without restricting the firing floor space. Ashes are elevated to the driveway level for removal in carts by a small hydraulic four-can ash hoist of the sidewalk elevator type, which is operated by the hydraulic elevator system of the main building; the hoist is located just outside the front of the building and rises to the level of the driveway. Although the floor level is depressed some 7 ft. below the sidewalk, it is still above that of sewers in the adjoining streets which facilitates drainage from the floors and from the blow-off tank.

The boilers are 150-h.-p. units with 6½-ft. shells, 20 ft. in length, containing eighty-four 4-in. tubes and were built by the Coatesville Boiler Works, Coatesville, Pa. They have ½-in. shells with quadruple riveted double butt strap seams and ⅝-in. tube sheets, and were designed for 125 lb. pressure. They are without domes, ample space being provided above the tubes for a low water line and large steam liberation surface, and in this space there is a dry pipe 84 in. in length, 9 in. deep by 8 in. across at the top, which connects with a 6-in. nozzle in the center of the front sheet. Five-inch safety valve nozzles are fitted to the center of the middle sheet of each shell. The boiler setting has 24-in. outside walls and 28-in. division walls and the boilers are supported on roller bearing rests. The settings have flush fronts, and are designed for three passes of the products of combustion, the third pass being from the boiler fronts over the tops of the shells to the smoke connection on top of the settings at the rear. The furnaces are hand fired, being fitted with McClave shaking grates for the burning of fine grades of anthracite coal, and the fronts of the setting are fitted with water arches over the fire doors through which the feed water is passed for preheating before entering the boiler.

The products of combustion are removed by a 150-ft. circular brick stack just outside the rear of the building and connected to the boiler flues by a 48x72-in. breeching at the level of the top of the settings. The stack has a 66-in. clear inside diameter to the top, the lower 22-ft. of the stack being square in section, while the upper portion is circular and is capped by a cast-iron cap cemented in position. The stack was erected by M. W. Kellogg & Co., New York. The boiler branches from the breeching are 3½ ft. square over each shell, changing thence to 2 by 8 ft. at the front. The flues are fire-brick throughout, supported on cast-iron T-bars and specially designed to prevent cracking. The draft from the stack is controlled by a Locke damper regulator mounted at the front of the boilers and operating the dampers through a shaft extended back to the flue connections at the rear; this shaft is mounted on ball bearings and operates a working damper in the flue connection to each boiler. There is also a large damper in the main flue connection to the stack arranged for hand control from the rear of the settings.

The boilers are fed by two Worthington duplex pumps in duplicate, each having 7½ and 4½-in. cylinders with 10-in. stroke. They have suction from a 42x96-in. cylindrical steel receiving tank mounted on the sidewall about 6 ft. above them to which condensation, returned from the heating system of the building, is delivered and through which the make-up water is added from the city mains when required. These pumps are not fitted with a governor but are placed under the control of a fireman, there being necessarily one man always on duty in the boiler room. The pumps deliver to the boilers through a 3-in. feed main which leads first to the feed water heater with by-pass around the latter, and thence along the boiler fronts, where 2½-in. branches are led through controlling valves to the water arches above the furnaces; from these arches the feed is delivered to the boilers through perforated pipes extending through the shells longitudinally just above the tubes.

The feed heater is a 32-in. by 10-ft. Berryman closed heater with 1¼-in. brass tubing, presenting a tube heating surface of 150 sq. ft. The shell has 10-in. connections at the bottom and top to which the exhaust main that is carried over from the power plant in the main building basement is connected; this exhaust main bypasses the heater and is carried up to an exhaust head above the roof line, so that exhaust steam may be passed through the heater or by-passed directly to the exhaust head as desired. The back-pressure valve, usually provided between the feed heater and the exhaust head, is in this plant located in the basement of the main building. In the winter there is insufficient exhaust from the steam-using machinery to provide for adequate heating; at such times no steam escapes to the feed water heater and it is cut out of service, this being practicable as the condensation returned from the heating system is delivered to the feed pumps at a high temperature and furthermore the feed is delivered to the boilers through the furnace water arches for additional heating. This back-pressure valve is a 10-in. Jenkins excelsior straightway valve.

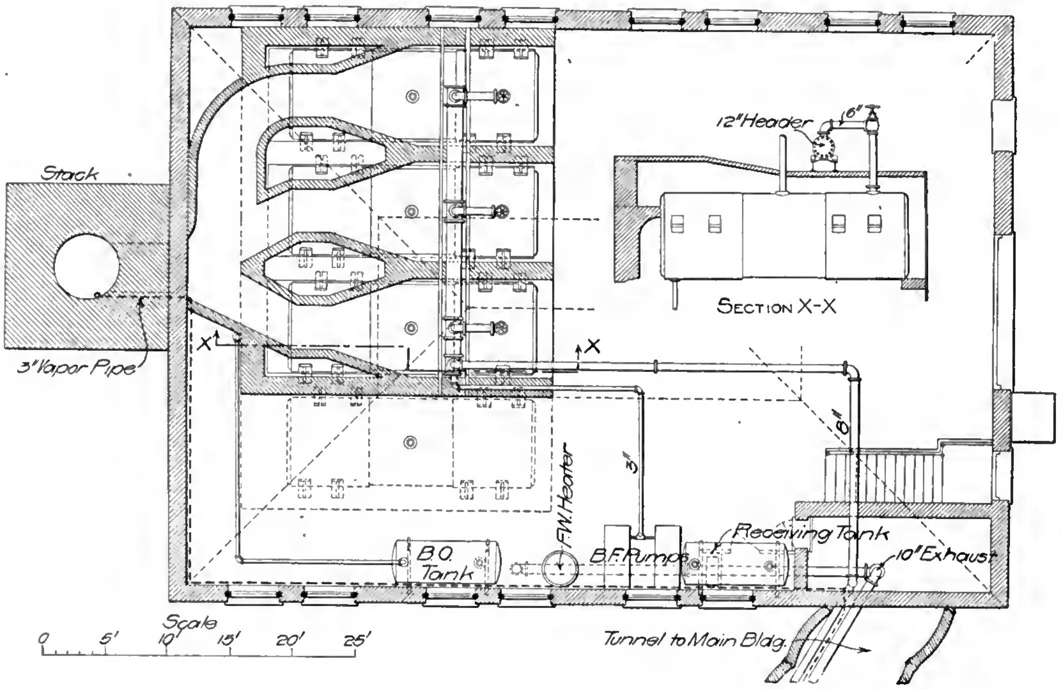
The blow-off system consists of a 3-in. blow-off main at the rear of the settings with 2½-in. branches to each shell, which main delivers into a 42x96-in. cylindrical steel tank at the side of the boiler room. This tank is above the sewer level, so that free drainage to the sewer is permitted, but the discharge connection is so made that the tank is maintained about half filled with water for the purpose of cooling the discharge received from the boilers. A 4-in. vapor pipe is carried up from the shell of this tank to the roof for removal of steam escaping from the hot discharge.

Steam Piping.—The steam piping of the plant is simply arranged, consisting of a 12-in. boiler room header over the boiler setting, from which a 3-in. branch extends to supply the feed pumps in the boiler house and an 8-in. line is carried through the tunnel to the power plant in the basement of the main building. From the steam-using machinery in the power plant a 10-in. exhaust line is extended through the tunnel back to the boiler house, where it connects with the feed-water heater and atmospheric riser to the roof exhaust head. The steam piping is all extra heavy wrought-iron with flanged connections, that for high pressure being designed for 200 lb. The high pressure piping is covered throughout with Keasbey & Mattison 85 per cent. magnesia covering while the low pressure piping is covered with H. W. Johns-Manville felt, all 1½-in. thick with a canvas jacketing. The arrangement of connections to the tunnel pipe line is such that expansion is easily provided for, there being right angle turns at both top and bottom of the shaft at the boiler house ends, while a 30-deg. bend of the tunnel near the main building introduces an additional bend which permits contraction and expansion.

Spacious quarters are provided for the machinery in the sub-basement of the main building as shown in the plan. The ventilation ducts are in all cases carried on the ceiling and practically all of piping is also on the ceiling, there being no trenches or pits except a 13x16-ft. pit in the westerly portion of the sub-basement, depressed 3 ft. below normal floor level to accommodate the condensation receiving tank of the heating system, the pump governor, return pumps and a cesspool.

The steam-using equipment in this section consists at present of the elevator pumps, two house pumps, two condensation return pumps, the Corliss engine for operating the ventilating fans, and the radiation of the heating system. To supply this equipment with steam, the 8-in. high pressure line carried over from the boiler house extends to the central portion of the machinery section, where, near the Corliss engine, it ends in a cross with a 5-in. connection to supply the elevator pumps, an 8-in. connection to the heating system, and an 8-in. branch blanked for future extension to the engine room when required. From this last extension a 6-in. branch is taken to supply the Corliss engine and a 3-in. branch to supply the condensation return pumps, while from the branch to the elevator pumps, a 1¼-in. line is extended to the hot water heating tank in the opposite end of the basement. The live steam connection to the heating system is made through a 6x8-in. Foster pressure-reducing valve with 4-in. by-pass, which connects directly to the 16-in. low-pressure header of the heating system.

The exhaust steam system which forms the basis of the steam heating system, is similarly planned to facilitate the addition of electrical generating machinery without change in the present installation. It consists of a 16-in. exhaust header which extends in the direction of the future en-



Plan of Detached Boiler House of the Newark City Hall.

gine room to a blanked flange, into which header all of the present steam-using machinery exhausts. The connections consists of an 8-in. line from the Corliss engine and the elevator pumps and a 3-in. line from the house pumps and condensation return pumps in the pit. The exhaust steam passes from the header to the heating supply main through a 16-in. Peerless grease extractor, furnished by Hussey, McCann & Co., New York, for the removal of lubricating oil. The extractor is mounted on the ceiling for convenience of connection to the header and supported by a substantial brick pier, the dirty drips from the receiver being discharged through a Heinz steam trap to the adjoining cesspool. Beyond the grease extractor, connection is made to the 10-in. line that extends through the tunnel to the boiler house for heating feed water when excess exhaust steam is available for that purpose. Between the latter connection and that for live steam supplementary supply, a gate valve is inserted to permit separation of the header into two divisions, permitting the heating system to be supplied solely by live steam, if desired, when the exhaust steam will be discharged from the header through the 10-in. line to the boiler house roof exhaust head.

Elevators.—The elevator system is hydraulically operated, the pressure for which is supplied by two 14 and 20x10x15-in. Worthington compound duplex pumps located with the necessary piping and tanks in the space within the dome foundations. Each pump is supplied with steam through a 2½-in. connection, with a Ford governor for control by the hydraulic pressure. The pumps draw through 8-in. suction connections from a large open discharge tank and deliver through 8-in. connection to a cylindrical steel pressure tank, from which the hydraulic pressure is supplied to the elevator control valves. The pressure tank is a 30-ft. steel tank 6 ft. in diameter, designed to withstand the operating pressure of 150 lb., and is maintained half filled with air for air chamber equalization of fluctuations of load. The discharge tank is an open steel tank 6x32 ft. in size and 6 ft. deep, into which the various discharge lines from the elevator control valves discharge. There are five passenger elevators in the main building and one as hoist in the boiler houses, all of the plunger type and installed by the Otis Elevator Co., New York. The five passenger elevators are arranged to run from the basement to the fourth floor, a total rise of approximately 70 ft. The four machines under the dome are designed to carry maximum loads of 3,000 lb. at a speed of travel of 300 ft. per min., while the fifth elevator, in the northwest corner of the court, is designed to carry 1,500 lb., at the same speed. The four larger machines have 7½-in. plungers, while the smaller elevator has a 5½-in. plunger. The ash hoist has a rise of about 10 ft. and a capacity of 1,500 lb.

Electrical Equipment.—The electrical installation is unusually extensive, decorative lighting and special illuminating features forming an important part of the building's equipment. A liberal use is made of studded ceiling and cove lighting, avoiding in general the use of large and complicated chandelier designs. The wiring system has been designed for abundant lighting of all rooms and departments of the building, there being a connected load of nearly 8,000 incandescent lamps, the greater part of which are, however, 8 c.-p. lamps in the decorative ceiling lighting scheme. But two motors are used in the building, driving ventilating fans on the roof.

The scheme of illumination is a practically general application of studded ceiling lighting by rows of 8 c. p. lamps. The corridors encircling the open interior court have rows of ceiling lamps on 12-in centers lining the cornices on the sides opposite from the court. All of the large offices and assembly rooms and many of the smaller offices are similarly illuminated, the lamps being very generally in rows bordering the cornices and distributed on 24-in. centers. In the council chamber and dome over the central portion of the corridor, special lighting schemes are attempted in which studded lighting is utilized with striking effect. The location and distribution of lamps are in all cases carefully proportioned for effective general illumination, the intensity of which may be varied by operating different combinations of lamp groups. This method of illumination rendered the wiring scheme very extensive and necessitated a very large number of outlets, the system providing in all 7,467 outlets for lamp connections. Of these over 1,400 are on the first floor, over 2,000 on the second floor, 1,460 on the third floor, 1,430 on the fourth floor, while the remainder are in the sub-basement and boiler house. The current supply of this lighting equipment is distributed by forty main feeders which vary in size from No. 1 to No. 0000 and extend from the main switchboard in the engine room to local distributing panel boards in various parts of the building.

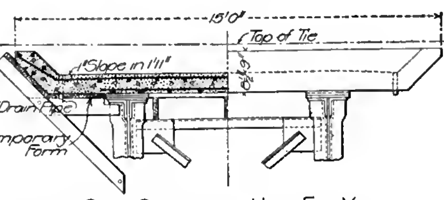
The wiring of the building is divided in general into four divisions, embracing the four sides of the building encircling the court, which greatly facilitated the running of the main feeders from the swithboard to central distributing boards on every floor. There is thus a panel distributing board on each floor near the middle of the corridor on each side facing the court, making six rows of boards on each of the four sides, all served by a single group of riser lines, or 24 boards in all, which together with two additional boards for special service, make 26 panel boards supplied by independent feeders, each under separate fuse and circuit-breaker control at the main switch-board. The feeders are extended to the groups of riser lines of panel boxes on the upper floors through lines of large conduits under the sub-basement floor which spread out into large convenient pull boxes at the base of each riser. These boxes are of heavy cast-iron with bottoms 1 ft. above the sub-basement floor and have heavy doors to enclose connections. A separate conduit is provided for each feeder, so that both the initial installation and subsequent access to any feeder for examination or repairs is greatly facilitated. All of the wiring for both feeder and distribution circuits is installed in concealed loricated conduit run on the loop system throughout. The main feeder cables are lead-sheathed from the switchboard to the pull box connections, beyond which standard rubber-covered wire is used throughout.

The switchboard is a six panel board of white marble, 25 ft. in length, mounted on an angle iron frame. It is at present enclosed in a glass partition for protection from dust and dirst in case the engine room is used for storage purposes. The board has eleven 400-ampere knife switches and circuit breakers, ten of 200 ampere capacity, two of 600 ampere capacity and two of 3,000 ampere capacity; a 5,000-ampere General Electric wattmeter, a 150-volt Thomson inclined-coil voltmeter and a ground detecter switch, no apparatus having as yet been installed for use in connection with generating apparatus. . The present current supply is at 120 volts alternating current, on the two-wire system, from the local lighting company.

The new City Hall was designed and its equipment selected by and installed under the supervision of Messrs. John H. and Wilson C. Ely, architects, Newark, N. J., and Mowbray & Uffinger, New York. The details of the mechanical equipment were designed by Mr. James H. Seymour, Jr., Newark.

(To be Continued.)

A Solid Floor for Plate-Girder Spans.



Burlington Bridge Floor.

Some features of plate girder design have recently been revised for standard construction on the Chicago, Burlington & Quincy Ry., where no bridge is considered up-to-date without a ballasted floor, and both deck and through plate girder spans are designed to receive reinforced concrete floors, although wooden floors may be used with them if desired. In a 75-ft. through span there are two girders 15 ft. 6 in. apart on centres and 8 ft. 4¼ in. deep, back to back of flange angles. Two lines of horizontal angles 18 in. apart in the clear are field riveted to the inner faces of the webs, with vertical legs inside, to form connections for the concrete floor construction, the top of the lower 4 x 4 ⅜-in. angle being flush with the top flanges of the stringers. With this construction the height from the top of the tie to the masonry is 3 ft. 10¼ in., and with the open floor it is 3 ft. 2 in. From the top of tie to clearance line is 3 ft. 3¼ in. and with the open floor it is 2 ft. 7 in.

Four deck spans have floors 15 ft. wide over all, with concrete slabs 8½ in. thick reinforced with transverse and longitudinal bars in the upper and lower surfaces. The outer edges of the slab are inclined upward at an angle of 30 deg. to make flanges 9 in. deep to retain their ballast. The top lateral system and the top angles of the sway brace frames are lowered clear of the top flange angles of the girders, to permit the forms for the concrete to be set with greater ease and to be supported on the transverse frames and lateral angles. The outstanding flanges of the vertical web stiffener angles in such girders are punched for connecting bolts to the knee-braces of concrete forms. A 75-ft. deck span weighs 95,800 lb. and one girder weighs 17,900 lb. For a 75-ft. through span the corresponding weights are 144,400 lb. and 40,860 lb. A 105-ft. deck span over Pope Creek on the Galesburg division weighs 208,000 lb. Its concrete floor weighs about 1.2 tons per lineal foot and raises the allowed unit stress from 4.86 tons allowed for ordinary floors to 5.5 tons.

All designs are made and the construction supervised by the Engineering Department of the railroad, Mr. W. L. Breckenridge, chief engineer, Mr. C. H. Cartlidge, bridge engineer. The Morava Construction Co., Chicago, was the contractor for the Pope Creek Bridge.

THE FLORIDA EAST COAST CANAL has been cut through from St. Augustine to Miami and work will shortly begin on its extension northward to the St. Johns River, affording a connection with Jacksonville. The construction has been under way for many years, backed mainly by Boston capital. The portion of the canal now completed is 55 ft. wide at the bottom and has from 6½ to 7½ ft. of water. Steamboats will be placed in regular service by the Florida East Coast Line & Transportation Co., which is constructing the canal, and it is expected that the long stretch of attractive land-locked water-way will bring many small yachts and house-boats. In addition it will furnish a useful method of transportation for every one along this noted portion of the Atlantic coast.

The Chateau des Beaux-Arts on Huntington Bay.

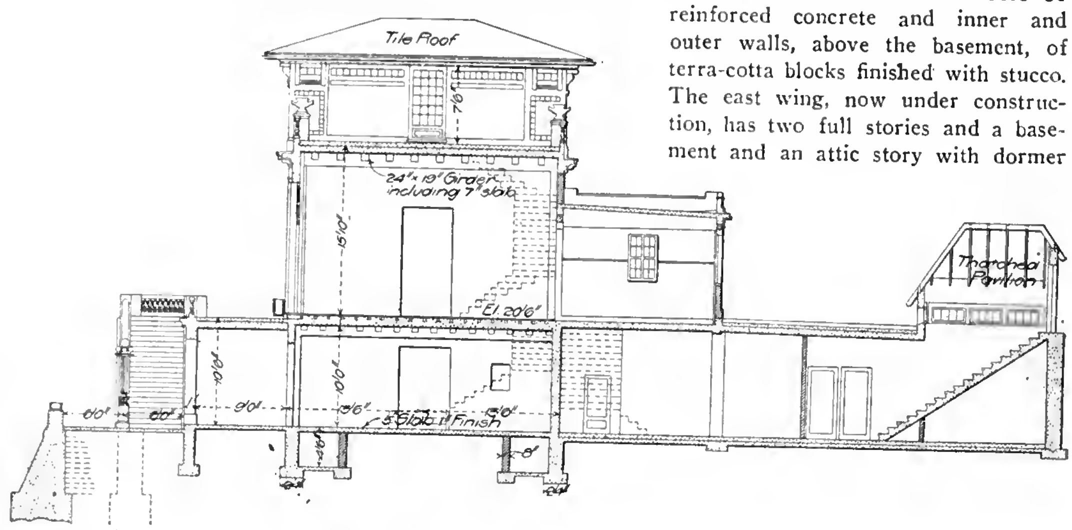
In the construction of the Chateaux des Beaux-Arts, a large summer resort now being built on the south shore of Huntington Bay, Long Island, concrete has been used almost exclusively, not only as a structural material, but also in forming the exterior and interior architectural ornament for the various buildings. The structures contemplated in the general scheme are: A large 3-story and basement central hotel building, with a 145x51-ft., 60-room wing on each end; a 135x36-ft. casino, with public and private dining rooms, billiard rooms and a roof garden; a garage to accommodate fifty automobiles; bathing pavilions and grounds for polo, tennis, golf and other sports. It is expected that ultimately a number of villas will be built on the rising ground in the rear of the hotel to be rented to summer occupants. The casino is now practically completed and the east wing of the hotel is well under way. These buildings and the garage will be available for the present season. The west hotel wing will be built next year and the central hotel building and other structures as soon as they are needed. The site of the main hotel building is now occupied by a 3-story frame hotel formerly known as Locust Lodge. This will be used as the main building at present and later will be moved to another site where it will serve as an overflow annex.

Where this development is in progress the land overlooking the bay rises sharply from the narrow beach, which is wholly covered at flood tide, to a height of about 20 ft., and then slopes gently back for about half a mile. A sea-wall of plain concrete is being built along the toe of the bluff in front of the chateau. Only about 205 ft. of wall is to be built at present, this portion being immediately in front of the casino. Later it will be extended in both directions to a total length of about 600 ft. The wall proper is 8 ft. high, 7¾ ft. wide at the footings and 2 ft. wide at the top. It is surmounted by an ornamental parapet wall about 2 ft. high, on the top of which will be placed growing plants in wooden boxes. The footings of the wall are about 5 ft. below mean tide and rest on chestnut and oak piles 15 to 30 ft. long, stagger-spaced on about 4-ft. centers, which were driven to refusal in the gravel. The wall is built in 32-ft. alternate sections with a concrete key and keyway at each joint. The part of the wall below flood tide level is built during periods of low tide. The manner of delivering the concrete to the wall will be referred to later.

Above the sea-wall on the edge of the bluff is the casino. This is a reinforced concrete structure about 135x36-ft., having a 1-story and basement central section which becomes at each end two stories and basement, by the addition of small pavilions, shown in the accompanying illustrations. The main floor is at El. 20.6, or about the same as the top of the bluff. In front of the casino, extending its whole length, at El. 20.1, is a concrete terrace 9 ft. wide, from each end of which stairs lead down to a 12-ft. terrace at El. 9.1, about 2 ft. below and just inside the top of the sea-wall parapet. In the rear of the casino is a low terrace garden, under which the basement is extended with a concrete column and slab construction. This portion of the basement, in which are kitchens and serving pantries, is connected with the hotel buildings by a reinforced concrete tunel, 8½ ft. wide and 10 ft. high. The basement directly under the casino building will be occupied by the cafe, billiard room and private dining rooms. The restaurant and other dining rooms will occupy the main floor, and on the roof of the central part of the building will be an open garden overlooked by private dining rooms in the two end pavilions.

The basement also extends under the upper terrace about 9 ft. beyond the front wall of the casino along its whole length. In front of the central section of the building this extension forms a long corridor, the floor of which is only 4½ in. above the sea-wall terrace, which is reached from the corridor through arch openings forming an arcade. The 1x4-ft. piers of the arcade are spaced 12½ ft., center to center, and support the front of the upper concrete terrace and its balustrade. They are without vertical reinforcement, but each arch is reinforced with two ½-in. round rods with bent ends and two similar rods are placed over each pier top.

In the casino space has been economized by building the wall and interior columns partly or wholly within the walls. The columns carrying the greatest weight are those on 12½-ft. centers along the front and rear sides of the cafe and restaurant. To these are attached the wall girders and the transverse girders which carry the main and the roof-garden floors. These columns are T-shaped, the stem of the T being



Cross Section of the Casino.

very short and enclosed in the wall. Their sectional dimensions in the basement and main stories are shown on an accompanying drawing. Each column is reinforced with four 1-in. round rods, one in each of the two inside corners, and the other two immediately in front of these near the outer surface. Hoops of ¼-in. round steel wire encircle the rods at 12-in. intervals.

The main floor and roof girders have a clear span of about 25 ft. and are 2 ft. wide and 18 in. deep, including the 7-in. floor or roof slabs, which are carried by the girders without intermediate support. Each girder is reinforced with one 1¼-in. and five 1½-in. rods placed near the lower surface. Each rod is 20 ft. long, including a 4-in. right-angle bed at each end. Three rods are tied into the column at one end of the girder and the other three rods are fixed in the column at the opposite end. The reinforcement near each end is therefore only half as much as that in the central three-quarters where the rods lap over. Each girder is also reinforced with four ¼-in. additional rods disposed in the upper half of the girder, as shown in an accompanying cross-section. These rods, however, serve more as a support for the stirrups and floor slab rods during construction than as reinforcement.

The wall girder below the roof slab forms the basis of an ornamental entablature, the upper part of the girder being built out roughly to form the corona of the cornice. This extension is reinforced with brackets made of ¼-in. rods and placed on 12-in. centers. These brackets and the forms for the girders are shown, ready for the placing of the concrete, in an accompanying picture, in which may also be seen the wooden strips lightly tacked to the inside of the forms to form a dovetail attachment for the cement bed moldings. Each dovetail is formed by three strips of wood, the center strip being triangular in section with its edge at the bottom of the dovetail and its greatest width flush with the surface. When the middle strip is taken out the other two can be removed readily without breaking the edges of the concrete dovetail. Between the bracket rods, in the position shown in the picture, were placed short pieces of tin speaking tube just long enough to extend through the corona. Through these tubes will be passed the wires used together with cement mortar in firmly attaching cement dentils. When the attachment is complete the wires will be wholly embedded in cement mortar to conceal them and protect them from corrosion.

The site of the hotel buildings is about 200 ft. in the rear of the casino. The main building will have on each side a wing, the three buildings being connected by a reinforced concrete covered passageway and all facing the bay. Each building will have a framework and floors of reinforced concrete and inner and outer walls, above the basement, of terra-cotta blocks finished with stucco. The east wing, now under construction, has two full stories and a basement and an attic story with dormer windows under the mansard roof. It is 145x50 ft. and contains about sixty guest rooms. In each of these stories there is a longitudinal central corridor 6 ft. 4 in. wide along each side of which are arranged the bathrooms and closets with their accompanying chambers, as shown in a partial floor plan, which also indicates the general spacing of the columns.

In the upper stories practically all the columns are enclosed with the walls, their sections being rectangular, square, L, or T-shaped or cruciform, depending on the walls intersecting at a particular column. All the basement interior columns are octagonal and each is reinforced with four ½-in. rods spirally wound with 3/16-in. wire on about a 4-in. pitch. Above the main floor the outer lines of interior columns become cruciform and those along the corridors become square. The latter are in the pipe ducts or closets and do not form unsightly corners in the rooms. Above the basement, hoops of ¼-in. steel on 12-in. centers are used instead of the spiral winding. The arrangement of the reinforcement in making the transition from the octagonal to the cruciform section is shown in an accompanying sketch. In designing the columns 500 lb. was taken as the maximum allowable working stress in the concrete.

The floor slabs are 4 in. thick and are attached to the wall girders and to longitudinal girders extending along the four lines of interior columns. In the chambers the slabs are reinforced by longitudinal and transverse ½-in. rods on 6-in. centers in each direction. The corridor floors are reinforced with ½-in. transverse rods

on 6-in. centers and every third rod extends through to the inside chamber walls to provide reinforcement for the floors of the bathrooms, hallways and closets. The interior floor girders are 5x14 in., not including the floor slab, and each is reinforced near its lower surface between columns with two 1-in. rods. Extending through each column and into the girders near the upper surface of the floor slab are two 1-in. rods about 7½ ft. long. Stirrups of ¼-in. round steel are used to tie the upper and lower rods together.

They are dumped by an automatic device, which trips the side-door catches, allowing the gravel to fall to a pile from which the supply for the casino is taken in wheelbarrows. The supply for the other buildings is dumped from the cars into chutes through which it flows into dump carts. This hoisting engine is also used on the pile driver for the sea-wall, a supply of gravel being accumulated in advance sufficient to serve the work while the engine is not available for hoisting. The costs of material and handling are thus reduced to a minimum.

engine through a friction clutch and drum. A similar equipment is used at the east hotel wing. The concrete for the sea wall is mixed in the Ransome mixer at the casino and delivered to wheelbarrows on the main floor. It is then wheeled out on the upper terrace and dumped through chutes into the wall forms. Beyond the ends of the casino a trestleway has been built at the same level as the upper terrace, on which the wheelbarrows are run out.

In erecting the two buildings now under construction the column forms in each story have been set up and filled before the girder and floor centering for the floor above was put in position. This has been done so that the girder reinforcing rods at the top of the columns would not impede the ready flow of concrete into the form. In the hotel the columns in the three upper stories have the same lengths from the floor surface to the bottom of the girders above. This makes the same column forms available for each floor. The column forms end at the bottom of the girders and in framing the latter special pieces are cut and used as needed. All the forms are built on the work in a fully equipped shop.

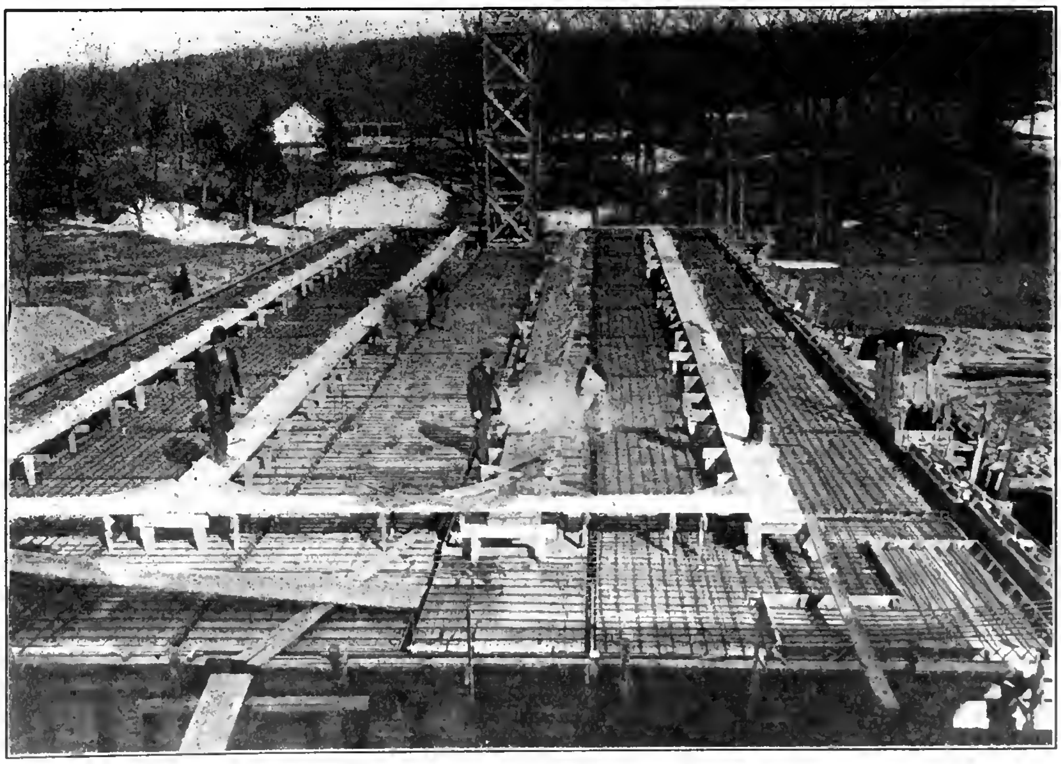
The reinforcement of the chamber floor slabs in the hotel wing consists of a double series of rods which were formed into mats of the proper size on a square wooden frame, the side pieces of which were notched to insure the proper spacing of the rods and facilitate the work. The intersections on all four sides were securely tied with wire and the mats put aside to be hoisted to the floor and placed where needed. The first floor of the hotel wing, just before the placing of concrete was begun, is shown in an accompanying illustration which also indicates the arrangement of the wheelbarrow runways and the position of the elevator.

Cornice Brackets in Wall Girder of the Casino.

The 8x21-in. wall girders at the sides and ends of the building form the basis for applied cement ornament of the general form shown in an accompanying cross-section. These girders are not designed primarily to carry the curtain walls, as the latter are built in solidly and their weight is transmitted to the concrete basement and foundation wall, but they act as floor girders, window lintels and building ties combined.

The garage as completed will be a 274x47-ft., 2-story reinforced concrete structure, but only one story is to be erected at present. Except for some small rooms at each end the entire floor area will be available for the storage of automobiles. There are two lines of 12x12-in. interior wall columns, placed 10½ ft. from the nearest sidewall and spaced on 17-ft. centers longitudinally. The 6-in. second floor slab is carried by transverse girders 12 in. wide and 24 in. deep, not including the floor slab. In designing this floor system it was assumed that the attachments at the ends of these girders and at their intersections with the interior columns were fixed, thus making the resisting moment of the wall and interior columns a factor in the support of the floor load. The arrangement of the reinforcing rods in these girders is shown in an accompanying sketch.

The concrete used in the structural work in all the buildings is made of Atlas Portland cement and unscreened beach gravel and is equivalent to about a 1:2:4: mixture. The cement is delivered in lighters at a dock about a mile and a half from the work and is hauled the remaining distance in wagons. The gravel is piled up on the beach in front of the casino with two-horse drag scrapers, when the tide is low, and is shoveled into two 1-yd. side-dump skip cars, which are hauled to the top of the bank on a double-track trestle incline by a Lidgerwood double-drum hoisting engine. At the top of the incline the cars are about 15 ft. above the ground.



First Floor of Hotel Ready for Concrete.

The concrete for the casino is prepared in a Ransome mixer placed in the basement near the center of the south side of the building with its hopper at the level of the main floor. It is driven by a New York Safety Steam Power Co. engine, supplied with steam by a vertical boiler some distance from the building. The mixer delivers into a dumping bucket elevator in the stair shaft which in turn delivers on each floor to a hopper from which wheelbarrows may be filled. The elevator is operated by the mixer

The cement ornament used on these buildings is formed in two ways. Balusters, hand-rails, columns, door-sills, dentils and similar pieces are cast in wooden molds made in the carpenter shop on the grounds. For this work a 1:3 mixture of Atlas Portland cement and beach sand is used, mixed about as dry as molding sand. It has been found that better results are secured if the mixture is allowed to take a slight initial set and is then retempered before being placed in the molds. This seems to prevent the

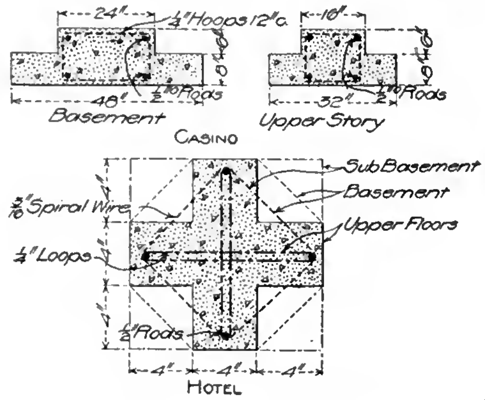
appearance of fine hair cracks and apparently in no way lessens the permanency of the work. The mixture is thoroughly rammed into the mold with ordinary wedge-shaped wooden molders' tampers. The casting is taken from the mold as soon as practicable and any broken corners or other imperfections are repaired with fresh mortar, carefully tamped into place and formed. In making the molds the carpenters work from full-size drawings provided by the architects.

Cornice and interior moldings of cement are formed with a screed in a manner similar to that generally used in forming plaster moldings. The rough concrete surface is first prepared by washing it thoroughly and dusting it while wet with a 1:1 mixture of very fine sand and cement, which is then rubbed in with an ordinary calcamine brush. A thin coat of a 1:3 mortar, mixed rather dry, is then worked on with a trowel. The ornament is then built up in ½-in. layers, a metal-faced screed, running on wooden guide strips being used to form the desired molding. Each layer of mortar is allowed to set 3 or 4 hr. before another is applied.

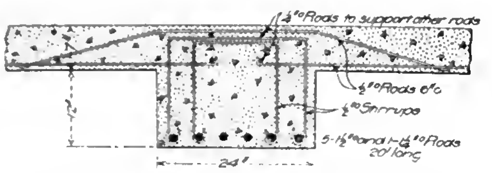
False floor girders, which have been liberally used to divide the restaurant and cafe ceilings into panels, are formed of cement mortar laid on expanded metal strips bent to shape over strap-iron brackets bolted to the ceiling with small wagon bolts, the heads of which are embedded in the ceiling concrete.

A rather interesting method was followed in the design and execution of this job in that the consulting engineer did most of his work through a draftsman in the office of the architects, and besides, secured for the owners a superintendent whose ability he could guarantee, who has had charge of all the execution. By this means large economies were secured in the design, jointly and simultaneously developed by the engineer and architect, along economic and artistic lines, respectively. In the same manner, economies in construction have been practiced by the engineer and owners working together so that the actual unit costs are said to be phenomenally low. If it had not been for the rigor of the past winter and the exposed site of the work, the progress would have been even better and the costs still lower. It may be noted that the methods herein followed are one solution of the difficulty usually encountered when reinforced concrete contractors are allowed to submit bids on their own designs. Even had the owners decided to erect the work by contract the same method of design would have been advantageous.

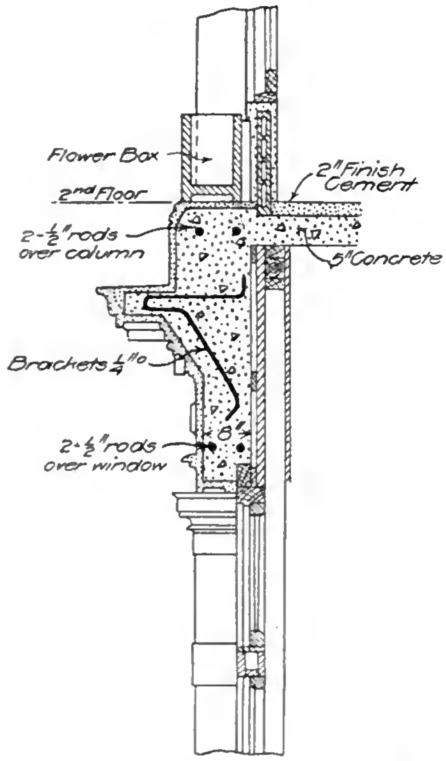
Messrs. Bustanoby Bros., proprietors of the Cafe des Beaux-Arts, New York City, are the builders and owners of the structures described. Messrs. Delano & Aldrich and Maurice Prevot are the architects, and Mr. E. P. Goodrich is the consulting engineer for the design and execution of the reinforced concrete work. All the details of the construction work have been under the supervision of Mr. Edward Mahl, superintendent.



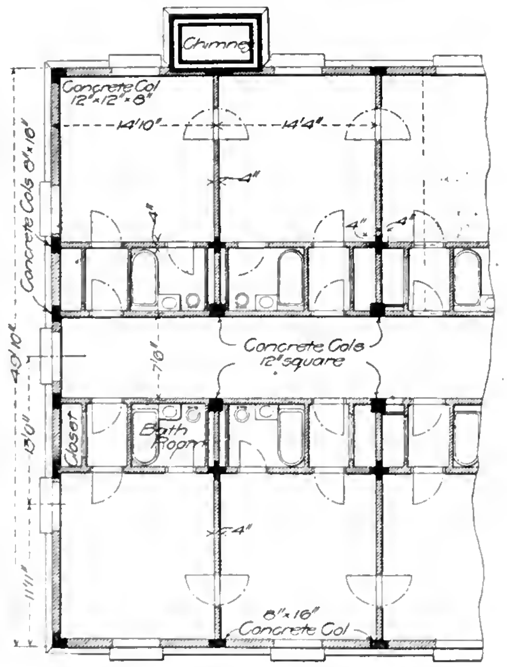
Sections of Columns.



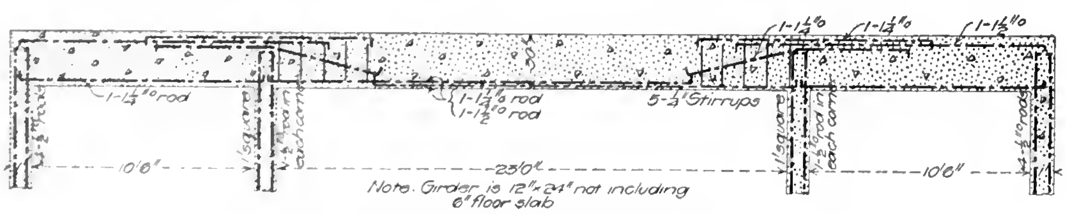
Section at Center of Casino Girder.



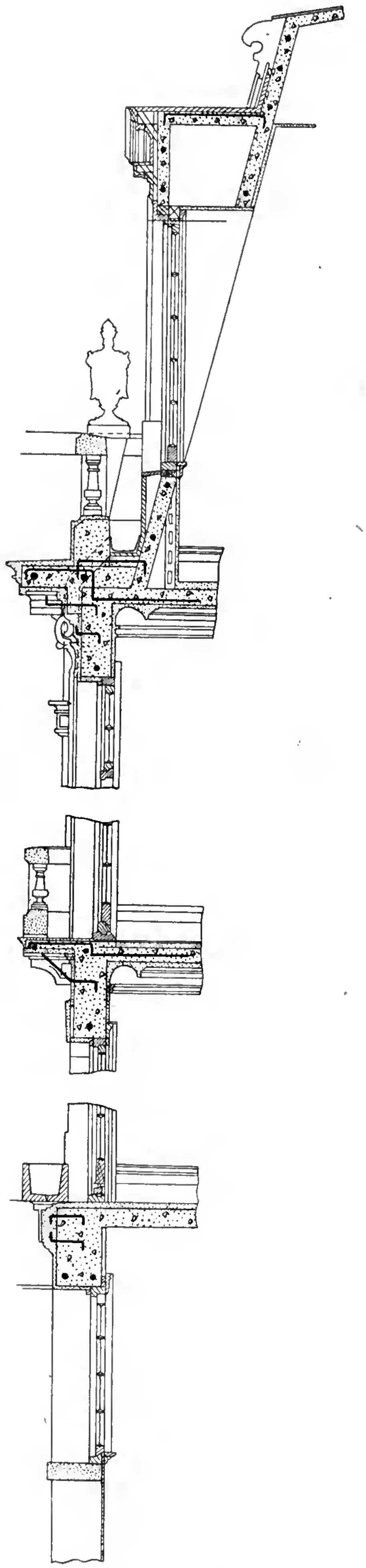
Wall Girder and Cornice of Casino.



Part of Upper Floor of Hotel.



Reinforcement of Columns and Girders of Garage.



Section of Hotel Wall.

An Important Correction should be made in the discussion of the Quebec bridge printed last week. The center post carries less than one-fourth of the entire shear of the cantilever and anchor arms, according to Mr. Theodore Cooper, instead of all of it, as stated.

Highway Work in Allegheny County, Pa.

Allegheny County, Pa., has now under construction 60 miles of macadam road, which when completed will bring the total of the county's hard roads up to 275 miles. The road work of the county since 1897 has been under the so-called Flinn Act, passed by the Pennsylvania legislature in 1895, which authorizes any county to take over from the townships such roads as it intends to improve, these roads then becoming county roads to be maintained thereafter without expense to the township.

The county has an area of 750 sq. miles of rough picturesque country, cut by deep valleys carrying streams to the three large rivers, the Allegheny, the Monongahela and the Ohio, which meet at Pittsburg, the geographical, as well as commercial center of the county. The topography has naturally made road construction quite costly, and at the same time has intensified the demand for road improvement. Heavy landslides are a common occurrence, and protection from streams has proved a costly item because of the great number of runs, most of which are torrents in time of high water.

The Road Department was organized in 1897 under the Act above referred to, and since that date has improved 215 miles of road. In addition to maintaining these roads it also maintains 24 miles of plank roads, which were purchased from corporations that had operated them on a toll basis. These will be maintained as they are until they are changed to macadamized roads. The earth roads still remain under the township authorities, the Road Department concerning itself entirely with hard roads. The total length of roads of all descriptions in the county is 1,766 miles.

The present development contemplates the expenditure of about $1,000,000 per year. The main roads radiating from Pittsburg are first improved, and when this work is completed connecting lines will be taken up, though where the latter are very important they are taken up at the same time as the other improvement. A county road tax and bond issue furnish the funds for the work.

The improved roads are built with a telford foundation and have a width of stone of 16 ft., and a width between slope lines of bank of 24 ft. The width of stone, 16 ft., allows of the passage of two vehicles abreast without crowding either one off the hard surface.

In improving an old road grades are revised, cutting the sharp hills and filling deep hollows. The sub-grade is rolled with a steam roller weighing not less than 10 tons, and all resulting depressions are filled, and the surface again rolled till it is even and compact. Shoulders are left on each side of the sub-grade and ample provision made for drainage through them. Where the existing soil is of such character that it must be removed, the surface is brought to the proper level with good material. Upon the sub-grade is laid a telford foundation of stones 8 in. deep, not exceeding 4 in. in width at the top and from 6 to 16 in. long. They are laid by hand with their broadest edges down, and longest side across the road. Not less than 10 per cent. of these stones may be under 7 in. in depth. The stones are laid to break joints, and are bound in place by inserting and driving down wherever possible stones of proper size and shape to wedge in solidly. All projecting points of the top surface are broken off with a hammer and driven into the spaces not already filled by the process of wedging. Wedging stones are driven until the foundation is to grade and 8 in. thick. The foundation is then rolled with a roller weighing not less than 10 tons, until the whole mass is thoroughly bedded into the earth subgrade, and the top is 4 in. below the finished grade at all points.

When the sub-grade is on shale instead of the telford foundation just described, a layer with a finished depth of 6 to 8 in. made with stone that will pass through a 3½-in. ring, and will not pass through a 2½-in. ring, is used. This layer is likewise compacted with a 10-ton or heavier roller. The stone used is that found convenient to the work, generally limestone or Ligonier stone.

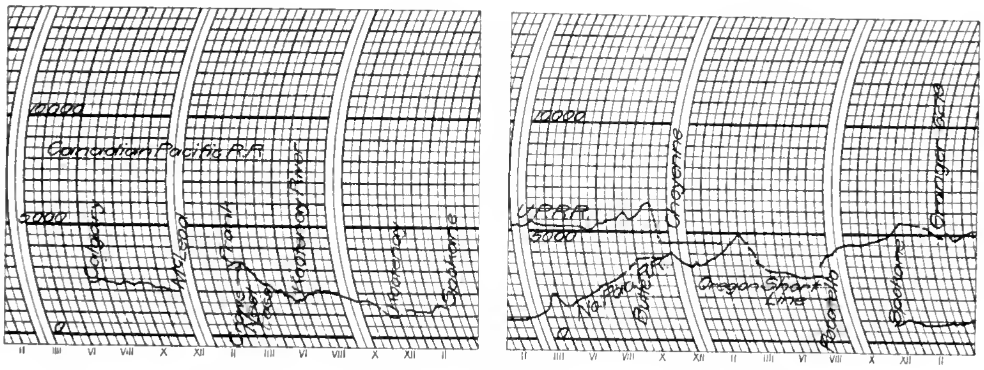
The surfacing consists of two layers of stone, with sometimes a finishing coat of crusher dust. The first surfacing layer is 2 in. thick when consolidated and is made of stones that will pass a 2½-in. ring, and not pass a 2-in. ring. After this has been rolled solid a second layer with a finished thickness of 2 in. is added. It consists of broken stone which will pass a 1½-in. ring, but will not pass a ¾-in. ring, to which may be added a proportionate amount of screenings, free from dust, that will pass a ¾-in. ring, and not a ¼-in. ring. This last course is thoroughly rolled until the surface is even and at the finished grade. When a binder course of crusher dust is used, it is thoroughly sprinkled and rolled until the mud flushes to the surface, and until the passage of the roller causes no wave in the surface. The surface of the berms between the broken stone and the gutters is finished with clay or good earth and then rolled.

In many places it is necessary to pave the gutters or open ditches, on either side of the road, and for this work a foundation of 3 in. of rammed gravel is used. Upon the gravel is placed a layer of bedding sand or gravel of sufficient depth to bring the gutter stones which will be rammed in to it to the proper grade. The paving stones are of roughly squared rubble, at least 8 in. in depth, set on edge, and the interstices between them are filled with sand.

At the same time the road is improved, fences on embankments, and watering troughs are constructed. The latter are placed at all springs and water courses.

The maintenance work on roads already improved is carried out systematically, the work being blocked out at the beginning of each year. The broken stone for resurfacing is bought by contract and hauled by contractors to the point of application on a tonnage basis. Six 10-ton rollers are owned by the department and used constantly in maintenance work.

The Road Department is under the direction of Mr. George T. Barnsley, chief road engineer of Allegheny County.



Cards from Recording Pocket Aneroid Barometer.

Letters to the Editor.

POCKET BAROMETER RECORDS.

SIR: You may be interested in the sheets inclosed, being the record of a pocket aneroid barometer. I have had this a little less than a year, and have traveled with it many thousands of miles, and across the United States, both east and west and north and south, and over the Rockies many times, and to the tops of some of our highest peaks. The inclosed sheets represent the record over a portion of the Canadian Pacific, of the Oregon Short Line and the Union Pacific railroads from Calgary in Alberta, via Spokane to Butte, Granger and Denver.

I find the instrument reliable within its limit of accuracy. The elevations on the present sheets should be increased by about 1,000 ft. You will see that they show a fairly accurate profile of the roads traversed. The horizontal distance is a function of the speed and consequently the profile is not to the same horizontal scale unless the speed is uniform. It serves, however, as an interesting record for reconnaissance.

The instrument consists of a small aneroid barometer with a pen something on the plan of the Richard recording instruments, the whole case being about 3½x4½ and 1¼ in. thick. The thing which makes it a success in railroad riding, walking and horseback riding, is the idea conceived by the maker of keeping the pen from the paper except at intervals of about two minutes. It then touches the paper for a short instant and is withdrawn, but without giving time for a long line.

I have carried the instrument on foot, on horseback, in my pocket and in all ways, without trouble in the record. Once in climbing a mountain, I slipped, fell down and rolled over, but without any effect upon the record. Should a jump take place at just the instant when the pen touches the paper then, of course, there would be a long line at right angles to the trace. When the descent or ascent is fast, the dots may not form a connecting line, as is shown in the passing of the hill near Cheyenne. This particular record included the crossing of the Rockies four different times. First at the Crow's Nest Pass on the Canadian Pacific, second, on the Northern Pacific some distance west of Butte, the third, on the Oregon Short Line east of Butte, and the fourth on the Union Pacific at Sherman Hill west of Cheyenne.

Yours very truly,

Fort Collins, Colo. L. G. CARPENTER.

CONCRETE SLAB FORMULAS.

SIR: In your issue of Aug. 3, page 131, you give prominence to a solution of the flat slab in reinforced concrete given by Prof. W. C. Unwin. It seems to me that the solution is one open to question. Prof. Unwin starts with the assertion that a flat square slab supported on all four sides fractures along a diagonal. Assuming that the bending moment is greatest along the diagonal of a rectangular slab a formula is derived for the magnitude of this bending moment, which is naturally a mathematical certainty, just as the bending moment along the diameter of a circular plate is a mathematical certainty. But the variation of intensity of this moment along the diagonal is entirely ignored, or rather the intensity is taken to be constant. There is just as much error in taking the intensity of this moment as uniform along the diagonal of a rectangle as there is in taking the intensity of the

bending moment along the diameter of a flat circular plate as uniform. It may be quite true that a flat slab, either square or rectangular, supported on four sides, will break on a diagonal line. This is proof of one thing, namely, that the greatest intensity of bending moment is at the center of the slab; for, as both diagonals are identically conditioned, either may be the one to fail, and their only common point is the center of the slab. It is not conceivable that the same intensity of bending moment extends clear to the corner of the slab. A crack once started in a diagonal direction would naturally extend into the corner and even over the support, merely on account of the brittleness of the material. This would be no evidence of a constant intensity of bending moment along the fracture. A crack once started in a brittle substance can be extended without the exertion of as much force as is required to start it.

On the same page of your issue the report quoted refers to flat plate theories as being applicable to reinforced concrete. These flat plate theories are worked out for steel plates, where the strength in both tension and compression is the same in all directions, and the extreme fibre stress at both top and bottom of the plate is found to be the same in all directions at the center. Furthermore, in Grashof's formula the true extreme fibre stress is not given, as in the case of beams, but it is throttled by a coefficient (Poisson's ratio). How can a fictitious extreme fiber stress in all directions be converted into actual stress in steel reinforcing rods in two directions? Advocates of Grashof's formula do not seem to have answered this question. They further do not make it clear why it should be necessary to pass through the labyrinth of the flat plate theory and through the loop of Poisson's ratio (and out again) in order to solve a flat plate in reinforced concrete, a material not at all contemplated in Grashof's formula.

Yours very truly, EDWARD GODFREY.
Monongahela Bank Building, Pittsburg.

COMPARISON OF VARIOUS PILES.

SIR: In designing the foundations of a building, the first and most important point to ascertain is the condition of the ground on the proposed site. It is not only necessary to learn the nature of the ground on the surface but the nature of the underlying strata must be determined. It often happens that while the upper ground may be firm and compact enough in itself to carry the required loads, yet the underlying strata are of such a nature, mud, quicksand, etc., that the application of any load would cause the upper stratum to settle seriously, thereby causing damage to the building. Or it may be that the upper ground is of no account at all for load carrying purposes, mud, swampy ground, etc., making it necessary to support the loads on some firmer stratum of earth found at some distance below the surface. In any such case, foundations are designed which are intended to transmit the loads of the building to firm and reliable ground, whatever distance that ground may be located below the surface of the earth. Sometimes it is found most expedient to use deep footings and heavy piers, going through the poor ground and resting on the good ground underneath. In other cases, principally from the standpoint of economy, piles, either of wood, iron or concrete, and of various sizes, are used for transmitting the loads through the poor earth to the firmer stratum underneath. These piles depend in a great measure for their support on the surrounding earth, and due to the friction between the sides of the piles and the earth, a great part of the load is taken up by the surrounding ground before the point is reached. It will be seen therefore that in using piles, a certain amount of dependence must be placed on the upper ground, inasmuch as it carries a certain portion of the load, the amount depending on the firmness of the ground.

Were it certain that the upper earth would always remain the same, the risk involved would be small, but there are certain points which make such a possibility uncertain. Very often piles are driven before any excavations are made, so that after the earth has been removed from around the tops of the piles for the capping, a certain amount of carrying capacity has been taken away from them. This, however, does not change the loads the piles have to carry. The lowering of the water level, due to drainage into nearby sewers or others reasons, will allow the tops of wood piles to rot, thereby rendering the proper transmission of the loads imperfect, sometimes causing serious settlement of, and consequent damage to, the building resting on the piles. Again, excavation near the building may destroy the supporting power of the surrounding earth, thereby causing the piles to settle, because part of the supporting surface is rendered useless.

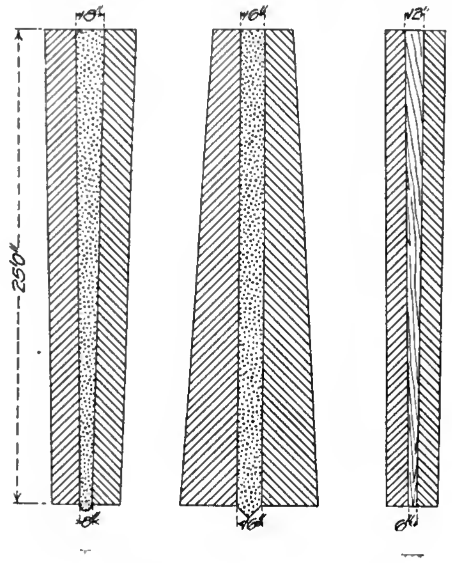


Fig. 1, Load Distribution by Friction.

All of these points must be considered in choosing the kind of foundation to be used for the building. The ideal pile would be one that transmitted the entire load to the firm and reliable ground, wherever that soil might be, placing no dependence on the poor ground through which it passes. There are no piles made which exactly fulfill these conditions, but it should be a matter of interest to everybody to find out which pile most nearly fulfills them.

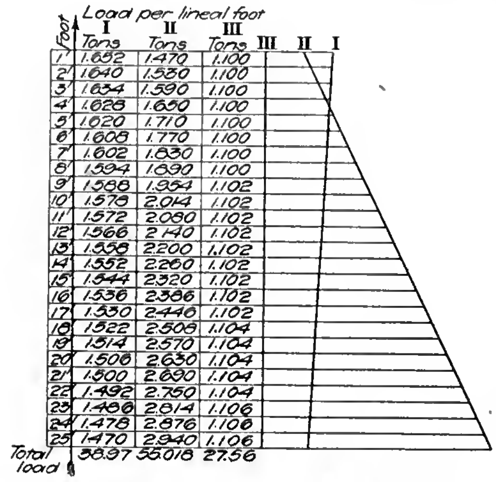
There are on the market, at present, practically only three styles of piles, the ordinary wooden pile, the tapered concrete pile, either molded before driving or made in place, and the cylindrical concrete pile.

For the purpose of comparing these piles let us assume ground conditions which will bring out the largest number of good points of each system, making the comparison as fair as possible to all concerned. Assume that the ground is of such a firm and compact nature that one square foot of pile surface at the butt of the pile will develop a carrying capacity of 0.35 ton, increasing uniformly to 0.7 ton per square foot of pile surface at the point of the pile. Assume each pile to have been driven 25 ft. into this ground. Also assume the ultimate friction of the concrete and wood against earth to be the same, and neglect the end bearing values of the piles. Then we have the superficial area for one lineal foot of pile at the butt and at the point for each pile to be as follows:

Pile	I.	II.	III.
Butt	4.71	4.2	3.14
Point	2.1	4.2	1.57

Multiplying these areas by the unit loads for the butts and points of the piles and scaling them off as shown in Fig. 1, and connecting the upper points with the lower points, diagrams are obtained which show not only the total loads carried due to superficial friction by the piles but also how the loads are transmitted to the surrounding earth. Fig. 2 shows this more in detail and also gives a table of loads carried by each lineal foot of pile as scaled from the diagram.

The diagram of pile I shows that a slightly greater load is transmitted to the surrounding ground at the butt of the pile than at the point. In other words, the very reason for the use of piles is defeated by placing over half the load on the poor upper earth. The diagram for pile III. shows that the loads are very uniformly distributed to the surrounding ground for the whole length of the pile, which is little better than pile I. The diagram for pile II., however, shows that small reliance has been placed on the carrying capacity of the upper earth, and that by far the greater part of the load is transmitted to the ground around the bottom of the pile. In other words, it shows that as the carrying capacity of the earth increased, the pile placed a



Foot	Load per lineal foot I Tons	II Tons	III Tons
1'	1.652	1.470	1.100
2'	1.640	1.530	1.100
3'	1.634	1.590	1.100
4'	1.628	1.650	1.100
5'	1.620	1.710	1.100
6'	1.608	1.770	1.100
7'	1.602	1.830	1.100
8'	1.594	1.890	1.100
9'	1.588	1.954	1.102
10'	1.578	2.014	1.102
11'	1.572	2.080	1.102
12'	1.566	2.140	1.102
13'	1.558	2.200	1.102
14'	1.552	2.260	1.102
15'	1.544	2.320	1.102
16'	1.536	2.386	1.102
17'	1.530	2.446	1.102
18'	1.522	2.508	1.104
19'	1.514	2.570	1.104
20'	1.506	2.630	1.104
21'	1.500	2.690	1.104
22'	1.492	2.750	1.104
23'	1.486	2.814	1.106
24'	1.478	2.876	1.106
25'	1.470	2.940	1.106
Total load	38.97	55.018	27.56

Fig. 2, Capacity of Piles per Foot.

greater load on it, thereby developing the power of the ground in a rational and logical manner. Pile I. places the greatest load where the earth is weakest and reduces the load as the soil becomes stronger.

Aside from this it will be noticed in summing up the loads carried by the various piles per lineal foot that pile III. carries the smallest load, pile I. next, and that pile II. will carry more than twice the load of pile III., and over half again as much as pile I. In all this discussion the end bearing of the piles has been neglected. To look at this point for a moment, it will be noticed that pile I. has an end bearing of 0.34 sq. ft., pile II. an end bearing of 1.4 sq. ft. and pile III. has an end bearing of 0.2 sq. ft., or, in other words, pile II. has an end bearing equal to four times that of pile I. and seven times that of pile III. Assuming in the soil discussed above that the end bearing will develop 5 tons per square foot, then pile I. will develop 1.75 tons, pile II. 7.0 tons, and pile III. 1.0 ton.

BOSTON, MASS. THOMAS MACKELLAR.

THE GALVESTON, TEX., CAUSEWAY which it is proposed to construct as a highway and railway structure from the mainland to the island on which the city stands will be nearly two miles long, according to present plans. About 8,000 ft. will be a causeway with a 50-ft. width for steam railways, 15 ft. for interurban railway, and 35 ft. for highway. The bridge is 2,000 ft. long and 63 ft. wide, consisting of a series of reinforced concrete arches, and a lift span of 100 ft. clear width.

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REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of THE ENGINEERING RECORD.

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Of this issue of THE ENGINEERING RECORD 14,250 copies are printed. Total circulation for 1907 to date 493,500 copies, an average of 14,515 copies per week.

TABLE OF LEADING ARTICLES.

A Notable Power Transmission.

In these days it is unusual to find a power trasmission plant which includes startling features of novelty, and it is therefore interesting to note in the Kern River No. 1 plant of the Los Angeles Edison Co. engineering of an exceptionally advanced type. This plant was described in the last two issues of this journal. The Los Angeles region was the scene of the earliest work on this continent in modern power transmission and the engineers of the Coast have consistently kept on the firing line of progress ever since. The first plants of the Los Angeles Edison Co. were in the region of the original Redlands system and took their power from the streams in the southern canyons of the Sierras that sweep westward toward the Pacific. Most of the available powers here have now been developed and in seeking an increase of output the engineers cast their eyes northward. The present great plant is therefore on the Kern River, which is a tributary of the San Joaquin clear across the mountains and drawing its water from an entirely distinct watershed more heavily wooded and of somewhat different characteristics. The result will be that the fluctuations in the total supply of power will be decreased, and the system will be the more reliable. The great network in the northern part of the Golden State has somewhat of the same characteristics, the De Sabla power house, for instance, drawing its water from a slope quite different in its character from that feeding the Electra powerhouse, yet there is probably no case where there is quite such independence in the water supply as in the Los Angeles system.

Another striking characteristic of the Kern River plant is the very extensive and deliberate use of tunnels for the hydraulic works. This was partly suggested by the topography, but more probably by the extent of the works in length and capacity. Most of the California plants are fed by timber flumes, which follow the earlier practice of the ditch companies. Others with shorter distances to cover use steel pipe throughout. Here the main part of the conduit is in tunnels lined with concrete, and what is still more striking the pressure pipe above the powerhouse is itself a steel-lined concreted tunnel practically clear down to the penstocks. Here again, topography had something to do with the matter, but the innovation is a striking one nevertheless and it certainly simplifies the carrying of the large volume of water since the steel is backed by the concrete and does not have the serious difficulties that would have been involved in a plain steel pipe of the requisite dimensions. The tunnel construction is undeniably expensive in first cost, yet the upkeep should be low enough to compensate in large measure for the fixed charges and the chance of a breakdown is certainly greatly diminished. A system like that of the Edison Co. must be considered as a whole and while the other plants act as a partial relay this 20,000-kw. installation is so much the most important one for future work that it was certainly good policy to take no chances with the hydraulic works.

In the design of the power plant itself, perhaps the most striking feature is the size of the units. The impulse wheels are probably by far the most powerful single units ever produced and the generators are the largest ever coupled to impulse wheels, especially when overload capacity is taken into account. The generators themselves are for 50 cycles, the frequency of the original Redlands plant and of the later plants near it. Whether any lower frequency than this might be desirable at greater distances of transmission is an open question, but certainly there are no signs yet that even the long 60 cycle lines further north have been at all inconvenienced by the frequency. The voltage at present in the Kern River plant is 60,000, although the system is planned for the use of 75,000 volts later. In the climate of California there is no reason to hesitate in using it after the lines have been worked into good running condition. One of the interesting details in construction work to which attention should be called was the installation of a temporary hydro-electric plant to supply power for driving the tunnels and doing other preliminary work, and even more characteristic of Pacific Coast enterprise was the installation of an automobile trucking line for carrying cement and other material up to the works from the railroad. Automobiles have been used in construction work times enough, but this particular operation is beautifully characteristic of the way they do things on the Coast, where conservatism is not counted a virtue in and of itself, and where standards are held precious only so long as they remain useful. It would be well if every Eastern engineer had to do a turn of duty in the Rockies and westward just to get shaken out of some of the hidebound precedents that infest Eastern practice. The Kern River system is now only at the start; there is room for other plants when the need for more power arises, and certainly the Los Angeles Edison Co. is to be congratulated on the daring and effective work it has already accomplished.

Power-Plant Machine Shops.

The development of power plants of very large capacity within the last few years has created many new problems in design and operation. The question of maintenance of equipment with respect to continuous service is present in all commercial plants, but as the size of installations increases, the problem of local repairs assumes an importance which cannot be overlooked in any well-planned station. Repairs are frequent in small installations, but in a plant of from 10,000 to 20,000 kw. rating and upward, there is practically a continuous necessity for the pushing on of such work. The main generating units may not require the attention which is proportionally expended on smaller machines, but the auxiliaries and piping, valves, traps and other fittings in very large plants are employed on such a large scale that ample provision should be made for their maintenance, if possible, on the premises.

The power-plant machine shop is the natural outcome of the foregoing conditions, and it is interesting to note the way in which the small shop is coming into its proper place in the design of the larger plants. The comparatively new station of the Suburban Gas & Electric Company at Revere, Mass., illustrates this tendency in plants of moderate size, where the custom is to pump-drive the necessary machine tools by a small motor; and the Port Morris station of the New York Central R. R., with its individually operated set of machine tools located on a special section of the turbine room gallery, shows the importance of the local shop in the exacting service of a very large plant. Formerly a simple workbench equipped with a vise and such tools as the operating staff might personally own and be willing to keep at hand sufficed for the machine shop of a power station, and there is no doubt that some ingenious and handy repair jobs were executed in this way. The conditions are more exacting in these days, and it is a source of satisfaction that progressive designing engineers are appreciating the economy of well-lighted and decently equipped repair shops in the important stations. This kind of maintenance work has yet to be put on a firm basis, however, for until very recently the minor plant repairs have been handled by pretty much any one on the engine room staff. The cost of these repairs has seldom been figured, records of the shop work performed have been few, and the actual money value of a good shop inside the power house walls has been left very much to the imagination.

It should be clear enough by this time that a simple shop with a few tools driven by power is desirable and necessary to the best results in almost any plant, no matter how small it is. The

operating engineers usually possess considerable mechanical skill, and few stations are without the services of at least one man with special aptitude for putting together simple, home-made rigs and combinations of apparatus which will save the plant good money every month when installed. To encourage this kind of inventive ability is worth a great deal more than the low fixed charges on a lathe, drill, shaper and emery wheel with a small motor drive for the group. Even in very large plants there should be facilities for the working out of special ideas aiming toward securing lower fuel and water bills, reduced repairs and increased flexibility of operation. In the latter case, however, it is probable that the shop work will be so important that one or more machinists will be continuously on duty, and the exactions of taking care of generating units of very large cost may leave little time for the development of special rigs. Unless meritorious ideas can be tried out, there is a defeating of its own ends in part by the power plant shop, and it should always be realized that a certain amount of research along economical lines is quite as important as the mere routine grinding of valves, straightening of stems, adjusting packing, and assembly of pipe fittings which so often absorbs the shop tools' activity. Such a shop can do valuable work in the assembly of a new plant, and sometimes for months after it is started the shop will greatly facilitate the final adjustments of equipment. Direct connected tools with variable speed control are most advantageous in the face of their cost, in large stations, but even the small plant with group drive deserves better than hand facilities for the quicker and lighter repairs.

Engineering Office Libraries.

One of the most instructive recent papers for engineers is that by Mr. Lee, librarian of Stone & Webster, on the library department of that firm's organization. An abstract of it appears elsewhere in this issue, from which it will be seen that the department is considerably more than a library, for it really is an information bureau, answering questions not only by research in books and journals, but also by correspondence with those outside and inside the organization likely to know what is desired by the inquirer. It is a recent development and probably ten years hence will be strengthened along several lines which at present are but dimly recognized, but the department to-day is a concrete demonstration of the important part printed information plays in the actual business work of a large engineering organization. The day has gone by when a few school books will answer the requirements of such an office. The time lost in hunting for information or in working out problems that somebody has already solved represents a considerable financial loss, which it is the purpose of this library department to save.

It will be noticed that a large part of the library consists of documents, which is naturally the case with such a business as that of Stone & Webster. Apart from these papers, such documents might well include all the results of minor investigations and experiments made practically all the time in engineering offices of much size. Any item of engineering information, jotted down on a sheet of appropriate size, is just as suitable for preservation in a real working library as a three-volume treatise. Probably the lack of any system for filing such notes is the only reason they are not kept more often. Most engineers have attempted to preserve short notes in manuscript books, only to give up the practice when the trouble of writing them out and of finding them again has been discovered by experience. In consequence, the same man often has to hunt up information on a subject several times, just because it is not made permanently available when found the first time. Probably the time lost in searching for it once is trifling, but when that loss is multiplied several-fold, the total is worth considering. Moreover, in a large office, the chances are pretty fair that a good many people will repeatedly have occasion to refer to certain classes of information, so that a standing order might properly be posted requiring all information gathered in office time to be noted for filing in the library. Incidentally, it may be added, information likely to be generally useful and not of the nature of trade or professional secrets, might be sent to class journals, as is now the custom quite generally in mechanical engineering, although not in civil engineering branches.

It will be evident from a consideration of Mr. Lee's paper that the secret of usefulness of such a business library is its arrangement and indexing for immediate availability. It is this feature of the work that is most troublesome to the engineer and often proves hopeless to a trained librarian without engineering education. The engineer is likely to regard many of the minor details of library work as mere fussiness, and consequently his own system, which lacks them, is likely to break down as soon as it is given a good trial. The trained library assistant, who believes that all knowledge can be classified by the decimal system, is thrown into confusion by the discovery that there are more than ten equally important sub-divisions of some engineering subjects. A decimal classification can be worked out which will probably give satisfaction, when used by people trained in its system; the experience at the Mechanical Engineering Department of the University of Illinois is an indication of this. On the other hand, the importance of a geographical classification is very evident in a business office, as Mr. Lee points out in his paper. It is safe to say that a business man consulting the bound volumes of any journal for information regarding the details of a power plant in St. Louis will look in the index for the name of the city rather than under "power plant," yet indexing geographically is considered crude by most trained librarians. Before a good classification for an engineering office library is adopted, it is therefore desirable for the owners to determine just what they wish to index and for the librarian to cast off all prejudices and learn what questions he will be asked to answer. It may happen that the decimal classification will prove best, or the geographical, or one which is arranged by letters instead of numbers, so as to avoid the limitations of the decimal notation. Time spent in a thorough study of indexing before beginning the library arrangement is warranted by the vital importance of the subject. If the work is properly done and the library skilfully conducted in accordance with the system thus developed, the result will be to make readily available the information gathered by the office in its business and all the contents of class journals, trade catalogues and books. The command of such resources is worth a considerable sum in many offices.

The library managed in this manner is particularly useful in securing the best results from the valuable contents of class journals. The librarian examines each publication carefully as soon as it is received, and any information of immediate concern to the business of the office is brought to the attention of the man who is in charge of the subject. Even in offices which do not maintain a library, it is often customary to have somebody examine all such publications as they are received, for whatever information of immediate interest they may contain. Where a library organization is maintained, however, this examination is more complete, and articles likely to be of permanent value are indexed according to the library classification, thus making it unnecessary to refer in many cases to the indexes of the volumes themselves, which is a tedious and often unsuccessful method of search. Attention is particularly called to this point, because many offices are doubtless already spending a considerable part of the sum needed for pretty fair library work on an examination of journals and trade publications for temporary purposes only. Whether it is best to issue a regular bulletin of notes regarding the contents of class journals, as is done by Stone & Webster, must be decided by the special conditions of each case, but it is probably true that most companies conducting a technical business find it desirable to subscribe to enough copies of each important journal in their lines to provide a file in each branch office as well as at headquarters.

Reinforced Concrete Floor Plates or Slabs.

The problem of determining stresses in either rectangular or circular plates supported or fixed along their edges has always been a complicated matter in the theory of elasticity of solid bodies, and there has never yet been established a satisfactory simple theory of such plates. Nor have there yet been made enough tests of the bearing capacity of such plates, either to enable purely empirical formulas to be established or to determine empirical coefficients for the analytic formulas of the provisional theories thus far proposed. The whole subject was considered to be more of analytic interest than of practical importance until the extended application of reinforced concrete to the construction of floor plates or slabs has given to it a degree of real importance which it hitherto has not possessed.

The Engineering Record has commented upon this general topic in the past, but the many inquiries which have lately been made regarding the proper methods to be employed for the design of these plates, and the regulations for their construction which have been proposed by many bodies, including the French government, show that the subject needs much more consideration.

In the issue of this journal of Aug. 3 there will be found a number of formulas set forth in the appendices of the reports of the British Joint Committee on Reinforced Concrete. There is no attempt in that report to go into any such extended and refined analysis as that given by Clebsch, Bach and others who have treated the problem as belonging wholly to the theory of elasticity. Perhaps it is as well that some approximate or conventional theory should be employed. That procedure certainly contributes to simplicity and avoids the complication of the exact theory, which, after all, is based upon such nice conditions regarding the supported edges and their continuity, when continuous, that they are never realized. It is in the interests of the actual features of the case, therefore, that approximate or provisional and simple theories should be adopted, in which empirical quantities may be introduced. What is needed is some reasonable expression for carrying capacity which may be made accurate enough for all practical purposes by an empirical factor determined by tests upon full-sized plates loaded as in actual use. The principal formulas of this class are those of Rankine and Grashof, or some similar formulas, with the later additions of Bach's empirical theory, and such regulations as those of the French government.

The formulas of Rankine and Grashof for rectangular plates are chiefly based upon their assumed division into narrow strips parallel to the two sides of the rectangle, these strips being supposed to be so loaded as to make their center

deflections equal. Other formulas have also been based upon these fundamental assumptions, but developed into little different shape for the purpose of meeting the conditions otherwise ignored. These assumptions, like all of this conventional class, result in approximate formulas involving far too much error for unlimited use under any circumstances, but they yield forms which can frequently be effectively used in connection with tests of actual plates. In this manner factors or coefficients based upon such tests can be fitted to them so as to make them sufficiently accurate for purposes of design, within limits wide enough to give them much practical value.

The assumption that these strips of plate at right angles to each other must have equal center deflections is, of course, erroneous for all except those that are axial to the plate, and in the vicinity of the four sides of the plate the error is large. Again it is always assumed in this particular class of problems that the distribution of pressure along each edge of the plate is uniform, a condition never realized and sometimes very far from being realized. In the case of reinforced concrete plates, fortunately, this particular assumption probably does not involve material error. On the other hand, such plates are almost invariably continuous and the degree of fixedness around the edges is not only undeterminable, but it varies with the amount and position of loading. Under such circumstances, it is manifestly impossible to determine any accurate theory of treatment. The only possible procedure giving any promise of practical value is that already indicated, viz.: to test plates in as near actual conditions of use as possible, observing carefully their action with different loadings up to failure and then by aid of these tests to fit empirical quantities to the best form of approximate formula which can be devised.

The recent tests of Bach indicate that the greatest bending moments in square plates, and those nearly square, are found along the diagonals, and this probably holds for plates that are considerably oblong in shape, but not for long and narrow plates. In the central portion of the latter, at least, the line of maximum bending moment usually is parallel to the two longer sides.

The carrying capacity of plates, both rectangular and circular, needs a most careful and comprehensive analytical study, as well as an equally extended experimental investigation with their sides either continuous or simply supported. With the extensive use of reinforced concrete for floor construction, it has become of great practical importance to have available methods of design which can be depended upon to yield reasonably accurate results, especially for the heavy floor loads now required for both storage purposes and manufacturing machinery.

Notes and Comments.

Patching Reinforced Concrete is often done so quickly that the engineer in responsible charge of the work is unable to see just what conditions are hidden by the patches. It is well known, however, that sometimes these conditions are decidedly bad and indicate a lack of careful workmanship which should not be tolerated. Mr. H. M. Kennedy has recently made the suggestion that the building code of a city should prohibit such patching until the spots to be covered have been examined by a city inspector. Just how this rule would work in practice is somewhat doubtful, for the trouble in getting an inspector to pass on work is already serious in some cities and causes delays which reach a large total in a building operation of some magnitude. Mr. Kennedy states that in the work of his company a rule of this sort was put in force some years ago, according to which absolutely no patching is allowed to be done on concrete work immediately after it is stripped of its forms until it has been thoroughly examined and passed by the company's own inspectors. The result has been that every superintendent, foreman, and workman realizes that the work done under his supervision or by him is subjected to a minute scrutiny, and in consequence the character of the work has risen considerably above what it was before the rule was adopted.

The New Haven Electrification described last week is particularly interesting to railway civil engineers as departing from the third rail construction which has been in this country the accepted means of current supply when large units are used. Granted the use of high voltage, which is the condition of success in heavy railway work, the third rail becomes progressively less desirable as the voltage increases. At 11,000 volts, the pressure used for distribution on the New York, New Haven & Hartford, overhead construction is a necessity, and the engineers in charge very evidently made up their minds to take no chance in installing it. For high-speed work with an overhead trolley the catenary construction is also necessary. The section of road concerned contains a varying number of tracks and could not well be broken by pole lines, and the result was exceedingly solid, although costly, bridge construction. No electric traction system has ever been put in under more strenuous conditions than this, since the terminal requirements of direct-current operation demanded not only motors of very remarkable properties, but a complete duplicate collection and control system. It was wise policy to take no chances with the overhead equipment, making it mechanically as sound and perfect as possible regardless of cost.

Alternating Current Frequencies are now receiving the earnest attention of electrical engineers to whom they have the same significance that the battle of the gauges had to railway engineers a quarter of a century ago. At the present time 60 and 25 cycles are standard American frequencies, although others are in use in old plants. It is now seriously proposed to add another frequency to the list, 15 cycles per second, for the sake of the recently developed single-phase series-motor, for interurban and electrified steam railroads. The output of an alternating-current series motor is increased by lowering the frequency from 25 to 15 cycles per second, although the amount of increase is a matter of difference of opinion, those in favor of the change claiming 30 per cent. to 35 per cent., and those opposed claiming only about 15 per cent. The reduction in frequency would involve an increase in the size and weight of the generators at the power houses and of the transformers, both step-up and step-down. The question at hand is whether a certain percentage more motor power can be placed on a single-phase locomotive sufficient to pay for the inconvenience and expense of a change in frequency. The question is a serious one from the standpoint of the future, although not a serious one from the standpoint of the present. Railroads, more than any other engineering structures, must correspond, and be built to standards. If one large railroad should become electrified at a frequency of 15 cycles per second, it would probably necessitate the sequence of future roads on the same frequency. It would then probably be too late to retrace steps, or change the frequency.

Molecules and Electrons were the cause of a battle royal at the recent meeting of the British Association. So far as the molecule is concerned it would be difficult to mention any proximate doctrine that has been more important to theory and practice than the splendid speculation of Kekule, and yet in view of the work of Van t'Hoff and his successors no chemist would seriously defend the thesis that the carbon atoms in a molecule of benzol are literally arranged in the conventional hexagon. It is quite sufficient that they behave in many respects as if they were actually hooked together with valences. As with the molecule so with the atom. For more than a quarter-century past it has been perfectly well understood that the atom must be dynamically complex and the epoch-making work of Mendeleéf left little doubt in the mind of any serious thinker that the so-called elements are in some way structurally related. As to the electronic theory of matter, it works out very prettily up to a certain point, like other theories of matter and then gets into trouble. If one postulates subatomic particles endowed with any plausible set of properties, their interactions can be made to fit a large number of the more general properties of ponderable matter, as witness various speculations from the day of Æpinus up to date. We have had Maxwell's idlewheels and the vortex atom and a few others within recent years, and it does not help the matter much to call the fundamental unit chosen "electricity." Truth to tell, there is very little known experimentally about the electron and until more is found out about its dimensions and relations, its derived properties are of secondary interest. This much is clear, that a sufficient breach has been made in subatomic dynamics to justify an assault in force, which, whether it succeeds now or a century hence, can never wholly be driven back. Great experimenters are particularly needed just now and they are painfully scarce. There is a tendency toward rushing into print with work half completed and ill done that is perhaps in keeping with the spirit of the times, but which accords poorly with scientific conscientiousness.

The Power Development which the Chicago Sanitary District Trustees desire to carry out by extending the drainage canal through Joliet and erecting a plant at Brandon's Road seems likely to arouse a bitter struggle in the legislature before the bill authorizing the work is passed. According to a statement issued by a Joliet taxpayer, Mr. John H. Garnsey, the electrical power now generated at Joliet is developed at a dam owned by the State but leased to the Economy Light & Power Co., and if this dam is removed as proposed by the Sanitary Trustees and a new one built 2 miles below it, neither the city nor the State will be able to exercise any control over the power. The 35,000 to 40,000 h.p. which the Sanitary District Trustees expect to generate at the lower dam, will be used for the benefit of the Sanitary District and the people of Joliet will suffer thereby. In reply to this statement, President R. R. McCormick, of the Trustees, has given out a letter stating that the company purchased for less than $100,000 the marsh land at the proposed terminus of the canal extension and has fixed a price on it of $3,000,000 to the Sanitary District. It is the latter which will make the property valuable by constructing the canal extension and the Trustees do not believe they should be held up for the benefits their work creates. No promise to furnish 40,000 h.p. has ever been made, but on the contrary the Trustees have offered to furnish the city of Joliet with current at a price equivalent to $38 per street light per year, an offer which was not accepted, although the Economy Co. is paid $75 a year. It is evident from these extremely divergent statements that there is a good prospect of hearing some important debates on hydraulic power development at the next session of the Illinois legislature.

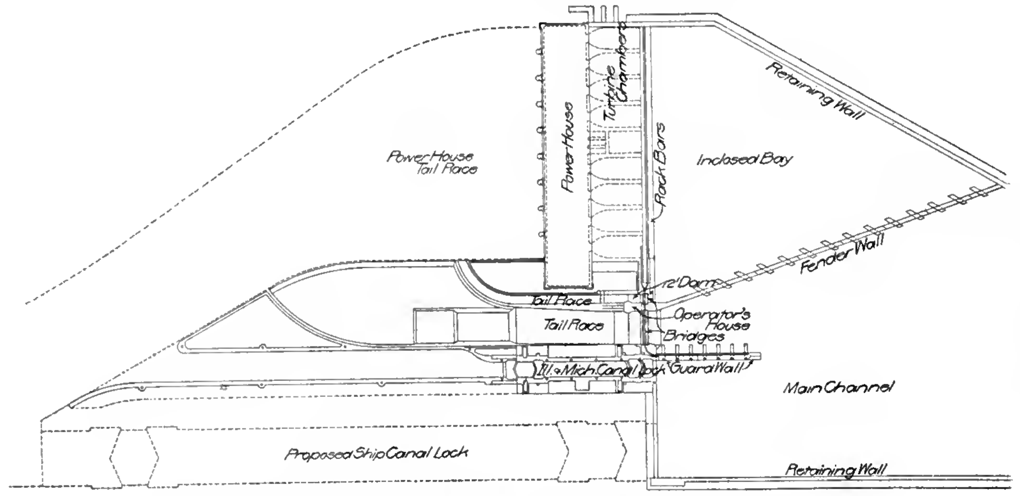
MOVABLE CREST DAMS AT THE WATER POWER DEVELOPMENT OF THE CHICAGO DRAINAGE CANAL.

Two movable crest dams, one 12 ft., and the other 48 ft. in length, are included in the water-power development of the Chicago Drainage Canal at Lockport, Ill. This power development will render available 33,000 h.-p. at the turbine shafts, based on a uniform flow of 600,000 cu. ft. per minute under the head of 36.5 ft. obtainable at the development, and on the guaranteed hydraulic efficiency of the turbines of 80 per cent. Under actual working conditions with an average flow at the rate of 600,000 cu. ft. per minute for the entire 24 hr. there will be available for peak loads 50,000 h.-p. or more, depending on the load factor. The works required to develop this power include an extension of the canal 10,700 ft. long, with a uniform channel width of 160 ft. and a nominal depth in this channel of 24 ft., the extension being partially in excavation and partially between concrete retaining walls and earth and rock embankments, a 69x380-ft. two-story power house and a tail race in earth and rock excavation, which is 6,800 ft. long, 160 ft. wide and affords a minimum depth of 22 ft. of water.

The canal extension is widened at its end at the power house to 522 ft., by a change in the direction of the right-hand retaining wall containing it. A forebay is thus provided for the power house, and space is obtained in a cross wall at the end of the head race and between the left-hand retaining wall of the latter and the off-shore corner of the power house for the two movable crest dams, a lock for the Illinois & Michigan canal and a lock for the canal of the proposed Chicago to the Mississippi River deep waterway. The power house has nine water turbine chambers on the upstream side which open directly into the forebay of the power house and are protected by trash racks, inclined slightly from the vertical. A heavy concrete fender wall, 525 ft. long, is built across the forebay from the right-hand retaining wall of the head race to the stream end of the power house, making an angle of about 80 deg. with the upstream side of the latter. This wall has fourteen arched openings in it, the tops of the openings being submerged at normal stages of water in the head race, and is provided to prevent vessels and large obstacles reaching the forebay. The 12-ft. movable crest dam is 45 ft. from the offshore upstream corner of the power house, in the cross wall at the end of the head race and inside of the downstream end of the fender wall. The 48-ft. movable crest dam is separated from the 12-ft. one by a concrete and iron structure, 12 ft. wide, which contains the operating apparatus for both dams; this dam is immediately in front of the downstream end of the fender wall. Beyond the larger dam and separated from it by a 24-ft. length of the cross wall at the end of the head race is a 20x220-ft. lock for the Illinois & Michigan canal. A heavy concrete guard wall, 150 ft. long, is extended upstream between the larger dam and the lock, at right angles to the cross wall of the head race, to prevent vessels being carried against the dam. Between the lock and the left-hand retaining wall of the head race is a 150-ft. length of the end wall of that race in which the end of a lock for the proposed ship canal can be built.

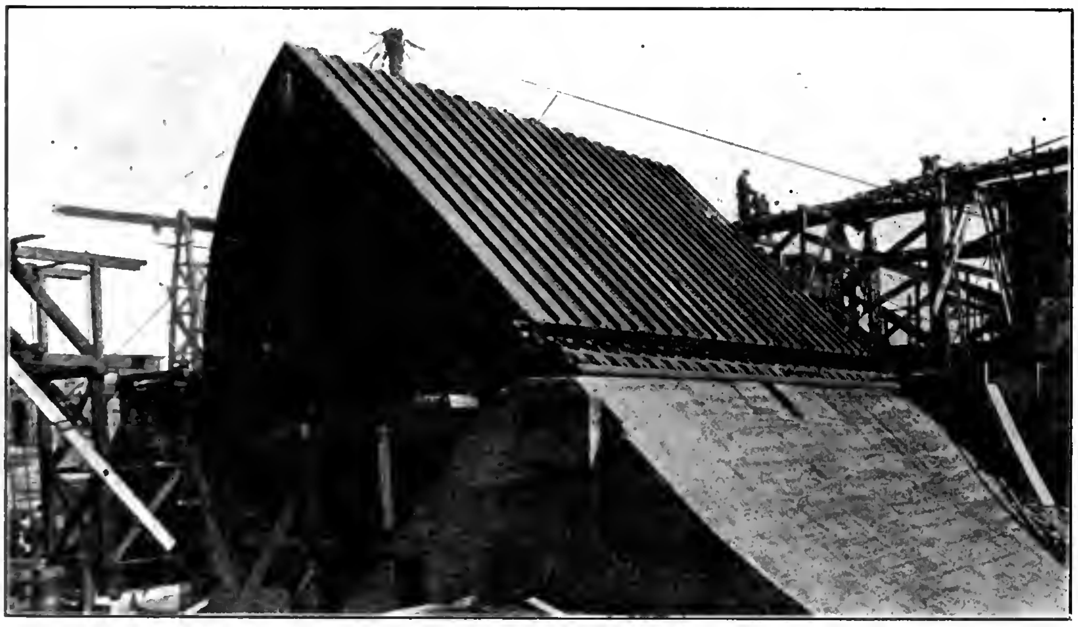
The two movable crest dams are provided to furnish a passage for all drift, such as ice, floating materials, waterlogged and submerged driftwood, and so forth, which cannot safely pass through the water turbines in the power house; and for controlling the rate of flow in the main drainage channel at times when only a portion of that flow is passing through the power house, and when otherwise necessary. Controlling works at one side of the end of the portion of the canal which is now in service are used at present for regulating the rate of flow in the Drainage Canal. These works are just above the upper end of the head race of the power development, the flow through them being discharged into the Des Plaines River. When the power development has been placed in service these works will be used only in an emergency. The two movable dams at the power house will then regulate the rate of flow, a vertical butterfly dam across the upper end of the head race being provided so the flow into the race may be shut off, if desired.

The 12-ft. dam is designed to provide means of passing all drift that finds its way under the fender wall into the enclosed bay above the power house. The trash racks over the openings into the turbine chambers of the power house are extended above a platform over those chambers. The upper end of the rack curves over a narrow-gauge track, which is laid on this platform and extends the length of the rack, so that small cars on the track will come partially under the curved ends of the latter. The trash which will



General Plan of Works at the Power Development Site.

collect on the rack may be pulled up over the end of the latter into the cars, which can then be run out on a bridge over the 12-ft. dam and dumped. The narrow-gauge track also extends across a bridge over the 48-ft. dam and out to the end of the guard wall of the canal lock. Machinery parts for the power house equipment may thus be delivered on vessels in the canal and then taken to the power house on this track.



Sector of 48-foot Dam, Blocked up during Construction.

The two movable crest dams are practically alike in details of construction and operation. Each movable crest is built of structural steel shapes and steel plates and is practically a 45-deg. sector of a cylinder with a 26-ft. radius. Each sector is hinged horizontally along the axis of the cylinder of which it would form a part, to the top of a back wall on which it is mounted on the downstream side. The radial deck plane and the curved upstream front of the sector are made watertight with steel plates, the deck being provided with steel angles for ice skids. The deck plane, the lower radial plane and the curved face are heavily reinforced by intermediate steel frames. When the crest formed by the intersection of the curved face and the radial deck plane is at the maximum operating height, the lower radial plane of the sector is horizontal. As the crest is lowered the sector rotates on its axis and moves into a space in the concrete base which is also approximately a sector of a cylinder, of about the same radius as that of the crest, the radial deck being horizontal when the crest is at its lowest position. The crests of both dams have a vertical range of 18 ft. from 2 ft. above to 16 ft. below Chicago datum, the water surface above the dams being 4 to 6 ft. below that level under normal conditions of flow.

The clearances and packing details between the ends of the movable sector and the faces of the concrete wall in which the sector is inserted, between the curved face of the sector and the top of the breast wall of the base and at the hinge on which the sector rotates are designed to confine the water in the chamber under the dam. Water is

admitted to and discharged from this chamber through controlling valves provided for the purpose. Air pipes under the radial deck of the dam are designed with details to maintain a free water surface in the chamber. The operation of the sector dam is similar to that of a bear-trap dam, the pressure due to the head of water under the sector balancing the weight of the latter and that of the stream flowing over it. This equality of moments holds for all positions of the crest, so that the sector being in equilibrium may be raised or lowered simply by raising or lowering the level of the water in the chamber under the dam. The height of this water level is controlled by a special balanced valve, called a weir tube, which is placed in a pit under an operating house between the two dams and is easily moved by a hand wheel in that house. Under the conditions of operation, the head of water required in the chamber will always be lower than the available head in the head race, the level in the latter ranging from 8 ft. below to 2 ft. or more above Chicago datum, in extreme cases.

A heavy cast-iron bed plate anchored to the top of the back wall of the concrete base carries the hinge on which the movable crest rotates. The anchorage for this bed plate consists of two rows of 2½-in. bolts. One row of these bolts is along the inner edge of the bed plate, the bolts being 2 ft. apart and extending vertically 16 ft. into the concrete base to anchor plates; the tops of the bolts in the other row are attached along the outer edge of the cast-iron bed plate, these bolts, which are 2 in. in diameter and 1 ft. apart, extending back at a 45-deg. angle to anchor plates 24 ft. from the face of the dam.

A cast-steel hinge chair is bolted to the heavy cast-iron bed plate on the back wall. This hinge chair is in 5-ft. 11 15/16-in. lengths, a clearance of 1/16 being provided between the lengths, a ¼-in. groove filled with cork packing preventing leakage. A 4-in. annealed steel journal is carried by the hinge chair and operate in a babbitted hinge box which is bolted to the movable sector. The hinge forms a water-tight joint between the concrete base and the movable sector. The upper and lower radial planes of the latter do not come quite to an intersection, but are connected by a tight diaphragm of steel plates to which the hinge box of the joint is attached. Two 1½-in. extra-strong galvanized-iron pipes are placed the length of the joint and have connections by which they may be supplied with live steam, so the joint may be kept free of ice in severe weather in case no water should be flowing over the dam.

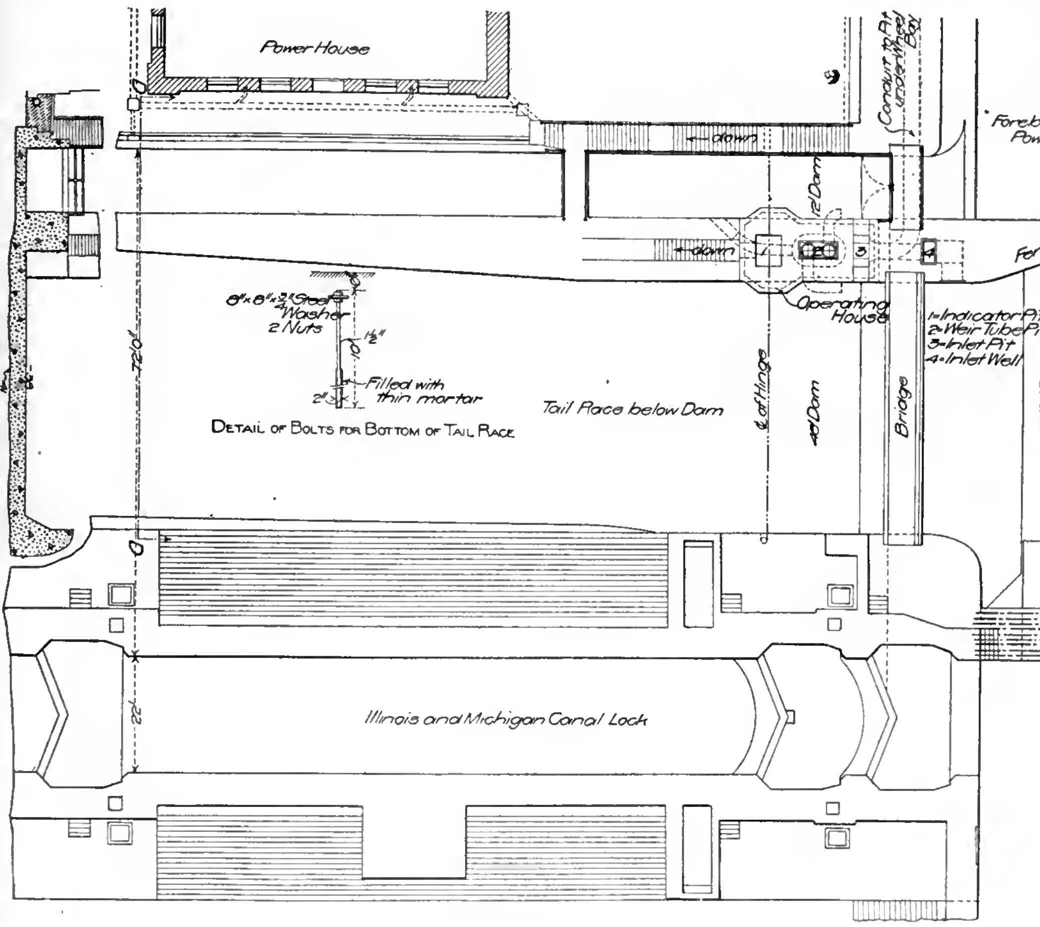
The face of the concrete walls at both ends of each dam are sheathed with steel plates riveted to Z-bars built into the concrete. These plates are normal to the hinge axis of the movable crest, and are ¼-in. from and parallel to the finished end of the latter at 60 deg. Fahr., so that the sector may rotate through its arc of 45 deg. and have ¼-in. clearance in all positions. In order to make these joints between the sector and the walls practically water-tight, a 1½-in. angle is placed loose over each joint the length of the deck plane of the sector. The tendency of the water flowing over the dam to enter the dam chamber through the joints at the end of the sector holds these angles in the joints. The angles are attached in such a manner as to prevent them from floating away or from being torn off by debris flowing over the crest. They are held against the side of the concrete wall by stiff steel springs. As under certain conditions the water in the dam chamber will tend to flow out of the latter, the joints at each end are also packed with brass on the inside along the part of their lengths where such outward flow might occur.

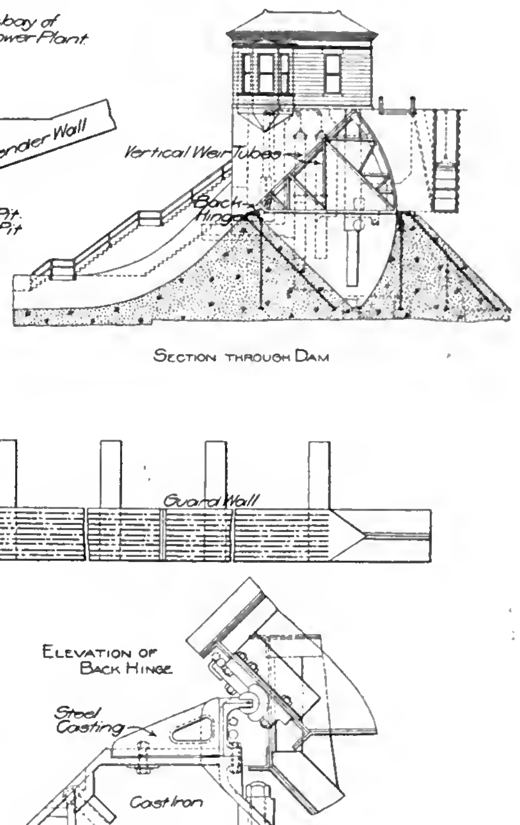
The joint between the curved face of the movable sector and the curved portion of the breast wall of the concrete base forming one side of the chamber under the sector is packed at the top of the breast wall in a manner which is designed to render it watertight. The plates which form the curved cylindrical face of the sector have planed edges and have the rivets which attach them to the frame of the sector countersunk. A steel angle, in 6-ft. lengths, is attached horizontally to a steel bed plate on top of the breast wall in such position that the full face of one of its legs bears against the curved face of the sector.

Three 1½-in. extra strong pipes to each panel of the sector connect the upper part of the chamber under the dam with the atmosphere and provide free air circulation above the water in the chamber. One of each three of these pipes permits a free flow of air or water into or out of the chamber, but the other two are provided with check valves which prevent an outward flow so the water will not be siphoned out of the chamber. Such water as may leak into the chamber will be carried away by the pipes, however, if the water level rises above the level of the openings of the latter.

When the dam sector is at its highest position, it can be blocked up by a series of props under the top of the plate on the breast wall which carries the packing angle that bears against the curved face of the sector. These props are notched cast-steel pawls which are spaced 12 ft. apart and are keyed to a 2 11/16-in. steel shaft so they can all be moved together. When the sector is resting on these props the water may be discharged from the chamber under the sector and the chamber entered for inspection, cleaning, and so forth.

The operation of both dams is controlled from a one-story concrete-block house, 12x26.5 ft. in plan, between the two dams. This house covers three pits in the concrete substructure on which it is built. These three pits are in a row, the axis of which is normal to the axis of the dams. The upstream one is called an inlet pit and is divided by two transverse walls into three wells; the middle well of this pit is connected through a conduit in the concrete wall between the two dams with the canal just above the 48-ft. dam. The port of this conduit is covered by a coarse trash rack mounted on a frame set flush with the vertical face of the wall. The water passes through a fine mesh rack in a wall between the





Arrangement of Movable Crest Dams.

end of the conduit and inlet pit before reaching the latter. The middle well of the inlet pit contains three valves; a pipe in the bottom of this well connects the two outside wells and is fitted with a gate valve, and the wall separating each outside well from the middle well is built with an opening, controlled by a sluice gate valve, through which the flow of canal water into each of the outside wells is controlled. All three of these valves are fitted with non-rising stems which terminate at the level of the floor over the pit and are operated by removable wheel keys. The inlet well, and through it the chambers under the dam, may be emptied through a conduit leading to the pit under the wheel bay in the power house.

Each of the two outside wells of the inlet pit communicates both at the top and bottom with the chamber under its corresponding movable dam. As the arrangement of the two wells is the same, a description of one will serve for both. The outer wall of the well is formed by the sheathing plates on the face of the wall at the end of the movable sector. Beneath the sheathing plate is an opening from the outside well of the inlet pit into the chamber under the dam, this opening being controlled by a sluice-gate valve with its valve rod passing up in that well. A rod on a lever which controls the shaft to which the props for supporting the dam are keyed also passes up in this well. A removable section or door opening into the inlet well is placed in the sheathing at the top of the well and provides means of entering the chamber under the dam when the latter is blocked up on the props in its highest position. In order to avoid accident to the operators or to the dam, this door is so designed that when it is in place it locks the rack bar which operates the dam props and the valve rod which operates the sluice gate at the bottom of the chamber.

A pit containing two vertical weir tubes is next to the inlet pit under the operating house. These weir tubes are made of 26-in. pipe and are swung from the top on chains passing over a pair of pulleys to counterweights. One of the tubes is connected with the chamber under one dam and the other with the chamber under the other dam, the water flowing out of these chambers over the circular weirs formed by the tops of the tubes. The height of the water level in these chambers can be regulated therefore by varying the height of these circular weirs, and the position of the crest of movable sector will thus be changed accordingly. This regulation of the height of water in the two chambers can be done separately or together, and is under perfect control at all times. An outlet conduit leads from the weir tube pit to the tail race of one of the dams.

The third pit under the operating house is at the downstream end of the substructure under the latter and next to the weight tube pit. This third pit has a window or door at the bottom on the tail race side and communicates with the chambers under both dams and with the outlet conduit from the weir tube pit. It contains a steel shaft and crank from each dam, harnessed in the operating room above to models of the dams which will indicate separately all the positions of each dam. Two pairs of 12-in. float gauge pipes, 12 ft. long, are also located in this pit and have connections which will indicate through floats attached to pointers, all stages of water above the dams and in the chambers under the latter. The pit is covered with a steel angle frame carrying a floor of hinged cast-iron plates. The weir tube counterweights and gears for operating the two weir tubes by means of floor stands in the operating room are placed under this floor. A bay window is placed at both ends of the floor over the indicator pit, in the sides of the operating house. The indicating gauges for one dam, the wheel for operating the gear of one weir tube, the model showing the position of the one dam, and so forth, will all be placed close to one of these windows and the similar apparatus for the other dam close to the other window so that they will be in easy sight and reach of the operator as he stands in the window. The operator may thus observe the movement of the crest of the dam as the regulating devices are manipulated, without leaving those devices.

The bridge over each dam opening in the end wall of the race is placed so a needle dam of timbers may be placed across the opening and the flow of water over the dam cut off as a final resource in case of an accident to the dams, or to a butterfly dam across the head race at the junction of the latter with the main canal. These bridges are of the through plate-girder type, their bottoms also being plate girders in order to bring both side girders into play when the upper ends of the timbers of the needle dam are placed against the girder on the upstream side. The lower end of the needle dam timbers will rest against a cast-iron plate in a shoulder on the upstream side of the base of the dam.

The downstream faces of the back wall of both dams is designed to suit the various conditions of flow. The 12-ft. dam has a tail race, 12 ft. in width, which connects with the tail race of the power house. The 48-ft. dam also has a tail race, 575 ft. long, connecting it with the tail race of the power house. Under certain operating conditions 40,000 h.-p. in water will pass over the 48-ft. dam, and will have to be dissipated between the latter and the tail race of the power house. Experience with the bear trap dam at the controlling works on the main canal has demonstrated that careful preparations must be made to gradually reduce the velocity of the water flowing over such a dam. The tail race of the 48-ft. dam is designed specially to break the force of the water flowing over the dam, without violent disturbance at any point. In the first 110 ft. of the race the width is gradually increased to 54 ft., the bottom dropping away from the dam on a slight grade. The bottom in this length is lined with a concrete floor anchored by bolts to the solid rock on which all of the structures of the power development are built. At the end of this 110-ft. length the bottom drops 11 ft. in 10 ft. forming a 55x75-ft. pool; beyond this is a second pool, 55x60 ft. in plan, which has 3 ft. less water in it than the first. A channel still 3 ft. more shallow than the second pool extends from the latter to a weir over which the water is discharged into the power house tail race. This weir has a total length of 275 ft., the tail race widening out to form a pool of that width just above it. A length of 48 ft. of the weir at one end has its crest 2 ft. above the bottom of the large pool at the lower end of the race; the crest of the balance of the weir is 5 ft. above the bottom of that pool. One side of the tail race is built on a curve so the principal flow over the dam will follow along it and pass over the low portion of the weir.

The power development of the Drainage Canal is being carried on under the direction of Mr. Isham Randolph. Mr. E. L. Cooley designed and detailed both of the movable dams.

Fender and Guard Walls at Movable Crest Dams from the Upstream Side.

SEWAGE DISPOSAL AT NORWICH, ENGLAND, will be conducted in an unusual manner, according to the London "Times," which states that Mr. A. E. Collins is the engineer of the works. The sewage will be forced by centrifugal pumps against a head of 117 ft. through a 33-in. reinforced concrete conduit about 2½ miles long to one or both of two vertical pipes and discharge over bell mouths into one or more of four detritus pits. The latter will have sharply sloping bottoms, and will be provided with sludge outlet valves leading to Shone pneumatic ejectors, by means of which the detritus can be delivered through rising mains to the higher levels of the farm. The arrangement of these pits is such as to enable nearly the whole of their cleansing to be done without stopping the flow of sewage through them. After leaving the detritus chambers the sewage flows over measuring weirs into the common supply channel of four hydrolytic tanks. The sewage leaves these tanks under a "skimming wall," and passes into further hydrolytic chambers provided with what are known as hydrolyzing cells. These cells are constructed with a large number of nearly vertical slate divisions, the object being to present as extensive a surface as possible. The solids in solution deposit upon these surfaces in the form of a feathery sludge which, on reaching a certain thickness, mostly falls to the bottom. It is removed from the tanks at intervals without interfering with their working, and flows to the Shone ejectors. The effluent will be used for irrigation of farming lands.

Retaining the Sides of a Large Excavation.

The new six-story steel-frame wholesale meat market building for Swift & Co., at 153rd St. and Brook Ave., New York, with its vaults under the 20-ft. sidewalk on two sides, occupies a 65x135-ft. area which has been excavated to a depth of about 21 ft. through 10 ft. of loose fill above a deep stratum of fine sand and quicksand, with abundance of ground water at a distance of about 12 ft. below the surface. The site was originally the bed of a considerable stream, which has not yet wholly disappeared, making it necessary to deal not only with ordinary ground water, but with a considerable subterranean flow. This condition, together with the treacherous and irregular character of the soil, made the excavation difficult and necessitated careful provision for the exclusion of as much water as possible from the pit and for the safe support of the earth on the outside. The sheeting was therefore designed not only to resist a heavy earth pressure, but to act also as a core wall or dam to intercept the flow of underground water. The soil was so wet and soft that the bottom of the pit offered very little resistance to vertical or horizontal pressure and would not afford a reaction for ordinary spur braces, so that a special system was designed to resist the external pressure on the sheeting.

A row of pits about 6 ft. square was sheeted down to a depth of 20 ft. at equidistant points on a line parallel with a long side of the excavation and about 20 ft. from it. A double line about 70 ft. long of 12x12-in. horizontal timbers, laid close side by side and breaking joints, was supported on the cribs at one end of the lot just above the bottom of the main excavation, which at this time had been carried, by preliminary open work, to a depth of about 12 ft. below the original surface. A narrow trench about 4 ft. deep was dug just beyond the line of excavation on each of the long sides of the lot, from end to end, and in each of them was laid a continuous line of 12x12-in. rangers. Transverse 10x12-in. timbers about 20 ft. long and 12 ft. apart were laid in inclined position on one side of the intermediate horizontal girder and their ends were abutted ad wedged against its vertical face and that of the outside ranger timber. Similar 12x12 in. inclined struts 45 ft. long were laid in the same planes on the opposite side of the intermediate girder and wedged against the corresponding ranger. The long struts were made in two pieces, spliced with butt joints and with a scab, and all of them were connected at both ends to the horizontal timbers by top and bottom scab pieces. Shallow trenches were dug to receive them where necessary and care was taken to locate them so as to clear the steel columns and piers in the frame-work of the building.

Sheeting and Bracing the Excavation for the Swift & Co. Building.

On one side of the lot where the excavation reached a maximum of 21½ ft. depth, 3x10-in. tongue and groove sheeting 24 ft. long was started on the outside of the ranger, and on the opposite side, where the excavation had a maximum depth of 14 ft., 2x10-in. tongue and groove piles 14 ft. long were started simultaneously with them. As the piles were driven, excavation was carried on, care being taken to keep the bottom of the pit generally 2 or 3 ft. above the lower ends of the piles, thus reducing the tendency of the quicksand in the bottom to rise. After the excavation was deep enough to develop considerable external pressure on the sheeting and bring the inclined braces to a solid bearing against the intermediate girders, one end of the latter was braced against the transverse ranger laid across the lot on the line of excavation and the opposite end near the center of the lot was temporarily secured by rakers, with their lower ends bearing against distributing timbers like grillages or dead men buried in the soil. Sheet piles were driven across the outside face of the end ranger and the excavation carried on inside of them; the external pressure they received was largely transmitted to the intermediate horizontal girder, where part of it was absorbd by the end raker and the remainder was absorbed by friction with the struts or was directly transferred to the side sheeting by a pair of special struts in the planes of the regular transverse struts, which were inclined about 80 deg. from the direction of the main girder so that their vertex pointed toward the line of transverse sheeting. The ends of these struts were scabbed to the center and side rangers like the regular transverse struts, and as any displacement in the center ranger tended to force them into a transverse line, they acted like a toggle, setting themselves tighter and tighter as the pressure increased and transferring it to the side rangers. By this device the pressure against the end sheeting was successfully resisted until the lines of rangers, the transverse bracing, and the side sheeting had been placed the full length of the lot and the intermediate ranger was made to abut against the transverse ranger at the opposite end, thus transmitting the pressures from one end to the other and dispensing with the need of the inclined rakers.

As the excavation progressed a second system of rangers was set against the sheeting about 6 ft. below the first and was braced through the intermediate ranger in the same way. Undue deflection in the transverse struts and in the intermediate ranger was prevented by the use of cribbing and vertical shores wherever necessary, which were changed to correspond with the increasing depth.

View Showing Excavation Carried to Greater Depth.

The sheet piles were driven by a No. 4 Inger-

soll-Sergeant steam drill with the rotating device removed and the drill replaced by a square steel bar. A flat steel bar was bent to form a rectangular frame and bolted to the drill enclosing the lower end. A rectangular hole through the flat end of this frame engaged a corresponding projection formed by a steel anvil block riveted to the upper side of a driving cap. The cap was simply a piece of a thick steel bar bent to a U-shape and fitted snugly on the top of the sheet pile. A pair of handles were bolted to opposite sides of the drill so that it was easily kept engaged with the driving cap while striking it rapid blows that forced the pile down about 1 in. per minute when the point was 4 or 5 ft. below the surface. An expenditure of $15 transformed the machine from a rock drill to a hammer which did very satisfactory service on this work and has been adopted by the contractors for similar work in other places. It is thought, however, that the efficiency of the hammer would be promoted by increasing its weight 50 or 100 lb., as may perhaps be done by adding castings to the framework. As it required 4 men to carry the hammer comfortably, it proved too heavy to hold, unaided, while in operation and was therefore suspended by a rope from overhead supports.

At first a pair of shear legs about 15 ft. high were set up on the edge of the excavation and served as towers for an old 5/8-in. derrick guy which was utilized for a sort of improvised cableway. The cable was rove through a snatch block, which, being reversed, served as a trolley for carrying the hammer over the sheet piles. While driving the sheet piles on the sides of the excavation, vertical posts were in some cases substituted for the shear legs to carry the cable-way, and in other cases the cable-way was replaced by a horizontal 2x12-in. plank 16 ft. long set edgeways at a clear height of about 12 ft. above the tops of the piles. This plank was supported at each end by a vertical post, seated on the top of the pile and having side pieces nailed to it to form jaws engaging the tops of the piles, so they could easily be slipped along from pile to pile. They were knee-braced by inclined struts spiked to the verticals and to the transverse horizontal struts.

The steam hammer was not in this case provided with a rolling support, but was merely suspended from a sling passed around the horizontal beam. In all cases the hammer was raised and lowered by a four-part hand tackle and required a vertical clearance of about 9 ft. for effective operation. The hammer was operated by two men on top guiding it with the handles and a third man below to adjust the pile cap.

The sheeting and bracing was accomplished in 5 weeks by an average force of 18 men. All of the excavation was done with pick and shovel, and the spoil was removed in wagons driven out of the pit on an incline at one end. After the sheeting was driven the water in the excavation was kept down by two Pulsometers.

The H. Wales Lines Co., of Meriden, Conn., is the general contractor, and the work above described was executed by Messrs. Miller, Daybill & Co., under the personal direction of Mr. F. Daybill, and Mr. H. L. Muchmore, superintendent.

THE COLORADO RIVER CONTROL work undertaken by the Southern Pacific Co. to divert the flow of the river from the Salton Sink was completed last month, and official announcement has been made that affairs are again in the hands of the California Development Co., which will have control pending an agreement between the governments of the United States and Mexico and the corporations involved. The Southern Pacific Co. has, it is stated, expended $1,500,000 in the work of closing the breaks in the bank which caused all the damage.

The Construction of the New York Central Office Building, New York.

An important feature of the terminal improvement for the New York Central & Hudson R. R. R. Co., now under construction in New York is the great office building occupying two complete blocks on Lexington Ave., between 43rd and 45th Streets. This building when completed will be about 275 ft. wide, 452 ft. long and about 280 ft. or 20 stories high above the curb, with one complete story and part of another extending to a maximum depth of 35 ft. below the curb. It will have three interior 62x130 ft. light wells extending from the roof to the second main floor 36 ft. above the curb which coincides with the first office floor. Below the street level the building will be used for train service, and the first story, which is very high and sub-divided for part of its area by a mezzanine floor, will be used for a branch post-office. The upper part of the building will be devoted entirely to office purposes.

The building is of steel cage fire-proof construction with cut stone exterior walls, backed with brickwork and with cinder concrete floors, roof and ceilings, and fire-proofing around all steel members. In a general way the building is symmetrical in plan around the longitudinal and transverse center lines. It will contain in all about 35,000 tons of structural steel and the estimated cost is approximately $9,000,000, exclusive of the value of the site. At present only the north end of the building, up to the sixth office floor, is under contract and this portion of it, which contains about 7,500 tons of structural steel, will be completed and the offices of the company transferred to it before construction is commenced on the corresponding lower part of the south end of the building, which is somewhat larger than the north end and will extend across 43rd street, containing two of the three light courts. The permanent floor of the sixth story will be built with the first section to serve as a temporary roof for the fifth office story and the thirteen upper office stories will be added at a future time not yet determined. The steel frame-work of the part now being erected is proportioned for the stresses produced by the full-height building and all of the structural details are designed for the requirements of the 20-story structure. A general description of the building and details of the structural steel work of fthe lower portion were published in The Engineering Record of Feb. 24, March 17 and April 7, 1906, and reference to them will show clearly many of the interesting features of the steel work alluded to in this article.

The general contract for the lower part of the building was awarded to the John Peirce Co., and in January, 1906, work was commenced on the first part of the building, 220 ft. long at the north end, reaching from 44th to 45th street. The ground had already been cleared and the excavation made to the required depth of about 20 ft. below the curb by the contractor for the yard improvements, who had also built at this point a massive concrete retaining wall adjacent to Lexington avenue. The general excavation for the building was carried everywhere into the solid rock, for the column foundations. In the entire building there are about 180 main columns and a large number of short sub-columns, many of which carry extremely heavy loads and are seated on single-tier I-beam grillages proportioned for a maximum pressure of 36 tons per square foot on the surface of the rock. In a few instances where cast-iron pedestals and short concrete piers were adopted the latter were reinforced and loaded with the same unit pressure which gives a very liberal margin over the maximum of 50 tons per square foot allowed by the Building Department.

All grillages are made with three to nine 24-in. 100-lb. I-beams, connected with three lines of tie-bolts and gas pipe separators. After the beams for each grillage were assembled together they were suspended by vertical bolts from pairs of transverse girders supported on blocking and very carefully adjusted with their panel lower flanges at the exact height required for the top flanges of the grillage beam. The suspender bolts were screwed up tightly, bringing the grillage beams into close contact with the supporting girders, while grout was filled in from the surface of the rock to about 1-in. above the bottom flanges, and the spaces between the beam webs were filled with well-rammed concrete, which was allowed to set thoroughly before the supporting girders and suspension rods were removed.

Timber cribbing was built up from the bottom of the excavation to about 18 ft. above curb level and on it were erected two wooden travelers each consisting of a horizontal platform with two stiff-leg derricks braced together at the forward corners. The derricks had wooden masts about 35 ft. high and steel booms about 60 ft. long, with a capacity of 15 tons each. The 20x30-ft. platforms were mounted on double-flange wheels running on rails spiked to 12x12-in. longitudinal stringers. These travelers unloaded the columns and girders from trucks in the street and assembled them in the structure. After erecting the first panels of columns and girders, the traveler truck was transferred to the floor-beams and thereafter the travelers moved on the completed portion of the frame-work and the use of cribbing was dispensed with.

Great energy was displayed in erecting the first two tiers of steel work as rapidly as possible so that the street floor could be built and the story below it used for the suburban passenger traffic which was put in service there in December, 1906. As it was necessary to complete entirely each tier of beams as fast as the traveler was advanced, there was considerable danger of interruption to the work through possible delay in receiving some of the beams or girders and therefore above the postoffice floor the travelers were largely superseded by four guyed derricks with 60-ft. booms arranged so as to command the entire area of the building and the adjacent street, making it possible to unload and erect materials without rehandling. These derricks were lifted up every second tier and were operated by Lidgerwood hoisting engines with separate boilers, two of which were located on the street floor and two on the third floor to avoid obstructing the trains in the basement story.

The special design of the building involved extremely heavy column loads and long span girders and resulted in the production of very massive members to be handled by the travelers and derricks. Among these were the bottom sections, over 50 ft. long, of columns with loads of over 3,190,000 lb., each which were made with special sections tapering from 24x24-in. at the top to 24x58-in. at the bottom. One section, the heaviest piece in the building, weighed nearly 32 tons; others weighed about 1,000 lb. per lineal foot and, although nearly as heavy as many of the girders, were handled by the single derrick booms.

In order to clear the railroad tracks, the basement columns were spaced 44 ft. apart on centers, a distance which, being unnecessary in the upper stories, was there diminished by intermediate columns carried on heavy girders and trusses of 44-ft. span.

Immediately over the track the floor was carried by 72-in. plate girders 44 ft. long and the

heavy outer wall, self-supporting up to the main cornice, 80 ft. high, was carried on pairs of 84-in. girders 44-ft. long, that weighed about 18 tons each. In the postoffice floor there are 48x22-in. box girders 44 ft. long and lattice girders over 7 ft. deep, and between the third and fourth office floors there is a series of heavy triangular transverse trusses 12½ ft. deep which support the fifteen upper stories. The members of these trusses were shipped separately, assembled in position, and field-riveted there. All other columns and girders with maximum weights of over 30 tons each were completed, shop-riveted and erected as single units. The rivets in the field connections were driven by an ordinary force of six gangs of men, each operating a Chicago pneumatic hammer driven by compressed air received from the mains supplying the plant installed by the contractor for the excavation and other work in the terminal yard adjacent. The erection of the steel work was commenced by laying the grillages in July, 1906, and was substantially finished in March, 1907, with an average force of about 100 men.

The first floor, at street level, was laid as soon as possible after the erection of the steel work had been carried above it, so as to afford a protection for the train service below. It was of the standard cinder concrete type proportioned for a live load of 365 lb. per square foot. To afford additional protection from possible falling objects all of the cinder floor in the Post Office department was covered with single 3-in. plank except in the city department, where it was doubled 3-in. planks. The floor of the pipe gallery below was protected by about 20,000 square feet of water-proofing. Besides this a temporary false roof of galvanized iron was built under a portion of the second floor, and special pains were taken in waterproofing and draining under the two concrete-mixing platforms.

All floors are of the Roebling flat-arch reinforced type and are independent of the ceiling construction, which will be of the suspended type. Beams, columns, girders and truss members are fire-proofed with cinder concrete 2-in. thick, reinforced with and laid on light steel-shapes, secured with standard clamps and hooks to the members, except the beam soffits, which are protected by ½-in. of cement mortar on metal lath. Wooden forms were built around the truss members, conforming closely to their cross-section, and the fire-proofing concrete was rammed within them to enclose all parts of the truss. About 11,000 yd. of 1:2:5 Atlas Portland cement concrete was required for the 432,000 sq. ft. of floor and roof surface and for fire-proofing the steel work. All concrete was mixed in two Foote machines made at Nunda, N. Y., each of them driven by a 10-h.p. General Electric motor. These machines were fitted with automatic screw feeds delivering without other measurements any required proportions of the materials to the mixing hopper where they were thoroughly incorporated together by a spiral mixer which carried them through the open trough and discharged them into a wheelbarrow below. Each machine had a capacity of about 175 yd. in 8 hr.

On account of the necessity of preserving the lower part of the building unobsructed for the train service, it was impossible to store sand, cement, cinders, brick and other material there, as is usually customary in such buildings, and the materials were unloaded and hoisted to the second floor, where they were stored and then rehandled as required. Concrete materials were elevated by a link belt conveyor to a small hopper in the top of the concrete tower whence they were automatically delivered by gravity to the automatic screw feed Separate General Electric motors were provided at each concrete machine to drive the elevators and a small crusher designed by the Roebling Construction Co. installed there to break up any large lumps of slag to a maximum size of 1 in. The concrete was discharged from the machine into wheelbarrows which were lifted in pairs by two platform elevators designed by the Roebling Construction Co., and built by the Lidgerwood Mfg. Co. Four other platform elevators were installed at equidistant points in the building to handle other materials. Two of them were made by the Lidgerwood Mfg. Co., one by the Maine Electric Co., and one, operated by steam, was made by the American Hoist & Derrick Co.

Interior Court of Grand Central Office Building Showing Scaffold.

The cut stone in the exterior walls includes about 62,000 ft. of Indiana limestone and 15,000 cu. ft. of granite from the quarries of the Stony Creek Granite Co., Conn. This stone was partly stored on the ground and partly on the sidewalk bridge alongside the building, and was handled entirely by four boom derricks seated on the roof and operated by Lidgerwood steam engines. The heaviest pieces weigh about 7 tons each and were carefully anchored to and generally supported directly from the steel framework. All of the window frames are made of cast-iron or bronze and were very carefully set before the stone work was built around them, the joints being afterward calked with oakum and putty. Almost as soon as the masonry work was commenced it was interrupted by a strike, which delayed it for nine months, so that effective operations on it were not begun until May 15, since when about 60,000 cu. ft. have been laid and the work is now rapidly progressing.

The cut stone is laid from the inside of the building but the brick face walls of the interior courts are built from outside scaffolds; part of these are of ordinary construction, supported on cantilever beams, but forty of them are patent scaffolds made by the Wm. Murray Co., New York. Each of the latter is about 5 ft. wide and 9 ft. long, with longitudinal floor boards laid on transverse pairs of 2x1½-in. angles, back to back, with vertical connection irons between their web. These connections project above the top flanges and receive small cast-iron drums fitted with worm-gears operated by detachable cranks.

Each scaffold has four drums and each drum has 100 ft. of ½-in. wire rope made fast at the upper end to 8-in. horizontal cantilever I-beams about 20 ft. long, projecting over the edge of the roof and anchored to it at their inner end. Stirrups enclosing the outer ends of the I-beams take bearing on their top flanges and have horizontal bolts through their projecting lower ends to receive the loops at the upper ends of the suspension rope. These platforms can be rapidly and evenly lifted by the brick layers so as to keep them always at the level most convenient for effective work. They have been found very convenient and efficient on this work and on other jobs where they have been used by the same contractor. About 250,000 pressed brick are required for the court walls and are backed up with ordinary red brick, 1,800,000 of which are required for that portion of the building now under contract. In the sixth story a buzz saw and an emery wheel driven by a 5-h.p. General Electric motor were installed and at each end of the building a broad temporary staircase with hand rails was built for the use of the workmen and was believed to have effected a considerable economy in saving time.

The average total force of about 350 men employed by the general contractor is under the direction of Mr. E. F. Dodson, superintendent. The steel work was fabricated and erected by the McClintic-Marshall Co. The work is designed and constructed under Mr. W. F. Wilgus, Vice-president of the New York Central & Hudson River R. R. Co., by Messrs. Reed & Stem and Messrs. Warren & Wetmore, associated architects. Mr. Chas. A. Reed, Executive, and Mr. H. G. Balcom in charge of steel work and structural designs.

The Value of Land taken for water works purposes, according to the Massachusetts Supreme Judicial Court in Sargent v. Town of Merrimac, 81 N. E. Rep. 970, is made up of the value of the land, apart from its special adaptability for water supply purposes, plus such sum as a purchaser would add to that value on the chance that the land might be some day used as a water supply.

The Asphalt Pavement on the Thames Embankment.

One of the most interesting pieces of pavement laid of late is the sheet asphalt work done on the Thames embankment at London. For a number of years an attempt was made to keep the roadway on this street in a satisfactory condition with macadam. It was believed that this would make the carriageway more agreeable, owing to freedom from noise, but the macadam has been a failure mainly on account of lack of durability and somewhat owing to dust. The street is one of the highest class in London and it was felt that the best type of pavement was warranted for it. Sheet asphalt was not regarded with particular favor in London, but the excellent results attained with it elsewhere finally led the authorities to award a contract to the Trinidad Lake Asphalt Paving Co., Ltd., for the work.

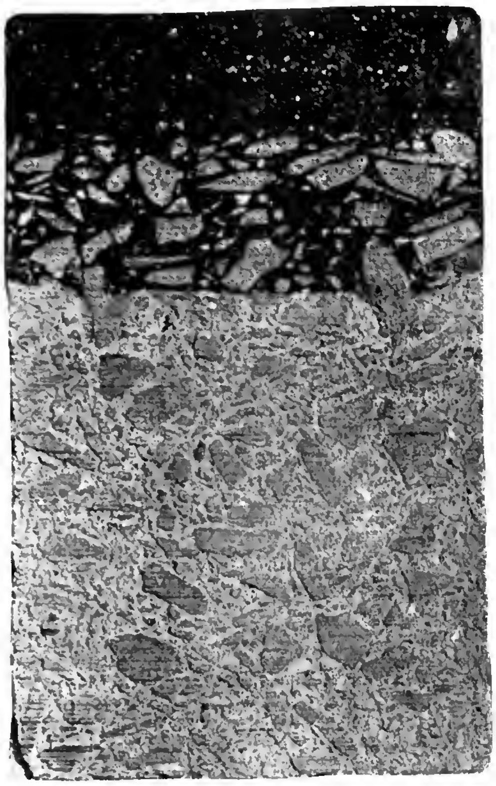
The macadam of the Thames embankment is of great depth, and it was accordingly decided that the best pavement to try would be one with about 3 in. of a very close binder, laid on top of the old macadam, and then a wearing surface suited for the character of the traffic. The old surface was accordingly graded down to a depth of 9 in. by means of a scarifier attached to a road roller in the manner shown in an accompanying illustration. The material loosened in this way [illegible] the harrows and when the full depth [illegible] had been taken off the surface was very carefully brought to grade. Owing to the compacting of the material under long traffic the portion remaining was in a hard, dense condition.

The most interesting feature of the work was the very thick course of close binder. This course is different from the open binder course used on many asphalt pavements in America, which has generally not been dense or strong enough, owing to voids and the use of unsuitable stone to carry a heavy traffic, and has been a source of weakness in consequence. The improved binder which is being introduced where the local authorities can be persuaded to pay for it consists of the same grade of stone as the old binder, but with the voids completely filled with the fine mixture used for the surface coat. With a mixture of such composition, well cemented with a bituminous cement, a perfectly stable course is obtained between the foundation and the surface, which is capable of sustaining the latter under any travel to which it may be subjected, without the slightest vibration.

The surface mixture was placed on the binder and rolled down in the customary way in this country, as shown in one of the accompanying illustrations. The pavement now has been exposed to wear for about a year, and its appearance and the class of traffic to which it is subjected are well shown in one of the illustrations.

In a paper by Mr. Clifford Richardson which was printed in this journal on June 1, attention was called by the author to what he considered the best type of sheet asphalt pavement for use on the streets having continuous heavy travel. The accompanying illustration gives a cross section of such a piece of pavement. Mr. Richardson considers that for such service a Portland cement concrete base at least 6 in. thick is necessary, and an even thicker foundation if the sub-soil is not of the firmest character. Under ordinary circumstances 6 in. of foundation is believed to be enough if it is constructed with a high-grade Portland cement and good hard stone, for which good gravel may be substituted in many instances. It is believed that every effort should also be made to provide proper drainage of the base.

Upon such a base Mr. Richardson advises the use of 2 in. of close binder, like that used in the Thames embankment pavement, and shown in the accompanying cross section. The stone for this binder should be hard enough to carry the travel without crushing. On this binder should be laid a wearing surface of standard grading made with a cement consisting of a mixture of suitable bitumens skillfully combined and handled. This surface should be 1 1-2 in. thick, and a thicker



Pavement for Heavy Travel.

Method of Loosening Old Macadam.

Close Binder Ready for Surface Mixture.

Placing Surface Mixture on Binder.

The Thames Embankment Pavement.

surface is unnecessary, if the work is done carefully and the materials are suitable, because the rigid character of the support makes it unnecessary for the top to be anything but a true wearing course. If an open binder course and poor foundations have been laid, than a wearing coat 2 in. thick is necessary.

The Pumping Plant at Milton-Royal.

The water pumping plant at Milton-Royal, England, is rather interesting on account of the use of two 20-h.p. Diesel engines for operating the triplex pumps which raise water from a pair of wells to a reservoir, the total height overcome being about 177 ft. Although the engineers are not normally required to do so, they will start the pumps against the full head of the reservoir readily. An automatic device has been provided for stopping the engines when the reservoir is full. Adirect-acting balanced float regulator is fixed in the reservoir at the head of the delivery main. The float is placed in a separate cast-iron chamber which has only a small opening into the reservoir to ensure perfectly steady motion of the float. When pumping is in progress, and the water in the reservoir has run to within an inch of its top-water level, the regulator commences to close, and gradually increases the pressure in the delivery main until the relief-valve in the pumping station opens automatically. Underneath the discharge-pipe of the relief-valve a copper bucket is suspended at the opposite end of a counter-balanced lever. When the bucket fills, it raises the counterbalance and in so doing closes the oil-cocks upon the pipes supplying fuel to the engines, which stop in about one minute. The water in the bucket then runs out at a small hole, and the bucket returns to its original position for the next automatic stop. The float regulator is set with a minimum opening sufficient to create a maximum back-pressure of about 50 ft. in the rising main when both engines are running, if the bucket is forcibly prevented from falling. The apparatus prevents the water from being run to waste at the reservoir unknown to the attendant, and allows him to be absent from the pumping-station for short intervals. The present practice is to run a set of engines and pumps every day until it stops automatically; one set being used one day, the other the next. This practice allows careful daily inspection of the machinery at rest, and of any repairs that may require but a short time.

Atlantic City Sewer Construction.

The sewer system at Atlantic City, N. J., was installed by a private company to serve a population which varies from about 40,000 in winter to over 400,000 in summer and at present has about 9,000 buildings connected, among which are many hotels, some of them of large size. As the surface of the ground is very flat and its elevation varies from 0 to 6 ft. above high-tide level, the grades of the sewers are necessarily kept very low and very careful design and accurate construction are necessary to secure a gravity flow, which, in some cases, is combined with pumping to the outlet. As the growth of the city is constant and rapid, corresponding extensions and improvements of the sewage system are continually in progress, which have varied in cost from $50,000 to $100,000 annually for several years.

The work under construction this season includes 4,600 ft. of intercepting mains receivlng the gravity flow of one district and a pump well 20 ft. deep and 25 ft. in interior diameter into which they discharge. This well is intended merely to connect the gravity and pumping systems, and is not designed to provide storage, as the sewage is pumped by centrifugal pumps to the outfall through a 16-in. and a 24-in. cast-iron pipe about 2 miles long. The well is located in very fine sand containing large quantities of ground water up to a level about 4 ft. below the surface. Its site was first enclosed by a circular cofferdam 33 ft. in diameter made with 12-in. 35-lb. United States sheet piles about 26 ft. long. Ninety of these, handled by a center boom derrick, were driven in three days with a single hydraulic jet, sometimes assisted slightly by a steam hammer.

Excavation inside the cofferdam was made by hand, the sand being shoveled out over the tops of the piles until the pit was about 8 ft. deep, after which a portion of it was shoveled on to platforms and thence reshoveled over the tops of the piles in order to continue the work while waiting for the installation of a Carson-Lidgerwood cableway of 300-ft. span, which is also to be used for the excavation of the sewer trench. The interior of the cofferdam is braced by successive tiers of horizontal rangers from 5 ft. apart at the top to 3 ft. at the bottom. These rangers are made of 10x10-in. timber, in lengths of about 6 ft., with their ends cut radial so as to fit together and make accurate polygonal rings exerting balanced reactions and forming horizontal arches in equilibrium, which resist the external pressure without any transverse or radial bracing, thus leaving the entire area of the cofferdam unobstructed. At each joint the rangers are securely spliced together between top and bottom steel plates 1/4 in. thick and about 24 in. long, secured to both timbers with vertical 3/4-in. bolts. As the sheet piles were driven several feet below the bottom of the excavation they form a sort of core wall which intercepts the flow of the ground water and enables the excavation to be kept dry by a single 3 1/2-in. pulsometer working in a sump which also drains a short length of the trench excavated for the connecting sewer mains.

After the excavation is completed, about 200 piles 12 ft. long will be driven in its bottom and cut off below grade. They are arranged about 25 in. apart in concentric circles 25 in. apart and are capped with circumferential 3x10-in. timbers on which is laid a continuous tight floor covered with 2 ft. of 1:3:5: concrete made with Atlas Portland cement and 1 1/2-in. broken trap rock. A six-ply felt and tar waterproofing is built into the concrete 3 in. above the bottom and extends continuously through the vertical cylindrical walls of the well to the surface of the ground. The upper portion of the concrete floor is reinforced by horizontal and transverse rods 1/2 in. square from 4 in. apart at the center to 8 3/4 in. apart at the circumference. The walls are made of unreinforced concrete 28 in. thick at the foot and support the pump room floor 10 ft. above the center of the bottom. The floor is made with a continuous 6-in. slab of concrete reinforced by two layers of expanded metal and supported in the center by a single 12x24-in. transverse girder with four 1-in. square reinforcement rods in its lower flange. A concrete roof similar to the floor construction will be supported on the tops of the walls.

The pump well has two inlets, one 36 in. in diameter connecting it to the old well, and the other 66 in. in diameter connected with a reinforced-concrete pipe 66 in. in diameter inside, which is 600 ft. long and intersects at the opposite end the similar 4,000-ft. line of new 54 in. intercepting sewer. All of the pipe is cast in steel molds near the site in sections 3 ft. long with male and female ends. The 66-in. pipe is 6 1/2 in. thick and is reinforced with seven 3/4x3/16-in. longitudinal bars and three 2x1/8-in. hoops, interlocking with them. Each hoop is cut so that the middle portion of the steel can be sprung out, forming loops engaging the

Driving Wooden Sheeting with Hydraulic Jet.

Driving Steel Cofferdam Sheeting with Jet.

longitudinal bars. The ends of the longitudinal bars project beyond the ends of the concrete sections and are bent back 180 degrees to form hooks overlapping each other and securely locked together by circumferential bars threaded through them after adjacent sections of the pipe are assembled together.

The pipe is cast vertically in molds, each with an annular cast-iron bottom ring forming the female joints and receiving the inside and outside walls of the mold. Each wall is made with four segmental cylindrical pieces of ⅛-in. steel connected together with top and bottom latches. The inner wall is secured at the bottom by an adjustable spider made with two horizontal ¾-in. pipe arms intersecting each other at right angles and terminating at their outer extremities with cross heads, each of them carrying two horizontal set screws for adjustment. The top of the wall is stiffened by an inside welded steel ring. The outer wall is braced in position by small separators engaging the inner wall, and the longitudinal reinforcement bars are set vertically with their lower ends engaged in sockets in the annular base plates and their upper ends fixed by the separating pieces.

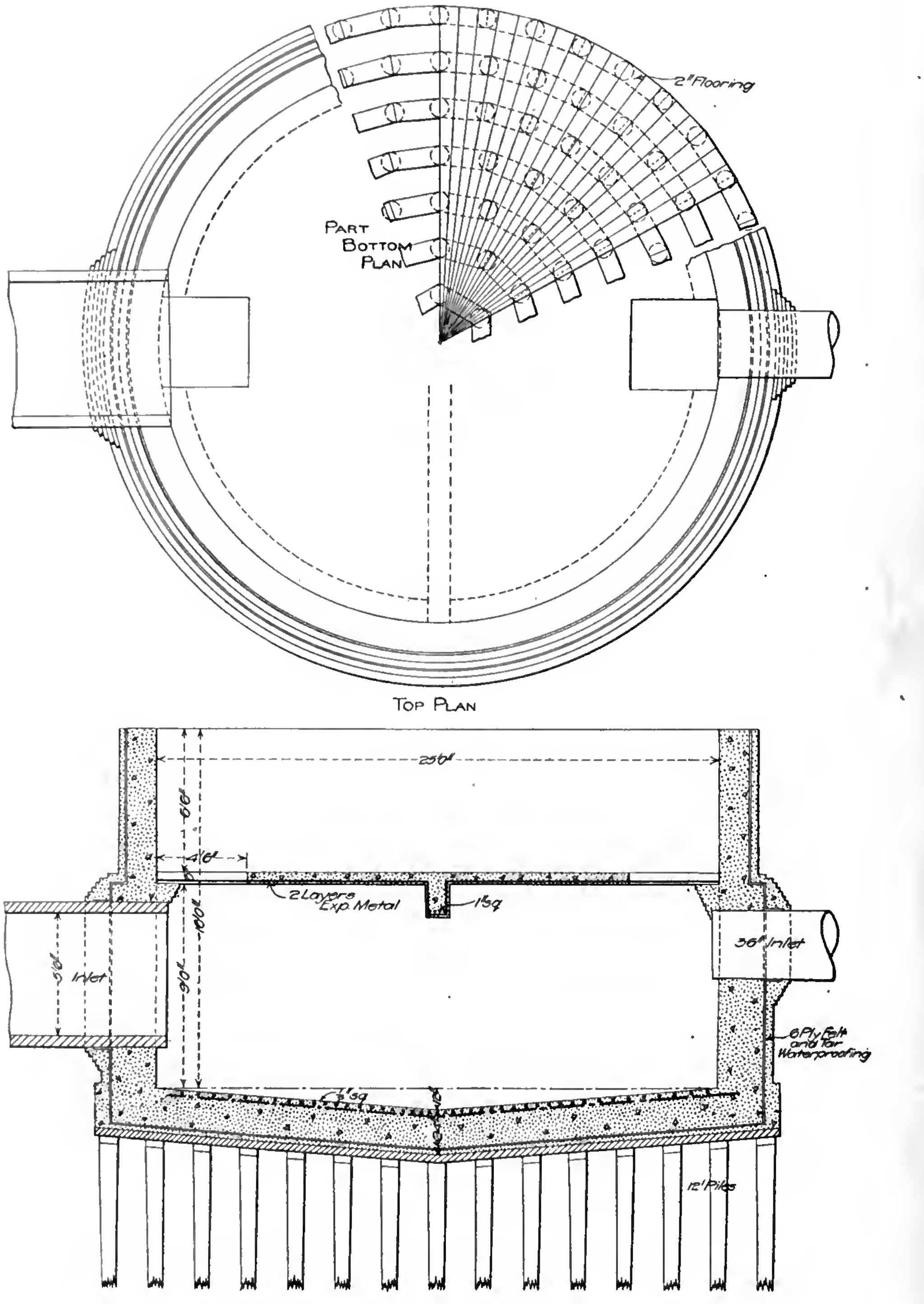
Small quantities of very dry concrete are placed in the mold and rammed until the water flushes well on top. When the mold is about one-third filled, the first ring is slipped down, engaging the longitudinal bars, more concrete is added and rammed, the second ring is inserted and finally the concrete is filled in to the top of the mold. All portions of it are thoroughly rammed with steel rammers weighing about 12 lb. and curved to fit the circumference of the pipe and nearly close the annular space between the walls. These rammers are about 12 in. long and their ends are slotted to engage closely the longitudinal bars and insure ramming both sides of them. After the mold is filled a special cast-iron top ring is set on it and filled with concrete to form the male end of the joint. As soon as this is well rammed the ring is removed and the pipe section left standing until the next morning when the mold is stripped from it and used for other sections. Each 3-ft. section of 66-in. pipe weighs about 4,000 lb. and contains 1 1/7 cu. yd. of concrete made with Lehigh cement and ¼ in. clean gravel. In this case the concrete is hand mixed and is made in proportions of 1:2:4, but when machine-mixed proportions of 1:2½:5 are found satisfactory. Ten complete molds were provided, and with them 10 sections of pipe daily are made with a gang of 12 men and superintendent.

The pipes were rolled along the trench and lowered to position by derricks and the stresses thus occasioned were considered to test them sufficiently, although they were subjected to very rigid surface inspection. One section of pipe only a few days old was struck by a heavy truck and the only injury it sustained was chipping off a few cubic inches of concrete on one edge, which can be easily patched, while the truck itself was seriously damaged. When the pipe sections are laid in the trench, their male and female ends are properly engaged, circular strips are threaded between the overlapping hooks of the longitudinal reinforcement bars at the joints, the inside of the joint is pointed with 1:1 cement mortar, the exterior is covered with a galvanized iron strip bolted in place over a canvas gasket, and the joint is filled with grout poured on the top of the pipe. This develops sufficient pressure to produce leaks if any weak places exist and these are immediately noted by the inspectors and corrected while the joint is being made so that it eventually makes a smooth, tight, strong connection between the successive lengths of pipes.

The trench for the 66-in. pipe is 9 ft. wide and 14 ft. deep, and is sheeted with 2x12-in. planks driven with a water jet at about 65 lb. pressure delivered through a 2½-in. pipe and a 1-in. nozzle. The edges of the planks are rabbeted 2½ in. to make a ship plank lap joint, which gives good satisfaction in this soil, composed of fine sand or quicksand. The trench is excavated to a depth of about 2 ft., and in it are assembled the 8x8-in. rangers or waling pieces and cross braces framed together with splice plates and blocked up to the level of the surface of the ground. The piles are rapidly driven outside them with the hydraulic jet, aided by occasional raps with a sledge hammer, and rapidly penetrate their full length of 18 ft., after which the excavation is completed and successive lines of rangers are framed in as the pit is finished. After the completion of the trench the pipe handled by the cableway is laid and jointed at the rate of about 22 sections per day by about 5 men.

Sections of similar pipe 42 in. diameter inside and 4½ in. thick were jointed together and placed on supports 8 ft. 3 in. apart on centers and tested by bending loads of 16,500 lb. uniformly distributed, which did not produce observable deflection. A deflection of ¼ in. was produced by a load of 17,500 lb., the first crack appeared with a load of 21,700 lb., and the pipes finally collapsed with a load of 28,320 lb. Three sections of 36-in. pipe jointed together were subjected to hydraulic pressure of 40 lb. per square inch which did not cause destruction but developed a longitudinal crack in one pipe.

The Atlantic Construction & Supply Co., Mr. J. H. Decker, chief engineer, is the designer and contractor for the work here described. The reinforced pipe is made by the Reinforced Concrete Pipe Co., Jackson, Mich., Mr. G. E. Johnston, superintendent.



Concrete Pump Well.

The Recovery of Brass in San Francisco has been carried on by interesting methods during the past few months on the site where the brass foundry of W. T. Garrett & Co. stood before the fire of April, 1906. At the time of the fire three stories of the building were filled with finished brass goods and the metal, melted by the heat, ran into the basement. Some of it has been recovered in large masses, some by screening the earth and debris, and some by hydraulic sluicing over riffles.

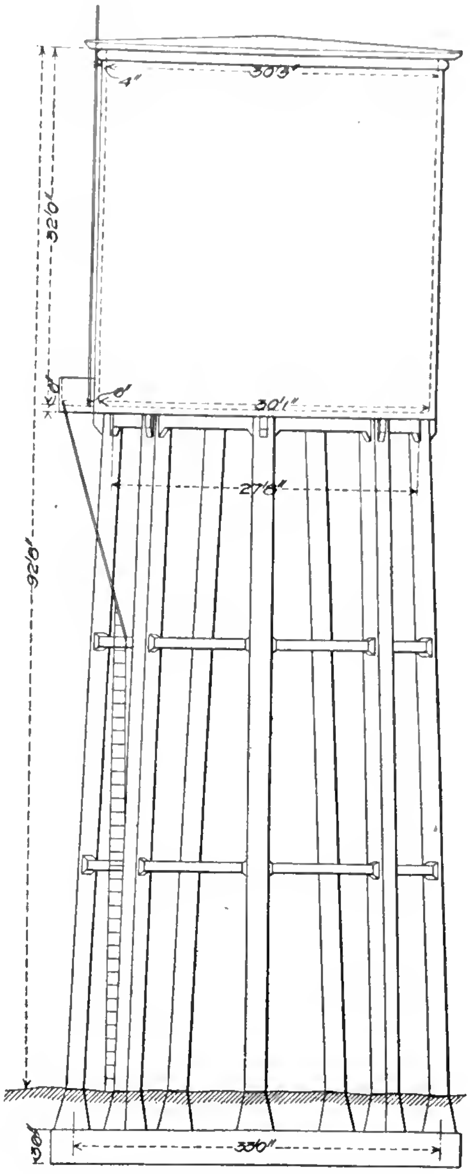
A Reinforced Concrete Water Tower at Anaheim.

In reconstructing the water works for the city of Anaheim, in southern California, the problem of a structure for an elevated water supply was one that had to be solved, the immediately surrounding country being very level with no natural reservoir site available. The population supplied is about 3,500 and it was necessary to have a storage capacity of 175,000 gal. with a minimum head of about 60 ft. Bids were called for upon specifications for an elevated hemispherical-bottom steel tank on steel towers and for a tank and tower of monolithic reinforced concrete construction. The specificatons for the concrete tanks required that bidders must be able to show successful examples of reinforced concrete construction either of tanks or stacks, or structures of a similar nature.

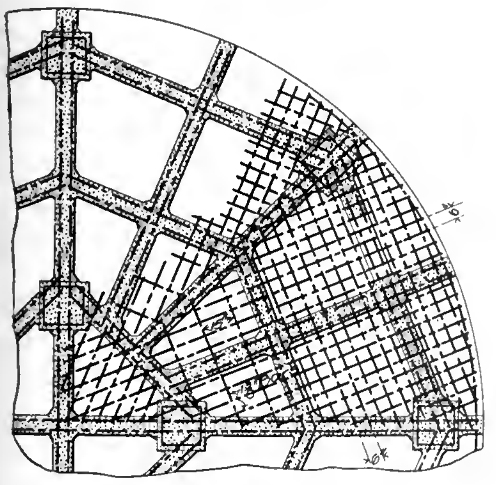
The bids for steel tanks and towers ranged from $9,200 to $12,500, while for the reinforced concrete tank and towers two bids were received, one for $10,400, which was accepted, and the other much higher. The greater durability, reduced cost of maintenance and better appearance led the city trustees to accept the reinforced concrete structure.

The specifications under which the contract was let required the contractor to furnish his own detail drawings and to give a complete description of his method of construction, but allowed considerable latitude in the kind of reinforcement and even in the plans for the structure, subject, of course, to the approval of the city. In the plans and specifications as prepared by the contractor, the design submitted by the city is closely followed, although the contractor elected to reduce the amount of concrete in some parts of the structure, to increase its richness and also to make some other slight changes.

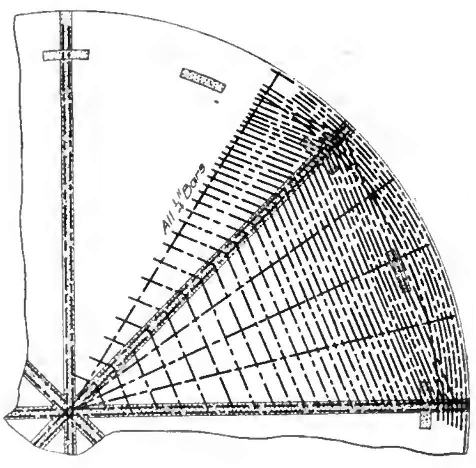
The tank is approximately 30 ft. 3 in. in diameter and has a clear interior depth of 32 ft. It rests on twelve reinforced concrete columns, each 22 in. square and 60 ft. 2 in. long, eight of them being placed equidistantly on the circumference



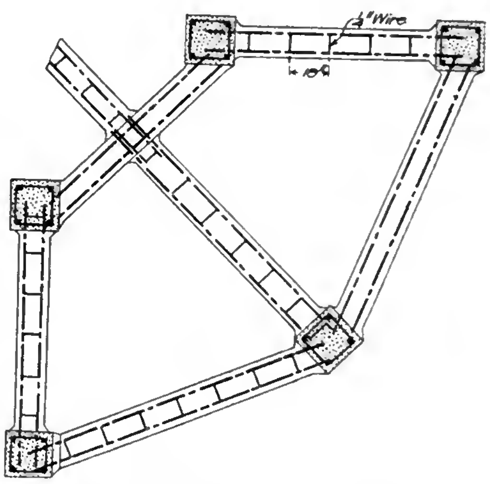
Reinforced Concrete Water Tower.



Floor and Girders at Bottom of Tank.



Roof Reinforcment.



Horizontal Strut Reinforcement.

of a 33-ft. circle and the other four on the circumference of a 4-ft. 4-in. circle. The columns are braced by two series of horizontal struts at the third points of the length of the columns, but no diagonal bracing in vertical planes is used. The batter of the columns and the manner in which they are built into the foundation slab and the tank floor are intended to provide for the lack of diagonal bracing. The horizontal struts evidently contribute in the rigidity of the tower by dividing the columns in effect into three compression members.

The soil at Anaheim is an alluvial deposit underlaid with strata of sand to a depth of 50 ft. and in periods of great rains these strata are said to resemble quicksand. This led to the adoption of a very conservative foundation bearing pressure. Holes sunk near the location showed that the first stratum of sand was about 8 ft. below the surface. The excavation is carried down 6 ft., and in case sand should be encountered at that depth it is to be removed for 18 in. and replaced with soil or clay.

The reinforcement consists throughout of twisted square steel bars tied together where necessary with ¼-in. round iron. The steel is to have an elastic limit of about 40,000 lb. per square inch before twisting and about 60,000 lb. after twisting, and an ultimate strength of 80,000 lb. Extra care is required in placing the steel in its proper position and especially to prevent any movement of the reinforcement while concrete is being placed. All joints between adjacent continuous rods in tension are to be lapped 12 in. and bound together by wrapping with soft steel wire.

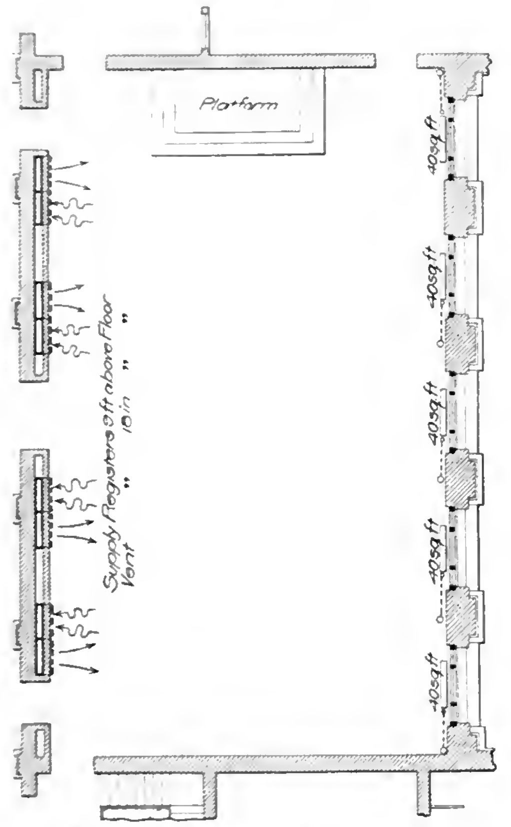
The foundation consists of a reinforced concrete slab 36 in. thick and 37 ft. square, extending out beyond the limits of the tower and tank on all sides. It is made of 1:3:4½ concrete, the crushed rock or gravel varying in size from ¼ to 3 in. in largest dimension, and is reinforced by twisted steel bars placed 2 in. from the underside of the slab. The bottom bars are of ⅞-in. material, 16 in. on centers and at right angles to them are placed the distribution bars of ¾-in. material, 12 in. on centers. On top of this foundation slab are built the pyramidal pedestals of the columns which are anchored to the slab by means of the twisted steel bars running through them and imbedded in the concrete of the foundation. The columns are reinforced with four ¾-in. twisted bars, one in each corner, tied together with ¼-in. iron wire. When the tank is empty the assumed wind pressure is sufficient to cause tension in the columns and the vertical reinforcing in the latter is therefore designed to resist both compression and tension. The ends of adjacent rods are kept in line by being placed in a socket about 12 in. long, and in order to resist tension are joined by a splicing bar of twisted square steel about 48 in. long, firmly bound to them with soft steel wire. The columns and girders are made of 1:2½:2½ concrete, using the run of the crusher under ¾ in. for the stone.

The struts have a cross-section 14x16 in. and are reinforced with four twisted bars either ½-in. or ⅝-in. material, one being placed in each corner and tied together, as explained for the columns. By far the most complicated part of the reinforcement consists in the beams and girders supporting the floor of the tank. Most of these beams and girders are 8 in. wide, varying in depth from 12 to 16 in. The placing of the reinforcement in them does not differ from the standard methods except that the stirrups of ¼-in. wires are used quite plentifully. The floor of the tank is 6 in. thick, reinforced with ⅜-in. bars placed with varying centers according to the span, the greater part of them being placed in a right angled grid on 6-in. centers both ways.

The sides of the tank vary in thickness from 6 in. at the bottom to 4 in. at the top and, like the floor, are made of 1:2:2 concrete, the stone being the run of the crusher under ½ in. In case the rock should vary to such an extent as to give a more dense concrete if mixed in some other proportion the amount of sand and rock will be varied accordingly. The reinforcement of the sides consist of ¼-in. twisted steel bars placed vertically on 24-in. centers around the circumference of the tank, running from the floor to the roof, across which laid horizontally and continuously around the tank as a hoop are ¾-in.

twisted steel bars with centers varying from 3½ to 12 in. For the lower half of the height of the tank these hoop bars are ¾-in. steel, for the next 5 ft. of ⅝-in. steel, and for the remainder of the height of ½-in. steel. The spacing of the ¾-in. bars varies from 3½ to 7 in., of the ⅝-in. bars from 5 to 7 in., and of the ½-in. bars from 5 to 12 in., the smaller spacing, of course, being used in the lower part of the section containing a given size bar.

The roof is a flat cone having a rise of only 12 in., and is carried by 8 radial reinforced concrete girders, varying in depth from 9 to 15 in. The roof is 2 in. thick reinforced with ¼-in. twisted steel rods laid both radially and perpendicular to the radii, the latter bars reaching between the girders which support the roof. The spacing of the bars laid crosswise of the radial ones varies from 3 in. near the edge of the tank, where the span between the girders is longest, to 12 in. near the center, where the span is very short. A steel ladder allows access from the ground to the tank.



Systems in Board of Works Meeting Room.

The water-proofing of the tank is considered the most particular part of the work. Every effort will be made to prevent lack of continuity in the walls due to cessation of work from day to day. The inside of the tank is to receive a water-proofing coat, ½ in. thick, composed of 1:1 cement grout. Of the cement used 96 per cent. must pass a 100 mesh screen and 82 per cent. a 200 mesh screen. The contractors will also use some astringent to aid the water-proofing. The specifications require the contractor to keep the tank filled with water for ten days before acceptance, during which time it must not develop any structural weakness nor any objectionable leakage.

The structure was designed by Mr. F. R. Schanck, of Messrs. Clem A. Copeland & F. R. Schanck, consulting engineers, Los Angeles, who have designed and have charge of the rebuilding of the municipal lighting plant and the water works of the city of Anaheim, of which Mr. A. L. Lewis is superintendent. The contractor is Mr. Carl Leonardt, Los Angeles, Cal., the plans being those of Mr. T. F. Osborn, engineer for the contractor.

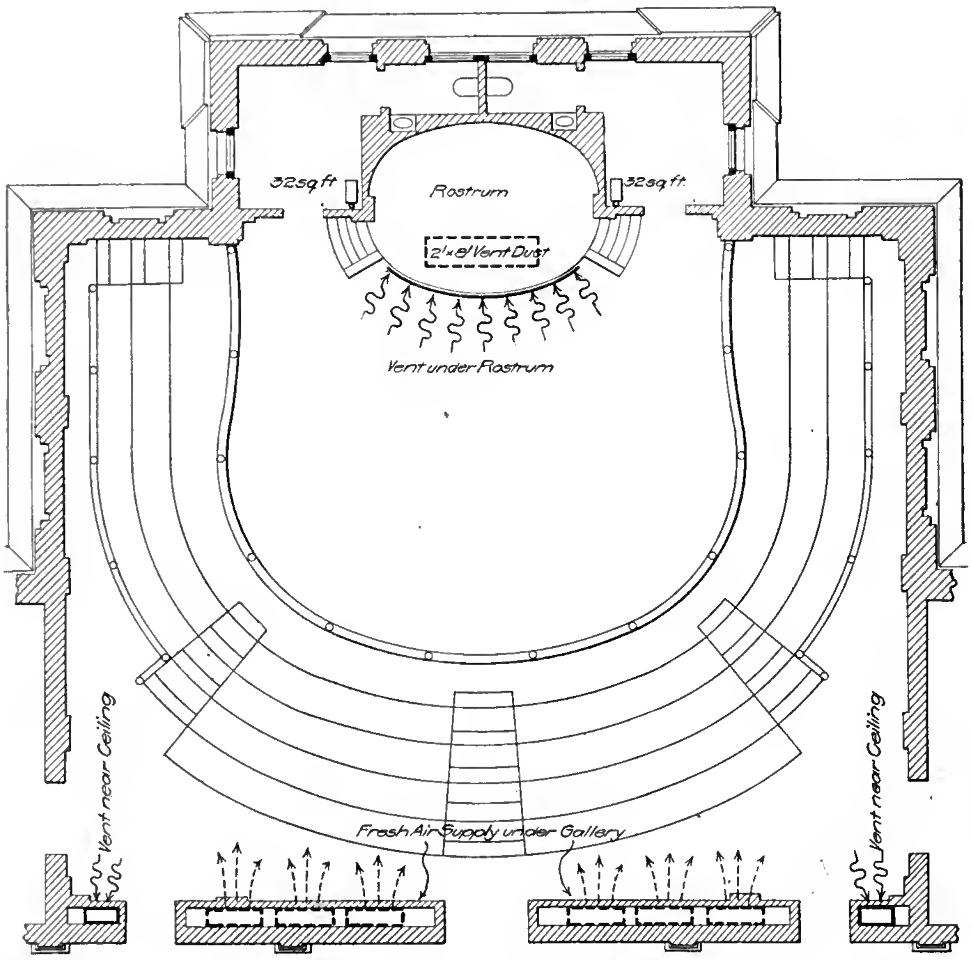
Mechanical Plant of the New City Hall, at Newark, N. J.—Part II.

Heating System.—The heating system of the new City Hall is a combination of direct radiation and hot blast operated with the exhaust from the steam-using machinery of the power plant, with make-up of live steam supplied automatically when the exhaust steam supply is insufficient. The radiation is in general connected on the single pipe system, with the exception of the indirect radiation which is supplied on the two-pipe system. The heating in a large part of the building is independent of ventilation, but in a number of the larger rooms used by many people the direct radiation is supplemented by indirect heating. The radiation throughout is operated with gravity return, but is in all parts of the building under automatic thermostatic control. An interesting feature of this installation is the use of an air line with novel exhaust, which connects the air valves on all radiators into a header in the sub-basement that extends across to the boiler house and up to an outlet inside of the chimney near the top, the purpose of the latter connection being to remove all air and vapor from the radiators freely by induced draft.

The radiation is distributed in the usual arrangement under window sills for counteracting window glass exposure, the heating surfaces of the units being proportioned on the thermal unit basis of heat loss from the building. The arrangement is such that there is a radiator unit under every window in all rooms to be heated, except in certain small rooms and store rooms which are not occupied. Even in rooms which are fitted for fresh air supply with indirect heating, the usual window-sill radiator arrangement is maintained, and in a number of the larger offices, radiators are installed on the inner walls to provide for additional heating or to counteract possible cool drafts from the corridors. In the Common Council chamber which has no side window lighting but dome sky-lighting only, there are no radiators installed, indirect heating being depended upon entirely. The interior court spaces within the corridors, which are similarly lighted by sky-lights, are heated in general by radiator units distributed at the basement corridor level, while the sky-light glass exposure is counteracted by hot blast delivery from the indirect heating system, which is directed upward toward the sky-light so as to diffuse with and counteract the cool descending currents of air. In the rear wing of the basement, however, there are two court-rooms which, although having side window lighting, are heated entirely by the indirect system, there being no radiators installed in the rooms.

The radiation installed is of the cast-iron construction throughout the entire building, including the tempering coils and reheaters of the ventilating systems, that for direct radiation being for the greater part of the Classic form in both the single and double column patterns and in heights of 31 and 38 in., according to the window-sill clearances. The reheater coils are of the Losee pattern and are installed in the duct connections of the fresh air supply system in the sub-basement as will be referred to in connection with the ventilating equipment. The latter radiators are under the direct control of the thermostats which control the direct radiation for the corresponding rooms supplied and are thus essentially a part of the heating system. The amounts of heating surface installed in the various sections of the building are given in the accompanying table.

Steam is supplied to the direct radiation from the sub-basement by 64 riser lines, which range in size from 1½ to 4 in. and supply from 1 to 8 radiator units each. Forty-three of these rise direct to the top floor of the building, 5 to the 3d floor, 6 to the 2d floor and the remainder to radiation on the 1st floor, all of the lines decreasing in size as the radiator branches are taken



Ventilation of the Council Chamber, Newark City Hall.

off. All of the lines are anchored on the second floor level, each anchorage consisting of a short

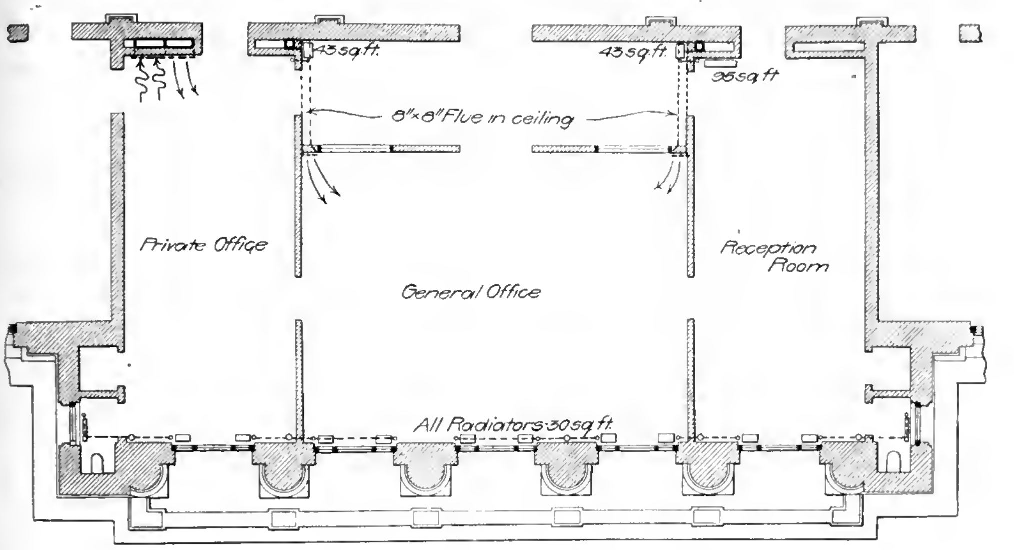
Newark City Hall Heating Equipment.

Portion Heated.	Number of Radiators.	Total Heating Surface, Sq. Ft.	Thermostatic Valves.	Thermostats.	Indirect Number of Stacks.	Total Heating Surface
Main Floor.....	64	4,809	83	29	13	2,540
Second Floor....	79	3,971	100	44	14	3,190
Third Floor....	59	4,278	56	43		
Fourth Floor....	52	4,290	52	15		
Basement and Corridor.	73	5,561	72	39	5	1,220
Main Rotunda..			8	2	4	3,200
Total	327	22,909	371	172	36	10,150

nipple connected into the pipe between two couplings, a strap anchor being clamped onto the nipple to prevent the pipe from settling. All branches to the radiators as well as also the air line connections are imbedded in the floor construction with due allowance made for expansion both upward and downward from the 2d floor anchorage point. All risers are fitted with cut-off valves just below the sub-basement ceiling, below which connections are made to branches of the heat distributing mains. Each of the risers is dripped at its base into the condensation return system which has mains and branches paralleling those for the low pressure steam distribution to all parts of the sub-basement; the drip connections are all large in size, having carrying capacities equal to approximately one-half that of the risers, and the drainage is all by gravity. The system of air lines through which air and vapor is drawn from the air valves on all radiators, corresponds exactly to that for steam supply to the radiation, the risers and branches to radiators duplicating exactly those for steam supply with the exception of size, the arrangement and proportion being approximately the same.

The heating supply system originates in the exhaust steam header in the power plant division of the sub-basement as referred to in the article in the previous issue. This header is a 16-in. exhaust line which connects through a grease extractor first to a 10-in. atmospheric exhaust outlet that leads to the boiler house exhaust head and thence through a gate valve to the heat distributing mains. Beyond the gate valve there is a live steam make-up supply connection through which live steam is added to the heating system when the exhaust from the steam using machinery is insufficient; the latter consists of a 6x8-in. Foster reducing valve which is capable of reducing the pressure from 90 lb. to 1 lb. and this is fitted with a 4-in. bypass for hand operation if necessary. The heating system header is a 12-in. steam line with four branches to the four corner sections of the building, those to the front corners being 8-in. and those to the rear are 10-in. lines. From the end of the heating main, an additional 4-in. line is extended to the fresh air supply fan room in the rear corner of the sub-basement to supply the tempering coils. Branch lines from these mains extend to all parts of the sub-basement to supply risers, decreasing in size as supply connections are taken off and they are graded with the flow of steam, condensation being drained out through the drip connections at the bases of all risers supplied.

The condensation return system parallels that for low pressure steam distribution in the sub-basement in general; the drainage connections at the bases of the risers and also those from the tempering and reheater coils of the fresh air supply system, delivering into a series of mains which conduct the condensation to a tank depressed in a pit in the westerly portion of the sub-basement. These mains are like the steam mains, arranged in four divisions, which extend to the four corners of the sub-basement to connect with the various apparatus and risers. The condensation receiving tank is a 3x8-ft. steel cylindrical tank which is located in the pit so that it is entirely below the sub-basement floor level, and the condensation gathering mains deliver into this in two groups, each through a 6-in. connection with return seal.



Heating and Ventilation of the Mayor's Office.

The condensation tank pit is about 3 ft. deep and 13x16 ft. in size in order to accommodate the return pumps on a level below that of the tank and thus facilitate the handling of the hot returns. These pumps are 7½x4½x10-in. Worthington duplex pumps which return the condensation, under control of a Kieley pump governor on the condensation return tank, to the boiler house for use in the boilers, as referred to in the preceding article upon the power plant of the City Hall. On account of the low level of this condensation tank, the condensation drains freely from the radiation both direct and indirect, and is delivered to the boiler house for boiler feeding as rapidly as it accumulates. The return of condensation is also facilitated by air line systems, which consists of a piping system with ⅜-in. connections to the air valves of all radiation, all of which connect into a 3-in. vapor header in the sub-basement that extends to the boiler house and up to an outlet within the sack near the top to effect an induce draft; the very srong draft of the stack induces a strong exhaust to these vapor lines and is found to be very effective in removing air and vapor from the heating system mains. All of the piping in connection with the heating system, both for low pressure steam supply and return, is covered with H. W. Johns fire felt applied to a thickness of 1½ in. and enclosed in canvas jacketing.

Ventilation.—While the City Hall building is situated on a spacious grounds and has ample corridor spaces within, which are the conditions most favorable for natural ventilation of a building, artificial ventilation has been provided for in a number of the public and more extensively occupied portions. These include the Common Council chamber, the Board of Works meeting room, the court-rooms in the basement, the Mayor's office and some of the large and much frequented offices. In certain of these, notably the Common Council chamber and the court-rooms, the fresh air supply system is depended upon solely for heating, while in the remaining portions fitted for mechanical ventilation, the indirect heating is supplemented by radiators which are so placed as to counteract window glass exposure, and accomplish partial heating if the indirect systems be shut down. Ample changes of air are provided for in all of the ventilated portions to provide for maximum conditions of occupancy so that, with the profuse ventilation that has been provided in the corridors and interior court area, a very satisfactory and effective ventilation of the entire interior of the building is secured. The equipment also includes two independent exhaust systems for the groups of toilet rooms in either end of the building and air filters of the cheese cloth type for the fresh air supply. An unusual feature of the installation is the use of a Corliss engine drive for the operation of both the fresh-air supply and exhaust fans.

The ventilation is applied to the building in general on the downward system, the fresh air being delivered to the rooms supplied near the ceiling line, while the foul air is exhausted through registers near the floor line. An exception to this is to be noted, however, in the case of the fresh air supply to the interior court areas which rise from the basement through the center of the building to large size double sky-lights at the roof line; in this case the hot blast is delivered to these spaces through registers located 10 ft. above the first floor level, the purpose being principally to deliver heated air centrally under the sky-lighting which will diffuse with the cool descending currents from the glass surface and prevent cold drafts. The mechanical ventilation is confined entirely to the basement and first and second stories and the greater part of it is applied to the more important offices on the first floor. On this latter floor, which has a clear head-room from floor to ceiling of 19 ft., the counting room of the Water Board, the Tax Commissioner's business office and the Tax Receiver's counting room are large important offices in which profuse ventilation was required. On the second floor there is the meeting room of the Board of Works, the Mayor's office and the meeting room of the Police Board, all large rooms, to be ventilated, while in the basement there are two police court rooms, the business office of the Street Department, and the general office of the Alms Department of the City, which are extensively occupied and require ample ventilation. Ventilation arrangements in the Common Council chamber was carefully designed to produce the best results without bringing the system into evidence and the design follows closely the methods which are usual in theater and public hall ventilating installations. In addition to this ventilation is provided in the sub-basement for both the engine room and a jail room of the Police Department.

The proportions of fresh air supply and exhaust selected for the various offices ventilated were taken with reference to average conditions of occupancy, while in the Common Council chambers, the court-rooms and the various meeting rooms, ample ventilation is provided for maximum conditions of occupancy, fully 30 cu. ft. per minute being supplied for every person accommodated in the room or hall. In addition to the capacity of ventilation provided in these rooms for crowded

conditions, the distribution of both supply and exhaust registers were carefully arranged to produce most effective results in clearing the air in all parts of the room. The registers and duct work are designed throughout for low velocities of flow, those for fresh air supply being operated with delivery velocities of about 2,000 ft. per minute in the basement duct lines which is reduced in the rising flues and connections to about 1,000 ft., and through the delivery registers to about 500 ft. per minute. The ducts and connections of the exhaust ventilation system are similarly proportioned, except that slightly lower velocities of flow are provided for. The details of the duct system connections and outlet registers for both fresh air supply and exhaust ventilation from all rooms in the building are presented in an accompanying table from which the general proportions of the system may be observed.

The ventilating systems, both fresh air supply and exhaust, are operated by fans located in the sub-basement. Owing to the extent of the service, two blower units are used in either case instead of one large unit, and each two units are located in spacious fan rooms that serve as intake chambers, the delivery being made direct from the fan outlets to the duct work or tunnel connections as the case may be. The fans are all three-quarter-housed steel plate fans, built by the B. F. Sturtevant Co., and have 12 vane wheels, 8 ft. in diameter, which are 60 in. in width for the fresh air supply fans and 48 in. wide for the exhaust fans. They are all operated at 225 r.p.m., at which the supply fans have each a capacity of 62,250 cu. ft. per minute or a total capacity of 12,500 cu. ft. per minute for the fresh-air supply division, while the exhaust fans at this speed handle 50,000 cu. ft. per minute each, removing together 100,000 cu. ft. from the building per minute. A unique feature of the fan installation is the method of drive, which consists of a 100 h.-p. Corliss steam engine with belted jack shaft driving connections. This engine is, as stated in the preceding article, located in the westerly portion of the sub-basement from which it is belted to a 98-ft. jack shaft extending along the rear wall in the direction of the fan rooms. This shaft is operated at 150 r.p.m., and the fans are driven by single belt drives, the wheel shafts being coupled in tandem. The engine is a Watts-Campbell simple Corliss engine with 16x30-in. cylinder and operates normally at 75 r.p.m., at which speed it develops 75 h.-p. It has a 10-ft. fly-wheel which is belted direct to the jack shaft and is fitted with a safety governor which will automatically stop the engine should the speed be increased more than 10 per cent. above normal.

The fresh air supply fans are located in a fan room 22x44 ft. in size in the easterly rear corner of the sub-basement to which the fresh air is drawn in through a group of cheese-cloth air filters and a set of tempering coils: the room itself thence serves as an intake chamber, from which the fans draw directly while delivery is made through duct connections to the distributing duct lines outside. The air filter consists of a series of 8 cheese cloth frames, 7 ft. in width by 11 ft. high, which present a total area of filtering medium of about 600 sq. ft., with which, at the maximum delivery of the fresh air supply fans of 12,500 cu. ft. per minute, a low filtering velocity of about 20 ft. per minute is obtained. The screens consist of wooden frames upon which the cheese cloth medium is stretched over wire netting for stiffening and backing purposes and they are mounted in an angle iron frame work, with provisions for removing when necessary for cleaning.

The air supply is heated in winter weather before being delivered to the building by a tempering coil in the fan intake and reheater coils in the duct delivery connections to the various rooms, by means of which arrangement the temperature of the air delivered to the various rooms may be accurately controlled. The tempering heater consist of a row of 10 special cast-iron radiators each containing 150 sq. ft. of radiating surface which are mounted in a row on a 12-in. brick wall, 5 ft. in height between the fans and the air filter. The upper portion of the rooms surrounding the radiators is shut off by a galvanized iron partition while in the brick supporting wall are three 36x60-in. dampers for the purpose of by-passing the tempering coil when desired, thus reducing the temperature to which the air supply is tempered in the intake.

The reheating coils are installed in the fresh air supply ducts to each of the rooms ventilated, for individual heating of the air thus supplied according to the requirements of each room. They are installed in the sizes indicated in the accompanying table of duct sizes and each reheater is thermostatically controlled from the room served. With this arrangement the most effective application of the indirect heating is secured as each delivery is thus independently adjusted to the heating requirements and is shut off whenever the direct radiators in the room can maintain the desired temperature. The Johnson system of temperature regulation is installed, there being thermostats in each of the rooms ventilated which, in addition to that controlling the direct radiation, controls all of the indirect heating of that room. The tempering coil is under the control of a thermostat in the supply fan room to regulate the amount of tempering of the incoming air.

The exhaust ventilating fans are located in an 18x20-ft. room in the central portion of the sub-basement space into which the exhaust gathering ducts from all parts of the building are led, this room serving as an exhaust chamber for the fans. The gathering duct connections consist, as will be noticed from the sub-basement plan of the City Hall in the preceding article, of two 6x66-in. ducts, a 34x108-in. duct and a 42x72-in. duct. The fans have intake direct from this chamber and deliver to the atmosphere through the piping tunnel which extends underground to the boiler house building at the rear of the main building. This tunnel is, as stated in the preceding article, 8 ft. square, and connects at the boiler house end, into a large brick flue rising to a point about 40 ft. above the sidewalk, where it has a hooded outlet. This flue is 6x15-ft. in area and has a full sized damper near the top which is controlled from below by ropes to permit of shutting off the outlet in case it is desired to shut down the system in cold weather. The ventilating flues are all without automatic dampers or control with the exception of those from the Council chamber which have automatic dampers under the control of thermostats in the chamber which causes them to open when the temperature increases above a predetermined point and closed when the temperature lowers.

The public toilet rooms of the building are ventilated by independent exhaust systems in order to prevent the possibility of communication of odors through the duct work to other parts of the building. These toilets are located in the two rear corners of each floor from the basement to the fourth floor, there being two on each floor, about 11x17 ft. in size, or 10 in all, and for their ventilation, two 2½x5 ft. vent shafts were built in the wall construction adjoining these rooms, from the sub-basement to the roof in either corner. They are connected with the toilet rooms by 6x6-in. vent register openings at the ceiling line for exhaust and also serve an important purpose in accommodating the soil pipes and other pipe lines of the plumbing system in open construction. These vent shafts are each connected in the attic to motor-driven cone exhaust fans, which operate continuously, independent of the other ventilation systems, and discharge through copper vent hoods through the roof. The fans are 36-in. 16-blade full-cone cased fans which are direct-connected to 3 h.-p. Sprague motors and operate at 650 r.p.m. Owing to the use of alternating current for operation of the lighting service in the building, these motors are operated on an independent supply of 500-volt direct-current, for which a special service connection is made by the local lighting company, and suitable switches are installed for control of the motors from the sub-basement. The private toilet rooms in other parts of the building have outside windows and are not fitted for mechanical ventilation.

The mechanical plant of the City Hall was designed for the architects by James M. Seymour, Jr., consulting engineer, Newark, N. J. The architects of the building were John H. and Wilson C. Ely, of Newark, N. J., and Mowbray & Uffinger, New York. The commissioners for the new City Hall were Andrew Kirkpatrick, Gottfried Krueger and James E. Howell.

SIZES OF VENTILATING DUCTS AND APPARATUS.

		Fresh Air Supply Systems.			Reheater	Exhaust Ventilating Systems.	
Floor	Room.	Size ft.	Ducts, ins.	Registers, ins.	sq. ft.	Ducts, in.	Registers, ins.
Sub-	Engine Room...........	36 x 57	......	......	......	1—10 x 24	1—30 x 24
Basement......	Jail Room..............	40 x 40	1— 6 x 18	50 holes.			
(11-ft. ceiling.)				2 in. diam.	100	1—6 x 24	1—18 x 24
Basement.....	Court Room............	24 x 46	1—8 x 78	1—24 x 78	330	1—12 x 24	2—18 x 24
(16-ft. ceiling.)	" "	24 x 46	1—8 x 78	1—24 x 78	330	1—12 x 24	2—18 x 24
	St. Dept. Business Office..	26 x 65	1—8 x 24	1—24 x 24	370	2—8 x 24	2—24 x 30
			1—8 x 42	1—24 x 42			
	Alms. Dept. Gen. Office...	27 x 28	1—8 x 36	1—24 x 36	190		
	Main Corridor..........	Space under dome.				4—6 x 66	4—18 x 66
First Floor....	Water Bd. Count. Room..		1—8 x 30	1—24 x 30	960	2—8 x 24	2—24 x 24
		26 x 100	3—8 x 42	3—24 x 42		2—8 x 30	2—24 x 30
(19-ft. ceiling.)	Tax Com. Business Office..	36 x 42	2—8 x 42	2—24 x 42	460	1—8 x 30	1—24 x 30
	Commissioner's Office....	14 x 31	1—8 x 24	1—24 x 24	130		
	Secretary's Office........	17 x 22	1—8 x 24	1—24 x 24	110	1—8 x 24	1—24 x 24
	Clerk's Office............		1—8 x 30	1—24 x 30			
		27 x 27	1—8 x 36	1—24 x 36	220	1—8 x 24	1—24 x 24
	Tax. Rec. Count. Room..	35 x 60	3—8 x 42	3—24 x 42		2—8 x 24	2—24 x 24
					660	2—8 x 30	2—24 x 30
	Interior Court..........		4—24 x 36	4—36 x 60	3200		
Second Floor.	Meet. Room Bd. of Wks...	35 x 60	4—8 x 42	4—24 x 42	480	4—8 x 30	4—24 x 30
(17-ft. ceiling.)	Mayor's Gen. Office......	24 x 32	2—8 x 8	2—16 x 16	200		
	Private Office............	14 x 32	1—8 x 30	1—24 x 30	120	1—8 x 24	1—24 x 24
	Meet. Room Police. Bd...	24 x 35	1—8 x 36	1—24 x 36	230	1—8 x 30	1—24 x 30
Common Council Chamber...........		48 x 60	6—15 x 48	2—15 x 78	2160	1—15 x 36	2—27 x 84
				2—36 x 48		1—24 x 96	15 x 180 Grille
				2—30 x 50			

THE ELECTRIC PUMPING PLANT of the Scunthorpe, England, water works consists of two units which force a supply through 2 miles of 9-in. main against a maximum head of 240 ft. The supply is drawn from an infiltration gallery. One pumping unit consists of a horizontal triplex pump, belt-driven from a 50-h.p. alternating current motor. The second unit consists of a three-stage Worthington turbine pump, driven by a similar motor through a flexible coupling. Three-phase 25-cycle, 2,200-volt current is supplied from a station 4¾ miles distant through an underground transmission line. The inaccessibility of the pumping station for carting fuel and supplies made the adoption of electrical power essential. The use of gas, oil and steam was fully considered, but the peculiar nature of the undertaking was decidedly in favor of electricity.

Some Notes on Oriental Water-Works.

A paper read before the American Water-Works Association by George A. Johnson, principal assistant engineer with Hering & Fuller, New York.

During the writer's recent trip around the world it was his privilege to make a somewhat extended study of numerous Oriental water-works. It would be out of place in a paper of this character to go much into detail or to attempt a complete description of all the works visited. In this article, therefore, will be given as briefly as possible the more salient features of Japanese water-works, and of the works at Shanghai, China, Singapore, Straits Settlements and Bethmangala and Calcutta, India, observing the general lines followed by the writer in his illustrated lecture on this subject delivered last June at the Toronto Convention of this Association.

Some of the data used in this paper have been taken from an article by the writer which appeared in The Engineering Record, May 11, 1907. For their great kindness in aiding the writer in his endeavor to obtain information upon the works described, hearty acknowledgments are due to Dr. Y. Nakajima of Tokyo; Mr. S. Inoue and Dr. S. Tanabe of Kyoto; Mr. Z. Mita of Yokohama; Mr. K. Funabiki; Mr. H. Ono, Mr. K. Inouye and Mr. Y. Tsujimura of Osaka, Japan; Mr. McLeod and Mr. Mollison of Shanghai, China; Mr. Pierce of Singapore and Mr. Bell of Penang, Straits Settlements;; Mr. Fogarth of Bethmanagala and Mr. McCabe and Mr. Peirce of Calcutta, India.

Water Works of Japan.—There have been public water supplies of a kind in Japan since the year 1600 when Iyeyasu, founder of the Tokugawa dynasty of Shoguns, inaugurated the first public water supply at Tokyo. These original works were remodelled and improved some 65 years later, and were improved and extended many times during the next two centuries. It was not until 1892, however, that the present modern and efficient works were put under construction, and it was 1898 before they were completed.

To Yokohama belongs the credit for having installed the first modern system of water works in Japan, begun in 1885. For the data from which the following digest of modern water works practice in Japan has been prepared the writer is indebted to his friend, Mr. S. Inoue, Chief Engineer of Kyoto Municipality, Japan, and a member of this Association. In 1889 the construction of the Nagasaki water works was begun. Osaka commenced her works in 1892, Hiroshima in 1896, Kobe in 1897, Hakodate in 1898, Shimonoseki and Okayama in 1900 and Akita in 1903. In all, therefore, there are ten cities in Japan provided with public water supplies, nine of which are filtered before delivery to the consumers, the Hakodate supply being unfiltered. In addition to these ten cities there are Kamiura, Sawarazawa and Iizuka, towns with populations of 2,165, 1,396 and 1,240, respectively, which have public supplies, that of one, Kamiura, being filtered.

The total population of the thirteen cities and towns which have public water supplies is in round numbers about 4,100,000, and of this number roughly 4,000,000 are supplied with filtered water. In general terms about one-third of all service lines are metered, and there is a fire hydrant provided to about every 50 houses. The average daily water consumption is about 25 gallons per capita. The total capital cost of all existing Japanese waterworks systems to date is in round numbers $11,500,000, or $2.80 per capita.

Tokyo Water Works.—The original design of these works called for a capacity of 45,000,000 gal. per day, or sufficient to serve a population of 1,500,000. Construction work was begun in 1892 and the works were first put into commission in 1898. In 1904 the population of Tokyo was 1,870,628.

The intake is located on the Tama River at Hamura, and from there to the present works the water flows by gravity through about 30 miles of open and closed canal. On reaching the works at Yodobashi the water passes through sedimentation basins, three in number, each 720 x 360 x 19.5 ft. deep, having a total capacity of 67,300,000 gal. These basins may be worked intermittently or continuously and when operating as continuous flow basins the period of sedimentation is equal to about 36 hours, and the velocity of flow through them to about 0.067 in. per second.

From the sedimentation reservoirs the clarified water flows through regulated outlets onto slow sand filters, of which there are eighteen one acre units. The sand layers are 30 in. in depth and are supported by 24-in. of graded underdraining material. The filters are operated at a rate of 2,933,000 gal. per acre daily, corresponding to a total gross capacity for the 18 filters of 52,794,000 gal. daily.

The filters require scraping about seven times a year on an average. At such times the dirty sand is removed from the beds, dumped into cement lined troughs, water applied and the sand agitated by coolies with rakes until clean.

There are three filtered water basins, all covered, located at Yodobashi, Hongo and Shiba respectively. The capacity of each basin is 7,500,000 gal., corrresponding to a total storage capacity of about 12 hours.

Two thirds of the supply is delivered by gravity to the low level districts. The remaining one-third is pumped at the Yodobashi station to the high level district in Yotsuya, Akasaka, Azabu, Shiba, Kojima, Ushigome, Koishikawa, Hongo and Kanda wards. The pumping station at Yodobashi contains four 300-h. p. pumping units each of a capacity of 7,500,000 gal. per day when working against a head of from 80 to 100 ft. There are twelve Lancashire boilers and two sets of Green economizers.

The charges for water vary, according to the use to which it is put, from 6 to 10 cents per 1,000 gal. The water is of excellent quality, clear, soft and without noticeable color.

At the present time there are 85,539 services and 5,177 fire hydrants. The metered services number 20,514.

The water consumption ranges from 11 to 23 and averages 17 gal. per capita daily. The total cost of works to date is $4,250,000.

Osaka Water Works.—The Osaka water works were put under construction in 1892, and originally designed to serve a population of 600,000. They were later extended to serve a population of 800,000. The population of Osaka in 1904 was 1,026,767.

The supply is derived from the Yodo River frrom whence it is raised by three centrifugal pumps to a series of four settling basins against a total head of about 30 ft. After 36 hours sedimentation the water is applied to slow sand filters and then pumped by seven triple expansion pumping engines of the Worthington type to the distributing reservoir at Osaka Castle against a total head of about 130 ft. The capacity of this storage reservoir is 3,750,000 gal.

The raw river water has a turbidity ranging from 10 to 350 parts per million. There will be about 20 days in the average year when the turbidity of the raw water will be over 100 parts per million, and about 50 days when it will be over 50 parts. The alkaliniity averages about 20 parts per million, and the numbers of bacteria range from 40 to 30,000 and average about 2,000 per cubic centimeter.

The settling reservoirs, four in number, are each 330 x 360 x 12 ft, effective depth. Their combined effective capacity is 42,600,000 gal. The sediment in these basins is flushed out once annually, when between 3 and 4 in., or about 5,200 cu. yd. are removed. The cost of labor for flushing out this material is 2 cents per cubic yard.

The cost of the basin completed in 1903, the effective capacity of which is about 10,000,000 gal., was $83,370, exclusive of the cost of land which costs at present $2.00 per tsubo, or $2,420 per acre.

The filters are of the slow sand type, eleven in number, ten of which are 151 x 182 ft. and one 182 x 350 ft. The total filtering area is therefore 7.77 acres. The tanks are of concrete and brick and the filter finished in 1903, 182 x 7.5 ft. deep cost $40,700 or $27,840 per acre exclusive of the filtering material which cost about $3,000 per acre additional.

The filters are operated in an up to date manner, although the rate of filtration is not automatically controlled and fluctuates with the pumpage. The average actual rate of filtration is 2,900,000 gal. per acre daily. The net rate is equal to about 2,600,000 gal. per acre daily.

Each filter requires scraping about twice a month on an average, and at such times about one-third inch of material is removed. No attempt is made to recover by washing the sand thus removed and it is used for fill. A gang of coolies is kept busily engaged at the river bank practically all of the time screening sand which is hand dredged from the bed of the Yodo River opposite the water works, brought to the shore in boats and there sun dried and pan screened.

The water rates vary from 10 to 60 cents and average about 20 cents per 1,000 gal. The filtered water is of excellent quality, has an alkalinity of about 20 parts per million, and during the year 1905 contained the average number of 25 bacteria per cubic centimeter.

There are at present 48,513 services of which 9,369 are metered. There are 3,000 fire hydrants. The total cost of the system to date is $1,653,020.

Yokohoma Water-Works.—The Yokohama water works were put under construction about 22 years ago when the first pipe lines were laid from the Sagami River. The new intake is located on the Doshi River near the foot of Fujiyama, and from there to the site of the filteration works on Nogiyama, a distance of some 30 miles, the water flows by gravity.

The works were originally designed to serve a population of 70,000 and have since been extended to serve 300,000 people. In 1904 the population of Yokohama was 331,597.

The raw water of the Doshi River is normally clear and noticeably free from color and turbidity except at times following heavy rains. The alkalinity of the water is about 27 parts per million.

On reaching the filtration works the four supply mains discharge into two receiving wells of masonry construction and from them is distributed to slow sand filters. These wells are small and permit of comparatively no storage. Suitable regulating devices are provided to maintain a constant water level in the wells and on the filters.

The three slow sand filters built some 21 years ago have recently been supplemented by three more filters. The beds are arranged in two batteries, one of four and one of two filters. The former are each 120 x 70 ft., and the latter are each 120 x 80 ft., corresponding to a total filtering area of 1.212 acres. The tanks are built of masonry and brick. The sand layer is 2.5 ft. thick supported on a layer of graded under-

draining material 18 inches in depth. The sand is of medium size, rather dark in color, and of good stable quality. It costs about $2.75 per cubic yard in the filters.

The filters are operated at the somewhat high rate of 6,530,000 gal. per acre daily, and require scraping about once a month. Sand washing procedures are similar to those employed at the Tokyo water works.

There are two baffled clear water basins, both covered and having a total capacity of 3,192,000 gal., corresponding to a storage of practically 12 hours supply.

The filtered water is high grade, clear, soft and colorless, and stands in enviable repute among the citizens of Yokohama. The works are well built and well operated. There are at present 2,745 metered and 7,679 unmetered services. There are 1,236 fire hydrants, or one to every 50 houses. The consumption ranges from 19 to 29 and averages 24 gal. per capita daily. The total cost of the system to date is $1,548,140.

Kobe Water Works.—The Kobe water works were put under construction in 1897 and consist of impounding reservoirs in the hills immediately back of the city, slow sand filters and small distributing reservoirs. The system is a gravity one throughout.

The impounding reservoirs, two in number, have a total capacity of 483,000,000 gal. corresponding to a storage of 140 days supply at the average rate of consumption of 3,480,000 gal. daily. The catchment area for the most part consists of the steep slopes of the hills back of the city and two small brooks serve as the main feeders. The watershed is but sparsely populated owing to its mountainous character.

The raw water, owing to the lengthy period of storage allowed, is never excessively muddy when applied to the filters. It is soft and free from noticeable amounts of color.

The filters are eleven in number, and have a total area of 3.04 acres. Prior to its application to the filters the water passes through a small settling reservoir of a capacity of 1,000,000 gal. The distributing basins are 5 in number and have a total capacity of 260,000 gal.

There are at the present time 11,581 services in the city, 2,576 of which are metered. There are 1,173 fire hydrants. The works were designed to serve a population of 250,000. In 1904 the population of Kobe was 295,276.

The water consumption ranges from 20 to 40 and averages 30 gal. per capita daily. The total cost of the system to date is $1,468,640.

Nagasaki Water Works.—These works were put under construction in 1889, and consist of impounding reservoirs, slow sand filters and distributing reservoirs. It is a gravity system throughout.

The original works were designed to serve a population of 60,000, but have since been extended to serve 182,000. In 1904 the population of Nagasaki was 159,041.

The impounding reservoirs are three in number and have a total storage capacity at a daily average consumption of 1,680,000 gal. or 293 days supply, or 493,000,000 gal. The supply is drawn frrom small mountain streams.

From the storage reservoirs the water flows to the slow sand filters, nine in number and having a total area of 2.36 acres. From the filters the water flows to four clear water basins, having a total capacity of 2,930,000 gal., from which it is distributed by gravity to the city.

At the present time there are 5,001 services in the city, 953 of which are metered. There are 492 fire hydrants.

The total cost of the system to date is $788,080.

Hiroshima Works.—Construction work was begun in 1896. Population in 1904 was 127,117. The works were designed to serve a population of 120,000. The source of water supply is the Ota River. There are two settling basins with a total capacity of 1,200,000 gal. The slow sand filters four in number, have a total area of 1.75 acres. The clear water basins, two in number, have a total capacity of 950,000 gal. Water consumption ranges from 15 to 40 and averages 28 gal. per capaita. There are at present 6693 services in the city, 1610 of which are metered. There are 709 fire hydrants. The total cost of the system to date is $465,560.

Shimonoseki Works.—Construction work was begun in 1900. Population in 1904 was 46,905. The works were designed to serve a population of 60,000. The supply is derived from small mountain streams. The impounding reservoir has a capacity of 286,000,000 gal. There are three slow sand filters with a total area of 0.87 acre. There are two clear water basins with a total capacity of 270,000 gal. Distribution is by gravity. Total cost of the works to date is $449,080.

Okayama Works.—Construction work was begun in 1900. Population in 1904 was 81,324. The works were designed to serve a population of 80,000. The source of supply is the Asahi River. There are two settling basins with a total capacity of 3,090,000 gal. There are four slow sand filters, with a total area of 1.31 acres. There are two clear water basins with a total capacity of 810,000 gal. The total cost of the syystem to date is $401,900.

Akita Works.—Construction work was begun in 1903. The population in 1904 was 33,695. The works were designed to serve a population of 40,000. The source of supply is drawn from the Asahi River, a branch of the Omono River The settling basin has a capacity of 100,000 gal. There are two slow sand filters with a total area of 0.66 acre. The capacity of the clear water basin is 750,000 gal. The total cost of the system to date is $235,150.

Hakodate Works.—Construction work was begnu in 1898. Population in 1904 was 88,071. The works were originally designed to serve a population of 60,000, but have since been extended to serve a population of 150,000. The supply is drawn from Aka River. The storage reservoir has a capacity of 1,530,000 gal. The water is not filtered. There are two distributing reservoirs the total capacity of which is 1,920,000 gal. The daily water consumption ranges from 22 to 35 and averages 26 gal. per capita. There are at present 2,509 services in the city, 729 of which are metered. There are 410 fire hydrants. The total cost of the works to date is $229,310.

Sawarazawa Works.—Construction work was begun in 1898. Population in 1904, was 1,396. The works were designed to serve a population of 1,229. The supply is drawn from small mountain streams. The impounding reservoir has a capacity of 300,000 gal. The water is distributed by gravity direct from this reservoirs to the consumers. The total cost of the works to date is $5,060.

Iizuka Works.—Construction work was begun in 1898. Population in 1904 was 1,240. The works were designed to serve a population of 1,085. The supply is drawn from mountain streams. The impounding reservoir, from which the water is distributed direct by gravity to the consumers, has a capacity of 200,000 gal. The total cost of the works to date is $4,090.

Kamiura Works.—Construction work was begun in 1900. Population in 1904 was 2,165. The works were designed to serve a population of 2,500. The source of water supply is the Ushimaki River. The water is applied direct to a small sand filter (area .017 acre). The clear water basin has a capacity of 22,000 gal. The total cost of the works to date is $3,410.

Water Works of Shanghai.—Shanghai is located on the east coast of China, south of the Yellow Sea and near the mouth of the Yang-tse-Kiang. It has a population of about 600,000. The water works were built with the particular object in view of supplying the foreign population of that city with pure water. The total number of people tributary to these works at present is in round numbers 45,000, of which 12,000 are of English and American birth and the remainder Chinese.

The water supply is drawn from the Hwang-ho River, the waters of which are normally very turbid, as is the case with all rivers emptying into the Yellow Sea. In fact it is the excessive muddiness of such waters as those of the Yang-tse-Kiang and Hwang-ho that gives the name to the Yellow Sea, the waters of which are colored a deep yellow for more than a hundred miles from the mainland of China.

The raw water is raised from the river by two centrifugal pumps of local make and discharged through two 20-inch pipes into the settling basins. These basins are four in number and provide a period of sedimentation of about 25 hours.

From the settling basins the water is applied to slow sand filters of which there are twelve. The areas of these beds range from 1/6 to 1/3 acre. Considerable fine clay remains in suspension even after a preliminary sedimentation of 25 hours, and the filters require scraping at intervals of one month or less.

Passing the filters the water flows to a clear water reservoir having a capacity of 6,000,000 gal., and is pumped therefrom through one 25-in. and two 20-in. mains to the consumers. The daily pumpage ranges from 5,000,000 to 7,000,000 gal.

The construction work in this plant is high grade, and the filters are very efficient notwithstanding the fact that they are somewhat overworked at times.

Singapore Water Works.—Singapore is located on the Island of Singapore at the southern extremity of the Malay Peninsula. The island is about 250 square miles in extent and is separated from the mainland by the narrow Straits of Tebrau. The population of the city is estimated at 200,000.

The water supply is derived from small jungle streams which drain about 28 square miles. The storage reservoir is located on Thomson Road a short distance outside the city and has a capacity of about 1,000,000,000 gal. The raw water is not particularly turbid, but is always highly colored. Much of the time the water has a strong fishy odor and to the taste is often highly objectionable.

The raw water flows from the storage reservoir by gravity to the outskirts of the city where the filtration works are located. The filters are of the slow sand type, eight in number, with a total filtering area of 2 acres. Operation is intermittent; that is, the beds are allowed to rest empty about 12 hours in every one to two weeks, the length of the operating period varying according to the season. By this procedure it is understood that a considerable degree of success has been achieved in removing the objectionable tastes and odors from the water, although at the time of the writer's visit, July, 1905, the filtered water had a pronounced "fishy" odor. The actual rate of filtration is said to be about 1,050,000 gal. per acre in 24 hours, corresponding to a daily yield of about 2,100,000 gal. for the eight filters. The average daily consumption is said to be about 5,000,000 gal. daily.

Water Works at Bethmangala, India.—These

works were constructed in 1903-4 for the purpose of supplying the Kolar Gold Fields with pure water. The gold fields are located in the State of Mysore, in southern India, and about 60 miles from Bangalore. The water works are located just outside the village of Bethmangala and about 7 miles from the gold fields. Up to the time of installing the present works the water supplied to the laborers at the mines was not only of extremely poor quality, but very scarce, a small given amount being allowed each laborer daily. These laborers are chiefly natives, but there are also, it is understood, some 800 English miners among the 20,000 workers at the mines.

The water supply is derived from the Palar River upon which the large storage reservoir at Bethmangala, together with many similar reservoirs used chiefly for irrigation purposes, is located. The capacity of this reservoir is 1,737,612,000 gal., sufficient at a daily consumption of 2,400,000 gal. for 724 days supply. The rainfall at Bethmangala averages only about 17 in. annually and the raw water is deeply colored, and at times high in suspended matter. (A number of the details which follow have been taken from an article by the designer of these works, Mr. E. B. Weston, and published in The Engineering Record, Dec. 17, 1904, acknowledgment of which is hereby made.)

As to the filtration and distributing system, the raw water enters a masonry inlet chamber located in the Bethmangala reservoir and thence flows by gravity to a suction well adjacent to the filter building from which it is raised by two lift pumps to the coagulating basin. The coagulant (sulphate of alumina) feed enters the raw water pipe leading from the low lift pumps to the coagulating basin. After four hours continuous coagulation and subsidence the water passes over outlet weirs into the supply pipe leading to filters of the American type. Passing the filters it is discharged through Weston automatic controllers into a flume and thence into the clear water basin, being raised thence by high lift pumps through a 16-in. main to the Kolar gold field against a total head of about 500 ft.

The coagulating basin, located just outside the filter building, is uncovered, is constructed of granite masonry and lined inside with brick laid in "surki" mortar. The floor of the basin is of concrete. The basin is divided into two sections by a partition wall and has a capacity of about 400,000 gal.

The filters, four in number, are of the Jewell gravity type, circular in plan and built of granite masonry. Over the manifold collecting system is placed a thin layer of gravel surmounted by 3.5 ft. of fine sand. Each filter has a rated capacity of 620,000 gal., corresponding to a total capacity for the four filters of 2,480,000 gal. per 24 hours. The rate of filtration is automatically controlled by means of Weston effluent controllers.

The clear water basin is located about 30 ft. from the filter building, is below ground level and covered. The basin is built of granite masonry and the roof of masonry.

There are two low lift pumping outfits with a total capacity of 5,280,000 gal. per 24 hours, and three high lift outfits of the Worthington type of a total capacity of 3,600,000 gal. per 24 hours. There is also a centrifugal pump for washing the filters having a capacity of 2,000 gal. per minute. The last named is belt-driven by a Pelton wheel operated with water from the 16-in. high pressure main. Steam to drive the high and low lift pumps is supplied by two Babcock & Wilcox boilers, each of 225 h.-p. with Green economizers.

There is a stand tank at Champion Reefs Mine in the gold fields, built of brick laid in cement mortar. All the filtered water is pumped to this tank from which lead branch lines to similar tanks located at the different mines, and to the service reservoir at Robertsonpet, a town about a mile distant.

The works were designed by Mr. Edmund B. Weston and built by the Jewell Export Filter Co., for whom Mr. R. W. Lawton acted as superintendent of construction. The amount of money appropriated for this work was $324,000.

Since the works were completed periodic analyses of the raw water and filtered water have been made by the official bacteriologist of the Mysore Government. The average results of the test made during the period Sept. 8-11, 1906, the last results available to the writer at this time, showed 4,350 bacteria per cubic centimeter in the raw water and 13 in the filtered water. Cholera, which prior to the installation of these works was very prevalent, has been practially absent among the employees of the mines since the works were put into operation. The filter plant itself is a model of neatness, and is operated in the most intelligent, painstaking and efficient manner.

Calcutta Water Works.—Calcutta is located in the province of Bengal, on the right bank of the Hugli River and about 45 miles inland from the Bay of Bengal. The present population is estimated at 1,100,000.

The Hugli River, from which Calcutta derives its water supply, is the most western branch of the Ganges. The drainage area of the Hugli is about 25,000 square miles, although in addition to the run-off of this watershed considerable excess flow from the Ganges enters the Hugli during July, August and September, when the flood season is at its height, through the Bhagirathi, Jellinghi and Matabanga Rivers which connect the Ganges and the Hugli above Palta.

The waters of the Hugli River are normally very muddy, and at times, especially in the rainy season, excessively so. A better idea of the effect on the muddiness of the water produced by the heavy rains which occur in the rainy season may be had from the statement that while the average rainfall in this vicinity amounts to only about 60 in. annually, as much as 40 in. has fallen in a single week, and in 1900 the rainfall on two successive days was 14.5 and 10.8 in.

The river water at the intake at Palta is subject to tidal influences; in fact the rise of the tides is felt 75 miles above this point. During the dry season, namely, February to June, the water is quite brackish for a part of practially every day, necessitating a cessation in pumping for substantially one-half of the time.

The original works were put under construction in 1867, greatly enlarged in 1888, and now consist of two pumping stations where the water is raised from the river, settling reservoirs, slow sand filters, and gravity conduits to a reservoir on the outskirts of the city. Auxiliary pumps here force the water through mains direct to the consumers in the northern part of the city, the remainder being discharged into three reservoirs, two situated in the town and one in the suburbs, from each of which it is pumped to the remainder of the consumers.

The original settling basins, construction of which was begun in 1867, are six in number, and are built of masonry. Four are provided with semi-concentric silt-catching pits and two are plain. The original basins are each 500x250 ft., and range in depth from 7 to 9 ft. The total capacity of these six basins is 21,000,000 gal.

The "new" settling basins, finished about 15 years ago, are merely earth excavations, puddling being practically dispensed with. Notwithstanding the fact that these basins are excavated in a sandy clay the leakage amounts to practically nothing. Two of these basins are each 2,500 x 350 x 9 ft. deep. The remaining two basins are each 2,500 x 250 x 9 ft. deep. The total capacity of the four basins is therefore 84,000,000 gal., making a total capacity for the six original and four new basins of 105,000,000 gal. These basins are worked on the fill and draw plan and the period of sedimentation is therefore variable.

As the water enters the settling basins it is treated for approximately three months in the year, namely, during the rainy season of July, August and September, with aluminoferric. The chemical is applied in the proportion of about 2 grains per gallon, although the method of application precludes accurate measurement. A bag of chemical is suspended directly over the inlet, and is dissolved by the inflowing water. The aluminoferric costs about $20.50 per ton delivered at the works.

The original filters are twelve in number, each 100 x 200 ft., corresponding to a total filtering area of about 5.51 acres. The filtering material consists of 30 in. of fine river sand supported on 4 in. of course sand and 12 in. of graded gravel, respectively. The effluent collectors consist of small cross drains covered with tiles. These drains lead the effluent to main collectors laid along the center of the beds and these main drains deliver the effluent into collecting wells from which it flows directly into the conduits leading to the auxiliary pumping station on the outskirts of the city.

The new filters are twenty-four in number, each 200 x 100 ft., corresponding to a total area of 11.02 acres. In construction these filters are in general the same as in the case of the original filters, with the exception that the effluent collectors consist of two courses of dry bricks laid sufficiently far apart to provide suitable waterways. The total filtering area of the thirty-six filters is 16.53 acres.

The average daily wastes consumption is estimated at 27,000,000 gal. daily (25 gal. per capita) and the actual rate of filtration at about 2,825,000 gal. per acre in 24 hours.

There are three effluent collecting wells in the plant, with a total capacity of about 42,000 gal., and from these wells the filtered water flows through two conduits to the outskirts of the city. The conduits are 4 and 3.5 ft. in diameter, respectively, and 12.5 miles long.

It is the custom at present to supply filtered water, to the entire city, under about 30 pounds pressure at the various distributing stations during the day hours, excepting the hours 10 a. m. to 3 p. m. during which hours water is supplied under low pressure only to the more thickly populated sections of the city.

Filtered water is not used for street sprinkling, sewer flushing or fire extinguishing purposes, a complete separate unfiltered water system, being in use for this purpose, the water being pumped direct from the river into the raw water mains.

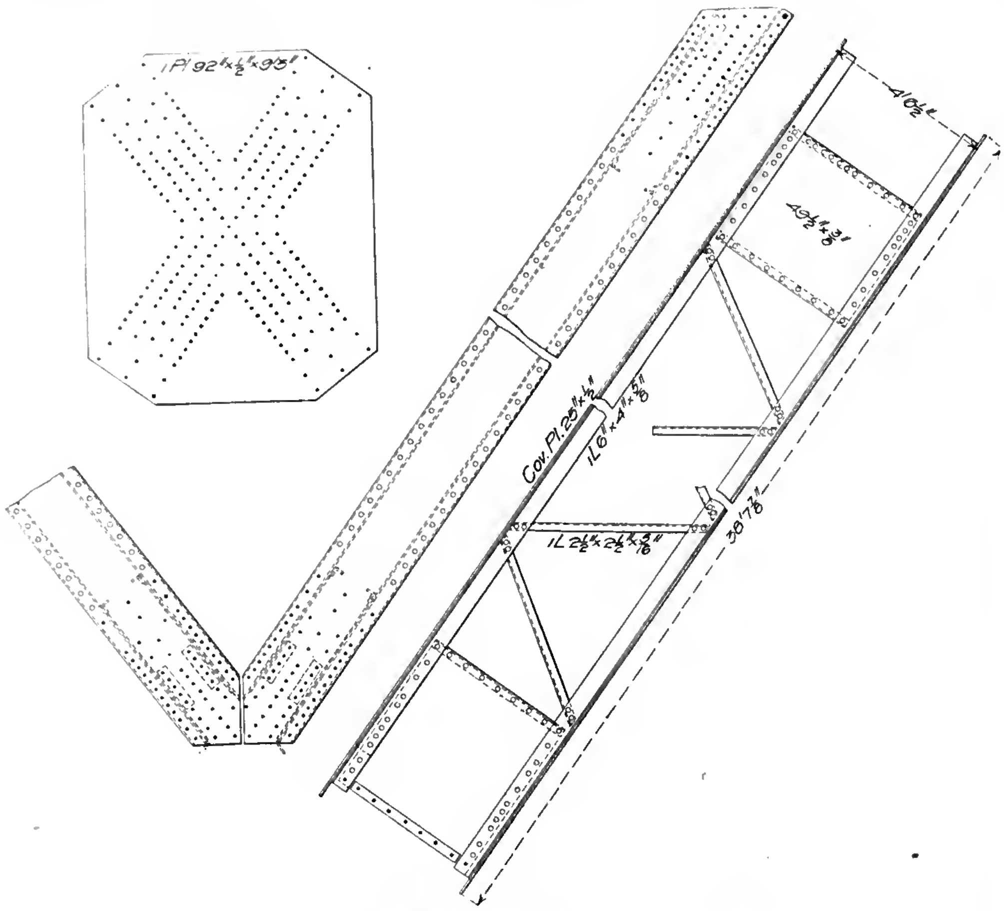
Tunnel Linings in Rock far below the surface are often considered exposed to extremely heavy pressures, which do not come into play immediately on excavation. According to Dr. Karl Brandau, such evidences of general pressure were never experienced during the construction of the Simplon tunnel. Where the superincumbent mass was greatest, the lightest type of masonry lining was almost universally employed, and has never shown the least sign of damage. Wherever merely local and unimportant pressures were observed, they were invariably due to decomposed rock of small internal cohesion. He therefore believed that no considerable difficulties arise from the pressure of the superimposed rock in the construction of a tunnel, even at depths of more than 6,800 ft., in good compact stone, though great difficulties are experienced in plastic material of considerable thickness.

The Quebec Bridge Superstructure Details.—Part IX.

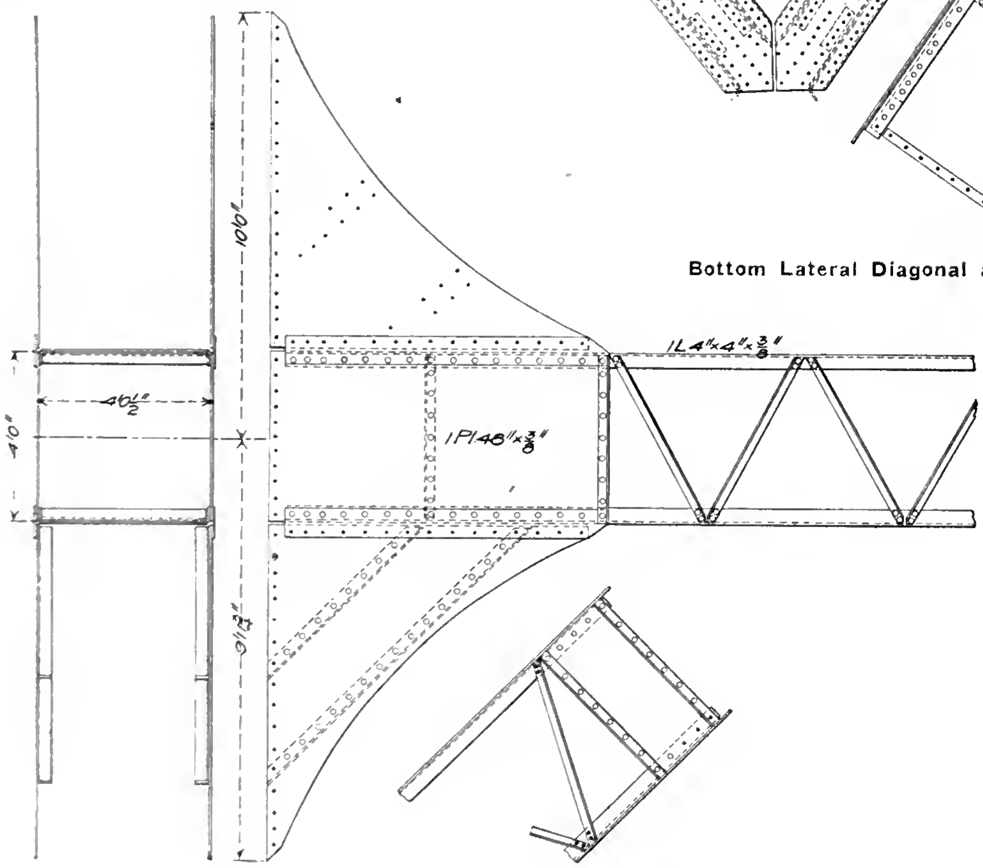
Transverse Bracing.—It is assumed that the bridge is exposed to a horizontal wind pressure of 25 lb. per sq. ft. on double the exposed surface of one truss and on one side elevation of the floor, one-half of the amount being static and the other half a live load. To provide for the stresses thus developed there are three lateral systems in the floor plane and in the planes of the top and bottom chords respectively, besides transverse bracing in the planes of all vertical posts. Horizontal shear is transmitted through special connections from the center suspended span to the ends of the cantilever arms and thence to the center posts where it is transmitted through the main transverse bent to the river pier. Wind stresses in the anchor arm spans are transmitted to the river piers and to the anchorage piers, reaching the latter directly from the floor system and the bottom chord and indirectly through the inclined end post and the vertical portal bents from the top chord system. The transmission of these stresses from the superstructure to the anchorage pier is effected by the very novel and ingenious connection illustrated in The Engineering Record of December 29, 1906.

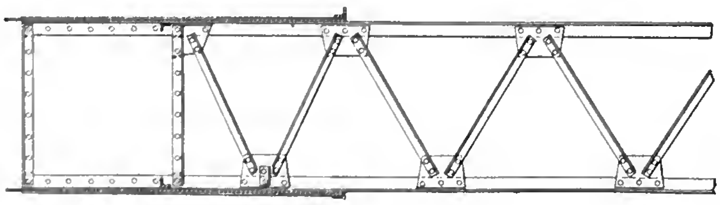
The top chords are connected by transverse struts at panel points and between them there are X-braces with I-shaped cross section having a uniform depth of 3 ft., and all of them made with two pairs of 6x3½x7-16-in. angles riveted together back to back and latticed. One of the struts is made continuous and the other is cut to clear it at the intersection where they are spliced together with top and bottom flange cover plates and vertical web-connection angles. The lattice bars are made with zig-zag angles having at each end two rivets in small gusset plates riveted between the vertical legs of flange angles. Their top and bottom flanges are field riveted between end connection plates at the ends of the transverse struts.

The top lateral transverse struts, like the diagonal members, are uniform throughout the anchor spans and have rectangular cross sections about 4 ft. deep and 4 ft. wide made with four 4x4x⅜-in. angles with their flanges turned inward and latticed on all sides by zig-zag 2¼x1½x5-16-in. angles with two rivets through the ends of each. Horizontal top flange plates project beyond each end of the struts and are field riveted to the top of the vertical post. The bottom flanges of the struts are also connected to the vertical posts at both ends by pairs of ⅜-in. gusset plate knee-braces 7½ ft. long which also serve as jaws to receive the field riveted connections of the X-brace diagonals. Horizontal and vertical batten plates are riveted to the four angles at both ends of the truss making a complete closed rectangular section there and stiffening it for the web plate connections with the diagonal struts.



Bottom Lateral Diagonal and Connection of Intersection.





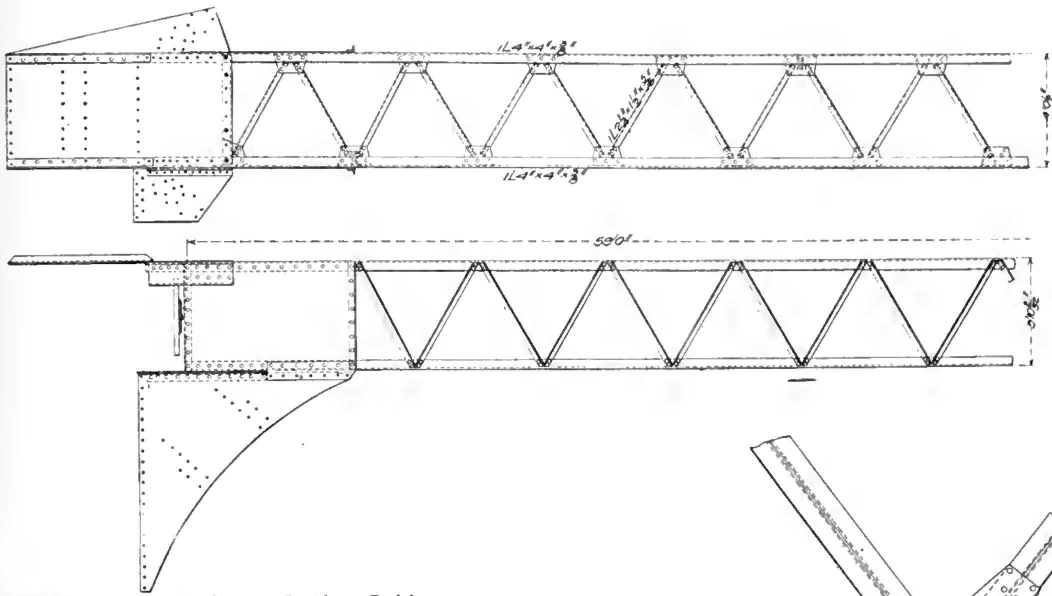
Intermediate Transverse Strut.

The bottom lateral system consists of transverse struts at panel points and intermediate X-bracing with diagonal struts having rectangular cross section 4½ ft. deep and 25 in. wide, made with four 6x4-in. flange angles riveted to 25x½-in. top and bottom cover plates and united by vertical latticing of 2x3-in. zig-zag angle bars. Both struts are cut to clear with mitred joints at the intersection where they are spliced by field riveted 92x½-in. flange cover plates 9 ft. 3 in. long and by vertical web connection angles on the side plates. The ends of the struts are field riveted between horizontal connection plates projecting from the lower chord flanges. The lower chord transverse struts are similar to the X-bracing.

All vertical posts are connected by top and bottom and intermediate transverse struts, the panels between which, excepting that which includes the space immediately above the railroad track, are X-braced with diagonal struts having rectangular cross sections made with four angles latticed like those of the transverse struts. At intersections they are cut to clear and spliced like the lower lateral diagonals and at the ends their flanges are field riveted between wide gusset plates on the ends of the transverse struts. At the end of the anchor arm the roadway is at the same level as the lower chord and has room for no transverse bracing below it. As the depth of the truss increases there are either one or two panels of transverse bracing below the roadway and the diagonal members have I-shaped cross sections made with angles back to back latticed. The transverse struts above the roadway have

very deep end cover plates field riveted to the flanges of the vertical posts with their edges curved to give a more pleasing outline. The projections of the plates below the horizontal struts serve as knee-braces and are stiffened by angle bracing frames like short trusses riveted between the inner faces of the plates and forming diagonals between the struts and the posts. In the deepest portions of the trusses special diagonals are provided in the panels just below the floor and their members virtually form portions of the trussed floor beams, as described in the last issue of The Engineering Record.

Mr. E. A. Hoare is the chief engineer of the structure and Mr. Theodore Cooper is consulting engineer. The contractor for the fabrication and erection of the steel work is the Phœnix Bridge Co.



Upper Transverse Strut. Quebec Bridge.

HEAVY EXCAVATION IN RED GRANITE has been carried on along the line of the Grand Trunk Pacific Ry. at a cost of 19.4 cents per cubic yard for drilling and blasting, by methods recently described in detail by M. G. P. McFarlane in the "Engineering and Mining Journal." In the smaller cuts, hand drills with 1-in. steel were used on holes to a depth of 30 ft. The holes were started with two hammers to the drill, and when down about 5 ft., the drill turner also took a hammer, for the rapid blows jumped the steel enough to bore a fairly round hole. Steam drills were generally used in the large cuts, a 3-in. machine drilling to 25 ft., and a 3¼ or 3½-in. machine to 30 and 35 ft. The cheaper grades of steel were used almost exclusively, as they were found to wear about as well as the high grade brands. Mr. McFarlane found it desirable to drill two holes 10 ft. on each side of the center line of the cuts and burdened not to exceed 15 ft. The advantage of this was that very little drilling was necessary to square up the bottom of the cut. Where the cut exceeded 30 ft., he found it best to take it out in two benches. After drilling, a chamber was formed at the bottom of the hole by springing with dynamite enough times to make a place to hold the blasting charge. The latter was figured at 60 lb. of black powder or 40 lb. of dynamite for each 100 cu. yd. of the shot. The advantage of machine drilling was evident in the springing necessary to make the chamber, for heavy springing causes the rock to shift at times and the larger holes drilled by machines permitted considerable shifting before the hole was finally closed off. The slips and floors caused by springing put a practicable limit to the size of the blast, which was reached with 30-ft. holes burdened 15 ft., and throwing out 400 to 800 tons of muck.

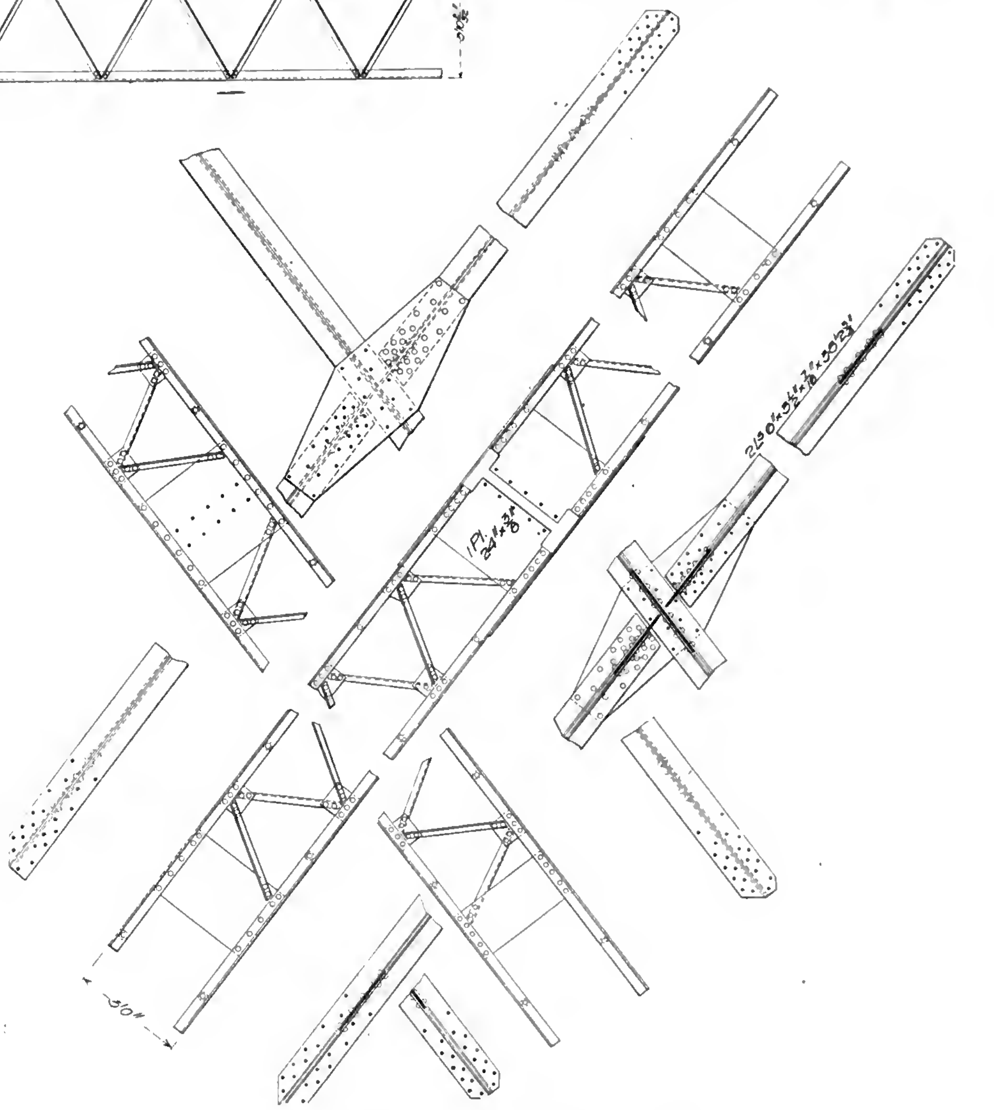
The Library System of Stone & Webster.

At the Asheville meeting of the American Library Association, a paper of unusual interest to engineers was read by Mr. G. W. Lee, on the library system of Stone & Webster, of Boston. This firm with its Engineering Corporation and their departmental offices, has the general control, including operation, engineering and financing, of some thirty public service corporations in various parts of the country, from Maine to Texas, from Puget Sound to Porto Rico, with also one in Cape Breton. Besides these, which have to do with gas and electric lighting, electric railway and power transmission, are three other industrial enterprises which would add electrochemical and textile manufacturing interests to the list. The library is at the service of them all, though particularly for the use of the headquarters in Boston.

Questions.—It is impracticable to give anything like a complete list of the questions and requests that come for immediate attention or for extended research, but a selection serves to indicate the scope of information which the library endeavors to have ready access to. The following are fair samples of what one would expect to find on the record of demands: (1) Underground conduit systems, more particularly the cost. (2) Periodical references on the grounding of the secondary. (3) Write-ups on power plants of Kansas City and Minneapolis. (4) Central station economies by Goldsborough and Fansler at the Niagara meeting of the A. I. E. E., July, 1903. (5) References on getting shocked through electric conductivity of fire streams. (6) The use of peat gas. (7) Vacuum system vs. direct steam heating. The answers to these particular questions were, for the most part, found through the indexes to the technical journals; though requests for works on railway construction, for methods of estimating population, for a book on boilers and stokers, and for information on the measurement of water flow were answered in other ways.

Questions of names and addresses frequently come up and, still more than the preceding, call for experience, besides familiarity with a number of reference books. They are such as might arise in almost any office, viz: (1) Name of Secretary of State of Texas. (2) Vice-President of Milwaukee, St. Paul & Sault Ste. Marie R. R. (3) Initials of Mr. Blackman, president of Rollins College. (4) How to spell the name of an automobile resembling "Michelon." (5) Is Charles S. Sperry's title "Captain Sperry?" Almanacs, newspaper directories, Who's Who, the advertising pages of trade journals, etc., are obviously possible sources of information for some of the above questions.

The group of questions concerning spelling, rhetoric, etc., like the one immediately preceding, includes the sort of questions people in general are likely to want answered, while savoring also of the personal use of the Library. The following are typical: (1) Is s always added for possessive singular after an apostrophe when a



Top Lateral Diagonals, Quebec Bridge.

word ends in s, i. e., is Davis' as correct as Davis's? (2) Authority for spelling to-day and to-morrow without a hyphen. (3) Authority for the spelling Phenix, Ala. (4) Is basket-ball one word or two words? (5) The abbreviation for mid-night. There has been many a failure to find rule or authority for much that one would expect to be settled by our ordinary dictionaries, encyclopedias or rhetorics. Particularly disappointing is it not to find cut-and-dried rules for addressing persons in public office.

Less obviously, to the uninitiated, the following list seems to bear upon the interests of street railway and lighting companies, viz: (1) Wealth of the United States and of the World. (2) Cost of living in Mass. for a number of years back, also an average for the whole United States. (3) Weights of different kinds of vegetables per bushel. (4) Altitudes of various cities. (5) Average temperatures of various U. S. cities. (6) Data on Key West. (7) Lumber shipments from Florida ports in 1904. (8) Is Savannah the greatest naval stores port in the world? It is such questions as these that stimulate one to preach a crusade for inter-library, inter-state, inter-national reference work, a clearing-house system for all human demands. But the people who ask these statistical questions are hardly interested in such Utopian ideas. They want their answers, and the frequency of such questions and the insistent demands to have them answered or to be put in the way of obtaining the answers, leaves Mr. Lee little time to work upon the construction of a royal road to anticipating all answers for all time to come.

Somewhat akin to the preceding are several of the following: (1) Discount on Cyclopedia of Applied Electricity for cash payment. (2) Standard works on financial matters, currency, banking systems, etc. (3) Should coal mine earnings be charged as railroad earnings where a railroad owns the mine? (4) Rates of interest of Interborough Railway notes. (5) Compound interest tables for annuity calculation. (6) The financial side of the Chicago traction situation. (7) Bank clearings for Seattle for 1905. (8) Assessed valuation of Seattle. (9) Comparative statements of the call and time money rates for the last six months of 1906, also the combined reserves of the clearing-house banks of Montreal. Finance is perhaps the common factor of business life, and a certain routine of reference books and experience enables one to put the questioner readily in touch with the answers to many questions of this kind, though one or two of the above proved to be puzzlers.

Again and again Mr. Lee has found that an apparently easy question has proved hopeless to answer. Look for the date of opening of the first interurban and see if you can readily find it. So also try to find in the ordinary rhetorics the proper way to address a woman's association: whether "Dear Madames," "Dear Mesdames," "Dear Sirs," "Ladies," or what not. In the actual case of this kind that came up the answer was obtained by telephoning the association in question and thus getting the answer from headquarters, "Dear Mesdames."

The inter-reference of office departments is of vital importance in the solution of many questions. The following were thus conjointly answered; and presumably the work of the Library in these instances was discharged in a few words, at a saving of much time: (1) Laws and ordinances governing Seattle elections (Ref. to Corporation Dept.). (2) Information on galvanizing (Ref. to Statistical Dept. and to Mass Institute of Technology). (3) Shall we buy the earlier volumes of transactions of Am. Institute of Mechanical Engrs.? (Ref. to Eng'g Dept.). (4) Capitalization of Turners Falls Pr. Co. (Ref. to Securities Dept.). (5) Cost of electric railway construction (Ref. to Statistical Dept.). (6) Trade catalogues or bulletins on file giving details of alternating current elevator equipment (Ref. to Purchasing Dept.). More questions are thus referred than the record shows, while of course the inter-working of all parts of the organization is something to be encouraged. Significant is the following extract from an address at a recent dinner of members of the office:

"One of the best known Americans to-day is our fellow-citizen of Boston, Edward Everett Hale. He has certain phrases that mean much, which he uses over and over again. They are the keynote of one of the most useful lives that has ever been lived. The principal phrases are, perhaps, 'Lend a hand' and 'Together.' In that way—together—an organization can accomplish more than in any other way, and we are here tonight to emphasize that word."

Libraries, clubs, societies, public depts., etc. The following questions were answered, successfully or otherwise largely by an appeal to resources without the office sometimes merely by telephoning, sometimes by a visit to the public or other library, club, etc.: (1) Book on hydraulic accumulators (Books from Public Library). (2) Description of patent granted to W. N. Patten and others on leather machine about four years ago (Ref. found at Public Library). (3) Hermann's map of Oregon (Not found in office or in Public Library). (4) Growth of region near Philipsburg, Pa., through which Center and Clearfield Railway runs (Letters to local library and newspapers without satisfaction).

Kindred to the above are the following, some of whose sources of information are discussed later: (1) Concrete dwelling houses (This was in 1905, when a trade catalogue obtained of an agent seemed best source of information). (2) Latest specifications for structural steel of the American Association of Steel Manufacturers (Obtained Pocket Companion from Carnegie Steel Co.). (3) Resistance of steel wire (Information obtained by letter from manufacturers). (4) Cost of heavy machine tools (Advised to appeal to manufacturers or dealers). (5) Balanced draft system, referred to in the Electrical World of 12|23|05 as to be used by Hudson River Power Co. for Utica plant (Information obtained from the publisher by letter). (6) Practice in interurban bridge design for various live loads (Learned from publishers of Street Railway Journal that articles thereon were about to appear in their publication).

The following suggest particularly the problem of how to develop the Library: (1) Bauxite in Ga. and Ala. and areas of deposits. (2) How to dispose of 51 volumes of the Transactions of the American Society of Civil Engineers? (3) Effect of crowded English cities on public health. (4) Efficiency of transmission lines. (5) Resistances of alloys. In considering the above the following questions arise:

(1) How far shall we stock the Library with data on mineral resources? Out of our usual line, but likely to come up, are questions similar to the one regarding bauxite, as experience has shown.

(2) What shall we do with good things that take up room but are not in immediate demand? With the mass of literature that is out of date, superseded, dead, or otherwise supernumerary so far as our purposes are concerned? At present we have what we call a "give-away sale," which means that most of the material is thrown into the waste-basket. The particular question of disposing of the 51 volumes was personal, being asked by one of our engineers. Likely enough, in the near future we would gladly purchase them at a high price. Meantime supply and demand fail to meet.

(3) The question as to the effect of crowded cities characterizes the wide range of the work and the need for bearing in mind general articles that may have to do with the extension of trolley lines for increasing the suburban population. How shall we keep in touch with these broad ideas without spending on them more time than is justifiable? It is almost the same question as "What shall we read in the magazines?"

(4) The efficiency of transmission lines was a question soon dropped as not at the time likely to be answered. It suggests, however, the need for keeping alive to the literature of efficiency. Often data of this kind are so much the stock-in-trade of its possessors that they are loth to publish them. How much, then, shall a private library attempt to publish of what the concern has obtained as a business asset? The concern itself must settle that. There are those who say, "Get all you can and tell as little as you can." If therefore we tell everything, who is going to confide in us?

(5) Resistance of alloys. Data on this point were readily found in several books a little differently stated in each. Why not go to the same book as often as possible and in the future assume that this is the book responsible for the data which may be disputed.

The following questions came up more than once, sometimes however in a little different form. They emphasize the importance of keeping a copy of each bibliographical list that is made, lest there be a subsequent call for it; also the importance of better team work throughout the departments, so that if one man studies a special subject the fact will be known before others start to study it. (1) Copy of contract to build Panama Canal (Obtained once or twice before, but mislaid). (2) Air lift pumps for water (Wanted by two or more engineers at different times). (3) Auxiliary station uses (Seems to have been asked from the engineering and also the advertising standpoint). (4) Books on municipal ownership. (Demands for such literature would warrant some good bibliographical work). (5) Articles on depreciation (Requested by several specialists). (6) Motor cars on steam railroads (This and the two following show a series of kindred questions). (7) Gasolene car on Delaware & Hudson R. R. (8) Literature on gasolene cars, such as tried on Union Pacific.

The following requests were fulfilled in a variety of ways. In two or three cases some one happened to remember that somebody else knew the answer; in others a good guess was made at what the questioner intended, or luck in some form helped out. The human element enters into business of every kind, and we can hardly hope, in this generation at least, to solve all our questions by the luxury of a push-button or nickel-in-the-slot machine.

(1) References on electrical fountains. (2) Household refrigerating machine and electrically operated carpet-cleaner said to be advertised by Edison Co. of Boston. (3) Equation of hysteresis. (4) Article in Street Railway Journal a few months ago on "long-distance engineering" (i. e., "designing at arm's length"). (5) Volume of an engineering magazine (not American) that the petitioner had borrowed two months ago or so. (6) World's Fair official guide giving altitudes (i. e., World Almanac). (7) Bullinger's buyers' directory (i. e., "Hendricks' Commercial Register"). (8) Get me that sheet of paper which I said, "Look out or it will be lost." (9) Please file this paper in such a way that it can be found even if the one asking for it "don't know what they want."

Sources of Information.—The sources of information may be classed as follows: a, Documents, mostly typewritten, the records of the business. b, Books, pamphlets and periodicals. c, Maps, atlases, etc. d, Indexes, catalogues, lists, etc. e, Other departments. f, Other libraries. g, Business undertakings, institutions and people in general. h, Miscellany: some unappreciated publica-

tions, emergencies, and matters of that sort.

One naturally expects that books and periodicals are the chief sources of information in a business library as in any other, else the term "library" were a misnomer. And yet misnomer it may in fact be when applied to this library; for the printed literature was taken on several years after the document file had been established, and in numbers there are perhaps fifteen times as many documnts on file as books and periodicals combined. Hence more properly the Library is called the Filing Department of the office, where literature is kept that may be needed for the purposes of the business. (There is also a Mailing Department where the correspondence is kept.)

In round numbers there are some 2,500 books and periodicals and 35,000 documents, the collection being added to at the rate of perhaps 25 a day in the proportion of something like one to fifteen—not a large Library, but one that aims to be and ought to be efficient for its purposes. The library force of six persons may seem out of proportion to the number of pieces on file or the results obtained; yet we are asking for still another to help us out.

The document file need be considered but briefly. It is largely typewritten matter, including propositions, statistical and financial papers of various kinds, legal papers such as franchises, petitions, mortgages, contracts and the like, also reports estimates and a manifold variety of engineering papers all bound in such documentary fashion as convenience requires. Maps and photographs, though considered as belonging to the Document File, are often of such sizes and make-ups as to require their own cabinets.

Up to 1900 there were a few bound journals and a small but growing list of reference books, precariously looked after and borrowed with little regard to their ever getting back. In the course of two or three years it seemed wise to have a goodly collection of technical journals dating from the beginning of the century. Later on it was deemed a convenience to have at hand a set of duplicate indexes (also dating from the first of the century) to obviate taking from the shelves volume after volume of the heavy and often dusty books in the process of looking up some fussy little reference.

The Library subscribes for upwards of sixty periodicals, including such popular ones as the World's Work and such technical ones as the London Electrician; and for about forty newspapers local to the cities in which the company has business interests. The Library makes much use of indexes and aims to keep in touch with book reviews while in the Purchasing Department are a large number of trade catalogues.

The Library tries to have all the topographic maps that the Government has published, for who knows whence a proposition may come? It needs to know the nature of the country in considering an electric railway scheme; to know the course of rivers in considering water power electric transmission schemes. It would like to have to-day the topographic maps that were published yesterday; but how can we arrange this, since the Geological Survey is not allowed to open accounts? The present method is to send three dollars about twice a year for "all the maps that have been published since our previous order," (asking for the balance in sheets that are usually duplicates for us and often of mere waste paper value). In addition to these Government maps there are the Rand-McNally state and city maps, besides those of the Scarborough Company and of many other publishers for the different localities in which the company is interested; so also the Century Atlas and the yearly Rand-McNally Business Atlas, also some atlases local to Massachusetts. There is also the List of Maps of North America published by the Library of Congress, and when recently a map of the Arctic Ocean was wanted this publication was a suggestive source for reference.

The Engineering Index, of several volumes, from 1884 to the annual of 1906, inclusive, with also its monthly issue, makes a good starting point for engineering research. Not satisfied, however, with even the annual volume, the monthly issues are clipped and pasted in classified form, so as to have ready references as nearly to date as practicable. Another great convenience is a collection of duplicate indexes, which has proved a great time saver at little extra expense. Ten to fifteen cents is the usual cost of such indexes as we care to keep in duplicate, while several of them are incidental to our subscriptions to two or more of the journals that we refer to oftenest. An index to the more general periodicals, including also some of the important engineering and statistical monthlies and a few of the weeklies, is the Reader's Guide, most familiar to librarians. The very inefficient or careless indexing of some of our most important journals emphasizes the need for having at hand more than one source of reference. Frequently an article is found in one journal through a digest or abstract of it in another. Notably the convention papers of the engineering societies are found first through their abstracts in the trade journals whose indexes appear earlier and are of wider scope than those of the societies' transactions.

The office is decidedly departmental, the other departments being (alphabetically) the Accounting, Auditing, Corporation, Executive, Mailing, Securities, Statistical, Stenographic, Transfer, and Treasury. The managers in the field, the men sent out to take charge of interests in various parts of the country, and all who are under their control, should be included as having the Library directly or indirectly to assist them. By the way of indicating the size of the organization Mr. Lee quotes from the address of the chairman at the dinner recently held for the office members. He said: "I have made some calculations as to the extent of this Stone & Webster organization. There are about 350 men at present immediately connected with the organization as it is established here in Boston. That includes all the men here, the men of the Stone & Webster Engineering Corporation, the Managers and some others in the field. Now under the control and subject to the direction of these 350 men there are some 12,000 to 15,000 employees, or something over an army division usually placed under the leadership of a Major General."

The above signifies that here are not only many people for the Library to serve, but many from whom it may obtain facts, for whom, therefore, it should act more and more as the clearing-house of information. On request for a description of the Taylor Underfed Gravity Mechanical Stoker, the Library referred to the Purchasing Department for a trade catalogue. When asked as to the best books on gas it referred to the manager in charge of the Fall River Gas Works Company. To decide whether it is worth while to add this or that book to its files, the matter is frequently referred to such departments as have the subject of the book for their specialty. To obtain statistics, maps, etc., of the various cities in which Stone & Webster are interested, circular letters have from time to time been sent to managers in the different localities.

The Boston Public Library, the several libraries of the Massachusetts Institute of Technology, the State Library, the library of the Boston Society of Civil Engineers and a few other local libraries, have been helpful sources of reference. Of these the Boston Public Library is used far the oftenest, not only for emergencies, but habitually for looking up new books.

The Document Catalogue of Government publications, the encyclopedias in general, the Statesman's Year Book, the almanacs, the city directories, the pathfinders, the telephone books (of other cities especially) are among many sources of information that we fail fully to appreciate. Mr. Lee called particular attention to the telephone book as a convenient directory.

Mobilizing and specializing are, of course, important features of a business library. For instance, when the company began to consider sociological questions such as municipal ownership and the like, the Library was weak in the number of books of this kind. One of the potentates expressed himself in strong language regarding the Library's weakness on this point, and so a sweeping order was given which soon equipped it with all the books particularly wanted.

The filing is geographical as far as practicable, that is, the Library assigns the number 1100 to the State of Maine, 1110 to a tenth of it, 1111 to a tenth of that; 1200 to New Hampshire, 1210, 1211, etc., to its divisions, and so on throughout the country. The first figure to the right of the decimal is assigned to the company, the rest are for class divisions, 1 for estimates, 2 for statistics, 3 for legal matters, etc., with their subdivisions. Books defy geographical classification for the most part, so that they are shelved generally with numbers only to the right of the decimal. The decimal idea prevails in the Library, though not the Dewey system.

The items of the "Engineering Index" are clipped and pasted in sub-classified form, on convenient sheets for reference purposes. The classification was provisionally made four or five years ago by playing a long game of solitaire with the clippings of the monthly indexes of some two years and a half. With the progress of engineering new terms and ideas appear so that the classification needs continual revision. In the main this classification is a sub-dividing of the general divisions and sub-divisions as given in the Index, the asigning of the number 10 to civil engineering, 11 to bridges; 12 to construction, etc.; 20, etc., to electrical engineering; 30, etc., to mechanical engineering; 40, 50, etc., to other branches; and to the minor divisions, under bridges, 11.1 for arches, viaducts, trestles, etc.; and 11.11 for arched bridges and arches in general. So it is throughout the whole, the 60's and over being reserved for personal matters and sources of information that are not covered by the Engineering Index.

The "Stone & Webster Current Literature" is a private engineering index made from noting on slips, of card index size, articles of interest in the current periodicals, book accessions and various announcements and memoranda, and listing them on typewritten sheets—or printed ones as a recent innovation—with nearly the same classification as used for the Engineering Index. The items are selected as being of interest to the Stone & Webster organization, and, though distributed to a certain extent gratuitously, its usefulness to others is necessarily limited. This printed form is planned as a quarterly publication, but it lags too far behind for current purposes. Hence, in mimeograph form there is issued for office reference what are called Semi-Weekly Specials. These, of course, do not admit of the same refinement of classification as the less frequent ones, though the main general divisions are used and serve for convenience in back reference.

Of what worth in dollars and cents is the Library to the organization? It is charged in the accounts as an expense, and some members of the office regard it as a colossal expense. Once in a while, however, just such persons may have some question answered which enables them to see that thereby plans in their work have been changed to effect the saving of thousands of dollars, and for this reason there seems to have been a healthy growth of the idea that the Li-

brary is a good thing and ought to be maintained in spite of all objections. Mr. Lee feels that when his department is more closely in touch with other libraries and getting information from various parts of the country to a much greater degree than heretofore, there will be decided evidence of what this department is, what it does, and what it can do for the benefit of the organization. It is too much in its infancy as a feature of business life to be accepted as a matter of course.

A Sewage Disposal Problem at Hanley, England.

The new sewage disposal works at Hanley must fulfil some unusually troublesome conditions. The engineers who designed them, Messrs. Willcox & Raikes, of London, were obliged to construct them on a very small site, within a short distance of numerous houses where any odor would cause serious annoyance. In designing the works it was necessary to provide treatment for dry weather sewage amounting to 1,800,000 gal., and wet weather sewage of 10,800,000 gal. In addition to making this provision for a wide range in capacity, the effluent must be discharged into a very small stream, which has a flow during the summer equal to but a small part of the volume of sewage reaching the disposal works. The sewage is first delivered into a screening chamber, from which it passes through three grit chambers having a total capacity of 410,000 gal., about a quarter of the dry weather flow. From the detritus tanks the sewage is discharged by gravity to low-level works or pumped to high-level works, any volume in excess of 10,800,000 gal. being allowed to pass into the river directly from the grit tanks, on the ground that it is too dilute to cause nuisance. The high-level works consist of four septic tanks of 2,460,000 gal. capacity, or 1⅓ times the dry weather flow, and 3¾ areas of bacteria beds. The low-level works consist of four septic tanks of 2,640,000 gal. capacity, and 5¼ acres of bacteria beds. These beds have walls of 14 in. of brick reinforced every 12 ft. by buttresses. They have concrete floors 6 in. thick with 6-in. semi-circular drains 6 ft. apart to carry off the effluent into a chamber where provision is made for allowing samples to be taken from the discharge of each ¼ acre. The filtering material consist of saggers, or refuse from the potteries in the vicinity. The beds are 4 ft. 9 in. thick and the material ranges in size from 2½ in. at the bottom to a top layer of particles from ¼ to ⅛-in. in maximum diameter.

The New Steel Plant at Gary, Ind., is to be developed immediately on an even greater scale than was originally contemplated, according to a statement issued last week by the United States Steel Corporation. The original appropriation to provide for the construction of the steel plant and the municipal works of the new industrial town adjacent to it was $75,000,000. The recently issued statement announces that an additional $45,000,000 has been set aside to be used in widening the scope and extent of the steel plant proper. Since the very extensive municipal works of the new town, which were described in The Engineering Record for July 20, 1907, are practically completed, and the vast amount of preliminary work required to develop the site of the steel plant is well under way, the additional funds will accordingly all be available for buildings and equipment for the steel plant. When it is considered that in the neighborhood of $120,000,000 is to be expended at once in forming this nucleus of the new industrial center at the southern end of Lake Michigan, the magnitude which that center may be expected to assume within the next few years is difficult to overestimate.

A Buttressed Concrete Dam.

The Beacon reservoir, a part of a gravity system of water supply, is situated just above West Point, N. Y., but on the opposite side of the river, on Mount Beacon, some 1,200 ft. above the high water level of the Hudson River, immediately back of the village of Matteawan, and was built for storing and furnishing a portion of the water supply for Matteawan, Fishkill-on-the-Hudson, the New York State Hospital at that place, and some important manufacturing establishments.. A storage reservoir is of course calculated to equalize the run-off-from the water-shed and the variations in the quantity of water flowing in the stream so as to produce so far as practicable, a sufficient supply the year through. The capacity of a storage reservoir, to be completely efficient when situated upon a moderate or small stream, should amount to the daily consumption multiplied by the probable number of summer and fall days during which the stream will be practically dry, or at least very much lower than the needed supply calls for; that is, during the hot months of August and September certainly, and perhaps during July and October as well, so as to provide against the actual use and wastage of water, besides the evaporation and whatever, if any, unavoidable leakages there may be from the reservoir itself and its conduits.

Also, the matter of spillway where the heavy rush of storm water is far above the ordinary flow of the stream needs careful attention, and, although the average rainfall per annum for the part of New York State under consideration is only about 48 in., it will be necessary for safety to provide spillway capacity for an impounding reservoir sufficient for the easy accommodation of the greatest quantity of water possible to reach such a spillway at any time; and this necessity was dramatically illustrated in a rather startling manner a few years ago at this very dam, when, in its form of construction previous to its present rebuilding and enlargement, the entire length of the dam was overtopped by a flood of storm water from an extremely heavy thunder shower, commonly called a cloud burst. In the reconstruction and increase in the height just finished, the new spillway was calculated for the heaviest known rainfall upon the water shed, was doubled in length, and was made about four times as deep as before, so that in all probability the area of watershed available, will be fully accommodated under the most extreme circumstances of storm water and run-off. From records kept since 1866 it is no doubt safe for supply to reckon upon 38 in. of water as the minimum rainfall for any year in this region, as 38 in. is the minimum for the period from 1866 to 1898, and very likely this amount will be greatly exceeded most of the time, and it will certainly be exceeded some of the time, as the average rainfall is 48 in. during the above-mentioned period for the Hudson Valley, from say, 10 miles south of West Point to 10 miles north of Newburg. The greatest rainfall for this period was 63.51 in. in 1888, the least rainfall was 38.33 in. in 1895; during 16 years of the 33, the annual rainfall was above the average, and during 17 of the years it was below the average. In 1869 and in 1891 it was very close to the average, just a trifle above; it was below 40 in. only two of the years, 1880 and 1895; and was below 44 in. during 8 of the years, 1872, 1873, 1874, 1875, 1876, 1880, 1883 and 1895.

The watershed of the Beacon Reservoir, on account of its lofty situation, is of so moderate an area that there is a limit to the profitable dimensions of the dam, but from the short and rapid run-off, the rock nature of the watershed surface, etc., it is no doubt safe to calculate upon 65 per cent. of the rainfall as available for collection in the reservoir. The water falling as rain upon the surface of the reservoir to the amount of 100 per cent. would not quite cover the evaporation for the low year, and the low year with corrected evaperation will yield a storage of 103,000,000 gal. For the average year there will be a yield of 134,000,000 gal. from the shed, and about 2,000,000 gal. over and above the evaporation from the surface of the reservoir, making in all say 136,000,000 gal. of water available for an average year.

The above figures indicate that the original height of the dam, which was 23 ft. above the bed of the stream, was about 6 in. higher than was actually necessary for the lowest record of rainfall; was more than 4 ft. too low for the collection due to the average record of rainfall; and could be filled if 12 ft. higher than originally built, at the high record rainfall of 1888. There might be some slight variations from these figures, probably towards the high side, but they are according to the best-known methods for determining such facts. The original dam might have been built for the low record, if not built previously to 1888, for in that year the rainfall was nearly down to the lowest (shown in 1895) for the 33 years. The Beacon is a reserve supply calculated to fill between November and the following July, against the time when the other gravity supplies of this system fail in the summer months, and it must be considered that it is not necessarily emptied every year and therefore the dam could be higher than the figures actually indicate for a complete filling, especially as a wet season preceeding and succeeding a dry season would give a larger storage than the average, and with even two dry seasons successively, a very large storage at the start would be of great advantage. Considering all of the facts, it was deemed good judgment in concluding how much higher it would pay to build the dam for the accommodation of this rather limited watershed, to take advantage of the average rainfall in excess of 48 in. (48 in. being the average for 33 years) as a basis for calculation, and this was found to amount to 54 in. Then allowing for evaporation, it was determined that the dam could be raised 7 ft., giving a total storage of 186,000,000 gal., including the new slopes to be covered by the rise of the water level. Therefore the plans and specifications were prepared for an increase of 7 ft. above the original height of crest, and made of sufficient resisting power to permit of still further height being obtained, in case it was found that the run-off from this unusally rocky and impervious watershed proved to be of still greater percentage of the rainfall than had been allowed for.

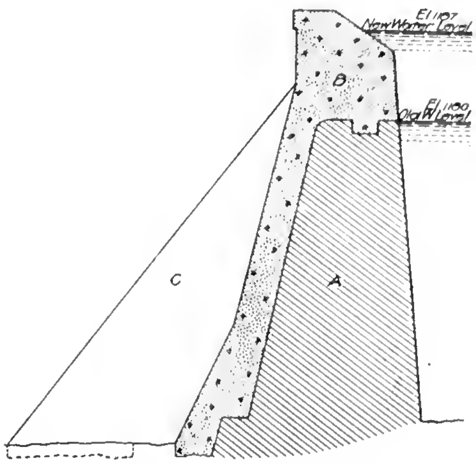
The accompanying diagram shows in the diagonal shading *A*, the typical or full section of the original dam, built of trap stone quarried near the site. The portion *B*, of the figure, indicating concrete, shows the addition to the dam in its fullest section, and also an outline *C*, of the buttresses. It will be noted that there is a groove or dovetail cut into the top surface of the original dam to provide a cut-off for the water and also to completely lock the old and new work together; also that the outer edge of the older dam is rounded to add strength to the concrete jacket at this point.

One of the views illustrates the method of putting up the forms for ramming the concrete in during construction, it being thought best to place all of the necessary forms at once, instead of ramming and shifting as is often done in concrete work; the complete series of forms permitting a continuous building of the work which was considered to give a better and closer knit character of fabric.

Another illustration gives a view of the enlarged and completed dam, showing the but-

tresses and spillway at the downstream face, and it will be noticed that the original dam is completely covered up and hidden by the buttressed reinforcement of concrete which now really forms the dam at the downstream side. The back of the original stone dam, or the side not here seen, still shows beneath the line of the new concrete work, but at some future day it will probably be sheathed either with concrete or new stonework, as this older work heretofore gave evidence of considerable leakage through the masonry, which although practically stopped by the front facing will be further improved by a new back lining.

The original stone dam was built probably over twenty years ago, and was located upon a solid rock foundation bed, the rock extending well up the slopes at the ends of the dam, in fact to a sufficient height for the safe support



Section of Enlarged Dam.

Completed Dam of the Beacon Reservoir, Matteawan, N. Y.

of the new work. The original spillway was simply a shallow notch of very moderate length formed through the crest of the dam near the middle of the length, and permitted the outflow to fall from the top to the bottom of the dam at its greatest height of section. The spillway for the new work is of very liberal dimensions and is situated at the easterly end of the dam where the fall of the outcoming water is comparatively little and where a natural rock bed forms an excellent passageway for the storm water coming over the spillway, down to the stream bed below the dam.

The new concrete structure is about 350 ft. long and 33 ft. high at its greatest depth of section, the depth of the water immediately back of the dam being about 30 ft. The peculiar

Engineer's Estimate on Beacon Dam Rebuilt, at Matteawan, N. Y.

Quantity of concrete in place in completed work	1,500 cu. yd.
Concrete mixture—1 cement, 2½ sand, 5 crushed stone.	
Quantities of materials—	
Cement	2,400 bbl.
Sand	6,000 "
Crushed stone	12,000 "
Cost at the dam—	
Cement per bbl., bags	$1.85
Sand per cubic yard	4.50
Crushed stone per cubic yard	5.00
15,000 ft. B. M. lumber	450.00
Labor on lumber	600.00
Estimated cost of the dam—	
Crushed stone	$7,500.00
Sand	3,375.00
Cement	4,440.00
Labor	2,070.00
Forms for concrete	1,050.00
Foremen, expenses, etc	1,065.00
Stone cutting	500.00
Valves and fittings in place	165.00
	$20,165.00
Contractors profit, expenses, etc., 10%	2,016.50
Total of estimate	$22,181.50

buttress design was suggested naturally enough by the extremely high cost of material delivered at such an out-of-the-way site; the prime object being to reduce the amount of materials to the lowest terms, the labor being quartered upon the premises reaching scarcely above normal. Materials such as cement, sand, crushed stone and lumber at the ordinary points of rail and water delivery were reasonable enough in price, but transportation to the site of the work was nothing less than heroic in character, and brought the costs of such materials up to the figures exhibited in the accompanying estimate.

In round numbers, this is $23,000, and the contract was let for about 7 per cent. less.

This estimate was made in the spring of 1904 just after prices of all kinds of materials had begun to fall; they have gone considerably higher since that time, but even at present prices the above given cost would probably be safe. Considering the difficulties of transportation up a grade of 1,200 ft. within 2 miles, the contract price for the work was considered quite satisfactory, to the buyers at least; a part of the saving on the cost of the dam was probably due to the fact that the successful bidder calculated upon taking a stone crusher up to the work, which he did, and as the trap rock was obtained upon the premises without any cost to him, he also saved the cartage upon a good many tons of material, bearing only the small expense of operating the crusher.

The concrete improvements were designed, and the plans, specifications, and estimates were prepared by Mr. Charles A. Hague, Mem. Am. Soc. C. E., consulting engineer, New York.

A Stream Pollution Decision.

The pollution of streams by mining operators was recently before the Alabama Supreme Court in Ala. Con. Coal & Iron Co. v. Vines, 42 Sou. Rep. 377, when it was decided that, though mining companies may use a stream for mining purposes, they must not place in it anything which will materially pollute the water where it passes the land of a lower riparian owner, or which, being deposited on his land, by an overflow of the stream, will injure the land. The

Forms for Buttresses and Addition to Dam in Place.

measure of damages due to coal dust deposited by such an overflow includes loss of crops already sustained, as well as permanent injury to the land, though the loss of crops cannot be added to permanent damages as such.

Economical Methods of Highway Bridge Construction.

The constantly advancing prices for all kinds of timber have made the cost of falsework expensive for light bridge erection, and serious study has been given to different methods for reducing it. A novel and ingenious scheme for making wooden falsework adjustable to different heights and adapting it to be used over and over again for successive bridges, so that it is shipped from place to place like hoisting engines or other parts of the bride erector's appliances, has recently been developed and satisfactorily used by the York Bridge Co., of York, Pa., Mr. Guy Webster, President, and Mr. F. W. Bigger, engineer.

For ordinary work transverse bents are made with two vertical and two battered posts 10x10 or 12x12 in. The timber for these is purchased in as long lengths as are available and the joints between successive stories at each end of the transverse horizontal struts, corresponding to the caps and sills of ordinary construction, are made with a pair of steel plates about 18 in. wide and 5 ft. long in vertical planes with their long dimension horizontal. Vertical 12-in. channels 18 in. long are riveted across one side of each plate with clear spaces of 1 in. between them, and the 1-in. spaces are punched for 7/8-in. horizontal tie bolts connecting the pairs of plates on opposite sides of the horizontal struts and of the vertical posts.

The vertical and battered posts and horizontal struts are arranged side by side between the inner faces of the plates and the latter are clamped very tightly together by bolts passed through them in the spaces between the timber. These can be drawn up tight enough to develop friction sufficient to hold the entire load on the falsework and thus enable the connection to be made absolutely without cutting or boring the timber and provides for it to be made at any point of the vertical posts, thus enabling the latter to slip past each other and make a telescopic joint which permits of any height of falsework within the limits of the length of the material. The plates have slotted holes to receive the hook ends of diagonal rods with sleeve nut adjustments and with sections made with pin-connected flat bars enabling the lengths of the diagonals to be varied by increments of 3 in. in the pin holes and of smaller distances by the sleeve nut adjustments. Falsework assembled with these connections has been found very rigid and satisfactory and has been taken down and moved from one site to another with greater economy and convenience.

An important advantage of this type of falsework is the opportunity it affords of compensation for any irregularity of settlement in the different posts. If one of them goes down farther than the rest, or if irregular scour exists underneath it, it is very easy to loosen the clamp bolts adjacent to it, insert a jack on top of it with reaction pieces reaching up to the next joint, and force it down readily as far and as often as may be required without interfering with any other part of the falsework. The adjustable diagonals also lend themselves very satisfactorily to the distortion of panels and can be changed as often as the falsework may require it to provide for settlement or any other variation in the panel.

This falsework is erected by a special traveler with a horizontal rolling platform and two stiff-leg derricks mounted on the forward corners with sufficient reach to overhang one panel in advance, and sufficient strength to lift together a completed bent of falsework, and put it in position. The steel work is erected by a second 2-bent traveler running inside the trusses and provided with four booms, one at each corner. The bents have no bottom transverse sills, but are connected by longitudinal top and bottom sills and X-bracing. Their transverse X-bracing is arranged so as to give clearance enough in the center for material cars to be run through the traveler on a track laid between its posts, and thus deliver directly to the forward booms. The hoisting and topping-lift tackles of each boom are operated by separate individual electric hoists making altogether 8 for the traveler, besides which there is an additional hoist suspended from the jigger beams at each corner of the traveler, making a total of 12.

The hoists are of special construction, designed by the York Bridge Co., and manufactured for them by the Westinghouse Electric Co. They consist essentially of a small drum with spiral grooves to guide the steel cables used. They have pinions integral with them which engage a worm thread cut on the shaft directly connected to the motor, the latter being made special for the purpose and adapted to instant reversal. This arrangement keeps the load always under absolute direct control with no possibility of back-slide or overhauling, allows the motor to be started and stopped at any point or to be reversed instantly and dispenses with the use of brakes, friction clutches, and other complicated parts of an ordinary hoisting engine. They are so simple that they require little or no attention, and do not suffer when exposed to severe conditions and inclemencies of very bad weather. The same hoists are used on the derricks of the falsework traveler and for all other hoistng purposes in the erection work done by this company.

The erection appliance considered standard for bridges of any magnitude includes a boiler plant shipped direct to the site and installed in a special power house built for the purpose at any convenient location on shore near the bridge site. An air compressor driven directly by steam is also installed there and a Westinghouse generator of 35 k.w. capacity furnishes the electricity for operating all of the hoists and makes the plant entirely independent of local electrical power. Riveting, reaming, and steel drilling are done by tools built by the Cleveland Pneumatic Tool Co., and facilities are thus provided for handling highway bridge erection as rapidly, economically and thoroughly as is customary with railroad work. A recent bridge erected with this plant is the State Bridge at Berwick, Pa., and another, now in course of erection, is a fourteen-span bridge at Sunbury, Pa.

Steel Inside Traveler with Twelve Hoists.

The Berwick bridge, across the Susquehana River, is 1,800 ft. long and carries a highway at an elevation of about 60 ft. above the water and on a 1½ per cent. grade. It comprises six 250-ft. channel spans and three 100-ft. approach spans with a roadway 22 ft. in the clear carried on transverse wooden joists, and contains about 3,000,000 lb. of steel and 270,000 ft. b. m. of lumber.

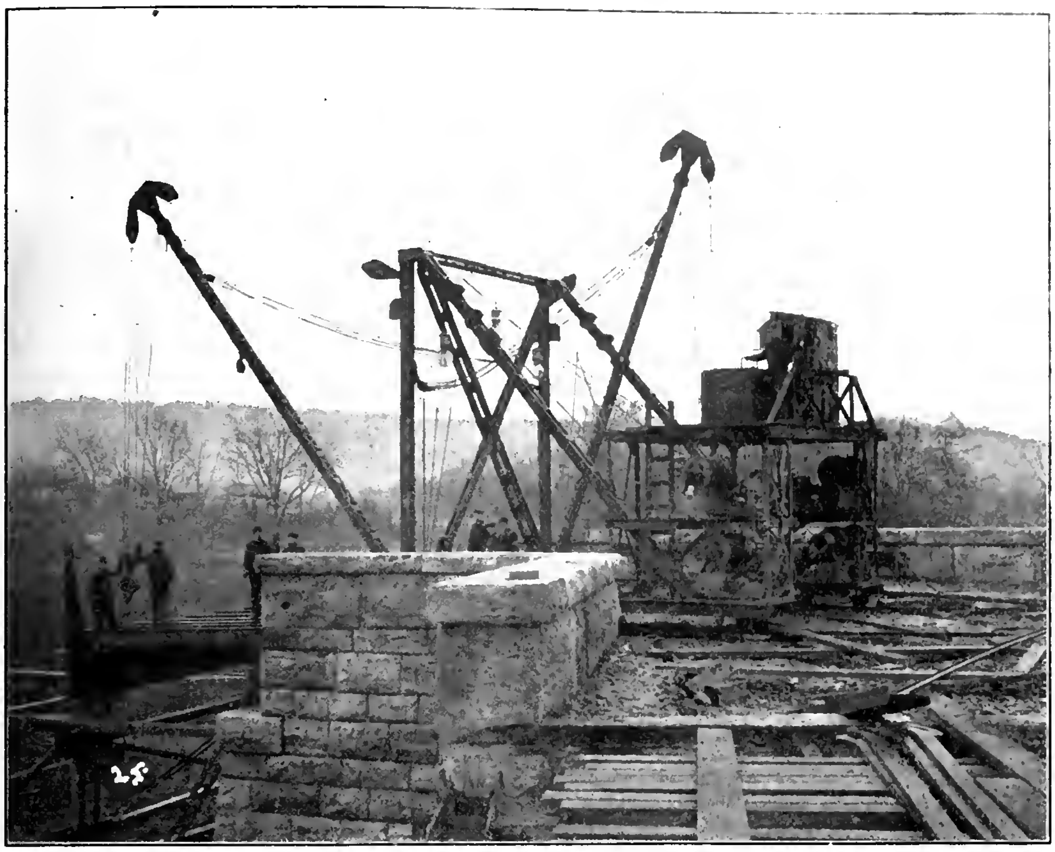
The very irregular river bottom is of shale rock with vertical seams filled with gravel and coal culm which washes in and out with varying stages of the water. A survey and careful soundings were made for each of two lines parallel with the bridge axis and 10 ft. distant from it in the planes of the falsework vertical posts. From these data profiles and cross sections were prepared and the falsework was accurately designed to suit the location. All posts were made with

8x8-in. timber with the corners slightly chamfered to fit the fillets of 8-in. channels riveted to the insides of the clamp splice plates previously described. The posts were assembled with struts and diagonals complete in horizontal planes near the traveler track. They were run through the traveler on trucks and lifted and swung forward one panel in advance by the traveler booms which maintained them in a vertical position until their lower sections were driven to solid bearing by a hammer (consisting of a 6-ft. section of old rail or equivalent weight), operated by a whip line from the hoisting engine and guided by a man standing on the joint. The braces and diagonals were connected making the bent stable, stringers and track laid and the traveler advanced to the next panel and so on. In each bent the center transverse strut was pin-connected to the splice plates on the first post and at the other end was temporarily lashed to the top of the post. The lower strut was similarly connected to the other post, so that when both posts were in position it only remained to add the top strut and longitudinal braces.

The falsework traveler was made of steel with clearance through it for material cars and had two-story rear extension platforms on both sides for the four electric hoists which operated the booms and were all controlled by one man on the bridge platform overhead, where he could see all parts of the work. The falsework posts were lifted and swung out by both booms together, after which one tackle was slacked off faster than the other to drop the foot. This traveler was also used to erect the low trusses of the approach spans.

Material was unloaded from the cars by an 80-ft. guyed steel derrick, which arranged it in assorted piles and loaded it without unnecessary handling on the service cars which delivered it to the erection traveler. This traveler, also of steel, is about 60 ft. high, weighs 20 tons, and has four wheels. It is of adjustable width and in this case was framed with a width of 16 ft., leaving 3 ft. clearance on both sides with the trusses. Small working platforms on both sides are adjustable to any heights convenient for making the truss connections, and the twelve electric hoists are all controlled by one man on the upper platform. The traveler was provided with arc lights run from the dynamo in the power house at the end of the bridge, and used early in the morning and late at night of short dark days. Before the trusses were assembled by the main traveler the floorbeams and joists were set by the falsework traveler, great care being taken to place them very accurately, for which purpose they were adjusted to line and level by an instrument set up on the pier masonry. After the trusses were swung the falsework bents were removed by tackles suspended from the superstructure; their removal and transfer from one span to the next proved to be a difficult and expensive task.

The erection of this bridge was described and illustrated in an interesting and valuable address made by Mr. Webster at the annual meeting of the Bridge and Structural Society at Chicago, Jan 15 and 16, 1907. He spoke from a practical and commercial standpoint and strongly urged the importance of careful investigation and study, thorough preparation and the best and strongest appliances for erection work. He criticized the tendency to dispense with permanent erection organization and asserted that a good erection is the best salesman. Careful examination of all conditions, analysis of the requirements and provision in advance for all successive stages and operations of the work are essential to satisfactory work, and it is economcal to make new appliances of ample size and strength. He emphasized the superiority of a poor idea well planned over a better idea with no preliminary thought, and advised a system of accounts classifying the costs of different items of the work. He suggested improvements in removing and transferring falsework and in a light traveler that should be adjustable to pass under transverse struts, for painting, riveting, etc., at any height.



Traveler Erecting Falsework.

Electric Hoist.

Part of Falsework Bent Assembled Ready for Erection.

The Pig Iron Output of this country during the first half of the current year was 13,478,000 gross tons, the largest production during six months in the history of the American industry, and greater than any year before 1899.

A Submerged Power Station.

A submerged power station that rivals in interest, although much smaller, the famous plant constructed at Snoqualmie Falls a few years ago has recently been put in operation on the Patapsco River, near Ilchester, about 15 miles from Baltimore. It is the first example of a type of power station which the designers, the Ambursen Hydraulic Construction Co., of Boston, and Mr. H. Von Schon, of Detroit, consulting hydraulic engineer, have suggested for a number of places. In reinforced concrete dams of this type, there is a large space within the structure, and the desirability of utilizing this space for power machinery is evident in those cases where other local conditions do not permit a greater head to be developed by constructing the station elsewhere.

The cross-section of the dam near Ilchester is shown in the accompanying cut, which also indicates the position of the water wheels. The dam is 220 ft. long and 26½ ft. high from normal tail water to the overflow of the spillway, which is 168 ft. long. At each end of the spillway the buttresses and deck are carried 10 ft. above its crest, making a total height of 36½ ft. at these places. The buttresses supporting the deck are 12 ft. apart on centers, 2 ft. thick at the bottom and 16 in. thick at the top. The deck is 18 in. thick at the bottom and 10 in. at the top and reinforced with corrugated bars in the usual manner adopted by the builders.

The apron extends only half way down from the crest, the remaining downstream portion being entirely open and provided with windows so that the interior may be lighted. The shape of the apron is such that the water is thrown away from the windows, and, on a clear day the illumination is all that could be desired, although it is poor during rainy weather and at times when the water is muddy.

The water-tightness of such a station has to receive special care, because electrical apparatus will not give the best service in the presence of considerable moisture. Up to the present time no trouble whatever has been experienced from dampness at this plant. The concrete of the deck is a 1:2:4 Portland cement mixture laid very wet, but without any particular precaution to insure tightness. Nevertheless, very little water finds its way through the concrete, and that little trickles down the under surface of the deck to a drain at the bottom. In order to make it certain that no water falls on the equipment of the station, 108 ft. of the dam which houses the power plant is fitted with a false ceiling, as shown in the cross section. This completely protects the apparatus.

The station contains two 34-in. horizontal Leffel wheels with Woodward governors, each wheel direct-connected to a 300-kw., 11,000-volt, three-phase, 60-cycle alternator. Each alternator drives by a belt a 125-volt exciter. The water for the wheels is taken from the deck of the spillway about 5½ ft. below its crest, through a 7-ft. flume, which runs directly into the shell of the wheel. It is discharged from the latter through a draft tube carried down into a well about 3 ft. below the river bed, from which it flows away through a channel cut in the rock. The advantage of such an arrangement in eliminating losses due to long pipes and bends is manifest.

The plant is owned by the Patapsco Electric & Mfg. Co., Ellicott City, Md., and supplies current for lighting and power purposes.

Permanent Bench Marks established by the City of Chicago in 1898 have settled in the district honeycombed by the operations of the Illinois Tunnel Co., but not elsewhere.

Letters to the Editor.

Results at the South Bethlehem, Pa., Filter Plant.

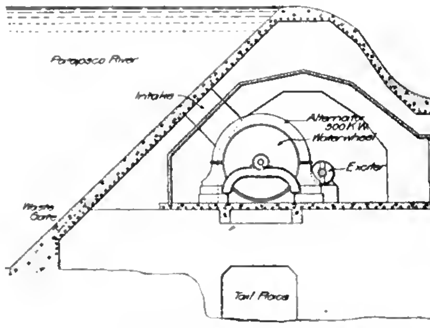
Sir.—The following are the results of the bacterial analyses of the water furnished by the Bethlehem City Water Co. to its consumers, as per reports submitted by Mr. F. W. Green, bacteriologist of the East Jersey Water Co., Little Falls, N. J., to Dr. H. S. Drinker, president of Lehigh University, South Bethlehem, Pa.

	Bacteria in 1 c.c.		Colon Bacilli in 1 c.c.	
Date.	Subsidence Reservoir.	Filter Outlet.	Subsidence Reservoir.	Filter Outlet.
Dec. 29, 1906..	100	2	Present.	Not present.
Jan. 14, 1907..	2300	11	Present.	Not present.
Feb. 16, 1907..	130	5	Present.	Not present.
Mar. 9, 1907..	210	[illegible]	Present	Not present.
Mar. 23, 1907..	475	12	Not present.	Not present.
Apr. 6, 1907..	350		Not present.	Not present.
May 11, 1907..	1700	3	Not present.	Not present.
Apr. 20, 1907..	150		Present	Not present.
May 25, 1907..	900	2	Present	Not present.
June 8, 1907..	950	1	Not present.	Not present.
June 22, 1907..	550	1	Present	Not present.
July 13, 1907..	950	0	Not present.	Not present.

Yours truly,

Philadelphia, Pa. A. W. K.

[The South Bethlehem slow-sand filter plant was described in detail in The Engineering Record of July 15, 1905. It was designed by Mr. P. A. Maignen and has an ultimate capacity of 4,000,000 gal. per day at a uniform rate of about



A Submerged Power Plant.

7,000,000 gal per acre per day. The settled water is passed through preliminary scrubbers before it is delivered to the slow-sand filters.]

The Topographical Party.

Sir—I have noticed that the most disputed topics in a railroad preliminary camp in mountainous country are the proper organization and the methods of the topographical party. The reason is largely because many of the men were educated on prairie work and try to introduce the methods to which they are accustomed.

Many of the older railroad surveying manuals and field books give a somewhat elaborate organization for the topographical party, and prescribe the duties of topographer, assistant topographer, rodman and tapeman. Most field engineers have concluded that such an organization is not economical and on many roads, where hand level and tape are used, the party consists of two men. While it is true in general in open flat or gently rolling country that the four-man party is unnecessary, it may not always be true in mountain districts. Where there is little sketching to be done, a topographer and a rodman can do fairly well in open country where there are few buildings, and contours are taken for only a short distance each side of the center line. But, on the contrary, where much sketching must be done the opening of the note book and fumbling for a pencil every few feet is costly in time, and tends toward slovenly note keeping, while the amount of detail work required of the topographer introduces a considerable liability to error.

But not satisfied with using the two-man party in its proper field, level country, the prairie-educated engineer when transferred to the mountains often fails to recognize the new conditions and sticks to his pet organization, arguing that it saves in the total number of men on the work. He does not recognize that the vital points are the cost of the survey per mile, and the reliability of the data, and on these bases the three or four-man party demands consideration. I have seen mountain preliminary parties laid up one or two days every week in order that the transitman and the levelman might help the topographer catch up in his work. Many engineers fail to recognize the value of specialization and expect the transitman and levelman and their crews to take as much and as good topography in a day as the topographical party. In few cases is this realized. Of all the positions in the field, that of topographer requires more experience and the greater exercise of judgment than any save that of locating engineer or chief. This practice of "catching up" has the further disadvantage of breeding discontent among the cheaper men on the party, who, as a rule, dislike topographical work.

From the writer's experience a return to the larger organization of the topographer's party is desirable in mountain country for economy and improvement in the quality of the work. The topographer should be given at least three men, and where the mountains are steep and the brush thick, four men, the last man carrying an ax and acting as rear tapeman when there is no cutting to do.

Any man of ordinary intelligence can be taught to use a hand level with accuracy and a $50-per-month man once given the height at the center line above or below the contour can pick out the succeeding contours with more reliability than the topographer himself, since his sole duty is to carry his elevations, while the topographer must sketch, note the character of the land, and record all the data. A 5-ft. stick, on which to rest the hand level, and a 7 or 8-ft. rod, with the alternate feet painted in different colors, are the best "instruments" in mountainous country.

The rodman in going uphill acts as head tapeman and the topographer, levelman or extra man, when one is provided, reads the tape. Going downhill the levelman drags the tape, and one of the other men reads it. The most rapid work can, of course, be done with two tapemen and a hand levelman, in which case the topographer does nothing but handle his note book. But even with three men the topography in quite hilly country can be kept up pretty well. This saves laying off both transit and level parties, a costly procedure, and requires only one or two extra men, depending on whether three or four men are used in taking topography, at the lowest salary paid, the regular topographer's rodman acting as hand levelman. I have heard it objected that a rodman is not paid to bear the responsibility of a levelman, but the average rodman is able and anxious to do the work.

The improved quality of the work can be judged when it is considered that under the two-man method the topographer acts as levelman and carries his elevations in mind, reads the tape and carries distances metally, records all data, sketches, and makes necessary topographical notes, while with three or four men his duties are confined to sketching and recording.

Very truly yours,

Transitman.

Missoula, Mont.

Condenser Troubles in a station having two surface condensers employing sea water for cooling have been overcome by placing pencils of zinc about 6 in. long in the suction chamber. Formerly the galvanic action between the iron base and the other metals in the condensers led to the rapid corrosion of the iron. This has apparently ceased entirely since the zinc pencils were introduced, although the latter are eaten away rapidly.

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Of this issue of THE ENGINEERING RECORD 14,250 copies are printed. Total circulation for 1907 to date 507,750 copies, an average of 14,507 copies per week.

TABLE OF LEADING ARTICLES.

The Function of Light Railways.

No country more than our own has felt the need of a complete transportation system and none has more railways to show for it. Yet it is a fact that even in old and rather densely populated sections transportation is very unevenly developed, leaving large districts without adequate facilities. Railroads have grown over the country in a sprawling, irregular fashion ever since the zig-zag war dance of the Union Pacific over its land allotments. The result is that while the major transportation is fairly well taken care of, barring delays of six or eight months in side-tracked freight cars, the minor transportation that affects most intimately the life of the people as a whole has been in many cases badly neglected. Until the coming of the electric railway, rural communities had little chance for decent service, and even now they have not received the full benefits that are their due. Many interurban roads have been been built, it is true, but generally with an eye to important termini rather than to the intermediate country. There is a splendid service to be done by rural roads when the situation shapes itself so that they can be profitably built. The greatest present obstacle to this improvement is a certain species of megalomania among both promoters and the people to be served.

So far as the promoters are concerned they are naturally enough looking for profits. If they would confine themselves to operating profits all would be well, but the bankers who stand behind them are looking not so much for hard earned dividends as for a rake-off on the roads they underwrite. The practical question often asked is not how the proposed line can show the best earning capacity on the investment, but how large a bond issue it can stagger along under with due allowance for the probable growth of traffic. On the other side, it is hard for the enterprising citizens of Luggage City to realize that their town, population 2,311, is not to become in due season a metropolis second only to Chicago or St. Louis. Hence they view a franchise for an electric line through the main street as the source of indefinite future wealth, not to be granted without large concessions. When a railway proposition comes along through the country, it is hard hit by the local authorities, and having something of a swelled head itself, the total cost rapidly mounts to a figure that is entirely inappropriate save for a line between really important centers. Electric roads can be, but seldom are, built at cost low enough to secure adequate returns in sparsely settled communities, and until their cost can be kept down they will fail of their maximum usefulness. Now and then a light road is built with a proper appreciation of its legitimate functions, and it nearly always proves extremely valuable to its patrons and reasonably profitable to its promoters.

When a community is approached with a proposition for an electric road to bring it into communication with its neighbors, it may reasonably and properly ask good service and ordinarily favorable fares. It may also very properly insist that the capitalization on which the road must make its earnings out of the community shall represent a real investment in money or its equivalent, and that its projectors shall build and operate the road for legitimate transportation and not as a stock-jobbing proposition. If this is assured the community can very well afford to work hand in hand with the projectors and take its profit in increased business and valuation without demanding any considerable direct return from the franchise. In this way the community and the road are in a species of informal partnership that leads generally to good results. It has often happened that a well planned road has increased the value of property along its line to an extent that more than balances the cost of construction. This benefit is too often forgotten in striking a bargain for the future. A town gains far more in this way than does the railway, and, therefore, can afford to be generous. But the town should insist that the earnings to which it contributes shall be based on investment and not on water. To this end it should seek skilled advice on any propositions with which it has to deal and hold the project down to a conservative basis before it enters into any alliance whatever. If the promoters squeal when asked to squeeze out the water, they disclose their intentions at once and the more quickly they are thrown out the better. If they are willing to put their enterprise on a conservative and honest basis, the community will gain by helping the cause along in any proper way. Some of the best lines have been built with local aid in the taking of securities by enterprising citizens and when a proposed road starts in such wise it is pretty sure to give the community a square deal. But beware of the concern that places its bonds with a construction company and tries to unload its stock (very common stock) upon local investors.

The Clermont and the Lusitania.

It was on August 17, 1807, that Fulton's "Clermont" made her trial trip, at an average speed of about 5 miles an hour. She was 133 ft. long and measured 160 tons by the custom-house rules of that day. Her engine had a single vertical cylinder, which drove the side paddle-wheels through connecting rods and a bell-crank lever, and was rated at 19 h.-p. She was not the first steamboat, by any means, nor was she the first vessel propelled by steam to run in regular passenger service. Fitch drove a small boat by steam in 1786 and a larger one during the following year, the engine in each case actuating paddles on each side of the hull. In 1788 he built a third boat and 1790 a fourth, which was placed in passenger service between Philadelphia and Trenton for some months, probably being the first steam vessel to undertake such business. Rumsey built boats in this country and England about the same time as Fitch, and Patrick Miller also did the same in England. In 1802 the "Charlotte Dundas" made successful trips on a Scotch canal. Col. John Stevens' twin-screw boat of 1804 is almost as well known as the "Clermont," so it is evident that the achievement of Fulton has brought him enduring fame for some other reason than that of a strikingly original invention.

Almost one hundred years after the trial trip of the "Clermont" the new Cunard steamer "Lusitania" was given a series of trial runs that a good many marine engineers regard as equally significant to that on the Hudson a century before, in their influence on floating steam plant of high grade. This enormous ship, which will shortly start on her maiden voyage to the United States, is 785 ft. long over all and 760 ft. between perpendiculars. She has a molded breadth of 88 ft., a depth of 60⅓ ft. and a gross rating of 32,500 tons. She has accommodations for 552 first-class passengers, 460 second-class and 1,186 third-class. Her turbine engines have a nominal capacity of 68,000 h.-p. and she was designed for a speed of 25 knots. She is unique only in her great size, but this is not her important feature, which is the adoption of turbines under conditions far more severe than anything hitherto imposed on engine builders. The splendid showing made by this ship on her trial runs, when all contract requirements were exceeded beyond the expectation and even the wildest hopes of owners and builders, is a very significant indication of the fact that engineering will find some new tool or process to overcome difficulties that are insurmountable by anything available among past precedents. The "Lusitania" is very far from being the first turbine-driven ship, for many of them have been in service in the waters about Great Britain and some in the trans-Atlantic trade. But the problem presented to the designers of the "Lusitania" and her sister ship was not one of merely reaching forward from the safe footing of experience with these existing turbine vessels, but to make a bold jump for a distant goal, reaching which would be success,

but failing which would be a disaster of the most serious kind. It is a tremendous advance from the 36,000 and 38,000 h.-p. rating, 23,600 and 26,000 tons displacement and 23½ knots maximum speed of the crack German liners to the 68,000 h.-p., 38,000 tons and 26.45 knots of the new Cunarder.

These two events in marine engineering gain their significance from their timeliness. Fulton was a great adapter and improver, as well as an inventor, and he was aided by Robert R. Livingston, whose business ability supplied the incentive for the "Clermont." The latter foresaw what steam propulsion would mean if commercially successful, and in 1798 he had secured from the New York legislature an exclusive franchise for the navigation of the Hudson by steamboats. It was the existence of this franchise which compelled Col. Stevens to abandon his project to establish steamboats on the river, for which service he completed, almost as soon as the "Clermont," the "Phœnix," which is credited with having made the first deep-sea voyage under steam in her trip from Hoboken to Philadelphia in 1809. Fulton and Livingston together were masters of the art of utilizing and improving existing apparatus and finding a commercial purpose for it, and were thus real captains of industry, in the modern sense. In the same way, it may be said that the owners and builders of the "Lusitania," with their technical staffs, have accomplished a great beneficial work. Just as Fulton and Livingston showed that commerce need not be fettered by the caprice of the winds but could utilize to its advantage the steam engines which had already thoroughly established themselves on land and made some attempt to win recognition afloat, so the British shipmasters and shipbuilders have proved that commerce need not be fettered by the limitations of the reciprocating engine, but will find in the steam turbine a means of driving ships as large as harbor channels will admit and as fast as passengers will pay to be carried. The beautiful ship recently turned out from the Clydebank yards may therefore be considered to open another century of marine engineering with a promise of achievements that cannot even be sensed now.

Grade Crossing Elimination in New Jersey.

The crossings of railways and highways at grade in New Jersey have a number of features that make their elimination a matter of more than usual difficulty. There are many of them in the State, as might be expected from the great railway mileage per 100 square miles and the early date at which a large part of the lines were constructed. These death traps are now numerous in districts which had only a few country roads when the railways were built, and, in many cases, the crossings have been put in at grade against the vigorous protest of the companies. Their danger was appreciated by the railway officials, but the county and town authorities failed to foresee it, and consequently there has developed a sort of disregard, as something inevitable, of fatalities and injuries due to the collision of trains with vehicles. Recently there has been some local half-hearted opposition manifested in a few places to a continuation of these serious conditions, but no real study of them has as yet been undertaken except by the railways themselves. The latter have already carried out some extensive works at a heavy expense, the most recent undertaking being the elimination of grade crossings on a large part of the Morris & Essex division of the Lackawanna R. R. This elimination work has only been begun, however, for in the places where grade crossings are most dangerous it is extremely difficult and expensive. In these districts there is an enormously heavy train movement at certain hours of the day, when people are traveling between New York, Jersey City, Hoboken and Newark and their suburban homes. Any interference with this passenger traffic affects a large number of people, many of them men of large affairs whose time is extremely valuable. It is also necessary to keep streets open in some way at many of the worst crossings, for otherwise serious inconvenience would result to important business interests.

A new State Railroad Commission has recently been appointed, which has shown indications of a desire to take up the problem of eliminating grade crossings, along with other features of railway affairs. It is a matter of considerable doubt just what powers this body posessses, for it was created by the legislature in a hastily drawn and manifestly crude act. In some respects, it is apparently merely an advisory commission, but it seems to have definite authority to order railway companies to make such reasonable changes in their roadbeds, tunnels and bridges as it considers in the interest of safety. Whether it can compel the companies to execute such orders remains to be seen, and it is open to question whether the elmination of grade crossings can be legally included under such a classification as that mentioned, for grade crossing accidents rarely hurt the train crews and passengers whose safety is supposed to be the purpose of this provision in the legislative act. It will be a good thing, however, for the commission to ascertain by test cases as soon as practicable just what powers it has, for until it has done so its work will be of problematical value. It seems certain that some State commission should have liberal powers in connection with grade crossing betterments, in order that the problem may be thoroughly investigated as a whole and the work may be directed in the interests of the people of the whole State rather than those of a single city or borough. It is often impracticable to alter grades materially in one city without introducing conditions that make changes necessary elsewhere, for otherwise a succession of short ascents and descents will disfigure the profile of the track. As conditions are now, one community can make so much trouble that improvements affecting the safety of travel in an entire district are held up indefinitely. The law should be so drawn that the commission will have power to authorize a railway company to go ahead with an important improvement under such conditions, leaving the settlement of the disputed matters to arbitrators whose decision shall be final.

For some reason that it is hardly worth while to attempt to discover, there is an apparent prejudice against any division of the expense of grade-crossing elimination between the railway companies and State and local treasuries. Whether this feeling really is a general one, or is held only by that portion of the community which supports the local newspapers expressing it and is not shared by the much more influential suburban population of the Northeastern part of the State, is open to doubt. It seems to be the prevalent opinion, however, and it ought to be generally made known that until this opinion is materially altered the progress of grade-crossing elimination will be distressingly slow. There is nothing equitable about forcing all the expense of eliminating these crossings upon the railways, for in many cases they have been made by local public authorities against the desire of the companies, and in other cases they are the result of the development of a town which has been made possible only by the service given by the railways. In Massachusetts, where more work of this nature has been done than elsewhere, only 65 per cent. of its cost is charged to the railways; New York and Ohio charge 50 per cent. to the companies, and Connecticut and Rhode Island have also made provision for a distribution of a part of the expense among public bodies. There is the more reason for hoping that the equitable practice of other States may soon be introduced in New Jersey for the reason that before long the electrical operation of surburban trains into the terminals on the Jersey side of the North River will become necessary in order to handle the greatly increasing passenger traffic, and the adoption of electrical operation must wait upon the elimination of grade crossings. It would be far better for the traveling public, which forms by far the most important part of the population of Northeastern New Jersey, to bring about something like the Massachusetts system of apportioning the expense of grade-crossing elimination than to continue to obstruct railway work, which is directly in its own interests, by fostering a sentiment not based on justice and equity, but dug up from the wording of old charters granted in the days when a mail coach could give a railway train a good stiff race. The problem is one of present necessities and not a subject for library research into ancient legislation and the opportunities for legal hair-splitting.

Rejecting Low Bids.

It is quite a common impression that in competitive bidding for municipal contracts the award should be made to the lowest bidder, or at least that it should be so made unless there is glaring lack of responsibility. There are, however, many cases in which the statute governing awards not only does not require the contract to go to the lowest bidder, but distinctly charges the awarding power to select such a responsible bidder as will execute the contract to the greatest advantage of the municipality. The City of New York is a marked instance of this kind. Two of its boards at least, one the Aqueduct Commission and the other the Board of Water Supply, act under statutes giving them a wide latitude in the award of their contracts, but laying upon both those bodies a far heavier obligation and a duty of far graver responsibility than if they were rigidly bound to award their contracts to the lowest bidders. As the matter stands, both the Aqueduct Commission and the Board of Water Supply must consider seriously whether they are properly discharging their duties in awarding any competitive contract to the lowest bidder. In other words they must scrutinize most thoroughly and carefully every feature of tenders made to them for constructing the public works under their charge, and determine, in view of all the considerations involved, which offer they will accept. The laws governing their action do not even direct them to make the award to the lowest responsible bidder. It is difficult to conceive of graver responsibilities placed upon public officials in rendering such a kind of service. A political commissioner might consider these conditions admirably adapted to serve his puprose, in favoring his friends, but a conscientious officer will realize that his action under such circumstances must be guided by the most scrupulous regard for the public trust imposed upon him.

Some rather unusual experiences in connection with the contracts under the Aqueduct Commission and Board of Water Supply have lately been observed. It will be remembered that the former body awarded the contract for the Cross River dam to the highest bidder but one, out of five, while the contract for the Croton Falls Dam went to the bidder next higher than the lowest, both awards being in accordance with the recommendations of the chief engineer. The first of these instances was so unusual as to receive approving editorial comment in this journal. The wisdom of the recommendations of the engineering organizations of both the Aque-

duct Commission and the Finance Department of the City of New York has been shown by the present practical completion of the Cross River dam within the prescribed contract time, in spite of serious legal delays for which the contractor was in no way responsible. This is probably the first instance of the completion on contract time of any great public work in the history of the City of New York, or at any rate for so long a period that "the memory of man runneth not to the contrary."

The result of the bidding for the main dams of the Ashokan reservoir apparently placed the Board of Water Supply in much the same condition which confronted the Aqueduct Commission when the tenders for the Cross River dam were opened, with the additional complication of an amount of public money several times larger being involved. As has already been announced in The Engineering Record there were five responsible bidders for this work, the tenders varying from a little above ten millions to a little below fifteen millions, the extreme difference being nearly fifty per cent. of the smaller sum. The Engineer's estimate of the cost of this work is reported to be about two and a half millions above the lowest bid. In other words the latter was probably somewhat under the actual cost of the work, assuming that all the exigencies inevitably developing in connection with such operations are reasonably favorable. When it is remembered that such exigencies are on the whole practically certain to be unfavorable, there is the same practical certainty of a material loss resulting to the contractor who should attempt to execute the contract at the lowest bid. The next highest bid was about $2,300,000 above the lowest. The serious question arose whether the Board of Water Supply should award this large contract at a price below cost, even to parties entirely responsible.

In the first place, as is well known, it is not only desirable but absolutely imperative to bring the Catskill water to the City of New York in the shortest possible time. No person experienced in the execution of contracts for the public works of this city can suppose for a moment that that imperative condition would even be approximately fulfilled by any contractor losing money in doing it. No matter how responsible he may be the work would lag and lag seriously when its prosecution incurs a loss. Further than this, experience has shown with equal certainty that a losing contractor will use every means within his power to recoup such losses. Every contract furnishes opportunities for such efforts, and the larger the contract and the more powerful the contractor, the more those efforts will be made, and the greater will be the success attending them. The final results, therefore, would be a greatly delayed completion of the work with costs so greatly increased over the contract price as easily to overcome the difference between the original bid and that next above it. At the present time heavy judgments against the city have been secured by contractors under precisely the conditions outlined above and this case would certainly be added to those by any contractor doing the Ashokan work at a loss.

The statute governing the Board of Water Supply is absolutely clear in requiring its members to act in the best interests of the city largely independently of the prices bid, and there are already exact and weighty precedents for their guidance. The Board of Water Supply could not have rendered a better service to the city or more wisely have discharged its resopnsibilities than by awarding the contract for the Ashokan dams to responsible contractors of experience in this line of work, as reported in this issue of The Engineering Record at a price which, with good management, will yield a fair profit, even at an apparent sacrifice of $2,300,000 by rejecting the lowest bid.

Notes and Comments.

THE USE OF STREETS by interurban electric cars in Indianapolis was recently considered by the Indiana Supreme Court in Kinsey v. Union Traction Co. The decision was one of the most voluminous ever handed down by that court, but its most interesting feature to city engineers is summed up as follows in 81 N. E. Rep., 922: "A street railway company operating on a city street, for the carriage of freight and passengers, interurban trains of three cars, each 60 ft. in length, at a rate of 20 to 30 miles an hour, thereby rendering the use of the street dangerous and causing the house of an abutting owner 60 ft. from the track to shake so as to cause the plastering and ceilings and the pictures on the walls to fall, and to disturb the comfort of the owner and his family occupying the house, is liable to the abutting owner for the special damages sustained, the operation of its cars in such a manner by a street railway being unlawful and unjustifiable."

THE CHICAGO & ALTON change of ownership has been inevitable for some time, although just who would take the property has been in doubt. Its ownership by the Rock Island has been possible just so long as the Government refused to let it come within the scope of its official knowledge, for the Rock Island and the Alton are competing lines and one could not acquire the other without running into legal complications and dangers that are not gratifying to the stockholders The line has been purchased by the Toledo, St. Louis & Western R. R., better known as the Clover Leaf road, and the companies associated with it under the control of Mr. Edwin Hawley, namely, the Minneapolis & St. Louis R. R. and the Iowa Central R. R. With the Alton, a system is thus formed with something over 3,000 miles in the best part of the Central States, reaching over its own lines into Chicago, St. Louis, Kansas City, Minneapolis, Des Moines, Toledo and Detroit. It is a system that can be developed into a very strong competitor for business between Chicago and Kansas City and western points, while its local business in some sections will always remain large. The purchase is not yet definitely closed, for the Hawley interests do not care to buy a law suit, such as is possible until the Government definitely determines whether it will take action against the Alton in connection with the rebates which resulted in the $29,000,000 fine imposed on the Standard Oil Co. It will undoubtedly be a good thing for shippers and travelers to have the deal carried out, for it is much easier to do business with a large system capably managed than with a number of short independent lines.

PROFESSIONAL ETHICS are now receiving the attention of the American Bar Association, in some respects the most influential professional organization in the country, and it is reasonable to expect important results from its deliberations. At present there are codes in force in Alabama, Colorado, Georgia, Kentucky, Maryland, Michigan, Missouri, North Carolina, West Virginia, Wisconsin and Virginia. Eight canons of professional conduct are incorporated in the charter of the Louisiana Bar Association and the oath administered to lawyers admitted to the bar in the State of Washington contains a brief outline of professional duty. A committee representing all sections of the country has been investigating the subject and at the meeting of the American Bar Association on Tuesday of this week, it presented a rough draft of a proposed code in order that all interested in the subject may have an opportunity of sending their views to the committee. The adoption of such a code is deemed to presage such important effects on the development of the legal profession that the committee believes it should be done only after mature and careful deliberation, and much fuller consideration than can be given it at an annual meeting. This wise recommendation and cautious procedure is recommended to those who are interested in the subject of professional ethics among engineers, a class which must eventually come to some code, although there does not seem at present to be any early prospect of the adoption of such canons. If those who feel the need of a code were to act with the deliberation and the regard for all criticism which mark the work of the American Bar Association's committee, there would probably be a better chance of securing an engineering code that would be of real use as a stimulus to higher professional conduct.

THE LONDON WATER-WORKS, which have been under public ownership for about three years, now supply a population of about 6,800,000. Part of the people living outside the administrative County of London doubtless obtain water from private wells or other sources, for the average daily consumption of the public supply is only 261,600,000 gal., or 38 gal. per capita. About one-quarter of the supply is ground water and the remainder is from the Lea and Thames. As a result of centralized public ownership, the various districts formerly served by independent companies have been coupled together, so that any extraordinary conditions in one district can be met by drawing on the resources of others. As a result of these new connections there has been a great increase in the quantity of water taken from the Thames for two districts. These results have led to hearty approval of the management of the works by those usually opposing municipal ownership.

FOREST PLANTING in the northeastern states is receiving particular encouragement from the Forest Service of the Department of Agriculture, for large areas in this section of the country are fit for forest growth only and from an economic standpoint it is important for these lands to be put into a state of productiveness. There are large lumbered areas on which successive fires have destroyed all young trees of valuable species, and inferior trees have sprung up. While this land is worthless in its present condition, forest planting will bring it into a useful state where adequate protection against fire can be provided. There are also large tracts, once cleared for farming, but since abandoned on account of loss of fertility or through the greater attractiveness of cities to their owners. In places these abandoned farms are now covered with white pine, but this crop is being removed rapidly and little reproduction will follow, owing to the absence of seed trees. Such lands offer exceptionally fine opportunities for forest work, owing to their nearness to markets and freedom from brush. There are also large barren sand plains in the New England states and New Jersey which cannot be cultivated, but will support in many cases a fair growth of white pine or other species of pine. The high price of good timber, which is sure to steadily increase, coupled with the presence of these lands near good markets, should be an incentive to take forestry up earnestly. It will accordingly be strange if far-sighted men with enough capital to undertake the work do not take advantage of the opportunities afforded in the northeastern states to make an investment which is likely to bring in a good revenue and also furnish an opportunity of supervising about the most interesting outdoor work that can be undertaken. From a purely engineering point of view, it is to be hoped that the suggestions of the Forest Service will be put into immediate practice, in order that the local timber supply may be increased instead of considerably depleted.

THE WALNUT LANE BRIDGE, FAIRMOUNT PARK, PHILADELPHIA

A Description of the Methods Employed in Constructing a Concrete Arch of 233 Feet Span.

The highway bridge carrying Walnut Lane over Wissahickon Creek in Fairmount Park, Philadelphia, is a concrete structure 585 ft. long, 60 ft. wide and about 150 ft. in height above the surface of the water. The main span, 233 ft. long in the clear, has a rise of 70 ft. 3 in., and is flanked by five full-centered approach spans of 53 ft. The main span is the longest concrete arch in the world and the third longest masonry arch of any description; its general features were illustrated in The Engineering Record of November 17, 1906.

It is made with two ribs, each 18 ft. wide and 18 ft. in the clear from the bridge axis. The radial thickness of the ribs diminishes from 9½ ft. at the skew-back to 5½ ft. at the crown and each is made with 22 long voussoirs and 17 short ones, the latter serving as keys, and all of them being cast in forms built on the regular arch lagging. The vertical faces of the voussoirs are scored 1¼ in. deep in radial lines from 24 in. apart at the crown to 33 in. apart at the skew-back to give them the appearance of cut stone course joints and the outer faces are grooved with a curved concave moulding of 5 in. radius, parallel to the soffit, above which the vertical face projects 2½ in. farther than it does below it.

Ten vertical transverse walls built up from the arch ribs to the level of the crown carry at their upper ends the 20-ft. longitudinal spandrel arches, the cornice and parapet and four lines of longitudinal spandrel walls supporting the roadway platform. Transverse I-beams 6 ft. apart are seated on the longitudinal wall spanning each rib and the space between the ribs, and carry the transverse floor arches 9 in. thick at the crown above which there is a cinder concrete filling and asphalt roadway. The arch ribs are made without reinforcement except for three 1-in. horizontal transverse rods at the foot of each transverse spandrel wall and six 1-in. rods bent at right angles to bond the horizontal seat for each transverse wall with the rib. The transverse spandrel walls are reinforced with 1-in. horizontal rods 3 ft. apart vertically.

The skew-backs of the main span and the vertical piers at the same point are both seated on a common foundation 58 ft. 2 in. long and 29 ft. wide, with its footing carried down to offset seats in the solid rock a few feet below the sloping surface of the ground.

The approach arches and their piers are of ordinary simple construction, and, like the main arch, are made with two separate ribs joined by the continuous roadway platform. The abutments are of solid concrete masonry with heavy cross sections to act as retaining walls for the embankment behind them, their faces are paneled to give the effect of piers for the ends of the approach arches above which recesses are formed to receive the spandrel walls. The wing walls are curved, the faces are vertical and the rear is offset to the required thickness, making, altogether a somewhat elaborate construction of large dimensions, their height being over 50 ft., and the length more than 100 ft. transverse to the axis of the bridge. The wings and the faces are reinforced with 1-in. horizontal rods 2 ft. apart vertically, curved around the corners.

The floor platform is uniform over the main and side arches, and the 20-in. transverse I-beams which support it between the arch ribs are spliced to the 15-in. beams which support it over the arch rib by horizontal angles bolted to the webs and flanges of the beams, as shown in the detail. The lower flanges of the I-beams are protected with 3-in. of concrete reinforced by loops of 3-16-in. wires, 3 in. apart, spaced by 2 pairs of horizontal transverse ⅛-in. wires. The floor slabs have transverse expansion joints on the center lines of all the transverse spandrel walls.

The bridge is proportioned throughout for a live load consisting of 100 lb. per square foot or a concentrated load of forty tons on two axles 20 ft. apart, the wheels 6 ft. apart on the axles, and for a wind pressure of 50 ib. per square foot of vertical surface. The dead load of the center span is about 26,000 tons, nearly one-half of which is due to the weight of the arch ring alone. The maximum unit stress in compression on extreme fibres of the arch at the points of greatest eccentricity of the center of pressure is 500 lbs. per square inch, which includes temperature stress, and the maximum total stress at each skew-back is 16,500 tons.

The vertical shear at the skew-back gives a unit stress greater than is allowable on plain concrete, and a much higher value in shear is obtained by embedding in the concrete radial one-man stones. The form of the arch curve was determined by and follows closely the curve of the line of pressure, which is contained well within the middle third of the arch ring.

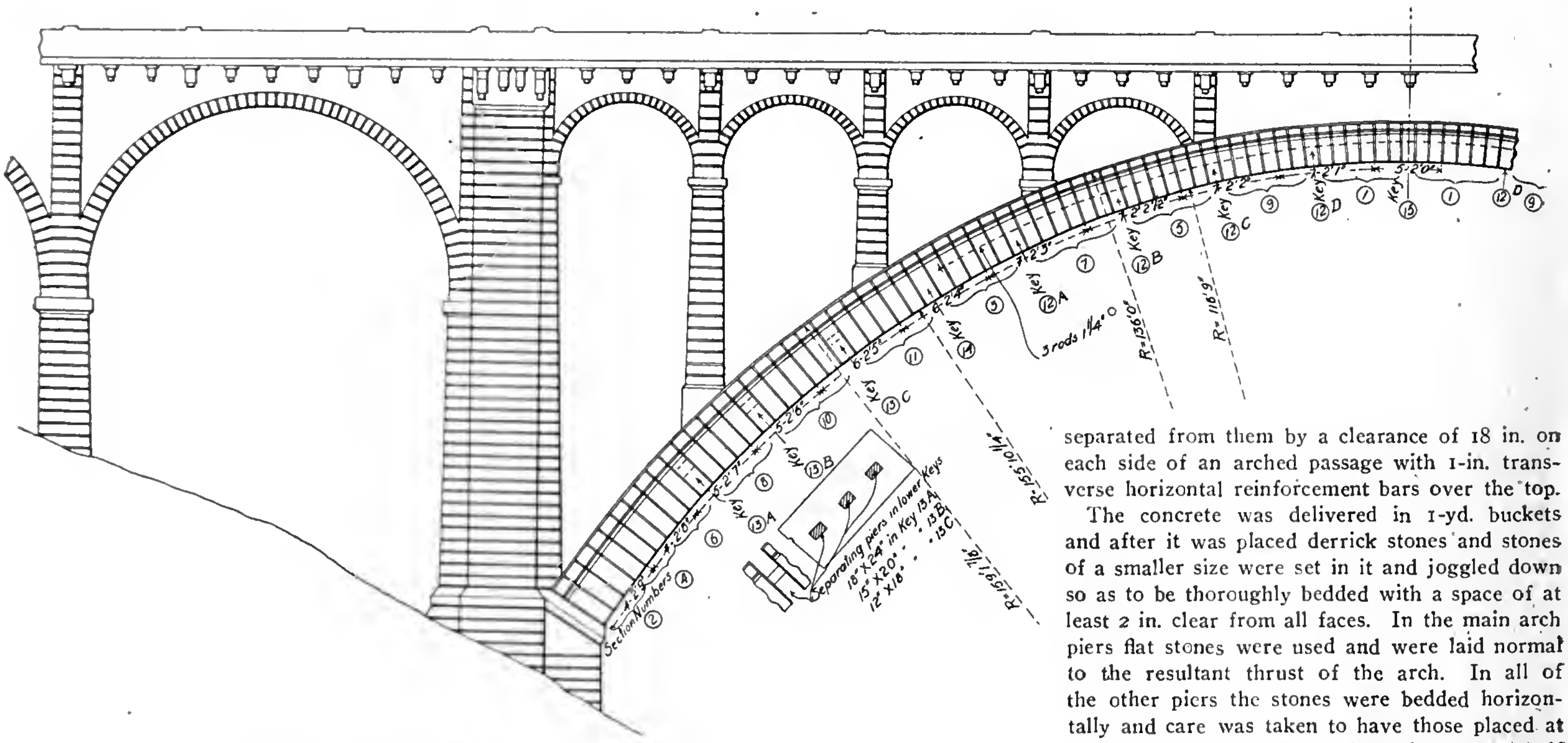
The footings of all piers and abutments were carried down in open excavation to solid rock, which in all cases was dry and developed ideally rugged surfaces in sound hard material from about 5 to 20 ft. below the original surface of the ground. The foundation pits were excavated by hand and only in a few cases required any sheeting. The footings were built with 1:3:6 concrete and were made solid to a level above the surface of the ground where for each pier they receive two shafts carrying the separate arch ribs. A 30-in. water main just above the surface of the rock passes through all of the foundations in a line parallel to the axis of the bridge and is separated from them by a clearance of 18 in. on each side of an arched passage with 1-in. transverse horizontal reinforcement bars over the top.

The concrete was delivered in 1-yd. buckets and after it was placed derrick stones and stones of a smaller size were set in it and joggled down so as to be thoroughly bedded with a space of at least 2 in. clear from all faces. In the main arch piers flat stones were used and were laid normal to the resultant thrust of the arch. In all of the other piers the stones were bedded horizontally and care was taken to have those placed at the end of each day's work project about half of their height above the surface of the concrete so as to form dowels bonding the concrete with that to be laid the next day.

Above the surface of the ground the piers were built in ordinary forms made with 2-in. horizontal boards 18 in. wide, planed on the inner face and on the edges and secured as usual by vertical outside studs with tie rods through the upper ends. The lower ends were secured by ¾-in. bolts 12 in. long with their inner ends engaging nuts and washers permanently embedded in the pier concrete 8 in. back from the face.

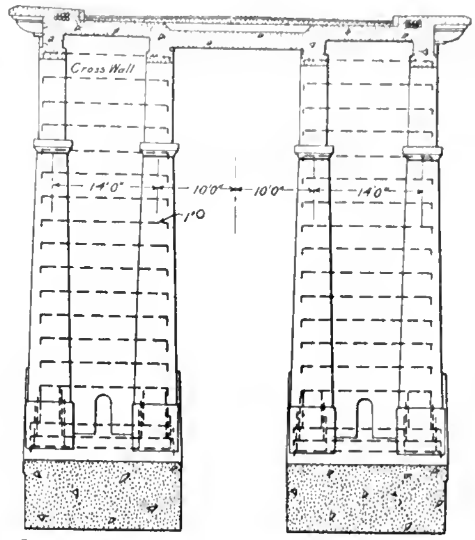
Courses of concrete four boards deep were laid daily and the bolts securing the lower four boards of the forms were unscrewed from their nuts and taken out and the boards removed and built on top and the holes left in the concrete were filled with plaster. Triangular horizontal strips 2½ in. wide and 20½ in. apart vertically were attached to the inner faces of the forms to produce course joints in the face of the concrete. On the day after the concrete was placed the form boards were removed and the surface was scrubbed with a brush and rinsed with water, which produced a very uniform color and texture and entirely removed all traces of the form boards.

The centering for each of the 53-ft. arch ribs was made with seven triangular wooden trusses 4 ft. apart on centers which spanned the full width of the arch and were carried at the spring-



Walnut Lane Bridge Showing Voussoir Scoring.

ing line on transverse horizontal 10x10-in. yellow pine upper sills, supported by pairs of oak wedges under each truss on 10x10-in. lower sills scabbed to vertical 10x10-in. posts set on the rock bottom adjacent to the mould for the pier foundation. The trusses were like scissors rafters with straight lower chords made of two spliced 3x12-in. planks with zig-zag bracing to the top chords which consisted of ordinary scarf boards made with two 3x12-in. planks bolted together. Forms were built on the lagging and loaded with stone at the crown and the arch rings were built up from both skew-backs simultaneously to the crown, care being taken to finish the work each night on radial planes parallel to the axis of the arch. The false-work and forms for each of the 53-ft. spans was built by a party of seven men in about four days and the 140 cu. yd. of concrete in the arch ring were laid in one day. When the concrete was one month old, the centers were struck by carefully slacking the wedges and no settlement



Cross Section through Spandrel Arch.

proper is 232 ft. long and 42 ft. high and has twenty-one transverse bents. Except at the ends the bents are all two stories high and all are made with ten vertical posts and two panels of 2x9-in. X-bracing in each story.

The upper section of false-work 30 ft. wide has its 15 transverse bents in the same planes as the center bents of the lower section of false-work and each bent is made with six vertical posts in one, two, or three stories, each with a single panel of X-bracing. The ends of the first story caps are braced by batter posts to the ends of the first story sills, thus giving an extended base for lateral stability. False-work is braced longitudinally by six lines of double panel X-bracing and horizontal ledgers in the upper section of the false-work and eight sets in the lower section.

All X-braces are 2x9-in. planks, the upper and lower ledger pieces of each section are 4x12-in. and the intermediate ones are 3x12 in., and all other timber in the false-work is 10x10-in. yellow

Construction of First Rib of Main Arch, Walnut Lane Bridge.

at the crown could be perceived. No especial delay was required before commencing the 53-ft. spans after the completion of their piers. It was, however, required that the main piers should be completed at least 30 days before commencing the concreting of the main arch rib.

Each main arch rib with its transverse spandrel walls contains about 2,400 cu. yd. of concrete and imposes a maximum load of about 6,000 tons on the false-work. The application of this great load varies with the changing condition of the concrete as it gradually drys and sets and develops different frictional resistances on the lagging. To provide for the somewhat indeterminate stresses and prevent deflection the false-work was made heavy. The upper part of the false-work was trestled separately from the lower part and divided from the latter by a space for the adjusting wedges. From this line down to a level considerably below the skew-backs, where it was supported on a steel and masonry sub-structure, the false-work was braced to form a lower section.

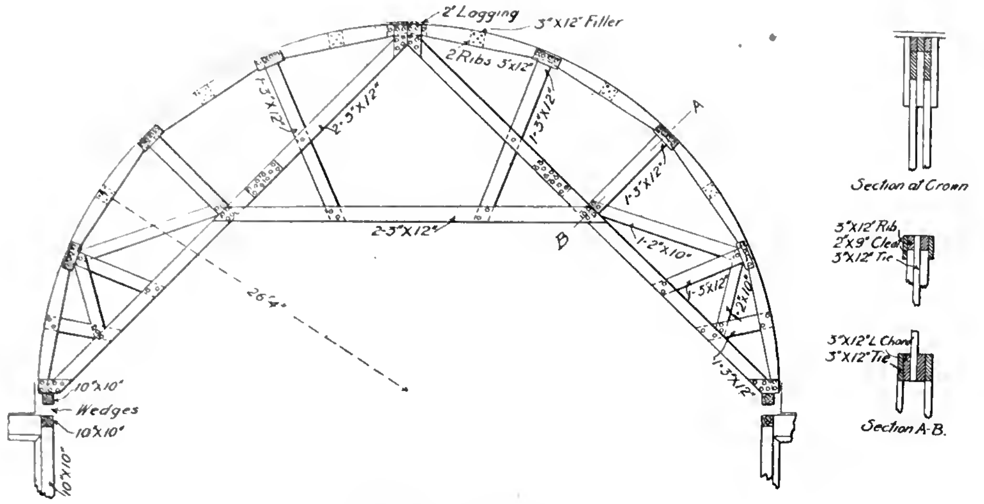
The sub-structure is carried on concrete piers about 85 ft. long and 2 ft. wide on top. All of them have their footings carried down to solid rock and have their faces battered 1:12. On shore the rock is near the surface of the ground and the heights of the piers vary from 2 to 8 ft. The four piers in the creek are about 12 ft. high and were built in cofferdams made with cribs sheeted inside and filled with puddle. Each of the creek piers carries a transverse steel bent 50 ft. long and 20 ft. high, made with ten 12-in. 31½-lb. vertical I-beam posts bolted to top and bottom pairs of horizontal 12-in. 25-lb. channels forming caps and sills, between which they were X-braced with two sets of 6x3½-in. angles. The caps carry ten lines of 24-in. 80-lb. longitudinal I-beams, the five panels of which have a total length of 132 ft., and are supported at their extremities on the shore piers. The false-work

pine, except the 10x16-in. caps of the upper story which carry 6x16-in. and 6x18-in. scarf timbers spaced 12 in. apart on centers and covered by 1½-in. tongue and groove lagging 28 ft. long, planed on the upper side. The falsework contains about 370,000 ft. b. m. of timber. Fire protection is provided by a 1½-in. water main under 75 lb. city pressure, which extends from end to end of the bridge and is provided every 50 ft. with a tee having its outlet closed by a screwed nipple with the outer ends flattened and welded. These nipples were removed and streams were played on the false-work, soaking it thoroughly for 48 hr. before the keys were concreted between the arch voussoirs. At this time the weather was hot and during the succeeding five weeks the timber dried out so much as to cause considerable shrinkage but not enough to release the false-work from the concrete arch. It is considered, however, that the shrinkage afforded a very slow and delicate diminution of the pressure and was very desirable

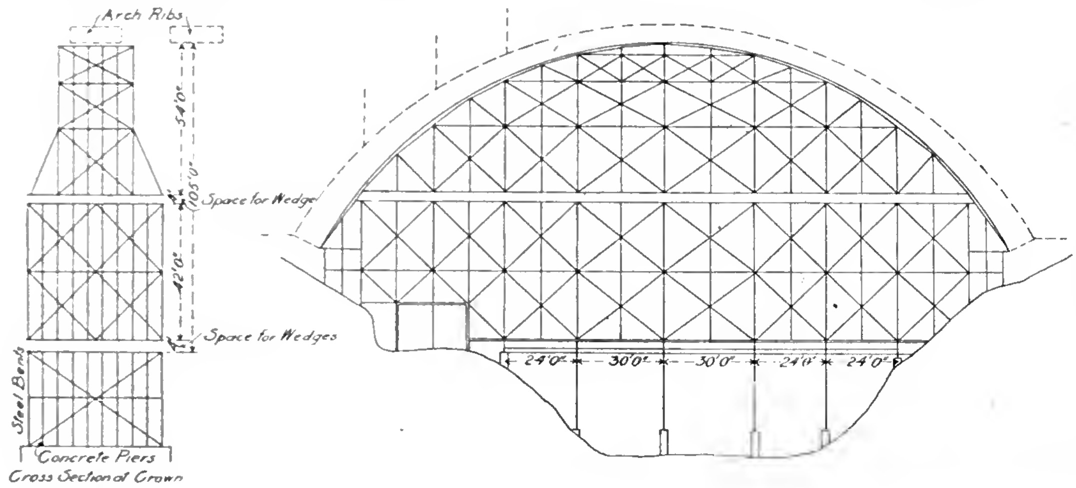
in transferring the stresses from the falsework to the arch ring.

The steel sub-structure, and the end main bents of the lower part of the timber false-work, take bearing on fifty 6-in. steel rollers 18 in. long, parallel to the axis of the bridge which are engaged on top of the concrete piers between continuous 19 × ¾-in. top and bottom back plates. While construction work is in progress all bents are anchor bolted to the piers and the rollers are immovable.

A ladder and a wooden hand rail is provided along each edge of the lagging to safeguard the men working on the false-work, the maximum height being nearly 135 ft. The forms 18 ft. wide, about 8 to 11 ft. long and 5½ to 9½ ft. high, are built with 2-in. tongue and groove planed horizontal boards set on the lagging in the positions indicated by the numbers showing the sequence of construction of the voussoirs. The transverse faces of the forms are in planes radial to the intrados of the arch and all four sides are made with panels having transverse cleats. The inclined faces of the forms are heavily braced by inclined struts to 6x12-in. cleats thoroughly bolted to the lagging.



Center for 53-Foot Arch.

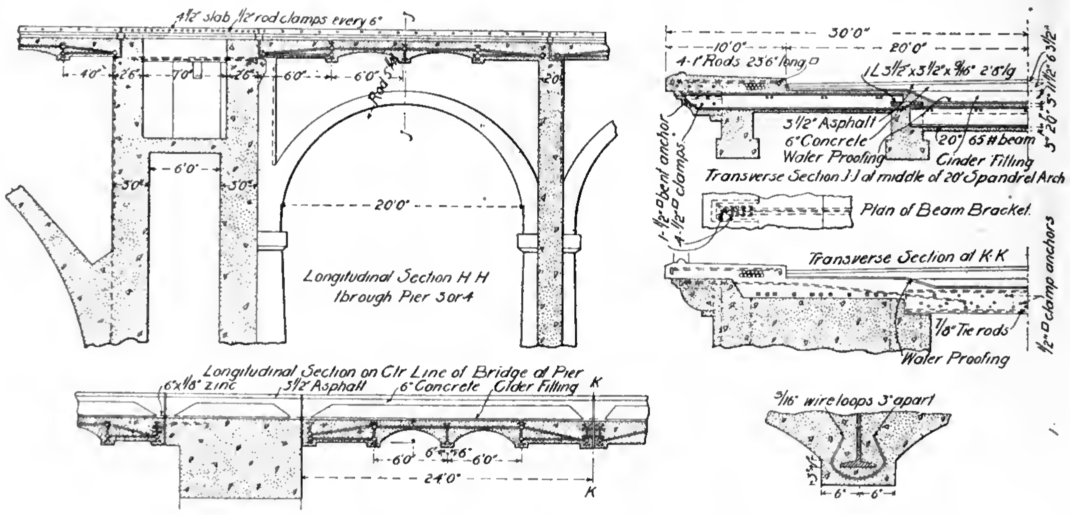


Centering for 233-Foot Arch.

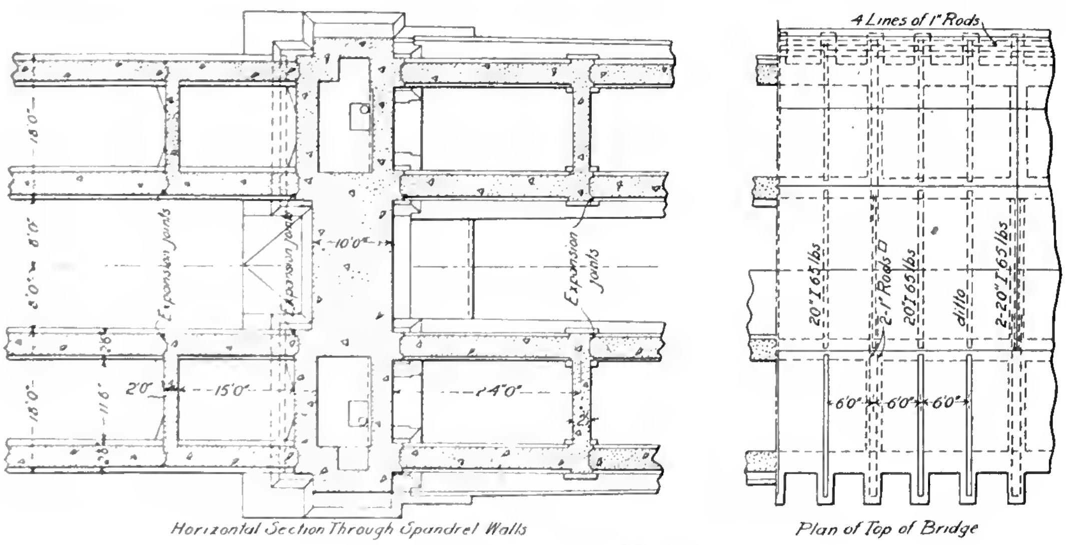
Except at the crown the surface of the lagging is an inclined plane of varying steepness, much of it exceeding the angle of friction. In order to prevent the voussoirs from slipping together before the keys between them are filled, sets of three concrete struts were built between adjacent voussoirs and transmitted the dead load stresses continuously from crown to skew-backs after the mould braces were removed. The struts were 18x24 in., 15x20 in., 12x18 in., in three successive keys from the skew-back up. When the keys were filled in the struts remained in position forming part of the permanent arch ring.

As some of the voussoirs weigh as much as 170 tons each and are seated on steep inclines the workmen were distrustful of the frictional resistance of such as were placed before the lower ones and therefore could not be supported by concrete struts, so, to inspire in them a feeling of absolute security three lines of 1¼-in. steel longitudinal bars, curved parallel to the intrados were bedded into the concrete at the mid line of the arch ring from the crown to the quarters providing balanced anchorage for all the blocks engaged. The rods were made in convenient lengths and their overlapping ends had nuts bearing on reaction plates in radial planes.

The 1:2:5 concrete for the arch ring was delivered to the voussoir forms by the cableway in four 1-yd. bottom dump Stuebner steel buckets, which delivered it directly into the voussoir moulds where it was spread and spaded by two ten-men gangs, who also placed in it one-man



Floor Details of Walnut Lane Bridge.



Horizontal Section Through Spandrel Walls *Plan of Top of Bridge*

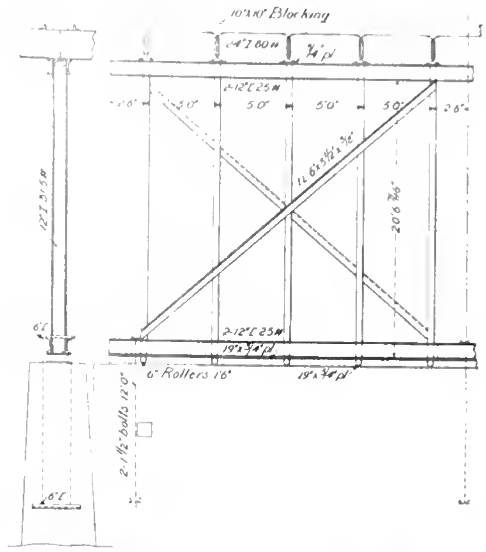
Horizontal Section Through Walls and Top Plan.

Conshohocken flat stones with a thickness equal to about one-fourth of their average dimension. These stones were placed edgeways to the lagging in radial planes as close together as possible. They were bedded in the concrete and worked down into it. The concrete was flushed against the outer face forms with hand mixed 1:2:3 granolithic mixture delivered in buckets to landing platforms just above the voussoirs from which it was lowered in coal buckets as required. The one-man stones were delivered to the same receiving platform by the cableway skips and packed in so closely as to form about 40 per cent. of the volume of the arch ring. Work was maintained continuously on each pair of voussoirs from the time they were started until completed, days being from 8 to 14 hr. long. The corresponding voussoirs on the opposite sides of the crown were always made simultaneously in order to load the false-work systematically, and about 3 weeks were

required for making all of the voussoirs of the first rib.

The deflection, settlement and expansion of the false-work was considered merely moderate. At the haunches it was noticed that as the successive voussoirs were concreted, the lagging sprung clear of the skew-back voissours making a clearance of perhaps 1-16-in. with them. Vertical wooden gauge rods were suspended from the false-work in four places with their lower ends registering with stakes in the ground and the middle one showed a settlement of 13-16 in. at the crown due to the weight of the first pair of voussoirs which were placed at the crown. Levels were taken daily on the top of the false-work and the ultimate total deflection of the false-work at the crown when all voussoirs were placed was 2 in.

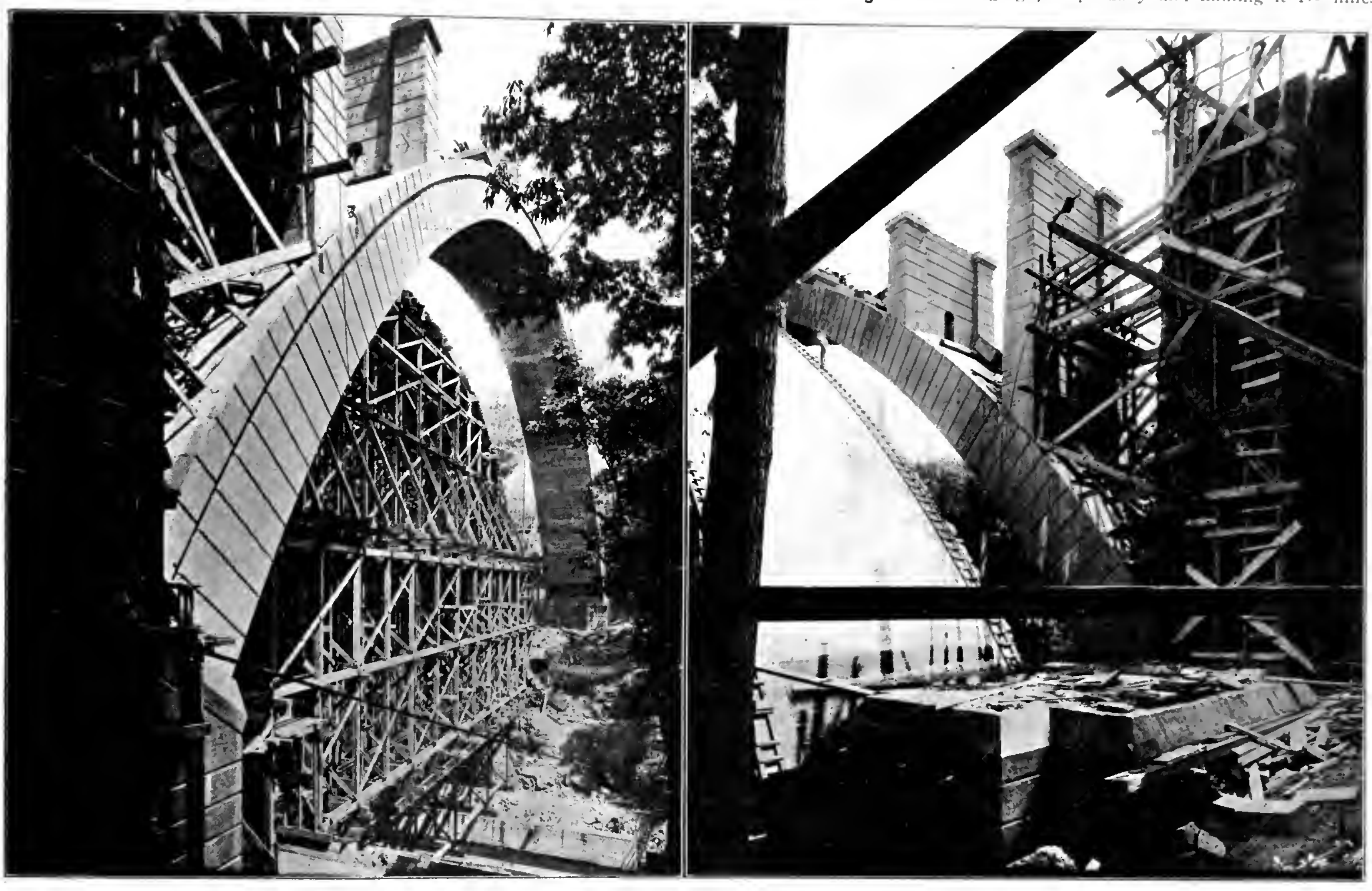
The voussoirs were always stripped when they were one day old and scrubbed on the faces. When the last voussoir of the first rib was 14 days old and all settlement had taken place in the false-work and the voussoirs had fully shrunk the



Steel Bent of 233-Foot Arch Centering.

the concrete commenced to set. When 24 hr. old the balusters are taken out of the mould and scrubbed and are then immersed in water where they are kept for one week. They develop a very hard, smooth gray surface with sharp corners that are not inclined to crack or chip and which resemble handsome cut stone work. The reinforced concrete hand rail will be cast in position on top of the balusters in lengths of about 22 ft. with expansion joints between the ends of the rail and the balustrade piers filled with asbestos felt, a device which has proved effective in preventing crushing and distortion of similar hand rails in other bridges built by the same designer.

The contractor's plant has been establised at grade near the Roxborough end of the bridge and comprises office, repair shop, carpenter and smith shops, storehouse, storage bins, concrete plant, stables, derricks and a cableway. Trap rock broken to pass a ¾-in. screen and be rejected by a ¼-in. screen is delivered by 15 teams, each averaging 7 trips daily and hauling it 1½ miles



First Rib of Main Arch after Removal of False Work, Walnut Lane Bridge.

17 keys were concreted as nearly simultaneously as posible. Thirty days later the centering was struck by slacking the wedges. This operation was commenced at the middle and progressed towards each end. Eight men with sledges lowered the false-work sufficiently to free the arch in six hours. This was very successfully accomplished and caused a further settlement of only ⅛ in. of the concrete at the crown of the arch.

After the false-work was clear of the first arch rib the achor bolts connecting the transverse bents to the concrete false-work piers were removed, a 35-ton ball-bearing ratchet jack was set horizontally against the rear end of the bottom sill of each transverse bent of the false-work or substructure and reacted against blocking secured by the anchor blocks in the concrete piers. The jacks were simultaneously operated by two men each and pushed the falsework and sub-structure, having an estimated weight of 900 tons forward on the rollers 34 ft. in three days. The voussoirs were anchor bolted to the concrete piers as at first and the upper and lower sections of false-work were raised on the wedges on both sides until the lagging was at the required position for the second arch rib and the concrete was carried on as for the first rib.

All parts of the structure are concreted in place except the 884 balusters. The latter, about 23 in. long and 10 in. square are cast vertically in cast-iron molds at the rate of 20 daily by a gang of 5 men. The bottom is recessed to engage a projection in the coping to which it is bonded with a vertical steel dowel. At first considerable difficulty was occasioned by cracks appearing just under the upper fillet. These were thought to be caused by the internal stresses caused by the setting and adhesion of the outer portion of the baluster first and were finally overcome by troweling down the sides at the top of the mould when

from the railroad to a platform at roadway level where it is dumped through double trap doors into a 200-ton hopper bottom bin. Sand is similarly received in a 100-ton bin adjacent to it and both are delivered through bottom gates to the hopper over a bucket elevator driven by a 5-h.p. Reading engine. The buckets discharge on opposite sides of a partition into an elevated storage bin. The bins deliver through 10x12-in. horizontal steel gates to twin charging hoppers with measuring strips on the inner surface to gauge the amount of material required for different proportions of concrete.

Portland cement stored in an adjacent house with a capacity of 1,500 barrels is wheeled from it to an 18-in. belt conveyor which is inclined at a steep angle with the horizontal and is provided with transverse wooden shelves 8 in. wide and about 24 in. apart on which the bags are placed by hand. The belt reverses and deposits the bags

on the measuring platform where they are emptied by hand into the mixing hopper. When the hopper is filled the cement man operates the levers that control the hopper gate and delivers its contents to a 1-yd. McKelvey mixer below, a measured quantity of water is added from a barrel and delivered through a foot valve into the mixer. The concrete is delivered from the mixer into 1-yd. steel buckets on flat cars on a 20-in. gauge track about 20 ft. long, the ends of which project about 5 ft. beyond the sides of the concrete tower and clear of it to enable the buckets to be hoisted by the cable-way trolley without danger of swinging against the tower. Granite grits for the 1:2:3 granolithic surface are stored at ground level in a 50-yd. bin adjacent to the concrete mixer and shovelled from it and is chuted to a hand mixing platform in the bottom of the bucket pit where sand and cement are also received and the small quantity of a mixture required is prepared and delivered in buckets by the cable-way.

The 785-ft. Lambert cable-way is anchored at the ends to dead men made with logs in the bottom of a pit covered with a reaction platform loaded with 40 tons of stone. All machinery is operated by steam furnished by the central power plant in which there are installed one 30-h.p. and three 20-h.p. boilers for the concrete mixer, elevators and cable-way machinery. There is also a 10x10x10-in. Ingersoll-Rand air compressor, driving pneumatic hammers used for bush hammering the arch soffit. There are four 10-ton derricks with 60-ft. booms which are moved from pier to pier and are operated by three 20-h.p. Lidgerwood engines and one Mundy engine, each with an individual boiler.

The main quantities are 19,200 cu. yd. of concrete and 96,000 lb. of reinforcement steel in the bridge, 6,000 cu. yd. of excavation, 370,000 ft. B. M. of yellow pine in the falsework, 270,000 lb. of steel in the falsework sub-structure and 800 cu. yd. of concrete in the falsework piers. Whitehall Portland cement has been used on the work. The contract price for the finished bridge is $253,551 and it is required to be finished in 18 months. Excavation was commenced August 1, 1906, the first concrete was laid September 20, the construction of the falsework was commenced January 1, 1907, and finished April 1. The concreting was commenced on the first main arch rib April 29, and finished June 7, the rib was swung July 22, and the centering was removed for the second rib August 3. An average force of about 125 men is employed and the largest amount of concrete laid in one day was 100 yd.

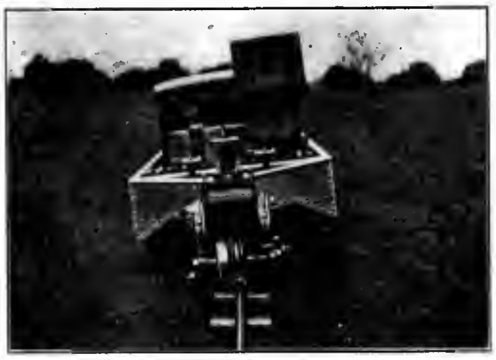
Great care is taken to execute the work in the best possible manner and make it conform strictly to specifications, efforts in which the contractor co-operates heartily with the engineer. One inspector is constantly stationed at the concrete mixing platform and one at each concreting gang. All cement is sampled at the storehouse and is not used until after it has successfully pasesd a 7-day test. Six inch concrete cubes are made as samples of each day's work for test in the city laboratory. The bridge was designed and its construction is supervised by the Bureau of Surveys of the City of Philadelphia, Mr. George S. Webster, chief engineer, and Mr. Henry H. Quimby, assistant engineer in charge of design and construction of bridges. The contractors are Messrs. Reilly & Riddle, the general supervision of the work is under the personal direction of Mr. T. H. Riddle. Mr. Moriz Bernstein is their engineer and Messrs. Chambers Lattimer and O. G. Hoover are assistant superintendents.

A Railroad in Nigeria, Africa, will be constructed by the British colonial government to develop the resources of the country, and in particular to stimulate the cotton growing industry. The road will be about 400 miles long.

The Brennan Monorail Car.

By C. O. Burge, M. Inst. C. E.

Some years ago there was an agitation for reducing the standard gauge in railway extension in many parts of the world, unfortunately only too successful in many instances. This was advocated on the three principal grounds that (1) friction on curves would be diminished, thus enabling sharper ones to be used; (2) lighter construction would be made possible, and (3) dead weight in proportion to paying load would be reduced. Experience has since proved that by reducing gauge the first object, which, however, is only really important in hilly districts, has been practically the only one gained, for strength of road bed construction does not depend on the distance apart of the rails, but on the load and speed, whether on broad or narrow gauge; and lastly, aside from exceptional cases, the loads, especially in new countries with raw produce of low specific gravity forming much of the freight, are more favorable to the ordinary gauging; that is to say, if the narrower cars were to be loaded to their full weight-carrying capacity, by wool, cotton, cattle and similar light freight, the height would cause instability, while



Effect of Side Loading.

full loads as to both weight and capacity can be, in such cases, conveyed safely by the wider car. Now, however, when Mr. Brennan, of torpedo fame, ingeniously and boldly proposes to reduce the gauge to zero, the first advantage, reduction of curve friction, is secured to a very much larger degree; the second object is partly attained, and the third very much more so, for, through the action of the main feature of the invention—the gyroscopic principle—perfect stability independent of width is attained by the automatic preservation of the position of the center of gravity of the car and its load relatively to the single rail support. That the invention, notwithstanding some obvious drawbacks to which we shall refer later, has a good deal to say for itself, is shown by the fact that the Indian government, which makes its own railways and has an experienced consulting engineering staff in London, has, after due inspection, advanced £6,000 to Mr. Brennan, to assist him in experimental work. When, therefore, on Aug. 10, the present writer, with about half a dozen other experts, visited, at Mr. Brennan's courteous invitation, his beautiful home in Kent, England, to see further experiments with a model car, he was intensely interested.

The general principles of the application of gyroscopic action in this case, have already been widely published, and it is only necessary here to say that in the 5 ft. 9 in. by 1 ft. 6 in. model car, two 5-in. vertical wheels, normally parallel to each other and to the length of the car, are revolved in opposite directions at a speed of 7,000 revolutions per minute, this proceeding whether the car is in motion or not. This stability mechanism occupies but little space and is placed concealed under the seat of the cab in the front, the weight being only 5 per cent. of the gross load. The particulars of the automatic device by which the gyroscopes recover their parallelism after the required couple has been exerted, have not been published and are believed not to be yet perfected, but the effect is something not far short of the miraculous. The loading was all heaped up on one side of the car, and as each piece was transferred, the vehicle arose automatically on that side, so as to throw the center of gravity vertically over the rail, while when the car was tilted over by hand and then released, it recovered its position at once, showing how oscillation of speed was dealt with by the gyroscopic influence. Similarly, when the car was put in rapid motion over one of the numerous sharp curves on the model line, the centrifugal force generated was at once automatically opposed by a righting tendency, and the requisite cant inwards, ordinarily effected by super-elevation, was developed. The road wheels are grooved and are fixed to a pair of tandem two-wheel bogies, one at each end, pivoted for vertical as well as horizontal curves on the track, so that inequalities in level are not much felt—the motive power for these, of course, may be that most suitable for the service required.

The car went round easily a curve so sharp that while the leading bogie had passed over it, the trailing one had not reached it, though the tangents of the curve were at right angles, the axis of the car forming the chord of the curve from springing to springing. In fact, the small rigid wheel base of the bogie alone limits the curvature, and mountain lines on this system can be constructed with a facility as regards curves, gradients, and cost of works, to which even the narrowest two-rail lines cannot approach, while the width of the car, as far as stability is concerned, is unlimited in the one case, and not in the other. But there is not only the practicability of negotiating unusually sharp curves, but the almost entire abolition of frictional resistance on all of them, on the monorailway. So much for curvature.

As to the second point, it has been claimed that inasmuch as one rail only is required, the road bed may be lighter, but this is the old fallacy of the narrow-gauge advocates, the weight of rail and bearing of tie being approximately regulated by the weight and speed of the load irrespective of the number of the rails or their distance apart from each other. We say approximately, for the double rail construction suffers under the oscillation arising from the practical impossibility of keeping the two rails exactly level transversely. Hence, each rail has to be strong enough to bear more than half the load, with its impact, while the single rail cannot have any more than the whole to deal with. The same considerations apply, with modifications, to bridges, for some sort of floor would be necessary in any case, and in large structures wind stresses must be provided for, so that the usual width could not be much diminished.

On the whole, not much advantage would be gained in this system by cheapening cost of road-bed.

On the third point, as to economy in dead loading, it is very clear that stability being insured by Mr. Brennan's apparatus, the capability of the car as regards weight and space can be made harmonious, and the machine can be thus worked to its full power in both ways. As this result is, on the whole, well attained on the standard and wider gauges, this particular advantage is limited to countries where the narrower gauges exist.

Generally, as far as the system can be judged at this stage, its chief scope will be for lines in mountainous countries in which economy of construction through reduction of curvature, and of traction thereon, will be great. The absence of the effects of the oscillation which limit velocity on the two-rail line may be a recommendation

for the adoption of the monorail for high speed interurban service also.

Mr. Brennan is now constructing a car approximately eight times, in linear dimensions, the size of the model, in which he calculates that the gyroscopic speed will be reduced to 3,000 revolutions per minute, though he states that 850 is enough to maintain stability. He has had placed at his service land adjoining his property belonging to the British War Department, on which to build an experimental full-size mono-railway, when the investigations, now being gone into for improvement, will have their full effect, possibly within a year or eighteen months.

Side View of the Brennan Experimental Monorail Car.

There is no doubt, from the experience gained, of the absolute perfection of the gyroscopic action while in operation, and if the small motive power requisite to produce it happened to fail, the gyroscopes, being on ball bearings and working in vacuo, would retain sufficient momentum to revolve at a high speed for a long time, giving ample opportunity for providing stability by other means. But there is the possible failure of the gyroscopic mechanism itself, or of the ball bearings, unlikely in the latter case in the absence of crank or belt stresses as in the case of an ordinary flywheel, but still a contingency, though remote. However, no human contrivance is infallible, and such an occurrence is certainly not more likely than that of an axle breakage, impossible in the mono-rail car, which we risk every day and which would equally lead to disaster.

The danger might be got over by providing a double set of gyroscopes for each vehicle, but this of course involves extra space being sacrificed, and extra cost in construction, the necessity of one set in each car being sufficiently objectionable in these respects. Trial on a much more extensive scale will alone show whether the undoubted advantages gained will not be counterbalanced wholly or partially by the extra cost of construction and maintenance of the gyroscopic mechanism.

The adoption of the monorail for branch feeders to a main line of the ordinary type and gauge, has one advantage over those of narrow gauge, which latter system has been, somewhat unwisely, carried out in some countries, thus involving transhipment, and what is more, isolating the branch rolling stock. This advantage arises from the possibility, with some slight modifications at stations, bridges, tunnels, etc., of running the monorail vehicles over one rail of the main line, so that transhipment of freight, difficulty of access to workshops, etc., inherent in the other case would be avoided.

There are certainly sufficient possibilities in the new invention to cause all engineers concerned in railway construction and working to await with deep interest, the result of the larger experiments which are promised.

A Tar and Feathers Road.

Road improvements in Athens, N. Y., have not found favor with the conservative majority of its people, and the progressive element considered strong measures necessary. One morning the center of the town's leading thoroughfare was found planted with several rows of cabbages. The town council was stirred to action and consulted a local inventor as to what should be done. He decided that the street had a gravel bottom and by pouring tar on it a good pavement would result. He was so confident in the success of the method that he offered to furnish the labor if the council would supply the tar. Two blocks were covered in this way on the first day, but the conservatism of the town revolted and the next morning the street was found coated with feathers.

An Infiltration Water-Works Intake Under the Ohio River.

An infiltration water-works intake built of well point strainers buried in the sand bottom of the Ohio River, has been in successful operation for nearly a year in connection with the system of the Owensboro, Ky., Water-Works Co. The system is owned and operated by this company, embracing a pumping station on the bank of the Ohio River and distribution mains from which the city of Owensboro is supplied. The pumps in the station are in dry wells and formerly drew water directly from the river. While the raw river water is unsatisfactory for domestic purposes during a large part of the year, and at certain times it is even dangerous for such uses, when clarified it furnishes a very satisfactory supply. Although the company desired very much to secure better water, it preferred not to build a filtration plant of any type, or resort to any means of purification which would require maintenance and operating expenses, if a desirable supply could be obtained by other means. A broad, deep bar of clean sand and fine gravel which exists on the opposite side of the river from the pumping station, has its surface kept comparatively free of mud and silt at all times by the current in the river. After considerable investigation the decision was made to build an infiltration intake in this sand bar near the line of extreme low water in the river, and to connect the intake with the station by a suction main laid in a trench in the bed of the river.

The suction main which extends across the river from the pumping station to the intake consists of 20-in. hub-and-spigot cast-iron pipe, with a flexible joint to each fourth 12-ft. length. This main is laid nearly at right angles to the channel

Laying Cast Iron Pipe in 24-Feet of Water in the Ohio River.

of the river and connects at the outer end through a 20x16-in. tee with a 16-in. cast-iron pipe laid at right angles to it and in both directions from it. This 16-in. pipe extends 175 ft. downstream and 225 ft. upstream from the end of the suction main. A four-way special connection, having two 8-in. and two 16-in. legs, is placed in the 16-in. pipe every 50 ft., starting 25 ft. on each side of the end of suction main. A 12-ft. length of 8-in. cast-iron pipe is placed in each 8-in. leg of these connections, forming at each 50 ft. two laterals

at right angles to the 10-in. branch of the 20-in. suction main. Flexible joints are used on the 8-in. laterals. An 8x6-in. tee connection is leaded into the end of each of the latter and carries in each 6-in. leg a standard 6-in. No. 8 Cook well point strainer, 10 ft. long. The thirty-six strainers thus provided are, therefore, in two rows parallel to the 10-in. branches from the 20-in. suction main, the two rows being 28 ft. apart on centers and the ends of the strainers in the rows 18 ft. apart.

The strainers have the usual slots at right angles to their axes, cut in them, the slots in the strainers used being 0.008 in. in width. The whole system of strainers and connections is buried 4 ft. 7 in. below the natural surface of the bar of sand and fine gravel, the backfill being carried 18 in. above that surface to allow for settlement. A bed of filtering sand and gravel 60x450 ft. in plan and 4 ft. 7 in. deep is thus obtained. Owing to the location of the sand bar relative to the position of thr river channel, and to the current over the bar, the surface of the latter is kept clean at all times so no trouble is expected from the sand bed becoming filled with silt. In fact, during the time the system has been in service a clear, safe water has been obtained, which it is believed will improve after the sand over the strainers has had an opportunity to settle. The cost of operating the pumps in the station has been considerably reduced by the removal of the sand from the water. Formerly the pump plungers had to be packed once a week, but they have been packed only once since the intake has been in service and are still in good condition.

The important feature of the infiltration intake is its capacity to produce pure, clear water from the river at all stages of the latter and all conditions of the raw river water, without expense after the installation was made. Although the details of this intake are a departure from what has been done along these lines, they could be utilized in obtaining a supply from a river wherever a sand bed formation of suitable character is available.

The intake has an estimated capacity of 12,500,000 gal. per day under normal conditions, some allowance being made for a reduction in capacity. The 20-in. suction main is capable of supplying 5,000,000 gal. of water per 24 hours under economical operating conditions at the pumps. The average daily consumption supplied by the Owensboro water system, however, is only 2,500,000 gal., so it is believed the present intake will furnish an adequate amount of water for some time to come.

The intake and suction main were both laid with the assistance of a diver, from a scow on the surface of the river. The original intention had been to place the intake 48 ft. toward the shore from the extreme low water line. Conditions existing at the time the work was done necessitated a change of plans, however, the intake being placed about 50 ft. off shore from the low water line. The site of the intake was excavated to the desired depth with a floating dipper dredge. The latter was also used in opening up the trench for the 20-in. suction main which was laid at a minimum depth of 2 ft. below the surface of the river bed. On the Kentucky side of the river a ledge of sandstone rock was encountered for a length of 150 ft. in making the trench for the suction main. An 8-in. wrought-iron pipe, fitted with a sharp point and heavily loaded, was used to break up this rock by dropping it from a hoisting block on the scow used in laying the pipe. The rock was successfully broken out in this manner and was then removed by the dredge.

All of the work on the suction main and the intake was carried on with no small amount of difficulty. The water was from a minimum of 6 to 30 ft. in depth to a maximum of 10 ft. above that level during the time the under-water work was in progress, the current varying from 3 to 6 miles an hour at different places. The dredging work was done with the almost continuous assistance of a diver who worked at great disadvantage in the deep water and swift current. In the section of the trench for the suction main where rock was encountered, the operation of the pointed and weighted pipe used in breaking the rock was done under the direction of the diver, and the latter also directed the removal of the rock.

The suction main and intake were laid from a 24x80-ft. scow carrying a guyed A-frame at one end and a hoisting engine. The suction main was laid in sections consisting of four 12-ft. lengths of pipe, extending from one flexible point to the next. The three hub and spigot joints between the four lengths of pipe to each section were made on the shore on skids. The ends of the section were then blanked with wooden bulkheads to assist in floating it when first placed in the water. After the scow had been anchored over the position the section to be laid was to occupy, the section was swung over its designated site by the derrick and lowered to place from a triple block on the latter. The flexible joints between the sections were then made by the diver.

The intake pipe and strainer system was laid in sections 50 ft. long, a flexible joint being placed every fourth length of the 16-in. branches from the suction main. These sections were assembled on the scow and lowered into place from the derrick, after which the strainers were placed by the diver. High water interfered with the backfilling over the intake, which was finally done with a suction dredge.

A 12x12x8-ft. valve chamber built of concrete was built at the end of the suction main. The latter leads to a 20-in. four-way connection in the valve chamber, a 16-in. and a 20-in. line leading out of two legs of this connection to the pumps. A 20-in. pipe extending to the river directly from the fourth leg of the connection provides means of obtaining a supply in case the suction main is out of service. The valve chamber is just inshore from the low water line and is submerged 50 to 60 ft. during high water. Sediment and drift are kept out of the chamber by a heavy timber cover well anchored to its side walls. A hydraulically-operated valve, manipulated from the pumping station, is placed on the 20-in. emergency intake and one on the 20-in. pipe leading to the pumps. The usual arrangement of such valve chambers along the Ohio River, where high water is about 70 ft. above low water level, is to build a tower over the chamber to a point well above high water, this tower being connected to the shore by a bridge. The submerged valve chamber with the hydraulically-operated valve avoids such a tower and bridge and has been satisfactory in service.

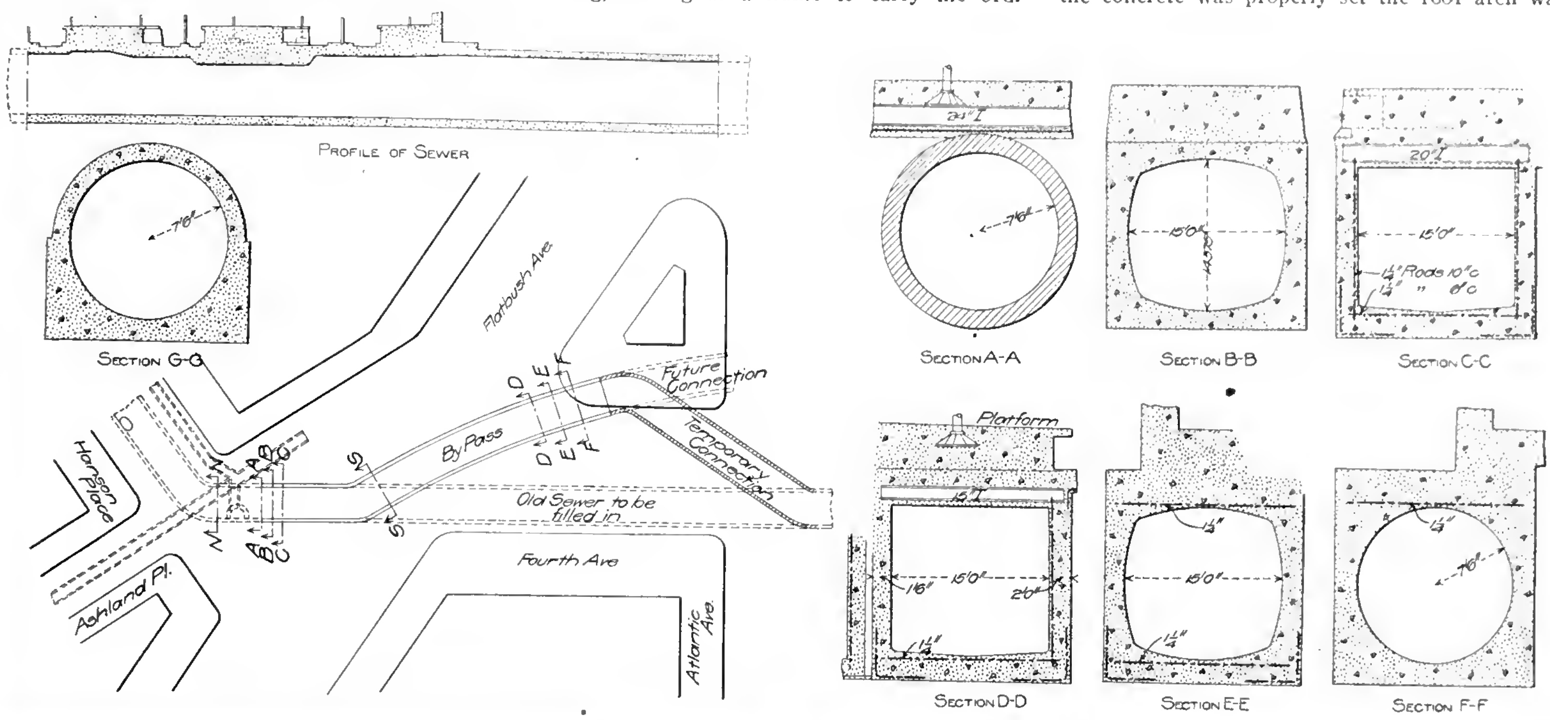
The infiltration intake, suction main and other improvements to the system were designed by Mr. Owen Ford, consulting engineer of St. Louis, Mo., and were installed under his direction. The suction main and intake were laid by Mr. Joseph G. Falcon, of Evanston, Ill., who also furnished the flexible pipe joints used.

The Railways of the World had a total length of 563,772 miles on Jan. 1, 1906, according to German statisticians. Of this amount 215,713 miles were in the United States and 192,248 miles in Europe. New construction during 1905 added 12,524 miles to the total, of which 2,485 miles were in Europe. Germany showed the largest increase, building six times more road than Great Britain. Considerable progress was also made in constructing railways in Africa, particularly in the German possessions. The compilers of the statistics estimate that the entire capital invested in the world's railroads amounted on Jan 1, 1906, to 43⅓ billion dollars.

Constructing a Sewer Under the Brooklyn Subway.

The tracks of the Rapid Transit R. R., in Flatbush Ave., Brooklyn, will pass through a standard rectangular reinforced concrete four-track subway to the intersection of Flatbush and Atlantic Avenues where they will enter a station communicating with the adjacent Long Island R. R. Depot. At this point a short depressed spur will be built dropping under the grade of the main tracks and crossing them to provide for a future connection with a subway which may hereafter be built on Fourth Ave. At this point a 15-ft. circular brick sewer coming down Hanson Place, is deflected about 45 deg. and continued through Fourth Ave., at a clear depth of about 23 ft. from the surface of the streets to the top of sewer. The straight portion on Fourth Ave. is low enough to pass clear beneath the main tracks of the subway, but is not low enough to clear the depressed tracks, the center lines of the subway for the latter and of the sewer itself being about in the same horizontal plane. As the grade of the sewer could not be altered it was necessary to deflect it for a short distance to clear the sub-subway before the construction of the latter was commenced. The new work is very simple and consists merely of a curved by-pass 290 ft. long forming two sides of a triangle connected at both ends with the old sewer and permitting the intersected portion of the old sewer to be removed to leave clear space for the construction at the same level of the single track depressed subway spur which will at present terminate in the triangle enclosed by the two sides of the by-pass and the connecting center line of the old sewer. Practically the new construction and the whole of the by-pass is permanent construction and it is built like regular standard sewer work and will not be modified unless the depressed spur is hereafter continued to connect with a subway in Fourth Ave., in which event it will intersect the by-pass and it will be necessary to cut off one side of the latter and continue the other or up-stream side for some distance parallel to the subway through Fourth Ave., until a point is reached where the ascending grade of the subway carries it high enough for a connection to be made between the by-pass and the existing old sewer, thus virtually lengthening the present by-pass as occasion may demand. On this account the angle of the by-pass where such a future extension may be made is indicated by dotted lines in the general plan and is there noted as a future connection.

In order to maintain the grade of the sewer and to carry it through the limited head-room under the main subway it was necessary to increase the cross-sectional area by transforming it from a circle to a rectangle for a length of about 172 ft., beyond which it resumes the regular circular section. The change of cross section at each end is made in a 20-ft. length of concrete construction which enables the curved surfaces to change smoothly and gradually to flat surfaces. The rectangular cross-section has an inside width and height of 15 ft. and 12 ft., respectively, thus affording a somewhat increased area. The invert and vertical side-walls are reinforced with 1¼-in. square rods 6 in. and 10 in. apart on centers. The rectangular section corresponds closely with that of the depressed subway and is built adjacent to it, resembling very much a twin structure, both structures pass underneath the tracks and station of the main subway and support on their roof numerous of the latter structure. The roof of the sewer has a variable thickness and elevation according to the requirements of the structure above and it is formed with a solid concrete slab from 2 to 3 ft. in thickness, which is car-



Location, Profile, and Principal Sections of By-Pass Sewer.

Anchorage of Steel Pipe.

Timbering over Old Sewer.

ried on I-beams with a depth of 15 to 20 in., and a spacing of 7½ to 24 in., according to the superimposed columns and other loads. Except for these irregularities and special features the sewer design is simple and the principal features of interest are comprised in the methods adopted for constructing it and for safeguarding the old sewer and maintaining its service uninterruptedly during the new work.

The sewer carries so much storm water that it is sometimes under pressure sufficient to blow off the man-hole covers, and it was considered unsafe to demolish it completely in ordinary open trench. A method was therefore devised for reconstructing the invert before disturbing the roof arch at the two points where it unites with the ends of the by-pass. Transverse falsework bents of 10x10-in. timbers, 15 ft. apart, were seated on the invert of the old sewer and supported a pair of continuous longitudinal girders 5 ft. apart on centers, each of them having a T-shaped cross-section made with a 20-in. I-beam and a 15-in. channel, both breaking joints and spliced with cover plates bolted on the webs. These girders carried upper transverse bents 5 ft. apart, made with vertical and inclined posts supporting arch-like transverse timbers, carefully wedged against the brick work and forming altogether a system of underpinning similar to that used by the same contractors for the rectification of the Battery tunnel which has been described in several articles published in these columns.

After the completion of the underpining of the sewer roof at the upper end of the by-pass a dam about 4 ft. high was built across the sewer invert with bags of sand and cement, and through the bottom of it was carried one end of a riveted steel pipe 3 ft. in diameter and 64 ft. long, serving as a flume to carry the ordinary flow of the sewer. The upper end of the pipe was chained securely to a 12x12-in. transverse beam with the ends concreted into recesses cut in the sides of the sewer to serve as an anchor and resist the tendency to displacement, which was found to be considerable. The lower end of the pipe emptied into the old sewer through a similar dam, thus allowing the space between the two dams to be pumped dry and the inverts cut out and connected with that of the by-pass.

At the point where the change in cross-section of the old sewer commenced, just above the by-pass, a 7½-ft. length of the old brick invert was cut out to a level a little above the springing line on both sides, the old brick work removed and the necessary excavation made and carefully sheeted with horizontal boards and vertical rangers braced by inclined struts to the feet of the underpinning bents. The new concrete invert was then built and care was taken to have the reinforcement rods in the side wall project far enough above the surface of the concrete to form 4-ft. lap joints with the reinforcement bars in the upper part of the sewer. Alternate 7½-ft. sections of invert were thus built for the full length required and after the concrete was properly set the roof arch was carried from them by means of bracing, reacting against longitudinal timbers with vertical shores placed between the jack screws. The transverse false work bents were then shifted to seats on the new invert and the intermediate sections of old inverts were replaced by new inverts built in the manner already described, the remainder of the roof was supported from the side walls, transferring the roof weight entirely to the vertical shores.

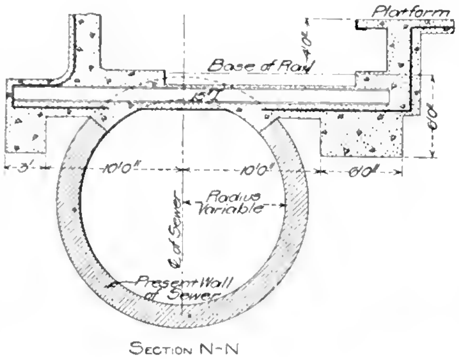
Several elevated railroad columns are located over the line of the sewer and in order to carry them and provide clearance for the excavation and construction below street surface, nine 6x6-ft. pits were sheeted down from the surface of the street to the top of the sewer arch

which was cut through and a corresponding hole cut through the invert of the sewer and the excavation continued a little below subgrade of the new sewer. The bottom of the excavation was concreted to form part of the footings for the new invert and receive a timber grillage on which were seated four 12x12-in. vertical posts extending through the sewer roof arch where they were enclosed with concrete completely sealing the hole and capped to receive two 12x12-in. timbers about 22 ft. long, which reach to the surface of the ground. Here they were capped and braced to receive one foot of the adjustable A-frame, described in previous articles, for the support of the main transverse girder of the elevated railroad structure. The Elevated Railroad column remains suspended from the transverse girders after its footing had been removed until the new sewer and subway above it is constructed and a pier built on the I-beam roof girders of the latter is ready to receive the column pedestal. A full width trench was then sheeted down in the usual way on the center line of the sewer, the old roof arch removed and the new roof constructed, completing the new sewer.

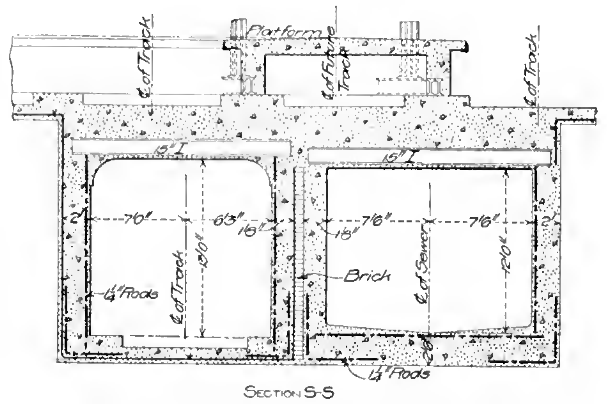
The old sewer thus replaced was built about 17 years ago by the Anderson & Barr pilot method with its brick lining constructed inside a riveted steel shell with segments about 15 in. wide and 3 ft. long, made of ⅛-in. plates and 2x3x¼-in. flange angles. These were found to be little rusted from their long exposure to the comparatively dry soil and many of the ordinary wooden barrel staves used as poling boards in the original excavation were found in perfectly sound condition. There were, however, many cavities unexpectedly encountered in the earth just above the old sewer, some of them having a capacity of 6 cu. ft. or more, one of them being so large that two men fell into it up to their waists. Much of the planking used as a cradle for the invert was also found perfectly sound, although it had not been continuously saturated.

Unusually heavy pressures were developed against the sheeting and it was necessary to provide extra numerous and heavy rangers well braced by cross-struts and diagonals. The by-pass sewer between its connections with the old sewer was entirely built in open trench, the invert being completed before the construction of the roof was commenced. No difficulty was encountered from ground water and pumping was only required in cases where excessive storm water was delivered by the old sewer and flooded the excavation. All water and gas mains and other conduits encountered were supported from beams and girders across the top of the open cut, and no special difficulties except those already described were encountered in the construction which involved about 12,000 cu. yds. of excavation, 200 cu. yds. brickwork and 1,650 cu. yds. of concrete made with 1-3-4 Portland cement, mixed on the surface of the ground and delivered where required through 8-in. galvanized iron chutes. The excavated material was removed from the trench in 1-yd. steel buckets handled by a mast and boom derrick, operated by a Lidgerwood hoisting engine, and was dumped into wagons in the street and into cars provided by the Brooklyn Rapid Transit Co., and carried away as fast as hoisted. As a matter of convenience part of the depressed subway alongside of the sewer by-pass was built at the same time as the latter, although independent of it and part of the old sewer was demolished to give clearance for it, the remainder of the old sewer remaining intact beyond the upper end of the by-pass. The sewer work was commenced Oct. 18, 1906, and was completed July 15, 1907.

The sewer work was designed and its construction supervised by the engineering department of the Rapid Transit Railroad Commission, Mr. Geo. S. Rice, chief engineer; Mr. Alfred Craven, deputy chief engineer; Mr. Sverre Dahm, general inspector of designs. Mr. Amos L. Schaeffer, division engineer, and Mr. Thad. L. Wilson, assistant engineer, in charge of work The Rapid Transit Subway Construction Co., Mr. George H. Pegram, chief engineer, and Mr. Percy Litchfield, division engineer, are the general contractors. The work was executed as a sub-contract by Messrs. Cranford & McNamee, Mr. J. C. Meem, chief engineer, and Mr. M. B. Loonie, superintendent.



Old Sewer under Subway.



Sub-Subway and By-Pass.


Underpinning for Sewer Roof and Temporary Pipe.

Cantilever Construction of the Wear Bridge.

Two tracks of the North Eastern Ry. of England will shortly be carried over the River Wear on the upper platform of a double-track bridge which, with its approaches, has about 9,000 tons of steel in the superstructure. It includes a 330-ft. clear channel span, 85 ft. above high water, and three 200-ft. approach spans. The double inter-section riveted trusses of the channel span have horizontal bottom chords and curved top cords and are 45 ft. deep at the center. They are 32 ft. apart on centers and have cantilever floorbeams about 64 ft. long, with sidewalks outside the trusses and a street car track and roadway between the trusses. The trusses have three webs in the top and bottom chords and a center rib in the vertical post.

The work is chiefly interesting on account of the method of erecting the center span as a cantilever. The approach spans on both sides were first erected on falsework and from their river ends the main span will be built out panel by panel, with the bottom chords supported by guys from the tops of temporary steel erection towers weighing over 600 tons and seated on the main piers. A large full-width solid floor working platform and a smaller riveting platform will be suspended from and travel on the lower chords.

The Baltic-Black Sea Canal scheme seems to have improved in character, for the U. S. consul at Riga states that Mr. M. S. J. Maxinovitch of the Department of Ways of Communication has been orderd to prepare plans for this route, long the plaything of Belgian promoters. It is intended for use by 900-ton barges, and in its length of 1,525 miles there will be numerous locks and canalized river sections as well as strictly artificial canals. The construction of this waterway will also permit a large amount of power to be developed at several places along the Dwina and Dnieper Rivers.

The Water Purification and Softening Works at New Orleans, La.

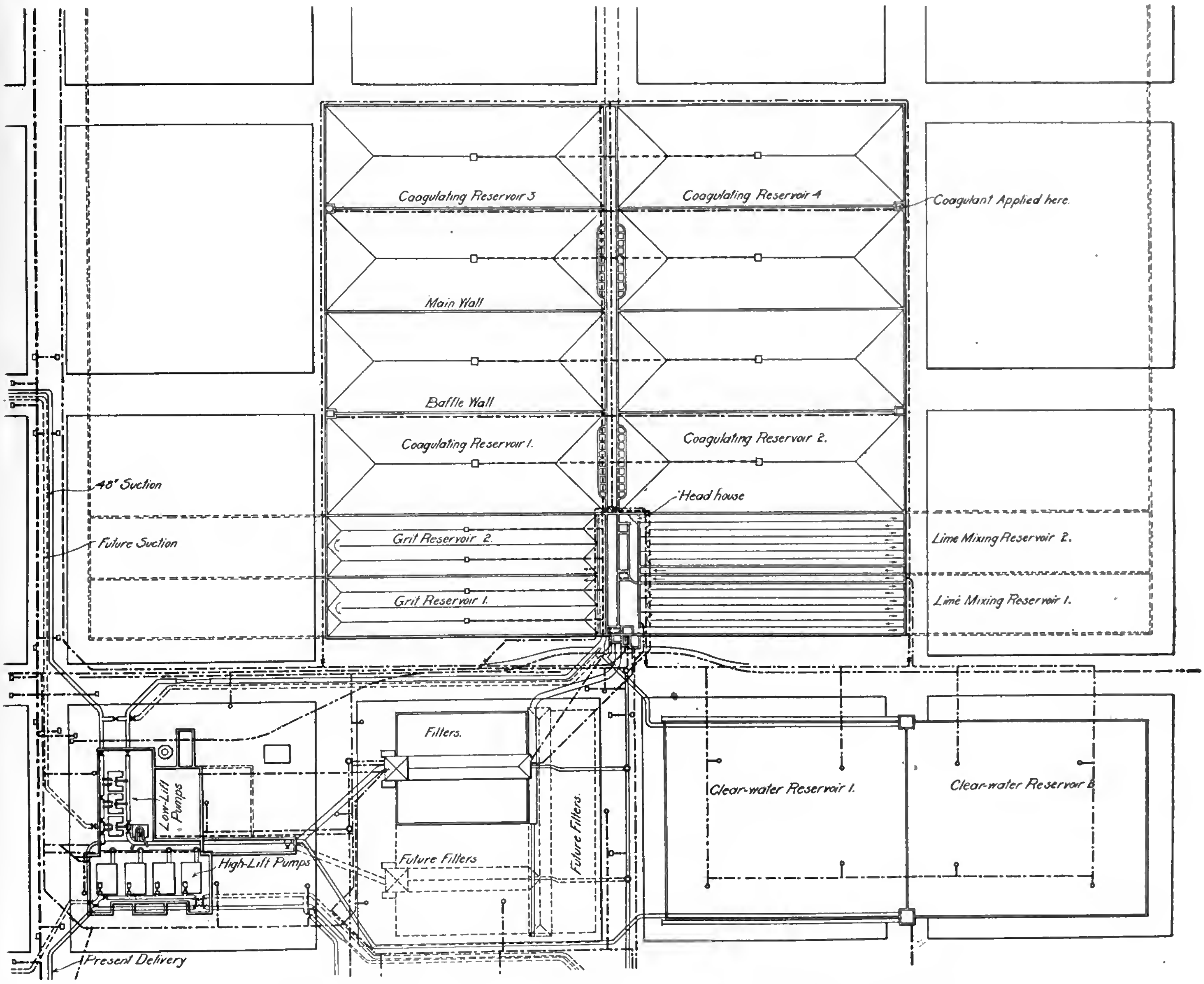
In connection with the extensive water works now under construction at New Orleans, La., two plants for filtering and softening the Mississippi River water are being built, of 40,000,000 and 4,000,000 gal. nominal daily capacity, respectively. They are similar in their general plan of construction and operation, both being designed to reduce the sulphate or permanent hardness as well as the carbonate or temporary hardness and both using mechanical filters to remove the precipitates resulting from the softening process. Sulphate of iron will ordinarily be used as a coagulant.

The larger plant will cover an area about 1,000 x 1,350 ft. It comprises a combined low-lift and high-lift pumping plant; two 72x338-ft. grit chambers, 18½ ft. deep; two 72x320-ft. lime-mixing reservoirs; four coagulating reservoirs, each about 246x342x12½ ft. deep; ten 31x53-ft. filters; and two 262x311-ft. clear water reservoirs, 14 ft. deep. The various reservoirs and the filters will be made mainly of reinforced concrete and the buildings of brick and concrete. These structures will be founded for the most part on piles, as the average bearing power of the ground at New Orleans is only about 1,200 lb. per square foot.

Raw water will be taken from the river through a surface intake, and will be drawn through 4,000 ft. of 48-in. level pipe line, laid with its top about 3 ft. below low water level, by low-lift centrifugal pumps driven by horizontal compound condensing engines. These pumps discharge into a headhouse through a 48-in. cast iron main in which is a Venturi meter. On one side of the headhouse are two grit reservoirs and on the opposite side are the two lime-mixing basins. When the river water is very muddy it will be admitted first to the grit chambers where subsidence will remove the heavier suspended matter consisting of sand and silt. Each grit chamber has a longitudinal baffle wall on its center line which makes the water travel double the length of the tank. The total capacity of the grit chambers is equivalent to about one hour's flow. Returning to the headhouse, the somewhat settled water will pass through submerged orifices into the lime-mixing reservoirs, each of which is divided into sixteen longitudinal passages by seven vertical longitudinal baffle walls and one horizontal baffle midway between the top and bottom of the reservoir. At the entrance to this reservoir, lime will be added regularly to reduce the carbonate hardness and to assist in the coagulation. Soda when necessary for the elimination of the sulphates will also be applied as the water flows through this reservoir, although the latter will not be used save during low-water stages in the river when the sulphates are high. The quantity of chemical solutions added will be automatically regulated in proportion to the varying volumes of water treated by the flow through a series of submerged orifices. The automatic controlling apparatus throughout the plant is one of its distinguishing characteristics.

Lime will be added, not as lime water but as a milk of lime containing about 5 per cent. of lime by weight, which will be kept thoroughly stirred by motor-driven rakes and paddles. The coagulant department in the headhouse contains besides a storage room, three slaking tanks 7 ft. in diameter and 6 ft. deep, and three milk of lime tanks, 11 ft. 3 in. by 11 ft. by 11 ft. deep. Ventilating arrangements are provided to remove the steam and lime dust from the slaking room. Sulphate of iron will be prepared as solutions containing 5 per cent. by weight in three tanks, 8 ft. by 10 ft. 6 in. by 10 ft. deep. A similar set of tanks is provided for the application of soda. Compressed air will be used for stirring the solution of soda and sulphate of iron. All of the tanks in the headhouse are of concrete. Lead-lined iron pipe will be used for the sulphate of iron solutions, for the most part, several connections being of copper or brass. Iron or vitrified pipes will be used for the soda and lime.

The headhouse, 150x50 ft. and two stories above the water level, will contain in addition to the coagulant department the main office for the purification works and a suite of laboratories. The latter, four in number, occupy an area of 1,000

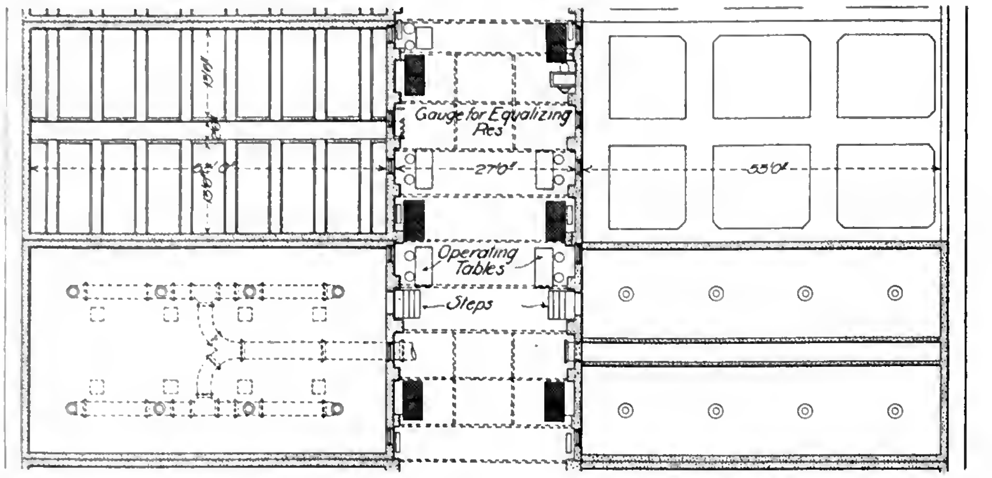


General Arrangement of Water Purification and Softening Plant at New Orleans.

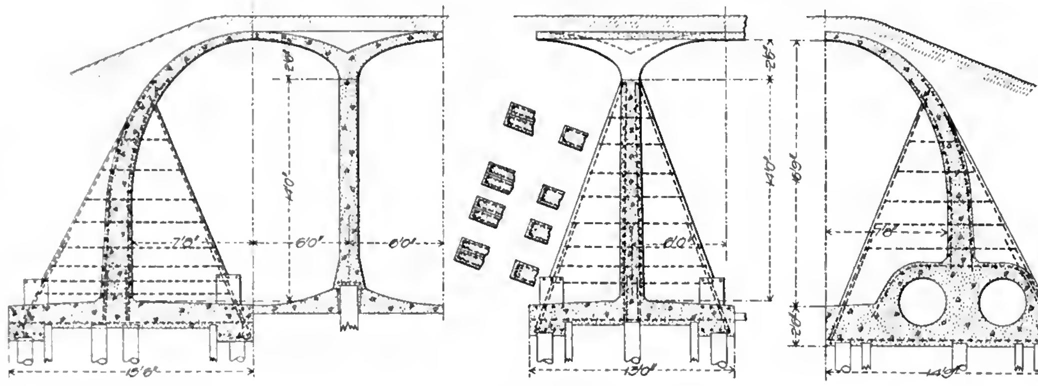
square ft. and will constitute an important part of the plant from the standpoint of efficient and economical operation. Beneath the main floor of the headhouse will be a chamber for the sludge pumps and numerous compartments or waterways to facilitate the flow of water to various connecting portions of the plant in a manner best suited to the varying character of river water.

The flow through the lime-mixing passages will normally require about one hour and the velocity will be such as to facilitate the solution of the applied milk of lime, the reaction of the resulting lime water with the river water, and the thorough mixing of the resulting precipitate with the silt and clay. The water will then reach the head house again and will be passed into the coagulating reservoirs, holding about 7 hours' normal supply, where subsidence due to the coagulating effect of the lime will take place and where sulphate of iron will be added to complete the coagualtion and to eliminate the caustic alkalinity. River water will also be conducted to the coagulating reservoirs to assist in reducing caustic alkalinity, if required. These reservoirs are in several compartments so that the period of subsidence can be varied as desired. The treatment of the water in the grit, lime-mixing and coagulating reservoirs will be a continuous process, the water flowing through each compartment constantly. From the coagulating reservoirs the water will pass through the headhouse and on to the filters.

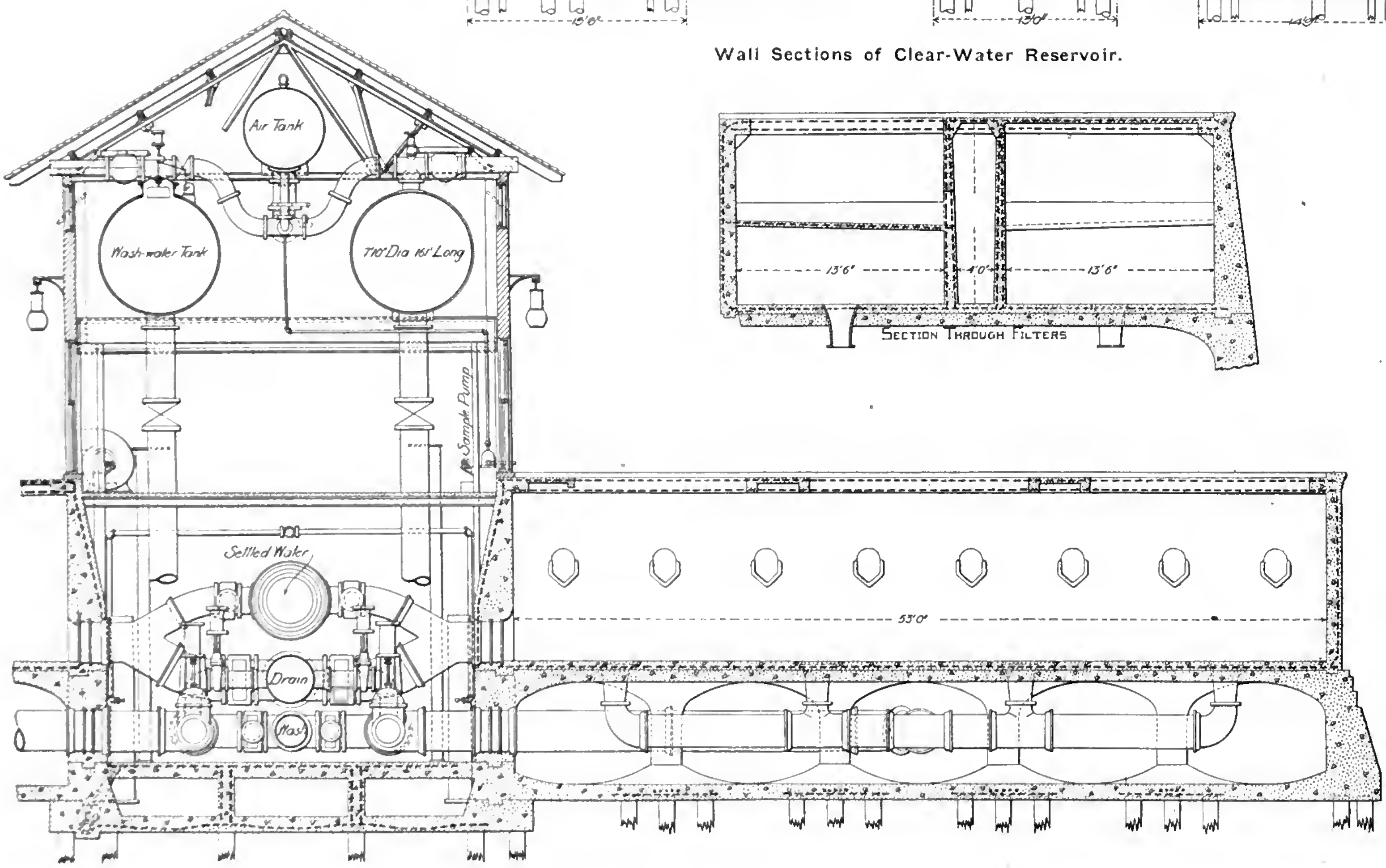
The flow through the filters will be automatically regulated between fixed limits, ranging from a 50 per cent. underload to a 50 per cent. overload. The normal daily yield per filter unit of 1,430 sq. ft. will be 4,000,000 gal. corresponding to a rate of 125,000,000 gal. per acre per day, or about 2 gal. per square foot per minute. By a gradual change in rate so that their efficiency will not be affected, the filters will tend to respond to the demands of the distribution pumps, filtering at a high rate when the water level in the equalizing clear water reservoir beneath the filters is low and at a low rate when it is high. The equalizing reservoir is directly connected with the pump well, and each filter can be placed under this form of control or can be set to any required rate regardless of the height of water in the pump well.



General Arrangement of Filters on Operating Floor.



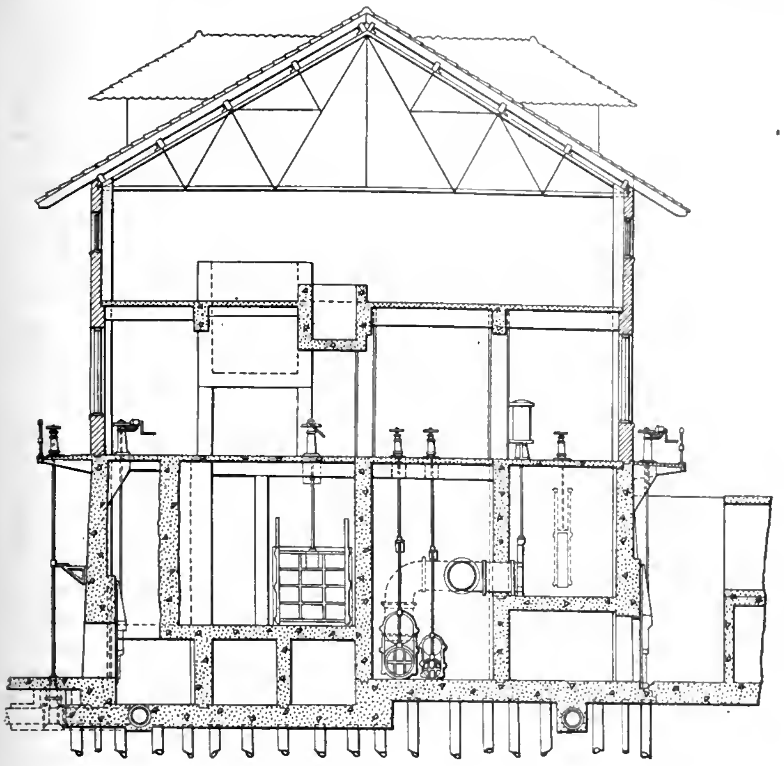
Wall Sections of Clear-Water Reservoir.



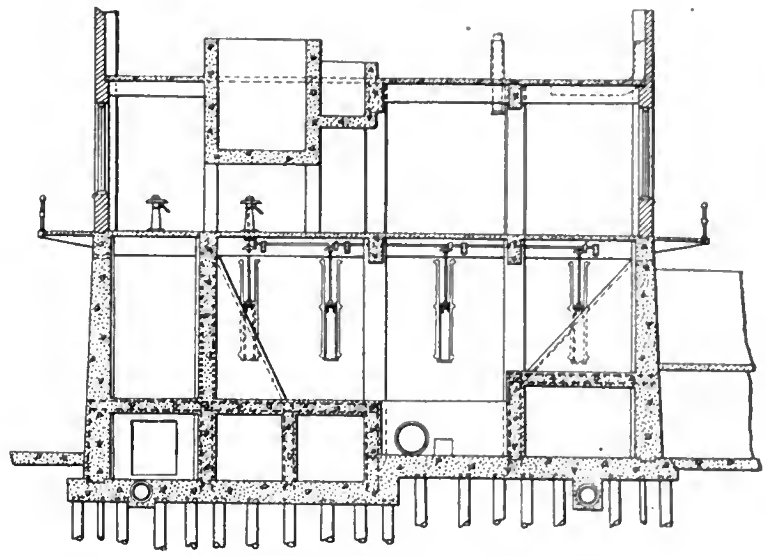
Section Showing Piping Layout in Filters and Filter Gallery Building.

Other than as regards their comparatively large size of unit the filters will be characterized chiefly by being uncovered and by being washed with water without the aid of agitation of the sand layers either by compressed air or by mechanical stirrers. They are designed to receive wash water at a vertical velocity of 30 in. per minute. Wash-water will be supplied from two steel tanks placed beneath the roof of the filter house, and into which water from the distribution system will be allowed to enter slowly. Above the wash-water tanks wil be a third tank, with suitable regulating valves, to receive the air forced from the wash water tanks. This air can be compressed to about 60 lb. pressure and will be available with the aid of reducing valves for increasing the rate of flow of water from the wash-water tanks to the filters as desired.

To insure a constant supply of water in the pump well, and a fairly uniform rate of filtration, the covered clear water reservoir, holding about 6 hours' supply, will be pumped full at night



Section at H3.



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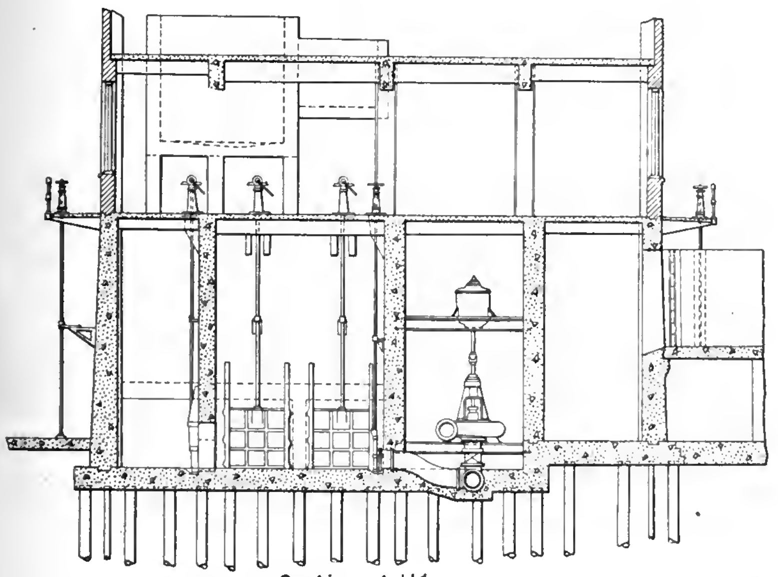
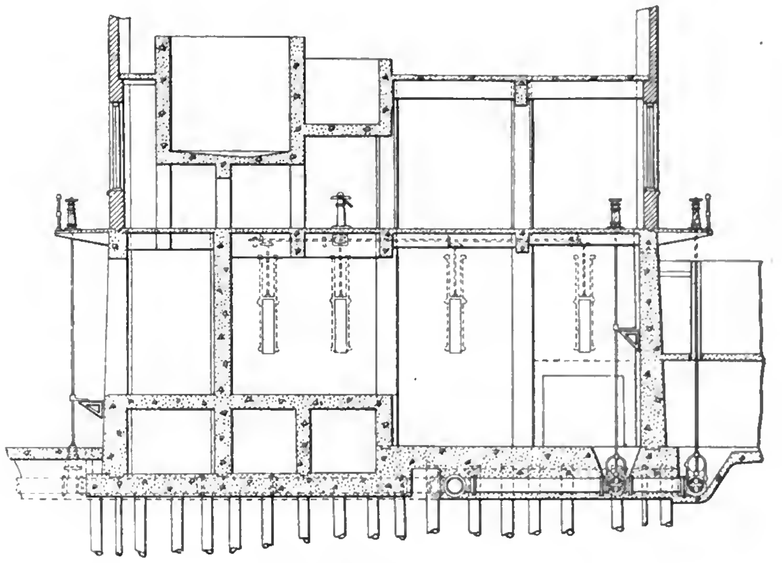
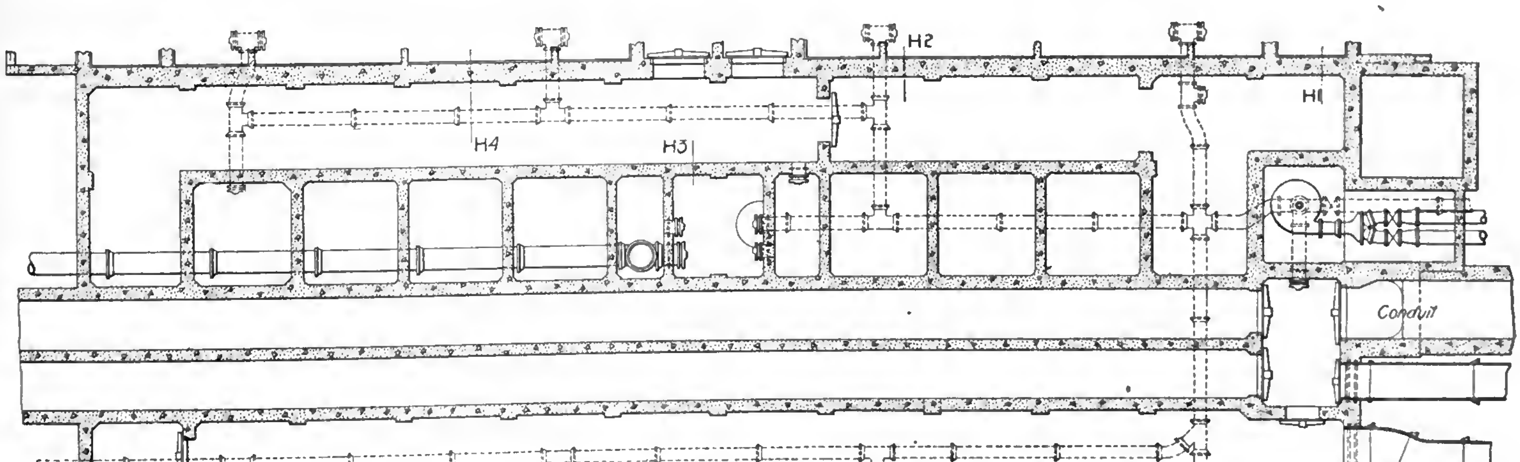


Section at H1.



Section at H2.



Sectional Plan of Headhouse Immediately above the Foundations.

when the consumption is low. These are connected to the pump well by a 48-in. pipe line in which is an automatic valve which will open whenever the water in the well falls below a predetermined level. The water is forced into the distribution mains by vertical triple expansion crank and fly-wheel pumping engines supplied with steam by water-tube boilers equipped with automatic stokers.

The 4,000,000-gal. plant, which in general design and operation is very much like the larger one, is situated on the west bank of the river and will serve the Algiers district with a population of about 20,000, about one-fifteenth of the city.

The construction of these works is in the hands of the Sewerage and Water Board of New Orleans, Mr. Geo. G. Earl, General Superintendent and Chief Engineer. The purification plants were designed by Mr. Geo. G. Earl, Messrs. Geo. W. Fuller and Rudolph Hering acting as consulting engineers. Messrs. Black & Laird, Ltd., New Orleans, are the contractors for the two plants, exclusive of the pumping machinery. Their bid was $1,840,727.30. The equipment of the filters was sublet to the Roberts Mfg. Co., of Philadelphia.

The Use and the Abuse of Sewage Purification Plants.

A paper read before the Ohio Engineering Society by Mr. A. Elliott Kimberly, Special Assistant Engineer, Ohio State Board of Health.

The adequate protection of inland streams and lakes from pollution by the sewage of cities and towns has become one of the great problems of the present day. From the early nineties the advance in knowledge of the art of sewage purification has been so great that to-day as a result of research and of experience gained by the operation of sewage purification plants upon a large scale, it is generally considered practicable to carry the purification of domestic sewage to such a state that the once foul liquid is rendered stable and no longer shows putrefactive tendencies. In a further discussion of the subject, which is no doubt familiar to the members of this society, the thought suggested itself to the speaker, that some benefit might accrue from viewing it from the standpoint of practical results, that is, with this question in mind: By the use of the sewage plant has there been afforded a protection of rivers and bodies of water; or if not, what are the causes underlying the failure of the sewage purification plant to accomplish this end?

Problem of Sewage Purification.—Shortly after the introduction of the water carriage system of sewerage in 1855, it began to be recognized that the withdrawal of the liquid wastes of the community from the immediate neighborhood of the city or town did not entirely effect their satisfactory disposal, especially where such communities were located on the banks of streams of small flow subject to summer drought. During such low flows, offensive odors would emanate from the sludge deposits on the drying shores, affecting the health and welfare of the inhabitants of the community itself or of others located below upon the same stream. For the benefit of the community itself, or as a result of suits on the part of the lower riparian owners, it became necessary to adopt such means for the purification of the polluting discharges that the original purity of the stream would be restored to as great an extent as practicable. Such, in a general way, is the case to-day, especially in inland cities and towns located upon the banks of small streams. A dilution of from 36 to 45 to 1, such as is usually considered to be sufficient to prevent putrefaction on the part of mixed sewage and river water, is usually obtainable only in the case of cities or towns situated on the shores of the larger rivers, hence in other cases the problem of the purification of sewage presents itself for consideration.

As it well known, the extent to which it is necessary to carry the purification of domestic sewage is governed largely by local conditions. By this is meant that according to circumstances of flow of a stream, the character of its waters and their subsequent use as a source of water supply, the needed degree of purification of the sewage discharged into the stream may vary within wide limits. Aside from the discharge of sewage into the sea, where after rough screening, putrefaction is overcome by processes of dilution, the needed degree of purification of domestic sewage may be said to be governed by three general rules. These are as follows:

1. Where the sewage effluent is to be discharged into running streams subject to floods and with a water containing considerable turbidity at all seasons of the year, the degree of purity required need not be more than that of an effluent which undiluted will no longer putrefy under summer conditions.

2. In streams the waters of which are clear except at times of flood, the purification of the sewage should be such as to remove from it the largest practicable quantity of suspended matter, so that the visible purity of the stream will not be affected, the non-putrefaction of the effluent being taken as coincident with a degree of purification which will afford an absence of all but small amounts of turbidity.

3. In drinking water streams, and in certain cases of sea discharge where shell fish layings must be protected from contamination, the purification of the sewage must needs be carried out to its fullest extent, and besides the production of a chemically stable effluent, the problem practically reduces itself to the destruction of all the disease-producing bacteria present in the raw sewage, by subjecting the well-purified effluent to some form of sterilization process.

The conditions referred to in the first instance are such as obtain quite generally in Ohio and the Middle West. In practically all of the plants in operation in this State, the attainment at all times of a non-putrescible effluent would satisfactorily accomplish the purpose for which the sewage plant was installed. That is to say, in this section of the country where the glacial drift formation is absent and where abound clayey soils subject to easy erosion, practically all streams are muddy throughout the year, and except in a few cases where there is involved the protection of a water supply, the abatement of a nuisance from the discharge of sewage into small streams with but low dilution, is readily effected by processes of purification, depending upon the use of filters of coarse material operated at fairly high rates and yielding effluents, which, when clarified by subsidiary subsidence, mixed with river water, successfully pass tests for ultimate stability.

In cases where streams are of low turbidity except in flood stages, processes of sewage purification looking merely to the ultimate stability of the effluents therefrom, owing to the suspended matters incidental to their effluents, will tend to impair the general appearance of the stream, and in these, advantage must be taken of types of purification processes involving the use of materials of fine grain and operated at comparatively low rates. Such conditions are generally found in New England and in some of the States upon the Atlantic coast line, where, fortunately, sandy areas of suitable size and character are usually available, and under proper supervision and intelligent management, the use of these areas produces effluents of a high degree of purity containing but small amounts of suspended matters for the greater part of the year.

In streams used subsequently as a source of water supply, the discharge of sewage therein must be prevented whenever possible. Many instances are to be found, however, of sewage discharge under such conditions as the above, and hence there becomes necessary a form of sewage treatment that not only will prevent what may be called the chemical pollution of the stream, but such as will destroy all bacteria of pathogenic origin as well. As yet, but little practical knowledge has been developed in this country as to the practicability of destroying the bacteria of disease which the most thorough practical sewage treatment fails to remove. Considerable recent work, however, has been done along this line in England and in the United States, and experiments have been conducted in several places in this country looking to a solution of this phase of the sewage problem. A number of disinfectants have been tried thus far, chief of which may be mentioned: Lime, acids, ozone, permanganate chlorine as bleaching powder and also produced electrolitically, and copper sulphate.

Data are yet too meagre to enable conclusions to be drawn as to the practicability of the disinfection of sewage effluents, in part as to the most efficient reagent to be employed, and in part on the grounds of cost, but with the accumulation of evidence from experiments carried out up to the present time, it appears to be quite generally recognized that the day is not far distant when drinking-water streams will be rendered free from pollution by sewage bacteria of disease origin by the use of sterilizing agents, before the sewage effluent carried to a non-putrescible state by a modern process of sewage purification, shall be allowed admission into a stream used below the outfall for domestic consumption.

Ohio Sewage Plants.—At the present time the Ohio plants comprise eighteen municipal, town or village plants and nineteen institutional plants; seven are under construction and the number of proposed plants appears steadily to increase.

The sewage plants in this State embrace practically all the principal methods of sewage treatment from simple clarification by the use of chemicals followed by settling tanks (chemical precipitation), a practice followed so largely in the earlier days of sewage treatment, to the modern continuous filter composed of particles of coarse grain and operated with settled sewages at high rates of filtration per acre. In fact, within about a year, the city of Columbus will be treating its sewage in a plant which represents the most advanced type of sewage purification plant, wherein the screened sewage, settled in septic tanks, will be applied to filters of coarse grain material 5.0 ft. in depth, the application of the sewage being effected by means of nozzles operating under a head of about 5.0 ft., causing the sewage to reach the filters in a spray or in fine drops similar in effect to the action of lawn sprinklers. The Columbus plant when completed will be the largest of its type in operation in this country, as it will comprise septic tanks of 8,000,000 gal. capacity, ten acres of filters and subsidiary settling tanks of 4,000,000 gal. capacity, the ultimate capacity of the design being 20,000,000 gal.

General Efficiency of Ohio Plants.—In view of the great variety of sewage purification treatments carried out in this State, it is not surprising that the degree of purification obtained varies within very wide limits.

The older chemical precipitation processes at best effect a clarification of the sewage with a removal of from 50 to 60 per cent. of the suspended matters, but, of course, the resulting effluents are highly putrefactive, of foul odor and require a high dilution with river water to prevent the rise of a nuisance along the shores of the streams into which they are discharged. In some instances, moreover, the effluent appears to be more highly putrescent after chemical treatment than before, due, it would appear, to the well-known solutionizing action of lime in excess upon suspended organic matters.

In general, it may be said that the treatment of sewage by chemical precipitation alone will probably be productive of foul odors and obnoxious conditions, in addition to the heavy burden of sludge disposal, and in the speaker's opinion, the process, except in rare cases, is to be considered superseded by those of more recent origin.

In the smaller plants, sewage is treated either upon areas of sandy soil, at times also heavy with clay, or upon sand filters of artificial construction, according to the well-known process of intermittent filtration. The variation in the details of a sewage plant of this type is very great, especially as to the character of the filtering medium, the method of flooding the filters, the amount of sewage applied at each dosing, and the amount of preparatory treatment to which the applied sewage has been subjected.

Excellent results are being obtained by the intermittent filtration process in cases where the material is of suitable grade, the quantity of sewage to be treated is not excessive, and where

the supervision is such that the filters receive the proper amount of attention, by which is meant the raking of the surface material, the operation of the filters upon a strictly intermittent basis, in the absence of automatic flooding devices, and the thorough cleaning of the filters in case there develops evidence of ponding due to over-dosing or to clogging on the part of the surface layers.

As a general rule, the filters composed of material of fine grain now in operation in Ohio may be said successfully to purify the sewage applied to them, except in the case of a number that need enlargement or to which but little attention has been paid on the part of those in charge. The clear-cut effluent obtained from the intermittent sand filter is met with occasionally, but requires optimum conditions with respect to the quantity and the quality of the applied sewage, rigid intermittence in the flooding and careful attention to the filter surfaces to ensure the ready admission of the oxygen essential to a maximum of oxidation.

In a number of plants constructed in the last eight years, some form of preparatory treatment has been included in the design aside from the older chemical precipitation processes. Chief of these processes is the treatment of the crude sewage by sedimentation in septic tanks, wherein there is effected a removal of about 50 per cent. of the suspended matter of the crude sewage with the resulting liquifaction of from 25 to 50 per cent. of the deposited sludge. At the present time there are fifteen septic tanks in operation in this state; of this number, twelve are covered and three are open tanks.

The general appearance of the different septic tanks varies greatly. Of those mentioned above, some appear to destroy sludge readily, while in others the accumulation of sludge is quite rapid. The presence or absence of scum on a septic tank is somewhat difficult to foretell, as it seems to be dependent upon several conditions, chief of which perhaps is the relative strength of the sewage, dependent on the per capita sewage flow. With a small per capita flow, sewage tends to possess a turbid, milky appearance, is strong smelling after but short storage and contains a relatively large proportion of colloidal suspended matters. Highly diluted sewage, especially where large amounts of surface water are included, generally carries suspended matters of a flocculent character, capable of rapid subsidence under a reduced velocity and at times carries a small amount of dissolved oxygen through the septic tank. Broadly speaking, sewages may be separated into the above two classes, the division between which is rather indefinite. From the observation and the experience of the speaker, however, it has been noted in many instances that scum formation and highly concentrated sewage are in some way intimately related, as in the case of tanks treating weak sewages, the rising sludge forced upward by the gases incidental to sludge fermentation generally falls back again before a permanent scum has an opportunity to be formed.

The efficiency of the septic tank may now be said to be dependent upon the relative quantity of suspended matters that may be removed by the tank, the older view of the modification of the liquid portion of the sewage itself having been disproved by a number of instances in recent years. Without the aid of chemical analysis and carefully averaged samples extending over a considerable period, it is of course difficult to judge of the actual efficiency of the septic tank. At the same time, from the general appearance of the oxidizing devices and from the fact of the successful operation of the plant at rates considerably higher than would be possible were the raw sewage applied to the filters, it will be apparent that the septic tank as a preparatory process for the removal of a part of the suspended matters in many instances has proven itself an important factor in sewage purification.

There is another side of the treatment of sewage in septic tanks that deserves considerable attention, namely, the disposal of the residue from the hydrolysis of the sludge. The first advocates of the septic process were firm in their convictions that at last there had been devised a process for sewage treatment that would effectually solve the problem of the sewage problem, the disposal of the sludge. Many statements were made and many views were expressed that a septic tank, when installed, would never require cleaning; that in some manner not clearly understood it was capable of destroying the sewage solids to be subsequently applied to it. Such views are now known to be untenable. While the process does effect the destruction of a certain proportion of the deposited suspended matters, yet there always remains an ever-accumulating quantity of sludge which in course of time requires removal, in fact in the most modern designs sludge areas are provided for the cleaning of the tanks.

Considerable experience has been gained relative to the cleaning of septic tanks, and the undertaking is not generally considered to be attended with the production of a nuisance, as might be supposed. In fact the removal of the sludge from a septic tank which has been in service for a considerable period, may readily be handled at any plant without particular discomfort on the part of the workmen or of the people in the immediate neighborhood. The absence of odor in well-matured septic sludge is such as to cause considerable comment when for the first time an opportunity is afforded to witness the cleaning of a septic tank. As reported by Mr. R. W. Pratt, C. E., the Mansfield septic tanks were cleaned in the spring of 1906. In all there was removed about 1,200 cu. yd. of sludge. This sludge was of a pasty nature, it had been compacted during its four years' storage to a water content of only 82 per cent., and, further, its putrescent components had been so altered by bacterial decomposition that the wind blowing over a comparatively large surface of the sludge ponded to a depth of a foot and freshly deposited, brought therefrom practically no noteworthy odors. Such then is the result of what may be said to be one of the important offices of the septic tank, the conversion of the non-hydrolized sludge into a residuum no longer amenable to putrefaction and without an appreciable odor.

In addition to the above mentioned points in regard to the efficiency of septic tanks, there is still another phase of this form of preparatory treatment which deserves more than a passing notice, that is, the periodic upheaval of the sludge deposits and the consequent clogging of the oxidizing units by the suspended matters thus carried onto the surface material. It is a well-known fact that there are periods in the operation of a septic tank usually subject to continuous quiet ebullition of gases, and with a relatively high subsidence efficiency, when of a sudden there rises to the surface of the sewage large masses of undigested suspended matters borne upward by the sudden release of a comparatively large quantity of gas confined under perhaps a heavy deposit of sludge. At such times, the suspended matters in the effluent increase abnormally and tend to choke the pores of the filters, and in certain cases cause the production of decided odors in and about the tank and the plant. This feature of the periodic upheavals in septic tanks, in many ways is, of course, a marked detriment to the process, owing to the load of finely divided suspended matters that are forced upon the oxidizing devices; it is, however, a condition which may be considered as inevitable in the case of most sewages and to a certain degree it would be desirable to provide means to prevent the damage which is caused by the sudden discharge of suspended matters in such large quantities. Generally, aside from surface baffles located near the outlet end of the tank, these being intended to cause the sewage in discharging to pass out with a minimum of disturbance, no special devices have been employed to reduce the suspended matters at the periods of unusually violent septic activity, and the effluent heavily charged with suspended matters passes on to the filters. At such periods filters of fine grain require especial care in their operation, and unfortunately for the general efficiency of the plants, the lack of attention they receive is in many cases deplorable. In the case of strong sewages it appears to be a difficult matter to control these fomenting periods in septic tanks, although tanks on the comparment plan and those operated in series may quite possibly be effective in some instances.

About the time sudden impetus was given to the construction of sewage plants by the rise in favor of the septic tank as a part of the design of such plants, considerable work was carried out particularly in England as to the feasibility of treating sewage in filters composed of fairly coarse grain material. The first of these were operated upon the contact plan, wherein the outlet of the filter is closed, sewage admitted until the pores of the filter are filled, after which the sewage is allowed to stand for a stated period in contact with the filtering material, thus subjecting it to the action of the bacteria retained thereon. The contact filter will be recalled as a type of filter resulting from the increased knowledge of the bacteriology of sewage treatment brought forward particularly as, by its adoption, the purification of sewage was hoped to be the more economically accomplished in cases where fine grain material was scarce and where a limited area was available as a site for the sewage plant. As the head required for the operation of a sewage plant involving contact filters is less than that necessary for the most recent development —the sprinkling filter—there are many cases where the installation of a contact filter plant may successfully solve the problem of sewage purification especially where sand filtration is impracticable.

The plants operated on the contact priniple in Ohio number eight, and in each case the sewage is subjected to some form of preparatory treatment before being oxidized in the filters. The efficiency of these plants varies considerably. In some instances the resulting effluents are carried to the non-putrescible stage as a result of the preparatory and the oxidizing treatment, while in others, the effluents of the contact filters possess considerable odor, are free from dissolved oxygen and protecting nitrates, and do not successfully pass tests for putrescibility.

In the majority of cases the effluents as discharged are low in suspended matters and hence of good apeparance. This feature of the retention of the suspended matters of the applied sewage is characteristic of the contact filter and it is evident that the amount of suspended matter contained in the sewage applied to filters of this type controls in a measure their holding capacity and thus the period between obligatory cleanings of the filtering material. Owing to the detrimental effect caused by flooding contact filters with a poorly prepared sewage, that is, an influent of high suspended matter content, the operation of contact filters in conjunction with septic tanks should be carefully watched. By taking advantage of the flexibility of the design of the preparatory devices, the endeavor should be so to operate them, that, changing conditions being met by modified operating procedures, the sewage applied to the contact filters may be as free as possible from suspended matter, never showing evidences of too prolonged retention, conditions

which will tend to enable the contact filters to operate at their best with a minimum of clogging.

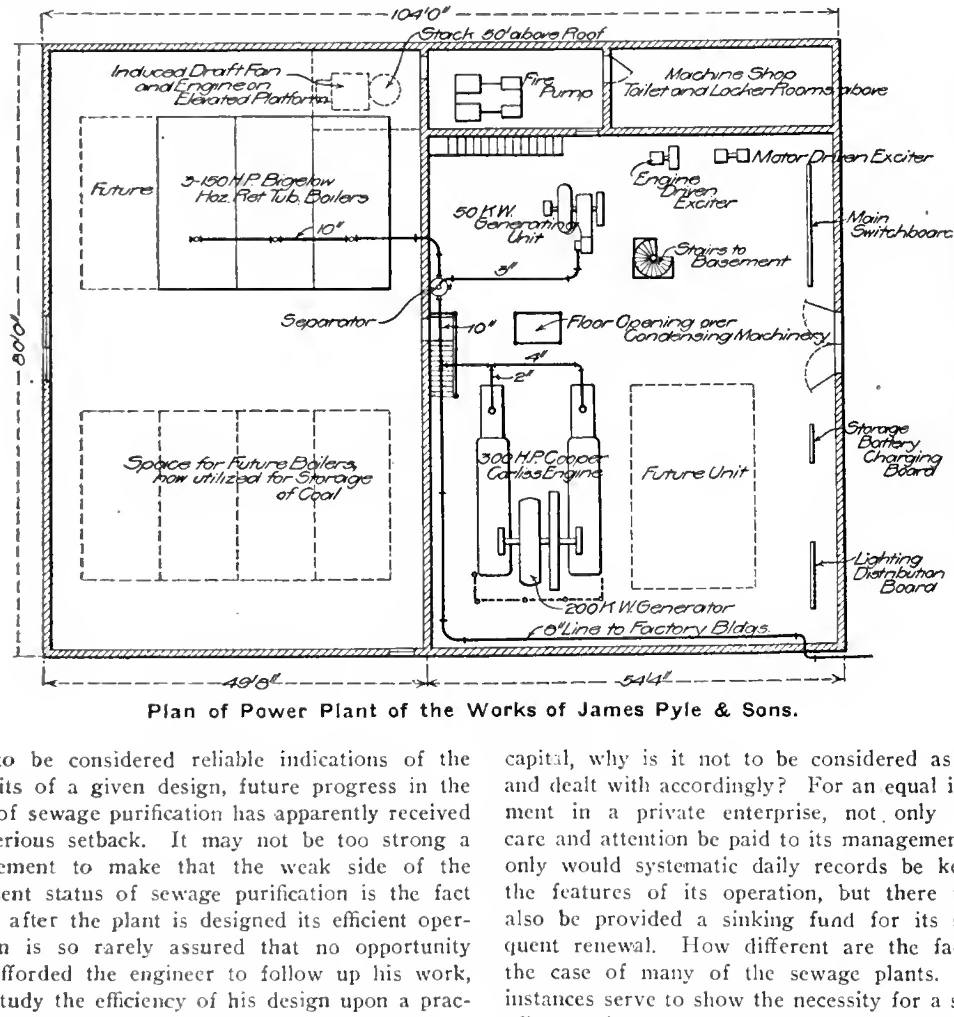
While the sandy area or the artificial sand filter receiving practically crude sewage or that treated by subsidence in septic tanks, are chiefly represented among Ohio plants, yet there are certain cases where a finishing process follows the oxidizing treatment, by which are obtained effluents of considerably purity, generally stable and of low suspended matter content.

Neglect of Sewage Plants.—The failure of the sewage plants at present in operation, is due in many instances to the lack of careful supervision, to the utter disregard of the principles underlying the successful prevention of a nuisance by the use of the sewage plant, to exceeded capacity and at times to faulty design. The types of sewage plants represented by those just reviewed, depend for their success upon the manner in which they are operated.

The idea that the construction of a sewage plant ends the matter in so far as relates to those responsible for its construction, is clearly false in the extreme. New conditions are constantly arising brought about, if you will, by the ever-increasing volume and strength of the sewage due to new connections, especially in towns recently sewered, and to meet such changed and ever-changing conditions means should be provided for the due care and attention of the sewage plant at all times. In planning the purification of the sewage of a city or town questions of economy at times demand that the areas initially provided shall be limited to such as will effectively handle the estimated sewage flow for the immediate needs of the community, together with slight additional amounts to provide for future growth. In addition to the quantity of sewage provided for by the design, the flexibility of the design should be such that additions to the plant may readily be made when the future demands upon the plant require such extensions. As the period of service of the sewage plant increases and as the adoption of the water carriage system of sewage becomes more general in a community, the sewage plant in many instances subject to but scant attention has become so overburdened by the largely increased volume of sewage reaching it daily, that under the best of supervision and management it will not be adequate to meet the increased volume of sewage flow. There appears to be but little attention paid to this side of the sewage purification question and as a result there are to be noted a number of plants which are fast approaching the nuisance stage. The needed increase in the area of a sewage plant commensurate with the increased number of connections with the sewage system brings up the further point that before drawing definite conclusions as to the problem of the sewerage of a city or town, in cases where disposal by dilution may serve for a time to prevent nuisance, the details of the sewerage system should be such that a sewage purification plant may be installed without undue cost when dilution facilities become inadequate with the increased use of the sewers.

With the installation of an automatic device, the idea seems to have become fixed in the minds of some, that such devices eliminate for all time the necessity for all supervision and at times plants so equipped are to be found in a state of sad neglect. Not alone do the filters themselves suffer from this lack of care and attention, but the dosing or discharging apparatus itself has gradually deteriorated, its moving parts have become rusty for want of oil with a final result that the feature of automatic operation has to be abandoned and the plant is then hand operated with enforced supervision, often times but little more systematic than obtained during the life of the automatic appliances.

In the case of plants operated on the intermittent basis, it is apparent that considerable care is necessary to keep the surface material porous and free from vegetation, in this way overcoming the deterioration of the effluent resulting from the inability to operate the filters intermittently. The cost of maintenance for sewage plants is not as great as might first appear and surely by due regard to the condition of the plant at comparatively frequent intervals, thereby insuring its high efficiency at all times, there will be entailed less cost in the long run than the extensive repairs, weed cutting, grubbing, plowing, etc., eventually necessary when plants have been utterly neglected for long periods.



Plan of Power Plant of the Works of James Pyle & Sons.

For the protection of the waters of this ever-growing country there is a need for the purification of all sewage within a given water shed. With a sewage plant ready for service, every effort should be made to operate it to the best advantage. Unless the results obtained from sewage plants under practical operation are such as to be considered reliable indications of the merits of a given design, future progress in the art of sewage purification has apparently received a serious setback. It may not be too strong a statement to make that the weak side of the present status of sewage purification is the fact that after the plant is designed its efficient operation is so rarely assured that no opportunity is afforded the engineer to follow up his work, to study the efficiency of his design upon a practical scale and to add to the progress of the art of sewage purification by the modification of future designs according to the experience gained from the operation of plants designed according to older standards. A neglected sewage plant can hardly be counted upon to afford much reliable information along the above mentioned lines, hence it is apparent how urgently necessary is a radical improvement in the handling of sewage purification plants.

The need for the expert supervision of the sewage plant, especially in the early history of its service, is well expressed by Alvord in a paper read before the Western Society of Engineers, several years ago. He says: "The termination of the expert supervision of sewage purification plants usually takes place a few weeks after their completion. The engineer who had their inception and formation, and who has studied every phase of their environment, who knows what kind of sewage is to be dealt with and its quantity and variations, who understands how such variations are to be met, and who will be equal to any emergencies, drops out, is paid off, and the plant is turned over to the tender mercies of a place-hunter perhaps, or is forced on the unwilling care of some city official with other duties which already fill his time. This is wrong, and to this condition can be traced many cases of dissatisfaction on all sides. The engineer who has carefully designed and constructed a sewage disposal plant should be retained to supervise its operation for at least a year after it is started. He is the one of all others who can successfully launch it on a successful career, and meet the problems of control."

Another phase of the neglect of the sewage plant is the indifference exhibited by officials. The sewage plant is not a revenue producer, it was installed in many cases as a result of suit, it will probably reflect no special credit on the political administration, hence a tendency to cut to a minimum charges for operating expenses, to allow it to pass into oblivion. As the sewage plant represents so much of the city's invested capital, why is it not to be considered as such, and dealt with accordingly? For an equal investment in a private enterprise, not only would care and attention be paid to its management, not only would systematic daily records be kept of the features of its operation, but there would also be provided a sinking fund for its subsequent renewal. How different are the facts in the case of many of the sewage plants. Such instances serve to show the necessity for a strong effort to improve present conditions, and all in any way associated with sewage purification plants should take advantage of every opportunity to place the practical side of the purification of sewage on a better footing.

In these days of the rapid advance of sanitary science, it is signally fortunate that by recent Ohio legislation there has been provided a means whereby attention may be called to the neglected sewage plant and whereby opportunities may be afforded for closer study of the sewage problem upon a practical basis, with the endeavor to raise the operating standards of all sewage plants that they may effectively solve the problems of sewage purification.

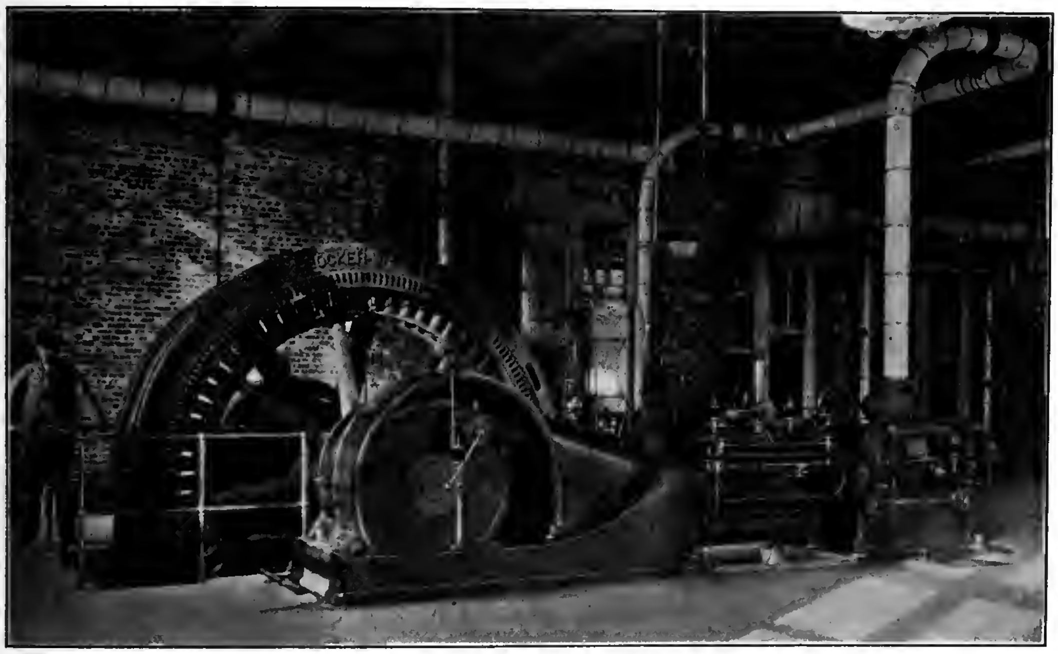
Peat Briquettes are now being made at Norfolk, Mass., with a machine invented by Mr. M. C. Sharpneck, and controlled by Dr. S. D. Treible, of 41 Boylston St., Boston. The peat is cut up by revolving knives like a meat chopper and then pressed through a die in a continuous bar, which is sliced into briquettes by a knife operated automatically.

Power Plant of the New Works of James Pyle & Sons.

An extensive plant has recently been completed for James Pyle & Sons, at Shadyside, N. J., for the manufacture of Pearline powder and other soap products. The location of the works is at the foot of the Palisades on the west shore of the Hudson River, some six miles north of Jersey City and directly opposite 90th St., Manhattan. Ample space available at this site permitted an arrangement of plant best suited to the handling of materials and processes of manufacture, and a scattered lay-out of buildings was selected with power transmission for its operation from a central power plant. There are two large manufacturing buildings, one three stories and the other five stories in height, and a two-story stock and office building. The former are of fireproof construction throughout, while the latter is of modified mill construction. The power requirements of the plant include the supply of steam for heating the buildings and for the operation of boiling tanks for the manufacturing processes, and also the supply of power for the operation of machinery and lighting. The power plant is located at the rear of the site, convenient to rail connections for the receipt of coal.

The station is a brick structure nearly square in shape with concrete floors and wooden roof carried on steel trusses, and is divided through the middle by a brick wall separating the boiler rooms from the engine and pump rooms. The boiler room is 50x80 ft. in size, having its floor practically on ground level, with a clear headroom under roof trusses of 20 ft. The engine room is 54x68 ft. in size with 15 ft. headroom under roof trusses and its floor elevated for an 8-ft. basement underneath. The remaining 12 ft. space at the north end of the engine room is a pump room and a workshop at the boiler room floor level, and above these a laboratory and locker room. A feature of the design is the simplicity of building construction and layout, which provides for very considerable extension in capacity without alteration of the present structure. In the boiler room there are at present but three boilers, although the projected arrangement provides for another unit to the present row at the east side and subsequently four more on the opposite side of the firing floor in the space which is now utilized for the storage of fuel. In the engine room there is sufficient space for the addition of another large generating unit alongside the present one, while additional smaller units may be located in the northerly section of the room.

There are three Bigelow horizontal return tubular boilers, each of which has a heating surface equivalent to a rating of 150 h.-p. The shells are 72 in. in diameter by 18 ft. in length, without domes, and contain 72 4-in. tubes, 18 ft. long. The settings are fitted with U. S. shaking grates for hand firing, a fine grade of anthracite fuel being used. In preference to a tall stack for natural draft, an induced draft equipment has been installed consisting of a Sturtevant fan located on a platform above the boiler settings at the rear and discharging through a 48-in. steel stack which extends about 50 ft. above the power house roof. The fan has an overhung wheel to remove the bearings from the heat and is driven by a direct-connected Sturtevant enclosed engine. No coal or ash handling equipment has been installed, coal being stored in a pile at the rear of the boiler house and also in a vacant portion of the boiler room, from which it is wheeled to the firing floor. Ashes are at present utilized for filling in low portions of the property.



Cooper Corliss Engine and 185-Kw. Generator.

The steam piping has been laid out with special reference to future extension of the plant. There are two boiler room headers which lead to a separator at a central point in the engine room, from which the engine supplies and the high-pressure line to the manufacturing buildings are taken off. Only one of the boiler room headers is now installed, a blank opening being provided on the separator for connection to the future header on the other side. The boiler room header is a 10-in. line from which 6-in. branches connect to each of the three boilers. In the engine room there is a 10-in. connection from the separator which feeds an 8-in. high-pressure line extending to the manufacturing buildings and a 4-in. line to the compound Corliss engine which drives the large generator, this branch having a 2-in. by-pass connection to the low-pressure cylinder. From the opposite side of the separator a 3-in. branch is extended to supply a 75-kw. generating unit and also a 3-in. main to the boiler-room basement for the supply of pumps and the exciter engine at the rear of the engine-room floor.

The engine-room equipment consists of a 300-h.-p. cross compound Corliss engine direct-connected to a 185-kw. alternating current generator, a 100 h.-p. engine driving a 75-kw. generator and two exciter units, one steam-driven and the other electrically-driven. The cross compound engine is a 13 and 26x36-in. horizontal Corliss engine, built by the C. & G. Cooper Co., Mount Vernon, Ohio. It operates at a 120 r. p. m., and with a normal boiler pressure of 150 lb. and operating condensing, it has a rating of 300 h.-p. The condensing equipment, which has been installed for the operation of this engine, is of the surface type and is located in the basement between the cylinder foundations, and an opening in the floor at the rear of the cylinders facilitates inspection of the pumps and connections by the operating engineer from the main engine-room floor. Circulating water is obtained from the adjoining river through an intake line about 500 ft. in length. The smaller unit consists of a Harrisburg simple horizontal high-speed engine direct-connected to the 75-kw. generator, which, operating at 277 r. p. m. with a boiler pressure of 150 lb., non-condensing, has a rating of 100 h.-p. The exhaust steam from this engine as well as from such auxiliary machinery as may be in operation is utilized in a Cochrane open feedwater heater in the basement for the preheating of the boiler feed water. The remaining unit in the engine-room is the 30-kw. exciter which is direct driven by a New Britain simple vertical high-speed engine. Another steam-using unit is a standard underwriter's fire pump, located in the pump room enclosure adjoining the north side of the engine-room, and connected to pressure mains that lead throughout the buildings for protection of the plant from fire.

The electrical equipment consists of the 185-kw. alternator direct-connected to the cross-compound engine and the 75-kw. alternator direct-connected to the simple engine, auxiliary to which are two exciter units, one of 18-kw. capacity direct-connected to the New Britian steam engine and the other of 15 kw. capacity direct-driven by a 25 h.-p. General Electric induction motor. Both main generators are of the new alternating current type built by the Crocker-Wheeler Co., and the exciters were also supplied by that company. The generators deliver three-phase alternating current at 60 cycles and 240 volts, the large unit having 60 poles and operating at 120 r. p. m., while the 75 kw. unit has 26 poles and operates at 277 r. p. m. The exciters deliver 125 volts direct current. For the control of the generator and distribution circuits, three switchboards have been installed, one of four panels, 16 ft. in length, for the control of the two main generators, the exciters and the main feeders to the distribution board; a three-panel board 9 ft. in length on which the power and lighting distribution circuits to the different portions of the plant are controlled, and the third, a single panel board, 5 ft. in length, through which the charging circuits of an electric automobile truck that is operated about the plant are handled.

The engineer for James S. Pyle & Sons is Mr. R. S. Woodward, Jr., and the contractor for the installation of the plant was the New York Steam Fitting Co., New York.

Grouting Mine Shafts in water-bearing strata has been quite successful in work described by the "Genie Civil," Paris. The quantity of cement for each injection varied widely according to the inclination of the strata, and when these approached the vertical not only was the quantity of cement required excessive but the success of the operation was by no means so pronounced. When the strata are thus steeply inclined greater efficiency has been obtained by sinking the shaft by short lengths and injecting each new length in advance by means of radial boreholes driven from the last completed length of shaft. The greatest care is necessary to prevent the fine mud from mixing with the grout.

Electrical Machinery Used in Coke Operations.

The total annual capacity for the production of pig iron by the U. S. Steel Corporation at the present time is about 25,000,000 tons. This enormous production makes the company a correspondingly large consumer of coke for use in its furnaces. With the exception of a comparatively small percentage all the coke which is used is supplied by its subsidiary companies. The two principal operators furnishing this coke are known as the H. C. Frick Coke Co. and the U. S. Coal & Coke Co. The mines and works of the former are located in the Connellsville district, largely comprising Fayette and Westmoreland Counties, Pa. Those of the U. S. Coal & Coke Co. are located at Gary, McDowell Co., W. Va. Both of these companies are operated along the same general lines. The H. C. Frick Coke Co. at present owns about seventy separate coal mines, each mine having its own set of ovens which it supplies with coal. The number of ovens at each mine ranges from approximately 100 to 800, depending upon the output of the mine and other conditions. These are located close to the openings of the mines and conveniently arranged in relation to railroad sidings. The coke ovens are, with few exceptions, of the beehive type, into which the coal is introduced at the top. The residual heat and that of the adjoining ovens starts the coking process, in which the volatile portion of the coal is driven off through the top of the oven into the atmosphere. When all of the volatile matter is driven off, the bed of coke is raked out at the bottom and loaded into cars for shipment.

The continued increase in furnace capacity of the Steel Corporation calls for a corresponding increase in coke production. It is estimated that the new furnaces under construction will add at least 2,000,000 tons to the present productive capacity of pig iron. This will necessitate between 6,000 and 7,000 more coke ovens with the necessary additional mining capacity and machinery equipment. Similar conditions prevail in respect to independent furnaces.

In coal mining power is used for operating haulage locomotives inside the mines, pumps which drain the mines and large ventilating fans. In shaft and slope mines power is also required for hoisting purposes. From the mine the coal is carried to a tipple, whence it is discharged into what are known as coke oven larries, small steel cars equipped with electric motors for propulsion and supplied with chutes for discharging the coal into the ovens. It is customary to arrange the ovens on either side of the track on which the larry runs; coal being discharged from both sides. The electric motors on the larries are small railway type machines. Electrically operated drawing machines are used for removing the coke from the ovens. The machine draws the coke out of the oven by a scraper, discharging it on a conveying belt whence it is dumped directly into freight cars. Two motors are used on this machine; one is of the series wound railway type and the other a shunt wound constant speed motor.

The operations of the H. C. Frick Coke Co. at their Yorkrun plant are of special interest on account of modern features. Of the ovens here 100 are especially selected and so connected by flues as to conduct the hot gases from the ovens to the boiler house. The heat discharged from the coke ovens represents an enormous waste, and its use under the boilers therefore saves the use of a corresponding quantity of coal to produce the same heat; thus a large amount of heat is economically obtained at Yorkrun. It is roughly estimated that the heat developed by each oven is the equivalent continuously of 18 h.p.

The powerhouse is supplied with four alternating-current generators rated 400 kw., 2,300 volt 3-phase, 25 cycles, built by Allis-Chalmers Co. The equipment is complete with motor and engine driven exciters. In the main powerhouse is located a rotary converter sub-station supplied with two 200-kw. rotary converters and six 75-kw. step-down transformers. All the machinery in the powerhouse is controlled by a large 17 panel blue Vermont marble switchboard with complement of oil switches, indicating and recording meters. The rotary converters supply direct current at 600 volts for haulage locomotives and coke oven larries at the Yorkrun mine. Alternating current is used for pumps, mine fans, hoists and scrapers. Within a radius of between two and three miles there are located at various points four additional rotary converter sub-stations; each is equipped with one 200-kw. rotary converter, three 75-kw. step-down transformers and complete switchboard. These sub-stations are located so as to supply both alternating and direct current for mining and coking operations required by one or more mines. The switchboard in the main station is provided with feeder panels for the sub-station feeder lines. By means of integrating and recording meters a record of the power consumption is afforded at each mining and coking operation.

Additional mining and coking operations can be supplied from this same powerhouse by running additional high tension lines. Instances arise, however, where this is not practicable. Where locations are too remote, or when intervening property cannot be traversed by high tension lines, it becomes necessary to install separate isolated plants. A number of such plants are now being installed to meet the increased demand for coke. At the Phillips mines two 100-kw. direct-current railway type generators with switchboards are being installed; also at Ronco mines two 200-kw. direct-current engine type railway generators with switchboard are being started and at Dearth mines two 200-kw. direct-current engine type generators with switchboard. All of this electrical equipment is being supplied by the Allis-Chalmers Co.

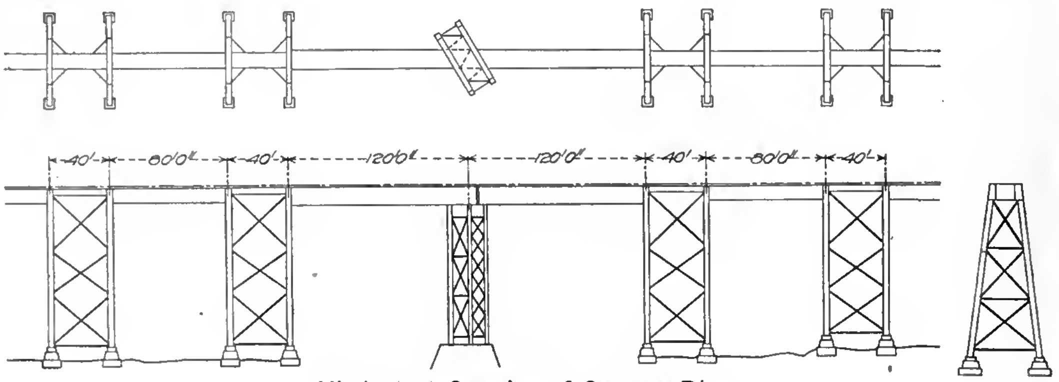
The powerhouse of the U. S. Coal & Coke Co. at Gary, W. Va., is equipped with two 24 and 42x42-in. cross compound heavy duty Allis-Chalmers Corliss engines driving 750-kw. 6,600 volt generators. In sub-stations there is a total of twenty-seven 75-kw. Allis-Chalmers transformers used for rotary converters. The general lay-out of this plant is similar to that of the H. C. Frick Coke Co. at Yorkrun except that waste heat from the ovens is not used.

A Third Pipe Line has been begun on the Thirlmere aqueduct bringing water to Manchester, England, thus completing the project as originally planned by Messrs. Hill & Sons. The water of Thirlmere Lake must be raised 50 ft. above its natural level, or 15 ft. higher than it is now, in order to supply all three pipes.

The Genesee River Viaduct, Erie R. R.

The Genesee River R. R., about 33 miles long, from Cuba, N. Y., to Hunts, N. Y., is a branch of the Erie R. R. system, which is now under construction, as described at considerable length in this journal on March 2. It crosses the Genesee River and valley on a viaduct with a steel plate girder superstructure, 3,121 ft. long and about 120 ft. in height from the water level to the base of rail. It is made of alternating 40 and 80-ft. plate girder spans, except immediately at the river crossing, and is intended to carry a single track at first and afterwards to be widened to a double-track structure. The towers are designed for the latter service, excepting that the columns will then be reinforced and the longitudinal girders are so arranged that the two lines at first erected will later serve for the inside girders of two parallel tracks. The general features of the design and the regular spans and connections are like those of the Moodna Creek Viaduct, illustrated in the Engineering Record of July 6, 1907.

The principal difference between the two structures lies in the crossing of the Genesee River, which is made with two 120-ft. (nominal) plate



Viaduct at Crossing of Genesee River.

girder spans supported at their adjacent ends on a 10x28-ft. 3½-in. vertical tower 120 ft. high with their piers skewed to the axis of the bridge and the direction of the river. The girders of one span have expansion bearings and those of the other span have fixed bearings on this tower, while the opposite ends of both spans have fixed connections to the regular towers. The span has square ends on both sides of the river and oblique ends on the skew center pier.

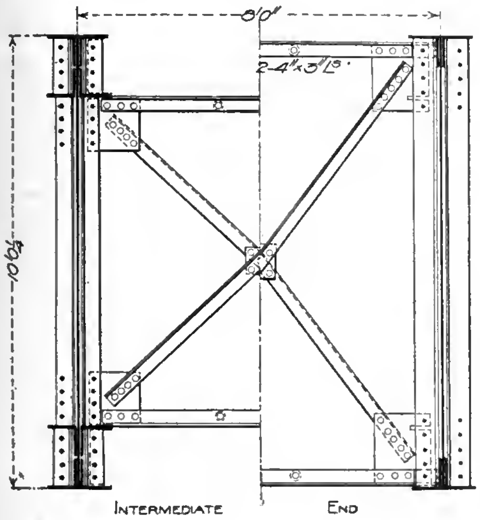
The columns of the river tower correspond with those in the other bents except that they are vertical instead of battered and that they are field riveted to the full-length webs of the transverse girders which is also field riveted to the top flanges of wide solid web knee-brace shop riveted to the columns. Each column is made in two sections and the lower section 65 ft. 3½ in. long is provided with a 54x60-in. base plate 1¼ in. thick, stiffened by wide connection angles and four pairs of vertical pocket angles 22 in. long milled at both ends and engaging upper horizontal shelf angles to afford bearings for the nuts on the top of the anchor bolts which pass through the pockets and through the 5x6-in. slotted holes in the base plates. The column webs are stiffened at the lower end by a 22x½-in. x 9-ft. diaphragm faced to bear at the lower ends on the base plate. This diaphragm is in the plane of the one designed for the future reinforcement of the columns when the second track is added to the viaduct, and stiffens the posts for the distribution of stresses from the struts.

There are two transverse girders at the top of the tower carrying the longitudinal girders, each of them having two full-length 96x½-in. web plates 30 ft. 3 in. long and 26⅜in. apart in the clear. The upper ends of the columns en-

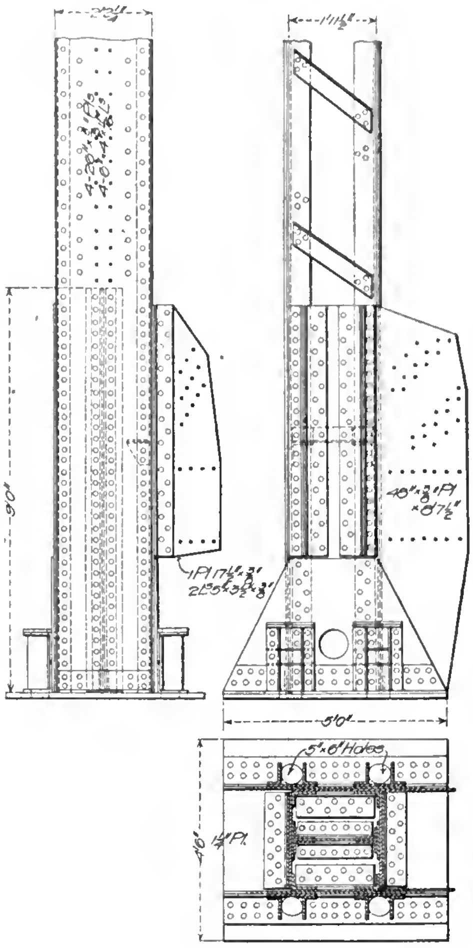
gage these webs and are field riveted between them with one hundred ⅞-in. rivets driven in holes reamed to a cast-iron template for each column. The girder webs are connected by three ⅜-in. full-depth diaphragm plates and by four top flange tie plates. The webs in reality belong to separate girders, each of the four flanges being composed of two 6x6x⅝-in. flange angles and one full-length 14x⅝-in. cover plate. The inside bottom flange angles are cut to clear the columns.

The longitudinal girders of the 120-ft. spans are made with 120x½-in. web plates, in lengths of about 15 or 16 ft., spliced with four vertical rows of shop driven rivets in pairs of 13½x⅜-in. cover plates, 7 ft. 3 in. long. The top and bottom flanges are alike, each having an H-shaped cross-section made with four 8x8x⅝-in. angles and five 18x½-in. cover plates. The angles are each made in two pieces, from about 23½ to 86 ft. long with staggered splices. The outside flange angles are spliced with pairs of 7⅜x7⅜-in. cover angles 6 ft. 4½ in. long cut down from 8x8x⅝-in. angles. The inside angles are spliced with similar cover angles and have in addition an 8x8x⅝-in. angle of the same length with its horizontal flange riveted to the horizontal flange of the main angle and its vertical flange riveted to the girder web above it. The first flange cover plate is of full length and is made in two pieces spliced by the outer plates which diminish in length to 35 ft. for the last one. The web splices are carried over the vertical legs of the flange angles with pairs of short cover plates with eight shop driven rivets in each end. The web is divided into panels 6 to 8 ft. long by pairs of vertical web stiffener angles at splices and at intermediate points. Each angle is made in three lengths with the ends carefully fitted to bearing on the horizontal legs of the flange angle.

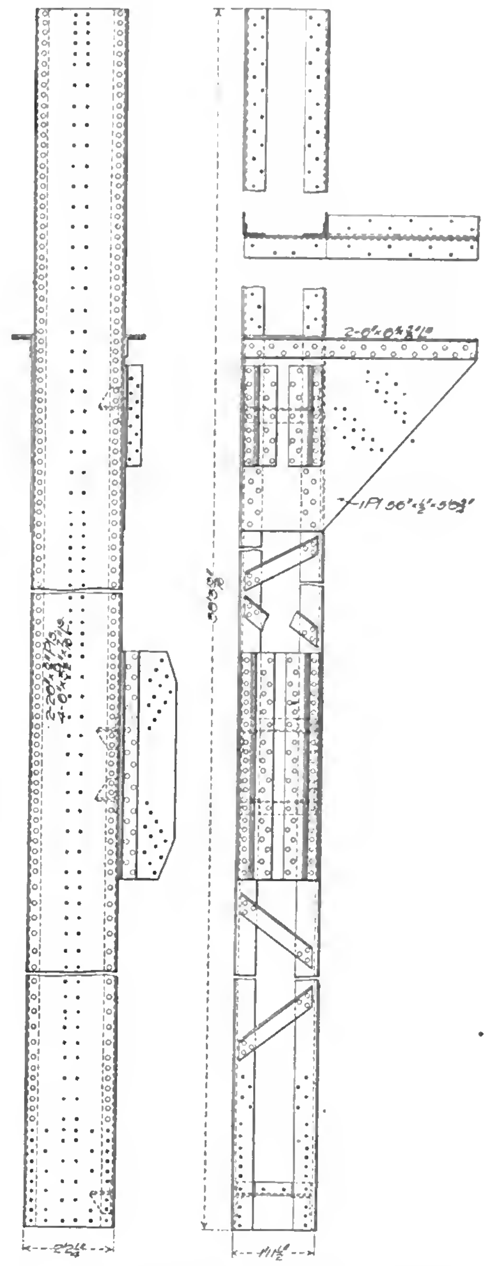
At the tower or double bent 13, the 125-ft. 4-in. and the 120-ft. 8-in. girders of span No. 7 are



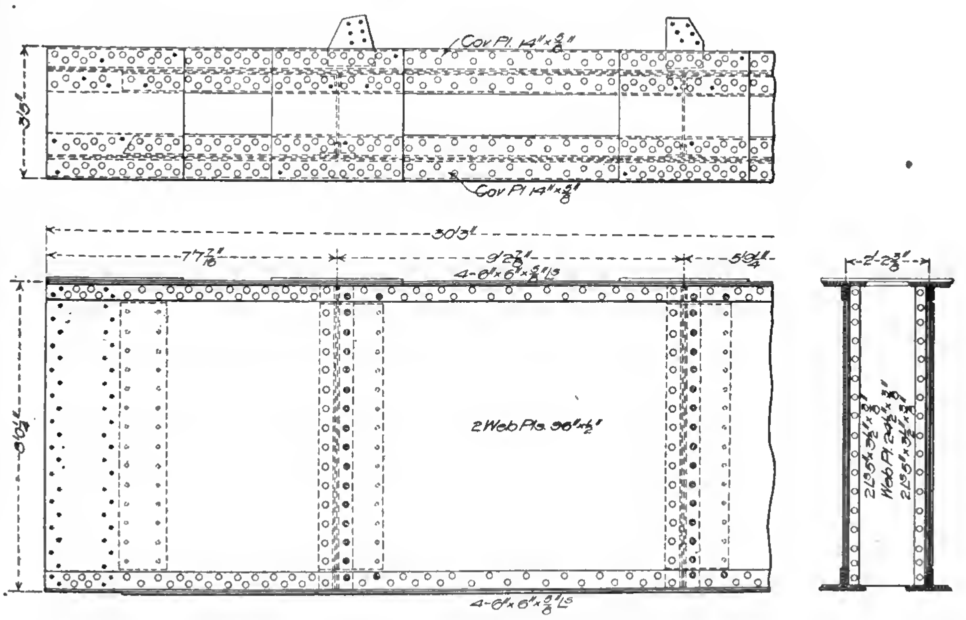
Cross Section of 120-Foot Span.



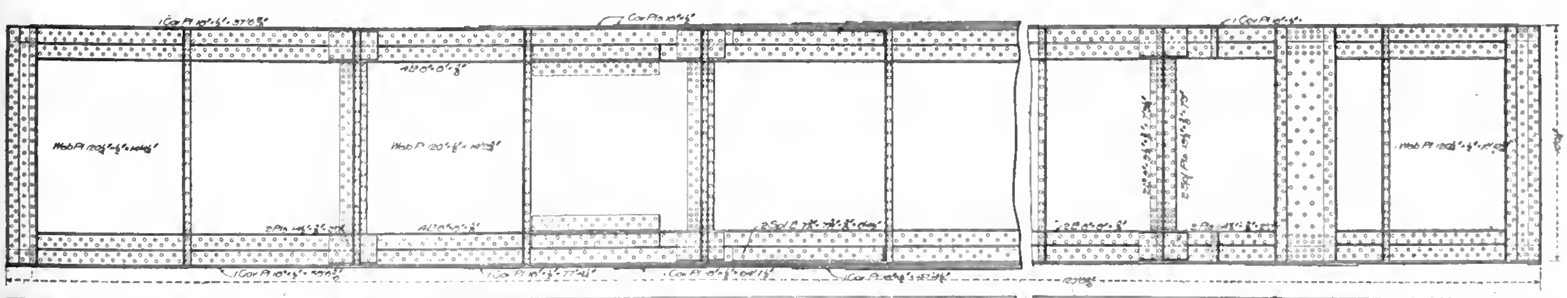
Base of Columns.



Top of Column.



Transverse Tower Girder.



Girder Over River Crossing.

seated on one of the twin transverse girders and project beyond it to the second twin transverse girder on which they take bearing with narrow sole plates. The end of the longitudinal girder is 4 in. clear of the first half of the transverse girder on center lines, thus leaving abundant clearance for the support of the longitudinal girder of the adjacent span. The girders of span 7 have their webs reinforced by double cover plates and two pairs of 6x6-in. vertical stiffener angles 31 in. apart over the bearings of the transverse girders. At all of the other bearings of the longitudinal girders the webs are similarly reinforced, but the cover plates are only 18 in. wide. The web plates are cut to make a cambre of 1¼ in.

The girders are X-braced in vertical transverse planes at alternate panel points with single 5x3½x⅜-in. diagonal angles and double 4x3x⅜-in. horizontal angles riveted together back to back on opposite sides of the vertical connection plates field riveted to the web stiffener angles and slotted near their center point to clear the horizontal leg of the inner flange angle. At intermediate panel points the horizontal transverse angles are flush with the horizontal legs of the inner flange angles, at the ends of the girders they are separated farther and are made flush with the horizontal legs of the outside flange angles. The girders are X-braced in the planes of the horizontal legs of the inside top flange angles, each diagonal member is made with a pair of 4x3x½-in. angles riveted together back to back. One member is continuous in each angle and the other is cut to clear it and splices with a horizontal flange plate shop riveted to the flange of the long angles.

The transverse girders in the top of the tower are conected together by full-depth solid web vertical diaphragms perpendicular to the transverse girder webs and the center lines of the columns and of the longitudinal girders. The diaphragms are made with 96x⅜-in. web plates and pairs of top and bottom 6x4x⅜-in. flange angles. The diaphragms are connected to the webs of the tranverse girders with field riveted bent plates about 14 in. wide.

The Erie Railroad construction department is in charge of Mr. J. M. Graham, vice-president, and Mr. Francis Lee Stuart, chief engineer, under whose approval the viaduct, including the foundations, was designed by Mr. Mason R. Strong, engineer of bridges and buildings, with the assistance of Mr. F. A. Howard, assistant engineer of bridges and buildings. The inspection is in charge of Mr. W. H. Wilkinson, inspector of bridges of the Erie R. R. The metal work was furnished by the McClintic-Marshall Construction Co. and will also be erected by them.

A Burr Truss Bridge consisting of five spans, each about 225 ft. long, was taken down recently at Pittsburg. It spanned the Allegheny River at its confluence with the Monongahela River, and was built in 1874 for the Union Bridge Co. and maintained as a toll bridge. The entire structure, including trusses, footwalks and roadway, was enclosed by a wooden covering, roofed with sheet iron. The removal of the bridge disclosed the fact that, though it had deteriorated in parts, it could have been made serviceable for many years with easy repairs. The principal reason for its removal was the fact that it was too low and hindered river traffic. The timbers and the iron tension rods were, on the whole, in excellent condition. The removal of the bridge was accomplished by placing ten timber bents under each span, five to each truss, and then dismantling the arch, allowing the weight of the trusses to come on the stringers on top of the bents. Each bent rested on five piles driven for that purpose in the river bed. The bridge was taken down by the Dravo Contracting Co.

Speed Regulation of High-Head Water-Wheels.

There are few features of hydraulic power plants operating under high heads that are more puzzling than the speed regulation of the wheels. It is not many years since serious troubles were experienced in starting up some plants in the West which had been provided with sensitive governors that had given entire satisfaction in plants operating under low or medium heads. This trouble took the form of great speed fluctuations, which the governor seemed to increase rather than diminish, and it is understood that occasionally the long steel penstocks leading to the wheels were injured by violent pulsations of the water. An interesting discussion of this problem has recently been contributed by Mr. H. E. Warren to the "Technology Quarterly," from which the following notes have been taken.

In the case of an impulse wheel, the great waste of energy which occurs when speed regulation is attained by deflecting a part of the water from the vanes, has brought about the design of such wheels where the jet of water is not deflected at all, but instead the cross-section of the stream is altered by means of a needle valve in the nozzle. The construction is such that the stream flows through the annular space between the inner surface of the nozzle tip and a peculiar valve spindle, the two parts being held concentric by force of the flowing water. When these parts are properly designed the stream does not remain hollow, as might be expected, but converges to a solid cylinder of water a short distance from the nozzle. By moving the valve spindle back and forth axially, the width of the annular space through which the water flows may be changed at will, and thus the efficiency of the wheel may be kept high throughout the entire range of output. the only important objection to this type of wheel, according to Mr. Warren, is that an element of great danger is introduced by such sudden variations in the velocity of the water in the long pipe line which must invariably be used.

In order to get the benefit of safe and good speed regulation, impulse wheels are now furnished with combination deflecting nozzles which have needle valves, the governors being designed to control the deflection, and some other means provided to produce slow movements of the needle valves. Ordinarily with this arrangement the needle valve which regulates the cross-section of the jet is adjusted from time to time by hand as the maximum load varies, so that the governor in order to maintain constant speed is obliged most of the time to direct the stream almost, but not quite, squarely against the moving buckets. If the load increases so that the portion of the stream which is held in reserve by the governor is inadequate to maintain the speed during sudden peaks in the load curve, the cross-section of the jet is increased by an attendant.

By a device recently invented the need of an attendant to look after this detail may be eliminated. Instead, a small electric or water motor is mounted on the nozzle, so that it may move the needle valve in or out very slowly. Control contacts or valves for the motor are arranged to actuate it in a proper direction whenever the main nozzle is deflected away from a predetermined position by the governor. As a result, the cross-section of the jet will be maintained at a certain margin above that necessary to carry the average load.

The function of a governor in connection with a water-wheel is to maintain the speed nearly constant. In order to do this it must be able to control the water acting upon the wheel; generally it must be able to exert great force. Since the load is liable to change rapidly, the governor must move quickly. Since the governor cannot act at all until the speed has departed from the normal, it is important that it should be exceedingly sensitive to slight speed variations and should begin to move as soon as they occur. Because the speed cannot return to its normal value as quickly as the governor moves, the machine must act and then wait for the speed to return. The governor ought to be able to act, according to Mr. Warren, when the water-wheel is standing still, for otherwise some other means must be used in starting.

As regards force exerted in action, governors are now in constant service which develop at their normal rating 50,000 lb. push at the piston rod. For speed of action the limit at present on small governors is somewhat less than one-half of one second for a complete stroke, which means that the governor can shut off or turn on the entire supply of water to the wheel within that interval. The largest governors have a maximum speed of from one to three seconds per stroke. Regarding sensitiveness, it is possible to make adjustment while the governor is in action. Variations within one-half of 1 per cent. cause prompt movement; in fact, it is not easy to measure the smallest variations which will be felt by the machine. The feature of waiting, after it has moved the gates a proper distance, for the speed to return is called anti-racing. This may not be expressed in units, but is quite satisfactory under actual conditions.

The speed regulation of high pressure impulse wheels with deflecting nozzles is the easiest problem in governor engineering. A small regulator developing from 2,500 to 7,000 ft.-lb. is powerful enough for the largest units, and should be of the oil-pressure type, according to Mr. Warren. The degree of speed regulation which can be obtained is about the same as with a steam engine.

The problem of getting the best possible speed regulation from a high pressure turbine or an impulse wheel with needle valve control needs very careful thought if, as is nearly always the case, either of these is located at the end of a long feeder pipe. The great difficulty is that a long column of water possesses so much inertia that its velocity cannot be changed with sufficient rapidity, and moreover the changes in rate of flow which actually occur introduce a element of great danger. Imagine a turbine operating at the end of a feeder pipe 5,000 ft. long. Assume a maximum rate of flow in the pipe of 8 ft. per second, which is frequently exceeded. If the head were 400 ft. and the pipe 5 ft. in diameter this would correspond with an output of 5,600 h.p. In such a case the actual weight of water in the pipe would be slightly over 3,000 tons, which exceeds that of a loaded freight train half a mile long. Now 8 ft. per second is 5½ miles per hour, and it does not require very deep thought to see that it would be a rather difficult operation to start such a train from rest, bringing it to that speed within a second or two; it would not be much easier by the use of the engine alone without brakes to bring such a train back to rest again in the same time interval. Yet this is just what some engineers expect can be done to an equivalent water column. If the water and pipe were absolutely inelastic, it would be easy to calculate the average pressure in pounds per square inch which would be required to stop the moving water within, say, two seconds. This would be equal to about one-eighth of the weight of a column of water of 1 sq. in. section 5,000 ft. long, because 8 ft. acceleration in two seconds is approximately one-eighth as great as the acceleration due to the weight of a substance acting on its own mass. This amounts to 271 lb. per square inch, while the static head is only 171 lb. per square inch. As a matter of fact, the pressure induced in stopping the moving water column by the action of a governor upon the gate of the turbine would greatly exceed this amount, because the retarding action would not be distributed uniformly over the two-second period. An

exact solution of the problem is impossible because of the irregular movement of the turbine gate in combination with the uncertain elasticity of the water and pipe. While it is impossible to determine the actual initial rise of pressure caused by a sudden closing of the turbine gates, the matter is made even more complex by pressure waves, which, originating near the gate, travel back and forth through the water with the velocity of sound, setting the whole mass into vibration like an organ pipe. Because of these waves there are formed nodes and loops of pressure at various points in the length of the pipe, so that it may happen that the stress will be greatest near the middle.

The foregoing argument shows clearly the need of a relief valve wherever a feeder pipe is so long that dangerous pressures will be generated by the necessarily quick action of a governor. However, this solution is not so easy as it seems, on account of the part played by the pressure waves which run back and forth through the elastic water column. Any ordinary valve, such as is used for steam, would open and close so rapidly as to act like a reed upon an organ pipe, and thus maintain and increase the vibration of the mass. In order to be at all effective, a relief valve must be deadbeat; but it must also open quickly. Its time of closing must be long compared with the vibration pitch of the water column. This latter requirement is rather difficult with the exceedingly long pipe lines. which sometimes bring water several miles. Special valves are now built which will open instantly and consume several minutes in closing, the speed of action being, of course, adjustable.

Although it is possible to prevent excessive rise of pressure due to reduction in velocity of long water columns, no means have been devised to produce quick acceleration of the water when, because of a sudden increase in load, the speed of the turbine begins to fall. The governor will open the gates promptly, with the immediate result that the water pressure will drop, and also the already inadequate power of the water-wheel; therefore the speed will fall still farther and the governor continue opening the gates until they are wide open. The reason why the pressure falls when the gates open is simply on account of the inertia of the mass, which cannot keep pace with the demand for water. After a certain time interval, which may be several seconds, the water column will have accelerated sufficiently to supply what is needed by the turbine. By this time, however, the speed may be far below normal. There will be a rapid acceleration of the water-wheel, which will pass normal speed because of the excessive gate opening, and as a result the governor will close the gates quickly, causing the relief valves to operate. If the governor is not made very deadbeat and rather sluggish, this cycle of events will be repeated to the great detriment of the speed regulation. When the governor is made sufficiently deadbeat so as not to encourage pressure oscillation of the water column, it will be found that the speed regulation is poor if the load changes are large and sudden; it is impossible for this to be otherwise, because the water column cannot possibly alter the energy given to the wheel fast enough, whether the gates be in one position or another.

The only complete remedy for the troubles in speed regulation caused by excessive inertia of a water column is some form of by-pass valve directly connected with the water-wheel gates, arranged to open as they close, and thus keep the velocity of the column nearly constant. An arrangement of this kind is substantially equivalent, as regards water efficiency, to an impulse wheel with deflecting nozzle. This involves a frequent waste of water equal to that required for the largest load variations, and cannot well be permitted in many installations. Therefore in such power plants as have been described some compromise is usually reached. Speed regulation is partly sacrificed for the sake of water economy. Frequently such stations are connected electrically with others where the hydraulic conditions are favorable to good speed regulation. This arrangement ensures the even speed of the whole system with good efficiency.

The predetermination of speed regulation obtainable under given conditions is of great importance, and has been left too much to governor manufacturers, in Mr. Warren's opinion. As a result their salesmen have sometimes made guarantees that were impossible of fulfillment without changing the laws of physics. He submits an analysis of the problem which leads to the following equation of the relation between the percentage temporary change in speed, d, the time required for the governor to make a stroke, T, the moment of inertia or flywheel effect of the revolving parts, I, the normal revolutions per minute, S, and the horsepower output from the wheel before and after a change, p and p_1 respectively:

$$d=81{,}000{,}000\ T\ (p-p_1)\div I\ S^2$$

From the form of the equation it is apparent that the percentage speed variation is directly proportional to the slowness of the governor. Under certain conditions the effect of the governor in promptly adjusting the output of the water-wheel after a load change is interfered with by the inertia of the water column in the penstock, and in such cases the predetermination of speed variation is sometimes very difficult. For simple deflecting nozzles with tangential wheels and with most turbine installations the formula is of great service.

Of the quantities in the equation there is one, T, which cannot be exactly determined. Any governor manufacturer will state the time required for a complete stroke of one of his governors, but it should not be assumed that fractions of the stroke will be covered in correspondingly lesser intervals. Experience shows that short governor movements take place at a much slower rate of travel than long ones. It is necessary that this should be so in order to prevent overtravel in adjusting the output of the water-wheel. As a matter of fact, one may assume, without introducing a serious error into the calculations, that the time T required for any governor to alter the power of a water-wheel after a great or small sudden load change will be approximately constant and equal to the time required for a full stroke.

After a power plant is in operation, it is often necessary to determine, among other facts, whether the speed regulation is as good as was guaranteed by the governor manufacturer, or at any rate as good as it should be. A method of obtaining simultaneous measurements of load, voltage, and speed has been devised by Mr. Warren which is free from instrumental defects, and which, while requiring only one or two skilled men for its use, will give results of great value in any power plant where there are two or more independent alternating current units.

It is evident that the number of cycles per second of current generated by any alternator could be used to measure the speed if these cycles could be accurately counted. The oscillograph provides means for doing this in a very interesting way. This instrument is a sensitive reflecting galvanometer, which has such an exceedingly short period of vibration and is so deadbeat in action that the actual current wave, varying, even though it may, as rapidly as several hundred times a second from a positive to a negative value, can be accurately followed and recorded on a sensitive photographic film. If the film could be moved at an absolutely uniform rate, so that the trace of the current value would be drawn as an approximate sine curve, it would be necessary merely to measure the spacing of this curve in order to determine the frequency of the generator and, consequently, its speed. It is not easy, however, to provide absolutely uniform motion for the film, and there are some other difficulties in the way. Since, however, several oscillograph curves may be superimposed on the same film, it is not necessary that the sensitive photographic surface should move at a uniform rate, because one sine curve may be measured in the terms of another sine curve. If one of these is known to pass through a constant number of cycles per second, it may be adopted as the standard unit of time, and its waves, as shown on the film, be used to measure the number of cycles per second of the other curve and, consequently, the speed variations of the machine under test.

The measurement of the comparative frequency of the two curves becomes a very simple matter if they are allowed to overlap on the film, because in such a case interference effects are produced in a very beautiful manner. These interferences are due to the fact that at times the traces of both curves overlap on the film so as to produce a single line; while at other times, one curve having gained part of a cycle over the other, the two lines will be side by side and more or less confused. When the speed of motion of the film is right, the negative shows alternate shaded bands, the distance apart of which, when counted in cycles, is an accurate measure of the relative speeds of two generators being compared. Everything depends upon one generator running at constant speed. In practice it is not difficult to fulfill this condition with ample precision. To do so the generator, which is to serve as a standard measure of time, must be given a perfectly steady load, or, better still, no load at all, excepting the trivial current required by the oscillograph. The gate of the water-wheel which drives it should be disconnected from its governor and fixed in position. The water pressure upon the wheel should be maintained very nearly constant. The generator should be allowed to run fifteen or twenty minutes before measurements are made. Its speed should be observed very carefully by a sensitive recorder of some kind in order to be sure that it is steady. A frequency indicator will answer very well for the purpose, even though its graduations may be far from correct, because it is to be borne in mind that steady speed is the only desideratum. The great inertia of the revolving parts of the water-wheel and generator in the absence of any external load will be found to maintain the speed with remarkable uniformity. There should be no trouble at all in keeping this standard machine steady within 0.1 per cent. without any difficult manipulation of the water-wheel gate. The frequency of this standard machine should be adjusted 5 or 6 per cent. below or above that of the normal frequency of the machine of which the speed is to be measured.

Assuming that the standard generator is running 5 per cent. in speed below the normal frequency of the machine under test, it is clear that the fast machine should gain five cycles over the standard in 100 cycles; or, in other words, the interference points should be twenty cycles apart. If, however, the machine under test should drop in speed 5 per cent., it would then have the same frequency as the standard machine, and the interference points would be an infinite distance apart. If the loaded machine should gain 5 per cent. above its normal speed, it would then be 10 per cent. faster than the standard one, thus gaining ten cycles in each 100, so that the interference bands would be spaced at ten cycle intervals. The extreme precision of the method is shown in the large varia-

tion in the spacing of these interference bands, corresponding to comparatively small variations in relative speed. Another great advantage of the method over any other, however, lies in the fact that not only is the speed of a machine under operating conditions determined with extreme precision, but also that the voltage of such a machine is recorded simultaneously, for the amplitude of the oscillograph curve depends precisely upon the voltage of the machine being tested. By measuring the width of the curve, the voltage value corresponding to each speed value is obtained.

Furthermore it is possible to obtain simultaneous measurements of the current output from the loaded machine, which means practically the variations in load, and this is the most important feature of all. To do this a third oscillograph mirror is impressed into service, being connected with a current transformer in circuit with the generator under test, so that the amplitude of the curve traced by the light reflected from this mirror shall indicate at every point on the sensitive film what the actual output of the generator was, corresponding to the speed and voltage shown by the other two curves. This method makes it possible to conduct a speed test of any alternating current unit, either steam or water driven, under actual load conditions, and is therefore of much greater value than any test, however accurate, under special conditions, which are never exactly the same as when in service.

FORESTRY WORK has been started by the Atchison, Topeka & Santa Fe R. R. in order to provide ties and other timber. It is now planting 700 acres in a ranch of 9,000 acres in Southern California with eucalyptus seedlings, and this planting is to be repeated annually, it is understood. Each tree is expected to yield six ties at the end of 15 years or about 3,300 ties to the acre. These ties will be cut from 700 acres of the orchard annually, after 15 years from the first planting, about 2,250,000 being obtained each year. As the rate of removal will be equal to the rate of planting, the same total acreage will, theoretically at least, maintain the same annual supply of ties. The cost for each cultivated tie is below that of ties of white oak now bought.

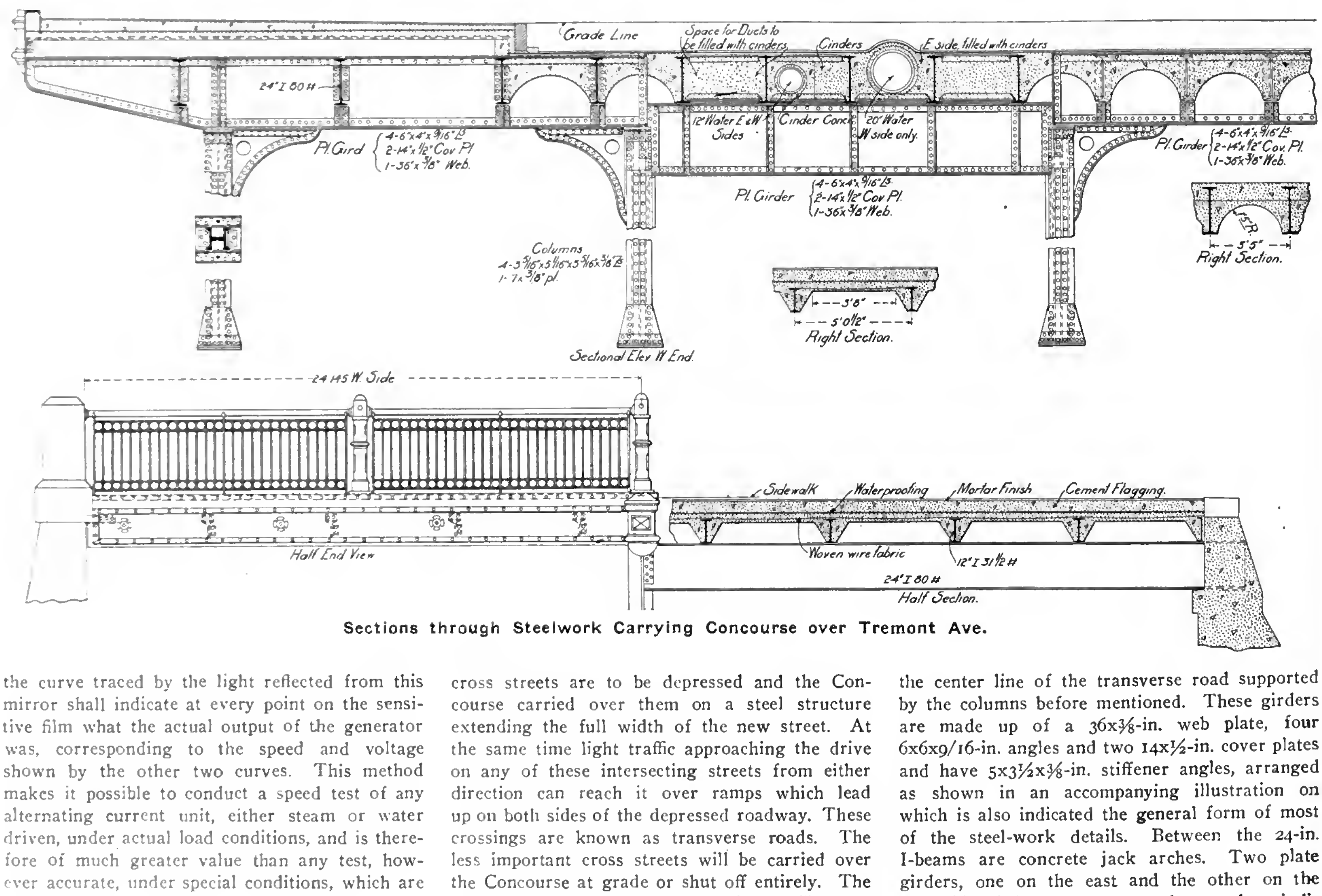
Road Intersections along the Grand Boulevard and Concourse, New York City.

The Grand Boulevard and Concourse in the Borough of the Bronx, New York City, the general features of which were described in The Engineering Record of Aug. 8, 1903, will, when completed, connect Central Park with the parks north of the Harlem River and form an important part of the city's great park system. The concourse is over 4 miles long and has a total width of 182 ft., made up of a 58-ft. central roadway for speeding, two 9-ft. cycle paths with strips of turf along each side, two 24-ft. macadam roadways for pleasure vehicles and two 20-ft. sidewalks, each flagged for a width of 8 ft. in its center, leaving 6-ft. strips of turf along each side. No heavy traffic will be permitted on the boulevard and to provide means for such traffic and for street cars to cross the line of the pleasure drive nine of the principal cross streets are to be depressed and the Concourse carried over them on a steel structure extending the full width of the new street. At the same time light traffic approaching the drive on any of these intersecting streets from either direction can reach it over ramps which lead up on both sides of the depressed roadway. These crossings are known as transverse roads. The less important cross streets will be carried over the Concourse at grade or shut off entirely. The transverse roads under construction at Tremont Ave. and Kingsbridge Road are typical of all that are to be built.

Tremont Ave. crosses the Concourse at an angle of about 70 deg. necessitating a skewed arrangement of the steel structure as shown on an accompanying plan. The depressed central roadway is 45 ft. wide between the faces of the retaining walls. The asphalt block pavement is 36 ft. wide between curbs and has a 4½-ft. cement sidewalk on each side. A line of steel columns, 18.175 ft. on centers, placed on the center line of the roadway, carries part of the weight of the steel work which will be referred to later. The concrete retaining walls in general have the sections shown in the accompanying illustrations, the section in rock where the concrete forms a face wall rather than a support being materially lighter than where the backing is earth or loose fill of any sort. At Tremont Ave. and Kingsbridge Road about 60 per cent. of the cutting was in rock.

Each of the ramps carries an asphalt block roadway 23 ft. wide with a cement sidewalk on the outside. The walk is 10 ft. wide where no outside supporting wall is required an 8 ft. wide where such a wall is necessary. Outside walls are not required at the two crossings mentioned but the maximum section prescribed for such walls, which will be dry rubble, is shown in an illustration. At Tremont Ave. the depressed roadway has a maximum grade of about 3⅓ per cent., 466 ft. long. The west ramps have a length of about 325 ft. in which there is a rise of about 20 ft. The corresponding figures for the east ramps are 466 ft. and 3.4 ft.

The steel work of the overhead crossing consists of 24-in. 80-lb. I-beams parallel to the course of the boulevard, about 3⅔ ft. on centers in general, carried on the ramp walls as abutments and on a single line of plate girders on the center line of the transverse road supported by the columns before mentioned. These girders are made up of a 36x⅜-in. web plate, four 6x6x9/16-in. angles and two 14x½-in. cover plates and have 5x3½x⅜-in. stiffener angles, arranged as shown in an accompanying illustration on which is also indicated the general form of most of the steel-work details. Between the 24-in. I-beams are concrete jack arches. Two plate girders, one on the east and the other on the west side of the concourse are depressed, as indicated in the drawings to afford room for public service pipes between the I-beams, which in these panels rest on top of the girders. In the panels reserved for pipes the jack arches are replaced by 4-in. slabs of concrete between the top flanges of the I-beams and the spaces between the bottom flanges are filled metal plates, and the entire panels filled with cinders. Cinder concrete will be packed around the pipes to hold them in place and prevent freezing. To the surface of the jack arch floor will be applied a waterproofing coat consisting of three layers of roofing felt thoroughly mopped above and below with hot pitch. This waterproofing will be protected by a 1½-in. layer of Portland cement mortar, one part cement and two parts sand. The pavement on these crossings will be macadam to correspond with the Concourse paving. The details of the sidewalks carried by the steel work



Sections through Steelwork Carrying Concourse over Tremont Ave.

are shown in the drawings. The railing has a wrought-iron filling, cast-iron posts, and a 3-in. bronze hand rail.

At each transverse road a complete drainage system will be provided to carry the surface water entering the depressed road and flowing down the ramps from the Concourse into the existing system of sewers. At Tremont Ave. there are three lines of 12-in. drains on concrete cradles with brick manholes at about 100-ft. intervals. The inlets have flat cast-iron gratings. The center drain in the depressed road is for surface water only, but the drains on the ramps are for house drainage as well as surface water.

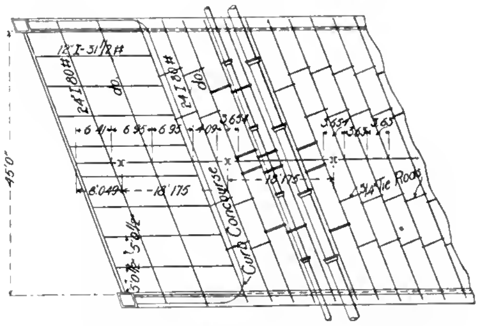
The concrete known as Class A, used in the copings, jack arches and sidewalks, is a 1:2:4 mixture of Lehigh Portland cement, stone screenings and crushed trap rock. The concrete known as Class B, in the column footings, ramp walls and abutments, is a 1:3:6 mixture of the same materials. The broken stone used in Class A concrete passes a 1-in. and is retained on a ¼-in. mesh screen. The limits for Class B concrete stone are 1½ and ¾ in.

At Tremont Ave. most of the concrete was prepared in a Smith mixer, placed near the north edge of the cut about on the center line of the Concourse. The materials for each batch were placed in a 1-yd. bucket and delivered to the mixer by a guyed derrick, with an 80-ft. boom, placed to the eastward of the mixer and operated by a Lidgerwood double-drum hoisting engine supplied with steam by a 60-h.-p. Olney & Warren boiler which also served the steam drills used in the rock cut. The mixer delivered to 3-yd. Koppel cars which were operated by hand on track laid along the outside of both ramp walls, the track for the south wall being carried across the cut on a trestle. In order to bring the cars close to the forms, so that they could be dumped directly into the latter, the track was carried on transverse timbers attached to the form studding at one end and resting on the earth or stone bank at the other. Three cars were used at once, a switch and short stub track being provided to facilitate the passing of empty and loaded cars.

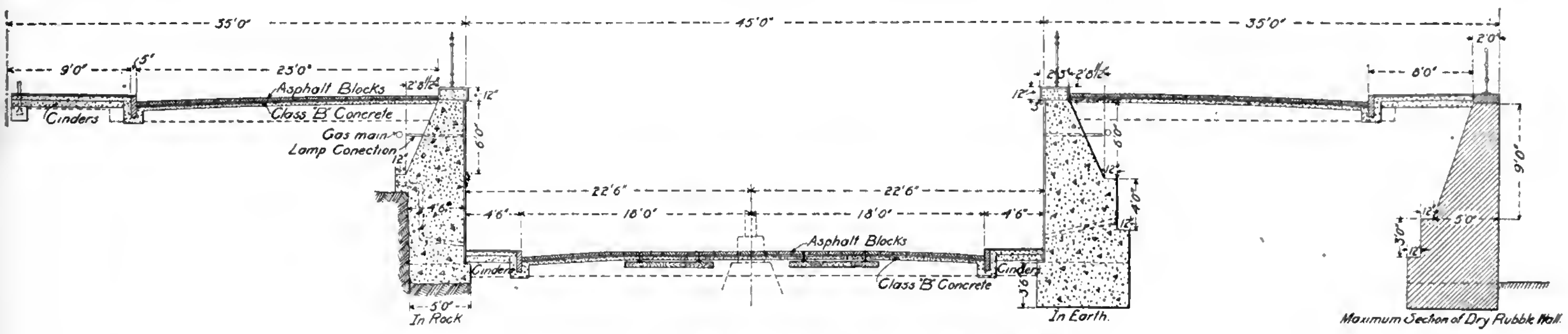
The placing of concrete was begun at the extreme west end of the cut and the two walls were carried forward almost simultaneously. Each wall was built in 50-ft. sections and the concrete in each section was allowed to set before the next one was built, two-ply tar paper being placed in the joint to provide for expansion. A 1-in. cement finish was secured by using ⅛-in. sheet steel face plates, 6 ft. long and about 14 in. wide. The centering for the jack arches between the 24-in. I-beams was supported on cross pieces hung from the lower flanges of the I-beams with L-bolts in the usual manner.

At Kingsbridge Road the stone excavated in the cut is crushed for use in the wall concrete. An oscillating crusher with a capacity of about 60 yd. per day, made by the Farrel Foundry Machine Co., is set up on the north side of Kingsbridge Road, about on the center line of the Concourse. It is operated by a double cylinder vertical Westinghouse Machine Co. engine and produces screenings and ¾-in. to 1½-in. stone. The uncrushed stone is delivered to the platform of the crusher or to storage piles nearby by two guyed derricks on the north side of the cut located near each side of the Concourse. These derricks have 85-ft. masts and 80-ft. booms, and are operated by Lidgerwood double-drum hoists supplied with steam by a central boiler plant composed of an 80-h.-p. Olney & Warren boiler and a 40-h.-p. boiler taken from a New York elevated railway locomotive. These boilers also serve the crusher and mixer engines and the steam drills.

The crusher product is delivered to a bucket elevator which hoists it to the screen over three elevated bins holding about 9 yd. each. These are a few feet east of the crusher. About 20 ft. north of the elevated bins is a guyed derrick, with a 40-ft. boom, handling a 1-yd. bucket. The proper quantities of screenings and larger aggregate are drawn into the bucket from the bins; cement is added from the cement shed just north of the crusher; and the whole is delivered as a batch to the Smith mixer which is on an elevated platform about 30 ft. east of the derrick. The mixer delivers to Koppel cars which are handled on tracks carried just behind the wall forms as at Tremont Ave.



Part Plan of Steelwork, Tremont Ave.



Section of Transverse Road Near Concourse Crossing.

General supervision of all work on the Grand Boulevard and Concourse is exercised by Mr. Josiah A. Briggs, chief engineer of the Borough of the Bronx, New York City. The work is under the immediate supervision of Mr. S. C. Thompson, principal assistant engineer of highways, under whose direction the structures described were designed. The construction work, which is now in charge of Mr. Chas. Gartensteig, assistant engineer, was begun by Mr. R. H. Gillespie, assistant engineer, who resigned last May. Mr. J. C. Rogers, Jr., is the general contractor. The steel work for both Tremont Ave. and Kingsbridge Road was fabricated by the American Bridge Co., and will be erected by the Terry & Tench Co., New York City.

THE WATER encountered at some places during the boring of the Simplon tunnel was remarkable for the entire absence of chlorine from it, in which respect it was new to chemists. Several geologists and analysts have reached the conclusion that the water had never been on the surface of the earth, but no very satisfactory explanation of its presence in the rock at the location of the tunnel has yet been made.

The Choice of a Bituminous Coal.

By R. H. Kuss, Secretary, Committee on Smoke Abatement of the City Club of Chicago.

An ever-recurring problem confronting the operating engineer is that of determining which coal is best suited for his purposes, everything considered, for although he may have reached a satisfactory conclusion at one time, circumstances are bound to arise subsequently which make it desirable to renew the investigation. To the careful buyer, the problem of selecting coal divides itself naturally into a consideration of the following main topics:

1. Availability, contingent upon the location of the mines, labor conditions, transportation, etc.
2. Relative costs of evaporating a certain unit quantity of water or its equivalent.
3. Flexibility and adaptability of the coal within the capabilities of the apparatus in which it is used.
4. Degree of smoke reduction attainable.
5. Quantity and quality of the resulting refuse and ease of its handling or removal.
6. Effect of treatment of the most desirable coal on all of the previous items.

The items enumerated are necessarily interdependent, and, of course, dependent also upon the apparatus in which the coal is used and upon the character of the available labor. The scope of this article will, however, be restricted to the consideration of the six divisions mentioned, with only such incidental references to the apparatus and the method of firing as may be necessary to indicate the leading factors to be treated.

Under the head of availability it is safe to assume that the ordinary plant is destined to lean toward the use of a coal of a character like that which comes from the nearest mines reached by competing coal railways. The force of this influence is particularly noticeable with mechanical stoker installations which may be built particularly for a coal of a special characteristic, such as a coking quality, which eventually gives way to a cheaper coal, however unsuited the latter may be for the apparatus on which it is burned. It is true that in small plants, where there is a likelihood of inadequate equipment and the coal bill forms a small percentage of the total plant operation cost, little attention is sometimes paid to this matter. It is no less true, however, that the good intention of an owner to buy a superior grade of coal in the beginning, so as to reduce smoke emission or the like, is likely to give way to the use of the cheapest available fuel, sometimes even at an increased cost in some other item than the bill because the auxiliary expenses of coal use are not so easily recognizable as the cost of the fuel itself. Most consulting engineers fail to appreciate and to provide for this natural tendency and consequently complain because their specifications as to operation are not fully complied with, when, as a matter of fact, their grievances are not so serious as those of the owner who pays toll every day for the shortcomings of the consulting engineer. Obviously, the conclusion should be that the furnace design should provide the best available means for the

use of the coal nearest at hand, whether that requires an additional initial expenditure or not. Any other course is a makeshift and an example of poor engineering.

The cost of evaporating a unit quantity of water is contingent upon the circumstances of operation, the available equipment and similar factors. By the time the final decision as to the coal to be used is reached the equipment has already been provided and no longer is to be considered a changeable factor. In deciding which is the cheapest fuel to use, it is a mistake to assume that the matter can rest with the relative showings of the particular coals tested, though it would appear at first sight that everything has been taken into account by such a course, the apparatus, as said before, not being considered capable of change to meet the requirements of the different grades. The force of the foregoing statement is apparent from a consideration of the relative costs of handling the refuse, the wear and tear of equipment, the care required for firing to obtain results comparable with those of the tests, and the effect of dust of the fuel on the surrounding firing room and contiguous properties. Of these items the cost of refuse removal overlaps the wear and tear item more or less, depending upon the quality of the refuse, some of which will put an ordinary conveyor system out of commission much sooner than the refuse of other coals or that of the same basic coal treated by washing, sizing or otherwise. Of course, the quantity of refuse to be removed is indicated by the amount found on analysis, though the relative performances of two coals different in uninflammable content do not bear a like relation in actual performance, because one coal may cause a greater percentage of combustible to appear in the refuse than a comparison of the analyses would indicate, even to one who is competent to interpret analyses.

That there are serious disappointments in the use of a certain coal after an apparently fair and careful series of tests is due to the fact that test conditions are not strictly representative of working conditions. The preparation for and performance of all of the tests of a series operates to throw two wholly different coals more nearly on an equality, the coal of the lower grade receiving greater benefit by the same care in firing, whether by hand or by mechanical stoker, than the better grade. To explain by example, a good grade of coal may admit of a range of efficiency of eight per cent. between careful manipulation and ordinary firing, while the poorer grade admits of a range of fifteen per cent. The test series tends to compare only the high performance marks of the several coals while the fuel selected is used according to ordinary treatment.

Another point to be considered is that the test conditions of the apparatus, if brought back for each fuel to equal cleanliness of furnace and heat-absorbing regions at the start of each test run, are in ordinary operation put out of all comparison with the test conditions more quickly with some coals than with others. In spite of the best that can be done, the apparatus as a unit deteriorates rapidly between periods of complete cleanings for some fuels, owing to soot deposits in combustion chambers and tube chambers, while with other coals the trouble is less marked. The test series cannot serve to indicate this difference to the degree desired, although a study of minor happenings in all of the tests is of service to indicate a difference in coal behavior even in this regard. Smoke observations and chamber examinations, the latter both before and after test runs, serve to throw light on this matter. Of course, the degree of ease in removing soot and finely divided refuse from the affected regions is a salient factor in this branch of the subject.

Under the third item, adaptability of coal to the apparatus, there is one of the most difficult features attending the selection of a coal for a particular duty. Here, again, the test series is likely to fail, especially if a whole battery of boilers is available to take care of the variations of duty while the steam delivery from the apparatus employed in the test is maintained without material fluctuations. Nor will a series of tests conducted on the basis of under, even and over-capacity give the information desired. This portion of the subject can be handled to some degree by a study of the quantity and quality of the refuse, and the ease with which it may be removed if the contingency arises. For example, two grades of coal may be compared, the first being one that gives a tenacious, gummy, compact clinker and the other a clinker that is very fragile and easily broken up under the action of an ordinary rocking grate. In the first case we are restricted because the best available means of adjustment, damper regulation, is ineffective, since the resistance of the fuel bed is not capable of easy change, while in the second case we can materially affect the rate of furnace performance. It is not sufficient to dismiss this important subject by declaring that when a fire is in a condition where it refuses to respond to damper regulation it is time to clean, for that would impose the necessity for cleaning very often with some fuels, a service which, in ordinary running operation, is not likely to be performed.

In some localities it is very important to reduce smoke to a degree where it no longer is a menace. In such plants where recourse must be taken to a particular high grade of fuel either because of inadequate furnaces or because of the nature of the service demanded in order to reduce the smoke emission, the situation is indeed unfortunate and the real remedy is a substitution of furnace or method of coal use. An inadequate furnace arrangement imposes, necessarily, an undesirable restriction as to kinds of coal available for use, though it may be said that a bad furnace for one kind of bituminous coal is very likely to be as bad for any other kiud.

In selecting a coal for the primary purpose of avoiding smoke, more progress can sometimes be made by trying the several variations of sizes of a promising coal from one field than by experimenting with a number of coals from as many different fields.

The quantity and quality of the refuse have been previously considered as an important factor under several heads. The quality of the refuse is the more important, since it bears upon the proposition of resistance to air passage to a larger degree than the quantity itself, and besides is the leading factor in determining the ease with which it can be removed. In certain mechanical stokers this matter becomes less important than for hand-firing, though in others it is more important.

The treatment of which a coal is capable presents to the user a field of speculation that seems to offer promising results. First to be thought of in this connection is sizing, the separation of the coal into several groups of which the pieces are of approximately the same weight. The advantage of this treatment is that the percentage of voids in a given thickness of fuel, the pieces being of irregular shape and not fitting into each other, approaches a maximum the more nearly uniform they are in size. Spheres of the same diameter present when piled into heaps a fixed percentage of unfilled space or voids irrespective of what the diameter may be. Now, the same holds true, but to a less extent, with uniformly sized coal. Hence, in the case of a bed of sized coal we may expect to use a thicker layer than with mixed coal. This means that it is possible to have a thicker bed of incandescent fuel on the grate, thereby causing a smaller variation of furnace temperatures to come about when green fuel is fired. Again, it is possible with a thicker fuel layer to have a greater variation in fuel bed thickness with less deleterious results than with a thin layer. It is not difficult to see that the thicker layer can be put on just as evenly as a thin layer, and the same degree of unevenness will not be relatively so important in the case of the thick layer as in the thin fuel bed. Again, the thicker layer of fuel presents an opportunity of taking care of an increase in the demands on the furnace without the same increase of quantity of coal fired that obtains where the fires must be kept thin.

Still another factor must be mentioned before dismissing the subject of sizing, the amount of surface presented to the gases passing through the fuel bed. While the percentage of voids is independent of the sizes themselves, the total surface for a given mass of fuel is a function of the size, becoming rapidly greater as the pieces become smaller. One would naturally expect the greatest surface to be the most effective, which would hold true were it not for the fact that the rate of volatile distillation might become too high for the capacity of the furnace, or if smaller coal did not result in a more compact layer of refuse than larger coal. The tendency surely would be to reduce the size of the coal the better the furnace facilities, other features of the coal being the same, if they can be.

An entirely different aspect of the case comes about in a forced draft installation, for to gain the best results it may not be desirable to impose as little resistance to air passage through the incandescent fuel bed as possible. It is probable that the sizes may well be mixed in such a case, rejecting the smallest as well as the biggest and retaining everything between them.

The use of coal dust under ordinary natural draft conditions is, of course, not a reasonable application of the principle of uniform size selection, since this imposes an abnormally high resistance to air and gas passage. The small interstices demand an exceedingly thin fire to gain the proper combustion rate, a matter nearly impossible in coal of very small size.

The washing of coal is a comparatively recent venture in the Illinois region and unfortunately is not always well done nor effective when every intelligent effort has been expended on the coal. The common impression exists that washing is always beneficial whereas it is sometimes decidedly the reverse. Even in those cases where an apparent gain is made, the good results very often come from the sizing rather than the washing. Comparatively few coals exhibit any noticeable degree of betterment after washing, and in many cases the latter imposes a decidedly unnecessary hardship. A guide to whether a betterment comes about is to compare the analyses of the coal before and after washing. If the ratio of amount of sulphur to the total refuse after washing is greater than before or even equal to it the fuel has not been improved sufficiently to warrant the expense, if a use of the unwashed fuel shows it to be a serious one to handle because of the nature of the clinker. The foregoing test does not follow absolutely, since the washing process may remove the most objectionable sulphur portion allowing the unobjectionable portion to remain. This belief is not commonly entertained, because those who have to do with the use of coal by a study of the analyses are over-impressed with the greater percentage of pure coal remaining after washing. The experiences of the operative are more to the point, however, since he deals with the difficulties of the resulting refuse, not so much because of its quantity but because of its character.

The use of a mixture of small size anthracite and bituminous is one of the best fields of investigation to be considered in this connection. This course is very effective where the

bituminous coal results in a particularly stubborn clinker. The presence of the anthracite refuse in such a case serves to offer innumerable places for clinker fracture when the coals are combined and thereby makes the refuse bed easily tractable. On shaking or rocking grates the advantages of this method are strikingly evident. The combination need not be made with equal parts of the two coals, but different proportions may be tried until a workable combination is arrived at. Necessarily, the effect of combining a high fixed carbon coal with a high volatile one is to create a fuel which is more easily made to conform to an inadequate furnace than a bituminous coal alone.

Ore Handling in the Marquette Iron District.

The mines in the Marquette, Mich., iron-ore district have been worked for over fifty years, but the output from this district has been greatly increased only in the past eight or ten years. The principal mining centers in the district are at Ishpeming and Negaunee, which are about 15 miles from Lake Superior in a direct line, although many other important mines have been developed at various points throughout the district. Two classes of iron-ore are mined in the district, one in the form of very hard rock and the other more like dense clay, or heavy soil. The mines are all worked from shafts, which vary from 100 to 1,000 ft. in depth. The ore is taken out at several levels in each shaft, the spacing of the levels depending largely on the manner in which the ore occurs. Most of the hard-ore mines can be worked without timbering, so the ore is generally removed from the deposits as the headings advance from the shaft. In the soft-ore mines, on the other hand, the general practice is to drive a heading from the shaft to the limits of the deposit to be tapped, and then work back toward the shaft in mining. In this method, only enough timbering is used to hold the roof temporarily, the ground being permitted to cave after mining operations have ceased.

The ore is hoisted from the shafts in the cars in which it is loaded at the working face. When ore is being shipped immediately, it is dumped from the mine cars through a tipple into standard-gauge cars. The remainder of the time it is dumped into stock piles, from which it is loaded into the standard-gauge dump cars by means of steam shovels.

The natural outlet for the district is Lake Superior, which is reached most practically at Marquette, 16 miles from Negaunee, and 19 miles from Ishpeming. A large tonnage of ore, nevertheless, is carried by rail to Escanaba, on the west shore of Lake Michigan, for transportation by water to the steel mills at the lower end of that lake, and also to the lower lake ports. At Marquette the ore is delivered to vessels which carry it to various distributing and industrial ports on the Great Lakes.

The Lake Superior & Ishpeming Ry. was built from Ishpeming to Marquette by the Cleveland-Cliffs Iron Co. and allied interests to handle the output of the mines controlled by that company and those interests. Something less than half of the output of the mines in the neighborhood of Negaunee and Superior is carried by this railroad. The latter is built with 80-lb. rails and has thoroughly modern equipment adapted to the traffic tributary to it. The standard ore cars of the road are of steel and have a capacity of 50,000 lb. They have two four-wheel trucks, and as they are only 24 ft. long, over all, a very concentrated load is brought on the track and structures by them. Ishpeming is 850 ft. above Marquette, so the line is practically down grade all the way, although the maximum gradient is about 1.63 per cent. Consolidation type engines having 22x30-in. cylinders, 80-in. boilers and a combined weight of engine and tender of 173 tons are used in the ore traffic. These engines haul forty-five loaded 50,000-lb. cars to Marquette and return with 45 empties, without a helper at any point, notwithstanding the fact that there is a continuous climb of about nine miles, in which the maximum grade occurs several times. These engines are each equipped with two air pumps for the air-brakes, either pump having sufficient capacity to furnish enough air to operate the brakes of a full train. Since the brakes are applied a considerable portion of the time on the downward trip, the wear on the wheels is heavy, but it has been found that the wear on the tires of the locomotive wheels can be greatly reduced by applying a fine stream of water to them while the brakes are set.

The ore is unloaded from the trains into the vessels through a long, high dock at Marquette. This dock and most of the approach to it are a continuous timber trestle, the dock proper being on piles cut off at the water level. The approach rises on a 2 per cent. grade for about 2,300 ft. The dock is 54 ft. high above the water, 1,200 ft. long and 52 ft. wide. It has two longitudinal rows of ore pockets, one on each side of the center line, and will hold approximately 30,000 tons of ore. Four tracks are extended the length of the dock over the pockets, the latter being spaced so the center dump hopper-bottom cars which are used can be placed one at each pocket. The cars are handled up the approach 15 to 18 at a time by a 130-ton geared Lima locomotive; the switching on the dock is done by an ordinary locomotive.

The ore is fed by gravity from the storage pockets into the holds of the vessels through hinged chutes, which can be raised to permit vessels to pass. In addition to the trainmen and switchmen on the dock, a force of laborers is required to raise and lower the loading chutes and to loosen the ore as it becomes jammed in the pockets. The soft ore, in particular, causes considerable trouble from this source, but the hard ore generally flows readily.

The number of ore trains operated over one of the ore roads each day and the total tonnage for the season of open navigation on the lakes, which averages about seven months, naturally depends chiefly on the output of the mines tributary to it. During the season of 1906 in the neighborhood of 1,800,000 tons of ore were handled through the dock of the Lake Superior & Ishpeming Ry., practically all of which came from mines in the vicinity of Negaunee and Ishpeming.

The Duluth, South Shore & Atlantic Ry., which carries the remainder of the ore traffic passing through Marquette, handled about 1,700,000 tons in 1906 over the three docks which it operates there. Two of these docks are older structures, but the third was completed during 1906, and is now used chiefly for the ore traffic of this road. It is similar in arrangement and construction to the dock of the Lake Superior & Ishpeming Ry., except that the tracks on it are 74 ft. above the water, in order to facilitate the loading of the very large ore-carrying vessels which have been placed in service during the past few years.

The total quantity of iron-ore which passes through Marquette, 3,500,000 tons in 1906, is only a little more than one-tenth of the total tonnage of iron-ore that passed through the locks at Sault Ste. Marie last year. A large percentage of the remainder came from the Mesabe and Vermillion districts, to be northeast of Duluth. The construction, equipment and operation of the roads which deliver ore from those districts to the docks along Lake Superior are much the same, however, as those of the Lake Superior & Ishpeming Ry.

Book Notes.

A little more than a year ago attention was drawn in this journal to the special structural shapes which the Bethlehem Steel Co., South Bethlehem, Pa., will roll on its new universal mills and some of the properties of these shapes fitting them particularly for bridge and building work were pointed out. The company has now issued a handbook prepared by Mr. George H. Blakeley in which complete tables of these properties are given and standard details for connections are illustrated. This pamphlet, entitled "Bethlehem Special Structural Shapes," contains information that every designer of steel work will find it desirable to have at hand, for the company will shortly be ready to begin shipping these shapes.

The Office of Public Roads has recently issued a pamphlet on "Rocks for Road Building," written by Mr. E. C. E. Lord, petrographer of the Office, which describes in some detail with the aid of excellent engravings the most important quantitative methods of rock analysis by means of the microspoe and proposes a classification of material suited for highway construction. Since the establishment of the laboratory of the Office in 1900, over 1,500 samples of rock from nearly every State, as well as Cuba, Porto Rico and Hawaii, have been examined miscrosopically and physically tested. The average mineral composition and physical properties of these samples are given in tabular form, and the various road-making rocks are arranged so far as posible according to their genetic relations, as shown by the tests and examinations. The general conclusions regarding these materials are stated as follows: (1) Igneous and metamorphic rocks, owing to a higher degree of crystallization and a preponderence of silicate minerals, offer a greater resistance to abrasion than nearly all varieties of sedimentary rocks. (2) The coarse-grained intrusive rocks of the igneous class are harder, but break more readily under impact, than the finer-grained volcanic varieties of like mineral composition. (3) The deleterious effect of atmospheric weathering on the wearing qualities of rocks is evident. (4) The cementing value of rocks is, to a certain degree, measured by the abundance of secondary minerals resulting from rock decay. (5) Metamorphic rocks have, as a rule, a low binding power owing to a regeneration of secondary minerals and to the effect of heat and pressure. The foliated types readily part along planes of schistosity and are therefore not well adapted to road construction. (6) The quantitative mineral analysis of rocks serves to a certain extent as a measure of their useful properties for road construction. The pamphlet may be obtained by applying to the Office of Public Roads at Washington.

With the widespread interest in the development of water powers there has arisen a demand for a thorough treatise on turbines, and engineers who are familiar with the German language will doubtless find this need well satisfied by "Die Turbinen fuer Wasserkraft-betrieb," by Prof. A. Pfarr, of the Darmstadt Polytechnic Institute, who was associated for twenty years with Dr. J. M. Voith, the well-known turbine builder, who has done much to raise the standard of such machinery. The book is voluminous and goes into great detail in places, and suffers somewhat from the absence of a good index. On the other hand, it is written from a viewpoint with which The Engineering Record is in complete sympathy and is marked by an absence of obsolete and useless illustrations that is almost as gratifying as the excellent drawings and diagrams that are provided. The author points out that the theory of what water actually does in turbines is based on a great many as-

sumptions, and the best that can be done is to use extreme care in selecting those assumptions which are most likely to be correct, and then to test the theories by careful experiment. The formulas deduced by theory and fitted with working constants derived by experiment have limitations due to both the range of experiment and the liability of error in the assumptions of the theory. Consequently only those who know the steps by which the theory was deduced and the extent and reliability of the experiments are able to use the resulting formulas with the full knowledge an engineer should possess. It is for this reason, also, that the author has not cared to provide a compendium of formulas for "ready reference," but has illustrated his methods by carrying through complete detailed designs with a thoroughness that is likely to be particularly useful to beginners. It is very rare indeed that the complete details of such designing work are given or drawings of actual installations are dimensioned so fully as in this book. The first three chapters discuss the power characteristics of flowing water, the different types of turbines and the work of water within a turbine. Anybody who desires to obtain a good presentation of the theory of turbine action now held among German-speaking engineers will find this portion of the volume clear and comprehensive; in fact, engineers who have already studied the subject somewhat may consider that the author gos into too much detail. Draft tubes and head are taken up in the next two chapters, the former subject being treated with particular fullness. Four chapters follow in which the design of different types of turbines is explained, both analytical and graphical methods being employed. The next section, running through several chapters, is one of the most complete discussions of gates and control that has yet appeared, and is succeeded by one on shafting, bearings, yokes and other parts. The remainder of the book relates to turbines actually built and their installation and governing. The work appears in a text volume of 821 pages of large octavo size and an atlas of 46 admirable plates. (Berlin, Julius Springer, 36 marks.)

Letters to the Editor.

Steel Frame for Concrete Reinforcement.

Sir—I take pleasure in sending you herewith a picture of the reinforcement of the Owl Drug Co.'s building now under construction in Mission street, near Second street, in this city. The method of reinforcement marks an innovation in concrete reinforcement, in that the steelwork forms a complete unit before any concrete is put in place. This unit is so completely formed that it is quite practicable to erect all steelwork before any concrete is poured, as can be seen in the accompanying picture, which shows several stories of free steel.

Among the advantages of this method of construction the following may be mentioned: The steel forms a complete structural unit in itself and does not cause internal stresses in the concrete, allowing the latter to perform the functions for which it was designed. Defects in the steelwork cannot escape notice, and there is little likelihood of derangement of the steel during the pouring of the concrete. The design can be computed readily and permits very quick erection.

Yours respectfully,

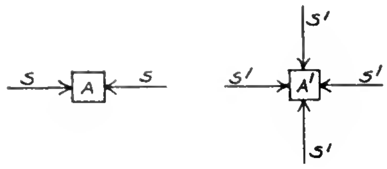
John M. Ettler.

San Francisco, Aug. 15.

Concrete Slab Reinforcement.

Sir—There are two questions I would like to have answered in regard to designing concrete slabs reinforced two ways at right angles.

First, what percentage of the working stress allowed in concrete reinforced in one direction only can you allow as the working stress in each of the two directions when reinforced in two ways? For example, let A be a small portion of a slab reinforced in one direction an A^1 be a small portion of a slab reinforced in two directions at right angles. If a working stress of



S=750 lb. per square inch is allowed on the extreme fiber of A, what should be allowed for the working stress S^1 on the extreme fiber of A^1?

Second, is the steel found by the formula 1/20 $w\ l^2$ the least amount that can be used in each direction of a slab fixed on all four sides, or is there a plate action that will permit using less steel?

Yours truly,

Robert G. Lose.

Wilkinsburg, June 14.

Reinforcement in Owl Building.

[The answers to this inquiry cannot be made very precise, for the theory of flat plates supported on edges is in neither a very simple or satisfactory condition at the present time. It is customary to assume that the plate is supported uniformly on its edges where those edges are simply supported or held rigidly fixed. If the plate is square, it is frequently assumed that the half of the load is carried in each direction and for each direction the plate is assumed to be an ordinary beam. Just what should be taken as the working stress in the concrete for each direction is to some extent a matter of judgment. It will probably be safe to take that working stress at three-quarters of its value in an ordinary reinforced concrete beam. The resultant stress where the bending moment is greatest would then certainly be safe and reasonable. Another method justified by experiment is to take the total load as dead and as uniformly distributed around the edge of the plate and then take moments by the diagonal of the rectangular or square plate, using as the working stress that which would be permissible in an ordinary reinforced concrete beam.]

A Large Moving Operation.

Sir—Much interest has recently been manifested in what is said to be the largest moving job of its kind ever undertaken. The new thoroughfare leading down from the heart of the business district of Brooklyn to the end of the new Manhattan Bridge, now under construction, is an extension of Flatbush avenue. It has been cut through a number of thickly built-up blocks, and one of the most prominent buildings in its path was the old Montauk Theater, later known as the Imperial Theater. This building was considered too valuable to be torn down, and efforts to save it from destruction have resulted in its being moved bodily to a new site a few feet to the eastward of its original position.

The building is of brick, with a steel skeleton, and the weight is said to be about 8,500 tons. The walls are 90 ft. high. The lobby, on Fulton street, has been torn down. The back of the old building was on DeKalb avenue, but in the new position it will be on Hudson avenue, a half block from DeKalb. The moving has consisted of three main movements; a displacement southward towards Fulton street of nearly 40 ft.; a rotation about its own center of mass (clockwise, as view from above) of about 65 deg.; and a further displacement, eastward, of more than 100 ft. to a new brick foundation, which has been already prepared for the building.

In the preparatory work, holes were knocked in the foundations, and I-beams varying from 40 to 60 ft. in length were pushed under. These were built up inside laterally and transversely at intervals of about four feet each way. Altogether, nearly 600 of these beams, representing some 1,500 tons of steel, have been used. Beneath these have been placed railroad rails on wooden ties, but the rails were not spiked down. These rails, which have the standard length of 30 feet, have been placed in groups of four to six. The steel I-beams were braced with stout timbers, and shoes some 24 in. square were built under them along the outer edge of the building, at intervals of 4 ft. Under each of these shoes, and resting upon the groups of rails, were placed in each case about a dozen steel rollers 2 in. in diameter and 24 in. long.

These preparations being made, the building was raised a fraction of an inch by means of several score of jacks, and the weight was transferred from the old foundations to the rollers on the the back of the building, on DeKalb avenue, and rails. A string of heavy timbers was run along anchored securely. Along this string were placed twenty jack screws, well oiled and working in hardwood drums. At a whistle signal, each jack was given one twist, and the building moved just the distance covered by the thread on the screws while making that portion of a revolution. In this manner the building was moved about 12 ft. in four hours.

For the twisting motion, the center of the building was indicated by a red light, and the steel rollers involved in this motion were all placed with their axes and the light in the same plane. The other translatory motion will be but a repetition of the first. The work is being done by Iverson, Gustatson & Co. A new facade facing the new Flatbush avenue will be built and then the theater will be again ready for use.

Yours truly,

Brooklyn. Sidney G. Koon.

Block Signals have been installed on 1,500 additional miles of the lines east of the Pennsylvania R. R. during the past three years, and at present the important mileage of these lines is protected, although about 500 miles of industrial and branch roads have not been equipped. The cost of the additional equipment was $856,520, and it will add $210,816 yearly to operating expenses.

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NOTICE TO ADVERTISERS.

Changes in advertisements intended for a particular issue should reach the office of The Engineering Record on Friday of the previous week. New advertisements can be received up to noon of Wednesday of the week of issue.

NOTICE TO SUBSCRIBERS.

Remittances.—Remittances should be made by check, New York draft, or money order, in favor of The Engineering Record.

Changes of Address.—The old address should be given as well as the new, and notice should be received a week in advance of the desired change.

Back Copies.—No copies of issues prior to July, 1906, are kept on sale, except in bound volumes.

Date on Wrapper indicates the month at the end of which subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

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TABLE OF LEADING ARTICLES.

Removal Notice.

The offices of The Engineering Record have been removed to the new building of the McGraw Realty Company at 239 West 39th Street, New York. This structure, named the Thirty-ninth Street Building, is but five minutes' walk from the Engineering Societies' Building, and is the most notable example of reinforced concrete construction in the city, as well as the most perfect structure yet erected to answer fully the special and different requirements for office and printing purposes. The Engineering Record will be pleased to see its friends at this new address.

The Utilization of Small Water Powers.

With the growth of electric power transmission has come an awakening to the importance of water privileges and one of the interesting results has been the rediscovery, as it were, of falls half forgotten and entirely passed by. In spite of this a great number of small streams remain undeveloped and offer excellent opportunities, not, to be sure, to the promoter who wishes to float bonds upon them, but to the actual investor and to the manufacturer who wishes power for his own proper uses. The bane of hydroelectric enterprises is "high finance," which saddles upon a proposed plant all the bonds that it can stagger under for years to come. A water power of one or a few hundred horsepower is too small to "finance," yet it often offers a capital chance for the bona-fide investor. Few people, even few engineers, realize fully what can be done with a comparatively small stream when intelligently developed. Other things being equal the smaller the stream for a given power, i. e., the higher the head, the better, since the cost of the hydraulic development is thereby greatly reduced. Also the cost of storage in considerable amount is then brought within reasonable bounds and adequate storage adds enormously to the practical value of the stream, as everybody knows. Few, however, appreciate the full importance of storage as applied to small streams, since on large streams generally developed at low head the practicable amount of storage is limited by the cost of the necessary riparian rights.

The ordinary stream is subject to enormous variations in flow, which cannot adequately be expressed in conventional averages. The spring floods are likely to be from twenty-five to fifty times the real minimum flow, and even more if one compares the maximum flood of a term of years with the minimum of the same period. The value of a stream for power purposes cannot be measured by the average flow since this is determined by unutilizable maxima. In a time of flood the flow is often so great as to cut down the working head, and is always greater than the capacity of any plant that can be profitably installed. Every stream has years of great and small flow scattered apparently by chance. A record of five or six years will catch the ordinary maxima and minima, but at least a quarter of a century is required to stand a reasonable chance of including extreme floods and extraordinary minima. Hence, so far as possible, the water should be stored. It is ordinary custom to store water during the night, thus holding double the normal flow for use during working hours. This is generally easy to accomplish at moderate cost. For instance, at 50 ft. working head a flow of 1,300 cu. ft. per minute will give about 100 h.-p. off the wheel shaft. If the power is used twelve hours per day one can store the other twelve hours' flow in a pond of a little less than 4.5 acres filled 5 ft. deep. This, however, is only the beginning of storage. The next step is so considerable a one that it is seldom undertaken, although it often would be very practicable. The ordinary continuous period of low water, at least in Eastern streams, is seldom more than 30 to 60 days and is preceded and followed by periods of considerably increased flow.

Now if sufficient storage capacity can be secured, say a hundred acres or so, this dry season can be tided over entirely and several times the normal low-water flow used steadily for twelve hours a day. Practically one is then able to use the stream on the basis of a point much nearer the average flow of the year than is possible with merely ordinary night storage, and to sell perhaps two or three times the amount of power that would otherwise be feasible without a stream reserve. One can, of course, go even further and store the entire yearly rainfall in an artificial lake, thus creating a useful water power from a stream entirely too small to consider except for storage. This has been done in a very few instances, and will be done more frequently as time goes on. The main point is that the usual small powers, apparently of little account, can, if the head be reasonably high, be developed by storage into excellent and reliable sources of revenue. The 100 h.-p. assumed at the start can be expanded not only into 200 h.-p. for twelve-hour use, but into 300 or 400 h.-p. and sometimes more. An electrical plant on which the demand for power fluctuates greatly through the day or night has its value determined very largely by the maximum load which it is able to carry over the peak and with good pond capacity this is measured by the capacity of the installation. Ordinarily the peak on a small plant will be three or four times the average daily power, so that if the plant just discussed is properly developed it may be able to carry a peak of 800 to 1,000 h.-p.

Lacking storage the peak must either stop at the normal flow or be eked out by auxiliary steam power. And the point needing emphasis is this, that in many cases, particularly on small streams, extensive storage is far cheaper than auxiliaries. One can hardly hope to install an auxiliary plant for less than $50 to $60 per electrical horsepower delivered, while in the case supposed a hundred acres of storage could generally be obtained, even if farm land had to be bought, for a sum far less than the first cost of the auxiliary it would replace. In these days of high voltage, a few miles of extra distance back in the hills involves no considerable extra cost, so that it would generally pay to develop well upstream where pond space would be available. There are many chances all through the hills of the country for just such small enterprises. In some cases the market will be found in lighting and power in towns a few miles distant, in others a single factory may find it profitable to utilize a stream for its own especial benefit. Many a small industry in which power is relatively a large item can in this way fall into an economy of production that is quite impossible if power has to be purchased or generated at the ordinary city rates. If engineers in drifting about the country on their various works would keep their eyes open for hydro-electric possibilities, they would find a surprising number of capital opportunities. The ordinary state surveys which purport to take account of the hydraulic resources of the country are very imperfect, since they notice only the more obvious falls and the larger streams. It is on the relatively small streams in a broken country that capital chances lie latent until some one with a keen eye brings them to light.

The Operation of Large Turbo-Units.

Few engineers who have not looked into the problem from the practical side realize the broad differences required in operating methods between very large and small or medium capacity power plants. The development of turbo units of 5,000 to 7,500 kw. normal rating demands a high degree of organization in the operating force of the plant which is made up of such large machines and their auxiliaries. In handling generators and turbines or direct-connected engine units of moderate capacity, the amount of money represented by each machine is not large enough, as a rule, to demand the elaborate precautions which one finds in the few great stations thus far built in 5,000-kw. units; and, again, the stoppage of a single machine in a station of a few thousand kilowatts rating does not mean anything like so much as it does in the case of a plant like the Long Island City station of the Pennsylvania or the Port Morris installation of the New York Central. There is no doubt that as the applica-

tions of electric power increase on a commercial scale, the use of very large units will become more common; and it is particularly important for prospective purchasers of such high-powered turbines to realize that the simpler and more easy-going methods of earlier plants must give way to an operating organization demanding real generalship in its handling, if the full reliability, flexibility and economy of the new and costly units are to be enjoyed.

In round numbers, a 5,000-kw. turbo-alternator represents an investment of from $150,000 to $200,000. The penalty of damaging such a machine by crude operating methods is evident on its face. Turbines of this capacity are designed so far as possible to take care of a long list of contingencies as to load and speed, and the governor mechanism may be counted upon to hold the machine within safe limits of turning over through all ordinary exigencies of starting, phasing in or shutting down. At the same time, definite responsibility and order of procedure must be insisted upon both on the switchboard gallery and on the floor of the turbine room itself. One or more sets of signals between the board and the floor are essential, and these must be reliable and simple, without the likelihood of their being confused in times of emergency. Hand signals are doubtless good enough for the working conditions of small plants, but in these very large stations lamp, bell or whistle signals, with supplementary telephone or speaking tube connections between floor and gallery are important features of good operation.

Anticipation of all probable contingencies is the main point at issue in planning for the skilled handling of large units. Under normal conditions the load upon the plant on the first five days of each week tends to follow substantially the same general variations from hour to hour, though the momentary fluctuations show less resemblance from day to day. Hence in routine service experience soon shows the hour each day at which a machine must be ready for service, and the probable duration of its service. Authority to cut in an additional unit may be granted to the floor engineer in charge of a given shift in case it becomes clear that the machines in service are in danger of being too heavily overloaded, but in any case the switchboard operators should be empowered to order in new machines if they are in practice held responsible for the continuity of the station output. The conditions in different plants vary considerably, and the exact measures of responsibility must be assigned with reference to the organization in force, but there should be no chance for things to go wrong because of divided authority. If the entire station is in charge of a single watch engineer, the decision may rest with him when to cut in or out machines, but a suitable organization will provide for fixed limits of continuous overload which shall not be exceeded without a second unit being thrown upon the bus-bars, in case one machine is handling the entire output of the station.

A clear-cut printed list of instructions as to the order of procedure and the signals to be used in bringing a turbine up to speed, synchronizing, cutting it out of service, transferring the load from one machine to another, handling exciters and auxiliaries, starting machines with the utmost possible speed in emergencies, and shutting down with all possible speed, is a valuable aid to operation in plants where such instructions can be properly applied and enforced. It ought to be unmistakable just what machines are designated by a given signal, and in this connection the use of audible signals can be very readily supplemented by lamp indications. Thus, the use of some form of engine telegraph, either with dial or lamp indications referring directly to the printed words "Start," "Stop," "Standby," etc., as in marine service, tends to reduce the chance of mistakes, as does the employment of an electric interlock in connection with the closing of the turbine oil switch which throws the machine upon the operating bus-bars. In some of the later installations it is impossible to complete the oil switch circuit unless the synchronizing plug is in its receptacle, and the circuit breakers cannot be closed unless the voltmeter plugs are in. The use of red and green pilot lamps to indicate the limit of speed conditions on the turbines, of similar lamps to show whether high tension switches are closed or open, with illuminated signs and special calls for emergency conditions, all tend toward reliable service. Foresight applied to minute details is the fundamental need of power plant organization in dealing with units of high capacity.

The Ambrose Channel at the Port of New York.

It is hardly likely that one American in a thousand, even in well-informed circles, appreciates what an important influence on commerce the Ambrose channel at the port of New York is likely to become. A few people have had a very hazy idea that an important channel was being dredged somewhere for some purpose connected with the improvement of the port, and a few engineers and contractors recall the work mainly on account of the troubles of those who originally agreed to carry out the undertaking for a sum about equal to that which an experienced dredging manager estimated as the cost of the necessary equipment to cut the channel in the time stipulated by the original specifications. As a matter of fact, it is the excavation of the Ambrose Channel that has made the "Lusitania" a practicable proposition, and without the work which the Corps of Engineers of the army has been urging forward with all practicable speed that great ship and the still larger vessels that will doubtless be constructed in the future would be hopeless failures. The relation of cause and effect in harbor work has rarely been shown more clearly than in the case of this channel and the famous liner that will shortly thread her way through it on her maiden voyage. The recent passage of the Cunarder "Caronia" through the new channel demonstrated its safety and great advantage over the old course, and showed that commerce will shortly be freed from its chief physical hindrance at the leading American port.

The problem in shipbuilding for the trans-Atlantic trade has been to secure maximum carrying capacity at minimum cost, or to increase the water-line length without an excessive addition to operating expenses. The high speeds attained by some liners cost so much that the vessels are generally understood to be operated at a loss, which is considered justifiable as an advertising proposition and is recouped by the profits of the slower vessels. If it were possible to build longer and deeper vessels, this high speed could be attained without such serious financial sacrifices, but it is manifestly no use to build a ship which cannot get into the harbor which is her destination on this side of the ocean. Up to the present time, therefore, ship-building has been checked, so far as fast liners were concerned, by the winding course and 30-ft. depth of the old Gedney Channel, and it was not until the Washington authorities gave an absolute promise of a better entrance to the harbor that the Cunard Company regarded the project for the "Lusitania" type of ship as practicable. The Ambrose Channel in its present incomplete condition will permit such vessels to come to their docks more easily than smaller liners have formerly made the trip over the old course, while the completed channel will admit vessels of 35-ft. draught at all stages of the tide and of lengths that would be unnavigable in the narrow, twisting Gedney Channel. It will thus be seen that the new channel does away with a physical restriction on the development of an important part of the port's commerce, and opens the way for progress in ship-building, the limits of which nobody can now foresee.

The channel which is making such a marked change in shipping and ship-building is intended to be 2,000 ft. wide and 40 ft. deep at low water eventually, although it will be a good many years before it is completed to these dimensions. At the present time it has a width of about 800 ft. and a minimum depth of 32 or 33 ft. at low water. This depth is not enough to make the channel free for the "Baltic," let alone the "Lusitania," at low tide, if they are fully loaded, but it will permit them to come up at any stage after the voyage over, when their coal supplies have been depleted. The new channel is about seven miles long. It begins about a mile and a quarter southwest of Coney Island, the famous amusement resort of New York, and extends in a generally southeasterly direction to deep water about half a mile north of the Gedney Channel. In the part already completed the channel has a depth of 45 ft. at the ocean entrance and come up for a mile and a half on the southerly side of the proposed 2,000-ft. channel; then crossing over gradually to the northerly side. The trial trip through the channel which was made by the "Caronia" indicates that the time of passage through it from the dock to deep water will be about half that required in going through the old course. The use of the new route for some time will be restricted to vessels of deep draft in order that interference with the work of improvement shall be as little as possible, and it is considered likely that for a time not many of the companies will care to follow the lead of the Cunard people and send their best ships over the new course. Even in its present incomplete state, however, the channel is a most instructive example of the assistance engineering can afford to water-borne commerce.

Riveted Connections in Steel Structural Work.

Notwithstanding the great developments made in steel structural work up to the present time there are a number of important details which cannot yet be satisfactorily designed in consequence of a lack of the requisite experimental data. The eye-bar, which was for many years of a more or less unknown, or at least speculative, character, may fairly be classed among those main details of a steel bridge structure which may be designed rationally and safely, if not with extreme accuracy. There has been accumulated a mass of results of tests of full-size bars of various classes of steel, and with such a variety of proportions as to form a fairly complete empirical basis of design for both large and small members. The design of an eye-bar head of such dimensions as to develop the full capacity of the body of the bar is no longer a matter of material uncertainty; the amount of experimental data now available is ample for its purpose. There are a number of other important structural details about which the same general observation may be made, but there are still others, including both riveted tension and compression connections, whose rational treatment in design is even now impracticable with substantial accuracy in consequence of a lack of sufficient experimental data.

Tests to failure of riveted joints in plates have been made in considerable number, especially for the purpose of determining the ultimate resistances of tension, shearing and bearing in riveted joints, but there have been comparatively few tests of either tensile or compressive connections between angles and plates or of the connections

of angles with each other. There have been postulated certain obvious principles applicable to the design of all classes of riveted joints, such as that requiring the lines of stress in the members joined to pass through the centres of gravity of the groups of rivet holes employed in the connections. It has also been recognized that, in general, the best results in connecting angles to plates will be reached by using angle lugs so as to catch both legs of an angle member with the joint rivets. Furthermore, it has been recognized with equal clearness that the centre lines of stress of all the members meeting at a joint must intersect at one point. In applying these simple principles, however, there is such a paucity of experimental investigations in this class of riveted connections that it is in reality impossible to design such connections with that degree of accuracy which ought to characterize the best class of steel structural work at the present time. Again, the determination of the proper net section where rivet holes in different lines are staggered cannot be made in a rational manner, although an experienced engineer of good judgment may, and does, design his work so as to make this feature of his connections entirely safe. Also, if an angle lug is employed to catch that leg of the steel angle which stands at right angles to the connection plate, the designer is greatly in the dark as to the value of the lug as a detail of the connection. It is even unknown in some cases whether the latter will be improved by the lug or not, but that is practically about all that can be said with any degree of certainty.

Under such circumstances a paper on experimental investigation in this class of riveted details like that on "Tension Tests of Steel Angles, with Various Types of End Connections," read before the American Society for Testing Materials, at its recent convention at Atlantic City, by Prof. F. P. McKibben, cannot fail to be of substantial value. Although the number of tests is not very extended, they were made with full-size angles and there are enough of them to yield significant indications of practical importance.

While the results are not sufficiently extended to be conclusive, it appears that there may be a gain of ten to fifteen per cent. in efficiency by catching both legs of an angle, by the aid of a lug, in a tension connection when the greatest available net section is attained by a suitable staggering of the rivets. This gain appears to increase as the inequality in the lengths of angle legs diminishes. Indeed, that gain may disappear or even become negative, i. e., a loss, if the inequality in length of the angle legs becomes great. At first sight this may seem irrational, but it is what should be expected. When the leg perpendicular to the connecting plate becomes relatively short, as in a 6x4-in. angle, the rivet holes through it, required by the lug, may decrease the net section to such an extent as more than to compensate for the advantage of catching both legs. The tests of connections with that size of angles discloses precisely the results indicated, but with the difference in efficiency so small as to indicate that the 6x4-in. angle lies about at the limit. In other words, it may be advisable to use lugs with a less inequality of lengths of legs, but not when the inequality is more. This is an important practical indication, and its confirmation or modification should be sought by a continuation of tests of this class.

The investigations set forth in this paper also show clearly the importance of a well-considered disposition of the units at the connection. A proper staggering of them, especially with unequal legs, may materially increase the net section and thus enhance the efficiency of the connection. Finally, the results of Prof. McKibben's investigations indicate that it is more advantageous to use equal-legged angles and connecting lugs than those with unequal legs, either with or without lugs, as the efficiencies of the former are sensibly higher than those of the latter.

Few or no compressive tests of this class of connections have been made, in spite of the fact that they are much needed. Compressive connections are simpler in character than those in tension, as the complication of net sections does not exist, but the influence of bending is unknown in amount and can only be determined by actual tests.

Notes and Comments.

THE COLLAPSE OF THE QUEBEC BRIDGE on the afternoon of August 29th was a wholly unexpected occurrence, in spite of reports in the newspapers to a contrary effect. The cause of the collapse of the south anchor and cantilever arms is as much a mystery at this writing as ever, and while several explanations of it have been advanced they rest on such inadequate basis of fact as to be mere speculations which are worse than useless on account of their tendency to warp the judgment. The portion of the bridge that fell had been standing over a year; it had passed through the storms of the winter, and nobody had seen anything about it indicative of any serious condition. It is true that Mr. Theodore Cooper telegraphed on the day of the accident to the builders not to place any more load on the structure until it was looked over, but he authorizes the statement that this telegram meant nothing more than a warning that it was desirable to stop work until the superstructure had been critically examined. Neither he nor his inspector dreamed for a moment that there was any danger of immediate collapse. That the structure fell is, however, one of those grave facts which the engineer must face in all its stern reality. It seems almost hopeless to attempt to seek the cause of the accident in the twisted wreckage or to discover in the statements of those present at the time of the failure any clue to the reason for the catastrophe. Yet until that reason is definitely found engineering will be looked upon by the public with suspicion as daring too much for its resources and as too willing to run risks; the Philadelphia "Ledger" voiced this sentiment as follows: "The world's confidence in the skill and judgment of the engineering profession will be seriously shaken unless it can be shown that the accident was the consequence of unforeseen and unavoidable contingencies." Engineers themselves know full well that probably no structure ever received more careful attention in design, manufacture and erection than the Quebec bridge and they will be unwilling to attribute its collapse to defective proportions, inferior materials or faulty erection until definite proof is established to the contrary. Full details of the design and the method of erection have been published in a long series of articles in this journal, and elsewhere in this issue is a statement of all the facts that have been brought to light concerning the accident and the local conditions at the time it occurred. An examination into the accident is now being made by the Canadian authorities and it is to be hoped that this will be so thorough and complete that the cause of the collapse will be definitely revealed. Until it is known, the hazard of bridge-building on such a great scale will be something to consider with apprehension.

THE ELECTRIFICATION of the Sacramento division of the Southern Pacific Ry. will be studied by Messrs. Frank J. Sprague, the eminent electrical engineer, and Mr. Allen H. Babcock, the company's electrical specialist. The latter has been investigating the electrification of the road from Rockline to Sparks for three years and the engineers of the large electrical manufacturing companies have made a special study of the subject. In many respects the problem of increasing the capacity of the division in question is one of the most important in the railroad world. It is over this division that the entire freight and passenger traffic of the transcontinental Union Pacific system, for Central California, is carried, and likewise the eastbound traffic. Some idea of the difficulties may be judged from the fact that in a distance of 83 miles there is a rise of nearly 7,000 ft., this section forming a part of the division on the west and east slopes respectively.

A BLOW-OFF TANK EXPLOSION in a St. Louis store resulted in the death of a power-plant operator, whose widow brought suit against the owners of the building for the death of her husband. The case has recently been decided, 103 S. W. Rep. 588, by St. Louis Court of Appeals in a decision of importance to consulting engineers. There were two blow-off tanks, sunk flush with the floor and separately connected with the boilers and the sewer. A 3-in. vapor pipe was provided for each tank, running up a few feet, then horizontally 12 ft., making three 45-deg. turns before rising to the roof. There was an upper and a lower valve in the pipe connecting the boilers and each tank, the lower valve being opened first and then the upper valve opened very slowly. The tank that exploded was within 18 in. of a boiler, so that to blow off the latter it was necessary for the operator to stand on the top of the tank, which was made of cast iron. While the operator was blowing off the boiler in the usual way this cast-iron top blew off and he was killed. The top was broken into pieces which were found to be honeycombed with holes. The owners of the building claimed that they were not liable for the results of the explosion, because they contracted with experienced and reputable people to furnish and install the machinery under the supervision of competent mechanical engineers also employed by them. They showed by witnesses that the blow-off tanks were of the standard type employed in the city and installed in the customary way, and consequently they claimed freedom from responsibility. The court has refused to uphold this contention and damages have been awarded against the owners of the building. It is laid down as good law as well as simple justice that the owners could not shift to the shoulders of another the responsibility for insuring the safety of the working place for their employees. The evidence showed conclusively that the lid was not subjected to any kind of test, and the court held that any ordinarily prudent person would have tested its soundness before putting it into use. This was the duty of the mechanical engineers engaged for the purpose of insuring the installation of a good plant, and these engineers were the owners' agents in the matter, so that their negligence was legally the negligence of the owners, for which the latter were liable in damages. This brings up a proposition which those who are struggling with proposed professional codes will do well to consider. According to the court's decision, "that the engineers were negligent in failing to test the head of the blow-off tank which blew up, does not admit of doubt." This being the case, should the engineers be considered responsible to the owners for the results of such negligence? According to the court's decision the accident was not due to an error in judgment, for which no professional man is properly held responsible in this way, but was caused by pure negligence, which is a very different matter. The question whether a professional man is liable to his client for damages in such a case is manifestly one that is open to considerable debate.

THE HYDRO-ELECTRIC DEVELOPMENT OF THE GREAT NORTHERN POWER CO.—PART I.

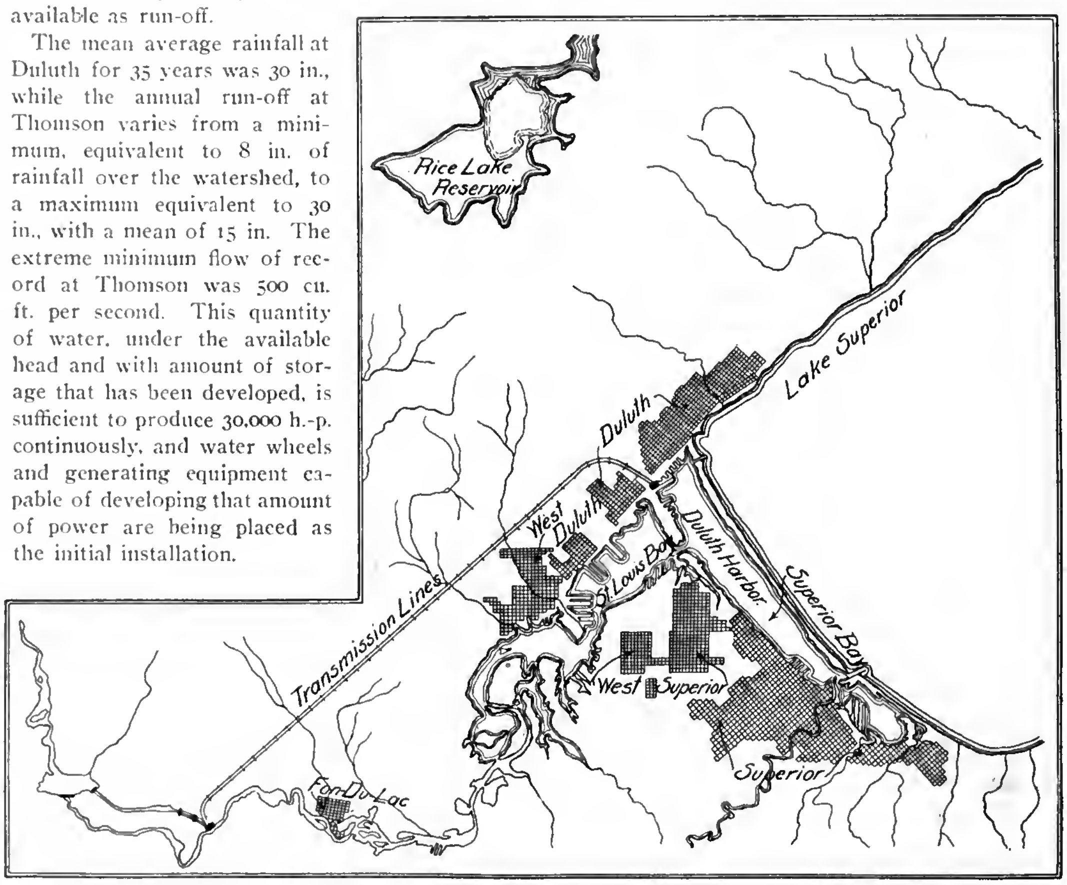
The hydro-electric development of the Great Northern Power Co. on the St. Louis River, near Duluth, Minn., is one of the most comprehensive hydraulic power projects that has been undertaken in this country. The important part of the hydraulic features of this development are practically completed, and that portion of the electrical generating equipment to be installed at first will soon be ready to operate. A service reservoir, with a capacity of 130,000,000 cu. ft., has been developed on the river at Thomson, 17 miles from Duluth. The river is by-passed from this reservoir to the power station, which is 2.8 miles down stream in a direct line. This by-pass consists of an open canal, 1⅔ miles long, that leads across a level plateau above the steep river valley, and of pipe lines extending from a forebay 3,500 ft. long, at the end of this canal, down the side of the river valley to the power station, which is at the edge of the river. The market for power generated in the station includes within easy transmission distances the cities of Duluth and Superior, the Mesaba, Vermillion and Gogebic Iron Ranges and other power consuming centers.

Water Power Available. The St. Louis River offers the only opportunity for any large, or important water-power developments within more than 100 miles of Duluth. The course of the stream is approximately a semi-circle, 150 miles in length, the headwaters of the main river being about 60 miles northeast of Duluth. The river flows west from its source, gradually changing in direction to south and finally to southeast near its mouth, which is 10 miles southwest of Duluth, in St. Louis Bay, an arm of Lake Superior. The Cloquet and the White Face Rivers are the principal tributaries of the St. Louis River. The headwaters of the former are about 15 miles southeast of the headwaters of the main river, the general course of the stream being toward the southwest for its entire length of approximately 75 miles. The Cloquet River passes to the north of Duluth, 15 miles from the city and joins the main river 30 miles from the mouth of the latter. The source of the White Face River is between the headwaters of the Cloquet and the St. Louis Rivers, the course of this stream, which is approximately 55 miles in length, being generally parallel to, and 15 miles north of the Cloquet River.

The sources of the three rivers are in the neighborhood of 1,150 ft. above Lake Superior, but only 585 ft. of this total fall of the main river occurs between the headwaters of the latter and a point 15 miles from its mouth. At this point there is a fall of about 45 ft., and in the next 4 miles a series of light rapids introduce a gradual fall. In the remaining 10 miles, from the upstream end of the service reservoir to the mouth of the river in St. Louis Bay, the total fall over a series of rapids is 465 ft., all of which will be utilized eventually by the Great Northern Power Co. Of this total fall, 378 ft. has been developed for the present hydro-electric station, and the remainder of the fall, which occurs below that station, will be utilized in a hydraulic development near the mouth of the river.

The total drainage area of the St. Louis River and its tributaries is about 3,700 square miles, consisting largely of connecting swamps, with alternate ridges covered with timber, dense undergrowth and small lakes. Although this territory has been made accessible recently by railroads from Duluth to the Mesaba Iron Range, which range is along the northern edge of the drainage area and about 60 miles from the city, it contains only a few settlers' clearings, county highways and logging railroads. Practically all of the pine that once covered the catchment area has been removed, but a dense forest of balsam, tamarack and hardwoods of various kinds still exists over most of the area. The surface of the latter consists of heavy glacial deposits of mixed gravel, sand and clay; these glacial deposits are underlaid on the headwaters of the river with hardpan, then for a width of 10 miles just above the present development, with slate, and from the end of this underlying slate to the mouth of the river, with brown sandstone. The catchment area is thus an excellent gathering ground for water, which is so gradually delivered into the streams that a relatively large percentage of the rainfall is available as run-off.

The mean average rainfall at Duluth for 35 years was 30 in., while the annual run-off at Thomson varies from a minimum, equivalent to 8 in. of rainfall over the watershed, to a maximum equivalent to 30 in., with a mean of 15 in. The extreme minimum flow of record at Thomson was 500 cu. ft. per second. This quantity of water, under the available head and with amount of storage that has been developed, is sufficient to produce 30,000 h.-p. continuously, and water wheels and generating equipment capable of developing that amount of power are being placed as the initial installation.



Map Showing Power Development, Duluth and Superior.

In order to provide for additional power installations, other storage reservoirs will be developed on the watershed. This reservoir development can be carried out very economically, as the swamps which make up a large proportion of the country at the headwaters of the three rivers offer unusually favorable opportunities to create immense storage reservoirs. The latter can be developed by simply placing dams across the small streams where these streams have broken through the glacial ridges. These dams for the most part need be only small structures, and it is estimated that the average cost of storage which will make 30 per cent. of the mean annual rainfall continuously availabe for power is approximately $1,500 per square-mile-foot.

Based on the development of storage areas which will render continuously availabe this 30 per cent. of the mean annual rainfall, another project, known as the Duluth Heights System, which is entirely distinct from the development at Thomson, is under consideration. This project contemplates the diversion of the headwaters of the St. Louis River and its tributaries through a series of canals and storage reservoirs to the crest of the steep hillside on which Duluth is built. This hillside reaches an elevation of over 800 ft. within a short distance from the water front of the city, and farther back forms the divide between the St. Louis River and the small streams flowing through the city into Lake Superior. A depression occurs in this divide through which the headwaters of the three rivers can be delivered into the central part of Duluth with a fall of 740 ft., or nearly twice as great as that available at the station on the St. Louis River. A reservoir which contains 17 square-mile-feet of storage has already been developed at Rice Lake in this depression, and for the time being will deliver water to the station at Thomson, but it is the controlling feature of the diverting scheme.

In case this scheme is carried out, 2,375 square miles of catchment area will still be tributary to the present station. If sufficient storage capacity is provided to render available 30 per cent. of the rainfall on this area, or one-half the total run-off, 80,000 electrical horse power can be developed in this station, based on a 42 per cent. load factor. At the same time 10,000 electrical horsepower can be developed in a station in Duluth operating on the water diverted from the three rivers under the available head of 740 ft. made possible by this diversion, and based on the same amount of storage and the same load factor as is contemplated for the station at Thomson. In addition to these two developments, 15,000 h. p. can be rendered available by the construction of a dam and power station to utilize the 70 ft. of fall in the river below the existing station.

Service Reservoir. The principal function of the service reservoir at Thomson is to conserve and regulate the flow equalized by the storage reservoirs so the variable demands for power each day may be met without loss of water. The capacity of this reservoir between the crest of an overflow spillway and the lowest depth to which water may be drawn into the canal leading from it to the power station, in a total draft of 12 ft., is 130,000,000 cu. ft., which is sufficient to accomplish this purpose of conservation and regulation. This reservoir is also capable of furnishing water to operate the ultimate installation of 80,000 electrical horse-power at 50 per cent. load factor for 23 hr. without supply from the river. Furthermore, it will permit sufficient time to obtain a supply from the storage reservoirs in case of an emergency, without interruption to the service.

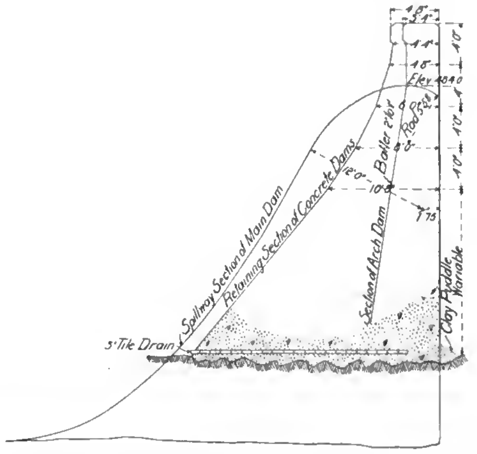
The service reservoir is about 1½ miles long and ½ mile wide, its long axis being nearly at right angles to the channel of the river. The latter in this vicinity cuts across a series of ridges of dense slate rock, which rise 10 to 60 ft. above the general level of the country, one of these ridges forming the downstream side of the reservoir. A main dam was built across the channel which the river had cut through this rock ridge and a series of low dams were erected to close the breaks in the latter.

The main dam has a total length of 1,120 ft., and is a gravity-section concrete structure. The spillway section of the dam is 40 ft. high from the bottom of the foundations to the crest, 42 ft. wide at the base and 365 ft. long. At one end of this section three sluice-ways are extended through the dam near the bottom so the reservoir may be drawn down through them. Each of these openings is controlled by a 7x9-ft. sluice gate. These gates have non-rising stems which pass through operating stands in a concrete gate house built on top of the dam. The stands are geared so they may be operated by hand.

A retaining section of the dam, 609 ft. long, extends from the gate house to a high point on the rock ridge, and a second retaining section, 146 ft. long, extends from the opposite end of the spillway of the dam to a spillway that has been formed by cutting down the rock ridge. The crest of the spillway of the dam is at Elevation 484, as referred to the level of Lake Superior; the top of the remainder of this dam and of the smaller dams around the reservoir are at Elevation 490, except two earth dams, the crests of which are at Elevation 492. The spillway formed on the rock ridge has a length of 1,000 ft., and is 18 in. higher than the crest of the main dam, that is, at Elevation 485.5. An extreme flood of 60,000 cu. ft. per second can be passed over the spillway of the main dam and this rock spillway without overtopping any of the retaining dams. This is in excess of any floods that may reasonably be anticipated, however, as the maximum flood of record is 52,000 cu. ft. per second.

Seven of the smaller dams, of which eleven were built, are gravity-section concrete structures. Two low earth dams, with paved slopes on the water side, one rock-fill dam having a concrete core wall, and one arch concrete dam make up the remainder. The rock-fill dam was built with the material removed to construct the spillway over the rock ledge. The core wall of this dam rises to the same height as the retaining dams. The arch concrete dam was built across a deep, narrow opening in the rock ridge in order to save concrete as compared with a gravity-section dam. It has a clear span of 60 ft. at the crest, is 60 ft high at the middle, and is built as an arc of a circle with a 100-ft. radius.

Upper Head Gates on Canal. The outlet from the service reservoirs into the canal connecting the latter and the pipe lines leading to the power station, is through submerged openings in a concrete retaining dam at the end of the reservoir closest to the station. The design of the outlet is such that the water will be drawn from the bottom of the reservoir in a manner that will keep the velocity of approach low, so that very little ice or floating matter is expected to pass through the submerged openings and enter the canal. The substructure for a gate house, 35x83 ft. in plan, is built into the dam and contains the outlet openings, of which there are eight, each controlled by a 6x9-ft. sluice gate. These gates are each in a well on the reservoir side of the substructure, the water entering these wells through a heavy timber rack. This rack, which is expected to intercept floating debris and ice, consists of 3-in. planks, set on edge and spaced 10 in. apart on centers. These planks are supported by steel frames arranged so sectional iron grate bars of any spacing that may be found desirable may be installed later in place of them. The rack is outside of the gate house superstructure, a platform walk being provided along the top of it to facilitate the removal of debris intercepted by it. Three of the eight sluice gates are now installed, and the remaining five openings are closed with stop logs placed in the channels provided in the concrete on both sides of the gates until such time as more gates are required. These gates have rising stems, each of which passes through a ball-bearing operating stand in the gate house. These stands are arranged so the gates may be operated by induction motors, which will be started and stopped automatically by a float in the well connected with the canal; the motors may also be operated by switches in the gate house; or the gates may be opened and closed by hand.



Sections of Concrete Dams.

Main Dam and Spillway over Rock Ledge at Service Reservoir.

Canal. The canal has a total length of 1¾ miles between these headgates and the forebay and is entirely in excavation. It has been built to supply water to operate the ultimate installation of 80,000 h.p. The first mile of it from the service reservoir is through an earth cut, which crosses occasional rock ridges. This length of the canal was designed to be 36 ft. wide on the bottom, 15 ft. deep and to have side slopes 2 on 1. The grade of the bottom is 0.00015 and the coefficient of roughness of the wetted perimeter is assumed to be 0.03. The maximum velocity of flow through the earth section when the canal is running to its full capacity will be about 2.8 ft. per second and the discharge 2,900 cu. ft. a second. The excavation was largely made with a steam shovel, and in order to reduce the cost of this work, the cut was made 66 ft. wide in the bottom and has steeper side slopes than specified by the design. It is expected these slopes will flatten out later, probably to an excess of 2 to 1. The remainder of the canal, a length of about 3,500 ft., has been excavated through slate rock with occasional short sections of earth reaching nearly to the bottom in some cases. The cut through the rock was designed to have as a minimum cross-section a rectangle 36 ft. wide and 15 ft. deep. As actually constructed the section is somewhat irregular, but in no place is the cross sectional area less than 450 sq. ft. The grade of the canal in this rock section is 0.0015, and the coefficient of roughness 0.033. The maximum velocity through this section will be about 7.5 ft. per second, with a discharge of 2,900 cu. ft. per second, the same as for the earth section.

The canal crosses one of the tracks of the Northern Pacific Ry. about ½ mile from the upper head gates. According to the original location the canal and the railroad formed an acute angle at this crossing, but it became necessary to introduce a reverse curve in the canal in order that the railroad might be crosssd more nearly at right angles. The railroad crosses the canal on a 70-ft. span deck plate-girder bridge carried by concrete abutments, which are built for a double-track bridge. The sides of the canal are lined with concrete in the form of warped surfaces in both directions from the abutments in order to bring the side slopes of 2 to 1 in the earth section to the vertical at the abutments, and to prevent wash at the sharp turns.

A concrete wasteway, 200 ft. long, is built in the right-hand side of the canal just below the railroad crossing, where water can be discharged over it into a ravine. This wasteway has a concrete lining, 18 in. thick, and is sloped 2 to 1 on the canal side, a discharge apron of paving stones set in cement mortar being placed on the hillside below it. The crest of the wasteway is at an elevation which will prevent the overtopping of the embankment that forms one side of the forebay at the lower end of the canal. The latter being all in cut is protected against such difficulty, as well as against breaks.

Forebay. The 40-acre forebay at the lower end of the canal is included to provide for sudden fluctuation of station load without necessitating continual changing of the upper head gates on the canal. The forebay also acts as a settling reservoir which prevents grit being carried to the water wheels. It has an average depth varying from 25 to 30 ft., and an available capacity of approximately 15,000,000 cu. ft.

The forebay is formed on the side of the hill by an embankment 3,500 ft. long and with an average height of 30 ft. This embankment was designed for a top width of 20 ft., with a slope of 2½ to 1 on the water side, paved to a depth of 3 ft. with rock from the canal excavation, and a slope of 1½ to 1 on the outer side. As built

the embankment has greater dimensions and contains more material than called for in the design, spoil from the canal excavation which was unsuited for the embankment proper having been wasted on its outer slope. The inner slope is also somewhat steeper than specified and is covered with rock from the canal excavation which was thrown on it roughly. About 85,000 cu. yd. of treacherous material was removed from the site of the embankment in order to reach a hardpan foundation. A timber core wall, consisting of a double-lap row of 2-in. planks, was built up on the center line of the embankment, extending from the hardpan nearly to the top of the latter. Material was dumped into the embankment from cars on a trestle, and was sprinkled as it was placed. The bottom of the forebay consists of a 3 to 10-ft. layer of good clay which forms a water seal with the core of the embankment. The latter has been finished nearly two years, during which time it has consolidated and retains the water in the forebay without any leakage.

Ice Conditions. Ice conditions on the river have been carefully observed and provisions have been made in all open water-ways to prevent interruption to the operation of the power station by ice in any form. It is believed that surface and needle ice will neither one be specially troublesome. A water-power development at the 45-ft. fall which is 5 miles upstream from the service reservoir has operated for 7 years without interruption by ice, although no provision to avoid difficulty from this source has been made and the natural conditions are much less favorable than at Thomson. Very little needle ice has been observed in the river at the site of the service reservoir, because the stream above this point freezes over in November, the ice remaining intact and covered with snow during the entire winter. The water is thus protected from direct contact with the cold air and the formation of needle ice is reduced to a minimum. Furthermore, the river enters the reservoir something over a mile from the upper head gates on the canal, so any needle ice that may reach the reservoir will probably be dissipated in passing this distance. The ice sheet formed in the river has thus far melted in place in the spring, so very little floating ice has been observed in the reservoir.

The expectation is that ice will form over the water in the earth section of the canal, in which the velocities are low, during such time as only enough water is supplied to operate 30,000 h. p. and probably until nearly the ultimate of 80,000 h. p. has been installed. It may also form over the water in the rock section of the canal at the start, but the water in this section is nearly certain to be more or less open when the full installation is in service. The period of time that the water will be exposed in the open sections of the canal will be so short, and the depth and volume of water in these sections so great that little, or no needle ice should be formed while the water is passing these sections. The water in the forebay will be frozen over and will afford the same protection against needle ice entering the pipe lines that is afforded to the canal by the service reservoir.

Lower Headgates. The outlet from the forebay into the pipe lines is through headgates at the downstream end of the forebay. A heavily reinforced concrete substructure for a gate house, 40x145 ft. in plan, is built across the end of the forebay, the reinforced-concrete bottom of this structure being on hardpan at the same elevation as the bottom of the forebay at the approach to it. A concrete cut-off wall extends 10 ft. into the hardpan on which the bottom of the structure rests, and the full length of the latter. The bottom also extends into clay puddle at the front of the structure, the junction being protected by rock paving. Concrete wing walls are built from each end of the gate house into the adjoining banks in such manner as to form a perfectly safe seal that prevents water from escaping around the ends of the structure.

The upstream side of the gate house substructure is a heavy curtain wall containing eight submerged arch openings through which the water passes to enter a rectangular chamber for racks that intercept any floating debris that may reach this chamber. These racks consist of steel bars spaced close together and assembled in removable sections. In the rear of the rack chamber, which is within the lines of the gate house that is to be erected on this substructure, are eight wells, each 15x20 ft. in plan. The openings leading to the pipe lines are each controlled by a 6x9-ft. sluice gate, one of which is to be placed in each gate well. These gates have non-rising stems which pass through ball-bearing operating stands on the floor of the gate house. The pitch of the screws on these stems was made high so the gates can be closed very rapidly by hand. Provision has also been made so the gates may be operated by motors, and as it will require considerable time to open the latter by hand, the motors will probably be installed and will be arranged so they may be controlled directly from the switchboard in the power station in case of an emergency.

Head Gates at Lower End of Forebay during Construction.

Spillway of Main Dam Prior to Erection of Gate House.

Thus far only three of the eight wells are provided with gates, the others being closed with stop logs until such time as they are needed. Grooves are built into the forward end of each well so stop logs may be inserted on that side of each gate to facilitate repairs to the latter.

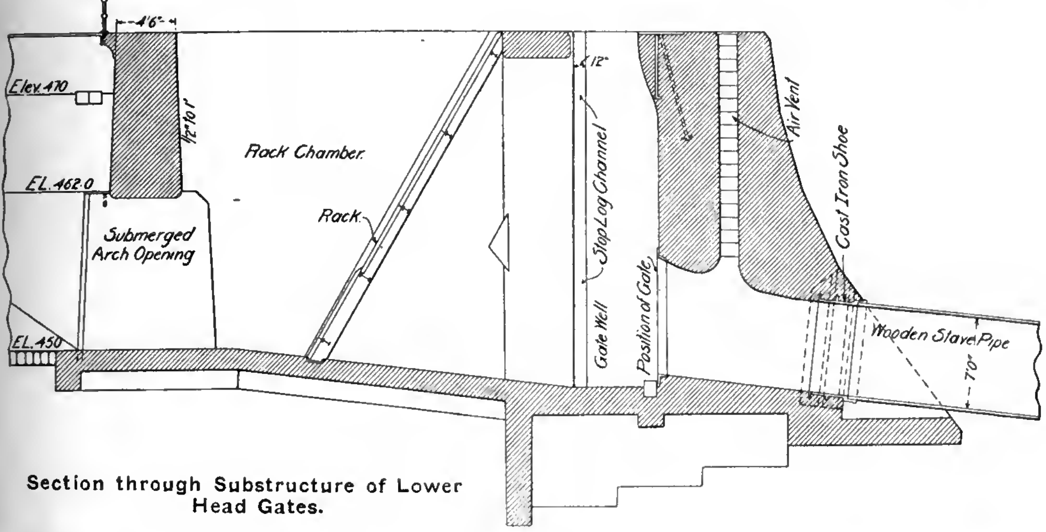
The ice and debris which collect in front of the curtain wall can be flushed out of the forebay through a rectangular sluice way opening in the wall at one end of the gate house substructure. The bottom of the sluiceway is well below the quiescent water level in the forebay, and a rising gate is provided in the sluiceway so ice and other debris may be flushed over this gate at different stages of water. A wooden sluice box on a trestle extends out on the hill side for a short distance to a point where a drop of about 20 ft. is secured. The flow from the sluice drops on a wooden apron and is carried away from the works at the end of the forebay.

Construction View of the Wasteway on the Canal.

Pipe Lines. Three 7-ft pipe lines have been laid in a trench from the lower head gates to the power station, a distance of 5,000 ft., and will be covered with 2 ft. of earth. Wooden-stave pipe was used for the first 4,000 ft. of these lines from the head gates, in which distance the fall is 150 ft., and riveted-steel pipe in the remaining 1,000 ft., in which the total fall is 228 ft. The grade on which the wooden pipe is laid is continually descending and at the flattest point is

sufficient to maintain velocities that will prevent any tendency toward a collection of air in the pipes. It was determined that the economical point to end the stave pipe and begin the steel pipe was where the pressure was equivalent to 150 ft. of head. The cost of wooden-stave pipe up to this head was estimated to be less than that of steel pipe, owing to the fact that the bands which take the strain can be placed in such manner as to obtain the most efficient distribution of metal, which variations would not be practicable with steel pipe. It is expected that the steel bands may rust out in 20 to 30 years, but in such event, they can be replaced one at a time in a manner that will avoid interference with the operation of the pipe lines. It is believed that the staves will last indefinitely, as they will be kept saturated by water under pressure.

The staves are of California redwood, which was almost perfect lumber, without knots or flaws. They are each 3½ in. thick and were cut



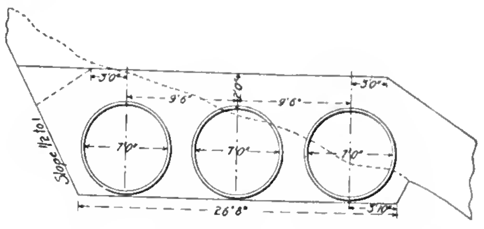
Section through Substructure of Lower Head Gates.

accurately to a template with arcs and radial sides of a 7-ft. circle. The bands are made of round ¾-in. steel, the shoes and turnbuckles used to join them being malleable cast-iron. The bands and shoes were dipped in hot asphalt before being placed and were spaced according to the pressure in the line. Leakage between the butt ends of the staves is prevented by inserting plates of metal, which were placed in saw cuts and then driven to a tight fit. The wooden stave pipes, which were built by the Excelsior Wooden Stave Pipe Co., of Lynchburg, Va., proved perfectly satisfactory when tested.

The joint between the stave and the steel sections of each pipe line was made by inserting the stave pipe into a cast-steel bell on the steel pipe and calking the joint with oakum and lead. A similar joint was also made at the end of each wooden-stave pipe at the gate house, where a cast-iron bell flange for each pipe was set in the concrete.

The 1,000 ft. of steel pipe at the lower end of each 7-ft. pipe line is built up of steel plates. The longitudinal seams are triple-riveted, with double-butt straps and the circular seams are double-riveted, with double-butt straps. The pipe was designed with a factor of safety in excess of three, an additional 1-16 in. of metal being added for rust. The pipe was dipped in hot asphalt and is laid in a trench and backfilled the same as the stave pipe. The grade at which the steel pipes are laid is all in the direction of the power house, the fall being about 228 ft. in the 1,000 ft. of pipe. The lower ends of the pipes are anchored securely in concrete and are tied into the brown sandstone ledge under the foundations of the power station with railroad rails. No expansion joints were placed in the steel pipe, as it is assumed the expansion caused by the variation between the limits of temperature during operation would be taken up by the elasticity of the metal. Reaction to insure this occurrence is obtained by angles which are riveted to the pipe at short intervals and flare out into the backfilling. Care was also taken to make the last joint in the steel pipe when the temperature was about the same as the average temperature of the water. The pipe was built and placed by the Riter-Conley Mfg. Co., of Pittsburg.

Manholes are provided at suitable intervals



Trench for Three 7-Foot Pipe Lines.

along each pipe line and two automatic air valves are placed in each pipe to prevent any tendency toward the formation of a vacuum due to a very sudden acceleration in the flow of water. These air vents are at changes in the grade of the pipe lines, and an open vent is placed on each pipe inside the gate house at the upper end of the pipe lines. The outside vents are protected from freezing to insure their action in cold weather.

The velocity of flow in each of the 7-ft. pipe lines when delivered 335 cu. ft. of water per second, which is equivalent to 10,000 electrical horse power at the generator, will be 9 ft. per second, and the maximum velocity will be about 11 ft. per second. The average velocity, due to a 50 per cent. load factor, will be about 5 ft. per second. The average friction loss in the entire 5,000 ft. of stave and steel pipe lines will be approximately equivalent to 10 ft. of head.

Stand Pipe on Pipe Lines.—Each of the three 7-ft. steel pipe lines from the forebay to the power station is connected to a large steel standpipe erected on a tower which spans them at a point about 500 ft. back of the station and 155 ft. above the water level in the river. A cross receiver, 8 ft. in diameter and 36 ft. long, is placed horizontally over the pipes and between the legs of the standpipe tower. Each pipe has a short 60-in. riser connecting it with this receiver through a 60-in. valve. A 6-ft. riser extends from this receiver to the standpipe tank, which is 30 ft. in diameter and 69 ft. high. The top of this tank is 235 ft. above the footings for the standpipe tower and 495 ft. above the level of Lake Superior, while the water surface in the forebay will be 472 ft. above that level. This standpipe was built and erected by the Chicago Bridge & Iron Works.

The standpipe has several important functions in connection with the operation of the water wheels in the station. First, it will relieve the pipe lines of excessive pressures due to a sudden closing of the gates in the water wheels following a quick drop in the demand for power. Second, it will also maintain pressures and speed regulation in the station when sudden demands are made for water; the 30-ft. standpipe has sufficient capacity between Elevations 426 and 472 to supply enough water to the wheels to meet a sudden demand for power up to 15,000 h.-p. and to maintain the head required for good regulation by governors on the water wheels until the water in the pipe lines back to the forebay is given an opportunity to accelerate sufficiently to meet the added demand for power. Third, the top of the standpipe being well above the water level in the forebay, enough back pressure will be exerted on the pipe lines to prevent any tendency toward the formation of vacuum at the changes of grade where the air valves are placed. Fourth, the cross receiver and standpipe will permit a flow to be maintained continuously in all the pipe lines during freezing weather, even though all of the water wheels in the power station are not in service; the friction losses in the pipe lines can also be reduced when the station is running at part load by continuing all the pipes in operation through the cross receiver. And, lastly, the standpipe provides a vent for the escape of any air bubbles or entrained air that might otherwise tend to produce water hammer in the casing of the water wheels. The principal value of the standpipe, however, is the saving it will effect in the water that

Three 7-Ft. Wood Stave Pipe Lines Looking toward Lower Head Gates.

would otherwise be wasted through relief valves which are provided at the water wheels in order to secure proper speed regulation and to avoid dangerous excess pressures in the water system.

The cross receiver and the base of the four legs of the standpipe tower are on heavy concrete footings. The 60-in. connections for four pipe lines are imbedded in the concrete under the receiver, so the fourth pipe line can be attached when it is laid. The four additional pipes, which are contemplated when the ultimate installation is completed, will be connected with an extension of the cross receiver.

The standpipe tank is of standard design with a hemispherical bottom. The 6-ft. riser has a slip expansion joint at the bottom of the tank, but it is to be so protected as to prevent the water from freezing. A frost box, 9.5 ft. in diameter, will be built around the riser, and the tank will also be lagged, so during excessively low temperatures warm air may be passed through the space enclosed by the frost box and lagging.

(To be continued.)

Glass Blocks for Tunnel Lining.

The Pennsylvania R. R. has for some time been seeking a thoroughly satisfactory lining for the passenger tunnels leading under the tracks from the stations to the platforms on the opposite side, and though repressed and waterproof brisk, glazed and glass tile, and enamel brick have been used, none of them have been free from objections. On the other hand, some of them possess quite marked merits as a material for a finished lining for tunnel work. Some of the materials mentioned are subject to cracking on account of changes of temperature, others chip and spall off under the action of frost, and a number of them being non-porous allow the moisture which accumulates on their surface to drip down upon passengers going through the tunnels. The main trouble occurs in the winter when the temperature rises above the freezing point after several days or weeks of severe freezing weather. The bench walls become chilled and remain so for about 24 hr. after a change to warmer weather. At such times the condensation upon the surface is heaviest and the spalling off and crazing is most severe.

After a consideration of the materials mentioned it was decided to try something new, and accordingly specially designed glass block will be used in the passenger tunnel now building at Edgewood, a suburb of Pittsburg. Certain features have been embodied in the design of the new material, which it is hoped, will result in doing away with the objections found in the other linings.

The defects of all of the materials thus far experimented with can easily be seen by anyone making a casual inspection. Repressed brick, which is usually of a porous nature, absorbs moisture condensed on its face, and owing to its damp condition becomes a lodging place for dirt and grime and in a short time presents a very unsightly apeparance. Waterproof brick, on the contrary, does not have the most objectionable feature of porous repressed brick but does condense the moisture permitting it to run down the face of the lining to the floor. The experience with enamelled brick has been very extensive, almost every make and size having been used. Some of these have been found to craze and spall off under the action of frost, while those not affected in this manner nevertheless condense the moisture, the same objection mentioned in connection with waterproof brick.

Glazed tile will absorb moisture, and in zero weather this moisture freezes and spalls off the glazed face together a portion of the tile itself. These unglazed portions soon become black and the whole lining assumes an unsightly appearance. Glass tile has been found to be nearly impossible to bond to the plaster lining necessary in tunnel construction, and the moisture eventually gets in between the tile and the plaster and in freezing weather forces off the entire tile face.

It is recognized that a lining for this purpose must meet rather severe conditions owing to its exposure to large temperature variations, and the fact that the temperature of the lining will not change concurrently with changes in the atmosphere, due to the tunnel being surrounded by the earth embankment of the railroad. In designing the new blocks, therefore, these severe conditions have been held continually in mind, and the elaborations of the constructions is justified by the difficulties which it is expected to overcome. The glass brick which will be put in at Edgewood measure 2 x 4 x 8 in., and have a hollow center, the wall forming the face being 5/8 in. thick. The brick is to be laid on a specially prepared concrete foundation offsett, having a 2-in. invert to receive any condensation from the interior of the brick and conduct same to the sewer. In addition to this precaution the hollow interior allows the brick to be well ventilated and the passage of air through it will insure almost as rapid a change of the temperature of the lining as of the atmosphere itself. The ventilation is provided for by placing brass grills the same size of the brick, every tenth brick in courses next to the floor and the ceiling.

It is not expected that condensation will be entirely overcome, but as glass rapidly assumes the temperature of the air it comes in contact with, and as precautions have been taken to insure good ventilation, it is hoped that the condensation will be brief and practically unnoticed. As glass is non-porous there will be no trouble with the face of the work spalling off, due to frost, and no trouble is apprehended from crazing, as experience has shown that this does not occur where glass is used alone. The glass naturally has the same advantages as enamelled brick and glazed tile in giving a smooth, pleasing finish and a surface that does not afford lodgment for dirt.

Mr. W. C. Richey, master carpenter, Pittsburg, has charge of the work.

Oiling Roads as a method of laying dust has aroused considerable criticism in some quarters, and for this reason some statements concerning a piece of work of this sort in Morristown, N. J., recently made by Mr. Wm. S. Bacot, one of the leading road engineers of this country, deserves considerable attention. Mr. Bacot states that a stretch of about 2 miles in Morristown has been oiled with an odorless compound unknown to him, but the results are so satisfactory in laying dust that he considers the experiment an important one. Prior to the oiling of the road, the large number of automobiles using it made the dust in the vicinity of the road so heavy that, in his opinion, the oil treatemnt would be advisable even if the roads wore out faster on account of its use. Fortunately the wear on the road does not seem to be at all comparable in amount with that on other roads in the vicinity, supporting an equal travel, but sprinkled with water regularly. Mr. Bacot states that he has observed the effect of oiling a hard road free from dust to be more lasting than is the case with roads having a surface of considerable loose material, which required frequent applications of the oil to produce the same results. In this connection reference may be made to the report of a commission appointed by the Minister of Public Works of France, noticed in this journal four weeks ago, expressing the same opinion.

A Combined Underpinning and Sheeting Job.

A new six-story steel cage bank building on the southwest corner of Murray St. and Broadway, New York, is enclosed on two sides by an L-shaped seven-story and basement office building, with the floor beams supported without columns in the thick brick wall, having their foundations seated about 12 ft. below the curb on coarse sharp sand. The adjacent walls of both buildings are throughout their entire length in contact upon the party lines and recesses had to be cut in the face of the long wall of the old building to clear the steel columns of the new building. The vaults for the new building extend about 15 ft. under the sidewalk in both streets and are enclosed on the outer sides by heavy brick retaining walls about 24 ft. high with their foundations at the same level as those of the other footings, above water level on the dense sand about 24 ft. below the curb. After the demolition of the old building the first work was the underpinning of the adjacent building and the sheeting and bracing of the outer side of the excavation to retain the earth under the roadway. The contract for both sheeting and underpinning and for the construction of a sidewalk bridge and overhead platform on two faces of the lot was awarded to Miller, Daybill & Co., Brooklyn, and is now nearing successful completion.

Six equidistant pits about 6 ft. square in a line parallel to the long wall of the adjacent building and about 10 ft. distant from it were sheeted down to a depth of 24½ ft., about 6 in. below sub-grade of the new cellar, and in each of them there was built a timber crib 5 ft. square and about 15 ft. high. Four lines of 12x12-in. timber breaking joints, were supported on the tops of the cribs forming a continuous 48x48-in. longitudinal girder about 125 ft. long parallel with Murray St. At the end farthest from Broadway this girder supported one end of a similar 48x48-in. transverse girder, about 25 ft. long with the opposite end carried on a similar crib pier. The two girders thus formed a continuous L-shaped footing extending around two sides of the lot to receive the ends of the needle beams used for supporting the walls of the adjacent building while they were underpinned.

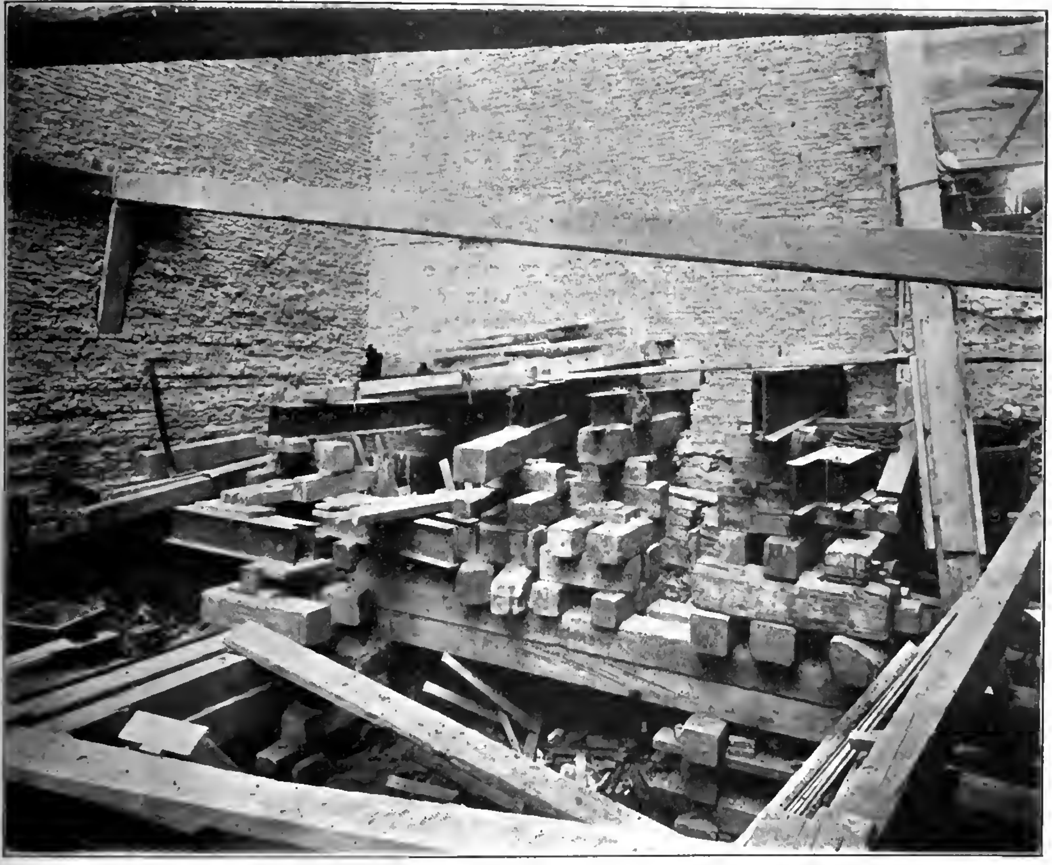
The basement of that part of the adjacent building which fronted on Broadway was occupied and therefore inaccessible to the contractor who was obliged to do his work without interfering with it. He therefore cut holes about 6 ft. apart on centers through the footing of the wall below the level of the basement floor for the needle beams and from these holes excavated short horizontal transverse drifts about 15 ft. long under the basement floor. From the extremities of these drifts a tunnel about 5 ft. deep and 4 ft. wide was driven the full length of the wall, 135 ft., and on the bottom of it were laid four tiers of 12x12-in. timbers, breaking joints and making a 48x48-in. continuous sill comparable with the girder on the opposite side of the wall and intended to receive the inner ends of the needle beams. A set of three 15-in. I-beams about 25 ft. long was inserted in each of the holes with the ends resting on the 48x48-in. girders and sills in the old building and on short cribbing piers on top of the 48x48-in. girder in the lot. A 15x¾x20-in. horizontal bearing plate was laid on the top flanges of the group of girders in the plane of the wall and a corresponding piece of plank 3 in. thick long leaf yellow pine covered with cement mortar was set on top of it filling the space between the top of the beam and the upper part of the hole in the brick work. As soon as the cement commenced to set wedges were driven between the steel plate and wooden plank and forced the latter up to make solid

bearing against the old brick work when the remaining cavities between the wedges were filled with grout and the whole allowed to set and form tight packing between the needle girder and the wall. A thick horizontal cast-steel plate engaging a special 4-in. 24-ton jack screw with bevelled threads was set on a pair of beams built into the crib-work under the outer end of the needle beam with the upper end of the jack-screw bearing against a cap plate engaging the lower flanges of the I-beam. The jack screws under the needle beams were simultaneously operated until their supports were thoroughly compressed and settled and the full weight of the wall was taken by the needle beams giving them a deflection of about ¼ in. at the center point.

Similar needle beams under the 40-ft. long wall parallel to Broadway were allowed to penetrate the unoccupied basement in that wing of the old building and were therefore supported at their outer ends on higher timber cribs built up from the top of the 48x48-in. transverse girder. As the width of this wing of the building is only 15 ft. from out to out, the needle beams were carried entirely across it and their inner ends projected through holes cut for that purpose in the opposite wall and were seated on the brick work there thus making the wall and its footings serve as a sill distributing the load from the needle beams, instead of preparing a special sill as in the other wing of the building.

At an angle formed by the intersection of the walls of the old building the corner pier of the brick work was carried by a needle beam making an angle of 45 deg. with each wall and intersecting both just beyond their point of intersection so as to secure full bearings on both. This needle beam consisted of two 15-in. I-beams 20 ft. long seated on one 12x12-in. timber 25 ft. long that was supported at both ends on the adjacent needle beams carrying the intermediate portions of the wall as already described.

The wall parallel with Broadway terminates at Murray St. with a 3x4-ft. brick pier having an estimated load of 100 tons. On account of the small area of the pier it was underpinned in sections and care was taken to cut away only a small portion of the brick work and immediately support it on a part of the sectional underpinning before reducing the area of the pier to any great degree. A recess 6 in. deep and 24 in. high was first cut on the outer face of the pier and in it was placed 2 20-in. I-beams supported at the extremities like the other needles and wedged and cemented to solid bearing against the brick work. A similar recess was then cut across the opposite face at a little lower level and a pair of I-beams inserted in it and in a hole cut through the face of the adjacent wall so that the pier was carried by needle beams engaging shoulders on each side. To give it still further security a recess, at right angles to the first two was cut across the inner face of the pier and a short horizontal I-beam was seated in it and supported at both ends on the two needle beams already mentioned. The pier at the termination of the outer wall at the Broadway front had also a load of about 100 tons and was underpinned in the same manner. The Murray St. pier was braced by two 12x12-in. spur shores about 40 ft. long at right angles to each other, one of them reaching across the sidewalk and at a clear height sufficient to prevent obstructing it and the other at a somewhat smaller angle with the vertical being carried down to a footing in the bottom of the excavation. Both of these spurs had their square upper ends set in recesses cut in the brick walls and their lower ends adjusted by pairs of wedges on transverse horizontal sill pieces. An additional brace was provided by a 12x12-in. horizontal timber about 20 ft. long which was placed at an angle of 45 deg., with both of the underpinned walls which had recesses cut in them at the second floor level to receive the ends of the beam which were brought to bearings by pairs of wooden wedges driven by a man suspended in a boatswain's chair suspended from the roof at a height of about 40 ft. above the bottom of the excavation.



Needlebeams under Murray Street Building.

After the weight of the building was transferred to the 48x48-in. girders, six 12x12-in. inclined horizontal transverse braces were set with their lower ends engaging the long 48x48-in. girder and their upper ends engaging the lower horizontal ranger piece for the sheeting which retained the side of the excavation for the Murray St. vault. These braces were continued from the opposite side of the girder to footings of the old building thus providing balanced reaction and utilizing both the inertia and weight of the old building to resist the lateral thrust of the earth in the street. The upper rangers for the same sheeting were braced by transverse 12x12-in. struts inclined upwards in the same vertical planes as the lower struts. The opposite ends of these struts took bearing on 12-in. horizontal pieces about 6 ft. long laid against the face of the wall of the old building and distributing the pressure on it, thus acting both as for shores for the wall and as cross bracing for the retaining wall. The upper ends of these braces are supported by struts about 6 ft. long slightly inclined from the vertical with their lower ends seated in recesses cut in the face of the brick wall, their upper ends being stabbed to the lower surface of the 12x12-in. struts.

The sheeting around the sidewalk vault is made with 3x10-in. square edge planks about 24 ft. long driven as the excavation progressed, but having their lower ends always kept 3 or 4 ft. below the bottom of the pit. They were rapidly and economically driven by a No. 4 Ingersoll-Sargent steam drill having the rotating device removed and the drill bit replaced by a square ended bar striking on a heavy removable steel cap which enclosed the top of the pile. The sheeting is allowed to remain permanently in the ground, and is faced up on the inside with a 4-in. brick wall to which the water proofing is applied and after which the heavy foundation wall is built up against it. At the Murray St. pier the cross wall at the end of the vault was carried on vertical shores reaching to the foot of the excavation and located so that it was very difficult to remove them and they were permanently built in and enclosed by the outer brick work for the water proofing. At this point the excavation was very difficult and it was necessary to put the sheeting in with short vertical boards set and braced as fast as the pit was carried down.

The work was executed without difficulty from water and although very heavy and somewhat complicated has been done rapidly and successfully. The principal difficulty was to arrange the girders, piers and both systems of struts so as to clear the permanent structural work in the building and this has been done so successfully that it was only necessary to move one of the struts to permit the building of the brick work and the erection of the steel frame work.

As the excavation was carried down to sub grade the footings under the adjacent walls of the old building were removed and the basement floor was shored up when necessary. A new concrete footing and brick foundation wall was built in the bottom of the excavation up a height just clearing the lower flanges of the needle beams. Between the groups of needle beams brick piers were built a little higher and capped with pairs of cut stone. The upper stone was well covered with cement mortar and double steel wedges being driven between the stones, the mortar was forced up against the lower side of the old brick work, making a solid bed for the latter. The pairs of wedges were gradually driven until the weight of the wall was transferred from the needle beams to the piers between them and the needle beams were released, a condition which was indicated by the disappearance of their flexure as they sprung back to a horizontal position.

Marc Eidlitz & Son are the general contractors for the building and the underpinning and sheeting have been done by Miller, Daybill & Co., under the personal direction of Mr. Alfred Daybill.

A 7-Ft. Steel Pipe Line at St. Louis.

Among the improvements to the water supply system of St. Louis, Mo., that are under construction is a 7-ft. steel pipe flow line, 19,634 ft. in length. This flow line extends from a series of settling basins near a low service pumping station, at the Chain of Rocks, 10 miles above the central portion of the city, to a high-service pumping station in the northern end of the latter. Water is drawn from the Mississippi River by pumps in the low service station, from which it passes through the settling basins before being delivered to either of two high-service pumping stations that supply the distribution mains directly. A general description of the settling basins, including the design and construction of two large reinforced concrete basins was printed in The Engineering Record for July 6, 1907.

A horseshoe-shaped brick and masonry conduit, 11 ft. wide at the springing line of the arch and 9 ft. high, extends from these basins to the two high-service pumping stations at Baden and at Bissell's Point, the former being about 4 miles and the latter 7 miles down the river from the basins. Although this conduit has a sufficient carrying capacity to supply the two high-service stations, even during periods of maximum demand for water, it is at present the only means of conveying water to those stations, so the 7-ft. steel pipe line is being laid to the first high-service station to insure a supply at all times.

The new flow line starts at an outlet gate chamber near the down-stream end of the basins at the Chain of Rocks and parallels the brick and masonry conduit at varying distances to a 25,000,000-gal. storage reservoir at the Baden high-service station. The gate chamber from which the flow line starts has conduits connecting it with all of the settling basins, so water may be drawn into it from any of the latter. The pipe line is laid on a grade of about 6 in. to the mile from this chamber, which gives it an estimated carrying capacity of 35,000,000 gal. per 24 hours without head; it can, however, be operated under a 15-ft. head and will then deliver 10,000,000 gal. per 24 hours. It is nearly all in cut, only a few crossings of waterways being required. At most of these crossings the pipe line is close enough to the brick and masonry conduit so the crossings which were constructed when the latter was built are being extended to serve the pipe line.

A creek crossing about midway on the line requires the only bridge structure of any size. This bridge is a 137.5-ft. span having two Warren trusses with riveted connections, which are 14 ft. apart on centers, the height of the truss from center to center of chords being 11 ft. The bridge has a tight concrete roof and floor, both carried by transverse steel beams between the trusses. The floor system is designed to carry a live load of 50 lb. per square foot, in addition to its own weight, the weight of the 7-ft. flow line filled with water and the concrete supports of the flow line. The roof is proportioned to carry a uniform live load of 100 lb. per square foot in addition to its own weight. The wind pressure for which provision is made in the design is assumed to be acting horizontally in either direction at 30 lb. per square foot of a surface bounded by the extreme dimensions of the bridge. The allowable stresses of the steel and the methods of testing the latter are generally the same as those usually employed in railroad bridge design.

The pipe line is made of soft open-hearth steel plates ½ in. thick, and 84 in. wide, only one longitudinal joint being allowed to each plate. The steel is required to contain not more than 0.05 per cent. phosphorus, 0.05 per cent. sulphur, 0.05 per cent. silica and 0.5 per cent. manganese. The tensile strength specified is between 52,000 and 60,000 lb. per square inch, the elastic limit being required to reach at least 30,000 lb. per square inch. The pipe is assembled with taper rings in 28-ft. lengths, each made up of four rings. The small end of each ring at the transverse joint is inserted within the end of the next adjacent ring, the inside diameter of the small end of each ring being 84 in., and the inside diameter of its large end great enough so that the end will fit over the small end of the adjacent ring.

The lengths of pipe are tested at the mill under a hydraulic pressure of 30 lb. per square inch before being coated. After passing the test the lengths of pipe are cleaned and heated and are then dipped in a bath of mineral rubber asphalt coating. Suitable care is taken to protect this coating from the time the pipe is removed from the bath until it is accepted in place in the trench.

Laying Pipe in Close Quarters.

The construction of the pipe line presented no particular difficulties, as most of the trench excavation was in soil which stood well after the trench had been opened. The depth of cutting for about one-half the length of the line was under 12 ft. and for the remainder the cutting ran from 16 ft. to 22 ft. In the more shallow excavation the latter was made by hand, and in nearly all of this part of the work no shoring was required; shoring was employed, in fact on a very small percentage of the total amount of trench that has been opened.

A steam shovel mounted on a traveling platform is being used in making the excavation for the deeper sections of the trench, on which work is nearing completion. This platform, which is about the size of the platform on which a regular 20-ton Vulcan steam shovel is mounted, carries a boiler and a hoisting engine to operate the crane and dipper arm. The platform is carried by four 18-in. I-beams, 30 ft. long, two of which are placed across the trench under the front end of it and the other two under its rear end. These beams have truss rods connecting their ends, the latter resting on rollers on plank runways laid on both sides of the trench. These runways are back 2 ft. from the top of the trench and distribute the load on the sides of the latter to such extent that in the soil thus far encountered no caving has been caused by the load of the shovel outfit. The latter was built by the Vulcan Iron Works and removes the principal part of the excavation, the extra space required at the joints between the 28-ft. lengths, and extra trimming being done by hand.

The city of St. Louis operates a standard-gauge electric railway between the low-service and the two high-service pumping stations, which railway parallels the location of the 7-ft. flow line at a distance of 50 to 300 ft. This railway connects with steam railroads in the city, and on it has been delivered over 5,300 tons of the steel pipe required in building the flow line. The pipe was brought in over this line in the cars on which it was loaded at the mills and in a large portion of the trench was unloaded along the section of the trench it was to occupy, so little difficulty was encountered in pipe transportation.

The pipe is handled into the trench by a stiff-leg derrick set between the latter and the electric railway. Each 28-ft. section of pipe is lifted by one line around the center, this line being threaded through a hose to prevent injury to the coating of the pipe. The joints between the 28-ft. sections are made with pneumatic hammers supplied with an under pressure from either of two compressor outfits mounted on four-wheel trucks. One outfit has a 10x10-in. Laidlaw-Dunn-Gordon compressor and the other a 10x12-in. Curtis compressor, each of which is direct-connected to a 50-h. p. motor that receives power from the transmission line of the electric railway. They can be moved readily by one team and have been found very serviceable in this work.

The pipe line is tested, in lengths of approximately 2,000 ft., to a hydraulic pressure of 30 lb. per square inch. This pressure is maintained until all leaks in the entire section under pressure have been caulked and the pipe made tight.

The 25,000,000-gal. storage reservoir to which the 7-ft. flow line delivers at the upstream one of the two high-service pumping stations has only recently been completed. It has buttressed reinforced-concrete side walls and its bottom is lined with concrete. The excavation for the basin was nearly all made in dense limestone rock, the tops of the sides of the basin being about flush with the ground surface. The pipe line terminates in a gate house at the reservoir. A connection is made between this gate house and the reservoir, and a 60-in. hub-and-spigot cast-iron pipe is extended across the later on concrete pedestals, 10 ft. high, to the pumping station. The 7-ft. flow line is also connected through the gate chamber to the brick and masonry conduit from the settling basins at the low-service pumping station.

Mr. Ben C. Adkins is water commissioner, Mr. Edward E. Wall is assistant water commissioner and Mr. Arthur I. Jacobs is engineer of the supply and purifying division of the water department. The flow line is being built by the Parker-Washington Co., the work being under the direction of the St. Louis office of that company. The steel pipe was made by the Carroll-Porter Boiler & Tank Co. of Pittsburgh.

The Key West Extension of the Florida East Coast Ry. has been making rapid progress lately and construction trains are now running over half the distance from Miami to Key West. The more difficult half of the road is unfinished and it may be two years before it is ready for regular operation. There will be about 5¾ miles of concrete arches of a type already illustrated in The Engineering Record. Their spans are 50 to 60 ft. and they will rise about 30 ft. above the water. At one place the track is carried for 10,500 ft. on a succession of these arches.

Science and Engineering.

The relations between science and engineering were discussed in the opening address of the engineering section of the recent convention of the British Association for the Advancement of Science. The address was made by Dr. Silvanus P. Thompson who asserted at the outset that the astonishing development of the material resources of civilization is due to science. Chemistry, physics, mechanics and mathematics have furnished the means for this development, and the profession most potent in using them is that of engineering. The difference between the England of Edward the Seventh and of Edward the Sixth, between the Germany of William the Second and of Charles the Fifth is due more to the progress made in science and its applications than to the changes in politics, art, philosophy and religion. The following extracts from the address cover its leading topics:

In engineering, above all other branches of human effort, we are able to trace the close interaction between abstract science and its practical applications. Often as the connection between pure science and its applications has been emphasized in addresses upon engineering, the emphasis has almost always been laid upon the influence of the abstract upon the concrete. We are all familiar with the doctrine that the progress of science ought to be an end in itself, that scientific research ought to be pursued without regard to its immediate applications, that the importance of a discovery must not be measured by its apparent utility at the moment. We are assured that research in pure science is bound to work itself out in due time into technical applications of utility, and that the pioneer ought not to pause in his quest to work out potential industrial developments. We are invited to consider the example of the immortal Faraday, who deliberately abstained from busying himself with marketable inventions arising out of his discoveries, excusing himself on the ground that he had no time to spare for money-making. It is equally true, and equally to the point, that Faraday, when he had established a new fact, or a new physical relation, ceased from busying himself with it, and pronounced that it was now ready to be handed over to the mathematicians. But, admitting all these common places as to the value of abstract science in itself and for its own sake, admitting also the proposition that sooner or later the practical applications are bound to follow on upon the discovery, it yet remains true that in this thing the temperament of the discoverer counts for something. There are scientific investigators who cannot pursue their work if troubled by the question of ulterior applications; there are others no less truly scientific who simply cannot work without the definiteness of aim that is given by a practical problem awaiting solution. There are Willanses as well as Regnaults; there are Whitworths as well as Poissons. The world needs both types of investigator; and it needs, too, yet another type of pioneer, namely, the man who, making no claim to original discovery, by patient application and intelligent skill turns to industrial fruitfulness the results already attained in abstract discovery.

There is, however, another aspect of the relation between pure and applied science, the significance of which has not been hitherto so much emphasized, but yet is none the less real—the reaction upon science and upon scientific discovery of the industrial applications. For while pure science breeds useful inventions, it is none the less true that the industrial development of useful inventions fosters the progress of pure science. No one who is conversant with the history, for example, of optics can doubt that the invention of the telescope and the desire to perfect it were the principal factors in the outburst of optical science which we associated with the names of Newton, Huygens and Euler. The practical application, which we know was in the minds of each of these men, must surely have been the impelling motive that caused them to concentrate on abstract optics their great and exceptional powers of thought. Had there been no industrial development of the steam engine, is it at all likely that the world would ever have been enriched with the scientific researches of Rankine, Joule, Regnault, Hirn, or James Thomson?

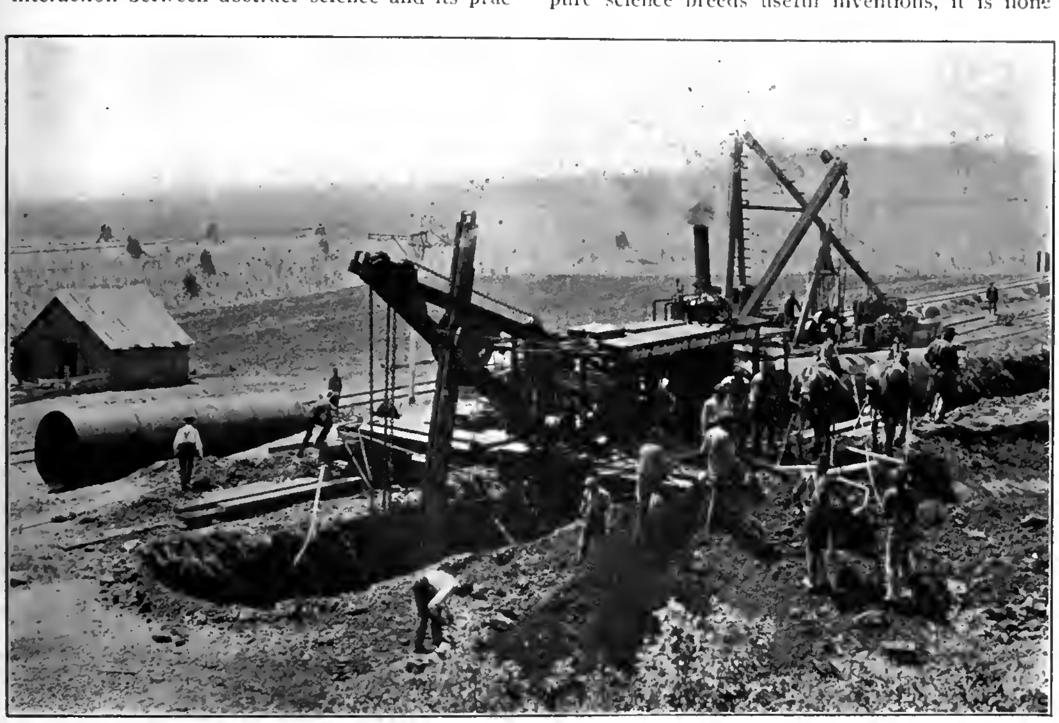
In considering this reflex influence of the industrial applications upon the progress of pure science it is of some significance to note that for the most part this influence is entirely helpful. There may be sporadic cases where industrial conditions tend temporarily to check progress by imposing persistence of a peculiar type of machine or appliance; but the general trend is always to help to new developments. The reaction aids the action; the law that is true enough in inorganic conservative systems, that reaction opposes the action, ceases here to be applicable, as, indeed, it ceases to be applicable in a vast number of organic phenomena. It is the very instability thereby introduced which is the essential of progress. The growing organism acts on its environment, and the change in the environment reacts on the organism—not in such a way as to oppose the growth, but so as to promote it. So is it with the development of pure science and its practical applications.

In further illustration of this principle one might refer to the immense effect which the engineering use of steel has had upon the study of the chemistry of the alloys. And the study of the alloys has in turn led to the recent development of metallography. It would even seem that through the study of the intimate structure of metals, prompted by the needs of engineers, we are within measurable distance of arriving at a knowledge of the secret of crystallogensis. Everything points to the probability of a very great and rapid advance in that fascinating branch of pure science at no distant date.

There is, however, one last example of the interaction of science and industry which may claim closer attention. In the history of the development of the electric motor one finds abundant illustration of both aspects of that interaction.

We go back to the year 1821, when Faraday, after studying the phenomena of electromagnetic deflexion of a needle by an electric current—Oersted's discovery—first succeeded in producing continuous rotations by electromagnetic means. In his simple apparatus a piece of suspended copper wire, carrying a current from a small battery, and dipping at its lower end into a cup of mercury, rotated continuously around the pole of a short bar-magnet of steel placed upright in the cup. In another variety of this experiment the magnet rotated around the central wire, which was fixed. These pieces of apparatus were the merest toys, incapable of doing any useful work; nevertheless, they demonstrated the essential principle and suggested further possibilities. Two years later, Barlow, using a star-wheel of copper, pivoted so that the lowest point of the star should make contact with a small pool of mercury, found that the star-wheel rotated if a current was sent through the arm of the star while the arm itself was situated between the poles of a steel horseshoe magnet. Shortly afterwards Sturgeon improved the apparatus by substituting a copper disc for the star-wheel. The action was the same. A conductor, carrying an electric current, if placed in a magnetic field, is found to experience a mechanical drag, which is neither an attraction nor a repulsion, but a lateral force tending to move it at right angles to the direction of flow of the current and at right angles to the direction of the lines of the magnetic field in which it is situated. Still this was a toy.

Two years later came the announcement by Sturgeon of the invention of the soft iron electro-magnet, one of the most momentous of all inventions, since upon it practically the whole of the constructive part of electrical engineering is based. For the first time mankind was furnished with a magnet, the attractive power of which could be increased absolutely indefinitely by the mere expenditure of sufficient capital upon the iron core and its surrounding copper coils, and the provision of a sufficiently powerful source of electric current to excite the magnetization. Furthermore, the magnet was under control, and could be made to attract or to cease to attract at will by merely switching the current on or off; and, lastly, this could be accomplished from a distance, even from great distances away. How slowly the importance of this discovery was recognized is now a matter for astonishment. To state that Sturgeon



Steam Shovel Used in Trench Work for 7-Foot Steel Pipe Line.

died in poverty twenty six years later is sufficient to indicate his place among the unrequited pioneers of whom the world is not worthy. Six years elapsed and then there came a flood of suggestions of electric motors in which was applied the principle of intermittent attraction by an electro-magnet. Henry, in 1831, and Dal Negro, in 1832, produced see-saw mechanisms so operated. Ritchie, in 1833, and Jacobi, in 1834, devised rotatory motors. Ritchie pivoted a rapidly commutated electro-magnet between the poles of a permanent magnet—a true type of the modern motor—while Jacobi caused two multipolar electro-magnets, one fixed, one movable, to put a shaft into rotation and propel a boat. A perplexing diminution of the current of the battery whenever the motor was running caused Jacobi to investigate mathematically the theory of its action. In a masterly memoir he laid down a few years later the theory of electric motive power. But in the intervening period, in 1831, Faraday had made the cardinal discovery of the mechanical generation of electric currents by magneto-electric induction, the fundamental principle of the dynamo. Down to that date the only known way—save for the feeble currents of thermopiles—to generate electric currents had been the pile of Volta, or one of the forms of battery which had been evolved from it. Now, by Faraday's discovery, the world had become possessed of a new source. And yet again, strange as it may seem, years elapsed before the world—that is, the world of engineers—discovered that an important discovery had been made. Not till some thirty years later were any magneto-electric machines made of a sufficient size to be of practical service even in telegraphy, and none were built of a sufficient power to furnish a single electric light until about the year 1857. In the meantime in America other electric motors, to be driven by batteries, had been devised by Davenport and by Page; the latter's machine had an iron plunger to be sucked by electro-magnetic attraction into a hollow coil of copper wire, thereby driving a shaft and fly-wheel through the intermediate action of a connecting-rod and crank. Page's was, in fact, an electric engine, with 2-ft. stroke, single-acting, of between 3 and 4 h.-p. The battery occupied about 3 cu. ft., and consumed, according to Page, 3 lb. of zinc per horse-power per day. This must have been an under-estimate; for if Daniell's cells were used, the minimum consumption for a motor of 100 per cent. efficiency is known to be about 2 lb. of zinc per horse-power per hour.

An instructive view of the development of electric motors half a century ago can be obtained from a discussion of electro-magnetism as a motive power which was held in April, 1857, at the rooms of the Institution of Civil Engineers. On this occasion the most eminent engineers one and all condemned the idea of electric motive power as unpractical and commercially impossible. Even Faraday, in his lecture on Mental Education, in 1854, had set down the magneto-electric engine along with mesmerism, homœopathy, odylism, the caloric engine, the electric light, the sympathetic compass, and perpetual motion as coming in different degrees amongst "subjects uniting more or less of the most sure and valuable investigations of science with the most imaginary and unprofitable speculation, that are continually passing through their various phases of intellectual, experimental, or commercial development, some to be established, some to disappear, and some to recur again and again, like ill weeds that cannot be extirpated, yet can be cultivated to no result as wholesome food for the mind."

Fifty years have fled, and Hunt, Grove, Smee, Tyndall, Cowper, Joule, Bidder and Stephenson have long passed away. Lord Kelvin remains the sole and honored survivor of that remarkable symposium. But the electric motor is a gigantic practical success and the electric motor industry has become a very large one, employing thousands of hands. Hundreds of factories have discarded their steam engines to adopt electric-motor driving. All traveling cranes, nearly all tramcars, are driven by electric motors. In the Navy and in much of the merchant service the donkey engines have been replaced by electric motors. Electric motors of all sizes and outputs, from one-twentieth of a horse-power to 8,000 horse-power, are in commercial use. One may well ask: What has wrought this astonishing revolution in the face of the unanimous verdict of the engineers of 1857? The answer may be given in terms of the action and reaction of pure and applied science. Pure science furnished a discovery; industrial applications forced its development; that development demanded further abstract investigation, which in turn brought about new applications. It was beyond all question the development of the dynamo for the purposes of electrotyping and electric light which brought about the commercial advent of the electric motor.

Interplay of action and reaction make for progress not only in the evolution of the scientific industries, but also in the development of the individual engineer. In him, if his training is on right lines, pure theory becomes an aid to sound practice; and practical applications are continually calling him to resort to those abstractions of thought, the underlying principles, which when known and formulated are called theories. Recent years have brought about a so much better understanding of education, in its bearing upon the professions and constructive industries, that we now seldom hear the practical man denouncing theory, or the theorist pooh-poohing practice. It is recognized that each is useful, and that the best uses of both are in conjunction, not in isolation. As a result of this better understanding distinct progress is being made in the training of engineers. Of this the growth of the engineering departments of the universities, and of the technical colleges and schools, affords striking evidence. The technical schools, moreover, are recognizing that their students must have a sound preliminary education and are advancing in the requirements they expect of candidates for admission. They are also finding out how their work may best supplement the practical training in the shops, and are improving their curricula accordingly. In the engineering industry, too, Great Britain is slowly following the lead taken in America, Germany and Switzerland, in the recognition afforded to the value of a systematic college training for the young engineer, though there is still much apathy and even distrust shown in certain quarters. Yet there is no doubt that the stress of competition, particularly of competition against the industry and the enterprise of the trained men of other nations, is gradually forcing to the front the sentiment in favor of a rational and scientific training for the manufacturer and for the engineer.

Knowledge, perfected by study and training must be infused into the experience gained by practice; else we compete at very unequal odds with the systematically trained workers of other nations. Nor must we make the mistake here in the organization of our technical institutions of divorcing the theory from its useful applications. In no department is this more vital than in the teaching of mathematics to engineering students. For while no sane person would deny that the study of mathematics, for the sole sake of mathematics, even though it leads to nothing but abstract mathematics, is a high and ennobling pursuit, yet that is not the object of mathematical studies in an engineering school. The young engineer must learn mathematics, not as an end in itself, but as a tool that is to be useful to him. And if it is afterwards to be of use to him, he must learn it by using it. Hence the teacher of mathematics in an engineering school ought himself to be an engineer. However clever he be as a mathematical person, his teaching is unreal if he is not incessantly showing his learners how to apply it to the problems that arise in practice; and this he is incapable of doing if these problems do not lie within his own range of experience and knowledge. Were he a heaven-born senior wrangler, he is the wrong man to teach mathematics if he either despises or is ignorant of the ways in which mathematics enter into engineering. The fact is that for the great majority of engineering students, the mental training they most need is that which will enable them to think in physics, in mechanics, in geometric space, not in abstract symbols. The abstract symbols, and the processes of dealing with their relations and combinations, are truly necessary to them; but they are wanted not for themselves, but to form convenient modes of expressing the physical facts and laws, and the interdependence of those physical facts and laws. When the student looses grip of the physical meaning of his equations, and regards them only as abstractions or groupings of symbols, woe betide him. His mathematics amount to a mere symbol juggling. That is how paper engineers are made. The high and dry mathematical master who thinks it beneath him to show a student how to plot the equations $y = A \sin x$, or $r = b \sin \theta$, or who never culls an example or sets a problem from thermodynamics or electricity, must be left severely on one side as a fossil.

One evidence of the wholesome change of opinion that is springing up concerning the training of engineers is the abandonment of the system of taking premium pupils into works with no other test or qualification than that of the money-bag. Already many leading firms of engineers have been finding that the practice of taking sons of wealthy parents for a premium does not answer well, and is neither to their own advantage nor in many cases to that of the "pupil," whom it is nobody's particular business in the shops to train. Premium pupilage is absolutely unknown in the engineering firms of the United States or on the Continent of Europe. The firms who have abandoned it are finding themselves better served by taking the ablest young men from the technical schools and paying them small wages from the first, while they gain experience and prove themselves capable of good service. Messrs. Yarrow & Co. have led the way with a plan of their own, having three grades of apprenticeship, admission to which depends upon the educational abilities of the youths themselves. Messrs. Siemens have adopted a plan of requiring a high preliminary training. The Daimler Motor Company has likewise renounced all premiums, preferring to select young men of the highest intelligence and merit. Messrs. Clayton and Shuttleworth have quite recently reconstructed their system of pupil-apprenticeship on similar lines. The British Westinghouse Company and the British Thomson-Houston Company have each followed an excellent scheme for the admission of capable young men. Even the conservatism of the railway engineers shows signs of giving way; for already the Great Eastern Railway has modernized its regulations for the admission of apprentices. What the engineering staffs of the railway companies have lost by taking in pupils because of their fathers' purses rather than for the sake of their own brains it is impossible to gauge. But the community loses too, and has a right to expect reform.

A Unit Table for Talbot's Spiral.

The accompanying table based on Talbot's Spiral has been compiled by Mr. G. A. Kyle, principal assistant engineer of the Chicago, Milwaukee & St. Paul Ry., of Washington, for use on the Pacific extension west of Butte, Mont. Professor Talbot's formulas are used, the only departures being in symbols and in the form of the equations for obtaining deflections from points on the spiral other than the beginning or initial point. The unit table is developed to a limited extent in the printed editions of this easement curve, but the table presented here is adapted to any length up to 400 ft. varying by whole feet.

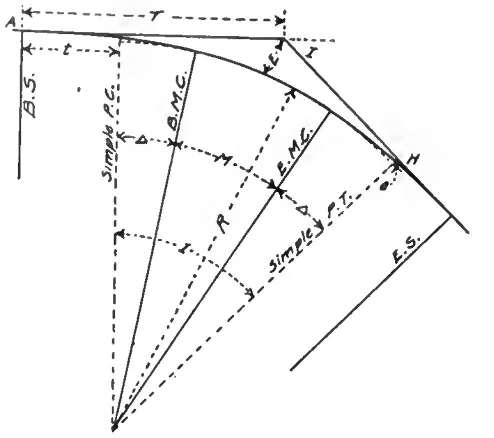


Figure 1.

Most spiral tables are based on a fixed chord length and when a certain chord has been chosen no other points than those tabulated can be set without the use of complicated formulas. With the spiral under consideration, however, the chord lengths can be chosen of any length to suit local requirements, since fractional chord lengths do not involve any extra labor of computation. This advantage is readily appreciated when points are required for trestle bents, or when it is impossible to set stakes at the full chord points.

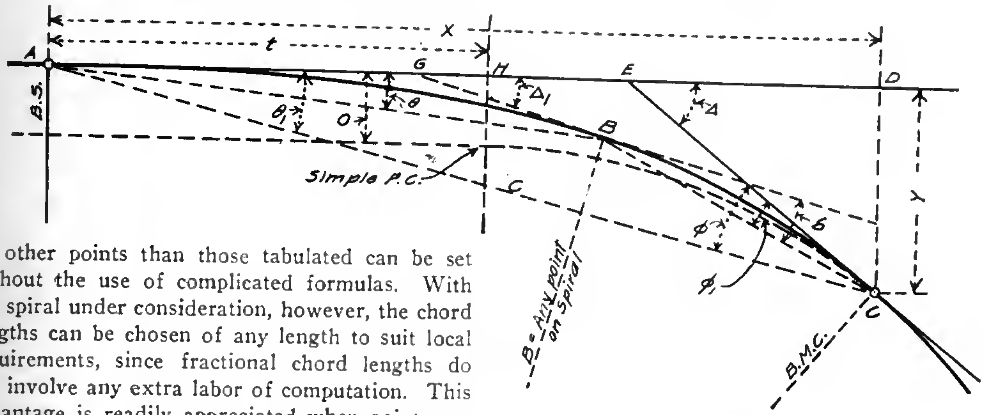


Figure 2.

Attention is called to the use of the terms B. S., beginning of spiral, B. M. C., beginning of main curve, E. M. C., end of main curve, and E. S. end of spiral. There are a number of minor departures from Professor Talbot's notation, and a new symbol, δ, is introduced, indicating a deflection angle turned from the tangent to the spiral at any point, except the B. S., to the B. M. C. For this angle a special formula has been derived which is used instead of the general equation—

$$\phi = \tfrac{1}{2}\, a\, L^1\, (L - L^1) \mp \tfrac{1}{6}\, a\, (L - L^1)^2$$

where L is the distance along the spiral from the B. S. to the point to be located, and L^1 is the distance from the B. S. to the point where the instrument is set up. The equation for ϕ_1 is also a special case of the above general equation, and it will be noted that if it be desired to set points between the B. S. and an intermediate point on the spiral at which the instrument is set up, that the equation for ϕ_1 may be used by merely assuming that the instrument point for the time being is the B. M. C. The angles δ, ϕ and ϕ_1 are always between a tangent to the spiral at the point considered and a chord to some other point on the spiral. To get on tangent at any point on the spiral when the B. S. can be seen it is only necessary to turn off the angle ϕ, backsighting on the latter point. The quantities A, d and d_1 are also original with this table.

The equation for the length of the spiral was evolved by Mr. Kyle in a modified form in 1900, while he was division engineer on the Northern Pacific Ry. at Tacoma. The equation is

$$L = V\,E$$

where L = length of spiral in feet; V velocity of the train in miles per hour; and E = elevation in track in inches for speed V. This formula is explained by its author as follows:

"Before spiral curves were used it was a common and almost uniform practice on Western roads to attain the difference in elevation of rails on curves by an approach usually on the tangent but sometimes one-half on the tangent and one-half on the curve, allowing 60 ft. in which to attain 1 in. difference in elevation, the maximum speed being assumed at 45 miles per hour. Then, to find the distance required to attain 1 in. difference in elevation of rails at any other speed, allowing the same time to attain a fixed elevation, the procedure was as follows:

Let E equal difference in elevation of tracks in inches on main curve.
V^1 " maximum velocity in miles per hour assumed in raising 1 in. in distance D^1.
D^1 " distance assumed in which to raise 1 in. at V^1 miles per hour.
V " velocity of train in question.
D " distance required to raise 1 in. at V miles per hour.
L " length of incline required to attain elevation E at V miles per hour—assumed to be the correct length of spiral curve.

Then, to find the distance D required at any speed V to attain 1 in. difference in elevation of rails we have,

$$D = D^1\, V \div V^1 \qquad (1)$$

inserting the assumed values of D and V, we have

$$D = 60\, V \div 45 = 1\tfrac{1}{3}\, V$$

and to attain the whole elevation E

$$L = 1\tfrac{1}{3}\, VE \text{ or } L = D^1\, VE \div V^1 (2)$$

Later it was found that this gave an excessive length of curve and the original assumptions were changed so that the maximum speed should be 50 instead of 45 miles per hour, and the distance required to attain 1 in. in elevation at 50 miles per hour was taken as 50 instead of 60 ft.

Inserting the above figures in the formula

$$L = D^1\, VE \div V^1 \text{ we have } L = V\,E \qquad (3)$$

The formula now in use is theoretically correct, assuming that the constants and distance in which to raise 1 in. are based on the proper

SPIRAL LENGTHS FOR DIFFERENT SPEEDS AND CURVATURE.

Deg. of Curve.	25 / 10	30 / 5	35 / 3⅓	40 / 2½	45 / 1⅔	50 / 1¼	55 / 1	60 Miles per Hr. / 7/10 Values of a.
1°	10	20	30	40	60	80	100	142.8
1° 30′	15	30	45	60	90	120	150	214.2
2°	20	40	60	80	120	160	200	285.6
2° 30′	25	50	75	100	150	200	250	357.0
3°	30	60	90	120	180	240	300	
3° 30′	35	70	105	140	210	280		
4°	40	80	120	160	240			
4° 30′	45	90	135	180	270			
5°	50	100	150	200				
5° 30′	55	110	185	220				
6°	60	120	180					
6° 30′	65	130	195					
7°	70	140	210					
7° 30′	75	150						
8°	80	160						
8° 30′	85	170						
9°	90	180						
9° 30′	95	190						
10°	100	200						
10° 30′	105	210						
11°	110							

UNIT TABLE FOR TALBOT'S SPIRAL.

L in 100 ft. Stations.	D Deg. and Min.	θ Min.	φ Min.	Δ Min.	X Cor. Minus.	C Cor. Minus.	t Cor. Minus.	U & V Cor. Plus.	Y Ft.	O Ft.
.01	0-0.6	0.001	0.002	0.003	0.	0.	0.	0.	.00001	.0000002
.02	0-1.2	0.004	0.008	0.012	0.	0.	0.	0.	.00002	.000005
.03	0-1.8	0.01	0.02	0.03	0.	0.	0.	0.	.00003	.000006
.04	0-2.4	0.02	0.03	0.05	0.	0.	0.	0.	.00003	.000008
.05	0-3.u	0.03	0.05	0.08	0.	0.	0.	0.	.00004	.00001
.06	0-3.6	0.04	0.07	0.11	0.	0.	0.	0.	.00005	.00002
.07	0-4.2	0.05	0.10	0.15	0.	0.	0.	0.	.0001	.00003
.08	0-4.8	0.06	0.13	0.19	0.	0.	0.	0.	.0002	.00005
.09	0-5.4	0.08	0.16	0.24	0.	0.	0.	0.	.0003	.00007
.10	0-6.0	0.10	0.20	0.30	0.	0.	0.	0.	.0003	.00008
.11	0-6.6	0.12	0.24	0.36	0.	0.	0.	0.	.0004	.0001
.12	0-7.2	0.14	0.29	0.43	0.	0.	0.	0.	.0006	.0001
.13	0-7.8	0.17	0.34	0.51	0.	0.	0.	0.	.0008	.0002
.14	0-8.4	0.20	0.39	0.59	0.	0.	0.	0.	.0009	.0002
.15	0-9.0	0.23	0.46	0.69	0.	0.	0.	0.	.001	.0003
.16	0-9.6	0.26	0.52	0.78	0.	0.	0.	0.	.001	.0003
.17	0-10.2	0.29	0.58	0.87	0.	0.	0.	0.	.001	.0004
.18	0-10.8	0.32	0.64	0.96	0.	0.	0.	0.	.002	.0005
.19	0-11.4	0.36	0.72	1.08	0.	0.	0.	0.	.002	.0005
.20	0-12.0	0.40	0.80	1.20	0.	0.	0.	0.	.002	.0006
.21	0-12.6	0.44	0.88	1.32	0.	0.	0.	0.	.003	.0007
.22	0-13.2	0.48	0.96	1.44	0.	0.	0.	0.	.003	.0007
.23	0-13.8	0.53	1.06	1.59	0.	0.	0.	0.	.004	.001
.24	0-14.4	0.58	1.16	1.74	0.	0.	0.	0.	.004	.001
.25	0-15.0	0.63	1.26	1.89	0.	0.	0.	0.	.005	.001
.26	0-15.6	0.68	1.36	2.04	0.	0.	0.	0.	.006	.001
.27	0-16.2	0.73	1.46	2.19	0.	0.	0.	0.	.006	.001
.28	0-16.8	0.78	1.56	2.34	0.	0.	0.	0.	.007	.002
.29	0-17.4	0.84	1.68	2.52	0.	0.	0.	0.	.007	.002
.30	0-18.0	0.90	1.80	2.70	0.	0.	0.	0.	.008	.002
.31	0-18.6	0.96	1.92	2.88	0.	0.	0.	0.	.009	.002
.32	0-19.2	1.02	2.04	3.06	0.	0.	0.	0.	.009	.002
.33	0-19.8	1.09	2.18	3.27	0.	0.	0.	0.	.010	.003
.34	0-20.4	1.16	2.32	3.48	0.	0.	0.	0.	.011	.003
.35	0.21.0	1.23	2.46	3.69	0.	0.	0.	0.	.012	.003
.36	0-21.6	1.30	2.60	3.90	0.	0.	0.	0.	.013	.004
.37	0-22.2	1.37	2.74	4.11	0.	0.	0.	0.	.015	.004
.38	0-22.8	1.44	2.88	4.32	0.	0.	0.	0.	.016	.004
.39	0-23.4	1.52	3.04	4.56	0.	0.	0.	0.	.018	.004
.40	0-24.0	1.60	3.20	4.80	0.	0.	0.	0.	.019	.005
.41	0-24.6	1.70	3.40	5.10	0.	0.	0.	0.	.020	.005
.42	0-25.2	1.80	3.60	5.40	0.	0.	0.	0.	.022	.005
.43	0-25.8	1.85	3.70	5.55	0.	0.	0.	0.	.023	.006
44	0-26.4	1.90	3.80	5.70	0.	0.	0.	0.	.025	.006

(Continued on page 260.)

usage. It takes into account the constant time function required to attain a fixed elevation, and the mechanical difficulties for the trucks to assume their radial position on the main curve.

The elevation E on curves is represented by the formula

$$E = G v^2 \div 32.2 R$$

in which G is the gauge of track, 4.71 ft.

E equals elevation main curve in inches.

v equals velocity of train in feet per second = $1.4667 V$.

V equals velocity of train in miles per hour.

R equals radius of main curve in feet equals $5730 \div D$ (approximately), equals degree of main curve.

Substituting values of $V^2 R$ and G in the above equation.

$$E = (4.71 \times 1.4667^2 V^2 D) \div (32.2 \times 5730) = 0.00005491 \; V^2 \; D \text{ (in feet)}$$

Reducing by multiplying last half of equation (3) by 12

$E = .00005491 \; V^2 \; D \times 12 = .00065892 \; V^2 \; D.$

Substituting value of E in equation $L = V \; E$.

$L = .00065892 \; V^3 \; D$ (4)

in which the length of spiral curve varies as the cube of velocity and as the degree of curve."

This equation $L = V \; E$ is also used by Mr. J. R. Stephens in "The Six-Chord Spiral," as the proper length of spiral curve.

A study of the formulas here given will explain the use of the unit table, which has been so named because it gives quantities computed for a value of a, the rate of change of the spiral per station, of unity. All the elements of the curve are functions of a, and to use the table for any particular case it is merely necessary to multiply the tabulated values by the a, or square of the a, selected for the case in hand. The quantities D, θ, ϕ, Δ, Y and O vary directly as a, and X, c, t, U and V vary as a^2 The quantities in the correction columns for the latter group must therefore be multiplied by the square of the a selected.

The use of the various corrections tabulated are evident from an inspection of the formulas. To obtain x or c the corresponding correction is subtracted from the spiral length from B. S. to the point to be located, the t correction is subtracted from half the length, the U correction added to 2/3 the length, and the V correction to 1/3 the length, the length being expressed in feet. It will be noted that these corrections all vary as the square of a.

The table here given takes the place of the dozen or more tables usually necessary for using any spiral, and embodies all possible spirals varying by whole feet up to 400 ft. Any length of spiral or any rate of change can be used, and the only operation necessary is a simple multiplication.

An additional table also presented here gives the values of a and the lengths of spiral used by the road for different speeds and degrees of curvature. The instructions issued with the table give the following rules: "The maximum speed on main line will be 50 miles per hour generally, excepting on mountain grades, sharp curves or points on line where instructions direct speed to be reduced.

"The maximum elevation is not to exceed 6 in. except in sags or at points where speed may be higher than the maximum speed above indicated. (See instructions for elevating on curves.)

"The table gives the nearest even lengths of spirals and their respective values of a for different speeds and degrees of curvature which will be made the standard and will be used by all engineers. For any other degree of curvature the length of spiral will vary as the degree of curvature and for any other speed will vary as the cube of the speed. In all cases leave a

UNIT TABLE FOR TALBOT'S S[illegible]

L in 100 ft. Stations.	D Deg. and Min.	θ Min.	φ Min.	Δ Min.	X Cor. Minus.	C Cor. Minus.	[illegible]	[illegible]	Y Ft.	O Ft.
.45	0-27.0	2.00	4.00	6.00	0.	0.			[illegible]	.007
.46	0-27.6	2.10	4.20	6.30	0.	0.			[illegible]	.007
.47	0-28.2	2.20	4.40	6.60	0.	0.			[illegible]	.008
.48	0-28.8	2.30	4.60	6.90	0.	0.			[illegible]	.008
.49	0-29.4	2.40	4.80	7.20	0.	0.			[illegible]	.008
.50	0-30.0	2.50	5.00	7.50	0.	0.	0.		[illegible]	.009
.51	0-30.6	2.60	5.20	7.80	0.	0.	0.		[illegible]	.009
.52	0-31.2	2.70	5.40	8.10	0.	0.	0.		[illegible]	.010
.53	0-31.8	2.80	5.60	8.40	0.	0.	0.	[illegible]	[illegible]	[illegible]
.54	0-32.4	2.90	5.80	8.70	0.	0.	0.	0.	[illegible]	.011
.55	0-33.0	3.00	6.00	9.00	0.	0.	0.	0.	[illegible]	[illegible]
.56	0-33.6	3.10	6.20	9.30	0.	0.	0.	0.	.051	.013
.57	0-34.2	3.30	6.60	9.90	0.	0.	0.	0.	.054	.014
.58	0-34.8	3.40	6.80	10.20	0.	0.	0.	0.	.057	.014
.59	0-35.4	3.50	7.00	10.50	0.	0.	0.	0.	.060	.015
.60	0-36.0	3.60	7.20	10.80	0.	0.	0.	0.	[illegible]	.016
.61	0-36.6	3.70	7.40	11.10	0.	0.	0.	0.	.066	.017
.62	0-37.2	3.80	7.60	11.40	0.	0.	0.	0.	[illegible]	.018
.63	0-37.8	4.00	8.00	12.00	0.	0.	0.	0.	.073	.018
.64	0-38.4	4.10	8.20	12.30	0.	0.	0.	0.	.077	.019
.65	0-39.0	4.20	8.40	12.60	0.	0.	0.	0.	[illegible]	.020
.66	0-39.6	4.40	8.80	13.20	0.	0.	0.	0.	[illegible]	.021
.67	0-40.2	4.50	9.00	13.50	0.	0.	0.	0.	.088	.022
.68	0-40.8	4.60	9.20	13.80	0.	0.	0.	0.	.092	.023
.69	0-41.4	4.80	9.60	14.40	0.	0.	0.	0.	.096	.024
.70	0-42.0	4.90	9.80	14.70	0.	0.	0.	0.	.100	.025
.71	0-42.6	5.00	10.00	15.00	0.	0.	0.	0.	.105	.026
.72	0-43.2	5.20	10.40	15.60	0.	0.	0.	0.	.109	.027
.73	0-43.8	5.30	10.60	15.90	0.	0.	0.	0.	.114	.028
.74	0-44.4	5.50	11.00	16.50	0.	0.	0.	0.	.118	.029
.75	0-45.0	5.60	11.20	16.80	0.0002	0.	0.	0.	.123	.031
.76	0-45.6	5.80	11.60	17.40	0.0002	0.	0.	0.	.128	.032
.77	0-46.2	5.90	11.80	17.70	0.0002	0.	0.	0.	.133	.033
.78	0-46.8	6.10	12.20	18.30	0.0002	0.	0.	0.	.139	.035
.79	0-47.2	6.20	12.40	18.60	0.0002	0.0001	0.	0.	.144	.036
.80	0-47.8	6.40	12.80	19.20	0.0003	0.0001	0.	0.	.149	.037
.81	0-48.6	6.60	13.20	19.80	0.0003	0.0001	0.	0.	.155	.039
.82	0-49.2	6.70	13.40	20.10	0.0003	0.0001	0.	0.	.161	.040
.83	0-49.8	6.90	13.80	20.70	0.0003	0.0001	0.	0.	.167	.042
.84	0-50.4	7.10	14.20	21.30	0.0003	0.0001	0.	0.	.173	.043
.85	0-51.0	7.20	14.40	21.60	0.0003	0.0001	0.	0.	.179	.045
.86	0-51.6	7.40	14.80	22.20	0.0003	0.0001	0.	0.	.186	.046
.87	0.52.2	7.60	15.20	22.80	0.0004	0.0002	0.	0.	.192	.048
.88	0-52.8	7.70	15.40	23.10	0.0004	0.0002	0.	0.	.199	.050
.89	0-53.4	7.90	15.80	23.70	0.0004	0.0002	0.	0.	.205	.051
.90	0-54.0	8.10	16.20	24.30	0.0004	0.0002	0.	0.	.212	.053
.91	0-54.6	8.30	16.60	24.90	0.0004	0.0002	0.	0.	.219	.055
.92	0-55.2	8.50	17.00	25.50	0.0005	0.0003	0.	0.	.227	.057
.93	0-55.8	8.70	17.40	26.10	0.0005	0.0003	0.	0.	.234	.058
.94	0-56.4	8.80	17.60	26.40	0.0005	0.0003	0.	0.	.242	.060
.95	0-57.0	9.00	18.00	27.00	0.0005	0.0003	0.	0.	.249	.062
.96	0-57.6	9.20	18.40	27.60	0.0006	0.0003	0.	0.	.257	.064
.97	0-58.2	9.40	18.80	28.20	0.0007	0.0003	0.	0.	.266	.066
.98	0-58.8	9.60	19.20	28.80	0.0007	0.0003	0.	0.	.274	.068
.99	0-59.4	9.80	19.60	29.40	0.0007	0.0003	0.	0.	.283	.071
1.00	1-00.0	10.00	20.00	30.00	0.0007	0.0003	0.	0.	.291	.073
1.01	1-00.6	10.20	20.40	30.60	0.0008	0.0004	0.	0.	.300	.075
1.02	1-01.2	10.40	20.80	31.20	0.0008	0.0004	0.	0.	.309	.077
1.03	1-01.8	10.60	21.20	31.80	0.0009	0.0004	0.	0.	.319	.080
1.04	1-02.4	10.80	21.60	32.40	0.0009	0.0004	0.	0.	.328	.082
1.05	1-03.0	11.00	22.00	33.00	0.0010	0.0005	0.	0.	.337	.084
1.06	1-03.8	11.20	22.40	33.60	0.0010	0.0005	0.	0.	.347	.087
1.07	1-04.2	11.50	23.00	34.50	0.0010	0.0005	0.	0.	.357	.089
1.08	1-04.8	11.70	23.40	35.10	0.0010	0.0005	0.	0.	.367	.092
1.09	1-05.4	11.90	23.80	35.70	0.0010	0.0005	0.	0.	.377	.094
1.10	1-06.0	12.10	24.20	36.30	0.0012	0.0005	0.	0.	.387	.097
1.11	1-06.6	12.30	24.60	36.90	0.0013	0.0006	0.	0.	.398	.099
1.12	1-07.2	12.50	25.00	37.50	0.0013	0.0006	0.	0.	.409	.102
1.13	1-07.8	12.80	25.60	38.40	0.0014	0.0006	0.	0.	.420	.105
1.14	1-08.4	13.00	26.00	39.00	0.0015	0.0007	0.	0.	.431	.108
1.15	1-09.0	13.20	26.40	39.60	0.0015	0.0007	0.	0.	.442	.111
1.16	1-09.6	13.50	27.00	40.50	0.0016	0.0007	0.	0.	.454	.114
1.17	1-10.2	13.70	27.40	41.10	0.0016	0.0007	0.	0.	.466	.117
1.18	1-10.8	13.90	27.80	41.70	0.0017	0.0008	0.	0.	.479	.120
1.19	1-11.4	14.20	28.40	42.60	0.0018	0.0008	0.	0.	.491	.123
1.20	1-12.0	14.40	28.80	43.20	0.0019	0.0009	0.0003	0.0006	.503	.126
1.21	1-12.6	14.60	29.20	43.80	0.0019	0.0009	0.0003	0.0006	.516	.129
1.22	1-13.2	14.90	29.80	44.70	0.0020	0.0009	0.0003	0.0006	.529	.132
1.23	1-13.8	15.10	30.20	45.30	0.0021	0.0009	0.0004	0.0007	.542	.135
1.24	1-14.4	15.40	30.80	46.20	0.0022	0.0010	0.0004	0.0008	.555	.139
1.25	1-15.0	15.60	31.20	46.30	0.0023	0.0010	0.0004	0.0008	.568	.142
1.26	1-15.6	15.90	31.80	47.70	0.0024	0.0011	0.0004	0.0008	.582	.145
1.27	1-16.2	16.10	32.20	48.30	0.0025	0.0011	0.0004	0.0008	.596	.149
1.28	1-16.8	16.40	32.80	49.20	0.0026	0.0012	0.0004	0.0008	.611	.153
1.29	1-17.4	16.60	33.20	49.80	0.0027	0.0012	0.0004	0.0008	.625	.156
1.30	1-18.0	16.90	33.80	50.70	0.0028	0.0013	0.0005	0.0009	.639	.160
1.31	1-18.6	17.20	34.40	51.60	0.0029	0.0013	0.0005	0.001	.654	.163
1.32	1-19.2	17.40	34.80	52.20	0.0030	0.0014	0.0005	0.001	.670	.167
1.33	1-19.8	17.70	35.40	53.10	0.0032	0.0014	0.0005	0.001	.685	.171
1.34	1-20.4	18.00	36.00	54.00	0.0033	0.0015	0.0005	0.001	.701	.175
1.35	1-21.0	18.20	36.40	54.60	0.0034	0.0015	0.0006	0.001	.716	.179
1.36	1-21.6	18.50	37.00	55.50	0.0035	0.0016	0.0006	0.001	.732	.183
1.37	1-22.2	18.80	37.60	56.40	0.0037	0.0016	0.0006	0.001	.749	.187
1.38	1-22.8	19.00	38.00	57.00	0.0039	0.0017	0.0006	0.001	.765	.191
1.39	1-23.4	19.30	38.60	57.90	0.0040	0.0018	0.0007	0.001	.782	.195
1.40	1-24.0	19.60	39.20	58.80	0.0041	0.0018	0.0007	0.001	.798	.199
1.41	1-24.6	19.90	39.80	59.70	0.0043	0.0020	0.0007	0.002	.816	.204
1.42	1-25.2	20.20	40.40	60.60	0.0044	0.0021	0.0007	0.002	.834	.208
1.43	1-25.8	20.40	40.80	61.20	0.0046	0.0022	0.0008	0.002	.851	.213
1.44	1-26.4	20.70	41.40	62.10	0.0047	0.0022	0.0008	0.002	.869	.217
1.45	1-27.0	21.00	42.00	63.00	0.0049	0.0023	0.0008	0.002	.887	.221
1.46	1-27.6	21.30	42.60	63.90	0.0051	0.0023	0.0009	0.002	.906	.226
1.47	1-28.2	21.60	43.20	64.80	0.0053	0.0024	0.0009	0.002	.925	.231
1.48	1-28.8	21.90	43.80	65.70	0.0054	0.0024	0.0009	0.002	.944	.236
1.49	1-29.4	22.20	44.40	66.60	0.0056	0.0025	0.0009	0.002	.963	.241
1.50	1-30.0	22.50	45.00	67.50	0.0058	0.0026	0.001	0.002	.982	.245
1.51	1-30.6	22.80	45.60	68.40	0.0060	0.0027	0.001	0.002	1.002	.250
1.52	1-31.2	23.10	46.20	69.30	0.0062	0.0028	0.001	0.002	1.022	.255
1.53	1-31.8	23.40	46.80	70.20	0.0064	0.0029	0.001	0.002	1.043	.261
1.54	1-32.4	23.70	47.40	71.10	0.0066	0.0030	0.001	0.002	1.063	.266
1.55	1-33.0	24.00	48.00	72.00	0.0068	0.0031	0.001	0.002	1.083	.271
1.56	1-33.6	24.30	48.60	72.90	0.007	0.0032	0.001	0.002	1.105	.276
1.57	1-34.2	24.60	49.20	73.30	0.007	0.0032	0.001	0.002	1.127	.282
1.58	1-34.8	25.00	50.00	75.00	0.008	0.0032	0.001	0.003	1.148	.287
1.59	1-35.4	25.30	50.60	75.90	0.008	0.0034	0.001	0.003	1.170	.292
1.60	1-36.0	25.60	51.20	76.80	0.008	0.0034	0.001	0.003	1.192	.298
1.61	1-36.6	25.90	51.80	77.70	0.008	0.0034	0.001	0.003	1.215	.304
1.62	1-37.2	26.20	52.40	78.60	0.009	0.0036	0.001	0.003	1.238	.309
1.63	1-37.8	26.60	53.20	79.80	0.009	0.0037	0.001	0.003	1.261	.315
1.64	1-38.4	26.90	53.80	80.70	0.009	0.0037	0.001	0.003	1.284	.321
1.65	1-39.0	27.20	54.40	81.60	0.009	0.0038	0.002	0.003	1.307	.327
1.66	1-39.6	27.60	55.20	82.80	0.010	0.004	0.002	0.003	1.331	.333
1.67	1-40.2	27.90	55.80	83.70	0.010	0.004	0.002	0.003	1.356	.339
1.68	1-40.8	28.20	56.40	84.60	0.010	0.004	0.002	0.003	1.380	.345

(Continued on page 261.)

UNIT TABLE FOR TALBOT'S SPIRAL.—Continued.

L in 100 ft. Stations.	D Deg. and Min.	Θ Min.	φ Min.	Δ Min.	X Cor. Minus.	C Cor. Minus.	t Cor. Minus.	U & V Cor. Plus.	Y Ft.	O Ft.
1.69	1-41.4	28.60	57.20	85.80	0.010	0.004	0.002	0.004	1.405	.351
1.70	1-42.0	28.90	57.80	86.70	0.010	0.005	0.002	0.004	1.429	.357
1.71	1-42.6	29.20	58.40	87.60	0.011	0.005	0.002	0.004	1.455	.364
1.72	1-43.2	29.60	59.20	88.80	0.011	0.005	0.002	0.004	1.487	.370
1.73	1-43.8	29.90	59.80	89.70	0.012	0.005	0.002	0.004	1.507	.377
1.74	1-44.4	30.30	60.60	90.90	0.012	0.005	0.002	0.004	1.533	.383
1.75	1-45.0	30.60	61.20	91.80	0.012	0.006	0.002	0.004	1.559	.390
1.76	1-45.6	31.00	62.00	93.00	0.013	0.006	0.002	0.004	1.587	.397
1.77	1-46.2	31.30	62.60	93.90	0.013	0.006	0.002	0.004	1.614	.404
1.78	1-46.8	31.70	63.40	95.10	0.014	0.006	0.002	0.005	1.642	.410
1.79	1-47.4	32.00	64.00	96.00	0.014	0.006	0.002	0.005	1.669	.417
1.80	1-48.0	32.40	64.80	97.20	0.014	0.006	0.003	0.005	1.697	.424
1.81	1-48.6	32.80	65.60	98.40	0.015	0.007	0.003	0.005	1.726	.431
1.82	1-49.2	33.10	66.20	99.30	0.015	0.007	0.003	0.005	1.755	.439
1.83	1-49.8	33.50	67.00	100.5	0.016	0.007	0.003	0.006	1.784	.446
1.84	1-50.4	33.90	67.80	101.7	0.016	0.007	0.003	0.006	1.813	.453
1.85	1-51.0	34.20	68.40	102.6	0.016	0.007	0.003	0.006	1.843	.461
1.86	1-51.6	34.60	69.20	103.8	0.017	0.008	0.003	0.006	1.873	.469
1.87	1-52.2	35.00	70.00	105.0	0.017	0.008	0.003	0.006	1.903	.476
1.88	1-52-8	35.30	70.60	105.9	0.018	0.008	0.003	0.006	1.934	.484
1.89	1-53.4	35.70	71.40	107.1	0.018	0.008	0.003	0.006	1.964	.491
1.90	1-54.0	36.10	72.20	108.3	0.018	0.008	0.003	0.006	1.995	.499
1.91	1-54.6	36.50	73.00	109.5	0.019	0.009	0.003	0.006	2.027	.507
1.92	1-55.2	36.90	73.80	110.7	0.020	0.009	0.003	0.007	2.060	.515
1.93	1-55.8	37.20	74.40	111.6	0.020	0.009	0.003	0.007	2.092	.523
1.94	1-56.4	37.60	75.20	112.8	0.021	0.009	0.004	0.007	2.125	.531
1.95	1-57.0	38.00	76.00	114.0	0.021	0.009	0.004	0.007	2.157	.539
1.96	1-57.6	38.40	76.80	115.2	0.022	0.010	0.004	0.007	2.191	.548
1.97	1-58.2	38.80	77.60	116.4	0.023	0.010	0.004	0.008	2.225	.556
1.98	1-58.8	39.20	78.40	117.6	0.023	0.010	0.004	0.008	2.259	.565
1.99	1-59.4	39.60	79.20	118.8	0.024	0.011	0.004	0.008	2.293	.573
2.00	2-00.0	40.00	80.00	120.0	0.024	0.011	0.004	0.008	2.327	.582
2.01	2-00.6	40.40	80.80	121.2	0.025	0.011	0.004	0.008	2.363	.591
2.02	2-01.2	40.80	81.60	122.4	0.026	0.012	0.004	0.009	2.399	.600
2.03	2-01.8	41.20	82.40	123.6	0.026	0.012	0.004	0.009	2.434	.609
2.04	2-02.4	41.60	83.20	124.8	0.027	0.012	0.005	0.009	2.470	.618
2.05	2-03.0	42.00	84.00	126.0	0.027	0.013	0.005	0.009	2.506	.627
2.06	2-03.6	42.40	84.80	127.2	0.028	0.013	0.005	0.009	2.544	.636
2.07	2-04.2	42.80	85.60	128.4	0.029	0.013	0.005	0.010	2.581	.645
2.08	2-04.8	43.30	86.60	129.9	0.030	0.013	0.005	0.010	2.619	.655
2.09	2.05.4	43.70	87.40	131.1	0.030	0.014	0.005	0.010	2.656	.664
2.10	2-06.0	44.10	88.20	132.3	0.031	0.014	0.005	0.010	2.694	.674
2.11	2-06.6	44.50	89.00	133.5	0.032	0.014	0.005	0.011	2.733	.683
2.12	2-07.2	44.90	89.80	134.7	0.033	0.015	0.005	0.011	2.773	.693
2.13	2-07.8	45.40	90.80	136.2	0.033	0.015	0.006	0.011	2.812	.703
2.14	2-08.4	45.80	91.60	137.4	0.034	0.015	0.006	0.011	2.852	.713
2.15	2-09.0	46.20	92.40	138.6	0.035	0.016	0.006	0.012	2.891	.723
2.16	2-09.6	46.70	93.40	140.1	0.036	0.016	0.006	0.012	2.932	.733
2.17	2-10.2	47.10	94.20	141.3	0.037	0.017	0.006	0.012	2.974	.743
2.18	2-10.6	47.50	95.00	142.5	0.037	0.017	0.006	0.012	3.015	.754
2.19	2-11.4	48.00	96.00	144.0	0.038	0.017	0.006	0.013	3.057	.764
2.20	2-12.0	48.40	96.80	145.2	0.039	0.018	0.007	0.013	3.098	.774
2.21	2-12.6	48.80	97.60	146.4	0.040	0.018	0.007	0.013	3.141	.785
2.22	2-13.2	49.30	98.60	147.9	0.041	0.018	0.007	0.014	3.184	.796
2.23	2-13.8	49.70	99.40	149.1	0.042	0.019	0.007	0.014	3.227	.807
2.24	2.14.4	50.20	100.4	150.6	0.043	0.019	0.007	0.014	3.270	.818
2.25	2-15.0	50.60	101.2	151.8	0.044	0.020	0.007	0.014	3.313	.828
2.26	2-15.6	51.10	102.2	153.3	0.045	0.020	0.007	0.015	3.358	.839
2.27	2-16.2	51.50	103.0	154.5	0.046	0.021	0.008	0.015	3.403	.851
2.28	2-16.8	52.00	104.0	156.0	0.047	0.021	0.008	0.016	3.449	.862
2.29	2-17.4	52.40	104.8	157.2	0.048	0.022	0.008	0.016	3.494	.876
2.30	2-18.0	52.90	105.8	158.7	0.049	0.022	0.008	0.016	3.539	.885
2.31	2-18.6	53.40	106.8	160.2	0.050	0.022	0.008	0.017	3.586	.897
2.32	2-19.2	53.80	107.6	161.4	0.051	0.023	0.008	0.017	3.633	.908
2.33	2-19.8	54.30	108.6	162.9	0.052	0.023	0.009	0.017	3.680	.920
2.34	2.20.4	54.80	109.6	164.4	0.053	0.024	0.009	0.018	3.727	.932
2.35	2-21.0	55.20	110.4	165.6	0.054	0.025	0.009	0.018	3.774	.944
2.36	2-21.6	55.70	111.4	167.1	0.056	0.025	0.009	0.019	3.823	.956
2.37	2-22.2	56.20	112.4	168.6	0.057	0.026	0.010	0.019	3.872	.968
2.38	2-22.8	56.60	113.2	169.8	0.058	0.026	0.010	0.019	3.922	.980
2.39	2-23.4	57.10	114.2	171.3	0.059	0.027	0.010	0.020	3.971	.993
2.40	2-24.0	57.60	115.2	172.8	0.060	0.027	0.010	0.020	4.020	1.005
2.41	2-24.6	58.10	116.2	174.3	0.062	0.028	0.010	0.021	4.071	1.018
2.42	2-25.2	58.60	117.2	175.8	0.063	0.028	0.010	0.021	4.123	1.031
2.43	2-25.8	59.00	118.0	177.0	0.064	0.029	0.011	0.021	4.174	1.043
2.44	2-26.4	59.50	119.0	178.5	0.066	0.030	0.011	0.022	4.226	1.056
2.45	2-27.0	60.00	120.0	180.0	0.067	0.030	0.011	0.022	4.277	1.069
2.46	2-27.6	60.50	121.0	181.5	0.069	0.031	0.011	0.023	4.330	1.082
2.47	2-28.2	61.00	122.0	183.0	0.070	0.031	0.012	0.023	4.382	1.095
2.48	2-28.8	61.50	123.0	184.5	0.071	0.032	0.012	0.024	4.437	1.109
2.49	2-29.4	62.00	124.0	186.0	0.073	0.033	0.012	0.024	4.491	1.123
2.50	2-30.0	62.50	125.0	187.5	0.074	0.033	0.012	0.025	4.544	1.136
2.51	2-30.6	63.00	126.0	189.0	0.076	0.034	0.013	0.025	4.600	1.150
2.52	2-31.2	63.50	127.0	190.5	0.077	0.035	0.013	0.026	4.655	1.164
2.53	2-31.8	64.00	128.0	192.0	0.079	0.036	0.013	0.026	4.711	1.178
2.54	2-32.4	64.50	129.0	193.5	0.080	0.036	0.013	0.027	4.766	1.191
2.55	2-33.0	65.00	130.0	195.0	0.082	0.037	0.014	0.027	4.822	1.205
2.56	2-33.6	65.50	131.0	196.5	0.084	0.038	0.014	0.028	4.880	1.220
2.57	2-34.2	66.00	132.0	198.0	0.086	0.039	0.014	0.029	4.938	1.234
2.58	2-34.8	66.60	133.2	199.8	0.088	0.040	0.015	0.029	4.996	1.249
2.59	2-35.4	67.10	134.2	201.3	0.090	0.040	0.015	0.030	5.054	1,263
2.60	2-36.0	67.60	135.2	202.8	0.091	0.041	0.015	0.030	5.112	1.278
2.61	2-36.6	68.10	136.2	204.3	0.093	0.042	0.016	0.031	5.172	1.293
2.62	2-37.2	68.60	137.2	205.8	0.095	0.043	0.016	0.032	5.232	1.308
2.63	2-37.8	69.20	138.4	207.6	0.096	0.043	0.016	0.032	5.292	1.323
2.64	2-38.4	69.70	139.4	209.1	0.098	0.044	0.016	0.033	5.352	1.338
2.65	2-39.0	70.20	140.4	210.6	0.099	0.045	0.017	0.033	5.412	1.353
2.66	2-39.6	70.80	141.6	212.4	0.101	0.045	0.017	0.034	5.474	1.368
2.67	2-40.2	71.30	142.6	213.9	0.103	0.046	0.017	0.034	5.537	1.384
2.68	2-40.8	71.80	143.6	215.4	0.105	0.047	0.017	0.035	5.599	1.400
2.69	2-41.4	72.40	144.8	217.2	0.107	0.048	0.018	0.036	5.662	1.415
2.70	2-42.0	72.90	145.8	218.7	0.109	0.049	0.018	0.036	5.724	1.431
2.71	2-42.6	73.40	146.8	220.2	0.111	0.050	0.018	0.037	5.789	1.447
2.72	2.43.2	74.00	148.0	222.0	0.113	0.051	0.019	0.038	5.854	1.463
2.73	2-43.8	74.50	149.0	223.5	0.116	0.052	0.019	0.039	5.918	1.479
2.74	2-44.4	75.00	150.0	225.0	0.118	0.053	0.020	0.039	5.983	1.496
2.75	2-45.0	75.60	151.2	226.8	0.119	0.054	0.020	0.040	6.048	1.512
2.76	2-45.6	76.20	152.4	228.6	0.122	0.055	0.020	0.041	6.115	1.529
2.77	2-46.2	76.70	153.4	230.1	0.124	0.056	0.021	0.041	6.182	1.545
2.78	2-46.8	77.30	154.6	231.9	0.126	0.057	0.021	0.042	6.250	1.562
2.79	2-47.4	77.80	155.6	233.4	0.129	0.058	0.021	0.043	6.317	1.579
2.80	2-48.0	78.40	156.8	235.2	0.131	0.059	0.022	0.044	6.384	1.596
2.81	2-48.6	79.00	158.0	237.0	0.132	0.060	0.022	0.045	6.453	1.613
2.82	2-49.2	79.50	159.0	238.5	0.136	0.061	0.023	0.045	6.523	1.631
2.83	2-49.8	80.10	160.2	240.3	0.138	0.062	0.023	0.046	6.592	1.648
2.84	2-50.4	80.70	161.4	242.1	0.141	0.063	0.024	0.047	6.662	1.665
2.85	2-51.0	81.20	162.4	243.6	0.143	0.064	0.024	0.048	6.731	1.683
2.86	2-51.6	81.80	163.6	245.4	0.146	0.065	0.024	0.049	6.803	1.701
2.87	2-52.2	82.40	164.8	247.2	0.148	0.066	0.025	0.049	6.875	1.719
2.88	2-52.8	82.90	165.8	248.7	0.151	0.068	0.025	0.050	6.948	1.737
2.89	2-53.4	83.50	167.0	250.5	0.154	0.069	0.026	0.051	7.020	1.755
2.90	2-54.0	84.10	168.2	252.3	0.156	0.070	0.026	0.052	7.092	1.773
2.91	2-54.6	84.70	169.4	254.1	0.159	0.072	0.027	0.053	7.167	1.792
2.92	2-55.2	85.30	170.6	255.3	0.162	0.073	0.027	0.054	7.241	1.810

(Continued on page 262.)

minimum length of tangent 60 ft. between spiral curves of opposite directions.

"The last length of spiral in each column is the maximum to use for the speed at the head of the column. For less speeds use next column to left. The table will be found sufficient for all general cases and any special case can be figured by formula $L = V E$."

Abbreviations.

D_1 = degree of main curve.

D = degree of curve at any point on spiral.

a = rate of change of spiral per station = degree of spiral curve 100 ft. from B. S.

A = deflection in minutes to point on spiral 100 ft. from B. S.

θ = deflection angle at B. S. to any point on spiral.

ϕ = deflection angle at B. M. C. from tangent to the spiral to B. S.

ϕ_1 = deflection angle at B. M. C. from tangent to the spiral to any point on the spiral.

δ = deflection angle from tangent at any point on spiral to B. M. C.

Δ = total angle in spiral at $E = D\ E\ C$. (Fig. 2.)

Δ_1 = angle in first portion of spiral from B. S. to any point on spiral, as from A to B at $G = D\ G\ B$.

Δ_2 = angle in second portion of spiral from any point to B. M. C., as from B to C at F_1.

L = total length of spiral in 100-ft. stations.

d = distance from B. S. to any point on spiral in stations.

d_1 = distance from any point on spiral to B. M. C. in stations.

c = long chord from B. S. to B. M. C., as $A\ C$.

X = distance along tangent to any point as $A\ H$ or $A\ D$.

Y = offset from tangent at any point on spiral as $D\ C$.

U = first tangent of spiral, $A\ E$.

V = second tangent of spiral, $E\ C$.

t = distance from B. S. to point where main curve produced is parallel to tangent as $A\ H$.

T = distance from P. I. to B. S. or E. S. as $I\ A$ or $I\ X$.

E = distance from P. I. to center of main curve.

M = main curve angle.

I = total intersection angle between two main tangents $= M + 2\ \Delta$.

O = offset distance between main tangent and a tangent to main curve produced at H.

Formulas.

When quantities are required for any point on spiral, insert d for L in equations.

$a = 0.269 \sqrt{(D_1^3/O)} = D_1/L$.

$D = a\ d \quad d = D/a$.

$A = a/6 = D_1/6\,L$.

$D_1 = a\ L \quad L = D_1/a$.

$\Delta = \frac{1}{2}\ a\ L^2 = \frac{1}{2}\ D_1\ L = D_1^2/2a = 3a\ L^2$.

$\Delta_1 = \frac{1}{2}\ a\ d^2 = \frac{1}{2}\ D\ d$.

$\theta = \frac{1}{3}\ \Delta = \frac{1}{6}\ a\ L^2 = \frac{1}{6}\ D\ L = D^2/6a = A\ L^2$.

$\phi = 2\theta$ for whole spiral.

$\phi_1 = A\ d_1\ (3d + 2d_1) = A\ d_1^2\ (3d/d_1 + 2)$.

$\delta = A\ d_1\ (3d + d_1) = A\ d_1^2\ (3d/d_1 + 1)$.

$\Delta_2 = (\Delta - \Delta_1)$.

$Y = 0.2909\ a\ L^3 - .00000158\ a^3\ L^7$.

$X = 100\ L - .000762\ a^2\ L^5$ X Cor. $= .000762\ a^2\ L^5$.

$O = .0727\ a\ L^3 = .0727\ D_1\ L^2 = \frac{1}{4}\ Y$.

$L = 3.714 \sqrt{(\sigma/D_1)}$.

$t = 50\,L - .000127\ a^2\ L^5 = 50\,L - \frac{1}{6}\ X$ Cor.

$c = 100\,L - .00034\ a^2\ L^5$ (in feet).

$U = X - Y \cot \Delta = X - V \cos \Delta = \frac{2}{3}\ L + \frac{1}{3}\ X$ Cor.

$$V = \frac{Y}{\sin \Delta} = \frac{100}{3}\ L + .000244\ a^2\ L^8 =$$

$\frac{1}{3}\ L + \frac{1}{3}\ X$ Cor.

$T = t + (R + o) \tan \frac{1}{2}\ I$.

UNIT TABLE FOR TALBOT'S SPIRAL.—Continued.

L in 100 ft. Stations.	D Deg. and Min.	Θ Min.	φ Min.	Δ Min.	X Cor. Minus.	C Cor. Minus.	t Cor. Minus.	U & V Cor. Plus.	Y Ft.	O Ft.
2.93	2-55.8	85.80	171.6	257.4	0.164	0.074	0.027	0.055	7.316	1.829
2.94	2-56.4	86.40	172.8	259.2	0.167	0.075	0.028	0.056	7.390	1.848
2.95	2-57.0	87.00	174.0	261.0	0.170	0.077	0.028	0.057	7.465	1.866
2.96	2-57.6	87.60	175.2	262.8	0.173	0.078	0.029	0.058	7.542	1.886
2.97	2-58.2	88.20	176.4	264.6	0.176	0.079	0.029	0.059	7.619	1.905
2.98	2-58.8	88.80	177.6	266.4	0.179	0.080	0.030	0.060	7.696	1.924
2.99	2-59.4	89.40	178.8	268.2	0.182	0.081	0.030	0.061	7.773	1.943
3.00	3-00.0	90.00	180.0	270.0	0.185	0.083	0.031	0.062	7.850	1.962
3.01	3-00.6	90.60	181.2	271.8	0.188	0.085	0.031	0.063	7.930	1.982
3.02	3-01.2	91.20	182.4	273.6	0.191	0.086	0.032	0.064	8.010	2.002
3.03	3-01.8	91.80	183.6	275.4	0.195	0.087	0.032	0.065	8.090	2.022
3.04	3-02.4	92.40	184.8	277.2	0.198	0.088	0.033	0.066	8.170	2.043
3.05	3-03.0	93.00	186.0	279.0	0.201	0.090	0.034	0.067	8.250	2.063
3.06	3-03.6	93.60	187.2	280.8	0.204	0.092	0.034	0.068	8.332	2.083
3.07	3-04.2	94.20	188.4	282.6	0.208	0.094	0.035	0.069	8.415	2.104
3.08	3-04.8	94.80	189.6	283.8	0.211	0.095	0.035	0.070	8.497	2.124
3.09	3-05.4	95.50	191.0	286.5	0.215	0.097	0.036	0.072	8.580	2.145
3.10	3-06.0	96.10	192.2	288.3	0.218	0.098	0.036	0.073	8.662	2.165
3.11	3-06.6	96.70	193.4	290.1	0.222	0.100	0.037	0.074	8.747	2.187
3.12	3-07.2	97.30	194.6	291.9	0.225	0.101	0.037	0.075	8.832	2.208
3.13	3-07.8	98.00	196.0	294.0	0.229	0.103	0.038	0.076	8.917	2.229
3.14	3-08.4	98.60	197.2	295.8	0.232	0.104	0.039	0.077	9.002	2.250
3.15	3-09.0	99.20	198.4	297.6	0.236	0.106	0.039	0.079	9.087	2.272
3.16	3-09.6	99.9	199.8	299.7	0.240	0.108	0.040	0.080	9.175	2.294
3.17	3-10.2	100.5	201.0	301.5	0.244	0.110	0.041	0.081	9.263	2.316
3.18	3-10.8	101.1	202.2	303.3	0.248	0.112	0.041	0.083	9.351	2.338
3.19	3-11.4	101.8	203.6	305.4	0.252	0.113	0.042	0.084	9.438	2.379
3.20	3-12.0	102.4	204.8	307.2	0.255	0.115	0.043	0.085	9.526	2.382
3.21	3-12.6	103.0	206.0	309.0	0.260	0.117	0.043	0.087	9.616	2.404
3.22	3-13.2	103.7	207.4	311.1	0.264	0.119	0.044	0.088	9.706	2.426
3.23	3-13.8	104.3	208.6	312.9	0.268	0.121	0.045	0.089	9.797	2.449
3.24	3-14.4	105.0	210.0	315.0	0.272	0.122	0.045	0.091	9.887	2.472
3.25	3-15.0	105.6	211.2	316.8	0.276	0.124	0.046	0.092	9.978	2.494
3.26	3-15.6	106.3	212.6	318.9	0.280	0.126	0.047	0.093	10.071	2.518
3.27	3-16.2	106.9	213.8	320.7	0.285	0.128	0.047	0.095	10.164	2.541
3.28	3-16.8	107.6	215.2	322.8	0.289	0.130	0.048	0.096	10.258	2.564
3.29	3-17.4	108.2	216.4	324.6	0.294	0.132	0.049	0.098	10.351	2.588
3.30	3-18.0	108.9	217.8	326.7	0.298	0.134	0.050	0.099	10.446	2.611
3.31	3-18.6	109.6	219.2	328.8	0.303	0.136	0.051	0.101	10.541	2.635
3.32	3-19.2	110.2	220.4	330.6	0.307	0.138	0.051	0.102	10.637	2.659
3.33	3-19.8	110.9	221.8	332.7	0.312	0.140	0.052	0.103	10.734	2.683
3.34	3-20.4	111.6	223.2	334.8	0.316	0.142	0.053	0.105	10.831	2.708
3.35	3-21.0	112.2	224.4	336.6	0.321	0.144	0.053	0.107	10.928	2.732
3.36	3-21.6	113.0	226.0	339.0	0.326	0.147	0.054	0.109	11.026	2.757
3.37	3-22.2	113.6	227.2	340.8	0.331	0.149	0.055	0.110	11.125	2.781
3.38	3-22.8	114.2	228.4	342.6	0.336	0.151	0.056	0.112	11.224	2.806
3.39	3-23.4	114.9	229.8	344.7	0.341	0.154	0.057	0.113	11.324	2.831
3.40	3-24.0	115.6	231.2	346.8	0.346	0.156	0.058	0.115	11.425	2.856
3.41	3-24.6	116.3	232.6	348.9	0.351	0.158	0.059	0.117	11.525	2.881
3.42	3-25.2	117.0	234.0	351.0	0.356	0.160	0.059	0.119	11.628	2.907
3.43	3-25.8	117.6	235.2	352.8	0.362	0.163	0.060	0.121	11.729	2.932
3.44	3-26.4	118.3	236.6	354.9	0.367	0.165	0.061	0.122	11.832	2.958
3.45	3-27.0	119.0	238.0	357.0	0.372	0.167	0.062	0.124	11.938	2.984
3.46	3-27.6	119.7	239.4	359.1	0.378	0.170	0.063	0.126	12.039	3.010
3.47	3-28.2	120.4	240.8	361.2	0.383	0.172	0.064	0.128	12.144	3.036
3.48	3-28.8	121.1	242.2	363.3	0.389	0.175	0.065	0.130	12.249	3.082
3.49	3-29.4	121.8	243.6	365.4	0.394	0.177	0.066	0.131	12.355	3.089
3.50	3-30.0	122.5	245.0	367.5	0.400	0.180	0.067	0.133	12.461	3.115
3.51	3-30.6	123.2	246.4	369.6	0.406	0.183	0.068	0.135	12.567	3.142
3.52	3-31.2	123.9	247.8	371.7	0.412	0.185	0.069	0.137	12.676	3.169
3.53	3-31.8	124.6	249.2	373.8	0.418	0.188	0.070	0.139	12.784	3.196
3.54	3-32.4	125.3	250.6	375.9	0.423	0.190	0.071	0.141	12.893	3.223
3.55	3-33.0	126.0	252.0	378.0	0.429	0.193	0.072	0.143	13.002	3.251
3.56	3-33.6	126.7	253.4	380.1	.0436	0.196	0.073	0.145	13.112	3.278
3.57	3-34.2	127.4	254.8	382.2	0.442	0.199	0.074	0.147	13.225	3.306
3.58	3-34.8	128.2	256.4	384.6	0.448	0.202	0.075	0.149	13.334	3.333
3.59	3-35.4	128.9	257.8	386.7	0.454	0.204	0.076	0.151	13.446	3.361
3.60	3-36.0	129.6	259.2	388.8	0.460	0.207	0.077	0.153	13.558	3.389
3.61	3-36.6	130.3	260.6	390.9	0.467	0.210	0.078	0.156	13.672	3.418
3.62	3-37.2	131.0	262.0	393.0	0.474	0.213	0.079	0.158	13.785	3.446
3.63	3-37.8	131.8	263.6	395.4	0.480	0.216	0.080	0.160	13.909	3.477
3.64	3-38.4	132.5	265.0	397.5	0.487	0.219	0.081	0.162	14.015	3.504
3.65	3-39.0	133.2	266.2	399.6	0.493	0.222	0.082	0.164	14.132	3.533
3.66	3-39.6	134.0	268.0	402.0	0.500	0.225	0.083	0.167	14.248	3.562
3.67	3-40.2	134.7	269.4	404.1	0.507	0.229	0.084	0.169	14.366	3.591
3.68	3-40.8	135.4	270.8	406.2	0.514	0.232	0.086	0.171	14.483	3.621
3.69	3-41.4	136.2	272.4	408.6	0.521	0.235	0.087	0.174	14.602	3.650
3.70	3-42.0	136.9	273.8	410.7	0.528	0.238	0.088	0.176	14.720	3.680
3.71	3-42.6	137.6	275.2	412.8	0.535	0.241	0.089	0.178	14.840	3.710
3.72	3-43.2	138.4	276.8	415.2	0.543	0.244	0.090	0.181	14.960	3.740
3.73	3-43.8	139.1	278.2	417.3	0.550	0.247	0.092	0.183	15.081	3.770
3.74	3-44.4	139.9	279.8	419.7	0.557	0.251	0.093	0.186	15.202	3.800
3.75	3-45.0	140.6	281.2	421.8	0.564	0.254	0.094	0.188	15.324	3.831
3.76	3-45.6	141.4	282.8	424.2	0.572	0.257	0.096	0.191	15.446	3.861
3.77	3-46.2	142.1	284.2	426.3	0.580	0.261	0.097	0.193	15.570	3.892
3.78	3-46.8	142.9	285.8	428.7	0.588	0.265	0.098	0.196	15.695	3.924
3.79	3-47.4	143.6	287.2	430.8	0.596	0.268	0.099	0.199	15.819	3.955
3.80	3-48.0	144.4	288.8	433.2	0.604	0.271	0.100	0.201	15.944	3.986
3.81	3-48.6	145.2	290.4	435.6	0.612	0.275	0.102	0.204	16.071	4.018
3.82	3-49.2	145.9	291.8	437.7	0.620	0.279	0.103	0.207	16.197	4.049
3.83	3-49.8	146.7	293.4	440.1	0.628	0.283	0.105	0.209	16.324	4.081
3.84	3-50.4	147.5	295.0	442.5	0.636	0.286	0.106	0.212	16.453	4.113
3.85	3-51.0	148.2	296.4	444.6	0.644	0.290	0.107	0.215	16.581	4.145
3.86	3-51.6	149.0	298.0	447.0	0.653	0.294	0.109	0.217	16.711	4.178
3.87	3-52.2	149.8	299.6	449.4	0.661	0.297	0.110	0.220	16.840	4.210
3.88	3-52.8	150.5	301.0	451.5	0.670	0.301	0.112	0.223	16.971	4.243
3.89	3-53.4	151.3	302.6	453.9	0.678	0.305	0.113	0.226	17.103	4.276
3.90	3-54.0	152.1	304.2	456.3	0.687	0.309	0.115	0.229	17.234	4.308
3.91	3-54.6	152.9	305.8	458.7	0.696	0.314	0.116	0.232	17.367	4.342
3.92	3-55.2	153.7	307.4	461.1	0.705	0.318	0.117	0.235	17.500	4.375
3.93	3-55.8	154.4	308.8	463.2	0.714	0.322	0.119	0.238	17.634	4.408
3.94	3-56.4	155.2	310.4	465.6	0.723	0.326	0.120	0.241	17.769	4.442
3.95	3-57.0	156.0	312.0	468.0	0.732	0.330	0.122	0.244	17.904	4.476
3.96	3-57.6	156.8	313.6	470.4	0.742	0.334	0.123	0.247	18.041	4.510
3.97	3-58.2	157.6	315.2	472.8	0.751	0.338	0.125	0.251	18.178	4.544
3.98	3-58.8	158.4	316.8	475.2	0.760	0.342	0.127	0.253	18.315	4.579
3.99	3-59.4	159.2	318.4	477.6	0.770	0.346	0.128	0.257	18.453	4.613
4.00	4-00.0	160.0	320.0	480.0	0.780	0.351	0.130	0.260	18.592	4.648

Forests and Run-Off.

It is a matter of dispute whether the removal of forests always affects the amount of run-off from watersheds, for records of certain European districts indicate that deforestation has not been followed by increased floods and erosion of the soil. In examining the subject in detail, however, it has been observed repeatedly that where the removal of the forests has been followed by agricultural work which opens up the pores of the soil, assuming the latter to be somewhat coarse grained, the run-off and soil erosion may not be materially affected. This relation of forests and agriculture to run-off and soil erosion is pointed out in an exhaustive bulletin on the Potomac River basin recently issued by the U. S. Geological Survey, from which the following notes are taken.

If the rain-fall is all absorbed, as by a coarse, sandy soil, there is no run-off and no erosion. As the soil becomes finer in texture, more compact, and correspondingly less pervious, the rain is not absorbed as fast as it falls. The impact of the raindrops loosens the fine particles of soil, and unless absorption takes place the drops gather into small streams and rivulets, transporting with them, by a system of natural elutriation, the finest particles of soil and leaving behind the larger and heavier grains. At first this is entirely due to the hydraulic action of the impinging raindrops, but no sooner do the rivulets gather power, either by the added volume of water or by increased gradient, than they likewise begin cutting loose and transporting the soil.

The capacity of a stiff soil for water is in practice 35 to 50 per cent. of its volume, or for ordinary farmed soils 4 to 5 inches of rainfall to the surface foot. In spite of this capacity, the greater part of a heavy shower will usually not be absorbed. The coarse structure of a sandy soil permits the rainfall to be absorbed as rapidly as it falls. In a clay soil, unless in a high state of tilth, the pores are smaller and there is less open cellular communication between them, and absorption must largely take place through cracks, worm holes, and root holes, and when there are few of these absorption is largely retarded until the air can be expelled. In the extreme case, that of a raw clay soil with its surface puddled by a previous heavy rain, the result is, as King points out, "that when a heavy rain falls, the close structure and feeble granulation result in the surface pores of the soil becoming so quickly closed that the soil air has little opportunity to escape, and yet only so fast as it does escape can rain enter the soil, and hence during heavy rains the water accumulates quickly and extensively upon the surface."

The greater portion of the tilled soils of the Potomac basin, especially of the lower part, are of heavy type and close texture, and the run-off from them indicates failure to absorb. But were they well granulated and in good tilth they, as well as the more permeable sandy soils, could readily absorb, without undue accumulation of surface water, a much heavier rain than commonly falls at one time on the Potomac basin.

The porous condition or granulation of a heavy soil necessary to effect absorption is best procured by the addition of humus.

There is room for a large storage of storm water in farming soils, and more rational farming methods must ultimately lead to this. The effect of such storage would be reflected in a diminished run-off of flood water, especially of heavy midsummer rains. Little of the water thus accumulated would normally pass off as seepage to spring and river flow. The improved growth of the crops would utilize such stored water, and give a more constant and available amount of soil moisture.

Any additional storage, either transient, tending to prolong or distribute a flood crest, or deep seated, tending to increase the amount of the dry-season flow, can be secured only in the forest soil. Storage in forest soil, except in sandy phases, takes place very largely through the medium of humus. The amount of water which is actually retained by a thin humus is small, in fact, a thin humus is usually far more litter than humus and has a very low retentive capacity; but the chief function of humus, except where it has accumulated to a great depth, are (1) to maintain the volume and depth of the soil by preventing erosion; (2) to secure the porosity of the soil; (3) to promote the absorption of rainfall by the soil in retarding the run-off of heavy showers until the water can be absorbed, as the air is gradually expelled from the soil; (4) to act as a mulch and lessen the evaporation of soil moisture.

On coarse, deep sands of low gradient the office

of humus is at a minimum. There is no surface flow of storm water and no soil transportation; evaporation of soil moisture is low both from the surface of the soil and from transpiration by the xerophytic flora, and the larger part of the rainfall passes as percolation. With an increase in the clay component, greater radient, and a decrease in soil depth, humus becomes more essential in supplementing the water-absorbing and water-carrying capacity of the soil, its functions in this respect attaining a maximum on heavy, shallow clays of mountain slopes.

Where the humus is thick, however, it possesses a high storage capacity. While there is some doubt in regard to the exact amount of water humus is capable of holding, the quantity is relatively large. The lowest estimates by Ebermayer place it at considerably more than its own weight, and Wiley's investigations of Florida mucks give it about the same capacity, while Wollny places it at about four times its weight, and Henry's laboratory experiments tend to confirm Wollny's high limit. The capacity of humus must vary, however, not only with the state of decomposition, but with its origin as well, since the pore space is the final determinant of its water-bearing capacity. The undecomposed litter, which covers the humus and from which humus is formed, does not exhibit the characters of humus toward water. It protects the humus, as humus does the underlying soil, from excessive transportation by surface water and in addition from excessive evaporation, acting as a mulch.

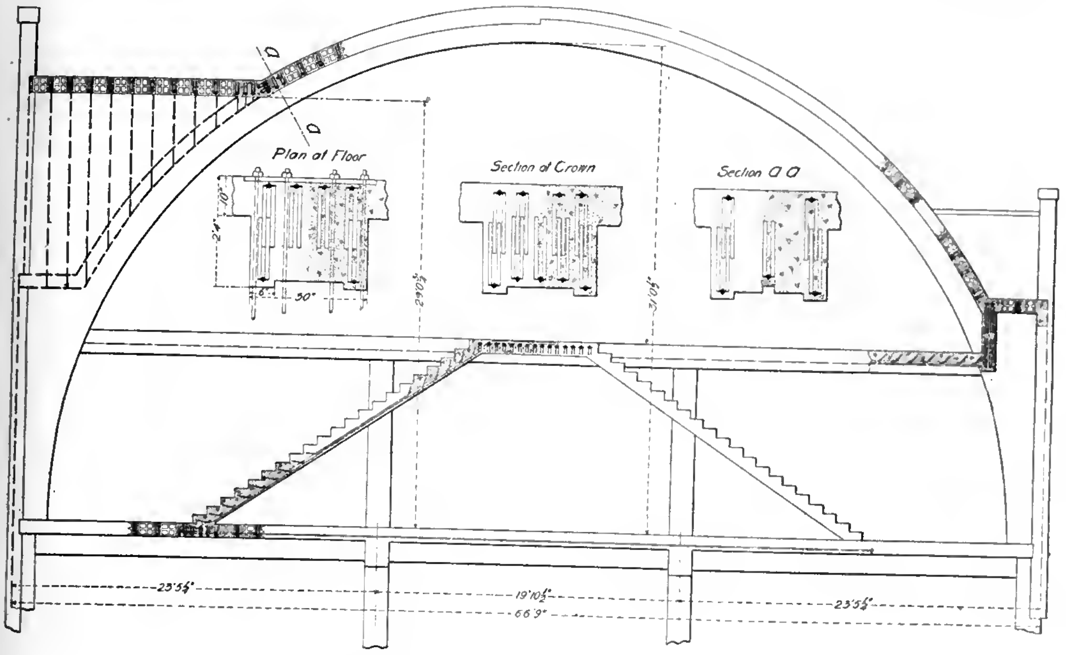
The accumulation of humus on forest soil depends, if it has neither been disturbed nor destroyed, on the kind of species forming the forest and to some extent on the soil, the destruction of humus proceeding rapidly on loose, porous soils, which permit freer circulation of air and afford the condition best suited for bacteriological activity, and since many species of trees, especially the white oak and chestnut, have a wide range of soil adaptability, their capacity to accumulate humus is modified both by their rate of growth on the soil and by the oxidizing capacity of the soal on which they happen to be growing.

The Bosphorus Bridge linking Europe to Asia is a project that Sultan Abdul Hamed has long had under consideration. The last bridge was that built by Darius for the use of his army long before the Christian era. The plans for the Turkish bridge were accepted years ago and call for short suspension spans between a succession of granite towers, of which the foundations are now being built.

The New Manufacturing Plant of the George N. Pierce Co., Buffalo, N. Y.

By Howard S. Knowlton.

One of the latest industrial plants to be completed in Buffalo is the new automobile manufacturing establishment of the George N. Pierce Co., located on the site of the Pan-American Exposition grounds. The company employs about 1,600 men, and it has been building the well-known Great Arrow car. The group of buildings which comprise the plant are all of reinforced concrete, the engineers and architects for the work being Messrs. Lockwood, Greene & Co., of Boston, with Mr. Albert Kahn, of Detroit, as associate architect. The designs and plans for the reinforced concrete work were made by the Trussed Concrete Steel Co. The office or so-called "welfare building" was designed by Mr. George Cary, of Buffalo.

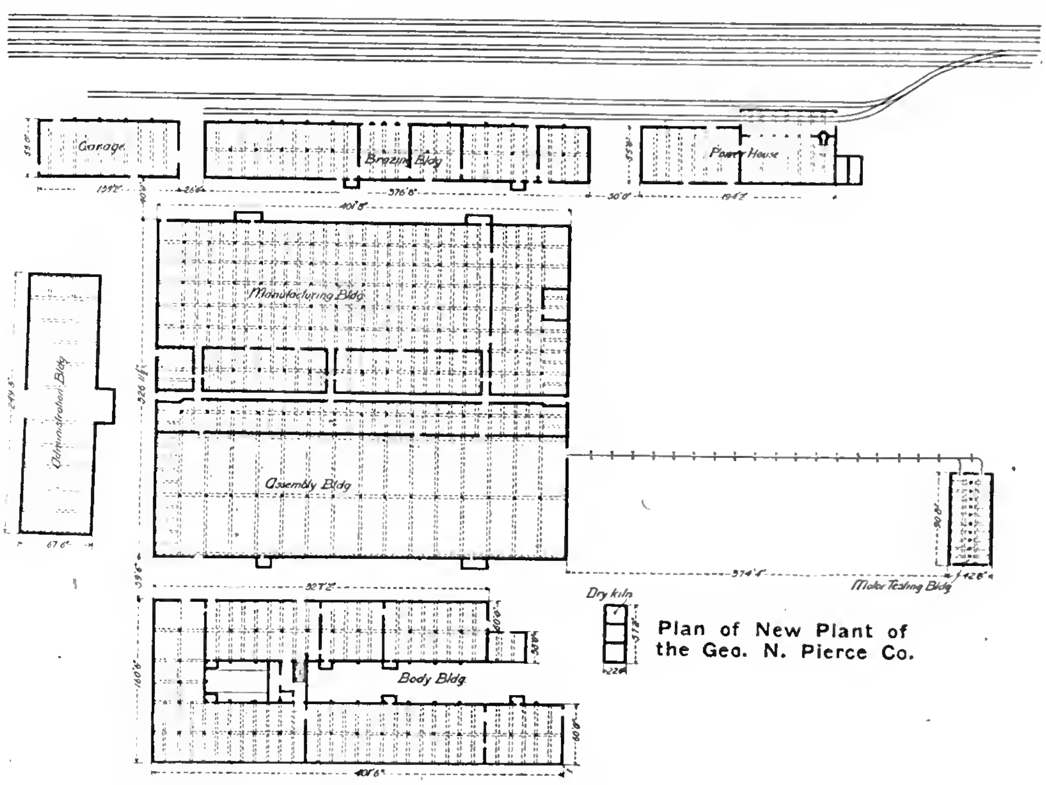


Cross Section of Administration Building.

Administration Building.—The plant occupies part of a lot of land fronting on Elmwood Ave., and is located beside the New York Central & Hudson River R. R. with special siding facilities for the receipt of materials and the shipment of products. The area of the property is about 15 acres, the lot being nearly rectangular, 997.3 ft. long and 655.2 ft. wide. There are eight buildings in the establishment at present. At the Elmwood Ave. entrance of the works, near the centre of the property, stands the Administration or Welfare Building, which is about 252 ft. long by 70 ft. wide, and three stories in height, with a barrel-arch roof. This building is the main entrance to every department of the plant. In the basement are provided lockers, bicycle and wash rooms for the employees, and from this basement the main manufacturing building is reached by underground passages. On the first floor are located the administrative and general offices of the company with a club room for department heads. The second floor is devoted to welfare work and its principal feature is a large restaurant for the use of employees.

The unique feature of the building is the barrel roof, carried by arches spaced 30 ft. on centres at the end spans and 20 ft. for all other spans. The ribs are approximately 30 in. wide by 26 in. deep, and are reinforced by nine 1¼x3¾-in. Kahn bars, five in the intrados and four in the extrados, at the crown. Four 1⅛-in. round rods run between the springing lines of the arches imbedded in the second floor. The roof slabs are made of 10-in. hollow tile spaced 16 in. on centres, with a 4-in. concrete joist between each row of tile. The joist has a ¾x2-in. Kahn bar as reinforcement. The first and second floors are of somewhat similar construction.

Shops.—In the rear of the Administration Building are the main shops. These are composed of the Body Building, about 401½x160½ ft.; the Manufacturing Building, about 327x402¾ ft.; the garage, 139¼x55 ft.; the Brazing Building, 376¾x55 ft., and the power house, 194¼x55 ft. There are also a 22x57½-ft. dry kiln, a gas house 26 ft. square, and a motor-testing building, measuring 90¾x42¾ ft. The last is located 374 ft. from the nearest shop to allow for the extension of the works to meet future business requirements.



Plan of New Plant of the Geo. N. Pierce Co.

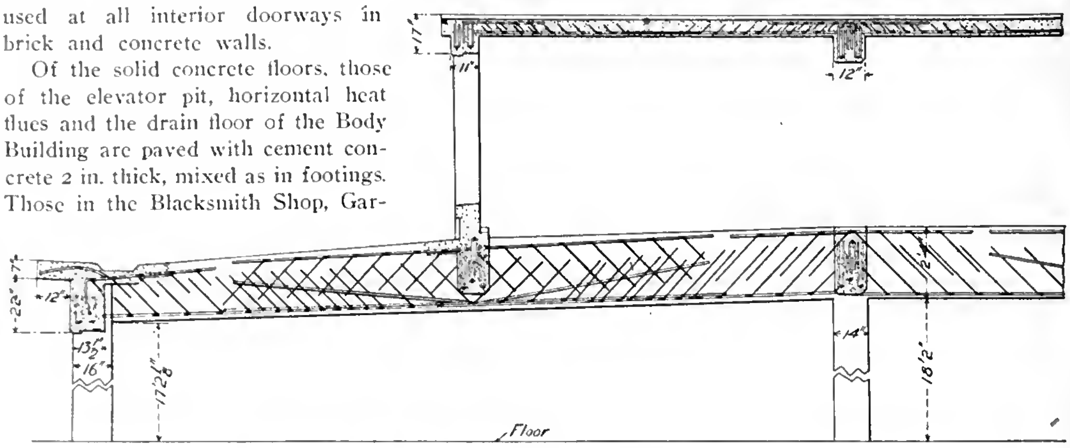
The Body Building is two stories in height, and divided by brick firewalls into the various storage and fitting, paint, lumber, filing, gluing, varnishing, trimming, pattern and blacksmith shops necessary in the production of the automobile body. The manufacturing building is one story in height and contains stores, tool, inspection, machine shop, experimental and assembly divisions. The assembly department is located

on the side of the building nearest the Body Building and is 402¾x122 ft. It is separated by a brick fire wall from the main manufacturing section. The Brazing Building includes in its single story brazing and tin shops, sand blast, case hardening, nickel plating, chip and receiving rooms. The power house has a coal pocket, boiler room, compressor and pump room, and an engine room. The side tracks have an aggregate length of 2,115 ft., and are three in number. One serves the coal pocket, and the other two serve the engine room, brazing building, and garage. The total floor space in the plant aggregates 280,000 sq. ft. Ground was broken on April 23, 1906, and the last building was turned over to the owners in November.

General Details.—All supported floors and roofs in the plant are built of hollow tile and reinforced concrete on the Kahn system. The beams, columns, footings and stairs are of concrete-steel. The concrete is composed of one part Portland cement, two of sand and four of crushed stone. The stone for footings was not allowed to exceed 2 in. in size, and for all other work ½-in. standard hard burned tile grooved on all sides, was used, and the concrete was all machine mixed. The concrete was designed to resist direct compression and shear up to 30 lb. per square inch. The minimum thickness of the concrete covering on the steel at any point is 1 in. The maximum elastic limit allowed in the steel was 45,000 lbs. per square inch, and the tensile strength of the steel was specified at a minimum of 60,000 lb. with 20 per cent. elongation in 8 in. test pieces. The cold bending test was 180 degrees. The design of the centering was planned to enable the slab forms to be removed first, and then the sides of the beams, leaving the bottom supports of the beams and girders to be removed last. Exposed faces of beams, girders and columns were finished smooth.

Floors were tested after the centering had been removed one month, to twice the nominal safe live load, uniformly distributed over the panels. The maximum specified deflection allowed was 1/400th part of the span, with return to normal position after removal of the load. The reinforced concrete work was designed for the following unit stresses: For hooped or latticed columns of concrete, 750 lbs.; shearing stresses in concrete and adhesion of concrete to steel, 30 lbs.; beams, slabs and girders in direct compression, 500 lbs.; tensile stress in steel, 16,000 lbs.; compression in steel, 12,000 lbs. The tensile strength of the concrete was not considered, and the ratio of the moduli of elasticity of concrete and steel was 1:12.

Girders and beams were designed with top reinforcement over the bearing to provide for continuous girder action; and the diameter of columns was taken at a minimum of one-sixteenth the total height. Footings were built of 1:3:6 concrete, and were laid in 5 in. layers, each layer being started before the previous one had commenced to set. The foundation walls were built of concrete mixed in the same proportions as for footings.

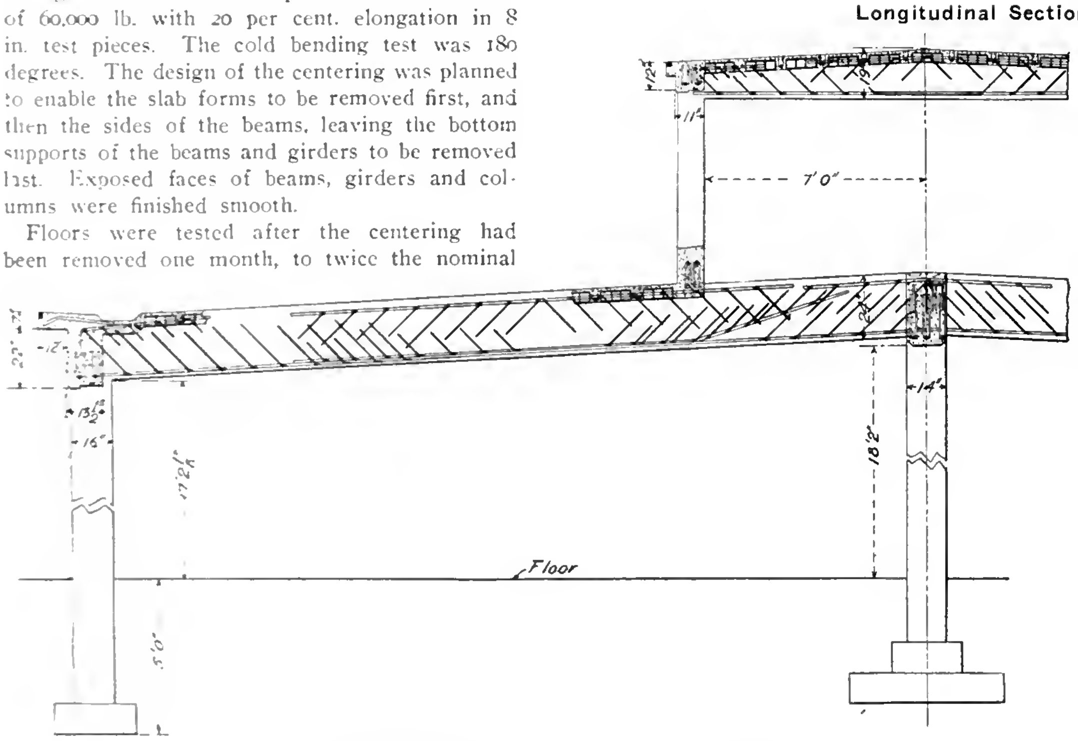


Longitudinal Section of Brazing Building.

Brickwork was employed in various interior walls, all fire walls being thus made; in the walls of buildings, where the spaces between columns are not occupied by windows; for certain footings, and in filling in the gaps between adjacent windows and the horizontal reinforced concrete wall columns. The tunnel from the power house to the Body and Manufacturing Buildings is provided with walls and roofs of reinforced concrete, the floor being plain concrete. Window sills are reinforced, and in the floor of the garage are built pits with sides and bottoms of cement concrete. Cast iron sills are used at all interior doorways in brick and concrete walls.

Of the solid concrete floors, those of the elevator pit, horizontal heat flues and the drain floor of the Body Building are paved with cement concrete 2 in. thick, mixed as in footings. Those in the Blacksmith Shop, Garage and Brazing Building are laid with a 5 or 6-in. base of cement concrete and a 1 in. wearing surface of Portland cement mortar. The floor of the Testing Building is laid with a 3½-in. cement concrete base, with a 1-in. Portland cement mortar wearing surface. The roof of the Body Building is covered with dry cinders, with a top layer of 1-in. concrete, drained to sumps formed in the latter. Earth floors were used in pipe pits. Water-closet floors are reinforced concrete covered with rock asphalt ⅞ in. thick. Tar concrete floors 4 in. thick are used in the first story of buildings with plank wearing courses.

Partitions in the Manufacturing, Garage and Brazing Buildings are of metal and plaster, 2 in. thick, braced with 3-in. channels running to the beams, and one side of the studding is covered with steel lath and plastered. Where hollow tile partitions are used, the tile are laid in 1:3 cement mortar, the tiles being wet. The under sides of all hollow tile floors and roofs are plastered with two coats of cement mortar.



Transverse Section of Brazing Building.

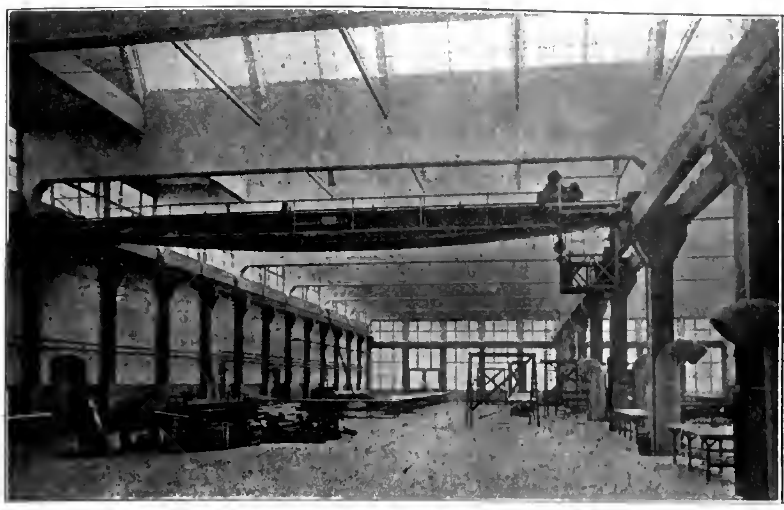
The entire skylights, except the ends and space occupied by the sash are of reinforced concrete. The ends are hollow tile, and the fronts have wood frames anchored to the concrete for securing the sash. The sashes are of 2¼ in. cypress stock, and are glazed on the outside with ¼ in. ribbed glass in one length and on the inside with clear glass. The concrete work in front and the tile work at the ends are covered with 16 oz. copper. The roof, columns and beams of monitors on the Blacksmith, Garage and Brazing Buildings are reinforced concrete and the monitor sashes are glazed with ½-in. ribbed glass. The skylights over the Testing Building and the sand blast rooms in the Brazing Building are framed with heavy galvanized iron with condensation gutters which discharge on the roof. These are glazed with ¼-in. plate glass 18 in. wide. The backs of all saw tooth skylights and roofs are covered with five-ply asphalt and slag roofing.

Brazing Building.—The Brazing Building is designed with a single row of columns, one every 25 ft. This is considered to give the most economical arrangement, because of the wide spacing of columns affords large unbroken floor areas. Because of the necessity of good ventilation this building is built with a monitor its entire length. Sashes 13 ft. 4 in. high on each side of the monitor give a quick means of ventilating the entire building.

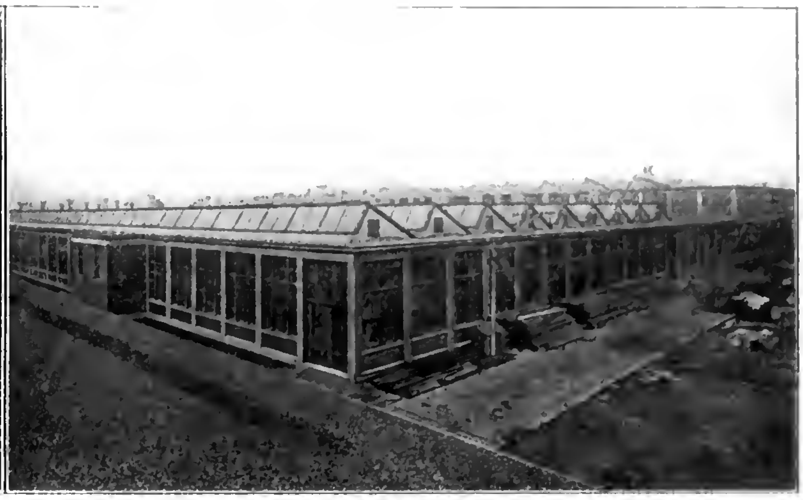
The transverse beams in this building are 12x24 in., reinforced with two 1¼x3¾ in. bars and one ¾x2-in. bar. One 1x3-in. compression bar is also used. The top continuity bars over the supports are 1x3 in. The main horizontal girders are 14x28 in. reinforced with three 1¼x3¾ in. and two ¾-in.x2-in. bars. As these girders were not of T section, it was deemed necessary to put in two 1x3 in. compression bars and also a 1x3 in. continuity bar over all columns. The transverse beams are supported alternately on columns and by the longitudinal girder. The interior columns are 14x14 in., reinforced with four ¾x2 in. bars. The exterior columns are 16x16 in., being made that size for architectural effect. The corners of all columns and beams are chamfered.

The roof of this building is constructed of 4-in. tile 16 in. apart on centres, with 4 in. concrete joists between the tile courses. Each course is reinforced with ½x1½ in. Kahn bar. One inch of concrete is spread over the tile in order to give a fastening for the waterproof roofing.

Manufacturing Building.—In the Manufacturing Building the columns are spaced 25 ft. apart lengthwise and 20½ ft. 6 in. crosswise. The minimum headroom from the finished floor to the under side of the beams is 16½ ft. The saw-tooth skylight beams are spaced every 12½ ft., one coming over every column and one midway between columns, with a 4-in. tile slab rein-



An Aisle in the Assembly Building.



Manufacturing and Assembly Buildings.

forced with ½x1½ in. bars. The inclined beams are reinforced with two 1x3 in. bars and one compression bar, together with the top reinforcing bars. The pitch of the roof is about 30 degrees, while the windows are inclined at an angle of 60 degrees.

In order to carry the large amount of shafting and machinery in this building, a system of 8-in. I-beams is used, spaced 8 ft. 4 in. apart on centres. A stiffening is run from the roof to the centre of each I-beam to prevent vibration. The construction of the roof itself depends in no way upon these steel beams, which are put in only to facilitate hanging shafting.

The main girders of this building have 25 ft. span and are 14x26 in. reinforced with two 1¼x3¾-in. and one 1x3-in. bars and two ¾-in.x2-in. compression bars. In all valleys of the roof of this building, concrete saddles were formed to provide for the drainage, the downspouts being approximately 50 ft. apart. The columns are 14x14-in., reinforced with four ¾x2-in. bars.

This building is at the present time filled with machine tools of every description, most of them to be used for turning out small pieces of work requiring careful execution and inspection. The employees prefer to work in the interior of the building rather than at the wall benches, as the light is better and more constant 200 ft. away from the walls than it is next the outside windows.

Assembly Building.—The Assembly Building section is divided in the centre by a row of 24x24-in. columns. Two 3-ton cranes travel the full length of the building, and the single row of columns was arranged to give these a large area of action. These are two bays 62 ft. wide and 401 ft. long, so the sawtooth construction was faced east, and the 62 ft. span taken care of by a reinforced concrete girder 16x84-in. in section.

The crane girders are reinforced concrete throughout, no steel beams of any description being used. The girders fastened to the centre row of columns span 25 ft. and are 12x22 in., reinforced with 1x3-in. bars, together with a compression bar and a top reinforcing bar at every column. The rails are fastened directly into the concrete, ⅝-in. bolts being used, which together with iron clamps used to hold the rail in position, are bedded in the concrete. The crane girders in the sides of the building are 12x16 in., reinforced with two ⅜x2 in. bars and one 1x3-in. bar, together with one ¾-in. compression bar and one ¾-in. top reinforcing bar. These girders are designed to carry a 5.5-ton wheel load on a 10-ft. wheel base. In tests recently made a centre load of 28,000 lbs. was placed on one of the beams, and a deflection of a scant 1/16 in. resulted.

The centre row of columns in this building are 24x24 in., reinforced with four 1x3 in. Kahn bars, and four 1¼x3¾ in. unsheared Kahn bars. Owing to the necessity of having proper clearance for the cranes, brackets have been provided on these columns where the crane girders are attached.

For all outside windows ⅛ in. ribbed glass was used. The lower and upper sashes are provided with Taber fixtures, which permit the windows to swing out and also to be raised and lowered. About ten sashes are operated from a point.

Body Building.—The floors of the Body Building are designed to carry a live load of 150 lbs. per square foot. The roof is designed and built as strong as the second floor so that another story can be added at any time. The pitch of the roof is furnished by cinder fills. Each wing is arranged with a row of columns down the centre longitudinally, a column occurring every 25 ft. The floor slab, which has a span of 12 ft. 6 in., is composed of 10 in. hollow tile 16 in. on centres between 4 in. concrete joists reinforced with one ½x1½-in. bar. The cross beams carrying this floor are 14x30 in., reinforced with three 1¼x3¾-in. and two 3¾x2-in. bars. One 1x3-in. compression bar is also necessary. Every other beams rests on the columns while the beams between the supported at the centre of the longitudinal girder. Longitudinal girders are 18x36 in., reinforced with five 1¼x3¾-in. and two ¾-in.x2-in. sheared bars, and three ¾x2-in. unsheared bars.

The centre row of columns in each wing in this building are 24x24 in., carrying the second floor, and 20x20 in., carrying the roof or future third floor. The reinforcement of the lower columns is four 1¼x3¾-in. and four ¾x2-in. Kahn bars and four 1x3-in. unsheared bars. The columns above are reinforced with four 1x3-in. sheared bars and four 1x3-in. unsheared bars.

The footings for this row of columns demonstrate the elasticity of the application of rein-

First Floor of the Body Building.

Shafting Supports in Manufacturing Building.

forced concrete design. Figuring this footing as carrying two floors and the roof, a size of 12 ft. 0 in.x12 ft. 0 in.x30 in. deep, reinforced with 28—1x3-in. bars is necessary. The columns rest directly on a small cap 3 ft. 4 in. x 3 ft. 4 in. x 18 in. thick. Owing to the way in which the property previously had been cut up by the Pan-American Exposition, and also because of the poor quality of the clay, it was necessary to design the footings of all buildings at a very low bearing value, averaging between 3,000 and 4,000 lbs. per square foot. In many cases, owing to the way in which the ground was broken up by old foundations, sewers and other works, it was necessary to make a great many changes in the footings. With reinforced concrete this was very easy to do, as bad portions of the ground could be arched over or beams put in, spanning the weak spots. In many cases the outside curtain walls are not carried on a footing of their own, but a reinforced concrete sill was put in, and the walls carried on this. A great deal of time and expense was saved in this way, as in some cases it would have been necessary to go down 10 or 12 ft. below grade for proper footings.

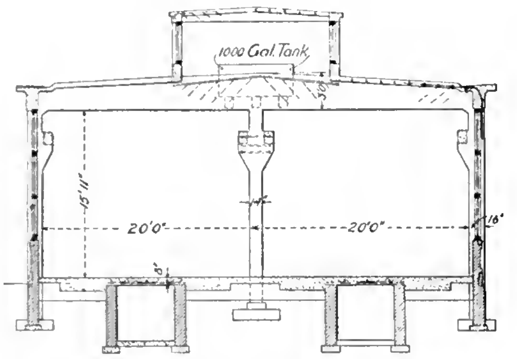
In one section of the second floor it was found desirable to construct a slatted platform at the same level as the finished floor, so that the unfinished bodies could be placed on this portion and washed down. This was arranged by dropping the concrete slab a little, making it flush with the ceiling below and building over this depressed portion a hard pine drain floor.

roof to 40 in. at the wall columns. The construction and reinforcement of the building is in the main similar to that of the Brazing Building.

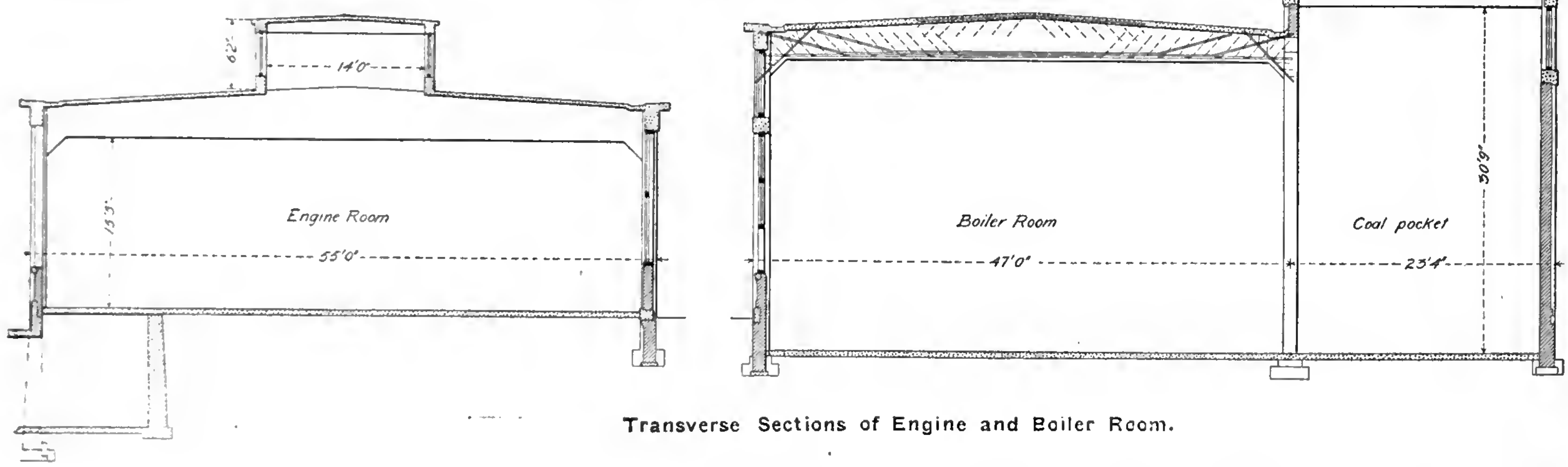
Power Plant.—The power plant supplies the different buildings with electricity for lighting and motor operation, compressed air, filtered city water, Acme gas, live and exhaust steam for heating purposes. The coal pocket is located on the side of the boiler room nearest the railroad tracks and it is 89 ft. 3 in. long, 21 ft. 6 in. wide and 30 ft. 9 in. high. A spur track enters this pocket on a trestle at a height of 13 ft. above the floor and coal is dumped into the pocket by gravity, whence it is delivered to the boiler room stokers by hand. The boilers are equipped with Jones underfeed stokers.

The boiler room is 89 ft. 3 in. long by 45 ft. wide and 25 ft. 3 in. high. It contains at present two batteries of horizontal return tubular boilers, aggregating four units, with space for a fifth, supplied by the Skinner Engine Co., of Erie, Pa. Each boiler is 84 in. in diameter and 18 ft. long, and contains 104 4-in. tubes, with Tupper grates, 84x60-in. and a 6-in. steam outlet. Each boiler discharges into a round breeching carried along the front at the top of the drums, and increasing in diameter from 30 to 54 in. From the breeching the gases are delivered to a Green economizer mounted at the end of the boiler room parallel to the longitudinal axes of the boilers, a by-pass connection being provided from the breeching directly into the chimney. The economizer is supported on columns and beams of reinforced concrete, and contains 352 4-in. tubes 10 ft. 2¼-in. long installed in two sections.

The chimney is reinforced concrete mounted on a reinforced concrete foundation. Its inside diameter is 6 ft. and its height 157 ft. It was built by the Weber Steel Concrete Chimney Co., of Chicago. Owing to the fact that the stack intersected a row of beams in the end of the building, it was necessary to carry cantilever beams to carry the roof up to and around the chimney. This construction did away with the necessity of putting in small columns, and it also keeps the stack clear of the building and the column footings independent of the stack footing.



Transverse Sections of Testing Building.



Transverse Sections of Engine and Boiler Room.

A special feature of the coal pocket is the provision therein of a reinforced concrete shavings vault 6 ft. wide, 9 ft. long and 22 ft. 6 in. high over all into which shavings are discharged by a 12-in. pipe leading from the Body Building wood working division. The boiler nearest the pump room is served almost exclusively with these shavings.

The pumps for feeding the boilers are mounted in the boiler room at the side of the battery nearest the engine room and consist of two 6x4x6-in. horizontal duplex units. Near the pumps is mounted an Otis feeder water heater. A 3-in. Penberthy injector is also available for boiler feed. The boiler room floor level is 3 ft. 3 in. lower than the engine and pump room floors.

The pump room, between the boiler and engine rooms, is 52 ft. 4 in. long by 18 ft. wide, and it contains at present one 1,000 gal. Knowles underwriter fire pump and two air compressors. One of the latter is a 12x16¼x12-in. Ingersoll-Sergeant machine and the other a 14¼x10-in. compressor of the same make.

The engine room, 79 ft. 3 in. by 52 ft. 4 in., contains space for five units. Two 200-kw. sets, a 125-kw. and a 35-kw. set are now in place, with room for another 200-kw. unit in the future. The engines were all supplied by the Skinner Engine Co., of Erie, and the generators are of Westinghouse make. One of the 200-kw. generators is direct-driven by a 15x20x20-in. engine, tandem compound type; the other 200-kw. generator is direct-connected to a 19x20-in. simple engine, and the 125-kw. generator is run by a 15x16 in. engine. The 35-kw. set has a 10x12 in. engine. The two large machines are 440-volt alterators; and the others are exciters. The switchboard is 6 ft. from the north wall, and it is 20 ft. long. It is separated by a special railing from the rest of the engine room.

The power house service is supplied to the different buildings through an 8x8 ft. concrete tunnel which leaves the engine room basement near the pump room. There are two live steam mains in the boiler room, each of which increases from 10 to 12 in. in the run past the boilers. At the end nearest the pump room the two mains are cross-connected by a 12-in. pipe which equalizes the steam pressure in the mains and provides a flexible method of securing live steam on either side. One of the mains passes into the engine room, where it delivers steam to the engines by loops dropping down to the cylinders, and the other feeds the fire pump, the two air compressors, and the buildings, via the tunnel. The tunnel line starts as a 10-in. pipe, decreasing as the different building branches are taken from it. This main line is provided with a valve so that all apparatus beyond the fire pump may be cut off.

The fire pump exhaust is a 5-in. line which rises vertically to the roof and terminates in a

In many cases it was necessary to suspend shafting, motors and machinery from the ceilings of this building, and this was done by cast-iron sockets supplied by the Trussed Concrete Steel Company.

The Body Building is separated from the Assembly Building by a court 40 ft. wide. The west end of this court is bridged over to furnish a working floor 50 ft. long by 40 ft. wide. The beams carrying this floor are 18x42 in., reinforced with five 1¼x3¾-in. and five ¾x2-in. bars. The floor construction is the same as in the Body Building. For the finished floor in both buildings 2x3-in. beveled sleepers were laid crosswise of the tile about 16 ft. on centres, the space between being filled with cinder concrete and ⅞ in. maple wearing surface nailed to these sleepers.

Motor Testing Building.—The design of the Motor Testing Building is somewhat similar to that of the Brazing Building, with the addition of two light crane runways. It is connected with the Assembly Building by a covered trolley way.

Garage.—In the Garage Building no interior columns are allowed, as it is necessary to have a large unbroken space in which automobiles can be easily moved around. The entire floor is left clear. Large spans and heavy construction resulted. The roof beams are 16x56 in. at the centre of the building, sloping with the

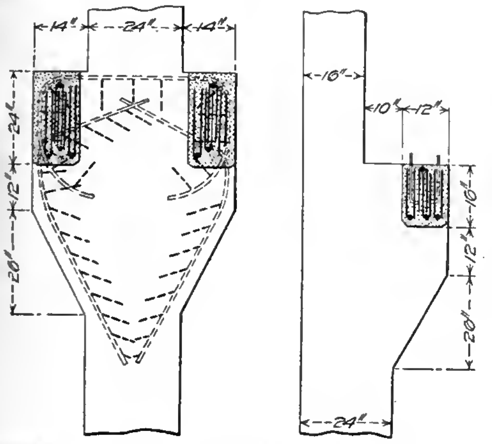
free exhaust head. The engine exhaust is collected in a basement main which reaches a diameter of 18 in. at the end of the engine room nearest the boilers, and it receives the 7-in. exhaust of the air compressors en route to the feed water heater. The heater is by-passed in the usual manner with free atmospheric exhaust.

The air inlet pipes on each compressor are 6 and 12 in. in diameter, respectively. These take air from a 12-in. pipe which runs from a concrete box under the pump room floor through the roof to a screen and hood. From the air outlets of the compressors 6 in lines are run to two receivers in the pump room, long radius bends being used on these lines. The two receivers feed the buildings through a 6-in. pipe which runs through the tunnel. A 5 in. air line also is run through the engine room to the Brazing Building, the pipe being supported on the engine room wall behind the live steam main. The fire pump water supply is drawn from the city mains through a 16 in. connection and 12 in. suction pipe, a blank flange for a second 12 in. outlet being provided for a future fire pump of the same size. The fire pump discharges into an 8 in. line, which connects with the hydrant main serving the various parts of the factory.

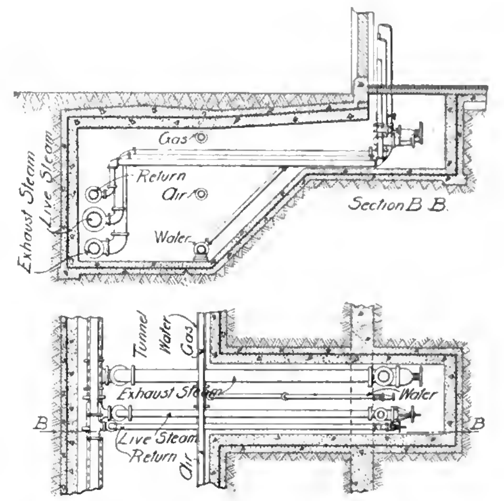
The reinforced concrete tunnel connecting the power house with the various buildings carries live steam, exhaust steam, water, air, gas and return pipes together with electric wires for lighting and power service. All the wiring conduits are carried on the ceiling of this tunnel. Branches are taken off at each building. The top of the tunnel is kept about 2 ft. below the outside grade in order to insure freedom from frost in winter. At the commencement of the tunnel the sizes of these service pipes are: Live steam, 12 in.; exhaust steam, 12 in.; water, 7 in.; air, 6 in.; air to Brazing Building, 5 in.; condensation return, 8 in.; water to Brazing Building, 6 in.; Acme gas, 4 in.; producer gas, 5 in.; water to motor-testing building, 3 in.

Heating.—The method of heating the buildings was devised by the Buffalo Forge Co. In each building a section is partitioned off for a stack of pipes through which exhaust steam is tossed. The air is forced through this heater by an engine-driven fan and discharged through tunnels beneath the floors upward through risers into the rooms. In some cases these tunnels are 6x7 ft. in cross section, and all are built of reinforced concrete. An elaborate system of fire fighting equipment is installed, and the Garage and Body Buildings are provided with an automatic sprinkling equipment because of the value and inflammability of the materials stored in them.

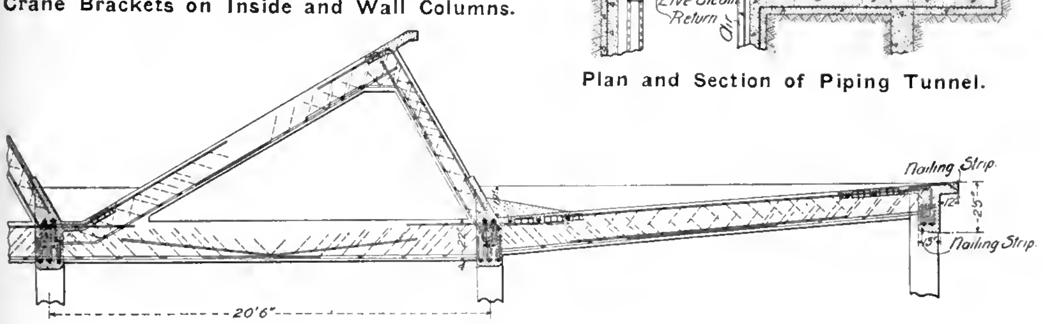
The floor area of the entire plant, including the Administration Building, is approximately 280,000 sq. ft. In the execution of the contract over 1,087 tons of steel and 178,000 sq. ft. of 10 and 8-in. tile were used, together with over 15,000 bbls. of Portland cement. On the completion of the buildings several tests were made. The crane girders in the Assembly Building were tested to twice the working load and the deflection at the centre was less than 1/16 in.



Crane Brackets on Inside and Wall Columns.



Plan and Section of Piping Tunnel.



Roof Section of Manufacturing Building.

At the Body Building a superimposed load of 250 lbs. per square foot was put over a panel, with a deflection of slightly less than 1/32 in. and no permanent deflection was observed.

The buildings were erected in six months by the Concrete Steel & Tile Construction Co., of Detroit. This was about one-third the guaranteed time for either mill construction or steel. The mechanical engineer for the power house was Mr. F. A. Shoemaker, of Buffalo.

THE PACIFIC BUILDING in San Francisco is one of the most important reinforced concrete structures yet undertaken. It is nine stories high, exclusive of a mezzanine floor and basement, and covers an area of 145x195 ft. The reinforced concrete columns are spaced on 16-ft. squares each way. The floors are 4½ in. thick and are reinforced in each direction by 22⅜-in. rods and two sets of four diagonal rods. An interesting structural feature is a spiral staircase of reinforced concrete and another is a cantilever balcony overhanging 6 ft. at the mezzanine floor. The concrete of the wainscoting and baseboards is colored and treated so as to resemble African marble. The facade is faced with terra cotta and glazed tiles in green and brown colors. The ground floor will be used for stores, the basement for a cafe, and each of the eight upper floors is laid out in 64 offices. Dean reversible windows are used throughout, and there are one freight and six passenger elevators.

The Detection of Pollution in Underground Waters.

Extracts from a paper read before the Association of Water Engineers by John C. Thresh, M.D., D.Sc.

The fact of underground water becoming polluted is too often only discovered by a sudden outburst of typhoid fever. Such would probably never be the case were the water submitted to periodical examination. This examination should not be limited to a mere chemical analysis, as from our point of view a bacteriological examination is the more important. If examinations are made systematically, the normal condititon of the water is soon ascertained; and should at any time an abnormal condition be found, its cause can be sought for, and, when detected, it may admit of a remedy. This remedy may possibly prevent outbreaks of disease which sooner or later would have ensued had not the defect been discovered and the remedy applied.

Unfortunately, the cause of the contamination is often very difficult to find, and sometimes one has to admit an utter failure to discover it; but usually this is because the water authority will not go to the necessary expense, or cannot obtain sanction from tenants or landlords to carry out the experiments required. The systematic examinations above referred to often enable the investigator to form some opinion with reference to the character of the polluting matter, and its proximity to the source of the water. For example, a certain well water yielding about a million gallons per day gives unexceptional chemical and bacteriological results save on rare occasions when there is a very heavy rainfall. Within twenty-four hours of a downpour, the number of bacteria present in the water increases enormously. Some of these are of an objectionable type; but they disappear again almost as quickly as they appeared. Chemically the water undergoes a scarcely appreciable change. Here it is obvious that the microbes do not come from any great distance—in fact, their source cannot be far from the well. Their nature indicates that they are derived from manured soil; and an examination of the surrounding area leaves little doubt as to their sources. In another instance certain objectionable bacteria appeared in a spring water supplying a small town; but their appearance was many days after an appreciable rainfall. An examination of the collecting area showed that there were large gravel pits about 200 yards away, and that recently some house refuse had been tipped therein. Experiments were carried out which established the connection between this gravel pit and the spring; showing that it would be exceedingly dangerous to allow house refuse to be tipped therein.

Before making experiments with chemicals, a careful survey of the whole position must be made. The geology of the district must be studied, the depth and section of the well and the length and direction of any adits must be known, as the records of the systematic analysis must be considered and compared with the rainfall and with the height of the water in the nearest ponds or streams. Some information must be sought with reference to the direction of flow of the subterranean water, and as to the cone of depression caused by pumping. The position of the outcrop of the water-bearing stratum may also require to be known, so that it may be examined, if not too far away to be possible source of danger. If evidence can be obtained of the presence of fissures, and of their extent and direction, it may prove of the utmost value in the investigation. All the possible sources of pollution must then be sought out and considered in connection with the knowl-

edge so ascertained. This will enable the investigator to determine which is most likely to be the cause of the trouble, and therefore the one which should first receive attention. If such experiments as will be described shortly fail to show any connection between this possible source of pollution and the spring or well, attention must be directed to the next most probable source, and so on, until something definite has been determined.

It is not always the well with apparently the best surroundings that yields water of most uniform quality, nor the well with doubtful surroundings which yields water of most varying quality. Take, as an example, the well of the Windsor Corporation Waterworks. It is sunk in the chalk on an island in the Thames—and the character of the Thames water is too well known to need description. It would seem almost certain that this well would be affected by the river, and that in times of flood the water would show unmistakable signs of being so affected. Such, however, is not the case. Careful chemical analysis show that there is a decided difference in the same saline constituents of these waters; and the bacteriological examination fails to give any indications of great rises in level of the Thames water. As another example of the opposite character, one may mention a very deep well in the new red sandstone —one of a series of four—which often shows unmistakable signs of contamination with surface water, yet the surroundings are almost ideal; and a probable source from which any polluting matter can be derived has not yet been found.

To ascertain whether a given source of pollution can affect a given well, it is usual to introduce some chemical at the point of suspicion, and then to examine the water at frequent intervals to ascertain whether the chemical selected can be detected in it. For this purpose common salt (sodium chloride), a lithium salt, or a dye named fluorescein have been employed; and recently the author has used ammonium salts, since, in certain cases, it possesses advantages over the others. Sodium chloride is used chiefly because it is very cheap, easily obtainable, quite innocuous, and easily detected and estimated in the water. As all waters contain chlorides, the normal chloride must be first ascertained, then any subsequent increase during the experiment may be attributed to the salt used. Slight variations are often observed in water from the same well. Consequently enough salt must be added to produce a more marked effect than any recorded in the normal water. The quantity must be at least equal to one grain of salt per gallon (=0.6 grains Cl.). Should it prove necessary to add this amount to a large quantity of water, the weight of salt used must be considerable. For example, it may be necessary to add sufficient salt to materially increase the chlorine content of a million gallons of water. To do this would require 1,000,000 grains, or 143lb of salt—an amount which can easily be handled and readily dissolved and passed into the soil. If, however, it is estimated that at least 100,000,000 gallons of water will have to be affected, then six to seven tons of salt must be used—an unwieldy quantity, difficult to deal with. Where anything like this volume of water has to be considered, a substitute for salt would now be used.

One of the best examples of the use of salt is recorded in connection with an outbreak of typhoid fever at New Herrington, Durham, in 1889. The well, when inspected, was found to receive water from various fissures; and one at a depth of 45 ft. from the surface came under suspicion, since the water therefrom contained more chlorides than the water entering elsewhere. From a study of the dip of the strata and direction of the fissures, it was surmised that there might be a connection with a farmyard about three-quarters of a mile away, since the sewage from this farm disappeared down a fissure and was no more seen. Two experiments were made; two tons of salt being used in the first and five tons in the second. This was washed into the fissure with an enormous volume of water. On the following day the chlorine in the water in the fissure inceased from four to six grains per gallon—its ordinary limits of variation—to 15 grains per gallon; and in six days it reached a maximum of 24 grains. A few days later it fell to the normal amount.

Another example quite as conclusive, but in which a much smaller quantity of salt was used, may also be quoted. The *bacillus coli* was frequently found in a public supply derived from a spring in the mountain limestone. The chemical analysis of the water gave uniformly good results, and the chlorine was constant at 1.6 grains per gallon. This low chlorine figure, and its constancy, did not indicate direct pollution with sewage; and a careful survey of the neighborhood led to the suspicion that the polluting matter entered at a fissure in some marshy ground about half a mile away. The soil round this fissure swarmed with the *bacillus coli* and similar organisms, probably derived from a farmyard a little distance above. A little fluorescein was placed in the water which could be seen in this fissure; and it disappeared so quickly that it was obvious that there was a rapid flow of water. It was considered too risky to put a large quantity of coloring matter in. Consequently, at 10.30 o'clock on a Wednesday morning, half a ton of salt was shovelled in, and samples of water were collected at frequent intervals from the spring. The results were as follows:—

GRAINS OF CHLORINE PER IMPERIAL GALLON IN THE SPRING WATER.

	Wednesday.	Thursday.	Friday.
9.00 a.m.	—	—	1.6
9.30 "	—	1.6	—
10.30 "	1.6	1.6	—
11.30 "	1.6	1.6	—
12.30 p.m.	1.6	—	1.6
1.30 "	1.6	1.6	—
2.30 "	1.6	—	—
3.30 "	1.6	2.1	1.6
4.30 "	2.0	—	—
5.30 "	2.0	2.1	1.6

Pumping ceased.

In this case it was obvious that the water from this fissue only entered when the level of the water in the reservoir over the spring was depressed by pumping; and on comparing the levels it was found that such must be the case, as when the reservoir was full the water level was practically the same as the level of the water in the fissure.

A salt of lithium has frequently been used instead of salt. Exceedingly minute quantities of this can be detected by means of the spectroscope. A crude lithium sulphate, which answers every purpose, can now be purchased at 4s. per lb. About one part of this salt in 1,000,000 of water may be detected—1 grain in 14 gallons —and inasmuch as lithium is not a normal constituent of potable waters, its detection after the use of salt is positive proof of direct connection between the point where the lithium has been placed and the source of the water. Unfortunately, the detection of such minute traces in a considerable amount of deposit left by the evaporation of the water is very tedious and troublesome; and to use any quantity of the substance very expensive. For these reasons lithium salts are now rarely employed.

The author has recently used ammonium chloride—sal ammoniac—in several investigations, with marked success. It is very cheap, free from color, perfectly harmless, and the ammonia, even in great dilution, admits of easy detection and estimation. When 7 lb., costing about 3s. 6d., is dissolved in a million gallons of water, the ammonia can readily be detected. The amount of ammonia present in all good subsoil waters is too trifling to interfere. But certain very deep wells, yield waters and many polluted waters contain very varying quantities of an ammonia salt might not lead to definite conclusions. It must also be remembered that the salt must be put directly into the subsoil water or fissure, as if spread on fertile ground a portion of it might be nitrified by the nitrifying organisms of the soil. Probably, however, in any case, the amount nitrified would only be an infinitesimal portion of the salt employed. On the whole, it may be regarded as much more convenient for use than either common salt or salts of lithium. In one of the experiments already referred to, where objectionable bacteria in a spring water were traced to the deposition of house refuse in a gravel pit, ammonium chloride was the salt used. The records of the experiments are as under:—

December 12th.—Four pounds of ammonia chloride placed in a hole in the gravel pit and water poured in until the salt had disappeared. Samples of water collected and examined daily until January 15th. On December 26th the water contained a distinct trace of ammonia; on no other day during December was ammonia discovered.

On January 14th the ammonia again suddenly appeared in marked quantity; but next day no trace could be discovered. The rainfall was as under:—

Dec.	12	0.02	inch
	13	0.36	"
	14	0.08	"
	15	0.19	"
	16	0.30	"
	17 to 23	0.00	"
	24	0.07	"
	25	0.31	(3½ in. snow)
	26	0.06	as snow
	27	0.15	"
	28	0.13	"
	29	0.00	
	30	0.22	snow and rain
Jan.	1	0.35	snow melted.
	2	0.13	
	3 to 5	0.00	
	6	0.01	
	7 to 9	0.00	
	10	0.20	
	11 to 18	0.00	

The heavy rains from December 13th to the 16th apparently affected the spring water on the 26th; and the rain and melting snow on January 1st and 2nd also carried the ammonia from the gravel pit to the spring, affecting it on the 14th. There is no doubt that water from the gravel pit reached the spring in from ten to fourteen days, after a heavy rainfall. Ammonium sulphate would probably answer equally as well as the chloride, and as it was manufactured on a large scale for use as an artificial manure it is much cheaper. It may, however, contain large traces of arsenic, which renders it necessary to examine the sample before deciding to use it.

Another substance of an entirely different character, which is of special importance in such investigations as the above, is a coloring matter called fluorescein. Many of the aniline dyes possess enormous colorific power; but most of them, when in very dilute solution, are colorised by filtration through soil, and others are too expensive or are objectionable in other respects. Fluorescein appears to be unaffected by passage through chalk, sand, surface soil, &c., and when dissolved in water by aid of an equal weight of caustic soda it can be easily detected by its fluorescence when the dilution is 1 in 100 millions. Under very favorable conditions 1 in 200 millions may be detected. In other words, 1 lb. of fluorescein will distinctly color 10 million gallons of water. As the demand for this substance has increased, the price has gone down, until it can now be purchased at 7s. 6d. par lb. in quantities of 10 lb. and upwards. The rel-

ative cost of these various substances used in sufficient quantity to affect one million gallons of water would be fluorescein; 9d.; common salt 2s.; ammonium chloride, 3s. 6d.; and lithium sulphate, 40s. Fluorescein is, therefore, much the cheapest; it is the easiest to apply, and far the easiest to detect. There is only one possible objection to it, and that is that, if used incautiously, it may so colour the whole of a water supply as to cause alarm on the part of the consumers. For this reason it is in most cases preferable to use salt or ammonia chloride in the first instance; and if, when used in moderate quantities, these give no definite results, to employ fluorescein. This dye has been largely used for tinting underground streams to trace their course, and to a certain extent for determining the direction and rate of flow of subsoil water, and one case is recorded where it unexpectedly made its appearance in a public water supply, and caused considerable astonishment and some alarm. More recently it has been applied for the special purposes dealt with in this paper, and some recent experiments carried out on a somewhat large scale near Cambridge may be cited as examples.

In 1905 a series of cases of typhoid fever occurred at the County Asylum near Cambridge, and the Local Government Board instructed Dr. Monckton Copeman to investigate it, and more especially to report with reference to the risk of pollution of underground water supplies by the sewage of the asylum. A detailed description of the geology of the district is given in Dr. Copeman's report. The asylum sewage was disposed of by a crude system of broad irrigation on land, which consists of a thin layer of loamy soil covering the chalk. The well supplying the asylum is about 60 ft. deep, and some 1200 ft. to the west of that portion of the irrigation area selected for experiment, and about 2500 ft. east from a well, 70 ft. deep, which furnishes the chief supply to the city of Cambridge. A hole was dug to the chalk on the irrigation area and 0.5 kilos. of fluorescein dissolved by aid of caustic soda was washed into the chalk and samples of water from pits and wells around afterwards collected for examination. The resullts not being conclusive a further experiment was made, using 5 lb. of fluorescein. The experiment was started at 11 a. m. on October 18th, and at 3 p. m. the color appeared in a pit 200 ft. N. N. E.; at 9 a. m. on the 20th it was found in a pit 700 ft. E. N. E.; at 4.30 p. m. on the 21st it was seen in a pit between the sewage plot and the pit in which it was observed on the previous day; on October 22nd it was found in the water of the asylum well; and on October 27th it was found in the water of the Fulbourne well. It had therefore taken 103 hours to travel about 1200 ft. westward, and about nine days to travel 2500 ft. to the eastward. The wide diffusion is an interesting point, as the wells both to the east and west were affected. At no time previously had these waters come under suspicion, and neither bacteriological nor chemical analyses apparently had ever indicated contamination. Dr. Copeman therefore adds: "It does not, of course, necessarily follow, because the fluorescein should have proved capable of detection at various points, inclusive of the asylum well, at so great a distance in different directions from the point at which it was introduced, that bacteria, harmful or otherwise, would be equally capable of transmission for so considerable a distance, but, nevertheless, the results of these experiments are decidedly instructive and important."

The Asylum Committee were advised to make some arrangement for dealing with their sewage which should remove all risk of the effluent contaminating either of these sources of water, and the author was requested to report upon the best method of securing this desirable result. A study of the geology of the district had led him to infer that, beyond a certain line, the underground water would be travelling in a direction away from these wells; and to prove this a hole was bored on the site, and 2 lb. of fluorescein dissolved and suitably diluted, was poured into the bore. It quickly disappeard; but although all the pits, walls, springs, &c., around were watched, no trace of the coloring matter was ever again seen. A further experiment on a larger scale was therefore decided upon, and carried out in the following manner:—Two bore-holes, 30 ft. deep, were made at opposite sides of the field selected. They were 110 yards apart, and both yielded water freely. A trench was cut from a point six yards north of the south bore to a point six yards south of the north bore. This trench was 96 yards long, 1 ft. wide, and 6 in. deep. Water was pumped from the south bore at the rate of 25,000 gallons per day; but it filtered through the trench so rapidly that a pump had to be placed in the north bore. When the second pump was started the whole of the trench could be flooded, and also a shorter trench cut at right angles and communicating with it. Pumping was kept up for three days to thoroughly saturate the ground before the fluorescein experiment was commenced on March 8th. A tub was mounted at each end of the long trench; and in each was placed 1 lb. of the dye. While pumping was continued the solution was allowed to dribble into the water as it entered the trench. The time taken in running in the solution was, on an average, four hours. Four pounds were put in on the 8th, 4 lbs. on the 9th, 2 lb. on the 10th, and on the 12th 1 lb. was run directly into the north bore-hole.

The amount of dye used would have distinctly coloured about 150 million gallons of water. Watch was kept at seventeen different points. At no time did any colour appear in the south bore-hole; but in the north bore-hole the water was tinted seven hours after the commencement of the experiment. No trace of colour appeared elsewhere until nine days later, when the water in a chalk pit 300 yards N. N. W.; on March 31st, the color observed in a well water 1200 yards further N. N. W.; and on April 7th it was detected in the marsh water near the river Cam, about 3000 yards away, still in the same direction. At no other points has any trace of color been detected. The second experiment, therefore, not only confirmed the first in so far as it showed that water from this locality did not travel towards either of the wells, but it also proved that the colored water travelled in a definite direction, which, fortunately is quite away from the sources of supply. The depth of color observed has never been greater than that produced by 1 part of the dye in 130 million parts of water, save at the north bore-hole, where it was much more deeply tinted.

To do away with any doubt as to whether bacteria can be conveyed from any given point to a deep source of water, it has been suggested that certain easily recognized bacteria should be introduced into the soil at the point where pollution is suspected to arise, and to examine the water repeatedly for the special bacteria. Experiments of this kind have been recorded, and it has been shown that bacteria can be washed by very heavy rain through a few feet of soil into collecting trenches beneath, but they have never been traced any considerable distance. The author's experience with this test, using the bacillus *prodigiosus*, has not led him to regard it with any favor, nor would it justify him in recommending it, though one can conceive cases in which such a test would afford information of some value. Some time ago, the author commenced a series of experiments in a brick channel about 36 ft. long, 1 ft. wide and 3 ft. deep. A little shingle was placed along the bottom, and the trench was filled up with fine sharp sand, such as is used by builders. At intervals of a yard glass tubes 2 in. in diameter were inserted 2 ft. into the sand, and water was run in until the water level was about 1 ft. from the surface. Water was then allowed to flow away slowly from the bottom of the trench at the opposite end to that at which the water was being introduced, and a condition of equilibrium maintained. An emulsion of the *bacillus prodigiosus* was then placed in the tube nearest the water inlet, and samples of water were collected from the other tubes and also from the outlet. In every experiment the bacillus was detected in the outlet water in a few hours, but it was never discovered in the water in the tubes. Apparently the microbes were first carried downwards into the shingly layer and then carried forward to the outlet. The results merely showed that polluting matter on a collecting area may pass downwards, get into a stratum of greater porosity, and then travel a considerable distance.

Afterwards the same organism was used in connection with the gravel pit referred to in the ammonium-chloride experiment, but the bacillus never showed itself in the spring water. As there is undoubtedly a connection between this gravel pit and the spring, as was proved by the ammonium-chloride test, possibly one might conclude that it was not of such a character as to permit of objectionable bacteria going into the spring water.

The difficulty and trouble in carrying out such a test are very great, and the instances in which it is desirable are very few. Possibly in every case a comparatively simple experiment with fluorescein, together with a series of ordinary bacteriological examinations, would give more valuable and reliable information.

ANOTHER POLAR RAILWAY is contemplated by a leading Russian engineer and contractor named Knorre, who has recently received the concession for the Polar-Ural R. R. He has been over the entire route and says that it is perfectly practicable, with an easy grade over the Ural Mountains. This road is intended to help the development of agricultural western Siberia. It will be the outlet and inlet for the splendid water freight routes of the Yenesei and Ob rivers and of the Irtish, the great tributary of the Ob. It will more than double their importance, because it will do away with the difficult, dangerous and uncertain navigation of that part of the Arctic Ocean called the Kara Sea. The railroad that will now be built will start from Obdorsk on the Ob River at the Polar Circle and extend northwest across the tundra to Bolvansk Bay, the southern part of Pechora Bay, about 266 miles. As compared with the Kara Sea route the railroad will shorten the distance between the Siberian rivers and the ports of western Europe by about 1,000 miles, as by the route now used vessels have to travel far north to circumvent the Jalmal Peninsula. Pechora Bay is open for commerce more than four months in the year, and the navigation season on the great rivers of western Siberia is still longer, while in the great grain region of the southwest on the upper Ob and the Irtish it is six and a half months. All the large trade centres of the southwest, as Tobolsk, Pavlodar, Semipalatinsk, Tomsk and Barnaul are on the Ob and Irtish highways leading direct to the railroad, whence the journey will be safe and easy to all the leading ports of northwest Europe.

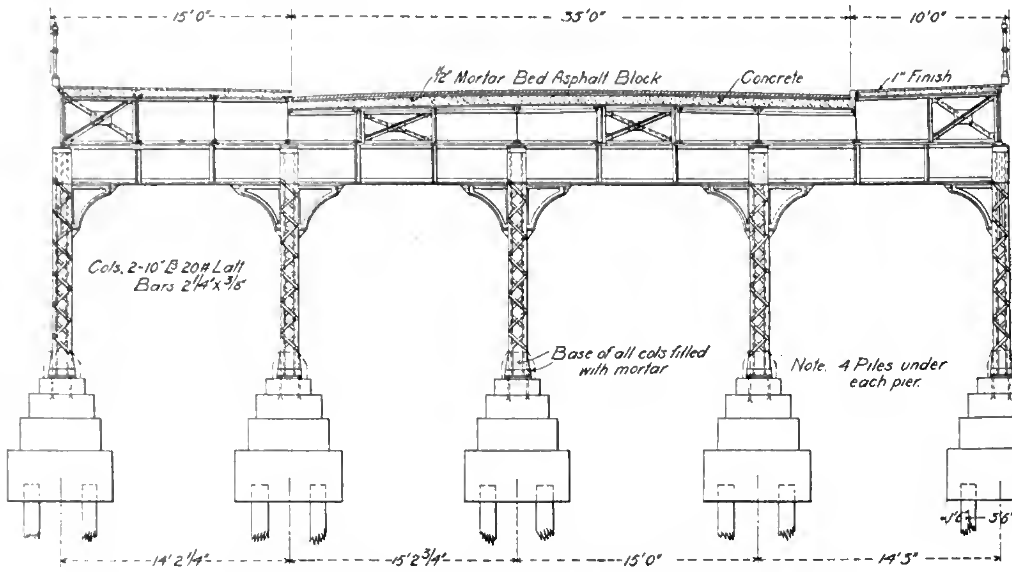
Elimination of Grade Crossings in New York Central Electric Zone.

The frequent train service inaugurated in connection with the electrical operation of the New York Central & Hudson River R. R. has made it necessary for the safety of the public and the efficient movement of the traffic that all grade street crossings within the Electrical Zone in New York City be abolished. This is being accomplished at some points by means of overhead bridges and at others by carrying the street under the elevated track. At the High Bridge and Morris Heights stations the former plan has been adopted. At these stations the four tracks of the Hudson division and the two tracks of the Putnam division occupy a strip on the east side of the Harlem River parallel to the river's general course and 150 to 300 ft. from the water's edge. The tracks are a little higher than the wharves along the water front. The station buildings at High Bridge and Morris Heights have their main street entrances on the second floor, which is at the same elevation as a steel girder bridge 10 ft. wide which in each case extends along the front of the station across the railroad tracks. This bridge connects at its west end with an incline leading down to the area along the water front and at its east end with one or the other of the streets mentioned in the title. In construction and design the structures over the railroad tracks afford no features of special interest. Their east approaches are formed by earth fill between dry rubble masonry walls. The construction of the west approach in each case, however, involves heavy concrete work which has been handled by efficient methods.

At the Depot Pl. or High Bridge station the approach to the west end of the bridge over the tracks consist of a straight ramp about 525 ft. long which extends southward parallel to the railroad track and the bulkhead line close to the former. This ramp, which is on a 4.3 per cent. grade, consists of an earth fill between plain concrete walls having the maximum and minimum sections shown in an accompanying illustration. The clear width between the coping courses is 23 ft. 2¾ in. Of this, 5 ft. along the river side is devoted to a bluestone flag sidewalk and the remaining width is occupied by a granite block pavement on a sand foundation with a single gutter along the sidewalk curb. The wall concrete is a 1:3:6 mixture of Lehigh Portland Cement, sand and gravel and the coping concrete is a 1:2:4 mixture of the same materials. Tongue-and-groove 2-in. pine plank forms in 2½x16-ft. units are used and a 1-in. finishing coat of 1:2 cement mortar is applied as the wall concrete is laid by means of thin sheet-steel finishing plates.

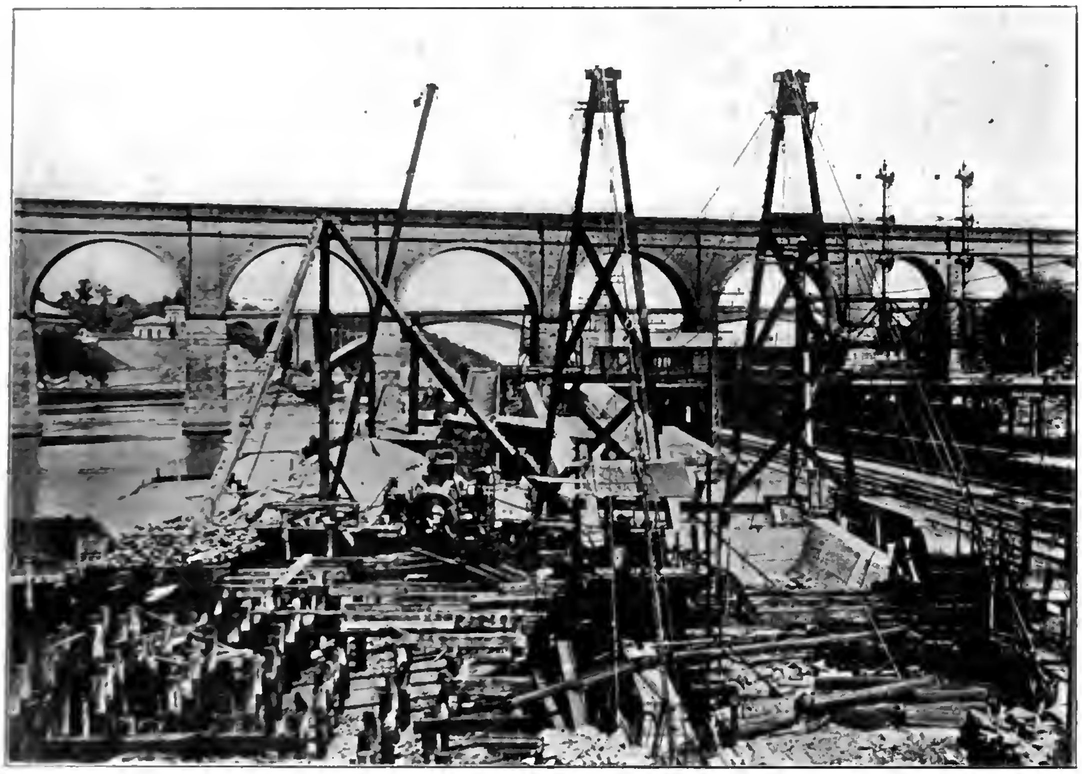
The wall footings are about 6½ ft. below mean high water and rest on piles, 20 to 55 ft. long, whose tops are embedded 1½ ft. in the footing concrete. These piles are placed in three longitudinal rows where the over-all height of the wall exceeds about 24 ft. and in two rows where the wall is lower. The spacing of the piles in each line varies from 3 to 4½ ft. according to the weight supported.

The two walls have been carried forward from the lower toward the upper end of the ramp in 59-ft. sections, the work alternating from one wall to the other. Expansion joints are formed with one thickness of heavy tar paper placed as shown in accompanying sketches. Wooden sheet piling is used and two Cameron steam pumps, sizes 9 and 11 have been employed to keep the water down while the footing concrete was placed.



Section of Steelwork of Morris Heights Approach.

Near the south end of the ramp the roadway is carried over an old abandoned canal, the bottom of which is above low tide, with a plate-girder and reinforced concrete bridge. There are three 42½-in.x36-ft. girders placed 13 ft. ⅝ in. on centers carrying 15-in. 42-lb. I-beam floor beams on about 6-ft. centers. The 13x6-ft. panels thus formed are covered with a continuous 7-in. slab of concrete reinforced in a direction parallel to the course of the canal with ¾-in. round steel rods on 12-in. centers and in a direction parallel to the center line of the ramp with the same size rods on 6-in. centers. This canal formerly served an entrance to a neighboring coal yard, but it was abandoned long ago.



Approach to Bridge over Railroad Tracks at High Bridge Station.

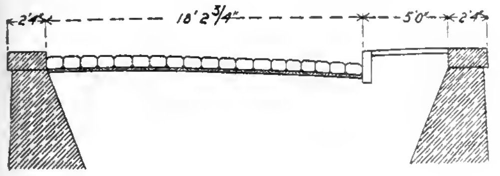
Sand and gravel is delivered alongside the work on lighters holding about 600 cu. yd. each. Each lighter is loaded with both materials, the proportions being the same as required for the concrete. The boats are unloaded by shoveling the material into 1-yd. buckets which are delivered to storage piles near the mixer on shore or to the mixer itself by a stiff-leg derrick placed at the water's edge on the north side of the canal and operated by a Lidgerwood hoist. The 1-yd. Smith mixer is placed near the derrick on a slightly elevated platform and delivers to 1-yd. buckets which are conveyed to the proper point along either wall by two cable-ways, one over each wall. One of these cableway outfits was made by the Lidgerwood Mfg. Co., New York City, and the other by W. A. Crook & Bros., Newark, N. J. The cableway engines are mounted one on the extreme south end of each wall and the guyed A-frames forming the towers are placed on the south abutment of the canal bridge and beyond the north line of the bridge over the railroad tracks, as shown in an illustration. Steam is supplied to the various engines and pumps by a 60-h.-p. Erie boiler and a 40-h.-p. locomotive boiler formerly used on the New York elevated railroad. These boilers are in a shed about 100 ft. north of the old canal and close to the west wall of the ramp. The cableway conveyors are being used to deliver the filling material which is brought alongside the work on scows and placed between the walls before the coping courses are built.

For the convenience of the users of the water front at the High Bridge station, pending the completion of the permanent improvements, a timber incline has been built just outside the west line of the west wall connecting at its upper end with the bridge across the track.

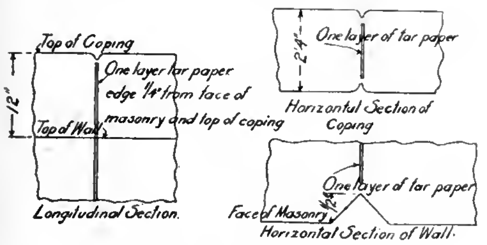
At the 177th St. or Morris Heights station the bridge over the tracks will be extended westward about 141 ft. by a similarly designed elevated steel structure 60 ft. wide, carried by five longitudinal lines of latticed columns spaced 34 ft. 8 in. center to center in each line. The longitudinal floor

girders are spaced in general on about 5-ft. centers, thus dividing the floor into long panels about 5 ft. wide. The 9-in. reinforced concrete floor carrying the 35-ft. roadway, rests on the longitudinal girders and is reinforced with ½-in. round rods, those parallel to the girders being on 12-in. centers and those perpendicular to them being on 6-in. centers. A 15-ft. cement sidewalk extends along the north side of the bridge roadway and a similar walk 10 ft. wide is on the south side. These sidewalks and the roadway slope downward on a 4 per cent. grade to the extreme west end of the steel structure where they meet a concrete and earth fill incline U-shaped in plan, as shown in accompanying illustrations.

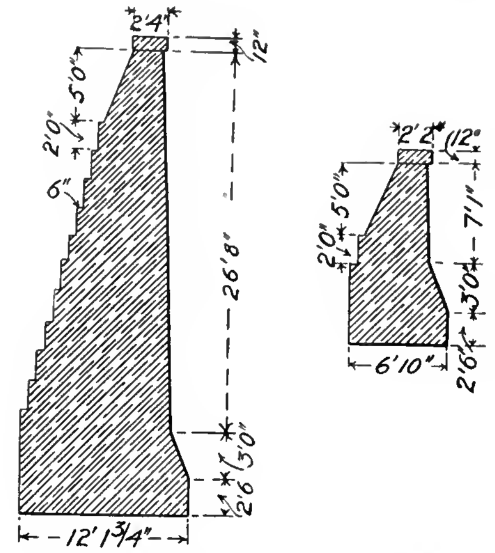
In general, the concrete walls of this plant have the same sectional form as those at High Bridge and are built of the same materials in the same proportions. The high transverse wall at the east end of the earth fill, however, has a much heavier section than the other walls since it serves as an abutment for the west end of the steel



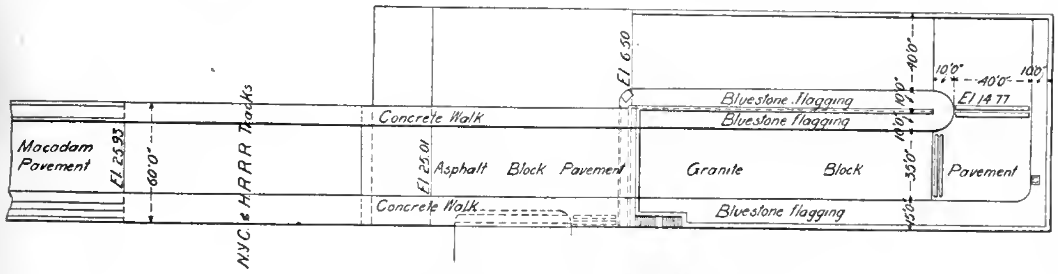
Section of Ramp at Depot Place.



Expansion Joint.



Maximum and Minimum Wall Sections at Depot Place.



Plan of Approach at Morris Heights Station.

structure. The pile supporting these walls are 20 to 53 ft. long.

Sand and gravel is delivered at Morris Heights in lighters, as at High Bridge. During the early stages of the work these were unloaded with 1-yd. buckets handled by a small stiff-leg manually-operated derrick. The abutment and the center and north walls were constructed first. While this work on these was in progress, the mixer, a 1-yd. Smith machine, was placed on a slightly elevated platform near the middle point of the center wall on its south side. Sand and gravel was hauled from the lighters to storage piles near the mixer in dump wagons and the mixer was served from the storage pile by wheelbarrows. The mixer delivered to 1-yd. buckets which were handled by a stiff-leg derrick with an 85-ft. boom, placed between the center and north walls about 80 ft. west of the abutment wall and operated by a Lidgerwood hoist. Later during the construction of the west and south walls the mixer was placed in the corner formed by the south and west walls on an elevated platform, the small derrick was replaced by one with a 70-ft. boom operated by a Lidgerwood hoist, and the large derrick mentioned before was mounted at the west end of the center wall from which point it could reach the mixer and the forms for the west and south wall.

In handling the water encountered at Morris Heights, two Cameron steam pumps of the same sizes as those at High Bridge were used. Steam was supplied to the pumps and hoists by a 60-h.-p. Olney & Warren boiler placed near the east end of the south wall.

The structures immediately over the railroad tracks were built by the New York Central & Hudson River R. R., and the approaches are being constructed by the City of New York. Mr. Josiah A. Briggs, chief engineer of the Borough of the Bronx, New York City, exercises general supervision over the work which was planned and is being executed under the immediate supervision of Mr. S. C. Thompson, principal assistant engineer of highways. The approaches at High Bridge and Morris Heights are being constructed under one contract, Mr. J. C. Rogers being the contractor. The construction work which is now in charge of Mr. Chas. Gartensteig, assistant engineer, was begun by Mr. R. H. Gillespie, assistant engineer, who resigned last May to take up other work. The American Bridge Co. will fabricate and erect the steel structure at Morris Heights.

RAILWAY STATISTICS from advance sheets of "Poor's Manual" show that the average receipts per passenger-mile in 1906 were 2.011 cents, as against 2.028 cents in 1905. The average revenue per ton-mile in 1906 was 0.766 cent, as against 0.784 cent in 1905. At the close of the year there were 222,635 miles of railway.

Sewage Disposal Results at Berlin, Ont.

A sewage disposal plant, comprising two septic tanks, two storage tanks, a pumping station and

TABLE 1—AVERAGE RESULTS OF TESTS TO DETERMINE EFFICIENCY OF SEWAGE DISPOSAL PLANT AT BERLIN, ONT.

Description.	No. of Specimens Examined.	Parts per 100,000 — Free Ammonia.	Parts per 100,000 — Albuminoid Ammonia.	Parts per 100,000 — Chlorine.	Percentage Removal by Septic Tanks and Beds of Albuminoid Ammonia Over Raw Sewage.	Percentage Removal by Each Bed of Albuminoid Ammonia from Septic Tank Effluent.
Raw sewage	19	2.935	1.406	29.13	....	....
Septic tank effluent	20	2.450	0.723	27.08	48.5	....
Beds 1 and 2	13	0.594	0.172	20.23	87.7	76.2
Beds 3 and 4	10	0.982	0.169	21.08	87.9	76.6
Beds 5 and 6	11	0.798	0.133	20.78	90.5	81.6
Beds 8 and 11	7	0.5735	0.1159	20.40	91.8	84.0
Beds 9 and 10	9	0.305	0.093	14.83	93.9	87.1
Bed No. 12	8	0.142	0.080	21.05	94.3	88.9
Bed No. 13	8	0.342	0.089	22.82	93.6	87.6
Bed No. 14	8	0.291	0.118	18.37	91.6	83.6
Bed No. 15	3	0.3413	0.0437	18.43	96.9	94.0
Bed No. 16	10	1.176	0.131	24.44	90.6	81.8

14 acres of intermittent sand filters in 16 beds was placed in operation at Berlin, Ont., in 1905. Since then samples of sewage from various parts of the plant have analyzed by the chemist and bacteriologist of the provincial board of health of Ontario from time to time to determine the efficiency of the plant. The average results determined by these tests are given in the accompanying table. From these results it may be seen that the average removal of albuminoid ammonia from the raw sewage by the septic tanks and filters was 91.8 per cent., and the average removal of albuminoid ammonia from the effluent of the septic tanks was 84.14 per cent. On no occasion was the effluent from the filters putrescible.

This sewage plant and the conditions governing its design and operation were fully described in The Engineering Record for Dec. 23, 1905. Briefly, the combined capacity of the septic tanks and storage tanks is 500,000 gal., which is approximately the average daily sewage flow. Of this flow nearly 200,000 gal. is trade wastes from a brewery, a woolen factory, a gas works and four tanneries. Formerly these wastes rendered the sewage particularly difficult to treat, but a series of experiments conducted prior to the construction of the disposal plant demonstrated that they could be made much less harmless by simple treatment of different kinds before being turned into the sewers. Provisions have been made for the preliminary treatment of these wastes so that their influence on the activities of the septic tanks and filter beds is much reduced.

The disposal plant was designed by Mr. Wm. Mahlon Davis, consulting engineer, of Berlin, Ont., who has supplied the data concerning the results obtained by it.

A TURBINE TEST of a 1,000-kw. Allis-Chalmers unit was recently made at the power-house of the Kokomo, Marion & Western Traction Co. by Mr. Paul Diserens of Purdue University and representatives of the owners and builders. The turbine was designed for 1,000 kw. at 1,800 r.p.m., using dry saturated steam at 140 lb. at the throttle and 28-in. vacuum at 30-in. barometer. The auxiliaries include a motor-driven exciter, a steam-driven exciter, two small circulating pumps, and a standard Allis-Chalmers turbo-jet condensing apparatus. The average load during the test was 553.3 kw. and the run was 4 hours. The steam pressure at the turbine throttle was 136.4 lb. and at the turbine inlet 61.9 lb. The vacuum was 26.59 in. with the barometer at 28.98 in., equivalent to a vacuum of 27.66 in. with a 30-in. barometer. The turbine ran at 1,800 r.p.m. The water used was 55,662 lb., the drip 450.6 lb. and the boiler leakage 5,344.6 lb. The moisture in the steam was 2.82 per cent. by calorimeter. Dry steam supplied to the turbine per hour 12,115 lb., and the actual consumption 21.9 lb. per kilowatt-hour, the guarantee at half load being 24 lb. with a 28-in. vacuum.

A Method of Tunneling High Railroad Embankments for Culverts.

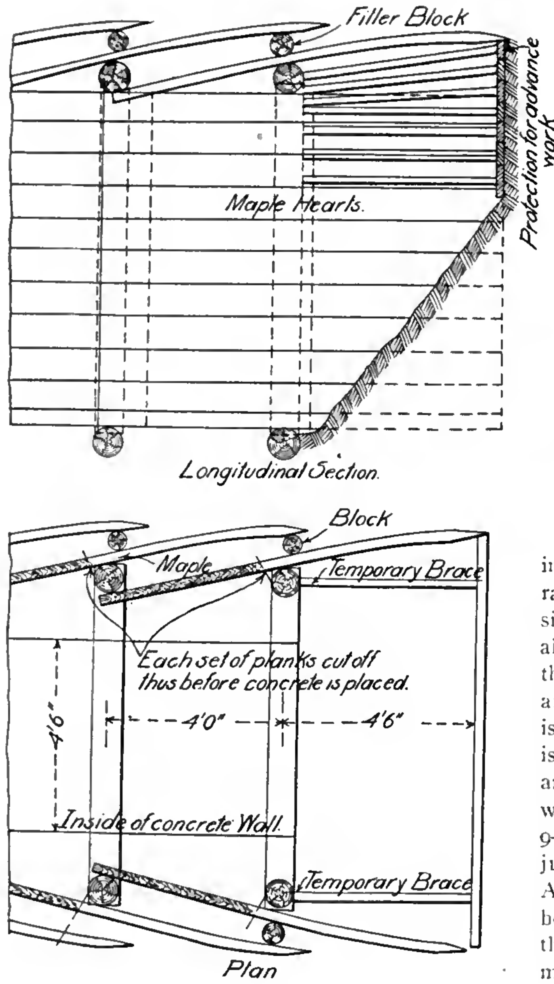
A wooden-box culvert and two cast-iron pipes which have failed under high embankments of sand on the Lake Superior & Ishpening Ry. are being replaced by reinforced-concrete culverts built in tunnels driven through the embankments. A flat-top reinforced-concrete culvert, 190 ft. long, 4.5 ft. wide inside, 4 ft. high at the sides and with a curved invert, giving it a clear inside height of 4.5 ft. at the longitudinal center line, is being built to take the place of a 60-in. cast-iron pipe which failed under an embankment 65 ft. high. A concrete culvert, 284 ft. long and 3x3 ft. in cross section inside, replaces a 36-in. cast-iron pipe under a 95-ft. fill, and one 150 ft. long and 4x4 ft. in the clear in cross-section will supersede the wooden-box culvert which is under a sand fill, 50 ft. in height.

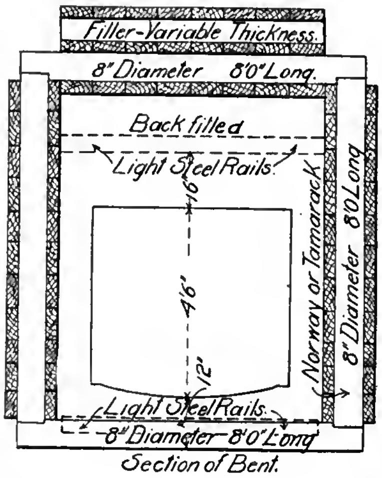
One of the embankments through which these culverts are being constructed was made eleven years ago, when the road was built and the other two, seven years ago, at the time a cut-off from the original line was built. Their height and the material in them precluded any possibility of constructing the culverts in open cut, so a tunnel had to be built through each of the embankments. The comparatively small cross-section required in these tunnels, the character of the sand through which they were to be driven and the necessity of avoiding settlement that would interfere with the heavy traffic on the track carried by the embankment necessitated the adoption of a method of tunneling which would insure both safety and economy.

The tunnel for the largest culvert is 6x7.5 ft. in the clear inside the timber lining, and those for the two smaller culverts are of proportionate size. The method of excavating and timbering the three tunnels is practically the same, so one description and the accompanying illustration will suffice for all. The timbering consists of framed bents of Norway pine or tamarack logs, at least 8 in. in diameter, and 3-in. hard-maple planks for sheeting on the sides and top. The bents are spaced 4 ft. apart on centers, each bent having a bottom sill, two vertical posts and a cross brace connecting these posts at the top, these pieces all being in 8-ft. lengths. The sheeting is driven as closely together as possible and is arranged so a double row of it with a space between the rows, is provided on both sides and the top at all places.

After a start has been made in the side of the embankment by setting two bents in their regular positions and driving the sheeting, the excavation and timbering is carried forward through the balance of the tunnel by the following method: The face of the excavation is closely sheeted with horizontal planks placed against the front side of the last bent erected in order to hold back the fine sand; these planks extend from the bottom of the tunnel to the sheeting at the top so as to prevent the sand from running into the tunnel and undermining the embankment. When this seal has been placed in a manner that will be explained, 3-in. planks in 9-ft. lengths are driven over the top brace of the foremost bent, against which the seal rests. These 9-ft. planks are driven with a slight inclination upward so when they have penetrated until their rear ends are under the second foremost bent, their front ends are over the site of the next bent to be placed and clear the top brace of that bent 8 in. to 1 ft. The planks of the seal across the end of the excavation are then removed one at a time, beginning at the top, and as they are taken out the sand is excavated under the roof sheeting which has been driven ahead of the foremost bent. The planks forming the side sheeting are driven one at a time as this excavation progresses. These side planks are slanted upward to correspond with the slope of the roof planks, and are also pointed so they diverge outward from the center line of the tunnel. They are in 9-ft. lengths in order to form the double row of sheeting on the sides, their arrangement in regard to the bents being the same as in the roof planks. That is, the rear end of each plank is against the inside of the vertical post of one bent; midway, the plank is against the outside of the vertical post of a second bent, and at the forward end is 8 in. to 1 ft. clear of the third bent, each set of planks extending past three adjacent bents.

As the planks forming the seal at the end of the tunnel are removed, the excavation is carried ahead to the site of the next bent to be placed, the material being shoveled into cars, which are pushed out by hand. When necessary, as it usually has been in this work, a seal for the new face is started at the top of the tunnel and carried to the bottom of the latter as the excavation proceeds, the planks being braced temporarily against the bent already placed. After the excavation has been carried forward to the next bent in this manner, the side sheeting driven and the new seal completed, the bent is built up in position. Filler blocks are placed meanwhile between the two rows of sheeting where the latter pass the bent, in order to prevent the projecting part of the outer planks from breaking when the excavation advances further. The cycle of operations is then repeated in this manner until the tunnel has been finished.





Timbering for Tunnels under Embankment.

The sheeting planks could scarcely be driven by hand in the limited room available, and through the hard driving encountered, so a simple battering-ram device that has been improvised for driving them has proved particularly advantageous. A 12x12-in. timber, 12 ft. long, is fitted with a hook near the middle, by which it can be hung from a chain; the chain is attached to the rear one of two pieces of 2-in. pipe placed across the tunnel about 3 ft. apart, near the roof, and just back of the point where work is in progress. A handle is attached on each side of the ram so two men can swing the latter back and forth and drive the plank. As the plank advances the ram is moved forward to the second pipe. The planks are driven quite rapidly and easily in this manner.

Four or five men work in the tunnel while the excavation and timbering is in progress, one man frames the bents and timbering outside the tunnel and a foreman is in charge of the work. With this force an average of about 4 ft. of tunnel is completed each 10-hr. shift.

The construction of the culvert was not started until the tunnel had been finished. The invert of the culvert is 18 in. thick at the sides and 12 in. thick at the middle. The sills of the bents are imbedded in the concrete and two pieces of light rails are placed horizontally between each two sills as reinforcement. The top of the culvert is also reinforced with light rails. In construction, the invert is built first for a considerable length, after which the side walls and the top are finished at one operation. The concrete of the sides is extended back to the outer row of sheeting, and in order to accomplish this the inner row, which is formed by the rear half of each set of 9-ft. planks, is removed by cutting off the planks just back of the middle bent covered by each set. As the culvert is finished, back filling is rammed between the top of it and the sides and roof of the tunnel lining, so settlement of the embankment will be prevented when the timbering decays, as it may do eventually.

The concrete materials are delivered along the track on the embankments in a special form of quick-dumping car, so very little delay is occasioned to train movements. A concrete mixer is set up at the mouth of the tunnel, the materials being delivered down the side of the embankment in chutes to storage piles at the mixer.

The cost of the tunneling, including all labor charges and the cost of timbering, was about $7 per foot for the 8x8-ft. tunnel. Laborers were paid $2.25 and the foreman $3 a day. The 3-in. maple planks used for sheeting were rough heartwood, costing $12 a 1,000 ft. The timbers for the bents were Norway pine or tamarack in logs, except that they were cut at each end for framing. The cost of the concrete culverts is not available at this time, but is probably at least no more expensive than such work done in the open, as no outer forms were required.

This work is being done under the direction of Mr. R. C. Young, chief engineer of the Lake Superior & Ishpeming Ry., to whom this journal is indebted for the information from which these notes were prepared.

Book Notes.

Every few weeks an inquiry reaches this journal for information concerning plunge baths, particularly their heating. A little book that answers these questions in much detail has just been written under the title of "Swimming Pools" by Mr. John K. Allen. It describes their construction, water supply and heating, and gives detailed directions for the selection of apparatus for the latter purpose. A number of installations of different types are illustrated and altogether the book is a decidedly good one. (Chicago, Domestic Engineering, 50 cents).

A large number of tables in regular use by the engineering department of the Trussed Concrete Steel Co. have been published with explanatory text under the title of "Kahn System Standards." Although some of the pages are trade arguments, the volume is esentially a handbook of the practical calculation and application of reinforced concrete, of marked value to those using this system of reinforcement. The beam and girder tables are based on the following assumptions: (1) A section plane before bending remains plane after bending. (2) The tensile strength of the concrete is entirely neglected. (3) There are no initial strains in the beam. (4) All shearing strain is provided against and there is no slipping between the concrete and steel. (5) The modulus of elasticity in concrete is constant. The tables are extended to include T-beams and also beams in which the design is limited by the compression of the concrete and the full tensile strength of the steel is not developed. Reinforced concrete floor slabs and the floors composed of tile and reinforced concrete are covered by the tables, and there are special beam tables of safe loads uniformly distributed which are arranged like the tables of steel beams issued by rolling mills. The tables of column strength relate to hooped and unhooped types, and those relating to footings are unusually extensive. The book also contains the tables of earth, grain and coal pressures which are used by the company's engineers, a digest of part of the requirements of the building codes of New York, Chicago, Philadelphia, Boston and San Francisco, and drawings and tables of standard highway and railroad culverts and arches. At the end there are some excellent rules for construction and tables of the amount of material required for mortar and concrete of different proportions. (Detroit, Trussed Concrete Steel Co., $1.50.)

A complete description of the new water works of the Swedish capital, written by Major F. V. Hansen, gives an account of an undertaking containing many features of design and construction different from those usually adopted in the United States. The title of the book is "Stockholm's Nya Vattenledningsverk vid Norsborg," and it is pubished by K. L. Beckman, of Stockholm. The supply is drawn partly from wells and partly from a large lake. The well water is treated to remove the iron it contains and the lake water is filtered, slow sand filters roofed over with steel trusses and skylights being employed. There is a pumping station connected with the works, a long tunnel, a covered reservoir, inverted syphons, a reinforced concrete aqueduct and many less important features of interest. Their details and cost are stated quite completely and the text is illustrated with many engravings and plates.

The second section of the third part of the cyclopedic "Handbuch fuer Eisenbetonbau," published under the editorial direction of Dr. F. von Emperger, is particularly useful. It opens with an explanation of the theory and design of reinforced concrete reservoirs and vats, underground, surface and elevated, for holding water, wine and other liquids. So many elevated towers are now being considered that the portion of the book outlining the steps to be taken in computing their parts is likely to prove useful to a large circle of readers. The author, Mr. Richard Wuczkowski, of Vienna, also describes many completed structures, a number of them being in the United States. The next division of the book, by Mr. Fr. Lorey, of Bernburg, is a description of the design, construction and test of reinforced concrete pipes, conduits and aqueducts, ranging in size from small sectional pipe carried in stock like vitrified clay sewer pipe to large ornamental aqueduct bridges. Mr. B. Nast, of Frankfort, contributes a short chapter on the uses of reinforced concrete in mine shafts, tunnels and large subways, and Mr. A. Nowak, of Vienna, continues the subject, closing with a description of some unique snowsheds and avalanche galleries. The book is profusely illustrated. (Berlin, Wilhelm Ernst & Sohn, 15 marks).

The voluminous paper on "Elevating and Conveying Machinery in Steel Works and Rolling Mills," read by Prof. G. Stauber at the annual meeting of the Society of German Iron Masters last May, has been reprinted in pamphlet form for sale at 4 marks by August Bagel, Dusseldorf. The illustrations are profuse and cover a great range of machinery, particularly heavy apparatus like special cranes, machines for handling ingots and the like.

A small handbook of the principles governing the design of water power and water supply works, apart from machinery and reservoir details, has been written by Mr. Ferdinand Schlotthauer under the title "Ueber Wasserkraft—und Wasser-Versorgungsanlagen." Its methods are those well known through the famous "Huette" pocket-book and the "Handbuch der Ingenieurwissenschaften." There is nothing particularly novel in the contents, but it explains clearly the steps to be taken in designing small power canals, weirs, penstocks, aqueducts, syphons, and systems of street mains. The engineer who is not looking for details of theory and the design of large works where the minor points are so important that the engineering work becomes complicated, will doubtless find this little book sufficient for his needs. (Munich, R. Oldenbourg).

Students of mill architecture will find a large amount of valuable information on the 25 plates of details in Mr. H. W. Morton's "Details of Mill Construction." This is a quarto volume of drawings for actual mills or sketches made from measurements of existing structures. All the text is lettered directly on the plates with the exception of a few general statements which the author gives in his preface. All drawings have been endorsed by the Boston Board of Fire Underwriters as being in conformity with their requirements. Some of the details call for much less expense than others, so that the reader has quite a range of choice in the designs for the same purpose. The sketches are useful to designers of stores, warehouses, power stations and stables as well as mills. (Boston, Bates & Guild Co.).

Messrs. Henry C. Horstmann and Victor H. Tousley have written a pocket-book entitled "Electrical Wiring and Construction Tables" which seems to be well adapted for the use of foremen on work. It gives direct and alternating current wiring tables and diagrams and an explanation of their use, a chapter on methods of obtaining the utmost economy in laying out wiring jobs, numerous conduit diagrams and a large amount of miscellaneous information relating directly to wiring. The book is small enough to be carried readily in the pocket and is bound in limp leather. (Chicago, Frederick J. Drake & Co., $1.50.)

The U. S. Forest Service of the Department of Agriculture has recently published two books of general interest to those who appreciate the importance of greater care in the use and maintenance of our timber resources. These books show how many advantages will eventually result from the system of federal control over the important timber tracts now known as national forests. Some people have the idea that these lands are great restricted picnic grounds into which the public may intrude only in fear and trembling, prohibited from breaking a branch or culling a posy. As a matter of fact, the homeseeker can travel all through a national forest, pick out the agricultural land he desires, settle there and live for the rest of his years on this tract. The policy of the Forest Service is to encourage such settlement, for it enables more men to be secured promptly to fight forest fires. prospecting and mining go on just as before, and uncontrolled lumbering alone is stopped. The timber is not made useless, however, for not only is it given away to the home-builder and to the prospector, but it is sold for commercial purposes as well, provided the trees may be felled at the time without interfering with sound forestry principles. All these things are explained in considerable detail in the "Use of the National Forests," a well illustrated handbook which contains also considerable information regarding the location, extent and character of the various reservations. The reader who desires to become familiar with all the regulations issued by the Department of Agriculture to govern forest reservations will find the complete text in the "Use Book," which is an annotated collection of these rules and instructions showing every detail of the conditions under which the public may make use of the national forests.

The water, gas and drainage piping and fixtures that are used in buildings are governed generally by the rules of the local building department. These rules are necessarily drawn up to insure sanitary conditions when the job is done with the cheapest materials in the least exensive manner possible to satisfy a minimum hygienic standard. This grade of work and materials is not that desired by most owners, and for this reason it is not possible for them to rely on the specifications of the building department or the inspection of its employes. It is therefore desirable to have the specifications for such work prepared by somebody who is thoroughly familiar with the various grades of installations and to have the job under constant competent inspection as it progresses. This is likely to save money and future annoyance to the owner in the long run, and the reason it has not been done better in the past is the fact that only a sanitary specialist, plumber or fitter really knows where to look for intentional or careless or ignorant mistakes. In order to supply just such information Mr. William Paul Gerhard has prepared a book entitled "The Superintendence of Piping Installations in Buildings," in which he gives the results of an experience covering more than 25 years in planning and supervising such work. The book is prepared so as to be equally useful to architectural superintendents, plumbing and health inspectors, plumbing superintendents and the owners who wish to assure themselves that the sanitary work done on their property is properly executed. The book takes up the superintendent's responsibilities in the order in which they come to him, starting with the sewer, gas and water connections from the street and passing through the rough work and the setting of

fixtures to the tests and the preparation of final records and plans. There is a very general need for such a book and this one answers the requirements admirably. (New York, McGraw Publishing Co., $1.00).

The American Society of Mechanical Engineers, 29 West 39th St., New York, has reprinted the presidential address of Mr. F. W. Taylor on the "Art of Cutting Metals," and is selling it bound in cloth at $3. The demand for this address has been very great, and the number of "Proceedings" in which it first appeared was exhausted directly after the last annual meeting.

The West Virginia Geological Survey has issued a special report on the topography, geology and mineral resources of Ohio, Brooke and Hancock Counties. It is written by Prof. G. P. Grimsley, assistant State geologist, and is sold at $1.50 at the Survey office at Morgantown.

The nature of matter has been a fascinating subject for the philosopher and physicist, the thinker and the worker from the days of Democritus and Lucretius down to the present hour. And, indeed, it may safely be said that at no time in the history of scientific discovery was greater activity displayed in the study of problems relating to the constitution of the ultimate forms of matter than in recent years. Were proof needed, it would be afforded by every one of the 230 pages of Dr. Oliver Lodge's "Electrons." This volume shows a clearness of exposition which leaves no lingering doubt in the mind of the reader. The author has done pioneering work in the electronic field and has discussed proposed solutions of outstanding difficulties with the leaders of scientific thought at home and abroad, so that this latest work of his is sure to command at once the confidence of the reader, even when dealing with the more speculative parts of the subject. That the "electron" has opened up not only a new chapter, but also a vast domain in general physics will be evident from a glance at some of the titles of the successive chapters: Nature of chemical and molecular forces; increase of inertia due to rapid motion; the electron theory of conduction and radiation, etc.

Though several good works on that smallest of entities, the electron, have recently appeared, no student of physical theory can afford to be without this volume. (London, George Bell & Sons, 6s.)

Letters to the Editor.

Railway Topography.

Sir:—In your number of August 24 a correspondent who signs himself "Transitman" makes some interesting observations on the subject of topographical work on railway surveys. He very properly lays stress on the fact that the aim should be to secure the topography with the desired accuracy at a minimum cost, which leads him to the opinion that the methods followed in open prairie country are not applicable in the mountains. With this opinion a good many of us who are engaged most of the time on location will probably agree, yet there are two things to be considered which your correspondent did not mention. The first of these is the very rough nature of considerable location, made for companies of limited resources or for the consideration of directors who have no intention of ordering construction for some time to come except under rather unlikely conditions. The second thing that must be considered is the difference in men, for I have seen a few "natural" topographers whose skill was so great that it is safe to say one of them with a single assistant will map as much topography as an average four-man party and with equal accuracy. The first man of this type I saw was engaged on a party in western Iowa which was trying to locate a line now a part of the Burlington system. The country was the worst I ever traversed, although it did not look particularly bad, and I have often wondered if the Burlington engineers who have been engaged of late years in the improvement of those old lines leading to the Missouri have the same feeling of respect for the twisting gullies of that district that I have maintained for a generation as the result of early experience there. The country is much worse than real mountainous districts, because, until it is all covered by a topographical survey like those of some States where the U. S. Geological Survey has been active, it may be questioned whether it is really possible to know just what is the best location. In mountainous districts, the salient peaks and passes furnish a guide that enables the possible lines to be reduced speedily to a few.

Where the country is difficult, your correspondent is perfectly correct in stating that of all field positions that of topographer requires more experience and greater exercise of judgment than any save that of locating engineer or chief. The late A. M. Wellington once wrote that "in country at all rough the topographer fills the most responsible position on the party below its chief, and should so rank." If he is not competent the map will be of little value, or it will be extremely costly on account of the time put on the topographical work by members of the party engaged for other work. In consequence of this fact, I have always endeavored to obtain permission to use my judgment regarding the detail of topographical work, so that where a poor man is employed on it the amount taken in easy country shall not be so great as to hold back the whole party. This sounds like makeshift work, yet on some surveys it is entirely proper. Where directors will not furnish funds for engaging thoroughly competent men, but demand results on a certain date, they cannot expect these results to be as detailed and as accurate as those obtained on the excellent railway surveying lately done by two great companies in the district from which your correspondent writes.

It seems to me that in a good deal of mountain country in which I have worked there would be no call for such a large force on topography as the writer of the letter advocates. Some mountainous districts are not at all difficult to map expeditiously, for while the slopes are steep, they are uniform and not covered by such a growth of brush that there is any difficulty in seizing upon their contour. In many such districts two men trained in the work are certainly enough. There is no use in getting results to a greater degree of accuracy than will be clearly shown on the map, and I have noticed quite often lately that this unnecessary accuracy seems to be considered essential. Paper locations are extensively made, and some companies are stated to make their final location practically a topographical proposition, the maps of the preliminary party being sent back to a main camp where the final line is plotted on them and then at once run in on the ground. I know nothing about this method, and have never even talked with anybody who has been on work where it is employed, although great claims for its speed and economy have been made. It demands special skill on the part of the topographical men, for they must be both speedy and accurate in order not to delay either of the field parties, and I should like very much to learn more about the working of the method.

There is a feature about topographical work that possibly is overlooked at times. The permanent addition to a party of every extra man means more than the wages of that man, for his subsistence and quarters have to be considered, and the fact that every extra man means so much more delay in getting about. Everybody who has lived in the field for a number of years knows that small parties accomplish more per man than large parties. It is for this reason that I should much prefer to have two good men on topography in difficult country than four of average ability. I have rarely found it necessary to put transitmen on topography where the regular topographer was really skilled, although at times I have had the transit party run lines near both the uphill and downhill sides of the strip so as to reduce the distance the topographer had to work out from a surveyed line. This is equivalent to sending help to the topographer from other members of the party, but it gives him help in such a way that he is not made to appear slow in his work, and the instrumentmen are thereby taught that the work done by the topographer must be borne in mind by them. A very little of such double-line running is necessary with a good topographer, and I believe its cost is far below that of a permanent extra man in the organization, except where the country is broken. Possibly this opinion may be due to the unwillingness of old men to change their views, but it is nevertheless the result of a lifetime of experience in railway surveys and associated work.

Very truly yours, Richard Lea.
Los Angeles, Aug. 26.

The Power Plant of a Small Flour Mill.

Sir: My attention has just been called to an error in an article with the above title in your issue of July 20th, describing improvements made in the power plant of a flour mill at Washington, Mo., which are stated to have resulted in a fuel saving of 120 per cent., a truly astonishing result. The data for this article were prepared in my office and it is possible also that the 120 per cent. figure was made here. The original coal consumption was 43.5 lb. per barrel of flour; after improvements, 19.6; saving, 23.9. This is 122 per cent. of the final and not the original consumption. The saving over the original consumption was 55 per cent., which is, of course, the figure which should have been used. That the statement should have been made in this shape, and was furthermore overlooked when I read the proof, is one of those inexplicable occurrences which sometimes tend to our confusion in spite of the greatest care and watchfulness.

Very truly yours, William H. Bryan.
St. Louis, Aug. 28th.

Graphite Lubricants.

Sir: In your number of July 22 you print the following: "The United States Graphite Co., Saginaw, Mich., has developed a lubricating graphite in which the graphite is held in suspension in oil sufficiently long for it to perform its purposes when fed through oiling pipes. Amorphous graphite reduced to an impalpable powder is used, one teacupful of it being mixed with about a pint of oil."

This gives the reader a wrong impression of the lubricating graphite which we prepare. This differs from the ordinary flake graphite in that it is an impalpably fine powder, air floated and gritless which, when mixed with lubricating oils in the proportion of one teaspoonful graphite to the pint of oil will feed through lubricator tubes without clogging and remain suspended in the oil sufficiently long to perform its functions.

Your notice states that a teacupful should be mixed with a pint of oil whereas the correct proportion is a teaspoonful. And should any of your readers try to use the same in the way you recommend, the results would be very disastrous to them and would tend to hurt the sale of this lubricant.

Very truly yours,
United States Graphite Co.

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TABLE OF LEADING ARTICLES.

The Growth of Electric Motive Power.

Prof. S. P. Thompson's presidential address before the Engineering Section of the British Association, extracts from which were printed on September 7, contains a most interesting abstract of the history of electricity as a motive power. It is immensely difficult to set one's self back in viewpoint a half century and to look on the electric motor and its possibilities as they were then seen. In 1857 the machine was no novelty; it had in fact been known for at least a quarter of a century. At the beginning of that epoch there was precious little popular interest in electricity. It was unfamiliar to all save a few savants, and to them it was mainly of theoretical interest. But a few years later the advent of the telegraph waked the world to some appreciation of things electrical. The commercial needs of the growing art brought about the invention of improved batteries, and the study of the principles of electro-magnetism. An immense amount of active experimenting went on and so it came to pass that at just about the period mentioned by Prof. Thompson, that is, in the "fifties," there was in progress an active "boom" in electrical work, checked only by the lack of adequate sources of electrical energy. A great deal of clever invention work was being done, so much that many an incipient patent of to-day has received its quietus from the work of Page and his contemporaries. And it is worth noting that since that period there have been but few and slight improvements in the electric battery.

Lacking the dynamo, however, it is small wonder that even the most far-sighted should look upon the electric motor as of questionable practicability. There were those who even then held firmly to the belief that electricity would supersede steam as a motive power, yet the sounder judgment was of those who held that its chances were small on account of the uneconomical source of energy. Although to-day a million horsepower and more of motors are in regular use, the doubters of 1857 were essentially in the right. The steam engine is no nearer to being pushed aside now than it was then. The battery stands just where it did then—it was and is incomparably more costly as a source of power than the steam engine. Lord Kelvin, the sole survivor of the brilliant group that discussed electro-magnetic engines on the occasion referred to by Prof. Thompson, need not, fifty years after, retract a word of his early opinion. His contingent possibility has come to pass, that is all. It was a decade later that the beginnings of the dynamo were in evidence, and a score of years before the electric motor in the modern sense of the word made its appearance. And up to the present time the motor has been chiefly an immensely useful intermediary between the steam engine and its point of application. This statement points out the vast economic loss that is still part of our every day life. Although an electric motor of moderate capacity may have an efficiency as high as 95 per cent., mankind is still condemned to furnish it energy from a prime mover with an efficiency of only 10 or 15 per cent.

Electricity direct from coal is as far distant as it ever has been. The few carbon-consuming batteries devised have failed of any commercial usefulness and there have been no cheap batteries invented in the least able to compete with coal and engine. Perhaps the most interesting possibility in this line is the thermo-regenerative battery, thus far of only theoretical interest. This is merely a primary battery of which the current producing reaction is reversible by heat, just as in the storage battery it is reversible by electrolysis. Heat the battery and it goes back to its initial state ready for a new task. Perhaps some chemist may solve the problem and enable the heat of coal to be applied at an efficiency enormously greater than is possible with a steam engine, an efficiency perhaps as great as that of our present boilers. It will take some such revolutionary discovery as this to put the steam engine in some form out of business. The internal combustion engine we have, of course; but great as are its possibilities it has not yet pushed the steam engine hard in actual economy in spite of the fact that it has double the thermo-dynamic efficiency. The next few years should show great strides in the use of gas engines in large sizes, and also some material improvements in steam practice which will probably keep the steam engine still in active work. The electric motor is still the intermediary, though it has been pushed into use to an extent that even a dozen years ago seemed scarcely possible. The advent of the alternating current motor in its various forms has been the strongest recent stimulus in the art. If the great experiments in traction by alternating motors result favorably, the first important inroad on the absence of the steam engine as a working motor will have been made, but behind the motor and the dynamo will still be the engine and boiler, in spite of all. The engineers of the "fifties" were not so far wrong in their chief premises, after all; they merely failed to appreciate the importance of the flank movement which actually took place. And, truth to tell, it is often the flank movements in engineering that enable important positions to be carried in cases where a frontal attack might miserably fail. It is trained resourcefulness that counts.

Power Plant Instruction Books.

The complex operating problems present in many of the electrical industries demand clearly worded and carefully printed instructions in the form of small handbooks for the use of employees. Particularly in transportation service has this necessity become recognized, and the preparation of special books covering the operating exigencies of electrified terminal service is an outgrowth of the new conditions in the field of heavy electric traction. In the work of the New York Central in the vicinity of the metropolis, special instruction books have been prepared in connection with the operation of the high and low tension distribution systems, the maintenance of the third rail and its auxiliaries, and the operation of the new electric locomotives. The New Haven locomotives have also been made the subject of treatment in a small pocket book issued by the latter company. The detailed operation of power plants has not received this sort of treatment to any extent, though in the case of the New York Central sub-stations the printed instructions are very carefully worked out with reference to the maintenance of continuous service.

It is a question if the handling of very large power plants could not be considerably facilitated if the instruction book idea were applied to installations of high capacity and great responsibility of output. The operation of power plant machinery is, of course, a regular business or group of occupations in itself, and to a large degree men employed by a company for power house service are supposed to know the details of their work before they take an active hand in the operation of the equipment. But the facts usually are that the conditions in no two plants are alike, and especially in isolated installations supplying a great variety of service, perhaps including heating, ventilation and refrigeration, it is a matter of no little time for a new man to feel sure of his ground in the rapid handling of valves and switches. It would certainly be a distinct help if some equivalent of an instruction book or at least a type-written set of data expressing the main physical features and operating peculiarities of the system could be kept as a part of a complicated plant, being a sort of mechanical and electrical inventory of the equipment and its arrangement.

Small plants would not need anything like the fulness of instruction desirable in high-powered stations. The latter contain as a rule much more auxiliary apparatus; the exact responsibility and duties of each employee are more essentially specified, and in the case of very valuable machinery, the handling of it should become a matter of established routine, both in normal and emergency conditions as far as they can be antici-

pated. A clear statement of the functions of different main and auxiliary switches and valves, of the order of operations desirable in starting up a large generating unit and in shutting it down, of the proper sequence of moves in starting rotary converters and other apparatus, the routine of handling storage batteries—these and many other points carefully considered in a small instruction book would certainly save time in the breaking-in of new men, and in the maintenance of a higher mental efficiency on the part of more experienced employees. Amended from time to time such a book would represent the kernel of the best operating knowledge in that particular installation. No instruction book can take the place of an alert and intelligent employee at the switch or throttle in times of crisis, but if stripped of the dead wood of long-winded descriptions of standard machinery and packed full from cover to cover of practical operating points it would be a most valuable aid to high efficiency of personal service in large and complicated installations.

The Cause of the Quebec Bridge Failure.

Up to the present time nothing has been discovered which in any way adds any essential information regarding the condition of the wrecked Quebec bridge to the statement published in the news section of this journal last week, nor has the inquiry by the coroner developed any facts not given then. It is not at all surprising that this is the case, for the nature of the accident was such that the wreckage cannot be expected to contribute any definite information save that the material and workmanship were of the highest character. Engineers who visited the wreck agree fully on this point. In view of the special care taken in testing, fabricating and inspecting the material any other conclusion is untenable, and those acquainted with this work are fully convinced that the examination of the twisted and distorted ruins will confirm this opinion. While it is desirable that a thorough detailed examination of the fallen portion of the structure should be made, it will be most improbable that the cause of the accident will be discovered there. It is also possible to discard the horrible suggestion that the accident was due to the malicious acts of persons with some fancied grievance against the builders, for it is inconceivable that the structure should have failed as it did if the accident were due to such a cause.

There is little reason to believe, however, that the cause of the accident will remain undiscovered, which would be an engineering calamity greater than the collapse itself, but there is ground to expect that some theories or methods of bridge engineers will be modified. Engineering is not an exact science, but a highly developed craft, so highly developed as to merit the dignity of a profession. It closely resembles medicine in this respect. Thousands of people died from what physicians termed diseases of the alimentary tract before the nature of appendicitis was determined, and knowledge of this disease is so recent that it lends particular emphasis to the point to be made. Nobody lost confidence in the medical profession when it became known that failure to discover earlier the nature of appendicitis had been responsible for great suffering and countless deaths. On the contrary, people rejoiced at the progress that medicine had made. Engineering is precisely like medicine, except that its weaknesses are blazoned abroad while its achievements are overlooked. It is universally known that a physician has to make assumptions in connection with his diagnosis; but it is not so well known that the engineer also has to make assumptions, and that about the only way he can know that these assumptions were wrong is through the results which his works produce. The accident at Quebec demonstrates that something was wrong, and while there is a possibility that this weakness will be found by a search through the ruins it is also possible that it will be discovered by a critical examination of the design. This statement is no reflection in any way upon the work done by the engineers connected with the Quebec bridge, for that structure was the result of the careful study of men widely recognized as careful, thorough and competent. It simply means that in making that design, like the design of every large bridge, many assumptions had to be made regarding the distribution of stresses, and it is possible that these assumptions did not recognize all the features of the details of the design that affected the stresses.

It is noteworthy that among the suggestions regarding the cause of the accident that have been made by structural specialists to The Engineering Record the unforeseen influence of secondary stresses is advanced more often than any other possibility. The letter on the subject printed elsewhere in this issue is an example of these opinions, and this particular letter, it might be added, was written only after a computation had been made and checked to confirm the views stated regarding secondary stresses. There is hardly a subject connected with the design of steel work which is the subject of more controversy than this. In fact the difference in the views held regarding it is well shown by the fact that the eminent specialist whose computations are stated in the letter should reach a result so different from that of the engineers who designed the Quebec bridge. For this reason it would be eminently proper for the American Society of Civil Engineers to follow the precedent it established in the case of the Johnstown dam failure and appoint a committee to investigate the cause of the Quebec bridge collapse. While the engineers who are officially connected with the investigation now in progress for the Dominion government will doubtless discover valuable facts, the kind of an investigation that is most needed is one that can be made only by a very carefully selected committee of the American Society of Civil Engineers acting solely in the interests of engineering. The expense of such an investigation will be considerable, but the Society could do no better work for its members and for the public which relies on its members' abilities than to conduct a thorough examination of this sort. In making this suggestion The Engineering Record repeats that until such a strictly professional investigation is made the cause of the disaster will not be definitely known, and it may not be then. It fully recognizes the importance of secondary stresses, but it wishes to have the most positive and complete data regarding them in this case before accepting them as the real cause of the disaster. As a rule, secondary stresses are much more dangerous in tension than in compression members, which seem to have been the first to give way in the Quebec bridge. The deflection of the lower chord section of the anchor arm near the main pier, which was noticed by an inspector some time before the accident, may have been due to a weakness of some sort rather than to secondary stresses, and it would not be surprising, when all the facts are known, to discover that the failure was due to a cause whose main element was not secondary stresses.

There is one element of the accident which leaves no ground for debate, however, and that is the importance of stopping work and ordering men off a structure as soon as any sign of buckling is seen in a compression member. It is customary for bridge erectors to look upon small deflections without much consideration as to what may be their cause. These deflections are seen so often and so very rarely cause any trouble in small structures that their significance is not appreciated in large bridges. The deflection observed in the lower chord of the anchor arm in the panel next the main pier was probably the result of the final weakening of the resistance of the structure to the forces that produced its collapse, and with this incident as a precedent it is to be hoped that hereafter any such signs will be considered a signal for an immediate investigation of the most thorough nature.

A Matter of Signals.

A curious controversy has recently been vexing the pages of a contemporary, "Science," regarding some questions of physiological optics involved in railway signaling. It had its origin in a so-called "popular" article in the "Century," and has now degenerated into that singularly fruitless academic hair-splitting to which the professional mind seems prone. The main issue has been quite lost in the shuffle and the disputants are too busy hurling citations at each other to hunt it up. Now "popular" scientific articles in the magazines are, as a rule, by no means badly done, although they can seldom withstand the ingenious analysis of the petty controversial mind. It is next door to impossible in matters of physical science to make a definite and unqualified statement in plain intellectual English which is not open to attack for some inconsequential sin of omission or commission. In the case in hand the original author laid down the proposition that on account of the inefficiency of the eye in judging colors in weak light it would be wise to substitute for colored signal lights a system which should show the condition of the track by the position of luminous lines. In other words, since color signals are for certain definite reasons liable to be confused, let us try position signals which are free from the faults under consideration. Whether as a matter of practical railroading the proposed system would prove advantageous one can hardly say offhand, and it is safe to assume that the railroads would not change generally to this or any other improved system save under dire compulsion, because changes cost money.

Unhappily the writer of the "Century" article expressed himself somewhat carelessly and left several possibilities of misinterpretation which a Western professor pounced upon like a hungry cat upon an incautious mouse, and immediately those who were watching the affair found themselves in trouble. Experiments in physiological optics are rather discordant and indefinite at best, and the subsequent controversy, although rich in something very like the "odium theologicum," has been poor in every day facts to which the engineer can pin his faith. Now the matter of dispute, in so far as it concerns signals, is in theory quite simple. The human eye sees color very badly when the source of light is weak, not at all if it be very weak. Whether the "dark-adapted" eye can distinguish color as well, or a hundred times as well, as the "light-adapted" eye cuts little figure when it is notorious that neither sees well enough to work successfully when the source of light is very dim.

If the eye be color blind in the usual form of red-blindness, wholly or partially, the regular red signal light will prove comparatively inefficient and even if one has normal color vision his judgment of a very faint signal light may be tragically wrong. The usual signal-red glass lets through not only red, but orange, yellow and even a little yellow-green, and seen at a distance or through mist the red, even to the normal eye, pales, through the low luminosity of the full red, until the apparent color may change considerably. Thus a red lighthouse flash sometimes loses its

characteristic color long before it ceases to be seen as a light. Any other strongly colored light, if likewise of impure color, is subject to analogous change as the luminosity decreases. That the failure of the color sense in very dim light has caused serious accidents can hardly be doubted. As regards position signals they can, if of adequate dimensions, be seen as long as the lights are visible as lights and long after all color values have disappeared.

The main contention for a position signal as against a color signal as giving better visibility is unquestionably sound. Whether a change in practice is feasible, and if so what should be the form of the position signals, are questions not so readily answered. As the speed of trains has increased there is increasing need of signals capable of being clearly distinguished for a very long distance. The practical trouble is that the necessary distance which is approximately the braking-distance of the train, is very much greater than the penetration of any signal light now in use. In a fog a few hundred feet distance will render the lights totally invisible, whether one or many, white or colored, while to be of much use a signal should be distinct up to at least a thousand yards. It is rather doubtful whether any visual signal can be made effective enough to meet this condition and the final result may well be an entirely different solution of the problem. Audible signals or electrical signals delivered directly in the cab, or even a positive automatic block system may be the final recourse. Any of these offers a far better chance of real safety than visual signaling. In earlier days, when train speeds were usually low and the trains themselves were light, the situation was simpler. Every train, like every electric car, must be considered as carrying before it a dangerous space equal to the braking distance, within which lies peril. For an electric street car this distance may be one or two hundred feet; for a fast and heavy train one or two thousand yards. If warning of danger is not conveyed from ahead of this space, an accident cannot be averted. Most of the recent appalling collisions are due to disregard of this exceedingly simple fact. There is no excuse for neglecting to provide signals of some kind capable of spanning the dangerous space. If lights and semaphores fail, then it is high time to try something else. The frightful casualty list on our American railroads bears witness of the need for immediate action.

Notes and Comments.

THE CITY OF NEW YORK like other bodies of a corporate nature has been suffering during the summer from a serious difficulty in obtaining ready cash. Some contractors have been forced to receive payment in bonds at par which were sold subsequently at a lower rate which made them an unsatisfactory form of payment and seriously reflected on the credit of the city. This condition has been heralded far and wide as indicating the immediate descent of hard times upon the entire country; consequently it is most encouraging to observe that a sale of bonds held this week in New York resulted in a subscription of five times the amount of the issue. The city offered $40,000,000 4½ per cent. gold bonds and for them over nine hundred bids were received, aggregating $207,159,420. Two of the bids were for the entire issue. All the bonds will be sold considerably above par, and the result of the sale, the largest of the kind ever held in the city, shows that the financial troubles of the summer just passed were due to temporary conditions that are now a thing of the past.

AN ENGINEERING FEAT deserving mention has been accomplished by the undergraduate engineers of the Colorado Agricultural College. This was running a line of levels to the top of Long's Peak, which for many years it was thought impossible to ascend. The upper part of the peak is an immense granite boulder, about half a mile long and 500 ft. high. On one face is a precipice of 2,600 ft. The ascent was finally made by starting on the northeast corner and passing completely around the peak, part of the way on a narrow shelf, and finally reaching the top in a crevice on the southeast corner. The students connected with a bench mark of the Union Pacific Ry. in Estes Park, and ran a duplicate level for a total distance of about 16 miles horizontal distance, and nearly 7,000 ft. vertical difference of level. Since then the U. S. Geological Survey has run a double line of levels, one via Longmont and one via Loveland, connecting with the work on the plains, and finally with the line of precision levels of the U. S. Coast Survey. The height of the peak as finally determined, is 14,255 ft. above sea level. The work of the Hayden survey has universally been recognized as being very good. This is shown by the fact that the elevation of the Peak as given by Hayden is 14,274 ft., a difference of only about 19 ft. in elevation. Long's Peak is probably the only peak besides Pike's Peak, where a line of spirit levels has been run to the top. There is no comparison in the difficulty of ascending and running levels over the two peaks.

THE EXCAVATION PROGRESS that is being made on the Panama Canal is decidedly encouraging to those who hope to see the work completed within the time anticipated by those responsible for the adoption of the high-level plan. During the last month the total amount of excavation was 1,274,000 cu. yd., the largest record yet made, and as this volume was excavated during one of the most rainy months of the year, it is safe to assume that a still larger amount will be taken out during most of the other months. Hence it seems fair to believe that the excavation will be carried through to completion in less than seven years from the present time, when all the steam shovels now under construction are delivered and the tracks for spoil are completed. The figures recently received from the isthmus show how completely misleading were the statements sent North by newspaper correspondents a few months ago regarding the demoralization of the working force on account of the administration's determination to place the control of the work in the hands of eminent members of the Corps of Engineers of the army. At the present time the only feature of the work which foreshadows any probability of trouble is the construction of the dam and lock at Gatun, and unless definite unfavorable information is received concerning the condition of the works in question the excellent showing made last month by Colonel Goethals and his staff warrants the public in anticipating that the time of doubt and uncertainty regarding this great undertaking is now past.

THE TWO-CENT FARE LEGISLATION of Pennsylvania received its first judicial setback recently in the Philadelphia Court of Common Pleas, which decided that the law was unconstitutional. Of course this decision was made in a minor court, and until it is settled by courts of final jurisdiction the matter will remain in dispute. Nevertheless it is interesting to see that the law has been rejected, not only as being a violation of the Pennsylvania Constitution, but also as violating the Federal Constitution, in that it is confiscatory in character. If this opinion is confirmed by the highest Pennsylvania court it is safe to say that those of other States will take a similar view of the matter when it is brought before them, except in a few cases where the State judiciary has long been decidedly averse to the fair treatment of capital invested in public service undertakings. It is also necessary to bear in mind that the sweeping general laws regarding rates which were put on the statute books in some States recently may produce a very nice legal situation that was not brought up in the Pennsylvania case. It may be found in a few States where the constitutionality of these laws will shortly be before the courts that some roads have actually benefited by the greater amount of traffic resulting from the lowering of the rates. On the contrary a minor road may show a loss. In view of such a situation, the futility of any general attempt to regulate rates by law will become evident. What has helped one company has injured another, and it is entirely possible that some of the minor companies may be forced into bankruptcy by legislation of this character. The problem is a complicated one, and as it vitally affects a large amount of engineering work held in abeyance until the troubles are settled, it behooves engineers to give it their most careful consideration.

THE FIRE HAZARD of lofty office buildings was the subject of dire prophecy by the president of the New York Board of Fire Underwriters at a recent meeting of the building code revision committee of the New York Board of Aldermen. According to this fire insurance specialist, with the present unlimited height of buildings in the financial center, where the streets are being converted into canyons by the walls of lofty structures, a great disaster exceeding any ever yet experienced is being courted. It was asserted that the San Francisco fire showed that so-called fireproof buildings cannot withstand the attacks of a great wave of flame. Fire underwriters were stated to anticipate that a fire starting in a group of lofty buildings would be beaten across the narrow streets from the windows on the top floors, and no system of sprinklers or fireproofing would avail in the least to prevent the spread of conflagration. Firemen down below in the narrow streets could accomplish nothing. With respect to this utterance, which is not at all unlike those previously made by fire-underwriters, it is necessary to point out in the first place that gentlemen engaged in the insurance business naturally take the gloomiest view of the probability of the spread of a fire. It is their duty as well as their business advantage to preach the utmost completeness in provision against the spread of a fire. In the second place, there seem to be ample reasons for the belief that the protection afforded by a well-built and properly equipped office building against the spread of fire is something generally unrecognized. For example a good many years ago in the City of New York, the Home Insurance Building unquestionably prevented the spread of a serious fire in the downtown business district. The character of the office buildings in respect to their resistance to the spread of a fire is really more under the control of the insurance interests themselves than under that of the city. The building laws formulated by a city must always, of necessity and equity, prescribe minimum requirements consistent with reasonable safety and sanitation. It is out of the question for the city to demand the character of construction which insurance people consider best suited to prevent the spread of such fires as those under consideration. The insurance interests themselves, however, can materially advance the cause they have at heart by an adjustment of their rates which will make it more desirable for building owners to erect structures of the highest resistance to fire.

THE SUBSTRUCTURE OF THE DEARBORN STREET BRIDGE, CHICAGO.

The Sanitary District of Chicago is increasing the width of the Chicago River and the South Branch of that river to 200 ft., and the depth of the main river and this branch to 20 ft. below Chicago datum, the latter being about 1.5 ft. below the mean stage of water in the river. This undertaking has already involved a large amount of difficult and expensive construction work, included in which is the replacement of the old centerpier highway drawbridges with bascule bridges. Eleven of these new bridges have been completed and are in service, and still more remain to be built. A minimum clear channel width of 142 ft. inside protection cribs for the piers is provided at the new bridges, while a bypass back of each pier increases the cross-section of the waterway at the crossings to nearly the same as that of the standard channel width and depth.

The bridge across the main river at Dearborn street, which will soon be opened for service, is one of five bridges which carry the great volume of traffic between the North side of the city and the central business district, and also the crosstown traffic between the North and South sides. This traffic has all been confined to four bridges for two years, since the old Dearborn street bridge was torn down, with the result that all of these bridges have been badly crowded during rush hours. The new bridge will, therefore, greatly relieve the present situation, and particularly so with regard to the provision of an additional outlet for street railways from the central business district. It is a double-leaf Scherzer rolling-lift bascule bridge, having a clear span of 164.5 ft. between the centers of the front bearings, and providing a 36-ft. roadway, with a 10-ft. walk on each side.

Each leaf of the bridge is carried by a heavy reinforced-concrete abutment, which forms the front wall of a large sub-structure containing a by-pass waterway, two pits for the counterweights and a pit for the floor of the leaf. The two sub-structures of the bridge are the same in general design. They are each 48.5x67 ft. in extreme dimensions in plan at the top and rise to a height of 29 ft. above their footings. The abutment carrying the front bearing of the leaf and the front end of the track girders for the counterweight is 8 ft. wide at the top and is battered 1 in. to the foot on both sides. Back of this abutment is a by-pass, 8 ft. wide at the bottom, which extends through the sub-structure, normal to the axis of the bridge. The counterweight and floor pits are separated from this by-pass by a heavy concrete wall, the counterweight pits having an irregular shape in transverse cross-section, corresponding with the shape of the counterweights. The sub-soil conditions at the site were such that it was necessary to build each sub-structure on twenty 6-ft. circular concrete columns carried down to rock, or to material affording a good foundation. Most of these columns extend from 95 to 105 ft. below the mean water level in the river, and are designed to carry practically the entire weight of the sub-structure and the load on the latter.

The river bottom at the site of both sub-structures is soft river silt to a depth of 7 to 14 ft., under which is a soft plastic blue clay that extends down 40 to 45 ft. below the mean water level in the river. This clay has about the same consistency as putty containing a surplus of oil and has very little capacity for carrying loads unless thoroughly confined. Below this plastic clay, are various strata of a stiffer clay, and of hard, brittle clay, until hardpan is found at about 65 ft. below Chicago city datum. From this hardpan down nearly to bed rock is a material generally termed miners' loam, which when dry is hard and brittle, but when wet has much the same nature as quicksand. The bed rock is about 95 ft. below the water level on the south side of the river, but drops away to a depth of 105 ft. below that level on the opposite side. Immediately overlying the rock, between the latter and the miners' loam, is a stratum of quicksand of varying thickness, which contains a large amount of water and is filled with gravel and boulders.

In addition to these peculiarly difficult soil conditions, two brick-lined tunnels for gas mains had been built under the site approximately parallel to the center line of the new bridge and at a depth of 31 to 43 ft. Both of these tunnels are on the same side of the center line of bridge. One of them is 6 ft. in diameter, and the other has an elliptical cross section, with axes of 5 and 7 ft., each tunnel carrying a 30-in. gas main. The location and profile of these two tunnels are shown in an accompanying illustration, from which their proximity to the concrete columns carrying the sub-structures may be seen. The pipes in these tunnels are important feeder mains that had to be kept in service at all times while the work was in progress.

Owing to these local conditions and limitations, the construction of both sub-structures was handled with considerable hazard. After the draw span of the old bridge on the site had been floated away on scows to another location, the center pier and the crib-work protection for this pier were removed and the channel dredged to about the established standard depth of 20 ft. The two rest piers of this span were also taken out, meanwhile, the intention being to build both sub-structures for the new bridge simultaneously. It was considered, however, that the proximity of the protection of the draw span of the Clark street bridge, a block downstream, would interfere with traffic in the river if cofferdams for both sub-structures were built at the same time. Accordingly, a cofferdam enclosing the site of the south sub-structure was built first and the latter completed; this cofferdam was then removed and the one for the substructure on the opposite side built.

Two Views of North Cofferdam Showing Head Hoists, Concrete Mixing Outfit and Other Construction Plant.

The details of one of the cofferdams, which were both generally the same, are shown in one of the accompanying illustrations, each cofferdam unwatering a space 53x64 ft. in plan. The treacherous soil conditions and the location of both sub-structures outside of the dock lines required all four sides of each site to be enclosed. Each of the three sides in the river had on the outside a row of heavy round timber piles, against which was a row of triple-lap Wakefield sheet piling made of 3-in. plank; and on the inside, a second row of heavy round piles, against which was driven a row of Friestedt interlocking channel-bar steel sheet piling. The space between the two rows of sheet piling on the ends of the cofferdam was 8 ft., while on the river side this space was increased to 13 ft. over the tunnels as shown in the plan. The space thus enclosed was filled with clay to make the cofferdam watertight. The round piles were in 30-ft. lengths, and were driven to a penetration of 10 ft., except over the tunnels where care was taken to avoid penetrating the latter. The wooden sheeting was in 30-ft. lengths and was driven to about the same penetration as the round piles. The steel sheeting had been used previously in four cofferdams, but was still in good condition. It was in 40-ft. lengths, which were driven to a penetration of 6 to 8 ft. more than that of the wooden sheeting, except over the

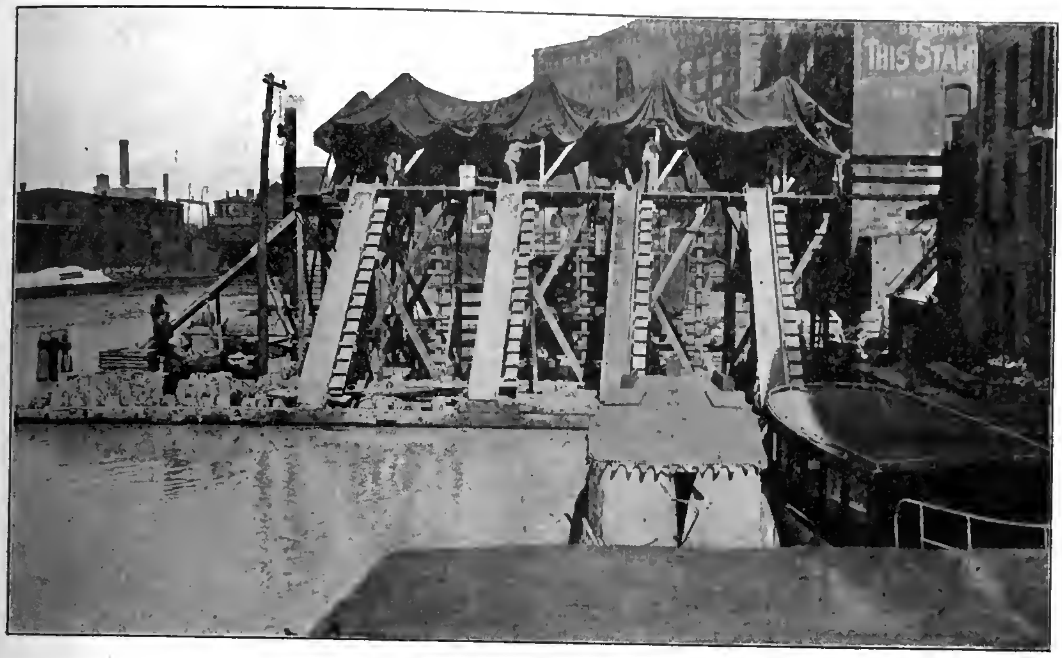
tunnels. The land side of the cofferdam consisted of a close row of heavy round piles, tied together with waling pieces so as to form a footing for the bracing used in the cofferdam.

In building each cofferdam the inner row of piles and steel sheet piling were driven around the three sides in the river with a floating pile driver. After the completion of this work the outer row of piles and sheeting were driven by the same driver and the enclosed space filled with clay by a dredge. The water in the cofferdam was then slowly pumped down, in order that the system of heavy cross-bracing might be placed. This bracing was in four horizontal planes, one just below the top of the piling, and the next three spaced 6, 4 and 3 ft. apart on centers, respectively, from the top down. The bracing consisted of 12x12-in. timbers, placed in regular transverse and longitudinal rows, the sets in the different horizontal planes being braced apart with vertical posts. In both cofferdams the river bottom was considerably higher at the back of the cofferdam than at the front, so in order to permit the bracing to be placed regularly, the excavation was started as soon as any of the bottom had been exposed by pumping. This excavation was made by shoveling the material into buckets and hoisting the buckets out with a turntable derrick crane mounted on one end of the cofferdam. When the cofferdams were pumped out the head of water against the face on the river side was from 20 to 22 ft. The cofferdams stood throughout the work without accident, however, although a portion of the river side of the north one directly over the tunnels was pushed in to some extent, but the steel sheeting prevented a failure at this point. A pulsometer pump was capable of keeping each cofferdam free from water, and during most of the time was not worked to its full capacity.

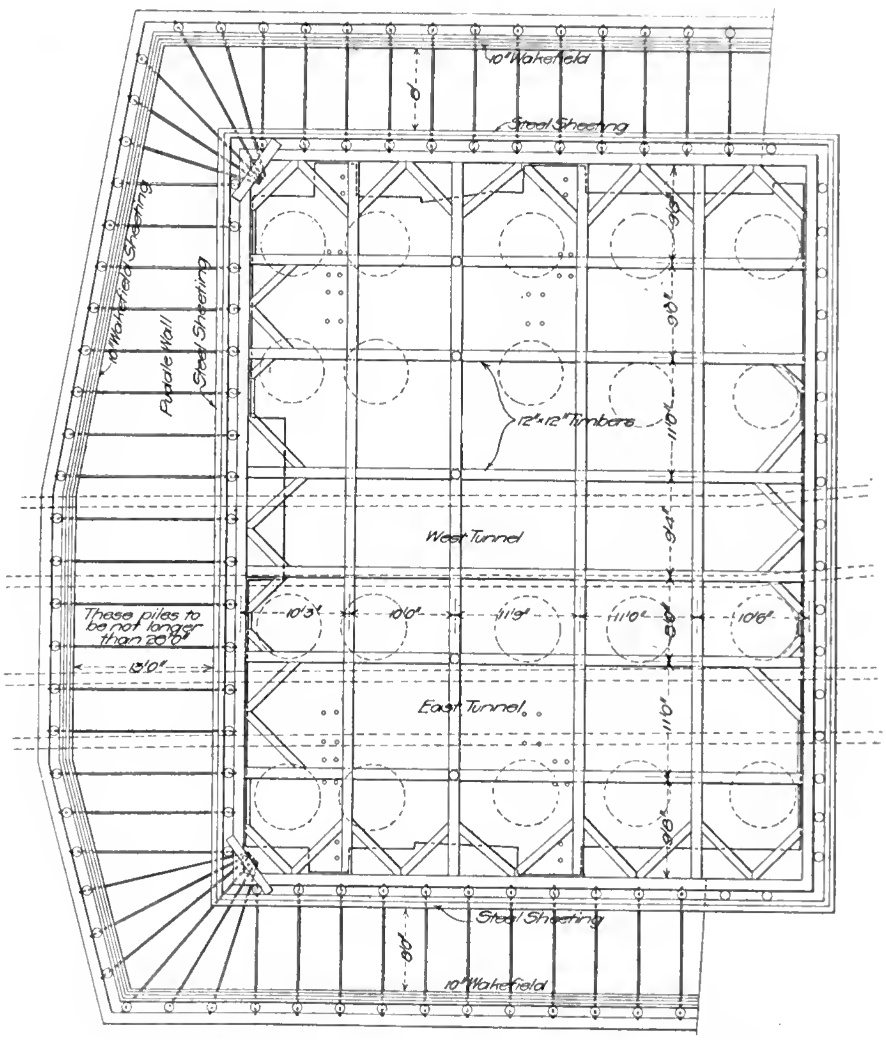
After the material in the bottom of the south cofferdam had been excavated down to a depth of 18 ft. below the water surface in the river, work was started on the excavations for the concrete columns. The latter are in four rows of five each, two rows toward each end of the sub-structure. Each column was built in a separate circular well, according to the same general method employed in building similar columns for footings for large buildings, as is regularly done in Chicago. Five of these wells were opened up at a time, the four inshore ones in the row at one end and the offshore well in the adjoining row being sunk first. The well in the outer corner of the cofferdam was thus left until these first five had been finished and the concrete columns built up in them; this well and the four in the second row were next opened and columns built in them. The same program was then carried out with the ten wells under the other end of the sub-structure.

In the greater part of the wells, 3x6-in. tongue and grooved plank were used for sheeting; 3 and 5-ft. lengths were employed, depending on the character of material, two steel lagging rings being placed to each set of planks. In driving through the sand boulders and water overlying the rock, it was found necessary to use steel cutting shields for a distance of 14 to 17 ft. These shields were each made up in four parts, the cutting section being 5 ft., and the remaining sections 3 ft. long. They were built of 5/8-in. plates, reinforced with two 2-in. angles. The sections were assembled in the well and the shields forced down to rock by means of jackscrews bearing on bulkhead timbers placed across the well. The excavation was all made by hand, the material being hoisted out in buckets.

Five separate, portable head-hoist platforms were built when the excavation of the wells was started, one for each of the wells that had been opened. These platforms were each 10x10 ft. in plan and were placed on a cross and sway-braced four-leg tower, 20 ft. high. A small tripod derrick was erected over each platform. These derricks carried a block at the top, through which a hoist line was passed to a hoisting spool at the base of the derrick. These spools were driven by an endless wire cable, which was driven in turn by a hoisting engine. The cable passed along the row of towers, and through the hoisting spools at each of the latter, the arrangement being such that buckets could be hoisted independently from any one or all of the wells. An opening large enough to pass a heavy bucket was left at the center of each platform, the tower for the latter being set on the top bracing of the cofferdam and directly over one of the wells in which the excavation was in progress. Two men were required on each platform to handle the hoisting line and to dump the buckets when the latter reached the surface. The materials brought up on each platform were dumped from the buckets on a flume leading down to the water just outside the cofferdam, these flumes being steep enough so the clay would slide on them. The materials from the wells were dumped into the river at the ends of the sub-structure in this manner and were later dredged out and hauled away in scows when the cofferdams were removed. After the five wells of the set had been finished, the head hoist plat-



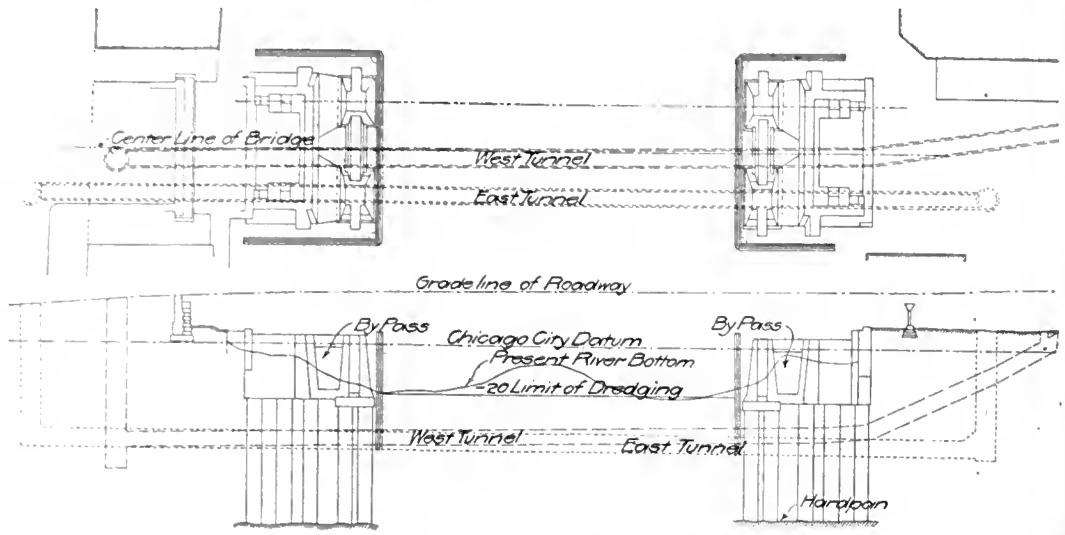
Head Hoists on South Cofferdam.



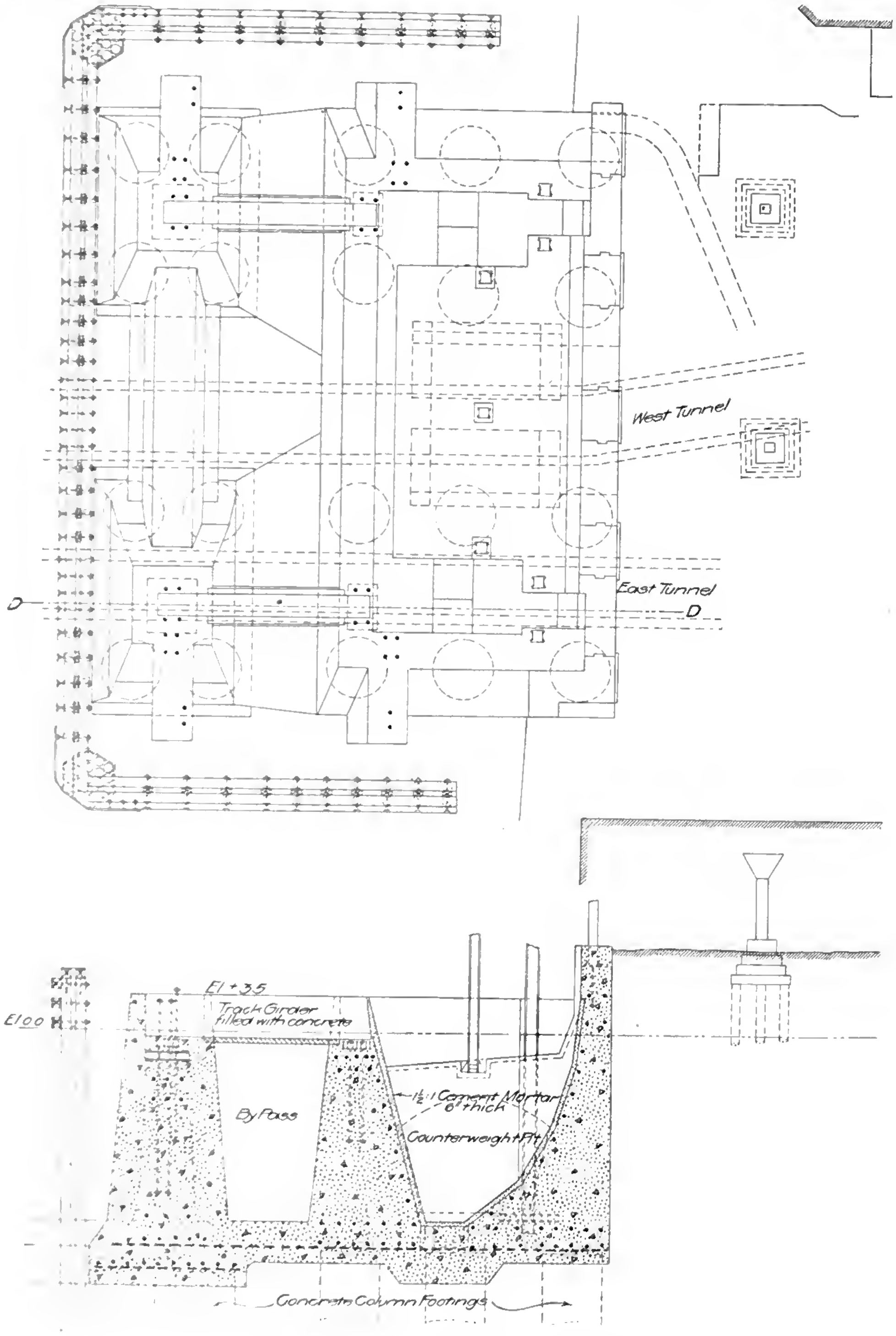
Details of Cofferdam for Dearborn Street Bridge.

forms were picked up by the turn-table derrick crane and moved to the next position, or were moved across the bracing on rollers.

The concrete for the wells and also for the sub-structure was made in the proportions of 1 of cement, 2½ of sand and 5 of broken stone. All of it was made in a pug-mill mixer set up on the fourwheel wide-gauge truck of a turntable derrick. Charging hoppers for the mixer were erected over the latter, a working platform being built around these hoppers. The mixer outfit was brought to the work on a scow and then run out on rails laid on the bracing of the cofferdam. Materials were supplied to it from scows by either of two turn-table derricks, both placed on the ends of the cofferdam. The concrete was delivered from the mixer directly into chutes and pipes leading to the bottom of the wells. As soon as one set of wells was completed the mixer outfit could readily be turned so as to deliver to the next set.



General Plan and Profile at Dearborn Street Bridge.



Plan and Cross-Sectional Elevation of North Substructure.

When the wells and sub-structure on the south side of the river had been finished, the whole construction plant was moved to the other side of the river, where the work was handled in practically the same way as on the south side, and in nearly the same sequence. The wells in the south cofferdam reached solid rock at a depth of from 90 to 95 ft., and, with the exception of considerable water in the quicksand directly over the rock, no particular difficulty was experienced in sinking them. In the wells of the north cofferdam, on the other hand, rock was not found until a depth of in the neighborhood of 105 ft. below the water in the river had been reached. Water was encountered in great quantities in the quicksand at this depth, but three wells were sunk to the rock and filled with concrete. As additional pumping from the wells might have caused damage to adjacent structures the decision was then made to increase the cross-section of the footings of the balance of the wells at a depth of about 64 ft., where hardpan had been found, and to form an elliptical 12x16-ft. base at this level for each column.

The two tunnels for gas pipes which pass under both sub-structures required very careful work in sinking the wells for the concrete columns. One of the tunnels is between two rows of columns under each sub-structure, and the two are so close together under the south sub-structure that there was barely room enough to sink wells between them. The work was completed, nevertheless, without materially injuring either tunnel, although one of them, which was lined with a single ring of brick laid in lime mortar, filled with water after the south cofferdam was flooded. The cofferdam was, therefore, pumped out again and the tunnels were filled with concrete from shaft to shaft.

The plans for the Dearborn street bridge were prepared by the engineering departmnt of the Sanitary District of Chicago, and the construction work was carried on under the supervision of that department. Mr. C. R. Dart is bridge engineer for the District. Mr. R. I. Randolph was resident engineer on the work. The old bridge was removed and the sub-structure of the new one was built by the Great Lakes Dredge & Dock Co.

Run of Mine Coal has been used successfully in the Chicago pumping stations, where formerly it was the practice to employ only lump coal which was supposed to have passed over 1¼-in. screens at the mines so that all pieces under that size were screened out before shipment. This made the coal more expensive, but theoretically it should evaporate more water per pound. By using run-of-mine instead of lump coal the average price was cut down from $2.55 in 1905 to $2.38 in 1906. In 1905 it required at all pumping stations 15.97 lb. of coal to pump 1,000,000 gal. to a height of 1 ft., while in 1906 it required but 15.026 lb. for the same duty, or 0.498 lb. less than in 1905. The total cost of pumping 1,000,000 gal. 1 ft. high in 1906 was 3.89 cents, while in 1905 it was 4.25 cents, showing a saving of 0.36 cent. Of this amount 0.25 cent was due to a saving in coal and 0.11 cent to saving in other causes. The Municipal Division of Tests and Inspection is making the tests.

Completion of the Cross River Dam, Croton Water-Works System.

The contract for the Cross River dam, near Katonah, N. Y., which is to impound about 9,000,000,000 gal. of water for the increased supply from the Croton valley for New York City was awarded, June 23, 1905, to MacArthur Brothers Co. and Winston & Co., for $1,246,211.60. The time limit of 26 months required the completion of the work on August 23, 1907. The time lost by the cessation of work due to an injunction served on the contractors soon after their organization was well completed, and in the reorganization and collection of a large number of employees in a difficult season of the year together caused a delay estimated to be equivalent to five or six months. Notwithstanding this gratuitous interruption, the work is now essentially completed except final touches and auxiliary construction like roads and bridges which do not at all interfere with the service of the dam or the impounding of water to supplement the city supply which was recognized as very inadequate in case of prolonged drouth.

It will be remembered that the need for the dam was so urgent that its construction was classed as emergency work, and the contract was awarded to a high bidder in consideration of experience and available plant assuring the most rapid and efficient progress. The result justifies the unusual action and should be a source of satisfaction to the city of New York, its engineers and the contractors.

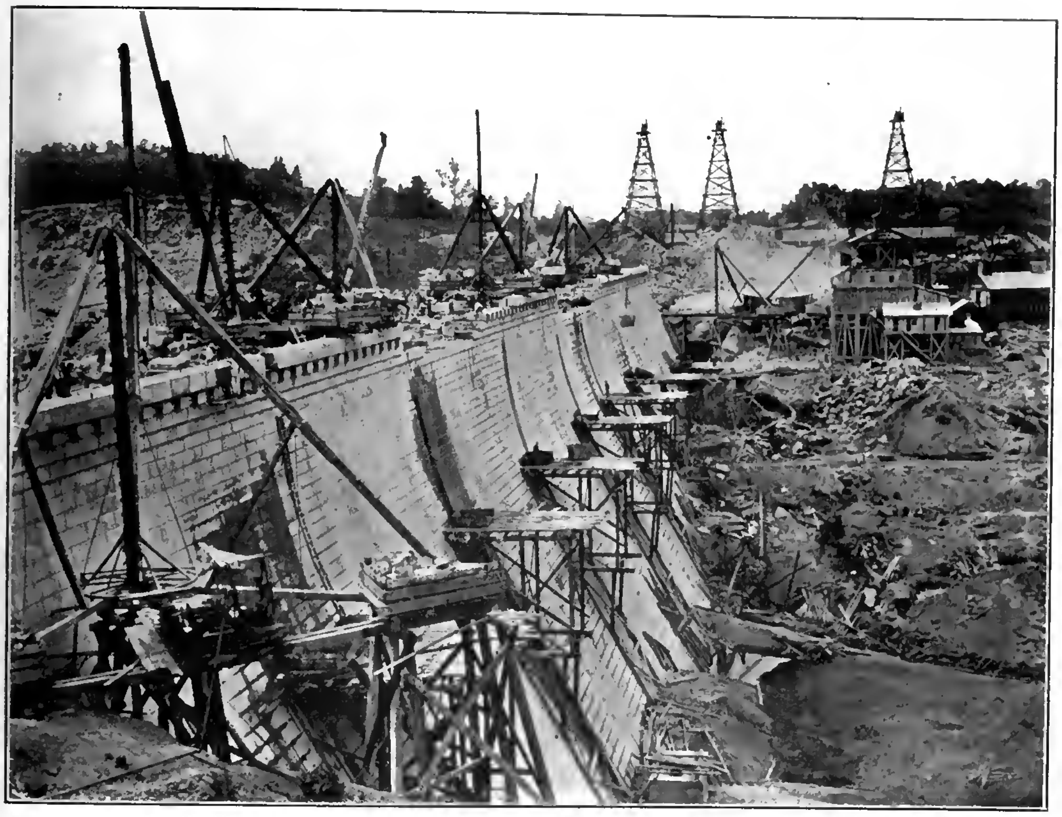
The design of the dam was specially adapted to expedite its construction by the use of moulded concrete blocks instead of cut stone in the face of the dam and the contractors' determination to make good their responsible undertaking installed a combined system of multiple cableways and derricks and provided an equipment far more extensive and expensive than is usually considered adequate for much larger works. With it they have been able to lay masonry at the rate of 18,500 cubic yards per month on a comparatively small area and have essentially completed the main dam, including excavation, diversion work and other preliminaries, in about 20 months working time, inclusive of about six weeks' delay through stress of weather.

The main part of the dam is about 900 ft. long and 170 ft. in extreme height, with a width of 23 ft. under the coping and 115 ft. at the widest part of the base. Its foundations are carried down to solid rock at a maximum depth of 40 ft. below the original low water level of the river. Both faces of the dam are battered except the upper part of the up-stream face which is vertical. It is built of cyclopean masonry faced with large moulded concrete blocks. The principal quantities involved are about 117,000 cu. yd. of excavation and 155,000 cu. yd. of masonry. The details of design, the plant installed and the methods adopted for the execution of the work have been described in The Engineering Record of May 20, 1905, June 16, 1906, and January 5, 1907.

Since these articles were published the design has been modified by the introduction of several horizontal tiers of continuous longitudinal tension bars in the upper part of the masonry to prevent cracking. For this purpose about 106,000 lb. of Thacher bars in 30-ft. lengths are placed in sets of two to six bars in horizontal planes 3 to 5 ft. apart vertically. The hooked ends of successive bars are engaged and special care is taken to bed them thoroughly in the concrete at all points. This requirement operates to limit the size of the cyclopean stone and has made the work somewhat slower.

It has also been decided to carry a 22-ft. roadway on top of the dam, and a 6-in. concrete pavement, crowned 3 in., is laid between the coping stones and is separated from the cyclopean masonry which supports it by a layer of tar paper. The pavement is pitched to five cast-iron catch basins in each gutter, which deliver through transverse 6-in. cast-iron pipes to a 12-in. cast-iron longitudinal pipe, pitched 1:100, which discharges into a cesspool beyond one end of the dam.

In order to handle supplies and machinery as rapidly as possible the contractors built a standard gauge track about 1½ miles long, with heavy cuts and fills and several trestles and bridges, to connect the dam site with the Harlem River Railroad at Katonah. The waters of the Cross River were diverted from the dam site by two earth and rock fill dams across its channels about 1,200 ft. apart. Between the dams the flow of the river was carried in a wooden flume and two 5-ft. riveted steel pipes about 90 ft. long, the latter being built permanently into the dam masonry. Excavation was made by pick and shovel and by blasting, and the spoil was handled successively by wheelbarrows, carts, bottom dump wagons, wooden skips and steel buckets, the latter being hoisted first by derricks and afterwards by cable ways.



Downstream Face of Dam, Showing Derricks, Cableways and Landing Platforms.

Quarries were opened in the hillsides at both ends of the dam, and the larger stones were used for the cyclopean masonry, while the remainder were crushed for concrete, thus utilizing a very large proportion, estimated at 95 per cent. of the total amount of stone quarried. A 700-ft. and an 800-ft. cableway, transverse to the axis of the dam with their towers on opposite sides of the center line were installed to handle the excavated material from the pit and for the back fill, and were moved parallel with themselves several times to command the differet parts of the excavation. Three 1,300-ft, 15 and 18-ton longitudinal cableways with traveling towers were installed on high level tracks on both sides of the valley at the ends of the dam and commanded its entire area. The cables have a clearance of 25 ft. above the finished crest of the dam and, together with nearly a score of derricks have handled all materials.

A power plant was located on the south side, and in it were installed steam boilers of about 1,000 h.-p. capacity, an electric plant and an air compressor plant of about 1,120 h.-p. capacity furnishing power for the operation of all of the machinery. Two stone crushers located on the bank above the south end of the dam receive stone from the quarries, and after it is crushed deliver it by a bucket elevator to a cylindrical screen, from which it passes to the storage bins and thence by a belt conveyor to the concrete mixing machine delivering through 2-yd. steel buckets pushed on narrow-gauge cars to the cableways which transfer it to the required points on the dam. The concrete machinery is contained in a wooden tower and is operated through clutches by an 18x22-in. engine driven with compressed air at 110 lb. pressure. An additional boiler plant was eventually installed to operate the crushers independently.

Water for the steam plant and for the dam was at first provided by two large pumps installed on the river bank below the dam which deliver to an elevated wooden tank. Later, in order to provide an additional water supply at the north end of the dam, a Worthington pump was installed on a raft in the river and delivers through a 2-in. pipe 800 ft. long to a 3,000-gal. wooden stave reservoir tank at elevation 380 which provides an independent supply with a good head for the work most remote from the original water station. A blacksmith shop, machine shop, carpenter shop and saw mill, all well equipped with machine tools, were also provided near the power house and served for maintenance, repairs, and the construction of much of the plant used by the contractors. Buildings were also erected for offices, store houses, commissary, lodging and a number of small cottages for foremen and mechanics.

An area of over 40,000 sq. ft. was levelled on the south hill at an elevation of about 50 ft. below the crest of the dam, and in it were installed forms for casting about 200 large face blocks at once which were constructed at a maximum rate of 65 per day by a 10-man gang, using a rolling overhead concrete platform. This yard was equipped with five boom derricks which handled materials, forms and blocks and piled the latter in storage often to a height of 5 or 6 tiers.

These derricks interlocked and loaded the blocks on cars delivering directly to one of the main cableways which usually transported them out on the dam during the night, leaving it available during the day for delivering stone to the crushers. Normally two of the cables were in constant use in the day time delivering concrete to different parts of the dam, where it and the cast blocks were handled by stiff leg derricks with 60 ft. booms arranged clear of the working face in two rows, one on the upstream and one on the downstream side.

These derricks were at first seated on the ground and afterwards as the work progressed and the elevation of the top of the masonry rose above their effective clearance they were successively lifted up and seated on towers against the faces of the dam. All movements of the derricks were generally made at night when they were handled rapidly and easily by the cableways which transferred them bodily to their successive positions with minimum trouble and often without any interruption of the work. This system promoted the utmost rapidity of construction and although it involved a large amount of plant, has been found very satisfactory.

In the later part of the work this arrangement was somewhat modified by transferring seven of the derricks to the top of the wall. With this arrangement, the six 9-man gangs of masons and the four 3-man gangs of block layers laid 980 cu. yd. in one 10-hr. day. In this masonry the proportion of rock to the entire volume of the masonry varied from 12 to 22 per cent. The output of the quarries was closely regulated by the amount of stone required for the dam and averaged about 2,500 cu. yd. per week. About 580 cu. yd. of concrete was a maximum output for one 10-hr. day.

In order to facilitate the handling of materials from the cableways to the derricks on top of the dam, six 20x30-ft. landing platforms were built at equidistant points on the down-stream face of the dam. The decks were made of 6-in. ties carried on wooden towers with their vertical posts braced on all sides and secured at the feet to inclined timbers resting against the curved face of the masonry and abutting at the bottom on a longitudinal timber sill laid on the surface of the ground. The platforms were at first built at elevation 272 and afterwards as the masonry progressed were raised to elevation 289, 42 ft. below the crest.

The large face blocks of a maximum weight of about 6 tons each were cast in knock-down forms arranged in rows in the casting yard, and after they were at least 2 days old were stripped and later turned over and finally stored in tiers until required in the dam. The concrete was shoveled into them from an overhead rolling platform and as none were cast in cold weather, their manufacture was very much delayed by the late season this spring, so that only about 1,000 cu. yd. were manufactured during the month of May. The weight and dimensions of the blocks are so great that when the work was commenced considerable difficulty was encountered by the springing of the moulds and consequent bulging and convexity of the blocks. This was finally remedied by taking great care to tamp and solidify the ground under the moulds and by reinforcing the moulds themselves.

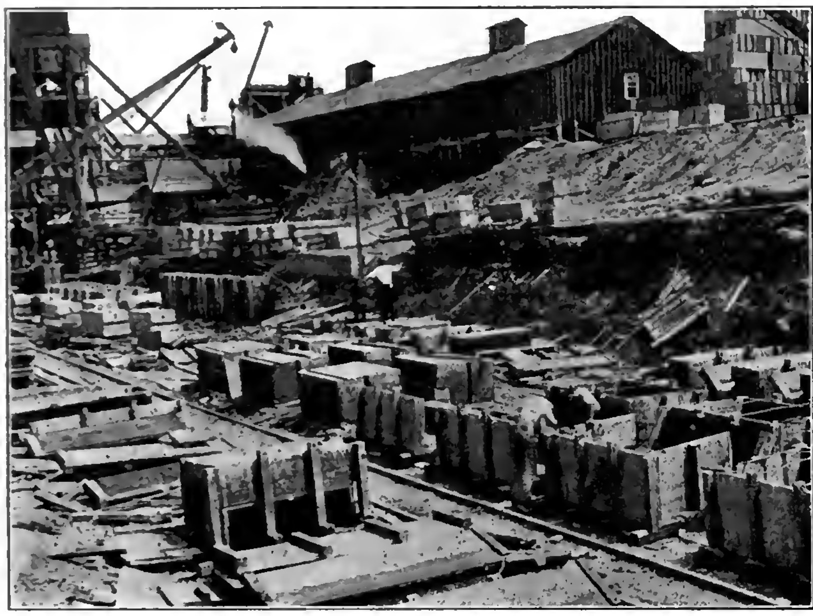
The best results were obtained by casting the blocks with the exposed face downward, and in some cases where two faces were exposed, one side of the mould was inclined slightly from the vertical to give a little pressure of wet concrete against that face. At first dog holes were cored in the blocks when they were cast, but as this was found unsatisfactory, the practice was later abandoned and the holes were cut by hand as soon as possible after the blocks were stripped. A maximum of about 7,000 cu. yd. of molded blocks were stored at once in the yard. The blocks and all other concrete were made with Giant cement and weighed 151 pounds per cubic foot.

All cement was sampled and sealed in bins at the mills and tested at the site. After its receipt at the dam it was held to await the results of 7-days' test before use and usually showed improvement.

The 32½x24½-ft. gate house on the up-stream face of the dam has monolithic concrete face walls cast in position with sliding shutters moved upward in the usual way as the work progressed and arranged to have their lower edges always overlap the finished concrete work and preserve the alignment of the upper part. The 3x6-ft. panels were made of 2-in. tongue and groove horizontal boards with vertical cleats 3 ft. apart and were held in place by ⅝-in bolts 18 in. long threaded at their inner ends to engage nuts and washers permanently bedded in the concrete 12 in. from the surface.

To facilitate the most expeditious construction of the masonry by avoiding the constant movement of derricks and the obstruction of the working surface of the dam, the original designs contemplated the support of a number of, derricks on permanent steel towers built into the concrete masonry. With this system it was intended to deliver stone and concrete by cars on a horizontal service platform alongside the dam. This involved the use of about 160 tons of steel in the towers at an estimated cost of $100 per ton, 1,600,000 ft. board measure of lumber at $40 per thousand and 5,000 lin. ft. of round piles. The use of this system was not obligatory on the contractor and the specifications gave him the option of executing the work in the manner outlined or of adopting any alternative plan which the engineers were convinced would give equal or more satisfactory results.

As the contractor was in a position to cover the work with an unusually large installaton of cableways he was allowed to substitute them for the derrick tower system, and it is considered that the results justified the substitution, and that this plan was the most desirable one both on account of the facilities it afforded for the very rapid movement of all other portions of the plant, such as derricks, platforms, etc., without dismantling them, and because, as the height of the structure increased and the width of the working surface diminished, the vertical movement of materials decreased correspondingly, thus facilitating the rapidity of operations. With the derrick system, on the contrary, the height to which materials were hoisted and the consequent time required to lay a given amount of masonry increased in direct proportion to the height of the structure.



Block Yard, Concrete Tower and Machine Shop.

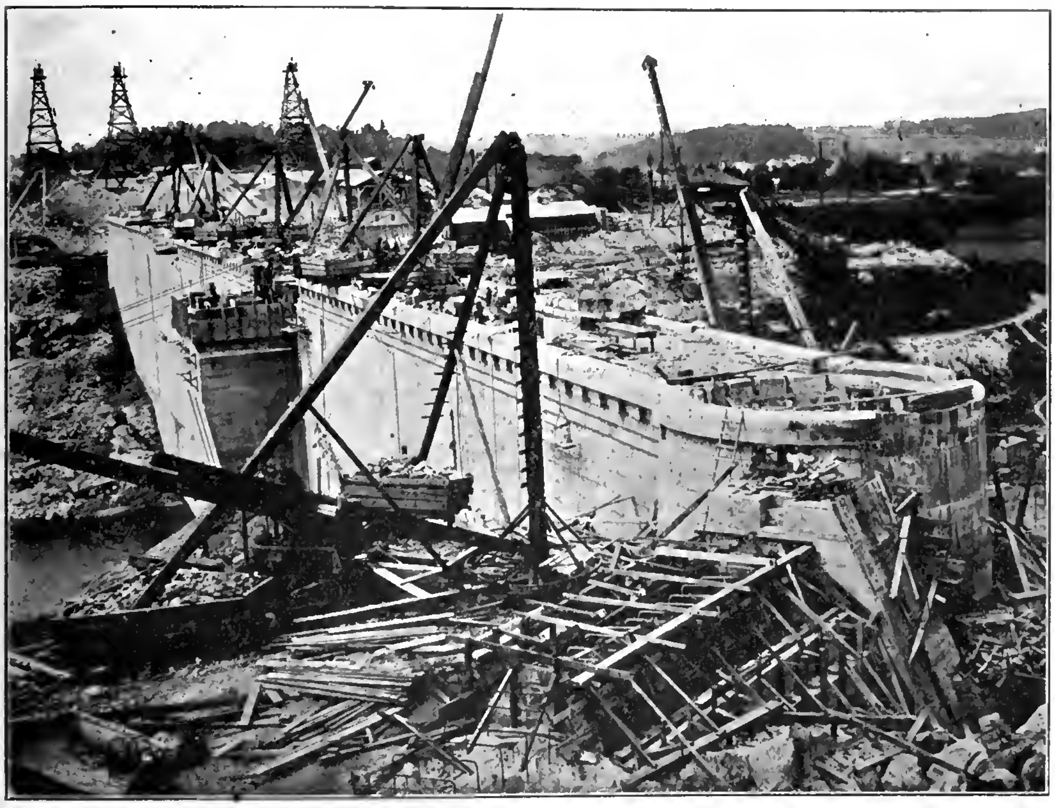
Roadway Foundation and Bars in Crest of Dam.

A cofferdam was built around the upper end of the two 5-ft. steel flume pipes, which carried the flow of the Cross River through the dam during construction, and on July 24th the flow was cut off and during the following night the water level in the reservoir rose 18 in., and the water commenced to flow through the permanent waste pipe at the rate of about 7,000,000 gal. daily, an amount corresponding approximately to the minimum dry weather flow of the river. The flume pipes were immediately closed with rubble masonry very carefully filled in by gangs commencing at the middle and working both ways to the end. The rubble was packed as close as possible, the ends of the pipe were securely closed by heavy dish plates and rubber gas tips bolted on and afterwards all interstices in the masonry were filled by grout forced in under pressure through a full-length perforated pipe.

Besides the construction of the dam the work in progress involves the building of about 1½ miles of macadamized road, 1½ miles of grading, and 5½ miles of gravel road 28 ft. wide. There will be required about 20,000 cu. yd. of open cut at Cross River and 25,000 yd. of cut and 18,000 yd.

of fill at the reservoir and two 40-ft. concrete arch spans across the river and the spillway, involving respectively about 250 and 400 cu. yd. of concrete. The work throughout has been handled as a unit, different portions of it being accelerated or retarded and groups of men shifted from one service to another to maintain a uniform progress and secure the most rapid total advance. A maximum force of about 650 men has been employed and the contractors established a camp large enough to accommodate 600 of them, besides 3-room cattages, boarding hall and dormitory for 60 foremen and mechanics. The camps were supplied with electric lights and water and were carefully cleaned and disinfected twice a week.

Very few fatalities have occurred on the work and there has been no serious accident or epidemic. A regular physician has been retained to care for all cases of sickness and injury without charge to the patient and is paid for out of a fund provided by an assessment of 60 cents per month each on every person employed on the work from the superintendent down. Beds were provided in the New York and White Plains Hospitals as required.



View Looking Downstream, Showing Gatehouse and Bastions.

Mr. W. H. Sears is the chief engineer, and Mr. G. G. Honness is the acting division engineer. Mr. James Winston, of the contracting firm, and Mr. M. J. Look, chief engineer, are in direct charge of the work.

AN UNUSUAL HOT BLAST HEATING SYSTEM has recently been installed in a hospital at Salinas, Cal., in which a furnace heater is used as the source of heat instead of steam coils. The hospital is a 37x90-ft. two-story brick building, and has accommodations for about 30 persons, for which a system with a capacity for delivering about 3,000 cu. ft. of air per min., or the equivalent of about 6,000 cu. ft. per capita per hour, was installed. As there is no steam plant installed, the fan, a 55-in. centrifugal blower, is driven by an electric motor and the air delivered is heated by a large Royal hot air furnace, located in an enlargement of the air casing. The hot blast is distributed by ducts in the basement ceiling with flues rising to each room.

British Power Plant Accidents in 1906.

The annual report for last year of Mr. Michael Longridge, chief engineer of the British Engine, Boiler & Electrical Insurance Co., of Manchester, England, gives interesting information concerning accidents to power plants. The only thing about most of these accidents that is not regrettable is the fact that the information they afford is turned to the use of builders and users of such equipment through these annual reports, which give warning of danger at the expense of somebody else.

The rate of breakdowns among insured steam engines was unusually high during 1906, amounting to 1 in 8.1 of the engines insured, although among oil and gas engines it was lower, 1 in 12.4. The reasons assigned for this difference are that gas engines have fewer parts than steam engines, these parts are generally much smaller than the parts of steam engines of the class insured, and gas engines cannot be habitually subjected to stresses much heavier than the parts were designed to bear. The percentages of the total number of failures of all kinds which were caused primarily by the giving way of various parts first were as follows: Valves and valve gear, 23.3; spur gearing, 12; air pump motions, 9.9; columns, entablatures, bedplates and pedestals, 8.6; air pump bucket and valves, 6.9; cylinders, valve chests and covers, 6.1; connecting rods, straps and bolts, 5.6; main shafts, 5.2, and other parts in smaller percentages. Twenty-eight per cent. of the breakdowns were due to accident or unascertained causes, 36 per cent. to old defects or deterioration by wear and tear, 22 per cent. to the negligence of owners or attendants, and 14 per cent. to weakness, bad design, workmanship or material. In the case of gas and oil engines, the failure is believed to have begun in the valves and valve gear in 28.7 per cent. of the cases; cylinders and cylinder ends 16.7 per cent., main shafts, 15.7; connecting rods and their bolts, 12; govenors and governor gear, 7.4; pistons, 6.5. The unusually high percentage of breakdowns in steam engines on account of wear and tear is attributed to the exceptional activity in the cotton trade, which encouraged spinners and manufacturers to increase their production and consequently their demands for power to the utmost. The increased strain upon the engines found out weak parts which, under rather easier conditions of working, might have remained serviceable. On the other hand the percentage of breakdowns ascribed to weakness, bad design, workmanship and materials was unusually low.

Some of the accidents are described at some length by Mr. Longridge. One of these, interesting as showing the value to power plant owners of the advice of the company's inspectors, occurred to an engine on which more than £300 insurance was refused. It was a horizontal tandem compound engine, with cylinders 19⅛ and 35 in. diameter, by 4 ft. 6 in. stroke, running at 68 revolutions per minute, with a boiler pressure of 120 lb. per square inch. The power, about 450 i. h. p., was transmitted by a rope drum, 24 ft. diameter, grooved for 24 ropes, 1½ in. diameter, and weighing about 21 tons. The peripheral speed at 68 revolutions per minute was, therefore, 5,060 ft. per minute. One morning, while the engineman was filling the crank pin lubricator, he became aware that the engine was gaining speed. As the stop valve was placed between the cylinders, and therefore in a direct line with the rope wheel, he ran to the boiler-house to close the junction valve, but before he could reach it the rope drum burst. All the segments and arms were torn off and broken, leaving the boss only upon the shaft. One of the pieces fell through the boiler-house roof and broke the steam main; other pieces smashed the air pump, condenser, and exhaust pipes, valve and governor gear, and destroyed the engine-house roof. Fortunately, the cylinders escaped. The mill was stopped one month. The accident would probably have been prevented, Mr. Longridge states, by the use of a "knock-off," the absence of which has been reported many times.

Another instructive accident happened to a pair of horizontal tandem tri-compound engines, with high-pressure cylinder, 22 in. diameter, intermediate 35 in. diameter, and two low-pressure, each 40 in. diameter, the high-pressure and one low-pressure piston being coupled to one crank, and the intermediate and the other low-pressure piston to the other crank. The stroke of the pistons was 6 ft., the speed 43 revolutions per minute, and the boiler pressure 160 lbs. per square inch. The power—about 960 i. h. p.—was transmitted by a spur flywheel and pinion, 18 ft. 9 in. and 6 ft. 5 in. diameter respectively. Soon after breakfast one morning a fire broke out in one of the spinning rooms which the engine drove. The operatives at once threw off the machinery and made for the exit, and the engine began to gain speed. The engineman ran to the "knock-off" gear, pulled the trip gear out of action, and began to close the stop valve. While thus engaged, he received an urgent order to start the fire pump, and left the engine-house with the engine slowing down and the stop valve nearly shut. As soon as he had gone, a mechanic rushed in, and, finding the engine still in motion, and no one present, threw the trip gear into action and opened the stop valve as quickly as he could, thinking, in his excitement, that he was closing it. The engines at once began to race, and before the valve could be shut down, had attained sufficient speed to break the cast-iron bell crank levers which drove one of the air pumps. Fortunately, no further damage was done. It is in emergencies like this, Mr. Longridge points out, that such an apparatus as an electric stop motion, which enables anyone to stop the engine by simply pressing a button in the engine-house or in any room in the mill, is useful.

On account of the few instances in which the complete history of broken shafts can be ascertained, the three following cases are important:

The first shaft accident happened to a McNaughted beam engine, with cylinders 20 and

20 in. diameter; strokes of pistons, 2 ft. and 4 ft.; revolutions, 50 per minute; boiler pressure, 75 lbs. per square inch. Power transmitted by spur wheel and pinion. Crank shaft, 23 years old, of wrought iron, with neck 6⅞ in. diameter and 9½ in. long. Bending stress, crank on centre, 7,075 lb. per square inch. Stress due to combination of bending and twisting, 7,920 lb. per square inch. Number of revolutions made by shaft, 193¼ millions. The shaft failed in the neck, the crack being partly longitudinal and then circumferential.

The second shaft accident happened to a horizontal tandem compound engine, with cylinders 17¼ in. and 30 in. diameter, by 3 ft. 6 in. stroke, running at 77 revolutions per minute, with a boiler pressure of 100 lb. per square inch. Power transmitted by spur wheel and pinion. Crank shaft, 19 years old, of wrought iron, with neck 10 in. diameter, by 16 in. long. Distance from centre of bearing to centre line of engine, 19⅜ in. Load on crank pin, about 30,000 lb. in recent years, probably somewhat less in early life. Bending stress with 30,000 lb. load, 6,280 lb. per square inch; combined bending and twisting, 7,400 lb. per square inch. Life of shaft, about 246 million revolutions. The fracture was diagonal for one-third of circumference of neck, and forked at each end.

The third shaft accident happened to a horizontal tandem compound engine, with cylinders 15 in. and 30⅛ in. diameter, by 5 ft. stroke, running at 41 revolutions per minute, with a boiler pressure of 110 lb. per square inch. The crank shaft was of wrought iron, with neck 9⅛ in. diameter, by 15⅛ in. long. The body of the shaft was 10 1-16 in. diameter, swelled to 11 in. to carry the spur flywheel by which the power was transmitted. The shaft broke at the end of the neck farthest from the crank at the junction of the neck to the body. The fracture was circumferential, and practically lay in a plane at right angles to the axis of the shaft, and had extended deeply into the neck all round before the final break. There was no fillet at the change of section where the crack occurred.

The engine was built in 1876 as a simple condensing engine, the low-pressure cylinder being the original cylinder, and worked as such with a boiler pressure of 50 lb. till 1890. The diameter of the cylinder was then reduced by the insertion of a liner to 26 in., and a new high-pressure cylinder placed behind it, converting it into a tandem compound engine. At the same time the boiler pressure was raised to 110 lb. per square inch. In July, 1905, more power was required, and to obtain this the liner was taken out of the condensing cylinder, which was bored out to 30¼ in.

When the alteration was proposed, the Insurance Company strongly advised the replacement of the shaft which had worked for nearly 30 years, but as there was no outward or visible sign of decrepitude the advice was not accepted, and the old shaft was retained. Fourteen weeks later it broke, as described above. The stresses which it sustained are given with fair accuracy as follows:

1876 to 1890; 95½ million revolutions; from bending moments, between 7,600 and 8,450 lb. per square inch; from bending and twisting moments, between 6,800 and 7,200 lb. per square inch.

1890 to 1905; 103½ million revolutions; from bending moments, about 6,800 lb. per square inch; from bending and twisting moments, about 8,700 lb. per square inch.

July, 1905, to October, 1906; about two million revolutions; from bending moments, about 8,150 lb. per square inch; from bending and twisting moments, about 11,000 lb. per square inch. The total number of revolutions was about 202 millions.

Another class of accidents is due to the defective manipulation on condenser plants. A case of this sort was an accident to an inverted vertical two-crank compound engine, with cylinders 12 and 19 in. diameter, by 9 in. stroke, coupled to a continuous current dynamo, giving 700 amperes at 220 volts. Speed, 435 revolutions per minute. Boiler pressure, 160 lb. per square inch. The engine was connected to an independent jet condenser, with an air pump driven by a small electric motor, receiving current from the bus bars on the main switchboard. The set was used for lighting the mill previous to the starting of the main engine at 6.30 a. m. After that hour, the current required both for the lighting and for driving some motors was supplied from a 250-kw. machine driven by the main engine. In transferring the lighting from the smaller to the larger dynamo, the custom was to bring up the voltage of the latter to 220 volts, to switch it on to the bus bars, so as to run in parallel with the pilot dynamo, and then to switch off the latter and stop the pilot engine. During this operation the speed of the main engine had to be regulated by the opening of the stop valve, as the governor would not keep it steady while the load was light.

Under these conditions it is evident that if the steam supplied to the main engine at the moment of switching in the larger dynamo were just sufficient to keep the voltage steady at 220 volts while the dynamo did no work, it would be insufficient to keep the engine up to speed and the voltage of the dynamo up to 220 volts when the load was transferred from the pilot set, or when any of the motors in the mill were started. The maintenance of the voltage would therefore depend upon the manipulation of the stop valve of the main engine by the engineer. If it were not promptly opened, the voltage would fall and the current taken by the motors would increase. On the other hand, if the stop valve of the main engine were opened too quickly or the steam shut off the pilot engine too soon, the pilot dynamo might run as a motor receiving current from the main switchboard. Indeed, the conditions were such as to demand considerable experience and watchfulness on the part of the operator to accomplish the change over without a hitch.

It is not surprising, therefore, that accidents occurred. The first was typical of many others, resulting from the improper manipulation of independent jet-condensing plants. It occurred at 6.30 a. m. one morning on stopping the pilot engine when the main engine had taken the lighting load, and was caused by the attendant switching the current off the air-pump motor, thus stopping the air pump before the pilot engine had come to rest, and before the vacuum in the cylinders was destroyed. The result was that the injection water, instead of being carried away by the air pump, filled up the condenser and exhaust pipe and overflowed into the cylinders, causing the breakage of both cylinder covers.

New covers were obtained during the day, and the engine was started again early the following morning, when another accident occurred, this time through some mistake or want of skill in changing the lighting load over from the pilot to the main dynamo. Exactly what happened could not be ascertained, but the effect of the mistake was that while making the change the voltage suddenly dropped and the current increased sufficiently to throw out the circuit breaker between the main dynamos and the bus bars, and cut off the current before the pilot engine had come to rest. This stopped the motor which drove the air pump for the condenser connected to the pilot engine, and the water again got into the cylinders. The damage on this occasion was not limited to two broken covers. Both cylinders were broken, also the high-pressure piston rod, piston-rod crosshead and guide, and the connecting rod was bent.

Many independent jet-condensing plants are dangerous unless the following rules are observed: 1, Shut the injection cock before stopping the engine. 2, Stop the engine before stopping the air pump. A vacuum breaker arranged to come into action automatically when the water rises above a certain level in the condenser is also a safeguard, so long as it remains in working order, but its adoption should be no excuse for breaking the rules given above.

An accident to an air pump that deserves mention happened to the equipment of a pair of horizontal cross-compound engines, 21 years old, with cylinders 38 and 66 in. diameter by 6 ft. stroke, running at 52 revolutions per minute, with a boiler pressure of 100 lb. per square inch. The power was transmitted by a drum grooved for 40 ropes 1¾ in. diameter, carried on the crank shaft between the engines. The air-pumps, two in number, each 37 in. diameter by 20 in. stroke, were driven by a bell-crank lever from the tail rod of the low-pressure engine.

On looking round the engine one morning, the engineman noticed a vertical crack in one of the air-pump barrels. On closer examination he found several others, which were extending. He at once stopped the engine, and drew the air-pump bucket. He then found the rings very thin, one of them broken in pieces, and the part of the coil spring jammed between the bucket and the barrel. The bucket was said to have been examined six months before the breakdown, but it was quite clear from the worn condition of the rings that no proper examination had been made. The rings were said to be 21 years old. Fortunately the practice of fitting rings into the buckets of vertical pumps has been almost universally abandoned. Besides being a source of danger, they are quite useless, in Mr. Longridge's opinion.

The air pumps usually put in are so large that considerable water leakage may take place past the buckets without materially affecting the vacuum. Not long ago one of the Insurance Company's inspectors found an air-pump bucket, without packing rings, ¾ in. less in diameter than the barrel, yet the vacuum varied from 10 to 12 lb., according to the load on the engine.

Turning to gas-engine accidents it is interesting to observe that the breakages of crank shafts in 1906 were fewer than in 1905, although the number of engines insured was greater. The decrease is no doubt due to the larger diameters which many makers of gas engines have adopted during the last two or three years. Shafts which might have been strong enough five years ago are insufficient for the higher compressions and heavier flywheels now in use, while shafts which were too weak for the old conditions are still more inadequate to-day; calculations of the stresses upon the shafts of gas engines are so difficult and uncertain as to be practically impossible, and makers have to rely to a very large extent on experience, which can only be gained slowly and at considerable expense.

The general practice seems to be to make the shafts and particularly the crank pins, of small engines relatively stronger than those of large. Calling C the diameter of the cylinder, D and d the diameters of the crank pin and shaft journals respectively, l the distance between the bearings on each side of the crank, and r the length of the crank arm, all in inches, the following values of $C^2 (l + d) \div D^3$ and $C^2r \div d^3$ represent roughly the best modern practice. For engines with cylinders below about 12 in. diameter the value of $C^2 (l + d) \div D^3$ varies from 10 to 11, and rises to about 15 for engines with cylinders 20 in. diameter. For small engines, also, the value of $C^2r \div d^3$ is usually 10 to 11, but does not often rise much above 13 for large.

The shafts of some makers give larger constants, and are consequently weaker than those from which the figures given were derived, but in such cases the tendency is to increase diameters. Nevertheless, weak shafts are still being made, and in the keen competition for business the makers of these shafts gain an unfair advantage, for the buyer of a gas engine, particularly a small one, has seldom the fainest idea whether the shaft supplied to him is strong or weak. Mr. Longridge is inclined to think that $C^2 (l + d) \div D^3$ should have a value of about 12 for engines with two bearings and overhanging flywheels, and about 14 for engines with three bearings, and $C^2r \div d^3$ a value of about 10. In any case, large fillets at the junctions of the journals with the crank webs are most important.

Of the shafts that broke in 1906, 77 per cent. had two bearings, 23 per cent. had three or more bearings. Of the shafts with two bearings, 53 per cent. had one flywheel, 47 per cent. had two flywheels. Of the shafts with two flywheels, one broke in one of the crank arms, and one in the body close to the skew wheel for drivng the side shaft. The rest broke in one of the necks, usually the neck at the end which carried the driving pulley.

Of the shafts with one flywheel, two broke in the crank pin, the rest in the neck between the crank and the flywheel. The shafts with three bearings all broke in the neck between the crank and the flywheel.

The breakage of the shaft of the two-flywheel engine close to the skew wheel was unusual. The engine was six years old. It had a cylinder 6¼ in. diameter by 12 in. stroke, and ran at 160 revolutions per minute with town gas. The shaft was of steel 2¼ in. diameter, with two bearings, each 6 in. long. The skew wheel was fixed close to the end of the left-hand bearing, and just beyond it was one of the flywheels. The other flywheel and driving pulley were at the other end of the shaft. The left-hand end of the shaft, with its flywheel, dropped off and careered across the engine-room, and the skew gear was broken. The fracture occurred close to the edge of the skew wheel and between it and the flywheels. It was at right angles to the axis of the shaft, and partly old. Apparently it had started with a skin crack produced by a scriber or by pressure of the sharp edge of the skew wheel, and had then extended across the shaft.

Special attention is called in the report to the fact that the connecting rod bolts give way more often than might be expected; and that flywheels are found loose so often it is probable the keys are not deep enough or are not fitted with sufficient tightness against the driving surfaces of the keyways in contradistinction to the beds. It is also doubtful whether many of the flywheels fit their shafts well enough to be held securely with one sunk key.

One of the most interesting gas engine accidents recorded in the report related to a horizontal gas engine 10 years old, with cylinder 16 in. diameter by 20 in. stroke, running at 160 revolutions per minute with lighting gas from a town main. In November, 1905, the cylinder end fractured, and was replaced. In November, 1906, the new end cracked. The cause was overheating, due to the accumulation of deposit in the water jacket. The owners had been repeatedly advised to keep the water spaces clear, and professed that they were careful to do so. In fact, the Insurance Company's inspector was informed that the jackets had been cleaned five weeks before the crack was noticed, yet when the end was taken off and broken the whole of the heated surface was found coated, and the water spaces round the exhaust-valve chamber completely filled with lime. Pieces of deposit ⅞ in. thick were taken from them.

The case clearly proves the necessity for providing mud holes in the jackets of the cylinders of gas and oil engines, Mr. Longridge states. The company has urged this necessity for many years, but has been met by the argument that, as the water never attained, or ought never to attain, a temperature high enough to cause deposition of lime, mud holes were not required. There is no doubt, however, that hard waters do deposit lime and dirty waters mud, and that provision should be made for removing both. Happily the necessity is now being recognized, at least in the case of large engines. Small ones, however, are still turned out in great numbers without any convenient means of cleaning out the jackets of the cylinders.

In the case of electrical machinery, the breakdowns increased in a somewhat lower ratio during 1906, both in number and in cost, than the number of dynamos and motors insured. In the case of motor-starting switches, however, breakdowns have increased far more rapidly than the number of instruments insured and the cost of repairs in a still higher ratio. The number of breakdowns during 1906 among dynamos was 1 in 16, and among motors 1 in 8.2. Accidents due originally to faults in armatures and rotors made up 44 per cent. of all; commutators and brush gear, 28 per cent.; magnet coils and stators, 14 per cent.; the remaining accidents were too varied to be classified. Of all the breakdowns 22 per cent. were accidental, 11 per cent. were due to age and neglect; 23 per cent. were due to age and deterioration, 9 per cent. were due to bad workmanship and design, and 7 per cent. to overloading.

The inspection of steam boilers and other containers exposed to internal pressure is, in some respects, the most difficult branch of the company's business. While, by the passing of the Factory Act of 1901, Parliament practically, although not explicitly, entrusted the duty of inspection to the boiler insurance companies, it gave them no compulsory powers. It threw the duty of inspection on experienced and responsible bodies, and at the same time compelled those bodies to consult the convenience and necessities of the boiler owners. Most of the demands for increases of pressure by boiler owners and of requests for reduction of pressure on the part of the inspecting companies involve differences of opinion which can only be reconciled by tact and compromise; while the companies have to consider the conveniences and financial necessities of boiler owners on the one hand, they have also to remember that, in the event of anything going wrong, their decisions will be reviewed by a tribunal by training and habit little likely to give purely commercial considerations the importance they have in the eyes of the manufacturer or in the eyes of the insurance companies, which have a more intimate knowledge of his difficulties.

The statutory inspection of boilers under the Factory Act is limited to one thorough inspection every fourteen months. During 1906, 92 per cent. of the boilers coming within the scope of the Act were thoroughly inspected, and over 50,000 inspections were made which were not required by the Act. The serious defects reported during the year were 123 cases of corrosion and grooving, 37 cases of fractures, and five cases where the mountings were out of order or inoperative. Before the end of the year 87 per cent. had been attended to.

THE AVERAGE PERFORMANCE OF STEAM SHOVELS in the iron ore deposits in the Mesabe Range, Minnesota, is about 900 cu. yd. per day of 10 hr. Three shovels together have made a maximum record of 190,000 cu. yd. in a month, a rate per shovel of 1,218 cu. yd. in 10 hr.

The McNulty Building, New York.

The 10-story and basement reinforced concrete McNulty Building, which occupies a 50x95-ft. 9-in. site on the north side of 52d St., between 10th and 11th Aves., New York City, is one of the first small-column reinforced concrete buildings erected in the Borough of Manhattan. The columns, which are of the hooped variety, were designed in accordance with the formula, $P = 1{,}600r^2 + (160{,}000\ Ah \div p) \times r + 6{,}000\ As$, recently developed by the Bureau of Buildings of the Borough of Manhattan for hooped columns. In this formula P = the total working load, r = the radius of the helix, As = the total area of the vertical steel, Ah = the sectional area of the hooping wire, and p = the pitch of the helix. The columns, girders, floor-beams, floors, roof and stairs are of concrete and the walls are of brick and stone. On the sides and rear of the building the panels formed by the wall columns and girders are filled with 12 and 16-in. brick curtain walls above and below the sixth floor, respectively, the exposed outer surfaces of the girders and columns being flush with the surfaces of the curtain walls. The two lower stories of the facade are ornamented with cut limestone and the two top stories with cast cement stone as shown in the accompanying illustration. The intermediate stories of the facade are finished with two shades of red pressed brick and stone window sills.

In plan the various floors are alike, being divided into two longitudinal and four transverse bays by a single line of interior columns placed on the longitudinal center line of the building on about 22-ft. centers. Except in the top story these interior columns are cylindrical in form, and in the basement and in all other stories except the ninth and tenth, they are 27 in. in diameter. In the ninth story the diameter is reduced to 21 in., and in the top story the columns are 12 in. square. Below the fifth floor the reinforcement in each of these columns consist of 2-in. round vertical rods, ranging in number from seven in the fifth story to thirty in the basement, surrounded throughout each story by a 24-in. helix of ½-in. wire with a pitch of 1½ in. Between the sixth and tenth floors the vertical rods are omitted and the diameter of the helix is gradually decreased while the pitch is increased. In the tenth story, four ¾-in. rods, one in each corner of the 12-in. square columns are used.

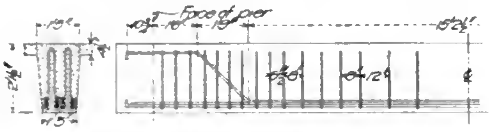
The side wall columns are in general 30x26 in., and carry loads ranging from 48,000 lbs. in the tenth story to 719,750 lbs. in the basement. Below the seventh floor the reinforcement in these columns consist of 2-in. round vertical rods, ranging from three in the sixth story to twenty-four in the basement, spirally wound with 5/16-in. steel wire forming a helix 23 in. in outside diameter with a 2½-in. pitch. Above the seventh floor the reinforcement is four ¾-in. round rods laced with ties of 5/16-in. wire on 18-in. centers. The columns, both wall and interior, rest on cast-iron shoes bedded on solid rock about 2½ ft. below the basement floor.

The main floor girders extend transversely across the building with a clear span of 21 ft. 8½ in. and are 21 in. deep, not including the 5-in. floor slabs. These girders are 15 in. thick at the bottom and 17 in. at the under surface of the floor slabs. Each is reinforced with twelve 1⅛-in. round rods and a large number of 5/16-in. wire stirrups arranged as shown in an accompanying sketch. The method of forming and placing the reinforcement in the columns and girders will be referred to later. The floor beams are placed in general 5 ft. 11½ in. on centers, the floor panels thus formed being about 5⅓x20½ ft. These beams are 15 in. deep, not including the 5-in. floor slabs, and 8 and 10 in. thick at the

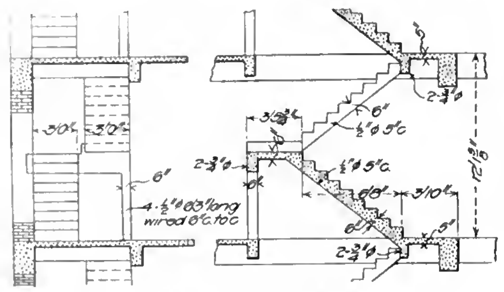
bottom and the under surface of the floor slab, respectively. Each is reinforced with two 1-in. round rods and two 1 1/16-in. round rods and with 5/16-in. stirrups disposed in the same general manner as those in the larger girders. The floor panels are reinforced with 5/16-in. round transverse rods on 5½-in. centers. These rods are cut 13½ ft. long and extend through two panels liberally lapping the succeeding rods at every other floor beam as shown in the floor plan. The side-wall girders have in general a clear span of 19 ft. 3¾ in. and are 2 ft. 2 in. deep including the floor slab and 12 in. and 16 in. wide above and below the sixth story, respectively. The reinforcement in the heavier of these girders consists of four ¾-in. round rods with 5/16-in. stirrups.

The brick work of the facade is anchored to the concrete by suitable anchor bolts and the weight over the windows is carried by cast-iron lintels.

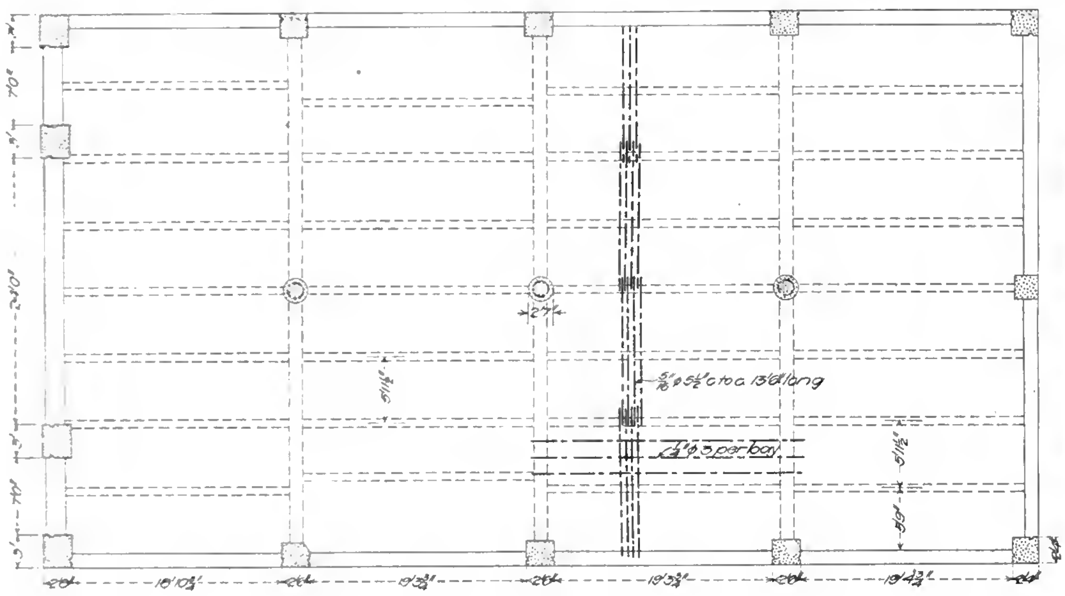
The stairs on both sides of the building are of reinforced concrete with Mason's safety treads.



Floor Girder.



Sections of Stairs.



Floor Plan of the McNulty Building.

The stair slabs have a minimum thickness of 6 in., and in general are reinforced with ½-in. round longitudinal rods on 5-in. centers. Sections of the west stairs on which the reinforcement is indicated are shown.

The reinforcement for all beams and girders was fabricated into units in the shops of the contractor and shipped to the work ready to be put in place, and the helices for the columns were wound and attached to some of the vertical rods at the shop to preserve the pitch. The vertical rods in each column project 6 in. above the surface of the floor slab above, where they enter 12-in. gas-pipe sleeves into which the ends of the vertical rods in the next column are placed. To insure proper spacing the rods placed on the work were slipped through a wooden disc template with holes bored near its circumference at points immediately above the gas-pipe sleeves on the floor below. The reinforcement for each beam and girder was built as a truss, the stirrups being hot shrunk on the longitudinal rods in their proper positions. In some of the heavier girders two such trusses were made for each girder and placed side by side in the form. Each girder and column unit was shipped to the work bearing a tag numbered to correspond with a number on the plan showing the proper position of the reinforcement. This method of preparing and placing steel reinforcement, which is known as the Unit System, it is said, not only assures the accurate placing of the steel but also effects an economy of labor.

The concrete is a 1:2:4 mixture of Giant Portland cement sand and ¾-in. trap rock. It was prepared in a Ransome mixer and was elevated with a Ransome self-dumping hoist, wheel-barrows being used to distribute it on each floor. The placing of concrete was begun about the middle of August, 1906, and the building was completed December 20.

The structural designs were prepared and the reinforced concrete work executed by Messrs. Tucker & Vinton, New York City; Mr. R. L. Bertin, chief engineer; Mr. P. H. Trout, superintendent of construction. The architectural plans were made by Mr. W. C. Lewis, of New York. Mr. Thomas D. Connors was the contractor for the brick work.

An Interesting Business Organization.

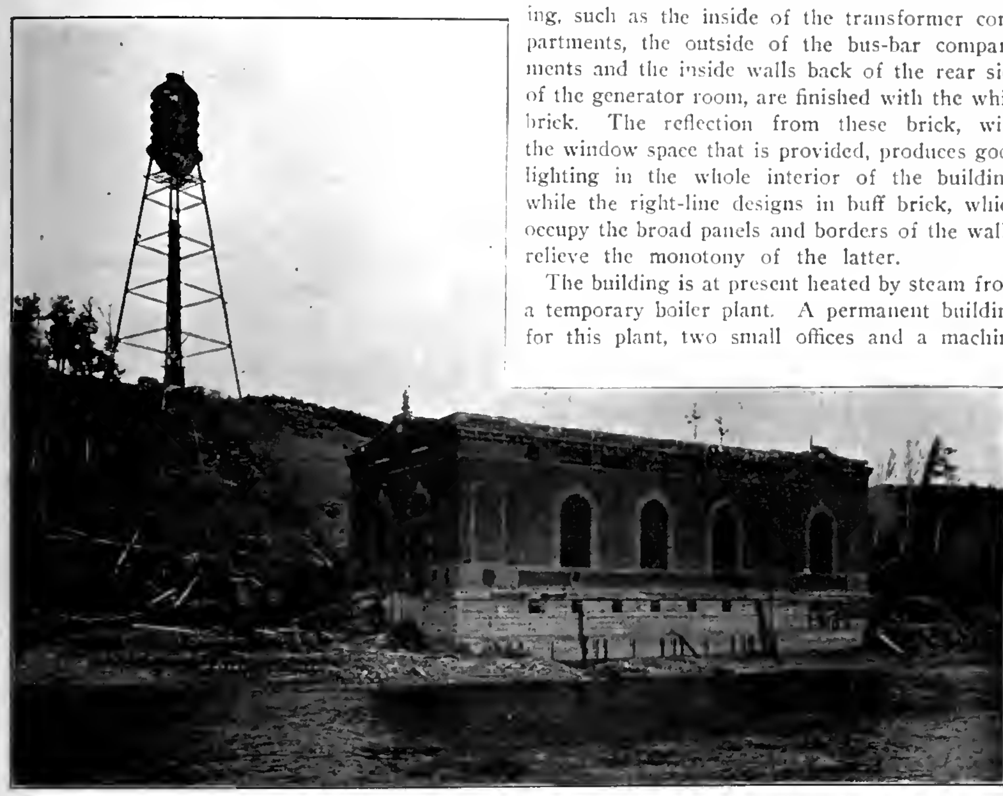
The business organization of the Stone & Webster Engineering Corporation of Boston is an interesting example of the perfection it is possible to attain in a large staff when care is taken to profit by past experience. When the firm of Stone & Webster began work on an extensive scale, construction was handled from its Boston office almost entirely. The more important details were designed there and the plans then turned over to a competent man who was sent to the site and allowed to finish up the work as he saw fit, funds being sent to him as he needed them. The work was done well under this method, but the headquarters office was generally in the dark concerning its progress and what it was costing. It was very soon discovered that there was a marked difference between a good constructor and a good engineer and that neither of them had any particular faculty of keeping the main office promptly posted concerning what they were doing. Even when reports were sent to headquarters, they were handled by different individuals and it was discovered that the data accumulated in this way were of little value for future work. About four years ago the Columbia Improvement Co. was organized to carry on the construction work the Stone & Webster Co. had in hand, but this plan, although a step in advance, proved to be not wholly satisfactory. Accordingly it was determined to combine the improvement company, the engineering department and the purchasing department, all of which are necessary factors in construction work, into a single organization, the Stone & Webster Engineering Corporation. The president of this company has three departments reporting to him, one under the vice-president and treasurer, the other under the engineering manager, and the third under the construction manager. The vice-president and treasurer looks out for the auditing, purchasing and office management at headquarters and the thirteen district offices. The engineering manager has charge of the engineering and architectural work and the drafting office. The construction manager has charge of thirteen district offices, and one of them, that in Texas, has three subsidiary offices. This organization keeps specially trained men in all the branches of engineering and construction work available for any of the Stone & Webster companies, and for general work.

The McNulty Building.

The Geological Conditions in the National Forests are to be investigated by the U. S. Geological Survey, the geologists being instructed to assist claimants to mineral lands in these reserves who are acting in good faith. The Government encourages mining in the forest reserves but many fraudulent entries have been found covering non-mineral lands and deposits which can never be profitably mined. The investigation will not only be of value to the Forest Service and to the miners, but will prevent such fraudulent practices.

The Hydro-Electric Development of the Great Northern Power Co.—Part II.

Station Building.—The building to house the ultimate installation of 80,000 h.-p. in generating equipment will be 77x313 ft. in plan, 90 ft. high, and of thoroughly fireproof construction throughout. A section of this building 181 ft. long has been completed, and is arranged to provide for the addition of the remainder. The design of the building is particularly well-chosen and was developed along pleasing artistic lines capable of practical application. The substructure of the building has a total height of 38 ft. and is of monolithic concrete built on a brown sandstone ledge which underlies the site. The superstructure has a steel frame enclosed in brick masonry trimmed with concrete blocks. The roof is carried by steel trusses which are a part of the building frame. The roof consists of book tile covered with four-ply roofing felt laid in asphalt and finished with tar and gravel.



Power Station during Construction, Showing Standpipe in the Rear.

The treatment of the exterior of the building is comparatively simple but produces a very satisfactory appearance. The outside walls of the substructure were molded to relieve the dead, flat surface of the concrete and the latter was carefully spaded in the forms to produce a homogeneous finish. The outside of the superstructure walls are finished with a mild red pressed brick. The concrete block trimmings, including the door and window lintels, the water tables, the stones of the corner columns and so forth, were cast in molds and were placed after they had hardened. The results secured by this combination of the brick and concrete blocks are all that could be desired.

The arrangement and finish of the interior of the building also evidence what can be done in proportioning and treating a structure of this type in order that the rough appearance so general in such structures may be relieved without diverging from practical limits. A basement, 18 ft. in height, extends under the entire building and forms the upper part of the monolithic substructure. The penstocks, water-wheels, auxiliary pumps and most other crude appearing equipment are in this basement. The latter is well lighted by windows on all four sides of the building, however, and its concrete walls were finished smooth as they were built. Above the basement, the building is divided into two equal parts by a longitudinal wall. A generator room, 38 ft. wide, occupies the river side; back of the wall and along the generator room are compartments for transformers, in the rear of which are compartments for the high-tension bus-bars, and the high-tension switching connections, and on a reinforced concrete floor over these various compartments are the main switches. The main floor of the building has a heavy reinforced concrete floor carried by the side walls of the substructure and by reinforced concrete columns. The inside walls of the generator room have a 7.5-ft. wainscoting of white enamel brick, above which they are finished with white and buff brick laid to right-line designs in the panels between the piers enclosing the columns of the steel frame and around the edges of the walls. Common building brick was obtained in both colors, so the designs were followed without added expense. All other interior surfaces of the building, such as the inside of the transformer compartments, the outside of the bus-bar compartments and the inside walls back of the rear side of the generator room, are finished with the white brick. The reflection from these brick, with the window space that is provided, produces good lighting in the whole interior of the building, while the right-line designs in buff brick, which occupy the broad panels and borders of the walls, relieve the monotony of the latter.

The building is at present heated by steam from a temporary boiler plant. A permanent building for this plant, two small offices and a machine shop, which would be distinct from the station building, has been contemplated, but it is now expected that space will be available for these purposes in the future extension of the main building.

The portion of the main building that is completed is designed to accommodate four 10,000 h.p. water-wheel-generator units, and exciters for eight units of that capacity. Three of these main units are being installed, and the fourth will be added as soon as it is required. These units are spaced 32 ft. apart on centers and are in a single row, with space for the exciters between the end of this row and the four additional units which are to be installed later in the future section of the building.

The initial hydraulic appartus consists of three turbine water-wheels, each having a maximum capacity of 13,000 h.p. under the available head of 378 ft. These wheels were built by the Allis-Chalmers Co., of Milwaukee, after general designs of the Escher-Wyss Co., of Switzerland. They are a modified form of the vertical-shaft Francis pressure type wheel, and are designed to operate at 375 r.p.m. Each of the wheels is connected by a penstock laid on the floor of the basement, with one of the 7-ft. pipe lines. The water is discharged from each wheel into a steel draft tube that passes through the basement floor and the front wall of the substructure to the river.

The penstocks are reduced in diameter gradually from 84 in. at their junction with the pipe lines to 66 in. just back of the wheels. At this 66-in. section a hydraulically-operated gate valve is placed in each penstock. These valves are set on edge on the concrete floor of the basement. They are believed to be the largest ever built for such high pressure, weighing 31 tons each and occupying a floor space 28 ft. in length. The water can be cut off from the wheels by these valves when repairs are required on the latter and also in case a leakage occurs through variable orifice gates in the wheels when the units are not in service.

Two 18-in. by-pass relief valves are placed on each penstock between the 66-in. gate valve and the water wheel which the penstock serves. These relief valves are built in a general way according to Escher-Wyss design. They are arranged so they can be operated automatically by a governor on the water wheel, or they can be set to open when the pressure in the penstock rises above a predetermined amount. It is intended at first to connect one valve on each unit so it will be operated by the governing mechanism of the water wheel and to set the other valve of each pair so it will open before the standpipe is overflowed. Each valve is fitted with a dash pot having a time-element release that closes the valve gradually and automatically after the pressure is relieved, in order to reduce the waste of water. As these relief valves are operated in multiple through the cross receiver at the standpipe, if one of them fails to work the remaining five will still be in service to meet the necessity for a relief of pressure. When the four additional main units are placed this multiple operation of the relief valves will be further improved.

The penstock of each water wheel terminates in a large tapering case, the cross-section of which is generally circular, the case being built on a spiral so as to surround the runner of the wheel. This case, generally termed the scroll case, is a steel casting made in two parts, having a combined weight of over 83,000 lb. Water is admitted to the runner from every point on the inner side of the scroll case, passing through an annular casting containing deflector blades and through movable guide vanes, or gates in a second case inside this annular casting. The scroll case, the annular casting and the guide case are all concentric with the shaft of the wheel. The movable gates, which are similar in general arrangement to register gates, resemble in shape to the head of an axe, thick at the middle, and each turn on a vertical pivot placed in the gate the same as the handle is placed in the axe. The gates are set in a circle concentric with the shaft of the runner, their arrangement being such that they overlap and can be turned to close the opening between them.

The amount of water supplied to the runner is controlled by the position of these gates, which position is determined in the following manner by a fly-ball governor driven by the water wheel: The pivots on which the gates are set extend to the top of the guide, or gate case, where they are each connected by a horizontal link with a bolt in a shifting ring, which fits around that case. This ring is arranged to revolve on an axis concentric with the shaft of the runner, but is required to move only a very slight amount in order to close or open the register gates. Two heavy links attached at diametrically opposite points on the shifting ring are each connected through a positive motion to the piston rod of one of two pairs of operating cylinders which are a part of the governing mechanism of the unit.

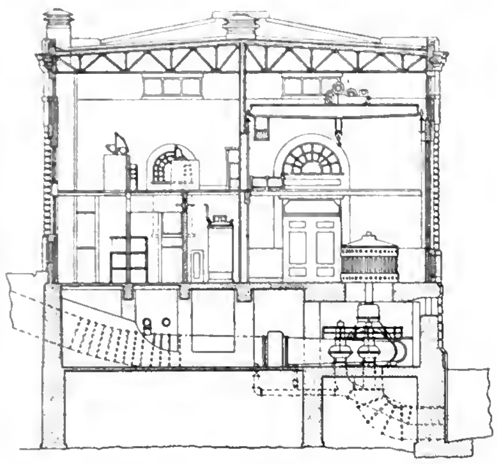
These two pairs of operating cylinders are placed horizontally, one pair on each side of a yoke over the wheel. The operation of each pair of cylinders is the same, the two cylinders of each pair being in tandem. Each cylinder contains a piston and the two pistons of the pair are connected to one piston rod. One cylinder of each pair is connected with the penstock, and the other with a high-pressure oiling system. The connection with the latter is through a pipe fitted with a variable orifice valve which is controlled by a fly-ball governor on the floor of the generator room, this governor being geared to the shaft of the runner of the water wheel. The pressure maintained on the oiling system being much higher than that in the penstocks, when the valve in the connection to that system is opened to admit oil to one cylinder of each pair, the pistons in the oil cylinders are pushed ahead against the lower pressure of the water on the pistons in the other two cylinders. The two pistons of each pair of cylinders are thus moved, the motion being transferred to the shifting ring by a link attached to the rod connecting the pistons, and through the links on that ring connecting with the pivot of the register gates the position of the latter is altered. A reverse motion is obtained by draining oil from the two oil cylinders, which reverse is also accomplished automatically by the governor. Each piston rod also carries a cross-head so it may be connected to one of the two relief valves of the unit by a long lever arm.

The runner of each water wheel is 62 in. in diameter and is mounted on the lower end of a vertical 15 in. shaft. The water passes horizontally into the wheel and then down through the draft tube. Such water as may splash over the top of the wheel will be drawn out of the case in which the latter is enclosed, by two 6-in. pipes leading down through the basement floor to a connection with the draft tube.

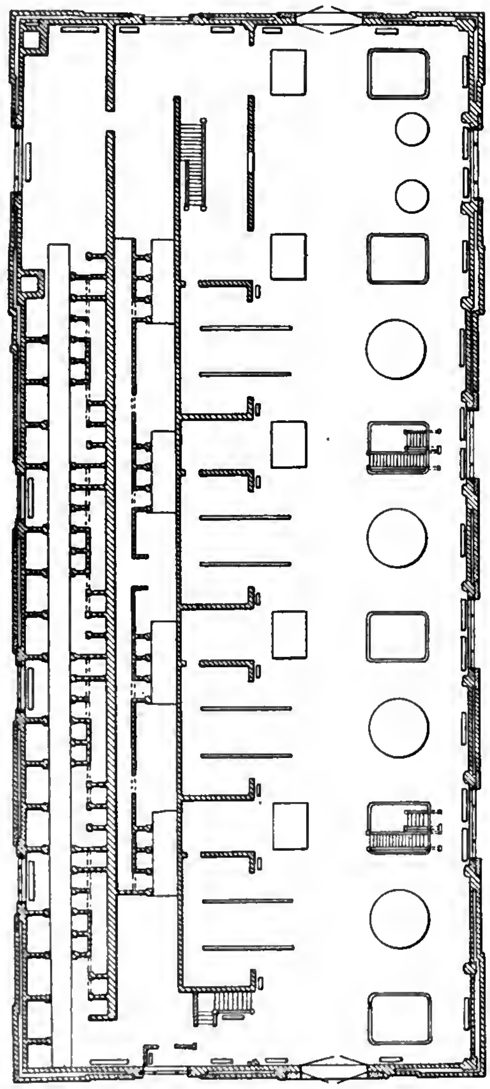
The generator of each unit is a 7,500-kw. 3-phase, 25-cycle, 6,600-volt vertical revolving-field machine built by the General Electric Co. The revolving field of each generator is mounted on an extension of the vertical shaft of the water wheel. The total weight of the revolving element of the unit is carried between the water wheel and the generator by a thrust bearing on the shaft. Two guide bearings are also provided to preserve the alignment of the revolving parts.

The thrust bearings each consist of a heavy ring attached to the shaft of the unit and resting on a second ring supported by a yoke on the wheel casing. The contact surfaces between these two rings are grooved and the weight of the revolving element of the unit is supported on oil forced between the two rings, which are enclosed in a tight case.

A complete system of pipes and pumps supply oil to the step bearings, each unit having an individual oil pump. These pumps are of the mesh-gear type and are specially designed for this service. They are two-stage machines, each stage being arranged to raise the pressure of the oil 200 lb. per square inch, so that the oil can be delivered at 400 lb. per square inch, if desired. Each stage consists of two closely-meshed gears operating to a snug fit in a tight gear case. The oil is squeezed through between the teeth of the gears as they mesh together with sufficient force to apply the pressure. The corresponding gears of each stage are on the same shaft, and the two shafts are geared to a third shaft. A Morris roller-bearing chain which passes over a sprocket on this main shaft and over a sprocket on a jack shaft geared to the vertical shaft of the main unit drives the pump. The latter takes suction from a central supply-tank under the basement floor and delivers into a small, closed, vertical receiver placed over it. One pipe leads from this receiver to the step bearing; a second pipe supplies oil to the cylinders of the operating mechanism which controls the position of the register gates of the water wheel. The drip from the bearing and the discharge from the cylinder are conveyed to a tank fitted with cooling coils through which water from the penstock is constantly circulated, the overflow from this tank being conveyed to the central supply tank by gravity.



Sectional Elevation of Power House.



Plan of Power House.

The oil supply system for each unit is also connected to a general system that is furnished with pressure by two pumps of the same size and type as those for the different units. These pumps are used while the units are being started and simply float on the oiling system as a relay. Each of them is operated by a bevel-gear drive from an impulse water wheel supplied with water through a connection with the penstocks. These reserve pumps draw from the central tank under the basement floor.

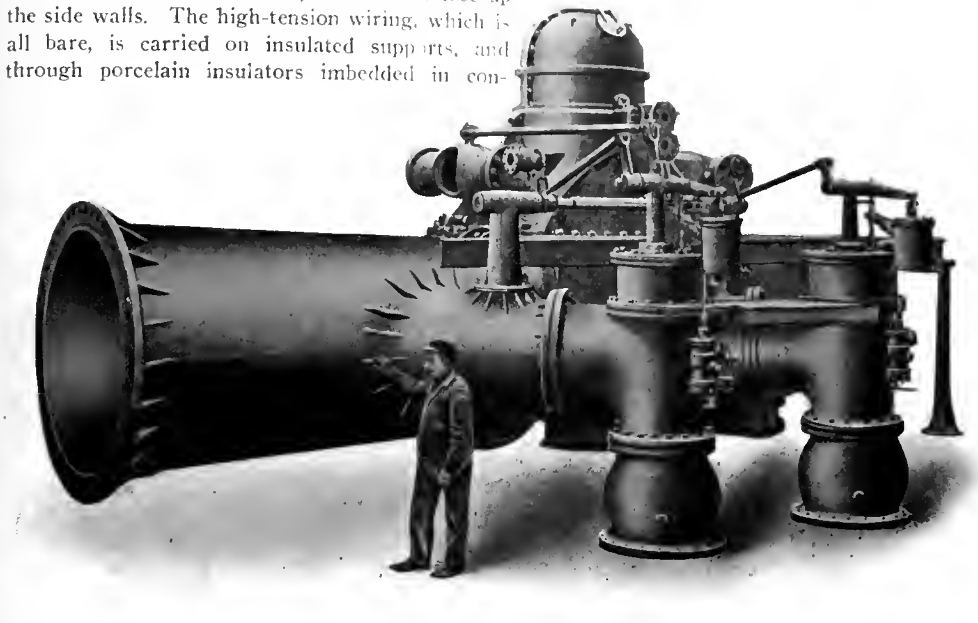
Exciters. Excitation current for the main generators is furnished by two 250-kw. 8-pole 125-volt direct-current generators each direct-connected to a vertical 500-h.p. impulse water wheel. Each of the generators has sufficient capacity to supply excitation current to all of the eight main units which the station will eventually contain. The water wheels are supplied with water from the penstocks, through a ring system of 16-in. pipes. Each leg of the ring is connected with each penstock and is fitted with valves arranged so either wheel can be supplied from any penstock. The amount of water furnished to either wheel is automatically regulated by a valve operated by a governor, but which can also be controlled by hand. The water is discharged from these wheels into the river through a pipe in the front wall of the building.

Transformers. Current from each main generator is delivered through auxiliary bus bars to a single 7,500-kw. three-phase transformer. The transformers are each placed in a separate fire-proof compartment immediately in the rear of the generator room and at the level of the floor of the latter. They are the largest transformers of this type ever built, and on account of their size permitted several special features of design. Each transformer is 14 ft. 10 in. high, 14 ft. long and 5 ft. 10 in. wide, its weight being 171,000 lb. The core and windings, which weigh about 65 tons, are hung from the cover by a framework and can be lifted bodily out of the containing steel tank. The transformer windings are arranged to step the generator voltage of 6,600 volts up to 30,000 or 60,000 volts for transmission, as may be desired.

Strictly speaking, the transformers are oil-insulated and water-cooled, although no water enters the containing case of the transformer, the oil being cooled outside the case in Worthington surface condensers of a special design. A motor-pump set, consisting of a motor direct-connected to a centrifugal pump on one side for handling oil, and to a second centrifugal pump on the other side for handling water, is installed in duplicate in the basement of the building. Two of the condensers are also installed, and are likewise in duplicate. The oil pump draws warm oil from any transformer into one of the surface condensers through a connection to a pipe header suspended from the ceiling of the basement, and then this same pump delivers the cooled oil to a compartment in the base of the transformer core, from which it rises through the latter and the windings. The overflow pipe from the transformer is equipped with a safety valve which closes if the level of the oil in the tank falls below the point essential for proper insulation. A 5,000-gal. tank placed in a small concrete building on the hillside above the station supplies fresh oil to the system. As this tank is always connected to the oil system a pressure greater than that reached by the water used in cooling is maintained; this arrangement precludes the liability of cooling water entering the oil system. The oil can be drained from any transformer to a 5,000-gal. cooling tank in the basement by gravity through either of two distinct outlet pipes. The latter are both fitted at the transformers with quick acting valves for use in an emergency.

Wiring Scheme. All connections between the bus bars and the various units are made through motor-operated oil switches on the main switching floor over the transformer compartments and the space occupied by the high-tension bus bars. These switches are all arranged for remote control from a benchboard on a gallery which projects out from the switching floor over the middle of the generator room, thus placing the operator in plain view of all the main units. The voltage at this board is the same as that of the exciters. The oil switches are each in a separate compart-

ment, which is built of brick laid in cement mortar and has concrete bottoms and tops. The motor which operates each switch is mounted on the top of the compartment for the latter. The front of each switch compartment is not built up, but is closed by loose asbestos-board doors hung over the openings. The bus bars are all in separate brick and concrete compartments, an opening being left at each support for the buses, in the sides of such of these compartments as are closed. All low-tension wiring is insulated and is laid in conduits in the floors, and carried free up the side walls. The high-tension wiring, which is all bare, is carried on insulated supports, and through porcelain insulators imbedded in con-



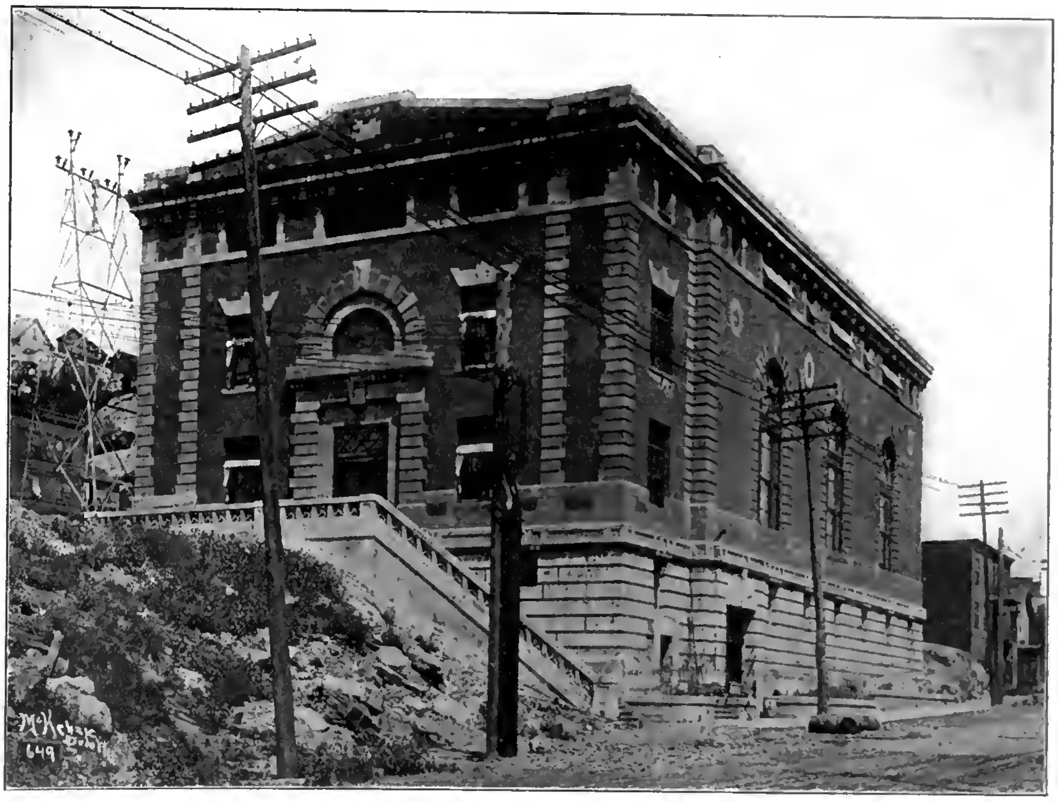
One of the Main Water Wheels Set up in the Shop.

crete blocks, where a connection passes through a wall. A disconnecting switch is placed on each side of every oil switch, in order that repairs may be made with perfect safety.

The three main leads from each generator pass through conduits buried in the floor of the generator room to the wall in the rear of the transformer compartments, and then up the rear side of that wall to the switch floor. Three sets of motor-operated oil switches are provided in a separate group on this floor for each generator. The current from the latter is passed through one set of these switches to a set of auxiliary bus bars in compartments built up in connection with the group of compartments containing the oil switches for that generator. From these auxiliary buses the current may be passed through one set of switches directly to the transformer immediately in the rear of the generator, or through a third set of switches to a set of main 6,600-volt bus bars, and from these buses connections may be made to any transformer through motor-operated oil switches. These main 6,600-volt bus bars and the switches which operate them are in a continuous row of compartments on the switch floor just back of the separate groups of compartments for the switches and auxiliary buses for each generator.

The leads from the high-tension side of each transformer are carried through separate compartments immediately under the concrete floor of the switch room to motor-operated oil switches on that floor; these switches are inserted in connections to auxiliary high-tension bus bars placed in separate compartments at the main floor level of the building. These auxiliary buses can be connected through a separate set of motor-operated oil switches to main buses, which are in separate compartments immediately in front of those for the auxiliary buses at the first floor level. Each set of these main buses can be connected to either of two transmission lines that go out of the plant. Each wire of these lines is in a separate vertical compartment built on the rear wall of the building and is provided with lightning arresters and a static discharger. In general the whole wiring system is thus arranged so current from any generator may be passed through any transformer and out through any transmission line, which arrangement is also contemplated to be extended in the future extension of the station.

The power for the auxiliary motors and for lighting in the building is obtained by stepping down a portion of the 6,600-volt current to 440 volts through three transformers in the basement. The switches in the connections to these transformers are also operated by motors controlled from the benchboard.



Duluth Sub-Station Showing Architectural Treatment.

The switchboard for controlling the ultimate installation of 80,000 h.p. is unusually compact, being not quite 19 ft. in length. The panel for the station lighting and power is placed at the middle of the board, and at each side of this panel are four panels for the eight main units that will be included in the completed station, with a panel at each end for the two exciter units. The panels are of blue Vermont marble, and are set in an ornamental iron frame designed to be in keeping with the remainder of the interior finish of the building. The small switches controlling the motor operated oil switches are on an inclined benchboard at the front, this board being surmounted by vertical panels for the indicating and recording instruments.

Crane. A 60-ton crane, equipped with alternating current motors, spans the generator room and travels the full length of the latter on runways carried by the building frame. The equipment on the floor of that room can thus be reached and hatchways in the floor of the room afford ample opportunity to place equipment in, or to remove it from the basement with the crane. The transformers are on trucks on a track so they can be rolled out under the crane, the front of the compartment for each transformer room being closed by removable doors. A railroad track is also extended into the building on the floor of the generator room.

Transmission Lines. Two three-phase transmission lines, carried on one set of four-legged steel towers, have been built to a sub-station in Duluth, 14 miles from the power station. The towers on which these lines are carried were placed at one side of a 100-ft. right of way, in order to provide space for a second set of towers at the opposite side. The towers are spaced 300 to 1,000 ft. apart, and were built in three heights, 40, 52 and 60 ft., depending on the topography of the country; specially heavy towers were also built at angles in the line. The four legs of each tower converge together at the top in pairs and are thoroughly cross and sway-braced. The two transmission lines are carried at each end of a cross arm at the top of the tower, the three wires of each line being placed at the corners of a 72-in. equilateral triangle.

At present a potential of 30,000 volts will be maintained on the transmission lines, which are No. 00 six-strand copper cables with hemp cores. These lines are designed for 60,000 volts, which will be used when longer transmission is required. A trussed steel pole is extended above the transmission lines on each tower and carries a steel cable of the same size as the copper cables of the transmission lines, as a conductor for lightning protection. This steel cable is grounded at each tower to increase the protection afforded.

A telephone line from the sub-station to the power station is also carried by the towers of the transmission line. The instruments on this telephone line are in booths set on insulators, these booths also being entered from an insulated platform, as protection from effects from the high-tension lines.

Market for Power. The market in short transmission distances from the sub-station in Duluth will consume all of the power that can be furnished by the generating equipment that has been installed. Arrangements have already been made to supply power to the companies which operate the local electric lighting and power stations in Duluth and Superior and for the street railway lines in both of these cities. Various large industrial plants and some of the extensive coal-handling docks along the water front of Duluth Harbor have also arranged to operate on power from the Duluth sub-station. A transmission line has been extended to the waterworks pumping station, from which the distributing system in Duluth is supplied, to operate a motor-driven pump in that station, the latter being a little over 11 miles from the sub-station. The demand for power by these assured consumers will certainly increase very rapidly, since the two cities are growing at a remarkable rate. Additional demands for power will also doubtless be made by other industries already established, and by those which have been contemplated since the inception of the project to develop the St. Louis River. The extensive operations in the Mesabe and Vermillion Iron Ranges, which are within 70 to 90 miles of Duluth, offer a market for power, however, aside from the demands which will doubtless develop in Duluth and Superior, that together with the existing market in those two cities, will, it is believed, eventually, consume more than can be developed on the St. Louis River even when the entire project of the Great Northern Power Co. has been put into execution. At any rate, that part of the development which has been started can scarcely be carried to completion fast enough to meet the power demands certainly in sight.

Sub-station. At present all distributing circuits will be taken from the sub-station in Duluth to which the transmission lines from the power station lead. This sub-station, which is 73x140 ft. in plan, is exactly similar in design and arrangement to the power station. The current from the two incoming transmission lines passes through a wiring system, which is the same as the one in the power station, allowing current from any incoming line to be passed through any transformer and supplied to any outgoing line. Three transformers of the same size and design as those in the power station have been installed. These transformers are arranged to step the incoming current from 30,000 or 60,000 volts down to 13,200 volts. All large consumers of power in Duluth and Superior will be supplied with 25-cycle three-phase current at this potential. The floor of the room in the sub-station corresponding to the generator room in the power station contains three 1,500-kw. motor-driven generator sets which furnish 600-volt direct current for street railway service in Duluth.

Six underground distributing circuits, aggregating about 12 miles of cable, and 16 miles of overhead circuits have been constructed. All important lines have double circuits each capable of carrying the total load supplied by the line. One of these underground circuits extends up the hillside back of the city and thence overhead for 11 miles to the waterworks pumping station. Two others extend about a mile east from the sub-station along the water-front to the power station of the local lighting company. A second two are carried about 1½ miles to a narrow channel across the bay between Duluth and Superior, and thence for 1,200 ft. under the bay in two No. 0000 rubber-insulated and armored submarine cables laid in a trench dredged 30 ft. below the low-water level. From the end of these submarine cables the underground circuits are continued about 1¼ miles to a static discharger, and are then continued overhead for about a mile to the power station of the local lighting and power company. Two motor-generator sets, one of 750-kw. and the other of 1,500-kw. capacity, which will supply direct current for operating the street railway system in Superior, are located in that power station. The latter will also be supplied with power from these circuits. A secondary sub-station will be erected later in Superior at the end of the underground circuits where the static discharger has already been installed.

The sixth underground circuit extends west from the sub-station along the water front for about two miles to a static discharger and then overhead two miles farther to two large industrial plants which are to be supplied.

Switchboard in Sub-Station.

The underground work for the two lines along the water front in each direction from the sub-station and for the line to Superior include eight tile ducts each, six of which are available for future use; manholes are placed about 400 ft. apart on these lines with stubs for connection to local consumers. Two three-conductor paper-insulated lead-covered cable, all No. 000, and each having a capacity of approximately 5,000 h.p. at 13,200 volts are laid in each of the circuits. These cables were made and installed by the Roebling Sons Co., of Trenton, N. J. The overhead construction consists of a pole line carrying two circuits and can be framed for four circuits. The poles are placed about 125 ft. apart and are 50 to 60 ft. in height carrying the lines above all those which are crossed; such local wire lines as are crossed are protected by guard wires.

Methods Used in Construction. The power company built a standard-gauge track 3½ miles long, from the end of a branch of the Northern Pacific R. R. to the power station, for use in delivering the materials required in construction at the power station and in that vicinity. The equipment for the station was also delivered over this railroad, which will be permanently maintained. The plant and materials required in building the service reservoir and the upper works of the development were brought in on the line of the Northern Pacific R. R., which crosses the channel. A spur track was extended from this railroad directly to the site of the main dam and greatly facilitated the delivery of materials for that dam and for several of the other adjacent smaller dams.

Although the project involved a large amount of construction work in the aggregate, the work was so evenly distributed that outside of the main dam and the power house no very great opportunity was presented to employ extensive construction plant. The main dam was built in a manner, however, that greatly facilitated its construction. The spur track from the railroad was carried up on a trestle that extended over the site of the retaining wall at one end of the dam and approximately at right angles to the spillway of the latter. A concrete mixing plant was erected at one side of this trestle, the sand and gravel used in the concrete being dumped from cars on the trestle into separate stock piles under the latter. A trench 6x6 ft. in cross section and about 200 ft. long, had been built under the site of the stock piles previous to the delivery of any materials, and was timbered over so as to form a tunnel under the piles. A belt conveyor placed in this tunnel was fed through chutes in the tunnel roof and delivered at the end to the boot of a bucket elevator. The supply chutes were placed at convenient intervals and were controlled by cut off gates. The bucket elevator was arranged to deliver to either of two storage bins erected over the 1 yd. Chicago cubical concrete mixer which was installed, one bin being provided for gravel and one for sand. Cement was stored in a shed close to the mixer plant and was raised to the charging platform of the latter by a bag elevator. A 1,000 ft. span Flory cableway, on 70-ft. towers was erected on the long axis of the spillway and spanned all of the straight part of the dam. The concrete mixer discharged into 1-yd. skips on

flat cars on a narrow-gauge track that extended from the mixer to the path of the cableway, these skips being picked up and carried to place by the latter.

The main dam, and in fact all concrete dams were built in alternate 30 ft. sections with a tongue-and-groove expansion joint extending entirely through the dam at the junction of each two sections. The retaining wall containing the three 7x9-ft. sluice gates and about half of the spillway section adjoining it were built first, a cofferdam being used in the river. The latter was later diverted through the sluice gates while the remainder of the dam was being built in a second cofferdam.

Concrete mixers were also used in building practically all of the other concrete structures included in the development, and, where feasible, plants for handling the materials were installed. Much of the concrete work on the dam and power house was laid in the winter when the temperatures frequently reached several degrees below zero Fahr., but all of it placed under such conditions is perfectly satisfactory, due chiefly to two reasons. First, the concrete materials and the water, were all heated by steam coils before being mixed, and after the concrete had been placed it was covered with canvas, under which fires were constantly maintained in salamanders until the concrete had received considerable set. Secondly, the weather remained uniformly cold until after the concrete was of considerable age, so no alternate freezing and thawing occurred.

In all, over 50,000 cu. yd. of concrete was used in the various structures connected with the development. The proportions of the concrete were varied continually to suit the materials, an endeavor being made to always secure about 10 per cent. surplus of mortar. Universal Portland cement, about 60,000 bbls. of which was required, beach sand and lake gravel were used exclusively for concrete, except at the lower head gates, where satisfactory gravel was obtained from the excavation. A laboratory was maintained on the work to test the cement daily and to determine the character of the sand and gravel, so the concrete mixture could be varied properly. In all of the cement used none was rejected. The sand was of excellent character, varying uniformly from quite fine to very coarse, and the gravel had the same quality, so the two formed an excellent combination, the voids in the latter frequently being only 20 per cent., or less.

The canal and forebay were built with four steam shovels and narrow-gauge dump cars handled by light locomotives, the total excavation in the canal being over 400,000 cu. yd., of which 100,000 cu. yd. were rock. Two stiff-leg derricks were also used in a part of the work where the material from the excavation was wasted.

View of the Transmission Line.

View of Main Dam under Construction.

The Concrete Mixing Plant at the Main Dam.

The project to develop the St. Louis River, according to the plans which have been followed, was conceived by Mr. F. A. Cokefair, chief engineer of the Great Northern Power Co., and it is largely due to his efforts that the project was carried out. Mr. C. C. Cokefair, president of the Great Northern Development Co., organized the Great Northern Power Co. and financed the project. Mr. C. A. Duncan is now president, and Mr. E. P. Coleman is general manager of the company. Capt. Alex. McDougall is a director of the company and has been actively interested in it since its inception. In addition to local capital that is interested in the company, Messrs. Chas. D. Barney & Co., of New York, and Tucker, Anthony & Co., of Boston, are managers, and the Knickerbocker Trust Co., of New York, is the trustee of the company. Mr. F. O. Blackwell, of Messrs. Viele, Cooper & Blackwell, consulting engineers, of New York, is consulting engineer for the company. During the design and construction Mr. E. C. Bacot was in charge of the electrical engineering department of the company and Mr. W. D. Rittenhouse, mechanical engineering department, under the supervision of Mr. F. A. Cokefair. The power station and sub-station were designed by Mr. A. H. Albertson, architect, of New York.

The contract for the construction of all such parts of the development that have been built was awarded to the National Railway Construction Co., of which Mr. Thos. Pettigrew is chief engineer. This company sub-let some parts of the construction work, but built the most important structures. The principal sub-contractors, in addition to those which have been mentioned, were Messrs. Truax & Thomas, who built two of the reservoir dams and the 3½-mile railroad, and Mr. J. W. Hilliard, who erected the sub-station. The electrical equipment for the entire project was furnished and installed by the General Electric Co. The hydraulic apparatus was built and erected by the Allis-Chalmers Co.

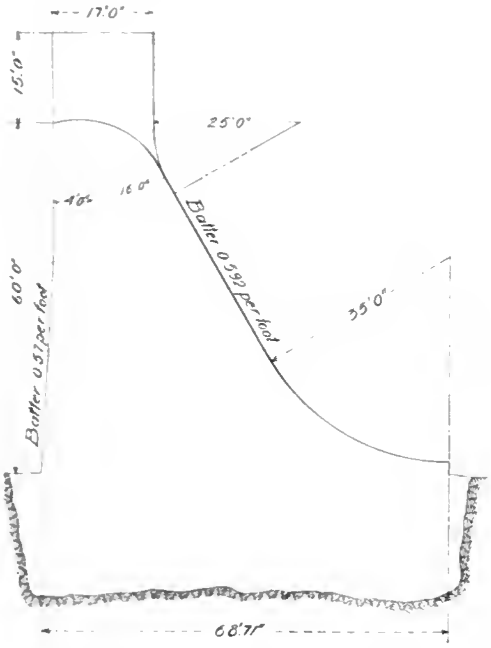
Lightning Protection for Chimneys.

Standards for lightning protection for power plant chimneys in the Navy Yards have been adopted by the U. S. Navy Department, the proposed means being varied for different heights of chimneys to cover those found in the different yards. It is specified that the conductors shall each be made up of seven No. 10 copper wires, two in number for chimneys up to 50 ft. in height, three for chimneys between 50 and 100 ft., and four in number for those higher than 100 ft., in all cases being symmetrically disposed around the stack and forming a cage enclosure. They are to be fastened firmly without insulators to the outside chimney surfaces by bronze anchors, the latter being spaced 10 ft. apart and soldered to the conductors at 50-ft. intervals. At the bottom of the stack the conductors connect with 3 ft. x 3 ft. x ⅛-in. copper earth plates buried in the ground below the water line, and at the top to a 1½ x 1½-in. copper ring, to which the discharge tip rods are attached. The latter are of ¾-in. solid copper, 10 ft. in length, spaced 4 ft. apart around the circumference of the chimney cap, each terminating in a two-pointed aigrette. The portions of the conductors near the chimney base are to be protected by a 1½-in. galvanized-iron pipe sheathing, rising 10 ft. above the ground level and extending 3 ft. below it.

The New Water and Sewerage Systems of Manila.

Early in 1906 the municipal board of Manila, P. I., let contracts for a sanitary sewerage system, and a large addition to the water supply of the city. The work is now well under way and it is expected that the water supply system will be completed about the middle of next year, and the sewerage system about a year later. The new water supply is to be taken from the Mariquina River, about 10 miles northeast of Manila, and will be brought to the city partly through a riveted steel pipe line and partly through a free flowing conduit. The work necessitates the construction of a dam at a gorge in the river, creating a reservoir with a capacity of about 2,000,000,000 gal., and the construction of a distributing reservoir about a mile from the present one. The sanitary sewerage system is to be extended to all parts of the city, and on account of the low elevation will consist of a combination of gravity and pumping systems.

The dam which will create the impounding reservoir has a length of about 400 ft. on the crest, the central portion, 160 ft. in width, being designed as an overflow or waste weir with its crest 15 ft. lower than the remainder of the dam. The maximum height above the bed of the stream is approximately 75 ft. The elevation of the reservoir is about 212 ft. above sea level.



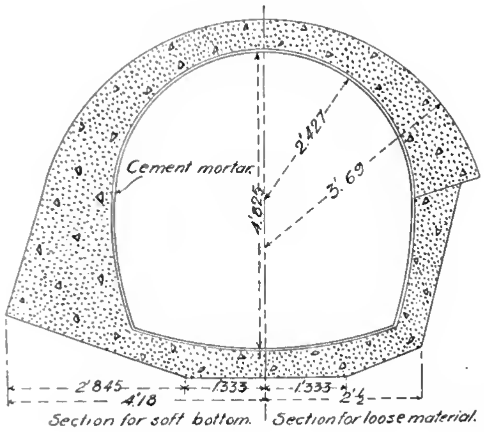
Spillway and High Sections of Dam.

The foundation of the dam is a bed of solid rock which was thoroughly cleaned of all dirt and debris and washed before the work was started. The bonding of the masonry to the foundation was further secured by stepping and grooving the rocks after all fissured and unsound portions had been removed. The excavation for the foundations amounted to about 16,000 cu. yd., 11,000 of which consisted of solid rock.

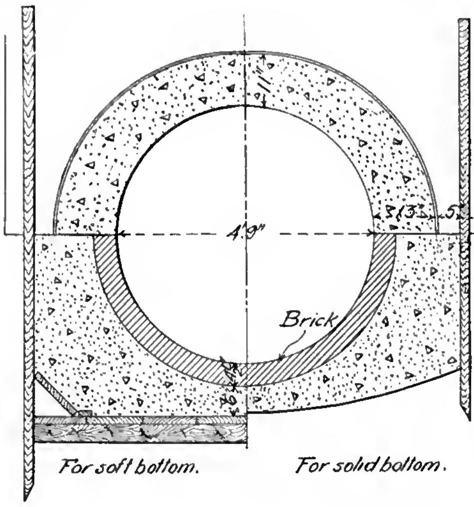
The dam is built of rubble concrete masonry containing about 50 per cent. of large stones laid in irregular fashion so as to avoid continuous joints through the structure. The stone is a marble—a high grade of limestone. The concrete is a 1:2½:5 mixture, the aggregate being gravel and broken stone, in sizes varying up to 2 in. in maximum dimension. The sand, gravel and stone were obtained in the vicinity of the dam. The upstream top and downstream faces are built of coursed-rubble made with stone, dressed so as to make ¾-in. joints, for a depth of at least 4 in. After laying the joints were raked out to a depth of 2 in. and pointed with a 1:1 cement mortar. The total yardage of the dam including large stones and concrete is about 28,000 cu. yd.

The gate house controlling the flow from the reservoir to the pipe line is built as part of the dam at one end of the spillway section. It measures 27x40 ft. in plan, the longer dimension being parallel to the axis of the dam. Two pipe lines run through it, one a 42-in. line carrying the supply to the city and the other a 36-in. pipe serving as a waste line and discharging into the river a short distance below the dam.

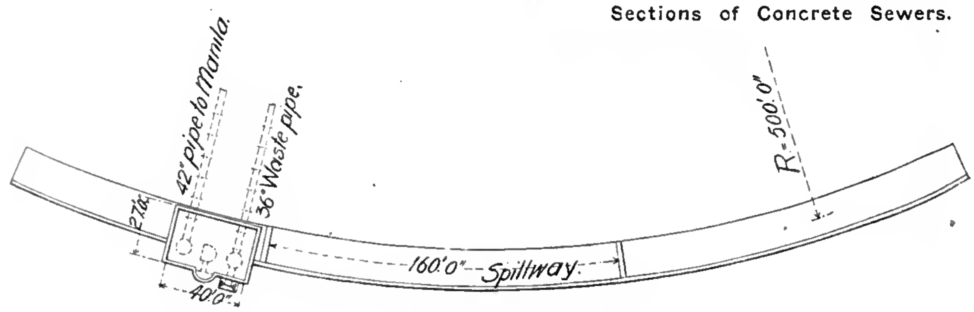
The pipe line consists of a 42-in. riveted steel main 10½ miles long, discharging at the end nearer the city into a conduit which follows the hydraulic gradient. For about two miles it follows the valley of the Mariquina River and then starts across country in a direct line for Manila, passing under the Mariquina River through a 36-in. cast-iron pipe. Through all parts of its length it is between 50 and 100 ft. below the hydraulic gradient, a depth of about 100 ft. being maintained for all but a short distance of the line. The pipe is made of plates about 2/10 of an inch thick of 2 courses, the smaller fitting into the larger, each course corresponding to the width of plates from which the pipes are made, being about 60 in. long. The longitudinal seams are double riveted and the circular seams single riveted, except at curves where circular seams are double riveted at the beveled joints, the rivets used being 7/16 in. in diameter. The pipes are fabricated at the shop of the Atlantic, Gulf & Pacific Co., in Manila, and transported to the work in sections 20 and 30 ft. long, depending upon the transportation facilities and the condition of the roads. The steel plates for the pipe were furnished by Henry H. Peabody & Co., having been purchased by the Municipal Board of Manila under contract awarded at the time of letting the remainder of the work. The pipe is caulked at all seams inside and out before being coated, and and tested at the shops to a hydraulic pressure of 100 lb. per square inch. After being laid in the trench, the pipe is again tested, the field riveting having been completed, to a pressure of 75 lb. per square inch. Blow-off pipes are provided at all sags in the line, and air valves at all summits, these in all cases being enclosed in suitable wells. The blow-off pipes are 6 in. in diameter and are discharged into convenient water courses. Brick manholes, 14x16 in., are spaced approximately 500 ft. apart throughout the entire line. The excavation for the pipes lines amounted to about 58,000 cu. yd. of earth and 18,000 cu, yd. of loose, solid and adobe rock. The minimum covering of the completed pipe is 2 ft.



Sections of Aqueduct.



Sections of Concrete Sewers.



Plan of Dam on Mariquina River.

The crossing under the Mariquina River near San Mateo is made through a 36-in. cast-iron pipe about 500 ft. long at each end of which reducers join on to the 42-in. riveted steel pipe in gate houses through which the valves controlling the 8-in. blow-off pipes are controlled. These gate houses are circular, 8 ft. in diameter, and surmount the 6-ft. concrete wells in which the valve mechanism is set.

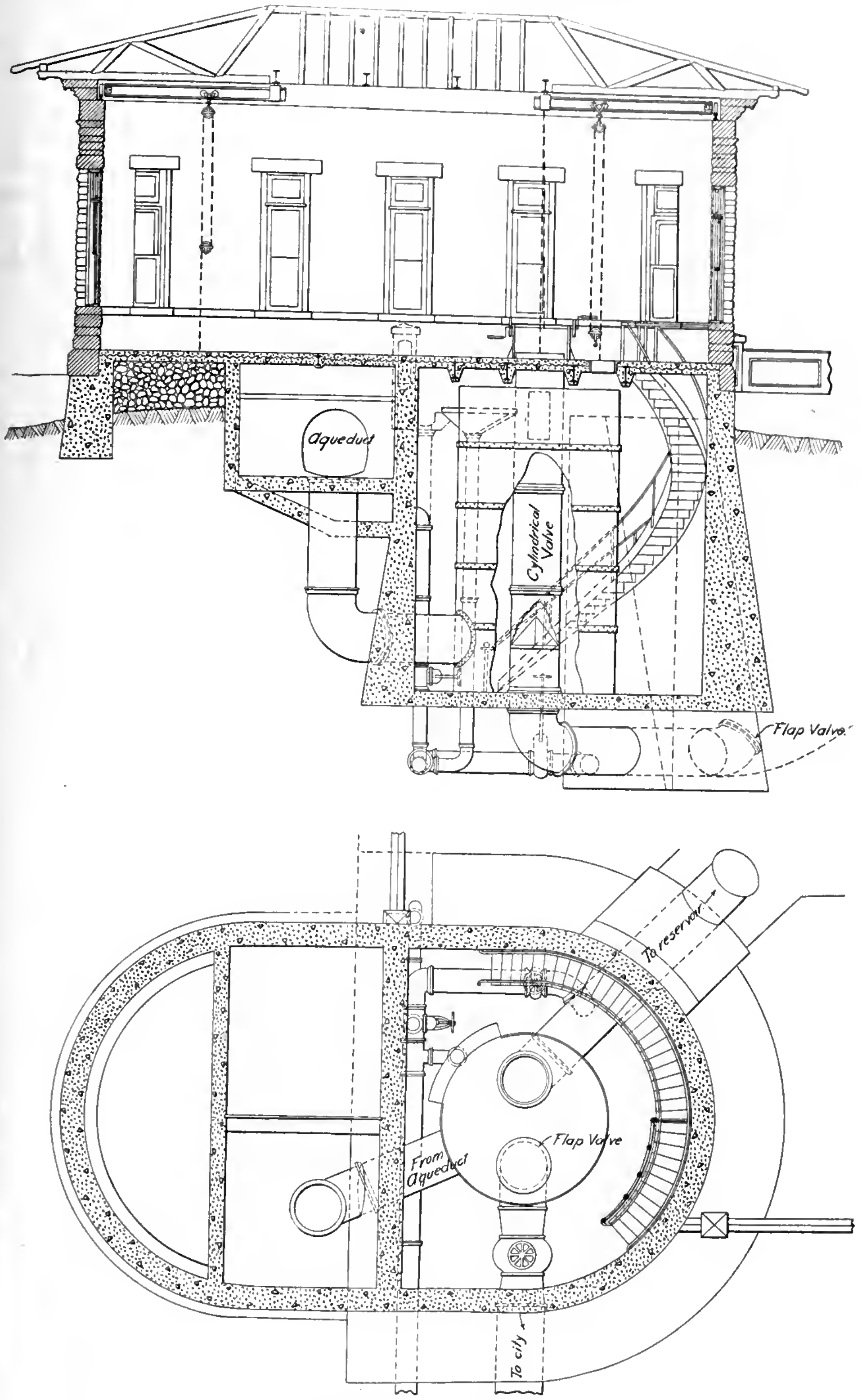
From the end of the pipe lines to the distributing reservoir, water flows through a concrete aqueduct constructed in tunnels the entire distance of 4 miles. Part of the work is done by the cut and cover method, but the greater part by tunneling carried on from 12 shafts. The total amount of earth and rock to be moved is about 34,000 cu. yd., most of which is adobe rock. The conduit has a horse-shoe section about 4½ ft. wide and a maximum height of 4 ft. 10 in. In solid rock sections the conduit is lined with a coat of 1:1 cement mortar, while in those parts where a full concrete section is required the same mortar finish is applied to the concrete. Where the line runs through loose material or a soft bottom is encountered, the concrete is spread out to afford an adequate foundation, and in places where the conduit runs through a section of rock overlaid with loose material the cut and cover method is used, excavating the lower part of the conduit in solid rock and building a concrete roof having the same interior arch as the other sections. The minimum thickness of concrete at the crown of the arch, is 6 in.

The siphon is composed of two 42-in. cast-iron pipes connected to the conduit by means of concrete siphon chambers, 8 ft. wide and 8 ft. high, to which access is had by means of 24-in. manholes.

The distributing reservoir is located about a mile east of the present Deposito, as the present reservoir is called, and 1½ miles outside the city limits of Manila, at an elevation of about 112 ft. above the level of the sea. It is rectangular in plan, measuring 504x769 ft., 20 ft. deep, and

has a capacity of 50,000,000 gal. It is built on ground sloping to the south with a maximum difference in elevation of 15 ft. The bottom of the reservoir is about 25 ft. below the natural surface where the ground is highest, and about 8 ft. where it is lowest, and consequently the greater part of it lies in excavation and only part of the banks are carried up above the natural surface. The banks slope 1:1 and in the rock section are covered with a thin coating of cement mortar while the other parts of the banks are lined with a 4-in. layer of 1:2½:4 concrete. Expansion joints are left in the lining every 20 ft. Where the top of the reservoir is above the natural surface of the ground an embankment is built up in the customary manner, laying thin layers of good earth and watering and rolling them thoroughly. A 10-ft. driveway on a 10 per cent. slope leads down inside the embankment so as to allow access to the bottom of the reservoir for wagons should it be necessary to make repairs. The excavation here involved amounted to 29,000 cu. yd. of earth and approximately 235,000 cu. yd. of rock.

The water supplied to the conduit is measured before entering the reservoir over a weir built into a concrete chamber which is surmounted by a suitable building. The weir box is 12 ft. wide and 29 ft. long from the end of the conduit to the weir. The weir itself consists of a steel plate bolted to plates set into the concrete of the chamber, the notch being 6 ft. wide and 2 ft. deep. The crest is approximately 3 ft. 3 in. above the bottom of the chamber. A 20-in. drain pipe controlled by a gate valve allows the silt that may accumulate in the chamber to be flushed out.



Gatehouse at New Reservoir.

The flow into and out of the reservoir is controlled from a single gate-house located at the corner of the dam toward Manila. The aqueduct, the gates of the reservoir and the supply pipe leading to Manila all meet in a riveted steel distributing tank and are fitted with suitable valves so as to divert the flow as desired. The aqueduct enters immediately below the floor of the building, which is on a level with the top of the embankment, and terminates in a concrete chamber across one end of which is a screen shutting off a second chamber, from which a 42-in cast-iron pipe leads down to discharge into the tank near the bottom of the latter. The discharge into the reservoir from the distributing tank is controlled by a cylindrical valve, and by a flap valve on the end of the pipe in the reservoir. The flow into the main leading to the city is governed by a flap valve which can be raised by mechanism on the floor of the gate house, and by a 36-in. gate valve located outside the steel tank in the concrete chamber. A 12-in. overflow pipe is attached to the tank and an 18-in. drain pipe is connected with the line connecting the tank and the reservoir.

The gate house is built with semi-circular ends 47 ft. 8 in. on the longest and 26 ft. 8 in. on the shortest dimension. It is built of ashlar masonry laid in Portland cement mortar, and the interior is finished with Mariquina marble. The water will be conveyed to the city from the new reservoir in a 42-in. cast-iron pressure pipe, the supply in the city being wholly by gravity due to the elevation of the reservoir.

Sewerage System.—Up to the present time Manila has been without a sewer system and the one now being built is a sanitary system, a distinct arrangement of open drains being projected to care for the storm water. The ground on which the city is built is very flat and varies in height above mean high tide from 2 or 3 to about 10 ft., and for this reason a purely gravity drainage system was out of the question. The natural solution of the problem of the disposal of the sewage was to discharge it into the bay at such a point where it would not be obnoxious and this plan has been adopted. The city has been divided into 6 districts, 3 on each side of the Pasig River, in each of which an independent gravity drainage system will be installed. The sewage of each district will drain to a pumping station from which it will be forced to the main pumping plant located on the shore of the bay at the beginning of the force main through which it will be discharged. All of the sewage from the three pumping stations on the south of the river will be carried under the river to the main pumping station through a twin inverted siphon consisting of two 24-in. flexible joint, cast-iron pipes.

There will be in all about 52 miles of sewers, 7½ miles of which will be composed of brick and concrete, ranging in size from a 2 x 3-ft. egg-shaped to a 4¾-ft. circular section, laid at depths ranging from 12 to 18 ft. below the surface of the ground; and about 42 miles of glazed terra-cotta pipe from 8 to 24 in. in diameter, laid from 5 to 16 ft. below the surface. In addition to these lines, there will be one 42-in. cast-iron outfall pipe, 6,500 ft. long, laid below the bed of the harbor, the crossing of the Pasig River above mentioned, and cast-iron pipe crossings of 9 esteros or canals.

The sewers are laid throughout in loose material, consisting of mud, sand and light clay, the sides of the trenches requiring very careful sheeting to retain the soft material. Pumping has to be done continually while the work is in progress. Much of the sheeting is left in place in order to prevent the caving of the streets beside the trench after the latter is refilled. The large sewers are built of concrete, with a single layer of brick laid in the concrete to form the invert. In the egg-shaped sewers a moulded concrete block replaces the brick in the sharp curve at the bottom of the invert. In insecure foundations the sewers are supported on timber platforms. The lower half of the terra-cotta sewers is surrounded with an annular ring of concrete from 4 to 6 in. thick, depending upon the size of the pipe, and where the foundation is not firm, the concrete instead of being placed as a ring is spread out so as to afford a footing and placed

upon a timber foundation the same as for the large sewers. The Portland cement used both on this work, and on the water-works system is of English make, K. B. & S., and White Bros.

The estero crossings are made by double lines of cast-iron pipe ranging in diameter from 16 to 36 in., the pipes in all cases going well below the bed of the canal. On each bank there is constructed a chamber, to which access is had through a manhole, in one of which are located gates for shutting off the flow in the pipe. In some cases where only one pipe was necessary a safety outlet has been provided through an extra chamber whereby the sewers can be diverted into the estero in case it is necessary to make repairs to the pipe. By closing a gate dividing the two chambers, the sewage is forced through the temporary discharge pipe which opens from this chamber. The second chamber is therefore left free and can be drained to afford a working place in putting cleaning devices through the pipes or making repairs. The pipes, whether single or double, are completely enclosed in concrete and where the soil requires it are placed on timber platforms. These estero crossings vary in length between man-holes on the banks from 84 to 223 ft. The crossing of the Pasig River is built of two 24-in. flexible-joint cast-iron pipes laid with their tops about 23 ft. below mean low tide level. The crossing is about 650 ft. long between the man-holes on the banks. These crossings of the esteros and the river were put in by dredging trenches, and lowering the pipe from barges.

The outfall pipe leading under the bay consists of a 42-in. cast-iron pipe with bell and spigot ends, 6,500 ft. long, supported on piles 9 ft. apart throughout the entire length. The piles are capped with a 10 x 10-in. timber, 6 ft. 6 in. long, and every 18 ft. additional piles were driven on both sides of the pipe to hold it against lateral movement.

The bay is quite shallow where the pipe runs, the water being from a few feet to about 8 ft. deep at mean low water. The pipe was laid in a trench excavated by a hydraulic dredge and after it was in place and calked the trench was refilled. The pipe was put together in sections 48 ft. long, consisting of four 12-ft. lengths, and loaded on barges and towed out to their position. The barges were brought up alongside a scow on which four tackles were rigged for lowering the pipe to place. The pipe was calked with oakum and soft lead by divers. The end of the pipe is located in 8-ft. of water in a concrete block 14 ft. square and 12 ft. high, resting on a timber platform built on piles.

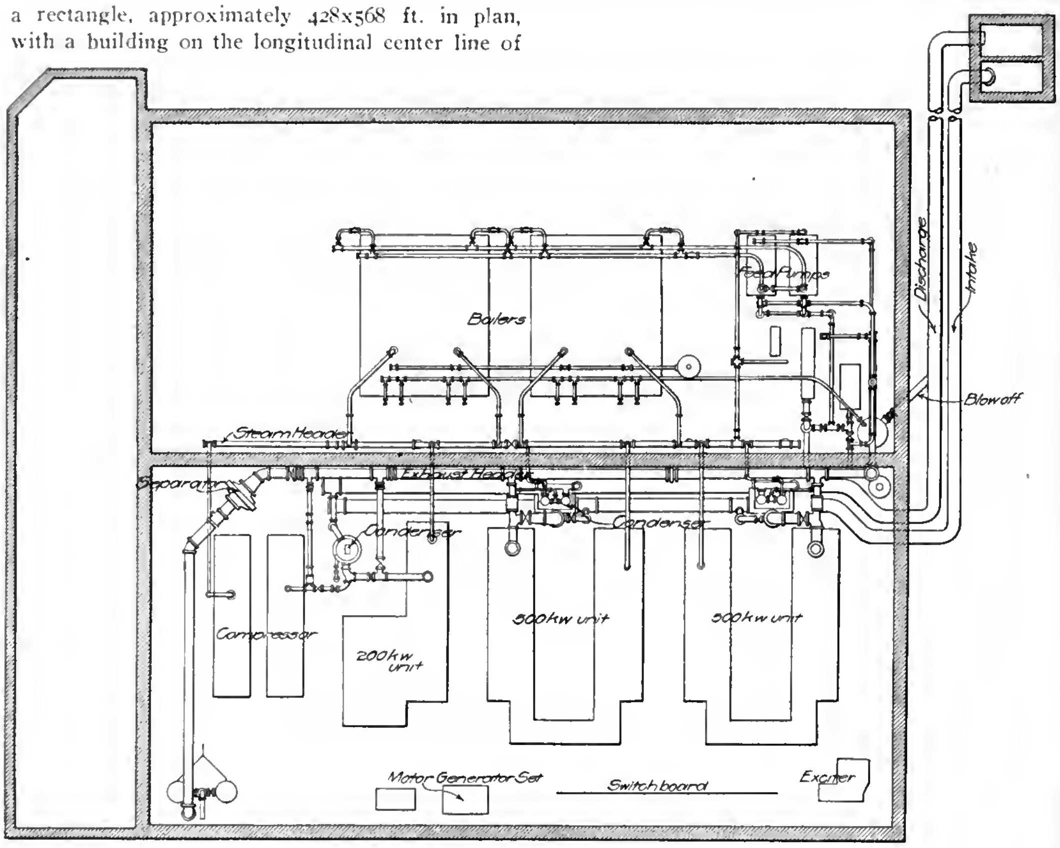
The amount of the contract for the water-works system is $1,026,000 and for the sewerage system $1,631,000. The work is under the Department of Sewer and Water-Works Construction, the water system being designed and in charge of Mr. J. F. Case, chief engineer of the department. The sewer system was designed by Mr. O. L. Ingalls, principal assistant engineer of the department. At the present time the sewerage system is 50 per cent. completed, the tunnels 75 per cent., and the riveted steel pipe line 33 per cent.

The steel pipe and tunnel of the water-works system, and the entire sewerage system are being built by the Atlantic, Gulf & Pacific Co., and the dam and reservoir by the Matson, Lord & Besler Co.

A LARGE DEPOSIT OF IRON ORE has been discovered on the Island of Cuba, in the Province of Oriente. It is located on a plateau ten miles long by about four miles wide. A large number of borings have been made and the property involved, about 27,000 acres, has been secured by a company that is about to develop it.

The Power Plant of the Elgin National Watch Works.

The manufacturing works of the Elgin National Watch Co. at Elgin, Ill., are in a group of large factory buildings on the left bank of the Fox River. The original buildings of these works were not arranged according to any defined plan, but had been added from time to time as more space was required. Several years ago after the business of the company had grown to large proportions, a broad general plan for the complete arrangement of the works was adopted. This plan contemplated that most of the old buildings should be abandoned and replaced by new ones, which could be arranged to better facilitate the operation of the works. The new buildings were to be placed around the sides of a rectangle, approximately 428x568 ft. in plan, with a building on the longitudinal center line of the rectangle. A part of this plan has been carried out by erecting new buildings along the front side and one end of the rectangle, and by abandoning some of the original buildings.



General Plan of Power Station.

The new buildings that have been completed are four stories and a basement in height, their design conforming to the uniform proportions of the general plan. They are of fire-resisting construction throughout and are built to produce the best of light and ventilation for the large number of employes housed by them. The greater part of the manufacturing carried on in these buildings is exceedingly intricate, but a considerable amount of work is done by machines which, together with the lighting, heating, ventilating, and service systems for the various buildings, necessitate a large power plant capable of responding to a load which varies widely from hour to hour and from season to season.

The original power plant of the works was in two brick buildings near the center of the rectangle of new buildings. The demands for power had gradually outgrown the capacity of this plant until the equipment of the latter was no longer equal to the requirements, although such additions as were feasible had been made to it from time to time. A plan for an entirely new plant arranged to provide for the growth of the works was therefore adopted and carried out.

The new power plant is in a separate brick building at one corner of the proposed rectangle of new factory buildings. The end of this building is in line with the buildings along the end on the river side, and the front of it is about 100 ft. from the site of the buildings which will occupy the rear side of the rectangle. The exterior of the power plant building conforms with the design of the new factory buildings. It is 108.5x115 ft. in plan and rises to a height of 61 ft. above the footings. The building has a concrete substructure built on solid rock. The side walls are of buff brick, trimmed with Bedford sandstone and ornamental terra cotta. The roof is carried by steel trusses resting on the side walls. The interior of the building is divided by a longitudinal brick wall into an engine room, 53 ft. 11 in. wide, and a boiler room 49 ft. 6 in. in width, a basement 11 ft. in height extending under the entire building. The basement has a concrete floor and the floors of the boiler and engine rooms are of reinforced concrete.

Coal for the plant is delivered by the Chicago & Northwestern Ry. and the Aurora, Elgin & Chicago third-rail electric line, the latter connecting with the Illinois Central and the Chicago, Milwaukee & St. Paul Railroads. An elevated switch track is extended from these lines over a track hopper at one end of the building. The coal is handled from this hopper to overhead storage bunkers in the boiler room by a traveling Link Belt gravity-overlapping-bucket conveyor, with a capacity for handling 40 tons an hour. The coal feeds by gravity from the track hopper into a crusher, belt-driven by a 15-h.p. induction motor in the basement of the boiler room. The conveyor is driven by a 7½-h.p. induction motor in a tower over the track hopper at the end of the building. It extends vertically up the end of the building from the crusher to the top of the boiler room, then horizontally the length of the latter, down at the opposite end of the room to the basement and thence in a horizontal run along the floor of the basement to the crusher again.

The boiler room contains four Cahall horizontal sectional water-tube boilers, which are placed in pairs in a row, with space at one end of the row for an additional pair. Each boiler is equipped with a Mansfield traveling chain-grate stoker, 6 ft. 5 in. wide. The coal conveyor de-

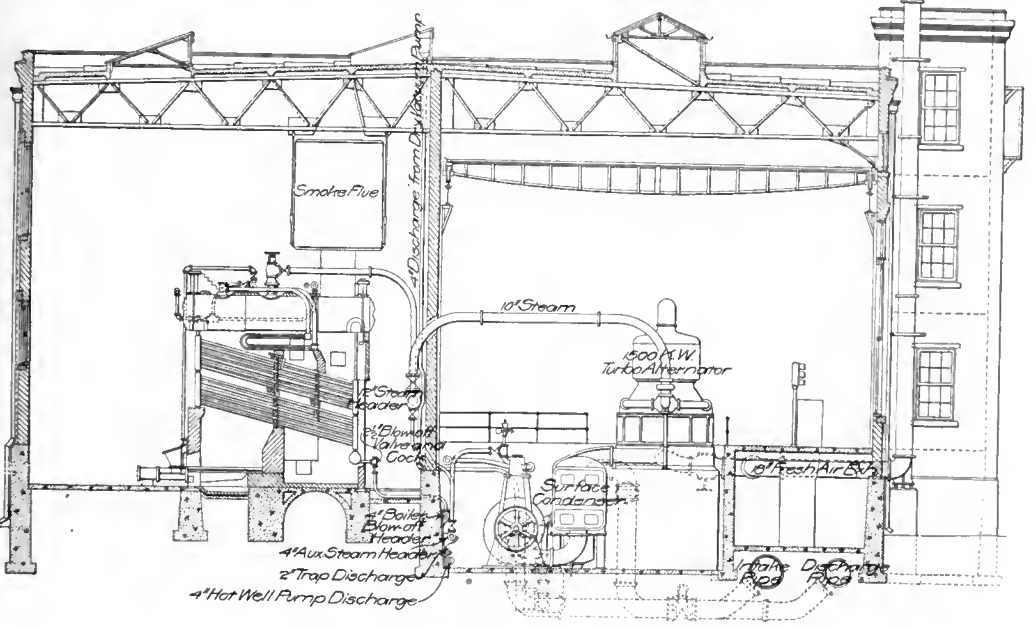
livers to four overhead storage bunkers, with a capacity of 1,000 tons, one for each of the present two pairs of boilers, one for each pair that will be installed in the future and one for storage. The bunkers each have two downspouts, one for each of the two boilers of the pair which they serve. The downspouts are controlled by undercut gates, and feed directly into the charging hoppers of the stokers. The coal which falls through the front ends of the stokers is caught in a hopper built in the concrete floor in front of each stoker. These hoppers are covered with an open grating and extend down to the horizontal run of the conveyor in the basment, so the coal which reaches them may be elevated to the bunkers again. The ashes fall from the rear end of the stokers into a pit built in the setting below the floor level of the boiler room. These pits are also connected by a chute with the space back of the boiler arch, so the fine ashes and soot caried over into that space can be removed through them. The run of the conveyor in the basement is placed close to the fronts of the boiler settings enabling the ashes to be drawn into it from the pits. The conveyor delivers the ashes to a storage bin over the track at the end of the building, from which they can be fed by gravity into cars on the track.

Washed Illinois screenings, containing from 10,000 to 11,000 B. t. u. per pound, are burned exclusively under the boilers. Careful firing is therefore essential to obtain satisfactory results. In order to assist in checking the operation of the stoker an Ados CO_2 recorder has been installed to analyze the flue gases. This instrument is placed in a tight wooden booth against the wall directly in front of the boilers where the firemen can see it at all times. A door is built in each side of the booth to permit the removal of the recorder. A double door in the front of the booth is provided at the top with a glass so the operation of the recorder may be observed without opening the larger front door. Gas is furnished to the recorder from the flue leading from the boiler to the stack by a device which insures a fresh supply for each analysis.

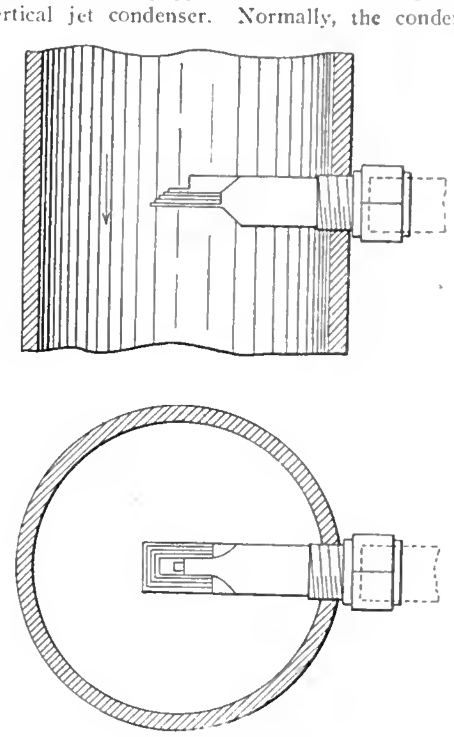
The recorder can be set so it will make and record automatically the results of analyses at various intervals, but in this case an analysis is made every 5 minutes. The results obtained are recorded on a strip of paper carried by drums moved by clock-work similar to a recording steam or water-pressure gauge. From the results thus obtained the percentage efficiency of the furnaces can be readily calculated.

When the recorder was placed in operation in June, last, the efficiency of the furnaces was found to be about 70 per cent., that is to say, 30 per cent. of the heat value of the coal was being lost up the stack. After the recorder had been in use about four weeks the loss was reduced to 15 per cent., due to greater care used by the firemen and to changes which had been made in the grates. The incentive given the firemen by the constant check on their work afforded by the recorder and the opportunity to observe the results of different methods of firing are considered to be the chief reasons why better firing is obtained.

Exterior of Power Station.



Cross-Sectional Elevation of Power Station.



Cylinder Lubricating Device.

The boilers embody no special features of design. They are rated at a combined efficiency of 64 per cent., when producing 300 h.p. each at 180 lb. pressure and on the washed screenings used; and a combined efficiency of 58 per cent., when producing 450 h.p. each, under the same conditions. Feed water is supplied to them from a Cochrane feed-water heater, on an elevated platform at one end of the boiler room, by either of two Prescott duplex feed-water pumps. These pumps are also arranged so they can draw cold water from a suction main connected directly with the river. A service pump in the basement of the boiler room supplies river water to the heater. Duplicate delivery lines from the feed pumps are carried over the front end of the boiler settings and are cross-connected at each of the four boilers, so any of the latter may be supplied from either line.

The two drums of each boiler are connected to a 9-in. steam header along the rear wall of the boiler room. This header is connected at each end to a 6-in. auxiliary header in the basement of the boiler room, forming a ring system. The main steam-consuming units in the basement of the boiler room are supplied from the 6-in. auxiliary header.

The engine room contains three main generating units, an air compressor, a steam-driven and a motor-driven exciter set, a motor-generator set and a 15-ton Whiting hand-operated crane. One of the main units consists of a 22x36x42-in. McIntosh-Seymour cross-compound engine, direct-connected to a 500-kw. Crocker-Wheeler 60-cycle 225-volt 3-phase alternating-current revolving field generator, operating at 100 r. p. m.; the other main unit is the same as the first, except that its low-pressure steam cylinder is 40 in. instead of 36 in. in diameter. This difference in the two engines was made in order that the second unit could operate non-condensing more economically.

The buildings of the works are heated by the Paul and the Webster exhaust steam systems, which are supplied chiefly from the non-condensing main generating unit. The latter, however, can be operated condensing, if desired, as each main unit is equipped with an Edwards twin vertical jet condenser. Normally, the condensing main engine carries the day load during the months when the heating system is not in service, or when it can be supplied with exhaust steam from the smaller steam-consuming units in the plant; and the non-condensing main unit carries the load at other times. The night load is carried by the 200-kw. generating unit, for, although a considerable portion of the machines in the works which require power are run continuously, most of the buildings of the works are closed at night, thus relieving the load due to lighting, heating, ventilating and service. This third unit consists of a 13x22x30-in. McIntosh Seymour Corliss tandem-compound engine direct-connected to a 200-kw. Crocker-Wheeler generator of the same type as the generators of the two large units, but operating at 150 r. p. m. This unit is equipped with an Allis-Chalmers vertical jet condenser, and is designed to operate condensing. The motor-driven exciter consists of a 50-h.p. induction motor driving a 30kw. 125-volt direct-current General Electric generator. The steam-driven set has a 50h.p. McIntosh-Seymour high-speed engine direct-connected to a Crocker-Wheeler generator of

the same capacity as the other, both units running at 300 r. p. m.

All three engines are designed to run on steam at 180 lb. pressure, and are equipped with non-releasing valve gears. The large engines can each develop 750 h.p. at one-fifth cut-off; 1,100 h.p. at one-half cut-off; and 1,378 h.p. at seven-tenths cut-off. They were also built under the following speed regulation guarantee: with steam at 100 to 180 lb. pressure and a variation from no load to the full rated load of 750 h.p., or vice-versa, the revolutions per minute shall not vary more than 2 per cent.; with the same variation in steam pressure and changes from no load to a load of 1,100 h.p., or vice-versa, the speed variation will not exceed 6 per cent. of the normal.

The three condensers for these engines are supplied with cooling water through a 24-in. main leading from an intake in the river. A screen chamber covered by a small brick building is placed on this injection main near the intake. The discharge from the condensers is carried back to the river by a 24-in. main that passes through a chamber in the sub-structure of the screen chamber building and terminates at the intake. A manhole provides means of entering this chamber on the discharge main. The blow-off from the boiler is also carried to the chamber on the discharge pipe.

The air compressor in the engine room is of the two-stage cross-compound type, with a capacity of 500 cu. ft. of free air a minute, when operating at a 100 lb. pressure. This machine delivers to two receivers in the basement of the engine room. The air is piped to all parts of the works, in which it is used for a multitude of purposes in connection with the manufacturing processes.

The motor-generator set consists of a 100-h.p. alternating-current induction Crocker-Wheeler motor direct-connected to a 75-kw. 220-volt direct-current generator. The latter supplies power for operating direct-current motors for elevators in the various buildings, and for a few direct-current motors in different parts of the works.

The operation of the electrical units is controlled from a switchboard at one side of the front of the engine room. This board has sixteen panels of blue Vermont marble and is equipped with General Electric apparatus and instruments. A panel is provided for each of the main generator units, one for the two exciters, one for the motor and one for the generator of the motor-generator set and a totalizing panel. The remaining eight panels are each for one of the eight circuits into which the distribution system is divided.

The exhaust-steam heating system is supplied from an 18-in. header extending the full length of the basement of the engine room. The exhaust of all of the steam-consuming units in the plant are connected into this header. A riser extends from one end of the latter to an exhaust head above the roof. The feed-water heater in the boiler room is connected to a by-pass on this riser, in order that it may or may not be supplied with steam from the exhaust system. The exhaust riser is equipped above the by-pass to the heater with a back-pressure valve, a 6-in. air vent leading from just above this valve to a blow-off tank in the basement.

A 26-in Crane horizontal oil separator is placed on the 18-in. exhaust main just beyond the last connection with a steam-consuming unit. The oil and water removed from the steam by this separator are passed through a second specially designed separator in which most of the water is removed and run to the sewer, while the oil is collected, filtered and reused

The heating system for the buildings is operated on about 4 lb. pressure, in order to supply a distant building. When sufficient exhaust steam is not available from the units which are in service connections are made so live steam can be supplied. The condensation returned from the system is pumped to the feed-water heater by either of two Worthington volete pumps, with a capacity of 125 fal. a minute, which are in a sump in one corner of the engine room basement. Each of these pumps is direct-connected by a vertical shaft to 3-h.-p. vertical induction motor.

The boiler room contains a 20-ton exhaust-steam-absorption Carbondale ammonia refrigerating machine for cooling the drinking water supplied to the works. This machine has a capacity for cooling 600 gal. of water an hour from 80° Fahr. to 40° Fahr. A duplex Dean steam pump, with a capacity of 3,000 gal. an hour, circulates the cooled water through a piping system extending to the various buildings of the works.

Two fire pumps, one a cross-compound Underwriters machine, with a capacity of 1,000 gal. a minute, and the other a simplex Blake, with a capacity of 1,600 gal. a minute, are placed in the basement of the boiler room. These pumps draw water from the river and are connected to a private fire-protection system of the works. The buildings of the works are equipped throughout with automatic sprinkler system supplied from the fire-protection lines, which are normally under pressure from the city mains. The connection between the latter and the fire protection system is provided with a check valve which closes when the fire pressure from the station is turned on the system.

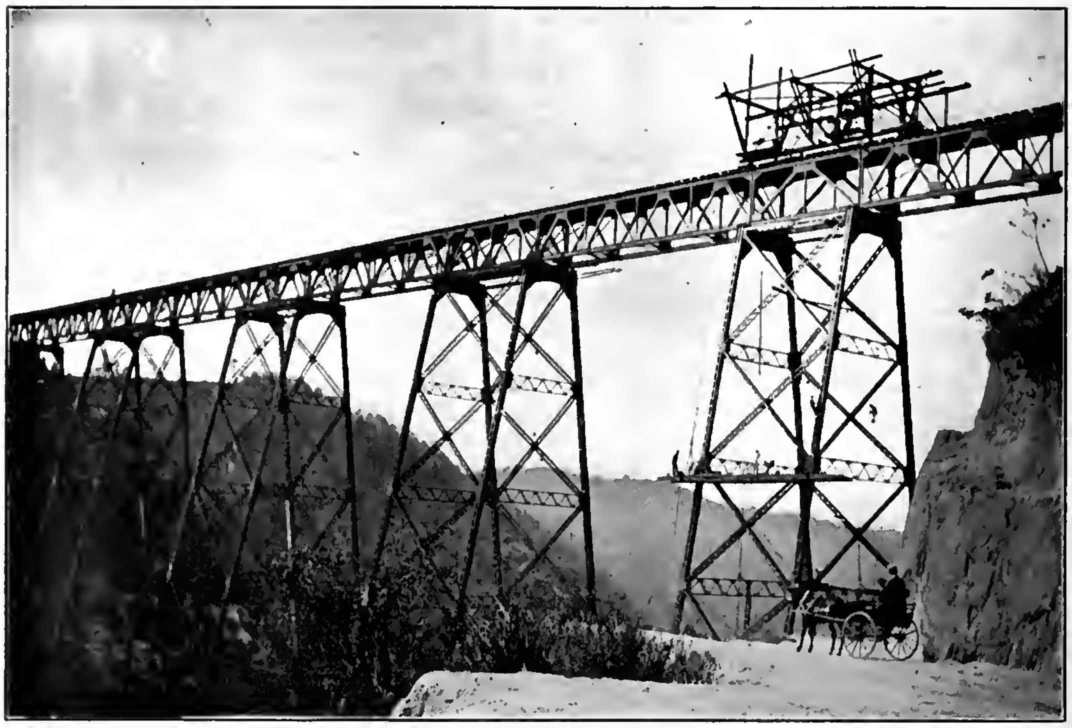
Water for flushing toilet fixtures in the different buildings is supplied from tanks carried by the roof trusses of the building. A 4-in. Worthington centrifugal pump, direct-connected to a 15-h.p. induction motor, is placed in the basement of the engine room and pumps river water to these tanks. This unit operates at 1,200 r.p.m. and was formerly installed in the old plant where it operated satisfactorily for three years at this relatively high speed.

Lubricating oil is supplied to the various units in the plant by a gravity-feed distributing system. A supply tank for cylinder oil and one for engine oil are suspended in the roof trusses. Two small duplex pumps raise the oil to these supply tanks from two storage tanks in the basement. The cylinders of all steam-consuming units are supplied with oil through a special form of oil atomizer which was designed and patented by Mr. W. L. Parker, chief engineer for the company. This atomizer is simply a short piece of threaded pipe of the same size as the tap for the regular oil inlet in the steam supply line to the unit. The opening of the pipe is contracted toward the end, inside the steam line, and terminates on a flat surface which forms the top of a rectangular projection with three sides widened out below this surface by steps, as shown in an accompanying illustration. The opening from the pipe on this surface is placed so the latter is against the direction of steam flow, with the result that the steam drives the oil in a fine spray from the bottom steps of the three sides of the small rectangle.

These atomizers were first used in the original plant of the works, in which they produced excellent results and are being used in the new plant with equal satisfaction. They have also been used to relieve troublesome cylinder lubrication conditions in a number of power plants in Elgin and vicinity.

The oil drips from the various units in the station are returned to two Turner oil filters in the basement of the engine room. These filters are over two storage tanks, one for cylinder and the other for engine oil, from which the oils are raised to the supply tanks under the roof.

Mr. Geo. E. Hunter is general superintendent and Mr. W. L. Parker is chief engineer for the Elgin National Watch Co. Mr. J. W. Lyons, of Chicago, was retained as consulting engineer for the company during the design and construction of the plant.



Traveler Dismantled for Use in Painting and Riveting, Las Vacas Viaduct.

An Interesting Competitive Test of marine engines will be made when the three scout cruisers, now under construction for the United States Navy Department at Quincy, Mass., are in the water. These ships are of identical dimensions, the only difference being that one of them will be equipped with the Parsons turbine, another with the Curtis turbine, and the third with ordinary reciprocating engines. It is purposed to have a triple trial of these vessels, taking them to sea at the same time, subjecting them to the same exactions, and observing the relative merits of the different types of motive power. It is expected that the trial will take place late in the Summer of 1908, by which time the ships should be completed. This will be the first opportunity American naval experts have had to examine closely the practical operation of turbines as applied to naval uses.

The Erection of the Las Vacas Viaduct.

The narrow gauge single track Las Vacas Viaduct of the Guatemala Ry. is 743 ft. long and 229 ft. high and has seven 30 and 40-ft. towers, supporting one 55-ft. span and seven 75-ft. spans. The towers are each made with two vertical bents having a maximum of seven stories and have X-braces in all faces and horizontal struts in the transverse planes only. The tops of the bents have transverse box girders about 4 ft. deep and 18 ft. long which weigh about 3,500 lb. each and have the column flanges field riveted between their webs. Each span is made with a pair of lattice girders 12 ft. deep and 10 ft. apart on centers with the usual top and bottom laterals and transverse sway bracing. The lower flanges of the trusses are seated on the box girders. The 30-ft. and the 75-ft. spans weigh about 26,000 and 50,000 lb. respectively and the maximum tower weight is about 25,000 lb., the total weight of the viaduct being nearly 1,000 ginning of operations. It was determined to erect the viaduct by the cantilever method with an overhead derrick traveler and plans for it were prepared and the operations outlined as illustrated in The Engineering Record of February 2, 1907.

The 35,000 lb. steel traveler was designed for service in the erection of other viaducts now under construction for the same R. R., and consisted essentially of a pair of riveted trusses about 53 ft. long, 10 ft. deep and 10 ft. apart on centers connected by transverse and lateral bracing in the planes of the top chord only and mounted on four wheels. The forward vertical end posts were continued 23 ft. above the top chords and braced together transversely to form masts for a pair of 60 ft. tapered steel booms 30 in. square at the center. Each boom was rigged with a 4-part topping lift and a 5-part hoisting tackle of 6,500 lb. capacity. A wooden boom 20 ft. long was also provided between the steel booms. Swinging tackles were attached to the they were used as anchorages for the succeeding span. For this service the trusses were to be temporarily reinforced by wooden vertical posts to carry the vertical shear over the tower bents.

The traveler was to advance to the front of the tower and erect a wooden falsework tower about 50 ft. high to receive the 2nd panel point of the first 75-ft span. After the span was erected up to the tower it was to be connected for reaction stresses to the forward end of span 2 and the traveler moved forward on it to complete its erection and erect the 2nd tower. When this span was completed its forward end was to be jacked up from the 2nd tower releasing the connections between the rear end of the span and span 2 and the traveler advanced to complete the remainder of fthe viaduct in the same manner. The travelers were designed by Mr. H. D. Bush, and the method of erection and the other details of plant were developed by Mr. A. W. Buel.

Erecting Section of a Tower Bent.

Erecting First Tower from Falsework.

tons. The towers have a maximum width of about 87 ft. at the base where one column of each bent has an expansion bearing. Excepting some suspension rods supporting the longest members and diagonals in the horizontal planes through the bases of the towers all members of the viaduct are riveted and all were shipped separately and assembled in erection. The details of the design were described in The Engineering Record of Jan. 26, 1907.

The location of the viaduct is remote and rather inaccessible, supplies and skilled labor are difficult to secure, no machine tools or steelworks are available within a great distance, many weeks are required to receive erection plant or materials from the bridge shop and communication with headquarters in New York is difficult and costly so that it was imperative that the erection plan should be fully developed before construction was begun and that all plans and materials should be at the site for the be- extremities of a long horizontal transverse beam fastened to the deck in the rear of the mast and the traveler was anchorred to the finished viaduct when in service. Materials were delivered at grade at the first end of the viaduct and are run through the traveler underneath the top lateral bracing. The hoisting engine and boiler were carried on an extension at the rear ends of the top chords of the traveler trusses and served to counter-balance ordinary loads on the derrick booms.

It was proposed to assemble the traveler at grade on the ground just beyond the first abutment of the viaduct and in that position to erect with it the first bent of the first tower and the first span. The traveler was then to advance partly on the first span and complete the erection of the tower and the tower span, the latter being temporarily connected by top chord links and bottom chord blocks to the first span so as to transmit temporary erection stresses when

When the work was executed some of the conditions encountered varied slightly from what had been anticipated and the erection although conducted closely on the lines above described was modified somewhat to suit the cirumstances and to secure the greatest total expedition and economy. The principal modifications consisted in the omission of the wooden boom, the operation of the swinging lines by hand tackles, the erection of the trusses in sections, bracing them transversely by bolted wooden outriggers, the movement of the entire traveler back and forth to carry pieces forward instead of raising and lowering the booms, and the modification of the traveler to serve for a moveable riveting and painting scaffold after the erection of the steel work was completed. All of these changes were made with a careful recognition of the existing conditions and were fully justified by the successful issue of the work. The cautious handling of assembled sections of the

trusses as single units and the method of carrying them forward and connecting them proved simple and convenient and suggests similar methods of operation in designing future cantilever erection of small riveted trusses, a class of work which has been very seldom attempted by the cantilever methods. The erection methods are well described in the following letter from Mr. W. D. Penny, contractor.

"I consider the traveler the finest machine for viaduct work I have ever used. The booms worked admirably in the heaviest wind, and it blew very hard twenty-five per cent. of the time. The tackles to swing the booms were 10-in. blocks rove with 1 1-4-in. manilla lines; there were times I wished they were larger. Each line was run individually to a hand winch, these winches being bolted to the sides of the traveler just above the sills and easily reached from the track. The reasons that these lines were not led to the winches of the donkey were to avoid the confusion of too many lines being operated at once and to avoid the tying of lines at winch heads as much as possible, but the chief reason was that the winches were worked by native labor and a considerable saving in money was effected. One man at each winch could easily and safely in the heaviest wind swing the booms with a heavy post suspended from each. I never put in the center boom. I could see no benefit to be obtained from the use of it.

I never cantilevered the entire length of any cantilever spans, for the following reasons. First, it would have made the box girder a diffifficult and slow connection in a very inaccessible place. Second, I was afraid I could not get sufficient guys on the end of the span and did not like to run the traveler out so in the heavy winds. So I adopted the following plan in erecting the cantilevers.

"I backed the traveler up till I had sufficient room to connect together one side section of first portion of the cantilever. This I put together, laying it down under the booms, firmly bolting and drifting it together and connecting all lateral plates, etc. It was then picked up by both tackles, one attached to the bottom chord and one to the top chord and properly balanced. The traveler was then run ahead to a proper connecting distance and firmly clamped down. The section was never raised over a foot from the track while being run out, so when the tackle on the bottom chord was slacked off the section hung almost in the connecting position, it only being necessary to slack it down about a foot. The cantilever links were then connected and the section slacked off. The operation of picking up, carrying out and connecting the section never occupied over a half an hour. To move the traveler with the section suspended to it, all I ever used was a 1¼-in. runner on each side.

"In erecting the towers I raised one section on the side nearest to the traveler, then moved out as far as possible on the center section of the span and out hauled the difference with a runner from the donkey. This operation was continued until the third section from the top was reached; then one side of the tower was run up to the top, the box girder put on and the bottom chords of the span connected. The rest was easy.

"In running up one side of the tower, the tower braces were connected to the third section down. This left only two sections without bracing, and even with the box girder on, before the bottom chords were connected, there was very little sway motion. To back up, raise the box girder with both boom tackles, run out and connect it, generally occupied twenty minutes. It was the easiest connection we had. I never telegraphed ahead anything but light members. I found it quicker and safer to back the traveler up and run ahead with the load, it could be moved so easily.

"To wind-brace the cantilever, I bolted a 12x12-inx30-ft. piece across the end of the first section of the span, then bolted 3x12-inx30-in. pieces from the end of the timber both ways to the span. There never was any motion to speak of. The booms were very seldom raised or lowered, and never with a load. We avoided the raising of the booms by moving the traveler, In erecting the first 75-ft. span, I avoided counterbalancing and cantilevering by running the near side of the tower to the top at once, bracing it at some of the sections to the timber tower.

"The only casualty of any kind during erection was the death of one native, who in passing fuel from the deck of the viaduct to the donkey engine on the traveler, carelessly fell between the ties. This happened on the highest part of the structure. He had a clear fall to the ground, and was, of course, instantly killed.

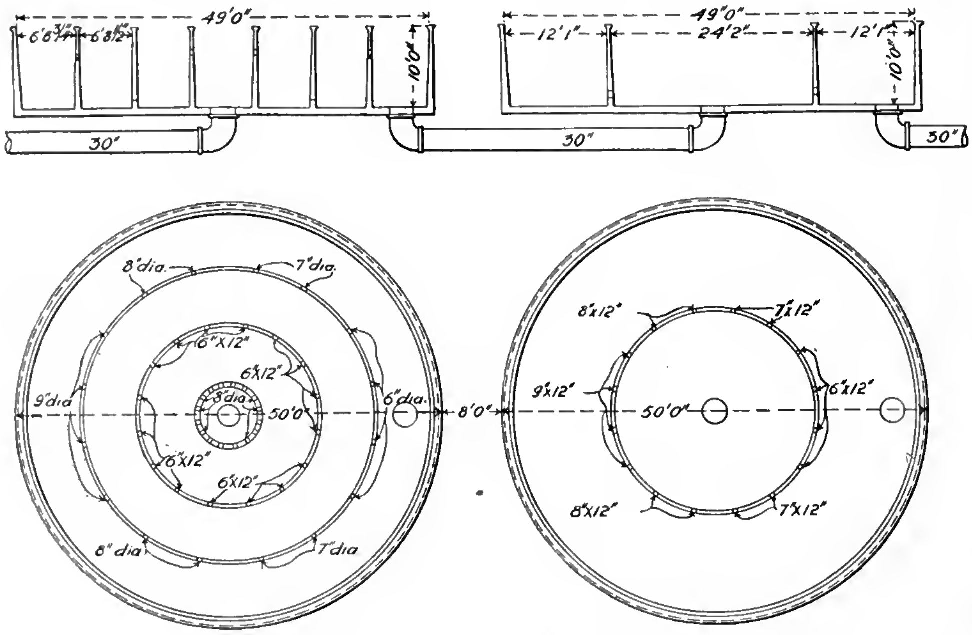
"Although the erection is finished, I have the traveler still in commission, using it to rivet and paint from. I have taken off the booms and high end bent, removed the hoisting engine and the deck, putting false caps 5 ft. above the original deck to give head room for locomotives. I have scaffolds 4 ft. wide and 45 ft. long suspended by 10-in. blocks and 1¼-in. lines hung on each side of tower. Each scaffold carries two gangs with their tools, including forges. The scaffolds are started at the top and lowered as the riveting and painting proceed. When tower is completed to the ground, they are hoisted to the top and the operation repeated."

The viaduct was designed by Mr. V. G. Bogue, New York, Mr. W. H. Kennedy and Mr. A. W. Buel, associated engineers on railways and bridges respectively; Mr. S. F. Shaw is chief engineer and Mr. J. H. Pope bridge engineer of the railway company. The steelwork was fabricated by the Baltimore Bridge Co. Mr. H. D. Bush, vice president and manager, and was erected by Mr. W. T. Penny.

A 150-TON WHARF CRANE has just been completed at the works of Messrs. Armstrong, Whitworth & Co., Elswick, Eng., for placing heavy machinery in erected form, in vessels alongside the wharf. It is mounted on a steel pedestal above the wharf, so as to turn in a complete circle, and has a lifting range of 100 ft. It is hydraulically operated, having two gears of 75 tons capacity each, and an auxiliary lifting gear of 25 tons capacity which has a range of 117 ft.

The Circular Tanks at the Lancaster Filtration Plant.

The water supply of Lancaster, Pa., is drawn from the Conestoga River, a stream subject to frequent and sudden floods, at which times the water carries much loam, clay and vegetable detritus. This supply is purified by a 9,000,000-gal. filtration plant which has been in operation about a year and a half and which consists of a water softening or coagulating system, a series of preliminary filters and a series of final slow-sand filters. There are fifteen preliminary filters, each 6x16x35 ft., and fifteen slow-sand filters, each 6x16x140 ft. The preliminary and the slow-sand filters are of the Maignen type and are very much like those of the 4,000,000-gal. South Bethlehem plant, described in detail in The Engineering Record of July 15, 1905. The tanks into which the water first enters after the coagulant is added, however, where it is agitated and settled and receives preliminary scrubbing are unusual in design and operation. They are designed to remove the bulk of the mud and coagulant before the water reaches the preliminary filters.



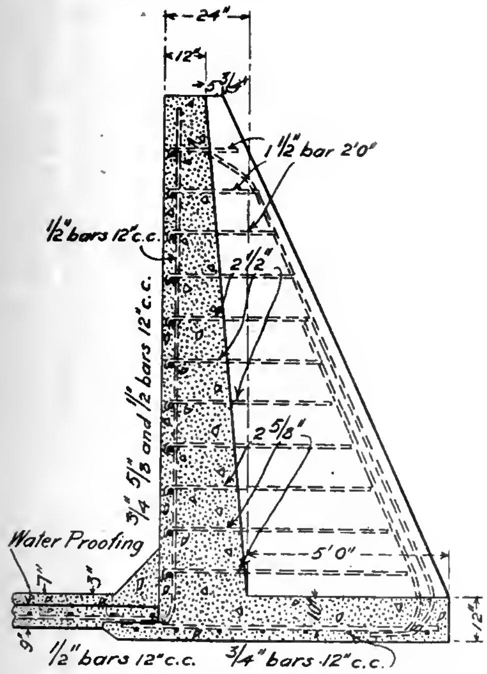
Plan and Section of Tanks at Lancaster Filtration Plant.

At first the reagents used at Lancaster were mainly lime and soda but, as it was considered desirable not to change the chemical character of the water, sulphate of alumina and soda carbonate are now used. These neutralize each other and simply form a coagulating precipitate without making the water harder or softer and without leaving anything objectionable in it. The reagents are added as a dry powder which is thrown into the water by a distributing device actuated by a Poncelot undershot water-wheel operated by the water as it flows into the coagulating basin.

From the coagulating basin the water passes first into a circular agitating tank, 49 ft. in diameter and 10 ft. deep, entering the tank through a vertical 30-in. pipe in the center of the bottom. The tank has three circular concentric baffle walls placed as shown in accompanying illustrations. The first or inner baffle is provided with a series of 8-in. round openings about 6⅓ ft. above the tank bottom through which the chemically-charged water passes into the second section of the tank; the second baffle has openings at the bottom, 6 in. wide and 12 in. deep; and the third has 6 to 9 in. round openings 6 ft. above the bottom; the water leaves at the bottom of the fourth section through a 30-in. pipe that leads to the center of the next tank. The openings in the baffle walls are calibrated so that the

flow through each wall is equally distributed about its circumference as nearly as possible. By the time the water reaches the outlet pipe it has been thoroughly agitated and all the activity of the chemicals as a coagulant has been expended.

The second tank, also 49 ft. in diameter and 10 ft. deep, is provided with a single circular baffle wall with rectangular openings, 12 in. deep and 6 to 9 in. wide, arranged so as to distribute the flow evenly. In this tank the velocity is low and most of the coagulated material, which appears as coarse particles, settles to the bottom while the clarified water passes out through a



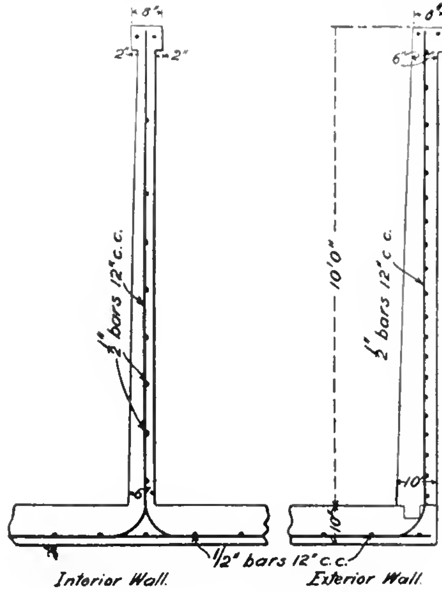
Section of Wall of Pure Water Basin.

30-in. pipe in the bottom of the outside section of the tank and on into two 49x10-ft. tanks without baffle walls. These tanks are preliminary scrubbers and the water is divided equally between them. It enters at the bottom and, being distributed over the floor by suitable concrete drain-tiles, rises through layers of cobble stones, coarse coke and sponge and passes off at the top. By the time the water has reached the surface of these rough scrubbers it is clear enough to be admitted directly to the regular Maignen preliminary filters even during the worst flood periods. There is plenty of room in the coarse material of the rough scrubbers for large deposits of mud and all the circular tanks can go a long time without cleaning. When they are to be cleaned it is done by flushing and shoveling during periods when the river water is clear enough to go direct to the filter plant proper without passing through the coagulating system.

The soil in which these tanks are built is a good loamy clay resting on bastard limestone rock. The excavation was made in original soil. There is now about 5 ft. of earth about the walls.

The circular tanks are made of a mixture of crusher-run limestone, ¾ in. being the maximum size, and Dragon Portland cement in proportions equivalent to 1:3:5, reinforced with New Style corrugated Johnson bars for which the unit working tensile stress assumed was 12,-500 lb. Each bottom slab is 10 in. thick and is reinforced with two series of ½-in. bars on 12-in. centers, 2 in. of the slab being below the reinforcement. The outer walls are 6 and 10 in. thick at the top and bottom, respectively. They are reinforced with ½-in. vertical bars 12 in. on centers, placed as shown in an accompanying section and bent into the floor slab about 18 in., and with circumferential bars, ½ in. to ¾ in., spaced 5 to 9 in. on centers as shown. The baffle walls have ½-in. vertical rods on 16¾ and 19¾ in. centers and ½ in. circumferential rods on 18-in. centers. The openings in the baffle walls were made to come between the rods of both series and the openings for the 30-in. pipes in the floor slabs are surrounded by a flanged metal ring into which the floor slab rods are hooked.

In constructing each tank the floor slab rods were first put in place and wired at their intersections; then the vertical wall rods were put in place and the floor concrete was laid. The vertical rods for the outer walls were held in place during the placing of the floor concrete by attachments to the framework for the lagging. Holding in place the vertical rods of the baffle walls was more difficult but it was managed by wiring the rods together and running guy wires



Sections of Circular Tank Walls.


Coagulating and Softening Tanks, Lancaster Filtration Plant.

to the outer wall forms and to the pipe hole in the center of the floor slab. The floor was laid at one time, a joint recess being provided for the outer wall as shown on the section. No special joint was made for the baffle walls as it was not necessary that these be watertight. When the floor concrete had set enough to hold the vertical wall rods in place the circumferential rods were wired to them, the forms being built up and the concrete poured at the same time. The concrete was very wet and dense and though a Sylvester wash was to have been used it was found to be unnecessary as the tanks were watertight when the forms were removed. The circular framing for the walls was made at a planing mill in 8-ft. sections and ⅞-in. dressed lumber was used for lagging. The surface of the concrete was not treated in any way after the forms were taken down.

The pure water basin is also built of reinforced concrete. It is 100x200 ft. and 12 ft. deep, giving a capacity of 1,500,000 gal. The dimensions of the walls, floor slab and counterforts and the arrangement of the reinforcement is shown in an accompanying illustration. The counterforts are placed 12 ft. on centers.

The Lancaster plant was built by the Pennsylvania Maignen Filtration Co. according to designs prepared by Mr. P. A. Maignen, and has a guaranteed bacteriological efficiency of 97 per cent., a requirement that has been more than fulfilled in regular performance. Mr. W. H. Boardman was chief engineer for the filtration company and Mr. F. H. Shaw acted as consulting engineer for the city. The designs for the reinforced concrete tanks and pure water basin were prepared by Messrs. Webb & Gibson, reinforced concrete specialists, Philadelphia. Messrs. Harmer & Quinn, Philadelphia, were the general contractors, Mr. Chas. Doebler, superintendent of construction.

Canal Transportation in France.

The following report, covering the cooperation of State and communities in the construction of French canals, the cost of constructing them, and the comparative freight charges by canals, rivers, and railways, is furnished by Consul-General Robert P. Skinner, of Marseille:

The systematic effort to improve and facilitate river navigation in France took the form, in 1879, of a general law in regard to railroads, rivers, canals, and seaports. It was rightly considered that these were all branches of the same subject and that there should be a scheme of general improvement harmonizing in every detail. The law of 1879 was, in fact, merely a programme, intended to be executed as the resources of the country might permit, and up to 1890 it had been departed from only to the extent made necessary by the progress in methods of transportation. One of the essential features of the Freycinet programme of 1879 was the standardizing of various types of canals which had been brought into existence through local pressure. M. Freycinet proposed a canal type permitting the utilization of barges 126.31 ft. long by 16.40 ft. beam and drawing 5.9 ft. of water.

Among other projects contemplated in this scheme was the cutting of a canal from the Rhône River at a point near Arles to the city of Marseille, thus shortening the distance between this city and Lyon and making it possible to utilize barges and other craft, which can not with safety navigate in the Mediterranean Sea. The project for this canal has been recast a number of times, and actual work has been commenced only recently. The canal will be 50.33 miles in length, will have a channel 9.84 ft. deep,

and will accommodate barges of 2,000 tons burden. The cost has been fixed at $13,703,000, of which the State is to pay $6,851,000, the town and department councils $2,605,500, and the Marseille chamber of commerce $4,246,000. When this canal was first proposed the Rhone was navigated by steamboats, most of which have been replaced by barges moving in fleets.

Where the French policy of canal, port, and river improvement differs strikingly from that prevailing in the United States is in the matter of original expense. While such works in France are invariably controlled by the State, it is recognized as a fixed rule that the localities through which waterways pass or where ports are created profit to a degree which can not be enjoyed by the community at large, and that these localities should contribute an appropriate part of the primary investment.

In discussing the details of work to be first taken up the Senate committee thus expressed itself: "Priority should be given to enterprises which, while urgently demanded, have also the advantage of an assured financial co-operation amounting to 50 per cent. at least."

The chambers of commerce are usually the instruments through which municipalities contribute, and the obligations so created are usually met by the issuance of bonds, the interest and sinking fund thereof being provided for by the collection of authorized fees, the chamber of commerce being frequently an administrative body. The Marseille chamber of commerce will collect a toll of 2 cents per package upon imported merchandise in barrels, boxes and sacks, and per ton upon merchandise in bulk, as a means of discharging its financial obligation in respect to the Rhone Canal, and it is already collecting fees and rentals with the proceeds of which it maintains certain wharves in a high state of efficiency, for the use of shipping of every nationality.

The length and cost of the French transportation system up to Jan. 1, 1901, were as follows:

Description.	Length in Miles.	Paid by Interested Localities.	Paid by the State.	Total Cost.
Local highways	316,898	$227,740,000	$81,060,000	$308,800,000
National highways	23,656	....	303,975,000	303,975,000
Tramways	2,628	126,608,000	....	126,608,000
Local railroads	2,971	88,587,000	2,509,000	91,096,000
Trunk railroads	23,784	1,920,736,000	834,532,000	2,755,268,000
Rivers and canals	7,397	6,755,000	322,503,000	329,258,000
Ports	......	25,669,000	174,858,000	200,527,000
Total	377,334	$2,396,095,000	$1,719,437,000	$4,115,532,000

The freight embarked on canal and river boats for the past four years was as follows:

	1903. Tons.	1904. Tons.	1905. Tons.	1906. Tons.
Canals ...	18,513,471	18,195,000	18,657,806	18,357,339
Rivers ...	14,617,471	14,243,701	15,119,534	15,381,963

Freight rates by canal are materially lower than rates upon the same merchandise by rail, but the difference is less striking perhaps than an American investigator might expect. On March 23, 1907, the comparative rates per ton from Cette to Toulouse and Bordeaux were as follows:

Articles.	Cette to Toulouse. Rail.	Canal.	Cette to Bordeaux. Rail.	Canal.
Wine	$1.33	$1.16	$2.02	$1.64
Wheat	1.33	1.06	2.02	1.73
Oil	3.38	1.16	4.90	1.73
Petroleum ..	1.33	1.21	2.02	2.02
Phosphates...	1.43	1.16	2.39	1.93
Coal	1.84	.77	2.87	1.45
Tiles	1.96	1.16	2.99	1.93

Nearly the entire freight traffic on the Rhone River is controlled by one company, which enjoys a practical monopoly thereof, but there appears to be no reason why other companies, if equipped with the necessary capital and provided with an efficient fleet, might not enter the field. Although shipments by river to Marseille are transported a much greater distance than shipments forwarded by rail, on account of the absence of the connecting canal now being constructed between Marseille and Arles, river freight rates are nevertheless considerably lower than those quoted by the railway company. The following sample scale of prices prevailed on March 26, 1907, upon the two routes, Marseille to Lyons:

Article.	Water. Per Ton.	Rail. Per Ton.
Soap	$2.07	$2.89
Vegetable oil........	2.99	4.24
Wine in casks........	2.70	3.38
Petroleum	2.70	3.86
Coal	1.54	2.41
Wheat	1.93	2.63

Between Marseille and Lyons canal and river tonnage is always available for any amount of freight that may be offered. The business is not very remunerative on account of the strong competition of the railroad company.

As to whether it would pay to build the French canal system now, had it not been called into being before the existing railways were constructed, can be answered in the affirmative. It is very unlikely that various cities, notably Marseille, would be clamoring at this time for the right to spend their own money upon improved waterways, if they were not convinced of their practical utility. While the French railway system, with the exception of some comparatively unimportant lines, is the result of private enterprise backed by government guarantees, according to the French theory of political economy they belong to the state, and ultimately will be brought under state ownership, as they are already under state control. It is considered that the railways and canals both have their particular function in the modern state, and that the proper equipment for economic development is incomplete without both. Referring to the results already obtained in France from an imperfectly developed system of waterways, the Senate committee said in 1903:

"It is important that we achieve the concordance of the dimensions of intercommunicating canals, and that we select for first execution the waterways yet to be constructed which appear to be of the greatest necessity. It is impossible to deny that traction itself is less costly by water than by rail. The interested localities have the right to demand the connection of existing railways and canals, where such connections would be favorable to the trade of regions not in direct contact with the canals. In nations where canals and railways are in the hands of the state, this has been accomplished already. . . . Where transportation by water and rail are both available, they complement and complete each other, the one transporting heavy materials, the low cost of which is an indispensable condition to the vitality of industries which aliment in their turn the traffic of the railway lines."

A New Type of Current Insulator for high-tension transmission lines was suggested by Mr. H. W. Buck at the recent meeting of the American Institute of Electrical Engineers, which bids fair to materially change present methods of line construction. It consists of a simple form of unreinforced strain insulator with wide flaring petticoats, which are linked in series to support the line wires by a swinging suspension at each pole. At intervals of about every 10 poles, the line is anchored in either direction by the strain links similarly arranged. It is claimed that but 10 towers or poles need be used per mile with this construction, and that the voltage carried is limited only by the number of insulators inserted in the links, only four of the insulators in series being needed for a 100,000-volt line.

The Vacuum Heating System in the Godfrey Block, Grand Rapids.

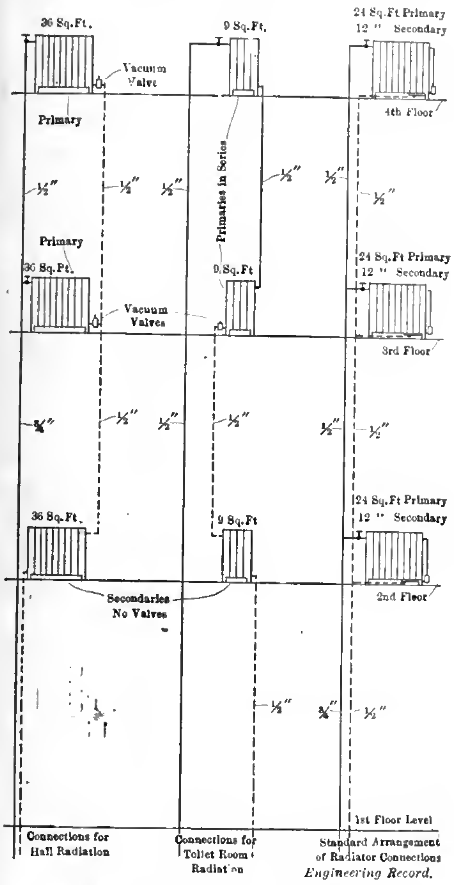
A vacuum steam heating system has recently been installed in the Godfrey Block at Grand Rapids, Mich., which is a departure from the usual arrangement of connections and radiation for vacuum heating. The building is a four-story and basement brick structure having a north and western exposure. It is 27x110 ft. in plan and is occupied by stores on the lower floor and offices on the upper three floors. It has an unusually large amount of window glass exposure, rendering it difficult to heat, and was recently refitted with a low-pressure two-pipe steam heating system having a total of 2,500 sq. ft. of radiation for the entire building, which has a novel system of return connections.

The requirements of the building for heating were for about 400 sq. ft. of radiation on each of the three upper floors, 750 sq. ft. on the first floor and 186 sq. ft. in the basement, in addition to the exposed mains. The distribution of heating surface on the three upper floors is such that there are ten units on each floor, while that upon the main floor consists of nine comparatively large units, arranged so that by supplying five of the first-floor radiators from the basement ceiling main, the upper floor equipment could be supplied from seven riser lines. These risers, as installed, carry from 96 to 386 sq. ft. of radiation each, and are of only ¾ to 1¼-in. pipe, whereas, as ordinarily figured, these amounts would have required 1½ and 2-in. sizes. The return risers are similarly of ½ and ¾-in. pipe, owing to the use of the vacuum system. The supply risers receive steam through a basement main connected to the boiler through a 1½x3-in. reducing valve. This main divides into a 1-in. line supplying a ½ and 1-in. riser at the rear and a 2½-in. main extending around the front side of the basement ceiling and supplying the remaining risers and radiator connections. The return system consists of a vacuum main on the ceiling and ranges in size from a ½-in. line at the extreme end to a 1¼-in. line at the return pump.

The selection of this particular range of pipe sizes is the result of the adoption of the Simonds compound vacuum system, which makes use of the heat carried in the return condensation in special radiation. Secondary radiators are so connected with the vacuum valves of the main radiators that the considerable amount of heat carried in the water of condensation after having passed through each main radiator and its vacuum valve is utilized before it enters the return mains. The water of condensation discharged from radiators in the ordinary low-pressure steam heating system ranges from 208° to 210° Fahr., and difficulty is often experienced with re-evaporation when this heated water passes through the discharge valve into the vacuum of the return line. This difficulty is here utilized by the installation of the secondary radiator units, the steam from the boilers being fed through the usual distribution system to the main radiators while the secondary sections receive the water of condensation which the main sections discharge through the regular vacuum valves. These secondary radiators are in all cases installed in capacities about one-half of those of the main or primary radiator units, it being figured that the heated water passing into the vacuum of the return lines will re-evaporate to a greater or less extent so that the secondary radiation will be of actual value as heating surface. This is borne out in actual experience, the condensation passing from the secondary radiation to the vacuum pump as solid water and no difficulty being experienced with

re-evaporation in the return lines, with consequent necessity of injecting cold water into the pump suction to condense vapor carried through and permit effective operation of the pump.

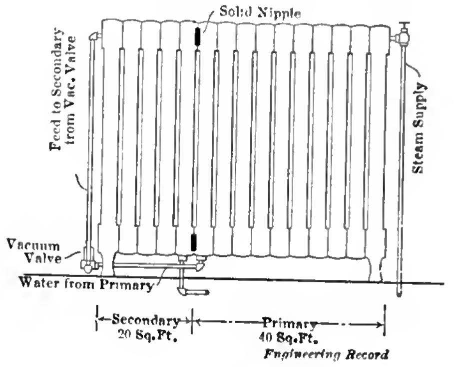
The radiation in the Godfrey Building is, for the greater part, installed on the usual compounded plan, with both primary and secondary sections in close proximity, although there has also been incorporated in this installation an unusual arrangement of primary and secondary radiation separated on different floors. This is carried out in the hall and toilet-room radiation, each of which groups has two primary radiators located on the third and fourth floor levels, which discharge their condensation through a single secondary radiator on the second floor level,



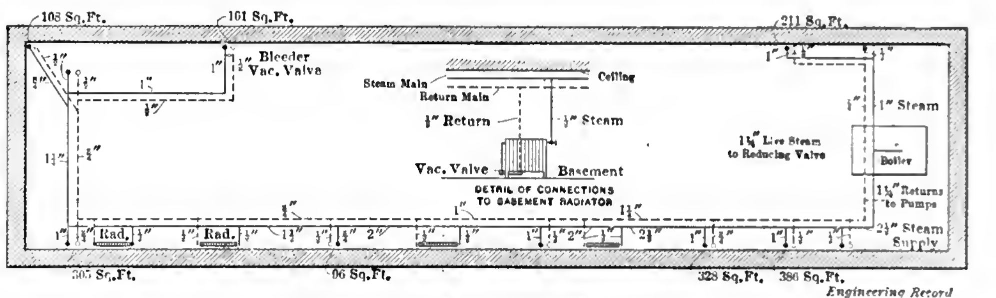
Details of Radiator Connections.

the only difference from the regular arrangement of units being that the secondary radiation is on a lower level to which the water of condensation flows freely. In the case of the hall radiation, there is a 36 sq. ft. radiator on both the third and fourth floors to which steam is delivered directly from the riser lines, each delivering through its regular vacuum valve to a ½-in. return line carried down to the secondary radiator of the second floor level; this return line feeds vapor and water of condensation to the secondary radiator, which is also a 36-sq. ft. unit and thus serves as an effective heating surface equal in capacity to that of the hall radiators above, except for the slightly reduced temperature due to the vacuum of the return system. In the case of the toilet-room units, a somewhat different arrangement was made. Here a 9-sq. ft. radiator is installed in the toilet on each floor, but steam is supplied to them by a ½-in. riser leading to the unit on the fourth floor only. This top floor unit has no vacuum valve, but the return connection is connected directly to the steam inlet of the similar unit on the third floor, and this unit has the regular vacuum valve to serve both units, which discharges the water of condensation and vapor to the second floor unit, as in the preceding case.

In the radiation installed in the various offices, the original arrangement of using separate radiator units for primary and secondary radiation has been dispensed with and compound radiator units installed. These consist of cast-iron sectional radiator units of the usual type, except that one-third of the columns on the return end are isolated from the other two-thirds on the inlet end by solid nipples at top and bottom connections, both sides having inlet connections at the top of the outside columns and return connections at the bottom of the inside columns next to the solid nipple. The arrangement of connections is, as shown in the accompanying detail sketch, for steam supply to the top of the outside column of the primary or inlet end, and return connections from the base of the inside column of this primary end to the vacuum valve which in turn discharges its condensation into the top of the outside column of the return or secondary section. In this section, the condensation vaporizes under the vacuum and effects additional heating surface, after which the water of condensation passes freely to the vacuum return system without encountering further valves or obstructions. This renders the radiators com-



Compound Radiator.



Heating Mains in Sub-basement.

pact, and no difference in appearance from the ordinary units. There is, it is stated, no difficulty experienced in raising the water of condensation from the vacuum valve up to the inlet end of the return side of the radiator units, as it is found that the condensation after passing the vacuum valve into the vacuum of the return line vaporizes partly if not wholly, merely condensing in the secondary section of the radiator to water before entering the return lines. In fact, no difficulty is said to be experienced in lifting the condensation considerable distances, as in the basement radiators the return lines are located on the ceiling and condensation is easily raised from the secondary unit to this level, a rise of about 9 ft.

Steam is supplied to the building by an Atlas internal-fired horizontal shell boiler of the marine type with internal furnace. It is a self-contained unit and is set without brick work, the shell being encased with asbestos block covering. It is of 40 h.-p. rating, being planned for sufficient capacity to operate the heating system on the ordinary method with gravity returns and also another building adjoining. It operates at 20 to 30 lbs. pressure and delivers to the heating mains through a pressure-reducing valve which lowers the pressure to about atmospheric, this being varied from 1-lb. pressure to 4 in. vacuum, according to the heating service required. The vacuum pump is a 4½x5x8 in. Burnham simplex pump which delivers from the return mains to a receiving tank, and from here the condensation is returned to the boiler by a simplex feed pump of similar make which has 3x2x3-in. cylinders.

The results that have been obtained from this system have been very satisfactory, the heating service having proved adequate in all parts of the building. The system as now installed was operated with a fuel consumption of 72 tons of mine run of soft coal for the heating season of 1905-6, while last winter but 69 tons were used. The small sizes of mains for steam supply and return contribute largely, it is thought, to the economy of the system, but, of course, the principle factor of saving lies in the reduction in the secondary radiation of the temperature of the condensation returns to a point where the injection of cold water into the vacuum pump suction, with consequent heat waste, is not necessary for proper operation of the pump. The system was designed and installed by the Simonds Heating & Specialty Co., Detroit, Mich., who control this system of vacuum heating.

Electric Locomotives of the Pennsylvania Railroad.

With a view to determining the type best adapted to pulling its heavy passenger trains through the New York tunnels, the Pennsylvania R. R. has in progress a series of experiments upon electric locomotives. Through the experiments on the West Jersey and Seashore division and the Long Island R. R., the company hopes to determine the general characteristics of the electric locomotive and to secure operating data based on actual service. Of the two direct-current locomotives now undergoing tests, one is equipped with four 350-h.-p. geared motors, and the other with four gearless motors. The gearless locomotive has one of its trucks equipped with two 320-h.-p. motors supported by springs from the main journals and independent of the truck frame, while the other truck has two 300-h.-p. motors rigidly fastened to the frame. In exterior appearance the two locomotives are almost identical. The trucks are of the four-wheel type, having frames placed outside the wheels, with pedestal boxes and adjustable wedges similar to those used in locomotive practice. On account of their short wheel base, the trucks have a tendency to tilt in operation, and thereby shift a portion of the effective load from one pair of wheels to the other. By an ingenious automatic switching mechanism the power delivered by the motor on the heavily loaded axle is increased and the power delivered by the motor on the lightly loaded axle diminished, in proportion to the difference in axle loads. By this expedient the pulling power of the locomotive is increased 25 per cent. The driving wheels are 56 in. in diameter. The cab is entirely of metal. The control mechanism is in duplicate and placed in diagonally opposite corners of the cab. The locomotives are equipped with hand, straight air, automatic and high-speed brakes. The weight of the geared locomotives is 174,100 lb. while that of the gearless locomotive is 195,000.

Book Notes.

A useful summary of some instructive experiments conducted under the direction of the Engineering Experiment Station of the University of Illinois has recently been published by it under the title of "Effect of Scale on the Transmission of Heat Through Locomotive Boiler Tubes." For a great many years it has been generally held that scale 1-10 in. thick required an expenditure of 15 per cent. more fuel to accomplish the same results as clean tubes, and doubling the thickness of the scale doubled the resistance to heat transfer. The experiments described in this pamphlet give materially different results. Some of them were made on a locomotive equipped at first with scaled and then with clean tubes and others on individual tubes procured from railways running through the Central States. They show that the loss in heat transmission with scale up to ⅛ in. thick varies between insignificant amounts to 12 per cent., and depends more on the mechanical structure of the scale than its thickness.

A book useful as a detailed account of the development of public health regulations in the British metropolis is "The Sanitary Evolution of London," by Henry Jephson, of the London County Council. It describes in the first chapter the sanitary measures taken prior to 1855, and gives quotations from reliable publications regarding the frightful state of filth in which a large part of the population were forced to live. It then takes up the progress made in each subsequent decade, explaining how the peculiar municipal subdivision of the district acted as a steady obstacle to progress until means for overcoming it were found. There were public commissions for paving, Mr. Jephson states, others for street improvements, others for lighting, and others even for bridges across the river. All in all, several hundred such commissions had been created without any relation one to the other, and without any central controlling authority, by as many acts of Parliament. They were mostly self-elected or elected for life or both, and were wholly irresponsible to the taxpayers, or to anyone else, nor were their proceedings in any way open to the public. Many of them had large staffs of well-paid officials and there were perpetual conflicts of jurisdiction between them and an absolute lack of anything approaching municipal administration. The development of sanitary improvements from such a condition of divided authority is traced in much detail in this book, and in many places the author's comments on measures and conditions are decidedly interesting, although all readers will not agree with his views. The book is one of those valuable reviews of engineering progress that are all too rarely written because of the great labor involved in collecting and compiling the data. (Brooklyn, 203 Fulton St., A. Wessels Co., $1.80).

One of the most interesting pamphlets relating to street improvements that has appeared in a long time is the "Specifications for Street Roadway Pavements," by Mr. Samuel Whinery. The author believes that in the present state of the art it is entirely practicable to frame specifications for paving materials and methods so that the engineer and municipality may safely assume responsibility for the quality of the work produced. It is his opinion that a contractor who negligently or purposely violates specifications during construction is unlikely to be more faithful or scrupulous in living up to any guarantees he may make with regard to the future, even where the terms and conditions of such guarantees may be clearly defined and indisputable. When his specifications are viewed in this light they are distinctly good, and subject only to the single general criticism of being so detailed that many engineers will probably prefer to abridge them for actual use. In respect to the details, there are a number of points with which The Engineering Record does not agree. It does not believe, for instance, that the contractor should be required to deliver cement for pavement foundations on the work at least ten working days before it is to be used, as the author suggests, for it is just as well at times to keep it in the cars or warehouse until actually needed, for it can be inspected there as easily as in a storage shed on the street. As regards the proposed requirements for asphalt there are details which seem unnecessarily severe and the necessity of specifying anything but the asphaltic cement is certainly open to question. In this respect the new Kansas City specifications will be preferred by many engineers, since their requirements are confined to the asphaltic cement, the material actually used. If the specifications go into the detail suggested by the author they must only be used by someone in close touch with the progress of asphalt technology, and even then the requirements will be open to criticism. For example, the author states that crude asphalt must be refined at a temperature not exceeding 450° Fahr., and material which does not distinctly soften at 185° will not be accepted. As a matter of fact some useful bitumens are injured at 450° and some of the best show no distinct signs of softening at 185°. Again, the section on refined asphalts excludes some of the Cuban asphalts which can be handled satisfactorily with an asphaltic flux. In this section there is also a clause relating to a test of asphalts in water which seems extremely severe in view of the showing made in actual service by asphalts which this clause would reject. In the section relating to flux, the requirement of a specific gravity of less than 0.958 would exclude admirable fluxes with an asphaltic base having a specific gravity of 0.96 to 0.99. In the section on asphaltic cement, there is a requirement regarding viscosity which would throw out material made from California residual pitch and might cause the rejection of good material made from Cuban and Trinidad asphalts. These are a few of the features of the asphalt pavement specifications which are open to criticism and similar comments might be made on the suggested specifications for asphalt blocks, granite and brick. They are pointed out to show the well-defined differences of opinion that exist regarding details of paving lest the reader should regard the specifications, good as they are as a whole, as beyond criticism in detail. (New York, Engineering News Publishing Co., 50 cents).

Letters to the Editor.

The Cause of the Quebec Bridge Failure.

Sir:—I understand that no allowance was made for secondary stresses in the design of the Quebec bridge, and also that the connection joining the lower chord members of the anchor and cantilever arms was rigid. This does not allow the adjoining chords to take their proper position, while the deflection takes place, without developing considerable bending stress in the chords. I would not be surprised to find the secondary stresses caused by this bending to run up as high as 50 or 100 per cent. of the direct chord stress and so might largely have contributed to the failure. I would therefore suggest checking the truss strain sheets for secondary stresses in the chords.

I have had much experience with secondary stresses in bridge members and have found them in some cases of great importance, and therefore would never neglect them unless the trusses were designed to minimize them. Rigid connections between anchor and cantilever lower chords have been used in other important bridges where they have given much anxiety, and I am convinced that they should always be eliminated and a connection designed with both members free to adjust themselves independently on the pin center. In the case of the Quebec bridge the effect of the secondary stresses is greater on account of the great depth of the trusses, and the corresponding considerable deflections of the first and second panel points from the main pier on both sides, tending to produce contraflexure, which, in webs of the depth there existing, develops enormous stresses to augment the primary stresses. This effect becomes less farther from the pier and, beyond the feet of the first diagonals, is not transmitted to the first two subpanels of lower chord. The V-shape member used in the Quebec bridge is, moreover, very difficult to build in the shops, very difficult to check and verify after construction and quite liable to inaccuracies in the angle and bearings, and in exact dimensions, any of which might concentrate the excess load on a very small area until the latter yielded enough to distribute the stress.

Bridge Engineer.

Unit Spiral Tables.

Sir: I have examined with much pleasure the table and explanatory matter for Talbot's Spiral in your issue of Sept. 7, and feel certain that all field men who use this easement curve will find it a great help. As stated in the article the unit table is partially developed in the printed editions of this spiral, and the advantages pointed out, but Mr. Kyle's table is much more extensive. The great advantage, to my mind, of a unit table lies in the fact that it embodies under one series of headings all of the quantities necessary for running the curve, while all other tabulated spirals that I have seen have from a dozen to thirty distinct tables, each one of which is applicable to a certain chord length, though sometimes, also, to the multiples of that length. This advantage was briefly mentioned in your article, but, in my opinion, should be emphasized. There is but one table to turn to and never any danger of taking values that apply to a different set of conditions, a cause for frequently re-running spirals.

Though not thoroughly conversant with the mathematics of many spirals I believe that a unit table like the one you have presented is possible only with a spiral such as Talbot's, in which the chord length can be varied from point to point along a given curve, in the same fashion as a circular curve can be run by setting intermediate points wherever desired.

It must have occurred to many of your readers that the table as set up in the regular edition of The Engineering Record is in rather cumbersome shape for field use, and I hope that you have decided to reprint it, together with the explanatory matter, in handy form. It would do much toward placing in the hands of field men one of the most conveniently arranged tables I have seen.

Very truly yours,

Chicago, Ill. N. E. A.

A Uniform Retardation Brake Gear is in use on the North-Eastern Ry. in England. It consists of an inclined slot mechanism applied to the brake shoes so that, as the grip on the wheels increases, owing to the greater coefficient of friction at decreased speeds, the shoes are drawn away slightly and the pressure relieved somewhat. It is said that the device prevents gripping and skidding. With plain gears the braking pressures are kept well below the weight carried on the wheels, but with this gear they are increased to 160 per cent. of that due to weight and then are reduced automatically as the train stops.

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TABLE OF LEADING ARTICLES.

The Calumet Canal.

The Chicago Real Estate Board has been looking into the project of the Trustees of the Chicago Sanitary District to construct a canal for the disposal by dilution of the sewage of the Calumet district, and its committee appointed to investigate the subject has protested vigorously against the proposition to construct such a branch of the present drainage canal. This Calumet canal is proposed by the Sanitary District trustees on the ground that it is needed to care for the sewage of the district about the Calumet river, that it will furnish a navigable waterway, and that its construction will enable a large water-power to be developed. It is pointed out that these triple aims complicate the problem, originally a purely sanitary one, and do not provide any further improvement of the Chicago river which, in view of the money already spent on the drainage works by Chicago taxpayers, might be considered of considerable weight. Some astonishing figures to show the importance of an immediate betterment of the river are given in the committee's report on the authority of Colonel Bixby. It is stated that in 1889 the tonnage entering the Chicago river was over 9,000,000 tons while in 1905 the tonnage entering both the Chicago and Calumet harbors was only 7,000,000 tons, excluding the shipments of iron ore which did not amount to much on the earlier date. During the same period the tonnage entering Duluth harbor increased from 3,000,000 to 22,000,000 tons, including about 7,000,000 tons of miscellaneous freight during 1905. The tonnage entering Milwaukee harbor in 1905 was at least fifty per cent. more than that of 1893. These figures are asserted by the Real Estate Board to indicate that the interests of the Chicago river as a harbor cannot be neglected upon the supposition that what is lost to the river will be gained through the Calumet; it is claimed, in other words, that so far as any navigation advantages resulting from drainage canal work are concerned it would be far better to concentrate attention on the Chicago river.

Turning from the navigation to the power aspect of the projected Calumet canal, the same arguments are advanced. The Real Estate Board claims that the argument for spending $13,000,000 for the new canal in order to develop power which can be sold for enough to pay interest on the cost of the work, is really as good an argument for obtaining the same amount of power by enlarging the Chicago river. It is true that the cost of the latter work is estimated at $20,000,000, but the additional expense is well worth while on account of the improved navigation facilities afforded, according to the report of the committee. Another aspect of the matter is also brought out in a letter to the committee by Mr. John W. Alvord. "It is a little difficult to see how this project," he writes, "which looks on the face of it to be purely for commercial purposes, can be related to the sanitary problems of Chicago, for which the district was created, and when one considers the risks and disappointments attending a business enterprise of this sort, it seems to be an open question if it is desirable for a public board to commit a municipal corporation like Chicago to a purely business enterprise, which is admittedly entirely unnecessary for the sanitary betterment of this community."

So far as the sanitary aspect of the problem is concerned, attention may be called to the report on the Calumet sewage disposal problem made by Messrs. Hering and Fuller some time ago to the International Waterways Commission and reviewed at considerable length in this journal on February 2 of the current year. In this report it was shown that for the Calumet district there are several methods of sewage disposal as effective as the method of dilution in preventing the pollution of the lake water, the most advantageous one being the use of septic tanks and sprinkling filters. This report is much more encouraging than a good many people in Chicago probably realize. It means that when the capacity of the present drainage canal as a receptacle for sewage has been reached, other methods of disposing of the surplus sewage are available, and if Chicago continues to grow as she has in the past the time is not so far distant when the modern methods must be adopted. It seems hardly conceivable that all the great cities depending in a large measure on their harbors for their prosperity will calmly allow Chicago to divert more water from Lake Michigan for sewage disposal purposes when that diversion means such a lowering of the level of the Great Lakes that navigation will suffer unless costly dredging is undertaken.

The continuation of this method of sewage disposal by Chicago seems likely to become wrapped up in a great project of a Lakes-to-Gulf waterway, and it is pertinent to inquire whether the advocates of this latter project have yet stated where the water for navigating the upper section of this great channel is to come from. If it is to be drawn from the Great Lakes it is surely in order to suggest that its effect on the American and Canadian harbors should be carefully investigated. The great commerce centering in them is an accomplished fact, a matter of pride to those engaged in it, and its injury for the purpose of enabling Chicago to dispose of sewage which can be otherwise handled, or to build a big power station, or to develop an inland waterway which is of problematical value, seems neither wise as a matter of transportation nor necessary as a sanitary measure. The deep waterway convention to be held in Memphis shortly will be well worth watching by the Great Lake cities on account of the facts just stated. The diversion of 10,000 cu. ft. of water per second by the present canal, which was permitted by the Deep Waterways Commission as a sort of moral obligation for not stopping the construction of the drainage canal at the outset, is stated by that Commission to be equivalent to a lowering of the lake levels from 4½ to 6½ in. The tremendous effect on lake commerce of any further lowering by a greater diversion of water is something to be regarded with apprehension.

Another Lesson on Signals.

Last week this journal made some comments on the dangers which lurk in current practice in railway signaling. Following it with frightful rapidity comes the news of another ghastly "accident" on a New England line in which more than sixty passengers were killed or hideously mangled. We all remember General Sherman's characterization of war, but the intentional slaughter of war is a Sunday School picnic in comparison with the awful details of such a tragedy as this. The soldier who follows the flag into the Valley of the Shadow has at least given his life for his country's welfare, but what consolation is it in the last bitter moment to him who is torn and crushed in the shattered wreckage of a train that he has helped to save the expense of a good signal system? In the case before us an express train, late and trying to make up time, met a heavy freight train in the gray mist of dawn in a headend collision. Probably somebody blundered, as is usual in such cases, a telegram went astray or was misread, and the usual result followed. If these collisions were an inevitable part of modern transportation, if they occurred impartially under every system of management and in every country, one might perhaps learn to take them philosophically and, thanking his lucky star for personal escape, go about his business without a protest.

It happens, however, that, as compared with other countries, our own has a sinister prominence in such calamities. The sanguinary casualty list of American railroads rises to near a hundred thousand victims annually. It is probable that accidents will never be entirely averted, yet comparison with records abroad shows that they can be greatly reduced in frequency by proper and usual precautions. There should certainly be means independent of mere telegraphic notice to prevent two trains from meeting on a single track, either in a head or rear end collision. The morning mists in the valleys of northern New

England are not new phenomena taking the unhappy railway men unaware. They are of regular occurrence before a clear autumn day and a known source of danger. They make the regular visual signals of no effect and prevent the trainmen from looking far enough ahead to clear the ordinary danger space. There is no use in writing down the catastrophe as an act of Providence, for there is no Divine law that prohibits the installation of good signals. Rather it must be set down to the blindness of those who will not see and the negligence of those who hold the lives of others cheap when it comes to a matter of business. It is one more evidence of the frightful inefficiency of the methods of signaling and train-dispatching used upon far too many railroads. It is high time for reform and for the introduction of better appliances. It is certainly not impossible to gain a far greater degree of security than now. Whatever system is used it is imperative to employ signals that can be made clear over at least the dangerous space of the train and that cannot be rendered useless by so common a cause as an early morning mist.

The Improvement in the Railroad Situation.

For a year or more engineers have necessarily been impressed by the important influence of public sentiment on the condition of undertakings in which a large proportion of their profession is engaged. Civic pride determines in a large measure the character of municipal works; in a community marked by business strength and public spirit the engineering works are generally planned on a broad and liberal scale and the men entrusted with their execution have the respect and confidence of the public. On the other hand, in cities which are devoid of this civic good feeling, public works are neglected and engineering offices are looked upon simply as political prizes. The sentiment towards public service companies affects engineering in a still greater degree. These companies must operate under franchises and rights of one sort or another granted by state or city legislation, and the feeling of the public toward them manifestly affects the character of the privileges they will obtain. Moreover, public service corporations are still more vitally influenced by the effect of public sentiment on the prices of the securities of such corporations. The great works these companies carry out must be constructed by private capital, and without reasonable security in investments of this nature, people are naturally loath to lend money for such undertakings. The extent to which these considerations influence the engineering profession can be readily understood by an examination of the lists of members of the four national engineering societies; it will be seen that an extraordinary percentage of the members are engaged in enterprises directly affected by public sentiment or in the manufacture of supplies for such works. Under such circumstances it is self-evident that the engineer should study these problems of the relation between the public and public-service companies from a purely selfish point of view as well as on account of his obligations as a citizen of a democracy. The hysterical waves of public antipathy toward all companies engaged in public-service work are unfortunate from every point of view.

It is encouraging to observe how the hostile spirit shown toward railroads and in a somewhat less degree toward street railways during the last two years is now subsiding. There was a time not so very long ago when the railroad official who held any feeling of regard toward the public except as a source of revenue was hard to find. After a street railway or electric lighting company received its charter and franchise it generally assumed toward the public an attitude which indicated its belief that it was engaged in business in exactly the same way as a commercial corporation conducts a department store. The fact that it was operated by public permission in a distinctly public service, affecting the methods of business management which it could rightfully follow, seemed for many years to be overlooked. When the public became dissatisfied with the service rendered, the possibilities of retaliation which the people possessed were overlooked or under-estimated by the companies' officials. The experience of the last two years, particularly the last winter, has shown that the public control of such companies is sufficiently great to thwart methods of management that persistently ignore public rights. From one end of the country to the other it is now recognized by all far-sighted men that the time has gone by when the capitalization of a public service corporation may be safely based upon anything but the cost of constructing the works and meeting the expenses incidental to the beginning of regular efficient service. The day of capitalization based upon maximum earning capacity has gone by.

In an interesting address at the fourth annual meeting of the Association of Transportation and Accounting Offices, Mr. A. G. Briggs, general attorney of the Chicago Great Western Railway, made the following statement: "The railroad company was organized upon the agreement that the stockholders might build, equip and operate the railroad, furnish proper service to the public and charge for that service a reasonable compensation; but always with the reservation, clearly understood, that should the stockholders fail to render proper services or should they charge more than a reasonable compensation for them, the state might, at its option, assert its right to regulate or control the railroads, determine what service should be rendered, how it should be rendered, the terms on which the road should be operated and for what compensation. This reserved right is absolute, limited only by the rule that the state cannot confiscate the stockholders' property or deprive them of a reasonable return on their investment." It is particularly instructive to notice that Mr. Briggs, speaking as a railway man to railway men, refused to consider the recent legislation against railroads and other public-service corporations as the work of demagogues. With some few exceptions, in his opinion, those responsible for these laws did their duty as they saw it. He believed the great majority of officials and legislators have tried to learn and do what is right, and the legislation they passed was due in no small measure to a general public opinion that no reliance could be placed on statements by public-service corporations. Unconscious prejudice is a potent factor in influencing legislation, and the measures of last winter are to be accounted for by it rather than by evil motive. He believed that the wave of public distrust had passed early in the summer, and that it was the duty of everyone connected with public-service corporations to win back confidence in the intention of such companies to render efficient service.

The other side of this matter was stated at some length at the meeting of the American Association of Freight Traffic Officers on September 14, by Mr. Martin Knapp, chairman of the Interstate Commerce Commission. His long connection with that Commission lends particular weight to the opinion, stated emphatically, that the Sherman anti-trust law defeats the purpose for which it was passed, and if it were not violated by the railroads we should have a chaotic condition suited only for savagery. This is an acknowledgment of the necessity of improved legislation deserving careful attention. Mr. Briggs told the railroad men he addressed that the greater good of railroads is in maintaining government inviolate, rather than in escaping temporarily the effects of a single valid law or of several such laws. It was his opinion that whether a law was bad or good the railroads should abide by it until it was repealed or amended. Mr. Knapp, speaking as the public official most directly concerned with enforcing national legislation concerning railroads, stated that the anti-trust law might have been applicable in the old days of stage coaches but was unsuited for present conditions. With railroad men like Mr. Briggs urging obedience to the laws and attention to reasonable public wishes, and officials like Mr. Knapp urging the passage of laws which will be helpful rather than harmful, it seems reasonable to anticipate that before long a more complete appreciation of the necessities and methods of control of public-service corporations will result in more equitable legislation, better service and less public distrust of such companies.

The Protection of Trade Secrets.

The protection of trade secrets was the subject of an important address by Mr. F. P. Fish before the American Society of Mechanical Engineers some months ago and since then several courts have decided cases of this sort. There is one feature of the matter, however, which has only recently been discussed judicially, although it is something that must have frequently been considered by manufacturers. This is the extent of the protection which will be afforded to a company employing a secret process not devised by anybody connected with it and obtained from another source than the original inventor. A case of this nature has recently been passed upon by the New Jersey Court of Errors and Appeals in the Vulcan Detinning Co. v. American Can Co. et al., 67 Atl. Rep., 339. The facts in this case are substantially as follows, according to the statements made by the court. Until about ten years ago the detinning of scrap had not been carried on successfully in this country although such a process was successfully operated abroad. This fact was well known to the dealers in tin scrap who had a large trade with a Flushing establishment as well as with one in Essen. In 1898 a number of American dealers and manufacturers agreed to build a plant for detinning scrap in this country providing a license for using the foreign method was obtained. In order to secure this license Adolph Kern, a dealer in scrap tin, was sent to Europe and obtained the secret from the Flushing company with permission to install it in two plants in the United States. These plants have passed into the possession of the Vulcan Detinning Co., the complainant in this case. The process was discovered by Goldschmidt Bros. and used by them in 1891 in Essen, where it was guarded as a secret. The same process was used at Flushing, where it was also kept a secret, although it had been obtained from the Goldschmidt works clandestinely. The Americans who obtained the secret from the Flushing establishment guarded it zealously. F. A. Assmann, one of the original promoters of the complainant company, was so impressed with the importance of guarding the process that he himself became individually the trustee of a copy of the formula for the express purpose of guarding it for the mutual benefit of himself and his associates. The business was a commercial and practical success from the outset. In 1901 Assmann transferred his personal interest as a manufacturer of tin cans to the American Can Co., the defendant in this case. He became its president and sold to it all of his holdings of stock in the two detinning companies, resigning his directorship in each. He also was the leading spirit in the installation for the American Can Co. of two detinning plants using the process employed by the complainant, and called to his assistance three former employees of the complainant.

The testimony in the case, according to the

decision rendered by the court, admits of no other conclusion than that the detinning plants which came into existence in this way in competition with those of the complainant, are employing the process originally purchased by the complainant which Assmann undertook to safeguard in its interest. That this result was brought about by a breach of confidence upon his part toward his original associates, both as regards the use of the process itself and the enticement of the former employees of the complainant, is stated by the court to be the only legitimate inference that can be drawn from the proofs. That in both of these respects he was acting directly on behalf of the defendant corporation of which he was president is decided to follow as a necessary deduction. The result of such conclusions is to raise the question whether upon such facts the complainant is entitled to any relief, and if so, to what extent.

The defendant's counsel argued that the complainant was entitled to no relief because the secret process it sought to enjoin the defendant from using was not, in fact, a secret, and moreover if it was a secret, the legal title to it did not exist in the complainant. From what has been said concerning the source of the secret, and the organization of the various companies in this country using it, it will be seen that the case is unusually complicated. The court discusses it at considerable length and the various considerations it mentions are of such a strictly legal nature that it is hardly necessary to follow them at length in this place. The conclusion to which they lead is that, entirely aside from the technical secrecy of the process or the abstract question of property in it, the complainant company is entitled to have its former trustee, Assmann, his associates and their servants restrained from using against the interest of the complainant the very process with which Assmann was entrusted for its benefit. The court points out that, apart from the peculiar rights of its discoverer, the secrecy of a process may be viewed in two aspects; first, as having for its object the keeping of the public in ignorance of the nature, source or composition of a commercial product that is put upon the market, and second, as having for its object the prevention of competition by rivals in production. In this case the publication by Assmann of the secret would violate the obligation of secrecy in each of these respects, but, as regards the second, the trust is held to be equally violated if the trustee himself uses the secret to engage in such competition, even though, as would clearly in this case be to his interest, he sedulously keeps the secret to himself, excepting so far as his use of it requires the cooperation of associates and servants. The court decides that when Assmann severed his connection with the complainant and installed the process in question for the defendant corporation as a competitor in production, it is the same in equity as if, without having severed such prior connection, he had broken faith with his fellows by imparting to a rival the secret which he had promised to preserve.

Although the court considers that there is no question about this action by Assmann himself, there is some question concerning the relief the complainant should receive against the defendant corporation for which Assmann was acting when he did the acts that constituted his breach of trust. It is all but impossible, the court says, to avoid the conclusion that the directors of the American Can Co. had actual knowledge of sufficient facts to constitute notice that Assmann held the secret of the complainant's process in a confidential capacity. On the other hand it is all but impossible to demonstrate by direct proof that a corporation has knowledge apart from the knowledge possessed by agencies through which its functions are performed. Hence in such a case the mere fact that the complainant is unable to adduce any corporate resolution of the defendant company expressly asserting its knowledge of the complainant's secret and of Assmann's connection with it does not prevent the court from reaching the conclusion that the defendant had such knowledge, if such is the inference to which the testimony tends by irresistible weight of probability. This consideration brings up another intricate point which the court argues at considerable length before reaching its final conclusion, which is that the defendant corporation is amenable to the same degree touching competition and publication as that already accorded to the complainant with respect to Assmann individually. The court therefore orders a verdict to be found restraining the defendant Assmann and the American Can Co. from using or making public this detinning process.

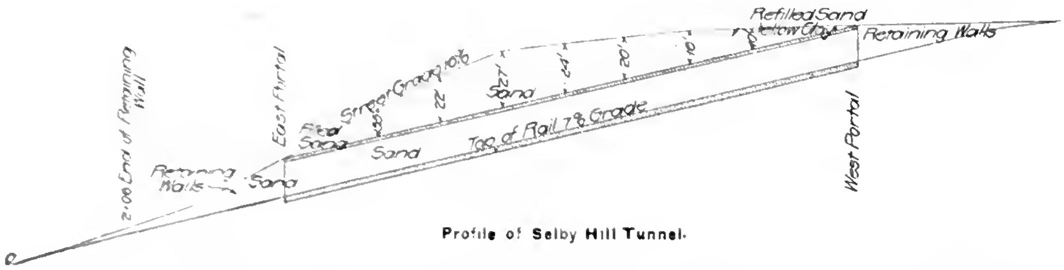
There is one further complication of the case that must be mentioned. There can be no question that Adolph Kern knew of the fact that the process used at Flushing was the same as that employed by the Goldschmidts at Essen and was obtained surreptitiously from them. It was held in one of the lower courts where the case was tried that this knowledge on the part of Kern, who became an agent of the incorporators of the complainant company, must also be imputed to that company, which therefore came into the court with "unclean hands." The Court of Appeals points out that there is a nice distinction in this matter. That the knowledge possessed by an agent but not acquired by him while acting for his principal will, under certain conditions, be imputed to the latter, is in the nature of a presumption indulged in by courts in working out the rights of litigating parties. The Court of Appeals points out that it is never a rule of evidence by which the actual possession of knowledge by the principal can, in point of fact, be established. On the contrary an essential part of the presumption in question is that the principal is ignorant of the knowledge that has been casually acquired by his agent. Hence, by the hypothesis, the principal is not only ignorant of the knowledge thus acquired, but, if such knowledge involves a fraud, the principal is innocent of such fraud. He may be bound by it in the sense that his legal rights may be determined with reference to the knowledge with which he is thus chargeable, but his conscience is void of offense, and hence it cannot be said with propriety that his hands are unclean, for "unclean hands" within the meaning of the maxim of equity that "one who comes into equity must come with clean hands" is a figurative description of a class of suitors to whom a court of equity as a court of conscience will not even listen, because the conduct of such suitors is itself morally reprehensible as to known facts.

Taking the case as a whole, it seems to be one of those which deserve a careful consideration by members of the engineering profession who have to do with inventions and their commercial use. As Mr. Fish pointed out in his address to which reference has already been made, the practice is growing of relying upon trade secrets rather than patents in certain kind of manufacturing. Cases involving trade secrets are bound to come up more frequently in engineering work and it consequently behooves engineers to keep in touch with the legal opinions concerning such matters. On the facts as presented in the opinion of the Court of Errors and Appeals, there can be no question that the decision just reviewed is in accord with principles of equity, particularly in view of the fact that the original inventor of the secret process had refused to take part in establishing a factory in America on the ground that it would be commercially impracticable.

Notes and Comments.

Publicity is again being given in the New York papers to the attempts of speculators to force the Board of Water Supply of New York to pay unnecessarily large sums for land needed in connection with the new Catskill water works. In this connection it might be pointed out that soon after the work in the Catskills was inaugurated the property owners likely to be affected by it were informed that if they cared to rely upon the Board of Water Supply and its representatives for fair treatment they would probably receive far better returns for any of their property needed for the works than they were likely to obtain by any other course. Events indicate that this is true. Those property owners who did not give up title to their land will receive from the commissioners the same sum for the same class of land as the speculators will get who bought property for a much lower price from the original holders. It is very unfortunate that this unwillingness to rely on the fairness of the commission has existed along the line of the new works, but those who have held it must thank themselves alone for the unfortunate results of their poor judgment.

The Battery Tunnel connecting the lower end of Manhattan with Brooklyn is rapidly approaching completion, but not rapidly enough to satisfy many people who wish to use it. Consequently there is a good deal of newspaper criticism of the work which is likely to cause some misapprehension concerning it. The tunnel is a part of a contract awarded by the late Rapid Transit Railroad Commission to the Rapid Transit Subway Construction Co., a subsidiary company of the Interborough Rapid Transit Co. operating the subway. The Construction Company has until May, 1908, to complete the entire contract. It is to its interest to get the work done as rapidly as possible in order that the Interborough train service may be started. It sublet the work in three sections. That in Manhattan has been finished and in operation for a considerable time. That in Brooklyn is well on toward completion although extensive modifications of the plans have delayed it. The tunnel under the East River is almost finished. It presented a number of new engineering problems and, like most subaqueous tunneling, developed difficulties which could not be foreseen. Concrete piles driven under the tubes where they cross fine sand have been carried down 75 ft. in places by the contractors in order to provide an additional safeguard, although Mr. George S. Rice, the chief engineer for the Commission, considered them unnecessary. The tubes have been reconstructed wherever the subcontractor deviated too much from grade, and there is now the same clearance for the cars in these tubes that has been provided in other parts of the subway. The same people who are the general contractors for the work will also have to operate the trains through the tunnel, as before stated, and consequently they have spared no expense to secure substantial and proper work. Unless something now unforeseen arises, which is always possible before the final completion of any subaqueous tunnel, trains will be running before the end of the contract time. Mr. Rice stated recently that cars might be started in one of the tubes in October although this was more likely to take place later, probably some time in November. In view of all the difficulties and new problems that have been encountered, this will be a surprisingly good showing. If new difficulties arise it is to be hoped that the Public Service Commission will disregard any clamor based on ignorance of these difficulties and will take a firm stand for the completion of the work in the best possible manner before authorizing trains to be put in service.



Profile of Selby Hill Tunnel.

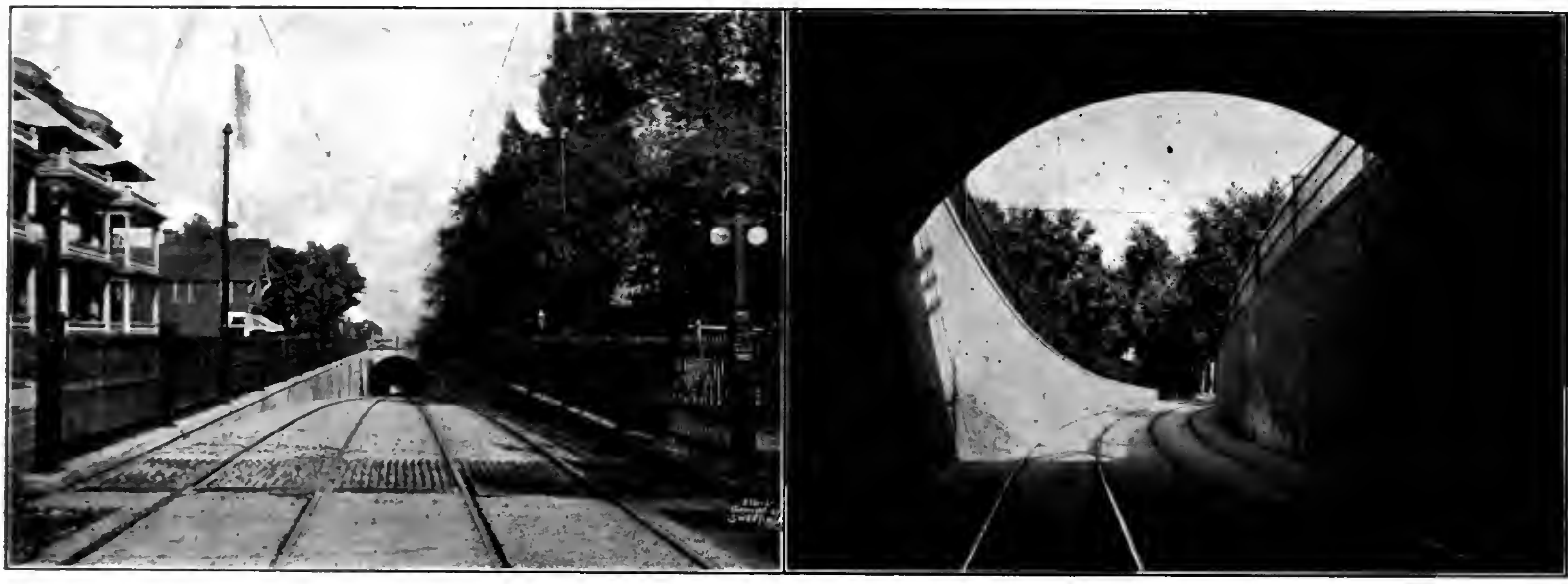
THE SELBY HILL STREET RAILWAY TUNNEL, ST. PAUL, MINN.

The Twin City Rapid Transit Co., of St. Paul and Minneapolis, has recently completed and placed in service a subway tunnel which greatly reduces a steep grade on one of the most important street railway lines in St. Paul, and eliminates the necessity of a counterweight formerly used to handle cars up and down this grade. The new tunnel is on Selby Ave., a short distance from the business district of the city. At the location of the tunnel the grade of the street was 16.5 per cent for several hundred feet, the business district being 125 to 150 ft. lower than the residence sections at the top of this hill. The cars of one of the three interurban lines between Minneapolis and St. Paul, as well as local cars, were operated over this steep grade, on which the counterweight device had been used track. The approaches are so arranged that after the backfilling has all been placed, the street will again be opened for traffic at practically the original grades.

The approaches are between reinforced-concrete retaining walls, which vary from 3 ft. to a maximum of 20.5 ft. in height. Where these walls are less than 6 ft. high they are built as gravity-section structures. Above that height they are vertical, reinforced-concrete slabs, having a horizontal slab footing, and buttresses, 2 ft. wide and 6 ft. apart on centers, on the rear side. The approach to the lower portal of the tunnel is at one side of the street, a roadway parallel with it connecting with the street over the tunnel. The approach to the other end of the tunnel is at the middle of the street, but a 13-ft. tained on a screen with 3/4-in. meshes being used. In all 10,400 cu. yd. of concrete and 55,000 bbl. of cement were required.

The details of the reinforcement of the tunnel section are shown in an accompanying illustration. The arch has two sets of 1 1/8-in. round rods, alternating with girder rails, all of which are spaced as shown. The rods in the side walls have their lower ends imbedded in the invert, and extend up into the arch, overlapping those in the latter in such manner as to produce continuous reinforcement. The invert is reinforced with two layers of old rails, placed transversely. The rails in the lower layer are 28.5 ft. long and are placed 4 ft. apart on centers; those in the upper layer are 28 ft. long and are 12 in. apart on centers, their tops being 1 in. below the surface of the invert section.

The tracks in the tunnel have 80-lb. T-rails attached to creosoted ties with screw spikes. The ties and rails are imbedded in concrete to within 1 1/4 in. of the top of the ball of the rail, the concrete being finished to a smooth surface to form the floor of the tunnel. The floor between the rails of each track is practically flat, transversely with the tunnel, and between the tracks is depressed only slightly toward the center line. Connections to a drain are made at intervals of 200 ft. in the tunnel so the floor can readily be flushed clean, thus avoiding any difficulty from



Approach to Upper End and Exit from Lower End of the Selby Hill Tunnel at St. Paul.

since electric traction was substituted in 1898 for the existing cable line on this street. The counterweight device consisted essentially of a traveling cable and a counterweight in a conduit below the street surface, and two grip cars, which were used to haul the street railway cars up and down the steep grade. The number of cars passing over this line became so great that the counterweight could not handle them fast enough to avoid delays. In order to eliminate the delays due to the auxiliary apparatus, and to obtain other operating advantages, the decision was made to build a double-track tunnel from the base of the hill to a point far enough back on Selby Ave. at the high level to obtain a satisfactory grade.

The total length of the improvement required in the grade reduction is 1,700 ft., including the tunnel and the approaches. An approach, 230 ft. long, leads up to the portal of the tunnel at the bottom of the hill. The tunnel is 920 ft. long between portals and has an approach 320 ft. in length at the upper end. The lower approach is on a curve with a 500-ft. radius, but otherwise the alignment of the improvement is straight. The grade of the new track is uniformly 7 per

drive was obtained on each side of it, so, on the whole, the street is much improved for highway traffic as compared with the old arrangement. The tops of the walls of the approaches and the portals of the tunnel are 0.5 ft. above the street grade, and are surmounted by a 6-ft. ornamental-iron picket fence, in order to prevent accidents.

The tunnel has a double-centered arch, with a span of 23 ft. at the springing line and a rise of 11.5 ft. The clearance at the center line of both tracks is 14.5 ft., while the center height is 16 ft. 10 in. The arch is 24 in. thick at the crown, and the bench walls are 4 ft. thick. Unlike most tunnels of this type that have been built the invert is perfectly flat, having a thickness of 2 ft., exclusive of the concrete in which the track structure is imbedded. The tunnel section proper required 9.782 cu. yd. of concrete per linear foot.

The concrete in the invert, in the side walls of tunnel up to the skewbacks of the arch and in the retaining walls was mixed in the proportions of 1:3:5. That in the arch was made in the proportions of 1:2:4. Owl cement, sand and run-of-the-crusher stone, with no pieces exceeding 2 in. in the extreme dimensions, were used in the 1:3:5 mixture; the stone in the arch was screened,

dust, or odors from refuse that would collect in stone ballast. At the same time the track structure is believed to be of such design that the concrete in which it is embedded will not have to be diturbed for a long period.

A 15-in. sewer pipe was laid under the invert, along the center line of the tunnel, from the entrance of the upper approach to the lower end of the improvement. An opening covered with a grating is placed across the end of the upper approach to intercept storm water and divert it into this sewer. Similar openings at other points in the approaches and the tunnel provide inlets to the sewer for storm water and for water used in flushing. The ground water back of the tunnel and retaining walls is also drained into this sewer through 4-in. laterals, which are placed 20 ft. apart on both sides of the main drain.

A four-way duct for cables is imbedded in the concrete along each side of the tracks, manholes being provided on these ducts at both ends and at the middle of the tunnel. Connections between the trolley wires and the cables in the ducts are made through conduits imbedded in the tunnel arch. The tunnel is lighted by 32-candle power incandescent lamps, spaced 10 ft. apart along the

connected to the cables in the ducts through conduits buried in the tunnel arch.

The construction of the tunnel was handled entirely in an open cut, 34 ft. in width, the maximum depth of the cut being 52 ft., and the average about 30 ft. The hill through which the cut was made consists almost entirely of a coarse glacial sand, containing some boulders and small stone. As the sand was practically free from clay, it would flow easily when dry. When the street was originally graded it was cut down 15 to 25 ft. below the natural surface on one side for a distance of 250 ft., toward the lower portal of the tunnel. A heavy masonry retaining wall had been built along that side of the street to hold back the ground, which continues to rise until a surcharge of from 10 to 30 ft. over the wall is produced within a short distance back from the street.

Forms and Centering for the Tunnel.

The deepest cutting for the tunnel was required along this wall, the top of the latter being 30 to 60 ft. above the bottom of the cut, while its base was directly at the edge of the cut. The work was successfully completed under these difficult conditions, however, practically no movement of the wall, or of the high bank back of it having occurred.

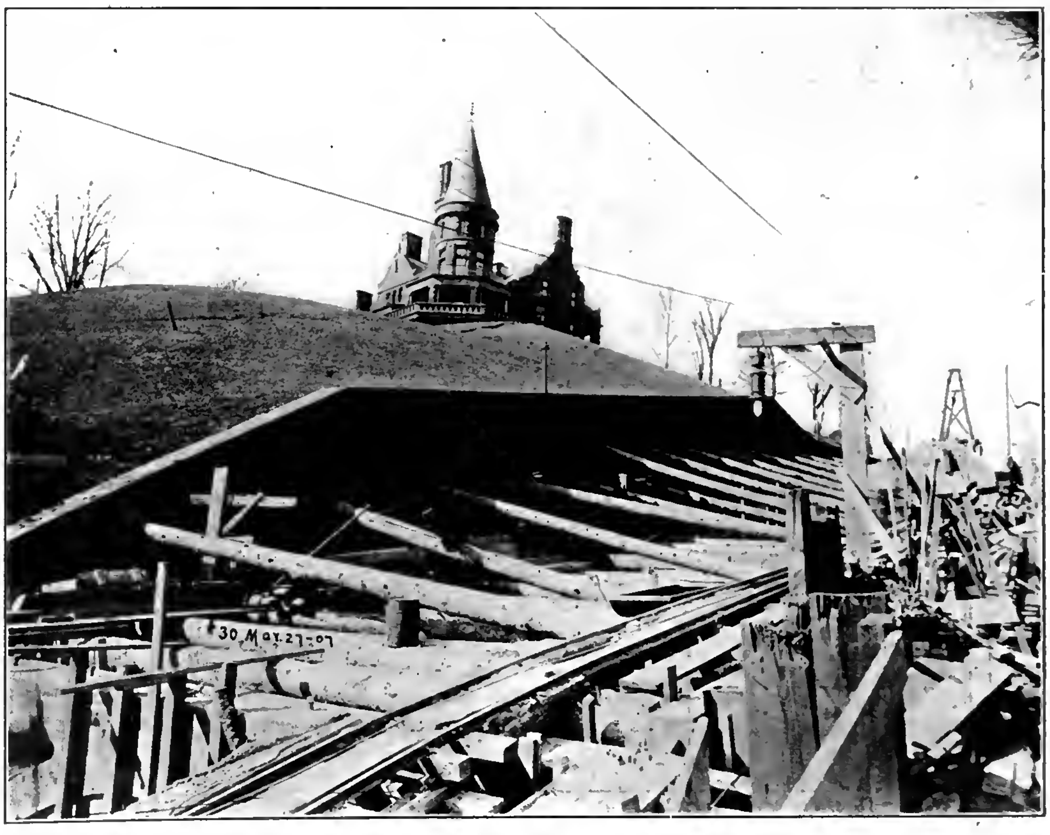
The excavation was started at both approaches and carried toward the middle. The material removed from the excavation was hauled away in 6-yd. dump cars handled by a motor-driven work car, until the amount removed was approximately equal to the quantity which had to be wasted. Most of this material was taken out of the approaches and was loaded into the dump cars by hand. Some of it, however, was taken from the tunnel cut, and a part of it was loaded into wagons by cableways.

Two cableways each having a span of 500 ft., were set up over the longitudinal center line of the tunnel. The two head towers of these cableways were close together near the middle of the tunnel, one tail tower being just beyond the portal at one end and the other beyond the other portal. After the excavation for the approaches had been made and the retaining walls of the approaches had been built, the excavation and concrete work on the tunnel were handled so material removed from the cut at one point could be placed by the cableways as backfilling on a completed section of the tunnel, or could be stored in convenient piles, from which it would afterward be readily available for backfilling. As the excavation in the portion of the work spanned by the cableway at the upper end of the tunnel was considerably lighter than in the part spanned by the other cableway this portion was completed first. The cableway at that end was then placed on the same towers with the other cableway, after which the two worked in conjunction. Buckets with a capacity of 21 cu. ft. each were used in connection with the cableways, which handled nearly 50,000 cu. yd. of material during the progress of the work.

The cut had to be closely sheeted and heavily shored from end to end, owing to the nature of the sand through which it was made, and the necessity of protecting the adjacent property. The sheeting consisted of 4x6-in. timbers in 22 and 26-ft. lengths. Against this sheeting were placed horizontally 12x12-in. waling, or ledger timbers, spaced 6 ft. apart on centers. The waling timbers in the corresponding rows were braced across the cut by poles, 10 to 14 in. in diameter, and 35 ft. long. The cross braces were spaced 6 ft. apart along the waling timbers, thus making a brace at each corner of every 6-ft. square on the side of the cut. The sheeting was driven by hand in advance of the excavation, to a depth of from 8 to 26 ft., and when the excavation had reached that depth, a second set of sheeting was started inside the lowest waling timber for the first set, and was driven to the bottom of the cut. The bracing timbers were wedged in place as the excavation was made, light vertical braces being nailed to them near the middle to prevent sagging.

The 6x6-in. sheeting was replaced for 250 ft. along the base of the high retaining wall by heavy round piles, 26 to 46 ft. long, which were driven closely together. Since the edge of the cut had to be made close to the base of the wall these piles were driven within 18 in. of the latter. As the excavation was made in this section of the trench the row of piles were braced against the sheeting on the opposite side with the regular heavy poles. Inclined braces, with one end against the sheeting on the opposite side of the trench, were also placed against the wall at various points. After the sheeting and bracing had been built up in this manner, the braces being placed as the excavation was made, the tunnel was built and the backfilling placed on it without injuring the high retaining wall or adjacent property in any way.

In all, approximately 1,000,000 ft., board measure, of timber was required in sheeting and shoring the tunnel. Practically all of this was handled by the cableways, which greatly facilitated the speed with which the heavy braces and timbers could be delivered and placed.



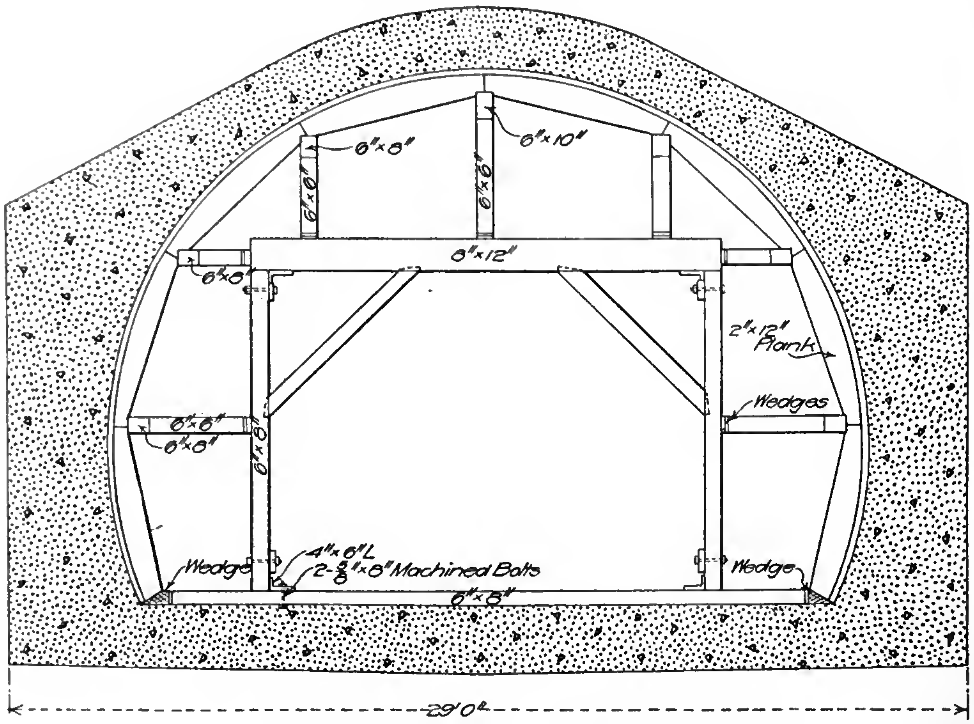
Bracing against High Retaining Wall during Construction.

The great pressures brought on the sides of the cut by the loose sand precluded any possibility of removing the bracing or sheeting as the concrete work progressed, without the load on each brace being transferred to another support capable of carrying this load. A system for building the tunnel section was developed, however, which not only provided for the transfer of the loading on the temporary braces, but also greatly simplified the centering for the tunnel arch. As soon as a section of the excavation was made ready for the concrete, the invert of the

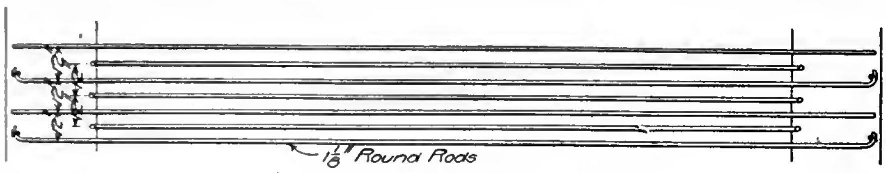
tunnel was laid nearly to the tops of the upper layer of reinforcement rails in it. Heavy concrete posts 4 x 4 ft. in cross-section, and reinforced with old steel rails, were built against the sheeting on both sides of the trench at the same time the concrete was placed in the invert. These posts were placed between the vertical rows of temporary braces and were 6 ft. apart on centers, a section of the two lower 12x12-in. waling timbers, 4 ft. long, being embedded in each of the posts. The posts were cast in rough plank forms, and were built enough in advance of the first work on the side walls of the tunnel to permit them to set for several days. They were held at the bottom by the invert and at the top by a temporary timber cross brace between the two corresponding posts on opposite sides of the trench.

Timber bents were then erected on the invert in such position as to form a center for the forms of the walls and the arch of the tunnel. These bents were 12 ft. wide and 11 ft. high. They were built with a 6x8-in. sill, two 6x8-in. plumb posts and an 8x12-in. cross brace at the top. The bents were spaced 6 ft. apart on centers, being directly opposite the vertical 4x4-ft. concrete posts. When they had been erected as far as the side walls were to be built at that operation, the lowest row of temporary sheeting cross braces between them were removed one at a time, transferring the load on the bottom of the sheeting to the concrete posts. The inside forms for the walls up to the springing lines of the arch, 5 ft. above the invert, could then be set and braced at the top and bottom against the bents of the centering, the sheeting of the trench forming the outside forms. After these wall forms had been filled, enclosing the lower ends of the concrete posts, the concrete in them was allowed to set for a few days. The cross braces between the second row of walings from the bottom were then removed, the load on the sheeting carried by these braces being transferred to the concrete posts. The arch forms were next erected on the bents of the centering up to a height of 11 ft., or just under the third row of temporary cross braces, and the walls built up to that height. When this concrete had set, the third row from the bottom of the temporary cross braces between the sides of the sheeting, and also the temporary braces between the tops of the concrete posts, could be removed and the balance of the arch built.

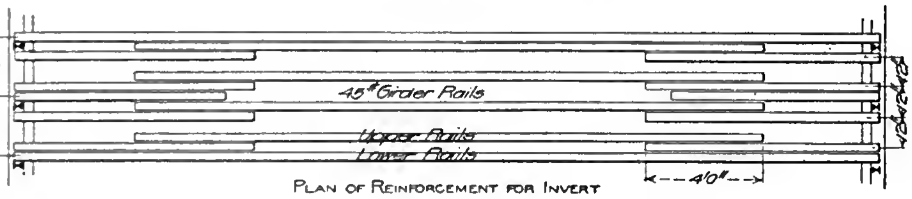
In all this sequence of operations no part of the sheeting was at any time unsupported. At the same time, the centering and forms for the concrete were erected practically without interference and the concrete could readily be placed. The temporary braces were also all saved, although the waling timbers and sheeting had to be left in place, which would have been required in any case. On the other hand, comparatively little extra work, or extra concrete was required by extending the limits of the walls to permit the construction of the 4x4-ft. concrete posts which temporarily carried the load against the sheeting.



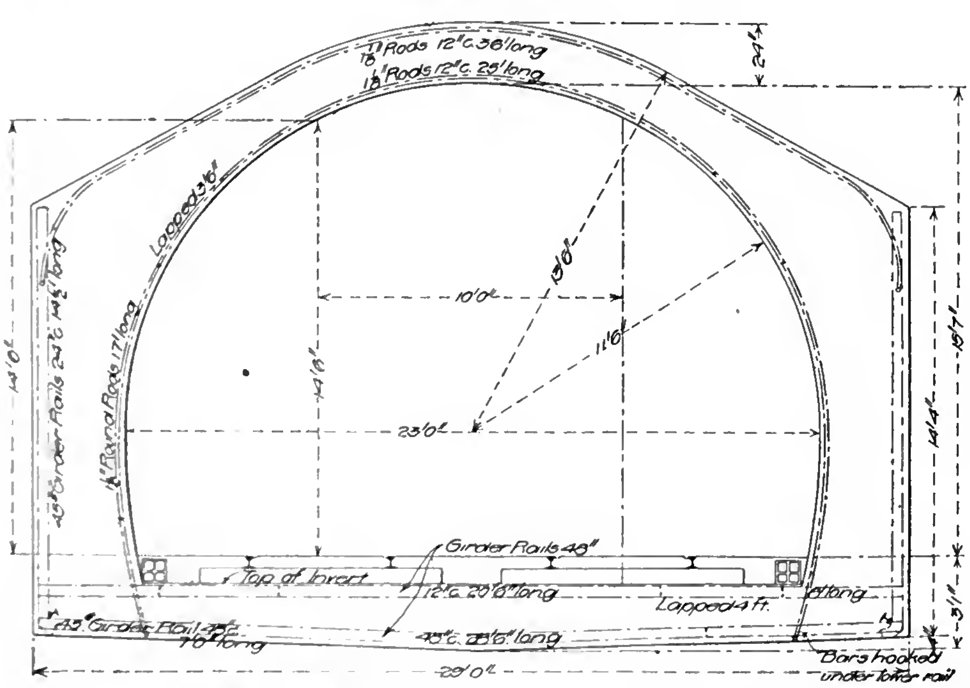
Centering and Forms Used in Constructing Tunnel.



Plan of Reinforcement for Arch Ring



Plan of Reinforcement for Invert



Transverse Cross Section of Tunnel Showing Reinforcement.

The forms for the tunnel had ribs made of 2x12-in. plank cut to a template to conform with the curve of the arch. These ribs were each in six sections, a section on each side extending up to the 5-ft. level of the walls, a second section on each side extending to the 11-ft. height, and two top sections in the closing part of the arch. They were spaced 2 ft. apart on centers and were lagged with 2x4-in. timbers. Ordinarily, the forms were permitted to remain in place at least 14 days before the centering was removed. The exposed surface of the concrete was all spaded carefully in the forms, with the result that a very uniformly good finish was secured.

Two concrete mixing plants, each containing a Smith mixer, were set up at the start of the work, one near each tunnel portal. The concrete materials were delivered to these plants by the work cars of the street railway company, over tracks which had been laid up to them. The concrete was handled from the mixers in 1-yd. Pettela narrow-gauge dump cars. For most of the work, two narrow-gauge tracks were laid longitudinally on the upper row of cross braces in the trench, one track toward each side of the latter. The cars from one mixer plant could be pushed along these tracks by hand, but at the other end of the work the tracks were on a grade, so the cars were handled by a hoisting engine set at the top of the grade. The concrete was dumped from the cars directly into place in the tunnel section.

The concrete work on the tunnel was carried forward in sections of various lengths, depending on the manner in which the excavation could be prepared. Backfilling was not placed on the arch until the concrete was at least 10 days old. The material from the unfinished sections of the

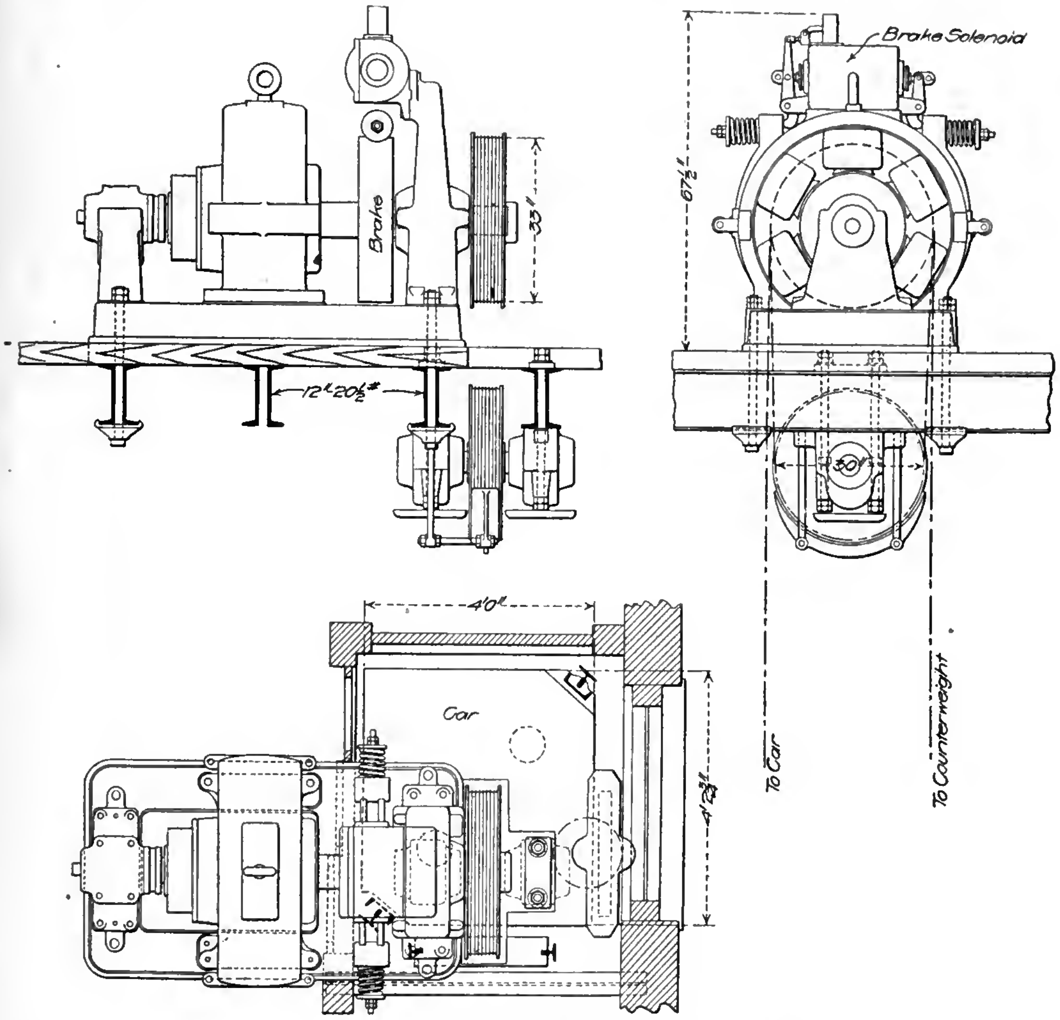
trench was generally piled on the finished concrete work by the cableways. The excavation was planned so very little of the material had to be handled twice, the backfilling being carried forward from both ends toward the middle of the tunnel. Approximately 4,000 cu. yd. of material had been stored on both sides of the trench in a street which crosses the tunnel about midway, and was used to close the final section. This stored material was entirely out of the path of the cableway, but was very economically handled back into the trench by a drag-scoop arrangement that was adopted. A double-drum hoisting engine was set up near the edge of the trench, close to the pile of material. A cable on one drum of this engine was rove through a block on the opposite side of the trench, and then carried back to the front end of the drag-scoop bucket, which had a capacity of 1½ cu. yd. Another cable on the second drum of the engine was rove through a second block on the opposite side of the trench, from which it was carried to a block in the rear of the pile of material and then to the back end of the bucket. The latter could thus be pulled back and forward from the storage pile to the trench very rapidly, discharging its load into the trench. Four men were required to operate the outfit; a driver for the hoisting engine, a signal man and two men to guide the scoop bucket as it was being filled. When the outfit was working to its full capacity it would handle as high as 250 cu. yd. in 10 hr.

The tunnel was designed by the engineering department of the Twin City Rapid Transit Co., of which Mr. George L. Wilson is engineer, and was built under the direction of that department by Mr. George J. Grant, general contractor of St. Paul. Mr. Charles R. Shepley was engineer in charge of the design and construction for the company. Prof. F. H. Constant, professor of structural engineering, University of Minnesota, assisted in the design.

The Electric Elevator Equipment for a Tall Office Building.

An 18-story office building has recently been completed at No. 1 Wall St., at the corner of Broadway, in New York City, which is a very unusual structure, occupying a ground plan approximately 30 x 40 ft. in size and rising to a total height of over 220 ft. above the sidewalk. It has the distinction of occupying a site for which a greater price was paid per square foot than has ever before been given for a building lot in New York City. Owing to the greatly restricted floor plan, an interesting feature is the interior arrangement of the building and the methods of communication between floors. As the available interior space on each floor averages but 28 x 37 ft., in which is included the elevator shafts and stairway enclosures, none of the floors are subdivided, each of those above the ground floor being devoted to a single large office, while the ground floor and basement are rented for store purposes, the basement communicating directly with the uptown platform of the Wall St. station of the Subway and serving as one of the station entrances. This interior arrangement obviates entirely the necessity of corridors on the upper floors and leaves the space that would otherwise be thus occupied available for office purposes, except on the ground floor, where an entrance corridor is necessary, and on the 18th floor, where there is a corridor for access to the upper works of the elevators. Stairway communication between floors is afforded by a line of stairs in a narrow enclosure at the rear corner of the building, having an inside measurement of 6 x 10½ ft.

Three elevators have been installed in a shaft 17 ft. long by 5 ft. deep, at the rear of the building, which is enclosed by wire glass partitions throughout its height, the elevator doors opening directly into the offices on the various floors. Two of the cars are arranged to travel from the basement to the eighteenth floor, a rise of 217 ft., 1½ in., while the third travels from the first to the eighteenth floor, a rise of 200 ft. 3½ in. The elevator mechanisms are each designed for maximum capacities of 2,000 lb., the machines being capable of moving the cars at a maximum speed of 500 ft. per minute with loads up to 1,500 lb. The cars are, of course, owing to the limited space available, of comparatively small size, having outside dimensions of 47½ x 51 in. The hatchway doors at each floor are of the double-telescoping type, giving an unobstructed opening of 38 in.



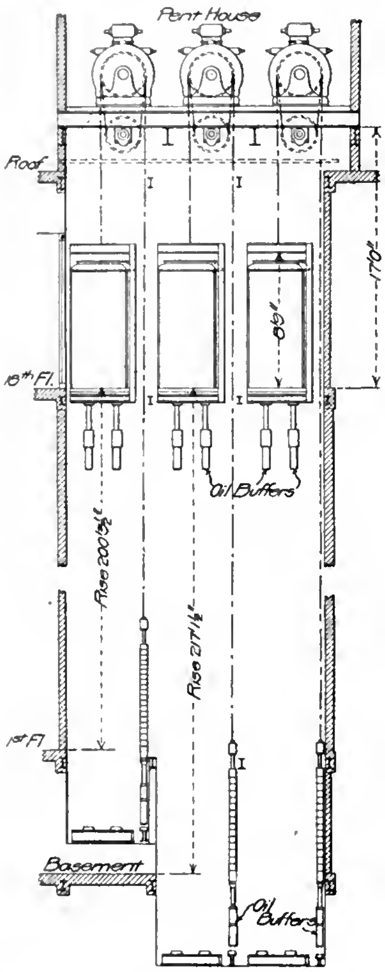
Traction Elevator Machine and Its Location over Hatchway.

Considerable interest is attached to this installation for the use of the Otis traction type of electric elevator machines, these being the first high-rise machines of this type that have been installed in New York City. This type employs a cable drive in its simplest form, entirely devoid of gearing, the elevator cables merely passing over a driving sheave which is mounted directly on the motor shaft, and are thus driven by the adhesion imposed by the weight of the car and counterbalance weights. The cables pass from the car over the driving sheave, thence for additional adhesion down under an idler sheave immediately below, and again up over the driving sheave, being attached at their other ends to the counterbalance weight. The speed of the car is thus always equal to the circumferential speed of the driving sheave. The motors are of a special slow-speed design, operated by the improved type of Otis magnetic control for rapid acceleration, and the two half wraps around the driving sheave give all the adhesion necessary for ordinary elevator service. The equipments are thus of the simplest possible form and specially adapted for high lifts and high speed, the height of lift being limited only by the practicable length of cable. This type of machine has, in fact, been adopted for the extreme high rise elevators in the 42-story section of the new Singer Building in New York City, and of the 45-story tower of the Metropolitan Life Insurance Building.

The elevator machines are, in this installation, located at the top of the elevator shafts in a pent house above the roof. This is, however, an arrangement to which this machine is particularly adapted and is an advantageous one, the machines being so located over the elevator shafts that the cables pass directly from the cars to the driving sheaves carried by the motor and then over and directly down to the counterweight, the motor shaft and sheave, in other words, displacing the overhead work of the usual construction and thus rendering all other sheaves unnecessary, with the exception of the idler sheaves immediately below the driving sheaves by means of which the second wrap around each driving sheave is secured for additional adhesion. The main bearings of the motor together with those of the idler sheave are the only frictional points encountered in the machine. The machines are self-contained, each combining on a single bedplate the motor driving sheave overhanging at one end and the brake mechanism, making a total weight of about 14,000 lb. Support was provided for the three units by a simple framework above the elevator shaft which is enclosed in a pent house that affords protection for the shafts and control mechanisms. The framework consists of four pairs of 12-in. 20½-lb. channels, which are so located upon cross girders supported by the building framework as to form bolting slots for the motor bed plates and the suspended idler shaft; the idler is hung directly below the driving sheave so that its support is a simple matter, as indicated in the elevation drawings of the machines at the top of the shaft and their methods of support.

The remaining structural features of the elevator equipments do not differ, except as affected by the location of the machines at the top of the shaft, from usual elevator practice, the usual form of T-rail guides being used for both cars and counterweight, while the speed of travel is limited by the usual form of Otis elevator governor. On account of the form of drive used and the location of the machines, however, these governors are made double-acting, arranged to operate the safeties in either direction of car travel, both upward or downward. The car safeties or guide grips are also arranged to be operated by emergency levers in the cars, if necessary. Furthermore, the ropes are not connected positively to the driving sheaves and there is no fixed relation between the position of the car and the position of the driving machinery. The limit stops, which prevent overrunning the limits of travel, consist of special switches at the top and bottom of the shafts, which are operated by cams upon the cars that act upon the control system. In addition to these provisions, there is an extra precaution taken in the attachment of oil buffers to the bottoms of the cars and counterweights, which are arranged to bring them to rest at the lower limits of their travel independently of all other devices; the efficacy of this means is evident from the fact that, if all other safety devices should fail, either the car or counterweight buffers would strike the impact blocks at the bottom of the shaft and prevent further descent so that continued motion of the elevator machine motor would result only in lifting the suspended weight sufficiently to allow slippage of the ropes.

The elevator machine motor is a six-pole direct-current motor of special design for the required capacity at the slow speeds of operation necessary, arranged to operate normally at 60 r. p. m. It is wound for operation at 250 volts, current being supplied to the building from the Edison street service. The controllers consist of series of magnet switches, mounted on switch panels with the resistances, near the machines in the pent house at the top of the shaft, and have the usual features of utilization of the increasing counter-electromotive force of the motors, in starting, for operating accelerating magnets to cut out gradually the armature resistance and finally introduce resistance in the field circuits, and retarding magnets, similarly used for slowing down in stopping. The holding brakes on these machines are of a special design, with double-acting solenoids above the outer main bearing caps which operate specially designed shoes that act upon large drums on the motor shafts. The brake shoes are leather lined and carefully fitted to the drum, and are operated by a special toggle motion requiring but a very slight movement of the solenoid core to grip the drum firmly. The solenoids are operated in conjunction with current limit switches which allow comparatively heavy currents to pass through them during the action of releasing the brake, but reduce the current flow to a fraction of its initial value while the shoes are merely held in release position, against the pressure of helical springs in compression.



Traction Elevators in No. 1 Wall Street Building.

Locomotive Smoke Prevention has been demanded in so many cities of late and is so desirable for the comfort of passengers that it was thoroughly discussed at the recent Chicago convention of the Traveling Engineers' Association. The unanimous sentiment was in favor of a brick arch for preventing smoke and protecting tubes. It was stated to assist materially in mixing the inflowing air with the gases of combustion, thus supplying oxygen and preventing the formation of smoke. The hot brick also help maintain proper combustion temperature when the engine is standing and gases are still coming from the coal.

Factory Lighting.

In a paper with the above title, read before the Ohio Electric Light Association, at Toledo, last month, Mr. A. P. Biggs pointed out that from the standpoint of illumination, the lighting of factories may be divided into space and applied lighting. For general space and floor lighting there must be some large source of artificial light, and the sources now available are the electric and gas arcs, the Cooper Hewitt and the Nernst lamps. The incandescent lamp in large sizes is still inefficient as compared with these others, and in ordinary sizes does not give the necessary illumination.

An arc requires minimum cost for installation, has the greatest efficiency per watt expenditure and lowest maintenance cost. The unsteadiness of an arc is not serious in space lighting, and while the shadows from a single arc are apt to be annoying, the arc on the whole is the best unit for such work as above noted.

The Nernst lamp is desirable in small space lighting, in low-ceiling machine shops, and in foundries. In one instance where the Nernst lamp is giving excellent results, the lamps are spaced from 8 ft. to 10 ft. apart at a standard height of 9 ft. The light is soft and pleasant, and energy consumption low.

For particular application of artificial light, single incandescent lamps are the sources used. Although the installation of a lamp at each machine in every kind of business is not sanctioned by all illuminating engineers, it has the sanction of custom, the recommendation of the wiring contractor, and enjoys the hearty endorsement of those responsible for getting the same amount of work out of the machine by artificial light as is expected by daylight.

In a shop having low ceilings and much window surface, illumination may be good from natural sources for the first six months or so, but after that, by continuous process, the windows, ceilings, walls, posts and everything blacken and cease to let in or to reflect any light. The lighting installation fares the same way, and the workman shades his eyes by covering the lamps with anything available, until there is almost no light available.

An example of shop practice with individual lamps—uncommon because definite data accompany it—was presented by Mr. K. C. Keech, before the Chicago Section of Illuminating Engineering Society in May last. A bare lamp, 13 ins. above the face-plate of a drill press, and 7 ins. from the center, gave 3.7 ft.-candles at the center of the face-plate. The dirtiest lamp in the shop when substituted, gave 1.55 ft.-candles, while a new clean lamp in the socket gave 5.7 candles.

When the customer gives us the opportunity of making recommendations upon his equipment, we generally advise him to place at every machine a drop or bracket lamp with reflector, and that he use 8-cp lamps wherever possible. Often, to satisfy the customer that the economies pointed out are worth securing, we loan him a half dozen styles of shades and reflectors, and he purchases when he has determined the kind most suitable. Further—and here the policy of the company may seem heretical—space lighting is often disposed of by advising and urging the use of gas arcs. All possible short-hour burning is turned over to the gas company, and the electric light company is relieved from the "lighting bill" complaint which formerly afflicted us for several months each winter. As this policy results from our differential rates, its presentation may be comforting only to those who make high prices per kw-hour for lamps burned but few hours per year; unless the "Flat Rate" man wishes to mend his way.

The usual factory lighting can be considered by central-station men as none other than unprofitable business, which is to an extent a necessary evil. By reason of its character, it requires all of the attention and all of the equipment which more respectable branches of the industry necessitate, but refuses to make adequate return on the investment and work to supply its need.

The assumption is not to be made that the Detroit Company is securing proper and adequate return for its service in this branch of lighting. The company has certain rates and is, as a public service corporation, required to furnish and does furnish service for all customers. Further, it is needful that this unprofitable business have a fairly low rate in order that we get the profitable business that goes with it.

The rates at which this class of lighting is sold in Detroit are as follows:

First—Open Order—Sixty hours' use per month of the demand at 16 cents per unit, balance at 4 cents per unit. This agreement is not a contract, having no definite term.

Second—Demand Contract—Thirty hours' use per month at 16 cents per unit, balance at 4 cents per unit; minimum bill 30 hours' use per month of maximum demand at 16 cents; term, one year.

The following discounts for prompt payment are allowed on both agreements: On bills less than $50, 10 per cent; on bills of $50 and less than $100, 15 per cent.; on bills of $100 or more, 20 per cent.

Under "open order" we furnish standard incandescent lamps and renewals—and trim and care for arc lamps and Nernsts owned by the customers. Under "demand" we furnish all incandescents, arcs, Nernsts, renewals and maintenance.

The "open order" is the most common prescription for factory lighting. It cares for that class of customers whom we term "short hour," who use our service as auxiliary to sunlight and daylight; who have a few places which, due to poor

construction of building, blackened windows, or later construction by their neighbors, need light occasionally during the day, but whose principal service is from dusk to 5:30 p. m., and who either cannot or will not make nor pay us for making the investment necessary for good lighting.

The "demand contract" is suited to the lighting conditions of but a small portion of factories, inasmuch as it is designed for the satisfaction of long-hour burners. The factory whose conditions are met by it is probably one in which there is a requirement for a large number of individual lamps, and for small lamps in isolated parts of the factory, for which there is necessity for service all through the day.

To illustrate that under our rates factory lighting is unprofitable to us, the following cases have been figured to show cost to consumer under "open order" and under "demand contract," and the amount the business should have brought in in order that it might just begin to be profitable, the later amount being arrived at as fixed charge per kw-year plus operating costs per kw-hour:

				Earnings	Income per Year	
	Kw.-h.	Connected Kw.	Demand Kw.	Open Order.	Demand Contract.	Minimum Allowable.
1..	4,330	29.0	12.0	$552.00	$632.00	$780.00
2..	8,163	36.6	13.5	916.00	815.65	973.89
3..	1,800	5.6	2.2	220.00	157.00	172.30
4..	6,850	30.6	22.2	884.00	1,061.70	1,410.80
5..	10,410	26.3	17.6	1,168.70	875.80	1,262.80
6..	3,052	16.6	9.16	416.70	492.93	500.40
7..	1,644	5.1	2.81	226.72	170.25	201.10

Nos. 1, 2, 3, 4, 5—On Open Order, 60 hours' use of the demand.

No. 6—On Demand Contract.

No. 7—On Open Order, 60 hours' use of connected load.

The first three calculations are for a carriage manufacturer, in successive stages of his business. For two years he did all his lighting by clusters; at the end of that time, by reconstruction of building, the electric lighting was reduced from 13 kilowatts demand to 2 kilowatts, and all general floor lighting was done by gas arcs. Only on this third year, after the changes had been made which took from us the pleasure of serving 650 lamps, did we make any profit on the business.

The fourth and fifth calculations are successive years in a cigar factory—a six-story building lighted throughout by incandescent lamps. At the end of the first year given, the customer was persuaded to change 300 individual lamps from 16 candle-power bare to 8 candle-power lamps with reflectors. Demand was reset and he was billed upon 60 hours' use by its readings—as he was an open-order customer. He saved considerable and we only lost 10 per cent. on the lighting business, against 60 per cent. the year before. His motor business in the last year amounted to 30,800 kw-hours, with a demand of 11.6 kilowatts.

The sixth is a manufacturer of shirt waists, skirts, etc.; has all electric equipment, using electric arcs for general floor lighting. His lighting business, which was on demand contract, lost us but $8. During this year we had the profit from the sale of 20,000 kw-hours for motors with demand of 8.5 kilowatts.

The seventh, which is a bathtub factory, has wood-working, sheet metal and brass foundry departments. For space lighting gas arcs are used, and the business gave us some respectable return.

As a public service corporation having established rates we must sell at these rates whether the customer causes us to lose on service or brings us revenue from it. We tell customers that by our experience his lighting will be cheapest for him, say, on demand, but inform him that there are so many conditions of surroundings, location of lamps, faults of building design, amount of natural lighting, etc., that he must fix his conditions and try it out for himself. Usually we install such service on open order—if we find later that demand contract rate will be to the customer's advantage, we offer it to him.

Our rates are based on customer's demand even when the open order is taken. If demand is same as connected load, and the customer signs the open order, we will bill him at 60 hours' use of the connected load at 16 cents. If his installation is greater than his demand, we install demand indicators and bill on showing of indicators. If he has many empty sockets in his installation, we install demand indicators, and probably bill on connected load until demand shows that customer has fitted empty sockets with foreign lamps and would have us continue to bill him without increasing his rate.

By the same method of figuring as used above, a business begins to be profitable to us when the customer has paid for 480 hours' use of demand per year at 16 cents, say, 40 hours per month. As an approximation—to get at classification of business as profitable or unprofitable—the consumption of energy per year of factories as found in several customers' ledger accounts, has been divided by 12 times demand, giving hours' use of demand per month. All of these factories are operating on a regular 10-hour day.

No. of Cases.		Average Hours' Use of Demand per Month.	
5	Bakeries, Wholesale	107	
8	Brass Works	57	
2	Breweries	85	
2	Brush	12	
4	Candy	51	
3	Chemical	10	
7	Cigar	29	
9	Clothing	37	(5 cases average 11.9)
3	Engravers	70	
3	Harness	35	(2 cases average 11.9)
1	Knitting	9	
14	Machine Shops	31	(7 cases average 13.4)
3	Paper Box	13	
4	Printing	20	
8	Sheet and Metal	18	
3	Sheets	33	(2 cases average 13.7)
2	Toys	31	
1	Upholstering	4	
1	Wire Works	12	
6	Woodworking	24	(4 cases average 11.10)

From their nature, several kinds of business are invariably profitable. The wholesale bakers use some lighting for 24 hours per day. Breweries have many small motors about their establishments which are shut down about 4 p. m., and the lighting load up to that time continues quite uniform throughout, making the lighting demand negligible.

Machine shops and brass works need electric lamps for individual machines only, and give a good lighting load summer and winter. The clothing manufacturer, whose record makes the best showing of his class—to our way of thinking—in the above list, has on each machine a movable arm carrying a lamp of low candle-power with parabolic reflector, permitting operator to bring source of light close to work without unpleasant effect on eyes; all his space lighting is by gas arcs.

We persuaded one customer operating a brass foundry to put in gas arcs for all lighting, and further satisfied him that, with little hardship, his air compressor could be shut down in the afternoon at such times as would prevent any increase of total load due to shop lighting. As a matter of general policy, in addition to giving other advice, we recommend to the manufacturer that a fraction of the amount spent this last year for lighting be turned over to a window cleaner and a man with a hand-pump and a tank of whitewash, expecting that both of us will then be satisfied with his factory lighting.

Our conclusions are: That an electric light company cannot afford to take on all factory lighting offered to it; that it is obliged to take a certain amount which is inherently unprofitable; that it should minimize this amount (first) by advising the customer how to reduce his demand by utilizing light to best advantage; that is to say, by good illuminating engineering; (second) advocating the transfer to daylight hours of any motor load that can be dispensed with during the evening hours, and (third) by passing over to the gas company such factory space lighting as can be profitably furnished by gas arcs, retaining for electricity the long-hour localized lighting.

It is worth while to note that the new metal filament incandescents may modify these conclusions. They will not change the rates of demand to sales, but they may make gas so comparatively expensive as to put it out of competition either partially or altogether.

In a paper with a similar title, J. T. Kermode stated that many manufacturing concerns are vacating their old premises to enter buildings of more modern construction, with saw-tooth roofs and windows on practically four sides, which is evidence that better lighted workrooms are essential and that the demand for a higher standard of artificial illumination is rapidly increasing.

The short-hour use and usually heavy demand on the station peak has brought about a condition where there is some question as to the advisability of factory lighting from a supply company's standpoint; it is, however, very important when combined with the supply of electricity for motors. In conjunction with this latter business considerable work has been done in Cleveland, where it has been the policy to make surveys, plans, specifications and to obtain bids for this class of wiring with special reference to the best and most economical method of illumination for the various kinds of work in different processes of manufacture.

The average factory requires artificial light during 10 to 20 per cent. of the working hours, not including overtime or night shifts; therefore, the illumination should be sufficient and the lamps so arranged that the quality and quantity of work accomplished during these hours can be as well and economically done as that which is performed by daylight.

The amount of light required varies, first, with the size of room, relative position of machines and the general shop conditions, and, second, with the character of work to be done. The arrangement that will effectively light a clothing factory cannot be efficiently applied to industrial plants, where the atmosphere is filled with smoke and dust.

Experience has taught that no general rule can be laid down to govern the many different situations that present themselves, but each factory must be studied separately to determine the amount of light, style of illuminant and the method of its installation, to give the best results.

For instance, large units cannot be successfully operated in roundhouses or car shops. The principal parts of locomotives that need special attention are so located, that, to be of value, the source of light must be reflected from each side of the engine. Five 100-watt Gem lamps, spaced 15 ft. apart, at an elevation of 7 ft., will light in a very satisfactory manner one side of two engines. Oil torches so commonly used in cabs, boiler and floor pits, can be conveniently done away with by the use of portable incandescent lamps

In foundries, forges, steel mills, structural iron works and boiler shops, where the walls are dark and the work does not require concentrated light, a lamp is needed that will give good general illumination Enclosed arc lamps, giving a white light, combined with shadows, are undesirable for this class of work, as the dark walls and dense atmosphere absorb a large percentage of their penetrating powers

The color and brilliancy of light produced by the flaming arc has attracted the attention of many manufacturing concerns, and, notwithstanding the cost of lamps and carbons, they are being extensively used to light large areas

In a large mill operating steel presses, 16 enclosed arcs were installed. On account of the dense atmosphere these lamps were hung below the tops of the presses, resulting in heavy shadows being cast around each machine. The 16 enclosed arcs were recently substituted by six flaming arcs. With slight changes in the wiring these arcs were placed 22 ft. from the floor, resulting

in the entire shop being flooded with a warm, bright light.

The use of flaming arcs reduced the connected load, and averaging two hours use a day, these lamps would save 234 kw-hours per month, which at the usual prevailing rate for energy would more than compensate for the cost of carbons, without considering the increased amount of illumination.

It is generally conceded that the best uniform illumination can be obtained by distributing small units over the space to be lighted, but this is not always practical, for one must consider the building construction, and purpose for which the space is to be used.

The use of higher candle-power arc lamps for factory lighting is rapidly increasing and the advantage that can be obtained by their use and efficiency must be recognized. The efficiency with which the light is produced and utilized, are two important factors, with which a supply company is intimately concerned.

In machine shops it is common practice, together with large units for general illumination, to furnish each workman with a single incandescent lamp, which when new, and at average height from his work, usually gives a fair amount of light. Oil and dust soon reduces the illumination one-half.

But it is not expected that the amount of work should reduce in the same proportion. Some reasons why this practice has become so popular are:

First. That up to a few years ago the majority of industrial shops were equipped with generating apparatus, but the cost of electric lighting was charged against the operation of the shop, and not against the cost of electricity, as it should have been.

Invariably, I have found, that where light is obtained in this manner, the generators, feeders and branch circuits are heavily loaded with inefficient apparatus and there is no incentive to economize.

Second. Wherever a large installation is necessary, the manufacturer usually employs a man to look after the operation, repairs and additions to the electrical equipment.

These men, as a rule, are not familiar with the improvements that are continually being made on the various devices that go to make up a modern electric installation. Consequently, inefficient light facilities are unintelligently installed.

Third. Employees have been educated to believe their work cannot be successfully performed unless each individual is furnished with an incandescent lamp, and realizing the flexibility of electricity, it seems comparatively easy for one to convince the foreman that an additional lamp should be added here or there, resulting in an over-lamped room for the number of machines operated and also in a poorly lighted room at an excessive cost.

In machine shops where lathes, drill presses, planing machines, milling machines, screw machines, punches, etc., are used good general illumination of uniform intensity is required. Nernst or Gem lamps are well adapted for this class of lighting.

The size and number of lamps to be used depends upon the size of the room, height of ceiling, color of walls, location of machines, belts and shafting. In estimating the size and number of units it might be of service to consider 50 watts per operator, or machine, as an average amount for all ordinary machine work and general illumination. For special machines or work needing bright light, individual incandescent lamps with reflectors should be used. Machines that are automatic in their operation are many times provided with unnecessary individual lamps. Appreciating that these machines do need good light for changing their adjustment, the use of portable lamps that can be connected to receptacles near each machine will, if intelligently used, save energy.

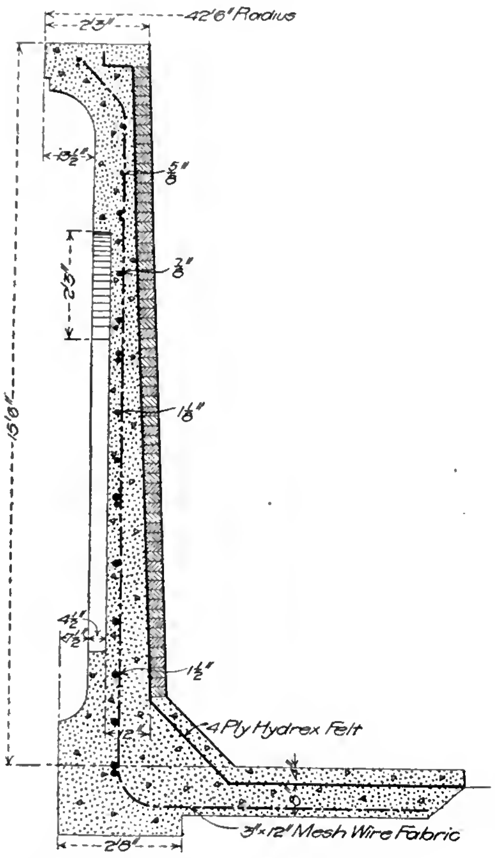
The general evenness of illumination with the absence of glare, together with the easy shadows and searching quality of the light produced by mercury-vapor lamps makes them especially adaptable for factory lighting by direct current. Unfortunately the alternating-current lamp up to the present time has not been successful, due to its inability to readily start.

Manufacturers of clothing require an even, shadowless, well diffused light of considerable brilliancy. Nernst lamps with prismatic reflectors can be utilized for this purpose with a comparatively low consumption per operator.

The difficulties that exist in factory lighting are familiar to all men engaged in the sale of electricity and it should be the duty of each central station to educate its men to successfully overcome these conditions by encouraging the use of lamps, shades and reflectors that have been produced for scientifically converting wasted energy into useful light. Recent discoveries in the production of electric lighting are of revolutionary nature, the same principles which have been utilized in the cheapening of gas light, that is, the use of the peculiar properties of rare earth and metals, have been appropriated by the electrical interest and the recent developments indicate the efficiency of electric lamps will be doubled in the near future.

Recently I have read an article in which a supply company recommends the use of gas for factory lighting that they might be successful in retaining power business.

Is there a more exaggerated case of false economy than that of requiring people to work by poor illumination? In comparison with the cost of labor, the cost of lighting is trifling. Take, as an illustration, the case of a skilled workman receiving $3 or $4 a day (say, an average of 30 cents an hour or ½ cent a minute), figure the cost of a 16-cp lamp burning 10 hours, and see how many minutes of the man's time it requires to pay for the light. Yet there are thousands of skilled mechanics handicapped with insufficient and ill-directed light.



Section of Wall, Cos Cob Reservoir.

A Concrete Power-Plant Reservoir.

A 600,000-gal. reinforced concrete reservoir, 80 ft. in diameter and 15 ft. deep, of attractive appearance, has been constructed for the New York, New Haven & Hartford R. R., at Cos Cob, Conn., in connection with the power plant described in The Engineering Record of Aug. 17, 1907. The reservoir is founded on solid rock and is without any surrounding fill, thus making some exterior embelishment very desirable. Accordingly the wall was designed with a cornice and a slightly projecting base and the flat belt between was relieved with a series of arched indented panels, forty in number, giving somewhat the effect of an arcade. The general appearance of the exterior of the tank is shown in an accompanying illustration.

The concrete wall has the form and dimensions shown in an accompanying sketch and has a 4-in. lining of brick laid up in cement mortar to protect the waterproofing coat. It is reinforced circumferentially with steel cable, varying in diameter from 1½ in. at the base to ⅝-in. at the top, forming a continuous spiral with 12-ft. splices made with sixteen Crosby clips where the ends of two sizes of cable are joined. The pitch of the spiral varies somewhat, as indicated on the drawing, but is in general about 1 ft. Inside the cable spiral is a continuous sheet of 3x12-in. mesh Clinton wire fabric, placed in vertical strips which extend 6 ft. into the floor foundation.

The inlet and outlet pipes are 10 and 12 in. in diameter, respectively, and enter through the floor of the tank near the east wall. Water-tight connections were secured where the pipes passed through the waterproofing by clamping a sheet of lead between two flanged screw sleeves, as shown in an accompanying sketch. Just outside the tank wall the two pipes enter a concrete valve chamber, 5⅔x11⅓ ft., in the top of which is a 30-in. manhole. A 3-in. steam pipe leading from the power house through the valve chamber into the tank and half-way across the floor, with a perforated upturned end, is provided for keeping the water above the freezing point in cold weather.

The natural surface of the granite outcrop on which the tank is built sloped considerably to the north. To make a level foundation the rock on the south side was blasted out and transferred to the north side, the rock fill being thoroughly compacted and grouted with cement and sand mortar until it was a practically solid mass.

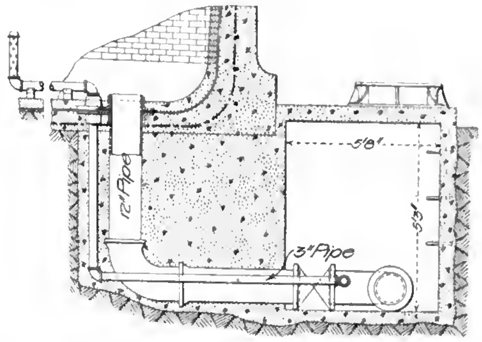
The wooden form for the exterior surface was built complete from the foundation to the coping and around the entire circumference of the tank. Screw hooks were then driven into the inner surface of this form, properly spaced to support the cable spiral. The cables were then hung on the hooks, the proper spacing between these points of support being maintained by wire ties, and upon the cables was wired Clinton electrically welded wire fabric in vertical strips as indicated on the drawings. The interior of this form, with the cables hanging on the hooks before the wire ties or wire fabric were attached, is shown in an accompanying illustration. The vertical supports for the inner forms were erected after all the reinforcement was placed and were wired to the outer forms at the proper distance. The concrete was prepared in a mixer placed just outside the tank, and delivered to place in 1-yd. skips by a guyed derrick placed in the center of the tank and operated by a hoisting engine which was outside the enclosed area. The derrick cables were run through the wall, the holes being filled after the forms were removed. The inner form was

built up a few feet at a time as it was filled with concrete, which was placed very carefully to insure the filling in of all spaces between the cables, wire fabric and forms.

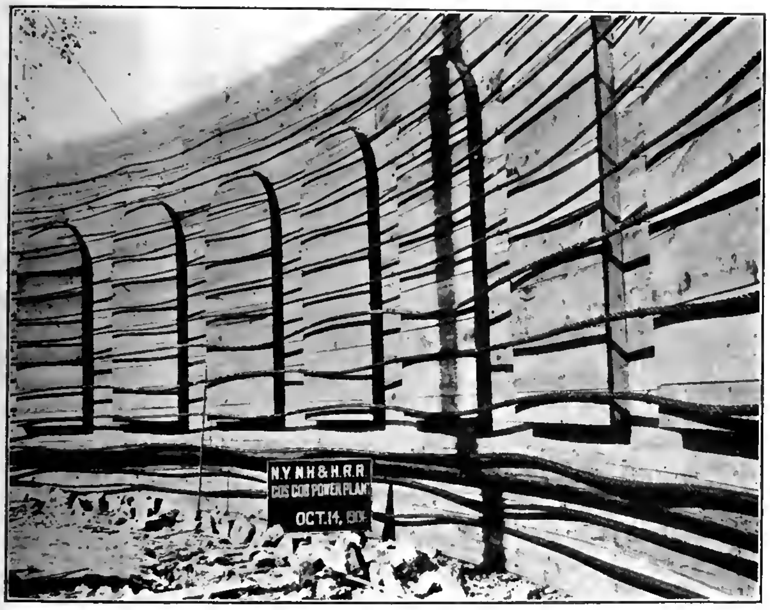
About ten days after the filling of the wall forms had been completed the forms were removed and the derrick was taken out of the tank. The floor was then concreted to an even surface and a 4-ply waterproofing coat of Hydrex felt was applied to the inner surface of the wall in vertical strips and to the tank floor. Hydrex compound was used to cement the layers of felt together.

A 4-in. protective covering of concrete was laid over the floor of the reservoir on the waterproofing coat and extending a little way up the side to give a footing for the 4-in. brick wall lining. The bricks were laid with cement mortar with a solid backing of mortar between brick and waterproofing.

The reservoir was designed and built by Messrs. Westinghouse, Church, Kerr & Co., of New York, engineers and constructors of the power house.



Section of Valve Chamber.



Inside of Reservoir Forms with Cables in Place.


The 600,000-Gallon Reservoir at Cos Cob Power Plant.

Electrical Equipment for Suburban Lines.

Electrical equipment for the suburban lines in Oakland and vicinity belonging to the Southern Pacific was ordered recently. The service given is distinctly of a suburban rapid transit character. The commuter traffic is confined largely within a radius of about seven miles, and the different roads conducting this service converge at Alameda Mole where they connect with ferryboats to San Francisco. The stations on the suburban lines average four-tenths of a mile apart, and the system as a whole is said to do a larger suburban business in number of passengers carried than any other in the country, the Illinois Central suburban lines out of Chicago alone excepted. The electrical equipment now decided upon will consist of multiple unit trains with from three to twelve cars per train, made up in the usual combination of motor and trail cars. The cars seat 80 passengers each. Eighty motor cars have been ordered and each will be equipped with four General Electric 125-h.p. motors. Direct current will be employed and overhead catenary construction will be installed. The power station will be equipped with two 5,000-kw., 25-cycle, 13,200-volt, three-phase units, the contract for which has been awarded the Westinghouse Machine Co. Parker boilers have been ordered for the plant and Worthington condensers and auxiliaries.

Electricity for Cement Plants.

A paper read before the Association of American Portland Cement Manufacturers by Mr. J. B. Porter, of the Light and Power Department of the General Electric Company.

The applications of cement have been so enormously increased in the last two years as to almost justify the name for the present period as the cement age. This increased demand and the high prices which have been maintained have created a large number of new companies, and have stimulated the remodeling of old plants to increase their output. It is predicted that the total output of cement for 1907 will equal, if not exceed, 60,000,000 bbl.; yet this supply, it is claimed, will fall far short of the demands.

The object of this paper is to point out some of the special advantages of the electric drive in the manufacture of cement, both in economy and flexibility. From the economical standpoint the savings of one cent per barrel on a 1,000-bbl. plant would justify a first cost of over $50,000. Economy in the manufacture of cement is so closely connected with flexibility that it seems almost one and the same thing. Economy to cement manufacturers means continuous operation, and continuous operation is contingent on flexibility.

There are few if any plants which are not making good profits under the present condition of prices; yet there are any number of plants which are producing cement at a high cost of manufacture because of the inefficient layout of their plants and the uneconomical transmission of their power.

The cement industry has been very conservative in the adoption of electricity for the transmission of power; yet in most other lines of manufacture, mechanical transmission has been superseded by electricity even at great expense, and the results have proved that the electric drive has either increased the output, simplified the process of manufacture, improved the economy, or made easy the superintendence of the plant. Many Western cement plants are already driven throughout by electricity, and yet in the East, the cement manufacturers use the electric drive only where the mechanical drive is impracticable.

The cement industry opens a large field for the application of electricity. The simplicity of the manufacture of cement permits a division into different departments in such a manner that each department can be regarded as a unit, having its local manager who is held responsible for its satisfactory operation. With the electric installation, a ready record can be kept of the power consumed in each department, and the superintendent can easily locate the department responsible for any decrease in output for each day. A record of the power consumed in each department shows at a glance whether the consumption is above or below normal, and any deviation should require a satisfactory explanation or should indicate that the machines are not operating satisfactorily.

The profits in the cement industry demand the continuous operation of each machine at its full load; to obtain this, it is necessary to have flexibility in the power applied, and electricity permits of greater flexibility than any other mode of operation.

The installation in the power house of two or three generators insures a constant source of power for each and all departments. The switchboard, if properly subdivided and arranged with one feeder panel for each department, each panel equipped with indicating ammeter or recording wattmeter, furnishes a constant indication of the power consumed by each department, and a record of these readings gives a ready reference to the operation of each department. Each department may be operated by one or more motors; if more than one motor is used, the group drive should be made as flexible as possible so that part of the load, if necessary, can be thrown from one motor to the other, or the groups entirely separated from the others so that part of the department will always be in operation.

The output of a plant is based on the output of each kiln and the number of kilns installed; this department is the very heart of the industry and the successful manufacturer should provide every means known to keep his kilns running and crowd them to the limit of complete calcination.

To accomplish this there are three different methods of control, variation of the speed of the kiln, variation of the feed of raw material, and variation of the coal feed for combustion.

All these variations should be under the hand of the operator at the point where he can watch the calcination and change any or all of these to accomplish the most satisfactory results; here the application of the electric motor should play an important part.

Where it is necessary to use a number of crushers arranged in groups, the most flexible arrangement would be to select a motor of about 150 to 200 h.p. and drive from a line shaft, each pulley on the shaft to be equipped with a friction clutch. If the number of crushers requires more than one motor, put in another line shaft so arranged that it can be connected to the first line shaft by means of a friction clutch. Should it be necessary to add more groups, this can be easily accomplished by placing the crushers either in parallel or series, whichever arrangement will enable the feeding and taking away of the material to be more concentrated.

The power house, if properly designed, should permit the shortest steam transmission from boilers to engines, and the building should be so constructed that if it becomes necessary to increase the number of units beyond the capacity of the building, the end of the latter can be taken out and an extension made for both boiler and engine rooms without interfering with the continuous operation of the plant.

Electricity permits the grouping of the buildings for each department in the most convenient sequence without being obliged to take into consideration the source of power, and also permits the shortest transmission of the manufactured material from one department to the next. If possible, the building for each department should be constructed similar to the arrangement of the power house so that extensions may be added.

Up to the present date it has been almost impossible to obtain satisfactory tests even on motor-driven machines in cement plants, as the power required to start some of the machines is so great and changes so quickly that it is hard to take a reading; and the running power is so small in comparison that manufacturers have been compelled to use motors of large horsepower ratings in order to be on the safe side. There is now on the market a curve-drawing meter which automatically records the power consumed, and it is to be hoped that tests with it will put the consumer in a better position to specify motors nearer the running horse-power of the machine than they are at present.

For best results, motors, both direct and alternating current motors, should be run as near their most economical point as possible, which naturally is full-load rating. It is not always possible to take these points into consideration, as the limiting feature is the starting torque, which is generally from two to three times greater than the running torque required for most cement machines, yet with these curves, it will probably not be necessary to install a 150-h.p. motor to operate a continuous load of 65-h.p. as many of the plants are doing to-day.

The belt drive is generally considered the most satisfactory for transmitting power from the motors to the machines. It often happens that crushers get clogged and it is practically impossible to furnish sufficient power to start them again without cleaning them out. The belt drive relieves the motor from the enormous shock consequent on the stoppage of the machine and the belt would probably slip before the circuit-breaker could act, giving a double protection and also giving a protection to the cement machines that it is impossible to obtain from a mechanical drive, as there is no flexible arrangement that would automatically shut down the machine, mechanically driven, when excessively overloaded. The belt drive also relieves the motors from the consequent jar of heavy starting loads. At one cement plant where a crusher was driven automatically, a large-size shaft was twisted off by the clogging of the crusher with a sledge-hammer head. It is almost improbable that such an accident could have happened had this crusher been driven by a motor with an automatic circuit-breaker.

Until recently, it has been the practice to equip manufacturing plants with 220-volt direct current, chiefly on account of the great advance that has been made in that line of apparatus and especially where variable-speed motors were needed for certain machine tools where the requirements are such that the direct current motor is more advantageous.

The alternating current has many special advantages in the equipment of cement mills. The motors that are exposed to the cement dust are so simple in their construction that they do not need protection except dust guards for the bearings. The spare parts are so few as almost to be left out of consideration. The wiring and automatic protecting devices are enclosed in such a manner as to eliminate any sparking and consequent fire risk, and the motors are rugged and better suited to heavy overloads.

The alternating current permits the transmission of power at a higher voltage than is advisable with direct current, which will greatly reduce the cost of installation. It was estimated in one plant of several thousand horse-power capacity that the use of 600 volts instead of 480 volts showed a saving of over $8,000 on the installation alone.

For ruggedness, simplicity and continuity of operation, the turbine-driven generator has no equal. This point is well illustrated by the following quotation from a letter of one of your members operating a cement mill in the West: "The 800-k.w. turbine now in operation is giving splendid satisfaction and there is no question in my mind but that this type of power equipment is far and away the best for cement mill practice. We have had absolutely no difficulty of any kind or description in starting or operating this machine, and, from our experience so far, we are inclined to think that when once properly adjusted, the turbine will practically run without mechanical attention indefinitely." This letter refers to an alternating-current turbine-driven generator and was written entirely unsolicited. It was a comment on the turbine, while the letter was begging the manufacturer to improve their promise of shipment on a new turbine of larger capacity.

With the mechanical drive properly subdivided, dependence must be placed on one engine for one or more departments. Electricity gives two or three prime movers from which to draw power.

If one line shaft distributes the power in any one department, and it generally furnishes power to more than one department, any accident to that shaft might tie up the whole production of the mill. With electric distribution properly subdivided, it would practically be impossible to so cripple the plant.

A line shaft has to be installed not only of sufficient capacity for the total maximum load but with a big margin of safety, and this entire mechanical drive has to be run continuously whether one or all the cement machines are in operation. With the electric installation, the power is drawn only for the machines in operation and the efficiency of the plant is practically maintained.

Even if the kilns were driven by a separate engine and an independent shaft, any tie-up of either of these means of power distribution would shut down and seriously cripple the day's production. A delay of one hour on ten kilns would mean over $150 wiped out of the profits for the day, and it is seldom, if ever, the repairs can be made in one single hour with the facilities at hand. The electric drive in this department would save many hours of anxiety. Mechanical transmission cannot give you the flexibility or the output you can obtain from the electric drive.

Engineers ask how the electric can be as cheap or as economical as the mechanical drive. The dynamic power of the engine has to be converted to electric power with a generator and back again with a motor. That is perfectly true, but the commercial operation of a plant is a practical operation. With the mechanical drive, the plant is started and everything made to run smoothly, the load is thrown on and a lot of money and time spent to make tests on engines to ascertain the efficiency, which makes a fine showing. Take the same plant after a year's run and find what an enormous increase is demanded to accomplish the same result. It has been necessary to patch up here and there and to do it in the shortest possible time, for the plant must run, and instead of twenty or thirty per cent. loss in the mechanical transmission, this figure will be found enormously increased, although there is practically no means of knowing this except from the coal pile or more tests.

The electric transmission depreciates with far less rapidity than the mechanical, and any change or patchwork in the plant changes only a small percentage of the gross output of the power station. The instruments showing the power consumed are always visible and any increase in the demand for power is shown immediately; this fact alone would justify the electric drive where it is so important to operate continuously and to anticipate and to avert any trouble.

It is practically impossible for an electrical engineer to make satisfactory recommendations of electrical apparatus in a cement plant or any other kind of manufacturing plant without being perfectly familiar with the conditions under which the electric motor is to operate. This requires the hearty co-operation of the superintendent of the plant with the electrical engineer.

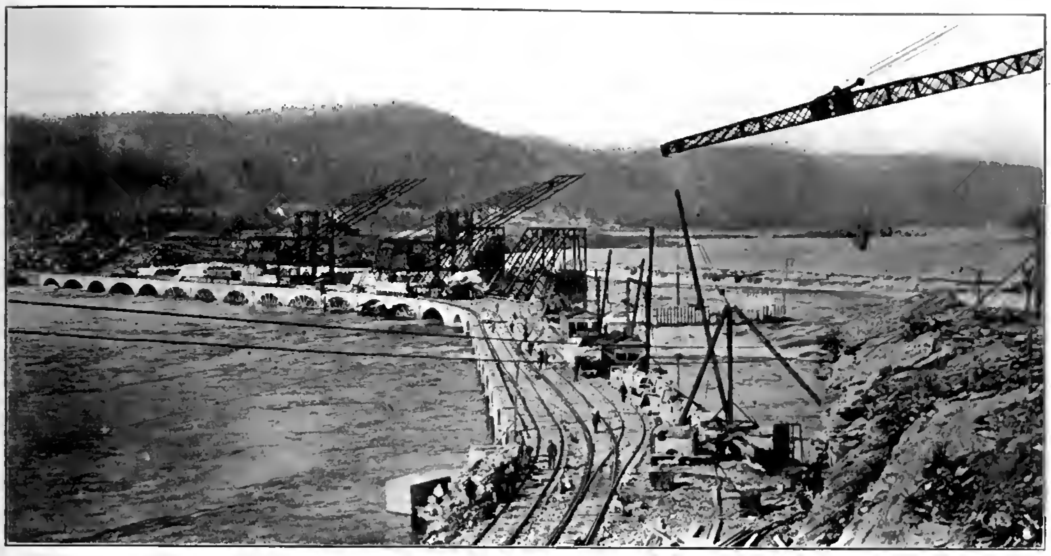
The keen competition of the present period demands the highest quality, together with the greatest output of material with the least possible cost. To be in a position to stand this competition, it is necessary for all manufacturers to use every means possible to bring their plants up to the highest points of economy and efficiency. It requires a man of strong character to seize the proper opportunity (which is generally dull times) to make these changes in his plant, in anticipation of the increased demand which will result from an inactive period.

A card index should be made of all generators and motors installed, and a record of any repairs or tests should be kept on these cards, the dates always being specified. The meters on the switchboard should be read at stated intervals during the day and night, and a regular record made and filed away for reference. These records will appeal to engineers, superintendents, managers and boards of directors; and such a file of records, if intelligently used, will put the cement industry on a scientific and economical basis heretofore unknown.

Boston Street Cleaning has been investigated for a citizens' committee of that city by Mr. R. T. Fox, whose work in Chicago was described in this journal on May 25, 1907. He found that the men he watched loafed a quarter of the time and cost of keeping horses was about twice that paid by business firms.

The Hydro-Electric Plant of the McCall Ferry Power Co.

There is now under construction at McCall Ferry, Pa., a hydro-electric plant having many unusual features in both design and methods of construction. It is on the Susquehanna River about 25 miles from Chesapeake Bay. The possibility of obtaining power from the lower Susquehanna has been realized for many years, but not until the McCall Ferry Power Co. began constructing its plant were any definite steps taken to profit by it. The originator of the project now being developed was Dr. Cary T. Hutchinson, who retained the late George S. Morrison,



Construction Bridge and General View of Site.

and in 1902 established gauging stations near the site of the plant now building to obtain definite information of the river conditions. Mr. Morison carried his work so far as to determine the site for the station, and the final studies and surveys resulted in the acceptance of this site.

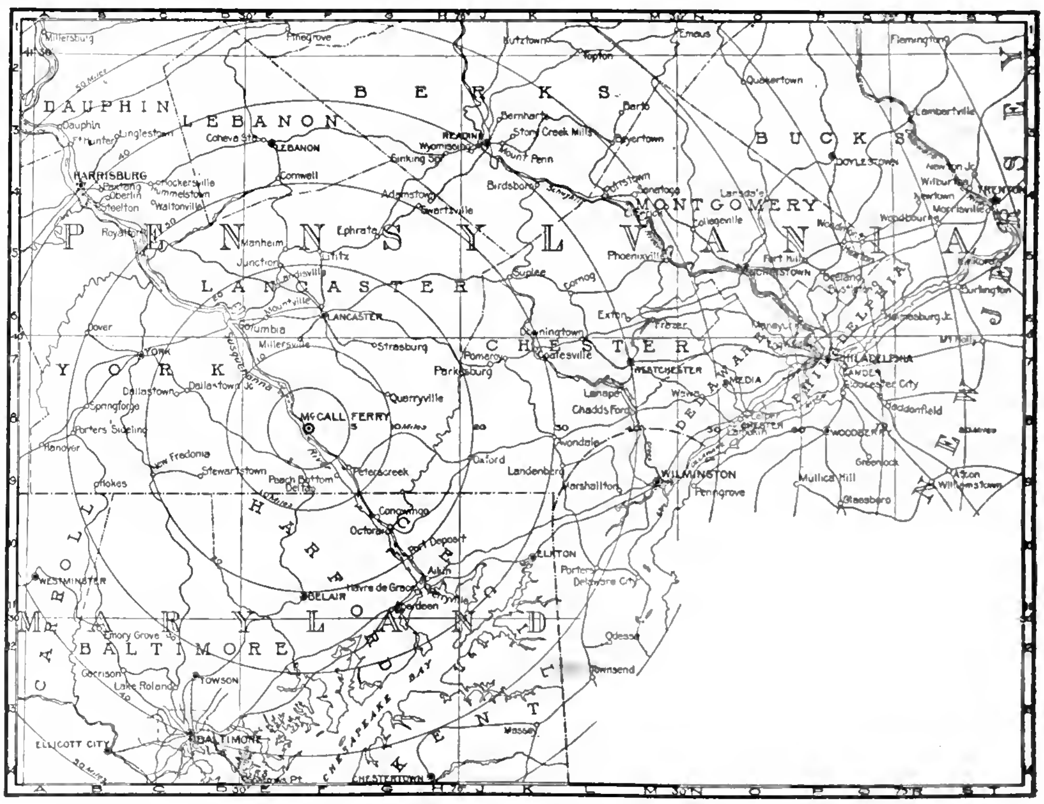
The situation of McCall Ferry is exceptionally advantageous for a large power plant, being in the center of a large well-developed manufacturing district and a short distance from tidewater. Within a radius of 60 miles are Philadelphia, Harrisburg and Chester, Pa., Wilmington and Dover, Del., and Baltimore, Md., and within 20 miles are many cities with populations ranging from a few thousand to 50,000, such as Lancaster, York and Columbia, Pa. The head of Chesapeake Bay, moreover, within 30 miles of the plant, offers in many small cities desirable factory locations accessible to large vessels. The present use of electric current for lighting, traction and manufacturing within a radius of 60 miles of McCall Ferry is great and the constantly increasing demand insures a large market. The McCall Ferry plant which is now making contracts to supply power in this territory has been designed for a nominal capacity of 100,000 h.p., half in an initial installation and the remainder developed by additonal units as needed. The total capacity for peak loads is 135,000 h.-p. on the turbine shaft.

Before the organization of the McCall Ferry Power Co. there were a number of plants projected at different points in the river both above and below McCall Ferry, which had secured water rights, and options on land. These developments were smaller than the station now being built, and the present company, having bought the rights of the smaller companies, was able to consolidate all the projects into two large ones. A possible site for another plant of 100,000 h.-p. exists at Conowingo, Md., 14 miles below McCall Ferry, and is controlled by the same company.

Hydraulic Conditions.—The Susquehanna River has a drainage area of 27,400 square miles, the larger part lying in Pennsylvania. Its watershed includes the steep slopes of the Allegheny Mountains, which cause sudden rises of rather frequent occurrence. The river occupies a deep valley, and for 125 miles above its mouth has an average slope of 3½ ft. per mile, the fall at McCall Ferry being 8 ft. per mile. The conditions on which the design of the plant is based have been studied at Harrisburg since 1890 and at McCall Ferry since 1902. The records thus obtained show that with the adopted head of about 55 ft. the flow of the river assisted by an adequate storage capacity can be depended upon for the continuous development of 100,000 h.-p. The storage will be secured by a lake 6 miles long and 4,000 ft. wide, formed by the dam. The discharge necessary to develop the normal rating of the plant on a 12-hour load is 10,000 cu. ft. per second, corresponding to an average run-off on the catchment area of 0.47 cu. ft. per second per square mile, the drainage area above McCall Ferry being 26,766 sq. miles. The discharge at peak load will be 27,000 cu. ft. per second. The flood flow considered in making the plans was about 671,000 cu. ft. per second; the record of the highest flood, that of June, 1889, corresponding to an average runoff on the drainage area of about 25 cu. ft. per second per square mile. The floods come with great rapidity, the flow in the river frequently jumping from 30,000 to 100,000 cu. ft. per second or over. The necessity of providing carefully for these conditions is further emphasized by the large amount of ice carried toward the end of the winter, much of it in large, thick cakes.

Dam.—The plant and dam are built at a point where the river is about 2,600 ft. wide, and divided into two channels by Fry Island. The east or Lancaster channel is about 900 ft. wide, and the west or York channel about 1,200 ft., and the island about 500 ft. The stream is only 400 ft. wide a short distance above the dam, but the depth and swiftness of the current forbade construction there. The present site offers a ready means of handling the flow during construction by reason of the two channels. Above and below McCall Ferry the river is dotted with small islands and crossed by ledges, on one of which the dam rests. The water a short distance above and below it is very deep. Another such ledge crosses the river at Cully's Falls, and a channel had to be cut through it for the tailrace. The rock, though hard, is considerably eroded and fissured.

On account of the floods, the dam has been constructed as a spillway throughout its entire length of 2,350 ft. The dam extends only 600 ft. across the Lancaster channel, the remainder of the channel being spanned by the power house. Its crest is 45 to 50 ft. above the average summer water level. The section has been calculated for a head of 17½ ft., above the crest corresponding to a flow of 304.7 cu. ft. per second per linear foot of the dam, a quantity equal to the maximum recorded flow of the river. The section was calculated on the assumption that the weight of the masonry was 135 lb. per cubic foot and the weight of the falling water over the dam, and the pressure of the water on the apron were neglected. The base of the dam is uniformly 65 ft. wide, below a point 51 ft. down from the crest of the dam. Where the dam crosses the island, the ledge rises to within 41 ft. of the crest, necessitating a change in the section, which was made



Map Showing Location of McCall Ferry.

by retaining for the lower part of the apron the same curve as was used elsewhere, the only difference in the two sections being in the length of this lower curve of the apron. The front face is vertical.

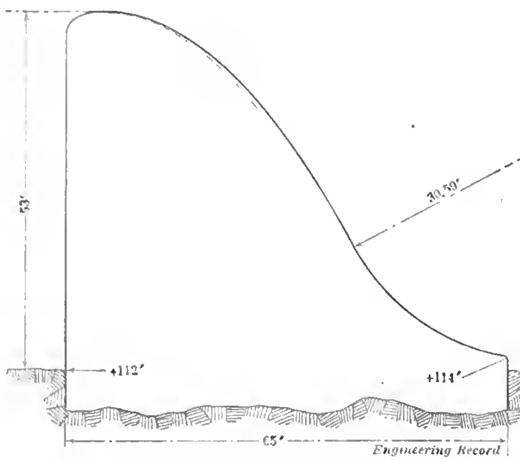
The dam is 1:3:5 Portland cement concrete with pudding stones up to 1 cu. yd. in size. Atlas and Giant cement are used. The sand is coarse and very clean, secured from a bank at Charlestown, Md. The stone is a very hard trap, weighing 193 lb. per cubic foot, used without screening, and contains pieces running up to 7 in. in length. The pudding stones are of the same rock, which is obtained at a quarry operated by the company at Conowingo, Md. These stones, forming 20 per cent. of the total yardage, are placed not closer together than 8 in. and 2 ft. back from the surface of the concrete. The amount of material in the dam is 174,000 cu. yd.

Power House.—The power house occupies the eastern part of the east or Lancaster channel, and stands at an angle of 42 deg. with the face of the main dam. In front of it is a forebay, where the racks and screens are located, and the entrances to the chutes for disposing of any ice which gets into the enclosure. The conduits leading to the turbines start immediately back of the inclined racks. They are built entirely of concrete, no steel being used either for reinforcing or for the intakes or draft tubes. The ten turbines are beneath the power house floor, five on each side of the two exciters in the center of the building. South of the power house is the transformer house, carried by arches spanning the draft tube outlets in the tail race.

The front wall of the forebay is carried on eleven arches, the crowns of which are 6 ft. below the crest of the dam, and 1 ft. below the low water level, so that they will always be submerged. Back of the arches and carried on inclined piers are the screens, and back of them are the gates closing the intakes to the turbines. The screens are built in panels 10 ft. wide and 11 ft. high, four tiers to a unit. They have frames of 10-in. channels, supporting the screen bars, which are 7/16x4½ in., with 2-in. spaces between them. Instead of using gas-pipe separators, as is generally done, the bars will be kept apart by plates ⅜ in. thick, which have notches cut in them of the thickness of the bars. The strips of metal between the notches are bent over the rods on which the bars are hung, thus holding the latter apart. The frames slide in cast iron seats bolted to the noses of the inclined piers. This arrangement allows the screens to be withdrawn for repair and cleaning by merely catching them with a line from the crane, and pulling them out. Within the forebay are two chutes for disposing of any ice that may get by the exterior ice protection. One of these chutes 6 ft. square is located between the two exciters at the center of the power house, and the other measuring 8x10 ft. at the east end of the forebay.

The gates closing the intake conduits are 16 ft. high and 6 ft. wide, and are raised and lowered by the large traveling crane in the screen and gate room. An auxiliary gate also lowered and raised by the crane is cut into the main gate, and can be opened so as to equalize the pressure in the forebay and the intake conduits.

The intake conduits for the main units start in three openings separated by piers each 6 ft. wide and 16 ft. high. Eight ft. back from the gates these three passages merge into one which is 15 ft. wide, and for a short distance 13 ft. high, expanding as the conduit forms the turbine chamber to a height of 33 ft. There are two draft tubes one leading from each wheel of the unit. These draft tubes join about 20 ft. from the unit, but are here divided by a vertical wall, the discharge outlet into the tailrace of each unit being composed of two passages, each 13 ft. wide and 15 ft. high. This arrangement of the draft tubes, since they are constructed of solid concrete necessitated very complicated form work, especially since it was necessary to have easily curving surfaces which would offer little or no resistance to the flow of water. The exciters are located in the center of the power house with five main units on each side of them. The intake conduits and draft tubes for them are 6 ft. square in section.



Section of Dam.

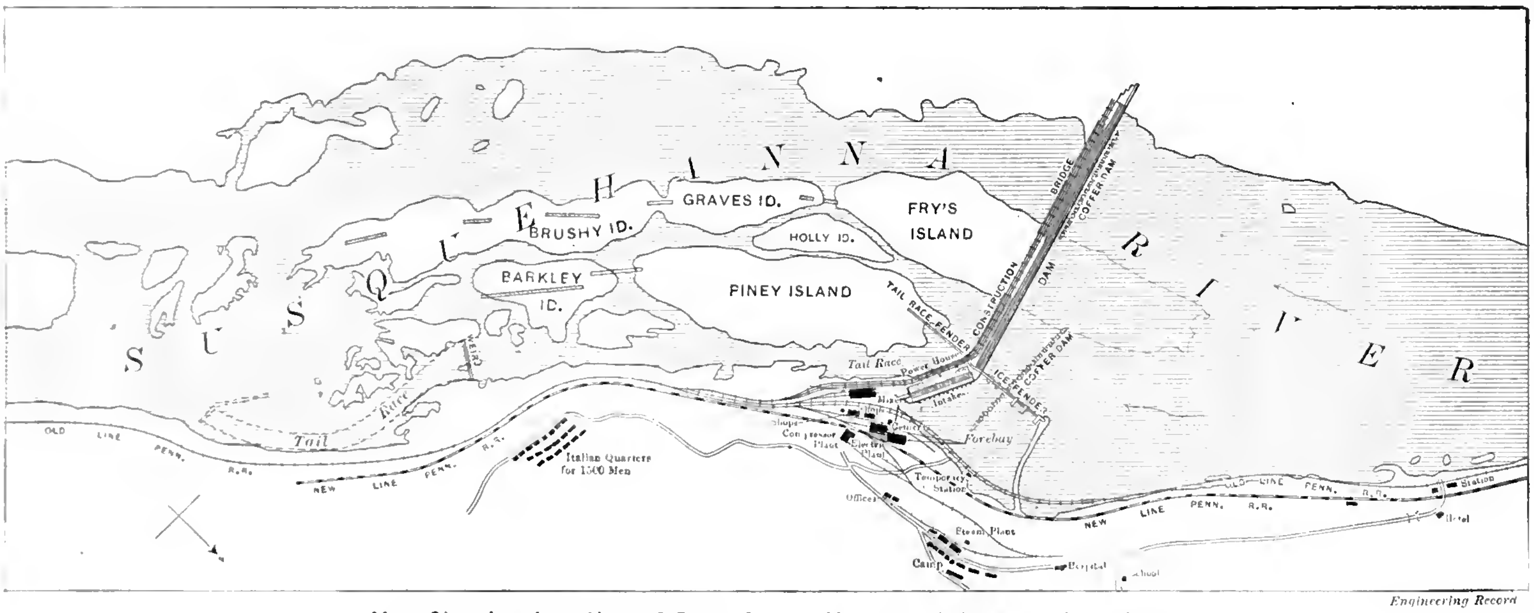
Each turbine is set in the concrete chamber without the usual steel or iron casing. Each chamber can be closed independently of all the others, and after being closed by the gates in front of the intake conduits and the stop logs at the ends of the draft tubes can be drained through outlets leading to pumps installed for that purpose.

Below the power house floor runs a chamber parallel to the length of the power house in which will be installed the pumps for draining the wheel chambers and the turbine-driven oil pumps for supplying the thrust bearings with oil.

The turbines are of the vertical shaft, inward and downward flow, Francis type, made by the I. P. Morris Co., Philadelphia. There are 10 main units each capable of developing 13,500 h.-p. under a head of 53 ft. with the gates open 80 per cent. at 94 r.p.m. Each turbine when run at its rated load will take about 2,700 cu. ft. of water per second. Each turbine has two separate wheels mounted on the same shaft, the latter being of forged steel, 20 in. in diameter. The upper wheel discharges through a steel casing leading to the draft tube while the lower wheel is set immediately over the draft tube pit, and discharges into it without the medium of a casing. The wheels are about 10 ft. in diameter.

The weight of all the moving parts of both generator and turbine is carried on a thrust bearing which is supplied with oil from pumps driven by small turbines. Separating the oil pumps in this manner from the main units allows the oil in the thrust bearing to be put under pressure before the unit is started. The thrust bearing which carries a total weight of 335,000 lbs., is supported by a lens-shaped casting set into the concrete. The exciters, also made by the I. P. Morris Co., have a capacity of 1,000 h.-p. and are of the same general type as the main units.

Ice Protection.—The large amount of ice which has to be disposed of and its long continuance each winter has necessitated special precautions for protecting the plant and turbines. It is aimed to keep the entire enclosed forebay free from ice and to accomplish this an outer forebay is provided and separated from the main river by a series of submerged arches and timber cribs, which form racks holding in place floating booms. This ice protection is 630 ft. long, and stretches from the point where the main dam and the power house join to a ramp 300 ft. long built out from the shore. The concrete ice protection consists of 3 submerged arches each having a span of 68 ft. with 8-ft. piers between them. The crowns of the arches are 2 ft. below the estimated low water elevation so that the arches are always submerged, the ice and floating debris being thus stopped and floated toward the dam, where a special runway for this purpose has been constructed between the main dam and the power house. The top of this concrete structure rises to a height of 22 ft. above the crest of the dam and 4½ ft. above



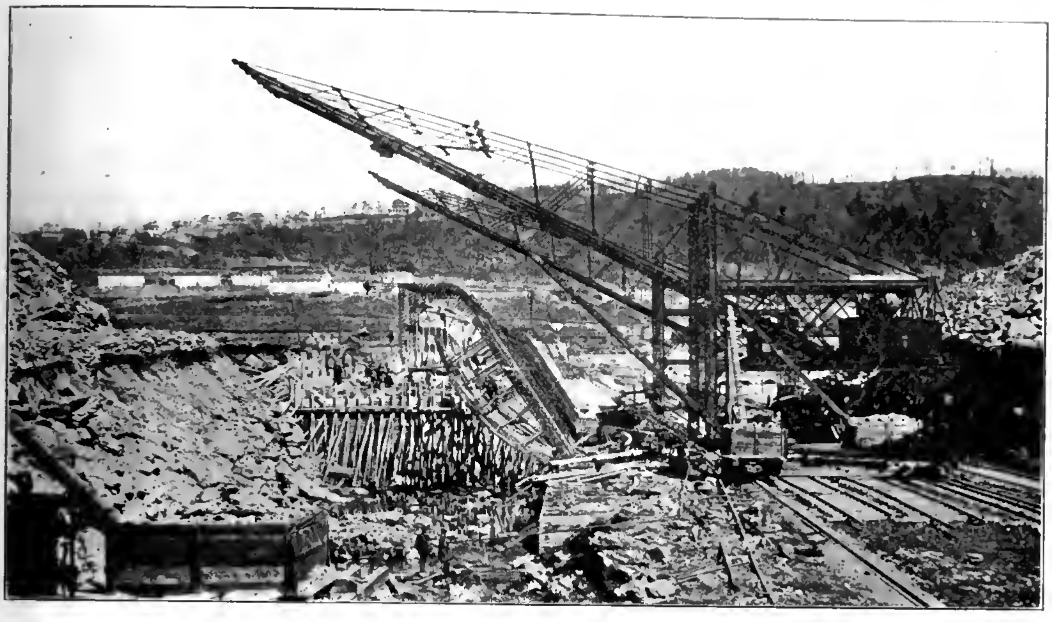
Map Showing Location of Dam, Power House and Construction Plant.

the high water elevation. The top is 6 ft. wide and the back face has a batter of 4 in. to the foot, the piers at rock foundation being 30 ft. long. The space between the concrete structure and the ramp is occupied by four timber rock-filled cribs, spaced 104 ft. apart and supporting floating booms. These cribs are 24 ft. wide and 16 ft. long on top, the length increasing with the depth, being 64 ft. at the foundation. The floating stop logs between the cribs are made of three layers of six 10x12-in. timbers each. They are bolted together with spaces between them so as to make the boom 7 ft. 8 in. wide and 3 ft. thick. The boom slides in recesses in the timber cribs, rising and falling with the stage of the water above the dam. The direction of the ice protection is parallel to the flow of the river so that the flow will assist in carrying the ice and debris toward the main dam and over the runway.

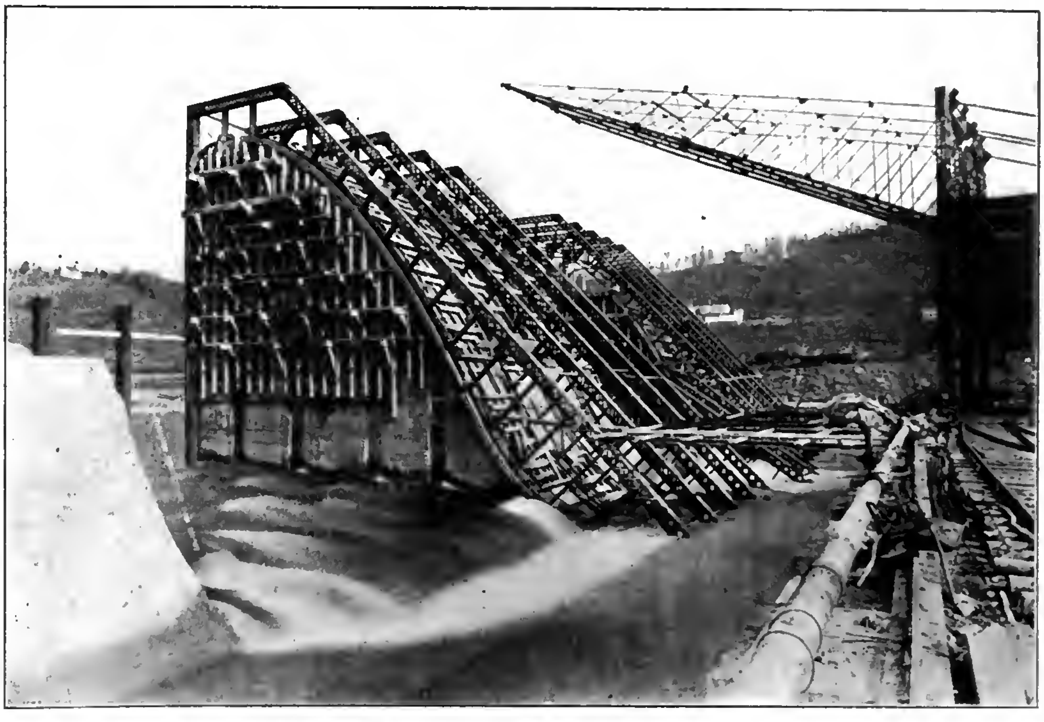
In addition to this ice protection, a spillway has been provided between the power house and the shore for disposing of any ice which forms in the forebay or finds its way into it. This spillway 40 ft. wide has the same elevation as the crest of the main dam. Separating it from the power house and protecting the latter from the ice passing to the spillway is a wall 8 ft. thick reaching above the high water elevation. This spillway cuts off the power house from the shore and access between them is had by a bridge 5 ft. wide, and by a tunnel 14 ft. wide and 16 ft. high running through it. The tunnel is laid with a standard gauge track which extends 55 ft. inside the power house, allowing the machinery to be handled directly from the cars by the power house cranes.

Tailrace.—The tailrace, 3,000-ft. long, is nothing more than the former bed of the Lancaster channel, lying between the east bank of the river and the chain of islands south of Fry Island. This channel presents a very curious formation. The bed is of solid gneiss, with benches on either side submerged at the original condition of the river from 7 to 10 ft., and having between them a channel about 100 ft. wide and from 80 to 90 ft. deep, with vertical walls. This unusual depth continues until near the point where the tailrace flows into the main channel of the river. A ledge of rock is here encountered through which a channel 1,000 ft. long and varying in width from 150 to 300 ft. is being blasted. In order to prevent the river from flooding the tailrace by flowing through the openings between the islands which separate the two channels, rock filled timber cribs are being thrown across these openings, and carried above the highest level which the water in the channel can reach. At the point where the rock ledge obstructs the channel near the end of the tailrace a concrete weir will be built, with its crest at the same elevation as the top of the draft tube outlets, so as to preserve a water seal for the turbines.

In order to prevent a large volume of the water which comes over the dam from finding its way at once into the tailrace, and thus raising the level of the latter, a deflecting dam 576 ft. long starts at the junction of the main dam and the power house, just opposite the beginning on the upstream side of the ice protection, and runs over to Piney Island, which lies south of Fry Island. This dam will be built of solid concrete, using pudding stones and the proportions which were adopted for the main dam. Its crest will be at the same level as the power house floor, 14 ft. below the crest of the main spillway. With this dam, and the crib work between the islands below the plant, the water coming over the main dam, is confined entirely to the western or York channel, allowing the Lancaster channel to be used for the tailrace. The low water level in the latter will be about 15 ft. below the water level in the spillway channel immediately below the dam.



Excavation for Dam on Fry's Island.



Pier Sections of Spillway Dam Showing Steel Forms.

Construction.—The preliminary work such as the erection of the camp and cutting the timber on the side hills was begun in Nov., 1905, and in the following January with a full force. Work on the dam was started on Oct. 25, 1906. It is expected that the plant will be in operation in June, 1908.

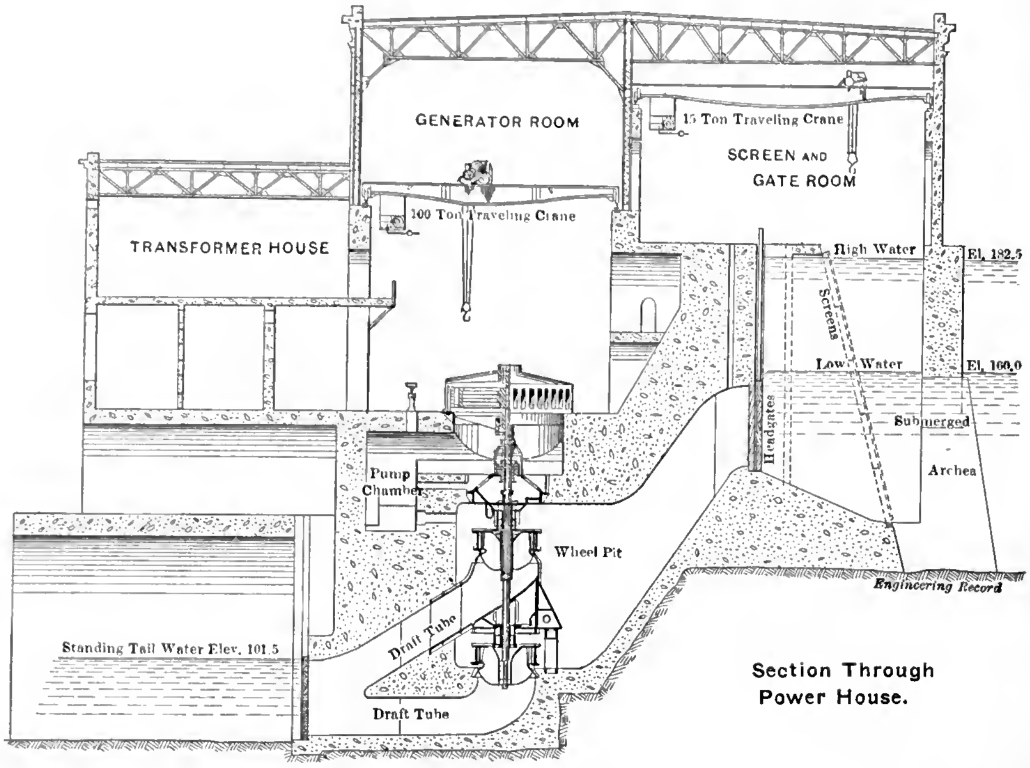
Construction was first started across the Lancaster channel, which carried the greater volume of water and in which the power house is located. On account of the rapid rise of the river, and the large discharge during high water, the problem of constructing the dam was a serious one. To have provided against the maximum flood during construction would have involved great expense, while any less provision meant the occasional stoppage of the work, and the probable loss or damage of the construction equipment and the partially completed work. After a thorough study of all the conditions it was decided to construct a cofferdam sufficiently high to prevent being overtopped by a flood less than 60,000 cu. ft. per second. Since the inception of the work, daily reports regarding the weather conditions on the watershed have been received from the weather bureau at Harrisburg, and when a flood above 60,000 sec. ft. is on the way preparations are made to meet it. Such a case occurred on Mar. 15, 1907, when a flood of 320,000 cu. ft. per second swept over the work. Warning had been received and everything movable in the path of the water was moved to a place of safety, and work carried on without interruption until within an hour of the arrival of the flood, when the remaining equipment was run to cover. The flood did no damage to the partially completed dam and power house, but carried off four standard gauge tracks laid with 60-lb. rail which were on the construction bridge below the dam.

Cofferdam.—The first step in the actual work of harnessing the river consisted in building the cofferdam, a rock filled timber structure 1,000 ft. long and about 300 ft. up the river from the site of the dam. Soundings had been made across the channel at the places where the cribs were to rest, and where these did not give a satisfactory description of the bottom, divers were sent down to get more accurate information. The bottoms of the cribs were then framed on shore to fit the rock foundation on which they were to rest, and after having a few courses of timber built upon them were launched, towed into position, and held there by cables anchored on shore. They were then built up in the usual manner, the tim-

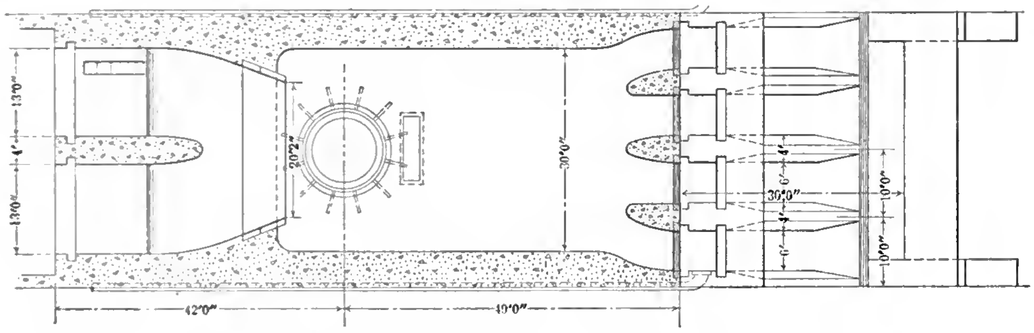
bers, which were 8x10 in., being drift bolted together with 7/8-in. drift-bolts, 30 in. long. The materials were conveyed to the cribs by means of a Lidgerwood cableway with a span of 1,200 ft. over the site of the cofferdam. In addition to this means of conveyance, a standard-gauge track was carried out and extended over each separate crib as soon as completed, and on it was run a traveling stiff-leg derrick. Rock was placed in the cribs to sink them as the timber work was carried up. The cribs were 16 ft. wide and varied in length, in multiples of 8 ft. from 24 to 40 ft., being built in bays 8 ft. square. The deepest crib was about 30 ft. below the original low water level.

The openings between the cribs were closed with stop logs, and in front of them were placed two rows of 2-in. timber sheeting, breaking joints. The careful placing of this sheeting is largely responsible for the remarkable tightness of the cofferdam. The separate planks were driven to the bottom, rammed slightly, and on being drawn up showed by the bruising of the ends how they were to be cut to fit the rock bottom. After being shaped they were again put in place and rammed, and withdrawn a second time to determine whether further fitting was necessary. Against the sheeting was thrown the strippings from the excavations for the dam and power house, a mixture of sand and loam, and on top of this a quantity of rip-rap.

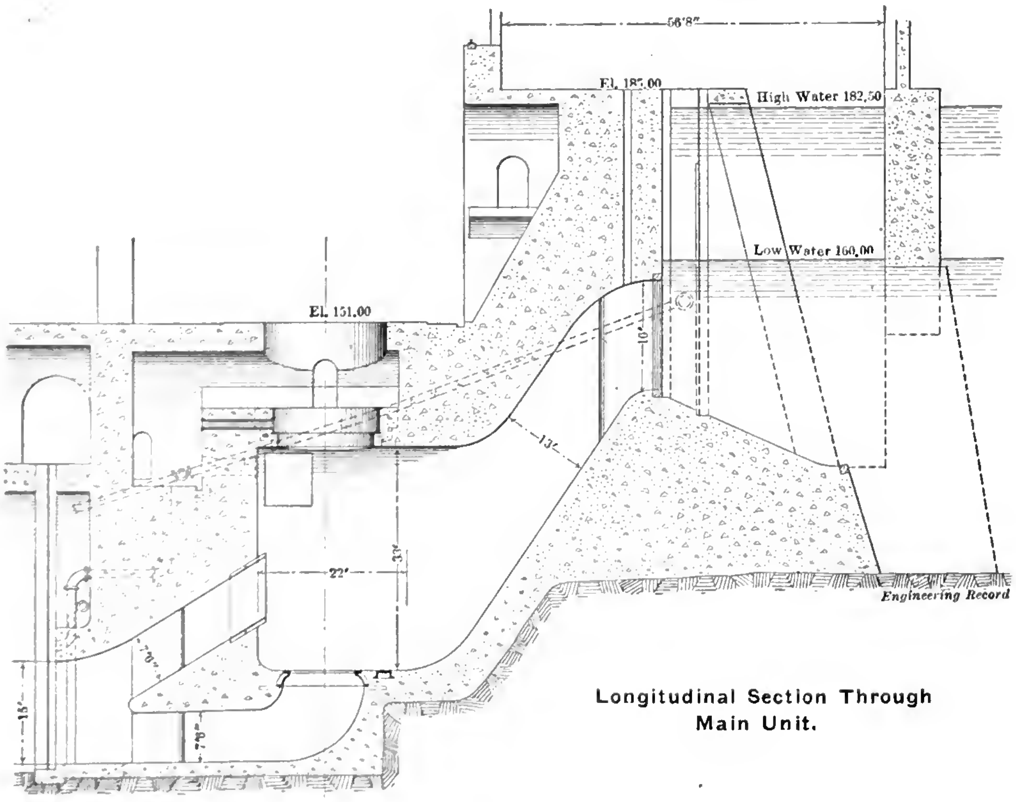
As soon as the cofferdam was sealed the dam site drained of itself. In order to determine the tightness of the work, the leakage was measured over a weir. The results were remarkable, for though there was a head of 22 ft. on the cofferdam for the greater part of its length of 1,000 ft., and the rock foundation was fissured and eroded, the leakage was only 1 gal. per second, at the present time after being overtopped by numerous floods the leakage is carried away by a 6-in. pipe.



Section Through Power House.



CROSS SECTION THROUGH C.L. OF CONDUITS



Longitudinal Section Through Main Unit.

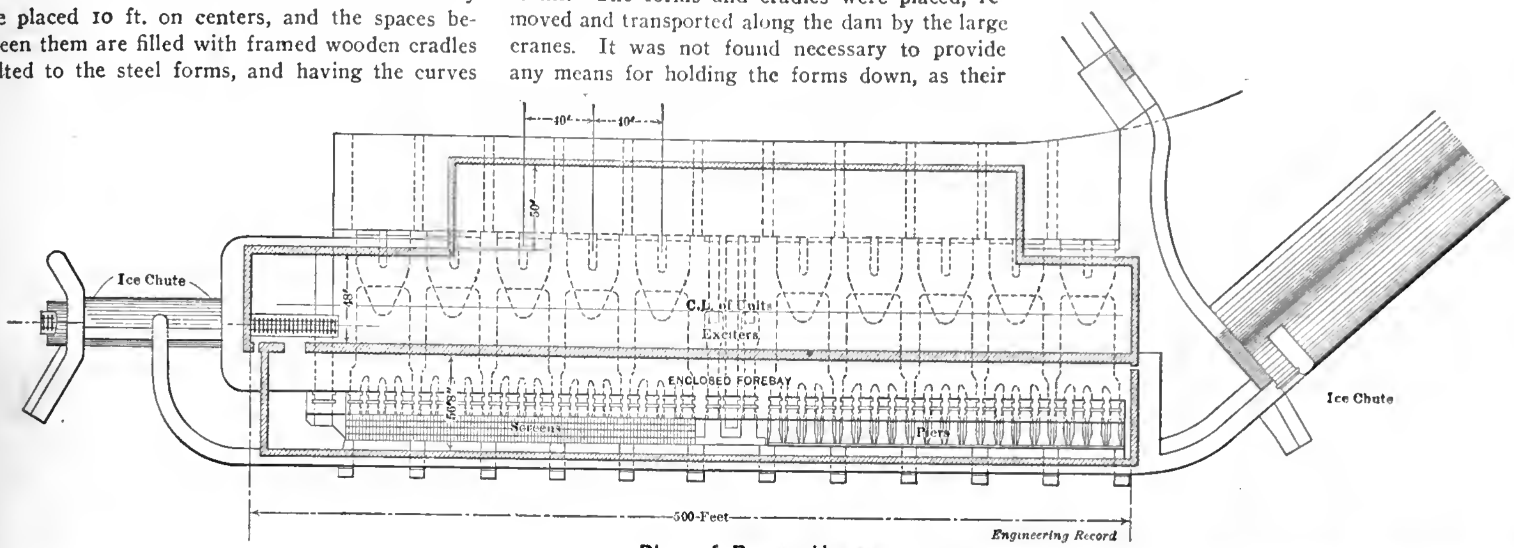
Foundation.—It was found that the rock bottom for the foundation of the power house was of the same hard gneiss which had been examined, before the work commenced, on the banks of the river and the islands near the proposed site. Near the western end of the power house, howver, the rock became more dense, contained less mica, and finally merged into a very hard and dense trap, quite similar to that quarried at Conowingo, and used in the concrete and for pudding stones. Examination showed it to be a dike which ran to Fry Island and then disappeared. Both the trap and gneiss were excellent foundations for the heavy structures and test holes drilled the whole length of the work showed the same high quality of rock for a depth of 40 ft. below the river bed. The surface rock which was considerably eroded and fissured was removed, and at the shore end of the power house about 50,000 cu. yd. of the solid rock had to be taken out. The surface of the rock was then thoroughly cleaned, and a layer of cement grout spread over it preliminary to placing the concrete. The amount placed at any one time was governed by the strength of the forms, very close supervision being given so as to guard against bulging. The bond between successive sections is secured by inbedding pudding stones in the surface of the work which is to be left to set. When the next course is added, the surface is first thoroughly swept with wire brushes, and then washed. Cement grout is spread over the surface, and the concrete work continued.

Forms.—The forms for the turbine intakes, and chambers, and draft tubes are quite complicated as everything is built of plain concrete. The forms are carefully designed and built by experienced form builders. Those that can be transported are put together on a framing platform adjoining the carpenter shop, and are carried to the work on flat cars, and set in place by means of cranes. In order to fashion the complicated curves on many of the forms, sheet iron and bass wood are used, the latter being bent into shape after being steamed. The forms are very heavily braced and tied across when possible by iron rods, as any bulging or displacement would result in altering the carefully designed water passages, and cause a loss of head by obstructing or changing the course of the flowing water.

The forms used on the dam are deserving of special attention and represent one of many instances on this work of the skillful design of construction equipment. Unlike the general run of large contracting plants which contain many makeshifts built primarily for some other class of work, much of the equipment here is of orig-

inal design, and well adapted for the work. The entire method of construction and the means for carrying it on show a well considered plan which was fully determined before the work was started. The length of the pier sections of the dam correspond with the most efficient working capacity of the bridge cranes, and the spacing of the structural steel forms, has likewise been fitted to these cranes so as to profit by their full capacity.

The forms for the dam consist of structural steel bracing completely spanning the section of the dam, and resting on two shoes, one on the upstream and one on the downstream side. They are placed 10 ft. on centers, and the spaces between them are filled with framed wooden cradles bolted to the steel forms, and having the curves the forms above the crest of the dam. At the shore of Fry Island, where the section was changed, the steel forms could not be used because of the warped surface connecting the sections. Wooden-braced forms were therefore put in place and the value of the steel forms was demonstrated by the difficulty experienced at this point. The steel forms were used on the island section by merely unbolting the rafter at the center and allowing the two parts to overlap and pass each other, the lower part of the apron having the same curve on both sections, thus obviating the necessity of having two distinct sets of forms. The forms and cradles were placed, removed and transported along the dam by the large cranes. It was not found necessary to provide any means for holding the forms down, as their house and dam is decidedly novel, and has proven economical and satisfactory. Before work was started on either structure a plain concrete bridge 1,060 ft. long and 50 ft. wide, containing 16,000 cu. yd., was built across the Lancaster channel to Fry Island, parallel to and 16 ft. from the downstream edges of the dam and power house. The York Channel now being closed by the coffer dam, the bridge is being extended across it, making the total length about 2,300 ft. The arches of the bridge immediately in back of the openings between the pier section of the dam have the same span as that opening, 40 ft., so as to dis-



Plan of Power House.

River Side of Concrete Mixing Plant.

Draft Tubes Looking from Tailrace.

of the surface of the dam. The steel forms consist of a post with a total height of 57 ft. supporting a rafter which runs over the apron, and rests on a shoe at a horizontal distance of 68 ft. 2⅞ in. from the shoe under the post. Beneath the inclined rafter is carried a 12-in. 20½-lb. channel having the exact curve of the apron. On the bottom of the chanel is a 2-in. timber, bolted to it, and having a width of 1 ft. 9½ in. Bolted to this strip are uprights 3 in. wide and 6 in. high on each side, having bolt holes through them by which the cradles are fastened between the steel frames. The cradles are each 8 ft. 2⅜ in. long and 4 ft. 2¾ in. wide, and each one is numbered according to an erecting diagram, for its proper place on the dam. On the channel sections the dam is being built in 40-ft. piers, with 40-ft. openings between them. For these piers five of the steel forms were used and braced together by diagonals, and by a large box beam connecting weight alone was sufficient, but wires were passed through the dam, tying the vertical post and the rafter together to prevent the latter from bulging. An additional advantage of the steel forms lies in the saving in instrument work, it being necessary to set only the shoes with transit and level.

The cofferdam in the York channel is now completed and sealed, the flow being diverted through the openings between the pier sections of the dam across the Lancaster channel. The remainder of the dam will be built behind the new cofferdam and carried up in the manner followed with the Lancaster section, leaving 40-ft. openings. These openings will then be closed alternately in the two channels by stop logs and the concrete carried up behind them, the flow being diverted alternately to the two channels.

Construction Bridge.—The method of carrying the materials to their places in the power charge readily all the water coming through the openings. Back of the piers, however, and alternating with the 40-ft. arches are 32-ft. arches, the discharge through them not having as high a velocity as that coming unchecked through the larger openings. The arches back of the power house have spans of 35 ft., this being the width of the draft-tube discharge passages into the tail race. This end of the bridge is to be part of the permanent construction and will serve as the foundation for the transformer house. The disposition of the remainder of the bridge has not yet been determined.

Cranes.—On the bridge are laid four standard gauge tracks, and spanning them with a gauge of 44 ft. are three large traveling cranes. The clearance under the latter is 16 ft. 3 in., so that cars and engines can pass beneath them. Each crane has four outriggers with a horizontal reach of 94 ft. and a capacity of 5,000 lb. at the end of

each outrigger. The carriages are operated independently of each other, and each crane is consequently the equal of four separate cranes, each with a capacity of 5,000 lb. The outriggers extend out beyond the upstream face of the dam and can deliver buckets, pudding stones, forms and necessary materials to any part of the work. The carriages run down over the tracks beneath the cranes and take the materials direct from the cars. The outriggers are spaced 10 ft. on centers to agree with the spacing of the steel forms and thus are enabled to deposit four buckets of concrete or place four pudding stones at a time. They are moved along the bridge by the dinky locomotives. The hoisting engines for the carriages are operated by compressed air, supplied from the main compressor plant.

The cranes on the bridge are used in placing materials in the power house as well as in the dam, but for building the former two additional cranes of special design are used. They consist of a tower 125 ft. high running on a track with a gauge of 45 ft. and carrying outriggers hinged 90 ft. above the top of rail. Each tower has two outriggers 135 ft. long with a capacity of 5,000 lb. each at the end, and since these can be carried horizontal as well as at an angle with the horizontal, the maximum reach is equal to the length of the outrigger. These cranes are placed on the upstream side of the power house, and the outriggers extending across to the tracks on the construction bridge, handle materials from the downstream side of the structure. As in the case of the cranes on the bridge they were designed especially for the construction of this plant.

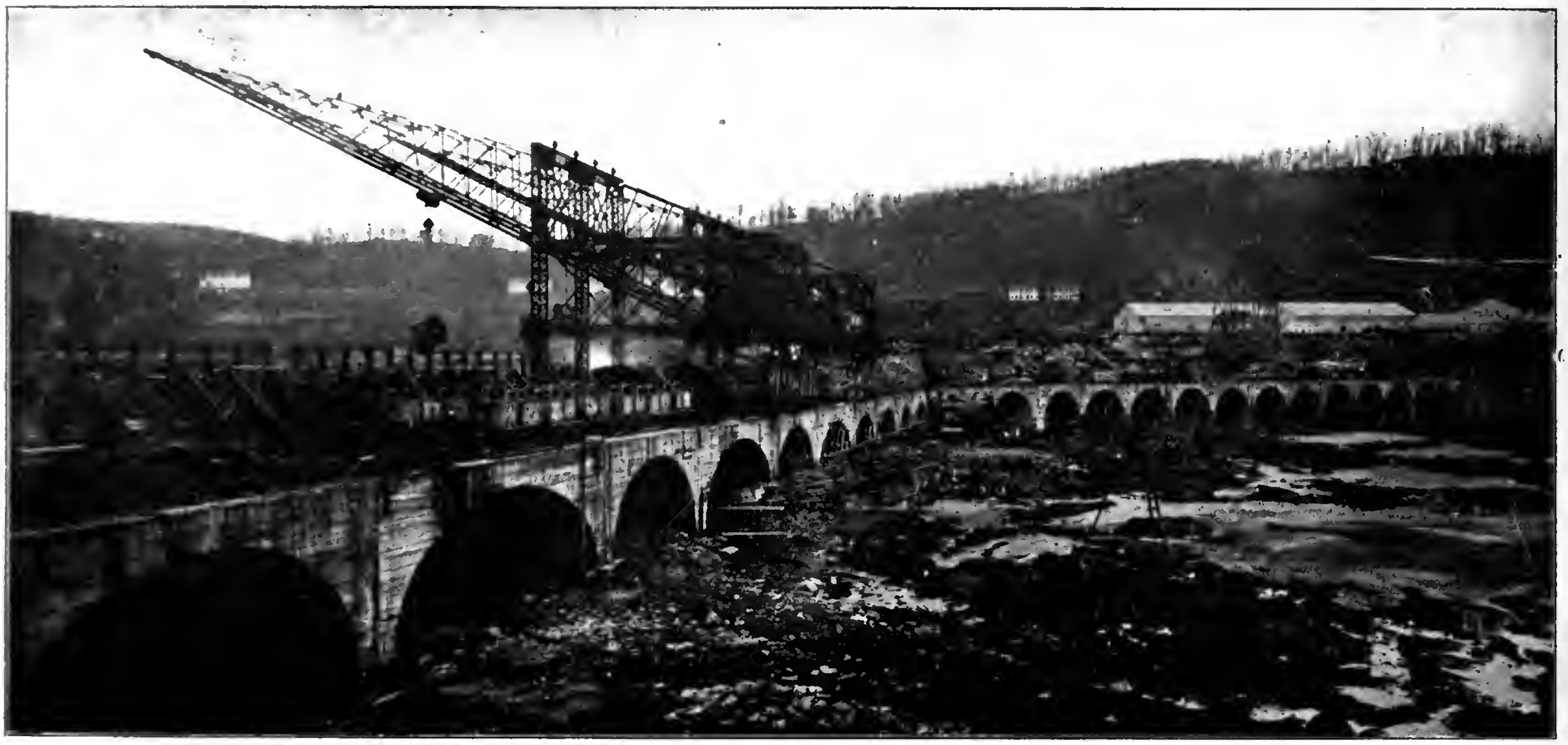
Concrete Mixing Plant.—The concrete mixing plant is placed on the Lancaster shore, near the beginning of the construction bridge. It is 200 ft. long and 90 ft. wide, divided longitudinally into four rows of bins, over each of which runs a standard gauge track. These bins which are 16 ft. deep are divided into smaller compartments by partitions 12 ft. apart. Three of the bins are used for storing stone, and the fourth for sand, while the cement is kept in a bay 25 ft. 8 in. wide running the entire length of the building, and served by a special track outside the plant. The passage of the various ingredients through the building is entirely by gravity. Beneath the bins and across the width of the plant directly under the discharge gates run tracks of 3-ft. gauge, on which the charging cars are operated. These cars are of the bottom-dump type, and run to hoppers which discharge into the mixers. The latter, of which there are eight, are placed 25 ft. on centers, and dump into 1-yd. buckets carried on flat cars on standard gauge tracks which lead to the construction bridge.

The materials are brought into the mixer plant in standard bottom-dump gondolas with a capacity of 100,000 lb. each, and unloaded into the bins. Charging cars having a capacity of 1 cu. yd. each are run successively under the discharge gates of the cement, sand and stone bins, and then carry the aggregate to chutes leading to the mixers. The discharge openings of the bins are closed with sheet steel sliding gates operated by compressed air. A rod connected with the piston of an air cylinder runs beneath each transverse row of bins and slides through U-bolts fastened to the under side of the sliding gates. When it is desired to secure a charge from a bin a pin is slipped through a hole in the rod immediately in front of the U-bolt of the door to be operated. Compressed air is admitted to the proper end of the cylinder and the door is opened. Closing is effected by slipping the pin in a hole in the rod on the opposite side of the U-bolt, and admitting the air to the opposite end of the cylinder. There are two narrow gauge tracks to each mixer, parallel to each other and served by a distinct transverse row of bins, so that while the car on one track is discharging into the mixer, the car on the other track is being charged with the ingredients for the next batch. The charging cars have been divided into two unequal compartments, one of which holds the proper amount of sand and cement for a batch and the other the proper amount of stone. Steam-driven Smith mixers with a capacity of 1 cu. yd. each are used.

The plant has a capacity of 2,400 cu. yd. in 10 hours. The storage capacity is about 5,700 cu. yd. of stone, 1,100 cu. yd. of sand, and, together with an auxiliary storage house, 70,000 bbl. of cement.

The track in front of the mixers runs directly to the construction bridge, and has a switch to an outer track at the end of the plant away from the bridge so that an engine bringing in a string of empty buckets, does not have to set them out on a siding in order to pull out the train of loaded cars. Should it be pushing the empties, it runs on the outside track beyond the mixng plant, then takes the switch to the track in front of the mixers, and pushes out the loaded cars. In pulling empties from the bridge, the dinky pushes out the loaded cars, and drops the empties in passing the mixers.

Auxiliary Plant.—The auxiliary plant connected with the work embraces a power house, machine shop and carpenter shop. The power house contains two Sullivan compressor outfits, with a capacity of 600 h.-p. supplying 3,800 cu. ft. of air per minute at a pressure of 100 lb. per square inch. The plant and camp are lighted by electricity, the current being furnished by a G. E. alternator. Steam for the engines and for heating the camp is supplied by four 150-h.-p. Atlas boilers. The machine shop contains 5 forges, a steam hammer, two engine lathes, two drill presses, two punches, a shaper and some smaller machines. The carpenter shop contains a swinging crosscut, a circular and a band saw. The augers used both in the shop and in the field are driven by compressed air. A number of small saw mills were used in cutting up the timber which originally covered the hills on both sides of the river, the timber for the cofferdams being all secured from this source.



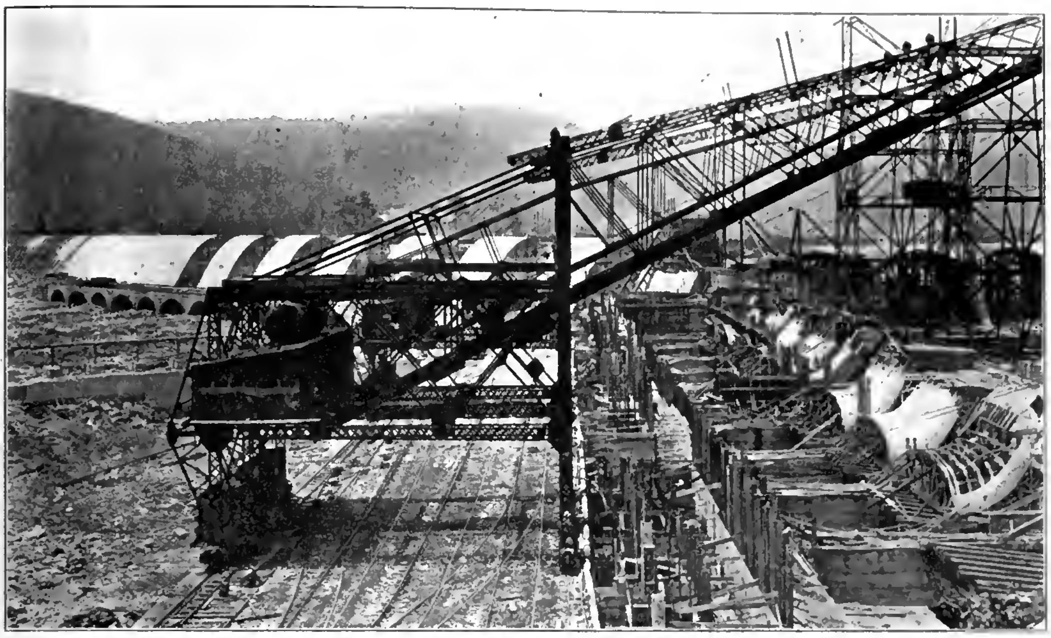
Looking toward Lancaster Shore Showing Dry River Bed, Construction Bridge and Plant.

Five standard flat cars are used on the work, 55 concrete cars carrying two 1-yd. buckets each, 16 mixer charging cars, twenty-five 6-yd. dump cars, 4 dinky standard-gauge locomotives, one 45-ton Baldwin yard engine, 4 narrow-gauge dinkies with a supply of 4-yd. narrow-gauge dump cars, 25 Ingersoll compressed air drills, 12 traveling derricks and one 12-in. and two 20-in. Morris centrifugal pumps. The concrete cars were all built on the work, the dump cars by the Western Dump Car Co., and the traveling derricks by the American Hoist & Derrick Co.

The amount of freight coming to the plant, about 50 cars per day, consisting of supplies, equipment, and construction materials has resulted in the running of a special freight train every day by the Pennsylvania R. R. to handle the business. The tracks in the power company's yard are well maintained with the result that there has never been a derailment.

Quarry.—The quarry at Conowingo, Md., is equipped with four 7-ton Lidgerwood cableways, each with a span of 550 ft. across Conowingo Creek. Rock is being taken from both sides of the stream for a stretch of 1,000 ft., the cable-

ways being mounted on tracks so that they can be moved to cover all parts of the work. The rock is hoisted by the cableways in skips and put into dump cars for transportation to the crushing plant, or into 50-ton gondolas for delivery to McCall Ferry. Six 10-ton traveling derricks are used in handling the material immediately alongside the railroad tracks. Thirteen Ingersoll-Rand, 15 Little Jap, and 4 Little Wonder drills, the latter made by the Hardsocg Wonder Drill Co., are being used. There are in use 3 dinky locomotives, one 45-ton Baldwin yard engine, twelve 12-yd. dump cars, six 7-yd. dump cars, and two No. 8 Austin gyratory crushers.



Dam, Power House and Large Crane, McCall Ferry Plant.

Miscellaneous.—The backing-up of the water by the dam will flood the present right of way of the Pennsylvania R. R., and the power company is therefore building a new line for the railroad, 13 miles long, at an elevation from 20 to 30 ft. higher than the present grade. This work is being done under contract by H. S. Kerbaugh, Inc.

When the work was started there were no accommodations at McCall Ferry or in the neighborhood for the large force required in building the plant. The company, therefore, built a camp and installed a steam heating system, electric lights, running water in all buildings, and sewerage and fire protection systems. About 1,500 men are employed, 400 of them being at the quarry at Conowingo.

The total yardage of concrete including pudding stones, in the power house, dam and construction bridge will be 330,000, about half of which has now been placed. The total rock excavation amounts to 200,000 cu. yd. The cost of the entire plant including property and the new line for the Pennsylvania R. R. will be $10,000,000.

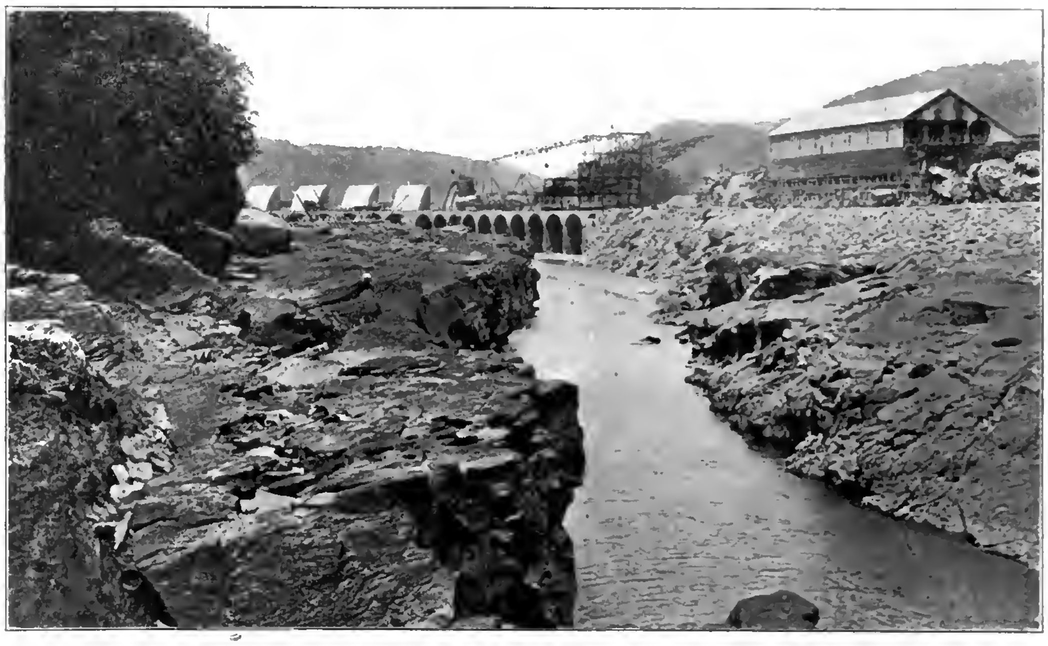
The work is being done by day labor. The New Jersey Bridge Co. built the bridge cranes and the steel forms for the dam, and the Baltimore Bridge Co. the tower cranes.

Dr. Cary T. Hutchinson is chief engineer of the McCall Ferry Power Co., and Mr. Wm. Barclay Parsons is consulting engineer. Mr. Hugh L. Cooper is the hydraulic engineer and designed and is constructing the hydraulic plant on an administration basis and no work is being contracted. Mr. B. R. Value is the engineer in charge of construction.

RAILROAD TIES for use on the lines of the Italian state railways will in future be preserved by the Rueping process. The government recently entered into a contract with the owners of this preservative process whereby all of the ties are to be treated.

Cost-Keeping as an Aid in Managing Men

Engineers are better qualified to act as managers of large enterprises to-day than they were formerly, owing to the development of cost-keeping and cost analysis, according to a paper on cost-keeping as an aid in managing men, recently published in the "Proceedings" of the Pacific Northwest Society of Engineers. The author, Mr. Halbert P. Gillette, chief engineer of the Washington Railroad Commission, first points out that before the development of methods of cost-analysis, the successful manager of men was usually one who relied mainly on his knowledge of human nature and his ability to hold men to his tasks. They were drivers, and only men willing to play such a role were successful as a rule. Of late years, however, engineers have been rising to the head of one undertaking after another, who have generally achieved their success through ability to get at the cost of each kind of work and study methods of reducing the expense of each item.



Natural Tailrace Channel and Mixer Plant, McCall Ferry Plant.

To most people, a cost-keeping system means nothing but a sort of bookkeeping, and they are unable to understand how a bookkeeper can develop into a successful manager. But the truth is that modern cost-keeping involves cost analysis, and cost analysis involves a study and comparison of the relative economy of men and of machines, and a study of relative economy leads to improvements, both in machines and the methods of using them. Cost-keeping has for its main object the determination of the efficiency of men. A proper system of cost-keeping tells daily what each workman or each gang of workmen has accomplished. It is better than a foreman, for it cannot "stand in" with the men. It is better than a foreman, for it costs you less and it tells more. A cost-keeping system tells who are good men and who are lazy men. It shows whom to discharge and whom to promote. It tells whose wages are too high and whose are not high enough. And, finally, it leads to that ideal condition of industrial organization known as profit-sharing. When a manager has learned, by cost-keeping, that certain men or groups of men produce more than others, he soon perceives that the advantage of stimulating them to further use of brain and muscle by paying them a bonus for each unit produced in excess of a prescribed minimum. The men respond to this stimulus, and often in a remarkable degree.

A proper system of cost-keeping shows the material used and the labor performed every working day. The day is the unit of pay for work done, and it must be made the unit in measuring work wherever the work is of such nature as to permit daily measurement. Often it is not practicable to make accurate daily measurements of work accomplished. Then it is usually possible to estimate the output approximately. For example, to measure the yardage of concrete placed in a day may not be readily done, but the number of sacks of cement used each day can be recorded, and the yardage of concrete thus estimated closely. It is in devising methods of approximating the output that an engineer has a chance to use his ingenuity and his engineering knowledge.

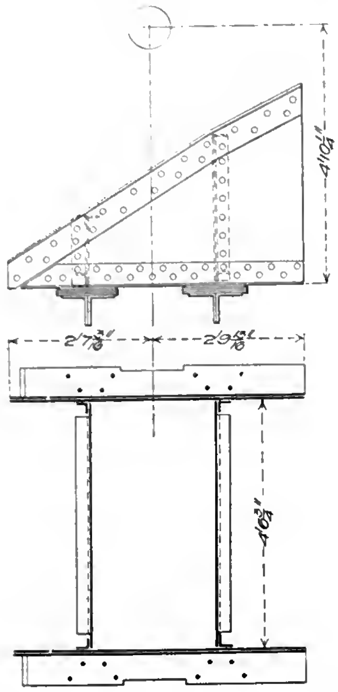
Second only in importance to securing records of work done is the devising of ways that enable the manager quickly to compare results day by day. All engineers have been trained to depict mechanical measurements and formulas graphically by the aid of charts, diagrams and curves. Hence it is second nature for the engineer to plot a "cost curve," which shows at a glance the unit cost of each kind of work for each day or each week. When a marked fluctuation occurs in the cost curve, indicating a rise or fall in the unit cost, then it is that the manager can usually visit the work to advantage. His very coming at such a time is in itself a spur to the men, for they realize that he is keeping in constant touch

with their progress, and immediately notices an increase or decrease in output.

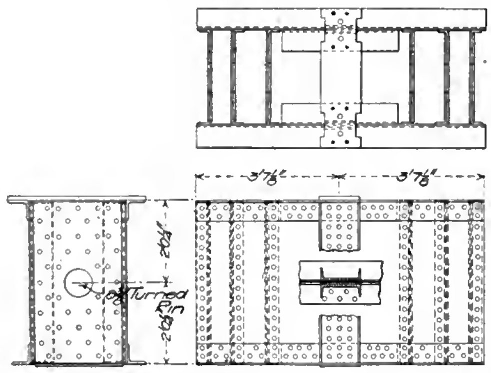
By the modern method the contractor receives a daily report of work done at every cut. In rock the report shows the number of linear feet of holes drilled, the pounds of explosive used, a chart of the location and depth of drill holes, carloads of rock hauled away, and such other details as are needed to determine both progress and economy of work done. Instead of the old progress profile, he has a mass diagram which indicated the total number of cubic yards in each cut, or in each group of cuts. On this mass diagram the amount of material removed each day is indicated, and, since the diagram is drawn to scale, the areas show at a glance the total work to be done, the amount done to date, and the amount remaining to be done. On a large mass diagram of the whole excavation it is well to indicate the points that should be reached at the end of each week, if the contract is to be finished within the time limit. Similar mass diagrams show the yardage of masonry and other diagrams are prepared for the quantities of other items in the contract.

Diagrams of this character possess two decided advantages over the tabulated reports from which they are prepared: First, they permit of quick comparisons of progress by days, by weeks and by months. Second, they insure that no reports are omitted or sent in incomplete. It is easy to overlook the omission of a certain daily report, when examining a pile of such reports, but on a diagram no such omission is possible.

In the prosecution of my present work of appraising the value of the railways of the State of Washington, I have gone through innumerable records of the cost of bridges, culverts and other structures. It has been noteworthy that the cost of a very large percentage of structures has exceeded the engineer's estimates; and, in such cases, the engineer, or the superintendent, tries to explain the cause of the excess cost. The records show, in most cases, that neither of them knew what the cause was until after the work was finished. No better example could be found of the

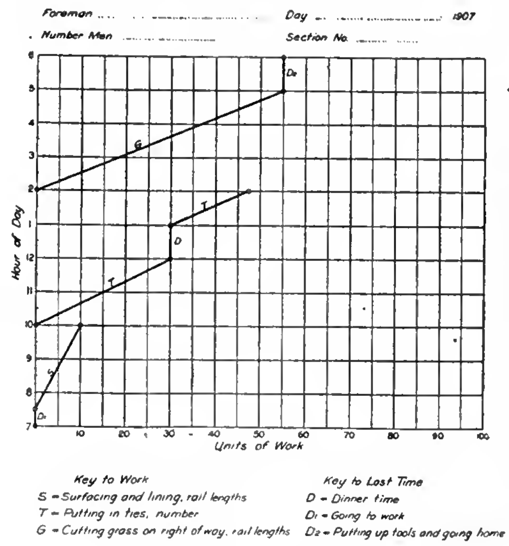


Filler between Inclined Chord and Bottom Girder, Quebec Bridge.

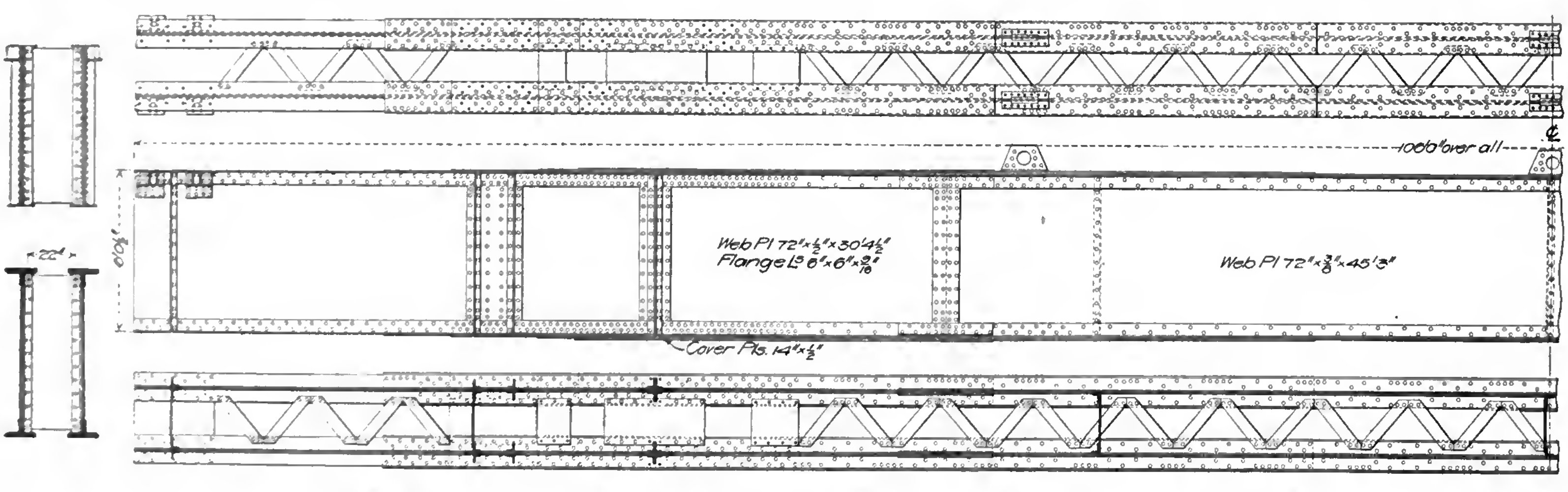


Bearing Girder under Bottom Girder, Quebec Bridge.

day and the progress from hour to hour. The diagram, or form, is a proposed card to be used by section foremen, and it shows the day's work done by a gang of section men. The vertical lines, or ordinates, show the hours of the day from 7 A. M. to 6 P. M. and the intermediate quarter hours. The horizontal lines, or abscissas, show number of units of work accomplished. The black circles are holes punched with a conductor's punch. The lines connecting the punch holes can be ruled in after the day's work is done. This particular card shows that the gang of men arrived at the site of the day's work and started in at 7.30 A. M. At 10 A. M. they had completed 10 units of work, and the key letter *S* on the straight line between 7.30 and 10 A. M. is found to be the number of rail lengths of track surfaced and lined. At 10 A. M. the gang began putting in ties, as is indicated by the key letter *T* on the straight line between 10 A. M. and 12 M. Then the curve of work rises vertically from 12 M. to 1 P. M., indicating that no work was done during the noon hour. From 1 to 2 P. M. the work of



Section-Gang Work Chart.



Tranverse Bottom Girder Suspended from Cantilever to Carry Falsework, Quebec Bridge.

inefficiency resulting from a lack of the use of modern methods of cost-keeping. Indeed, I may go a step farther and say that practically all the railroads of our country are poorly managed in nearly every department, simply because they cling to out-of-date methods of cost-keeping. Usually, however, they pride themselves upon the completeness of their records, but, as compared with the methods of cost-keeping used by up-to-date manufacturers and contractors, the average railroad is in the kindergarten class. Occasionally you will find a division superintendent who has charts made showing the daily movement of freight trains over a division. But I know contractors who have similar charts made every day which show the movement of every wagon load to the nearest five minutes of time. They can tell you not only the distance traveled and the number of trips made by each wagon, but each delay and the cause thereof. Surely if it pays to watch the movement of wagons with such care, it will pay to watch the movements of trains in a similar manner, and to study and compare results with even greater care. Yet, so far as I can learn, the details of train movement are not ordinarily plotted and studied with anything like the minuteness which a cost-analysis engineer employs in managing the movement of dirt trains over a narrow gauge temporary track.

For the purpose of indicating the degree of refinement of cost-keeping which certain contractors employ, I present herewith a diagram which is susceptible of wide application. It is like the log of a ship, in that it shows the events of each

putting in ties was continued. At 2 P. M. the gang began cutting grass, as is indicated by the key letter *G*, and quit at 5 P. M., having cut grass for a distance of 55 rail lengths. Then the curve of work rises vertically from 5 to 6 P. M., and the key letter *D* shows that this hour was lost in picking up tools and going home.

It will be noted that a card of this sort gives a perfect log of the day's work, showing all delays, their cause and duration, and number of units of work accomplished. On the back of the card a series of key letters should be printed so that the foreman can indicate on the curve of work any kind of work done, and the units in which it is measured. The rail length is a convenient unit for certain classes of work, the distance between telegraph poles may serve for other

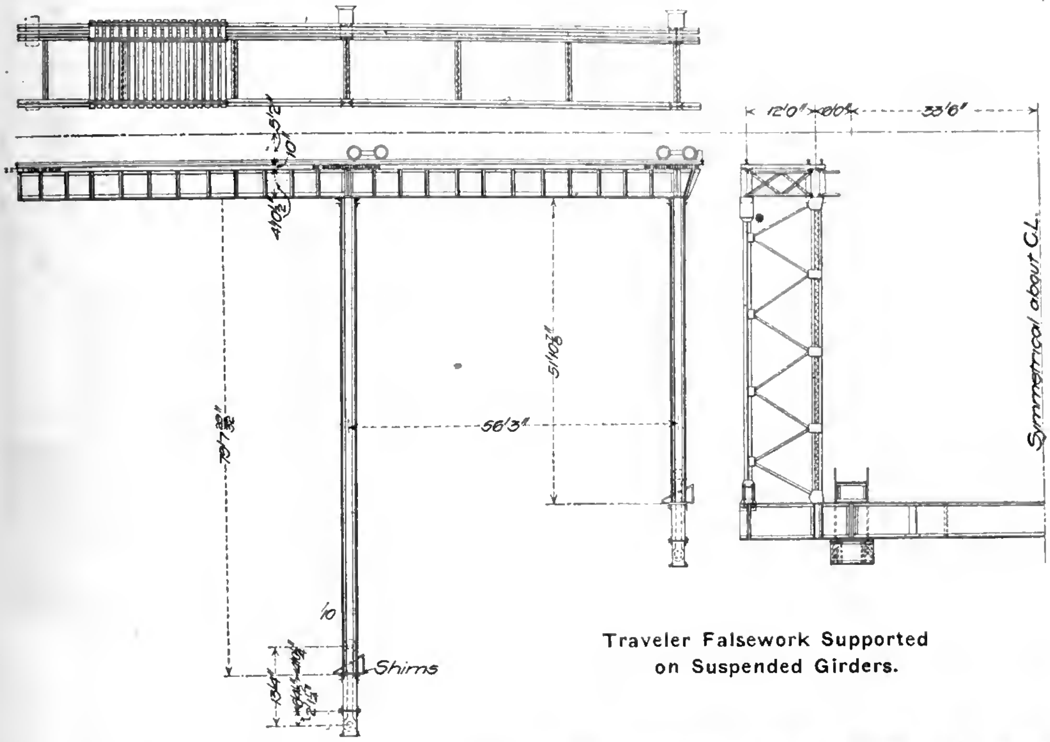
classes. Incidentally all telegraph poles on each section should be numbered consecutively. Then the foremen can be required to report the exact location of the work by writing the number of the pole on the curve of work diagram. With a system of this sort, and by paying section foremen about 50 per cent. more than is the present practice, it would be an easy matter for any engineer to increase the average output of section men by 100 per cent. over present outputs.

The card shown herewith is obviously applicable to innumerable kinds of construction or manufacturing where men work as individuals or in gangs. It becomes complicated when a gang under a foreman is split up into smaller gangs which are continually shifted from one kind of work to another. But such shifting is usually unnecessary, and can be obviated, as a rule, by the use of better judgment in the management of the work. Indeed, the very objection to the use of such daily card reports points the way to better management by indicating the lack of reason for using small units that putter away time.

There is a rapidly growing demand for engineers who can devise and apply a modern cost-keeping system. Indicative of this fact Mr. Gillette stated that within the last few months he had many inquiries from very large contracting firms, as well as from engineering departments of the federal government, for names of competent cost-analysis engineers. These inquiries are coming in with increasing frequency, showing that the value of the services of a cost-analysis engineer are being recognized. Frequently, however, the salaries offered would be no inducement to an engineer having a satisfactory position; but the chances for advancement in salary is infinitely greater than in the ordinary lines of engineering professional work. Moreover, the chance to become a partner in a firm is much better where a man is engaged in studying labor costs with a view to reducing them than it is where he is engaged in studying designs with a view of saving materials. Few men are capable of judging the true worth of the engineer who saves money by an economic design of a bridge or by the economic location of a railway. But no man is so blind as not to be able to see the ability of the engineer who reduces the cost of excavating rock by 10 cents a cubic yard, or who effects an increase of 5 per cent. in the tonnage hauled over a given division. Hence, it will always be more profitable to be a cost-analysis engineer than to be a designing engineer or a locating engineer.

The Suspended Falsework of the Cantilever Arms of the Quebec Bridge.

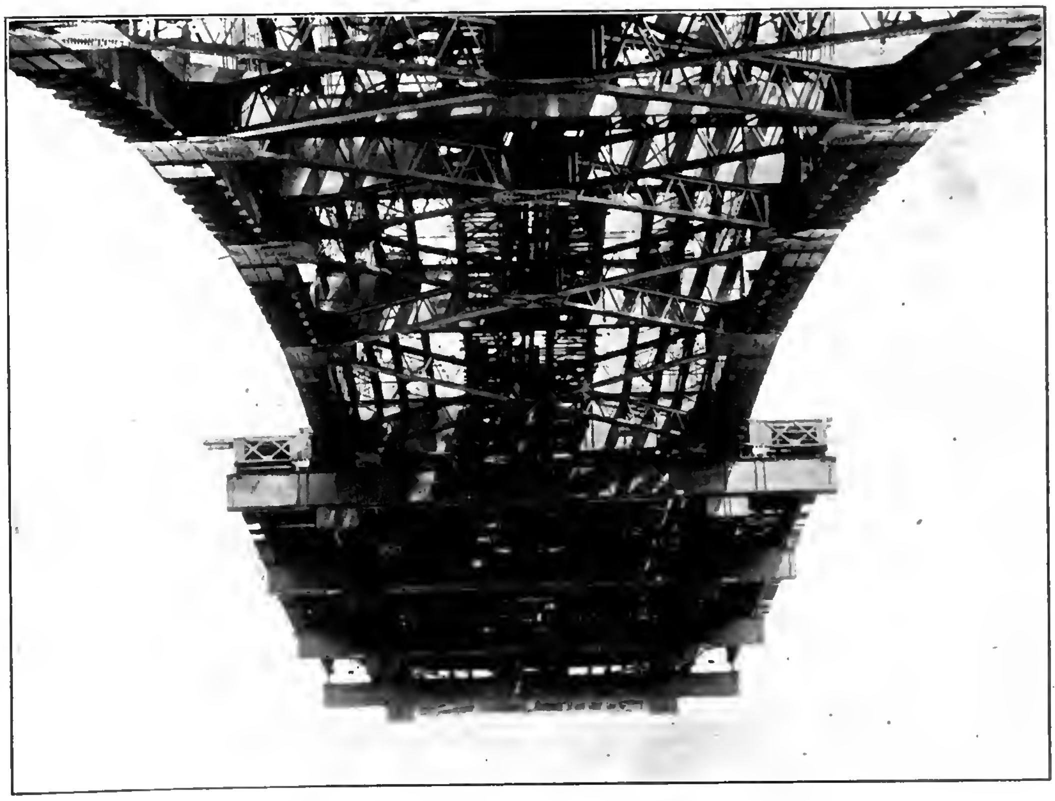
The recent collapse of a part of the Quebec Bridge gives added interest to anything connected with the design and erection of that structure. In earlier articles concerning it attention has been called to many of the details and to the carefully developed field methods. One of the most interesting parts of the erection was the use of suspended falsework in connection with the river arm, which will be described in this article.



Traveler Falsework Supported on Suspended Girders.

The 560-ft. cantilever arm of the Quebec Bridge had trusses 67 ft. apart on centers and 315 ft. in maximum depth erected by the same great gantry traveler which had already been used for the erection of the south anchor arm. The traveler, which was illustrated and described in The Engineering Record of March 4, 1905, weighed with its equipment about 2¼ million lb. and had a Z-shaped longitudinal elevation, with a 54x103-ft. tower, 212 ft. high and a 66-ft. forward overhead cantilever. It moved entirely outside the finished superstructure with horizontal and vertical clearances of 79 and 202 ft. respectively. It moved on two 12-ft. gauge tracks 91 ft. apart on centers, at roadway level, one track 12 ft. outside the center line of each truss. For the anchor arm these tracks were supported on two lines of steel falsework towers erected on shore between the main and abutment piers. The south cantilever arm had been and the north cantilever arm was to be erected by the cantilever method self-supporting during erection at a maximum clear height of about 150 ft. above the high water of a maximum depth of 200 ft. The support of the traveler tracks in the same manner as for the anchor arms was, of course, impossible and a system was devised of suspending them from the cantilever trusses in a novel and ingenuous manner which, before it proved to be successful, was considered by some bridge engineers to be impracticable and was undoubtedly without close precedent for its magnitude and the details of its construction.

The cantilever arm falsework consisted essentially of two sectional steel viaducts, about 80 ft. in maximum height, supported on each side of the cantilever arm on the cantilever ends of box plate girders suspended from the lower chord pins of the cantilever trusses. Each viaduct was made with three lines of longitudinal girders supported on transverse bents each composed of two vertical posts 12 ft. apart on centers; the bents being spaced 56 ft. 3 in. apart longitudinally to correspond with the panel points of the cantilever trusses. The vertical bents diminished in height from the piers to the extremities of the cantilevers but the box girders supporting them were duplicates for all points so that only four of them and four full sets of longitudinal girders were required. This provided one panel more than was necessary for the support of the traveler and permitted the removal of the rear panel and its re-erection in front, panel by panel, as fast as the traveler progressed. The total weight of the cantilever arm falsework was about 200,000 lb. exclusive of permanent track stringers utilized and the box girders, the heaviest members, weighed



Traveler Falsework Suspended from Cantilever Arm, Looking up.

about 25,000 lb. each. All members were handled by tackles swung from the completed portion of the cantilever arm or from the traveler itself and after the erection was well advanced the rear panel falsework could be removed and replaced in front ready for the traveler to be moved forward on it in a short time.

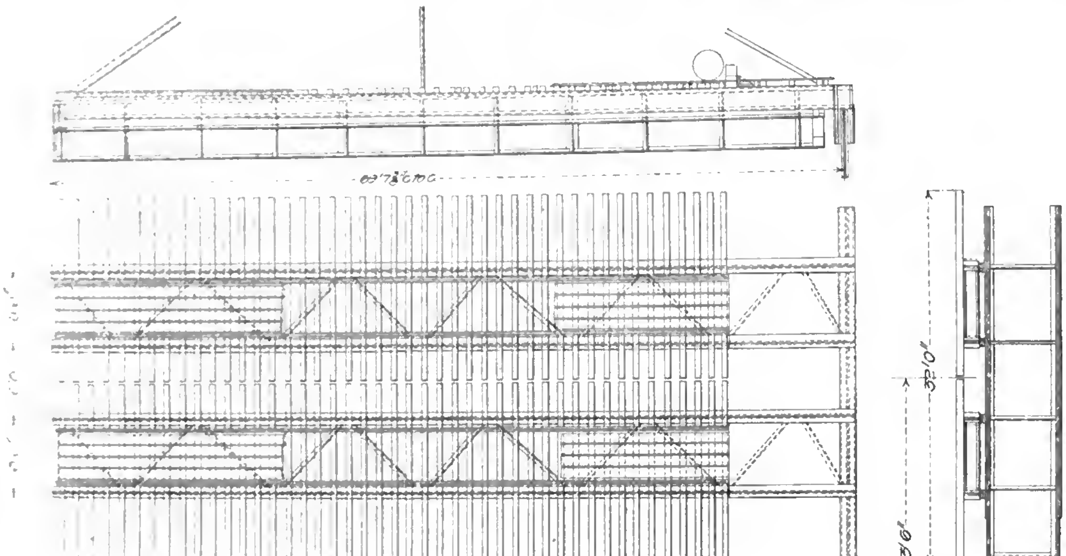
The suspended box girders were 106 ft. long, 6 ft. deep and 42 in. wide over all. Each girder had two 72x½-in. webs, 28 in. apart made in three shop-spliced sections, eight 6x6x9-16-in. full length flange angles and on each flange four 14x½-in. cover plates varying in length from 29 to about 87 ft. The webs were connected by five transverse vertical shop riveted diaphragms and both top and bottom flanges were connected by side plates and lattice bars as indicated in the general drawings.

Three sets of connections were temporarily bolted to the top flanges to provide for the attachment of the hoisting tackles by which the girders were handled. Each set consisted of a pair of short 12-in. channels with their vertical webs riveted together and bored to receive a 6-in. horizontal pin with its axis parallel to that of the bridge. The lower flanges were secured to the top flanges of the beam by 14 turned bolts through each and the connection resembles a simple shoe to receive the end bearing of a small truss. In the planes of the cantilever trusses and of the vertical posts in the falsework bents the plate girder webs were stiffened by vertical reinforcement angles and filler plates proportioned to receive the maximum vertical shear at these points.

To support the cross girder at any required panel point of the cantilever truss an eye-bar about 13 ft. long was engaged on each end of each lower chord pin and passing down between the webs of the girder, engaged a parallel pin through three vertical diaphragms, parallel to the bridge axis, which connected the web of a special bearing girder fitted to the bottom flange of the main girder at its intersection with each plane of the cantilever trusses. Each bearing girder was about 7 ft. long and 4 ft. deep with two webs 28 in. apart connected by six diaphragms 1¼ in. thick. The center of each web was reinforced by two 12-in. channels and two 12x½-in. vertical plates. In order to insure the proper position of the bearing girder under the transverse girder, a plate was riveted across the flanges of the former and engaged a slot in the flanges of the latter.

Riveted triangular filler blocks were seated on the top flanges of the main girders under the panel points of the lower chords and were wedged up to close bearing against the bottom flanges of the latter by means of tapered shim plates between them and the girders. These fillers were made with two ⅜-in. web plates about 4½ ft. apart parallel to the bridge axis and have single 6x6x½-in. flange angles on the outsides of their webs on the horizontal and inclined edges. The webs were connected by two ⅜-in. vertical transverse diaphragm plates and both upper and lower flange angles had open holes for turned bolts connecting them to the bottom flange of the lower chord and the top flange of the girders. The inclined top flange angles were slightly bent to enable them to conform exactly to both adjacent sections of the lower chord. In erection the bearing girders were permanently bolted to the main girder and the eye-bar suspenders were permanently connected to the former, the filler pieces being changed every time the transverse girders were moved, to correspond with the varying inclinations of the bottom chord.

Handling 106-Foot Bottom Girder to Support Suspended Falsework.



Cantilever Truss and Working Platform of Main Traveler,

The transverse trestle bent for each traveler track consisted of two vertical posts 12 ft. apart transverse to the bridge axis, braced with zigzag angles. The inside post carried a much heavier load than the outside post and had a rectangular cross section made with two built channels latticed. The outside post had an I-shaped cross section made with a web plate and four angles. Horizontal connection angles were riveted across tie plates on the opposite flanges at the feet of the columns and received four 1⅝-in. vertical bolts about 2 ft. long with upset ends which passed through pockets and had lower nuts bearing on corresponding angles riveted to the web of the transverse girder thus firmly securing the column to it. The base plate of the inside column was bolted to the top flange of the girder with 24 short vertical bolts. Each pair of columns was handled as a separate unit by tackles suspended from the overhang of the traveler and was changed for a shorter one to correspond with the increased elevation of the transverse girder every time the latter was moved.

Each column bent carried three lines of 4-ft. 10½-in. plate girder stringers, two of which were bolted close together with pairs of separators between their webs and were centered on the outside columns. The third girder was centered on the outside column and was connected to the other two by end and intermediate vertical transverse frames and bottom flange zig-zag angles rigidly uniting the three girders so that they formed a single unit shifted from rear to front as the erection progressed by tackles suspended from the traveler. Cross ties 10 in. high, 12 in. wide and 2 in. apart in the clear were bolted with the 3 lines of rails to the top flanges of the girders and at panel points, groups of seven

10-in. I-beams were interpolated between the ties to receive the concentrated loads from the traveler tracks. The top and bottom flanges of the inside girders were connected to the vertical members of the main trusses by short horizontal braces with bolted connections and similar braces were provided at the middle points of the longest vertical columns. The stringers used for this suspended falsework were borrowed from the railroad track of the center suspended span.

In order to deliver bridge members to the tackles suspended from the overhang of the traveler during the erection of the cantilever arm, a working cantilever platform corresponding to the overhang was extended from the foot of the traveler at roadway level. A light riveted triangular longitudinal truss 69½ ft. long and 38 ft. deep with a horizontal bottom chord was bolted through its end vertical post to each outside forward column of the traveler, 79 ft. apart transversely on centers. The lower chords of these trusses were stiffened laterally by inclined horizontal outriggers braced to form with the lower chords virtually horizontal triangular trusses 12 ft. deep at the inner ends. The outer ends of the cantilever trusses are connected by a transverse plate girder 6 ft. deep with its top flange bearing across the bottom flanges of the lower chords of the cantilever trusses. The girder was suspended from the lower chord at each end by four vertical angles engaging the webs of the chords, which were made with built channels having their flange angles turned in and latticed, and riveted at their lower ends to gusset plate projecting from the webs of the girder parallel with the bridge axis.

This girder carried the outer ends of four lines of plate girder stringers 5 ft. deep and 69½ ft. long, which at the inner ends were directly connected to the permanent floor beam. These girders had drop ends seated on the top flange of the forward transverse girder and were spaced 3 ft. 3 in. and 9 ft. 9 in. both sides of the center line of the traveler to correspond with a spacing of the two material tracks which they supported. The stringers for each track were braced together in the usual manner with vertical transverse sway-brace frames and zigzag flange angles. Each track had 6x8-in. ties 16 ft. long and 16 in. apart on centers, covered between the rails with a solid floor of 4-in. longitudinal spruce planks. It was at first intended to provide 2 additional stringers midway between the outside track stringers and the cantilever trusses to support solid floors about 16 ft. wide each side of the tracks, but these were finally omitted. Rail stops solidly riveted to the stringers and braced to the end of the platform were provided for each track to prevent the possibility of material cars being pushed over the end. The pairs of stringers, with the ties, rails and bracing for each track were independent units easily connected and disconnected from the cantilever overhang and were removed and set inside the traveler tower every time the latter was moved in order to give clearance for lowering the transverse falsework girders and permanent floor members through the framework of the cantilever overhang.

Each track on the overhang was long enough to receive one freight car and the forward truck of a second, a total of 6 axle loads, which when both tracks were simultaneously loaded were limited to the dead load of car plus 12,500 lb. each, equivalent to 50,000 live load on the car. When only one track was loaded a live load of 116,000 lb. per car, equal to a live load of 29,000 lb. on each axle was allowed. These loads produced total live load reactions of 65,000 lb. at each end of the forward transverse girder where the dead load reactions are 52,560 lb. Care was taken to remove the cars from the overhang as soon as their loads were lifted from them.

The Cooling Plant for Walter Baker & Co., Ltd., Dorchester, Mass.

In The Engineering Record of April 20, 1907, the new central power plant of Walter Baker & Co., Ltd., of Dorchester, Mass., was illustrated. It is the purpose of this article to describe a new cooling plant designed by the same engineer, Mr. F. W. Dean, of Boston, for this company. This plant is interesting as embodying the most advanced ideas in refrigerating engineering, and was designed with a view not only to simplicity and ease of operation but also to high economy.

The machinery is placed in a building previously used as a power house, but vacated upon the completion of the new central power plant. This building has been remodeled by the removal of a party wall, making a machine room 66 ft. long by 44 ft. wide. A new roof with monitor gives a clear height of 21 ft. under the main roof, and 31 ft. under the monitor. A waterproof pit 7 ft. deep and irregular in shape, with an area of 1,000 sq. ft., is used for the ammonia pumps, the aqua receivers and miscellaneous piping.

At the back, adjoining and partly over the Neponset River, an addition has been erected of brick and concrete, having a roof of mill construction with monitor. The roofs of both buildings are covered with tar and gravel and copper flashing and siding.

The condenser room has a clear height of 21 ft. under the main roof and 27 ft. under the monitor. All the woodwork in the room is wire lathed and plastered while the window frames are of copper and glazed with wire glass. All iron work is protected by concrete. One-half of the condenser room is over the river, and supported on concrete piers. The floor is of concrete sloped to drain all of the condenser water to the river. The whole river side of the house is open, except for the four reinforced piers which support the roof; openings are fitted with Kinnear rolling doors 14 ft. wide by 16 ft. high.

The steam for this plant may be obtained either directly from the boiler plant of the new power house, or from the low-pressure manufacturing lines, which carry exhaust steam to the various mills.

The refrigerating machine is of the well-known Pontifex Hendricks absorption type, operated either with exhaust or reduced-pressure steam.

The present plant is designed to cool 846 gal. of calcium chloride brine of a specific gravity 1.240 from 0° Fahr. to —10° Fahr., or each of the three units installed is capable of cooling 282 gal. of brine through a ten-degree range, the warmest brine never being above 0° Fahr.

The nominal rating of each unit is 100 tons of refrigeration or the total of the three, 300 tons of refrigeration in twenty-four hours. The plant has ben designed for an ultimate capacity of 600 tons of refrigeration, and all the units, piping, and other details are laid out with this in view. It consists of brine circulating, brine cooling, ammonia generating and condensing equipments, together with the water circulating and steam condensing units.

The purpose of this installation is to furnish refrigeration throughout the various mills of the company for cooling chocolate liquors and goods, and also for cooling rooms where chocolate goods are being manipulated.

There are some 30,000 lin. ft. of 2-in. galvanized pipe installed in bunker rooms, with air circulation to the various rooms where the refrigeration is required. Extensive mains run to all parts of the buildings, while specially designed equipment is used to reduce handling and save time. This is so extensive that no attempt will be made in this article to describe anything except the mechanical plant. All ammonia piping is confined to as small an area as possible and to the machine room, all such piping being directly under the eye of the engineer.

The brine circulating plant consists of two centrifugal pumps, in duplicate, each of 1,000 gal. capacity against a 100 lb. head and direct connected to a 75-h.-p. De Laval steam turbine operated condensing.

Each pump has an 8-in. suction taken from a 12-in. main brine return line from the various factories; a standpipe 12-in. in diameter and 21 ft. high takes care of all the air in the suction line, provides for expansion in the line, and insures a nearly constant head on the pumps.

There are three 8-in. pump discharge connections into a main supply header to the brine coolers, space being reserved for another pump of the same capacity. The brine from the pump is discharged into a 12-in. main distributing header, which has 6-in. branches to each cooler. An 8-in. by-pass is also provided for shunting a part of the brine around the coolers when desired. The brine coolers are of the Hendricks enclosed type, with spiral brine coils contained by a cast iron shell 45 in. in diameter and 15 ft. long, each weighing some 24,000 lb.

There are three Venturi meters, one on the supply to each cooler. These are provided with manometer tubes, so that the quantity of brine passing to each cooler may be easily noted. Thermometers are placed on the supply to and the return from each cooler, so that the temperature of the brine to and from each is obtained. Having given the temperature difference and the quantity of brine circulated to each, the amount of refrigeration, both total and that which each cooler is doing, in tons per twenty-four hours may be exactly computed.

The return from the cooler, which is also the supply to the factory, is 12 in. in diameter, and is connected into the main returns, both directly and through a brine tank. This tank is 4 ft. 6-in. in diameter and 14 ft. long, with a man-hole at the top for supplying calcium in bulk, when the charge needs to be increased or strengthened. It also serves as a reservoir for brine.

Adjacent to each cooler is its anhydrous receiver with the ammonia expansion line connection. These receivers are 18 in. in diameter and 10 ft. high, and contain cooling coils. Both cooler and receivers are provided with gauge glasses with automatic self-closing gauge cocks of the Hiller type. The insulation on both consists of Nonpareil sheet cork with hardwood lagging.

The generators, each consisting of a cast-iron shell 45 in. in diameter and 14 ft. long, have 2-in. diameter steam coils of the return-bend pattern, immersed in the aqua ammonia charge, and terminating in a 5-in. main steam supply header. The condensation from these coils is carried to a 3-in. main drip header, these headers being trapped and discharged to 7½ x 4½ x 6-in. Warren receiver pumps through a 3-in. pipe. These receiver pumps are in duplicate.

The main to the generator steam headers is 5 in. in diameter in each case, and is connected both into an 8-in. low-pressure main, and into an 8-in. high-pressure main through a 5-in. reducing valve. All reducing valves are by-passed and provided with valves, so that they may be repaired while the plant is running. A safety valve is also placed on the low side of this reducing valve in order to safeguard against excessive pressure. All the generator drips are pumped back to the boilers. The use of a separator on the main steam supply to the generator insures dry steam.

The refrigerating machines are designed to run on 5 lb. pressure during part of the year and on 20 lb. or thereabouts the remainder of the time.

The rectifier, absorber and condenser are of the atmospheric type and are contained in the condenser room on the river side of the plant. These consist of a series of vertical coils arranged side by side; the top coil is the condenser; the bottom coil the absorber, while between each 100-ton unit the rectifier is carried on pipe supports above and to one side of the condenser coil. This allows the warm water from the rectifier coils to go to waste without passing over either the condenser or absorber coils. Water distributing troughs are suspended over each vertical coil.

The rectifiers consist of 3-in. extra heavy galvanized pipe made into counterbored steel return bends, galvanized and fitted with gland and packing in addition to the pipe thread. These coils are 24-in. on center, ten pipes high and 26 ft. long.

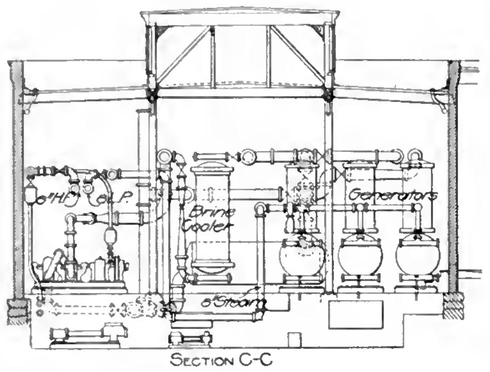
The condenser consists of 2-in. extra heavy wrought iron pipe, galvanized on the outside and made into counterbored cast steel return bends, galvanized with gland and packing. Each condenser has ten coils twenty pipes high, 26 ft. long, and the condensing surface is aproximately 2,500 sq. ft.

The absorber is of the same general design as the condenser, with gas distributing pipes entering the return bends. Each absorber has ten coils of 3-in. extra heavy galvanized, wrought iron pipe 18 pipes high and 26 ft. long.

generators are covered with 2 in. of 85 per cent. magnesia and ½ in. of plastic magnesia, the whole lagged with hardwood sheathing.

The water circulating units consist of two vertical duplex Warren steam pumps, each 7½ x 7 x 12 in. for the steam condensers, and two centrifugal pumps made by the De Laval Steam Turbine Co., each of 800 gal. capacity against 30 lb. pressure for the ammonia condensers.

The turbine pumps are direct-connected to a 20-h.-p. De Laval steam turbine operated condensing. The water for condensing purposes is



Section through Machinery Room.

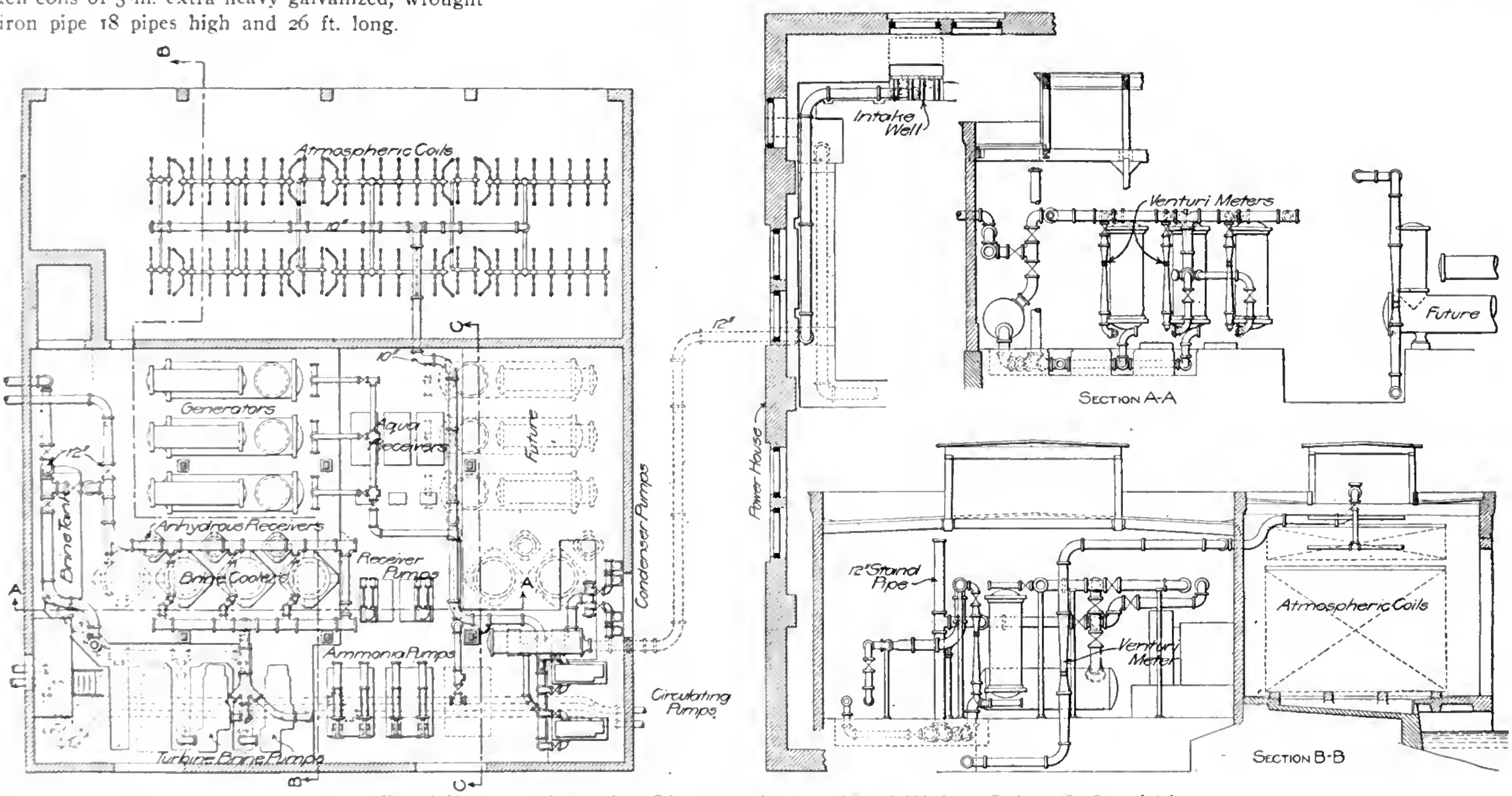
line, and to the steam supply of the generators. This applies equally to all steam pumps.

The Bulkley condensers are located on the outside wall of the machine room with space for an additional one when required. All the piping is designed with provision for future extension. The steam riser to each condenser is 7 in. in diameter, the water supply 3 in. in diameter, and an overflow 3½ in. in diameter, with a drop of 36 ft. to a main overflow drain which discharges into the river.

The discharge from the vertical pump is 5 in. running into an 8-in. common water main to the steam condensers. A strainer with by-pass connection is placed in this line which enlarges into a 15-in. drum having 3-in. outlets.

There are three gauge boards of grey polished marble, one is mounted with a Howard clock, two vacuum gauges for the steam condensers, one steam and one steam recording gauge for the supply steam. Another is provided with a brine suction, a brine discharge gauge and a recording gauge for the brine discharge. The third board is fitted with six ammonia gauges, one for each absorber, and one for each generator. There are also three steam gauges, one for each generator.

The large quantity of exhaust and low pressure steam available in the warm weather determined the choice of equipment. In the winter time



Details of New Refrigerating Plant at the Works of Walter Baker & Co., Ltd.

The condensing water to the atmospheric coils is through a 10-in. main, which supplies a multitude of headers with 1¼-in. branches leading to the water-distributing troughs over the coils.

The brine cooler, the generator and anhydrous receiver are provided with special Ashton automatic ammonia relief valves with removable metal seats. The brine tank, brine mains and all piping which frost or are liable to sweat are insulated.

Except in the subway, which is constructed for about 200 ft. under a street, the brine mains are insulated with 3 in. of hair felt and canvas jacket, painted. In the subway they are insulated with 3 in. of Nonpareil cork painted with rubber cement, and the pipes are supported with special hangers outside of the insulation. The brine coolers, the anhydrous receiver, and the brine tank are insulated with 4 in. of Nonpareil cork and sheathed with hardwood lagging. The

drawn from the Neponset River through a suction well, provided with screens and located in the basement of the large power house. A 12-in. cast iron main suction line leads from the well to a suction chamber 30 in. in diameter by 10 ft. long. All the water pumps take water from this chamber.

The atmospheric absorbers are each drained to a receiver 36 in. in diameter by 6 ft. long, and provided with gauge glass, and self-closing cocks. From the bottom of each aqua receiver suction lines are carried to the ammonia pumps. There are four such pumps, each of the Blake direct acting type, 12x6x16 in., one for each refrigerating unit and one in reserve.

The steam is condensed by two 7-in. Bulkley condensers, one for the turbine water pumps and one for the brine pumps. Not only may these pumps be run condensing, but are also cross-connected into an 8-in. low-pressure manufacturing

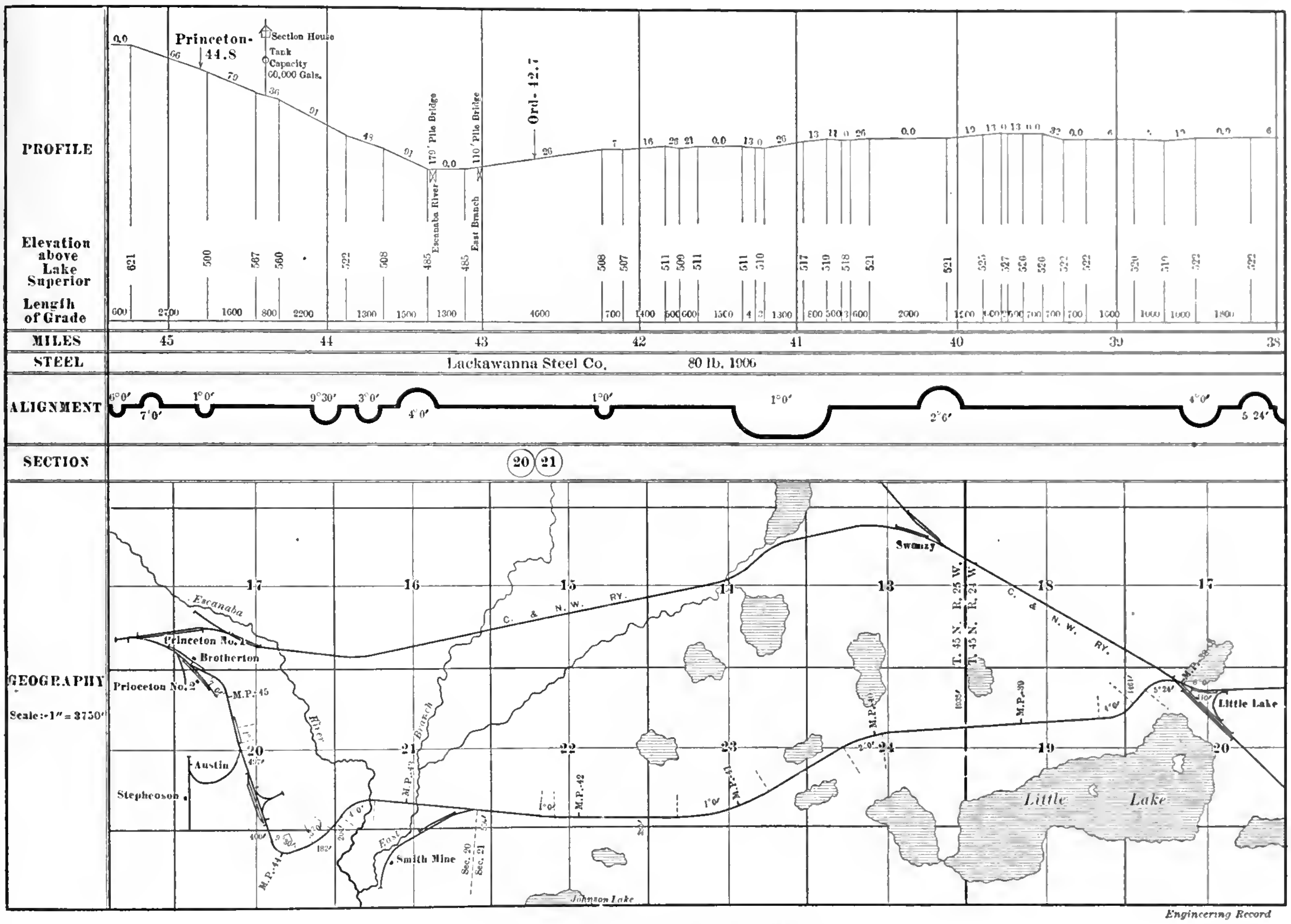
when the refrigerating machine is not in commission to any extent, large amounts of low-pressure steam are required for heating the mills. In the late spring, in the summer season and early fall, when the refrigerating machines are most used, the heating requirements are small and consequently the supply of low-pressure steam is ample for the needs of refrigeration. With the selection of economical pumping units operated condensing, the amount of live steam consumed should be small. The plant has been operated long enough to substantiate this hypothesis, and has demonstrated that although it is a comparatively large plant a minimum of attention is required.

A 1,200-VOLT DIRECT CURRENT on an overhead trolley electric railway was inaugurated recently by the Indianapolis & Louisville Traction Co. on its line between Scottsburg and Seymour, Ind.

A Convenient Profile Chart and Map.

A chart showing the geography, profile and various other information concerning railroad location and grades has been adopted by Mr. R. C. Young, chief engineer of the Lake Superior & Ishpeming Ry., the Munising Ry., and the Marquette & Southeastern Ry. A section of this chart covering about 9 miles of a new branch of the Munising Ry. is reproduced herewith. The method of indicating the geography of the line, which is shown at the bottom of the chart, involves no special features. Just above the map, the number of the section is given and above that the alignment of the track. The weight and the manufacturer of the rails and the year the latter were laid are noted in the next line. Above that is the profile proper on which are shown the length of each grade, the elevation of different points above Lake Superior and the rate of grade in feet per mile. The location of stations, section houses, water tanks and bridges is also given accurately. This chart is made in convenient lengths on tracing cloth, so any number of blue-print copies of it may be made. It has been found of considerable value to the operating department as well as for a record of the different features of the line for the engineering department.

In this connection the method of numbering bridges which is used by these companies is worthy of notice. The accounts of the various railroads and their branches are, for convenience, distinguished in the auditing department by different letters, which are also shown on the station list on the reverse of all working time tables. These same letters are used by the engineering department in numbering bridges, the number given each bridge being the distance in miles and hundredths of a mile from the base from which measurements are made. For example, the accounts of the branch shown in the accompanying chart are carried under the letter B and a bridge on that branch 5.33 miles from its starting point would be number B5-33. With this system a bridge can always be located at once and in case a new bridge is required or an old one abandoned, the continuity of the numbering of the other bridges is not changed.



A Convenient Profile Chart and Map.

Inspection of Asphalt Pavement in the Borough of Manhattan, New York City.

A system of inspection of asphalt pavement recently introduced in the Bureau of Highways of the Borough of Manhattan, New York City, has proved so satisfactory during the few months it has been in effect that it is believed all classes of pavement in the borough will be ultimately put under the same system.

The borough, the total area of which is about 21.9 square miles, is divided into six sections of nearly equal area, each in charge of a chief inspector. Each section is subdivided into two to five divisions, each in charge of a sub-inspector. The sub-inspectors patrol the asphalt paved streets in their respective districts and make daily reports of their condition to a special office of the Bureau of Highways. The reports are in tabular form and indicate the location of every hole, its dimensions and yardage, and how made. From these reports similar lists are made out and forwarded to every contractor from whom repair work is required, showing the location of all holes in pavements of his construction that are still under contract, together with an order that same should be repaired within five days after the receipt of the notice.

The repair work is in charge of an assistant engineer, to whom the chief inspectors report in person daily. They notify him of the number of repair gangs required in their respective sections on the day following and he arranges with the contractors to supply the men.

The chief engineer of the Bureau of Highways is supplied daily with a report showing the number of repair gangs at work and the location of each. For convenience this report is indicated graphically on a wall map of the borough with pins with various colored heads, a color being reserved for each contractor.

In the special office are large-scale wall maps on which are indicated in water colors the stretches of asphalt pavement under contract, a color being reserved for each contractor as before and pins being used to mark the general location of the defects reported. When the defects are remedied the pins are removed or, if they are not repaired, a pin of a different color is substituted, so that by a glance at the map a general idea of the condition of the pavements can be obtained.

The office is able in this way to keep closely in touch with the work of the contractors and notify them promptly when repairs are necessary. Sections 1, 2 and 3 comprise the area below 59th St., and in these sections the system is in full operation. The other three sections are being organized as rapidly as possible.

The new system was devised by Mr. Henry S. Thompson, Commissioner of Public Works of the Borough of Manhattan. Mr. George W. Tillson is chief engineer of the Bureau of Highways and Mr. D. B. Goodsell, assistant engineer, is in charge of the general repairs.

Test of the Reinforced Concrete Viaduct of the Richmond & Chesapeake Bay Ry.

The test of the Richmond & Chesapeake Bay Ry. Co.'s reinforced concrete viaduct at Richmond, Va., a description of which structure was given in this journal on Mar. 2, 1907, will, no doubt, be of interest to users of concrete. The viaduct was designed for a train of cars each weighing 150,000 lb., with a factor of safety of four. The cars are 54-ft. long, with trucks 33-ft. apart center to center, and the wheels of the trucks on 7-ft. centers.

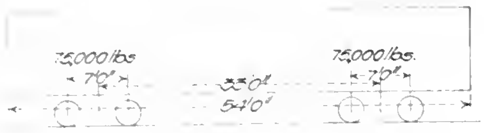
The specifications called for a test of twice the designed load, but as it was found practically impossible to carry out the exact prescribed test, the chief engineer devised a test load that would give practically as severe strains and a thorough test as to the strength of the structure. The accompanying sketch shows the weight and the approximate wheel spacing of the test load as agreed upon by the designer and the railway company. The gondolas were loaded with rails, spikes and bolts to their capacity, while the tender of the engine was piled with coal and the tank filled with water.

Results of Test of Viaduct of the Richmond & Chesapeake Bay Railway Co.

Span Between Bents.		Deflection of Girders. Right.	Deflection of Girders. Left.	Span.	Deflec. in Proportion to Length of Span. Right.	Deflec. in Proportion to Length of Span. Left.
Sledd St.	0-1	7/32"	7/32"	49' 0"	1/2688	1/2688
	1-2	.008'	.008'	23' 6"	1/2937	1/2937
	2-3	.010'	.010'	23' 6"	1/2350	1/2350
	3-4	.010'	.010'	23' 6"	1/2350	1/2350
	4-5	.011'	.009'	23' 6"	1/2136	1/2611
	5-6	.012'	.007'	23' 6"	1/1958	1/3357
	6-7	.013'	.011'	23' 6"	1/1808	1/2136
	7-8	.009'	.011'	23' 6"	1/2611	1/2136
Clay St.	68-69	3/16"	3/32"	67.4'	1/4314	1/8628
	66-67	3/32"	3/32"	33' 0"	1/4224	1/4224
	72-73	1/8"	1/8"	26' 0"	1/2496	1/2496
Marshall St.	82-83	5/32"	5/32"	67.4'	1/5176	1/5176

All of the concrete in the structure had had at least five months in which to harden and under a close inspection previous to the test, not a flaw or crack could be found which would in any way weaken the bridge. The front of the engine was attached to the cars and backed on to the structure, the tender therefore being the first to go on the bridge. The test train was first run over the bridge three times at a slow rate of speed and then accurate measurements were made for the deflection of a number of spans. The first span tested was the 49-ft. span over Sledd St. One end of these girders slide on a concrete abutment making a joint for expansion, while the other ends are built continuous with the adjoining girders. These Sledd St. girders are 54 in. deep and 20 in. wide, with a solid 3½-in. floor joining them. This span showed a ratio of deflection to total length of span of 1:2688.

The deflection of this span was measured in three different ways: First, by setting a sliding rod directly under the middle of the girders and reading by the vernier of the rod the exact deflections: second, by taking a sight with an engineer's level at the rod held on the girder unloaded, and then again with the load in the position to give the greatest bending; third, by measuring with a steel tape the exact deflection from a fine mark on the girder to a solidly driven point on the ground. The three methods gave exactly the same results, and therefore it was decided in testing other spans to use only that method of ascertaining the deflections which would be most convenient.



Car for Which Viaduct Was Designed.

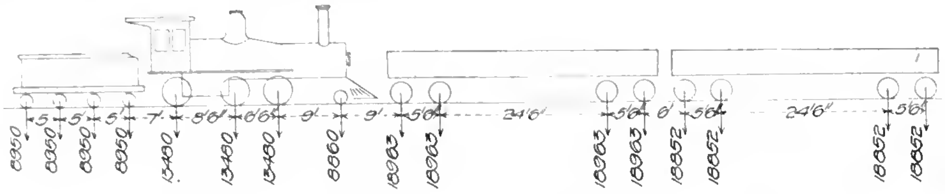
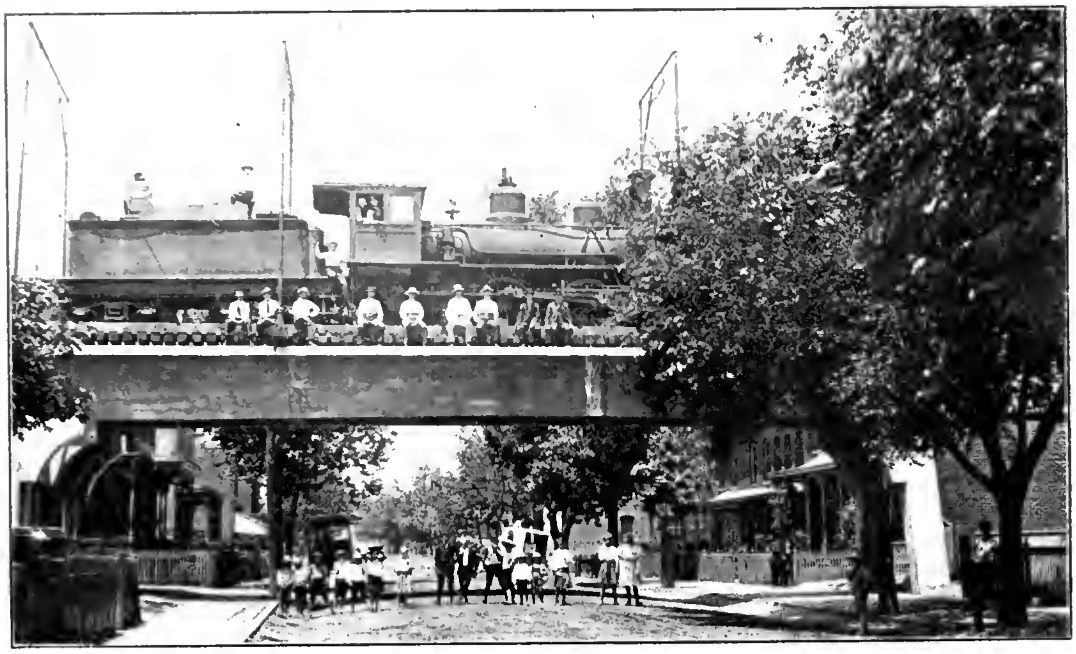
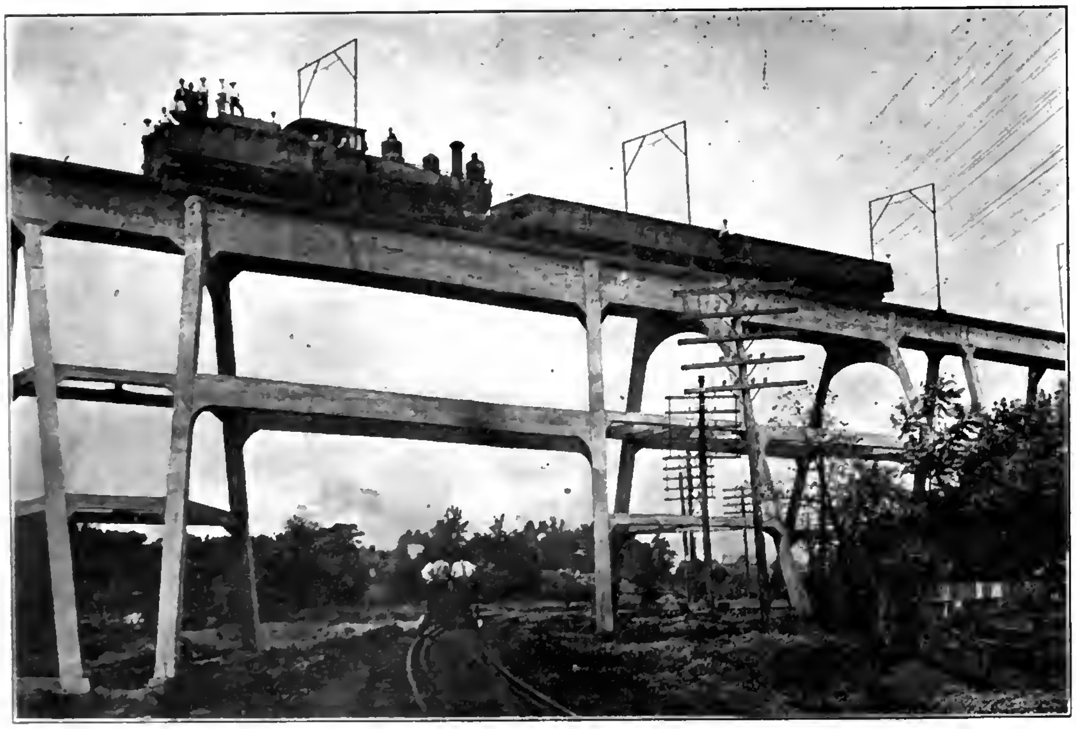


Diagram of Test Train for Reinforced Concrete Viaduct.


Test Train over Marshall Street, Span 67.4 Feet.


Test Train over Crossing of Seaboard Air Line Railway.

The next spans tested were a number of 23½-ft. spans adjoining the Sledd St. span, and where, on account of the viaduct being low, it was very easy to get exact results. The girders on each side of the bridge gave exactly the same results for deflection until the curve was reached, where, on account of the super-elevation of the outer rail, the center of gravity was moved toward the western girders and, as was to be expected, they showed a trifle more deflection than the eastern ones.

Fourteen of these spans were tested and showed a ratio of deflection to total span of from 1:1808 to 1:3357. Deflections for all of these girders were so near alike it was decided that it was only necessary to test typical spans in the remainder of the bridge, as it was practically impossible to get exact results where the bridge was 50, 60 or 70-ft. high, and where there was no solid place to set a level instrument.

A typical 26-ft. span showed a ratio of deflection to span of 1:2496.

A typical 33-ft. span showed a ratio of deflection to span of 1:4224. The Marshall St. span of 67.4 ft. center to center was next tested, and the ratio of deflection to the total span was 1:5176. The Clay St. crossing with the same span of 67.4 ft. as Marshall St. resulted in the east girder deflecting 3/32 in., making a ratio of 1:8628, while the west girder deflected twice as much, with a ratio of 1:4314.

As authorities give as the permissible ratio of deflection to span 1:750, and as all of the deflections measured were so small, it was considered unnecessary to continue measuring addi-

tional spans, so it was decided to test the effect upon the bridge of the train moving at a high rate of speed, and also coming to a sudden stop by the application of the air brake. The bridge showed remarkably little vibration under this heavy load moving at a high rate of speed, and repeated tests of sudden stops made no jar in the bridge that could be noticed at all.

The test train was run over the entire bridge seven times and gave a fair test of the perfect strength and stability of the structure. The girders were perfectly elastic, returning to their original position immediately when the test load was removed. At all the spans where there were expansion joints, the deflection was greater owing to the non-continuous girders. It might be interesting to note that on very hot days the expansion is very noticeable. Although no actual measurements of the expansion have been made so far, it is safe to say that on certain days it has expanded ½ in. in 200 ft.

Since the above test of the viaduct was made the heavy suburban cars, estimated to weigh 120,000 lb. loaded, have been running back and forth continuously at a rate of speed of about 25 miles per hour. A car was suddenly stopped by the emergency brake while running at the rate of about 15 miles, but no undue vibration could be felt although the car stopped within a distance of 3 or 4 ft.

Although no deflections were taken, a rather severe test was made some days later, which was not contemplated beforehand. In order that the construction trains of the railway company might pass it was necessary to send two of the electric cars, an engine and six ballast cars loaded with ballast and also a smaller engine and a line construction car all on the bridge at one time. The vibration was no greater with this long moving load than it is with one car. After the test was over the viaduct was again closely examined. No cracks of any description appeared and the structure seemed perfect.

The Railway Statistics of the United States compiled by the Interstate Commerce Commission for the year ending June 30, 1906, have just been made public. They show that the total single-track mileage in the United States was 224,363 miles or about 6,262 miles more than at the end of the previous year. The commission received operating data from 222,340 miles. The rolling stock reported consisted of 51,672 locomotives, of which 29,848 were in freight service, 12,249 in passenger service and the remainder used for switching; 42,262 passenger cars, 1,837,914 freight cars and 78,736 cars in company service. These figures do not include cars owned by private corporations. The average number of passenger-miles per passenger locomotive was 2,055,309 and the number of ton-miles per freight locomotive was 7,232,563. There were 1,521,355 people on the pay-rolls of the railroads, equivalent to 684 employees per hundred miles of line. Of this number 59,855 were enginemen, 62,678 were firemen, 43,936 were conductors and 119,087 were other trainmen. The employees in general administrative work numbered 57,054; for maintenance of way and structures, 495,879; for maintenance of equipment, 315,952; and for conducting transportation, 649,820. The par value of the outstanding railway capital was $14,570,-421,478, equivalent to $67,936 per mile. Of this amount 33.46 per cent. paid no dividends. The amount of dividends declared during the year was equivalent to 6.03 per cent. on dividend-paying stock. The average revenue per passenger-mile was 2.002 cents, and the average revenue per ton-mile was 0.748 cent. The total number of casualities during the year was 108,324, of which 10,618 were fatal. During 1906, one passenger was killed for every 2,227,041 carried and one was injured for every 74,276 carried.

Book Notes.

An excellent little trade list known as the "Directory of Portland Cement Manufacturers of the United States," has been compiled and published at $1.00, by Mr. C. Earle E. Bottomley, Land Title Building, Philadelphia. The compiler's position as secretary of the Association of American Portland Cement Manufacturers gives him the best of opportunities for obtaining accurate information regarding existing and projected companies. The statements in this directory have been corrected to Aug. 1 of the current year, and have been approved by the companies mentioned except in a very few cases. The information is arranged in the same order under the head of each company, and the notes relating to the companies are arranged alphabetically, the first company being the Aetna, and the last the York. The notes give the location of the principal office and that of the works, a list of the officers and the heads of departments, the capitalization, and the capacity of the mills.

For a good many years Mr. John K. Allen has been doing good work for sanitation through the columns of "Domestic Engineering," a trade journal which was started shortly after The Engineering Record, and has been maintained ever since as an exponent of good design and workmanship in everything relating to the heating, plumbing and lighting of buildings. During this period the sanitary fittings of a house have completely changed in their character, and what was the luxury of a few a quarter of a century ago is now the necessity of all. This is shown in a number of places in Mr. Allen's "Sanitation in the Modern Home," a small volume full of sound advice concerning the selection and drainage of a building site, the general interior arrangement from a sanitary viewpoint, the proper construction of cellar floors and walls, plumbing in the different rooms, warming by steam and hot water, furnace heating, ventilation and temperature control, lighting and other subjects. The information is well arranged and presented in such a form that anybody interested in healthy and comfortable houses can readily grasp it. (Chicago, Domestic Engineering.)

A description of works executed between 1897 and 1905 by the Mediterranean Ry. Co. has recently been issued in two sumptuously published quarto volumes profusely illustrated bearing the title "Relazione sugli Studi e Lavori Eseguiti dal 1897 al 1905." The text volume is divided into several parts, while the large atlas contains many admirable drawings and engravings. The book is mainly interesting for its account of the railroad connecting the Simplon Tunnel line with the Italian railway system. This connecting line has a number of unusual features: much of it lies through an Alpine country where the construction was extremely difficult and in places it was necessary to use helical tunnels such as were first introduced for overcoming grades on the St. Gothard R. R. The first part of the volume describes the railroads built by the company as contractor, and the second part is a collection of papers concerning their technical features, including extensive earthworks, masonry structures, iron bridges, tunnels and buildings. The last part of the book is a collection of monographs on some of the more interesting technical subjects. These include several tunnels in rock and in soft earth, the specifications for bridges prescribed by the Italian Government and other specifications for the same class of structures suggested by the company, and the geology of the region in which the work was done. The volumes form one of the most elaborate publications of an engineering nature ever issued and will be found full of valuable information concerning the construction of tunnels and railway work. (Milan, Società Italiana per le Strade Ferrate del Mediterraneo.)

Investigations of the mechanical properties of wood by the United States Forest Service are being conducted by several timber-testing stations in cooperation with the University of California, Purdue University, the University of Oregon, the University of Washington and the Yale Forest School. The general aim of these tests is to supply useful information for engineers and architects as well as to determine the value for specific purposes of quick-growing woods thus promoting the practice of conservative forest management and determining proper substitutes for material which is more valuable for uses other than those for which it is now employed. At the present time the programme of the investigation calls for tests to determine the properties of structural timber made on pieces of commercial size and grade: tests to determine the effect of the rate of application of the test loads and the effect of moisture, and tests to ascertain the influence on the properties of timber, of preservatives, methods of seasoning and fire retardants. The determination of the effect of moisture was assigned to the technical laboratory of the Yale Forest School under the general direction of Professor J. W. Toumey. The work was done by Mr. H. D. Tieman, and his report has recently been issued by the forest service under the title of "Effect of Moisture upon the Strength and Stiffness of Wood." Mr. Tiemann has determined factors by the use of which the results of tests of wood having various degrees of moisture may be reduced to a common basis in the case of certain species and certain kinds of tests. He has established the percentages of moisture at which the cell walls are saturated in the case of these species, and has determined the true nature of the law representing the effect of any further reduction of moisture on the strength of timber. His studies explain the reasons for the various facts and his subsidiary studies on case-hardening, on prolonged soaking, and on soaking followed by drying have direct application to the utilization of timber. The results apply to hardwood in small forms, such as are used in carriage building, and to softwood timber in some forms, such as crossarms for telegraph poles, where thorough and uniform drying and consequent large increase in strength may be obtained. An abridged form of the paper has also been published by the Forest Service under the title of "Strength of Wood as Influenced by Moisture," which contains the valuable reduction tables of the complete monograph.

So much depends upon proper illumination by artificial means that it is rather surprising no book on the practical features of the subject was published before Messrs. J. R. Cravath and V. R. Lansingh wrote "Practical Illumination," a work equally valuable to the technical and the non-technical reader. It is generally recognized that a large proportion of the light furnished by artificial means is wasted, while oculists are agreed that a considerable part of the deterioration of eyesight now so prevalent is due to the improper use of artificial lights. Accordingly the authors confine their discussion to the best use of light after it is produced rather than the apparatus for producing it. Most of the tests described were made in the Electrical Testing Laboratories of New York, and were thus uniform in method and character: no tests made by manufacturers have been used. Interior illumination alone has been considered, and a great many illustrations are given to show bad and good arrangements of lamps for a given purpose. The first three chapters outline the laws of light and its measurement and explain the methods of calculating the amount of illumination, thus preparing the reader to un-

derstand the methods of rating different sources of illumination adopted by the authors. Three chapters follow on individual electric, gas and acetylene burners, and their reflectors, shades and globes. The amount and dispersion of light from a naked source of illumination and their modification by reflectors and shades is a subject that few people have considered as carefully as they should, or otherwise the inefficient "decorative" shades so often seen where art alone is considered would have no sale. The number of people whose eyesight is hurt every night by attempts to reproduce the visually-destructive dinner-table candles of our forefathers must be enormous, and many have inveighed more than once against the outrages committed in the name of illumination in reading rooms and libraries. The use of clusters of incandescent lamps is becoming quite prevalent for some purposes, and a chapter is devoted to a discussion of methods of obtaining the best results from such groups. Chapters are also given on the characteristics of Nernst, electric arc, gas arc and vapor lamps, and the diagrams of the distribution of light from them give full information to those who are considering their use but are uncertain concerning the illumination they will give. Two important chapters explain the methods of making practical tests of lamps by means of demonstration rooms, and summarize the authors' views regarding the comparative uses of different illuminants. The remainder of the book describes the selection, arrangement and improvement of artificial lights for many classes of indoor service. It is illustrated by engravings showing the lighting arrangements, good and bad, in many different rooms, and will appeal directly to all who have been puzzled about the best way to light individual rooms as well as entire buildings. (New York, McGraw Publishing Co., $3.00.)

Letters to the Editor.

THE UNION PACIFIC LOCATION.

SIR: In an editorial article entitled "The Function of Light Railways," in The Engineering Record for August 31, 1907, occurs the following statement: "Railroads have grown over the country in a sprawling, irregular fashion ever since the zig-zag war dance of the Union Pacific over its land allotments." It surprises and grieves me that such thoughtless language should be permitted to appear in a leading article of a paper conducted with the dignity and fairness which we are accustomed to find in The Engineering Record.

One infers from the quotation above cited that the editorial writer believed that the Union Pacific Railroad as originally built was located on a tortuous route, so as to make it as long as possible and thus increase its land grant, which was so many sections of land per mile of main line. Such loose talk has appeared from time to time in the speeches of cheap politicians, with an axe to grind. But it is unkind for a reputable engineering paper to publish such a gratuitous reflection on the character of the engineers who located and built the Union Pacific.

When that line was built the country through which it ran was a wilderness populated only by savage Indians. There was no traffic except as the railroad created it. It was a common saying for years after the road was opened that the receipts from the occasional trains were not enough to pay for the fuel and wheel grease used. It would have been the greatest folly to make expenditures at that time necessary to build a twentieth century trunk line. And yet what was the character of the line the Union Pacific did build in the sixties? This question is practically answered by investigating the work done during the past ten years in efforts to improve grades, alignment and distance. With practically unlimited funds to draw upon, after thorough surveys and careful examination by skilled engineers, with able contractors, a railroad in operation to deliver men and materials at any desired point, the railroad people, after years of effort and millions of expenditure, succeeded in cutting down the total length of the Union Pacific from 1033 miles to 1003 miles, less than three per cent.! Does that look like a "zig-zag war dance over land allotments?"

The original location of the Union Pacific Railroad, with which I never had anything to do, not even an acquaintance with the engineers who made it, was a piece of remarkably good engineering judgment from beginning to end, and will be so esteemed by all thoughtful engineers who may be able to investigate the facts. The Union Pacific was not built in "sprawling, irregular fashion," although financial necessity has often compelled railroads in other parts of the country, which were built in the days of small things, to adopt that sort of a location.

Respectfully, T. A.

THE QUEBEC BRIDGE COLLAPSE.

SIR:—I beg to submit a theory of the Quebec bridge disaster that accounts for every phase of the disaster so far as the facts have been made public. The theory thus far given the greatest prominence is entirely inconsistent with the facts for the following reasons. (This theory is that a bottom chord member, A9L, on the left truss in the anchor arm failed and brought down the structure.) In the first place it is unbelievable that a member of the size of the one under suspicion, with the intensity of strain it sustained, could have failed under a steady load. In the second place, initial failure of a bottom-chord member on the left truss would have thrown the whole structure to the left and not to the right as it actually fell. In the third place, initial failure in the bottom chord of the anchor arm would have thrown an enormous thrust at the foot of the tower and pushed it toward shore instead of allowing the greater part of the tower to fall riverward. In the fourth place, if the failure were the result of the continuation of the weakness observed in bottom chord member A9L, we should look for that member to fail by bowing, since it was a partial bow that was observed. In the general collapse, however, this member took an S shape.

My theory is that the traveler, which was about twice as high as the truss where it was standing, was either pulled over by accident or fell over due to insufficient cross-bracing, and that this fall to the right threw the whole top chord system to that side, crushing the vertical posts and thus causing cumulative failure of the entire superstructure. The pulling over of the erection gantry or traveler may have been done by the workmen in bracing the traveler for the night. It is customary to take the falls from one side of a traveler and attach the block to some part of the other side of the structure, then vice versa, forming X-bracing. The pulling on one such diagonal line could easily start the traveler to fall. The truss posts could not resist the fall.

The reasons I have for believing that the whole cause of failure was due to the traveler are as follows:

(1) The traveler was being dismantled, and, though 300 tons of its weight had been removed, 800 tons remained. If only 500 tons of this was in the top structure, there would be a force of about five tons at the top chord of truss for every foot that the side bents were out of plumb.

(2) The traveler had little or no lateral bracing. If it was braced, it must have been with wire ropes, which in any event, by reason of their extensibility would allow large stretch and large swaying.

(3) The vertical posts, excepting the main tower post, had little stiffness laterally to resist such a force as this traveler would produce. The single lacing was in planes normal to the truss, making the posts exceptionally weak in that direction.

(4) A blow from the traveler, such as its falling to one side would produce, would cause just such a failure as the one that occurred. It would deflect the top chord, with the sway-bracing, to one side, and the weakest part, namely, the part of the posts beside the roadway opening, would bend. This would allow the entire upper system to come down.

(5) This theory would agree with what little has been published as to the observation of men at the bridge. They say no swaying of the structure was observed. This would be expected on account of the stiffness of the lateral system at floor level. They say that the floor of the anchor arm sunk and they had to run up hill. This would be the case if the upper structure should come down: the lower chord as an arch would not stand the weight of the floor. If the lower chord failed first on one side and in one member, there would be swaying of the floor because of the unsymmetrical failure.

(6) The S shape assumed by A9L, the lower chord member that is supposed by some engineers to have been the cause of failure, fits exactly in this theory. Your account states that this S was in both members A9. The lateral thrust to the right would be communicated down the first main diagonal and the first main post in the anchor arm, at the foot of which one end of A9L was located; and this end of A9L would be pushed to the right in forming the S, just as it was found to be. This lateral push was even enough to overcome the observed bow of which so much is made and reverse half of it.

(7) The failure must have been something that affected both trusses alike otherwise the almost vertical drop is inexplicable. This would be the case with a lateral force exerted against the top chord; for as soon as the vertical posts, which were under heavy stress, would bend to one side enough to fail, everything else would give way almost at once, and every part of each truss would be affected just alike. The sway bracing between posts above the overhead struts and below the floor would hold the posts vertical in these portions until the force of the fall would crush the posts.

There is nothing mysterious about the above theory to account for the failure, and it does not carry with it the suspicion that all other large structures in which there are heavy compression members may be on the point of failure. The failure is simply brought into the class with about all other great erection failures, and is due to an omission to provide sufficient unyielding sway bracing.

Yours very truly,
EDWARD GODFREY.

Pittsburg, Sept. 14.

THE PEAT-BRIQUETTING PLANT of the Commercial Artificial Fuel Co., near Lambertville, Mich., has a capacity of 60 tons daily, the product containing 16.7 per cent. moisture, 55.3 volatile matter, 20.5 fixed carbon and 7.5 ash. Its heating value is stated to be about 10,600 B. t. u. per pound. The peat is obtained from a 10-ft. bog by a dipper dredge and taken in scows to the plant. Here it is first passed through a cutter, in which it is thoroughly disintegrated, and then through a kneading machine. It is next compressed and discharged through a die as 4x4-in. bars, which are cut by knives into briquettes 12 in. long. The latter are then dried like soft brick in sheds.

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TABLE OF LEADING ARTICLES.

The Public Roads of the United States.

About ten years ago there was considerable controversy concerning the approximate length, cost of construction and maintenance charges of public roads in this country. Some figures were given out by government officials regarding the advantages to farmers of public roads of fairly good construction, and these figures were attacked as extremely inaccurate, and also for the illogical use made of them. The tilt between Prof. I. O. Baker of the University of Illinois and the late Roy Stone will be recalled with considerable interest by those who followed this controversy. Probably the figures were far from accurate, but they had a certain measure of value as attempts in the direction of securing information on which to base some decidedly important studies. It goes without saying that the federal government is best equipped to gather information of this nature, and Mr. L. W. Page, director of the Office of Public Roads of the Department of Agriculture recognized this fact some time ago and arranged for another and better investigation, covering the mileage, revenues and expenses of public roads in 1904 throughout the country. By his enthusiasm in public road affairs he was able to interest officials and private individuals to help him in this work, and the result, just made public, is an interesting compilation of data far more reliable than any previously gathered in this country.

The collection of the statistics has been a troublesome task, not only on account of the great diversity which exists in the methods of carrying on road improvements in different parts of the country, but also because it was necessary in some cases to write from fifteen to twenty letters to a single township in order to secure all the information needed to make the investigation complete. In some states there are as many as 1,500 of these townships which must be taken into account. In states where road taxes are assessed and collected by county officials, the task was comparatively easy, but that it was an onerous undertaking is shown by the fact that about 60,000 communications had to be sent out before the investigation was complete. The systems of road taxation and the methods of collecting and sending road funds differed so radically in various states and even in parts of the same state that it was necessary to prepare a great variety of blank forms before all the data could be obtained. After they were secured the accuracy of all doubtful figures was verified so far as practicable. Some reports were returned to those making them for checking or correction, and in some states the heads of the highway and geological departments rendered valuable aid in revising the figures. It is possible, however, that errors crept in, for the mileage of roads on the boundary lines of townships and counties may have been reported twice in some cases and not at all in others. The roads in many counties and townships have never been surveyed and estimates had to be made of their length in such cases. In some places no permanent records have apparently been kept of the collection and expenditure of road funds and in other places the records are in a confused condition. In a few instances the officials refused to supply the information unless paid by the Agriculture Department, and as the Department had no funds for the purpose, it became necessary to secure the information through unofficial sources. Taking the figures as a whole, however, it is believed that they are fairly correct and will form a valuable basis for comparison and future work.

The report uses the term "improved road" as signifying a highway graded, drained and surfaced with a material or combination of materials or treated with the application of some preparation resulting in a reasonably smooth, firm and durable surface. The figures show that in 1904 there were 2,161,570 miles of public road in the United States of which amount 7.14 per cent. had been improved as above defined. Of these improved roads 108,233 miles were surfaced with gravel, 38,622 miles with stone, and 6,810 miles with special materials like shells, sand-clay, oil and brick. Taking the country as a whole, there is 0.73 miles of road per square mile of territory, or 1 mile of road to every 35 inhabitants and 1 mile of improved road to every 492 inhabitants. These figures do not include roads in the Indian Territory, Alaska, and the island possessions or the mileage of roads in incorporated cities and villages.

The District of Columbia stands first with 3.18 miles of road per square mile of area, and Connecticut is next with 2.0 miles. Rhode Island has 2.24 miles, Pennsylvania 2.21 miles and Arizona has but 0.05 mile. The District of Columbia has 1,459 people per mile of road, Rhode Island 181 people, Massachusetts 164, New Jersey 127 and Connecticut 64. Nevada has but 3 persons per mile of public road, North Dakota 5, South Dakota 7, Wyoming 8, Idaho and Oklahoma 9 each and Montana 10. These figures relate to public roads of every sort. When the improved roads alone are considered, Indiana is found to have the largest mileage, 23,877 miles. Ohio has 23,460 miles, Wisconsin 10,633 miles, Kentucky 9,486, California 8,803, Illinois, Massachusetts and Michigan over 7,000 miles each, Minnesota over 6,000 miles, and New York over 5,000 miles. In about two-thirds of the states gravel has been the principal surfacing material used in improving the roads. Massachusetts has 45.89 per cent. of the roads improved in some manner, Rhode Island has 43.26 per cent., Indiana 34.94 per cent., Ohio 33.78 per cent., California 18.87 per cent., Connecticut 16.75 per cent., Wisconsin 16.72 per cent., Kentucky 16.60 per cent., New Jersey 16.32 per cent. It is interesting to observe how closely the higher percentages of improved roads agrees with the higher figures of population per mile of road. Unquestionably this fact is the kernel of the growing regard with which railroad corporations are holding highway improvements. Improved highways are becoming the best feeders for railways, and the heads of great railway systems are now seriously directing their efforts toward securing the betterment of common roads.

The feature of the investigation which is most important, however, is not that relating to the extent of the improvements, but rather to the amount of the expenditures for highway work in different parts of the country and the returns obtained from these sums. The investigation shows that during 1904 the public roads were responsible for an expenditure from property and poll taxes, bond issues and state-aid funds, together with the value of labor expended under the statute-labor laws, of nearly $80,000,000. Of this amount nearly $54,000,000 was obtained from property and poll taxes payable in cash, nearly $20,000,000 was the value of the labor taxes, and the remainder came from bond issues and state-aid funds. The expenditure amounted to $37.07 per mile of public road, or $1.05 per capita. These figures include the cost of such bridges as were necessary in connection with road improvements. Although the sum is small when it is divided on the basis of the total mileage of public highways, it is about eight-thirteenths of the expenditures for public schools in the country during 1903-1904, and about ten-thirteenths as much as was spent for river and harbor improvements.

The voluminous statistics which the Office of Public Roads has just made public shows conclusively that the best results will be obtained in those states where all road taxes are paid in cash, in order that the work may be placed in the hands of persons who have a practical knowledge of the subject and whose duty it is to devote their whole time and attention to highway improvement. New York and Pennsylvania have encouraged this practice by giving over to all counties where the practice of working out road taxes has been abolished in favor of cash payment, a certain percentage of the amount of the taxes so collected. Taking the country as a whole, the figures show that if the percentage of improved roads is a fair standard for judg-

ing the condition of a district, the best results have been obtained in those states which have abolished statute labor and where the road taxes are paid chiefly in cash. The amount of property taxation for road purposes varies widely, and one of the best features of the investigation referred to is the compilation of information concerning what is done in this respect throughout the country. If the investigation produced no other result than this comprehensive statement of taxation for road purposes, it would have been fully justified. It is impracticable to summarize it here and the reader is referred to the full report for it. The document is an important contribution to our knowledge of roads, and the Office of Public Roads is to be congratulated on the success of its investigation, from which a good many people did not expect any such useful and instructive results.

Operating Records in New Power Plants.

In the construction of a new power plant for important service the installation of the machinery usually takes so much attention from the operating staff that there is little opportunity for the keeping of records in great detail. Everyone realizes that it is useless to expect good economy in fuel consumption and labor cost per kilowatt-hour before the plant is half loaded, and for this reason the question of log sheets and load curves is generally one of the last things to be put on a regular working basis. In some plants practically no records are kept until the station is opened for commercial service.

The wisdom of not attempting too great refinement in early records is indisputable, but it is clearly a mistake to go to the other extreme and keep practically no station log whatever. For example, in the case of a power plant approaching completion in connection with the electrification of a steam railroad, steam is sure to be demanded from the boilers long before commercial trains begin to run; engines or turbines must be turned over and gradually speeded up to full usefulness; and some of the generating units will be finished in installation before others and will be needed for the operation of trial trains on experimental track sections, or for supplying current for construction purposes. In an industrial plant designed to supply power to a motor-driven factory installation certain departments will be first equipped, tested and commercially supplied, current being required more or less irregularly each day or two until the changeover is to a considerable extent completed. If no records of fuel consumption by days, general load variations and partial or complete shifts of attendance are kept, the company may know the grand total cost of getting the plant ready for service, but it will not know anything about the behavior of the installation on the cost side in relation to the exigencies of irregular though practically continuous service.

The main points of operation should be noted day by day during the construction period quite as much as in the routine days to follow. It ought to be possible to keep a close record of the coal burned each day, the total station output each day, the water consumption and the hours of attendants put in on operating work as distinguished from inspection of contractors' doings. It is a nice question in electrical auditing to determine just what part of a plant's running expenses during the installation period should be charged to construction, and what part to the operation of the service, as in the case of supplying trial trains with electric power. Separate meters are valuable in this connection, even if their use is temporary.

It is often claimed by the owners of new plants that the load curves imposed upon the station by the inauguration of a partial service are not representative, and therefore are of little interest. Few plants can show a daily load curve from the first hour in which they supplied current for actual use down to the present, but it is a fact that the study of some of these freakish diagrams in cases where they have been taken has proved to be of the greatest value from an engineering standpoint. It is distinctly the conception of the layman that matters must be well established in an installation before the results of operation will be instructive. Of course, deductions from incomplete data are a positive hindrance to good work, but if all the essential conditions are known, their analysis is bound to be suggestive, no matter how wide may be the departure of the data from the ordered regularity attained in routine service. The chief engineer may not have time to plot load curves himself during the construction period, but if the essential readings are taken and recorded, the deductions can be made at leisure. It is better to find out that a given machine needs modifications to secure economy before commercial service begins than afterwards. Just how much attention should be given by the operating staff of a station to construction and installation pure and simple is a question; practice in the past has neglected operating problems in the early stages in favor of assembly and erection oversight, but in the future it is probable that more consideration will be paid to the broader questions of plant economy. If the company's organization permits, its regular engineering staff rather than the operating men in the station itself should be charged with the duty of seeing that specifications and guarantees are met by contractors.

No general rules can be laid down as to the form of records best adapted to the needs of a plant in the early stages of its work, but a little foresight in each case will enable the essentials to be properly recorded. If a standard size of daily, weekly or monthly log can be determined at the outset much will be gained even though the forms of charts and tabulations may necessarily be varied and extended later. The great point is to have the records filed consistently with one another, leaving ample space for future contingencies. The deductions may be irregular or postponed, but if the facts are at hand, the company will never regret securing them during the days when everything in the plant from the coal-handling machinery to the high-tension lightning arresters was in a state of upheaval. Fuel consumption, labor, water and supplies will show extravagant figures per unit of output with the abominable load factors which irregular outputs in the construction period throw upon the plant, but they point the way toward a more efficient service as the duty of the station broadens out into routine service. It would be an instructive thing to plot the curve of coal consumption per kilowatt-hour from the early weeks of a new plant's service down to the months of regular operation on commercial loads, taking the fuel as the ordinate and time as the abscissa. Yet, as suggested above, few plants have the data upon which such a curve could be built. Such will not always be the case, for the time is coming when engineers will study the abnormal conditions of early service with the same interest that they give to the records of plants which have been turned over to the owners for the rest of their commercial lives. A special reason for keeping such records is their probable usefulness when something goes wrong during operation. It is well known that those who become acquainted with the behavior of a plant while it is being tuned up are generally able to locate promptly the cause of any troubles that subsequently arise.

The Maintenance of Small Works for Treating Sewage and Water.

The rapid increase in the number of small works for the treatment of water and sewage is noticeable, and it is therefore timely to sound a note of caution regarding the results to be expected from such plants. Practically all of them depend for their efficiency upon the properly controlled action of bacteria, and this action is affected by a large number of different conditions, some of which we are fairly well acquainted with while others present an almost untouched field of research. Most of the larger plants for purifying water and treating sewage are operated in a fairly efficient manner, and some of them receive excellent attention. This is not true, however, of the smaller plants, and as the total investment in them is probably much larger than that in the works built for great cities, the importance of a better appreciation of the responsibility for their efficient management is evident. For some reason it is comparatively easy to secure an appropriation for the construction of such works for small cities, but extremely difficult to have the plants managed properly after they are built. In fact, there are so many sewage disposal works in the Central States which are now practically useless on account of mismanagement that it is somewhat surprising more plants are being constructed all the time. It would seem as though the poor results from these mismanaged plants would stop the progress of sewage disposal. This would have happened, probably, were it not that public health authorities generally have power to compel small cities and towns to put in sewage disposal works, although unfortunately they have not been given authority to compel the owners of such plants to operate them in an efficient manner. It is strange that a town should be willing to spend a considerable sum in proportion to its resources for a sewage disposal or water purification plant, and then by its failure to put the works in charge of a competent man should practically destroy the value of such an investment. Yet this condition can be observed in so many places that it is a manifest fact which sanitary engineers must recognize. They are being held responsible in a considerable measure for the failure of a good many of these ill-managed plants to run as they should, and it therefore behooves them to take steps which will prevent such undesirable criticisms of their work.

There is a great difference in the character of the sewage and in the nature of the water supplies of different places, and for this reason hard and fast rules applicable to all communities have to be of such a general nature that they are useless except as somewhat superficial suggestions. Moreover, just what details will be most satisfactory in the management of sewage disposal and water purification works in any city may be open to some doubt. The most an engineer can do in designing such plants is to provide a system of works having enough flexibility so that by careful observation of the early stages of operation, the best procedure can be ascertained. When it is ascertained, the maintenance of the operations according to this method is comparatively easy. Where the character of a water supply fluctuates considerably from month to month and in those places where the sewage is liable to change in character for one reason or another, there is particular need of a careful study of the operation of the plants during the first few years they are in service. Accordingly there are good grounds for the belief that designing engineers will do well to urge their clients in some cases to make contracts with them to supervise the operation of sewage disposal and water purification plants for a sufficient period after their

completion to insure a full determination of the problems that will arise and the methods of meeting them. This supervision is not necessarily an expensive matter; it may cost considerably less than the losses incurred through faulty management of the works. It does not necessitate the constant presence of one of the consulting engineers at the works, nor does it require a highly trained chemist or biologist to be in constant attendance. In most cases the same class of men who have mismanaged the plants in so many small places, owing to their ignorance, could have been trained to look after the works properly if they had been under the supervision of the designers of the works from the outset of the operation.

The remedy for the present unfortunate situation lies largely with the designing engineers. If they take the position in arguing with their clients that the works built from their plans form a delicate piece of apparatus, which must be managed with a much higher degree of attention than a machine tool or an engine, in order to produce the best results, it is but reasonable to expect that the supervision of such works will be entrusted to their designers during a sufficient time to insure the proper training of the attendants and the proper procedures in treating the water or sewage under the different conditions that arise during the year. So much criticism is being made concerning the inefficiency of works of this nature, that engineers making a specialty of such plants ought to protect themselves by urging their clients to place the works under their supervision for operation during a short time at least.

A Possible Result of Electric Train Operation.

Elsewhere in this issue there is a description of some of the engineering features of the difficult mountain section of the Western Pacific Railway. It will be noticed in the article explaining it that there is an exceptional opportunity along the line to develop a large amount of water power; in fact, a power company has been formed for the purpose and it is currently understood to be working in harmony with the railway company. In the same way there are excellent opportunities for power development on the mountain line of the Chicago, Milwaukee & St. Paul extension to the Pacific Coast and also near the other northern trans-continental routes. It is generally believed that advantage will shortly be taken of these exceptional opportunities for developing water power to operate mountain sections of some of the roads electrically. The arrangements for electric traction were outlined in this journal on August 17, and it is unnecessary to review them at length again. The great advantage offered by the introduction of the electric locomotive is believed to be the increase of tonnage capacity of single track and the general reduction in cost per ton-mile resulting from handling heavy trains at higher speed with a certainty of operation not practicable with the steam locomotive. By properly proportioning the electric locomotive and the power station and line, it is practicable to operate trains at any speed up grade that is consistent with the alignment of the track. In other words, the same schedule can be maintained upgrade and downgrade, and the movement of trains on heavy-grade sections can thus be greatly facilitated.

There is another feature, however, of electric operation which will probably be found an important one, although it is opposite in a sense to that just stated. At the present time there is a marked demand for a more rapid movement of mixed freight. One of the serious criticisms against certain Western railroads is that even when high rates are paid for moving freight, the latter is handled only when the railroad gets ready and not with reasonable regard to the necessities of the shipper. In other words freight of every sort, except the most perishable classes, is held until a train load is secured satisfactory to the operating officials. Naturally enough on those roads which have been laid out with a view to handling business in this way, the attempts of the shippers to secure prompt deliveries by sending out lighter trains at more frequent intervals are not met with any marked degree of enthusiasm. There can be no question, however, that this matter of delay is responsible for a considerable part of the present general belief among business people and farmers that a reform can be made in some branches of railway operation without hurting the stockholders of the road and to the great advantage of the shipper.

Just how far the use of electricity will enable such a change in operation to be made is something of a problem, for it involves a good many other things than the use of electric locomotives. For instance, sidings have to be provided in suitable places for frequent short trains as well as for long heavy ones, and these sidings should not be at the same places for both kinds of operation. The amount of time a train spends on sidings when traffic is at all heavy is often so large as to be a material factor in the total time of transit of freight. It seems fairly possible, however, that electric operation on mountain grades for heavy trains, by supplying the means for equally economical operation of more frequent lighter trains, will lead to experiments with the latter. This is contrary to accepted methods of economical railway operation with steam locomotives, but if electric operation permits the defects of those methods to be avoided without appreciable sacrifice of economy, public opinion will eventually compel their adoption.

Notes and Comment.

THE BELMONT TUNNEL connecting Long Island City and Manhattan was traversed on Tuesday morning by an electric car carrying about forty officers of the road and the city and guests identified with New York traction matters. Later in the day, at a luncheon at the Hotel Belmont, a silver model of the car was presented to Mr. St. John Clark, chief engineer of the work, whose energetic direction of the tunneling operations is largely the cause of the fact that the first regular passenger car entering Manhattan by way of a subaqueous tunnel ran over this route. The work has been fully described in The Engineering Record of March 3, 1906, and June 8, 1907. It consists for the most part of two parallel single-track tunnels 28 ft. apart on centers and is about 1,700 ft. long. Three sections have been used, according to the material traversed. In rock the concrete lining has a clear width of 12½ ft. and a clear height of 13 ft., and is of horseshoe shape. In earth, the tubes have a segmental iron lining with a clear diameter of 15½ ft., and in Long Island about 1,800 ft. of double-track rectangular reinforced concrete tunnel has been built. Some of the shield work has been very difficult and dangerous. Where the sand was very soft, the shields were pushed ahead without excavating at all until the sand became too dense for any further movement and had to be removed in the usual way. Where it was soft, it was the custom to remove the slope under the hood of the shield as rapidly as possible and support the face by a bulkhead of horizontal boards braced against the shield, the diaphragm being backed with hay where the sand was fine enough to penetrate the cracks. Mr. Robert Shailer, chief engineer for the Degnon Contracting Co., which built the tunnel, was in personal charge of this work, and the manner in which he conducted it has been warmly commended by specialists in such construction. Mention should also be made of the expedient to prevent distortion of the iron lining by temporary unbalanced pressures. Each alternate ring, as soon as set, was provided with a 1¼-in. horizontal tie with sleevenut adjustment; this was pinned to the flanges of the ring at the springing line, and screwed to a moderate initial tension, holding the lining in shape until the earth settled firmly about it or grout could be injected behind it. Less has been said about this work than any other of the subaqueous tunnels entering the city, and most of the attention it has received has been due to controversy concerning the franchise under which operations have been conducted. When the terminal facilities are completed it will open up a rapid transit route into the heart of Manhattan which should play an important part in the development of the Borough of Queens, a section of the city which has been developing slowly on account of the absence of adequate communication with Manhattan. The location of this borough is such that the completion of the Belmont tunnel, the Blackwell's Island bridge and the Pennsylvania tunnels seem likely to bring it into a far more important rank in the divisions of the city than it has heretofore held.

THE BREAK IN COPPER PRICES is one of the most interesting recent commercial incidents to engineers, for it brings down to a reasonable basis of cost a very important metal for many industries. While the manifold extensive uses of it in electricity have increased surprisingly in the last decade, the production has also increased, and it has seemed very strange for some years that the price of the metal should remain so high. The explanations advanced, asserting enormous demand and barely sufficient production, hardly seemed consistent with known facts concerning metallurgical operations while it was felt that market manipulation was an important factor in the conditions. It is now known that these surmises were correct. There is an enormous stock of unsold copper on hand which has at last caused a sensational drop in prices, and the high prices for the metal have resulted in the production of alloys which may be substituted for it with a saving in cost for equal efficiency. The composite cable of steel and aluminum wire recently introduced for transmission lines is an example, and the substitution of aluminum for copper in various parts of electrical apparatus is going forward steadily. Nevertheless copper must always have an important place in the industrial world, and for this reason a study of the conditions leading to the present situation is advisable as likely to suggest a way to avoid another abnormal upward soaring of prices under the manipulation of masters of high finance.

THE INTERNATIONAL PHOTOMETRIC COMMISSION which met at Zurich this summer has settled some things regarding primary standards of light now in use. There are three of these, the hefner, the pentane standard and the carcel. The last is deficient in uniformity and reproducibility, and is not as good as the others; its importance is due rather to its considerable use than to its excellence. The hefner is open to criticism on account of its small power and inconvenient color, and the 10-c.-p. pentane standard is relatively complicated and subject to variations with atmospheric fluctuations. Moreover, in spite of the skill shown in experiments to compare the luminosity of the various standards there is an outstanding discrepancy of 5 per cent. in the results to be accounted for in some way. The discussion by the Commission shows that the investigation leading to a satisfactory primary standard of light will be a long one, since not only has the thing itself to be found, but the inertia of long usage must be overcome.

ENGINEERING FEATURES OF THE WESTERN PACIFIC RAILWAY.

By George P. Low.

When the Central Pacific R. R. was built, the aim was to secure railway communication between Ogden and the Pacific Coast by the easiest and most feasible route, to obtain which heavy subsidies were granted by the national government. The problem then was one of construction, viewed in the light of which its builders accomplished a marvelous piece of engineering work. To-day the problem to be solved in building a transcontinental railroad pertains to operation rather than to construction. The distinction is marked; where the Central Pacific spanned the distance from Ogden to San Francisco by the most readily-constructed route, the Western Pacific, in practically paralleling it, as shown in the map, virtually ignored any and all difficulties of construction where operative efficiency could be increased by so doing. In consequence, the Western Pacific engineers are to-day hewing a grade out of the granites of the Sierra Nevada Mountains that in many respects constitutes the most remarkable piece of heavy railway construction in existence.


The Western Pacific Railway Grade through Oroville and Five Miles East of That City.

The Western Pacific line will be longer than that of the Central Pacific by 143 miles, but its maximum grade after having been compensated for curvature will not exceed an actual 1 per cent., while that of the Central Pacific is 2.6 per cent (not 2.2 per cent. as claimed), with many miles of 10 deg. curves which bring the maximum gradient up to virtually 3 per cent. On the Western Pacific the maximum curvature is 8 deg. The Central Pacific crosses the Siera Nevadas at an elevation of 7,019 ft. above sea level, which necessitates the expensive maintenance of some 40 miles of snowsheds. The Western Pacific crosses these mountains at an elevation almost exactly 2,000 ft. lower and no snowsheds are necessary; during last winter, which was unusually severe, the maximum depth of snow on the line of the Western Pacific was 4 ft., while on the Central Pacific it was in excess of 40 ft.

It is anomalous that a piece of engineering work which is as heavy and as remarkable as is the trans-Sierran line of the Western Pacific should be so scantily possessed with features of engineering interest—indeed, the line presents greater opportunities for depicting natural scenery than for describing engineering achievement. The work is heavy in that practically throughout the mountains the grade is cut into the sides of rock-walled river and creek canyons, and it is remarkable, not only in that it crosses the Sierras at a comparatively low altitude, but in the manner in which it gets added distance and a lighter grade than would have been possible by adopting the more direct route presented in the canyon of the Middle Fork of the Feather River. The Sierra Division, covering 163 miles between Deep Hole, Nev., and Spanish Creek Crossing, Cal., contains two tunnels and a loop worthy of particular mention, and the North Fork Division, of 76 miles between Spanish Creek Crossing and Oroville, contains some special structures, but aside from these few features, standardization in all work prevails so universally that to describe one tunnel, for instance, describes all.

The most interesting portion of the line is in California from Chilkoot Tunnel, near the Nevada State line, to Oroville through a practically inaccessible region, although in the early days Beckworth Pass, which the line occupies, was well traversed. In traveling westerly, the Nevada-California State line is crossed at an elevation of 4,359 ft., whence the grade turns sharply to the south and enters Lake Valley, along which it parallels the Nevada, California & Oregon R. R. for about 17 miles, when it again takes the westerly course and, rising constantly with a maximum grade of 0.8 per cent., crosses the main divide of the Sierra Nevadas through the Chilkoot or Beckworth tunnel at an elevation of 5,018.76 ft. above sea level, the elevation of the trail over Beckworth Pass proper being about 5,250 ft. A slightly descending grade (0.4 per cent.) takes the line some 20 miles before reaching the town of Beckwith, and the head of the maximum grade of 1 per cent. extending practically all the way to Oroville, which is at an elevation of 199 ft.

The Middle Fork of the Feather River is reached within half a mile of the town of Beckwith, three crossings being made during the ensuing 12 miles. For 30 miles the grade follows the Middle Fork in a general northwesterly trend until reaching Spring Garden Tunnel, where it leaves the river at a point 15 ft. above extreme high water mark and cuts northwesterly through a divide which brings the line out on a small tributary of the North Fork of the Feather River. Though 80 miles of land lying within the State of California has been traversed thus far, the country, with its sage brush and cacti and arid wastes of sand, is characteristic of Nevada rather than of the Golden State, but on emerging from Spring Garden Tunnel, the westbound traveler will enter into a scene of paradise, so strongly contrasted are the Eastern and Western slopes of the Sierras.

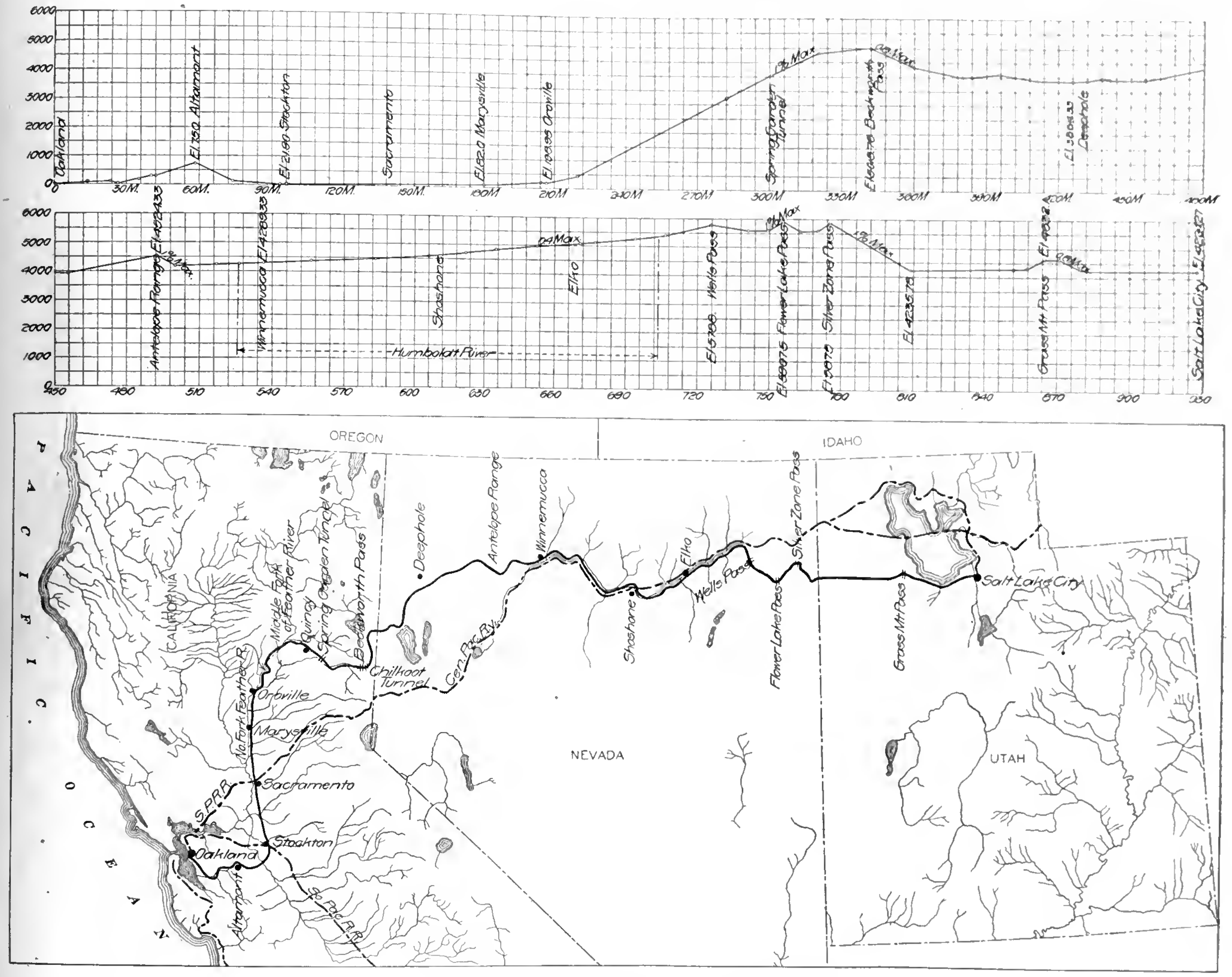
It would have shortened the distance from Spring Garden Tunnel to Oroville by approximately 45 miles to have continued down the canyon of the Middle Fork to Oroville instead of leaving it for the North Fork of the Feather, but by so doing the grade would have dropped from 4,000 ft., making an inadmissible gradient of considerably more than 1½ per cent. Besides the slopes of the route selected, though extremely difficult, are more practicable to build over than those of the Middle Fork. Within a mile after leaving the lower portal of Spring Garden Tunnel, the grade enters Williams Loop, which has a difference in elevation of 33 ft. between the two tracks where they cross. The loop has a maximum diameter of 1,600 ft., crosses Spring Garden Creek twice and Pine Creek once, its maximum curvature is 8 deg., and its minimum 5 deg., and its length is about 5,600 ft. Seven miles below the loop, the grade leave Spring Garden Creek for Spanish Creek, which it follows until reaching, first, the East Branch of the North Fork and then the North Fork of the Feather River, when its general trend becomes southwesterly in a course that is maintained along the canyon of the North Fork until reaching the junction of the North and Middle Forks which occurs at a point about 7½ miles from Oroville. Thence the canyon of the main river is followed until Oroville is reached.

Before determining upon the final location of the grade, a careful reconnaissance was made of the river canyons to be traversed, during which the extreme high water line was accurately determined, for of all destructive agencies to which engineering works in the Sierra Nevadas are exposed, water is recognized as the one whose action is the most sudden and violent, and which, if not anticipated and fortified against, is almost invariably attended with the gravest consequences. Seldom does the constructing engineer meet with altogether unexpected problems of more serious import than those which arise from the torrents of these most erratic streams which perennially discredit the predictions of "oldest inhabitant" wiseacres by out-doing all previous performances. During this reconnaissance the extreme high water mark—that of 1881—was clearly delineated along the canyon sides. At the junction of the North and Middle Forks, for instance, it was at an elevation of 275 ft. above sea level. Early in March last, a flood of unusual severity occurred during which the water exceeded by a few feet the record established by the flood of 1881. It was then believed that the country would be immune from excessive flood for years to come, but the storm in the mountains was renewed with redoubled vigor and on March 18, the level of

the river at the junction of the North and Middle Forks reached an altitude of 293 ft., or approximately 18 ft. above the high water of 1881, while the crest of the river at Pier 2 of the Western Pacific bridge across the Middle Fork reached 297 ft. above sea level.

A few incidents will illustrate the deceptiveness of these Sierran streams. The Great Western Power Co. has begun the construction of a series of hydro-electric and steam power generating plants in Central California which are to operate high-tension, long-distance power transmission lines that will commercially parallel the waters of the river were awash the floor of the tent, which shortly went downward with the flood.

Eight miles below, at Oroville, the streets were flooded from 5 to 6 ft., buildings were floated from their foundations and wrecked, the bridge across the Feather River to Thermalito was washed away, and one of the largest gold dredges of the Oroville district was torn from its moorings and utterly demolished. For the first time in its history, Oroville has become convinced that it must be protected by levees. Were it not for the fact that other cities in Central California cated the necessity of so building the roadbed that its various structures should be of the most stable character. As a result of the experience, nearly all wooden trestles have been abandoned in favor of earth fills, concrete masonry and steel structures. Aside from last winter's lessons, however, the fact remains that with the exception of a few landslides, the removal of which would not have caused an hour's interruption in the operation of the finished line, absolutely no damage was done to those portions of the Western Pacific roadbed which were completed, for it was fully realized at the outset that every precaution



Map and Profile of the Western Pacific Railway.

existing systems of the California Gas & Electric Corporation. The principal hydro-electric generating plant of this company is to be located at the Big Bend of the North Fork of the Feather River, 27 miles above Oroville. Buildings were erected last winter by the Great Western Power Co. to house the forces which were to have been engaged in the construction of the power plant during the present summer, but the flood of March last washed away the buildings and compelled the abandonment of all plans made for the location of the plant at that particular site.

An assistant engineer of the Western Pacific Ry. had his headquarters at the junction of the North and Middle Forks of the Feather River. The office building was at the top of a hill, and a tent wherein lived the engineer and his wife was not far away. Perfect security in its location was felt after the first flood of March had receded, but on March 18, most unexpectedly the are leveed, the cosequences of the flood elsewhere would have been equally as disastrous as at Oroville. At Marysville, for instance, the wagon bridge across the Yuba River was washed away, and the new steel bridge of the Southern Pacific Co. near by was practically under water. The track of the Northern Electric Co., operating a third rail electric system between Oroville, Chico and Marysville, was inundated for several miles, and the grade of the Southern Pacific Co. was washed out in some places and the damage wrought to its trestles, culverts and roadbed was so extensive that its monetary loss thereby probably reached $1,500,000.

These matters have been gone into thus fully in order to point out the fact that the occurrence of the unprecedented floods of last March was not only confirmatory of the sound engineering judgment of the locators of the Western Pacific Ry., but was providential as well in that it indi- must be taken to protect the roadbed against the action of water and to carry the water away from it. In fact, the late floods proved that the waterways and culverts were too large rather than too small.

In no case were the engineers misled by apparently dry gullies, as their lengths and drainage areas were fully investigated and ample waterways were provided for them before construction was begun. When, during the progress of the work, severe storms occurred, the assistant and resident engineers went over the work, observing closely the quantity and action of the storm waters with the view of determining more definitely the sufficiency of the openings contemplated or the advisability of reducing the size determined upon. Ample surface ditches were provided to carry off the storm water to the culverts and openings and to keep the water from saturating the slopes of cuts or undermining the

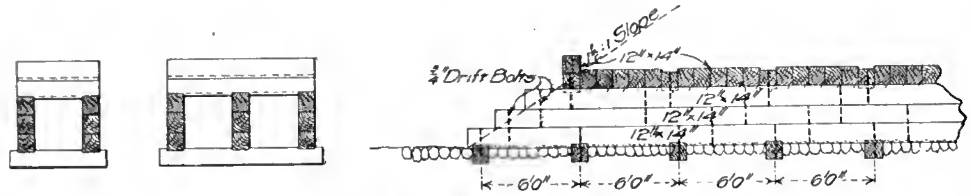
foot of embankments, causing them to slide. Where a ravine was found to descend abruptly to the roadbed, a catch basin was excavated to hold in every case at least 5 cu. yd. of debris in order to prevent the culvert from becoming choked. All culverts were built so that they would discharge water under any head that could possibly arise without injury to themselves or the embankment. Whenever practicable they were laid out at right angles to the center line and set low enough to drain the borrow pits. All culverts were built in solid ground wherever possible, but where it was found impossible to secure such foundation, the bottom was planked to prevent leakage and crowned slightly in the center to allow for settlement. Care was exercised in every case in filling around culverts not to tip or shove them out of place, inclined braces, both inside and outside the culvert, being used to prevent this. Blind drains, being regarded as objectionable, were always avoided unless the amount of water to be disposed of was known to be very small.

There are 44 tunnels in the line of the Western Pacific between Oakland and Deep Hole, Nev., of which three are in the Altamont hills east of Oakland, thirty are in the North Fork Division, and eleven are in the Sierra Division. The Chilkoot Tunnel, which is 6,000 ft. long and as stated pierces Beckworth Pass, is on a tangent with no engineering features of interest regarding location. It is of interest, however, in that it is east of the heavy snow fall region of the Sierra Nevadas. Usually the Pass is bare of snow; seldom does more than 1 ft. of snow fall upon it, and the heaviest snowfall ever known occurred in March last when it covered the ground to a depth of 2 ft. Spring Garden Tunnel, 7,400 ft. in length, is the longest tunnel in the line, but its interest centers in the advantage it gives of added distance and a lighter grade, as previously explained. The total length of tunnels in the North Fork Division aggregates 12,438 ft., the longest tunnel being 1,220 ft. and the shortest, 150 ft.

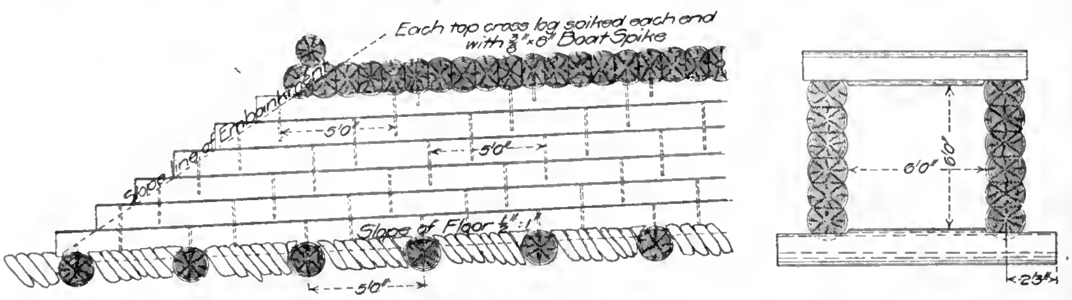
All tunnels in the Sierra Nevadas are being taken out for single-track construction, their normal cross section being not less than 16 ft. wide nor more than 17 ft. wide between vertical side walls, 22½ ft. high above sub-grade, and 1 ft. below sub-grade. The standard 16-ft. section tunnel is being built on tangents and curves of 3 deg. or less, and on curves of over 3 deg., the 17-ft. section is used. It has been found as a general rule that in excavating the approach, the cost of tunnel and of cut about balance when a depth of 50 ft. on the center line of cut has been reached, hence if solid material is encountered, the heading is placed approximately on this center line, but if the excavated material is loose and difficult to hold, the heading is started as soon as sufficient depth to secure a good face has been reached, as in so doing the weight of the heading timbers is reduced to minimum. The curves of the arches of these tunnels are a semicircle whose springing lines are 14 ft. and 14 ft. 6 in. above sub-grade in the 16-ft. and 17-ft. tunnels respectively. The normal cross-section for single-track tunnels contains an area of 368.4 sq. ft., equaling 13.65 cu. yd. per lineal foot of tunnel.

Tunnel 4, which pierces Cape Horn, on the Feather River about 2½ miles east of Oroville, may be accepted as typical of all tunnels on the North Fork and Sierra Divisions. It is a standard 17-ft. tunnel, 806 ft. long and built on a curvature of 8 deg. Work on the easterly and westerly approaches was begun in November, 1905, and in January, 1906, respectively, and the excavation of the heading was completed in October, 1906, while that of the bench was finished in January last. During the first one or two months, considerable progress was made in excavating the approaches, which were of loose rock and conglomerate, then solid rock was encountered and as hand drilling only was used, the progress was slow until February, 1906, when compressed air became available at the east portal. The advance was more rapid thereafter until in May a stratum of exceedingly hard rock was encountered so that during May and July but approximately 15 ft. headway was made. Then the material became easier to work and in November the maximum cut of 95 ft. was made in the bench. A similar condition existed from the west end where compressed air was introduced in March. The heading was finished in October and the bench in January last, the tunnel being completed a few weeks later.

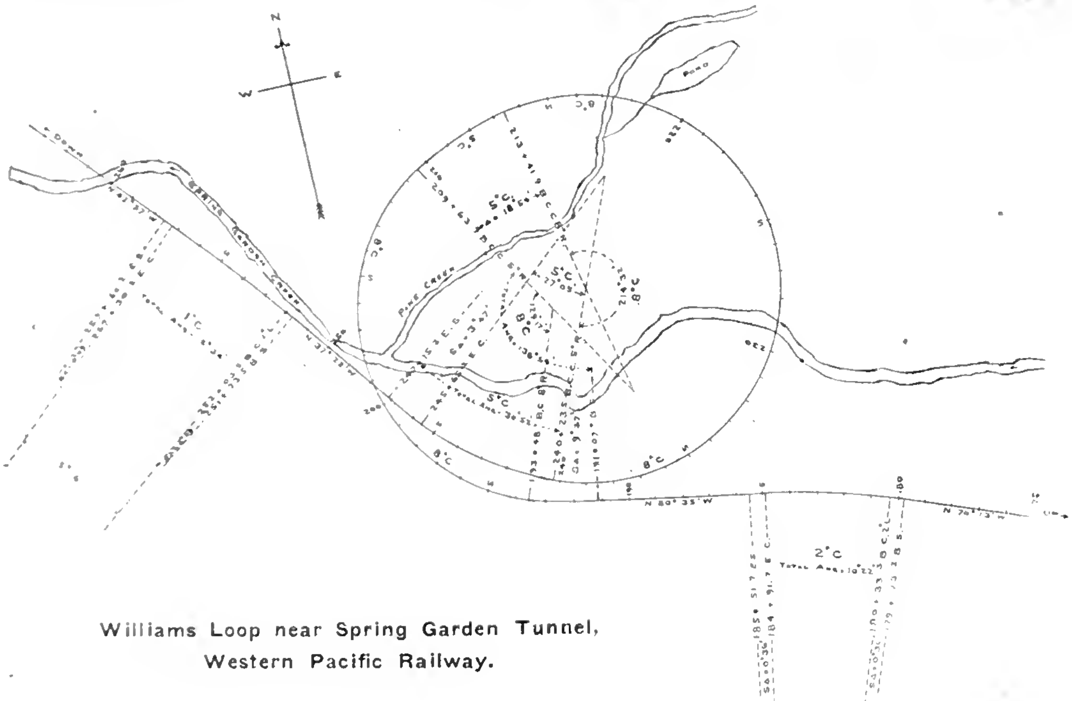
The portals and lining are of Oregon pine, their main timbers being 12 x 12 in. in size. At each portal, eight upright posts, lagged together with 6x12x12-in. blocks, bolted and toe-nailed, rest on 24-ft. sills and are stiffened by two outer and two inner main braces each 12 x 12 in. and 22 and 26 ft. long respectively, the posts being capped by 22-ft. timbers which are lagged with 4x12-in. planking continuing throughout the tunnel. The bents are 12 x 12 in. in size, set on 3-ft. centers with 4x12-in. plank lagging. In framing timbers the joints at the tops of segments were made to flare a little so that when pressure came on them, they were brought to a close fit throughout the flare. Particular attention is given to see that the dry packing used is tamped in solidly, an inspector being employed to look after this work.



Standard Timber Culvert.



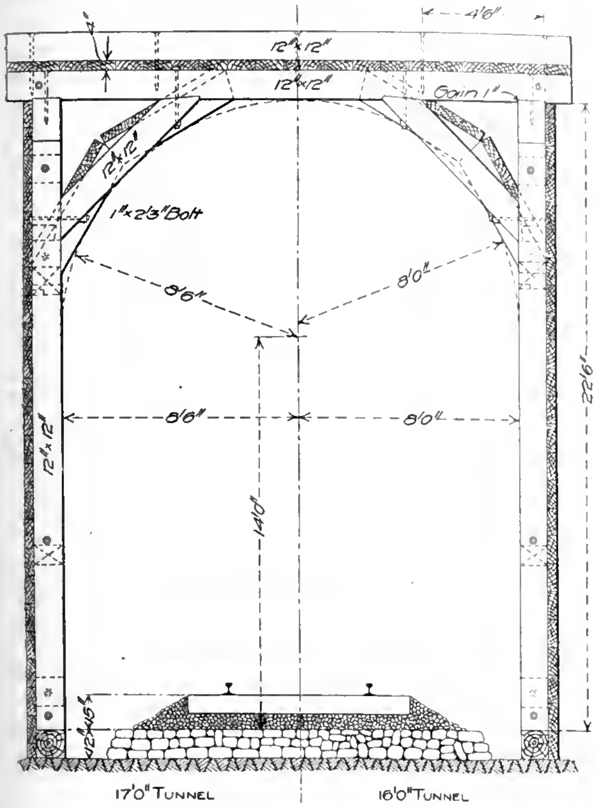
Standard Log Culvert.

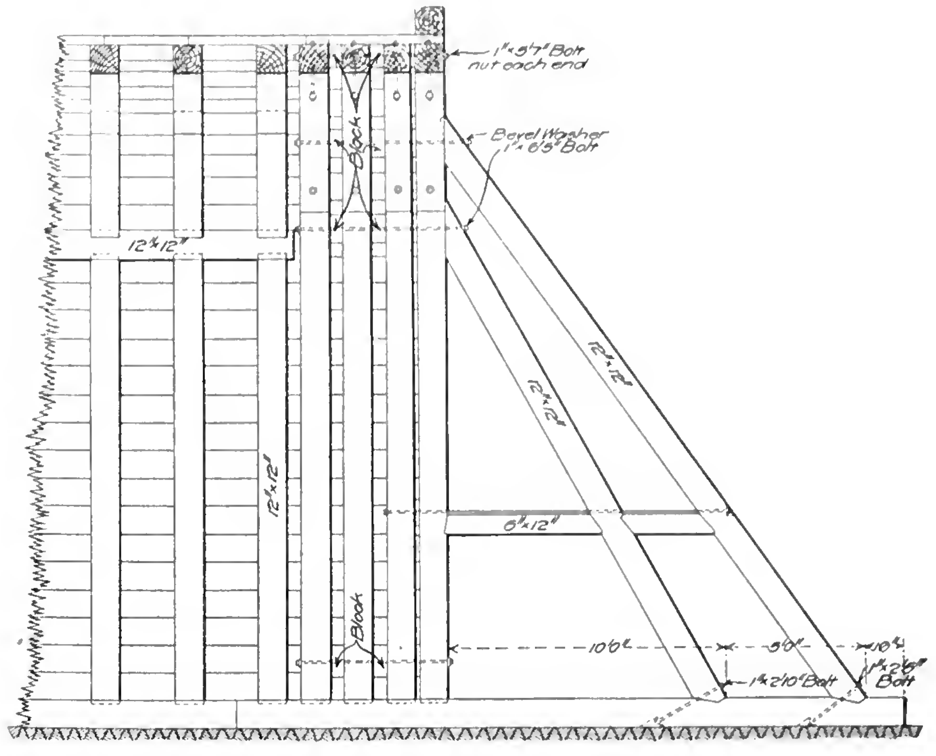


Williams Loop near Spring Garden Tunnel, Western Pacific Railway.

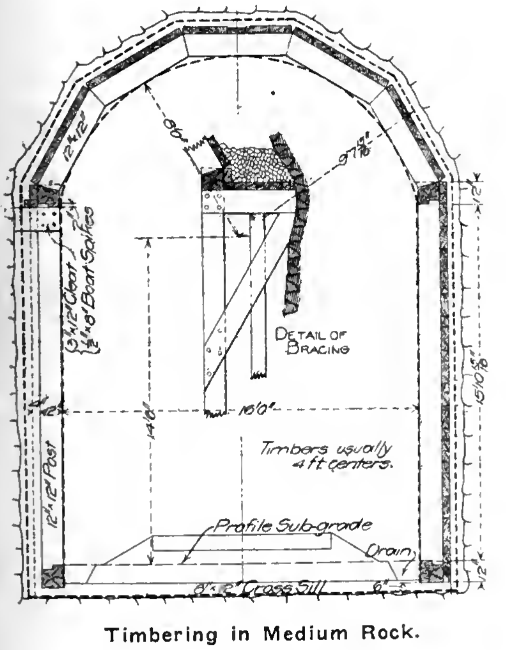
Roadbed sections are in three forms, earth filling for single track, and ballast, broken stone or cinder filling for double and single track respectively. From Oroville through to Stockton the track will be ballasted mainly with the gravel tailings of the gold dredgers in and about Oroville, and considerable of the track of the North Fork Division is to be similarly ballasted. Earth filling is to be used very sparingly, if at all, through the mountains, but when used it is to be made highest in the center where, for one foot on each side of the center line, it will be 3 in. deep over the top of cross ties, thence sloping off each way to the bottom ends of the ties. The ends of all ties are to be left just clear of the ground, and the roadbed outside and beyond the ends of the ties is to have a uniform slope descending away from them.

Retaining walls of either dry rubble or concrete or masonry are used in preference to log cribs wherever rock that breaks out in slabs can be secured. Their foundations are always sunk to a solid footing, the face batter varying accordingly to the type and height of the wall. The limiting heights of dry rubble and concrete or masonry walls are 20 and 30 ft. respectively. The stones used in building rubble walls vary in size and material with the character of the excavation, quarries or borrow pits whence they are obtained, but no stone used on the face of the wall is less than 8 in. in thickness nor less than 18 in. in its least horizontal dimension. Headers are at least 3 ft. long, unless the wall is 3 ft. in thick-

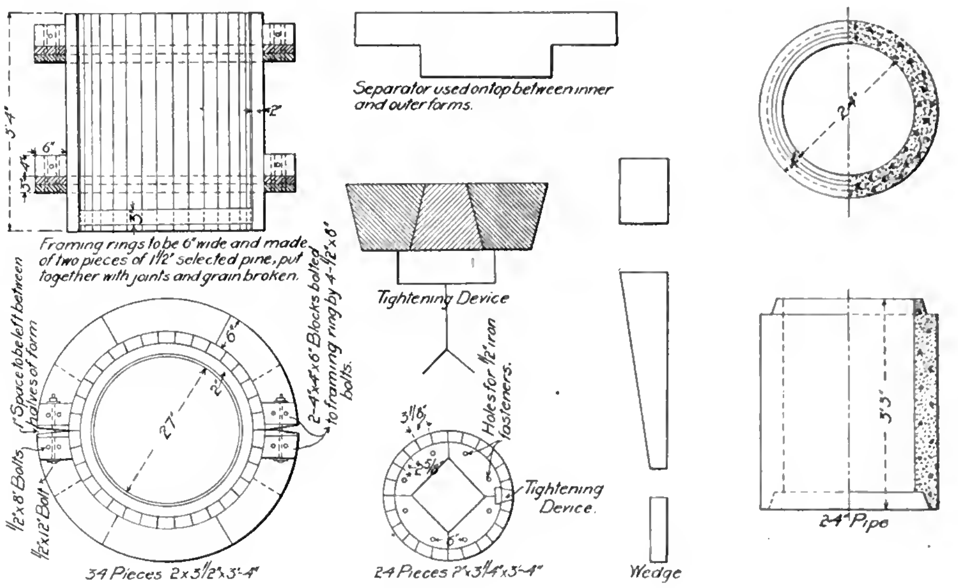




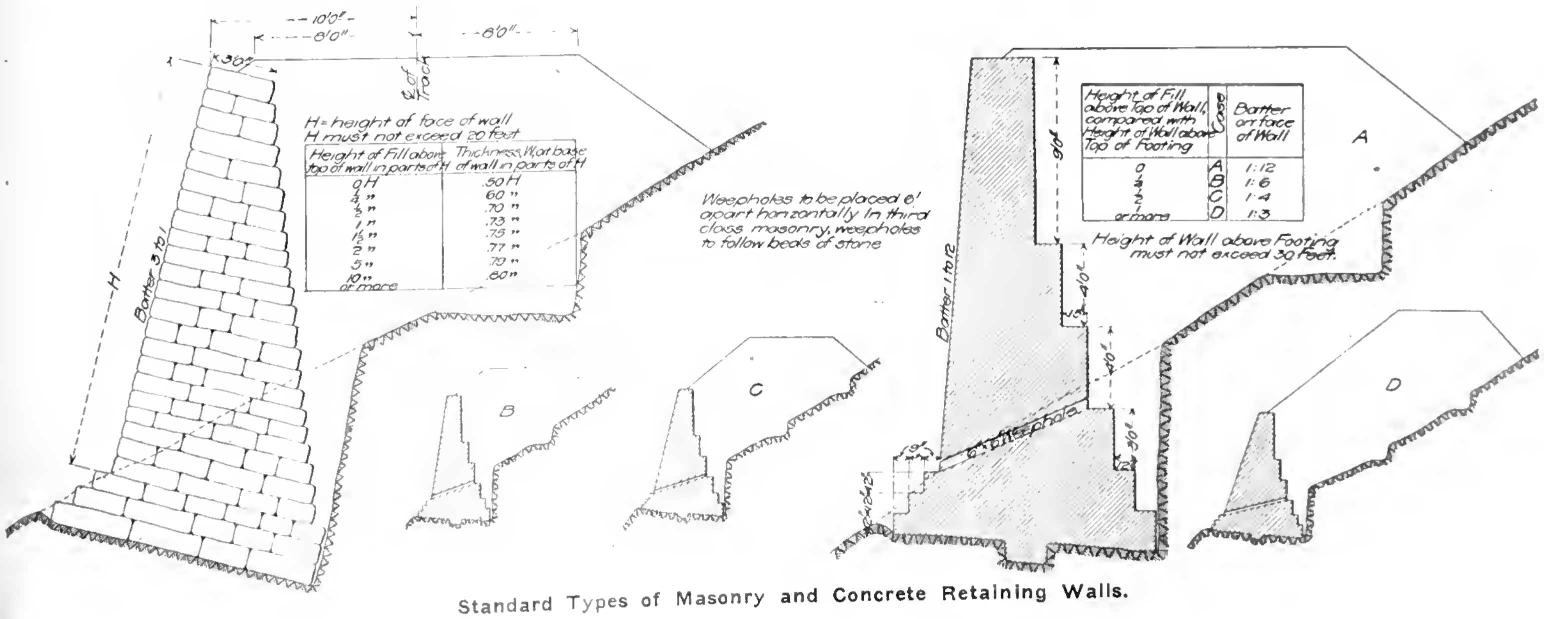
Portal for Timbered Tunnel.



Timbering in Medium Rock.



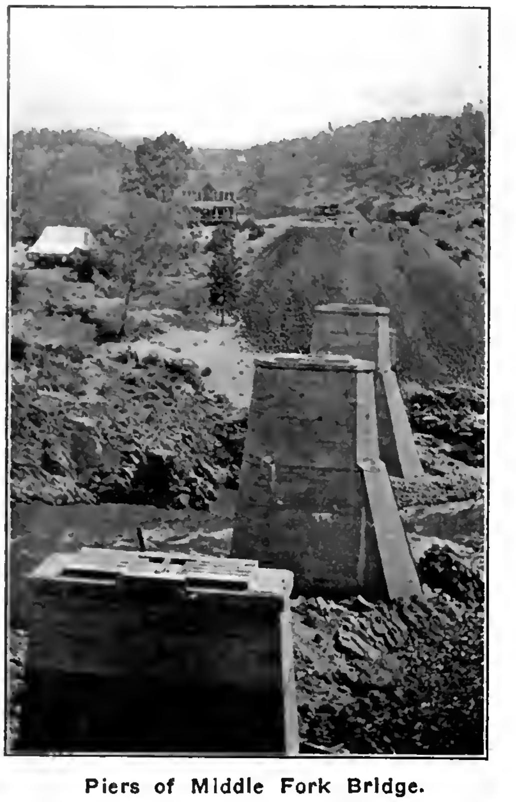
Forms for Concrete Pipe.



Standard Types of Masonry and Concrete Retaining Walls.

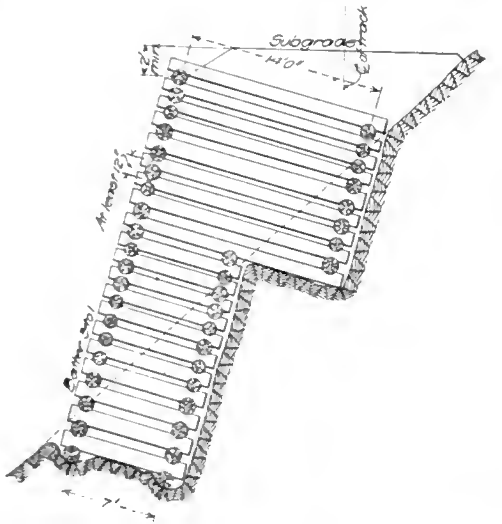
ness, in which event they extend entirely through the wall, at least one header being placed for every three stretchers. On steep slopes, steps are cut in the natural slope to prevent the embankment from sliding, regardless of the type of wall used. Walls built near the line of the roadway and having a height in excess of 10 ft. are invariably of third-class masonry or concrete. Ample drainage is provided through weep holes that are 6 in. square and placed 6 ft. apart as nearly in line as is possible with the natural slope, particularly if it be of stone. These walls rest on a base which is excavated to an inward slope of 1:12, and the center of this base is keyed in to the footing.

Where a suitable quantity of stone can not be obtained near by for building retaining walls, log cribs are being built to hold the foot of embankments, provided their maximum height does not exceed 30 ft. Such cribs are built log-house fashion, of round logs with bark removed. The face and rear longitudinal logs average at least 14 in. in thickness at the butts, and are laid with butts and tops alternating, so that each course, which averages at least 12 in., will build up nearly horizontal. Both tie logs and wall logs are notched at least 2 in. deep, so that a firm bearing will obtain. Tie logs are generally laid 8 in. apart, and the structure is bolted together, log by

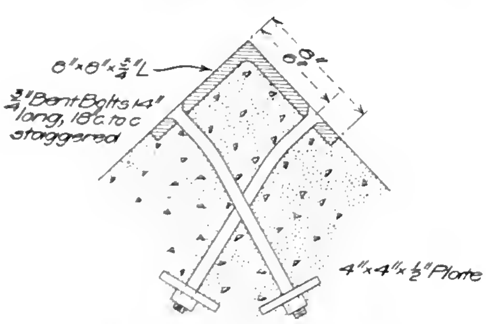


Piers of Middle Fork Bridge.

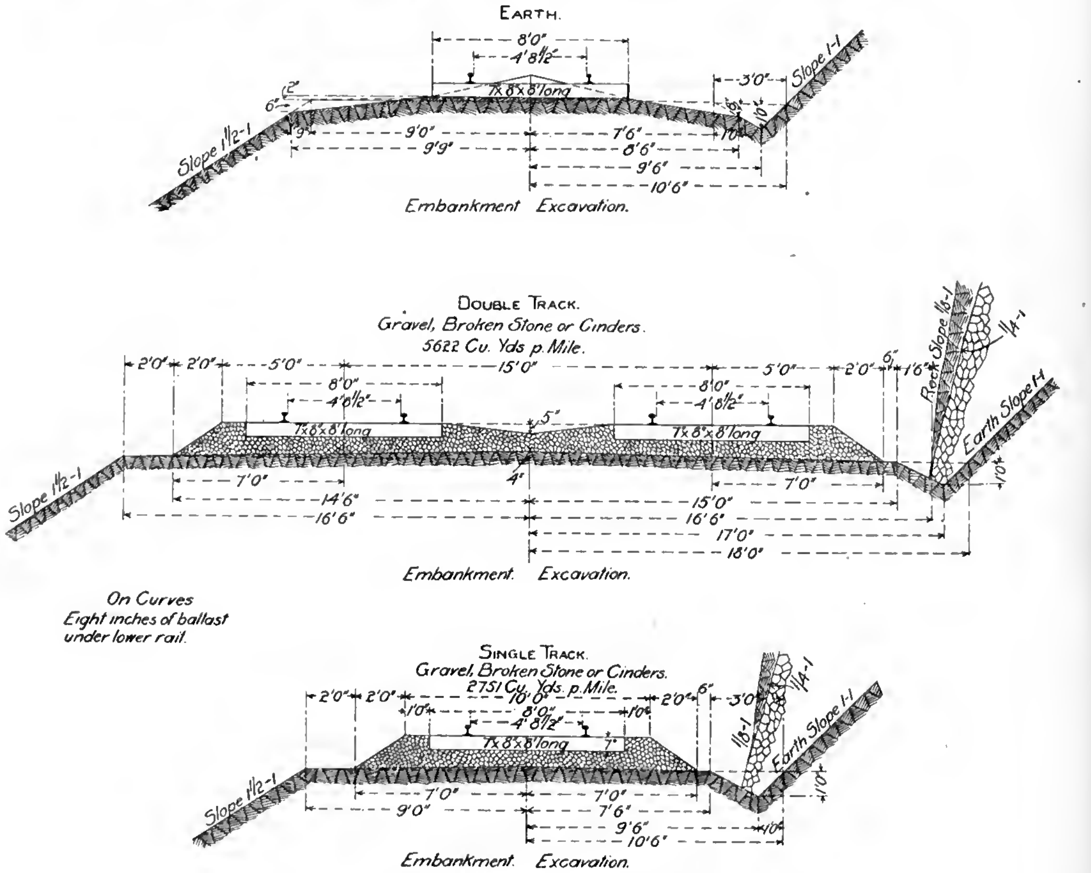
The bridges of the North Fork Division are to be nine in number, two across the North Fork of the Feather River, one across the Middle Fork, and the remainder being across various creeks. All of these bridges of consequence are to be of steel, and vary in length from a 60-ft. plate girder bridge to a 480-ft. plate girder and riveted deck span bridge at Spanish Creek. Bridge 18 which spans the Middle Fork at its junction with the North Fork is a typical struc- and will support two 125-ft. riveted deck spans and three 64-ft. deck plate girders, giving the bridge a total length of 442 ft. At this point the Middle Fork courses over a bed of solid rock which affords thoroughly stable footings for the four piers and two abutments. The tops of Piers 2 and 3 are on a level, barring the slight rise in grade which exists, while the elevation of the top of Pier 4 is some 13 ft. below, and the elevations of the abutments are approximately 20 ft. above, the mean height of the tops of the main piers. The piers and abutments were built during an extreme low water period which made cofferdamming unnecessary. The structures are of concrete, 2,230 bbl. of Atlas cement being used, its economic efficiency being found to be 1.07 bbl. of cement per cubic yard of finished structure. The mixture used was in the proportion of 1:2½:5, with considerable large rock incorpor-



Standard Log Crib.



Angle Iron for Pier Nose.



Standard Roadbed Sections.

log, with ⅜x18-in. drift bolts. The batter of the face varies with the slope of the ground, but generally it is 1:4, and the width of the log crib similarly varies with the slope, the endeavor being to make the width of its base as great as possible up to one-half its height. The sub-grade is at a minimum of 2 ft. above the line of the uppermost face log.

In drainage openings of a size not requiring arch, timber or log culverts, or where suitable material is not at hand for stone box culverts, concrete pipe culvert openings are being used in diameters varying from 12 to 48 in. These pipes are made of washed gravel or quarry-run crushed rock, no axis of which is greater than 1½ in., mixed wet with cement in the proportion of 1:4 and thoroughly tamped in forms. The pipe lengths are jointed with neat cement after having been laid on lines and firmly bedded. All pipes have a uniform length of 30 in. and a uniform depth of 3 in. at each end, their remaining dimensions varying as follows:

Inside Diam., in.	Thickness of Main Shell, in.	Thickness of Shell at Tips, in.	Base of Taper, in.	Width of Shoulder, in.	Cost of Complete Form.	Pattern.
12	2	¾	1¼	...	.....	Bell
12	3	1	½	1½	$13.75	Straight
18	3	1	½	1½	.....	"
24	4	1½	½	2	15.75	"
36	6	2½	½	3	22.75	"
48	8	3½	½	4	.....	"

In places on the Sacramento Division where culvert openings are used through levees on which the roadway runs, or where, in maintaining the grade, the embankment tends to restrain flood waters to their natural channels, the culvert pipes are provided with swinging check valves.

ated in the concrete of each structure, great care being taken to clean thoroughly and wet each stone before being placed. They are laid not closer than 18 in. from any surface, nor less than 24 in. from bottoms, and are placed at least 12 in. apart so as to give sufficient room for tamping.

These piers were subjected to a supreme test during the unprecedented flood of March 18, when, as already stated, the torrential waters of the Middle Fork reached a mean of 18 in. above previously recorded extreme high water as discernible by the wash in the canyon sides. At the point where these piers cross the river, the stream showed a crest of about 4 ft. at Pier 2, reaching within a foot of its top. Some 600 ft. above, a wagon road crossed the chasm of the river by means of a combination steel and timber bridge

having a 140-ft. span, which was lifted off its abutments and carried down stream transverse to the axis of the river. The center of the runaway bridge struck Pier 2 with terrific violence. For a moment the bridge quavered before breaking at its center, and, being held by the pier, as its ends swung together the bridge was lifted over the top of the pier by the backwater created, and then carried on down stream. Despite the fact that the forms had not been off the pier thirty days, it was absolutely uninjured save for a scratch on its nose.

The engineering organization of the Western Pacific Ry. Co. was explained in this journal on Aug. 3 of this year. The work is under the direction of Mr. Virgil G. Bogue, first vice-president and chief engineer. Mr. H. M. McCartney is the principal assistant engineer, with offices at San Francisco, and the division engineers are Messrs. C. Harlowe at Cobre, Nev., J. Q. Jamieson at Clio, Cal.; L. H. Jones, at San Francisco; Emery Oliver at Oroville; J. T. Williams at Oakland, and T. J. Wyche at Salt Lake City.

Calf Killer Bridge, Nashville, Chattanooga & St. Louis Ry.

The section of the Sparta branch of the Nashville, Chattanooga & St. Louis Ry. from Sparta to Bon Air was built in 1887, the crossing of the Calf Killer River being part of the work. At the south edge of Sparta the river makes a bend of 160 deg. inside of 700 ft., and the bridge was built in this bend on a tangent at right angles to the flow. The grade of the bridge was 1 per cent., ascending toward Bon Air. About 500 ft. south of the bridge the grade changed to 3 per cent, and, with the exception of four short benches, continued ascending at that grade to Bon Air. This put the Calf Killer Bridge at the base of eight miles of steep grade.

The masonry for the bridge consisted of two end piers, one middle pier and a stem wall at each end. The first pier (the north pier) was founded on concrete at a depth of 4 ft. below the surface of the natural ground; the second pier was founded on solid rock in the bed of the river at a depth of 48 ft. below base of rail, and the third pier (the south pier) was founded on solid rock at a depth of 45 ft. below base of rail. The distance from base of rail to bridge seat was 25 ft. 1⅛ in. The masonry for these two spans was made to take Phœnix-column deck trusses of Warren type, removed from the Tennessee River Bridge at Bridgeport, Ala. Their length, center to center of end pins, was 153 ft. 4 in., and width, truss to truss centers, 12 ft. There were five panels to the truss, of length 30 ft. 8 in. This bridge had been in service about fifteen years previous to its re-erection at Calf Killer in 1888.

The principal reasons for putting up a new bridge may be briefly stated thus: The old bridge was too light for present-day traffic; its location at the foot of the long, steep grade made it more dangerous than usual for trains of lost control coming down the mountain; the top chords of the trusses being of cast iron, made their strength an uncertain factor, and the style of columns and bases were such that a serious defect might be present and pass undetected. For the renewal of the entire deck of this old bridge 2-ply 8x16-in x 32-ft. wooden chords on the top chords of trusses on each side for the full length of the bridge and 8x14-in. x 14½-ft. ties were required. The deck of the new bridge requires only the 8x9-in. x 10-ft. ties.

A number of plans were suggested for rebuilding the bridge. One was to fill one-half of the north span and put a girder on the other half and replace the south span with a stronger span from Bridgeport; estimated cost, $23,000. Another was to renew the two spans on the same masonry; estimated cost, $21,000. Another scheme was to use one 30-ft. girder and two 60-ft. girders supported on towers in place of the north span and replace the south span with a stronger span; estimated cost, $17,000. Another scheme was to build two new piers and top out the old ones, using four spans of 75-ft. deck plate girders; estimated cost, $11,850. This latter plan was adopted.

A survey was then made to get the physical data of the crossing necessary to make plans for the new masonry and to get the exact position of the old bridge on the masonry, especially noting its position at points likely to interfere with the construction of the new masonry. This was done with a view to carrying up the new masonry without erecting false work before the time to put in the new girders and without delaying traffic.

The procedure in the construction of the masonry as adopted was: (*a*) Build up piers 1 and 5, encasing the end vertical posts and end braces, removing the latter when the old structure is taken down; (*b*) finish complete piers 2 and 4, leaving slots, through which the old chord bars can be withdrawn; (*c*) erect on both sides of pier 3 falsework towers sufficiently strong to support the ends of the new girders, after which the old spans will be taken down and the new superstructure put in place, when the old center pier (No. 3), without obstructions, will be built up. By this design the old masonry was to be built up to the finish for 7-ft. deck plate girders, using vertical faces and not exceeding the size of the old piers. The length of this top section on the old masonry was to be 14 ft. on each of the piers, and the design of the entirely new piers is in size and shape similar to the old mid-pier, with its new top section. This gives the set a uniformity of design and effect.

The first work to be done on the construction of the masonry was to put in a cofferdam for pier 4, the only one coming in the bed of the river, to be built entirely new. The cofferdam was started when water in the river was about 6 ft deep.

As piers 2 and 4 came midway of the center panel of the old trusses and the top of the new masonry being 8 ft. 1 in. from base of rail, they were built complete, without being obstructed by the middle diagonals of the old bridge, except to box around the bars of the lower chords, filling in the slots with concrete after the old bridge had been removed. A temporary pile bent was previously driven at each end of the bridge to permit of the removal of the end vertical posts of the old trusses, so that the top sections of the end piers could be built up complete, except for having to incase the bases of the end braces, which small open sections remaining could soon be built out even with the finished faces. These slots and open sections were not large enough to lessen the strength of the masonry perceptibly for carrying the bridge and trains. When all the piers but the middle one were ready for the new bridge, falsework towers were put up on each side of the middle pier and the new girders put in place, their ends at the middle pier resting on these towers just about 2 in. above the top elevation to be given the pier.

The plate girders are 75 ft. center to center of bearings, 77 ft. 6 in. out to out of girders, and spaced 8 ft. centers. The web plate is 84 in. deep by 7-16 in. thick. There are two flange angles 6x6x¾ in. for full length of girders on top and bottom. The top has four cover plates, each 14x⅜ in.; lengths, 7 ft., 34 ft., 49 ft., and one the full length of girder. The bottom cover plates are of the same size and number as the top ones, except that the longest one is only 54 ft. instead of the full length of girders. The rivet pitch used is 3 in., with alternate spacing.

Before placing the girders falsework bents were put up between the old trusses through one span to the height of the new masonry. Pony bents were erected on top of these to carry the track. The wooden chords on the top chords of the old trusses were shifted to these pony bents for stringers. The ties were replaced with shorter ones, allowing space between their ends and the old trusses to lower the girders to the main bents and new masonry. Before the girders were lowered the lateral rods and braces of the top of the old trusses had to be removed. The girders were handled from trucks on the bridge to place by a gallows from a traveler bearing upon the top chords of the old trusses. By these arrangements trains were carried on falsework for each span about three weeks, one span being put in before the other was put on falsework. If the stability of the old spans, with top lateral rods and braces removed, had not been so greatly impaired and the time required to shift and handle the long and large bridge ties had not been so long, these girders could have been put in without trains having to run on false work, except for the tower bents at the center pier and the bents at both ends of the bridge in place of the vertical posts removed. When these girders were in place and the old spans removed the middle pier was built up complete without obstructions. Then after the concrete was sufficiently set the tower bents carrying the ends of the girders were removed and the girders let to their final position on the pier.

The arrangements for handling the concrete material and for making and placing the concrete is worthy of description. The sand and aggregate, consisting of blast-furnace slag from South Pittsburg, Tenn., were unloaded from cars to platforms on a level with the top of rail about 100 ft. south from the south end of the bridge. The concrete mixer, a cubical form of 1-6 cu. yd. capacity, run by a gasolene engine, was located on a platform built up about 50 ft. south from the south end pier. A tank near the mixer to supply the water was elevated enough to get the desired head and was kept filled by a pump run by another gasolene engine located down on the river bank. The cement house was close by, a little to one side, between the mixer platform and slag pile. Wheelbarrows were used to deliver the slag and sand to the mixer. The mixer was so placed that it would dump onto the platform, and the concrete was then shoveled into the specially designed narrow-gauge car, which used one rail of the main track and an extra rail on the outside for its running track. A turnout for clearing passing trains was provided for at both ends of the bridge. The grade of the track over the bridge was descending from the mixer 1.05 per cent., so that with a little start the concrete car would roll alone down to points on the bridge; and only in returning empty to the mixer did the car have to be pushed by hand, although this was never for a distance of more than 400 ft. Over the piers on the bridge in the center of the concrete car's track, openings were sawed out to let the concrete pass to the forms below. To get the concrete into the forms with very little disturbance and fall there were used zigzag chutes, with arms about 10 ft. in length, which sections were removed as the level of the concrete in the forms came up close to the end. This chute was a convenience because its end alternated from one side to the other as the arms were removed in coming up. A swinging section could have been provided for the end to swing the concrete to the desired spot in the form; but the extra time required to swing it about, to detach from one section and attach it to the next, would have been much more than that required to shovel the concrete to points in the form not directly under the end of the chute.

The foundation work for this bridge was built

up by the railway's masonry gangs. The bridge company furnishing the girders put them in. The work was commenced about June 20, 1905, and the bridge was finished complete about Dec. 1 of the same year.

The cost of the masonry is shown in an accompanying table. There were 460 cu. yd. of concrete the cost per yard for the entire work being $6.49.

Cost of Foundations and Piers.

		Cost per cu. yd.
Unloading material	$ 88.15	$0.19
Labor on forms and bins	435.50	0.95
Lumber	472.00	1.03
Cofferdam—excavation, lumber and labor	293.20	....
Mixing and placing concrete	428.00	2.79
Cement, slag and sand	854.90	
Taking down forms and cleaning up	211.40	0.46
Engineering and supervision	200.00	0.43
Total	$2,983.15	

The new steel cost $10,082.80 erected, and deducting the scrap value of the old spans, $1,800, leaves the net cost for the steel as $8,282.80. This added to the cost of the masonry makes a total of $11,265.95, which is $584.05 below the preliminary estimate, made when the reconstruction of the bridge was first determined upon.

The weight in pounds of the metal of the two old spans was 186,860. The maximum safe engine load in tons of the old bridge was 84. The weight of the four new spans is 268,451 lb. The maximum safe engine load of the new bridge is two 141-ton engines coupled, followed by a uniform load of 4,500 lb. per foot, with allowance for impact as specified by the American Railway Engineering and Maintenance of Way Association. The cost of the new steel bridge erected per pound was 3¼ cents. This does not include the cost of the new deck, as this was charged to the renewal account. The steel work could not be duplicated for the above cost, for an error was made in the calculation of the weight of the bridge by the company making the bid. It is estimated that about $1,500 should have been added to the bid for the steel work to make the total cost come up to the cost of similar structures.

The work was described by Mr. J. G. Huff in a paper before the Engineering Association of the South, from which the data for these notes were taken.

Explosions of Coal Dust have caused so much trouble in cement mills that managers of such works will probably be interested to learn of experiments which Prof. Phillips Bedson described at the recent meeting of the British Association. His first experiment was made by fitting glass tubes 1½ in. in diameter into opposite sides of a 9-in. cubical tin box provided with a hole in the top and in the bottom so that a gas flame could burn within it. The dust was prepared for the experiments by passing it through a sieve with 100 meshes to the inch, and was then placed in one of the glass tubes and blown into the box by air pressure. It was found that some kinds of dust would inflame under this condition, flour and powdered aluminum flashing up violently, but coal dust acted in an uneven manner. In order that the experiments might give more definite results, Professor Bedson used a larger box and increased the charge of dust to two grams or more, which was ignited electrically while suspended in the box. Various modifications of the apparatus were made to enable him to vary the experiments. It was found that ordinary coal dust was not directly inflammable, the most inflammable coals seeming to be those which contained considerable volatile gas. The amount of moisture had little apparent influence so long as the dust was not absolutely wet. The main thing shown by the experiments was that it is necessary to make extended investigations before any definite general knowledge of the nature of these explosions can be obtained.

Examination of Water Purification Plant at Owensboro, Ky.

By Philip Burgess, Assoc. M. Am. S. C. E.
Special Assistant Engineer, Ohio State Board of Health.

In the issue of The Engineering Record for Aug. 31, 1907, is found an interesting description of the intake of the Water Works Company of Owensboro, Ky. As the writer had just completed an examination of this plant on Aug. 28, 1907, with particular reference to results obtained, it is thought that a report of this examination may be interesting as a conclusion to the above mentioned description. The Ohio State Board of Health has been so frequently called upon for advice relative to the installation of so-called natural filtration plants, particularly on the Ohio River, that it has been considered desirable to obtain all the information available regarding existing plants of this type. The plant at Owensboro, Ky., had been cited as an example of a successful infiltration plant, and this examination was undertaken to study its principal features and to determine the degree of purification obtained.

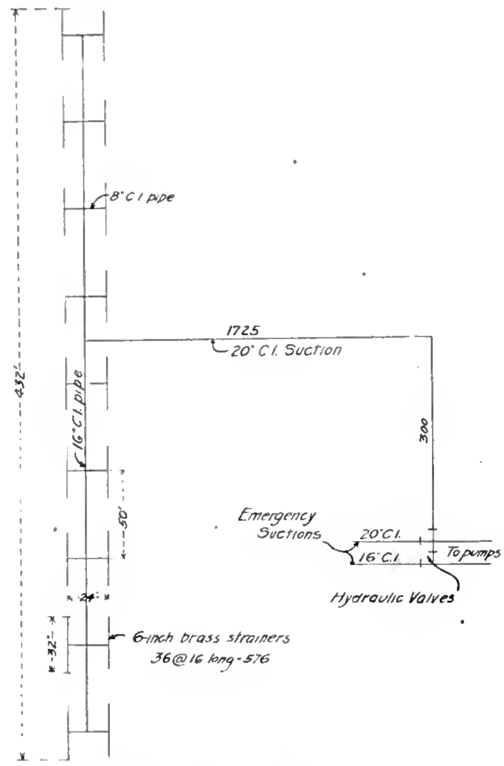


Diagram of Owensboro Intake.

Since May, 1906, the writer has been engaged by the Ohio State Board of Health in making examinations of the various water purification plants in Ohio, and the examination of the Owensboro plant was conducted in a similar manner to that in which these other tests have been made. Boxes containing the necessary laboratory media and supplies, especially built for this purpose, were shipped by express to the pumping station and such chemical and bacterial determinations as practicable made there, while samples of the water were shipped by express to the laboratory of the State Board of Health at Columbus for such determinations as it was not practicable to make in the field. Mr. Asa Williams, the chief engineer of the Owensboro Water Works Co., assisted the writer in making the examination of the plant and also furnished the data and descriptions embodied in this report.

Owensboro is a city of about 20,000 inhabitants, situated on the Ohio River about 115 miles below Louisville. Until recent years the water supply had been obtained directly from the river without purification and was unsatisfactory from all points of view, being very turbid at times and always subject to considerable pollution. About four years ago pressure was brought by the city officials on the Owensboro Water Co. to purify the supply. The water company was desirous, if possible, of installing some system in which the purification would not be dependent on the ordinary methods employed but one in which the necessary care and expense that are involved in the usual filter plants would be eliminated. After considerable consultation the present system was installed by which the purification is effected by the infiltration of water through the gravel bottom of the river and its collection into a system of horizontal brass strainers.

Several tests of the quantity and quality of the water obtainable were made before any construction was undertaken. Owensboro is fortunate in having a sand and gravel bar directly opposite the pumping station on the shore of an island, and it is from this bar that the present supply is obtained. In order to learn the quality of the water available, a small pipe was first driven into the gravel and water pumped from this by means of a hand-pump. In this way it was found that the supply was of satisfactory quality, but it was not possible to estimate the quantity obtainable. In a subsequent test a 2-ft. tile pipe was sunk into the bar to a depth of 8 ft., and the water which percolated into this well was pumped by a steam pump. It was noted that the water stood 58 in. deep in this well until the pumping was increased to a quantity greater than 50 gal. per minute. With a greater quantity than this, the level of water in the well was reduced, and finally at 90 gal. per minute, sand and water together were drawn up through the well. From these figures it was estimated that 50 gal. per minute was the maximum capacity of the well, corresponding to 16 gal. per square foot per minute. Water was pumped from this test well continuously for several hours and found to be of satisfactory quality, being clear and free from iron. At a depth of 14 ft. in the gravel, Mr. Williams stated that a water was obtained which soon turned red on being exposed to air and light and was evidently a ground water containing considerable iron.

The essential features of the plant as installed are a system of slotted brass pipes or strainers embedded in the bottom of the river at from 4 to 5 ft. in depth in the gravel bar, these strainers being directly connected by a system of collecting and suction pipes to the pumps by which the water entering the system is pumped into the mains without storage in a distributing reservoir. The river water thus percolates through the bed of the river into the collecting pipes, leaving the impurities behind on the sand and is not again exposed to the light until drawn from some part of the distributing system.

The strainers are what are known as the No. 8 Cook well-point strainers and are 16 ft. long, 36 in number, giving a total length of 576 ft. The openings in these strainers were cut with a tool 0.008 in. thick, at right angles to the axes. Mr. Williams stated that probably a somewhat larger opening would have been more suitable for the kind of material in which the strainers are laid.

As at the time of the examination the water in the river was about 10 ft. deep over the bar in which the intake is laid, it was impossible to examine the filtering material, which is said to consist of clean sand and fine gravel and is so located in the stream that there is little, if any, deposit of mud on the surface. The intake is at about the low water mark of the river, and the material over it is thus constantly submerged.

The accompanying diagram shows the layout of the strainers with the cast-iron collecting and suction pipes. It will be seen that the water enters the strainers, then blows through an 8-in. cast-iron pipe into a 16-in. pipe, and thence into the main 20-in. cast-iron suction leading to the pumps. The total length of the strainers, as stated, is 576 ft. and they probably drain an area of approximately 4,500 sq. ft. Assuming the capacity

of the sand bed to be 16 gal. per square foot per minute (as determined by previous tests), the maximum quantity of water available by the strainers is 72,000 gal. per minute, or 10,000,000 gal. per day, assuming the entire area equally efficient. At the time of the examination, water was being pumped at the rate of 1,200 gal. per minute, or about 1,500,000 gal. per day, showing that the estimated capacity of the intake provides for a very considerable future increase of consumption. The strainers are patented and were purchased at a total cost of $2,000.

On the diagram it will be noted that 16-in. and 20-in. emergency intakes are provided, which are intended to be used in case something happens to the strainers. As has been noted, there is no storage or distribution reservoir, and in case the strainers become clogged or for any reason do not give sufficient water, it is intended to back flush them by pumping direct, using one of the emergency intakes. The plant has been in use since July 1, 1906, and it has never been found necessary to back flush.

One interesting feature developed in operating the plant is that the suction lift seems to be independent of the stage of water in the river but varies only with the quantity of water pumped. Even with very high stages of the river, the ordinary vacuum of 3 in. is maintained when the pump makes 30 r. p. m.; but when increased to 34 r. p. m. the vacuum is 4 in. This is true also at low stages of the river, and it would seem that there is but little loss of head in the filtering process itself, the actual movement of water into the strainers being very slow, but that the loss of head developed while pumping is due to friction in the suction pipe. This is a very interesting fact, as it would be expected that ultimately the capacity of such systems would be limited by the amount of water that could be drawn through the sand, a quantity which depends finally on the suction lift at the pumps. It was stated that the suction at the pumps had not increased since the beginning of operations, and the fact that it has never been necessary to back flush and clean the sand would show that there is but little decrease in the capacity of the strainers.

After the plant was first started in operation it was found that the filtered water was occasionally turbid, and an inspection showed that proper attention had not been given by the contractor to leveling the sand and gravel after back filling over the strainers, so that there were numerous places where the filtering material was not of sufficient depth to give proper purification. In December, 1906, more filtering material was added and the river bed leveled off, since which time the plant has been in successful operation giving a very satisfactory water up to the present time.

The plant was operating under normal conditions at the time of the examination, the river being fairly turbid and rising, due to a rain of the previous night. Only four samples were collected: One from the river, one from a tap at the pump, and two from a tap at the force main.

The following table shows the analyses made and the results obtained in parts per million:

	River Water.	Tap from Pump.	Tap from Force Main 1	Tap from Force Main 2
Turbidity	170	2 ±	2 ±	2
Color	22	15	15	15
Carbon dioxide	2	14	12	..
Alkalinity	75	95	95	95
Incrustants	29	18	32	25
Total hardness	104	113	127	120
Iron	1.6	0.7	0.2	0.3
Chlorine	13.0	12.2	9.5	9.5
Bacteria per c.c.	26,500	29	29	21
Colon in 1 c.c.	Yes	No	No	No
Colon in 100 c.c.	Yes	No	No	No

The bacterial plates were made in the field, as were also the chemical determinations of turbidity, alkalinity, color, and carbon dioxide. The remaining analyses were made in the laboratory.

The above analyses show a remarkable purification of the river water, the bacteria being practically all removed by the filtration. The slight increase in total hardness and of carbon dioxide indicates a small percentage of ground water, but it will be noted that the filtered water contains even less iron and chlorine than the water in the river. There were a large number of bacteria in the raw water, and also the presence of considerable pollution is indicated by the coli results. No coli, however, were found in the filtered water.

It will be noted that there is not a very great removal of color, the reduction being but seven parts per million.

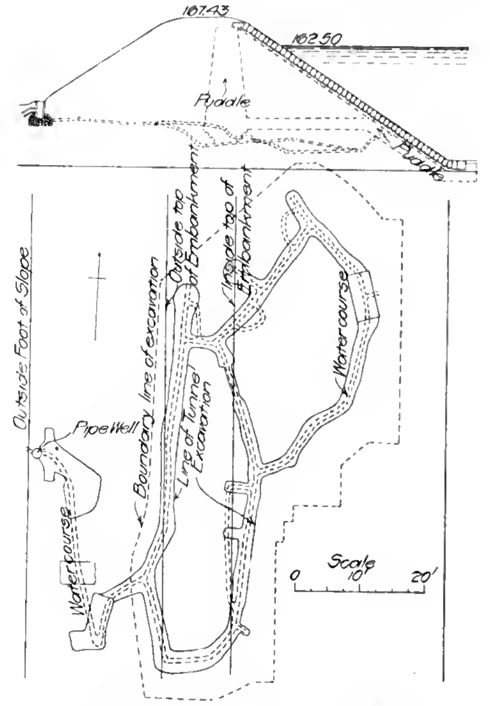
The samples of filtered water were seen to contain small particles of suspended matter, and a subsequent microscopical examination in the laboratory revealed the fact that there was present a considerable quantity of growth similar to Crenothrix. No trouble has yet been experienced with odors or tastes in the supply, but it is quite probable that in the future considerable trouble may develop due to the luxuriant growth of this plant, causing a subsequent closing of part of the strainers and a diminution of the capacity of the intake. Owing to the lack of storage of filtered water, it is necessary to run the pumps continuously, and it will be very difficult to treat the intake for the removal of any such growth.

In conclusion it should be said that the present intake of the Owensboro Water Co.'s plant has for about one year been furnishing a clear, satisfactory water obtained by the filtration of water from the river with no greater expense of maintenance than would be incurred by the pumping of untreated river water. At the time of the examination the supply was found to have a remarkably low bacterial content and to be in every way satisfactory as a municipal supply. The probability of future trouble by the clogging of the strainer system by growths very difficult of removal is apparent, a condition which might render the present supply very unsatisfactory.

A CORRECTION should be made in one of the values of the coefficient of discharge in the table on page 354 of this issue, being part of the article on "Experiments with Submerged Tubes 4 Feet Square." Under a head, h, of 0.20 ft. and form of entrance and outlet of type a, the coefficient for length of tube of 2.50 ft. should be .694 instead of .684 as printed.

Repairing a Leak at Hope Reservoir, Providence.

Mention was made last year of the fact that a leak which has existed for over 25 years in the embankment of Hope reservoir at Providence, R. I., had been giving the city engineering department quite a puzzle before its course was finally traced. This reservoir is a service basin surrounded by dwellings. The leak appeared originally at the foot of one of the slopes, where a pipe well was constructed to intercept the seepage and direct it into a street sewer. Measurements of the discharge were kept for many years, and during the last few years the amount had increased somewhat, although not enough to cause alarm. Examinations had been made a number of times and considerable time and money had been expended, without finding any clew as to the location of the point on the inside of the bank where the water escaped. In May of last year the reservoir was drawn off for the purpose of cleaning it, and advantage was taken of this opportunity to investigate and repair the leak. The work is described in the 1906 report of Mr. Otis F. Clapp, city engineer, from which the following notes are taken:



Seepage Channels, Hope Reservoir.

It was thought that the best way to trace the course of the water would be to follow the stream back into the bank. When the water had been drawn down so that there was a head of about 1 ft. on the discharge, digging was commenced. Almost immediately a water channel was found, measuring from 2 to 4 in. high and from 4 to 8 in. in width, and nearly level. This was followed some 54 ft. in open trench and then tunnelling was commenced. When a point was reached about under the outer top edge of the embankment the channel divided and ran in nearly opposite directions. In the belief that time could be saved by so doing, a lot of colored water was forced back into the reservoir by way of each of these two routes, but the color appeared at the same point on the surface of the water in the reservoir.

The reservoir was then emptied and cleaned and the tunneling was continued by way of both branches. The stone slope wall was taken down where the colored water had appeared and a hole was found several inches in diameter, which went back into the bank for several feet, where it branched and ran in opposite directions. The tunneling was prosecuted until the lines met, every effort being made to discover any side openings that might lead away, but only a few were found and those followed to the end. The material of the embankment was found to be hard and in the best of condition, only a few soft places were found, and those, all near the water course, were completely removed. The tunnel averaged about 4 ft. high and 2½ ft. wide, just large enough for a man to work in. This tunnel was surveyed and platted, and a sketch of it is reproduced here. The tunnel measured 251 lin. ft., with 54 ft. of open cut. There were discovered 359 lin. ft. of water course in embankment.

It was not thought safe to refill the tunnel, and so that portion of the bank lying over the tunnel excavation was taken out and the embankment rebuilt. The water channel was found to have been about on the surface of the original soil, or where the artificial work in building the embankment was begun. In repairing, the precaution was taken to go down lower in the line of the core wall, finding rock from 2 to 5 ft below where the embankment had been started before, and filling in with cement concrete. The excavation was then refilled with great care, some three carloads of clay being added to the soil taken out before replacing.

The work of repairing took about 3½ months to perform, and no sign of any leak has since

appeared at this point Mr. Samuel M. Gray, who was resident engineer at the time the reservoir was built, was consulted in relation to the repairs. A smaller leak or spring, co-existent with the other leak, is still discharging near the corner of the reservoir and will be examined later.

Strengthening an Old Lattice Girder Bridge.

By George Jacob Davis, Jr.

The city of Grand Rapids, Mich., is divided into two parts by the Grand River, which is spanned by a number of bridges, two of which were originally timber lattice girders. The lattice girder bridge at Bridge St. was replaced by a steel pony-truss bridge to accommodate street cars and these trusses were, in 1904, replaced by a reinforced concrete arch bridge. The lattice bridge at Leonard St., built in 1879, still stands and carries a very heavy traffic. A few notes on the method used by the designer in computing the stresses in the bridge and on its failure and strengthening may be of interest.

The bridge consists of eight spans of 104 ft. each, built of white pine. The trusses, as shown in the illustration, are sextuple system Warren trusses, fastened together at each intersection with treenails. There were, originally, no vertical posts except three in each truss at each end of the bridge, the trusses being continuous over the intermediate piers.

From the original computations it appears that the dead load was taken as 1,000 lb., and the live load as 1,848 lb. per running foot of bridge, on two trusses. Taking the distance between centers of gravity of chords as 13.3 ft. and the span as $104-5=99$ ft. (piers are about 5 ft. wide on top), and considering the girders as simple beams, gave the computer a stress of about 131,300 lb. on each chord, of which 78,800 lb. would be carried by the outer boom and 52,500 lb. by the inner boom. Calling the girders continuous would reduce the maximum strain to about 40,000 lb. or 800 lb per square inch, only 48 sq. in. being considered available at joints in the booms. In taking care of the shear the computer assumed all the diagonal strains to be carried by one system and delivered to the abutment by one strut giving a load of about 70,488 lb. per truss on the abutment or 70,488 sec. $\theta = 93{,}987$ lb. as the approximate strain on the diagonal, which was too great, but by dividing by six (the number of diagonals cut by a vertical section) gave roughly 15,500 lb. to be carried by one diagonal.

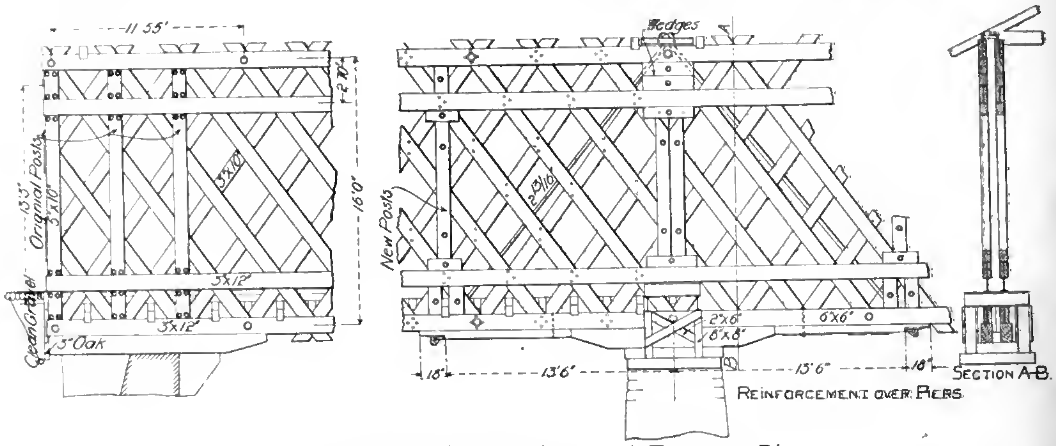
Assuming the 3x10-in. white pine diagonals to have an ultimate strength of 95,190 lb. and considering them to act as long columns, 3 ft. long, they were found to have a factor of safety of about six when the truss was considered as a simple beam. This factor of safety is still further increased by virtue of the fact of the truss acting as a continuous girder, but it is diminished by virtue of the fact that the diagonals are not rigidly supported at 3 ft. intervals, it being possible for several of them to tend to bend in the same direction, thus increasing the effective length of the columns. This action has, in fact, taken place. In some cases several of the diagonals have bowed, perhaps 1½ in., while in others, they are bent into an S form.

The chords each consist of two booms of four 3x12-in. timbers, each 30.8 ft. long. To determine the length required it was assumed that each timber would carry a stress of 27,000 lb., giving 1,500 lb. per square inch on the net area of 18 sq. in. which remain after deducting for the three 2-in. pins which were intended to be used. It will be noted above that the designer decided that only about 40,000 lb. would come on the two halves of the boom or 20,000 lb. to be transmitted past a joint by a single timber. Figuring the strength of the pins in single shear as 500 lb. per square inch, or 1,500 lb. per pin, gave a safe stress of 4,500 lb. per set of three pins. Hence to carry the 27,000 lb. past a joint six sets of pins were required. The sets are $11.55 \div 3 = 3.85$ ft. apart. This would require a plank 2x6x3.85, or 46.2 ft. long, plus something for end shearing. To reduce the length, clusters of four 1¾-in. pins were put in instead of three 2 in., the area of pins also being increased thereby from 9.42 to 9.6 sq. in. These pins also connect the lowest boom to the diagonals and they are here considered to be acting in double shear.

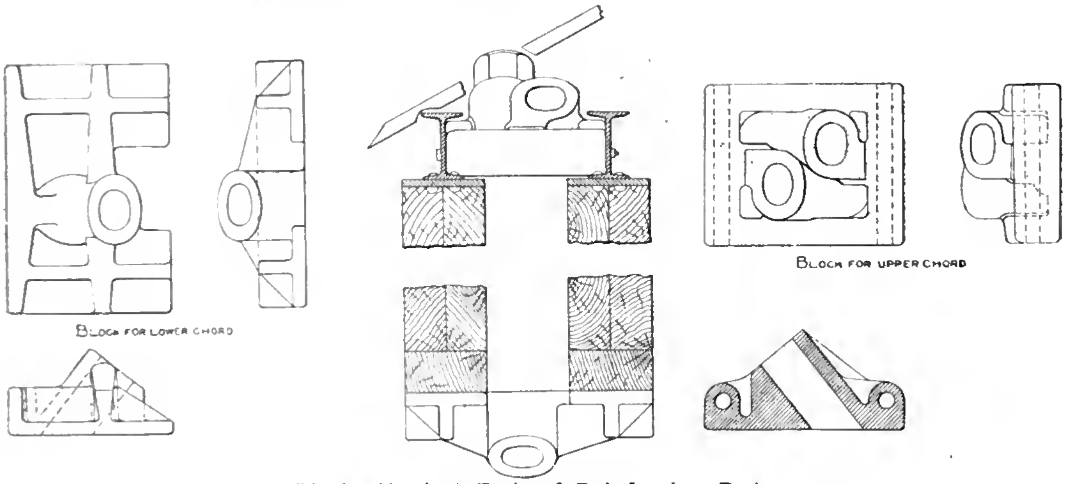
No clue is given in the old notes as to how the number and size of pins required to connect the diagonals to one another was determined.

A roof which covers the bridge has perfectly preserved the timbers except the ends of the floorbeams, which extend out to support the sidewalks and are thereby subjected to periodical wettings by rain.

The trusses have proved to be amply strong to resist the bending stresses. In the middle of the spans where the bending moment is greatest, there is no distortion noticeable in either diagonals or booms, the pins apparently have not sheared and the original camber still exists. Over the piers, however, the trusses have failed by shearing, allowing the bridge as a whole to settle approximately 0.2 ft. The floor, being supported by the lowest boom, which could not settle over the piers, shows ugly humps at these points. The failure occurred partly by the diagonals buckling between chords, as indicated above, and partly by the crushing and twisting of the lowest boom and probably a shearing of the pins connecting it to the diagonals or a distortion of the lower end of the diagonals. Of the 0.2 ft. by which the upper chord has approached the pier only about 0.02 ft. on an average was produced by the buckling of the diagonals, the remaining 0.18 ft. being the result of the other failures. The 8x14-in. bolsters and lowest boom are bent into an arc. The upper chord seems to retain very closely its original shape and the distortion in the lower chord extends only about 10 ft. each side of the piers.



End of Lattice Girder Bridge and Truss at Pier.



Blocks Used at Ends of Reinforcing Rods.

In reinforcing the bridge no attempt was made to bring the trusses back into shape, but only to relieve them of some of the stress and to prevent any further failure at these points. Jacks were put under the upper chord and screwed up, thereby stretching the chords apart slightly, and columns were then slipped in between the chords with very tight fitting joints. I-beams were next inserted under the upper booms of the lower chord and wedged up tight. Then the 2 13/16-in. round bars were placed and tightened until the new parts took a firm bearing and the bridge showed a slight rise on each side of the pier. The humps in the floor were removed by dressing down the stringers when the new flooring was laid.

Rankine states that lattice-work girders were first introduced by Mr. Ithiel Towne. They are not economical of material, being of the same strength in all parts regardless of the variation of the stresses. They were, however, easily and cheaply built, but have fallen into disuse on account of the growing scarcity of timber. Lattice trusses of iron and steel are still used somewhat in Europe. From the experience with this bridge it would seem that the introduction of posts over the piers when the bridge was built, in that way distributing the stresses from the pier reactions more uniformly among the various systems of diagonals, would have prevented the failure. The bridge is now apparently good for many more years of service.

The bridge was designed and built by Mr. Wm. Seekel, who was then city engineer of Grand Rapids. The recent reinforcement was done under the direction of the present city engineer, Mr. L. W. Anderson, the author being in charge of the work.

The Large Traveler used in erecting the Blackwell's Island bridge across the East River at New York, was injured by lightning on Sept. 23.

The Erection of the South Cantilever Arm of the Quebec Bridge.

The design, fabrication and erection of the Quebec bridge have been fully explained in previous issues of this journal, and those who wish to become familiar with the structure are referred to the list of articles which closes with this description of some details of the erection of the south cantilever arm, not previously published.

The erection of the cantilever arm was commenced with the forward bent of the traveler in the plane of the main vertical posts. The forward 69½-ft. cantilever trusses were secured to the foot of the traveler and their extremities were connected by the transverse girder 81 ft. long, which weighed 25,000 lb., and was handled from the overhang of the traveler by two pairs of wire rope tackles converging to a swivelled attachment at the center point. The top of the traveler was temporarily braced to the top of the permanent superstructure in order to avoid special anchorage at this point and the first panel of the cantilever arm was erected in 37 operations made with the traveler in the same position, which was the fifteenth counting from the commencement of the erection of the south anchor arm.

The erection superintendent was furnished with a blue-print showing the sequence and detail of all these operations and illustrated with dimension sketches giving the lengths and widths of all their principal members and showing where and how the tackles were attached to them. A number of diagrams were also given to show the positions of the different tackles suspended from the traveler and their capacities and the reference letters by which they are designated in the description, R and L, always meaning right and left hand.

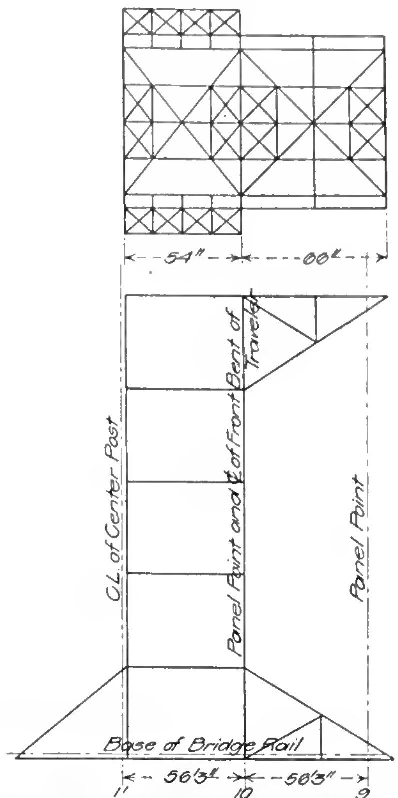
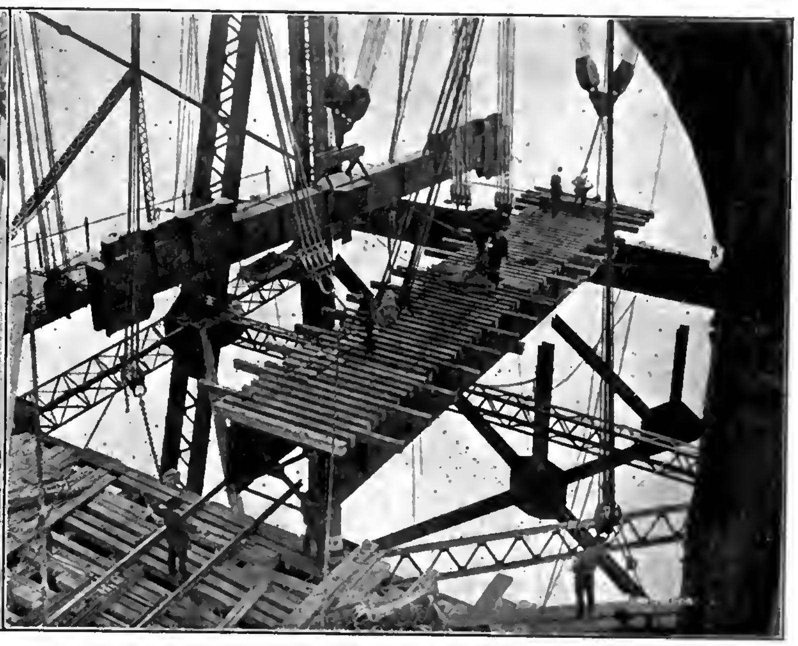


Diagram of Traveler.

Erecting First Panel of Cantilever Lower Chord.


Handling Track in Cantilever Platform of Traveler.

Preparatory to the first operation a pair of stringers and its track, making a unit 69½ ft. long weighing 60,000 lb., was delivered on cars in the tower of the traveler and hoisted by one 22-ton tackle EC and two 17-ton tackles MC, both attached to it at the center of gravity. Tackle EC was slacked off to fleet the girders forward under tackles MC which fleeted it transversely into position. The duplicate pair of track stringers on the opposite side of the bridge axis were similarly put in place and the first panel, No. 10, of bottom chord for each truss was delivered on 2 cars. Each piece was 70 ft. 7 in. long, weighed 195,000 lb. and was supported, 19 ft. from the forward end, on a bolster in the middle of a flat car 40 ft. 2 in. long over all. The rear end of the chord was supported on a bolster just in the rear of the forward truck of the rear car and was held back by a horizontal preventer tackle made with a 1½-in. rope rove through 14-in. blocks to exert a maximum pull of 15,000 lb. Pivoted attachments described in a previous article were secured to both ends of the chord projecting above its top flanges to receive two wire rope tackles HR and HL at the rear and two wire ropes tackles AR and AL in front by which it was unloaded, lowered and fleeted to position as shown in the photograph. After the lower end was splice bolted to the special V-shaped section engaging the shoe and pedestal, tackles H were released and the upper end was sustained by tackles A.

The first section LSB5, of each diagonal, R and L 63 ft. 9 in. long and weighing 29,000 lb., was unloaded by one tackle HR or HL attached to the center of gravity just above the center of gravity by a double 1-in. chain, snubbed to position with a double 1½-in. manila line and bolted securely at the lower end.

The lower horizontal struts SS6, R and L were each swung to position with two 1½-in. single foot lines and the connections at both ends bolted, thus completing the triangle and holding the diagonal members stable.

Temporary suspension bars were attached to the outer ends of the lower chord sections 10 R and L, releasing the tackles A, which were detached after the positions of the chords were adjusted.

The four bottom lateral members, not shown in the diagram, were erected with 1½-in. lines rove through single and double blocks and attached to their centers of gravity with ⅞-in chains.

In the sixth operation the second section MSP5 of the diagonal, 56 ft. long and weighing 22,000 lb., was unloaded and swung to place with a pair of 17-ton tackles, MR and ML attached a little above the center of gravity by a double 1-in. chain. The lower end was securely splice bolted and the tackles released.

The horizontal struts SS4, R. and L., were swung to position with single 1½-in. whip lines and securely bolted.

Transverse struts H2 and laterals N3 in the plane of struts SS4, not here shown, were swung to place with single whip lines attached at the center of gravity.

The third sections USP5, R. and L. of the diagonal, 80 ft. long and weighing 22,000 lb., were swung to position with 1 wire rope tackle FR or FL and a double 1½-in. snub line attached to double 1-in. chain a little above the center of gravity of the member. The bottom end was spliced bolted and the top end sustained in position by the tackles.

Struts SS8 R. and L. were swung to position with single whip lines and bolted at both ends.

The upper sections UT5 R. and L. of the main diagonal, 81 ft. 9 in. long and weighing 92,000 lb., each were swung to position by two pairs of wire rope tackles HR and L attached to the upper ends with a pivoted yoke and to 17-ton tackles M and MC attached to the lower end with a 1-in. chain.

Struts SS7 R. and L. and the transverse strut H3 and lateral 11 in the same horizontal plane were swung into position with single whip lines attached at their centers of gravity with 1-in. chains and bolted in position at both ends.

The lower sections LT6 R and L of the main diagonal, 81 ft. long and weighing 64,000 lb. each, were hoisted with two pairs of wire rope tackles, FR and FL, with special attachment to the member a little above the center of gravity, and temporarily held suspended by the tackles.

The upper ends UT5Z R and L of the hanger T5Z, 100 ft. long and weighing 55,000 lb. each, were hoisted by two 30-ton tackles EC at one end, attached to the lower end by a 1-in. chain and by two 55-ton tackles AR and AL with a special bent plate attachment at the upper end.

The transverse strut T1, not here shown, and the longitudinal strut SS5 R and L were hoisted with single whip lines attached with 3/4-in. chains.

The middle sections MT5Z R and L of the hangers, 54 ft. 9 in. long and weighing 21,000 lb. each, were swung by one pair of manila rope tackles X at one end and another pair of wire rope tackles HR and BL at the opposite end are all attached to it by 1-in. chains.

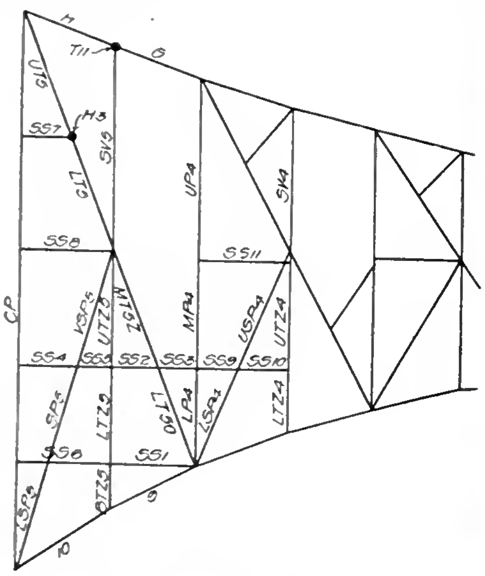
The hangers LT5Z R and L at panel point 10 were swung with single tackles attached with a 1-in. chain. All of the horizontal longitudinal struts SS, etc., were connected with temporary bolted plates permitting them to be adjusted as the panels of the truss varied during erection. The transverse struts XX, etc., were also assembled with temporarily bolted connections at one end until the main trusses came to their final adjustment.

The temporary suspension bars were removed from the river ends of the sections 10 R and L of the lower chords and the working platform on the left side of track on the cantilever of the traveler was removed. The first false-work transverse girder, 106 ft. long and weighing 108 tons, was fitted with bearing girders, chord blocks and eye-bar suspenders and swung with two wire rope tackles, HR and HL, AR and AL connected to it with a special swivelling attachment web-connected to a shoe-like device bolted to the top flanges of the girder. It was hoisted by operating the tackles HR and HL after which it was swung to one side and HL was cut loose. It was then pulled forward with tackles FR and AR and tackles HR and FR were cut loose after which tackles BL was connected to it and it was lowered to position.

Struts T6, T3, T4, T5 and T12 and diagonals T1, Too, T1 and To, all members of trussed floor beam 10, were each swung to position with two sets of manila rope tackles.

The top chord of the trussed floor beam at panel point 10, 65 ft. long and weighing 32,000 lb., was swung by a pair of 17-ton tackles MC and wire rope tackles BL and BR with a swivel connection to a horizontal beam having vertical bent plate hooks engaging the top flange of the floor beam at two points equally distant from the center. It was unloaded from the car by operating the tackle MC, drifted forward by operating tackles MDR and DL and lowered to position after the removal of the temporary track.

The two pairs of the stringers in the traveler cantilever were removed by two tackles MC and one tackle EC and were fleeted longitudinally with tackles EC and placed on cars.



Location Diagram, Cantilever Arm.

Traveler Erecting Cantilever Arm from Suspended Falsework.

Bottom laterals, diagonals N4, were lowered to position with single whip lines.

The permanent stringers were braced together in pairs at the storage yard, and one pair of railroad stringers was swung to position with two manila rope tackle EC and MC. Track was immediately laid on these stringers and cars were run out on them bringing the other stringers which were swung to position by manila tackles MC and M attached at the center of gravity.

The sub-verticals, SV5 R and L, 103 ft. 5 in. long, and each weighing 17,000 lb., were swung to position with a manila rope tackle at the lower end and two wire rope tackles WR and VL at the upper end both attached with 1-in. chains.

Lower diagonals T7, T9, T10, struts T2 and upper diagonals T8 and T9X and T10X, forming transverse bracing below sub-verticals SV5 R and L, were swung to position with single manila rope tackles.

In panels 10 of the anchor arm and cantilever arm the top chord bars were handled in three separate groups of eight each, as the space between the tops of traveler and the top chord was not quite sufficient to use the special clamps designed for the handling of the whole groups nor to fleet a group of bars over 10 ft. wide enough to clear the other twin members. In all other cases the bars were assembled in the yard and hoisted into place in one body.

The twenty-four 16-in. eye-bars in the top chord of panel H were accurately spaced and clamped together in three groups of eight bars each at the storage yard. The first outside group was swung from the cars with blocks X, MC and V and delivered to two 6-part wire rope tackle suspended from the traveler at each end of the panel with one tackle M on the overhang. The group weighing about 43,000 lb. was unloaded from the car by tackles X, MC and V suspended from the center line of the bridge and fleeted transversely into the planes of the trusses by two 6-part tackles and one 17-ton manila tackle M on each of the outside jigger beams of the traveler overhang. Tackles X, MC and V were then released and the bars were hoisted and fleeted longitudinally to position by corresponding tackles on the outside jigger beams and by the 6-part tackles at the ends of the eye-bars. The 6-part tackle at the upper end of the eye-bars was released and the bar was temporarily connected by a round timber through its pin hole. The center group of bars was swung from the cars with tackles FR and FL at the lower end and tackles X and MC at the upper end and were hoisted and fleeted to position with tackles M and a 6-part tackle suspended from the outside jigger beam. It was then drifted longitudinally to position with a 6-part tackle suspended from the outside jigger beam and a temporary pin driven as far as possible through the four holes. The third group of I-bars was swung from the cars and hoisted to position in the same way as the first group and the permanent upper pins fully driven and the temporary pin driven through the lower hole. In erection all of the bars were drifted longitudinally toward the river sufficiently to clear the main post with their upper ends and the lower ends were lifted temporarily above the top of sub-vertical post SV5. The upper ends were then drifted back longitudinally between the webs of the main post cap and the lower ends lowered to position for connection with the top of post SV5.

Top lateral diagonals L12, L13 and L14, not shown in the accompanying diagram, were swung to position with single manila tackles and the tracks and wheel stops were placed on the other stringers of the cantilever platform.

The inside vertical falsework post, 79 ft. 8 in. long and weighing 17,000 lb. each, of the first transverse bent of suspended false-work was handled by one 8-ton manila tackle X, attached with a 3/4-in. chain at the lower end and by one 10-ton manila tackle U and one 9-ton manila tackle S attached at the upper end with a 1-in. chain and after placing it into position bolted fast to the suspended transverse beam and to the truss.

The outside vertical posts of the same bent weighing 9,000 lb. each were handled by the same tackle and pulled out into position by a single tag line attached to them and rove through a snatch block on the end of an outrigger timber.

The right and left inside traveler stringers, weighing 17,000 lb. each, were swung into position with tackle M attached at the center of gravity by a 1-in. chain and fleeted into position by tackle S at the forward end and an outhaul tackle at the rear end.

The next operation was to move the traveler one panel forward until its front posts were at panel point 10 in the sixteenth position, after which the erection of the next panel of the cantilever arm was commenced with the two right and left lower chord sections, 9R and L. The number of operations for each panel was reduced to correspond with the reduction in the number of pieces. All main truss members not exceeding 140,000 lb. were erected simultaneously for both trusses, with the exception of a few

cases in which the traveler was holding up other truss members when handling these pieces.

The traveler was equipped with about 60 tackles including whip lines, all of which were operated by the eight drums and the 16 capstan heads of the four electric hoisting engines. The heaviest loads hoisted at one time were the pair of 100-ton bottom chord sections and the pair of 70-ton top chord sections simultaneously raised. All of the principal tackles were designated by numbers and signals for their operation were transmitted by the foreman to the enginemen by various gestures of the arms and head repeated a corresponding number of times. This system was so well perfected that the hoisting was done with ease and regularity and with remarkable silence, the engines running so smoothly under heavy loads that they could scarcely be heard. The work was also much facilitated by a complete telephone system connecting the superintendent's office, the traveler, the storage yard, the city of Quebec and the bridge shops at Phœnixville.

The lower cantilever working platform weighed complete about 80 tons and as already described the two pairs of stringers with their tracks were handled as separate units, each hoisted by four 8-part tackles which could remove them and place them on cars in the traveler tower in about four minutes. They were then run back to the storage yard while the permanent bridge floor was erected, after which they were returned and replaced in the traveler in its next position as already described. After the traveler had advanced to the fifth panel of the suspended traveler false-work the four vertical posts, the longitudinal girders and tracks on both sides, weighing about 40,000 lb. each, were hoisted with four 8-part tackles each in four minutes, and delivered to cars which carried them back to the storage yard until they were required for service in the next panel in advance.

The four vertical posts of the rear transverse bents were similarly hoisted, loaded on cars on the permanent bridge floor, and also sent back to the storage yard where they kept until required for use on the opposite side of the river. The suspended transverse girder was then disconnected from the lower chord pin and lowered by four 9-part tackles to a 28x100-ft. scow anchored directly below. The scow was then moved forward to a position under the fifth panel point and anchored there while the transverse beam was hoisted up and connected to the lower chord pins. Its elevation here was so near that of the track level that the vertical columns in the transverse bent were replaced by short steel blocking to receive the forward ends of the traveler track girders which were then brought back again from the storage yard and swung to position by tackles suspended from the traveler. During erection the utmost security was afforded by invariably filling every field rivet hole with a service bolt until the rivet itself was driven. Both trusses and traveler developed great rigidity and and the latter was so stable that when exposed to a wind of 55 miles per hour the upper part had an observed deflection of only 13 in.

Steel was erected in this cantilever arm with greater rapidity than it had ever before attained on cantilever erections. On Aug. 1, 1906, 410,000 lb. of steel were erected on the south cantilever arm and the maximum day's record was 340 tons when four bottom chord sections were erected for the south anchor arm. The significance of these amounts is emphasized by their comparison with the weight of an ordinary 200-ft. double track railroad bridge span which is less than the amount erected in one day on the cantilever arm with the pieces assembled in midair nearly 200 ft. above the water level.

As a matter of convenience to those who wish to study this structure, the following list of articles concerning it published in this journal is here given:

Anchorage and main piers, July 27, 1901.

Approach to anchor arm (still standing), April 11, 1903.

General methods of erection, March 4, 1905. This article illustrates the steel falsework for erecting the anchor arms and the various travelers.

The general design of the bridge—Part I, April 1; Part II, April 8, 1905. These articles outline the methods of calculation, describe the general features of the design, illustrate the anchorage and the portal bracing, and explain the chief features of the main and intermediate vertical posts, shoe and pedestal, bottom chords and eyebars.

Progress on erection of the bridge, Sept. 16, 1905. Illustrates some of the important members.

Progress on the erection of the bridge, June 23, 1906. This article contains some important illustrations giving an idea of the eye-bars and their assembly.

Steel falsework used in the erection, Sept. 8, 1906.

Camber adjustments made in the erection, Sept. 15, 1906.

Handling members during their erection, Sept. 22, 1906. Illustrates some of the special devices for this work.

The anchor arm, Dec. 1, 1906. Gives strain sheet and elevations of various bents, and notes on methods of design.

Notes on the fabrication of the bridge, Dec. 15, 1906. Describes shop methods.

Adjustable connection of anchor arm lateral system, Dec. 29, 1906. Illustrates one of the most interesting details.

Anchor pier towers, Jan. 12, 1907.

Erection attachments for bottom chords and vertical posts, Jan. 19, 1907.

Erection of the main vertical posts, Jan. 26, 1907. Describes some of the special equipment for the purpose.

Handling eye-bars, Feb. 9, 1907. Gives sketches of important eye-bar connections.

Main traveler for the ereccton, Feb. 23, 1907.

Erection of the south anchor arm, March 2, 1907. Illustrates some of the special equipment employed.

Vertical bent on main piers, June 22, 1907.

Pedestal and shoe on main piers, July 6, 1907.

Upper part of center posts, July 13, 1907.

Upper part of typical intermediate post, July 20, 1907.

Details of intermediate posts, July 27, 1907.

Details of diagonal members, Aug. 3, 1907.

Bottom chord details, Aug. 10, 1907. This article gives illustrations of members which have received adverse criticism in letters to this journal.

Floor system, Aug. 17, 1907.

Transverse bracing, Aug. 24, 1907.

The collapse of the bridge, Sept. 7, 1907, Current News Supplement.

Illustrations of the wrecked bridge, Sept. 14, 1907, Current News Supplement.

Suspension falsework of the cantilever arms, Sept. 21, 1907.

THE ELECTRIC TRAIN OPERATION contemplated on the Pacific Coast extension of the Chicago, Milwaukee & St. Paul Ry. will probably start near the east end of the 8,000-ft. tunnel through the Bitter Root Mountains and extend to some point west of Tekoa, Wash. Power will be furnished by developing sites along the St. Joseph River between Ferrel and North Fork, where something like 180,000 h.p. can be obtained if desired. It is understood that this power may be developed by an independent company, as in the case of the Western Pacific work, and the surplus sold at Spokane and in the Coeur d'Alene district.

The Melwood Avenue Retaining Wall, Pittsburg.

The Department of Public Works at Pittsburg, Pa., has now in course of construction on Melwood Ave., a reinforced concrete retaining wall about 220 ft. long which has a maximum height at the center of 64 ft., exclusive of the 4-ft. parapet wall. The wall spans a gulley which was formerly crossed by a timber trestle bridge. Since the street is an important thoroughfare at that end of the city, when the old timber structure decayed the problem was at once taken up of replacing it with a heavier and more permanent structure. Bids were called for on a steel viaduct and on a reinforced concrete retaining wall and resulted in the selection of the latter. The avenue runs approximately east and west and the front face of the wall forms the northern line of the street, the gulley back of it being filled in.

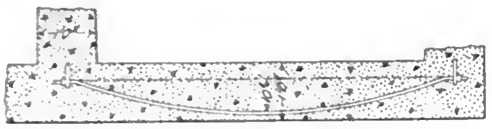
Briefly stated the wall consists of a reinforced concrete face and footings or floor, with reinforced counterforts at frequent intervals. The character of the grounds introduced some complications into the design of the footings and between successive counterforts hardly any two slopes of the footings are alike, the maximum being about 38 deg. parallel with the length of the wall, and about 30 deg. transversely. The footings were sloped transversely instead of being made horizontal not only to save excavation but also to save concrete. The ground consists of a layer of loose material beneath which is a bed of excellent shale on which the footings are founded.

The floor between the counterforts is 2 ft. thick, the front wall 18 in. thick through its full height and the counterforts 1 ft. thick. The concrete in the floor and the foundations consists of 1:2 ½:5 mixture and in the face wall, parapet and counterforts a 1:2:4 mixture, the sand being washed river sand, and the aggregate, gravel. The reinforced concrete portion of the wall has not been carried across the entire length of the hollow, there being a plain concrete gravity section 18 ft. long on the east end and 22 ft. long on the west end. Two vertical expansion joints have been provided at approximately the third points in the length of the wall, 74 ft. apart. These expansion joints are V-shaped and filled with three thicknesses of heavily-tarred paper.

The reinforcement consists of round rods varying in diameter from ½ to 1⅝ in., and anchored to plates imbedded in the floor and in the face of the wall by nuts and pins. These anchor plates are all ⅝ in. thick and are 8, 8½ or 11½ in. wide depending upon the height of the wall where they are used. One of these plates runs the entire length of the floor, imbedded in the latter under each counterfort and another plate is imbedded vertically in the wall in the same plane with the floor plate and the center line of the counterfort. These two plates are tied together by round rods varying in diameter from 1¼ in. at the lowest section of the wall to 1⅝ in. at the highest, their spacing and number being naturally dependent on the earth filling which they are to retain, the weight of the latter varying, of course, with the height of the section. At each end of these rods there is a forked eye and the connection is made to the plates by means of pins which after being driven are held in position by two split cotter pins. In the lowest section of the wall twelve 1-in. round rods are used, their spacing in the anchor plate imbedded in the floor being 9¼ in. on centers. From the floor anchor plates the rods spread out, the pins which connect them to the vertical anchor plates in the wall being 13 in. apart at the bottom and 41½ in. apart at the top, varying gradually between these two values. In the highest section of the wall there

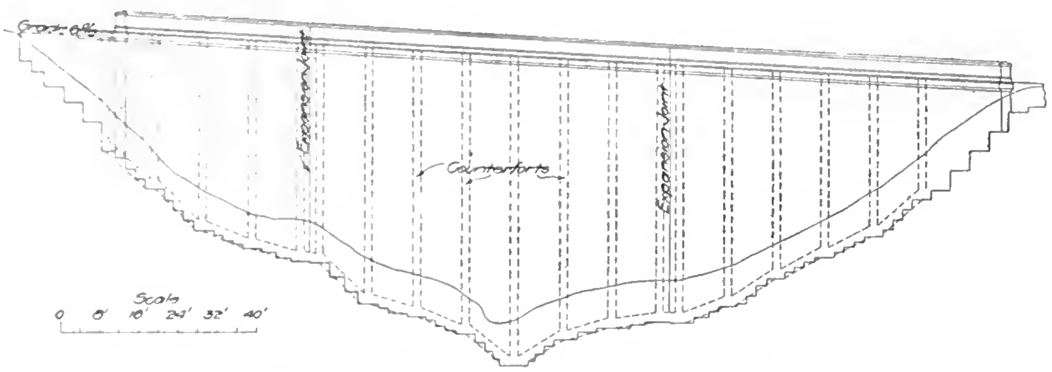
are forty-two 1⅝-in. round rods imbedded in the counterfort, their connections to the floor anchor plate being 8¼ in. apart and in the wall anchor plate 10 in. at the bottom and 6 ft. 3 in. at the top, varying, as described for the lower section, between these two values. The pins used in connecting the rods to the plates vary from 1½ to 2½ in. in diameter.

The floor rods in any given sections between two adjacent counterforts are all of the same diameter, varying from nineteen 1¼-in. rods where the wall is lowest to fifty-three 1¼-in. rods where it is highest. Rods of smaller size have been used in some of the other panels and the required total section made up by using a larger number of rods. The anchor plates have three lines of holes punched in them, the upper line in the floor anchor plate being for the connection with the tie rods running through the counterfort and the other two lines for the reinforcing rods in the floors. All of the floor rods on one side of the counterfort are connected through one line of holes, the rods on the other side being connected through the other line of holes. Nuts are used on the ends of seepage water, holes have been left through the counterforts at the floor level next to the face, the total area being about 24 sq. in. Since the greatest amount of the seepage would naturally collect at the lowest point or the hollow a 15-in. tile pipe has been laid on the floor alongside of the center counterfort with Y's projecting upward every 2 ft., this pipe extending the length of the footing at this point. The water collecting between the other counterforts drains down through the openings referred to above and discharges into this 15-in. tile which has been connected below the wall to one of the city sewers. The holes through the counterforts have been made by merely inserting cores of wood which were knocked out after the concrete had set. When the wall is completed, the drainage will be further cared for by putting loose crushed stone gravel or cinders on the footings and against the back face of the wall. Two feet of this material will be placed upon the floor, 3 ft. against the back of the wall and 4 ft. over the drainage openings of the 15-in. tile pipe. When this has been placed on the footing and over the tile pipe the earth exca-



Horizontal Section of Wall.

Section of Inclined Floor.



Elevation of Melwood Avenue Retaining Wall.

all of the reinforcing rods in the floor and in the wall. The length of the footings varies from 9 ft. to 29 ft. 6 in. in length, and the spacing of the reinforcing rods in them is always uniform in any given panel. All of the rods are bent downward, and though the tops of the floor anchor plates are about on a level with the floor itself the rods come within a few inches of the bottom of the concrete footings.

The reinforcing rods in the face of the wall are of the same general type as those used in the floor and are passed through the vertical anchor plates, in the planes of the counterforts, and held in place by means of nuts. Each rod spans between two adjacent counterforts. They vary in diameter from ⅞ in. at the bottom to ½ in. at the top, the spacing increasing from the bottom upward to suit the varying pressure of the earth backing. This spacing varies from 3 in. at the bottom of the highest section of the wall to 6 in. at the top of the same section. The number of reinforcing rods in the face varies from 53 in the end panels to 151 at the center.

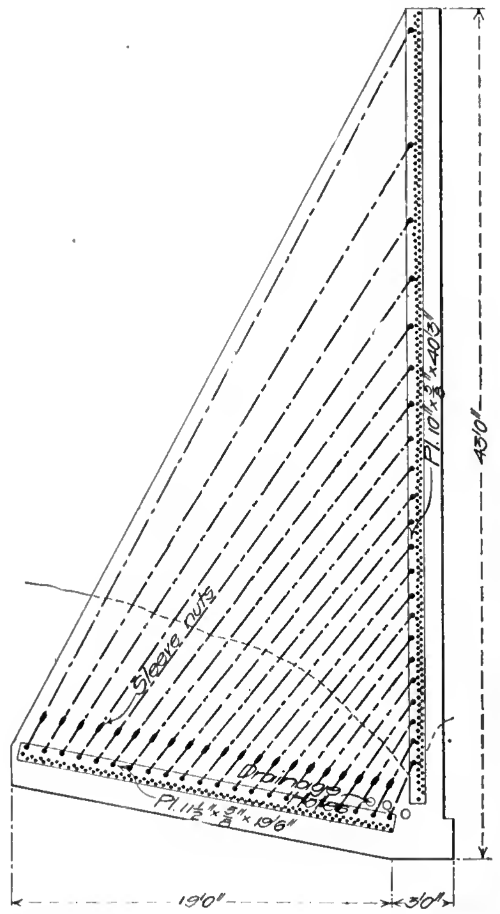
The counterforts are spaced 10 ft. apart on centers except at the two expansion joints where they are on 4 ft. centers. They are all 1 ft. wide and enclose the tie rods which connect the anchor plates in the floor and the face.

The drainage of the wall was very important because of the large run-off from the hollow across which the wall has been built. To provide for the rapid removal of the rain and vated in order to reach the solid shale foundation will be thrown over it and against the back of the wall, the entire hollow being filled up to the former street level.

The forms for the concrete work were made of 2-in. lumber dressed on one side and put together in sections. The concrete, in which Phœnix Portland cement was used, was placed in about 3-ft. courses on account of the thinness of the wall and the counterforts and the interference of the reinforcing rods. The front face of the wall was spaded and on its completion will be washed with a neat cement grout.

The materials for the concrete are all delivered at the west end of the wall and mixed on a platform at the edge of the gulley. Long-boom derricks of a combination stiff-leg and guyed type are placed in the bottom of the hollow and pick up the buckets in which the concrete is placed and handle them directly to the points where needed. These same derricks were used in making the excavation and placed the material to one side so that it can easily be picked up and used as back filling when the wall is completed.

The work is being done by the Bureau of Construction of the Department of Public Works of Pittsburg, of which Mr. Alexander B. Shepherd is Acting Director. Mr. N. S. Sprague, Assoc. M. Am. Soc. C. E., is Superintendent of the Bureau. The wall was designed by Mr. Willis Whited, Assoc. M. Am. Soc. C. E., and is being constructed under his supervision. The contractor is the Penn Bridge Co.



Reinforcement of Counterfort, Melwood Ave.

Underpinning Adjacent to the Silversmiths' Building, New York.

The Silversmith's Building, which fronts at Nos. 15, 17 and 19 Maiden Lane and at Nos. 18 and 22 John St., is a 20-story steel cage office building, with a 75x75-ft. main part reaching through from one street to the other, and two 25x75-ft. wings 12 stories and 5 stories high, respectively, one of them containing an arcade connecting the two streets. The site was previously occupied by brick buildings, with their basement floors at an average level of about 12 ft. below the highest point of the curb. As soon as these were removed an inclined plane was built with timber falsework and planking, and on it was removed the spoil provided by excavating down to a general level of 20 ft. below the curb, except under the boiler room, the floor of which was at a depth of 22 ft.

As the foundations for all but one of the adjacent old buildings were carried to a depth of more than 20 ft. below the street level, this excavation did not interfere with their stability and was made without reference to the future operations. The ground water level at the site is about 22 ft. below the curb, and the rock is covered with sand and quicksand, on which the new grillage foundations are seated at a depth of from 25 to 28 ft. below curb. As this depth was greater than that of the footings of any of the adjacent old buildings, it was necessary to provide against undermining them or causing settlement before work on the new foundations was commenced.

A 20x50 ft. plank platform at street level, supported on falsework bents set in the bottom of the excavation, was built on the south side of the lot and afforded entrance for wagons from Maiden Lane and provided for loading and unloading materials there without obstructing the narrow, crowded street. On this platform was seated a stiff-leg derrick, with a 40-ft. boom, operated by a 2-drum Lidgerwood hoisting engine, with capstan heads, which were used to swing the mast by means of an ordinary bull wheel. The cause-

way was removed, and the derrick was used for hoisting soil excavated from the pits for the foundation piers, which was shoveled into 1-yd. steel buckets and dumped in wagons driven on the working platform. Beams, girders, blocking and other supplies for the underpinning were similarly delivered to and from the excavation by the same derrick.

The two John St. wings are separated by the 5-story and basement dwelling at No. 20 John St., which is enclosed on three sides by the new building. Its exterior brick walls had footings carried down to a depth of about 17 ft. below the curb and were underpinned by new brick and concrete walls about 9 ft. deeper. The old walls were supported in the ordinary manner on needle beams made with pairs and double pairs of 12x12-in. timbers 25 ft. long, arranged two high and carried on jack screws at both ends. A line of full length timber sills and cribbing was placed across the cellar floor from end to end of the old building on the center line

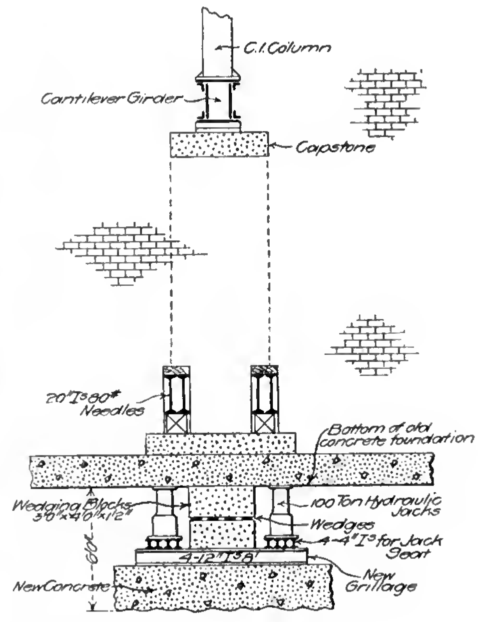
General View of Shoring.

and supported the inner ends of the row of needle beams installed for the west wall, which was the first one underpinned. The outer ends of these beams were supported on blocking, or solid timber crib work, carried down in pits below the level of the new cellar floor.

While the underpinning of this small building was in progress work was commenced on the protections of the tall buildings on both sides of the lot. The west side of the lot is bounded by a 12-story and a 15-story steel cage building, with grillage foundations for their wall columns, respectively 22 ft. 8 in. and 24 ft. 2 in. below the curb. These structures were in good condition and only required to be safeguarded against undermining through movement of the sand below the surface, due to deeper adjacent excavations. To provide against this possibility they were protected by a continuous line of United States steel sheet piles 12 ft. long, with their upper ends driven down to a level of 1 ft. above the bottom of the grillages before the new foundation excavations were commenced.

The piles were driven easily and rapidly by a 1,200-lb. hammer, with leads 28 ft. high, framed to a light portable T-shaped timber bracing like that used for driving sheet piles in the Title Guarantee & Trust Company's Building on Broadway, less than 100 ft. distant from this building and similar to the device illustrated in The Engineering Record of August 27, 1904. The hammer was made special to project beyond the face of the guide so as to work close to the plane of the wall, and with it the piles were driven 3 in. from the brickwork. The line of piles was made continuous from one street to the other, and in one case a pile soon after being started became jammed in the joint with the last driven pile and carried it down with it far below the surface of the excavation. Fortunately this occurred at a point between the two buildings, where no special external pressure was to be apprehended, and the gap thus formed in the wall was left unclosed, without any evil results. The tops of the steel sheet piles on the west side of the lot were braced by horizontal transverse 12x12-in. timbers about 10 ft. apart, abutting at one end against a ledger piece bearing across the faces of the piles and at the other end were wedged against the longitudinal sills supporting the feet of the spur piles for the side wall of the Hayes Building. The thrust of these braces against the sill was taken up by the pressure from the inclined shores and by contact of the sills against the sheeting of the crib pit for the needle beams.

On the Maiden Lane side of the lot the front wall of the sidewalk vault, being outside of the



Transferring Load to New Footing.

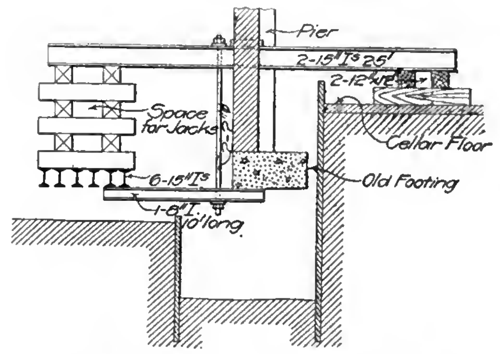
new vault line, was allowed to remain undisturbed and was secured by inclined braces against a horizontal ledger piece, while short sections of wooden sheet piles were driven below its foot to retain the earth below it when the excavation was carried to a greater depth.

On the John St. side of the lot the Cornell patent cast-iron combined curb and gutter, laid about 50 years ago, was found in a very good state of preservation and was temporarily left in service.

On the east side of the lot the John St. Building, five stories and basement in height, was supported in the usual manner on steel needle beams carried by wooden cribbing sills and timber piers, while the brick walls were carried down about 7 ft. further, or 25 ft. below the curb. On the same side of the lot the 8-story and cellar Hayes Building, at No. 21 Maiden Lane, is about 73 ft. deep and has cast-iron wall columns seated at street level on 4x4-ft and 4x5-ft. brick piers, with granite caps. The columns are enclosed in brickwork and connected by a 16-in. curtain wall extended at the base to a thickness of 4 ft. and seated on a concrete footing about 4½ ft. wide and 2 ft. thick at the height of about 22 ft. below curb level. At the beginning of operation this wall was braced with sixteen 12x12-in. inclined shores, with their upper ends gained about 12 in. into the brickwork. The lower ends were seated with wedge adjustments on a continuous line of double 12x12-in. horizontal timbers parallel to the wall and about 12 ft. from it, which was supported on a continuous grillage about 6 ft. wide of timbers. Ten of the shores were 40 ft. long and six were 25 ft. long. Three similar shores were provided to brace the exposed face of the rear wall column, to which were bolted three cast-iron lugs to receive the upper ends of the shores. The front wall of the building was braced by one 40-ft. and one 50-ft. inclined shore, with their feet outside of the sidewalk.

Opposite the 5-story building at 20 John St. pits 5 ft. wide and 8 ft. long were sheeted down about 10 ft. to a level below that of the foundation excavation, and in them were built timber crib work to support the ends of the needle beams, which carried the walls of this building and of the one at No. 24 John St. Sixteen other pits about 6 ft. square and 8 ft. deep were sheeted down to carry the crib work for other needle beams below the foundation excavation. Eight of them were located about 6 ft. apart in a row parallel with the side wall of the Hayes Building and 4 ft. in the clear away from it. These pits were sheeted with 3x10-in. tongue and groove yellow pine driven in the manner described in the recent article illustrating the work at the Murray Street Building by an Ingersoll air drill operated by steam purchased from the New York Steam Co.

At each corner of the pit the two adjacent units of sheeting were lag screwed to a 6x6x¾-in. vertical angle, which insured the alignment and water tightness of the excavation. The sheeting was braced against 4x10-in. waling pieces, and the excavation was carried down with pick and shovel as the sheeting was driven. Considerable



Suspended Support for Footing.

water was encountered, and in most of the pits it was removed by diaphragm pumps. In the deeper pits these were found inadequate, and an Edson double diaphragm pump was rigged with a walking beam and operated by a gasolene engine. Concrete footings were built in these pits and in most cases consisted of 2 ft. of 1:2½:5 hand-mixed concrete shoveled in. In some cases the water was so troublesome that it was necessary to deposit the concrete in bags, one of which was placed as fast as each shovelful of earth was removed. In each pit a 5x5-ft. pier of solid 12x12-in. yellow pine timbers was built up from the concrete footings to about the level of the top of the footing of the wall of the Hayes Building and supported a continuous line of longitudinal stringers 5 ft. in the clear from the wall, which was composed of six parallel 15-in. 60-lb. I-beams. These stringers supported the outer ends of 17 needle beams, each of them composed of 20-in. 80-lb. I-beams 25 ft long, with their inner ends resting on longitudinal double 12x12-in. continuous timbers about 5 ft. in the clear from the wall, which were laid on a continuous grillage 6 ft. wide of transverse 12-in. timbers laid on the cellar floor. Special needle beams were used at the corners of the building; all of the intermediate ones consisted of two I-beams each and were supported by one 10-ton jackscrew under each end of each I-beam, making four for each regular needle. These were set so that the I-beams had a clear span of 14 ft. between the

inner jackscrews and were calculated to have a maximum load of 50 tons each.

The cast-iron wall columns of the Hayes Building, being eccentric from their piers, are seated on cantilever girders, which have rocker bearing on cast-iron pedestals seated on capstones built into the solid brick work of the pier integral with the wall several feet above the old concrete footings. These footings were in such good condition that it required over 150 hours' work to trim a length of about 10 lin. ft. that had been partly broken away by accident. It was therefore decided, both for economy of material and more especially for the greater rapidity, to retain the old footings and build the new foundations about 6 ft. high under them. Two sets of needle beams were accordingly inserted through the old wall directly under the pedestal supporting each column and at a height just sufficient to give a working clearance over the old concrete footings.

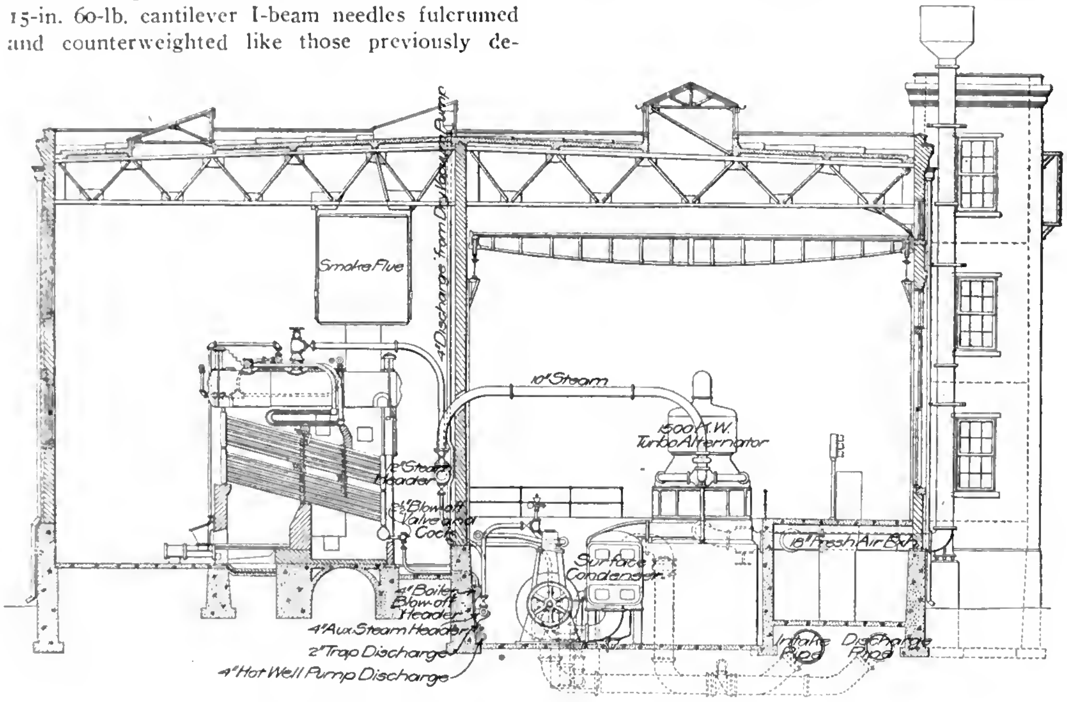
A steel bearing plate was seated across the top flanges of each pair of I-beams and gave bearing for the nuts on the upper ends of two 2-in. vertical rods about 7 ft. long. The nuts on the lower ends of these rods engaged a cross plate or saddle, forming a fulcrum for an 8-in. horizontal cantilever I-beam 10 ft. long. The long arms of the cantilever reacted upward against some of the I-beam stringers supporting the outer ends of the needle beams. The short arms took bearings about 2 ft. long on the under side of the old concrete footing, supporting it across the thickness of the wall, so that when undermined by the excavation for the new foundation the old footing looked in cross sections like a cantilever projecting about 2 ft. beyond the inner face of the wall and proved strong enough to resist the bending moment thus developed. The wall columns were about 9 ft. apart and the footing was divided in sections of corresponding length, which were alternately supported, undermined and underpinned, and were transferred to the new footings before work on the adjacent sections was commenced.

The new concrete footings were built in alternate sections 9 ft. long, excavated on the centers of the wall columns. The upper surface of the new footing was leveled off about 3½ ft. below the lower surface of the old footing, and on it on the center of each column was set a grillage of four 12-in. longitudinal I-beams 8 ft. long thoroughly bolted together with separators and concreted. In the middle of each footing was set a pair of 3x4-ft. cut granite blocks, 14 in. thick, separated by pairs of thin steel wedges. On each end of the grillage four transverse 4-in. I-beams were placed to form a seat for a 100-ton hydraulic jack reacting against the bottom of the old foundation.

As the jacks were operated the wedges were driven to maintain solid bearing between the old and new footings, with the granite blocks on the column center and thus prevented the possibility of displacement or injury to the wall from any failure of the jacks. The entire weight of wall and column was thus transferred to the new foundation, and the latter was rapidly forced to final bearing, so that no further settlement took place when the jacks were removed. By this method it is probable that excessive proportions of the loads were temporarily concentrated on each section of the footing, thus fully testing them and compressing the soil in excess of working stress and insuring against future settlement. After the jacks were removed additional pairs of wedging blocks were inserted in the positions vacated by them, and the remaining spaces between the old and new footings were closed in the usual manner.

Where the columns were placed close together no intermediate needle beams were required between their piers, but where the space was greater it was sub-divided by pairs of intermediate needle beams. The loads on the intermediate column piers were assumed at 200 tons each, but at the Maiden Lane end of the wall the pier at the corner of the building carries part of the front of the building and has an estimated load of about 300 tons. It was, therefore, carried by two regular needles, together containing four I-beams, and by one special needle, containing four more I-beams, making eight in all.

At the other end of the wall there is, adjacent to the corner pier, a 3x3-ft. pier, carrying a 24-in. iron smokestack 100 ft. high, with an estimated weight of about 6 tons. This was supported during underpinning by a single cantilever needle beam made with one 12x12-in. yellow pine timber, 25 ft. long, fulcrumed on the I-beam sills, which support the outer ends of the regular needle beams and counterweighted at the extremity of the 25-ft. long arm by a 1-yd. steel bucket filled with earth. Beyond this smokestack there is a short length of 12-in. 2-story brick wall, which during underpinning was supported by two 15-in. 60-lb. cantilever I-beam needles fulcrumed and counterweighted like those previously described. The end of this wall intersects a 20-in. cross wall, supported at the corner by an oblique cantilever needle beam made with a single 12x12-in. yellow pine timber 25 ft. long, fulcrumed on the last mentioned cantilever needle beam and anchored at the outer end by a wire cable attached to the blocking under the regular needle ebam. The jackscrews were operated to give all of the needle beams a deflection of about ¼ in. at the center and carry the full weight of the wall without causing any appreciable displacement. The old footings were then removed, the trench dug down to a depth of 1 ft. below the deepest point of the new foundations and the new footings and brickwork above them built and the weight of the old wall transferred to them in the usual manner. Careful levels were taken on a bench mark on the opposite side of the street, and repeated observations were made, which failed to show any settlement of the old walls during or after the underpinning process.



Cross-Sectional Elevation of Whitewood Station.

Nearly the full width of the Maiden Lane front of the Hayes Building is occupied by three large openings for the main entrance and wide show windows. One of these is spanned by a very flat stone arch, with the skewbacks built into the corner pier of the building very close to the underpinned side walls. To avoid the possibility of displacement of these side walls during the above described operations a pair of long inclined 12x12-in. timbers were wedged against the face of the side wall opposite the skewback of this arch, and their feet were made to engage the vault retaining wall just below sidewalk level. A similar pair of horizontal timbers were wedged against the wall at first floor level, and the two sets were united by vertical and diagonal bracing planks spiked on to them, making a sort of truss and thoroughly providing against any possibility of movement due to the thrust of the arch. As these timbers required wedging again after the work was commenced, it was assumed that they did not actually receive much stress and that their use was a precaution which might have been safely omitted.

Excavation below the cellar floor of the old building was commenced July 4, 1907, the underpinning contract was awarded July 12, and work on it was commenced the same day and carried on night and day, with two gangs of about 20 men each. On August 1 the underpinnings of the buildings at No. 20 and at 24 John St. were completed, the first pier was built in its pit on August 8, and on August 24 the underpinning of the Hayes Building was substantially finished and the work practically completed.

Clinton & Russell are the architects of the building, and the general contractor is the A. J. Robertson Co., Mr. L. H. Whitenack, superintendent in charge. The contract for underpinning was awarded to Miller, Daybill & Co. and was executed under the personal supervision of Mr. Alfred Daybill.

Patented Pavements were the subject of a recent decision of the Louisiana Supreme Court in Lacoste v. City of New Orleans, 44 S. Rep. 267. The court's syllabus of the decision is as follows: The fact that a pavement is patented is no obstacle to full and fair competition upon a municipal contract for the laying of it, when the patentee has filed with the city authorities an agreement to let the successful competitor for the contract have the free use of the patent upon payment of a fixed royalty, thereby placing all prospective competitors upon an equal footing; it appearing that the royalty thus exacted was reasonable, and did not destroy the margin of profit under the contract. It is no answer to say that the patentee can underbid his competitors for the contract. To him, as to the other bidders, the sole inducement for bidding on the contract is the margin of profit which he sees in it, and for him, as for all others, this margin of profit begins only after the royalty has been paid.

A Central Power Station in the Whitewood, S. D., Mining District.

The generating station of the Consolidated Power & Light Co. of Deadwood, S. D., has been built to supply electric current for power in the mines and mills in its vicinity, and for lighting in Deadwood, Lead and several smaller mining camps. This company was organized as a consolidation of the Belt Light & Power Co., and the Deadwood Electric Light Co. The station of the former company was at Pluma, midway between Deadwood and Lead, on Whitewood Creek and the Burlington R. R. This station was so favorably located that the decision was made to reconstruct and enlarge it according to the best practice, and to abandon the Deadwood station.

The station building as reconstructed and enlarged is 88 ft. wide and has an extreme length of 136 ft., as shown in the accompanying general plan. It is divided by a longitudinal brick wall into a boiler room, 40 ft. wide, and a generator room, 44.5 ft. wide. The original station contained two 200-kw. DeLavel turbo-generator units which were supplied with steam by three 200 h.-p. Freeman Scotch boilers. These generators and boilers have been left in their original position in the old part of the building, but have not been in service since the new equipment was installed.

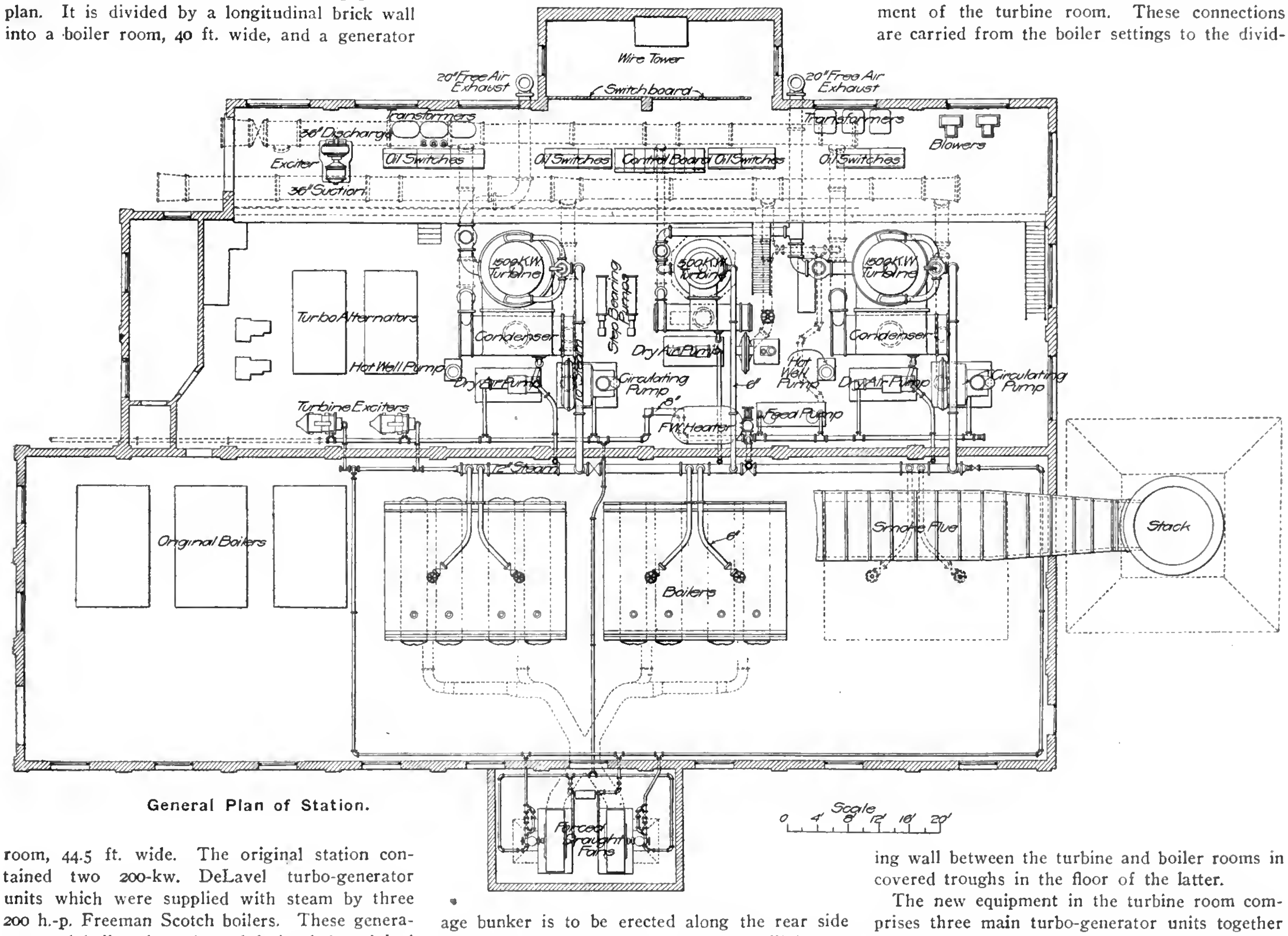
The boiler room contains four new Babcock & Wilcox boilers, arranged in two batteries, with space at the end of the row for two additional boilers. These boilers each have 3,500 sq. ft. of heating surface and are equipped with superheaters capable of raising the steam temperature 100° Fahr. above that of saturated steam. The furnace of each boiler is equipped with a Jones underfeed stoker, the forced draft used with the stokers being furnished by two American Blower Co. 120-in. blowers, either of which has sufficient capacity to supply draft to all four furnaces. These blowers and the two engines driving them are placed in a small separate room at the rear of the boiler room. The stoker rams are operated by steam in the usual manner, the automatic device controlling the supply of steam being driven by either of the blower engines. The speed of the latter is controlled by a Foster regulating valve arranged in such manner that the coal and air supply are varied automatically, so the boiler pressure is maintained constant within certain limits.

Wyoming lignite containing about 11,000 B. t. u. per pound when dry, is burned under the boilers; as this lignite is used at present, however, it contains approximately 20 per cent. of moisture. A temporary coal-handling arrangement is employed, pending the installation of a proposed coal-handling system. Coal is delivered one end of the building at present and then hauled into the boiler room and stored on the firing floor, from which it is supplied to the stokers by hand. A large structural steel storage bunker is to be erected along the rear side of the boiler room. A switch track will be extended over this bunker, in order that coal may be dumped into the latter from the cars. Chutes will lead from the bunker directly to the charging hoppers of the stokers, thus permitting the latter to be fed by gravity throughout.

Feed water is supplied to the boilers through duplicate feed lines by either of two vertical marine-type single-cylinder Dean Bros. boiler-feed pumps, either of which has sufficient capacity to furnish water to all four boilers under any operating conditions. These pumps draw from an open-exhaust Stillwell feed-water heater in the turbine room to which water is pumped from a hot-well in the basement of the generator room. Make-up water is supplied automatically by a low-service Blake pump from a circulating system for condensers in the turbine room. A float-regulated valve in the discharge of this pump actuates a Fisher governor which controls the operation of this pump. The main units in the turbine room are all operated condensing, the water of condensation passing to the hot well. The auxiliary steam-consuming units in the station are all run non-condensing, their exhaust being carried to the feed-water heater.

The boilers each have a 6-in. connection with a 12-in. steam header along the wall in the rear of their settings. These connections are each equipped at the boiler with a stop and a check valve. The header is divided in three parts, one for each pair of boilers, by stop valves. Each of these three parts is connected with a 4-in. auxiliary steam header in the basement of the turbine room, forming a ring system which enables the main units in that room to be supplied with steam under practically any conditions.

The mud drum of each boiler has two connections with a 4½-in. blow-off header in the basement of the turbine room. These connections are carried from the boiler settings to the dividing wall between the turbine and boiler rooms in covered troughs in the floor of the latter.

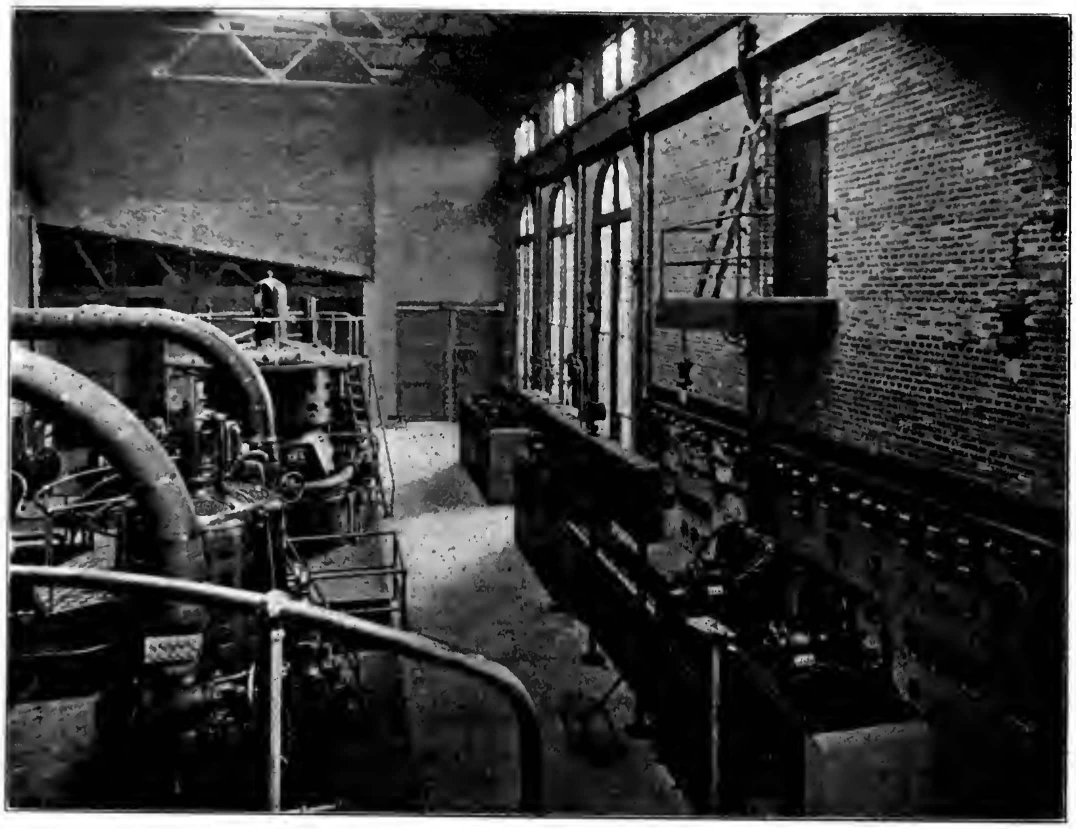


General Plan of Station.

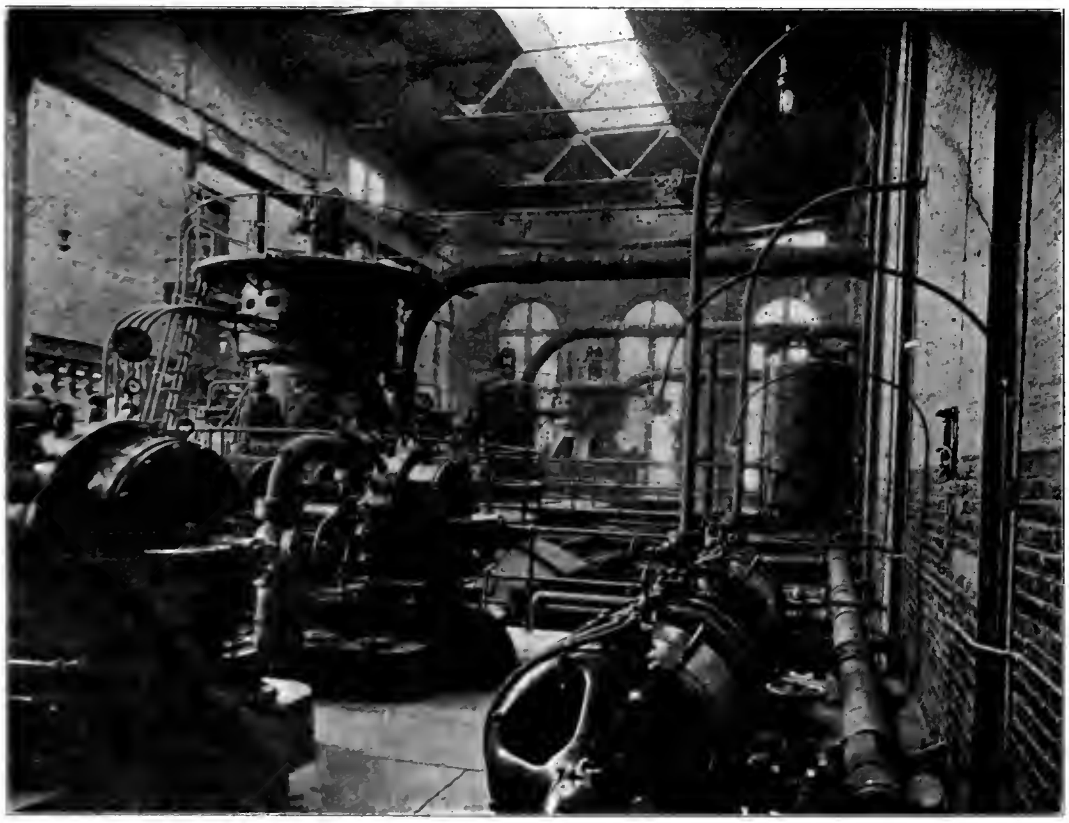
The new equipment in the turbine room comprises three main turbo-generator units together with their necessary auxiliary apparatus. One of these units is a 500-kw. 2,300-volt 60-cycle three-phase General Electric generator, direct-connected to a four-stage Curtis turbine, with water supported step bearings. The other two units each have a 1,500-kw. 11,000-volt 60-cycle three-phase General Electric generator direct-connected to a four-stage Curtis turbine; the turbines of these units also have water-supported bearings. The 500-kw. unit has a Wheeler admiralty condenser with 2,000 sq. ft. of surface, equipped with a 6x14x10-in. dry-air pump and a 10-in. steam-driven horizontal-suction centrifugal pump for circulating cooling water. The two large units also have condensers of the same type, with 6,000 sq. ft. of cooling surface, which are each served by an 8x18x12-in. dry-air pump and an 18-in. steam-driven horizontal-suction centrifugal pump for the cooling water. The exhausts of all three

units are connected to risers extending above the roof of the building where they are fitted with Wright exhaust heads. A 42-in. reinforced-concrete conduit extends from the channel of Whitewood Creek, which is about 200 ft. from the station building, to the latter and is continued into the building as a 30-in. main from which the circulating pumps take suction. The cooling water is discharged from the condensers into a second 30-in. main beneath the floor of the basement of the turbine room; this main terminates at the building line in a second 42-in. reinforced-concrete conduit leading back to the creek.

Owing to a scarcity of water in the creek at certain seasons, a dam has been erected across the channel of the latter, and a specially devised cooling system has been added to the end of the discharge conduit. This cooling system is only used when there is an insufficient quantity of water coming down the creek. It consists essentially of a manifold of standard hub-and-spigot cast-iron pipe, ranging from 24 in. to 16 in. in diameter, with special crosses having 5-in. flanged outlets for lateral pipes fitted with a series of sixty 3-in. Schutte spray nozzles. The manifold pipe is carried by concrete piers; the lateral pipes are each supported at the middle by a truss rod equipped with a turnbuckle and attached to a strut on the manifold. This arrangement has entirely prevented vibration. The laterals are made up of 5-in. and 3-in. pipe, with a total length of 22.5 ft. from the center of the manifold to the center of the outer nozzle, two of which are carried by each lateral. The nozzles are spaced 15 ft. apart on centers in all directions. Each nozzle is designed to spray 9,000 gal. of water an hour under a pressure of 12 to 15 lb. per square inch, but two valves in the manifold permit part of the nozzles to be cut out of service machine direct-connected to a 75 h.-p. three-phase 2,300-volt induction motor. The steam-driven exciters are against the rear wall of the turbine room; the motor-driven exciter is on a concrete platform at the front side of that room and level with the floor of the latter.



Switches and Switchboards in Turbine Room.



Three Main Units in Turbine Room.

The complete distribution of the spray by this method is shown in one of the illustrations. The dry air of the locality causes sufficient evaporation from the spray to cool the water satisfactorily.

Three exciter units for the main generators are provided. Two of these each have a 25-kw. 125-volt direct-current generator driven by a steam turbine. The third is a 60-kw. 125-volt

The switches, transformers and so forth are on the concrete platform along the front side of the generator room. Two switchboards are provided, one for the 2,300-volt circuits and the other for 11,000-volt. Three single-phase 2,300-volt lines are carried from the 2,300-volt board to Deadwood and three to Lead for commercial lighting. Two circuits for street arcs are also carried to Lead, and one to Deadwood from this board. The exciters are also controlled from the latter.

The two 1,500-kw. units and the 11,000-volt transmission lines are equipped with motor-operated three-phase oil switches. These motors are controlled from the second switchboard by the remote control system can be operated at voltages from 70 to 150 volts, the current being obtained from the exciter units. The transmission line switches can also be operated by hand in an emergency.

The 11,000-volt bus bars are in separate brick and concrete compartments in the space under the concrete platform carrying the oil-switches and transformers. The generators are connected to the ends of the bus bars, and disconnecting switches are provided in the latter between the generators and the circuits leads which are taken off from the middle portion of the buses. Disconnecting switches are also placed between each motor-operated oil switch and the bus bars for safety during repairs and cleaning.

Two banks of transformers are arranged between the two switchboards, in order that current may be taken from either one to the other. One set consists of three 100-kw. oil-cooled type, and the other of three 185-kw. air-blast type.

A fireproof brick tower, 10x30 ft. in plan and three stories in height, is provided on the front side of the building for all transmission lines leaving the station. The 2,300-volt switchboard is placed in an opening in the building side of the first story of this tower, and together with its connections and equipment occupies most of that story although very ample room for reaching the back of this board is available. Current regulating transformers for the 2,300-volt lighting transmission lines occupy the second floor, and lightning arresters, choke coils and so forth, the third. The 2,300-volt lines in the tower are oiled-cambric insulated cable; the 11,000-volt lines are bare wire in separate brick cells and on 20,000-volt insulators.

The 2,300-volt transmission lines to Deadwood and to Lead are both 1½-miles long. The 11,000-volt lines extend to various mining camps within a radius of 10 miles of the station. None of these lines embodies any special features of construction.

Mr. N. E. Franklin is vice-president and treasurer, Mr. J. W. Springer, manager, and Mr. J. H. Fuller, engineer, for the Consolidated Light & Power Co. Messrs. Sargent & Lundy, of Chicago, are consulting engineers for that company and were represented during the construction of the station by Mr. H. Boyd Brydon, to whom this journal is indebted for the information from which the foregoing notes were prepared. The extensive piping work in connection with the station was done by Mr. W. H. Pope, of Chicago.

The Spraying System of the Whitewood Power Plant in Full Operation and under Light Pressure.

Continuity in Reinforced Concrete Beams and Slabs.

The question of rejecting or recognizing continuity in the design of reinforced concrete slabs and beams is one of the disputed features of such work that will probably not be settled for a long time. The continuity is necessarily assumed when it is assumed that beam and not arch action takes place. This assumption is generally considered to be correct except where the ratio of depth to span is great, but it is possible that more attention will be given to arch action when experiments have become more numerous and comprehensive. The subject was discussed by Prof. Lewis J. Johnson of Harvard University at a meeting of the Boston Society of Civil Engineers some time ago, and the necessity of providing for continuous beam action was strongly urged in his remarks. Slabs, beams and girders are continuous beams as built, and for better or for worse will act as continuous beams, in his opinion, if they act as beams at all. Objection to recognizing this fact in design seems to be based upon the supposition that designing beams as continuous would lead to mid-span sections good only for positive bending moments of about $1/40\ wl^2$, a figure which would be nearly correct for a load distributed uniformly over all spans at once, but would be fatally in error in the case of the far more probable instances of unequally distributed load.

Objection of a similar sort is applicable to design upon the basis of discontinuity, where ultra cautious design for a mid-span bending moment of $\frac{1}{8}\ wl^2$ is accompanied by a more or less complete ignoring of the negative bending moment of the supports. The assumption of simple beam action may thus prompt serious error on the side of danger quite as certainly as similarly improper application of the assumption of continuous action. That trouble from this source has not been more abundant Prof. Johnson believes to be due partly at least to the undoubtedly considerable tensile strength of the concrete in the wings of T-section beams and girders. But if it is not safe to count on tensile strength of concrete elsewhere, it is not safe to count on it here, he holds.

The logical course to pursue, he states, is to recognize that, if the action present is beam action at all, it is continuous beam action, and to design accordingly. This means careful attention to the extreme values of the flexures at supports as well as at mid-spans due to all possible distributions of the live load. The end sections are then designed to meet these extreme conditions, and so are the mid-span sections. This is standard practice among the Germans and Swiss. Of course in applying this method, as in any careful design, attention will be given to all important facts, such as stair or elevator wells interrupting the continuity in places; and in cases of doubt, assumptions unmistakably on the side of safety will, of course, be made.

The labor involved in these computations is not so great as it would seem. As a matter of fact, the extreme conditions under uniformly distributed live load will almost always be covered in case of a series of beams and slabs of equal spans by designing for a live load flexure of $1/10\ wl^2$ (l being measured from center to center of supports) at the faces of columns and girders, and the same amount at mid-spans; and this, too, regardless of the number of spans in the line. At the column faces flexure would be negative and at mid-spans positive, and in both cases would, of course, be combined with the dead load flexures. If the spans are short and the live loads large in comparison to the dead, top reinforcement may be required at mid-span to provide for resultant negative flexures there existent. The similar extreme values for girders subject to concentrated loads have not been so well established, but the need of them is recognized and it is hoped that they may be forthcoming soon.

If a designer prefer, let him use $\frac{1}{8}\ wl^2$ at the mid-span section, but let him not fail to provide fully for the bending at the faces of the supports, Prof. Johnson advises. He must not overlook the fact that top reinforcement is as logical a requirement as bottom reinforcement at mid-span. Moreover there is additional justification for top reinforcement in that it is of the greatest possible value in case of weakening of bottom rods by fire. The top rods through cantilever action may carry the load after the lower rods, in the far more exposed position of the two, have failed. In fact, top reinforcement does not seem to have had the attention which its merits from the fireproofing standpoint would seem to entitle it.

It may be objected that continuous beam coefficients based upon the assumption of unvarying moment of inertia may be inapplicable to reinforced concrete beams. This is certainly a fair field for research, but Prof. Johnson believes that the practitioner may well proceed for the present with his $1/10\ wl^2$, taking comfort from realizing that the negative bending moment over supports would not rise above $\frac{1}{8}\ wl^2$ even in the extreme case when the moment of inertia becomes zero at mid-span, the case of two abutting disconnected cantilevers, most unlikely to occur. The error in the $1/10\ wl^2$, if any exist, must be extremely small and unimportant.

For beams under a uniformly distributed load, the top steel at the column faces and through the column may or may not be the same in amount as at mid-span, depending upon the relative depth of the beam at the two points, but Professor Johnson sees no escape from the belief that the negative moment of resistance at the column face should be as large as the positive moment of resistance at mid-span. If, as is usual, floors are figured with T-sections, this may call for the German practice of materially deepening the stems at, and for considerable distances each way from, the supports, to make up for the absence of flanges on what is here the compression side of the beam.

This leads to brackets at connections of girders to columns and of beams to girders. These brackets complicate the forms and are sometimes unsightly. They can be obviated by making the depth of stem at mid-span as great as required at the column faces, proportioning the bottom steel accordingly. This interferes with headroom and adds to the quantity of concrete required. It may in some cases be practicable to diminish this depth by the use of steel reinforcement in the compression lower side of the beam at the support. Though this latter reinforcement would also be effective and necessary reinforcement from the arch point of view, the brackets will in many cases be preferred to either of these alternatives.

Even if all these considerations are kept in mind, continuous beam action is unavoidable, according to Prof. Johnson. It must be reckoned with and properly provided for in all reputable reinforced concrete practice, he asserts, for there must be no departure from the principle of providing at all points of a structure for the most unfavorable conditions it is reasonable to expect. Moreover, it will not do to assume that we err on the side of safety when we ignore continuous beam action.

An Extensive Wireless Telegraph System has been installed by the United Fruit Co. on its fruit steamers and at numerous points on the Gulf of Mexico and the Caribbean Sea, for communication between the offices, steamers in transit, and its plantations in Central America and the West Indies. A station was recently added at San Antonio at the extreme western end of Cuba.

Experiments With Submerged Tubes 4 Ft. Square.

By C. B. Stewart, in Charge of Hydraulic Research Work, University of Wisconsin.

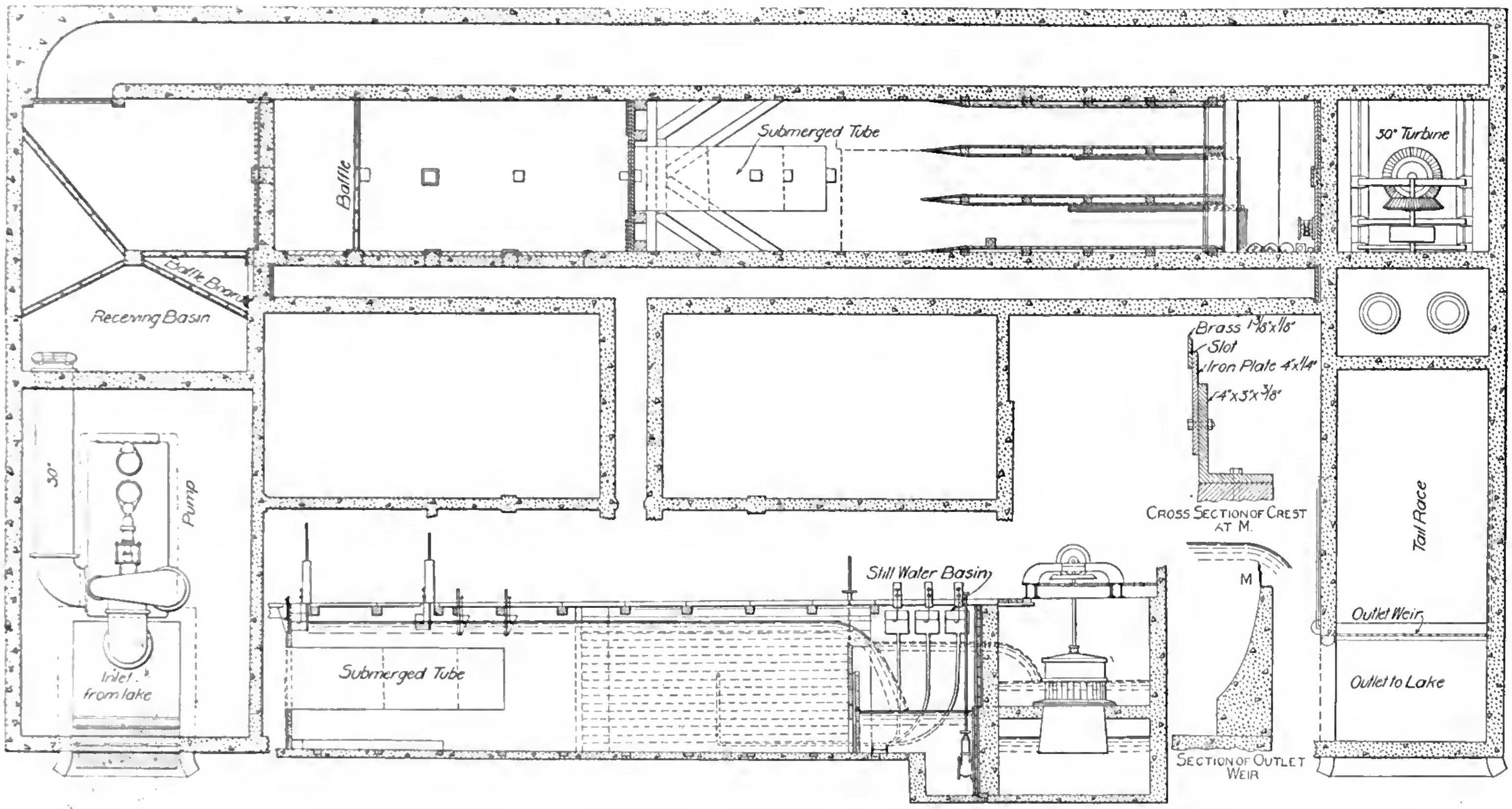
The recent construction of large works in connection with the various lines of Hydraulic Engineering has emphasized the need of further experimental knowledge concerning the losses of head resulting from various forms of resistances interposed in flowing streams of considerable size. The loss of head resulting from the flow of water through submerged gates, tubes and orifices of considerable size and with various forms of entrance is one of the most important divisions of the general subject which needs experimental investigation. Practically the only reliable experimental data available concerning the flow of water through large orifices are given in a valuable paper by Mr. Theodore G. Ellis, entitled "Description and Results of Hydraulic Experiments with large Apertures at Holyoke, Massachusetts," and printed in the "Transactions" of the American Society of Civil Engineers for 1875. Mr. Ellis determined the loss of head for flow through apertures the dimensions of which were 2 ft. square and 1 x 2-ft. when discharging freely into the atmosphere, and also made a very few experiments on the loss of head for flow through submerged apertures 1 ft. square and 1 ft. in diameter under heads from 2 ft. to 15 ft. In nearly all the experiments of Mr. Ellis, the thickness of the edge of the aperture remained constant, about ½ in. for wood and ¼ in. for iron, and perfect contractions of the emerging stream were supposed to take place on all sides of the aperture. In the single case of the aperture 1 ft. square, the entrance was subsequently modified so as to have a curved approach on all four sides, and the resulting coefficients of discharge were determined.

In the experiments at the University of Wisconsin described in the present paper, the cross-section of the orifice or tube has been kept constant, being 4 ft. square, and the effects of changing the length of the tube and of modifying the entrance conditions by curved approaches on one, two, three and four sides respectively, for each of the various lengths, has been studied.

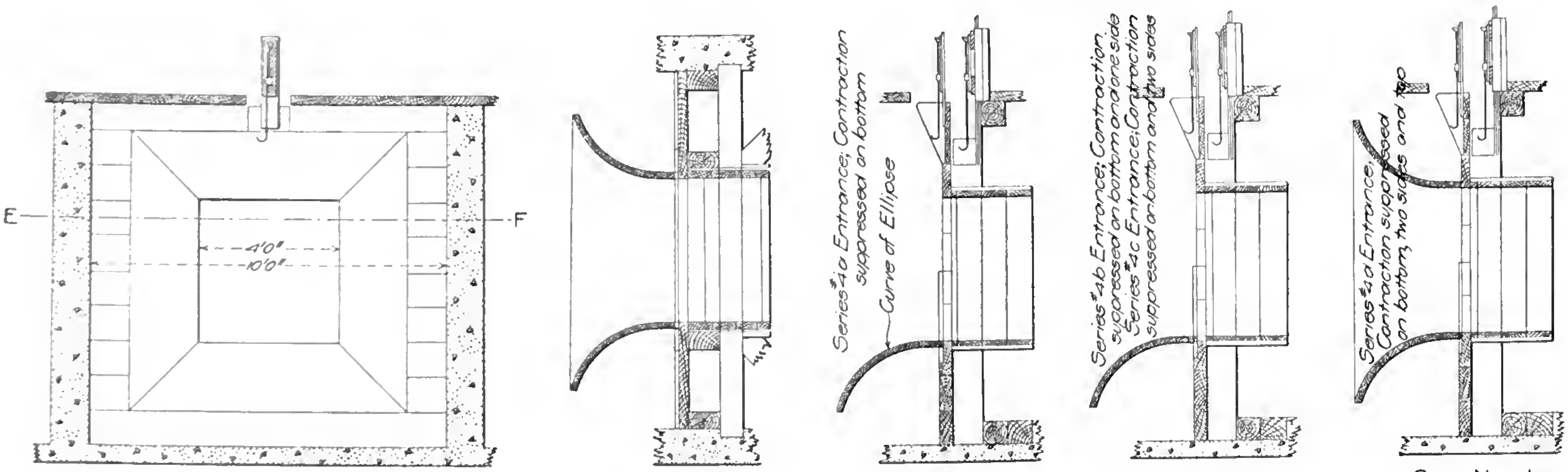
In future experiments on this subject at the University, it is planned to determine the coefficient of discharge for submerged tubes and orifices of various forms and areas of cross-section, with and without entrance modifications. It is hoped that the results of the experiments when completed will fairly cover the field of investigation laid out and be of material aid to the engineering profession.

The experiments were made at the new hydraulic laboratory at the University of Wisconsin (Engineering Record, April 21, 1906), which is located on the shore of Lake Mendota and furnishes an abundant supply of fresh water. Exceptional facilities were afforded for experiments on a large scale, and care was taken that errors of observation should be reduced to as small a percentage as possible. The accompanying plan of the laboratory shows the main features and arrangement for the experiments. The water was taken from the lake by a suitable inlet and raised about 12 ft. by means of a 30-in. Morris centrifugal pump, and delivered into a receiving basin which measures about 15 x 18 x 10 ft. deep. From the receiving basin the water flows through a flume 10 ft. wide, 10 ft. deep and about 68 ft. long, and may be used for operating a 30-in. turbine located at the end of the flume or may be wasted through gates underneath the turbine. The water flows back to the lake through a tail race 10 ft. wide, as shown. At the outlet end of the tail race is a sharp crested weir with end contractions suppressed and a crest 10 ft. long.

Suitable baffle boards were inserted in the receiving basin and at the entrance to the flume until it was found by trial that the water in the flume flowed in lines practically parallel to the sides of the flume.

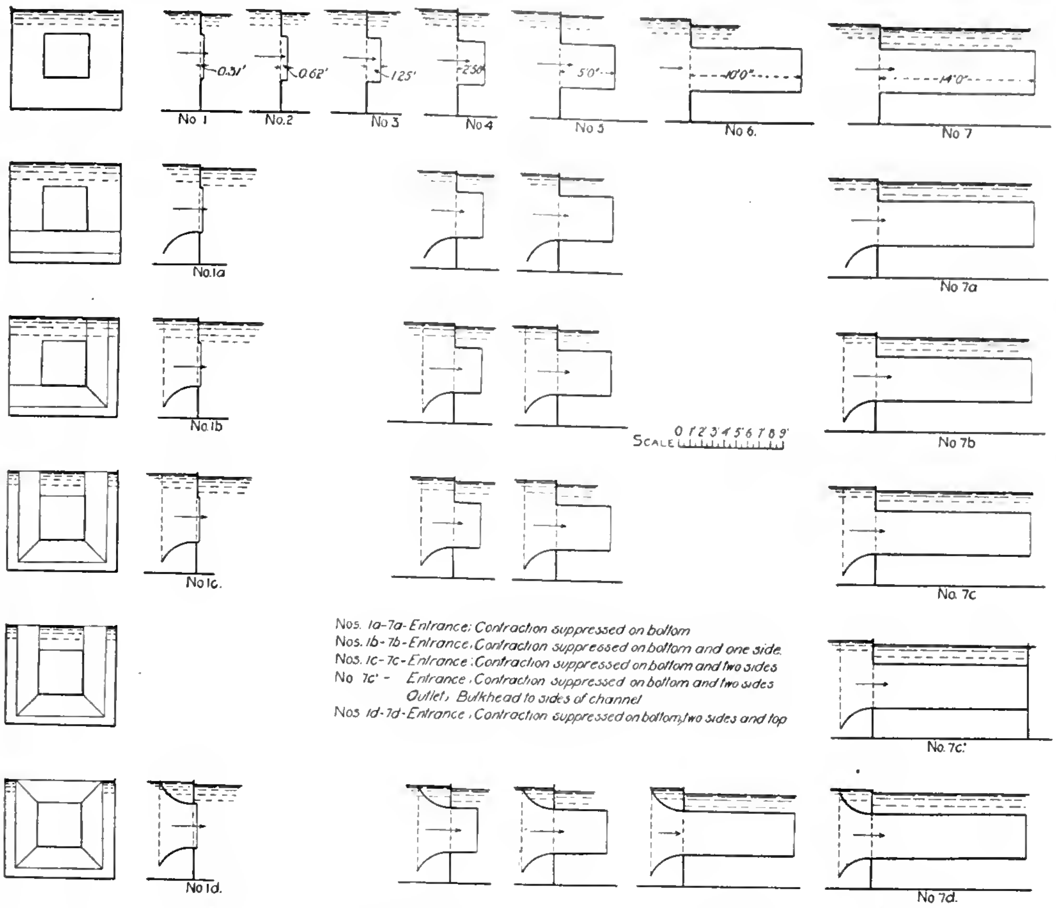


Plan and Section of Apparatus for Testing 4-Foot Square, Submerged Tubes.



Section E-F Series No.4a Series No.4b and 4c Series No.4d.

Details of Tubes with Suppressed Contractions.



Sections of Tubes Showing Forms of Entrances and Lengths.

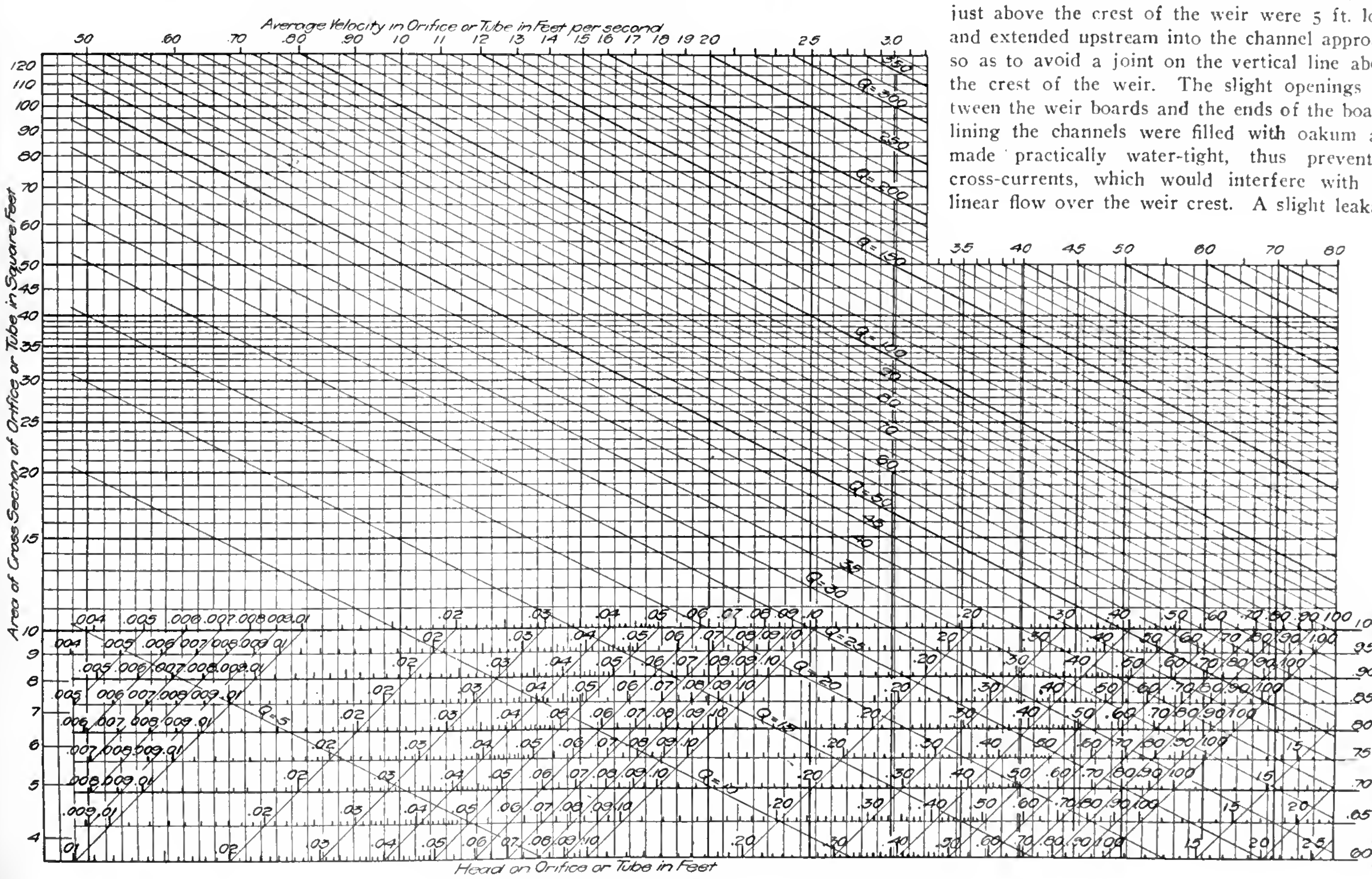


Diagram Giving Discharge Q for Submerged Tubes.

The bulkhead containing the tube experimented with was located about 24 ft. from the entrance to the flume.

The facilities for making a volumetric calibration of a weir whose length of crest is 10 ft. were not available, so the expedient of dividing the 10-ft. channel into three similar channels, each having a length of about 15 ft., and with a sharp-crested weir at the end of each channel, was used. In order to form a variable height of water surface on the downstream side of the bulkhead containing the submerged tube, the three sharp-crested weirs were made adjustable in height. The main feature of the weirs consisted of a fixed bulkhead, extending about 5 ft. above the bottom of the channel and a movable gate above the bulkhead, extending the full width of the 10 ft. channel and capable of being raised or lowered by means of two hand wheels, one on each side of the channel. The crest of the three weirs was made of a single plate of 6 x 3/16-in. wrought iron, bolted to the upper edge of the movable timber gate and beveled on the downstream side of the top edge to a thickness of about one-sixteenth of an inch. The joints around the weir openings were made water tight by means of gaskets formed of cloth insertion rubber tubing, one-half inch in diameter, the movable gate being drawn against the gaskets by means of lag screws passing through cleats adjustable vertically in the timber frame supporting the bulkhead and gate. Each of the three weirs had its own channel of approach about 15 ft. long. The sides of the channels were lined with one inch surfaced pine flooring boards so that all three of the channels of approach and weirs were practically alike, the only variation being that of slight difference in width of about one-half inch in the case of one weir. The board linings of the channel were extended downstream from the crest of the weir a distance of 1½ ft. and also below the crest of the weir, a distance of about 2 ft., so that the weirs had their end contractions suppressed and the filaments were guided in parallel planes after passing over the crest. The arrangement of the weirs with intervening spaces of about 8 in. between the ends allowed free entrance of air beneath the nappes.

The board linings around the crest of the adjustable weirs have to be removed each time the crests are adjusted. These boards were attached by counter-sunk flat head screws, and just above the crest of the weir were 5 ft. long and extended upstream into the channel approach so as to avoid a joint on the vertical line above the crest of the weir. The slight openings between the weir boards and the ends of the boards lining the channels were filled with oakum and made practically water-tight, thus preventing cross-currents, which would interfere with the linear flow over the weir crest. A slight leakage between channels of approach was unavoidable. The rubber tubular gaskets were horizontal at the top of the fixed bulkhead, and extended vertically upwards on each of the sides of the weir openings to the maximum height of water in the channel of approach.

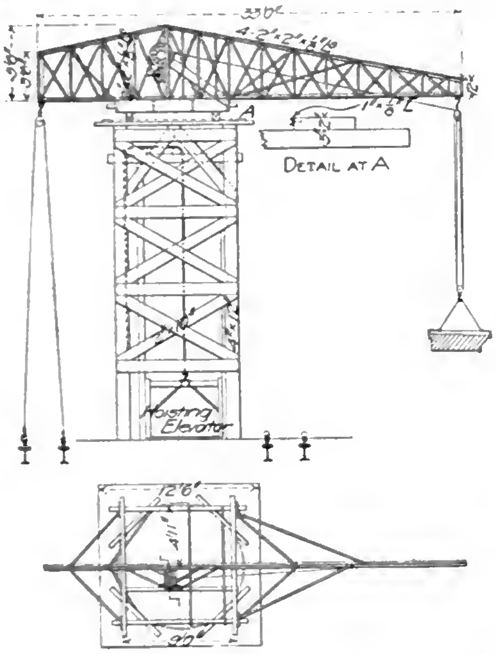
Before using the weirs for purposes of measurement they were tested for leakage by boarding above the crests of the weirs to a height of about

1½ ft. and filling with water. The tubular gaskets were very satisfactory and very little additional caulking was found necessary to make the weir channels water tight.

In the series of experiments with the submerged tubes 4 ft. square, the desired range of head on the tubes, zero to 0.4 ft., was possible without adjusting the height of the crest of the weirs.

The measurements of heads on the crest of the weirs were made by connecting the weir channels with still water basins located below the weirs, as shown in the illustrations, and taking readings of the elevations of water surfaces in the still-water basins by means of accurate hook gages. The connections between the weir channels and still-water basins were made by one-inch wrought iron pipes and one-inch rubber tubes. The tubes were attached to the basins by means of malleable iron unions and were easily disconnected. By lowering the outlet end of a tube and allowing free circulation of the water, the air in the connecting pipe and rubber tube could be easily removed.

The connections with the weir channels were made at points 8 ft. upstream from the crest of



Details of Turntable Crane.

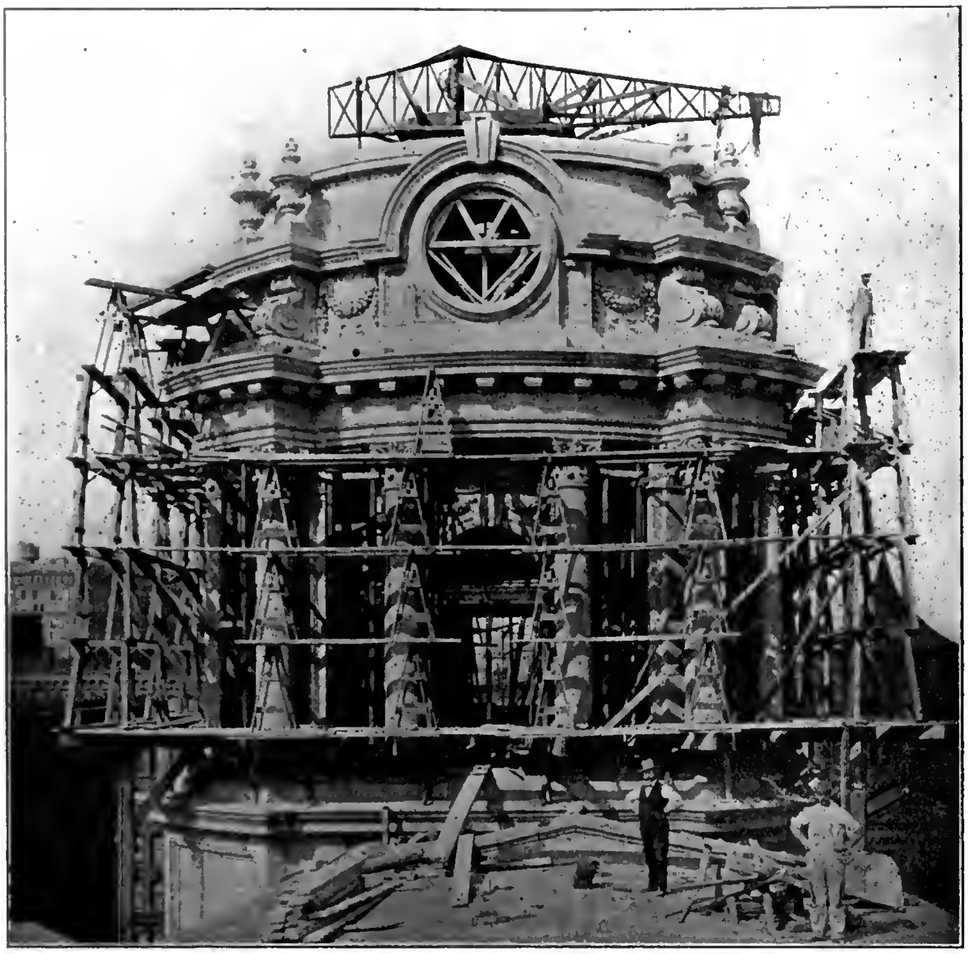
the weirs, 5 ft. above the floor of the channel and about 2½ ft. below the crest of the weirs.

The plan followed was to study the simple forms of submerged tubes, 4 ft. square and of length varying from 0.31 to 14 ft., finding the losses of head and coefficients of discharge for the various rates of flow through the tubes. The entrance to the tubes of various lengths was then modified by introducing curved approaches, elliptical in form, and thus suppressing the contraction first on the bottom, second on the bottom and one side, third on the bottom and two sides, and fourth on the bottom, two sides and top. One of the illustrations shows the details of the submerged tube 2½ ft. long with the curved approaches on the various sides.

The submerged tubes with entrance square corners and of lengths varying from 0.31 to 14 ft. have been designated by series. The letters *a, b, c, c'* and *d* have been used with the various lengths or series numbers to designate the entrance condition. The subscript *c'* has been used to designate the same entrance conditions as the subscript *c*, but the outlet condition has been varied by the construction of a bulkhead to the sides of the channel at the outlet of the tube. One of the drawings show the forms of entrance and lengths of tubes used in the experiments.

The head, *h*, on the submerged tube has been taken as the difference of level between the surface of water above the bulkhead containing the submerged tube and the surface of the water at the outlet of the tube. The table gives a summary giving the coefficients of discharge for the various submerged tubes used in the experiments.

One of the diagrams is a graphical solution of the equations $Q = C a \sqrt{2gh}$ and $Q = av$, used for submerged tubes and orifices. The ordinates on the left side of the diagram represent values of the cross-sectional areas *a* and vary from 4 to 120 sq. ft. The abscissas marked on the lower part of the diagram represent values of the head *h* on the submerged tube or orifice. These values of *h* have been platted on horizontal lines, each line representing values corresponding to a certain value of the coefficient of discharge, *c*, as shown on the lower right hand part of the diagram. The abscissas marked on the upper horizontal line of the diagram represent values of the average velocities *v* in the cross-sectional area *a* of the orifice or tube. The oblique lines in the upper part of the diagram represent values of the discharge *Q*. The diagram is used like an ordinary diagram, having rectangular coordinates, except that the line on which the abscissas *h* is to be read varies in position and depends on the value of *C*.



Turntable Crane on Tower of New York Police Headquarters.

Coefficient of Discharge for Flow Through Submerged Tube, 4 Ft. Square, for Various Lengths,

Losses of Head and Forms of Entrance and Outlet.

h, Ft.	Entrance and Outlet.	Length of Tube in Feet. 0.31	0.62	1.25	2.50	5.00	10.0	14.0
0.05	Square	.631	.650	.672	.769	.807	.824	.838
	a	.672	....	....	.742	.810	....	.848
	b	.740	....	....	.769	.832	....	.862
	c	.834	....	....	.769	.875	....	.890
	c'	....	....	....	....	....	....	.875
	d	.948	....	....	.943	.940	.927	.931
0.10	Square	.611	.631	.647	.718	.763	.780	.705
	a	.636	....	....	.698	.771	....	.801
	b	.685	....	....	.718	.791	....	.813
	c	.772	....	....	.718	.828	....	.841
	c'	....	....	....	....	....	....	.830
	d	.932	....	....	.911	.899	.892	.893
0.15	Square	.609	.628	.644	.708	.758	.779	.794
	a	.630	....	....	.689	.767	....	.803
	b	.677	....	....	.708	.787	....	.814
	c	.765	....	....	.708	.828	....	.839
	c'	....	....	....	....	....	....	.829
	d	.936	....	....	.910	.899	.893	.894
0.20	Square	.609	.630	.647	.711	.768	.794	.809
	a	.632	....	....	.694	.777	....	.819
	b	.678	....	....	.711	.796	....	.833
	c	.771	....	....	.711	.838	....	.856
	c'	....	....	....	....	....	....	.846
	d	.948	....	....	.923	.911	.906	.905
0.25	Square	.610	.634	.652	.720	.782	.812	.828
	a	.634	....	....	.705	.790	....	....
	b	.683	....	....	.720	.809	....	....
	c	.779	....	....	.720	.854	....	....
	c'	....	....	....	....	....	....	....
	d	.965	....	....	.938	.928	....	....
0.30	Square	.614	.639	.660	.731	.796	.832	.850
	a	.639	....	....	....	....	....	....
	b	.689	....	....	....	....	....	....
	c	.788	....	....	....	....	....	....
	c'	....	....	....	....	....	....	....
	d	.984	....	....	....	....	....	....

The diagram may be used in a variety of ways: Values of *C* and *h* may be assumed, as, $C = .75$ and $h = .10$, the vertical line through $h = .10$ will intersect lines representing *Q*, any value of which may be selected, and the corresponding value of *a* determined by the horizontal line through the point of intersection of the vertical line and the line representing *Q*, as, for $Q = 50$, $a = 26.3$. By producing the vertical lines to the horizontal line on the upper part of the diagram values of *v* may be determined, thus, for the above example, $v = 1.91$. The diagram may also be used by assuming values of *a* and *Q* or *v* and *Q* and the resultant values of *h* read on the horizontal lines corresponding to some value of *C*, as shown on the lower right-hand part of the diagram.

The diagram will be found of special service in preliminary study where it is desired to study the relative effects of changes in a portion of the equation $Q = C a \sqrt{2gh}$, as the effects on *h* of certain changes in *C* for a given area of cross-section and discharge.

A Railway Motor-Car Test for long-continued high speed was made by the Union Pacific on Aug. 22 between Omaha, Neb., and Denver, Colo. The total distance of 570 miles was covered in 16 hr. and 34 min. The schedule time of the regular fast train is 17 hr. 15 min.

A Special Turntable Crane.

The new police headquarters building now under construction at the northwest corner of Grand and Center Sts., New York City, is a massive stone and brick structure surmounted by a clock tower which rises about 40 ft. above the roof of the fifth story, as shown in an accompanying illustration. This tower is two stories high and will be capped by a hemispherical dome supported on steel trusses about 200 ft. above the building foundations. The material hoist for the building rises in a shaft under the dome. The construction of the tower up to the level of the architrave presented no unusual difficulties; above this level, however, the necessity of continuing the material hoist up to the base of the dome to serve the masons on the brickwork inside the tower and the fact that a boom derrick could not be used, owing both to lack of room inside the tower and the absence of guying-points, required the construction of a special revolving crane which was designed, built and erected on the work in three days.

This crane, which is clearly shown in accompanying illustrations, consists of a horizontal truss 33 ft. long, of the form shown in the drawings, mounted near its one-third point on a revolving table which is supported in turn at the level of the dome base on a 3-in. plank platform on top of the hoisting elevator framework, the latter having been specially braced and reinforced to carry the additional load. The truss is made up of 2x2x⅛-in. angle bars, four being combined in cruciform section for the upper and lower chords, two being used for all verticals, and single bars forming the X-bracing. The turntable consists of a frame, 9 ft. square, made of 3½x12-in. yellow pine beams placed on edge and braced across the corners with shorter pieces of the same sectional size. The four cast-iron wheels on which the table turns are 6 in. in diameter with 1½-in. flat face. They are pivoted to the lower edges of the corner pieces of the framework, the pivot point in each case being directly above the center of the wheel. A plank circle, about 9 ft. 10 in. in inside diameter and faced on its inner edge with ⅛x1-in. channel bar with the flanges turned toward the wheels, is nailed to the 3-in. platform to guide the turntable wheels which rolls directly on the planks.

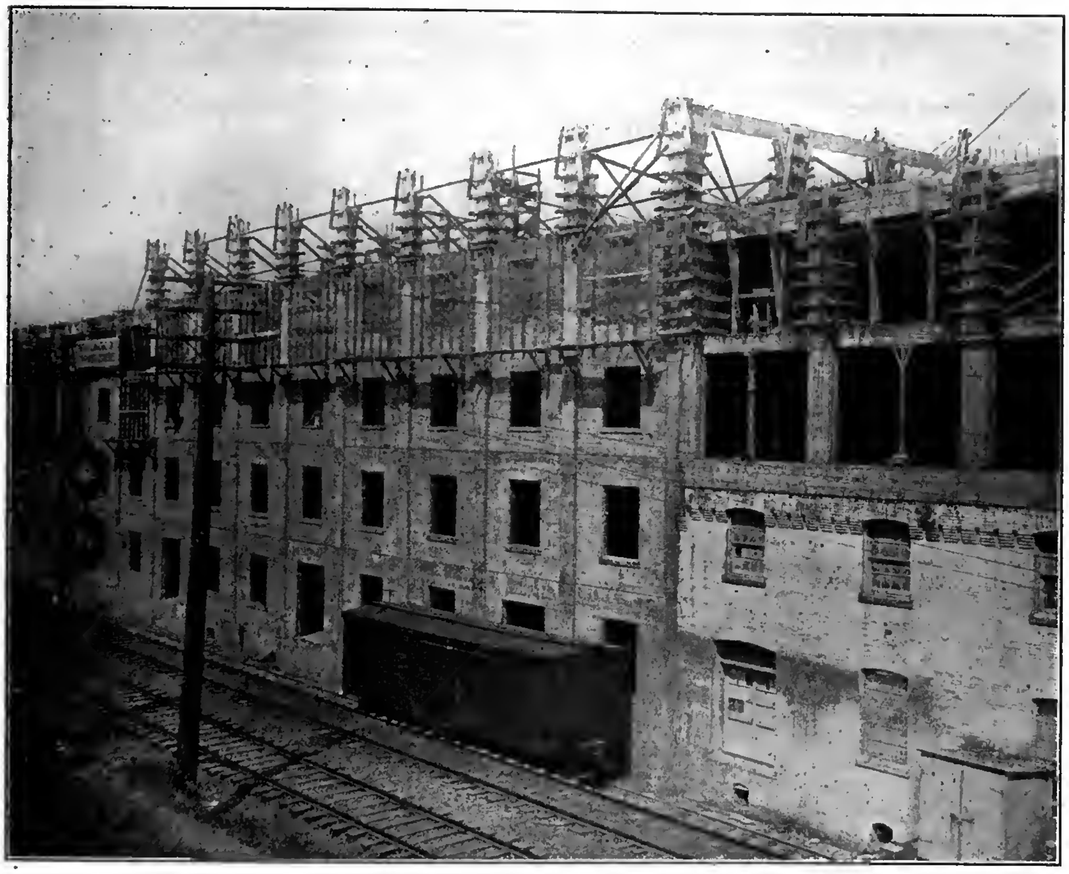
The manually-operated winch is fixed at one side of the truss over the turntable bearings on one side of the winch, being attached to a vertical truss member and those on the other side to a pair of vertical angles held in place at top and bottom by struts and braces in horizontal planes, as indicated on the drawings. To balance the overturning moment caused by the weight of the long arm of the crane and its load, the short arm was anchored to the beams of one of the tower floors by a tackle, as shown on the sketch.

All the stone and terra-cotta placed above the columns was delivered to the upper floor of the tower, about at the level of the architrave by the material hoist, which at the same time served the brick masons building the tower lining. The stone ornaments, some of which weighed over 1½ tons, were run on to the hoist at the first floor level on a four-wheel truck; when the hoist reached the level of the tower floor the truck was run off the hoist platform and across the floor to the inside of the wall opposite its final position outside; the stone was then hoisted, swung over the wall top and lowered to place with the crane tackle.

The crane truss was laid out full size on one of the lower floors of the building where it was riveted up in sections which could be easily handled. These sections were then carried up to the top of the hoist tower where the crane was assembled in place.

The building was designed by Messrs. Hoppin & Koen, architects, New York City, and Messrs. Gillespie & Walsh are the general contractors. Mr. Michael J. Garvey, superintendent, designed and erected the crane and other incidental apparatus described.

AN EARTH CURRENT of unusual strength was recently experienced on the telegraph lines of the Canadian Pacific Ry. in Western Ontario and Manitoba. The current was strong enough to set fire to the switchboard at Fort William.



Plaster Mill Buildings, Showing Brickwork of Building 5 A.

New Buildings of the King Plaster Mills, Staten Island.

Buildings 5 and 5A, now under construction as a part of extensive improvements to the plaster mills of J. B. King & Co., at New Brighton, on the north shore of Staten Island, New York, are five-story reinforced concrete structures occupying contiguous and irregular areas, as shown on accompanying plans, and designed to support floor loads of 200 to 600 lb. per square foot. They are located immediately on the bank of the Kill von Kull, a navigable stream, with their first floors about 5 ft. above mean high water. Behind the buildings is the right-of-way of the Staten Island Rapid Transit R. R., which provides a switch track for the several buildings of the plant. Behind the two buildings under consideration the tracks are about 4 ft. below the main floors.

Both buildings are founded on piles, 8 to 30 ft. penetration, driven through three sorts of material; riprap along the south side where a fill had been made by the railroad company; good soil outside the riprap; and old cribwork along the water's edge. In Building 5, where a floor load of 600 lb. per square foot is provided for on all floors, sixteen piles in general were driven for each interior column. In 5 A, which is designed for 200-lb. floor load per square foot on all floors except the sixth, where 600 lb. is provided for, there are in general six piles under each column and a continuous foundation girder distributing part of the column loads on intermediate piles.

Building 5.—The column footings in Building 5 are of the truncated pyramidal form and are in general 8 ft. square with their bases about 8 ft. below the first floor. The pile heads are embedded in the concrete 6 in., and 3 in. above their tops is a double series of ⅞-in. Ransome bars about 6 in. on centers each way. Owing to the unstable character of the foundation soil along the water front the three lines of interior columns immediately back of the north wall of the building were tied together and to the north wall columns at the tops of the footings by ties extending from the wall inward. Each tie is made up of two 1-in. Ransome bars encased in concrete to protect them from corrosion.

There are six complete lines of interior columns extending longitudinally through the building, the lines being 15 ft. on centers and the columns in each line 14¼ ft. on centers; besides these there are two incomplete lines similarly spaced, as shown on the floor plan. With a few exceptions the interior columns are octagonal in all except the fifth story, where they are square with the corners slightly chamfered. The typical interior column has the following dimensions and reinforcement in the various stories, the size being given as the side of the enclosing square: Below the main floor, 34-in., four 1-in. square rods and a spiral of ¼-in. wire 31 in. in diameter with 2-in. pitch; first story, 30-in., four 1¼-in. round rods, 7/16-in. wire, 27-in. spiral, 3-in. pitch; second story, 26-in., four 1¼-in. rods, ⅜-in. wire, 23-in. spiral, 2¼-in. pitch; third story, 22-in., four 1-in. round rods, ⅜-in. wire, 19-in. spiral, 3-in. pitch; fourth story, 17-in., four 1-in. round rods, 5/16-in. wire, 14-in. spiral, 2¼-in. pitch; fifth story, 12-in., four ½-in. Ransome bars, ¼-in hoops 12 in. on centers. The vertical rods in each column are continuous through the first and second stories; at the third floor there are 1-ft. gas pipe sleeves and the rods above are continuous through the third and fourth stories. In addition to the vertical reinforcement mentioned there there are also in each column in each story where spirals are used, three or four small rods to which the spiral is wired to preserve its pitch.

These were not considered in designing the columns.

The north and south wall columns are rectangular in form, varying from 20 x 24-in. below the first floor and in the first story, to 18 x 24-in. in the second and third stories, and to 16 x 24-in., in the fourth and fifth stories. The reinforcement is four vertical Ransome bars, 7/8 to 1/2-in., with 1/4-in. hoops 12 in. on centers. Across the west end of the building the usual wall columns are replaced by interior columns to provide for future extension in that direction. The east wall columns are carried up to the third floor beside a brick wall which will be referred to later. They are nearly square and somewhat heavier than the north and south wall columns. The first and second story columns are 12 ft. 6½ in. long from floor to floor. In the third and fourth stories they are 2 ft. shorter and in the fifth story they vary owing to the pitch of the roof.

The main floor girders extend longitudinally through the building and are in general 10 in. wide and 20 in. deep not including the 4¼-in. floor slab. The reinforcement consists of two 1⅛-in. and three 1-in. Ransome bars with ⅜-in. stirrups properly distributed. The floor beams are 4 ft. 9 in. on centers and divide the floor slab into panels, 4 ft. 2 in. x 14 ft. 2 in. They have three 1-in. twisted rods and 5/16-in. stirrups. The floor slab is 4¼ in. thick, including a ¾-in. finishing coat, and is reinforced across the beams with 5/16-in. Ransome bars, 30 ft. long and 5½ in. on centers. Each floor panel is bonded longitudinally with two ⅜-in. bars.

The typical wall girders, which are important only during construction when they serve as ties and carry the weight of the wall forms and concrete, are 4 in. wide and 20 in. deep and have one 1-in. bar and ⅜-in. stirrups. When these girders are poured six 5/16-in. rods, 2 ft. long are inserted in the concrete and left projecting from the upper surface of the beam to bond the wall to it.

The building is divided about on its north and south center line on all floors by a 6-in. concrete fire wall set into vertical 4 x 1-in. recesses in the columns. This wall is reinforced by vertical ⅜-in. bars 24 in. on centers and horizontal ⅜-in. bars 18 in. on centers. Wherever partition walls are required, and many are necessary to form bins, 1 x 4-in. recesses are left in the proper columns and vertical bond bars are inserted in the girders and left projecting above the floor to hold the bottom of the wall. Slot openings are left in the floor above all partition walls through which to pour the wall concrete.

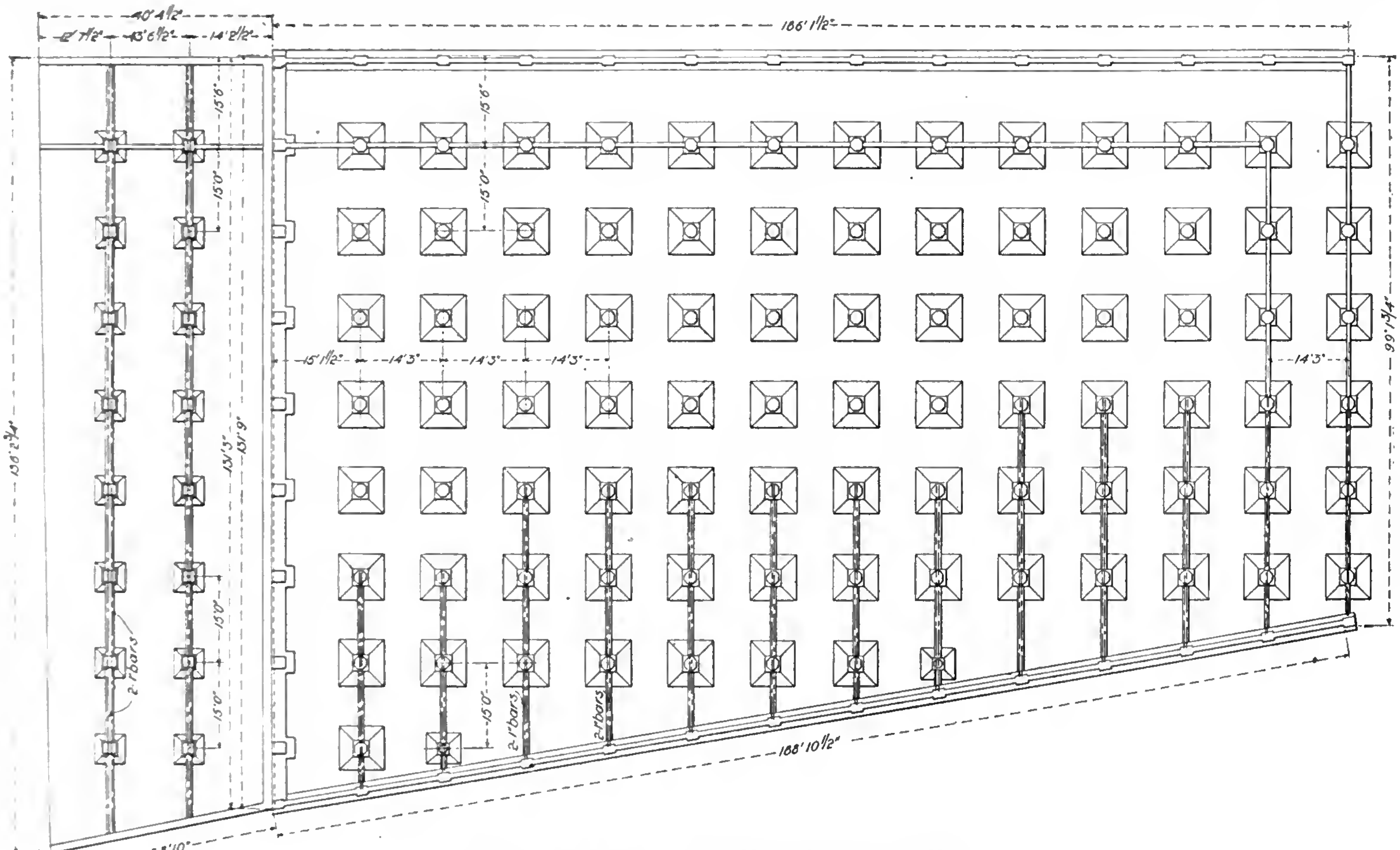
Building 5 A.—This building is immediately east of and adjacent to Building 5, and occupies a site upon which formerly stood a two-story brick building of mill construction, in fact, the north, south and west walls of the old two-story building form the walls of the lower two stories of the new building. Its east wall is the west wall of a five-story brick mill building. This wall is 20 in. thick and is securely founded on piles.

Structurally, Building 5 A is in general much like Building 5. It is much lighter, however, its floors having been designed to carry 200 lb. per square foot, except the second, which is designed to support 600 lb. per square foot. It is about 40½ ft. wide and 135 ft. long, both these dimensions varying owing to the irregularity of the site. There are two longitudinal lines of interior columns 15 ft. on centers in general in each line, dividing the building into three longitudinal bays, 12 ft. 7½ in., 13 ft. 6½ in., and 14 ft. 2 in wide. The transverse girders carry floor beams 4 ft. 4¾ in. to 6 ft. 4 in. on centers. The floor slabs are 4 in. thick except in the east bay of the second floor which is 5½ in. There are no wall columns on the east side, the ends of all girders on that side being set into the brick party wall 9 in. A recess 4 in. deep is also cut into the brick wall to receive the floor slabs. On the west side the same construction is used up to the top of the brick wall; above this there are wall columns resting on the brick wall and bonded to the wall columns of Building 5.

The north wall of the old two-story brick building had broken loose from the side walls, owing to the unstable character of the foundation material along the water front, and to secure this and guard against slipping, the interior column foundations were securely tied together throughout the whole length of the building by longitudinal lines of 1-in. bars encased in concrete and resting on top of the foundation girders. The base of the north wall was firmly secured to this system at numerous points by tie rods and plates.

Construction Details.—Building 5 A was started first but work on the two buildings is now being carried forward simultaneously. The concrete used in the columns is a 1:2:3½ mixture of Alpha or Atlas Portland cement, Cow Bay sand, and beach gravel. For the girders, beams, floors and walls a 1:3:5 mixture was used. The sand and gravel is delivered on the work by the owners from their large sand washing and drying plant at Port Washington, Hempstead Harbor, on Long Island Sound. It is brought to the bulkhead line in front of Building 5 in lighters; shoveled into buckets; and hoisted to a platform at the level of the second floor where it is dumped into large two-wheeled hand carts and hauled to storage piles on the second floor. These storage piles have at times been so deep that the load on four bays amounted to 1,200 lb. per square foot, but there was no noticeable deflection. The derrick hoist is operated by a Lambert portable single-drum hoist driven by a 7½-h.-p., 200-volt, G. & C. Electric Co. motor. The sand being thoroughly dry is closely compacted, 86 per cent. of it being equal to 100 per cent. of the same material undried. The cement is delivered from cars on the switch track to the first floor of Building 5, where it is piled near the mixer.

The mixer, a Ransome machine, is placed near the center of the first floor. Cement is delivered by wheelbarrow on an elevated platform beside the mixer and sand and gravel are introduced through a hopper on the second floor, being brought from the storage piles in wheelbarrows. The mixer delivers to a Ransome self-dumping bucket elevator with a hopper on every floor. Both mixer and elevator hoist are operated by



Foundation Plan of King Plaster Mill Buildings.

a 40-h.-p., 200-volt, motor made by the Eddy Electric Manufacturing Co., Windsor, Conn. The motor, Mundy friction hoist, and mixer are placed in a line in the order mentioned. The motor is belt-connected to the shaft of the hoist and the mixer is chain-driven by a sprocket on the hoist shaft, the drum being thrown in or out by a clutch. One man operates the hoist and attends the motor and mixer, a system of electric signal bells having been arranged for use with the elevator. Current for the motors is supplied from the private plant of J. B. King & Co.

The wire for the column helices is formed in coils of the proper diameter at the shops of the contractor. On the work it is formed into helices with the proper pitch on a long framework, T-shaped in section, the T being the right size to fit the inside of the spiral and one of the three leaves being hinged to permit the easy withdrawal of the completed helix. The pitch is adjusted according to marks on the frame and longitudinal rods are wired inside to preserve the spacing.

The forms present no unusual features. Cement block spreaders with a bolt hole through the center are used in the interior walls only. The small pieces needed in the forms are cut in a shop on the first floor in which are installed a circular saw, boring machine, and planer, operated by a 10-h.-p. 250-volt, General Electric motor. Several blind windows are to be filled with 4-in. concrete slabs made on the floor in front of the openings in tin-lined forms. A piece of rod bent in U-form and securely fixed in the back of each slab serves as an attachment for hoisting them into place with a hand tackle and portable derrick frame.

The buildings described were designed and are being built by the Turner Construction Co., New York City.

Book Notes.

It is rather difficult to understand just what purpose Messrs. W. S. Franklin and Barry MacNutt had in mind in writing their "Elements of Mechanics," for its text is such a contrast to that of successful textbooks on the same subject as to be startling. The orderly development of the principles of pure mechanics which is necessary to enable the student to grasp the fundamental facts of the subject is apparently abandoned in a measure in favor of somewhat disconnected sections on problems in applied mechanics. Prof. Franklin is the author of other books of high merit, which make it surprising to see his name attached to one of such a disjointed character. It may be that it will prove a useful class-room adjunct to a more vigorous course given by other means, but from the viewpoint of the usual class-room methods it seems about as useful as a text-book as the works on light and heat written by the late P. G. Tait and still regarded as unequalled examples from a master's hand of how an elementary book may become a mystery. And yet there are a good many sections of Messrs. Franklin and MacNutt's book that are inspiring to an ambitious beginner in physics, even if they have a tendency toward superficiality. (New York, Macmillan Co., $1.50.)

A book on detailing steelwork has been written under the title of "Notes on Construction in Mild Steel," by Mr. Henry Fidler, M. Inst. C. E. The preface is a particularly good statement of the complexity of the subject, which is the most troublesome part of structural steel design. The author repeats the familiar remark that the ability to analyze correctly the stresses in a roof truss and the ability to design a good riveted connection are not quite one and the same thing. Close study, observation and experience are needed for a draftsman to become a competent detailer and even then the knowledge of the real expert has not been acquired. This must be gained by becoming familiar with the treatment the steel receives in the furnaces, mills and shops, in order that the real degree of approximation of practical methods to theoretical assumptions may be known, and by learning in the field the procedures of the erection gangs and the troubles they have to overcome. The American reader should recognize, also, that the young engineers of Great Britain have not taken courses in technical colleges to the almost universal extent customary in the United States, and a British book on steel detailing is consequently required to go into matters that seem rather out of place to those who, as undergraduates, received a thorough grounding in metallurgy and the properties of materials. For this reason the numerous tables of tests of steel in the first half of the book have a value to the British draftsman which an American engaged in similar work will find some difficulty in appreciating. Nearly a fifth of the book is devoted to the chapter on the manufacture, physical and chemical qualities of mild steel and the second chapter gives in condensed form the same class of information regarding rolled sections that American engineers are accustomed to obtain from mill handbooks. The remainder of the volume is a discussion of detailing girders, columns, roofs and marine steelwork and of the methods of protecting steel surfaces. The numerous illustrations are mainly from drawings prepared for regular engineering purposes, and throughout the book are useful notes of special devices or methods of a kind that rarely get into print. The book is one that should prove valuable in any large detailing office and in the libraries of technical colleges. (New York, Longmans, Green & Co., $5.00.)

Mr. Allen Hazen has rendered a distinct service to all who wish to know about municipal water supplies by writing "Clean Water and How to Get It," a book which is both authoritative and free from the technicalities that interest sanitary and engineering specialists only. At the present time considerable harm is occasionally done by city authorities who, with the best of intentions, are misled by half-knowledge into undertaking works that should never be constructed. A careful reading of this book should prevent such ill-judged decisions; it has been written particularly for mayors and aldermen who have been chosen to office from walks of life in which they have had no water-works experience, and can be aided in serving their cities by clear statements of principles, illustrated by examples from large and small works which are fulfilling their purpose well. The book opens with a description of impounding reservoirs and explains the changes that take place in the quality of water stored in them under various conditions. A brief chapter on supplies from small lakes points out their similarity to those obtained by impounding streams. The chapter on supplies from the Great Lakes summarizes the views of the leading authorities concerning such a source, and calls attention to their danger on account of sewage contamination. The author states plainly, and deserves hearty applause for doing so, that while Chicago and Cleveland have succeeded in getting better water by spending millions in driving tunnels far out under the bottom of the lakes to secure supplies free from contamination, they have failed to get thoroughly good water. In the chapter of supplies from large rivers the author makes statements regarding sewage purification that are particularly important in these days of a growing public demand for the universal purification of sewage discharged into rivers. "The fact must be fully recognized," he asserts, "that the discharge of crude sewage from the great majority of cities is not locally objectionable in any way to justify the cost of sewage purification. Looking at the matter as one great engineering problem, it is clearly and unmistakably better to purify the water supplies taken from the rivers than to purify the sewage before it is discharged into them. The volume to be handled is less and the cost per million gallons of purifying water is much less than the cost of purifying sewage. It is also very much more effective to treat the water, because the methods of water purification are more efficient in stopping germs of disease than are the methods of sewage purification." Ground-water supplies are discussed in one of the most interesting chapters in the book, which explains the effect of different conditions on their quality and quantity, and the results of the action of water on iron pipes is described in an equally important chapter containing considerable information not readily found elsewhere. The next five chapters are on water purification and related subjects and are excellent outlines of what are now considered the best ways of purifying different waters and of removing turbidity, color and iron. That these methods can be improved as conditions demand is stated by Mr. Hazen in the following confident forecast: "It may be reasonably anticipated that far more efficient methods of purification will come to be used in course of time and in discussing the advantages and disadvantages of polluted waters after purification for use by cities through a long term of years with steadily increasing amounts of pollution, it will not do to consider only the methods of purification now in use. Better methods will be available for the more difficult service when they are needed." The subject of water pressures is given a chapter by itself and so is the designs and construction of works, and some wholesome advice is given in them which, if followed, would result in a gratifying reduction of charges or in improvement in service in some cities. The cost of waterworks is taken up briefly in another chapter. The chapter on the use and metering of water and that on the financial management of public works are different in character from the rest of the book, as they are mainly arguments in favor of the author's opinions concerning subjects which offer a wide field for controversy. (New York, John Wiley & Sons, $1.50.)

Letters to the Editor.

Lattice Bars in the Quebec Bridge.

Sir: I notice in The Engineering Record and elsewhere that a discussion has started on the question of secondary stresses, and yet I doubt if any of us for a moment believe that secondary stresses had anything to do with the failure. One particular lower chord section seems to be considerably under discussion, while it is evident that other lower chords were of quite the same section, that is, some 760 sq. in., something like 16 in. radius vertically and approximately 19 in. horizontally, with stresses within limits that no one would expect to cause failure. But we are all confronted with the fact that these members had only 2.8 per cent. of the weight of the section of the member in lattice and its rivets, while it is a fact that our practice shows that of moderate sizes in lightest section, 8 to 15-in. channels, the weight of lattice and its rivets of a two-channel members varies somewhat, but is about 30 per cent. of the weight of the two channels; that is, practice uses about eleven times as much relative weight of lattice on small-size columns as were used on the compression members of the Quebec Bridge. That this may be the real cause of failure, I am not prepared to assert, but

I am prepared to hazard the opinion that none of us will build latticed members in excessive sizes with as small lattice bars and as few rivets in their connections in the future as we may have done in the past.

The relation of lattice to the member is not specified anywhere in any general specification. That the individual lattice with its rivets should have some relation to the stress of the member surely appeals to us as reasonable since the failure of the Quebec bridge, and yet no one has ever put in print anything that has come to my notice on the subject.

Horace E. Horton.

Cost of Aerial Cableway in Making a Fill.

Sir: In making a single-track, 175,000-yd. fill, the Williams Bros. & Morse Co., of Cleveland, Ohio, saved $1,700 by using an aerial cableway in preference to a timber trestle. The fill was 400 ft. long and 95 ft. deep, between Stations 377 and 381 on the Lake Erie & Pittsburg Ry., now under construction from Cleveland to Pittsburg. A detailed, accurate account of all expenditures made on the cableway for material and labor was kept, and a careful estimate was made by Mr. A. E. Williams, of the Williams Bros. & Morse Co., of the least probable cost of a trestle which would have been necessary to meet the same conditions as were presented to the cableway.

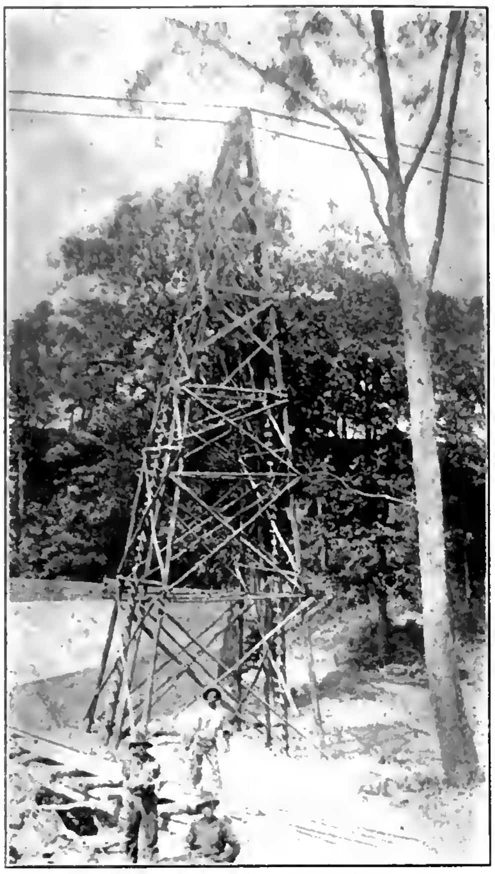
Frequent accidents on cableways have rather shaken the confidence of contractors in this means of providing a bridge for the dump cars, but it seems that these mishaps have been due to improper construction and the use of cables that were not large enough to stand the heavy strains. But in this case the cableway has well withstood the loads that have been put upon it, as the anchors and wooden supports were made extra heavy, and a 2¼-in. Roebling galvanized bridge cable was used.

Method of Anchoring Cables.

General View of Cable Road.

The anchors on either side were 400 ft. apart, and an A-frame was erected to support the cable in the middle; this made the span 200 ft. The anchor at the north bank consists of a log 18 ft. long, 24 in. thick, imbedded in solid rock. Two eyebolts screw into the log and are fastened by heavy nuts over 8-in. cast-iron washers. Connecting with these eyebolts are two 10-ft. chains with 10-in. links made from 2½ in. iron. These chains were put in to keep the cables from twisting by covering the chains with heavy weights. Two 3 in. turnbuckles, with a spread of 3 ft., made the connections between the chains and the cables. The cables were leaded into the turnbuckles. These turnbuckles, which were forged for this work, were used for taking up the slack.

The anchor at the south end consisted of a log 25 ft. long and 24 in. thick, placed in a new fill of sandstone 10 ft. deep. Three-inch planks were driven in front of the anchor log, two eyebolts 22 in. long and 2½ in. in diameter were screwed into the anchor log and fastened with nuts over cast washers 8 in. in diameter and 2 in. thick. The eyebolts connected with clevises by means of 3-in. pins. The cables were leaded into these clevises. A rise of 1 ft. in 3 ft. brings the cables to grade and to the end timber supports.



The Central Tower.

The fill is being made from the south end of the cableway and bents are put in as the work advances to help support the weight of the cars. The support for the cables on the north bank is made of 10-in. logs resting on mud-sills. There are two 6-in. hickory rollers on which the cables rest to allow them to accommodate themselves to different lengths.

The A-frame which supports the cables in the center is made of two bents of four timbers each. The lower 50 ft. of the frame is made of 10-in. round timbers and the upper 42 ft. of 8x8-in. square timbers. The cables on the top of the A-frame are 8 ft. above grade. The bents rest on 10-in. mud sills. They have a batter of 1½ in. to a foot. The frame is 32x26 ft. at the bottom.

A train consists of from six to twelve 4-yd. cars. These are emptied at the south end of the ravine and are pushed out onto the cableway as fast as they are emptied. The car rails are spiked to ties which rest on stringers. These stringers rest on 8-ft. logs fastened to the cables with U-bolts. The cables are 7 ft. apart. Most of the fill is being made from a sandstone cut about a half mile distant. This sandstone has a slope a little steeper than 1½ to 1.

The following is the actual cost of the aerial cableway: 1,000 ft. of 2¼-in. Roebling galvanized bridge cable, $600; 2½-in. eyebolts and clevises for both ends, $108.30; 2 3-in. turnbuckles at north end, $120; 2 2½-in. iron chains at north end 10 in. long, $62.40; 4 8-in. cast washers 2 in. thick, $2.46; timber for A-frame, all bracing and cross ties (other timber obtained on ground), 3,200 ft. at $34, $108.80; lower 50 ft. of A-frame, round timber, 56 ft. long, bought in tree, $32; cost of team work for hauling round timber and pulling timber to place for erecting, $65; carpenter labor on A-frame and end bents on bank, $231.40; time of superintendent, getting material and overseeing work in general, $60; common labor in digging trenches for anchors and putting up cableway, $112; nails and iron in A-frame and bents, $29.40; total cost of cableway, $1,531.76.

A conservative estimate made by Mr. Williams of the probable cost of a timber trestle for this opening, figuring on square 8x8-in. timber cut from native timber: 98,000 ft. (including all uprights, planks for bracing, stringers, etc.), at $26, $2,548; labor for putting up trestle, $6 per M., $588; spikes, $98; iron drift bolts, $40; total cost of trestle, $3,274.

Saving effected by using cableway: Estimated minimum cost of trestle, $3,274; actual cost of cableway, $1,531.76; difference in favor of cableway, $1,742.24. Yours truly,

Cleveland, Ohio. J. D. Mooney.

Tar-Macadam Roads are now being laid in several English localities by a method developed by the engineer of the Eton and Slough Rural District Council. After the upper layer of old macadam has been removed a coat of tar cement is spread and broken stone rolled into it until the tar shows on the surface. Such work has been done at about 42 cents per square yard.

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TABLE OF LEADING ARTICLES.

Portable Electric Plants.

The increasing use of electrical equipment in various construction work brings to mind the somewhat undeveloped state of portable plants for such service. Of course it often happens that work is being carried on within easy reach of central-station service, and in such cases it is a simple matter to make suitable arrangements for it. Yet it is common enough to find construction in which electric hoists, cranes and drills would be extremely useful, to say nothing of electric lighting, in localities where no available plants are within reach. If the works are of sufficient size it may be feasible to install a regular temporary plant as was done in the Kern River tunneling operations of the Los Angeles Edison Co. In this case a regular hydraulic transmission plant was put in and very successfully used throughout the period of construction. It is rare, however, to find need for power generation on so large a scale. In most instances a really portable equipment is needed, one that can easily be taken from place to place ready to operate motors and other apparatus whenever needed. Some few portable plants designed for various purposes are in existence, but it seems obvious that a great deal more can be done in this line, especially since the automobile has made small gasoline equipments so familiar that they are taken quite as a matter of course.

It is certainly no difficult matter to plan a combined auto truck and portable power station of say 40 or 50 electrical horse-power capacity, using a four-cylinder gasoline engine direct-connected to its generator and quite capable of furnishing power and lights on a considerable scale. The load conditions are not, of course, good, but they are certainly more favorable than in the case of the scattered steam engines now used. The gain in economy and facility is of no small moment, and there are many electrically-driven tools available for which there are no steam-driven equivalents. So far as economy of operation is concerned, there is certainly advantage in using gasoline engines rather than steam engines in the smaller outputs, while the electric equipment requires a smaller working force. In the matter of lighting for night work, the judicious use of arc lights is probably the best thing yet devised, the flaming arc having been used with particular success in excavations and other places which are exceedingly difficult to light with ordinary lamps or torches.

The small portable power plant certainly has a useful field, and were apparatus more readily available, it would be oftener tried. Very possibly some of the readers of The Engineering Record may have had experience with portable plants of one sort or another, and they would do their fellow engineers a good turn by giving them the benefit of the experience. In these days of difficult labor conditions, the more the better of auxiliary power apparatus. It has already demonstrated its usefulness, and the only trouble is that its field is as yet too contracted.

Compression Members for Bridges.

The built-up compression members used so universally in American bridge practice, commonly of laced channels or channels laced on one side and riveted to a cover plate on the other, the channels being either rolled or built, are members of such every-day construction that the usual procedures involved in their design have long since come to be accepted without any question whatever. The fundamental principles of long-column resistance as established many years ago, are fully recognized, the moments of inertia of cross-sections being computed in all cases as if there could be no possible question of all component parts of the column being held rigidly in their proper relative positions under all degrees of loading up to that causing failure. There is always an implicit, if not explicit assumption that the lacing, rivets, batten plates and other details are provided with sufficient dimensions and in numbers requisite to insure no distortion of the normal cross-section under any loading to which the column may be subjected. These assumptions obviously involve conditions imperative for a proper resisting capacity of the member. No matter what may be the cross-sections of the various parts of which the column is composed, if those parts are not held in their proper relative positions by sufficiently strong lacing or other spacing details and with a sufficient number of rivets of suitable size, it is clear that the column may fail to carry even a small fraction of the load for which it is designed.

Ever since the beginning of bridge construction in this country there have been many experimental investigations made for the purpose of securing complete information regarding the effects of shop processes on structural material in course of fabrication. These experiences have yielded data of so great value that there is afforded fairly complete knowledge of the effects of such manipulations as punching, shearing, cold straightening and other similar operations employed in the manufacture of built compression members. So full, indeed, has this information become that engineers have strangely failed to consider the necessity of testing full-size members of this class as completed and ready to perform their functions in the finished structure.

Forged eye-bars have been the subjects of ceaseless investigation as full-size members, until, it would seem as if there could be little left to ascertain regarding their action under any conditions of loading. Suitable dimensions of heads, the proper shape of the neck, the relation between width and thickness, the thickness of head or rather thinness inducing failure by dishing, the conditions for proper forging and other elements of the eye-bar problem almost without number, have been so amply treated as to leave little still to be desired. Indeed it is not too much to say that the eye-bar has come to be probably the most completely determined member used in a modern bridge. The pursuit of experimental knowledge regarding the properties of eye-bars has apparently been so absorbing that corresponding information regarding built-up compression members, although not less important, has been almost completely neglected. During the last quarter century scarcely ten full-size built-up compression members have been tested to destruction and not one large member of that class has ever been so tested. When it is remembered that members of the largest eye-bars yet forged have been subjected to the most careful experimental scrutiny for all degrees of loading up to failure, it must be admitted that the contrast is sufficiently remarkable to cause the gravest apprehensions in the minds of engineers having great compression members to design. This observation gathers much additional force from the fact that the number of full-size built steel columns tested to the present time is so insignificantly small that there would practically be no error in stating that there have been no such tests. All the full-size column tests made in the United States arsenal at Watertown, Mass., and reported in the executive documents of the 47th, 48th and 49th Congresses were of wrought iron, and they afford nearly all the experimental data available for the use of engineers in the design of built-up compression members.

Probably the most important single feature of the ordinary long column is the lacing bars or other similar spacing details. The maintenance of the proper relative positions of the component parts of such columns on which the carrying capacity wholly rests depends absolutely upon the lacing bars, and yet no comprehensive experimental investigation has yet been made to determine their proper sizes and distribution. The maximum panel distance of the lacing in terms of the thickness of angle leg or channel

flange to which the lacing may be riveted is approximately known as is the maximum unsupported width of a web plate for these built compression members, but the dimensions of the lacing bars on which the safety of the entire structure really depends has not even been approximately determined by experimental investigation. The design of those bars is, therefore, almost wholly a matter of the engineer's judgment.

As startling as this condition is regarding the designs of such an important part of built-up compression members, many experienced engineers know that the full-size column tests already alluded to yield some valuable information regarding the design of lacing bars, although it is of an inferential rather than of a positive character. Furthermore those tests have furnished bases for tables of standard lacings for built compression members composed of rolled or built channels from six inches up to thirty-four inches in depth. Although such lists have never been subjected to a series of crucial tests by the actual loading of large columns to failure they certainly accord with the older tests of columns on which they are based.

There has been a tendency at times to economize too much in these details of large structures. This is a mistake as the total metal required for such purposes is always a small percentage of the total metal in the structure, and it requires but a comparatively small amount of metal, properly disposed in such details, to make all the difference between safety and fatal danger. The component parts of great compression members, especially when there are three or four heavy webs, can be held in their normal relative positions only by correspondingly heavy lacing bars or plates, as can be at least approximately concluded from the proportionate bars employed in the latticed channel columns of wrought iron tested at Watertown.

While it is probable that great steel compression members may be safely designed by inference from those early tests, there is still the danger resulting from a legitimate but wide difference of engineering judgment, when acting by such a remote inference. An extended series of tests of full-size steel built compression members is imperatively needed to determine many important open questions on which depend the safety of the structures in which they act, as has been forcibly evidenced by at least one great bridge wreck.

Railway Maintenance and Chemical Research.

Among the problems which are constantly facing the modern railway manager the question of maintenance easily stands in the front rank of importance. Enormous sums of money are expended yearly on every large system to make good the effects of wear and tear, and the increasing traffic and higher speeds of train operation on railways are subjecting the engineering materials and equipment used in transportation to service tests that demand the best quality of supplies for economical performance. Both steam and electric railways are such heavy consumers of timber, fuel, lubricants, iron, steel and other great staple products that the purchasing agent's office is thronged from morning until night with sales engineers and representatives of supply houses; and the stream of correspondence, orders, requests for bids, and the like, never stops flowing. Important as are improvements in the design of locomotives, rolling stock, power plants and general machinery, it is becoming clear that there is a broad field for the saving of money in the purchase and use of supplies. But the physical and chemical characteristics of the materials must be thoroughly understood before intelligent selection and wise application of supplies can be made in bulk.

The co-operation of engineering and purchasing departments has become the regular thing in progressive organizations, and in so far as the physical properties of materials are concerned, operating companies are thoroughly alive to the importance of drawing specifications on the basis of engineering tests. It is only very recently, however, that the relation of chemical research to the engineering field, and particularly to railway maintenance, has begun to be appreciated. The chemical side of power plant work has been referred to in these columns, and the chemistry of the boiler-room is receiving widespread attention. A less general appreciation exists of the ability of the chemist to solve some of the problems of maintenance in busy railway systems, or at least to co-operate in their solution with the experts of the operating staff.

The purchase of steel rails, is, of course, an exception as far as the time element is concerned. It is nothing new to draw rail specifications on the basis of microscopic, physical and chemical tests. Information of this character is absolutely essential to the securing of durability and reliable service. Few engineers outside the sphere of laboratory influence, however, realize the scope of work or the specialization in progress which have lately fallen to the lot of the consulting chemist. It is not too much to say that the single question of fuels has become a special branch deep enough to provide the expert chemical engineer with a life work, and similarly the preservation of timber and the study of lubricants are now subjects of sufficient breadth to occupy the entire attention of specially qualified men. The organization of chemical specialists is a natural outgrowth of this progress, and its power to reduce the total cost of a given material in its life and service in heavy railway work is being demonstrated daily in the cases of companies which have decided to supplement the advice of the engineer with the recommendations of the chemist in holding up the hands of the purchasing agent to enable the latter to buy at the maximum point of advantage as markets rise and fall.

No maintenance problems can be properly solved unless the materials involved are thoroughly understood. In the case of electric railway trolley wheels, for example, an analysis of wheels showing both long and short lines is a necessary condition to the finding of the wheel which shall in the long run be the cheapest, allowing for the differences in cost, mileage and scrap value. Similarly the study of trolley wire composition, the constituents of bearing metals, suspension cars, crossing frogs, ties, insulating compounds, oils, greases and other materials and supplies must supplement the tests of tensile or compressive strength, viscosity, flash and fire points, specific gravity, porosity and other physical properties which enable accurate specifications to be drawn in the interest of reduced maintenance through increased durability.

It is needless to emphasize the importance of chemical analysis and calorimeter tests of fuel in these days when British thermal units, and percentages of carbon, sulphur and ash count for so much with intelligent consumers. At the same time, it is not so generally appreciated that the quality of fuel burned in a given locomotive furnace or under the boilers of a power plant has a direct bearing upon the depreciation of grates and tubes, which demands the report of the chemist before complete data are at hand to judge the fitness of a given fuel for given conditions. Again, it is one thing to specify coal of a certain character and another to make sure that it is delivered and stored in the most acceptable way.

The cost of lubrication is a subject of great importance in railroad circles, and some of the best engineering chemical work has been done with a view toward determining the quality of lubricants best adapted to a given service. The preservation of ties, poles, trestles, and other timber structures is another point of contact between chemical research and railway maintenance, and although the Government has done and is doing a vast amount of work in the field there is room for the commercial chemist to enter more extensively than he has yet done in the general effort to forestall decay and renewal expenses. The study of paints and varnishes is still another question of far-reaching consequence jointly to the laboratory and the operating company, and the attention it is receiving from the Association for Testing Materials is an indication of the general appreciation of its importance. In the scientific purchasing of the immediate future the specifications distributed to competing supply houses will bear the impress of expert chemical knowledge no less than physical, especially in work on a large scale which involves the durability factor.

The Diversion of Underground Waters.

The ownership of underground waters and the right of property owners to divert such waters from their lands have long been the subject of legal controversy. The first important English case of this sort was decided in 1840 and since then there have been a number of decisions which have pretty definitely settled the law regarding underground waters in Great Britain. An excellent account of them was given some years ago in a paper by Lord Robert Cecil, of which a comprehensive abstract was printed in The Engineering Record of Dec. 2, 1899. It was there pointed out that according to the British law there is no property in underground water, but on the other hand, each landowner may pump from his land what water he can get, with two exceptions, viz., he must not directly or indirectly take water already contained in a surface stream, nor must he abstract water flowing underground in a known and definite channel. He has a perfect right to drain the supplies to all his neighbors' well, however long they may have been enjoyed by their owners. So, too, he may pump until springs miles away have ceased to flow. Further than this he may not go. Once water is in the channel of a stream above or underground, it is safe from underground depredation. Many criticisms have lately been made regarding this British law. What was entirely equitable fifty years ago, when underground supplies were of little account, may no longer hold true. Formerly, where a question arose between the draining of a well and the shutting down of a mine, public policy required that the owner of the well should suffer. As the population of cities has grown it has become more and more necessary, where the water is drawn from wells, to drain large tracts of the underground water they contain. The inhabitants of these districts are loud in their complaints of the damage due to their property on this account, while those who are engaged in conveying water to large centers of population claim that the few people in the country must be sacrificed for the many in the towns.

Attention has been called by The Engineering Record a number of times in recent years to decisions of this subject in the United States. Such a controversy arose in connection with the ground-water supplies of the Borough of Brooklyn and attracted much attention. It has also arisen a number of times in other States, and it is a matter of congratulation that in most of these cases the courts have recognized that the

decision should be based, not on the precedents established by a British common law, but on the equities of the case. The climate and geological conditions in different parts of the United States vary, generally being different from those of Great Britain, and a recognition of this fact leads to the inevitable conclusion that what may be justice in one climate and under certain local conditions may be injustice in another. The Minnesota Supreme Court states this very clearly as follows: "Nothing is better settled than that the fundamental principles of right and justice on which the common law is founded and which its administration is intended to promote, require that a different rule should be adopted whenever it is found that, owing to the physical features and character of a State, and the peculiarities of its climate, soil, products and water supply, the application of a common-law rule tends constantly to cause injustice and wrong rather than the administration of justice and right."

This satement was made in a decision in the case of Erickson v. Crookston Water Works, Power & Light Co., 111 N. W. Rep. 391. The company bought two artesian wells in the Crookston artesian basin, well known among those interested in underground water supplies on account of its special features, and by deepening the wells and pumping from these the company obtained a large supply of water which it mixed with an inferior river supply and sold for domestic and other purposes. This heavy pumping from two wells lowered the water level in the ground to such an extent that wells in the vicinity were rendered practically useless, and the suit was brought to prevent it. It was natural to expect an interesting decision in this case, because in the matter of surface water the Minnesota Supreme Court had previously taken a view which was novel at the time it was announced. In the case of Sheehan v. Flynn, the liability of the landowner for diverting surface water to the injury of another was made to depend upon the necessity and reasonableness of the act. Although this rule is subject to considerable criticism even at the present day, it has been followed to a greater or less extent in many Western States. It is natural, therefore, to expect that the decision in the present case involving underground supplies would be similar in its reasoning, following the precedent originally established by the New Hampshire Supreme Court, which was particularly referred to in Lord Robert Cecil's address. In fact, the highest court in the State of New York has made a decision of somewhat like tenor in some of the cases growing out of the use of ground water for supplying the people of Brooklyn.

In Forbell v. New York, 58 N. E. Rep. 644, the court stated: "In the absence of contract or enactment, whatever it is reasonable for the owner to do with his sub-surface water, regard being had to the definite rights of others, he may do. He may make the most of it that he reasonably can. It is not unreasonable, so far as it is now apparent to us, that he should dig wells and take therefrom all the water that he needs in order to the fullest enjoyment and usefulness of his land as land, either for the purpose of pleasure, abode, productivness of soil, trade, manufacture, or for whatever else the land as land may serve. He may consume it, but must not discharge it to the injury of others. But to fit it up with pumps and wells of such pervasive and potential reach that from their base the defendant can tap the water stored in the plaintiff's land and in all the region thereabouts, and lead it to his own land, and by merchandising it prevent its return, is, however reasonable it may appear to the defendant and its customers, unreasonable as to the plaintiff and the others whose lands are thus clandestinely sapped and their value impaired."

Another case which deserves attention on account of the clear reasoning to be found in the decision as well as because of the precedent it establishes in a State where underground waters are specially valuable is that of Katz v. Walkinshaw, 74 Pac. Rep. 766. In this case the underground waters were found below an impervious stratum, the water-bearing material being fed from the rainfall on the slopes of the mountains encircling the valley. When the impervious stratum was perforated, true artesian wells were formed. The court held in this case that such percolating water rising through an artesian well was not a water course, so as to confer riparian rights upon the owners of the surface. It was further decided that the owner of a portion of a tract of land underlaid by such a water-bearing stratum cannot remove the water from wells for sale, if the remainder of the tract is thereby deprived of water necessary for its profitable enjoyment. A somewhat similar decision has been rendered in Texas.

The Minnesota Supreme Court has agreed with these views. It has decided that a water company had no vested right to deprive the neighboring land owners of water, naturally furnished by artesian wells, by pumping the water from its own wells to such an extent as to lower the whole underground water level. It will be seen that this is diametrically the opposite view to that of the British common law. It is in harmony, however, with a minority opinion by Lord Wesleydale in the famous case of Chasemore v. Richards, decided in 1857. Lord Wesleydale stated that a land-owner ought to exercise his right in a reasonable manner, with as little injury to his neighbor's rights as may be. He doubted the legality of a water purveyor's act in abstracting water for the use of a large district in the neighborhood unconnected with his own estate, for the use of those who had no right to take it directly themselves and to the injury of those neighboring proprietors who had an equal right with themselves. Each person who was supplied with water by the purveyor might not have been able to dig a well on his own land and take the like quantity of water, so that the purveyor may have taken much more than would have been abstracted if each had exercised his own right. These opinions of Lord Wesleydale have not been unheld in Great Britain because of the belief of the court that it would be impracticable to determine what was a reasonable use of underground waters. It will be seen that the American courts have been deterred by no such fear, and that in many of our States, as mentioned above, what is legal in respect to underground waters is made to depend solely upon what is reasonable.

Notes and Comment.

Economy of Manufacture in cement mills is brought to the front in Mr. Potter's interesting paper on the use of electricity in such plants printed in The Engineering Record, Sept. 21. The change taking place in such works at the present time as a result of the introduction of electricity and various other improvements is particularly noticeable. Attention is being paid everywhere to methods of reducing the cost of manufacture without deterioration in the quality of the product. That there is plenty of opportunity for improvement is generally admitted by cement manufacturers. The industry suffered in one sense from the fact that its product is mainly consumed during the months when work can be carried on readily out of doors. As a result of this fluctuation in demand, there is an accumulation of stocks every winter, so that when spring arrives it is natural for the manufacturer to feel very apprehensive concerning the future, for he generally has a large amount of capital locked up in unsold product. The manufacturing problem, then, is to meet economically a demand which is not unlike that thrown on central electric stations. There is a peak load which must be provided for by special means, an average load from which profits must be derived and a minimum load which must be brought up as high as possible in order to keep down manufacturing cost. Of course electricity will not be of much use in equalizing supply and demand, although it is certain that it will be a help in reducing operating expenses. There has been a tendency among some of the older companies to look upon electricity as too unreliable for a mill operating with such clouds of abrasive dust as arise in cement work. It is only necessary to refer to the many plants where electricity has been in satisfactory service for years to show that these fears are unfounded. One result of the adoption of electrical machinery, has been, however, the demonstration of the uncertainty new existing regarding the actual demand for power in cement production. Mr. Potter's statement concerning the good results which will inevitably follow careful investigation of this feature of cement works deserves consideration. Until it is known just how much power is required to operate the heavy machinery with different kinds of materials, it is out of the question to design the most economical electrical drives.

An Evidence of Civic Pride that deserves more than passing attention has recently been received from Frankfort-on-the-Main. The public works of this city have long been noted among engineers. The sewerage and water systems have been places of pilgrimage for twenty years, and the harbor works are among the most interesting in Germany. The city has been growing quite rapidly, and instead of allowing it to develop without restraint, a great deal of thought has been paid to the laying-out of all the suburbs. The pavement and methods of street cleaning are in keeping with the other public works, and taken all in all, there is probably no city in Germany which better repays examination by those interested in municipal works. This is so well known that a host of visitors connected with such affairs elsewhere go to Frankfort annually on inspection tours. These visitors have always been welcomed warmly and all possible information placed at their disposal. Nevertheless, the burden of supplying data to so many callers has been a somewhat serious matter and accordingly the city engineering department has prepared an excellent guide to all the public works under its charge. This has been published in an attractive form, editions being available in English, French and German. Such a book not only saves the members of the engineering staff of the city a considerable amount of time in answering the general inquiries of visitors, but it also insures to the latter absolutely accurate information free from defects that might creep in when general statistics are compiled hastily. The book is particularly interesting because it is printed by the city for free distribution to all who are interested in the Frankfort undertakings. It indicates a pride in the works built at the expense of the municipality which is rarely shown so clearly. There are a number of cities in this country which have public works of high character. Boston, for instance, contains many undertakings of this sort, and yet even Boston, noted for its municipal self-esteem, has not been so proud of its excellent engineering works that it has been willing to spend a few hundred dollars preparing a guide to them for the many visiting officials of other cities.

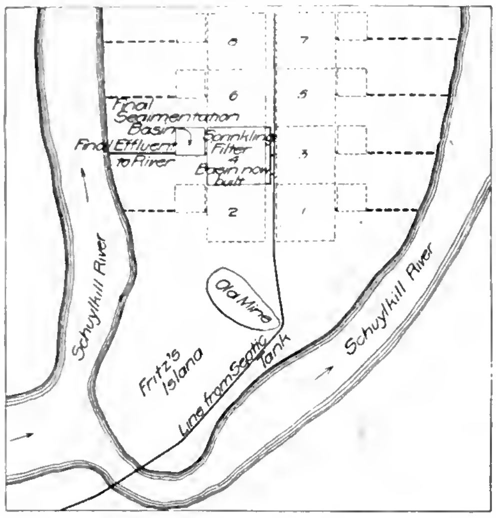
THE SEWAGE PURIFICATION PLANT AT READING, PENNSYLVANIA.

The city of Reading, Pa., is at present completing part of an interesting sewage purification plant which is the nucleus of an extensive system to be developed as the needs of the city require. The new installation consists of a sewage screening device, a septic tank, a sprinkling filter and a final settling basin.

The purification of the sewage of Reading was begun about 12 years ago when the present separate sanitary sewerage system was built. The system drained by gravity to a pumping station on the banks of the Schuylkill River in the lower part of the city and was pumped about 6,600 ft. to a filter plant. The treatment of the sewage was begun at the end of the gravity system and before pumping, by being passed through a 12-in. straining layer of fine coke, held in place by iron screens. The filter had two decks, one above the other, each deck having an area about 50x250 ft., the upper deck being supported about 10 ft. above the lower by an iron framework. The filtering material on the decks consisted of layers of graded slag, covered with sand. The sewage was thoroughly aerated by dropping freely through the air some 10 ft. to the lower bed. The results with this combination of a screening device, and double filtration accompanied by aeration are stated to have been quite satisfactory at first, the effluent being clear and of a good sanitary quality, but as the amount of sewage increased owing to new house connections to the sewers and the use of the coke strainers was discontinued, the filter became overtaxed, and required a great deal of attention to relieve clogging of the surface.

In 1905 the city contracted for the construction of about 60 additional miles of sewers, and in consequence the purification problem again became prominent, the more so, too, because the Department of Health of the State of Pennsylvania by an act of the Legislature had been given supervision of the discharge into rivers of the effluents of all sewers built after the passage of the act. Since the city was unable to issue bonds for the construction of the additional purification works, it was decided to call for bids for the construction and operation by a contractor of the necessary plant. The proposed contract was for a 5-year period, the compensation being a fixed sum which was to cover both the operation and the construction of the additional purification plant and the operation of the present pumping station. Mr. O. M. Weand, a Reading contractor, offered the only bid.

Study of the Problem.—Before the contract was closed the city decided to have the sewage problem thoroughly studied in order to determine the most efficient and economical purification system for the local conditions, and accordingly Messrs. Hering & Fuller, of New York, were retained as consulting engineers in March, 1906, acting in coöperation with the city engineer, Mr. Elmer H. Beard. Mr. S. J. Lewis was the assistant engineer in immediate charge. The investigation was begun at once and a small but well-equipped laboratory for making chemical and bacteriological analyses was installed by the city for the prosecution of the work. It included a study of the composition and quantity of the sewage, the performances of the old filter and of the devices suggested by Mr. Weand, when operated separately and in combination, and a comparison of these data with practical experience in purifying similar sewage elsewhere.



Plan of Filter Beds.

The average volume of sewage was about 2,000,000 gal. per 24 hr., at the time of the report of the city and the consulting engineers in July, 1906, and at times of very wet weather increased to about 2,750,000 gal. The sewage was found to be quite dilute, and was essentially of a domestic nature, though mixed with a limited quantity of trade wastes. A further investigation has also been made of these wastes, and it has been determined which shall receive preliminary treatment before being admitted to the sewers, and which may be admitted without such treatment, those requiring treatment being such as would interfere with the normal operation of the purification devices. The average composition of the sewage in parts per million was found to be as follows: Oxygen consumed 40, chlorine 100, total suspended matter 113, of which 78 parts were volatile and 35 parts fixed. About 40 per cent. of the organic matter was in suspension, and about half a part of nitrogen was found as nitrates. The average bacterial content was 2,200,000 per cubic centimeter.

Results of the Experiments.—In order to study the old filter part of it was restored to its original condition with fresh material. Both the upper and lower beds consisted of a 4-in. layer of 2 to 3-in. slag, 1 in. of ½-in. slag, 2 in. of ⅛ to ¼-in. pebbles, and 12 in. of clean, sharp, washed sand of medium size, the layers being in the order named starting from the bottom upwards. Raw sewage was applied to the upper bed at a rate of 1,000,000 gal. per acre per 24 hr., the rate which the filter was expected to handle when it was designed. Though the sewage was quite dilute, it was found difficult to operate the filter at this high rate. The effluent was nonputrescible and fairly clear, the suspended matter averaging 19 parts per million or 13 per cent. of the content of the applied sewage, the organic matter being reduced 74 per cent., and the nitrates increasing from 0.5 to 3.2 parts per million. The bacterial removal was from 66 to 76 per cent., and the liquid was almost saturated with oxygen both before and after its passage through the lower bed. The sewage was applied intermittently, 4 hr. periods of dosing and resting giving best results.

Sprinkling Filter for Sewage Purification, Showing Distributing System and Drains.

With this rate it was necessary every two or three days to remove a slimy deposit, ⅛ in. thick, from the surface of the upper bed, amounting to about 41 cu. yd. for each million gallons of untreated sewage that was filtered. The conclusion reached by the engineers was that the cost of maintenance was too great, even though the effluent was good, a conclusion agreeing with the general feeling that the sewage applied to filters should first be freed of the greater part of the suspended matter.

The preparatory devices proposed by the contractor consisted of two moving screens fastened together, one of 80 and the other of 40 meshes to the linear inch. For test purposes such a screen of brass cloth was built, together with a

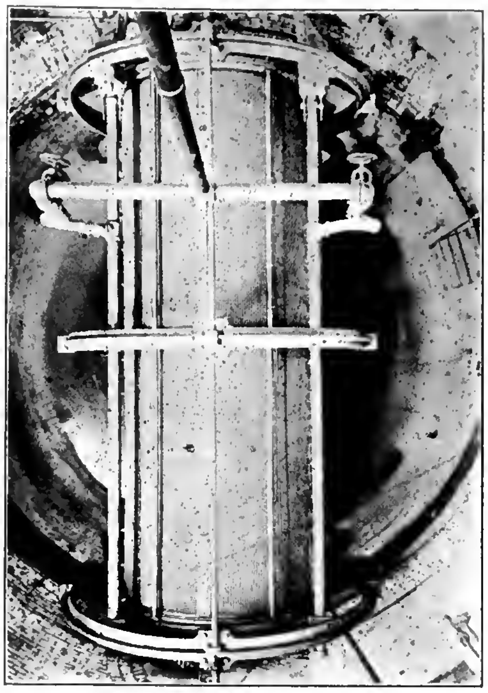
box or flume about 3 ft. deep, 10 ft. wide and 40 ft. long filled with coke. The sewage was passed onto the screen and fell through to the flume, the fine screen retaining quite a quantity of coarser suspended matter, a portion of which was discharged at one end of the screen. The suspended matter remaining on the screen was removed by steam jets. The volume of wet sludge, containing 73 per cent. of water, averaged about 1/3 cu. yd. per million gallons of sewage treated. The rate of application of the sewage to the screen was limited only by the quantity that can be treated by the coke strainer and the filter. The total suspended matter removed by the screen which has been locally termed a "segregator," was 20 per cent., and by the segregator and coke strainer combined 47 per cent.

When the filter was worked with the sewage already treated by the preparatory devices just discussed, the highest rate found advisable was the same as when the filter was treated with raw sewage, 1,000,000 gal. per acre per day, but the clogged material removed from the sand surface averaged but 11 cu. yd. per million gallons treated. The effluent was practically of the same quality as obtained when the filter was treated with raw sewage, the benefit of the preparatory devices being found in the reduction by about 75 per cent. of the clogged sand which must be removed.

Plan Recommended.—The report of the city and the consulting engineers, made to the Board of Public Works, after comparing purification experiences at Reading and elsewhere, finally recommended the following plan. 1. The sewage should first be thoroughly screened, the removal of the fibrous materials in certain of the local trade wastes being a special reason for so doing. 2. The well-screened sewage should be further treated by straining through coke or by sedimentation in a septic tank to remove still more of the suspended matter, the septic tank, in proportion to the work done, being much the cheaper of these means. 3. The aeration of the sewage effected by the double-deck filter is very important, but for economical reasons should be done by means of sprinkling filters, the filtering material being not less than 5 ft. thick and the particles not smaller than 1/2 in. 4. There should be sedimentation in shallow basins, holding one or two hours' flow in order to remove the scales of deposited material which have dried and peeled off the coarse filtering material.

This system is expected to produce a non-putrescible effluent and remove 90 per cent. or more of the bacteria in the original sewage.

The engineers further recommended that the present filter be dismantled and the framework be used in constructing a septic or settling tank for preparatory treatment, that the upper portion of Fritz's Island lying in the Schuylkill River half a mile below the old plant be purchased by the city as a site for the sprinkling filters, and that a contract be executed with Mr. Weand for the construction and operation of the purification plant.



Top View of Segregator, Looking down into Well.

Piping and Valves for Automatic Device for Dosing Filter Bed.

In accordance with these recommendations the contract with Mr. O. M. Weand was executed, which requires him to provide eventually for purifying a maximum of 7,000,000 gal. of sewage per day, to contsruct a second filter bed as soon as the increase in house connections demands it, and to operate the purification works and pumping station for five years. The contractor is to be paid a fixed sum yearly, and at the expiration of the contract the new works constructed and the improvements made revert to the city.

Accordingly the pumping plant in the city and the old filter were turned over to the contractor, and the new works commenced. The quantity of sewage to be treated at present requires the construction of only one bed, with an area of one acre, it being estimated that this will produce a non-putrescible effluent with a maximum rate of 3,500,000 gal. per acre per day, with the present dilute condition of the sewage during wet weather.

Pumping Plant and Screening Device.—The sewage pumping plant, to which the sewers drain by gravity, is located on the bank of the Schuylkill River in the lower part of the city. It has been used continuously since the installation of the original filter plant until the operation of the latter was discontinued on account of the new construction. The building contains an engine room, boiler room, and two wells, 20 ft. in diameter in which the coke strainers of the former purification system were located. In one of these wells the new rotating screening device, called a "segregator" by the contractor, has been installed, the other well being idle and reserved until such time as the quantity of sewage will make it necessary to duplicate the present apparatus.

The segregator, which has been patented by the contractor, consists of a screen 6 ft. in diameter and 16 ft. long, which revolves about a horizontal axis. The screen proper is of brass wire cloth, 40 meshes to the linear inch, which is fastened to a heavier "body" screen of 3/4-in. mesh galvanized iron wire by being soldered at intervals of about 6 in. in each direction. The revolving frame consists of three heavy cast iron rings, one at each end and one at the center of the screen, held in position by six 1 1/2-in. extra heavy pipes, through which bolts have been passed and screwed up tight. These rings carry iron strips, running the length of the barrel, which divide the circumference into eight segments, and carry bolts for attaching the removable strips holding the 40-mesh screen in place. The latter is made in these small segments so as to be easily removable to facilitate repairs, while the heavy body screen is in three pieces and attached permanently to the revolving frame. The latter revolves on the three heavy rings, which bear on six 12-in. cast iron wheels, two being attached to each of the three stationary rings, constituting the stationary frame of the segregator, and concentric with the heavy rings of the revolving element. The wheels on each ring are placed a short distance on either side of the lowest point of the screen, and a third 12-in. wheel at the top of each ring serves merely as a guide. The heavy rings of the stationary frame are held in position by three 1 1/2-in. extra heavy pipe, with bolts through them, as described for the revolving frame.

Attached to the outer rings on each side of the top of the screen are hangers carrying two 3-in. pipes, to each of which 15 cleaning jets are at-

tached, for directing water, steam or air against the outside of the screen. The jets are on 10-in. centers, and the two header pipes are made to travel 12 in. laterally, so that the travel of each jet overlaps 1 in. on the travel of each of its two neighbors, assuring the thorough cleaning of every part of the screen. The header pipes are connected to the stationary pipe by flexible pressure hose. The cleaning jets are 3-32 in. in diameter and can be operated under any perssure up to 200 lb. per square inch, though it is expected that 20 lb. will be sufficient to wash the sludge from the inside of the screen. Valves are provided to supply the jets with water, steam or air, or all three or any two of these together. The condenser water will generally be used, the heat helping to remove the sludge on the screen. The segregator makes 3 r.p.m., the power being transmitted by a link belt from a 2½-h.-p. engine.

The sewage enters the revolving screen at one end through a 24-in. main, the center of which is in the axis of the screen. A circular baffle plate 8 in. beyond the end of the pipe breaks the flow and spreads it to the circumference of the screen. The cleaning jets operating under pressure will loosen the sludge, which otherwise would clog the fine mesh, and thus a clean screening surface is always offered to the raw sewage. The sludge, gradually working to the open end of the screen opposite the sewage inlet, will be caught by a bucket conveyor and raised to the floor of the station, where a spiral conveyor will carry it to a hopper, to be discharged into bags. These bags will be placed in a Shaum & Uhinger centrifugal wringer, with a 42-in. basket, making 800 r.p.m., and the liquid forced out of the sludge. The latter will then be sold for fertilizer or mixed with coal for use as fuel, tests showing that it burns well.

The steam plant contains three 60-h.-p. Orr & Sembower boilers, two combined circulating and air pumps for the condenser, and two duplex compound-condensing plunger-pattern Snow pumps of 5,000,000 gal. capacity each.

From the pumping station the sewage, after passing through the segregator, is forced through 6,600 ft. of pipe to the septic tank located on the other side of the Schuylkill River at Millmont. The first 250 ft. is of 36-in. cast iron pipe, the next 450 ft. under the river of 30-in. pipe, and the remainder of 20-in. pipe.

Septic Tank.—The septic tank occupies the site of the former filter and utilizes part of the iron framework of the latter. Its elevation is such that the flow through the succeeding stages is entirely by gravity, even to the final discharge of the purified effluent into the river. The tank is not covered, measures 51 ft. 8 in. by 253 ft. inside and is 17.35 ft. deep. The sewage will normally stand 1 ft. below the top of the wall, and at that stage the tank will have a capacity of about 1,600,000 gal., giving an average period in the septic tank for a 3,000,000 gal. per day flow of about 12¾ hr. and for a 7,000,000 gal. per day flow of about 5½ hr.

The tank is of reinforced concrete, the reinforcing consisting of round rods, and the concrete of a 1:2:4 mixture, using Lehigh Portland cement, and slag, with a maximum size of 1½ in. The sewage enters the tank at one end through a 14-in. riveted steel header about 45½ ft. long, supported by two concrete columns, and the 20-in. vertical pipe, through which the sewage comes through the floor of the tank and enters the header. Twelve 5-in. holes 45 deg. below the horizontal are cut into the header, spaced 3½ ft. on centers. The header is 11 ft. above the floor and about 6 1-3 ft. below the top of the wall.

The outflow is over a timber weir and into a trough at the end of the tank opposite the inlet header, the crest of the weir being 1.15 ft. below the top of the wall. The weir and trough run the width of the tank and are supported by timber posts and by the 24-in. vertical effluent pipe, which is bolted to the bottom of the trough. The latter, which is 2 ft. deep, is anchored to the walls by spikes driven into wooden plugs set in the concrete. A 2-in. scum board, with its bottom 1 ft. below the crest of the weir, is mounted 5 in. in front of the latter.

An overflow weir 32 ft. 3 in. long, with its crest 0.7 ft. below the top of the wall, has been built in one of the side walls near the discharge end of the tank, and is fitted with a scum board. An apron projects 10 in. so as to throw the overflow away from the wall. Four baffle walls 4 ft. high, being part of the old filter structure, extend across the width of the tank, dividing it into five equal bays.

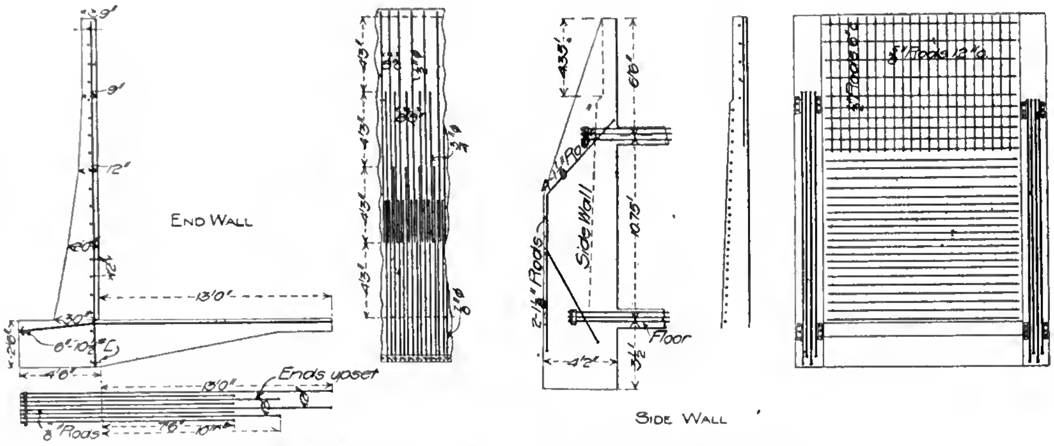
The side walls of the tank are 9 in. thick at the top and 18 in. at the bottom and are supported by reinforced buttresses 24 in. wide, spaced 12 ft. 9 in. on centers. In addition to being supported by these buttresses the side walls are tied together in the planes of the buttresses by two sets of round steel tie rods anchored in the buttresses and enclosed in concrete, one set being placed in a concrete "beam" 12 in. deep, and 14 in. wide on the floor of the tank, and the other set in a "beam" of the same section, with its center 10½ ft. above the lower one. The portion of the side walls below the upper "beams" and 1½ ft. above them has horizontal reinforcement, the wall acting as a girder, with the buttresses as supports. The portion above the "beams" has vertical as well as horizontal reinforcement and is figured as a cantilever, the stress being carried to the lower part of the wall rather than to the buttresses directly. Each buttress encloses one of the cast iron columns of the framework of the old filter, and two similar columns and one concrete column support each of the upper "beams" at the quarter points of the width of the tank. The buttresses are 4 ft. 2 in. long from the inside of the walls.

The end walls are 30 in. thick at the bottom and 9 in. at the top and, not having any tie rods running between them, are supported by vertical reinforcing rods, which carry the stress as a cantilever to a reinforced toe extending 13 ft. inside the tank.

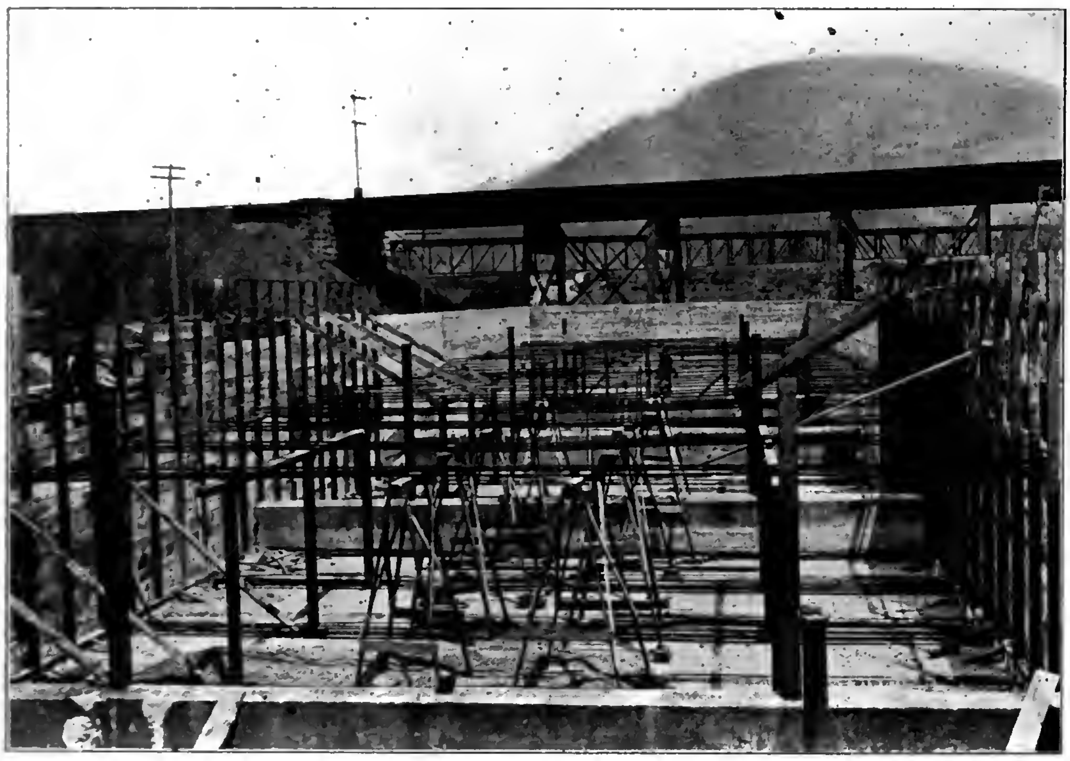
The horizontal steel in the end walls varies from ⅝ to 1 in. in diameter and is placed 12 in. on centers, while the vertical rods are ⅞, ¾ and ½ in. in diameter, spaced 3 in. at the bottom, not all of the rods running to the top of the wall. The rods in the toe are ⅞ in. on 3-in. centers and are anchored at the outer ends to 6-in. 10½-lb. channels.

The horizontal rods in the side walls are ⅞ and 1 in., with spacing varying with the height and diameter of the rods, from 5 to 7 3-16 in. The vertical rods are ½ in. on 6-in centers. In the upper, or cantilever, portion of the side walls are horizontal rods ⅝ in. diameter, spaced 12 in.

There are four 1⅛-in. rods in each buttress. In the lower tie "beam" there are four 1⅛-in. rods, and two ⅞-in. rods, anchored at both ends in the buttresses to 6-in. 10½-lb. channels. In the top "beam" there are four 1-in. rods and two ⅞-in. rods, anchored as in the lower "beam."



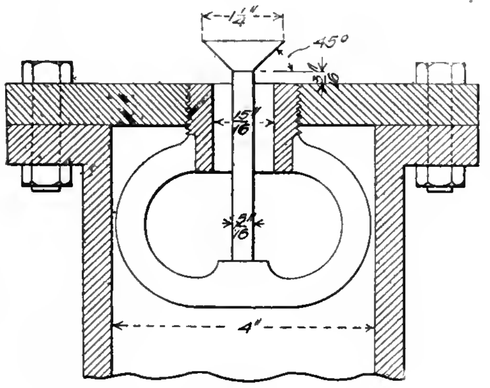
Reinforcement of End and Side Walls of Septic Tank.



Septic Tank under Construction, Showing Tie Rods Exposed.

The concrete was hand mixed and placed very wet in watertight forms. No water-proofing was applied, to insure water tightness. After the walls had been built, scaffolding was erected inside the tank for mixing the concrete for the "beams," and the materials delivered to it over runways extending along the top of the wall. A by-pass will be built around the tank so that the sewage can be diverted to the filters when the tank is being cleaned.

The effluent from the septic tank will flow under pressure, due to the elevation at which the tank is built, to the filter beds, about 2,500 ft. beyond. The pipe will be laid under an independent contract and will pass under a small creek and the smaller branch of the Schuylkill



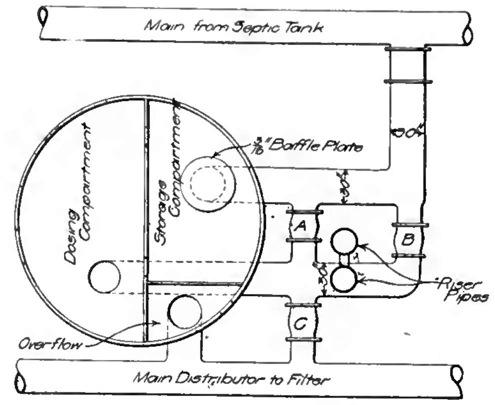
Sprinkling Nozzle for Filter.

River, the filter beds being on an island. The pipe will be 30 in. in diameter, built of concrete.

Filter Plant.—The site of the filter plant is a 30-acre tract on Fritz's Island, which slopes downward, looking up the river and to both sides, so that the effluent can readily be discharged into both branches of the stream. The situation is almost ideal for a filter plant, the more so because it lies considerably below the septic tank site. The highest part of the area is 12 ft. below the weir level and 17 ft. above the river at normal low water and slopes gently toward both branches. The filter floor is 8 ft. lower, the excavation on the area covered being from nothing to 5 ft. The ground has been laid out for eight beds of one acre each, four on either side of the 30-in. main from the septic tank. Each bed will have a separate dosing apparatus and a final settling basin, the latter being placed on the lower side, away from the filter influent main, so as to be filled by gravity from the bed. The settling basin in turn will discharge by gravity into the river. At the present time only one bed has been built, and it is so far completed that it can at any time be put in operation in a few hours. The work now waits on the completion of the pipe from the septic tank.

The filters are of the sprinkling type, the nozzles operating under a head varying from 7 to 2 ft., so as to distribute the sewage uniformly over the area served by each nozzle. The circumference of the spray is at its maximum under the highest head and gradually diminishes to about 3 ft. circumference. When the head drops to 2 ft. the flow ceases and the bed rests from 2 to 4 min., after which sprinkling again commences under a head of 7 ft. The filtering material is a 6-ft. bed of blast furnace slag, varying in nominal size from 1½ to 4 in. The bed as it now stands is 5 ft. thick.

Dosing Apparatus.—The dosing apparatus, which automatically controls the flow of sewage to the nozzles, is located between the main from the septic tank and the filter bed midway of the side of the latter. It consists of an elevated wooden tank 19 ft. in diameter divided by interior walls into three compartments of unequal size, the flow into and out of which is controlled by three butterfly valves operated by floats. The largest compartment is called the dosing compartment, the next in size the storage compartment and the smallest the overflow compartment. A 30-in. riveted steel pipe connects with each compartment through the bottom of the tank. The sewage coming from the main from the septic tank flows through a 30-in. pipe at right angles to the former and then into another 30-in. pipe parallel to the side of the filter bed. This pipe terminates in the storage compartment, which is always open to the flow from the septic tank. Two butterfly valves are placed between the pipe leading to the storage compartment and a parallel one to the dosing compartment. A third butterfly valve is interposed between this latter line and the main distributor to the filter, the latter being

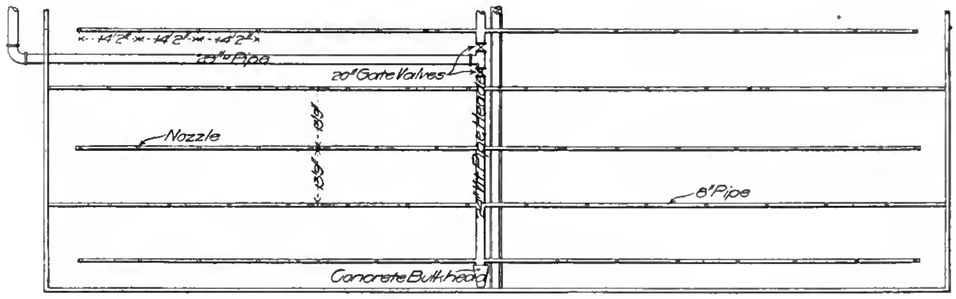


Dosing Apparatus.

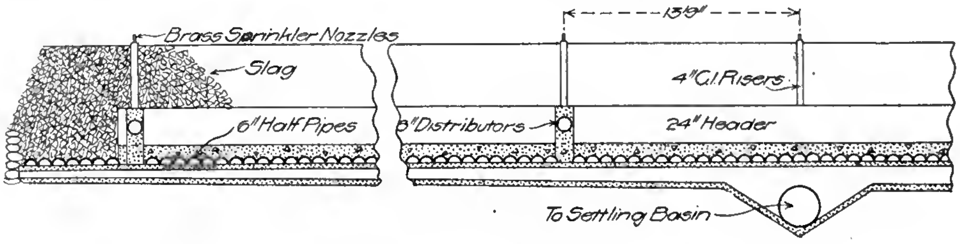
likewise connected to the overflow compartment by a short length of pipe. Cast iron riser pipes, containing the floats which operate the valves, are connected by 8-in. nipples to the 30-in. pipe leading to the dosing tank. All of the piping is of 3-16 in. riveted steel, except the float pipes. The valves are 20 in. in diameter.

The operation of the apparatus is as follows, the valves being described by the letters on the accompanying diagram: Starting at a time when there is no flow from the nozzles, valve A is open and B and C are closed. The sewage is then filling both the dosing and storage compartments, the level being the same in both, since they are connected through valve A. As the water rises valve B gradually opens, and when the compartments are full, equal to a head of 7 ft. on the nozzles, B is wide open, A closes and C opens, allowing the compartments to drain onto the beds and also the sewage to flow through valve B directly from the septic tank. When the head on the nozzles has dropped to 3½ ft. valve B closes, shutting off all connection between the septic tank and the nozzles and allowing the storage compartment to refill. The discharge from the dosing compartment continues until the head on the nozzles is 2 ft., when valve C closes and A is opened, restoring the starting condition. A weir is provided between the dosing and overflow compartments to allow a discharge in case the sewage rises over 7 ft. above the nozzles. The cycle of operations described will take from 7 to 8 min., the interval of rest being from 2 to 4 min. of this period. A patent on the apparatus has been applied for by the contractor, Mr. O. M. Weand.

Filter.—The filter bed is rectangular and covers exactly one acre. The main distributor, consisting of a 30-in. glazed tile pipe, runs 46 ft. each side of the dosing apparatus and connects at one end with a 30-in. glazed tile pipe and at the other with a reinforced concrete pipe 28 in. square, both of which run to the center line of the bed. Here they connect with a 24-in. vitrified tile pipe header, which runs the full length of the bed and has in it four valves, one on each side of the two influent main connections, so that each valve can cut off one-fourth of the bed when it is desired to give it a rest. From this header, every 13.7 ft., the 8-in. vitirified tile lateral distributors are taken off, extending at right angles to the header. The 4-in. cast iron pipe risers which carry the sprinkling nozzles are set vertically in tees at intervals of 14 ft. 2 in. in the laterals, the risers on adjacent laterals being staggered. The tops of the risers are 5 ft. above the axes of the laterals and about 1 ft. above the persent top of the slag.



Plan of Filter Distributing System.



Section through Filter Bed at Main Drain.

The main and lateral distributors and the header are built on concrete foundations, which for the 8-in. laterals are carried half way around the pipe on each side. All the joints are made with cement mortar. The laterals are joined to the header by cutting a hole through the latter, inserting the lateral and building around the connection a concrete ring about 4 in. thick, reinforced on each side of the smaller pipe with a ⅜-in. rod passing around the header pipe. About half of the cast iron riser pipes are set in the vitrified tile laterals with cement mortar and the other half with Pottsite, and a pier of concrete is carried up around each joint to a point 10 in. above the top of the lateral. A heavy concrete bulkhead at each end of the header takes up the thrust and relieves the cement joints of strain.

The sprinkling nozzles are of the stationary type, a modification of those adopted for the Columbus purification plant, and consist of an inverted frustum of a cone, carried by a rod passing through and in the center of a 15-16 nozzle orifice. The cone slopes 45 deg., is 1¼ in. in diameter across the top and is carried by a 5-16-in. rod, the junction of the rod and cone being 3-16 in. above the plane of the orifice. The cone,

rod and orifice are of brass and are set in a cast iron plate, which is bolted to the top of the riser with the aid of lugs cast onto the latter. A gasket insures a tight joint. This nozzle was adopted by Mr. Weand after numerous experiments.

The effluent drainage system is built on the floor of the filter, which consists of 4 in. of 1:3:6 slag concrete made with Lehigh Portland cement. The floor slopes 1 ft. from the two sides parallel with the distributing header to the center of the bed, and on it at right angles to the header were laid standard bell end 6-in. vitrified tile pipe split in halves longitudinally and placed with the convex sides up on 10-in. centers. A thin cement mortar was used to bed them well on the floor. The joints between the half pipe were laid open, so as to allow ready access for the effluent, and the pipe was covered with 5 and 6 in. pieces of slag, hand placed.

The half pipe drains to a longitudinal concrete trough parallel to and immediately to one side of the distributing header. The trough is 2 ft. wide, 4 in. deep at the ends and 12 in. deep at the center of the bed, so as to get a good slope for drainage. It is covered with concrete slabs 36 in. wide and 4 in. thick, supported above the half pipe on concrete sills. The main effluent drain connects at right angles with the trough at the center of the bed and runs beneath the filter floor to the final sedimentation basin. It is a 30-in. pipe, made of moulded segmental concrete blocks put together in place in the field with cement mortar.

The bed lies partly above and partly below the original ground level, and the sides in the excavation are built of rough stones plastered with concrete and cement mortar. Above ground the walls are vertical and of dry rubble for about 18 in. above the half pipe, and for the remainder of the distance to the top of the bed of large chunks of slag, having a batter of about 2 on 3.

The slag for the filter was obtained from an old blast furnace dump in Reading and was hauled to the site of the septic tank in bottom dump cars on the Philadelphia & Reading Ry. From this point wagons hauled it to the beds, where a dumping platform with inclined runways at each end was built at the level of the tops of side dump cars running on a track of 30-in. gauge. This track was shifted to different parts of the bed, a turntable being installed when needed. Three spurs were built at the dumping platform so that three cars could be loaded at once. On account of the large quantity of slag required a convenient dumping arrangement was built for the railroad to discharge the slag at the septic tank. The track was carried across on concrete piers, between which was an inclined timber apron that threw the slag out upon a loading platform, built at the height of the bottom dump contractors' wagons, which carried the material to the filter.

The slag was broken to size by hand and screened with forks.

Final Sedimentation.—The final sedimentation basin, built in excavation, measures 100 ft. by 95 ft. 9 in inside the slopes, which are 1 to 1. Its depth is 4 ft. at the end nearest the filter and 5 ft. at the end toward the river. Since the object of the basin is to allow the sedimentation of the coarse flakes of dried material that have peeled off the slag of the filter bed, it is made quite small, the capacity being about 340,000 gal., sufficient for about 2¼ hr. flow at the maximum capacity of the bed of 3,500,000 gal. per 24 hr.

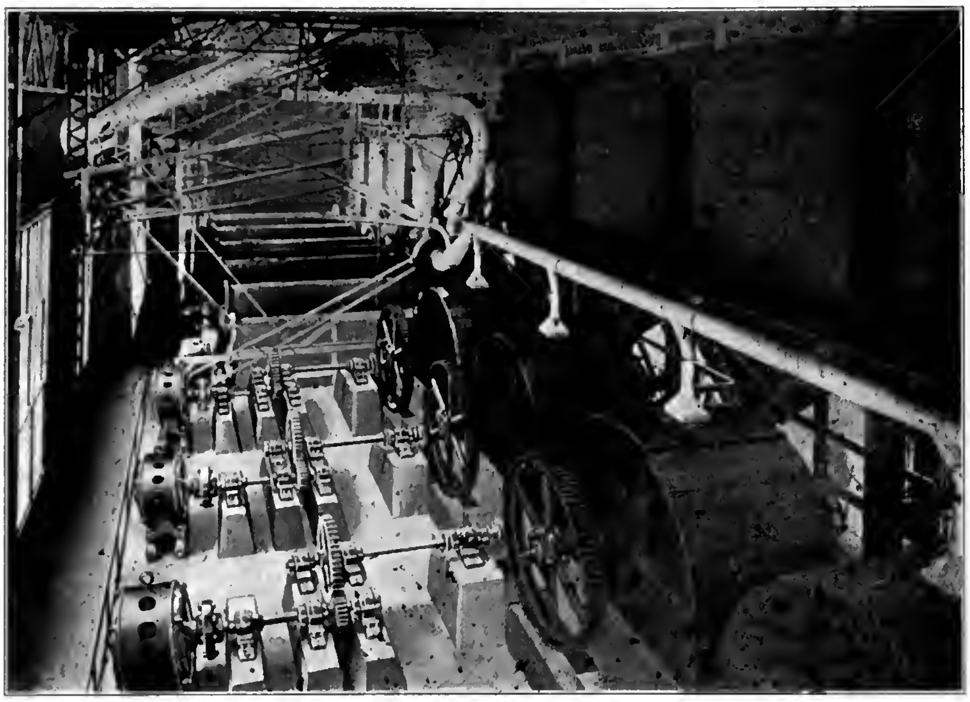
The basin is built of a layer of brick and cobble stones laid on the gravel and loam bed uncovered by the excavation and is plastered with cement mortar to make it tight. The effluent from the filter enters the basin through four ports, or openings with straight vertical sides, from a 30-in. concrete block pipe. It leaves the basin over a concrete weir extending the entire width of the side nearest the river and is then discharged into the stream. A 30-in. pipe by-pass, also of concrete blocks, allows the effluent to be discharged directly from the filter bed to the river.

The plant is being built by Mr. O. M. Weand, of Reading, under the direction of Mr. Elmer H. Beard, city engineer, and Messrs. Hering & Fuller, of New York, consulting engineers. Mr. A. L. Dabney is the representative on the work of the consulting engineers.

Electric Motors for Cement Mills.

By R. B. Williamson.

For driving the various machines used throughout a cement mill, electric motors are now almost universally employed, especially in the more modern mills, such as those for which Allis-Chalmers Co., of Milwaukee, has built and installed the complete equipment, the electric drive having here the same advantages of flexibility and economy that have been demonstrated in so many other lines of work. The elimination of belting and countershafting is specially desirable in a cement mill, where the gritty dust makes the maintenace of belts and bearings expensive.



Induction Motors Driving Ball Mills.

In some mills, particularly those located in the West, power is purchased from transmission companies, but usually each mill is provided with a steam plant of its own. In either case the alternating current system is almost invariably used in modern installations and it may be either 60 or 25 cycles, two or three phase. Although direct current has been used in a few cases, the present practice is to use alternating-current motors almost exclusively for this class of work. The polyphase induction motor has many advantages, not the least of which is the absence of commutator and brushes. The cost of maintenance is less than for direct-current machines, and in the dusty atmosphere of a cement mill, the simple "squirrel cage" rotor of an induction is much less liable to give trouble than the wound armature of a direct-current machine.

In these mills the motors are used for operating rock crushers, ball mills, tube mills, rotary kilns, hoists, conveyors, pumps; in fact, for all the machines used throughout a modern cement plant. In most instances the motors are run at or near full load continuously, and the service as a whole is specially severe. In nearly all cases they are of the squirrel-cage type with short-circuited secondary, a type that necessarily operates at constant speed. For variable speed work the induction motors are provided with a wound rotor, connected, through collector rings and brushes, to an external resistance. By this means the speed can be varied at the expense of lower efficiency. However, collector rings and brushes are undesirable features when exposed to cement dust, and these motors are used as little as possible; they are installed occasionally for operating rotary kilns where a variation in speed is sometimes desirable, and also for electric hoists; but for practically all other classes of work constant speed squirrel-cage motors are preferred.

Probably the most severe service is that demanded of motors for running ball and tube mills. These mills are used for grinding the raw material before calcining, and also the clinker from the rotary kilns. For driving the ordinary size ball mill a 50-h.-p. motor is required, while for a 5x22-ft. tube mill a 75-h.-p. motor is usually installed; a 5½x22-ft. tube mill requires about 95 h.-p. and a 6x22-ft., 115 h. p.; the 5x22-ft. mill is the size generally used.

Ball and tube mills, especially the latter, are difficult to start. The material clings to the sides of the mill, particularly in the tube mill, where pebbles are used to effect the grinding, and at starting the whole mass has to be swung up until the first half revolution has been made. This demands heavy starting torque, usually amounting to one and a half to two times full-load torque. It is desirable, therefore, to use for these mills a motor having starting torque higher than for ordinary service; if this is not done, the motor will take an excessive current at starting, or, if the voltage drops to any great extent, the motor may even fail to start the mill at all. Motors for this service must be of liberal size to give the requisite starting torque and also operate continuously at full load in a dusty atmosphere, without undue rise in temperature. It must be remembered that in cement mills the fine dust gets into the ventilating passages in the motor, and they may in time become clogged up, thus materially increasing the temperature rise.

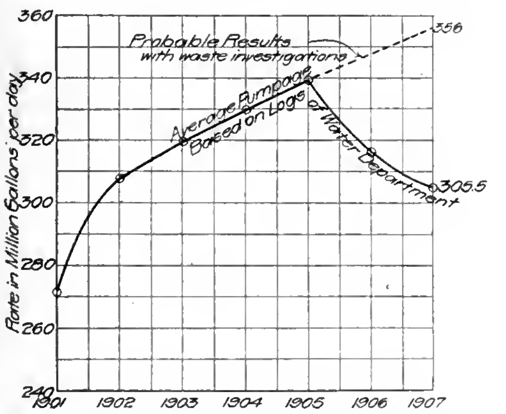
The starting apparatus used with these motors must also be of liberal design in order to carry heavy starting currents. Sometimes the mills are started by throwing the current off and on, giving them two or three swings until they

finally turn over. This is especially hard on the stator and should not be necessary if the motor has ample starting torque. All starters have oil immersed switches for changing the connections from "starting" to "running," and transformers are provided so that a reduced voltage can be applied to the motor at starting, thus reducing the current taken from the line. For this severe starting service where the motors are frequently operated by an unskilled class of help, the starters can be fitted with a device that prevents the handle from being left on a starting position; if left on a starting position it at once returns to the off position, thereby preventing a burn-out of the starter.

Motors for operating these mills are usually belted and run at moderate or slow speed. On 60 cycles, 50-h.-p. motors running at approximately 850 r.p.m. full load have been used for ball mills, but a slower speed motor is more desirable and 670 r.p.m. machines are now recommended. On 25 cycles, four-pole motors running at approximately 700 r.p.m. full load are used.

For 5x22-ft. tube mills a 75-h.-p. motor running at 670 r.p.m. full load on 60 cycles is suitable, while on 25 cycles speeds of 700 or 470 r.p.m. are available, the latter being preferred. Motors are belted directly to the main driving shaft on the mill from which the latter is driven through spur gearings.

As regards voltage and frequency, the majority



Average Total Primary Pumpage in Philadelphia for First Four Months of Year.

of cement mills are operated on 440 or 550 volts and frequencies of 60 or 25 cycles. Although there are instances where 2,200-volt motors have been used, the lower voltages are preferable on account of the greater security of the insulation on the motors and greater safety in working around them. There does not appear to be any settled practice as regards frequency, either 60 or 25 cycles giving satisfactory results; in many cases the frequency is fixed by that of the transmission system from which power is obtained and most plants supplied from such systems are operated at 50 or 60 cycles.

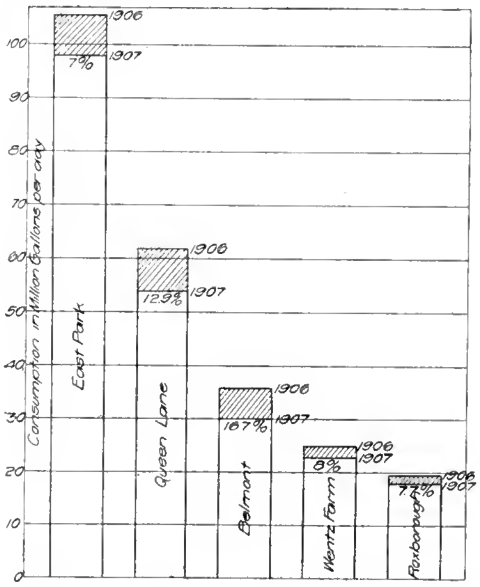
As regards mechanical features, it is important that the bearing sleeves be arranged so that they can be readily removed and relined. All bearings are made as dust proof as possible by means of felt dust guards, and journals are of liberal dimensions.

A New Use for Motor Boats has been found by the Austrian War Office, which is experimenting with them as substitutes for the iron pontoons used in constructing military bridges. Experience has shown that in building pontoon bridges much time is often lost because the pontoons break loose and must be towed back to position. With motor boats much time can be saved. These boats can be carried on wagons fitted with an inclined plane and a windlass so that the boats can be easily launched and taken out of the water.

Waste-Water Investigations in Philadelphia.

The Bureau of Filtration of the city of Philadelphia started under Major Cassius E. Gillette a broad series of waste-water investigations, which, during the past 20 months that the work has been in progress, have produced a number of exceedingly valuable results. The investigations were undertaken chiefly to determine the following conditions: First, to measure the amount of water delivered by each pump in the large stations in order to find whether the pumps were being operated economically; second, to ascertain whether the reservoirs were leaking; and third, to determine just what becomes of the water after it leaves the reservoirs.

Some work has been done along all of these lines. The investigations of the condition of the various pumps in the large stations were specially far-reaching, and showed that by making comparatively slight repairs the capacity of the pumps could be increased materially. The leakage from the reservoirs was found to be a very small percentage of the total quantity of water pumped. An imperative necessity for detailed waste in-



Decrease in Total Consumption of Five Districts.

vestigation in West Philadelphia and a lack of time prevented any of the extensive tests necessary to trace the entire output of water after it leaves the pumping stations. Although the investigations have been only well started it has been decided to discontinue them for the present, for reasons entirely foreign to the work itself.

The measurements of water were made throughout the investigations with pitometers. During the first year the work was done by representatives of the Pitometer Co., but since January 1, last, it has been under the supervision of the Bureau of Filtration, although conducted by experts formerly connected with the Pitometer Co. The photographic records of flow made by the pitometers and the analyses of these records furnish a great volume of interesting data, but an attempt will be made here to merely outline the results that have been secured.

Pump Tests.—The various pumps in all the large stations were tested to determine the relation between the amount of water actually pumped and the amount indicated by the pump registers, or, in other words, the percentage of slip. The actual quantity of water pumped by each unit was determined by measuring the flow through the discharge pipe of the unit with a pitometer, the duration of the tests ranging from 1½ hr. to 24 hr. In most of the original tests, however, records extending over 12 to 24 hr. were obtained; the shorter time tests were usually conducted to check those of longer duration. The amount of slip found in the various pumps tested varied from 3 to 72 per cent. of the registered pumpage. The amount of slip in all the pumps in the city was estimated, from the practically complete results obtained, to average 25 per cent. of the total registered pumpage. That is to say, the amount of water actually supplied to the city is about 75 per cent. of that shown by the pumping records to be furnished.

The results of a typical series of these pump-slip tests are shown in the accompanying Table 1, which covers a number of records made in testing the pumps in the Spring Garden station. The test of the No. 2 unit in this station, a 30,000,000-gal. Holly vertical triple-expansion outside-packed plunger pump, made Sept. 4, 1906, is worthy of special consideration. The actual quantity of water delivered by this pump, as shown by the 24-hr. test, was only 35 per cent. of the calculated displacement; a 12-hr. test of this same unit made shortly afterward indicated that the slip had increased to 72 per cent., that is, the actual output was only 28 per cent. of the calculated. On investigation of the pump valves and valve chambers, it was found that a number of the valves were misplaced and the suction chambers choked to a considerable extent by rubbish brought down the river during a sudden rise in the latter just previous to the tests. No reflection can be cast on the management of the station, however, because the pump was not running lame and presented no outward indications whatever of its serious condition. After repairs requiring less than two days to make, the slip of this pump was reduced to approximately 10 per cent.

The tests of the crank and fly wheel 20,000,000-gal. Southwark Foundry pump, No. 5 unit, in this station should also be explained. This pump on four distinct tests showed a slip varying from 44 to 65 per cent. of the calculated displacement. After an overhauling requiring one day this slip was reduced to 28 per cent., thus increasing its actual discharge by 8,000,000 gal. per 24 hr.

A 30,000,000-gal. Worthington duplex pump was thoroughly overhauled in February and March, 1906. Soon after it had been placed in commission a pitometer placed on its discharge to determine its output showed a slip of 15 per cent. The pump was then shut down to find the cause of the trouble which proved to be a quantity of waste, blocks and so forth that had lodged in the suction chamber and clogged the valves. After this debris had been removed the slip was reduced to 3 per cent.

The results outlined in the table show that the slip of the pumps tested varies between wide limits, the variation often occurring in a very short period. For instance, a single storm in October, 1906, occasioned an increase of slip at the Spring Garden station of 5 to 10 per cent. in each of the pumps. In practically all cases where tests determined large percentages of slip the pumps were considered to be in serviceable condition, judging from the operation. These and many similar service conditions make apparent the necessity for frequent and systematic pump-slip tests.

Reservoir Gaugings.—The outflow from various reservoirs from which the distribution mains are supplied was gauged several times during the tests to obtain accurate data regarding the amount of water furnished to different parts of the city, in order to determine the best distribution of filtered water. The amount of leakage, if any, in the different reservoirs was also measured by pitometer gaugings on the inlet and outlet pipes. The results of these experiments in connection with the Wentz Farm reservoir showed an apparent leakage of 700,000 gal. in 24 hr. A 24-hr. test of the Queen Lane reservoir showed no measurable leakage; the same result obtained with the East Park reservoir.

The data obtained by the reservoir tests fur-

nished a good foundation for a general pitometer survey of the distribution system of the Philadelphia water works. The results also supplied a basis for an interesting comparison of the per capita consumption, which according to the annual reports of the water department, had increased from 100 gal. per day in 1895. to 233 gal. in 1904. After the waste-water investigations were started in September, 1905, the per capita consumption was reduced to 227 gal. per day, and in 1906 to 218 gal. In this connection, it should be noted carefully that these figures are based on registered pumpage, but according to the pitometer measurements showing the large percentage of slip in the pumps—and these measurements are doubtless within 2 to 3 per cent. of being correct—the registered pumpage does not represent the true consumption, although it does represent the true relative cost of pumpage for these years. By pitometer measurements the average daily per capita consumption for 1906 was 165 gal., and during the first part of this year it was 150 gal.

District Tests.—The distribution system of the water-works in the main portion of the city was divided into several districts. Some tests were made in these districts, but the latter were not subdivided and the waste in them carefully traced, owing to the immediate necessity for concentrating efforts to reduce waste in West Philadelphia, where a shortage of water had presented a serious situation. The tests made in these districts were carried far enough, nevertheless, to show that the night rate was disproportionately high as compared with the day rate, indicating a large amount of waste. Practically all of these districts were covered with factories, small residences and tenements. In seven of the districts the night flow was found to be from 70 to 86 per cent. of the day flow. While a few large consumers, such as railroad terminals and factories working day and night, accounted for a portion of the high night rates in one or two of these districts, most of the night flow in the districts was believed to be waste, or unmeasured consumption. The necessity for diverting all the efforts of the experts conducting the waste-water surveys to West Philadelphia to relieve the situation there prevented further work, however, on these districts in the central portion of the city. The flow in the supply lines of certain large consumers was measured, nevertheless, showing in a number of cases very high night rates. Instances were found where practically the entire flow in a pipe line supplying a district would be taken by a single consumer, the night rates frequently equalling the day rates.

West Philadelphia is a residence district with an estimated population of 180,000 and is supplied with filtered water from the Belmont slow-sand filtration plant. When the investigations were started in June, 1906, the consumption was 36,000,000 gal. a day, or 200 gal. per capita, making it evident that considerable water was being wasted. The actual daily capacity of the Belmont filtration plant was determined by accurate pitometer measurements to be only 32,000,000 gal., which is reduced to 29,000,000 or 30,000,000 gal. when the river water is highly turbid. Since the capacity of the filters was not equal to the total consumption, the extension of the district to be supplied with filtered water was dependent on the reduction of waste.

Investigations to locate the waste in the West Philadelphia section were undertaken in a most comprehensive manner. The section was divided into twelve districts, which were of varying size according to the ease of isolating them by cutting off different supply lines and connections of the distribution system. When the consumption of each of these districts had been measured separately with pitometers, it became apparent that the per capita consumption was approximately equally high in all twelve of them. It was also found that the night rates of flow were disproportionately high as compared with the day rates, which, together with the high rates of consumption per capita, indicated that waste was occurring in all parts of West Philadelphia.

In order to determine as nearly as possible the actual night rates of consumption, block by block, throughout the entire section each district was subdivided. This isolation of subdivisions was accomplished by operating the gate valves on the boundary of an area as large as it was possible to cover in a single night so the entire supply entered the area through a single main. The flow in this main was measured by a pitometer, giving the night rate of consumption in the district. This night flow was then localized by a process of elimination, reducing the size of the area, block by block, the time of closing each gate being noted. Each change of flow thus occasioned was registered on the photographic record made by the pitometer, so it was a simple matter to interpret this record later and to determine the rate of consumption for each block.

The results of these investigations showed that a house to house examination of plumbing should be made. Accordingly, on July 25, 1906, thirty men started to follow up the pitometer gaugings by inspecting the plumbing in the districts. Although this system of day inspections greatly reduced the waste, it did not curtail all of it, as is shown by the following typical instance. After the first day inspection of a pitometer subdivision of 7 blocks, the night rate of flow was 252,000 gal. per 24 hr., showing that while some reduction had been made the night rate was still high. A second subdivision was made and a special inspection of the service connections was carried on at night with aqua-phones; the connections causing waste were then shut off and were not turned on again until repairs had been made. After this special inspection the night rate of flow in the same subdivision was found to have been reduced to 143,000 gal. per 24 hr.

The result of the pitometer survey in West Philadelphia is shown by the accompanying tabulation of the average daily consumption in that section as measured at various times.

This survey made it possible in October, 1906, to supply filtered water to half of West Philadelphia not so supplied previously and since then nothing but filtered water has been furnished to that section of the city. The necessity for reducing waste over the entire city as rapidly as possible made it advisable to carry forward the investigations without waiting for a complete pitometer survey. Sixty men were, therefore, added to the staff of inspectors in November, 1906, and the inspection work is still in progress. Although this day inspection of plumbing will undoubtedly greatly reduce the waste, the experience has been that the pitometer gaugings permit it to be reduced to a minimum. It is notable that since the inspections were started many premises have been re-inspected and reassessed where no inspections had been made for years.

		Gals. per 24 hrs.
March,	1906	35,000,000
June,	1906	36,000,000
July,	1906	57,500,000
September,	1906	35,443,000
October,	1906	31,700,000
November,	1906	29,000,000
January,	1907 (freezing weather)	31,300,000
February,	1907 (freezing weather)	31,600,000
April,	1907	29,000,000
May,	1907	30,000,000

Checking Circular Weirs.—An adjustable circular weir is placed on the 20-in. discharge pipe of each of the filters at the Belmont plant. In order to determine the actual capacity of these weirs several of them were rated with pitometers. Tests of these weirs when the plant was discharging 19,000,000 gal. a day indicated that they were over-rated about 10 per cent.; several tests under a discharge of 29,000,000 to 31,000,000 gal. per day for the plant showed these weirs to discharge 5 per cent. less than their rating.

Table 1. Pump Slip Tests at Spring Garden Station, Philadelphia.

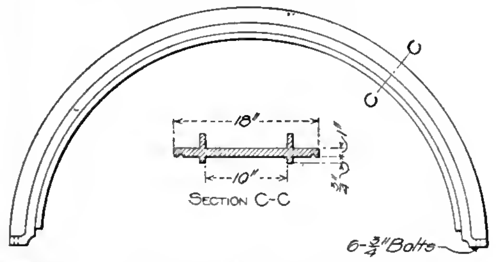
Pump No.	Make.	Type.	Capacity Mil. Gals.	Pumpage, Registered.	Pumpage, Actual.	Gal. Per Revolution.	Date of Test.	Length of Test, Hours.	Slip, Per Cent.
2	Holly	Vertical Triple	30	27,992,000	21,600,000	1080	10-19-05	2½	22.8
2	Holly	Vertical Triple	30	27,700,000	19,900,000	1080	2- -06	24	28.0
2	Holly	Vertical Triple	30	25,033,000	8,700,000	1080	9- 4-06	24	65.0
2	Holly	Vertical Triple	30	27,930,000	7,790,000	1080	10- 7-06	12	72.0
2	Holly	Vertical Triple Aft. Rep'g.	30	25,000,000	22,500,000	1080	10-12-06	12	10.0
	Holly	Vertical Triple	30	24,700,000	20,880,000	1080	5-20-07	1	15.0
3	Holly	Vertical Triple	30	28,493,000	25,495,000	1080	10-19-05	2½	10.5
3	Holly	Vertical Triple	30	27,700,000	19,900,000	1080	2- -06	24	28.0
3	Holly	Vertical Triple	30	26,072,000	20,740,000	1080	10- -06	24	20.0
	Holly	Vertical Triple	30	24,510,000	21,120,000	1080	5-20-07	1	13.0
5	Southwark Foundry	Quar. Crank and Fly Wheel	20	19,906,000	10,764,000	849	10-27-05	1	46.0
5	Southwark Foundry	Quar. Crank and Fly Wheel	20	19,522,000	11,040,000	849	11- 8-05	2	44.0
5	Southwark Foundry	Quar. Crank and Fly Wheel	20	16,310,000	6,990,000	849	10- 4-06	24	56.0
5	Southwark Foundry	Quar. Crank and Fly Wheel	20	21,300,000	7,400,000	849	5-20-07	1	65.0
	Southwark Foundry	Quar. Crank and Fly Wheel After Repairing	20	21,000,000	15,120,000	849	5-22-07	⅔	28.0
6	Simpson	Bucket and Plunger	20	9,792,000	4,445,000	500	11- 8-05	2	55.0
6	Simpson	Bucket and Plunger	20	Tested with No. 7, Combined Slip.					40.0
	Simpson	Bucket and Plunger	20	8,960,000	3,800,000	500	5-20-07	1	58.0
7	Marine	Compound Rotary	20	18,167,000	12,374,000	850	11- 8-05	2	32.0
	Marine	Compound Rotary	20	18,060,000	11,520,000	850	5-20-07	½	36.0
8	Worthington	Duplex				581			
8	Worthington	Combined Slip, Tested with No. 9 and 10					10-25-05	2	13.5
8	Worthington	Combined Slip, Tested with No. 9 and 10					10-27-05	½	16.0
8	Worthington	Combined Slip, Tested with No. 9 and 10					11- 8-06	½	19.0
9	Worthington	Duplex.	20	17,460,000	16,060,000	885	3-31-06	1	8.0
9	Worthington	Combined Slip, Tested with No. 10	20	34,916,000	32,270,000	885	10- 4-06	24	7.5
9	Worthington	Combined Slip, Tested with No. 10	20	32,858,000	27,270,000	885	10- 7-06	24	17.0
9	Worthington	Combined Slip, Tested with No. 10	20			885	11- 8-05	½	10.0
	Worthington	Combined Slip, Tested Alone.	20	18,720,000	14,820,000	885	5-21-07	½	21.0
10	Worthington	Duplex	30	17,891,000	15,200,000	885	3-12-06		15.0
10	Worthington	Duplex	30	17,820,000	17,300,000	885	3-31-06		3.0
11	Holly	Gaskill	20	20,198,000					

General Results.—In addition to results that have been noted as accomplished by this waste-water survey, many unexpected conditions of the water-works system as a whole, as well as the distribution system, have been revealed. The reduction in waste which has been accomplished is indicated by two accompanying diagrams. One of these diagrams shows the percentage of decrease in the total consumption of the five districts into which the water-works system is divided. The heavily shaded portion at the top of each of the areas representing the consumption for the different districts shows graphically the actual saving in that district, based on the average daily consumption for similar seasons in 1906 and 1907 from gaugings of reservoirs and main supply lines with pitometers. It may be noted that the greatest percentage of reduction was made in the district where the waste-water survey was most completely carried out, and the least, where

the smallest amount of survey work was done.

The second diagram is a curve showing the average total registered primary pumpage for the first four months of each year from 1901 to 1907, inclusive, this period being chosen in order to include the figures for the present year. Since this curve is based on the average registered pumpage, and the amount of water supplied to the city is actually 75 per cent. of these quantities, due to an average slip of 25 per cent. in the pumps, the points on the curve are all high. The curve as plotted, however, has the same general shape and represents practically the same percentage of saving, the registered pumpage values being taken in order to follow the logs of the water department from which the data was obtained.

The data from which these notes have been compiled was furnished by the Bureau of Filtration of Philadelphia, Mr. Fred C. Dunlap, chief engineer, and by representatives of the Pitometer Co.

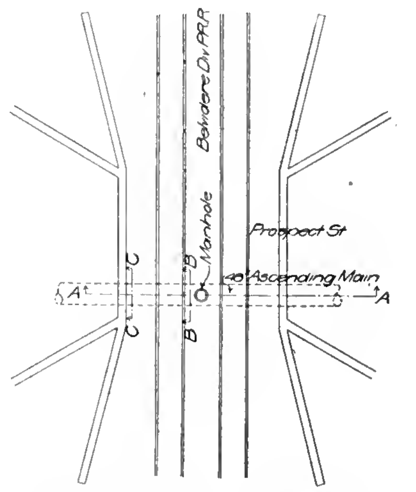


Cast-Iron Sleeve for Reinforcing Water Main.

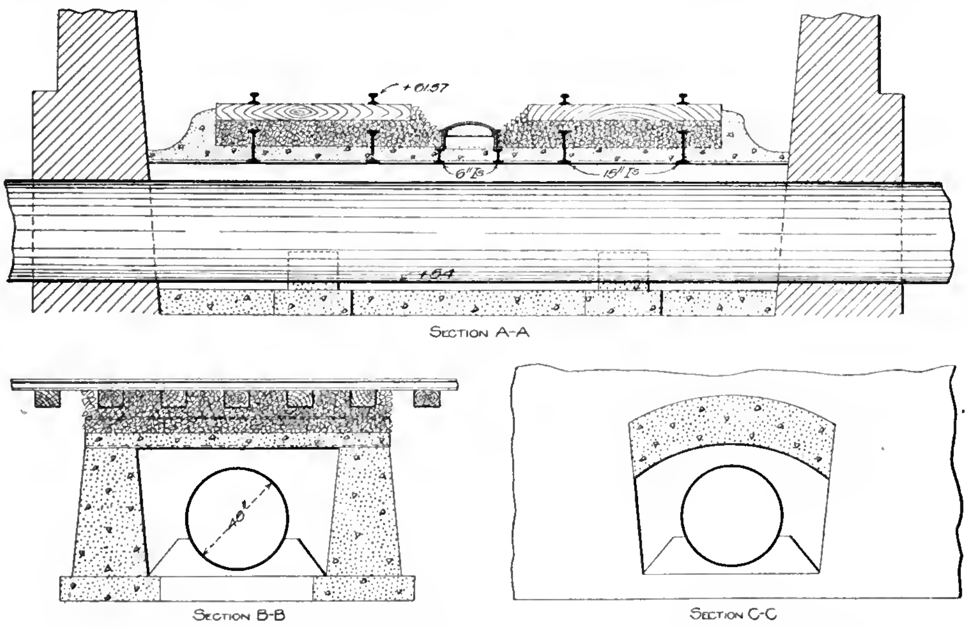
Asphalt Production in the United States in 1906 amounted to 138,059 short tons, valued at $1,290,340, as against 115,265 short tons, valued at $758,153, in 1905, an increase in 1906 of 20 per cent. in quantity and of 70 per cent. in value. Of this amount 24,085 tons were bituminous sandstone, 2,543 tons were mastic, 24,178 tons were hard and refined asphalt or gum, 9,900 tons were liquid asphalt or maltha, 12,947 tons were Wurtzilite and Gilsonite, 1,952 tons were Grahamite, and 62,454 tons were oil asphalt, according to the U. S. Geological Survey. The great increase in the production of hard and refined (or gum) asphalt in 1906 over that of 1905, which amounted to only 3,036 short tons, is due chiefly to the new refinery development in Texas, although the production of this variety in California in 1906 (8,178 short tons) is 100 per cent. in advance of the total for 1905. In the produstion of oil asphalt California stands almost alone, producing 62,361 short tons of the total quantity and showing a substantial increase over 1905. The Texas output is very small. Trinidad supplies about two-thirds of the American consumption.

Carrying a Steel Water Main under a Railway.

A 48-in. steel main under construction in Trenton, N. J., in connection with the improvements to the water supply system of that city, has been carried under the tracks of the Pennsylvania R. R. and the Delaware & Bound Brook R. R., under conditions requiring special construction to protect the pipe from excessive earth pressure and the jar of passing trains. The pipe, which is of the lock-bar type, is made of 5/16-in. plates and is delivered in 30-ft. sections so as to reduce the field joints to the lowest number possible. Sleeve-hub and lead joints are used, and at all bends these are reinforced with heavy cast-iron sleeves, of the form shown in an accompanying illustration, put on over the regular sleeve and and calked with lead in the usual manner.



Plan of Water Main Crossing.

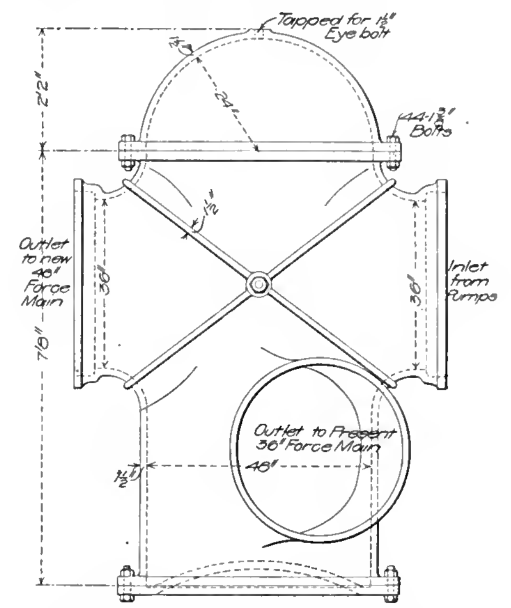


Plan and Sections of 48-Inch Pipe and Tunnel under Railroad Tracks.

For some distance the 48-in. main is laid along a street which passes over the Belvidere division of the Pennsylvania R. R. on a steel structure with stone masonry abutments. Here the pipe has been carried through the lower part of the abutments and under the tracks, with its top about 3 ft. below the base of the rails. Depressing the pipe below the tracks necessitated trenching from 10 to 27 ft. in depth, both approaching and leaving the bridge. Where the depth of trench exceeded 10 ft. it was thought unwise to depend on the ordinary steel pipes to carry the weight of the back-filled material. A cast-iron pipe might have proved satisfactory where the depth of trench was excessive but it was found that a steel pipe in a concrete tunnel would be no more expensive and even more satisfactory, owing to the ease with which it could be inspected and repaired if necessary.

The tunnel extends about 150 ft. above and 300 ft. below the bridge and consists of two heavy concrete walls carrying a 12-in. slab of plain concrete reinforced by 10-in. I-beams, except under the tracks where a 15-in. I-beam is placed under each rail, as shown in the accompanying illustration. Where the pipe passes through the opening at the bottom of each abutment a concrete arch was sprung across the top of the opening as a precautionary measure. Access is had to the tunnel through a manhole under the bridge between the tracks and through one at each end of the tunnel. A drain connecting with a sewer leads away from the lower end of the tunnel. The passageway is lighted with electric lights for which current is taken from the street lighting system, a switch being provided to make the connection when the tunnel is entered. The construction used in carrying the pipe under the tracks of the Delaware & Bound Brook R. R. is like that already described.

The connection of the new main with the reservoir is to be accomplished by inserting a stayed cast-iron Y-special in the present 36-in. ascending main within about 200 ft. of the present inlet. The leading end and one leg of the Y is to be the present line of main, and the other leg of the Y is to be connected with a 48 to 36-in. reducer, and then the 48-in. reducer is to be connected with the new ascending main. There is to be a gate valve, 36-in. and 48-in. respectively, provided for each of the ascending mains immediately back of the Y, so as to permit the use of either main separately or both together.



Special Connecting New and Old Mains.

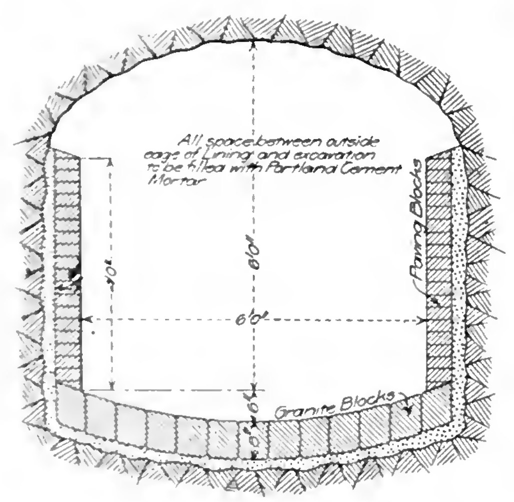
Mr. Newton A. K. Bugbee is the contractor for the ascending main, the plans and specifications for which were prepared by Mr. Chas. A. Hague, of New York City, consulting engineer. Mr. Alvin Bugbee is superintendent of the Trenton water works.

The Hardening of Hydraulic Cements was the subject of a voluminous paper read a few months ago before the Society of German Portland Cement Manufacturers by Dr. W. Michaelis. His conclusions are that hydraulic cements will be the more reliable and the more durable, the more limited the process of crystallization during their hardening, and hence he prefers cements low in alumina and lime. The surplus lime crystallizes and favors the formation of calcium sulpho-aluminate in the presence of aluminates and sulphates, he states, or the surplus lime is dissolved and carried off and in consequence the cement becomes porous. The alumina forms unstable crystals of calcium aluminate and, in the presence of sulphate solutions, the undesirable calcium sulpho-aluminates.

A Large Sewer Project in St. Paul, Minn.

The provision of a sewerage system for an area of 2,500 acres in the western part of St. Paul, which area is largely a manufacturing district that is developing very rapidly, involves several engineering features of large magnitude. The district is more or less rolling and has its surface drainage nearly all tributary to one watercourse. This watercourse is dry during a part of each year, but at times carries a large volume of water. The outlet of the watercourse is in the Mississipi River, which is about 150 ft. lower than the sewerage district and about one-half mile from the latter. The sewerage system is on the combined plan, the two main sewers which serve the district joining at a deep drop shaft in the bed of the watercourse; a tunnel, 2,500 ft. in length, extends from the bottom of this shaft to an outlet in the Mississippi River. The tunnel is finished, the drop shaft is approaching completion, parts of both main sewers have been built and the contract for the completion of these mains and the extension of the lateral sewers is to be awarded soon.

The 2,500-ft. tunnel from the river to the drop shaft has vertical sides, an arch roof and a curved invert, as shown in an accompanying illustration, its extreme height being 6.5 ft., and the clear width 6 ft. It was built entirely in excavation in a dense sandstone rock. The bottom is lined with 8-in. granite blocks laid in cement mortar, and the sides to a height of 4 ft., with vitrified paving blocks, also laid in cement mortar. The space between the lining and the excavation is filled with mortar. The tunnel is on a 1.4 per cent. grade throughout its entire length, so that the velocities through it are high and its capacity is quite large.



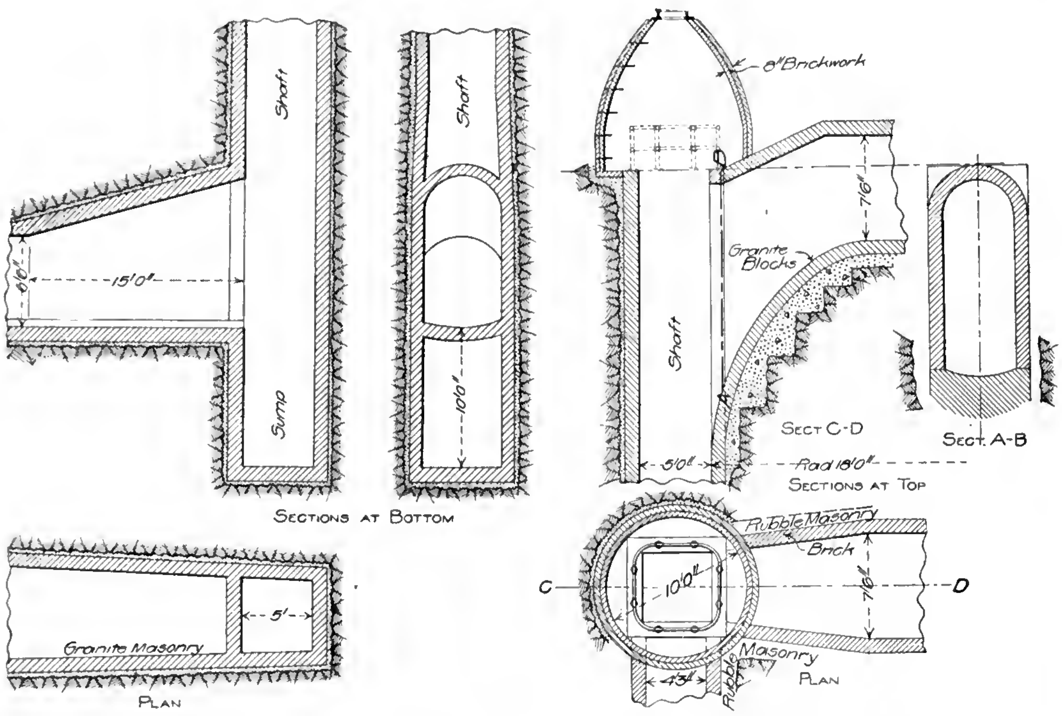
Cross Section of Outfall Sewer Tunnel.

The construction of the tunnel presented no unusual features, as the excavation was made through the sandstone without much difficulty. Work was started at the river end and driven through to the drop shaft. The excavated material was hauled back to the mouth of the tunnel at the river in small cars. From 2 to 4 men were generally engaged at the working face while the tunnel was being driven, one shift being employed. The tunnel was completed at a contract price of about $5 per linear foot.

The engineering work done during the construction of the tunnel is worthy of notice. The tunnel has a curve at the drop shaft and the alignment had to be carried forward from a single backsight. When the curve on the tunnel at the drop shaft had been run the center line of the tunnel intersected a 6-in. drill hole which had been put down on that line during the preliminary investigations made to determine the location of the tunnel.

The drop shaft has a total depth of 125 ft. from the ground level to the bottom and is 5 ft. square inside the cut-stone granite masonry with which it is lined. The two main sewers connect with the drop shaft near the top and on adjacent sides. One of these sewers is 7.5 ft. and the other 4.25 ft. in diameter up to the connections. The cross-sectional area of both sewers is increased at the connections and the side of the drop shaft is continued up as an arc of an 18-ft. circle to its junction with the invert of the sewer. The calculations that the flow of the sewage into the drop shaft will thus be diverted more directly down the shaft. The arcs of the circle at the connections are also lined with granite blocks to take the wear due to the high velocity of the sewage over them.

A sump, 10 ft. deep below the tunnel invert, is placed at the bottom of the drop shaft, so the sewage entering the latter will always fall on a water cushion. The outlet from the drop shaft into the tunnel is a large bell-mouth, 15 ft. long, which is designed to permit a maximum quantity of water to enter the tunnel.



Plan and Sections of Drop Shaft at the Upper End of the Outfall Sewer Tunnel.

The granite lining of the shaft ends just above the connections with the main sewers, or about 11.5 ft. below the ground surface. A bell-shaped manhole, 10 ft. in diameter at the base, is to be built from the top of the lining to the ground level. This manhole will be closed with a sealed cover, to prevent large pieces of debris entering or being thrown into the shaft. It is expected also that the shaft will rarely, if ever, have to be repaired owing to the very substantial way in which it is built.

The construction of the shaft has been carried on under exceedingly difficult conditions. The upper 20 to 21 ft. of ground at the site is ordinary glacial drift, below which is a depth of about 22 ft. of fine water-bearing sand containing some clay, which made it a very limpid quicksand. Under this quicksand was a thin layer of clay immediately overlying the sandstone rock through which the tunnel was driven. An excavation, 20 ft. square, was first opened at top and was lined with heavy wooden sheeting thoroughly braced and cross-braced. An attempt to carry the excavation through the quicksand in this manner failed completely, the contractor finally abandoing the work after the excavation had collapsed in the quicksand. The board of public works then assumed control of the work and has carried it practically to completion.

The timbering and sheeting in the collapsed portion of the excavation were first removed in order that a new method of handling the work might be started. United States steel sheet piling in 20-ft. lengths had been obtained meanwhile and was driven through the quicksand in such a way as to form the sides of a 10-ft. square. After the sand enclosed by the steel sheeting had been removed, the masonry lining of the shaft was then built up rapidly to avoid, as much as possible, any danger of the quicksand causing a blow-out. The steel sheeting held, however, under the great pressure brought on it and the lining was finished without any mishaps.

The excavation for the balance of the shaft through 35 ft. of rock was next carried down to the bottom of the sump. A steam drill, supplied with steam from the boiler of a hoisting engine at the mouth of the shaft, was used to make blast holes. Light charges of dynamite were exploded in these holes, without injury to the masonry lining which had been completed. The excavation thus made in the rock was smaller than that made for the portion of the shaft above the rock, so the lining already placed would not be disturbed. It was then trimmed out, commencing at the bottom, and the lining carried up to the top of the rock.

An 1,800-ft. length of the larger main sewer and a short section of the smaller one have been built. The 7.5-ft. sewer was built of three rings of hard-burned brick, and the 4.25-ft. one of two rings, all laid in cement mortar. Contracts for the extension of the 7.5-ft. sewer for 4,000 ft. in a 7-ft. circular reinforced-concrete section and the 4.25-ft. section for 3,500 ft., also in reinforced-concrete, are to be awarded soon. The lateral sewers leading from the mains will also be placed under construction at once.

The design and construction of the sewerage system for this district are carried on under the supervision of Mr. L. W. Rundlett, commissioner of public works of St. Paul. The sewer department is under the immediate direction of Mr. A. R. Starkey, assistant commissioner of public works, who has personally directed the construction work handled by the city.

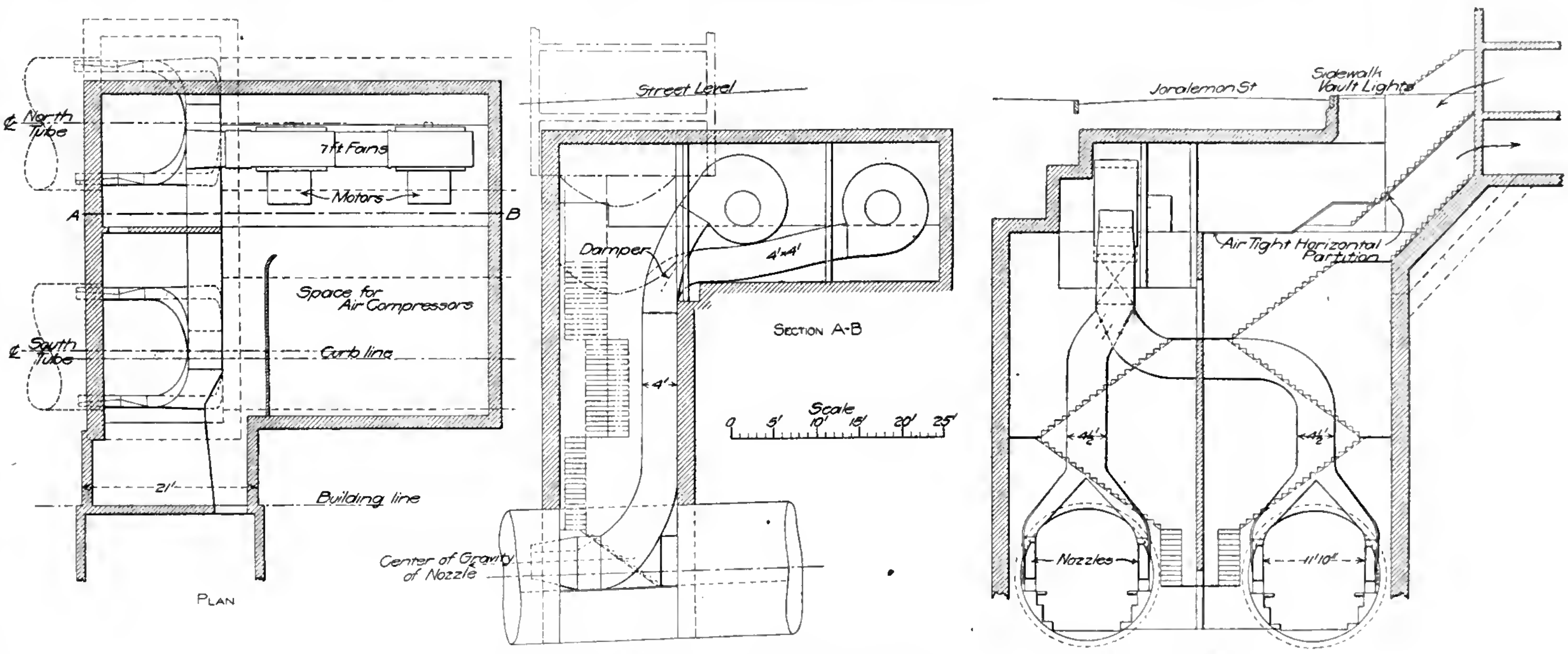
A Long Railway Tunnel will be built on the Midland Railway of Australia under Arthur Pass, the total length being about 28,000 ft., or about 5¼ miles. The contract has been let to J. McLean & Son. The section will be 17 ft. high and 15 ft., lined throughout. The material through which the tunnel will be driven is solid rock.

Ventilation of the Battery Tunnels of the New York Subway Extension to Brooklyn.

The two tunnels under the East River from Battery Park, Manhattan, to Joralemon St., Brooklyn, of the Brooklyn extension of the New York Subway System, have been practically completed and satisfactory progress is now being made with the work of their equipment, preparatory to the beginning of operation of trains within a few months. The subaqueous connection has been built as two single track parallel tubes, running from 26 to 28 ft. apart on centers and about 6,750 ft. in length. The tubes are cylindrical cast-iron shells, lined with concrete, having an inside diameter of 15½ ft. and they were projected toward the center of the river with gradients of 3 1/10 per cent., which are united at the lowest point near the center of the river by a vertical curve, with the tops of the tubes about 80 ft. below mean high water level in the river. The details of the construction of these tubes have been referred to in a number of articles in The dled through them, the conditions attending the problem of ventilation are without a doubt the most difficult that have ever been encountered, and the selection of a satisfatcory design was rendered far more difficult by the lack of precedent in application to conditions of this character. Owing to this a very careful study of the problem of tunnel ventilation was necessitated and the design was finally selected which embodies the more important features of the best practice in tunnel ventilation in this country and abroad.

Experience in the ventilation of railway tunnels where the smoke and gases from steam locomotives are to be dealt with, have indicated that the most effective ventilation may be secured where both ends of the tube must of needs remain open, by blowing air into them through jets or nozzles and in the direction of movements of trains. This method of tunnel ventilation will, in the case of a slow, heavy freight train, drawn by locomotives emitting dense black smoke, drive the gases ahead of the train and keep the atmosphere clear and comfortable for the train men to work in. While the difficulties of smoke and gas are not here encountered, the requirements for ventilation The most suitable location would, of course, have been one like that on the New York side, near the bulkhead line, but it was found impossible to secure rights on any of the water-front property or even in the first or second blocks nearest the river; only after a great amount of trouble and considerable litigation was an available site secured, which is at No. 58 Joralemon St., a private residence on the south side of the street and in the third block up from the river front.

After a careful study of the problem, the engineers in charge of the design decided that a volume of from 45,000 to 50,000 cu. ft. per minute should be introduced into either tube for the results desired with provisions for a slight increase over this amount for emergency conditions. With the space available for nozzles, however, the areas of the orifices were limited somewhat, which factor, of course, largely influenced the capacities of blowers selected. The nozzles although designed as large as possible for the spaces available are but 15⅜ in. wide x 4 ft. total height, the upper corners being cut off by the upper portion of the tube shells, and have



Apparatus and Ducts at the Brooklyn Ventilating Station of the Battery Tunnels.

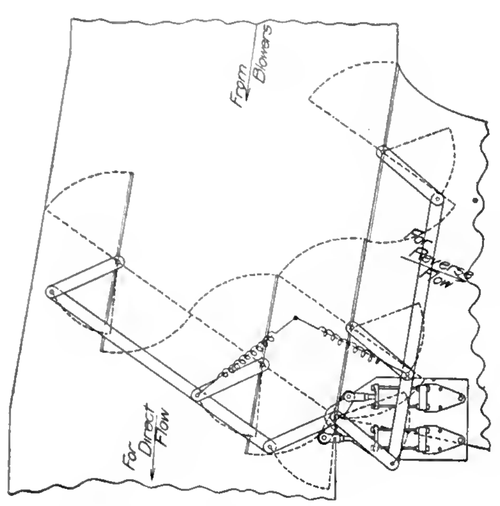
Engineering Record, notable among which are those in the issues of June 2, September 29, and December 22, 1906.

Owing to the length of the tubes and the restricted clearances within them when trains are in operation, some provisions for their ventilation were foreseen to be necessary, particularly in case of trains becoming blocked or stalled in the tubes. Under ordinary conditions of operation, it is expected, from the general experience in operation of trains through tubes of similar sections, that the piston action of the trains passing at frequent intervals in the same direction through each tube will suffice for all ordinary requirements for ventilation. This action of draft induced by trains in motion is, in fact, to be largely taken advantage of for ventilation, large openings to the tubes having been made at the shore ends to permit of free access of air behind all trains as they leave either side and correspondingly for discharge from in front of trains as they come up out of the tubes. But in order to provide adequately for any emergency conditions that might arise, it has been thought advisable to install a carefully planned system of mechanical ventilation which may be used continuously, if required, and which shall always be in readiness for emergency, sufficient reserve equipment being provided for this purpose. Owing to the length of the tubes and the character of the service to be han- are analogous, it being necessary to keep the atmosphere within the tubes frequently changing by driving a considerable volume of air through them, and essential that ample ventilating capacity be available in an exigency such as a stalled train. This method of ventilation was accordingly adopted, but difficulties of considerable magnitude were, however, encountered in securing convenient and proper location for the blower equipments near the ends of the subaqueous sections of the tubes and also of installing nozzles of sufficient size in the restricted spaces available in the tubes, to provide an effective blast. It was thought advisable to provide narrow nozzles on either side of the tubes in the spaces available above the bench lines which could thus be from 15 to 16 in. in width without restricting the clearance limits over trains and at the same time leave sufficient space next to the sides of the tubes on the horizontal diameter lines through which to pass a limited number of feeder cables or wires. With the requirement for admitting the blast in the direction of train movements, it was obviously necessary to install blowing stations on either side of the river, and a convenient location for the blower station was available on the New York side under the corner of Battery Park near the ferry stations, but a great deal of difficulty was encountered on the Brooklyn side in securing an available site in proximity to the water front. each a total cross sectional area of orifice of 5 sq. ft. Each tube thus has a total capacity of nozzle orifice of 10 sq. ft., each of the nozzles being supplied with air from the blowers through a converging connection from a delivery duct of 18 sq. ft. cross section. The blowers selected as best adapted to this duty with these particular sizes of connections were centrifugal downward-discharge fans with 7-ft. wheels, 4 ft. in width. Operated against a static pressure of 0.33 oz. blast, each fan has a capacity for delivering 46,500 cu. ft. per minute. The blowers are all ¾-housed steel plate centrifugal fans built by the American Blower Co., and 2 units are installed in duplicate at each blower station, it being thought that with this provision of reserve capacity, no combination of conditions will ever arise in which at least one unit cannot be kept in running order in each station. Each of the blowers is direct-connected to a 75-h.p. C. & C. interpole motor which is designed for operation on the 600-volt current from the third rail of the Subway propulsion system, and is fitted with control apparatus for a speed variation of from 300 to 413 r. p. m. The source of current supply has, also, been made doubly reliable by the extension of an independent feeder for this purpose from the substation of the Subway lines nearest to the blower stations, and a direct connection to the third rails in the adjoining tubes, although the latter will serve as an emergency

connection only and will not be used under ordinary conditions. They are also fitted with automatic starting switches arranged for distant control, so that the blowers may be placed in operation upon an instant's notice from the office of one of the despatchers of the Subway lines.

The interior arrangements of the blower stations and the apparatus and duct work are shown in the accompanying drawings. Each station consists of an underground chamber located near the surface, in which the blower and motor-drive equipments are located, and connecting with which are vertical shafts, 14 ft. in width, that are carried down to openings in both of the tunnel tubes. These shafts vary somewhat in longitudinal dimensions, being about 52 ft., inside, at the Battery Park station and but 45 ft. at the Brooklyn station, owing to the restricted width of Joralemon St., at that point. That in the Joralemon St. station is much the deeper, the tops of the tubes being there 48 ft. below the street level owing to a considerable elevation in the ground level at that distance back from the river front, while at Battery Park the tops of the tubes are but 25½ ft. below the surface. The shafts are divided vertically through the middle by partition walls so that the openings to either tube are independent and either may thus act as an exhaust chimney or flue from its tube for the discharge of air which is blown through or is driven out by the piston-action of the trains; in normal operation, however, this exhaust action will take place from the south tube at the Brooklyn station and from the north tube at Battery Park only, as the trains are to be operated on the usual "right handed" plan. The shafts at either end are arranged to be left permanently open to the outer air, the opening at Battery Park consisting of an irregular shaped grating of 252 sq. ft. area, directly over the shaft and that on the Brooklyn side, of a large passage which extends up into the building alongside of the station which was purchased for this purpose; this passage is 14 ft. wide and approximately 9 ft. in depth, and connects with a large opening up through the building into the outer air. The blowers have intake from the outside air through their operating chambers in the stations, that at Battery Park having an opening to the surface through a 252 sq. ft. grating, similar in shape to that for exhaust, while at the Brooklyn station a passage, 4 x 6½ ft. in cross-section, leading into the Joralemon St. building is made use of, through which air will be drawn in from an opening at the rear. Access to the operating chambers as well as also to the lower levels of the shafts are had by means of flights of iron stairs conveniently arranged, as shown in the accompanying sections of the station.

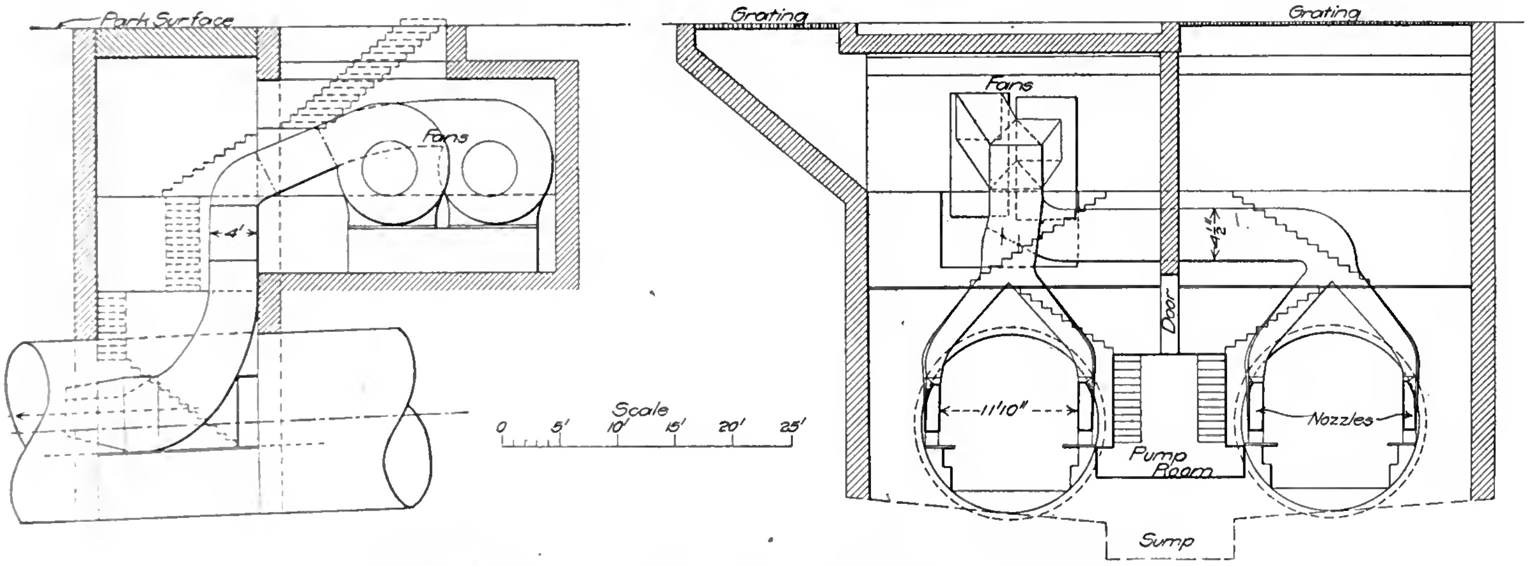
The duct connections from the blowers to the nozzles are simply arranged, consisting in general of a vertical rectangular duct of No. 18 galvanized iron, which extends from the delivery outlets of each group of two fans directly downward to the tube through which air will normally be blown, with cross branches to the other sides of the shafts to connect with the reserve nozzles for reversal of the flow in the tubes, if this may be necessary in emergency. The down delivery ducts are of 18 sq. ft. cross section which is ample to carry the maximum volume that can be delivered through the nozzles, and they divide over either tube, through a Y-connection, into two branches of 9 sq. ft. section which supply the two nozzles, the branches and connections to the nozzles being similarly proportioned and shaped on either side in order to equalize the flow from either nozzle. The blowers deliver through connections of 16 sq. ft. cross section which join at the top of the shaft into the down delivery ducts, special flap dampers being used at the joining to permit either blower desired to deliver independently, while in case it is desired to operate both blowers together, the dampers will assume a central position and thus not interfere with the delivery of either unit. The choice of these sizes of ducts is due to the fact that the capacity of the system is limited by the areas of the nozzle orifices, upon which the design of the blowers was based; the effect of the nozzles is such that even with the second blower in operation, the volume delivered through them would be increased but to a slight extent, probably not over 20 per cent. The control of the delivery to the nozzles in either tube is had through sets of louvre dampers in the ducts at points immediately beyond the joining of the cross branch to the vertical duct, which dampers are interconnected and so actuated that the blowers cannot deliver into the nozzles of both tubes at the same time; these damper mechanisms in the two stations are furthermore fitted for distant electric control, by means of which the interlocking arrangement is secured, and which also permits of instantly changing the direction of flow in both tubes from a distant point.



Interlocking Damper Mechanism.

One of the most interesting features of the blower installation is the above provisions for distant control of the dampers, as much study has been given to the matter of providing means for instantly adjusting the conditions of ventilation to the requirements of any emergency in the tunnels. Under all ordinary conditions of operation, it is expected that all requirements for ventilation will be met by the above-mentioned plan of directing the blast in the direction of train movements, i. e., eastward in the south tube from the Battery Park station and westward in the north tube from the Joralemon St. station, but with the heavy traffic that will be operated through the tunnels, an emergency may at any time arise, such as a stalled train or deranged electrical apparatus, in which it may be desired to quickly reverse the direction of flow of air. For this purpose the control of the dampers has been placed in the charge of the despatcher in the Bowling Green interlocking tower of the subway lines who is at all times in direct communication with all parts of the tunnels by means of a series of telephone stations, distributed at intervals of about 300 ft. throughout either tube; in case of any trouble reported to him he may thus instantly reverse the direction of flow, if necessary for the comfort of the passengers or workmen.

The distant control mechanism is of the electro-pneumatic type, the electrically-controlled pneumatic cylinders built by the Union Switch & Signal Co. for actuating signal mechanisms being used. As these cylinders are of the single-acting type, two are installed at each blower station, one for throwing the dampers in either position. They are mounted side-by-side on the side of the duct near the dampers and have their pistons connected to a rocker arm, pivoted at the middle, which carries a bell-crank so connected to the louvre dampers as to always maintain one closed while the other is open. The angles which the louvres assume when closed were so chosen in relation to the directions of flow that but about 60-deg. of movement of the vanes is required, and in order that the cylinders or levers may not stick in a partly opened position, positive throw spring attachments have been applied to the levers of either louvre which will always ensure completion of the motion of opening or closing, provided the cylinders throw the mechanism more than half way over. The electric air valves that control the pneumatic cylinders are actuated by the regular 16-volt direct-current supply for the signal sytem, a double-throw switch at the Bowling Green interlocker tower controlling both sets



Apparatus and Duct Connections in the Battery Park Ventilating Station.

of cylinders; when thrown in one direction, it actuates simultaneously the cylinders in both blower stations for the direct flow, while in the other direction, the cylinders for the reverse flow. In this way the adjustments of the sets of dampers are positively interlocked and it is thus rendered impossible through mistake to direct the blast into both ends of either tube at one time. No provision has been made for directing the blast in the same direction through both tubes at the same time.

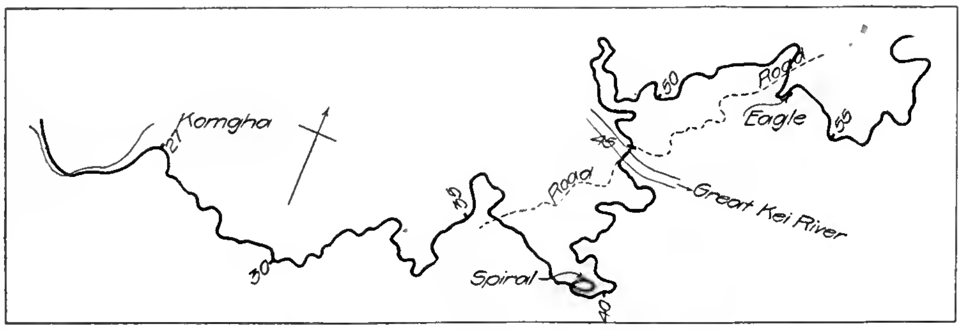
The provisions for ventilation thus made enable a great variety of conditions to be met. Under ordinary conditions, it is, as above stated, expected that the air in the tubes will be maintained sufficiently clear for the comfort of the trainmen and passengers by the piston-action of the trains passing through, while, if in hot summer weather, more ventilation should prove desirable for cooling purposes, the operation of one of the blower units for either tube will add considerably to the effect of the trains. It is, however, in the case of a serious emergency that the full value of the ventilating equipments would be realized. While there is no danger from fire in the tunnels, as cars of metallic construction only are to be operated on the Brooklyn extension, the smoke that would result from a burnt-out motor or other derangement of the electrical apparatus of the propulsion system could incite a serious panic amongst passengers; such smoke or obnoxious gases in case of a stalled train can, with the blowers in operation, be rapidly dissipated, and, by virtue of the provisions for reversal of flow, in such a manner as to be least offensive to the people at the scene of the accident. If, for instance, an accident of serious nature should occur to a train before it had reached the mid-point of the tunnel, the shortest distance of exit for the passengers would be in the direction from which the train had come, so that the regular flow of air in the direction of train movement would carry the smoke and gases in the opposite direction; if, on the other hand, the train had passed the mid-point of the tunnel when the accident occured the quickest exit would be toward the train's destination and a reversal of the flow of air would facilitate the same. By means of the system of telephones in the tubes, the trainmen may very quickly advise the despatcher if the reversal of flow is necessary, which is accomplished in the office of the latter by the mere throwing of a single-pole switch. Furthermore, if the blowers should happen not to be in operation, they could be instantly started by the mere throwing of another switch at the same point, one for either blower station, the blower motors being, as above stated, fitted with automatic starting equipments with distant control.

The ventilating system for the tunnels and the equipment were designed by the late Board of Rapid Transit Railroad Commissioners, of which Mr. Geo. S. Rice was chief engineer and Mr. D. L. Turner general inspector of stations. The details of the electrical devices were in charge of Mr. H. N. Latey, of the firm of Latey & Slater, consulting engineers to the late commission.

The Amabele-Butterworth Railway, South Africa.

The Amabele-Butterworth Ry., in the eastern part of Cape Colony, South Africa, one of the newest branches of the Cape Government Railways, starts from a station on the Eastern System about 50 miles from East London, an important town on the Indian Ocean. Its total length is 78 miles, but the central portion of the line from Komgha to Ndabakazi, 41 miles, is the only part interesting from an engineering standpoint, both the first part from Amabele to Komgha, and the last part from Ndabakazi to Butterworth, passing through easy country. From Komgha to Ndabakazi the road traverses the mountainous country of the Kei and Toleni Rivers, making it one of the heaviest lines in the Colony.

A short distance from Komgha, which is 27 miles from Amabele, the road starts down, from an elevation of 2,260 ft. above sea level, on its descent to the Great Kei River, the country traversed being very mountainous, and necessitating heavy earth work and masonry. At 39¼ miles from Amabele it became necessary in order not to exceed the maximum grade to build a spiral encircling a conical hill, and passing under itself through a short tunnel. This spiral is the only one on the Cape Government Railways. Between the spiral and the Great Kei River heavy earth work and a number of long culverts were necessary.



Mountainous Portion of the Amabele-Butterworth Railway.

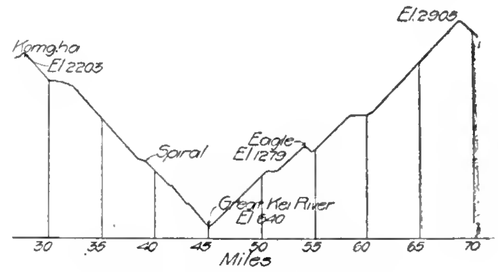
The distance from Komgha to the Great Kei River by railroad is 18 miles, though it is only 7 miles in a straight line and 11 miles by wagon road. This development was necessary in order not to exceed the maximum gradient of 1 in 36 or about 2.8 per cent. The difference in elevation between the two places is 1,563 ft., Komgha being 2,203 ft., and the river bridge 640 ft. above sea level.

The Great Kei River is crossed on a temporary timber bridge consisting of 22 spans of 25 ft. each. Owing to a difference in rail elevation of 21.95 ft. between the future permanent bridge and the present temporary one a switchback was put in, the line approaching it being built in a permanent position. This switchback lies almost entirely on a 2½ per cent. grade, is 3,000 ft. long and has a maximum curvature of 17 deg. 22 min.

East of the Great Kei River the ascent to Ndabakazi is commenced. For some distance the line follows up the valley, then rounds back 180 deg., by means of a 17 deg. 22 min. curve, and runs on the same side of the hill above the other line, until the Manqulu Valley is reached. At this point the upper and lower portions of the line are about 900 ft. apart horizontally, though the distance along the track is about 4 miles. Following up the valley to near its head the line crosses the Manqulu River on a viaduct of four 50-ft. spans, the rail level being about 51½ ft. above the river bed. The bridge is on a 2 per cent. grade and a 17 deg. 22 min. curve. After leaving the Manqulu River the line crosses over the divide to the Toleni Valley at Eagle, and from this point on the most difficult work is found. Heavy embankments are necessary and in one instance a rather complicated drainage system in which two culverts unite into one under the bank. The line for some distance hugs the precipitous cliffs that fall almost shear to the Toleni River, about 400 ft. above the water, and in this stretch a great length of retaining wall was built. Two tunnels, one 351 ft., and the other 578 ft. long were driven through projecting spurs. The Toleni River is crossed on a bridge of two 100-ft. spans.

The total quantity of earth work, exclusive of tunnel excavation, is 1,598,000 cu. yd., which omitting the last three miles near Ndabakazi, since they contain neither fill nor excavation, amounts to 42,000 cu. yd. per mile. With the exception of three cuts through rock and disintregated ironstone, nearly the whole of the work is loose shale, both soft and hard, with occasional ledges and boulders of solid rock. In one section, a mile in length, nothing but very hard rock was encountered. Various explosives were experimented with but dynamite gave the most satisfactory results.

Toward the completion of the work concrete arches with stone faces were adopted for culverts because of the saving in masonry and time of construction, but most of the openings under the track are built of hammer-dressed coursed rubble laid in cement mortar. Wherever possible, culverts have been placed high up in the bank to save masonry, drains being extended up into the



Profile beyond Komgha.

draw from the bank to catch the water. The total number of openings under the track including bridges, culverts and iron and tile pipe, is 366, or 8.9 openings per mile. At mile 55 the line crosses a deep double gully on a high bank. A culvert has been fixed in each gully and they join under the embankment into a common outlet. One culvert falls one in seven and the other, one in three, the roof of the latter being stepped down. The length of the present construction measures 133 ft., and had two separate openings been built the total length would have been about 260 ft.

In an endeavor to reduce the quantity of concrete used in one of the culverts a special design was drawn up for an 8-ft. semi-circular arch. The side walls battered one in five and the invert was curved. The length of the culvert was 13.1 ft., and the quantity of concrete 207 cu. yd., or a little over 7 cu. yd. per lineal foot.

The sand for the concrete had in general to be hauled quite a distance, such material as was found close to the various culverts being of poor quality. The sand that has given the best results is a sort of rotten ironstone found close to the main road in the Kei Valley. This was put in bags and conveyed by wagons to the various culverts. Trials were made of sand from the Great Kei River but as a rule did not give satisfactory results. In some places it was found difficult to get water for mixing the concrete and at one point it had to be carried up by men a distance varying from 200 to 300 ft. above the river. The total quantity of masonry in the 41 miles is 28,050 cu. yd., an average of 684 cu. yd. per mile.

There are three tunnels on the section of the line from Komgha to Ndabakazi, the shortest, the

one on the spiral, being 60 ft. in length and meriting no special description. It is on a 17 deg. 22 min. curve and as the formation was a soft shale it was lined with masonry. Tunnel No. 1 is 352 ft. long and lies entirely on a 14 deg. 28 min. curve. Tunnel No. 2 is 679.8 ft. long, the greater part of it being straight and the end on transition curves. The straight section is 527.4 ft. long. The cross section of both tunnels is 14 ft. wide on the straight portions and 16 ft. 4 in. on the curved portions. Shelters are provided every 66 ft. alternately on either side of the tunnel. The material in tunnel No. 1 is a very hard close grained rock and the lining for the walls and the arch is 18 in. of concrete. In tunnel No. 2 the nature of the rock is variable. The section through the softer rock will have a 24-in. concrete wall with an 18 in. arch, and where the harder rock is encountered the thickness of the wall will be reduced to 12 in. The drain in tunnel No. 2 will be in the center, but in tunnel No. 1 will be placed on the inside of the curve against the side wall.

Owing to the comparatively short lengths, the work of setting out these tunnels was not difficult. In tunnel No. 1 the first portion of the curve was discarded for driving purposes and a sub-tangent fixed at the mouth of the tunnel, the length of this sub-tangent being 231 ft. Although tunnel No. 2 commences and ends on transition curves, it was just possible to clear the sides of each entrance and run a straight line through, offsetting the curves. Two chains or 132 ft. from the Komgha entrance to the latter tunnel the line was crossed by a gully into which a cross cut heading was driven, meeting the center line 39 ft. from the face of the mountain. By this means 4 faces were worked at one time.

The rails are second-hand, weighing 60 lb., and the ties are of treated jarrah wood 7 ft. 10 in. long and 5 in. thick, 11 being used to a 30-ft. rail. The joints in the latter are laid square on the tangents and staggered on curves. The minimum depth of ballast below the ties is 5 in. The ballast used is a disintegrated granite found along the road. Track laying and ballasting is done by contract at $25 per chain of 66 ft.

The maximum curvature is 17 deg. 22 min., all curves sharper than 10 deg. 52 min. being transitioned, the length of the easement being 105.6 ft. The maximum grade is 1 in 36 or about 2.8 per cent., compensated 0.035 per degree of curvature. The maximum super elevation is 4⅞ in.

The work was done in short contracts varying from ½ to 2 miles in length, according to the quantities of earth work or masonry and the ability of the contractor. As a rule the earth work and masonry were let to different men, but experience showed that to combine the two under one contract was more satisfactory. The average price for earth, measured in excavation and including a free haul of 528 ft., varied from 56 to 68 cents per cubic yard. Solid rock varied from 87 cents to $1.00 per yard, and tunnel excavation from $5.00 to $6.20 a yard. The average cost of masonry was $11.95 per yard, concrete $11.08. The total cost for the 41 miles was $2,209,135, an average of $53,881 per mile.

The survey and the location of the line were made by Mr. A. M. Tippett, chief resident engineer for the Cape Government Railways.

Steel Ties will be used on the Bessemer & Lake Erie Railroad next year according to recent plans. About 70,000 ties will be necessary for renewals and repairs in place of wooden ties now in use, the lines on which they will be used aggregating 90 miles. The United States Steel Corporation during the present year has sold about 3,000 tons of steel ties, and on the roads it controls about $500,000 worth are in use, sufficient for about 160 miles of track.

Earth Slides.

Mr. H. Rohwer, formerly chief engineer of the Missouri Pacific Ry., has contributed to a recent bulletin of the American Railway Engineering and Maintenance of Way Association some notes concerning earth slides which are based on his long experience in railway work. After pointing out the fundamental fact that slides are formed when masses become disconnected, and hang on a slope steeper than the plane of friction due to the character of the material and its ability to resistance, he states that water being one of the most influential elements in reducing this resistance to a minimum, it is well to provide for proper drainage before slides set in. The golden rule is to "keep the water away from the roadbed." The study of geology is frequently overlooked by the engineer having charge of location, and he gives but little attention to the possibility of encountering slides caused by either the grade or location of line. If drainage is of so much importance, why not place the line, circumstances permitting, where drainage can be rendered most effective, allow sun and wind to act upon the roadbed, and pay close attention to the manner of constructing it?

When delegated to investigate the cause of slides in an embankment of one of the main trunk lines in the Middle West, constructed about the year 1861, Mr. Rohwer found the slopes considerably deranged. The embankment, about a quarter of a mile in length and over 22 feet high in the middle, was continually settling, and notwithstanding the attention given it by the operating department, this evil continued to exist. Trackmen, when called upon to remedy similar breaks, usually apply stone, which on account of the greater weight, increases rather than diminishes the evil and the cause of the slide is thereby not removed, in Mr. Rohwer's opinion. The method employed not being effective, piles were driven and a bridge constructed along and over the fill for such distance as was deemed necessary. As the piles did not rest in original ground, they swayed to and fro, and the maintenance of the line and grade became a matter of great annoyance and cost. About the time this pile bridge required renewal, Mr. Rohwer was asked to make an investigation of the trouble and to recommend what should be done to improve the safety of the road, and, if possible, prevent the slides and dispense with the trestle.

In digging a trench on each side of the track along the foot of the slope and parallel with the track, considerable seepage from the bank poured forth, leading to the belief that the water was retained in the bank by some cause or other, and was seeking an outlet. Mr. Rohwer then had intercepting drains constructed, extending towards the center of the embankment at intervals of 25 to 50 ft., according to the amount of water apparently confined in the embankment. The drains were then filled with stone—the heavier at bottom and the lighter on top—covered with cinders. This method accomplished the object of draining the embankment and rendered it stable so that the trestle could be removed, and no further difficulty at that point has been experienced.

In prosecuting this work, the drills were extended into the center of the embankment, and it was discovered that a number of partly decayed logs were embedded therein. Upon inquiry it was ascertained that the contractor at the time of construction had logs hauled in at night. The earth on the outside covering up this deception, the water was retained in the inside of the embankment, softening the material dropping into it, and with the heavier material on top, was forced to the sides, and thus creating slips or slides. In the case above cited, the slide sounded a timely warning, so that the proper remedy could be employed. However, crevices formed under the roadbed are much more dangerous, the latter producing slides without giving notice, this often being the case where the roadbed rests on the debris hanging on the side of bluffs, especially when bordering on a treacherous stream like the Missouri River.

Water coming down ravines can be readily conducted across the roadbed by bridges or culverts, but in such cases care must be exercised as to outlet. However, water falling on the sidehill between ravines or creeks and dropping from bluffs into the debris where it cannot readily be intercepted, will enter the roadbed, penetrate the underlying loose strata and find its way over and along the harder strata, thus creating the earth slides to which reference has been made. This water keeps the ground under the track in a constant moist state, a menace to the safe operation of the road. Oftentimes it will form crevices, and when once formed they will increase and may reach to the very surface, only to be discovered after a wreck has occurred, and are then usually termed "a washout." Again, the water may soften the material until it becomes slushy and will produce a slip at the foot of the lower slope. Borings made by Mr. Rohwer over a distance of seven miles on parts of tracks so situated showed that the roadbed developing such defects was invariably located directly against a bluff or perhaps resting on material underlaid by slanting rock, which rock forming a part of the bluff, had been eroded by the action of the water, either river or surface, or both combined.

If the water is collected at frequent intervals and conducted across the track either by means of small boxes (if pipe cannot be utilized) or conveyed in open ditches plastered with cement or rammed with small stone so as to prevent the water from penetrating into the roadway, the danger referred to can be greatly diminished.

The most remarkable slide coming to the notice of Mr. Rohwer was encountered on the White River Ry. at the entrance of a long tunnel, its magnitude precluding all thought of removing it. The disturbance first manifested itself at what might be termed a sidehill cut. In removing the footing, the mass of clay seemed to lose its hold on the rock whereon it rested, and began breaking off, first showing cracks insignificant in size and their location being confined to the right-of-way, but later reaching far out into the adjoining hills, bringing down trees and forming breaks in the surface 15 to 25 ft. in height and perpendicular in appearance.

The Omaha tunnel, 2,650 ft. in length, penetrates a sag in the Ozark Mountains, consisting of a so-called boulder formation, lime and rock being found intermixed with clay, a hydrated silica of alumina of brownish color, due to the presence of iron oxide. This clay is very plastic, especially so in the approaches where action of water is not constant, as in a tunnel. Here the layer of clay was from 5 to 100 ft. thick, underlaid with strata of solid rock of smooth surface and slanting at an angle of from 5 to 10 degrees toward the creek, along which the line had been located, then in course of construction. The grade of the roadbed entered the rock 20 ft. below the surface; in other words, the approach to the tunnel has a 20-ft. rock cut with clay in the slope overlying it.

As soon as cracks appeared on the surface, extra precautions were taken against surface water. The surface ditches were given steeper grades, and, where possible, bottoms were cemented so that the water could drain off more quickly, thus reducing chances of penetration to a minimum. In spite of this the ground continued to break and started to move toward the open cut, at first dropping into it little at a time, gradually increasing until after a rather heavy rain the

entire cut filled up with this stuff, involving an expenditure of one dollar per cubic yard for its removal. Though the moving masses had adopted a slope of nearly two horizontal to one vertical, the breaks continued, stretching for more than 150 ft. into the hill above the grade of the roadbed, and over 500 ft. distant from it.

To prevent similar occurrences during the time of operation, involving delay and expense, Mr. Rohwer had the rock cut arched over for a distance of 600 ft, from the portal of the tunnel. But an arch, framed of timber in order to furnish clearance, without protection against side pressure, cannot be relied upon as a permanent safeguard against slides. To make it serve, however, should the mass continue to move, the clay bank was removed for a distance of 12 ft. from the edge of the rock cut and holes were drilled into the rock 8 to 10 ft. in depth, and from 10 to 15 ft. apart in a row along the foot of the new bank, shots being placed therein and fired simultaneously by means of an electric battery. The rock was broken but not scattered, a trenchlike crack appearing at the surface. The writer then had logs cut from the timber, of which an abundance was found in the immediate neighborhood and these logs were placed alongside each other with the butt end in the rock crevices, the other end overhanging the timber arch, and resting upon its top. The material under the logs and between the logs and the arch was tamped, thus forming a solid flooring over which the material could slide, as was contemplated, distributing it over the entire arch and serving as a weight instead of a thrust.

The further object of cracking the rock was to permit the water coming through the clay to escape, thus leaving the footing dry and in better position to act as a support. The plan worked very satisfactorily. The first rain produced another slide, the logs carrying the material over the arch. With the drain in the rock at a distance of 12 ft. from the edge of the cut and over 30 ft. from the foot of the new slope, a good foothold had been created which served the purpose, for no further movement of the overhanging masses, estimated by the engineer in charge as reaching the enormous quantity of 130,000 cu. yd.; has taken place since that time, 1904. The few sticks of timber in the arch which had moved, were displaced not more than an inch.

This experience led Mr. Rohwer to the conclusion that many similar slides formed by masses moving along a rock surface might be checked by boring holes down to rock, lowering dynamite and breaking the surface by means of blasts and actual practice has confirmed this view.

An Investigation of Manhole Explosions at Aberdeen, England, disclosed the fact that coal gas leaking from street mains may become odorless by filtering through a moderately thick layer of earth without losing its explosive effect.

Crocker's Reef Dam across the Hudson at Ft. Edward.

By Herbert Spencer, C. E.

For the improvement of the Champlain Canal, extending from Waterford to Fort Edward, via the Hudson River, and from the latter place to Whitehall, on Lake Champlain, a series of dams will soon be in course of construction. The Crocker's Reef dam across the Hudson River is the first of this series to be constructed, and will serve to maintain the Barge Canal level for a distance of seven miles.

The accompanying views and sketches show the main features of the work and the methods employed by the contractors during construction. The dam is in two sections, the east spillway being 480 ft. long, and the west spillway 280 ft. long. The bottom of the river is rocky on both sides of the island, the rock being a shale formation, very common in this locality. One of the illustrations shows the lay-out of the east channel, with the sections; the west channel is similar, except that the abutment walls are not so long.

Method of Placing and Filling Cribs for Coffer-Dam; Crocker's Reef Dam.

Work was started on the dam proper on May 24, 1906, the contractors excavating the rock with pick and shovel. The section of the dam called for the neat line of the excavation to be on the back line of the dam, and that the concrete skewback should butt up close against the rock. Drills were set about 2½ ft. back of this cutting line, and after the holes were fired the rock was picked off to a neat line. A trench about 2 ft. deep was thus dug out of the rock, care being taken to secure a good rock shoulder against which the concrete could butt. The excavated material was thrown outside of the coffer dam on the downstream side, and helped weight down the sheeting and keep it in place.

As the water was shallow for about 150 ft. out from the east shore, it was decided to build a puddled coffer dam on the upstream side. The coffer dam consisted of 8x8-in. timbers, 5 ft. apart horizontally and 2½ ft. apart vertically, separated by ½-in. round bars with square nuts. The truss was braced by 4x4-in. vertical posts 5 ft. apart, and 4x4-in. diagonals. Two rows of 1-in. plank were then placed on the inside of this coffer dam on each side. Sand bags were placed at the bottom and clay puddle was placed inside.

The material for the puddle was taken from the canal prism just north of the dam, and consisted of a clayey mixture, with considerable earth mixed in. The downstream side was treated by placing two rows of 1-in. sheeting against the stringers at the south end of the trestle timbers. Sand bags were then thrown on the bottom and clay dumped in until it was well up on the sides of the sheeting. One of the illustrations shows a section of the coffer dam, and the arrangement of the track overhead.

At Sta. 2+20 of the line of dam it was decided to substitute a crib coffer dam in place of the interior puddled dam. This was on account of the deeper section encountered, and it was also thought to be more economical.

The cribs consisted of rough hewn timbers, mostly maple and elm, which were all cut from the spoil banks further up the river. The cribs were framed on shore by placing one log upon another, log house fashion, and drift-bolting with ½-in. pieces of iron. One of the illustrations shows a section of these cribs. On the inside was nailed 2-in. plank to hold the stone with which they were sunk.

When a crib was framed on shore it was buoyed up by placing empty oil barrels in it and towed out to place. Guy ropes anchored to trees on shore assisted in letting it down to the proper location, when it was lined up and sunk. A large raft loaded with stone always accompanied the crib, and when it reached its anchorage the stones were thrown in. Owing to the swift current it was difficult to always hold the cribs in place, and considerable care and ingenuity had to be exercised to sink them at the proper place.

A large crib 50 ft. long was framed on shore to close the last gap between the rest of the cribs and the island, and was floated to place in the usual manner. Unfortunately, the water was too swift and the guy ropes broke, allowing the crib to float downstream. It was with difficulty recovered and brought back to place. At this latter place a depth of water of 28 ft. was found, and the crib had to be sunk here. This depth was not looked for, as the cross-sections did not extend upstream far enough to take in the hole. However, it was successfully done, and a small wing crib placed at an angle to deflect the strong current away from the deep hole.

Three separate coffer dams were used to cross the east spillway and as soon as enough cribs were in place 8 x 8-in. timbers were placed on the upstream side to connect them. These were securely fastened to the crib, and the sheeting was then run down to the bottom. Two rows were used, one-inch plank for the shallow water and two-inch plank for the deeper sections. These plank were nailed to the waling pieces connecting the cribs, and as soon as they were in place the maneuvering boat was placed close by, and sand bags were guided by two poles held by hand until they settled on the bottom. These were firmly rammed in place, and all large holes at the bottom chinked up.

Clay was next brought over from the prism excavation in 4-cu. yd. dump cars, three cars to a train load, and dumped on a platform. Shovelers then threw the dirt over the sides and it slid down the sheeting and settled at the bottom, closing all joints between the planks. The downstream side was made secure by placing sheeting against the two ends of the trestle timbers, and throwing in dirt until it almost reached to the top of the dam.

The first section of coffer dam, about 130 ft. long, was pumped out in 17 minutes, and no trouble at all was encountered by leakage. In fact, all the coffer dams were exceptionally well built, and very little leakage occurred in any of them.

The trestle was built as the coffer dam progressed, and consisted of upright posts 9 in. in diameter, spaced 12 ft. apart. Across the top of the posts were placed rough timbers smoothed on only two sides and projecting over the posts about 2 ft. These were fastened, both longitudinally and transversely, and were also braced against the rock-filled cribs. Ties were placed on top of the trestle, and a 3-ft. gauge track on the ties. When the concrete had hardened sufficiently and the forms removed, the vertical posts in the upstream side were taken out, and the transverse timbers allowed to rest directly on the dam. The track was then shifted on the dam.

The concrete was a 1:2½:5 mixture, and was conveyed from the mixer to the dam by an 18-ton Porter locomotive, drawing a four-yard concrete car. The method adopted was as follows: When a car was filled with concrete it was started by giving it a shove, which sent it on the track to Point A. The locomotive at this time was on the siding B with an empty car, which it brought up to the concrete mixer C, uncoupled and then went back and shoved the car of concrete at A over to the dam. The return trip was not started until the locomotive gave a warning blast, at which time the men at the mixer prepared to start the loaded car off again.

An actual timing between trips showed an interval of about seven minutes, and that two minutes was taken to dump the car. The length of time it took to dump was due to the fact that the car, being an ordinary dump car, was not suitable for this work, as the concrete could not slide out fast enough. The bottom was covered with a large sheet iron plate, and the corners plastered with sand, so that very little mortar could run out going from the mixer to the dam.

Points were given at intervals of about 20 ft. on the bottom of the large curve for setting the forms. A string was stretched between these points and the bottom of the curve brought to this line. Ribs were made out of 2-in. plank and spaced 5 ft. apart. These ribs were fastened by cleats to the trestle overhead and braced against the rock at the bottom, and the forms nailed on this curve. Ribs were also made for the small curve at the crest, and ¾ x 2-in. lagging nailed on. The line for the crest at the correct elevation was given, and the small ribs brought to this line after allowing for the lagging to be nailed on.

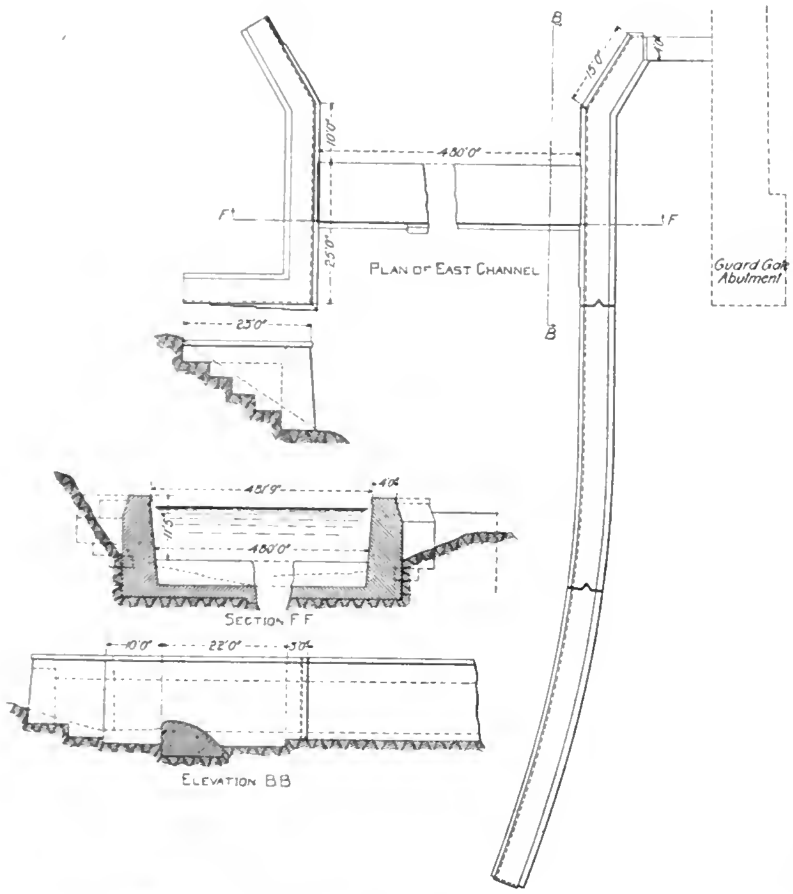
The slope below the larger curve was given by a template, and the tangent to the curve made by nailing pieces of 2-in. plank to the ribs and allowing them to rest against the rock at the bottom. The forms were then nailed to these straight ribs as far as the level of the rock.

The concrete was allowed to run out from inside the forms and fill the space between the rock and the bottom of the forms. This was the simplest and easiest way to construct the skewback, care being taken to see that the concrete had a close bond to the rock shoulder of the foundation.

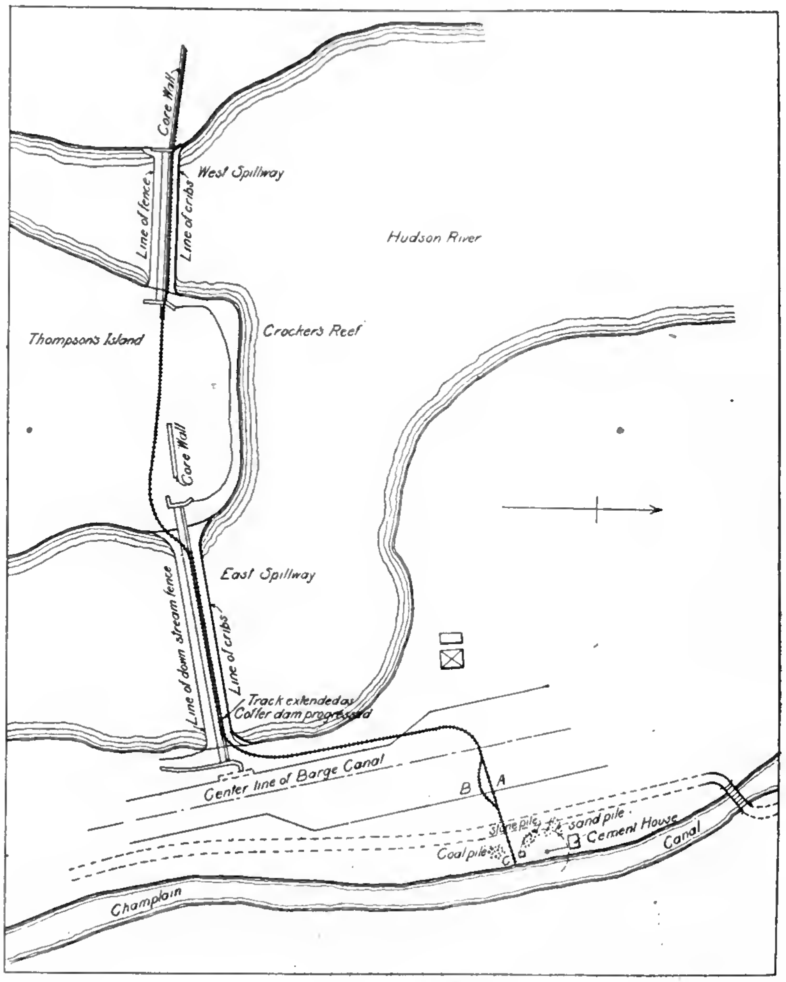
Large stones about 1 cu. ft. in size were placed in the dam, spaced 12-in. apart. About ten per cent. of the dam consisted of these stones. On account of the flat curve of the dam it was difficult to ram the concrete against the forms, and only enough plank were placed to keep abreast of the concrete. By this method the men in the dam could use their forks to pry back the stones.

The abutment walls for the spillway were well bonded into the rock on each side, the elevation of the top being taken 2½ ft. above the maximum high-water stage. The core walls on the island and on the west mainland are of concrete, with an earthen embankment 16 ft. wide on top and covering the top of the wall to a depth of 2 ft.

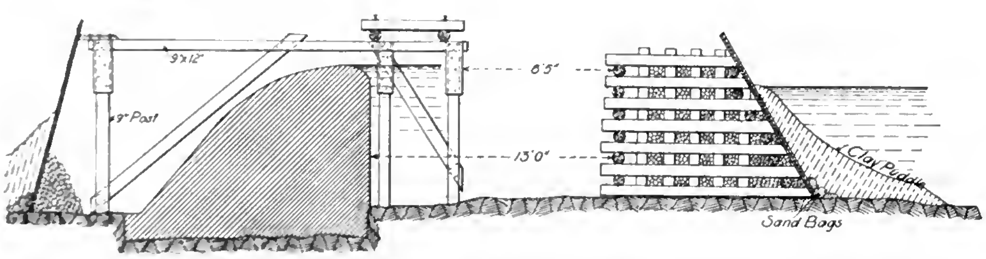
The dam was started the latter part of May, and completed about Oct. 10, 1906. The total length of crest is 760 ft. The contractor was the Empire Engineering Corporation of New York.



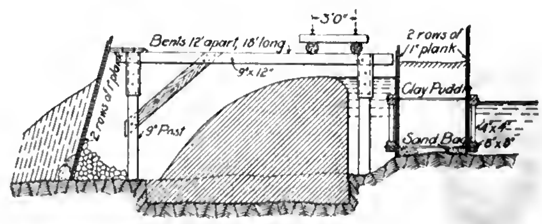
Dam across the East Channel.



Location of Crocker's Reef Dam.



Arrangement of Crib and Trestle for Use in Deep Water.



Arrangement for Shallow Water.

Back-Filling Trenches.

A paper by George C. Warren, President of Warren Brothers Co., before the Detroit convention of the American Society of Municipal Improvements.

It is pleasing to note that recent issues of engineering periodicals have devoted prominent space to this matter, which is both one of the most important and one of the most generally neglected matters that municipal officials and contractors have to meet in connection with street work.

One of the articles referred to quotes from specifications of the West Park Commissioners, of Chicago, which are incorporated in permits granted for making excavations in streets to reach underground service pipes. From the quotation the following extract is of special interest:

"All material excavated from any trench under paved roadways must be removed from the boulevard; said trench being refilled with clean cinders, sand, gravel, or crushed stone, placed in layers not exceeding 6 in. in depth, thoroughly compacted with heavy hand rammers, using the necessary amount of water to complete perfect consolidation of the back filling."

This specification is certainly on the safe side, but for general use in many, if not most cases, it seems to the writer unnecessarily severe and expensive in the requirement that all material excavated from any trench must be removed from the street and replaced by cinders, sand, gravel, crushed stone, etc.

In the case of West Chicago Park Boulevards such a general stipulation may be justified by either:

(a) The importance of not littering the boulevards any more than absolutely necessary and of maintaining their fine appearance as constantly as possible, or

(b) The knowledge, if it is a fact, that the sub-soil underlying this section of Chicago is of a character which, after once being disturbed, is unsuitable for backfilling of trenches. Whatever may be the reason and justification for such a claim by the Chicago West Park Commission (and I assume it is justified there), this should not be set out as a generally suitable provision and for all cities and all classes of sub-soil. I do not want to be understood as advocating the withdrawal of one iota of the greatest precaution and care in this important matter of backfilling of trenches, carelessness in which is costing an aggregate of hundreds of thousands of dollars annually in damage to pavement and vehicles. On the contrary, my purpose is to endeavor to point out the importance of the matter and to suggest practicable, general requirements for overcoming the difficulty in the most economical way as to each particular case.

With a quarter of a century of experience in street paving throughout the United States and Canada, I believe I have met the matter of backfilling of trenches in about all of its possible phases, and I appreciate that it is a most difficult matter to draft a specification which will give (a) efficient results and (b) a basis of payment for the work which will insure the greatest practicable economy to the city and fairness to the contractor.

Completed Section of Crocker's Reef Dam with Work in Progress beyond It.

The greatest difficulty arises from the fact that the method of treatment and its cost vary very widely with the character of sub-soil, which often varies very greatly within the limits of one sewer or water or gas main trench; this often cannot be foreseen and often varies with the weather conditions (wet or dry) which happen to prevail.

Before attempting to offer a solution I will mention a few instances which have come to my notice. There is a popular notion that trenches should be allowed to settle for a year before paving and that then the work is safe. This is not only a fallacy which breeds carelessness in cases where it is thought no pavement will be laid in a year or more, but it is impracticable to defer paving until a year or more after all mains and house connections are made, and equally impracticable to avoid cutting into pavement for installation of and repairs to service pipes, although the latter can be guarded against by the exercise of reasonable precaution much more than is generally done.

We all know that by careless or indifferent backfilling of trenches unpaved streets are often rendered dangerous and nearly impassable for years. I remember about fifteen years ago an instance in one of our older cities, where an asphalt pavement was being laid, replacing an old cobble pavement. The cobbles and a few inches of the underlying earth necessary to provide the sub-grade were removed; the sub-grade rolled with a steam roller, and a concrete foundation laid. While the concrete was "setting" there had been a good deal of rain, and at one point in the street the concrete settled and developed a hole, into which a hoe handle was inserted the full length without finding the bottom of the hole. Investigation and subsequent examination developed a serious hollow, several feet deep, about 2 ft. below the surface and over 200 ft. long, over a sewer which had been laid twenty-five years before and doubtless backfilled in what is still the quite generally customary way of merely throwing the earth loosely back into the trench. In this case a crust or arch of solid earth had become formed, which did not develop the hollow below until the excavation for the new pavement removed a part of this crust, and the rains caused the balance of the crust in one spot to fall into the hole. In another instance no trouble developed in the construction of an asphalt pavement laid on concrete foundation, but three years later a horse's hoof broke through the surface of the pavement and he broke his leg. Here examination revealed a hole 6 ft. deep, which it took fifty loads of earth to fill, over a sewer trench ten years old.

It is very common for a pavement to settle a year or more after it is laid along the line of a sewer trench filled several years before the pavement, where no trouble developed during the rolling and laying of the pavement. It is still more common to find almost insurmountable difficulty from settlement of old trenches while the paving work is in progress.

So much for the theory that however carelessly a trench or other fill is made it will settle itself within a year. On the other hand, I have never known of a case where trouble has followed from the settlement of sewer or service pipe trenches made immediately before the laying of the pavement where I had supervision of the backfilling, even with very treacherous soil conditions. I would far rather take my chances on the guarantee of a pavement laid immediately after a sewer trench, the filling of which I could control, than five years after the laying of a sewer, the trench of which was filled with the generally customary carelessness and usual view to the least possible cost only.

About two years ago I was going over a street about two miles long in the Middle West, for the paving of which bids were about to be received. A sewer, the trench of which was from 15 to 20 ft. deep to a clay soil, was being built, using an excavating machine, which backfilled without tamping. On account of the looseness of the fill the level of the roadway over the trench was being raised about 18 in., sloping to nothing near the edge of the road. An inspector was standing over the work, and I asked him to show me the specifications. They clearly provided for "thorough tamping of the trench in courses, not more than 6 in." On calling the inspector's attention to the provision he first claimed that it only referred to paved streets. I showed clearly that this was not the case and explained that my interest in the matter was as a bidder and possible contractor for the pavement to follow, and received the following retort: "You don't shuppose Misther Murphy (naming the contractor) is going to fill the sewer for youse!" The outlet of the same sewer passed through a paved street, which I found was actually being filled, without any tamping whatever, with tipcarts loaded from the excavation by buckets and hoisting engines. An appeal to the engineer brought a promise to investigate any continuation of the trouble, and

further inquiry brought out the explanation that this provision of the specifications was not generally complied with: that contractors did not figure on doing so; that the price showed the contractor did not figure on doing so, and that it would be a hardship to force him to the expense, and that as the pavement would not be laid for a year, the trench would probably be settled by that time. This is only a somewhat aggravated case of what happens to-day, I believe, in fully three-fourths of the sewer trenches which are being built every year.

Now, for the remedy, which is more difficult than to call attention to the common faults.

In case of permits to public service corporations, plumbers and abutting owners to cut into the streets, whether paved or unpaved (the former is but little more important than the latter) it is only necessary to stipulate in the permit that "the trenches shall be backfilled by such means as the City Engineer may direct, depending on the character of the excavated material, in such a manner that all excavated material shall be replaced in the trench without raising the grade of the roadway. Flushing will only be permitted in cases where the sub-soil is sand or gravel or other material from which the surplus water will readily drain away."

In criticism of this proposed requirement reference may be made to the volume of the pipe. My reply is that except in trunk sewers (which do not apply to the permits referred to) the volume of the pipe is so little, in comparison to the volume of the trench, as to be insignificant, and it is well known that, in ordinary cases, more earth can be tamped into a trench than is removed from it. There is the familiar farmer's post hole, which will take the earth removed from the hole and the post besides. In my judgment the only case where the rule of "get back all the dirt" cannot apply is in rock excavation, in which case the breaking up of the rock nearly doubles its volume, and the pieces of rock are so large that they cannot be replaced to their original density.

In the case of contract work for sewers, etc., the case is more difficult, in view of the necessary uncertainty of conditions to be met under ground and consequent uncertainty of the most economical way to properly backfill the trench and consequent impracticability of the contractor accurately figuring in advance what the cost per linear foot will be. On this account some contractors are sure to bid far too low to permit proper work, and others figure "safe" with the probability that if they happen to receive the contract the price will be too much advance on the probable cost. In one case the city has the almost impossible task of forcing the contractor to do proper work when the price is too low to permit it without loss. In the other case the probability is that the city will pay too much for the work. An effort should be made to avoid both evils.

My suggestion is, divide prices in such a way that whatever material is encountered a fair price will be allowed the contractor, as follows:

(a) Setting pipes, per linear foot.

(b) Earth excavation, per cubic yard.

(c) Rock excavation, per cubic yard (if rock is likely to be encountered).

(d) Hauling excavated material to spoil bank (if unsuitable for backfilling, and its removal directed by the Engineer), per cubic yard.

(e) Lumber delivered on work (if any required for shoring), per M. B. M.

(f) Placing or replacing (if lumber reused) in sewer trench, per M. B. M.

(g) Refilling trench, if backfilled, by flushing earth excavated from trench, per cubic yard.

(h) Refilling trench, if backfilled, by tamping earth excavated from trench, per cubic yard.

(i) Refilling trench, if backfilled, by flushing suitable borrowed material (to replace unsuitable excavated material, drawn to spoil bank by order of Engineer), including furnishing the material, per cubic yard, measured in the wagons as material is delivered.

(j) Refilling trench, if backfilled, by tamping suitable borrowed material (conditions the same as item "i"), per cubic yard.

(k) Refilling trench with rock excavated from the trench, per cubic yard.

Corresponding with such a schedule of prices in proposal and contract, the specifications should provide as follows:

1. Material excavated from the trench, which, in the opinion of the Engineer, is unsuitable for backfilling, shall be hauled by the contractor to a spoil bank and shall be paid for at the price bid per cubic yard for "hauling excavation to spoil bank." Measurement to be made in the wagons at point where loaded.

2. Flushing in backfilling will be permitted only in case the material is sand or gravel or other material, from which, in the opinion of the engineer, the surplus water will readily drain away and leave the earth filled solid.

3. Except where flushing is directed by the enginer, the backfilling shall be done by thorough hand tamping in layers not exceeding 6 in. in depth.

4. Whether backfilling of earth is done by flushing or tamping the full amount of material excavated from the trench, less the volume of the sewer shall be refilled into the trench without raising the grade.

5. In case rock is excavated from the trench it shall be backfilled by carefully hand-placing the excavated rock in layers with succeeding layers of earth well filled into the voids between the pieces of hand-placed rock.

6. In case the excavated material is clay, which, in the opinion of the enginer, is too wet to enable solid backfilling by tamping, the excavated wet clay and reasonably dry "borrowed" earth shall be tamped into the trench in succeeding layers, using enough of the dry earth to overcome the excess of water in the clay and to provide a solidly filled trench, to the satisfaction of the engineer. The "borrowed" earth, including tamping, to be paid for per cubic yard of "borrowed material," tamped into the trench. Measurement to be made in the wagons as delivered on the work.

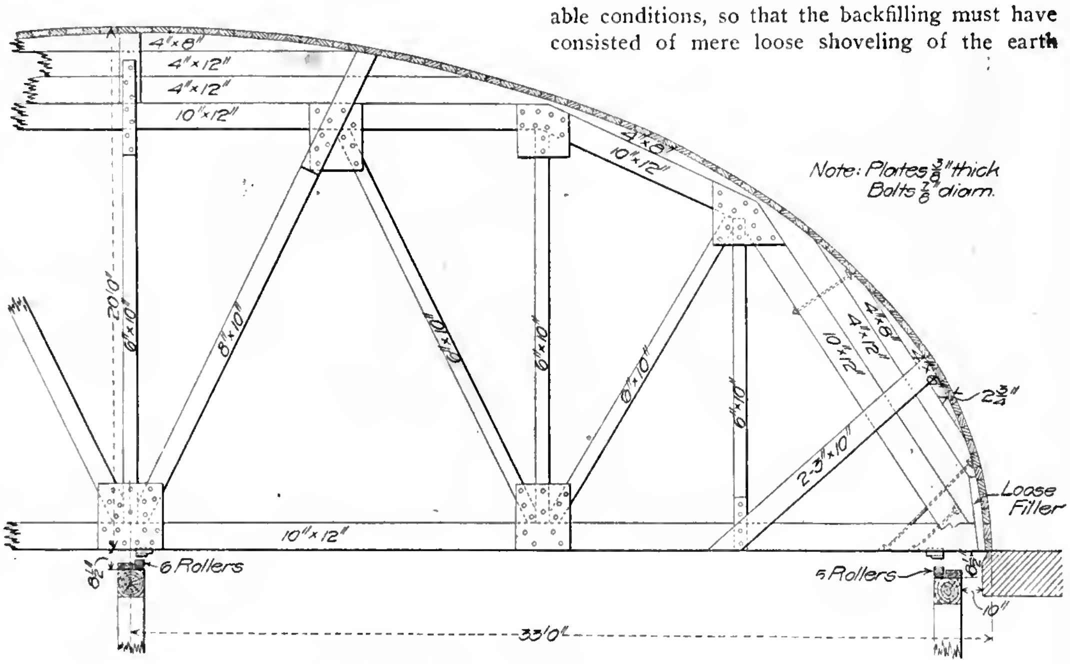
If this suggestion is criticised as being complicated the answer is: The conditions are necessarily complicated by practical inability to tell in advance the condition of material to be excavated and consequently the treatment it should receive in backfilling, and the simple but incomplete specifications and method of payment generally adopted in the past have resulted in quite general unsatisfactory results. Some condition should be provided which will correct the evil of poorly filled trenches, however complicated they may be.

Of course, it must be expected that the cost of efficient and proper backfilling of trenches will be much greater than the cost of the inefficient system at present generally in vogue, but the increased cost will be small, in comparison with the saving in repairs to road surfaces and vehicles.

A prominent engineering paper which makes a specialty of earth work in recent times published a series of interesting and complete cost data, evidently collected and tabulated with very great care. One report of twenty-six jobs on sewer sections in one city, aggregating 8,882 lin. ft., shows an average cost of backfilling the trenches of 7.22 cents per cubic yard. The soil is generally reported as good clay, and that backfilling was done by hand shovels. Now, it is well known that this is a very low average cost for the bare shoveling of earth under the most favorable conditions, so that the backfilling must have consisted of mere loose shoveling of the earth into the trench. What of the condition of the roadway, whether paved or unpaved, following this shoddy work, and what of the vehicles which have to pass over this nearly two miles of street during the next several years?

An important point not referred to above in connection with repaving over sewer trenches in unpaved streets is the matter of foundation. Even with the greatest care in backfilling the trench, it should be reinforced at the top by a solid Portland cement concrete foundation to the pavement, and the concrete should extend over the edges of the trench about 6 in. on each side.

One engineering journal recently suggested that tamping the earth in backfilling trenches be done with pneumatic or steam rammer, something on the order of pneumatic or steam riveting machines. This offers suggestive food for the mechanical inventor, but, as far as I am aware, nothing of the kind has yet been perfected. For the present tamping must be done by hand, and a good rule is two good men with heavy rammers in the trench to each shoveler outside, and of the three men, put the best two on the tampers. The common practice where there is even a pretence of tamping is, say, four to six shovelers to one tamper, with the poorest man in the trench, because his work doesn't count in the amount of trench backfilled.



Details of Centering for 175th Street Arch.

The Construction of the 175th Street Arch, New York City.

The Grand Boulevard and Concourse now under construction between 161st St. and Mosholu Parkway, in the Borough of the Bronx, New York City, is carried over 175th St. by an elliptical brick arch, of 66-ft. span and 20-ft. rise, built on a 9 deg. skew. This arch, which was described in detail in The Engineering Record of April 27, 1907, is approached from both directions over an earth fill contained between high, broken range, ashlar faced, rubble backed masonry walls 172 ft. apart, face to face under the coping. The spandrel walls over the arch and abutments are of the same class of masonry as the retaining walls except that the quoins are of Maine granite with 3-in. rock face and 1-in. chisel drafts on all exposed edges. The spandrel walls are 181 ft. 4 in. apart, face to face.

The abutments are of coursed granite backed with rubble, 20 ft. high from the top of the footings to the top of the coping courses or skewbacks which are 12 ft. 6 in. wide. The third course above the footings is a fine cut belt course and those above and below this are rock face, but the courses above have a 1-in. chiselled draft on all edges. The coping course is fine cut granite.

The arch ring is 40 and 48 in. thick at the crown and springing line, respectively, and is of hardburned brick except the soffit course which is buff vitrified brick. The ring is faced in the planes of the spandrel walls with fine cut granite voussoirs which extend into the ring parallel with the axis of the arch 3 ft. and 4 ft. alternately to bond securely with the brickwork. They are fine cut on the soffit and rock face on the vertical plane with a 1-in. chiselled draft on the radial and a 2-in. draft on all other edges. These voussoirs were cut on the work as required, the form of their soffit faces being laid off on the centering after the latter was in place.

The arch is being constructed in sections beginning at the west end and continuing eastward. The centering is supported on eleven wooden trusses placed in planes perpendicular to the axis of the arch and having the form and dimensions shown in an accompanying illustration. These trusses, which are placed 5 ft. on centers, are supported at their ends and middle points by three lines of 12x12-in. yellow-pine caps carried on 12x12-in. posts 5 ft. on centers resting on timber sills on concrete foundations. The upper and lower chord members of the trusses are of long-leaf yellow pine with the dimensions shown. Owing to the difficulty of securing yellow pine sticks 65 ft. long, the lower chord of each truss is made of two 32½-ft. timbers. The verticals and diagonals are short-leaf yellow pine and the lagging is 2¾x6-in. long-leaf yellow pine plank. Most of the connections are made with ⅜-in. steel plates on both sides of the members and ⅞-in. bolts, arranged as shown in the accompanying sketch. The trusses were built on a level spot near the work and, as it was absolutely necessary to have them all exactly alike so that when the centering was moved forward the lagging over the rear ribs would accurately fit the brickwork built over the front ribs, monuments were placed in the ground by the engineers in charge of the work to show the location of each panel point.

Building First Section of 175th Street Arch.

When it is necessary to shift the centering, which weighs about 105 tons, it is moved forward on a system of rollers under each bearing point. While this system is not new, it is believed that the arrangements in this particular case are in some respects superior to any which have been devised before for similar work. To the top of each cap is attached a 3x8-in. yellow pine bearing strip which carries the double oak wedges upon which the trusses rest. At one side of each 3x8-in. bearing plank and attached to the bottom sides of the lower chords of the trusses are 3x8-in. yellow pine roller plates carrying 1x8-in. oak shoes 20 in. long placed 5 ft. on centers. The 4-in. strip on top of each cap not covered by the bearing plate and immediately under the oak shoes is faced with a ¼x4-in. steel plate upon which the rollers bear. The latter are 4-in. sections of extra heavy 3-in. pipe. Five rollers are placed under each shoe at the ends of the trusses and six under each shoe at the middle point. When the centering is in place under the brickwork the clearance between the tops of the rollers and the under surfaces of the shoes is about 2¼ in.

Referring to the sketch it will be seen that it would be impossible for the centering to be lowered with all the lagging in place as the coping stones project slightly beyond the lagging strips immediately above them. To overcome this difficulty the lower ends of the upper chord of each truss were notched to receive filler strips about 4 in. deep and 3 ft. long. When the centering is to be lowered these filler strips are knocked out and the lagging planks supported by them are drawn out by hand.

The trusses were hoisted to place by two guyed derricks with 70-ft. booms, placed one on each side of the roadway near the west approach walls. Fish-plates about 8 ft. long were bolted to each side of the lower chord of each truss to prevent it from buckling while it was hoisted. The wedges were laid on the sills and the trusses placed directly on them so that when the lagging had been laid the centering was ready to carry the first section of brickwork.

The two derricks used in hoisting the trusses handled the facing stones and brick for the first section of the arch from the same position, but when this section had been completed before the centering was moved forward for the second section, they were mounted on top of the section just completed. The second section is now being constructed and when it is finished the derricks and their engines will be moved forward onto it. The earth fill will then be carried over the first section to form a roadway for the convenience of the contractor. These derricks are operated by Lidgerwood hoisting engines supplied with steam by a 40-h.p. boiler placed on the ground a little beyond the east end of the arch.

When the first section of the arch had been finished and the centering was to be moved forward, a bridle of steel cable was attached to the leading truss and a tackle of steel cable was attached to the bridle and to a deadman placed on the center line of the roadway some distance to the eastward. The free line of the tackle was carried to the drum of one of the hoisting engines placed on top of the completed section of the arch. The lagging over the coping stones was removed; the wedges were carefully driven out; and the centering was gradually lowered until the oak shoes took bearing on the rollers. Jackscrews were provided to assist in starting the centering but they were unnecessary as the engine started the load without difficulty. As the centering moved forward the rollers were shifted under each shoe by men who walked from one set of rollers to another on scaffolding hung from the trusses at the proper level. Twelve men were assigned to the work of shifting the rollers, four on each scaffolding; the actual time spent in moving the centering from the time it started till it came to rest was about three hours. The wedges were driven home to lift the centering by jackscrews placed between the ends of the upper wedges in successive sets, two wedges thus being driven at once. When the centering had been adjusted in its new position, with its west end lapping under the finished brickwork about 4 or 5 ft., the surfaces of the lagging and soffit course fitted perfectly. The settlement of the centering under its load has been found to be ¼ in., and the settlement of the arch ring after removal of the centering was ¼ in.

The 175th St. arch was designed and is being constructed under the direction of the engineering department of the Borough of the Bronx, Mr. Josiah A. Briggs, chief engineer, Mr. S. C. Thomson, engineer of highways, and Mr. Chas. Gartensteig, assistant engineer. The Uvalde Asphalt Paving Co. is the contractor. The centering and plan of work was devised by Mr. James H. Small, Jr., and Mr. Wm. Marshall, superintendent for the contractor, under whose personal direction the work has been carried forward since its beginning.

Triangulation and Traverse Work in The Bronx, New York City.

At the present time the City of New York is engaged in making complete topographical maps of all of the five boroughs in pursuance with one of the stipulations of the charter of Greater New York. The charter required that the triangulation system be in conformity with the methods used by the United States Coast and Geodetic Survey, and accordingly the city arranged to have the Survey take charge of the triangulation. In May, 1903, Mr. A. G. Mosman took charge of the triangulation as director, and in July, 1904, the President of the Borough of The Bronx started the field work by erecting the signal stations. An explanation of some of the methods followed in the work was given by Mr. Edward H. Holden, assistant engineer of the Bronx Topographical Bureau, in a paper recently read before the Municipal Engineers of the City of New York, from which these notes are taken.

The work of the Topographical Bureau called for the making of a topographical map on a scale embracing the entire district showing contours, rivers, roads, and such like topography; sectional sheets of the latter map on a larger scale showing more details; traverse sheets with range lines showing the traverse lines and stations with full dimensions; a general map of the entire section showing a plan of streets; sectional maps of the general map on a larger scale, showing contours, street lines, monumented lines with dimensions and grade elevations; and an accurate and complete record of all work done.

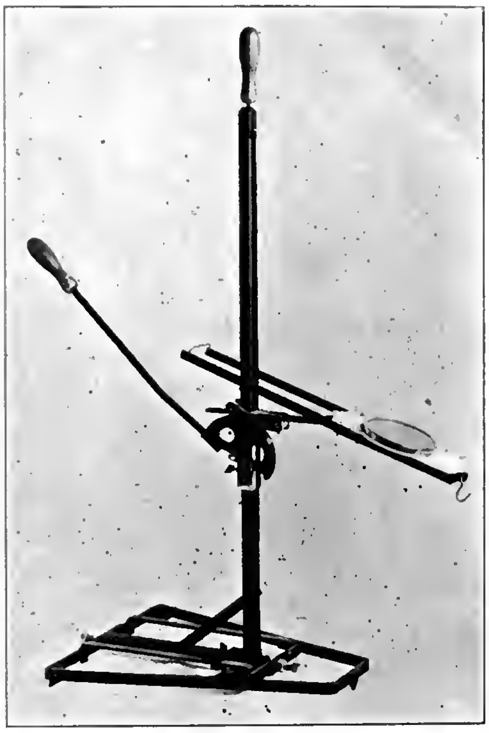
The first work was the selection of the triangulation stations. A reconnaissance survey was made showing the inter-visibility of the proposed stations and a plan of the same submitted to Mr. Mosman from which he laid out the base net and the general triangulation scheme. The base line selected was situated at Unionport and accordingly was so named, its length being approximately 1,200 ft.

Sixteen triangulation towers, ranging from 30 to 84 ft. in height were built, which together with eleven buildings and two poles constitute the twenty-nine stations for The Bronx. In the construction of these stations, high poles were used which materially lessened the time and expedited the work. These were set vertically in the vicinity of a proposed station to a height sufficient to get an unobstructed view of the surrounding stations. Without it one must occupy every station to find the inter-visibility of that station and the proposed one. With it you simply climb until you see the desired station and the height of the eye is the height of your station.

The high poles are 6 in. x 6 in. x 96 ft., consisting of 3 in. x 6 in. x 32 ft. timbers bolted together and breaking joints every 16 ft. The pieces are first laid out and marked on the ground, the holes for the bolts are bored and cleats nailed on one side of the pole, 1 ft. apart, on which the observer climbs. The lower section of the pole, consisting of a 6x6-in. section, 32 ft. long, and a half member section extending 16 ft. above the latter is raised by guide ropes, the half member forming the upper part breaking joint with its opposite half. Attached to the top is a pulley block by which the next member is hoisted into place. The poles were each laid out and raised in half a day, the horse used in hauling the lumber also raising the timbers. Five men constitute the necessary force. The poles were guyed all the way up.

Field work under the direction of Mr. Mosman was begun October 22, 1904, and finished in the Fall of 1905. The official report of the final results of the survey was received from Washington, December, 1905. It embodied the geographical positions of all the stations, the azimuths and back azimuths of the lines and the rectangular co-ordinates of the stations. Upon receipt of the report the Typographical Bureau began the work of connecting the traverses with the stations, and in many cases running new traverses connected directly with them. A comparison of the standard length of the Department of Public Works with that of the United States Coast and Geodetic Survey showed a difference of 0.01 ft. in 100 ft., so that in adjusting the traverses to the new survey, the lengths were first corrected for that difference, then started and closed on the triangulation line. The direction of many of the old fixtures laid down and monumented differed from the results of the Coast Survey, and as a result the directions and lengths as fixed by the triangulation in many cases played havoc with the final maps.

In general, traverses connecting the triangulation stations are called primary traverses. They



Forward Tape Stretcher.

are made with the utmost care, every precaution being taken to eliminate errors. The chaining is done in duplicate, the two results not differing more than 0.02 per thousand feet. Cloudy weather is used if possible. The apparatus used for primary traverses are the long tape, mechanical stretchers, and either sticks or tripods for supporting the tape. For secondary traverses the regular city engineers' 50-ft. spring-balance tapes are used with plumb bobs and tacks or marking pins.

The plumb bob, Mr. Holden thinks, has a proper place in the engineer's outfit. All plumb bobs used by the Topographical Bureau are tested to see that the line passing through the center of the chord suspending it shall when produced through the bob pass through the point. This secures the rejection of bobs which are not homogeneous, which are not properly bored to receive the string or have other imperfections. Every time a tape or chain is tested the plumb bobs used with it in the field are tested first.

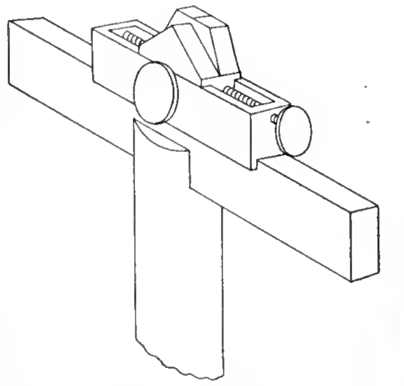
Equal care is taken with the measurement of angles on the traverses, at least two sets of six repetitions being taken and closing the horizon so that the closure shall be within 20 seconds. These limits have been easily maintained with normal conditions and reduce the traverse error to 1/4 in. per mile, which is the minimum distance between the triangulation stations.

As an example of the results of the work, the distance between Parkway and Baychester was measured with the primary apparatus, the distance being 6,347.356. The two measurements which were made differed by 0.01 ft. The line was divided into five sections and was defined by monuments set before the measurements were made. The first section was measured three times, and its length being 3,149.8185. The greatest range was 0.0044 ft. As an example of the rate at which the work was done about 2,400 ft. were measured in 45 min., an average of 100 ft. in 2 min.

On Tremont Ave., from Eastern Boulevard to Fort Schuyler Road, 8,000 ft. (over the line and back again) were measured in 5 hours and 55 min., a rate of 100 ft. in 4½ min. Many obstacles presented themselves, much clearing being necessary. The line crossed the salt meadows and the tide being up, the men had to pick their way over and around the streams. It was one of the worst places in The Bronx for this kind of work. The primary traverse apparatus was used.

In another traverse with a total length of 32,000 ft., the error of closure was 0.012 per 1,000 ft., and the six angles gave an angular error of 0.7 seconds per angle.

The line at Eastchester Meadows was measured with a 300-ft. tape, known as hoop-skirt wire tape, having a cross section of 1/50 in. by 3/32 in., and was supported every 50 ft. with a tension of 16 lb. The standardizing of this tape afforded an opportunity for studying the effects of temperature and forms of thermometers necessary with tapes of different cross sections.



Top of Portable Chaining Tripod.

A field comparator was established at Crotona Park and its length determined by the application six times of the Park Department 50-ft. standard length. This was done before sunrise to avoid the effects of the sun. The greatest range in these measurements was 0.003. The 300 ft. was measured twice in the morning and three times after sundown and again measured at an interval of two weeks and found by two measurements to be correct. The probable error of the standardizing was at least one in 600,000. The thermometers used were the chemical thermometers having no backing or support. They were graduated to single degrees, and estimated to 1/4 degree. Tests were continued from sunrise on and soon it was made certain that no reliable results could be obtained with the sun shining. Another fact made itself manifest that any kind of thermometer would not answer for all tapes, and also that certain thermometers would not answer at all. The thermometer of the so-called city engineers' tape is housed in a brass tube which stores heat and renders the readings misleading. Anything that stores heat is to be avoided.

The comparator was advantageously located in a place that was fairly shaded during the morning, and the air was influenced by the park, certain breezes causing alternately cool and warm currents of air about the tape. It was thus possible to learn if the tape and thermometers worked together. The tape was first watched and at a noted change the thermometer readings were

simultaneously called for and recorded. This was repeated several times and then the operation was reversed; that is, the thermometers were watched and the tape lengths recorded for the change noted in the thermometers. With the chemical thermometers the corresponding changes tallied exactly. With others this was not the case and their use was discontinued. The cross section of the tape regulates the sensitiveness required in the thermometer.

A most interesting fact has been observed in the 300-ft. tape in that it is constantly increasing in length. The cause, the engineers think, lies in the small cross section for the 16-lb. tension. The greatest care has been taken in reeling and unreeling the tape and no undue strain has been applied to it while so doing. A low-tension does not receive the endorsement of the United States Coast and Geodetic Survey, and the experience of the Topographical Bureau justifies the abandonment of small cross sections and low tensions.

About a year ago some steel tapes were received which had a cross section of 1/50 in. x 1/4 in., the outer surface being tinned to prevent rusting. It was found that they did not respond to temperature changes as do the ordinary steel tapes, the explanation being that the surface being bright reflects heat and does not therefore expand the same as the dull steel tape.

The tests made during the Summer of 1906 by the United States Coast and Geodetic Survey with four nickel steel (Invar) tapes show that they give results considerably more accurate and economical than steel tapes. [The tests were described in The Enginering Record of Feb. 9, 1907.] The topographical Bureau in December, 1906, ordered some of these tapes, but they have not yet been delivered. The same types of stretchers and portable supports will be used in connection with them as have been used with the steel tapes.

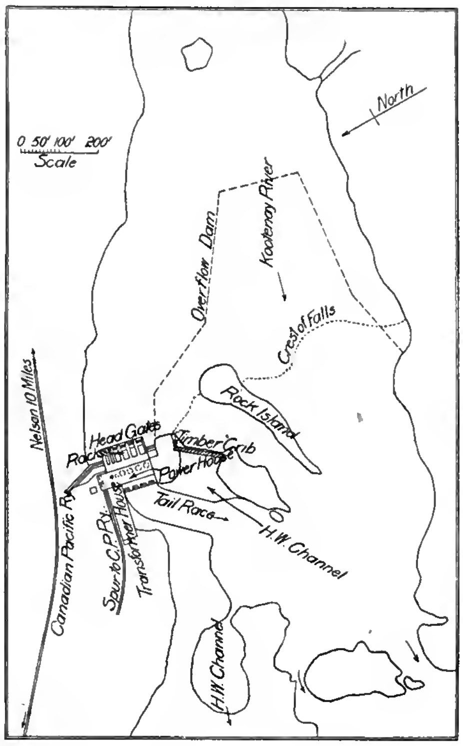
These stretchers and supports were designed by Mr. Holden. The front tape stretcher consists of an unright, hinging sideways at its lower end on its foot base, and terminating at the top in a handle. On this upright, traveling up and down, is a block, carrying the spring balance to regulate the tension. The tension is applied by a revolving half-wheel, centered in the block and working by a lever attached to its diameter. By means of the vertical motion of the block the balance at the front end of the tape is raised and lowered, while the motion on the upright gives lateral adjustment necessary for correct alignment. The rear stretcher is similar to the front one with the exception of the spring balance.

The advantages claimed for this stretcher are that it is manipulated with ease, and is instrumental in producing more accurate work because the tension can be maintained more easily for three minutes than in other forms for three seconds, the tape being absolutely under control for almost any length of time. With the tension released the stretcher is self-supporting, allowing one quickly to protect the tape from inadvertent injury, as from stray animals and from vehicles.

The portable supports are iron tripods with a round bar adjustable in height. The top of the bar terminates in a rectangular cross section forming a T-shape with the bar. This cross arm forms the track on which slides a block which forms a support for the tape, and adjacent to it, at a level with the tape, is the index mark which is brought to coincide with the tape graduations by means of a tangent screw. The block is set approximately near the tape graduation by sliding it along the bar and then clamping it. With the use of these tripods the driving of stakes is avoided, and time saved. Lines can also be measured over parks, lawns and pavements where stakes cannot be driven.

Both the stretchers and the supports are patented and are being put on the market.

The spring balance used with the city engineers' tape is faulty in respects other than that of the thermometer, and it has, in Mr. Holden's opinion, a wrong construction. The level tube is at the handle end, that is farthest away from the tape, working inside of the thermometer tube. The thermometer tube being attached away from the tape, takes a certain inclined position due to the catenary of the tape. This inclination must be secured every time the tape is used. For this position you rely on an inner tube which cannot be fitted close enough to secure parallelism without affecting the tension. The slightest movement out of parallelism gives a wrong level and a wrong length of the tape. Mr. Holden believes that the proper construction should be a reversion of the parts, that is, have the inner tube carrying the level immediately next to the tape with plenty of play between the inner and outer tubes. The level tube being absolutely free from friction would insure accuracy both of the levels and the tension. A further suggestion would be to have the end graduations on the tape and thus do away with the wear of the links which are interposed between the tape and the graduation on the handle.



Plan of Kootenay Power Development.

The Commissary Arrangements adopted by J. G. White & Co. in building railroads in the Philippines have resulted in securing at least 50 per cent. more work for the money paid to native laborers than was obtained on the highway construction in the Visayan Islands. Common labor is paid 50 centavos per day and subsistence. Food had to be provided as part of the wages, for if it was not some of the laborers would have gone hungry in order to use their money for other purposes, a habit observed among some of the negroes tried on the Panama Canal. A study of the subject showed that a diet consisting of six parts of rice, two parts of beef, one each of fish and vegetables, with condiments, was best adapted for natives engaged in hard physical labor. This food is prepared by a Chinese contractor, and while it costs 25 centavos per man daily, it has proved successful in attracting and keeping an excellent grade of men, who remain steadily at work.

The Hydro-Electric Plant of the West Kootenay Power & Light Co., Ltd.

The Upper Bonnington Falls power station of the West Kootenay Power & Light Co., Ltd., is located on the Kootenay River in British Columbia, 10 miles from Nelson, a town on the west arm of Kootenay Lake. The Kootenay River rises in British Columbia, a short distance east of the head waters of the Columbia River and flows southerly, approximately parallel to the north flowing waters of the Columbia for fifty miles and then crosses the international boundary into the United States. Here it continues to flow south then turns northwest and enters Canadian territory again, soon expanding into what is known as Kootenay Lake. The length of the river in the United States is about 120 miles. Kootenay Lake, which receives a small number of streams in its northern arm, discharges by way of the west arm, the river from this point keeping a southwesterly course to its junction with the Columbia River at Robson. The total length of the river is about 350 miles and the area drained by it and its tributaries above the power house site is about 9,800 sq. mi., of which 2,500 sq. mi. are in United States territory.

The development here described is owned by the company which has already developed the lower falls. The site of the plant was chosen on the north bank of the river, the channel between Rocky Island and that bank being used for the approach and the tailrace. The power house is built in the river and during its construction a cofferdam was built from the bank to the island, thus unwatering the whole site and diverting the flow to the south of the island. The installation is planned for 32,000 h.p., with a working head of 70 ft.

The minimum flow of the river was found to be 5,850 cu. ft. per second, the minimum occurring in January, 1905. The variations in the flow are very great, but no measurement of the maximum has been made as far as is known. The periods of high and low water differ from those of rivers not situated in mountainous country, and in the case of the Kootenay River, which depends largely for its supply on the melting snow on the mountains, the high water is comparatively late, in June and July. The variations between high and low water above and below the falls do not correspond, because the channel of the river below the falls is constricted by a number of rocky islands. These impede the flow of the stream, and it is intended to remove them in part so as to more nearly equalize the rise and fall on either side of the power station. Owing to these variations, which can never be entirely eliminated, except at a cost beyond commercial practicability, the vertical type of turbine was adopted, using all the head available at all stages of water, instead of adopting a head which would be nearly constant and which would involve a sacrifice of a large amount of power when low water prevailed. When the natural head is least, the volume of water used is not important, as the quantity available is more than ample, but at periods of low water the head is greatest and the vertical setting is an advantage since it permits the use of a higher head. Had a horizontal wheel been adopted, it would have been necessary to set the power house floor above high water, and, allowing the use of a draft tube of 24 ft., at this altitude, to maintain the tail water above low water, which would have involved a loss of head for a considerable period of each year, when water is low and consequently when head is most valuable.

It is the intention to increase the natural head by building a timber dam across the river to a height that will drown the rapids above the fall, thus affording an increase of head of 10 ft. It is

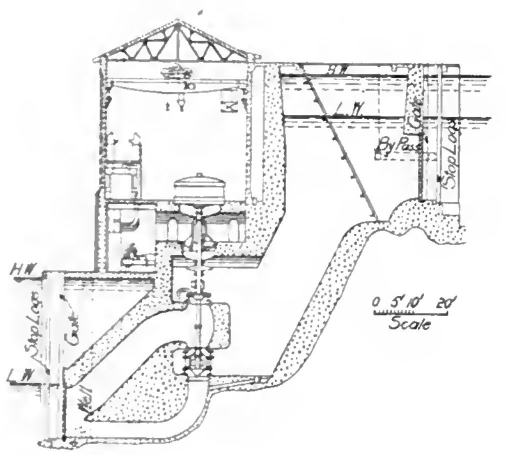
possible to construct work at the outlet of Kootenay Lake to maintain the lake level more nearly uniform and thus assist materially in reducing maximum discharge and increasing minimum discharge in the river. This will make the working conditions much better and increase the potentiality of the river considerably. The matter will be brought to the attention of the Government, for in addition to improving the power conditions of the river, it will afford a great advantage to navigation in the lake, which is now and will perhaps always be a part of the transportation system of this district, owing to the great difficulty of constructing a railway from Kootenay Landing to Proctor, 17 miles above Nelson.

The power house, measuring 40 x 140 ft., is built across the north channel of the river, and from the end of it the timber overflow dam continues to the south bank. Despite the material assistance of the natural channel, about 40,000 cu. yd. of rock had to be removed for the power house foundations and the tail race. The removal of this rock was somewhat difficult owing to the confined area in which the work had to be done, the difficulty of disposing of it, the nature of the rock, Nelson granite, and the irregularity in the direction of the seams. Some of the rock had to be excavated under water. As a large part of the concrete work admitted of the use of large stones, those most suitable for the work were piled up in convenient places, and a considerable quantity of the remainder were passed through crushers and the stone used in the concrete.

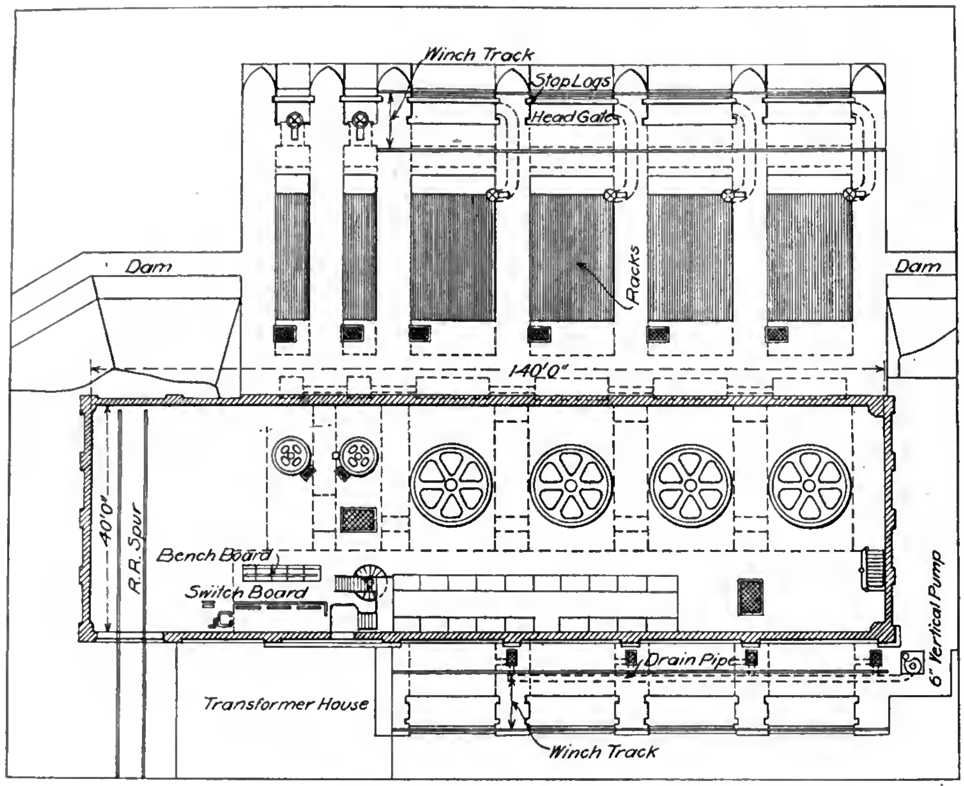
The power house building is entirely of monolithic concrete construction reinforced wherever necessary; the reinforcement consisting of round steel rods and in some places of steel rails, which were used in parts of the structure under severe strain. The four water wheels are placed in a row side by side and to the north of them are the two exciters. The switchboards are located on the down-stream side of the power house and beneath them runs a chamber in which the pressure pumps, governors and low tension tables are located. The only machinery on the floor are the generators, controlling board and the low tension switches. A spur railroad track connecting with the Canadian Pacific is run into the north end of the building so that the crane can lift machinery directly from the cars.

The water enters the intake through the submerged openings between the piers, and can be shut off by both gates and stop logs, the latter being provided so as to render the gates accessible in case of emergency. Behind the gates are the screens which are rendered accessible for repairs or cleaning. The intake and draft tubes and the turbine chamber are formed entirely of concrete, built integral with the structure, as cored openings in the monolith. Care was taken to secure very smooth surfaces on the inside of all passages, and their curves and cross sections were designed to offer as little resistance to the water as practicable. The exciter turbines are arranged similar to the main units but operate under a constant head by having the discharge at a higher head, which level is obtained by a weir. The tailrace openings are also provided with gates and stop logs, and any chamber can be emptied by a system of drains and valves, which lead the water to a well at the south end of the building, where a centrifugal pump throws it out into the tailrace. In laying out the station facility for inspection and the making of repairs were kept prominently in mind.

The floor of the power house is 24½ ft. below low water and 36½ ft. below high water, and since the building is located in the channel of the river and acts as a dam, special provision had to be made to care for whatever leakage should occur through the upstream wall of the building. The problem was solved by making the wall double as shown in the accompanying cross section and arranging for the drainage of the air space thus created.



Section through Main Unit.



Plan of Power House.

Each main unit operates at a speed of 180 r.p.m. under a head of 70 ft., and can deliver 8,000 mechanical horse power to its electrical generator. Each unit will require 1,260 cu. ft. per second, a volume equal to the flow of the river 100 ft. wide, 5 ft. deep, moving with a velocity of 151.2 ft. per minute. Each turbine consists of three inward flow Francis runners mounted on a vertical shaft, each runner being equipped with its own distributor and movable guide vanes. The top runner discharges downward and the middle runner upward into the same draft tube, and the bottom runner downward into a separate draft tube, which joins the former one just in front of the tailrace gates. The distributors are bolted to heavy cast-iron base rings secured to the concrete masonry, which forms the turbine wheel casings and the draft tubes for carrying the discharge water to the tailrace.

The runners are made of special turbine metal, approximately 88 parts copper, 10 parts tin, and 2 parts zinc. Each is built in one piece, cast in cores and bolted to the hub. The hubs are formed by enlarging the shaft at the points where the runners are attached, heavy flanges being turned on the shaft above the hubs, for attaching the runners.

In order to render the total resultant thrust on the shaft as small as possible, the chamber above the upper runner is by-passed to the draft tube, which relieves the pressure in the chamber, and thus eliminates the hydraulic thrust of this runner. Since the two other runners discharge in opposite directions, the total resultant thrust is theoretically zero. The thrust bearing, however, is designed to take care of a generous amount of thrust over and above the dead weights of the revolving parts. The latter consist of the rotor of the generator, the shaft, in three sections, three runners weighing 4,000 lb. each, couplings and bolts, making a total of 170,000 lb.

The thrust bearing consists of two specially close grained cast-iron discs. The lower disc is supported by a ball seat, while the upper is securely held in place by an adjusting nut upon the shaft. The discs have raised flanges on the outside and inside circumferences so as to form an annular pressure chamber into which the oil is forced under a pressure of 250 lb., thus lifting the revolving parts. When these parts are lifted the oil escapes between the surfaces of the discs, supporting the total weight on a film of oil.

The thrust bearing is fitted with a cover with glass peep holes. The oil is supplied to the bearing from a high pressure triplex pump, capable of working under a pressure of 500 lb. per square inch, and driven from the main turbine shaft, by bevel gearing and countershafting. Each turbine has its own pump, oil tank, piping, gauges, etc., making it independent and complete in itself. An extra motor-driven pump has been provided to act as a spare for any one of the main units or exciters and to supply oil to the turbines when starting up.

The main turbine shaft is kept in alignment by three guide bearings, the upper guide bearing being built in conjunction with the thrust bearing. It is lined with Parson's White Brass and is lubricated by oil provided under pressure. The intermediate and lower guide bearings, the former situated above the upper runner, and the latter between the intermediate and lower runners are of lignum vitae, made by driving the wood into dove-tail spaces in bronze boxes. As these bearings are submerged, they are well lubricated with water and require little or no attention.

The water is distributed to the runners through malleable iron, movable guide vanes, operated by means of links, which are connected to the vane

operating ring. The latter is operated by rods and levers from a vertical shaft which leads to the operating deck, where the governor is located. The governors are furnished with remote electrical control.

The two upper sections of the main turbine shaft are joined together by a cast steel coupling 4 ft. in diameter. The brake mechanism is fitted about the coupling, the outer edges forming the braking surface, against which the two shoes are applied, hand mechanism being provided to bring a force of 10,000 lb. on each shoe.

The turbines are guaranteed to give an efficiency of 80 per cent. when delivering 8,000 h.p. The hydraulic machinery was all designed and built by the I. P. Morris Co., of which Mr. W. M. White is the hydraulic engineer.

The generators each have a capacity of 4,500 kw. at 2,200 volts and 80 per cent. power factor, at a frequency of 60 cycles. They are of the umbrella type and directly connected to the water wheels. At the present time only two of the units have been installed. The exciters are two in number, each of a capacity sufficient to excite the entire equipment when finally installed. They are also of the umbrella type and directly connected to vertical wheels.

The current from the generators is carried to bus bars in compartments elevated above the station floor, and formed entirely of concrete. The top of the bus bar compartment, in which all the operating transformers are placed, forms the base of a platform on which are mounted nineteen 2,200 volt oil switches, all of which are motor operated by distant control from the benchboard. The latter which contains the control for the whole station, including switches for the 2,200, 22,000 and 60,000-volt switches, together with the speeders for the water wheels, is situated in front of the instrument panel at the end of the station, all connections thereto being reduced to a pressure of 110 volts. The general switching arrangement has been worked out on the basis of two separate and distinct plants, which may be coupled together or run separately on any transmission line or any bank of transformers.

The cables for connecting to the low voltage bus bars, and from them to the transformer station adjacent, are all rubber covered and drawn into bituminous fibre ducts, which are embedded in the concrete floors and partitions.

The transformer house, located at right angles to the power house and at the north end of the latter, is 36 ft. 1 in. wide, 136 ft. 6½ in. long, divided longitudinally into two sections, running the entire length of the building. The southern of these two divisions is devoted to the switches and lightning arrestors and is built in two stories. The north section is divided into five separate compartments, each of which contains three transformers, the barriers between the transformer banks and also the wall forming the main division of the building being of concrete.

The floor of the transformer room is 4 ft. 5½ in. above the top of rail of the Canadian Pacific spur, which runs along the north wall of the building. The latter consists of a series of doors, and the transformers being mounted on trucks, can be run from their positions directly onto flat cars with great ease.

Practically all of the power is transmitted at 60,000 volts, though the town of Rossland is supplied with 22,000 volt current over the existing lines of the old plant. The longest transmission at present is 83 miles, to Greenwood. All of the power so far sold is used in mining for large motor equipments and for the lighting and power of mines and mining towns within a radius of about 83 miles. It is expected that the company will at some future date sell power to the railways in the vicinity of Rossland for operating over the heavy grades. The haulage over these grades at the present time is done by steam locomotives of special type, some of them being geared. Switchbacks are necessary at a number of points. The heaviest grade is about 4½ per cent.

The plant was designed by Messrs. Ross & Holgate of Montreal, Canada, from whose paper before the Canadian Society of Civil Engineers, the data for this article were obtained.

The Cast-Iron Bridge erected by the Coalbrookdale foundry in 1797 at Stanford, Worcestershire, England, from the plans of John Nash, has been replaced by a Hennebique reinforced concrete structure of 96⅔ ft. span. It has three arched ribs; the center one is 20 in. wide at the springing line and 30 in. deep, and 20x22 in. at the crown, where the effective depth is increased 7 in. by the deck slab. The outer ribs are 14x30 in. and 14x22 in. at the springing and crown respectively. They are connected by transverse walls which are carried up to support the deck. Details of the old and new structures are given in "Engineering" of August 23.

An Umbrella Shed for Market Storage.

A 43x100-ft. umbrella shed has recently been built in front of pier 36 North River, New York, on part of an area secured by moving the bulkhead line out about 50 ft. farther into the river. It is used largely for temporary storage, especially of produce for city markets which is handled almost daily. In order to facilitate trucking and freight handling it was considered necessary to avoid to the utmost obstruction by columns along the sides, and the structure was designed with a light roof carried entirely by a single center longitudinal line of vertical columns 20 ft. apart on centers. The area covered by the shed was paved with asphalt pavement, in which six 4x4-in. pits were excavated to a depth of about 5 ft., and filled with concrete. Before they were concreted, 10x10-in. vertical posts 25 ft. long with 10x10-in. horizontal transverse sills 6 ft. long bolted to their lower ends were set in them and thoroughly bedded in the concrete. These posts were carefully plumbed and served to carry the entire superstructure. At their upper ends they are connected by a 3x10-in. mortised ribbed purlin and support the trussed rafters.

Umbrella Shed with Roof Frame Covered with Canvas.

Each truss is a triangular framework of 2½-in. screwed steel pipe, 2½ in. in diameter for the top chord and 3 in. in diameter for the bottom chord. The truss has a depth of 8 ft., and each side of the top chord, or each rafter, is a single length of pipe fitted at the upper end with an oblique screwed flange. The flanges of the two connected chord pieces are bolted together through the top of the post. The lower end of the top chord is screwed into a casting into which there is also screwed the end of the bottom chord pipe, which at the opposite end is also flange-connected to the vertical post through which it is bolted. The castings at the ends of the bottom chords also receive the screwed ends of horizontal eaves struts of 2½-in. pipe which support the intermediate rafters of 2x6-in. timbers 4 ft. apart with loop connection of flat iron engaging the struts. The upper ends of these rafters are mortised in the usual way into the ridge purlin. Half way between the ridge and eaves purlin there is a 2x6-in. intermediate purlin supported by a bent strap engaging the top chord of the roof truss.

The framework thus provided is covered with a continuous sheet of paraffined heavy canvas with transverse breadths sewed together sail fashion to make one large sheet or tarpaulin 100 ft. long and about 50 ft. wide, reaching continuously from the eaves on one side, up over the ridge purlin and down to the eaves on the other side where it is laced to the eaves strut. The side walls are formed of vertical curtains of the same material mounted on rollers at the eaves strut, which may be rolled up and give an entirely clear opening under the roof, or may be lowered and enclose the space to protect the goods within from rain or snow.

As the structure is very light and may be exposed to severe wind, extra bracing is provided by four inclined 4x5-in. struts, radiating from the intersection of the vertical post and its lower chord to the intermediate purlin, where they are kneebraced to secure stiffness and transmit the possible stresses to the main rafters. Additional stability is secured for the vertical posts by bolting to opposite sides of them pairs of 6x6-in. timbers 40 ft. long laid on top of the original asphalt pavements and serving as joists for the wooden floors, which is intermediately supported by 2x6-in. transverse joists also laid upon the pavement about 2 ft. apart.

Care is taken to leave 1-in. cracks between the outside longitudinal floor planks to provide for drainage. This construction is very simple and

proved easy to build and satisfactory in service. The estimated cost, including roof covering, end and side walls and floor, is only about $2,500, which compares very favorably with the cost of any other type of structure of equal strength and durability having the same cubical contents. It was erected in about two weeks actual working time by a small force of carpenters and pipe fitters. It was built for the Clyde Steamship Line by John Monk & Sons, contractors; Mr. J. W. Ripley, chief engineer, structural department.

Court Decision on Overflow of Land.

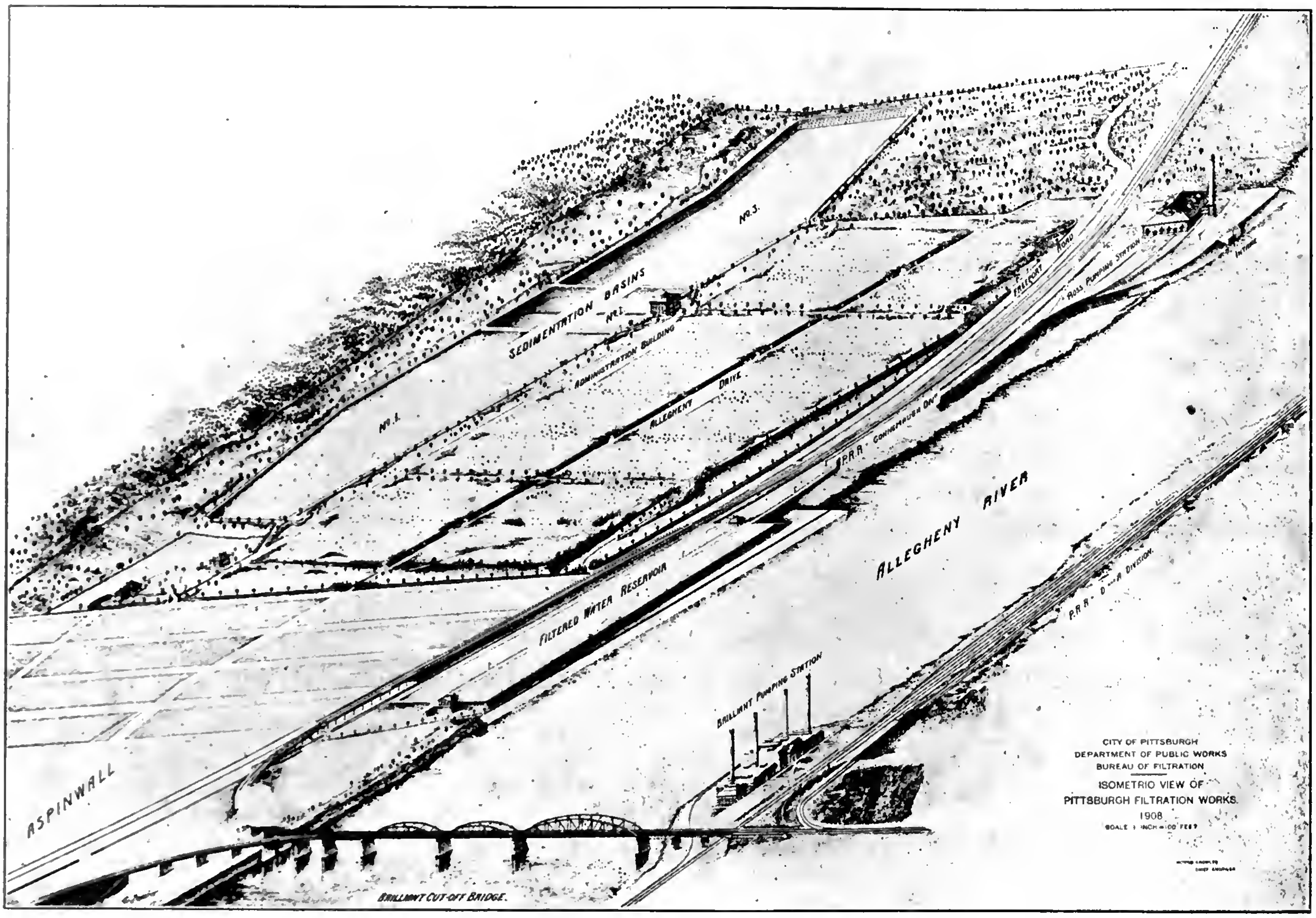
The overflow of land below a dam by the discharge of impounded water was recently before the Maine Supreme Court in Barker v. French, 67 Atl. Rep., 308. The laws of that State, unlike those of Massachusetts, do not authorize a complaint for overflowing lands below a dam, and consequently a case of this nature is necessarily an action at common law. Under this law, the court rules, a mill owner can only maintain a head of water for the use of his mill and only let it out at such times and in such quantities as are proper and reasonable for the use of his mill. He cannot hold water back when he has no use for it and there is no need of it. And if he has occasion to use his mill, he cannot turn out more water than is reasonably necessary and proper for the reasonable use of his mill. He must so far have regard for the rights and interests of those below him, although, within his rights to operate his mill, he can exercise these privileges, and if those below are injured, it is their misfortune in owning land below the mill. The case practically depends upon what constitutes reasonable use of water for power purposes.

The Pittsburg Filtration Works.

The design and construction of the water purification plant now being built at Pittsburg under the direction of Mr. Morris Knowles, was the subject of a series of articles printed in this journal during December of last year. The plant is of such an enormous size that those unacquainted with the details of filteration works will probably appreciate its magnitude better from the accompanying reproduction of a bird's-eye view of the plant as it will appear when completed, than from the more elaborate details of the design, which have already been published. It is located on the Allegheny River, from which the raw water is drawn, and considerable pains will be taken in the final finishing of the plant to give it an attractive appearance. The general idea that has been followed in developing the landscape plant has been to isolate the site from the surroundings by hedges and to plant hardy shrubs and trees of slow growth, which will require pruning only at considerable intervals. All attempts at elaborate decorations, such as flower gardens, set plants and fountains, have been avoided and the money will be spent on more permanent work. A growth of heavy timber on the hill back of the site will be retained. The entrances to the filter galleries from the drive over the Allegheny water main will be relieved by shrubbery. The entrances to the plant will be closed by iron gates carried by large stone piers. All overhead wires have been avoided by a system of underground ducts in which wires for all purposes will be carried.

The water is taken through an intake from the river into the low-lift Ross pumping station shown in the upper right-hand portion of the engraving. The pumps deliver it to the central sedimentation basin, marked No. 2 in the engraving. This has a capacity of 20,000,000 gal. and is flanked on either side by two much larger sedimentation basins, the three having a total capacity of about 150,000,000 gal. The water will pass from them to the filters, which are covered and lie on either side of Allegheny Drive, along which runs the Allegheny city water main. The filtered water flows into a covered reservoir built along the bank of the river, from which it passes through parallel twin steel conduits to the Brilliant pumping station of the Pittsburg waterworks. The plant will have a net capacity of approximately 100,000,000 gal. of water per day under normal operating conditions, with a maximum rate of 3,000,000 gal. per acre per day.

The filter beds are 46 in number, each with a net filtering area of 1 acre. Beds are arranged in eight rows transverse to the Allegheny Drive, with a covered pipe gallery 31 ft. wide in the clear between each alternate row of filters, or four galleries in all. These galleries are approximately 1,000 ft. long with the exception of the one at the end, and are divided in half transversely by the roadway over the 60-in. rising main of the Allegheny water works. The filters are entered from the galleries and all sand washing will be done in them, special appliances having been built to handle the sand economically between the filters and the washing apparatus. No storage for dirty sand is provided, for the system of operations will involve the continuous removal, washing and restoration of the sand. Provision has been made for warming these galleries so that all work connected with the maintenance of the plant can be done without interruption from the cold.



Isometric View of the Pittsburgh Water Purification Works Now Approaching Completion.

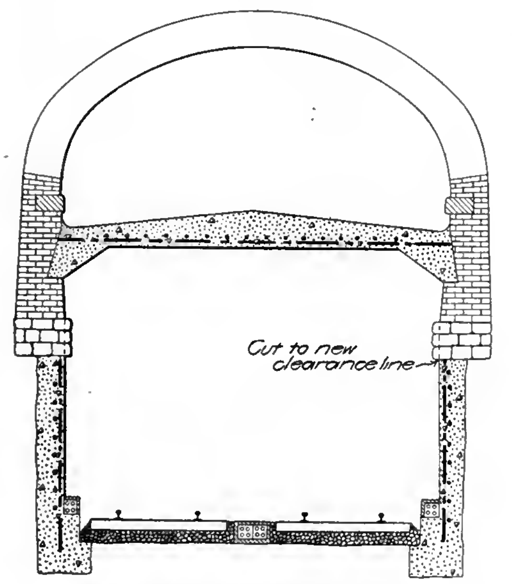
The Reconstruction of the Eighth Street Tunnel, Kansas City.

Upon the reorganization of the Metropolitan Street Railway Co. of Kansas City, Mo., in 1902 it was decided to secure better street car facilities between the Union Depot and the heart of the city. The depot is located in what is known as the "West Bottoms," of the Kaw River, at the foot of the bluff on the Missouri side. A number of street car lines reached the bottom lands, one of them the 12th St. cable line passing over a light viaduct on a 12 per cent. grade and another, the 9th St. cable line, being on a 27 per cent. grade.

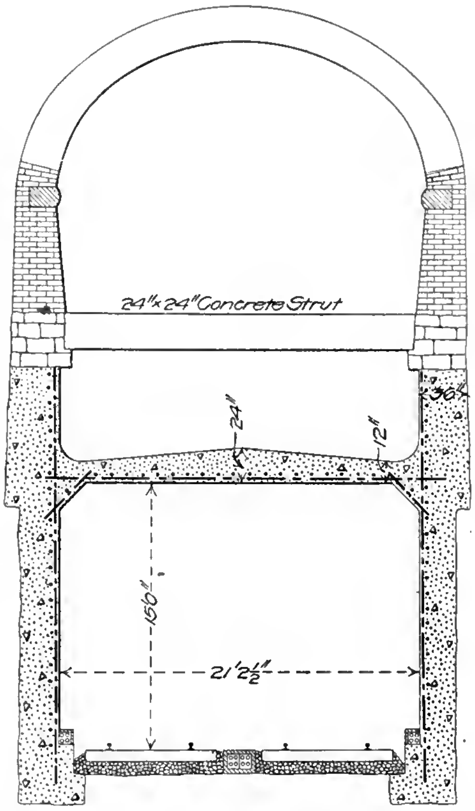
It was finally determined to make the improvements in the 8th St. tunnel which ran into the bluff close to the depot on an 8.648 per cent. grade. By this route the center of the city can be reached in about 8 min. The new schedule which was proposed called for two cars on each track in the tunnel at all busy hours, a condition too dangerous to be attempted on such a grade. The 8th St. line is the most direct between Kansas City, Mo., and Kansas City, Kan., and in the former city runs on the surface to Washington St., thence by the tunnel through the bluff directly onto the elevated structure, at a point about 500 ft. from the Union Depot, and continuing elevated to Kansas City, Kan. The plans for rebuilding called for changing the grade in the tunnel and strengthening and rebuilding the elevated to the depot, to accommodate the 80,000-lb. cars and thus make the line the main carrier to the different points in the cities, and building a return loop on the elevated at the passenger station.

The tunnel is in a thickly settled portion of the city and above its center line were a street lined with residences, a church and one house. The old tunnel was a 3-center brick arch, with 26-in. arch rings and 21 ft. 2½-in. span, the side walls battering below the springing line. Its length was 786.4 ft. The material in the bluff varied in character, limestone and a slippery shale being predominate. The shale was of a character to afford a good foundation and in general was a good material if protected from air and frost.

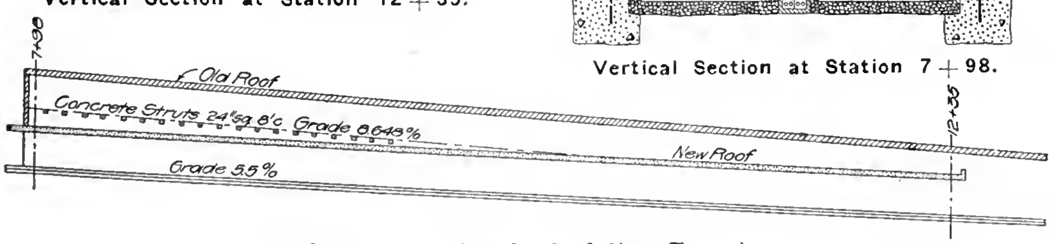
A study of all the conditions resulted in the selection of a reinforced concrete rectangular section for the tunnel, and a grade of 5.5 per cent., starting from the old elevated at the west end. The slope had to be extended 543 ft. beyond the old one to Broadway. This required the construction of 220 ft. of open cut retaining walls, 323 ft. of cut and cover section, including a 33-ft. arch and station at Washington St., and a new roof and side walls wherever necessary under the old tunnel. To provide for the new approach the street was widened for 20 ft. on each side for one block.



Vertical Section at Station 12 + 35.



Vertical Section at Station 7 + 98.



Section Showing Roof of New Tunnel.

The flood of June 1, 1903, carried away considerable of the elevated structure, and the tunnel work was to be carried on in connection with its reconstruction so that the entire line could be opened at the same time. The work was commenced in the latter part of August, 1903, the open cut work being the first part started. The first move in the latter work was to drive piling outside the proposed excavation, to be used later to hold the sheeting. The excavation east of Washington St. was handled entirely with wagons, and that portion of the open cut west of Washington St., and the tunnel itself was done with the aid of cars let down the grade on a 24-in. track by gravity and hauled back by a hoisting engine. This engine was installed at Washington St., and gradually lowered as the work progressed, being removed from the tunnel only when forced out by the track laying gang. All the excavated material west of Washington St. was wasted at the face of the bluff for the use of the park commission.

At the upper end the roof of the new tunnel structure was below the floor of the old one, but going down the new roof gradually cut into the old tunnel. This not only required a special design, but a careful method of procedure which would assure the safety of the older structure. The excavation under the old arch was handled by sinking a 12-ft. and in part a 13-ft. ditch the entire length down the sub-grade, and then gradually trimming the sides until only a 3-ft. or 4-ft. shoulder was left supporting the old footings. This shoulder support for the walls was divided into alternate 10-ft. and 12-ft. sections and excavation continued in the latter, going back 24 in. under the old wall and 18 in. below the new sub-grade. These sections were filled with reinforced concrete and allowed to set for 10 or 14 days, before the adjacent sections were excavated.

The shale and lime stone were found in nearly horizontal strata. A Fisher direct-connected gasoline air compressor and two air drills were installed and in addition to their work considerable drilling was done by hand with churn drills. After the first ditch was cut the use of the air drills was practically abandoned on account of the greater ease of placing a hole by hand in a difficult position. All of the holes were shallow and the shots light, the heaviest charge being 2½ sticks of 40 per cent. dynamite in a 4-ft. hole. For drilling into the shale an ordinary 1½-in. bridge auger, with the worm filed off, was used.

No trouble was experienced except at the east end of the old tunnel, where the excavation was deepest. Here the shale had vertical seams, and as it had been exposed to the air and frost for years, it was dried up into small cubes with almost no adhesion. The treacherous nature of the shale and the unevenness of the pile driving caused much more bracing to be used than would have been otherwise necessary. Upon this bracing the runways for the concrete barrows were afterwards placed. The braces were box struts of 2x8-in. stuff spiked together, and carried a house jack in one end. A test made of one of these struts resulted in breaking the jack without injury to the strut. Only one cave-in occurred, and that was outside of the old tunnel at the site of what was formerly a ravine.

The new tunnel has a flat roof of 21 ft. 2½ in. span, reinforced with 1¼ in. Johnson corrugated bars, 4 in. center to center across the span, and ¾-in. bars 12 in. center to center longitudinally, with 24-in. of concrete in the center and 13 in. at the haunches. The roof is carried on the side walls with the aid of an 18-in. 45-deg. continuous bracket. This roof extended 300 ft. into the old tunnel and was designed to act as a strut for the old side walls. Whenever no new side walls were built a groove was cut into the old brick walls and dowel pins put in before the roof was concreted. At the mouth of the old tunnel 24x24-in. concrete struts, 8 ft. center to center were put in between the foundations of the old walls. The height of the new tunnel above the top of the rail is 15 ft.

At the east end where the excavation was deepest and consequently the risk greatest, a complete 10-ft. section of the new side walls and roof was completed and allowed to set before undermining adjacent sections. The excavation for this section was made 12 ft. long and all longitudinal rods were cut in 12-ft. lengths, allowing 1 ft. to project through the forms to bond on to the next section.

At Washington St. a station was located and in order to provide the necessary platforms, the cross section was changed to a 33-ft. 3-center arch reinforced with two rows of ⅞-in. bent bars, 7 and 9 in. respectively center to center and ¾-in. longitudinal rods 12 in. center to center, the arch ring being 15 in. thick at the crown. The concreting of this arch was brought up to the springing line and allowed to set and the balance carried on continuously until the entire arch was completed.

East of the Washington St. station a poor foundation was encountered and reinforced concrete beams were placed below the sub-grade from one foundation to the other forming a sort of gridiron. This was done for about 60 ft., and then an old fill was encountered in which it was

almost impossible to get any foundation at all. It was, therefore, decided to make a complete concrete tube and a solid 18-in. floor was laid reinforced with old railroad iron every 12 in., this floor being necessary for about 200 ft. For the side walls of the open-cut approach 18-in. walls surmounted by a slightly ornamented coping were built.

The concrete used throughout was a 1:3:5 mixture with Lehigh and Atlas Portland cement, Missouri River sand and ¾-in. limestone. A No. 2 Smith mixer was used, and as high as 125 cu. yd. in 10 hr. was wheeled to the forms, 100 yd. being the usual day's work. Two inch planks were used exclusively for the concrete forms. The concrete was mixed on the surface for all parts of the work and run by means of wheelbarrows and spouts into place by gravity. Whenever possible the concrete under the old tunnel was wheeled in and dumped from the roof for the side walls. In other places it was dumped into a car and run down to the forms and shovelled into place, both sides being filled at once and kept at the same level. No attempt was made to get an exceptionally fine finish on the walls, as speed of construction consistent with strength and safety was the great object. Although the excavation was pushed both day and night, concrete work was carried on only during the day. The new tunnel was opened for traffic on April 14, 1904, 7 months and 14 days from the commencement of the work.

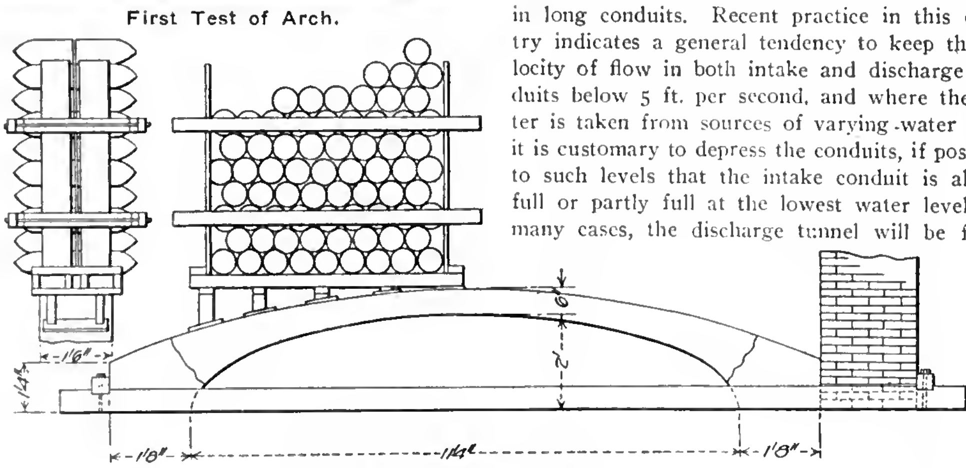
The work was done for the Metropolitan Street Railway Co., of Kansas City, under the supervision of Ford, Bacon & Davis, New York, Mr. C. M. Black being the engineer in charge of the Kansas City office. The contractors for the job were the General Construction Co., of Kansas City, under Mr. R. W. Waddell, the general manager. The contract was for the lump sum of $150,000. The work was described by Mr. W. M. Archibald in a paper before the Engineering Association of the South, from which the data for this article were taken.

Book Notes.

Considerable attention has been attracted to a series of articles on "Switches and Turnouts" contributed to the "Journal of the Worcester Polytechnic Institute" this year. The author, Professor Howard Chapin Ives, has developed the subject in a logical manner which should be particularly useful in the class-room. Special care has been devoted to the descriptions of the different forms of switches and to their effect on the lead; to the statement of practical conclusions at various places in the text and to the design of the slip switch, the mathematics of which have rarely been discussed. These papers have been reprinted by Mr. J. P. Williams, Worcester Polytechnic Institute, Worcester, Mass., who is selling them for 50 cents. As an explanation of the theory of switches and turnouts the pamphlet leaves nothing to be desired, and those engineers who are familiar only with the method used on one railroad system, and the tables for that method, will probably find the comprehensive discussion of the subject by Professor Ives an interesting and valuable review.

The fundamental factor in hydraulic power development, water supply and some other engineering works is the amount of available water. Although the importance of this factor is self-evident, it has long been a matter of surprise that so little information concerning the methods of gauging the flow of water is readily available. Most textbooks on hydraulics and surveying devote a few pages to these considerations, but the treatment is necessarily very sketchy. For this reason a small book on "River Discharge," recently written by Messrs. John C. Hoyt and Nathan C. Grover, is likely to find a wide circle of appreciative readers. There are few things offering a bigger chance of reward to the engineer who keeps his eyes open than the small undeveloped water powers throughout the country. Before their value can be properly determined, however, it is necessary to make a series of stream gaugings and to determine the amount of pondage that can be provided readily. Probably there is no other book which furnishes so much information on hydrographic work of this sort as this volume by two of the leading members of the engineering staff of the United States Geological Survey. It explains the conditions affecting stream flow, describes the methods, instruments and equipments used in making gaugings, outlines the best practice in selecting stations for making such measurements, describes the construction of weir stations, and gives a full discussion of the methods of analyzing and using the data accumulated in this manner. The book is to be highly recommended from both theoretical and practical points of view. (New York, John Wiley & Sons; $2.00.)

First Test of Arch.



Load Distributed Over Half of Arch.

Letters to the Editor.

Test of Arch for Filter.

Sir: With the idea that the result may interest your readers, there is sent you herewith a print showing the details of a recent test of a concrete arch. A timber framework made the abutments of the arch practically unyielding.

The first test is shown in the accompanying photograph, the load being 1,464 lb. per square foot. In the second test, the load was confined to about half of the arch, 9 square feet. The load over this portion of the arch was nearly uniform and aggregated 2,847 lb. per square foot; the arch cracked at the haunches. The shock or jar incident to this cracking was sufficient to scatter the projectiles. The arch itself did not collapse and was still apparently strong enough to bear the load for which it was designed, that is, 300 lb. per square foot.

The concrete was thoroughly mixed in the proportion of 1 bbl. of cement, 11 cu. ft. of sand and 19 cu. ft. of broken stone, and was carefully placed, but there was no steel reinforcement. The arch was built Feb. 25 and broken Aug. 15.

Yours very truly,

Charles W. Kutz,
Captain, Corps of Engineers.

West Point, Sept. 24.

Condenser Intake and Discharge Conduits.

Sir: What is the usual method of figuring the cross section of intake and discharge conduits for supplying condensing water to power station equipment, same to be based on the amount of water used and the distance traversed? Is there any standard work giving rules relating to this subject?

Pawtucket, R. I. Benjamin Gridley.

[In the absence of published information on the design of conduits for condenser circulation water supply, it may be stated that as conduits for this purpose are rarely more than a few hundred feet in length, the problem usually resolves itself into the use of good judgment in selecting ample sections for low velocities of flow and to provide for future extensions of plant rather than a study of the conditions that govern the flow of water in long conduits. Recent practice in this country indicates a general tendency to keep the velocity of flow in both intake and discharge conduits below 5 ft. per second, and where the water is taken from sources of varying water level, it is customary to depress the conduits, if possible, to such levels that the intake conduit is always full or partly full at the lowest water level. In many cases, the discharge tunnel will be found placed at a higher level than that for the intake, since, if it is desired to operate the pumps on the closed circulation system, this may always be accomplished by damming the conduit near its discharge outlet in order to maintain the water level at such height as to always cover the ends of the condenser discharge pipes. An important feature of the intake conduit is the provision of screens or trash racks, which precaution must be taken in practically all locations. These screening devices are, however, of widely varying design, but are all located in enlargements of the conduits in order to secure the necessary reduction of flow velocity, and in most cases there are two sets of racks provided so that one may be removed for cleaning, leaving the other still in service. The relative proportions of the intake and discharge conduits also vary considerably with differing conditions, many preferring a smaller section in the discharge conduit with consequent higher velocity of outflow. But in all cases, the preference has been shown by recent practice for intake conduit sections that will give flow velocities not to exceed 5 ft. per second, and as much larger sections as limits of cost will permit.]

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TABLE OF LEADING ARTICLES.

Small Producer Gas Plants.

It is only recently that producer gas as a source of power has obtained a firm foothold in this country. Even now, with a considerable amount of effort on the part of the manufacturers, comparatively slow headway is being made. Big gas engines are coming to be fairly well known, but the logical step of feeding them from cheap producer gas is rather seldom taken as yet. The philosophy of the matter is very simple. It costs heavily to produce gas of high thermal value and particularly of high luminous value. On the other hand, low-grade gas, from the mere fact that it is of small calorific value, has per unit of energy a heavy distribution charge against it if furnished by a supply company. Hence fuel gas of a thermal value such as to give minimum cost per heat unit has not become at all a familiar thing, and the ordinary man, when invited to make gas of 100 to 150 B. t. u., gets suspicious and sheers off. Yet the practical question in gas production for power purposes is not how to make a gas of maximum thermal value, but of maximum thermal value for the money, which is a very different thing. It has been shown over and over again that coal can be used to make gas for an engine much more efficiently than it can be used under a boiler, and it is pertinent to inquire why it is not more frequently thus utilized.

Probably the chief reason lies in human inertia which resists attempts to force the mind out of the line in which it has been traveling. A secondary one of considerable importance is fear of the apparent complication which the mind associates with gas making. Now, in point of fact, it is really simpler to make gas in a modern producer than to make steam under the pressure necessary for a steam engine. The producer has been made nearly automatic in its action and can certainly be run successfully by anyone who has ability enough to run an ordinary domestic furnace, when once he learns the trick. Whether a comparatively inexperienced man can operate it in such wise as to reach the best economy is another matter. The simpler producers are fairly fool-proof as regards producing gas, but it is more than likely that inability to produce good and uniform gas in unskilled hands has been one of the obstacles in the way of working the apparatus at its proper economy. Several makers are willing to guarantee the production of a brake-horse-power-hour on the consumption of 1 to 1.25 lb. of coal in the producer, and this even in units as small as 50 h.-p. How nearly these figures can be regularly reached with ordinary labor and with output rigorously measured is an open question, but there seems to be no doubt that under favorable conditions the guarantee can be made good. It must be remembered that the engine in such plants involves extra expenditure on account of having to utilize a large volume of lean gas, and that the depreciation of the producer is a somewhat uncertain quantity. Here again it is likely that the system may suffer on account of its claims to automatism. All in all, however, producer gas can be made a very cheap and convenient source of power, particularly on a moderate scale, and considerable further progress is likely. The system seems certain to find more and more applications every year.

The National Hydraulic Interests.

The statements made by President Roosevelt at Memphis on Oct. 4 deserve more thoughtful consideration than they seem to have received. Those portions of them reprinted elsewhere in this issue form a most comprehensive outline of the important and varied relations of the various national hydraulic interests. The development of navigation on inland water-ways has frequently been discussed in state papers but there has always been a tendency to consider that the subject ended there. It is true that in the West the value of water for irrigation has been recognized and during recent years our chief magistrates have dwelt from time to time on this subject. President Roosevelt seems to be the first, however, to recognize the intimate relations which all branches of hydraulic engineering bear to each other and to the national welfare. In fact, few engineers have probably stopped to consider the closeness of these relations, and anyone termed a hydraulic engineer in this country was generally considered, even among his associates, to confine his attentions to power developments. This narrow view is unlike that which prevails in Germany, for instance, where a recognition of the many directions in which water is employed has given to the term of hydraulic engineer a far wider significance than it has on this side of the Atlantic. It is particularly gratifying to notice that this comprehensive understanding of the importance of our national water resources was emphasized by the President at a gathering primarily called for the purpose of discussing only the improvement of internal navigation. The President did well to point out clearly that while navigation is important there are many other uses to which rivers and lakes are put, and anything which is done for one interest must be executed in a spirit of fairness to all other interests which are likely to be affected by it.

A great deal has been printed recently concerning some statements by Mr. James J. Hill, who has taken a decidedly pessimistic view of the ability of railways to keep pace with the demands for transportation which the development of the country will produce. It is probable that some of these statements by the eminent railway builder and operator are to be taken with a large grain of salt, but it is nevertheless noteworthy that a number of men engaged in the higher walks of railway affairs look with favor upon the improvement of internal water-ways. The congestion of tracks by bulk freight paying low rates and interfering with the operation of trains from which a much larger revenue can be obtained has been altogether too frequently observed in too many sections of the country during recent years. It is unquestionably true that there is no problem to-day which is full of greater complications, of more factors of debatable importance, than railway transportation, and when it is still further complicated by considerations of competing water transportation, the problem is one which may well stagger a master intellect. Yet it is one which must be faced and solved, and the fact that our President has so fully recognized its importance as to approve a special gathering for its consideration is a gratifying indication that he, at least, appreciates its many aspects and proposes to be guided in his recommendations concerning it by the advice of specialists who have first conferred together regarding the scope of each aspect of the problem and the relations of the various factors. The interests which are affected are so important and diverse that any other method of seeking the truth is certain to produce results based upon an imperfect, disjointed appreciation of the whole vast problem.

This is well indicated by the attempt to force the national government into undertaking prematurely the construction of a deep water-way from the Great Lakes to the Mississippi River by way of the Illinois River. The arguments so far advanced for such a water-way are partly good and partly bad, and are manifestly based on incomplete data. The Engineering Record cannot reconcile the enormous expenditure for constructing a ship canal from the Great Lakes to the Mississippi and then canalizing that stream to the Gulf for sea-going vessels, with any economical results which now seem likely to follow from the completion of a water-way of such magnitude. The effect of the diversion of an enormous amount of water from the Great Lakes to feed the upper portion of such a canal is a subject so vitally important to the existing lake commerce of the United States, to say nothing of the

Dominion of Canada, that the suggestion seems impracticable of fulfillment. Moreover, there is always the latent distrust of all arguments of this sort in the nominal interest of navigation on account of the manifest desire of a part of the people of Chicago to have the nation construct an enormous ditch carrying so much water to the Mississippi that the sewage of the city can be turned into it forevermore. Nevertheless, the complications and simplifications which mark this interesting subject as it passes from one stage to another may ultimately give it an entirely different appearance from what it now presents, and it is certainly the part of wisdom to maintain a mind open to conviction on all these great problems until the commission which is now studying them is able to make a report of the comprehensive nature which is essential for the basis of any satisfactory study.

The statements made by President Roosevelt concerning the value of water for irrigation, water supply and other purposes, deserves far more attention than they are likely to receive. At the present time very few citizens of the United States, other than those who have lived abroad and become familiar with public works there, have any idea of the value of pure water. Even to-day in a good many of our large cities it is a pretty expensive article. It is bound to become far more expensive, as the filtration of the supplies becomes more generally practiced and it is necessary to go farther for them. For this reason some measure of national supervision over the quality of water is highly desirable, for most of our large streams are of an interstate character and the control of their flow and the purity of their water rests with the people of no one state. The United States Supreme Court has decided, in the recent suit of Kansas against Colorado, that the national government cannot intervene to protect such streams under any authority now given to it by the Constitution, but this does not mean that government supervision cannot be arranged by the mutual consent of States or by some other indirect method which Congress may devise. The same consideration makes the pollution of water supplies of an interstate nature a problem of much complexity, the importance of which is hardly recognized at the present time. The President also points out the great value of many of our streams from a power development standpoint, something that has just begun to receive the consideration it deserves. All these hydraulic and sanitary aspects of our internal water-ways must be considered along with those of navigation, and the President has done well to call the attention of the nation to this inter-relation and its deep signficance to the country as a whole.

The Congestion of the Elevated Railroad Loop in Chicago.

The downtown union terminal loop of the four elevated railroads in Chicago has become so completely congested that it is entirely impossible to operate any of these roads satisfactorily during the rush hours. This congestion has been serious for several years and has been growing worse apace with the natural increase in traffic due to the rapid growth in the population of the districts served by the four lines. The recent opening of several new branches of the latter, which tap very populous districts, has required numerous additional trains to be passed around the already overcrowded downtown loop, with the result that long, tedious delays to traffic are occasioned for at least an hour and a half each morning and night. Under the existing conditions it is generally conceded by engineers familiar with the circumstances that no appreciable relief can be afforded to this situation which so seriously affects daily such a large population. As might be expected, however, a great volume of suggested solutions of the difficulty have been variously promoted through the local daily press, rivaling, indeed, in number and range of feasibility the methods which have been proposed to enable the Manhattan terminal of the Brooklyn Bridge to handle the traffic that has overwhelmed it for years during rush hours.

Several principal conditions, which it is apparently practicable to change, combine to limit the capacity of the loop to about half that which should be available immediately, to say nothing of provisions for the future. First of all, the trackage of the loop is totally inadequate to handle the trains from all four of the lines tributary to it. In the second place, the short platforms at the stations on the loop limit the capacity of the latter probably as much as any one condition. The arrangement of the connections between the tracks on the loop and the different roads is a feature that adds another great limit to capacity for handling trains. The present separation of the traffic of all four lines, thus preventing any possibility of routing trains through from one road to another, also precludes an increase in capacity that might be obtained otherwise.

The two tracks on the loop are each a trifle over two miles in length, the loop being five city blocks one way by seven the other, so the total trackage is close to four miles. The inadequacy of this amount of trackage to provide proper terminal facilities for the four roads using it may be indicated by the fact that during a period of one hour each day over 150 five-car trains are scheduled to enter and leave the loop. Each of these trains is required to discharge and receive passengers at ten different stations in the two-mile circuit of the loop. The result is that at the most crucial periods of the day both tracks of the loop are filled with trains spaced a few feet apart, and long lines of trains are held up on each of the four roads waiting to obtain an entrance. The most feasible method of providing greater trackage facilities for this great number of trains is generally believed to be the removal of the south end of the loop several blocks from the present location, as it is impracticable to move the other sides. At the same time, the right-of-way in the city streets for such a change could scarcely be acquired without a considerable outlay for damages to the abutting property, although the district through which the extension would pass has actually been greatly retarded by the fact that it is outside of the present loop. Various other means of securing additional trackage have been suggested by engineers familiar with the circumstances, most of which changes contemplate the construction of tracks within the loop, but such extensions are completely forestalled by local conditions.

The two platforms at each station on the loop are just long enough to serve simultaneously two five-car trains on each of the two tracks. Careful investigations have shown that if these platforms could be lengthened so two six-car trains might be accommodated the capacity of the loop would be increased at least 10 per cent. When an attempt was made some time ago to carry out this improvement, however, the property owners adjacent to the stations secured a permanent injunction which prevents any such additions, so advantage cannot be taken of this means of relief.

The necessary arrangement of the connections between the different roads and the tracks on the loop causes each train of the two roads which use each loop track to cross the other loop track either in entering or in leaving. The entrance and exit for two of the roads are at the same corner of the loop, while the other two roads each enter and leave at separate corners. Consequently, when the trains of one road are entering or leaving the loop they not only interfere with the trains of the two roads on the other track, but also hold up the trains of the other road which uses the same loop track. The switches at these connections are equipped with the most perfect apparatus available and the operators handling them are unusually proficient in their manipulation, so no further improvement in the present arrangement can be expected at these points. The separation of grades where a train on one loop track is required to cross the other track at the corners of the loop has been suggested, but the practicability of obtaining a clearance of at least 14 ft. in 400 or 500 ft. by inclines on an elevated structure over which such a large number of trains must be operated has been questioned. The through routing of the trains from one road to another would overcome a large part of the difficulty at these crossings, but as the four roads are separately owned such an arrangement is hardly feasible.

Three of the four roads using the loop, the Metropolitan West Side Elevated R. R., the Chicago & Oak Park Elevated R. R., and the South Side Elevated R. R., each have a stub terminal adjacent to the loop, and an ordinance was recently presented to the city council to permit the Northwestern Elevated R. R. to build such a terminal just across the Chicago River from the loop. The stub terminals of the first three roads have been built for some years, although none of them, except the one used by the Metropolitan, have been employed to any extent until recently. Notwithstanding this fact, all of these terminals are situated so passengers bound for certain parts of the loop district could save time by taking and leaving trains at them, and it may be expected that with the regular increase in traffic on the elevated lines that occurs in the Fall the congestion of the loop will become so acute as to cause the patrons of the different roads to appreciate the advantage of the stub terminals.

The only permanent relief of the elevated loop appears to be a system of subways in the downtown districts, such as has been proposed by Mr. Bion J. Arnold. The difficulties that will be encountered in building such subways, however, will unquestionably greatly postpone the time when they are placed under construction. The extensive changes that will have to be made in the public service mains and conduits that completely occupy the streets in the downtown district, and the handling of traffic on these streets during construction are simple matters, as compared with the shoring of the buildings adjacent to the excavations required for the subways. The soft blue clay that extends to a depth of 40 to 60 ft. from the surface over the whole area in which the most necessary subways will have to be constructed is an exceedingly treacherous material to handle. In fact, recent experiences in deep excavations for the sub-basements of tall buildings have shown that this clay will flow under any form of sheeting that can be devised unless this sheeting is carried down to the firm underlying strata before excavation is started. Since the freight tunnels of the Chicago Subway Co. occupy every downtown street at an average depth of 40 ft. below the surface, it is evident that subways for passenger service will have to be built above them in this soft, blue clay. At the same time, such subways are the only permanent means of relieving the present elevated loop, and as the capacity of the latter has long since been exceeded further extension of the various elevated lines tributary to it is useless. The utilization for residence purposes of the great undeveloped outlying districts within the city is limited largely therefore by the relief that can be afforded to the downtown terminals of the elevated railroads.

Coal Selection for Power Plants.

Possibly in no branch of power plant operation are there greater variations in the practice of owners and managers than in the selection of coal for steaming purposes. It is not surprising that this should be so, considering the differences in coal quality found in the open markets and in the mining regions, the discrepancies in freight rates, cost of handling, uncertain effect of storage, and variations in adaptability of fuels to specific boiler-room services. Within the last few years the determination of the heating power of coals by calorimeter and chemical tests has grown much in favor among large consumers, and there is no question that when such work is properly handled the results are of high significance and value, both to the engineer and the technical chemist. But when these tests are made by unskilled hands or with inferior apparatus, and unless the typical samples from barge and car are selected with experienced judgment, the work may be worse than futile, tending to produce warped judgments and decisions unjust alike to the producer and the consumer. These points were emphasized for the special benefit of engineers and public service corporations in a talk on coal economy given by Mr. E. G. Bailey, of the Little Laboratory, in Boston, before the Society of Chemical Industry on Oct. 4.

Emphasis from a chemist on the importance of coal tests by specialists may be *ex parte* judgment, but it hits close to the work when one considers the present uncertain status of the whole problem of fuel combustion. Reduction of fuel bills is one of the perpetual ends which power plant managers are striving to attain, and it is decidedly in fashion nowadays to carry on experiments in the fire room leading toward the use of less fuel by varying the conditions in the furnaces and flues. In some quarters, certainly, the great and encompassing difficulties of the problem do not seem to be realized, and hasty methods, careless observations and inaccurate generalizations have failed to bring the economies expected. It ought to be clear by this time that in the selection of coal for a given service, chemical tests should supplement the experience gained in the fire room, except in special cases where it would be simply out of the question to select other than a certain kind, as in the vicinity of particular mines. Even here much improvement in the situation may spring from a careful series of laboratory tests, particularly with reference to the betterment of firing conditions and furnace structures, draft adjustments and the like. The work may be done by the operating company itself if the organization can afford the quality of apparatus and the technical skill essential, otherwise, it had better be handled by a competent consulting chemist with special knowledge of fuels. To assume that any ordinary assistant steam engineer or electrician in a power plant is competent to sample coal in a representative way and accurately test its calorific power by the calorimeter or by proximate analysis is to invite conclusions that are void of scientific usefulness and are misleading as bases for the settlement of contracts and guidance in future purchases.

Almost any coal will produce steam, but economy in selection starts at the mine, makes certain that the handling is somewhere near right, and figures the transportation charges separately from the net cost of the fuel. Bad results often come from breaking the coal up more than is necessary, and it is not always the coal of highest calorific power which gives the best results in a given shipment. Variations in shipments make it most desirable for the purchaser to know exactly what he is getting. It is sometimes claimed that daily records of coal burned per kilowatt-hour are a sufficient check upon the quality of the fuel, but while such data are useful in running down both sweeping and gradual changes in station performance, they may easily come too late to give the necessary impetus to the required fuel changes. Undue reliance is frequently placed upon the weighing of ashes as a check upon coal quality, in view of the fact that the remaining unburned carbon and also the ashes carried up the stack by a strong draft are neglected. In a carefully made ash test cited by Mr. Bailey, the weight of ashes came short 5 to 10 per cent. of the total ash in the coal, after the unburned carbon was taken out. Under ordinary circumstances, where the carbon is not deducted, the ash frequently runs 25 per cent. higher than the coal analysis shows. As for the ability of the evaporative boiler test to throw a side light upon coal quality, there is no escaping the difficulty which attends the duplication of conditions in regard to firing while the variation of a single condition with the other factors constant is perhaps even more troublesome. Upon the calorimeter and the balances of the laboratory rest the ultimate determination of coal quality.

The diverse factors entering the problem of coal selection render the task a hard one for the layman. The interpretation of the analysis and British thermal unit record remains after the precise methods of the chemist have been applied. There is no question that the higher a coal shows in heat units, the more steam it will generate, other things being equal. It may not, however, be the best fuel for the particular plant in hand. The purchaser naturally desires to get as many heat units per dollar as possible, but there are other points to be considered in the selection of coal. A coal high in sulphur or a fine wet coal tends more readily toward spontaneous combustion and requires more careful watching. In the selection of coal it should be borne in mind that all coal will oxidize more or less, and that so long as the generation of heat can be kept from becoming cumulative, fire will not occur; but if the heat becomes sufficient to drive off the moisture, the danger point has been reached. A closer knowledge of the conditions which lead to spontaneous combustion in coal is much needed at the present time.

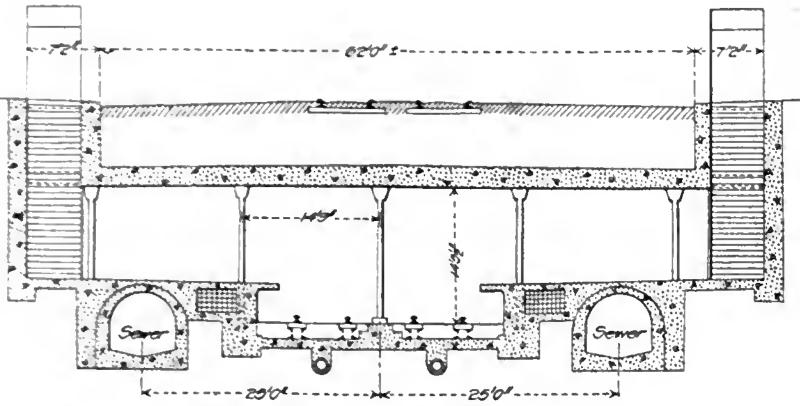
The problems of the boiler-room cannot be divorced from the questions of coal selection in finding out the fitness of a given fuel of known characteristic for a given plant. It is becoming clearer every year that the work of the chemist is but half done when the typical samples are tested. The boiler furnace, tubes, passes and flues are all parts of a laboratory on a large scale and to ignore this is to lose the vital conditions of a particular fuel problem. The cost of handling the coal from the barge to the grates is frequently under-figured. The interest of the fireman is often difficult to arouse unless it is backed up by a bonus for good records and assisted by good scales, a common-sense system of keeping consumption figures, and possibly by the pyrometer and CO_2 recorder. These points must be considered in testing the adaptability of a given coal in actual practice.

The only reason for buying coal on a B. t. u. basis is to make certain that a fair money value is secured on both sides. Coal specifications often set very high limits in calorific power, say, 14,000 B. t. u. as a minimum, and if a great variety of bids are desired this debars fuels which might be excellent for the purpose if investigated, or it possibly admits them under a penalty which artificially raises the price to a point high enough to give the coal dealer a good profit on top of the penalty. If coal of a certain known grade is desired, the limit in B. t. u. need not be as elastic. In cases of large consumption where a wide choice exists, the specification problem demands experience for its proper economical solution. Scientific methods of purchasing fuel do not cost much money in terms of their possible savings, but they must be carried out with skill and with first-class apparatus to be worth anything to the consumer.

Notes and Comment.

Specifications for Incandescent Lamps recently issued by one of the federal departments are interesting as being among the first, if not the first, to employ mean spherical candle power as a basis of comparison. The rating of the lamps called for remains on the mean horizontal candle-power basis, as is customary, but the initial specific consumption called for is 3.76 watts per mean spherical candle, corresponding to 3.1 watts per mean horizontal candle, when the spherical reduction factor is 82.5 per cent. There are many conditions in which increased candle-power in some particular direction is preferable to a nearly uniform distribution, as, for example, the case of a single incandescent lamp, without globe or reflector, suspended above a reading desk. In this case a type of lamp with powerful end-on candle-power with weakened horizontal intensity is preferable to a lamp of the usual type. No proper comparison of the two types of lamp would be possible on the basis either of end-on candle-power or of mean horizontal candle-power. The specification is an important recognition of improvements in lamps and the methods of using lamps, which is particularly significant as the result of long consideration of the subject by the government's staff.

A Contractor's Right to recover for work done under a contract subsequently taken from him has been before the federal courts for some time in an action by the Jonathan Clark & Sons Co. against the city of Pittsburgh. This company undertook to build the Highland Park reservoir in that city, but after carrying on the work for about three years was ordered by the Director of Public Works to discontinue any further construction under the contract. This order was issued in accordance with a contract provision giving the Director the right to stop the work if it was unnecessarily delayed or the contractor was wilfully violating any of the conditions. After the completion of the construction by other parties the contractor sued the city for retained percentages on what it had done and for extras. The city's defense was that no final estimate had been given the contractor by the Director and consequently nothing was due and that the contract specifically provided that the Director should act as an arbitrator in all disputes between the parties to the contract. The U. S. Circuit Court of Appeals has just upheld, 154 Fed. Rep. 464, a decision of the District Court in favor of the contractor. The items claimed by the contractor were sufficiently proved, it is stated, during the trial, and the provision for a final estimate did not apply when the contractor was put off the work. The arbitration clause is also held to be inapplicable in such a case. The city's action under the clause authorizing the Director to order the contractor to leave the work is held to provide impliedly for a determination of the rights of the parties by regular judicial proceedings. The case seems to be a rather unusual one, as shown by the fact that the editors of the "Reporter" could refer to nothing like it in the decisions of any court of final jurisdiction.



Second Street Station of the Market Street Subway.

THE MARKET STREET SUBWAY, PHILADELPHIA.

The Market St. Subway, about 2¼ miles long, is a very important portion of the system of the Market St. Elevated Passenger Ry. Co., the Philadelphia Rapid Transit Co. lessee. This system, as so far planned and authorized, includes about 7½ miles of two and four-track construction, equivalent to about 17 miles of single track. The main line follows Market St. about 6 miles from the Delaware River to 63d St., and east of 24th St., at the east end of the company's bridge over the Schuylkill River, being constructed in subways through the most congested part of the city. That portion of the subway extending from 24th St. to 15th St., together with about 4 miles of the elevated structure west of the Schuylkill River, has already been constructed and trains have been in service since March of the current year, though street cars from West Philadelphia have been running to 15th St. since December, 1905.

The remainder of the structure will consist of both elevated and subway construction, differing somewhat from that already completed, and is now under construction from 15th St., down Market St., to Front St., near the Delaware River, thence on property purchased by the company between Front and Water Sts. to Arch St. and thence along Delaware Ave. about 4,100 ft. to a terminal at the ferries at the foot of South St. Of this portion of the work that which is on Market St., about 1⅛ miles in length, is a two-track subway structure. That portion between Market and Arch Sts., comprising an incline to connect the subway and elevated railway, is partly a reinforced-concrete viaduct, the remainder on Arch St and Delaware Ave. being double-track elevated steel viaduct structure.

The subway between 15th St. and the Delaware River differs from that on the opposite side of 15th St., chiefly in that it is two-track instead of four-track, in the roof construction and in the methods employed in building it. Between 15th St. and 22d St. the subway, which was illustrated in The Engineering Record of February 25th, 1905, has a standard cross-section 48 ft. 6 in. wide inside and 14 ft. high above tops of rails, and is made with massive concrete side walls and inverts, the former reinforced with vertical and horizontal rods near the inner surface. The roof is made with transverse 5-ft. concrete arches reinforced over the tops of the beams only with wire cloth to prevent temperature and shrinkage of cracks, and supported on 20-in. I-beams carried by the sidewalls and by three intermediate rows of riveted columns. The structure was built in three successive longitudinal sections, the first two being made in open trench and including the side walls and part of the inverts to include the outside tracks. The excavation for the middle section of the structure was made by drifting and tunneling under the two surface tracks.

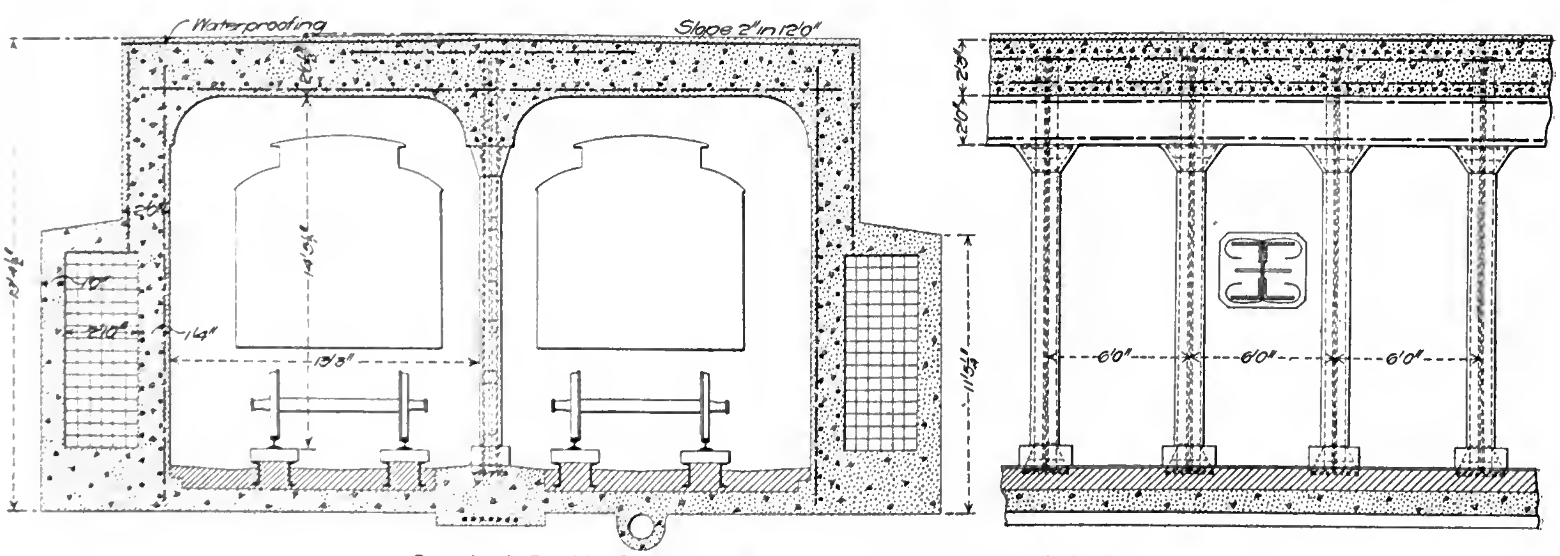
At its intersection with Broad St., between 13th and 15th St., the continuity of Market St. is interrupted by the City Hall, which occupies an area about 450 ft. square and approximately on its center line. It is an extremely heavy stone building, six stories high, with a tower about 538 ft. high, imposing very heavy loads on its foundations, on account of which, and the character of the soil, it was determined not to attempt to carry the subway underneath the structure, as is the rational alignment, but to diverge on both sides of it, thus forming a rectangular belt enclosing the City Hall, with substantially the same location as that of the present surface tracks. Provision is also made with this belt for connection with lines north and south on Broad St., and as the location was limited by the boundaries of City Hall Square, nearly all of the tracks are on curves with short tangents, which together with the cross-over switches and connections for future branches and provision for passing and connecting the express and local service, has made a very complicated construction which is too elaborate for other than a very general description in this article.

By "express" service is meant that of the trains which pass to and on the elevated railway, and "local" service includes that furnished by the street cars which enter the subway from the surface tracks in West Philadelphia.

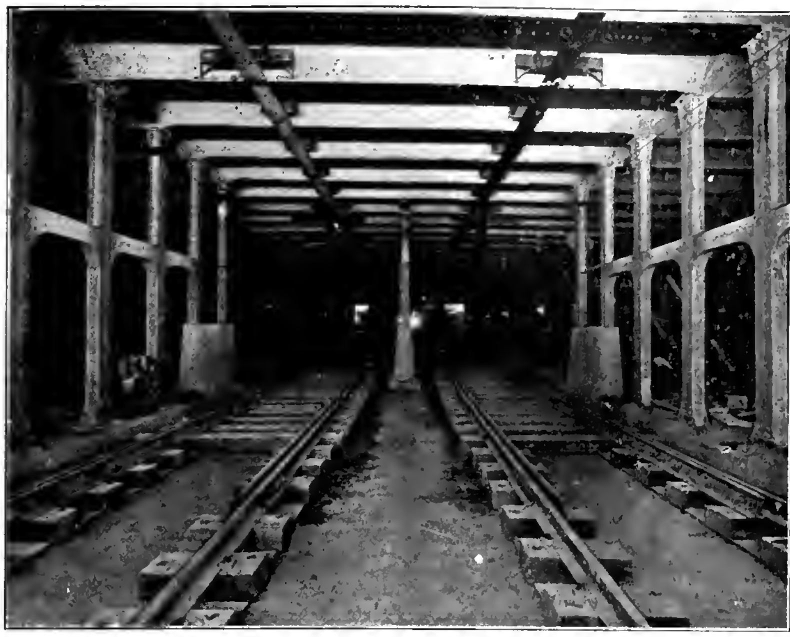
Between 15th and Broad Sts., the subway is about 70 ft. wide between outside passenger platforms and about 90 ft. wide between the main walls of the passenger station located there. The center tracks are used for express service and the outside tracks for local service, and both of them make a complete loop around City Hall Square, thus avoiding stub ends and providing for the continuous operation of trains in both directions from the 13th and 15th St. stations, respectively, to the terminals, and for looping the local cars about the City Hall, and as no provision is made in the subway for the local cars east of City Hall Square.

On the 13th St. side of City Hall Square the tracks for trains converge by curves through 90 deg. to meet the two tracks in the subway on east Market St., with switches and connecting track to allow the looping of trains from and to the tracks west of the City Hall. The tracks for the local cars on the east side of the City Hall run under the express tracks where the latter swing into the Market St. line. This arrangement provides for the express service to be continued on Market St., the east and westbound trains passing around City Hall Square, to the south and north, respectively. At both intersections with Broad St. there are two curved connections with the local tracks for future double-track subways in Broad St. The elevation of the express track varies from + 11 to + 17, that of the curb varying from about 34 to 41. The lowest elevation, about 0, is where the local tracks pass under the express tracks at Juniper St.

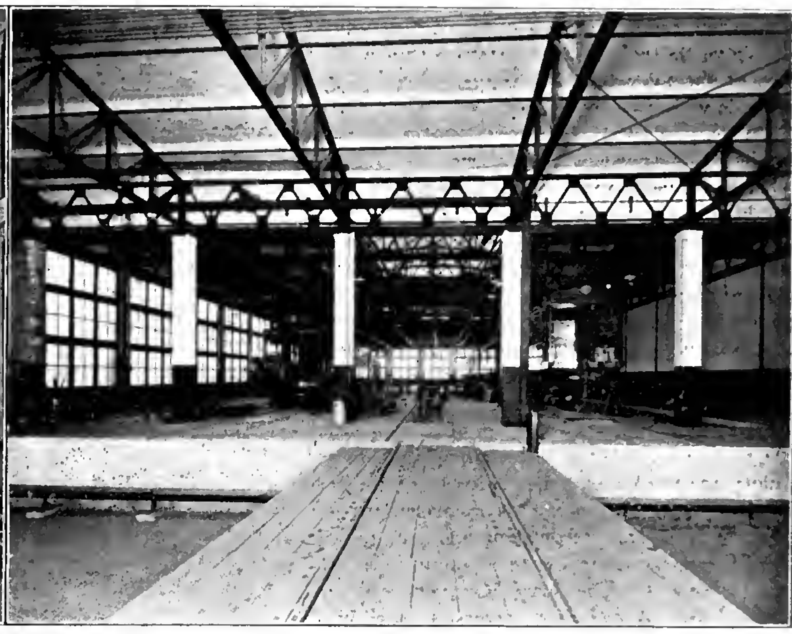
The subway has everywhere reinforced-concrete side walls and roof, the invert being reinforced below the ground water level, and is built with one row of columns where there are two tracks, the columns being omitted at the cross-overs. At the curved sections at the northeast and southwest corners of the City Hall Square, where the express and local tracks are at different elevations, there are no columns, and the roof is supported entirely by concrete wall S. The cross-section is everywhere rectangular and is a continuous integral structure whether the tracks are at the same or different elevations or in case of a cross-over or two-story track, and where there is a passenger subway underneath the track. Be-



Standard Double Track Construction, Market Street Subway.



Approach to 19th Street Station and Temporary Crossovers.



Car Repair Shop and Transfer Table at 69th Street.

tween the curved lines of Market and Broad Sts., at their intersection with City Hall Square, the walls of the subway form very large triangles and the roof is supported by a number of extra interior columns.

Besides the 15th St. station there are five others located at 13th and 11th, 8th, 5th and 2d Sts., all of them of the same general type with platforms having an effective length of 350 ft. on opposite sides of the two-track section and entrances on both sides of Market St. The station at 15th St. has four passages from the express platform to the street above the level tracks and below the street surface. It also has a direct entrance through the basement of the Broad St. station of the Pennsylvania Railroad. The 8th St. station, at the center of the retail drygoods district, is 400 ft. long over extreme end structures and is made with spacious platforms extending laterally to include the vaults under the sidewalks, thus increasing the width to 100 ft. The platforms are connected by two passageways over the tracks and below the street surface. The 5th St. station is about 80 ft. wide, and is of simple construction, with one row of columns between the tracks and two rows on each side of them, and has a large main sewer adjacent to each of the outside walls. The 2d St. station is about 80 ft. wide and is also made with five longitudinal rows of columns and has a 7½-ft. main sewer under each of the passenger platforms, manholes being provided for them at each end of the station.

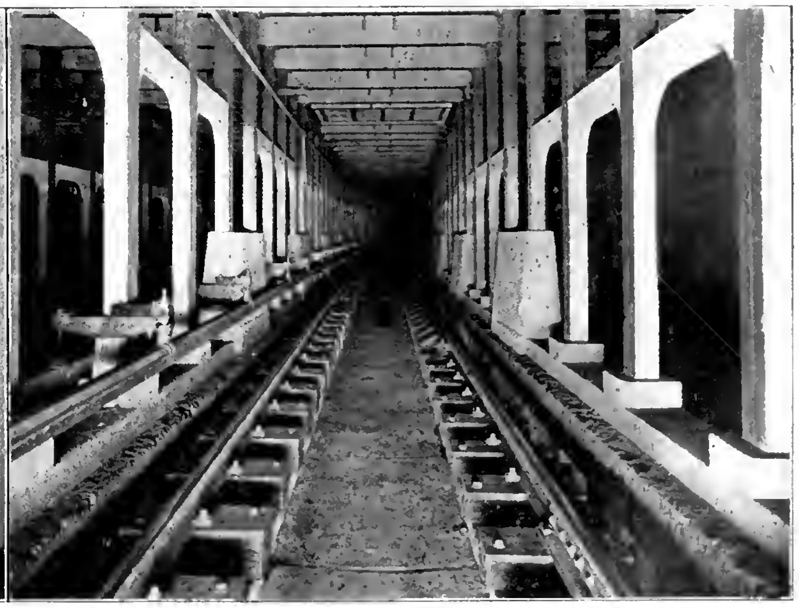
The standard double-track subway between 13th and 2d Sts. has a rectangular cross-section 30 ft. 6 in. out to out of walls and about 37 ft. wide over the duct construction, which varies in height above the floor and is 20 ft. deep over all with a flat concrete invert and reinforced-concrete vertical sidewalls and flat roof with a center row of riveted steel H-shaped columns 6 ft. apart on centers. The subway is 26 ft. 6 in. wide and about 15 ft. high inside with a longitudinal tile drain bedded in the concrete under the center of one track. Except under column footings, the invert is 11 in. thick, without reinforcement where above the ground water level. Below the ground water level the floor is thickened and reinforced to resist hydrostatic pressure.

The sidewalls are 2 ft. thick, except when they are enlarged, and have hollow spaces for the reception of the ducts, with vertical bars 12 in. apart and with horizontal bars 12 in. apart in two staggered rows near the inner and outer surfaces of the wall. The roof is reinforced with one tier of horizontal transversed rods 6 in. apart on centers extending the full width from sidewall to sidewall, 3 in. above the lower surface of the concrete. There are also horizontal longitudinal rods 12 in. apart in each of two staggered tiers, which are made in 30-ft. lengths overlapping 2 ft. at each end. Additional transverse bars, 12 ft. long, are placed over the tops of the columns, and six lines of bars are placed in the longitudinal concrete girder which forms an integral part of the roof in the planes of the columns. In each sidewall a rectangular space, the maximum size of which is 2 ft. 10 in. wide and 8 ft. high, is occupied by 96 electric ducts, the size of the space and the number of ducts varying along the line.

The corners between the roof and sidewall concrete have a concrete cove or fillet with a 2-ft. radius, and sockets are built in the roof to provide for the support of a possible future trolley wire. The columns are made with four 5x3-in. angles, and have four 6x⅜-in. tie plates besides the top and bottom web plates connected with the caps and bases, and are embedded in solid 10½x 14-in. concrete jackets. The concrete protection is reinforced and secured to the columns by ¼-in. bent rods like cotters through the column webs and by curved sheets of 3-in. mesh expanded metal wired on as indicated in the detail, and serves in place of usual web plates or latticing. The design of the track conforms to that installed in the subway on West Market Street, each rail being supported on 6x6-in. ties 2 ft. long and 2 ft. apart on centers, which rest on the tops of a pair of 12-in. channels 15 in. apart back to back bedded in 12-in. concrete laid over the top of the invert.

On curves and at crossovers pairs of columns are protected against collision and derailed trains

Local Track Section near West Portal.



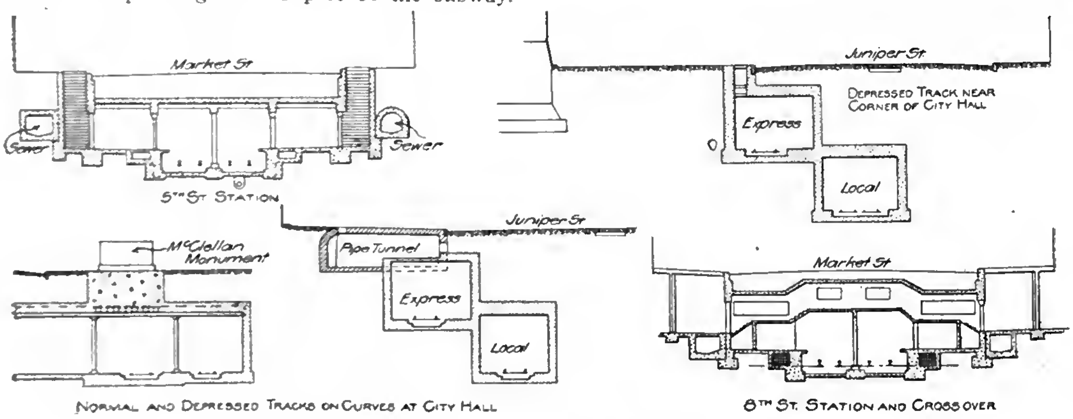
Express Track Section near West Portal.

by concrete piers enclosing them to a height of 4 ft. above the rail base and having a thickness of 18 in. at the top and 24 in. at the bottom. They are made with rounded corners and are reinforced with a pair of ⅜-in. horizontal rods forming a complete loop enclosing the columns.

On the curved portion of the subway about the City Hall the collision piers are 18 ft. apart on centers and the two unprotected columns between them, together with the adjacent end columns of each pier, are connected by a line of three continuous horizontal longitudinal concrete struts, about 6 in wide and 8 in. deep, engaging the webs of the columns at a height of about 8 ft. above the rail bed. Above these struts the columns are not concreted.

At cross-overs the center columns are omitted to clear the tracks, and the thickness of the roof slab is 3 ft. 1½ in., which is increased to 3 ft. 6½ in. by 1 in. of waterproofing and 3 in. of concrete protection over the waterproofing, for a clear span of 26½ ft. The span, however, is practically reduced by the deep covers at each wall, which act as continuous corbels. The reinforcement consists of two tiers of transverse rods, each tier 3 in. inside of the top and bottom of the main concrete, respectively, and three tiers of longitudinal rods, one in the center and one near each surface, inside of the transverse rods. The lower main rods are bent up at their ends, the spacing being 4 in. for the transverse rods.

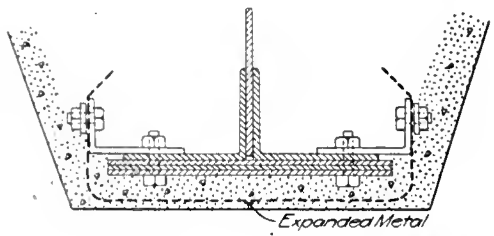
The shallow roof construction differs from the standard construction in that it is only 24½ in. thick and in that the tier of 12-ft. transverse rods is replaced by a tier of full-length transverse rods. The lower tier of transverse rods in the roof over the cross-overs has one 1.56 sq. in. cross-section, all other main transverse rods have 1 sq. in. cross-sections and all are of the twisted type. A layer of asphalted mastic waterproofing 1 in. thick is placed on the roof and is covered by a layer of concrete 3 in. thick. There is no other waterproofing in this part of the subway.



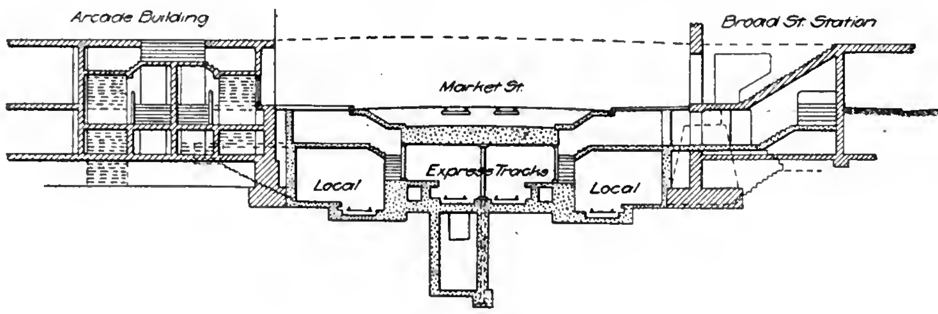
Subway Construction at Stations and on Curves.

The surface of the roof slopes 2 in. in 12 ft. from the center to each side.

The quantities involved per lineal foot in the construction of the standard two-track subway are as follows: About 38.1 cu. yd. of excavation, 7.8 cu. yd. of concrete, and 574 lb. of steel reinforcement, and 206 lb. of structural steel. The structure was designed by the Engineering Department of the Philadelphia Rapid Transit Co., Mr. Wm. S. Twining, chief engineer; Mr. C. M. Mills, principal assistant engineer. The contractors are the E. E. Smith Contracting Co. for the City Hall section, and the Millard Construction Co. for the section from the City Hall eastward toward the Delaware River.



Girder Flange Protection in Subway.



Four-Track Subway Station near City Hall.

A Diamond Drill Bore-Hole 6,700 ft. deep was put down in Upper Silesia in 1900, according to a note in The Engineering and Mining Journal. Another deep hole was put down on the Rand, South Africa, in 1905, the depth being 6,304 ft.

The Garbage Reduction Process at Toledo.

The garbage of Toledo, Ohio, is treated by the Edson reduction process, which furnishes two commercial products, grease and tankage. The garbage tankage is used by manufacturers of commercial fertilizers, and is sold at an average price of $9 per ton at the plant. The garbage grease is sold to soapmakers and brings about $80 per ton f. o. b. cars at the plant. The works have been under the charge of Mr. Thomas R. Cook as receiver during the past year, and at the recent meeting of the Central States Water-Works Association he read a paper concerning them, from which the following notes are taken. The fact that the company had to go into the hands of a receiver is a pretty strong commentary on the commercial aspect of garbage reduction under the existing local conditions.

The apparatus used in the process consists of hermetically sealed digesters, dryers and grease extractors. Two digesters and one dryer constitute what is known as a unit and are supposed to be capable of treating 20 tons of raw garbage every 24 hours. There are three units at Toledo, and consequently a total capacity of 60 tons in 24 hours. The delivery of garbage to the plant during summer months averages about 45 tons daily, and during the winter months about 30 tons daily, and consequently the plant has never been forced to its full capacity.

The raw garbage is delivered in steel wagon boxes, so constructed that a box can be picked up with an electric crane, hoisted to the fourth, or charging, floor, and there dumped into bins of concrete. The box is then thoroughly cleansed and cleaned by hot steam and returned to the wagon, the whole operation consuming less than five minutes.

The next step is to charge the digesters with this raw material, which is done through galvanized iron pipes running from the charging floor into the digesters on the floor below. When the digesters are filled they are sealed up, the steam is turned on, and the mass of garbage undergoes sterilization and disintegration for a period of about 9 hours. During this time the heat is regulated by air pressure upon the surface of the material, and no boiling occurs within. A valve is now opened and the mass is dropped through a sleeve into the dryer waiting to receive it. It is dried by external steam heat and the maintenance internally of a vacuum during the drying process, which lasts about 12 hours. The original mass of material is now dry and is discharged automatically from the dryer in the form of unpercolated tankage, or, in other words, tankage from which the grease has not been extracted.

During the entire process up to this stage this material has been under steam pressure and not once exposed to the air. All foul gases that arise during the operation are passed through a deodorizer for that purpose, and thence into the combustion chambers under the boilers. The unpercolated tankage is now conveyed by means of elevators and conveyors to the third floor of the grease extracting department, where it is ready to be put through the percolating process, which consists of cold filtration, using naphtha as a solvent. The material is fed through a galvanized iron pipe into the percolators, of which there are two, each having a capacity of about 5 tons of unpercolated material every 12 hours. The percolator being filled, it is then sealed, and naphtha pumped into it until the material is entirely flooded. It is allowed to stand for a certain length of time, and the naphtha and grease together are pumped out and into separating tanks, which are provided with mushrooms heated enough to vaporize the naphtha, which is conducted through vapor lines to the condensing tank, changed into liquid form and used again. The grease is then pumped into storage tanks. This process is repeated until the whole mass of material in the percolater is thoroughly percolated and the grease entirely removed.

The material is now ready to dry, which is accomplished in the same receptacle by external steam heat, thorough agitation and the maintenance of a vacuum. The dry tankage is now discharged automatically from the percolater and taken by means of an elevator and conveyors to the storage room, where it is ready to be shipped out for use in the manufacture of fertilizers. The percolating process consumes from 6 to 7 hours and the drying from 4 to 5 hours.

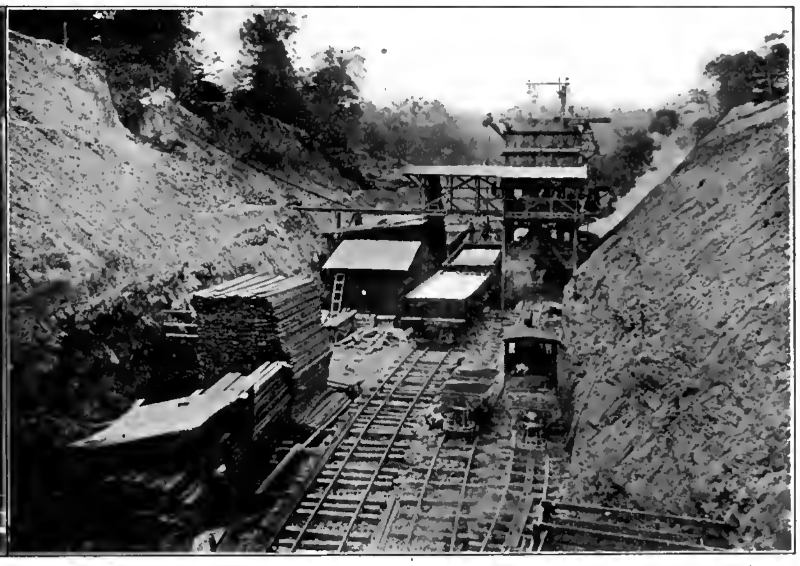
Using as a basis the class of garbage received in Toledo, which is not of the best, the amount of finished tankage from raw garbage is about 17 per cent. and of grease is about 3 per cent. This system will handle dead animals, bones and anything in the way of organic matter, in addition to garbage.

Lining a Tunnel With Concrete.

The Jasper-French Lick extension of the Southern Ry. in the southern part of Indiana includes a single-track tunnel, 2,200 ft. long, at a point about 4 miles from French Lick. The tunnel is on a 4-degree and 30-minute curve for 300 ft. at one end, with the remaining 1,900 ft. on tangent. It was driven through slate and soapstone rock, which had to be closely timbered throughout as the headings advanced from both ends. The timbering used in the tunnel consisted of local beech, the intention being at the time it was finished, about a year ago, to line the tunnel from end to end with concrete. The placing of this concrete lining was started in June of this year, and from the results that have thus far been attained, it is reasonable to expect that it will be completed by October 31, although the work had to be shut down for a month, and the slow delivery of concrete materials occasioned considerable delay while it was in progress.

The dimensions of the tunnel and the details of the lining are shown in the accompanying cross section. The tunnel was driven to a clear width of 21 ft., and a height of 26 ft. 3 in. at the center line, both measured to the outside limits of the timbering. Inside the latter the clear height at the center line was 24 ft. above the sub-grade, and the clear width 18 ft. After the concrete lining is placed, the clear width is 16 ft. and the clear height above the rail is 22 ft. at the center line, the arch being semi-circular, with a rise of 8 ft. The timbering consists of 10x12-in. uprights, spaced 3 ft. apart on centers, and carrying 10x12-in. horizontal wall-plate timbers, on which are placed 10x12-in. arch ribs, also set 3 ft. apart on centers. The upright timbers are on 3x12-in. sills, and are lagged with 3x6-in. plank, while the arch ribs are lagged with 4x6-in. plank.

Looking toward Tunnel Portal from Mixing Plant.



Looking toward Mixing Plant from Tunnel Portal.

The concrete lining has a floor approximately 14 in. thick, that is laid on the sub-grade of the tunnel. The track ballast is confined between two concrete curbs, 12 in. high. These curbs are built as a part of the floor, and are 1 ft. 10 in. from the side walls, thus forming a drain, 1 ft. x 1 ft. 10 in. in cross section, at each side of the tunnel. Weep holes, consisting of 3-in. vitrified tiling, spaced 20 ft. apart in the base of the side walls, open into these side drains. The side walls of the lining are 2 ft. thick, the arch decreasing from 2 ft. in thickness at the springing lines to 18 in. at the crown. The side walls and arch are reinforced, 3 in. from each face, with a row of 3/4-in. Johnson corrugated bars, spaced as shown in the cross section. The timbering is enclosed in the concrete lining, the reinforcement bars being arranged to avoid it. The lining requires 4.132 cu. yd. of concrete and 181.45 lb. of Johnson bars per linear foot of tunnel. The concrete was made in the proportions of 1 of Lehigh cement, 2 1/2 of sand and 5 of crushed stone. Screened crushed stone, all of which would pass a 2-in. ring and be retained on a screen with 1/2-in. meshes, was used.

The concrete lining was all carried forward from one portal of the tunnel. A complete plant for handling and mixing the concrete materials was erected near that portal, and a very satisfactory arrangement for delivering the concrete from this plant into the forms for the lining was developed. The concrete materials and other supplies were brought to the tunnel in standard-gauge cars, operating over the track that had been laid to French Lick.

The plant for handling and mixing the concrete materials was about 200 ft. from the adjacent portal of the tunnel. A low, temporary trestle, 500 ft. long and carrying an 18-ft. gauge track, was placed back of the mixing plant, in the cut which forms the approach to that portal. This trestle was 20 ft. to one side of the standard-gauge track laid in the cut, the space between it and the track being floored over, so sand and stone could be stored on it. A stiff-leg derrick and a hoisting engine were mounted on a platform traveling on four double-flanged wheels on the wide-gauge track on the trestle. This derrick has a 65-ft. boom carrying a 1-yd. orange-peel, or a 1 1/2-yd. clam-shell Hayward bucket. This boom, with the travel of the platform, gave the derrick a range for unloading sand and stone from gondola cars on the track to the storage piles, or directly to two 20-yd. supply hoppers at the foot of two inclined bucket elevators, which raised the materials to storage hoppers of the mixing plant. The sand and stone stored in the piles at the side of the trestle were loaded into 2-yd. dump cars on a narrow-gauge track at the same level as the trestle track, with the orange-peel bucket, and were delivered to the supply hoppers of the elevators by these small cars. During most of the time that work was in progress, however, crushed stone could not be obtained fast enough to permit any accumulation in storage piles, so most of the stone was unloaded from the cars directly into the supply hoppers of the elevators by the derrick.

The concrete mixing plant was erected on the same side of the track as the trestle carrying the traveling derrick. Two storage bins, with a capacity of 85 cu. yd., one of which was for sand and the other for stone, were placed on a timber tower, with their bottoms 25 ft. above the grade of the track. One of the bucket elevators delivered sand to one of these bins, and the other carried stone to the second bin. A working platform on which the concrete materials were measured in a charging hopper, was built directly under the storage bins. A shed for storing cement was erected on the opposite side of the track from the mixing plant, because no other space was available. The cement was raised from this shed to a bridge over the main-line track by a bag elevator, the bridge extending to the charging platform under the storage bins. The bags of cement were delivered on a flat car by the elevator, and were carried to the charging hopper on this car, which ran on a track on the bridge.

A 1 1/2-yd. cubical concrete mixer was placed directly under the hopper in the charging platform, the mixer engine being at the level of the track. The mixer was set high enough so 1 1/2-yd. Koppel dump cars could be run under it on a 3-ft. gauge track. This track was extended through the tunnel, to facilitate the delivery of the concrete.

The floor of the tunnel lining was laid first, the work being started at the portal farthest from the mixing plant. The concrete was delivered to place in the 1 1/2-yd. dump cars, which were handled by a light locomotive. As the floor was carried toward the portal at the mixing plant, the 3-ft. gauge track that had been laid in the tunnel was raised and suspended from timbers placed across the latter until the concrete had set. When the floor had been finished, a standard-gauge track was laid on it, with a third rail for the narrow-gauge track, and work was started on the side walls.

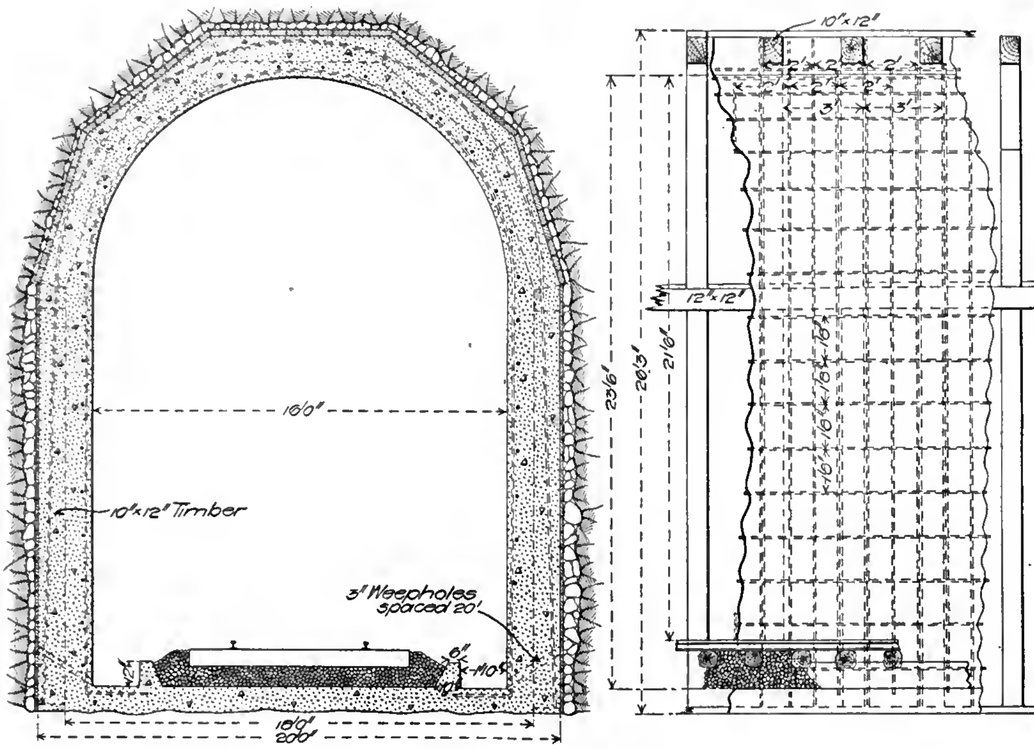
A special arrangement for handling the construction of the side walls and arch, which proved specially advantageous, was adopted. Two standard-gauge flat cars were attached together, end to end, and far enough apart so a working platform about 100 ft. long could be erected on them. This platform was made just wide enough so it would comfortably clear the forms for the side walls of the tunnel, and was placed at such height that concrete could be shoveled from it directly into the wall forms, up to the springing lines of the arch. An incline, about 60 ft. long, extending from the level of the standard-gauge track to the platform on these cars, carried a 3-ft. gauge track, which was continued the full length of the platform. This incline was built with a trussed under-frame, carried, independently of the cars, by two pairs of wheels. It was attached to the platform at the upper end by heavy hooks, and was arranged with a de-

tachable section at the lower end. The loaded 1½-yd. Koppel cars were brought to the foot of the incline from the mixing plant by the light locomotive, which also pulled them up the incline by means of a cable rove through a block anchored on the working platform. The concrete was dumped on the platform from the cars, and was then shoveled down into the wall forms, the tops of the forms being at about the same level as the working platform. The walls were finished for about 100 ft. to the full height in this manner while the cars were in one position. The portable section of the incline was then removed, and the incline and platform cars were moved along to the next length of the wall by the light locomotive. As the cars were merely blocked in position while concrete was being placed, they could be moved ahead without interrupting the progress of the work more than a few minutes.

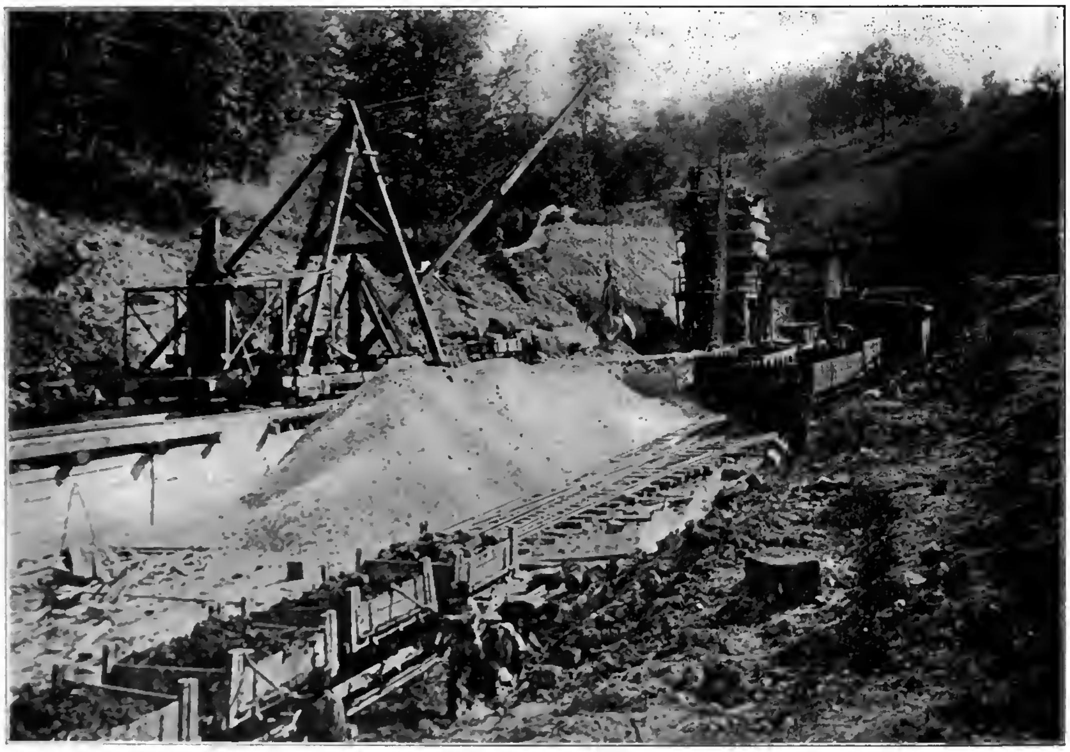
The forms for the side walls had 4x6-in. uprights, spaced 3 ft. apart on centers. These uprights were reinforced at the center by a 6x6-in. waling, which was attached to the plumb posts of the timber lining with lag bolts extending through the concrete wall; they were also attached to the timbering at the top by short pieces of plank, and were lagged with 2x12-in. plank, dressed on one side. The wall forms were allowed to remain in place at least 48 hr., after which they were carried ahead to be used again.

After the side walls had been completed, the platform on the two flat cars was raised until the 1½-yd. dump cars, when in a dumping position, would just comfortably clear the forms for the arch. Concrete work on the latter was then started at the portal distant from the mixing plant and was carried forward toward the other portal. The forms for the arch had 6x12-in. ribs, cut to conform with the curve of the arch intrados. These ribs were carried at each end on a horizontal 6x12-in. timber resting on 6x6-in. posts erected against the side walls already completed. A 6x6-in. waling timber was also placed along the foot of the ribs on each side of the arch, and was anchored to the timber lining by lag bolts, so the ribs were sustained without cross braces in the tunnel. The lagging of the arch ribs consisted of 2x6-in. plank in 6-ft. lengths. These plank were carried up on the sides of the arch just ahead of the concrete, until a space 18 in. wide was left at the crown of the arch. Lagging in 3-ft. lengths was then used to finish out the forms at this opening, the closing section of concrete being shoveled from the platform into place from the end of each 3-ft. section. Work on the arch was carried on day and night, in order that the closing section could always be placed before the concrete in the balance of the arch had set. An electric lighting plant was installed to expedite the night work, and also the work in the interior of the tunnel. The ease with which the working platform could be moved, the opportunity to handle the concrete work rapidly and the absence of any cross braces in the tunnel greatly reduced the number of men required and facilitated the progress of the work.

The general contract for the construction of the Jasper-French Lick extension of the Southern Ry. was awarded to MacArthur Bros. Co., of Chicago, which company built the tunnel and erected the timber lining. The concrete lining is being placed, under a sub-contract, by the Cullen-Friestedt Co., of Chicago, the plant and methods described herewith having been developed by the latter company. Mr. J. B. Anderson was engineer in charge for the railway company.



Cross Sections of Concrete-Lined Tunnel on Southern Railway.



Traveling Derrick for Handling Concrete Materials from the Cars.

Economy Tests of a 7500-Kw. Westinghouse-Parsons Turbine.

The following data comprise the principal results obtained on Sept. 1, 1907, during an 8-hour economy test upon turbine No. 253, installed earlier in the year, at Waterside Station No. 2 of the New York Edison Co. This test was conducted entirely by the New York Edison Co., under the direction of Mr. J. P. Sparrow, chief engineer. The various arrangements therefor were carried out in accordance with a mutual agreement between builder and operator, entered into previous to the test, and the results, as herein given, were obtained by independent computation.

The turbine unit tested is of standard Westinghouse construction throughout. It has a maximum rated capacity of 11,250 kw., and was built to operate on 175-lb. steam pressure, 28 in. vacuum and 100° superheat. Under these conditions, the turbine unit was guaranteed to have a minimum steam consumption of 15.9 lb. per kilowatt hour at the generator terminals with a normal speed of 750 r. p. m. Incidentally, the electrical efficiency of the generator was guaranteed to be 97.8 per cent., exclusive of friction and windage, at a load corresponding to that sustained during the test. The results of the test detailed below show an economy about 7.5 per cent. better than the guarantee.

During the test period, No. 2 Waterside Station sustained practically all of the 25-cycle load on the system, of which the unit under test carried practically 70 per cent., the remainder being taken by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test, the maximum variation in load was held within 4 per cent. above and below mean. During the last hour, however, the load decreased somewhat. Previous to the test, this turbine unit had been running on a load of 7,000 kw., which was increased to its test load ten minutes before the start of the test.

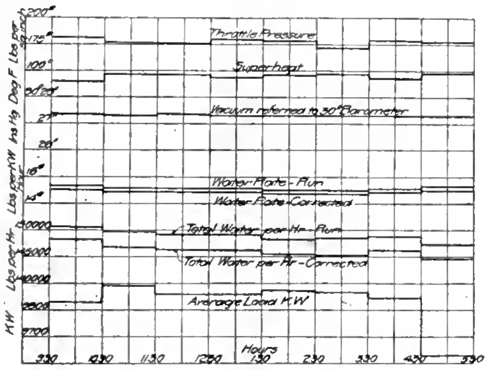
Three-phase electrical load was measured by the two-wattmeter method, using two Weston indicating wattmeters of the standard laboratory type. These instruments were calibrated at the

New York Electrical Testing Laboratories immediately before and after the test. Power factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot well. This condensation was weighed in a tank mounted upon platform scales, with a reservoir above large enough to hold the condensation accumulating between each weighing, the arrangement being shown in the accompanying sketch. These weighings of 12,000 to 13,000 lb. each were made at intervals of five minutes.

By the loop method of connecting the gland water supply, shown in the attached sketch, the necessity for correcting condensation by an amount equivalent to the weight of the gland water used is avoided. It will be noted that a continuous gland water circuit is used entirely outside of the weighing apparatus, and that all overflow from the standpipe returns to the hot well delivery.

As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which



Log of Turbine Test.

should be pure distilled water. On this account, condenser leakage was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed steam could be taken at the same time, this method made it possible to discover any change in the rate of condenser leakage taking place during the test, while the method of weighing above described provides only an average result during the period.

In this condensing plant, the delivery of the hot-well pump is automatically controlled by a float valve in the interior of the hot well. This maintains the water level therein at a practically constant point, and hence no correction had to be made for difference in level of water in the hot well before and after the test.

Steam pressures and temperatures were determined close to the turbine throttle. As usual, the degree of superheat was obtained by subtracting from the actual steam temperature the temperature of saturated steam at the corresponding pressure carried at the time. All gauges and themometers were calibrated previous to the test at the U. S. Testing Bureau. It will be noted that both pressure and superheat were somewhat below the guarantee.

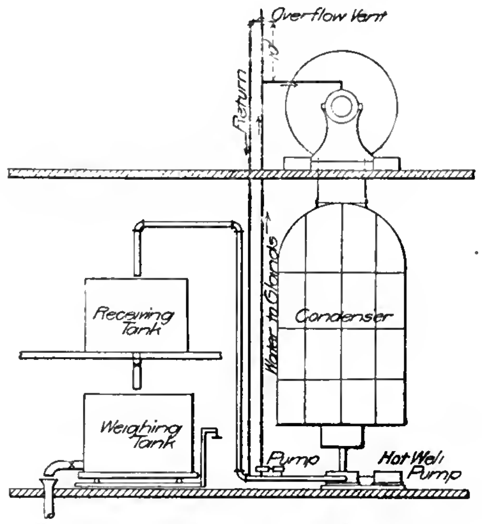
Vacuum was measured directly at the turbine exhaust by means of a mercury column with a barometer alongside for reducing to standard barometer, 30 in. This also obviated the necessity for temperature correction between the two mercury columns. During the test the vacuum was not maintained quite up to normal.

The following data represents the average results of the tests, calculated for the conditions as actually run; i. e., for instrument errors only: Duration of test, 9.30 a. m. to 5.30 p. m.; steam pressure at throttle, pounds per square inch gauge, 177.5; superheat at throttle, deg. F., 95.74; vacuum (referred to 30" barom.) in mercury, 27.31; load on generator, kw., 9830.48; steam consumption, as tested, pounds per kw. hour, 15.15.

Owing to the departure, during the test, from specific operating conditions upon which guarantees were based, it was necessary to correct the observed results by the following amounts:

Pressure (2.5 lb. high) correction, 0.25; vacuum (0.69 in. low) correction, 1.84 per cent.; superheat (4.26° low) correction, 0.29 per cent.

These corrections were mutually agreed upon previous to the test as representative of this type of turbine. When applied to the observed steam consumption given above, the following results, representing contract conditions, are obtained:



Method of Weighing Condensation.

Average corrected water rate during 8-hour test, 14.85 lb. per kw. hr.; guaranteed water rate, 15.9 lb. per kw. hr.

Referring now to the accompanying log, it is interesting as a check upon the average figures above presented, to observe the results segregated into hourly periods, as shown. Here it will be noted that the load was considerably lower during the first and last hour than during the main part of the test. Neglecting, therefore, these two hours and considering only the six hours period from 10.30 a. m. to 4.30 p. m., the results are as follows: Average corrected water rate, 14.8 lb. per kw. hr.; equivalent water rate, 10.65 lb. per bhp. hr., or 9.8 lb. per ihp. hr. The two latter quantities are determined by applying conversion factors for generator efficiency and for internal losses.

In connection with these tests, a noteworthy agreement exists between the results noted and those previously obtained from tests of machines of similar design installed in the Manhattan Station of the Interborough Rapid Transit Co., New York, and the Long Island City Station of the Pennsylvania R. R. At the same loads and with equivalent operating conditions, the performance of the machines is almost identical. These economic results, while not exceeding in actual steam consumption the best records of European practice, yet are extremely good in view of the moderate operating conditions under which the test was conducted. In fact they are considered by the builders to represent the best results that have yet been obtained by any turbine under the conditions named.

The Government of Formosa is organizing an irrigation bureau and has sent an engineer to study methods of the U. S. Reclamation Service.

Concrete Work at Charles River Locks.

The locks in the Charles River dam at Boston are being constructed by the Holbrook, Cabot & Rollins Corporation, and in the last report of Mr. Hiram A. Miller, chief engineer of the commission in charge of the work, there are some notes concerning the manner in which the concrete was handled. Gravel from the harbor and Shirley Gut was brought by scows and dumped in the river bed at one end of the coffer-dam surrounding the site of the locks. From there it was raised by an orange peel bucket to a 16 x 14-ft. hopper, with its top about 70 ft. above the bottom of the lock. From this hopper the material passed over four screens set at an angle of 1 to 12, which separated it into sand and stones which were deposited in bins of 120 and 200 cu. yd. capacity. Below the bins were the measuring hoppers for getting the proper quantity of sand and gravel. After leaving the hoppers, the sand and gravel passed to a 24-in. belt conveyor about 90 ft. long, which carried the mixture, together with the proper amount of cement, to a hopper over a cubical mixer holding a little over 2 cu. yd. From the mixer the concrete was dumped into bottom-dumping boxes holding about 2 cu. yd., mounted on trucks running on a track and operated by an endless cable.

The boxes were handled by a bull-wheel derrick on a platform at the elevation of the top of the lock walls, and carried on wheels running on rails laid on heavy timbers on each side of the bottom of the lock. The forms for the side walls of the lock were 40 ft. long and about 30 ft. high, and were built of 3-in. plank planed one side to even thicknesses. These forms were hung from a traveler 30 ft. high and 40 ft. long, running in advance of the movable derrick on the same rails.

The specifications provided that the lock should be built in sections not exceeding 40 ft. in length, and the ends of the sections were to have an offset or projection 6 in. in width, to form a water-stop. The ends of these sections were covered with two layers of tar paper applied with a hot mixture of coal-tar pitch, which was first spread over the surface of the concrete, then between the layers of tar paper, and finally over the entire surface of the tar paper joint.

The proper mixture and thickness to use for facing the side walls required considerable attention, and experiments were made to determine what proportions made the most impermeable concrete. From their results and from information obtained elsewhere, it was decided to use a 6-in. layer of 1 : 1 : 2 concrete for the facing. This was changed to a 1 : 3 mortar, after the results of further experiments were known. This facing was carried up with the other concrete for the side walls, the 6-in. space being maintained by a steel diaphragm 12 in. high and about 10 ft. long, with spacers 6 in. long at each end and one in the middle to keep a uniform distance from the forms. As soon as the facing was placed, the diaphragm was removed and the mortar and backing spaded together to make sure of a good bond, and strips of No. 16 gauge, 3-in. mesh, expanded metal, 12 in. wide, were placed horizontally in the soft concrete 1 to 2 ft. apart, in order to prevent the facing from separating from the main portion of the wall.

A Private Car Service for disposing of ashes and for hauling coal from Lake Michigan to its plant at West Allis, Wis., has been undertaken by the Allis-Chalmers Co. All-steel bottom-dumping coal cars and side-dumping ash cars of 50 tons capacity have been placed in service on the company's private tracks. The coal cars are loaded direct from vessels at the docks on Lake Michigan, and the ashes are used for filling and ballast.

The President's Message on Hydraulic Engineering Works.

In his speech at Memphis on Oct. 4. President Roosevelt took occasion to state the views of the administration concerning the improvement of the hydraulic resources of the country. On that day the National Waterways Convention, attended by the governors of sixteen States and by many men prominent in public affairs, held its first session. In his introductory remarks the President asserted that the Mississippi Valley is better adapted to the development of inland navigation than any other valley in either hemisphere, for there are 12,000 miles of waterway now more or less fully navigable, and the conditions are so favorable that it will be easy to increase the extent of navigable waterways to almost any required degree by canalization. Early in our industrial history this valley was the seat of the largest development of inland navigation in the United States, and the President stated that the first steamboat west of the Alleghenies was built by a Roosevelt, his great-grandfather's brother, in 1811, for the New Orleans trade, and in that year made the trip from Pittsburg to New Orleans. But from various causes river and canal transportation declined all over the United States as the railroad systems came to their full development. It is our business to see that the decline is not permanent, and it is of interest to remember that nearly a century ago President Madison advocated the canalization of the Mississippi.

The great variety of natural resources and the extent of the manufacturing interests in the Valley render its welfare a matter of national concern, and the Mississippi River and its tributaries ought therefore to be utilized to their utmost. Facility of cheap transportation is an essential in our modern civilization, and we cannot afford any longer to neglect the great highways which nature has provided for us. These natural highways, the waterways, can never be monopolized by any corporation. They belong to all the people, and it is in the power of no one to take them away. Wherever a navigable river runs beside railroads the problem of regulating the rates on the railroads becomes far easier, because river regulation is rate regulation. When the water rate sinks, the land rate cannot be kept at an excessive height. Therefore, it is of national importance to develop these streams as highways to the fullest extent which is genuinely profitable. Year by year transportation problems become more acute, and the time has come when the rivers really fit to serve as arteries of trade should be provided with channels deep enough and wide enough to make the investment of the necessary money profitable to the public. The national government should undertake this work. Where the immediately abutting land is markedly benefited, and this benefit can be definitely localized, the President hoped that there will be careful investigation to see whether some way can be devised by which the immediate beneficiaries may pay a portion of the expenses—as is now the custom as regards certain classes of improvements in our municipalities; and measures should be taken to secure from the localities specially benefited proper terminal facilities.

We should act on the same principle in improving our rivers that we should follow in improving our harbors. The great harbors are of consequence not merely to the immediate localities, but to immense stretches of country, and the same is true of the great rivers. It is these great rivers and great harbors the improvement of which is of primary national interest. The main streams should be improved to the highest practical degree of efficiency before improvements are attempted on the branches, and work should be undertaken only when completion is in sight within a reasonable time, so that assured results may be gained and the communities affected depend upon the improvements. Moreover, as an incident in caring for the river so that it may become an efficient channel of transportation, the United States government should do its full part in levee building, which, in the lower reaches of the river, will not only give a channel for commerce, but will also give protection to the adjacent bottom lands.

Immense sums have already been spent upon the Mississippi by the states and the nation, yet much of it remains practically unusued for commerce. The reasons for this fact are many. One is that the work done by the national government at least has not been based upon a definite and continuous plan. Appropriations by Congress, instead of assuring the steady progress and timely completion of each piece of work, as it was undertaken, have been irregular and uncertain. As a direct consequence, far-reaching plans have been discouraged and continuity in execution has been made impossible. It is altogether unlikely that better results will be obtained so long as the method is followed of making partial appropriations at irregular intervals for works, which should never be undertaken until it is certain that they can be carried to completion within a definite and reasonable time. Planned and orderly development is essential to the best use of every natural resource, and to none more than to the best use of our inland waterways. In the case of the waterways it has been conspicuously absent. Because such foresight was lacking the interests of our rivers have been in fact overlooked, in spite of the immense sums spent upon them. It is evident that their most urgent need is a far-sighted and comprehensive plan, dealing not with navigation alone, nor with irrigation alone, but considering our inland waterways as a whole, and with reference to every use to which they can be put. The central motive of such a plan should be to get from the streams of the United States not only the fullest but also the most permanent service they are capable of rendering to the nation as a whole.

The industries developed under the stimulus of the railroads are for the most part permanent industries, and therefore they form the basis of future development. But the railroads have shown that they alone cannot meet the demands of the country for transportation, and where this is true the rivers should begin to supplement the railroads, to the benefit of both, by relieving them of certain of the less profitable classes of freight. The more farseeing railroad men realize this fact, and many of them have become earnest advocates of the improvement of the Mississippi, so that it may become a sort of inland seaboard, extending from the Gulf far into the interior, and the President hopes ultimately to the Great Lakes. An investigation of the proposed Lakes-to-the-Gulf deep waterway is now in progress under an appropriation of the last Congress. We shall await its results with the keenest interest. The decision is obviously of capital importance to our internal development and scarcely less so in relation to external commerce.

This is but one of the many projects which it is time to consider, although a most important one. Plans for the improvement of our inland navigation may fairly begin with our greatest river and its chief tributaries, but they cannot end there. The lands which the Columbia drains include a vast area of rich grain fields and fruit lands, much of which is not easily reached by railways. The removal of obstructions in the Columbia and its chief tributaries would open to navigation and inexpensive freight transportation fully two thousand miles of channel. The Sacramento and San Joaquin rivers with their tidal openings into San Francisco Bay are partly navigable now. Their navigation should be maintained and improved, so as to open the marvelously rich valley of California to inexpensive traffic, in order to facilitate both rate regulation and the control of the waters for other purposes. And many other rivers of the United States demand improvement, so as better to meet the requirements of increasing production from the soil, increasing manufacture, and a rapidly growing population.

While thus the improvement of inland navigation is a vital problem, there are other questions of no less consequence connected with our waterways. One of these relates to the purity of waters used for the supply of towns and cities, to the prevention of pollution by manufacturing and other industries, and to the protection of drainage areas from soil wash through forest covering or judicious cultivation. With our constantly increasing population this question becomes more and more pressing, because the health and safety of great bodies of citizens are directly involved.

Another important group of questions concerns the irrigation of arid lands, the prevention of floods and the reclamation of swamps. Already many thousands of homes have been established on the arid regions, and the population and wealth of seventeen states and territories have been largely increased through irrigation. Yet this means of national development is still in its infancy, and it will doubtless long continue to multiply homes and increase the productiveness and power of the nation. The reclamation of overflow lands and marshes, both in the interior and along the coasts, has already been carried on with admirable results, but in this field, too, scarcely more than a good beginning has yet been made. Still another fundamentally important question is that of water power. Its significance in the future development of our whole country, and especially of the West, is only just beginning to be understood. The plan of the city of Los Angeles, for example, to bring water for its use a distance of nearly 250 miles—perhaps the boldest project of the kind in modern times—promises not only to achieve its purpose, but in addition to produce a water power sufficiently valuable to pay large interest on the investment of over $23,000,000.

Hitherto such opportunities for using water to double purpose have not always been seized. Thus it has recently been shown that water enough is flowing unused over government dams, built to improve navigation, to produce many hundreds of thousands of horsepower. It is computed that the annual value of the available but unused water power in the United States exceeds the annual value of the products of all our mines. Furthermore, it is calculated that under judicious handling the power of our streams may be made to pay for all the works required for the complete development and control of our inland waterways.

Forests are the most effective preventers of floods, especially when they grow on the higher mountain slopes. The national forest policy, inaugurated primarily to avert or mitigate the timber famine which is now beginning to be felt, has been effective also in securing partial control of floods by retarding the run-off and checking the erosion of the higher slopes within the national forests. Still the loss from soil wash is enormous. It is computed that one-fifth of a cubic mile in volume, or one billion tons in weight, of the richest soil matter of the United States, is annually gathered in storm rivulets, washed into the rivers and borne into the sea. The loss to the farmer is in effect a tax greater

than all other land taxes combined, and one yielding absolutely no return. The Department of Agriculture is now devising and testing means to check this enormous waste through improved methods of agriculture and forest management.

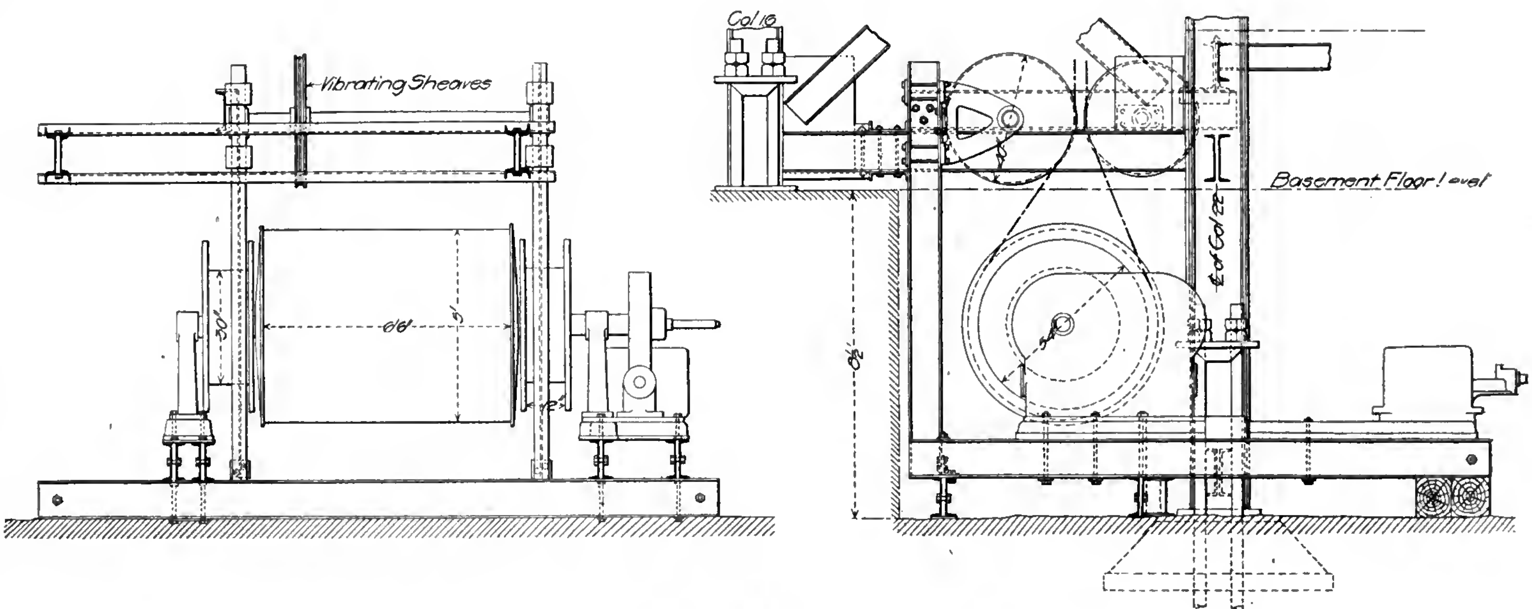
Citizens of all portions of the country are coming to realize that, however important the improvement of navigation may be, it is only one of many ends to be kept in view. The demand for navigation is hardly more pressing than the demands for reclaiming lands by irrigation in the arid regions and by drainage in the humid lowlands or for utilizing the water power now running to waste or for purifying the waters so as to reduce or remove the tax of soil waste, to promote manufactures and safeguard life. It is the part of wisdom to adopt not a jumble of unrelated plans, but a single comprehensive scheme for meeting all the demands so far as possible at the same time and by the same means. This is the reason why the Inland Waterways Commission was created in March last, largely in response to petitions from citizens of the interior, including many of the members of this congress. Broad instructions were given to the commission in accordance with this general policy that no plan should be prepared for the use of any stream for a single purpose without carefully considering, and so far as practicable actually providing for, the use of that stream for every other purpose. Plans for navigation and power should provide with special care for sites and terminals not only for the immediate present but also for the future.

The conservation of natural resources is the fundamental problem. Unless we solve that problem it will avail us little to solve all others. To solve it the whole nation must undertake the task through their organizations and associations, through the men whom they have made specially responsible for the welfare of the several States, and finally through Congress and the Executive. As a preliminary step the Inland Waterways Commission has decided, with the President's full approval, to call a conference on the conservation of natural resources, including, of course, the streams, to meet in Washington during the coming winter. This conference ought to be among the most important gatherings in our history, for none have had a more vital question to consider.

Steel Shot for Drill Points is now being made by spraying molten steel into cold water. The shot is extremely hard and in some formations can be used instead of diamonds.

Temporary Elevators for the Erection of the Singer Building Tower.

An unusual temporary elevator installation is in use during the erection of the 42-story tower of the new Singer Building at Broadway and Liberty street, New York City, as a precautionary measure for the safety of the workmen. Owing to the height of the structure and the incentive that usually exists in the construction of tall steel buildings to operate the material hoists at very high speed, it was here thought desirable to provide independent means of transportation for the workmen to and from the upper floor levels and thus free the material hoists from passenger duty. Accordingly a special elevator equipment has been installed by Mr. Ernest E. Flagg, the architect. It is of the electrically operated drum type, with provisions for raising the head-works from time to time and increasing the height of rise as the height of the structure increases. The equipment is, however, complete in every particular, with all the governing and safety appliances used in the best electric elevator installations, and is unique as one of the most effective measures taken for the safety of workmen in tall building construction, being the first installation of a complete elevator equipment solely for this purpose. The details of this tower extension of the Singer Building, and the many interesting features in its construction, have been described in a number of recent articles in this journal.



Details of Temporary Elevator Machine in the Singer Building.

One of the factors that has favored the use of the material hoist for the accommodation of laborers traveling to and from upper floors of buildings during construction is the facility with which the head-works may be raised from floor to floor as the structure increases in height. The upper works generally consist of nothing more than a sheave, supported upon a temporary framework, which may be raised from floor to floor as required, while the necessary additional cable is merely paid out from the drum of the hoisting engine. It is rightly considered as a temporary feature of the construction equipment and is used for passenger travel, with no further precautions for safety than increased vigilance on the part of the engineer operating the hoist, no safety appliances being generally used, as is required on approved elevator installations. In the Singer Building, however, the great height of rise, nearly 550 ft., rendered this mode of travel more than ordinarily hazardous, as there exists a strong tendency to operate the hoisting cars at too high rates of speed on the long descents, and accordingly it was the desire of the owners and architects to provide something better.

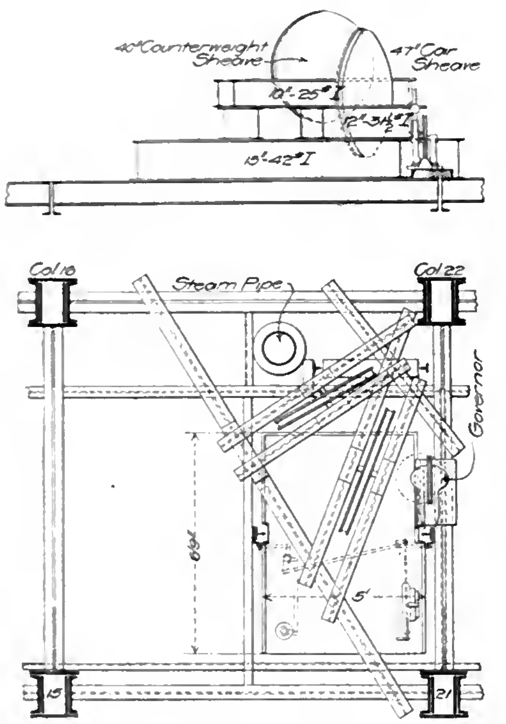
In a study of these conditions by the Otis Elevator Co., of New York, a modification of the standard drum electric elevator equipment, which meets with all the requirements of a temporary installation and in addition offers the advantages of the safety of the approved electric elevator apparatus, was suggested, and a contract was awarded to this company to install such an equipment for use during the construction of the building. It was required to be adjustable for seven different heights of rise as the erection of the structure proceeds, top landings to be made at the 10th, 15th, 20th, 25th, 30th, 35th and 40th floors, respectively, while the equipment must be removed entirely upon completion of the building construction, and the installation of the final traction type of elevator equipment which will be used there.

The electric drum type was selected as the most convenient, with respect to motive power, electric current for its operation being available from the 220-volt Edison street mains, which had been brought into the building for lighting and hoisting purposes, and as the maximum height of rise required, 546 ft. 9 in., is attainable by the use of a large drum. The special features necessary in the installation were, therefore, an extra size of drum to provide for the high rise, some means of storing the surplus cable while operating initially with the shorter distances of travel, and a means of readily transferring the headworks and the top limit mechanisms to the upper levels as it becomes necessary to increase the height of rise. A drum 5 ft. in diameter by 6½ ft. in length was chosen, with special mountings, providing for 12-in. reels between either end of the drum and the drum bearings, which served to carry the surplus cable for both car and counterweight before it was paid out for increased height of rise. The mountings are otherwise of the usual type of the Otis electric drum machine, consisting of the usual double worm-gear drive at one end, to which the driving motor is directly attached, but, owing to the temporary character of the installation, no permanent sub-base was used, the whole machine being mounted on 12-in. channels, rigidly bolted together, as shown in the accompanying details of the machine as installed.

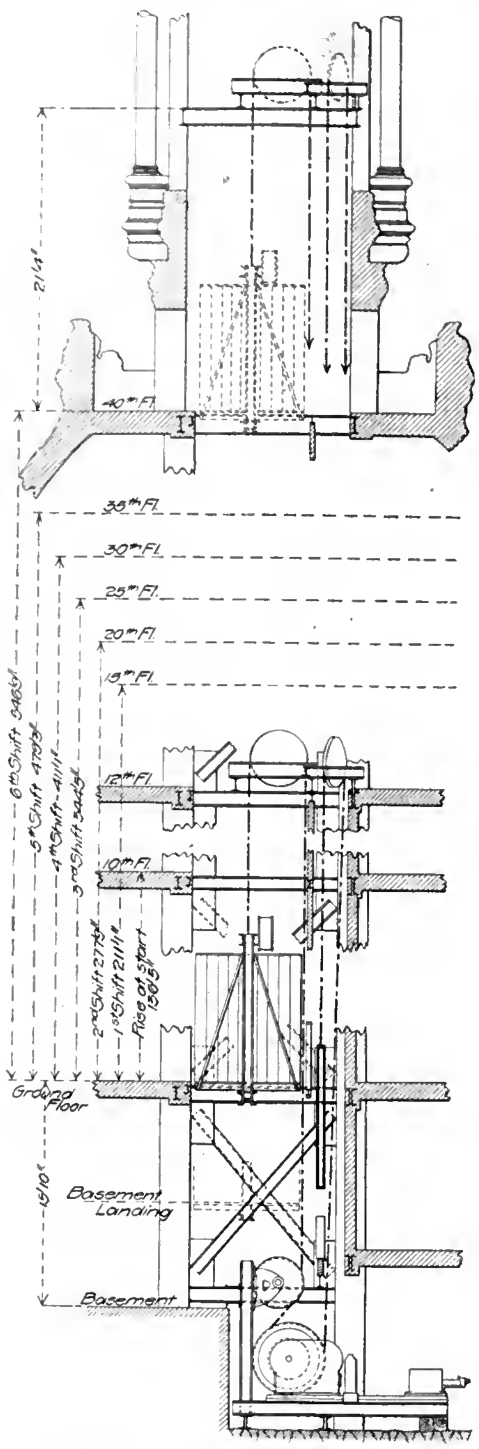
The frame carrying the machine consists of two pairs of longitudinal channels for foundation beams, which are, to withstand the lifting effort of the car and counterweight, shored down from the wind-bracing members of the tower frame-

work immediately above. Supported upon these beams are cross members, consisting of two pairs of channels for both the drum bearing and the worm-gear drive, and, at a distance of about 8 ft. above, a lighter auxiliary framework, which carries the shafts for the vibrating sheaves which guide the counterweight and car cables on and off the drum. The upper frame construction was simplified somewhat by attaching the members to the framework of the building, but the entire framework is firmly anchored to the foundation beams throughout. Considerable difficulty was experienced in locating the machine in the space at the foot of the elevator shaft, owing to limited room between a retaining wall and the adjacent building columns; it was, however, thought advisable to utilize one of the permanent elevator hatches for the temporary car, and this was accomplished by locating the drum in the 7-ft. space available between the columns and the retaining wall, allowing the motor and driving gear to project beyond the columns at one end.

The overhead gear was rendered easily removable by a special design of supporting beams for the car and counterweight sheaves, which are bolted together and so arranged as to be very



Details of Temporary Overhead Work.

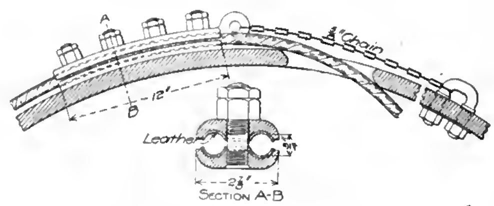


Rises of the Temporary Elevator.

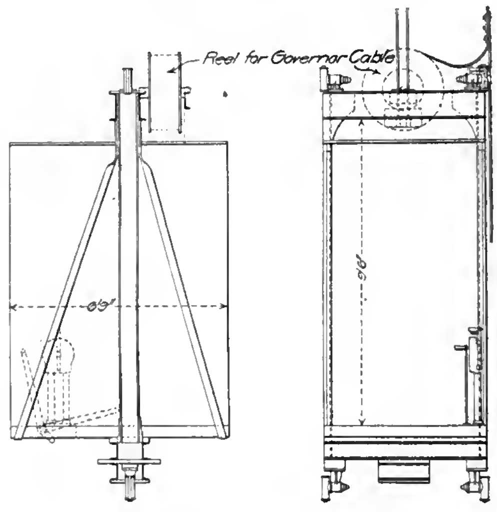
easily detached when it is necessary to remove them. This construction consists of two 15-in. I-beams, arranged diagonally across the hatch for foundation members, upon which are two 12-in. I-beams, so placed as to locate the car sheaves properly. Upon one of the latter beams and a block on the outer 15-in. beam two short 10-in. I-beams are placed to carry the counterweight sheave. Owing to the use of one of the permanent elevator hatches, it was arranged to make use of car and counterweight guides available for the future permanent elevator installation. Two complete sets of this overhead framework were provided to facilitate the work of changing the car travel to a higher rise, enabling one set to be erected without sheaves in the desired new position, and the other set to be removed after the cables and sheaves have been raised to the upper set of beams. Special clamps were devised for bolting the beams firmly in position, which can also be readily released for their removal. Other features due to the removal of the overhead gear are the governor and the upper limit stops of the control system; these are in both cases mounted on special frames, which are merely bolted in position at each of the top landings, and thence removed simultaneously with the overhead gear. For the governor rope not paid out a 12-in. reel, 2½ ft. in diameter, is mounted on top of the car adjacent to the governor rope fastening, so that when increased car travel is desired the rope is unclamped at this fastening and paid out to the new length desired.

The arrangement for storing the surplus rope until paid out for the higher distances of travel is, as above stated, narrow wooden reels mounted on the drum shaft between either end of the drum and the bearings, one of which is for the ropes leading to the car and the other for those to the counterweight. The reels are 12 in. in width and 4½ ft. in extreme diameter, or considerably less than that of the main drum, and the cables are fed out from them to the space inside the drum, and thence through a hole in the outer face to a special rope grip, by means of which it is anchored to the face of the drum. The rope grip is a forged clamp, with longitudinal leather-faced openings for the cables, and grips the two for a length of about 12 in., as shown in the accompanying detail, just after they pass through the hole in the face of the drum. Thus, in lengthening the rope for an increased car travel it is only necessary to loosen the bolts of the clamp, and after unfastening the reels pay through the required amount of additional cable, which is then clamped in the new position. The rope grips are fastened to the face of the drum in either case by a ⅝-in. chain about 20 in. in length, which extends from an eye in one end of the clamp to a U-bolt chain connection bolted to the drum.

The driving mechanism of the elevator machine is the gear of a standard No. 5 Otis double-screw drum machine, direct-connected to a No. 6½ Otis bipolar motor, which is wound for 220-volt direct current, so as to be operated from the Edison street service. The gear is designed for a regular operating speed of 400 ft. per minute, at which the car has a capacity of 2,000 lb., but for the purpose of lifting very heavy weights a back gear attachment has been added to the regular gear, which is readily thrown in by disconnecting a flange and shifting a pair of gears. This back gear has a ratio of 9 to 1 and facilitates raising the parts of the new traction elevator equipments which are to be installed in this building, an arrangement having been made by the Otis Co. in installing this temporary elevator to utilize it for this purpose. The machine is, for simplicity,



Rope Fastening on Drum.



Details of Elevator Car.

operated with two ¾-in. ropes for both car and counterweight, instead of a larger number of smaller ropes, these sizes offering sufficient capacity for the service to be carried. The machine is controlled through one of the Otis magnetic controllers similar to those used with the traction machines.

A 150-Ton Crane of unusual construction has been installed at Birkenhead, opposite Liverpool, England, for the handling of great weights into vessels alongside the wharf. It consists of a special 3-footed supporting framework, which rises about 60 ft. above the dock level and is enlarged at the top to carry a revolving derrick structure with an overhanging jib. The latter is pivoted on a step bearing within the lower part of the suporting frame, and bears at the top against a pressure ring that withstands the thrust of the overhang. The jib has an extreme overhang of 88 ft. 8 in., and at the end carries an auxiliary hoisting gear of 50 tons capacity. The main gear, of 150 tons capacity, has a radius of action of 28 ft. A peculiar feature of the derrick is the use of continuous current power for the operation of the hoisting motors.

Single-Phase Electric Motive Power on the Rochester Division of the Erie Railroad.

By W. N. Smith.

One of the most important electric railway developments of the present year is the change from steam to electric motive power on a portion of the Rochester Division of the Erie Railroad, which took place on June 18, 1907. This is the first installation of a single-phase alternating system of electrical motive power upon a steam railroad, to go into commercial operation.

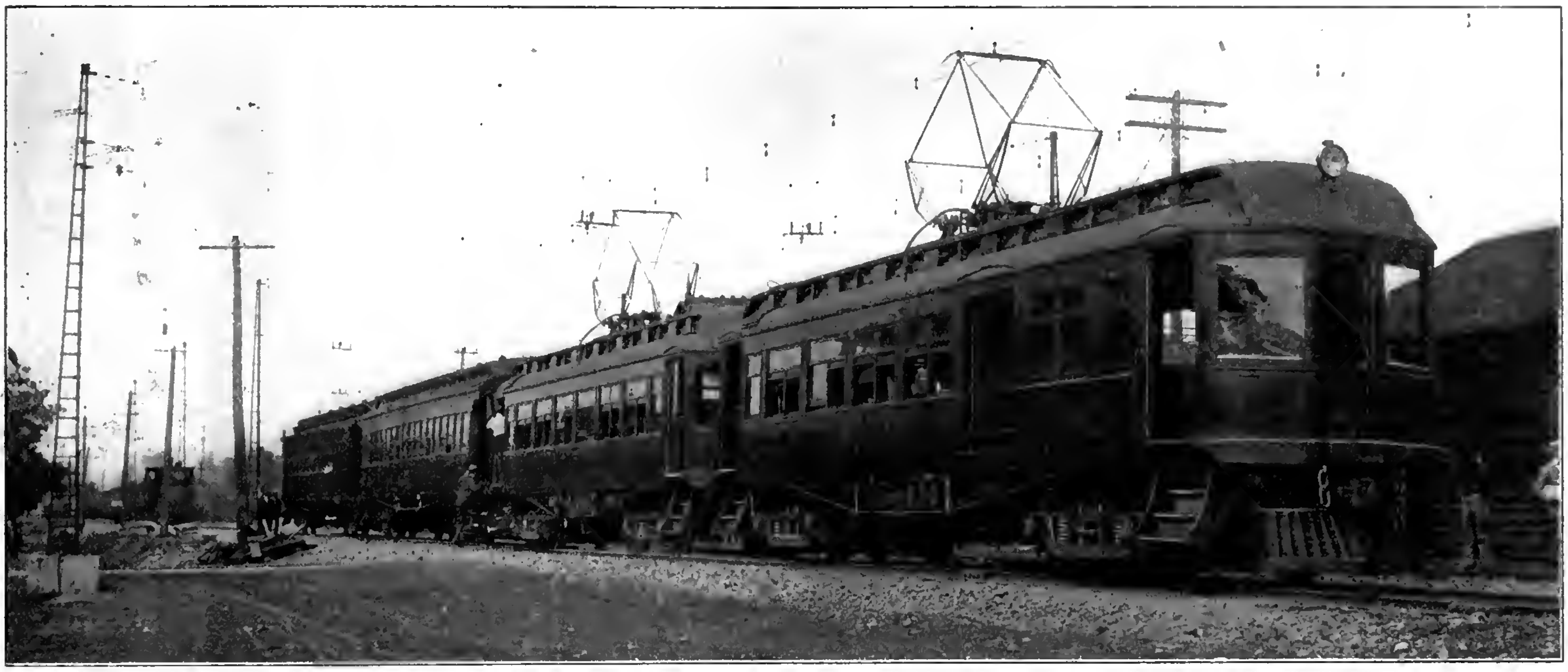
The Erie electrification can justly claim the priority of application of several important features which are of interest in connection with the discussion now prevailing upon systems best suited for steam railroad electrification. This line was the first in this country to operate electric cars on the single-phase system over the tracks of an operating steam railroad; the first in this country to use 11,000 volts working pressure commercially on a trolley, and the first instance of a single-phase traction system receiving power from a 60,000-volt transmission line. All of the construction described below, except that of the 60,000-volt power transmission line and the car bodies and trucks, was designed, executed and placed in operative condition by Westinghouse, Church, Kerr & Co., engineers.

The section of track equipped is 34 miles long, extending from Rochester, over the main line of the Rochester Division, to Avon, a distance of about 19 miles, thence 15 miles over the Mt. Morris Branch. The railroad is entirely single-track, with sidings at way stations, averaging 3 to 4 miles apart. The grades are light, and the curvature for the most part quite easy, the line being relatively quite straight.

The track was originally laid with 68-lb. rails, but was relaid with 80-lb. rail, taken from another division just prior to electrification. The roadbed is ballasted with gravel, and the joints are of the Weber type. A single No. 00 protected rail bond is applied to each rail joint under the plate, one of the advantages of the high-tension single-phase system being that the relatively small current combined with the high impedance of the main circuit renders it unnecessary to resort to heavy bonding.

The line crosses a number of bridges, the longest one, that over the Genesee River, about 1½ miles south of Rochester, being 780 ft. long and comprising seven spans. There are also through truss bridges at Rush, and at Canaseraga Creek, near Mt. Morris, and a stone arch bridge over Conesus Creek, a short distance south of Avon.

The electric service is devoted solely to passenger traffic, which is of the local interurban type. The freight service is handled exclusively by steam as heretofore, as are also the through trains operating between Rochester and Corning over the main line of the Rochester Division, a distance of about 94 miles. The steam service between Rochester and Mt. Morris originally comprised three round trips daily. The principal villages served are Avon, Geneseo and Mt. Morris the other regular way stations being little else than cross-road stops. The population is entirely agricultural, and the Genesee Valley traversed by this line is probably one of the most beautiful and prosperous farming regions of New York State. Instead of three round trips per day, the electric service has introduced six complete round trips between Rochester and Mt. Morris, and three more between Avon and Mt. Morris.



Four-Car Electric Train on the Rochester Division of the Erie Railroad.

Power Supply.—The power is generated at Niagara Falls, in the plant of the Ontario Power Co., and is transmitted at 60,000 volts, three-phase, over the lines of the Niagara, Lockport & Ontario Power Co. The Iroquois Construction Co. built a branch line from Mortimer, a little over 4 miles south of Rochester, to Avon, locating it upon the Erie R. R. right of way for nearly the whole distance. The pole construction used upon this branch transmission line is of the A-frame type, using two 40-ft. cypress poles, set abreast of each other, and inclined so that their tops are framed together, the butts being joined by horizontal plank braces underground. The cross-arms consist of two 3½ x 6-in. timbers, 8 ft. long. The insular pins are of cast steel, one being placed at the apex of the A-frame, and the other two bolted near the extremities of the cross-arms, so that there is an equilateral spacing of 7 ft. between each of the three wires. The insulator pins are grounded by copper wire. The neutral of the transmission system is grounded at the power station through a resistance. Lightning protection of the horn arrester type has been installed at every fifth pole. The conductors are of No. 4, hard-drawn, stranded copper cable. The standard length of span between poles is 220 ft., which is shortened at curves where necessary. When crossing over the tracks of the Erie, or other railroads, recourse is had to a special construction of No. 0 copper cables carried on steel towers, so reinforced by guys that it is impossible for a failure of the line to result in dropping the conductors across railroad tracks.

Sub-Station Building.—The sub-station building is located in the Y formed by the railroad tracks at Avon, and together with the car shed, is adjacent to the roundhouse and division repair shop. The walls of the building are of brick, resting upon solid concrete foundations, the roof and floors being of reinforced concrete. The floors are supported upon steel beams, but the roof beams are of reinforced concrete, like the slabs which they support.

In the basement of the building are located one of the transformer oil tanks and the oil pump. The main floor is divided into three rooms, the main transformer room being 43 x 17 ft., and extending the full height of the structure to allow room for the high-tension bus-bars, which are carried over the transformers. The remaining space on the main floor is divided into a high-tension room (through which the 60,000-volt wires enter, and which is the location of the high-tension circuit breakers, 16 ft. 8 in. by 19 ft. 8 in.) and the operating room, which is 19 ft. 8 in. by 24 ft., where are located all the 11,000-volt switching apparatus and the measuring instruments. Directly over the operating room is a mezzanine floor, reached by an iron staircase, in which are located the 11,000-volt lightning arresters, the 60,000-volt choke coils, and the 60,000-volt series coils. The high-tension connections enter through the high-tension room, which runs from floor to floor, and pass through the choke coils and series coil, on the mezzanine floor, and then turn through a wide opening in the wall to the 60,000-volt bus-bars, which are located in the upper portion of the transformer room.

There is space in the transformer room for another transformer of the same size and there is also space in the high-tension room for an oil-insulated circuit breaker should it ever be decided necessary. The interior is painted with cold-water paint of the same light green shade that is commonly used by the Erie R. R. for interior finish.

The interior lighting equipment consists of 47 16-c.-p. incandescent lamps. Heat is supplied by a simple system of Colonial wall-type steam radiators, supplied by steam from the locomotive roundhouse.

Sub-Station Equipment.—The transmission line terminates at the lightning arrester yard in the

rear of the sub-station. The arrangement of the 60,000-volt lightning arresters consists of three horn gaps, arranged one behind the other, on each of the three conductors, the first gap being 4¾ in. across, the second 5, and the third 6 in. A concrete column is in series with the first gap, an electrolytic arrester in series with the second and a 5-ft. fuse of No. 18 copper wire in series with the third, that is to say, between one horn and the ground. Both horns of each gap are of ½-in. round iron. Between the line and the first arrester there is a hook-type knife switch, and between the last arrester and the lead into the sub-station, there is a No. 18 copper wire fuse, in each conductor, placed horizontally upon a structure especially devised for it on top of a pole. These fuses are enclosed in wooden tubes about 5 ft. long, wrapped with torpedo twine. The entire arrangement of lightning arrester gaps, fuses and switches is mounted upon eighteen chestnut poles; and a suitable elevated platform, railed off and fitted with a gate to keep out trespassers, affords means of access to the apparatus when attention is required.

The three high-tension conductors enter the sub-station through glass disks held in 36-in. tile, set in the upper portion of the rear wall of the sub-station.

Within the sub-station, the wires first pass through three 60,000-volt stick-type circuit breakers, mounted directly inside of the rear wall. Thence, over bare copper conductors to the three oil-insulated choke coils, situated on the mezzanine floor, thence to three oil-insulated series transformers, also on the mezzanine floor, from which connections are taken to the power-measuring instruments in the operating room. The main connections finally terminate upon a set of copper bus-bars in the transformer room, which are run upon porcelain insulators mounted on wooden cross-arms and placed at a convenient height directly over the line of transformers.

The 60,000-volt three-phase current is rendered available for single-phase distribution by means of three transformers of the Westinghouse oil-insulated water-cooled type, each of 750 kw. capacity. For the present installation, two transformers only are used at one time, the third being a spare. The high-tension connections are such that in case of one transformer failing while in service, its connections can quickly be taken off the bus-bars, and put on the spare transformers. The transformer windings are fitted with taps enabling the three-phase to two-phase "Scott connection" to be used. The low-tension windings can be so connected that either 11,000 or 22,000 volts can be obtained, so that in case it should ever be desired to transmit railway current for an extension of 40 or 50 miles to another sub-station it could readily be done without adding transformers to this equipment. The low-tension windings also have six taps, enabling relatively small variations to be made in the secondary voltage, if they should be necessary to suit operating conditions in the trolley line.

One end of each low-tension winding is directly grounded to the boiler iron case, which in turn is, by means of a No. 0000 stranded copper cable, directly connected to the track return circuit.

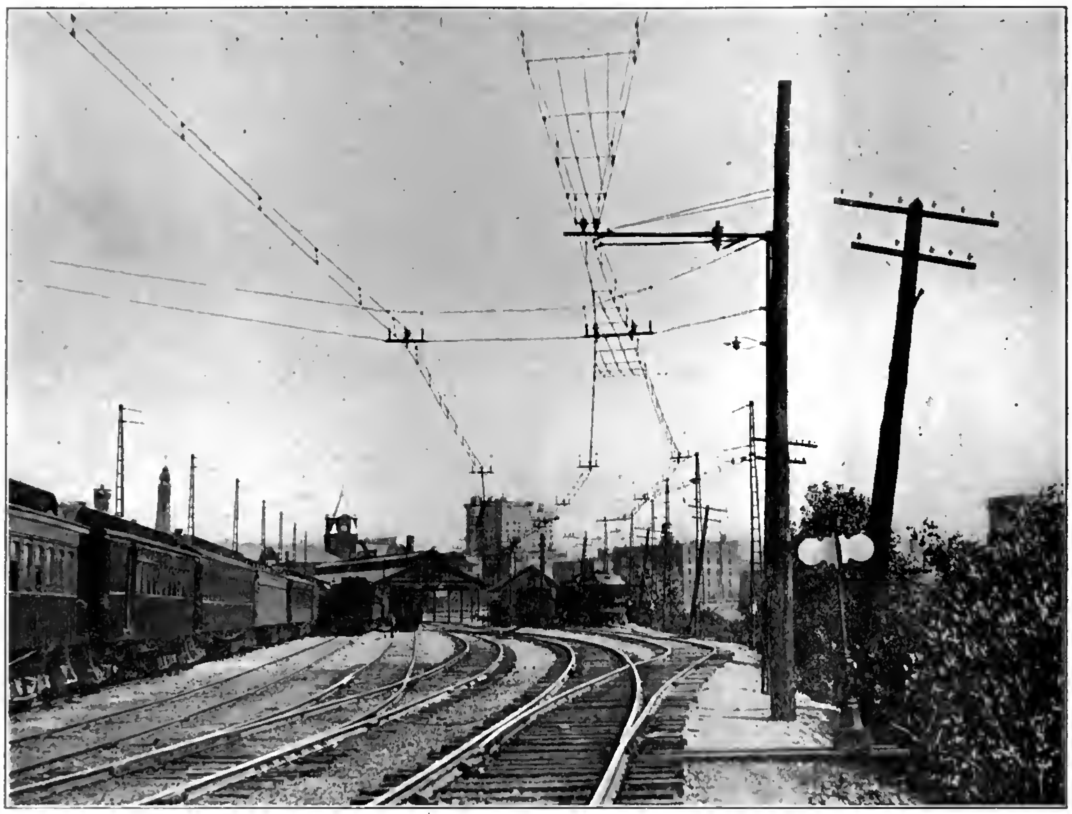
The transformer cases are made of boiler iron, and set on a square cast-iron base, which is in turn mounted on three pairs of wheels running upon an iron sub-base set in the concrete floor of the room. A track runs lengthwise of the room directly in front of the transformers, a transfer truck running upon it, upon the top of which there is another set of little wheels or rollers, which line up with those upon which the transformer cases are set. When it is desired to remove the windings from the transformer case, it is only necessary to disconnect the electrical, water and oil connections, roll the transformer off its sub-base and onto the track, which is then pushed to the rear of the transformer room, where it comes directly under a 10-ton hand hoist, which is able to lift any part of the transformer that repairs make it necessary to handle.

Two cylindrical boiler-iron oil tanks are provided, each of slightly greater capacity than a single transformer. One is located in the basement directly under the transformer room, so that the oil from the transformer can readily be drained into it. The other is suspended from the concrete roof beams at the top of the transformer room, close to the side wall of the building, this being intended to act as a reservoir for distributing oil back into the transformer. The oil is pumped from the lower to the upper tank by means of a steam pump supplied from the boiler room in the adjacent division roundhouse, where steam is always available. From the upper tank oil is fed by gravity into either transformer. It is thus a simple matter to draw the oil from any transformer if its insulating qualities are found to have depreciated, and the rehydrating, filtering or purifying apparatus can readily be employed with the aid of the pump, and the supply returned again to storage. The oil piping is of iron throughout.

The water circulation is by gravity, the supply coming from the railroad company's water tank system, at the adjacent roundhouse, being pumped originally from the Genesee River about a mile distant. An artesian well had been opened on the premises, but the water was so strongly impregnated with sulphur and other impurities that it was thought best not to introduce it into the copper piping in the transformers, although the cost of such a supply would have been practically nothing.

There are three separate water-cooled coils in each transformer case, each controlled by its own valve, so that the amount of water may be controlled as found necessary under various conditions of load.

The necessary transformation from three-phase to two-phase fits in very well with the natural subdivision of the electrified line into two sections, one of which is about 19 miles in length, north of Avon, the other about 15 miles in length,



Overhead Construction in the Rochester Yard.

being to the south of Avon. The connections were therefore laid out to operate such sections upon separate phases of the two-phase secondary system. Either the T or V connection can be used, the latter method being employed at present. Each one of the active transformers therefore feeds a separate section.

As mentioned above, one terminal of each single-phase, 11,000-volt transformer is grounded. The middle transformer of the three is ordinarily used as a spare, and the other low-tension lead from this transformer runs to the center of a double-throw switch, whose outside poles connect separately to two low-tension bus-bars. The ungrounded low-tension terminals of the other two transformers connect through single-pole switches, one to each of these bus-bars.

The low-tension bus-bars run along the wall of the operating room, and directly beneath them are three type-E Westinghouse automatic oil circuit-breakers, one on each of the two trolley feeders, the third breaker which is situated between the other two, being a spare. One pole of each of the three oil breakers is connected to the center pole of a double-throw hoop-type knife-switch, by means of which it is thrown upon either bus-bar. The other pole of the oil breaker runs directly to the feeder. The outgoing lead from the middle or spare circuit-breaker runs to the center pole of the double-throw hook-type switch, so that it can instantly be thrown upon either one of the feeders, should the breaker usually confronting that feeder be temporarily disabled. This system of connections is simple, compact and flexible, and has admirably fulfilled the conditions for which it is intended.

The outgoing 11,000-volt feeders run up to the mezzanine floor directly over the operating room, where they emerge from the building through perforated glass disks, set in 18-inch round tiles. Before emerging there are tapped to them two Westinghouse low-equivalent lightning arresters, set in brick compartments and reinforced by two electrolytic lightning arresters of the 11,000-volt type. A set of call bells is provided so that when the automatic breakers open, a bell is rung in the adjoining car-inspection shed. Also, if the temperature of any transformer runs above normal, a bell circuit connected

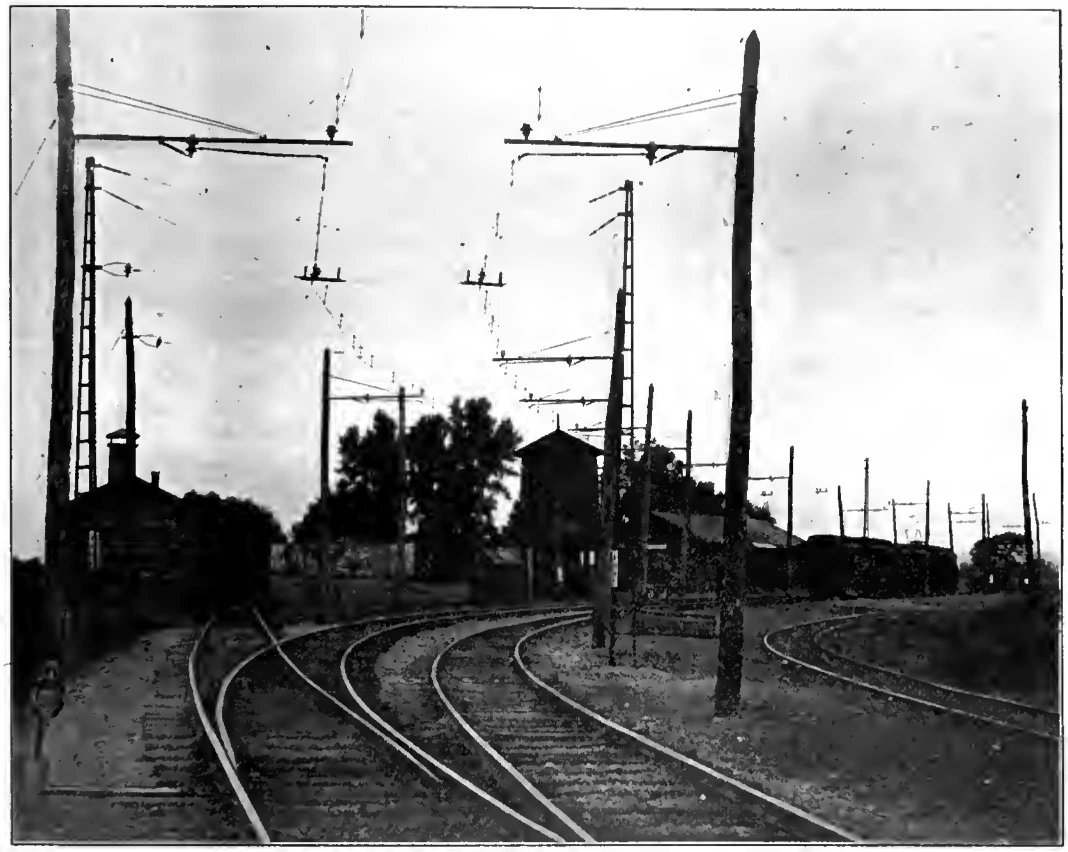
to a thermometer in the top of the transformer tank is similarly made to operate. The station itself does not require the continuous presence of an attendant, which is needed in the case of a rotary converter sub-station. The working force is so organized that the car-repair men are always available for manipulating the sub-station circuit-breakers, and the cost of attendance is thereby reduced to a minimum.

Catenary Trolley Construction.—The overhead trolley construction is in many respects unique. It was the first of all catenary installations to operate regularly at 11,000 volts. There were very few precedents to follow; many of the details of the overhead work are entirely original, and nearly all of them were especially designed for this installation by the engineers who executed the work.

The poles are of chestnut, averaging 25 in. in circumference at the top, and about 42 in. at the butt. Most of them are about 35 ft. long, but 40-ft. poles were used where the embankments were narrow and steep, and in span construction. Nearly all the construction is of the bracket type, except at the railroad yards at Rochester, Avon and Mt. Morris, and for some distance at Mortimer, where there is a siding on each side of the main track, which prevented the use of bracket construction there.

The poles are given about 12 in. rake. They are tamped with cobblestones, of which plenty were available from the coarse gravel with which the road is ballasted. The ground proved very deceptive as regards the nature of the digging, much water-bearing gravel and quicksand being encountered, and oil-barrels had to be resorted to in many instances, to prevent caving in of the holes during pole setting.

The brackets are of an entirely original design, each consisting of a 3 x 2½-in. tee, 10 ft. long, the heel of which is fastened to the pole by a pair of bent straps, the outer end being supported from the pole-top by two ⅝-in. steel truss rods, instead of the single rod commonly used for bracket work. The two rods are attached about 27 in. back from the outer end, and run one to each side of the pole, and are fastened there to a pole clamp devised for this work, which grips the top of the pole instead of requiring the bolt or truss rod to pass through it. In this way the timber of the pole is kept intact, and does not have a hole bored through it which will admit moisture and induce rot. The two truss rods are threaded at both ends, and at the upper end each one passes through a small iron casting which is in turn carried upon a bolt projecting out from the cast-iron portion of the pole clamp, like a trunion. The whole construction is extremely rigid, and is stronger and more conductive to a long life for the pole than any bracket hitherto used. Where necessary, at switches, extra long brackets are employed, being lengthened by splicing and an extra truss rod being attached by means of a clamp to the outer end of such a bracket and run to the extreme top of the pole.



Overhead Construction, Mt. Morris Terminal.

The insulator pins are of malleable iron, of a type specially devised for this work. The lower portion of the pin was divided and fitted closely over the flanges of the tee bracket, being provided with a single ⅝-in. bolt by means of which the lower split portion of the pin is clamped securely against the bracket. The brackets and pins were furnished to the engineers' designs by the Electric Service Supplies Co.

The insulator is of R. Thomas & Sons manufacture, 6⅞ in. in diameter and 6 in. high, made in two parts, but of the three-petticoat type, and known as No. 3029. It was designed by the engineers especially for this installation. As most of the overhead work was done during the winter months, and had to be rushed, a quick-setting cement of litharge and glycerine was used in place of Portland cement, which not only permitted rapid work in construction, but obviated troubles due to the freezing of hydraulic cement while setting.

The insulator pins are ordinarily about 12 in. from the end of the bracket, but there is 27½ in. space between the end of the bracket and the point where the truss rods support it, which permits sufficient variation in location of insulator to meet most of the requirements in shifting the alignment of the trolley wire on curves.

The messenger wire is of "extra high strength" steel, furnished by the American Steel & Wire Co. It is of seven strands and is 7/16 in. in diameter. Joints are made by using the so-called "open" and "closed" cable sockets, the sockets being sweated on to the abutting ends of the cables and joined by a pin connection through the eyes of the sockets. The trolley wire is No. 000 B & S grooved copper, the lengths being spliced with the usual type of soldered splicing sleeve.

The spans on the straight line track are 120 ft. in length, and as much shorter than this on curves as required by the radius of the curvature The maximum deflection from the center line of the track, on curves, is 7 in. each way. The catenary hangers were of the Electric Railway Equipment Co.'s drop-forged type, being modified by the engineers to suit the requirements. The messenger clip and the trolley clip are of the same type but grooved differently to accommodate their respective wires. They are joined by a ⅝-in. iron hanger-rod, with right-hand threads on each end, the longer rods being flattened in the middle to admit of bending them slightly, so as to conform to the divergence of the messenger and trolley wire near the ends of the spans. Both trolley and messenger ears are secured in position by jam nuts. This type of suspension was developed especially for this installation, and is so constructed that there is no possibility of parts coming loose and falling apart on account of vibration. It is also very quickly and easily adjustable on trolley wires. The hangers are spaced every 10 ft.

The steady strain rods are of treated wood of the Westinghouse Electric & Mfg. Co.'s make, and they are mounted at one side of the bracket instead of directly underneath, in order to give sufficient clearance for the pantagraph trolley on curves, where the super-elevation results in the tilting of the shoe from the horizontal.. Each steady strain rod is hinged to a spool type Thomas porcelain strain insulator, which is clamped to one side of the bracket in such a manner that the hinged end of the rod is almost at the elevation of the top of the tee bracket. The method of attaching the steady strain insulators to the bracket is such that they can readily be shifted along the bracket to follow up any change in alignment of the trolley wire that may be required by curvature or for any other reason. The clamps holding the steady strain insulators are of 3 x ⅜ in. bent iron. The spool type insulators are cemented on to pieces of ¾-in. pipe, through which passes the ⅝-in. eye-bolt by means of which they are attached to the bent irons. Steady strains are used only on curves and turnouts and were not found necessary on tangent track.

The tie wires are of No. 9 Extra BB, galvanized telegraph wire, because it was thought best not to make too rigid an attachment between the messenger wire and the insulator; so that if a bracket became detached from the pole for any reason, its weight and the shock of detachment would tear the wire clear from the messenger and allow the bracket to fall entirely away from the wire and reduce the chance of steam railroad trains colliding with it. An accident to the electrical equipment of a railway operating both steam and electric trains may shut down the electric service, but will not automatically place any check upon the steam service, so that accidents to steam trains must be guarded against, as a steam train might easily be wrecked by an obstruction which would automatically prevent power from being supplied to an electric train. This was one of the reasons for installing the system of "ground rods" from the brackets to the rails, which is carried out very consistently throughout the installation. Every bracket is

grounded to the rail, so that an insulator failure will instantly throw off the power, as it will cause a complete metallic short-circuit. There is thus no danger of setting the wooden poles on fire, which would be possible if this precaution were not taken. The burning of a wooden pole would not of itself necessarily cripple the electric service, but it would be quite likely to cause an obstruction dangerous to the passage of steam trains which are, of course, independent of any disturbances on the electric motive-power system. Up to the present time, however, there have been no cases where the overhead construction has caused any obstruction to the passage of the steam traffic.

The ground rods consist of 3/8 x 1 1/4 in. flat steel, their upper and lower ends being bolted to track rail and bracket respectively.

The span construction is as nearly as possible similar to the bracket construction and uses the same type of pin and insulator. A piece of 3 x 2 1/2-in. tee about 30 in. long is suspended from the span wire by hangers of galvanized strand cable, adjustable in length, and fastened to the span wire cable by specially designed clips, the construction forming a sort of stirrup upon which the pin and insulator are carried. The messenger wire rests upon the insulator just as in the case of regular bracket construction. This form is used, not only for spans where there is but one track, but also in the yards at Avon, and Rochester, where three or four parallel tracks are electrified. Span construction, in general, was only used where conditions absolutely required it.

The Rochester yard was a difficult piece of construction on account of the distance between supports (which reaches a maximum of 94 ft. where spanning seven tracks, four of which are electrified), and also on account of the uncertain nature of the soil which, on the river bank, is filled in with gravel and cinders. For these long spans, where it was impossible to use guys of the usual type (the river bank being on one side and the main highway which gives teams access for loading and unloading freight cars on the other side), it became necessary to use self-supporting span construction, and this was done by using the "Tripartite" type of steel pole, set in concrete. This type of pole being constructed of re-rolled Bessemer steel rails is less subject to rust and consequently more durable than any other available type of metal pole, and all of its surfaces are always open and easy of inspection. On account of the great tensile strength of the material, there is considerable saving in weight, and the fact that it was a standardized product enabled quicker delivery to be made than though special riveted poles of structural steel shapes had been specially designed for these locations. The span wires consist of the regular messenger cable fitted with cable sockets sweated on at each end, the same being fastened to turnbuckles and pole collars at the tops of the poles. There are two span cables at each pair of poles, the upper one being used to carry the weight, the lower one acting to steady the arrangement and also to act as a relay in case of an accident to the upper span. Similar construction was also used at Avon, where guying of side poles was not always possible.

A very simple type of pull-off was devised for curves in span construction, and it so happened that both the Rochester and Mt. Morris yards have considerable curvature. The pull-off consists simply of a spool-type insulator, with a piece of pipe cemented through the center, this pipe being slipped over the hanger spacing-rod joining the messenger and trolley clips, thus giving an insulating connection through which an ordinary pull-off cable can be attached to both messenger and trolley wires wherever required. The division of the horizontal pull between the messenger and trolley wire is easily adjusted to suit the conditions, by shifting the spool-type insulator up and down the spacing rod, by inserting longer or shorter nipples of pipe underneath it. In general, when near a span wire, the messenger cable is supported rigidly on its insulator and the trolley wire needs all the side pull; but in the middle of a span, the pull must be equally divided between messenger and trolley wire.

The presence of several through-truss bridges over streams, and two low bridges over the Erie right of way, necessitated the employment of special construction at these points, particularly at the bridge at Clarissa St., on the outskirts of Rochester. The original clearances here were so low that the road-bed had to be excavated and the track lowered about 2 ft., the minimum clearance between the rails and the trolley wire being finally 18 ft. The messenger is fastened to a horizontal spool-type insulator mounted at the center of a substantial piece of turned oak, which is long enough to carry two more similar insulators, one on either side of the center one.

The steel hangers reaching down from the overhead bridge structure carry the two side insulators, so there are always two insulators in series between the 11,000-volt messenger cable and the steel work of the bridge. These insulated supports are suspended at short intervals from the under side of the steel-work of the bridge and are further supplemented by the use of steady strains which prevent any side displacement of the trolley wire. The shortest sizes of hanger spacing rods are used in such places. Where the bridge truesses are high enough to permit it, an iron stirrup is employed like that used in span work, which carries the standard form of straight line insulator, and the regular type of catenary suspension is employed.

At either side of these overhead obstructions it was necessary to provide warnings for brakemen upon the tops of freight cars, as substitutes for the warnings of hanging pieces of rope previously used. They consist of the well-known type of horizontal, suspended, swinging wooden rod, mounted with its axis at an angle, so that it swings up as it is pushed to one side. The pantagraph trolley is fitted with a set of springs on each side, one of which strikes this warning sign a blow as it passes under and instantly throws it one side. The blow is struck upon a heavy leather strap held taut by a coil spring of steel wire in tension, the whole contrivence being fastened to the lower half of the pantagraph trolley mechanism so that it is at the right height for striking the warning sign. The swinging rod is mounted upon the pole by means of insulators, effectually preventing any leakage to the ground, even though a car might stand still directly under the sign and make contact with it for an indefinite length of time.

Nearly all the telephone and telegraph wires which cross over the 11,000-volt trolley wire have been put underground, particularly in the case of the leads composed of only a few wires, but where the line is crossed by heavy telephone trunk lines, they have been protected by the basket type of construction, so designed as to effectually prevent a broken telephone wire from falling across the messenger or trolley wire. This consists primarily of four galvanized steel cables stretched between opposite ends of two cross arms, one placed above and the other below the wires of the intersecting telephone line, and the four cables are joined by a basket-work of light strap-iron ribs placed at intervals of 3 to 4 feet across the whole span, forming the sides and the bottom of the cradle and effectually preventing a broken telephone wire from dropping any further. This construction was also followed in the case of an electric wire at Avon.

The telegraph department of the railroad company, in connection with the signal department, constructed a private telephone line of two copper wires between Rochester and Avon, with instruments at all signal towers and stations in the dispatcher's office, and at the sub-stations, and car shed, and master mechanic's office. This telephone system is run upon the trolley bracket poles, transposed every third pole, and has worked satisfactorily.

Lightning protection for high tension single-phase railway lines not having as yet been standardized, only a part of the line was equipped with line lightning arresters, which are of a swinging fuse gap type made by the Westinghouse Electric & Manufacturing Co. This type consists of a gap one side of which is connected directly to the trolley through a No. 4 copper wire, and the other side directly connected to the ground rod through a fuse enclosed in a tube which, while the fuse is intact, is maintained in an inclined position like a pendulum held back from its position of rest; but when the fuse is blown, a latch is released which allows the fuse tube to swing to a vertical position which shows conspicuously from the ground, and signifies to the patrolman that the fuse should be replaced. The fuse tube can then be lifted off the suspending lugs by a pair of insulating tongs made for the purpose, and the fuse renewed and replaced in a few moments.

On the other half of the line, lightning arresters were not installed. During the summer, two of the poles were struck by lightning, but the metal-work of the brackets and truss rods being entirely grounded, these poles were not damaged below the topmost point of attachment of the truss rods, which is generally not over 18 in. from the top of the pole. In a number of instances the lightning-arrester fuses have blown, but it is not known how many of them have blown simultaneously. Although the extent to which this type of arrester is fully protective is hardly established as yet, it can be stated that at no time since regular operation started has any injury to the car equipment resulted from lightning, though there were several severe storms during June and July.

The trolley line is divided into seven sections—one comprising the Rochester terminal, one the Avon yard, three sections in the main line between Rochester and Avon, and two sections south of Avon.

The sections are divided by trolley section insulators, made by the Westinghouse Electric & Manufacturing Co. They are of the overlapping type, made of impregnated wood, and are of sufficient length to insure insulation at 11,000 volts. Each section insulator is carried upon two brackets, mounted on poles spaced 10 ft. apart. As the trolley and messenger must both be completely insulated on opposite sides of the breaker, heavy strain insulators are introduced upon which the messenger is dead-ended, the two insulators being connected across the gap by a heavy steel rod. This entire combination is supported upon standard insulators mounted upon the regular brackets.

One of the breakers, that opposite the sub-station at Avon, is different from the above-mentioned type, in that it is not of the overlapping type, it being necessary to absolutely separate the two halves of the trolley line in order to utilize the separate phases of the trolley current of each half.

The only feeders necessary are those connecting the sub-station with the trolley on opposite sides of this section break. The principal object of cutting the trolley into additional sections is to facilitate the locating of line trouble.

The conditions of electric traction upon this line are such that no feeder is necessary besides the trolley wire, and consequently there is no necessity for feeding the sections separately. A jumper is therefore provided at each section insulator, in which is placed a hook-type knife

switch that can be operated in case it is desired to cut that section out. Normally, however, the switches are closed, and the effect of the jumpers is to make the trolley wire continuous.

Another detail peculiar to the catenary type of trolley construction is the "deflector," a sort of mechanical fender placed in the angle formed by the intersecting trolley wires at switches. The deflector here used consists of four or five bars of flat steel, ½x¼ in., suspended by riveted hangers from crossbars spaced 5 ft. apart, which in turn rest on standard trolley clamps, fastened to the trolley wire. The particular advantage gained by this construction is that no extra tension is needed to keep the bars from sagging and getting crooked, this type of deflector being of minimum weight and entirely self-contained. They are placed in both angles of each switch. The object of the deflector is to prevent the end of the pantograph shoe, when traveling under either wire, from becoming hooked over the other.

There being an open space between the abutting vestibules when two motor cars are coupled together, due to the rounded and projecting buffer beams of the platforms, this opening being nearly 18 in. in width, which is wide enough to allow a person to fall between the cars, there were provided canvas curtains about 5 ft. high, with snaps attached, which enable them to be quickly stretched across the space, one on each side of the vestibule end door, so as to insure the safety of trainmen and passengers when walking from one car to another with the train in motion.

The trucks are both alike, wheel base being 6 ft. 8 in. The axles are 6½ in. diameter. The trucks are of the standard M. C. B. swing bolster type, with heavy framing. The brake shoes are inside hung.

The heating equipment consists of 32 of the Consolidated Car Heating Co.'s electric heaters of the truss plank type, and 450 watts capacity each, in the main portion of the car, and two "No. 192 M. S." heaters in each cab.

Overhead Construction Showing Trolley Section Insulator, Rochester.

Cars.—The cars equipped with electric apparatus are six in number, and, together with their trucks, were furnished by the St. Louis Car Co. The electrical apparatus was installed upon the cars and trucks by the engineers at the railroad company's car shops in Buffalo, N. Y. The cars are 51 ft. 4 in. over bumpers, 43 ft. over corner posts and 29 ft. 4 in. between truck centers. They are 8 ft. 9 in. wide over sheathing and 13 ft. 8⅝ in. in height above the rail. Four of the six have two passenger compartments, the other two having a baggage compartment about 14 ft. long, and a smoking compartment, with six seats, besides the regular passenger compartment.

Each car is fitted with a 50-c. p. headlight at each end, on top of the hood, and it is also fitted with a gong, air whistle and with the standard train air signal used by the Erie R. R. The toilet is in the center of the car, adjacent to the partition between the compartments. The "Standard" steel type of platform buffer is used, and the regular M. C. B. coupling, air hose connections and safety chains are provided, so that the cars can couple up to any of the standard Erie rolling equipment.

Electrical Equipment.—The electrical equipment of the cars consists of four No. 132-A Westinghouse single-phase railway motors, with a nominal rating of 100 h. p. each, the gear ratio being 20:63. The suspension is of the nose type, and solid gears are pressed upon the axles.

The control system is of the Westinghouse electro-pneumatic type and includes three distinct circuits, the high potential, the low potential and the control circuit.

The high potential circuit includes the pantograph trolley, line switch and the transformer. The pantograph trolley mechanism is operated by a pair of springs and by an air cylinder. The trolley is raised and held against the wire by means of springs against its own weight, and it is lowered by the application of air pressure to pistons working in cylinders that form part of its base. When down it is automatically locked, and the latch of this lock can only be withdrawn by applying air pressure to another small piston, which then unlocks the pantograph, allowing the springs to raise it. This trolley mechanism is so connected with the control circuit through the line relay that any interruption in the supply of high-tension current immediately causes the trolley to be lowered by applying the air to the main cylinders in the trolley base.

The line switch is equivalent to a main high-tension circuit breaker. It is opened and closed by air pressure, admitted by electrically operated valves. In case the supply of air is exhausted, as when the car has stood for some time unused, the line switch must first be held in mechanically by means of a handle provided for the purpose, until the air pump, which can then be thrown into operation, has compressed air to about 50 lb. pressure, which is enough to properly actuate the control system. To raise the trolley when there is no air pressure there is provided a small automobile tire pump, placed underneath one of the car seats, which is connected by a three-way cock into the trolley air piping system, and enables the air-operated trolley latch to be withdrawn and power obtained that will start the air compressor and set going the motor generator set, which is used for charging the storage battery and supplying current to the control circuit.

The transformer is of 200 k. w. capacity and is of the oil insulated type. It has three high-potential and eight low potential taps, the latter running from 300 down to 110 volts, at which latter pressure current is provided for heating, lighting and auxiliary purposes.

The high-tension wiring of the car is done mainly with varnished cambric cable, drawn through loricated iron conduit. A small amount of high-grade rubber cable is used, but it is thoroughly protected with varnished cambric tape wherever there is danger of a brush discharge to ground breaking down the insulation.

In the main low-potential circuit are the switch group, the preventive coils and the reverser. The switch group is a set of air-operated switches, controlled by magnet valves, all mounted in one frame. It is placed athwart the car as near as possible to the low-tension end of the main transformer. The switches of the group are all provided with interlocks, which automatically govern the connections in such a way that each switch of the group acts only when the current in the motors has reached a predetermined value, thus making acceleration automatic. Preventive coils are used across the terminals of some of the switches of the group, to prevent excessive current flowing at the instant of closing the switch. Each switch in the group is fitted with its own blow-out coil. There are two reverser switches actuated by air pressure, one for each pair of motors.

Current from the main motor circuit is led through the motor limit switch, which makes effective the functions of the interlocks on the switch group, and renders it impossible for the successive switches to be thrown in unless the limit switch is closed.

The control circuit includes a master controller in each vestibule, the train line wires and their connections to the valve magnets, and interlocks a storage battery supplying current for these wires, and a motor generator set, which is used either to charge the batteries or to actuate the control system. The master controller makes the proper connections, by means of which the 15-volt storage battery actuates the valve magnets which control the action of the air-operated main contactors in the switch group, and the reversers. The controller handle is normally held in a vertical central position by springs, unless it is moved to one of the running points by the motorman. When released from the grasp of the hand it flies to the vertical position, cutting off the power, and enabling the emergency application of the brakes by means of brake relay valve alongside of it. There are two holes in the face of the master controller, directly under the handle, and attached to the handle by means

of a chain is a plug which may be inserted into either of these holes. The master controller is not operative unless this plug is pushed all the way into the lower hole, which closes the line switch connects the generator and battery, and puts the brake relay valve into circuit. This is the ordinary running position of the plug. In case the line switch is opened by an overload, which generally causes the trolley to be lowered, the plug is taken out of the lower hole and placed in the upper, which action immediately closes the line switch, releases the trolley and allows it to spring up against the wire. As soon as the power is thereby returned to the main circuit the plug is taken out of the upper hole and replaced in the lower one.

There is a push button upon each side of the bottom of the master controller case. That on the right-hand side is used for dropping the trolley and opening the line switch. When the button on the left-hand side is pressed the switch group is stepped up to the last, or high speed, notch and remains in that position until the handle of the controller has been returned to the off position.

There are four distinct notches on each side of the controller, the first corresponding to the coasting position with the power off, the others enabling such gradations of speed as may be desired. Reversal is effected by moving the controller handle to the opposite side of the center, or dead, point. If the controller stops on the dead point, as it will if released by the hand, it will immediately apply the brakes.

The motor-generator set is a compact machine of about 1/6 k. w., the motor being of the self-starting induction type, wound for 110 volts, the generator being normally of about 23 volts. It is placed under one of the seats in the car and is covered by a box with removable lid, so that it can easily be reached for such small attention as it requires. It is mounted upon rubber bushings, and runs so quietly that its presence in the car can hardly be detected.

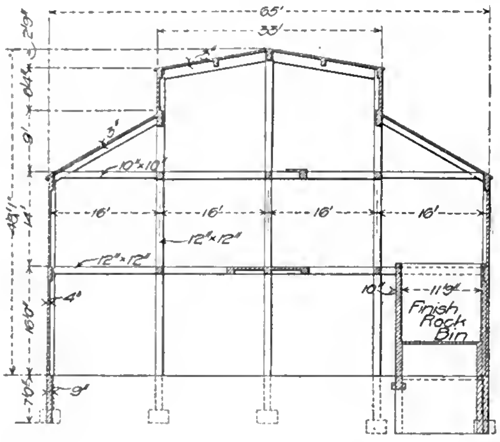
The storage battery consists of seven cells contained in a wooden box with handles, carried in an enclosed box underneath the car. No other auxiliary lines for any purpose are connected to the control circuit, in order to prevent it from being disabled by accidental grounds.

In one vestibule there is located in an asbestos-lined compartment, enclosed with steel doors, a slate switchboard panel, upon which are carried all the switches and fuses for the control of the battery and motor-generator set, the lighting circuits and heaters, and also the main connection from the low-tension side of the transformer to the auxiliaries.

The control circuit is fitted with junction boxes, branches running to receptacles at each of the four corners of the car directly under the end sills. The jumpers for connecting the cars and the receptacles are of the 12-point type, there being 12 wires in the main control circuit.

The low-tension wiring between the transformer and switch group and motors is all enclosed in a boxing of "Transite" to insure its protection against mechanical injury, as the inductive effect of heavy currents at low potentials renders the use of iron conduits impossible for this part of the wiring.

Operation.—The equipments above described were intended to be sufficient for operating single cars, with one stop per mile over the entire road, at an average schedule speed of 24 miles per hour, or to haul one trailer, making stops about 2½ miles apart, at the same schedule speed. The company has furnished shelters where the public highways cross the line, there being 22 of these flag stations, besides the regular intermediate way stations, at which steam trains stop, six in all, or a total of 28 stations at which electric cars may be required to stop. Practically the electric cars stop at all the regular way stations, but at only a portion of the flag stations. A single passenger coach is frequently attached to a motor car, and on some trains baggage, milk or postal cars are regularly hauled. When two trailers are hauled two motor cars are required, making a four-car train. The service has proved immensely popular throughout the Genesee Valley, through which it passes, and it is intended to increase the number of motor cars, in order to handle the business a little more comfortably next season. It is found that the electric trains on their 34 miles of line can be depended on to keep to their running time rather better than the steam passenger and freight trains operating over the main line.



Transverse Section of Plaster Mill.

Signal System.—The railroad company has installed a positive block system for insuring the safety of trains with the frequent headway at which they are obliged to be run upon the single-track road, which must also handle steam passenger and freight traffic at the same time. The blocks extend between the regular way stations, or if such blocks are too long switch towers are added, making the blocks average about 4 miles in length from one end of the line to the other. The sidings are fitted with interlocking switches controlled by the block operators in the towers or in the way stations, and the movement of trains is thus regulated with the greatest care. The towers are all connected by the private telephone line, while the way stations retain the usual telegraphic comunication with the train despatcher's office at Rochester. By means of the telephone communication it is instantly possible for a train crew to get in touch with the chief despatcher and be properly located, but all train orders are transmitted by telegraph and written out on Form 31, as is the uniform steam railroad practice throughout the country.

Telegraph System.—As is well known, the single-phase trolley system causes interference with telegraph lines along the right of way, and unless both the electrostatic and electromagnetic induction are properly compensated there is always danger of telegraphic communication being seriously affected. The static effect is particularly annoying, as it is absolutely continuous as long as the trolley line is charged, whether or not there are any cars moving. Various means were proposed and tried by the Western Union Telegraph Co. for the elimination of the "static," which always causes the telegraphic relays to chatter, but the most successful thus far known is that due to the inventive genius of Mr. E. W. Applegate, quadruplex expert for the Western Union Telegraph Co., who has developed a very simple means for overcoming static interference. Mr. Applegate worked upon the theory that it was useless to try to compensate for the static, and that the thing to do was to pacify the instrument by additional devices.

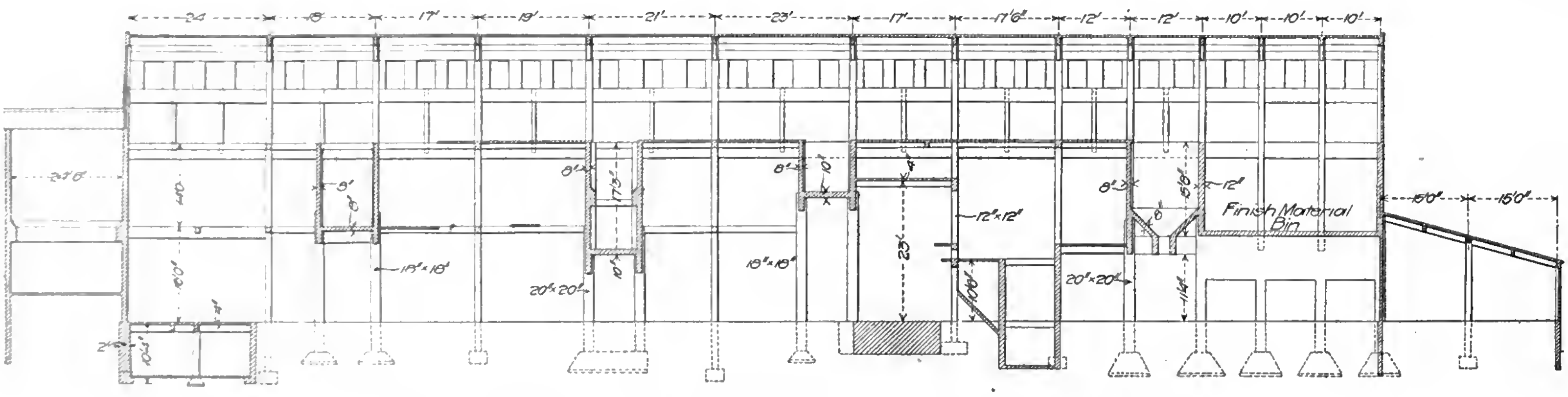
By this arrangement all the telegraph wires are "singled," and metallic circuits, the necessity for which was at one time pending, were discontinued, and the repeater service which they necessitated was also discontinued, and there is now a spare wire between Rochester and Mt. Morris through the entire zone of static interruption.

Speech over the telephone line is very clear and distinct, and, although the wires and instruments have a heavy static charge, a few simple precautions enable it to be of great use to the operating department. It is intended to carry portable telephones upon the cars.

Miscellaneous.—The single-phase system was recommended for the electrification of this division by the Electric Traction Commission of the Erie R. R., and after authorization by the company was installed under the general direction of Mr. J. M. Graham, vice-president and head of the construction department of the Erie.

The engineering and the construction work were carried out and the system brought into operative condition by Westinghouse, Church, Kerr & Co., who designed and erected the buildings and the catenary trolley construction, bonded the track and installed the electrical apparatus in the sub-station and on the cars.

The adjustment of the telegraph system was carried out jointly by the Western Union Tele-



Longitudinal Section of New Plaster Mill of the American Gypsum Co.

graph Co. and the telegraph department of the railroad company.

The order was given to the engineers on June 6, 1906, and, although the intense activity in construction work all over the country at that time rendered it difficult to secure materials and labor promptly, the work was pushed so rapidly that about 7½ months later, on January 22, 1907, the first official trial trip was run between Avon and Rochester. The severe winter weather thereafter prevailing delayed the completion of the work until spring. During April and May the whole equipment of sub-station apparatus, lines and cars was thoroughly tried out in a course of experimental operation, which also enabled the railroad employes to become familiar with the new system. On June 18 commercial operation began and has since continued, with marked success.

The Erie is one of the oldest steam railroads in the country, but that it is also one of the most progressive is demonstrated by its policy of giving a thorough trial to a system of electric traction whose characteristics of simplicity in construction and economy in operation make it so eminently fitted to replace steam motive power wherever the economic conditions point to the desirability of its substitution for the betterment of either passenger or freight service.

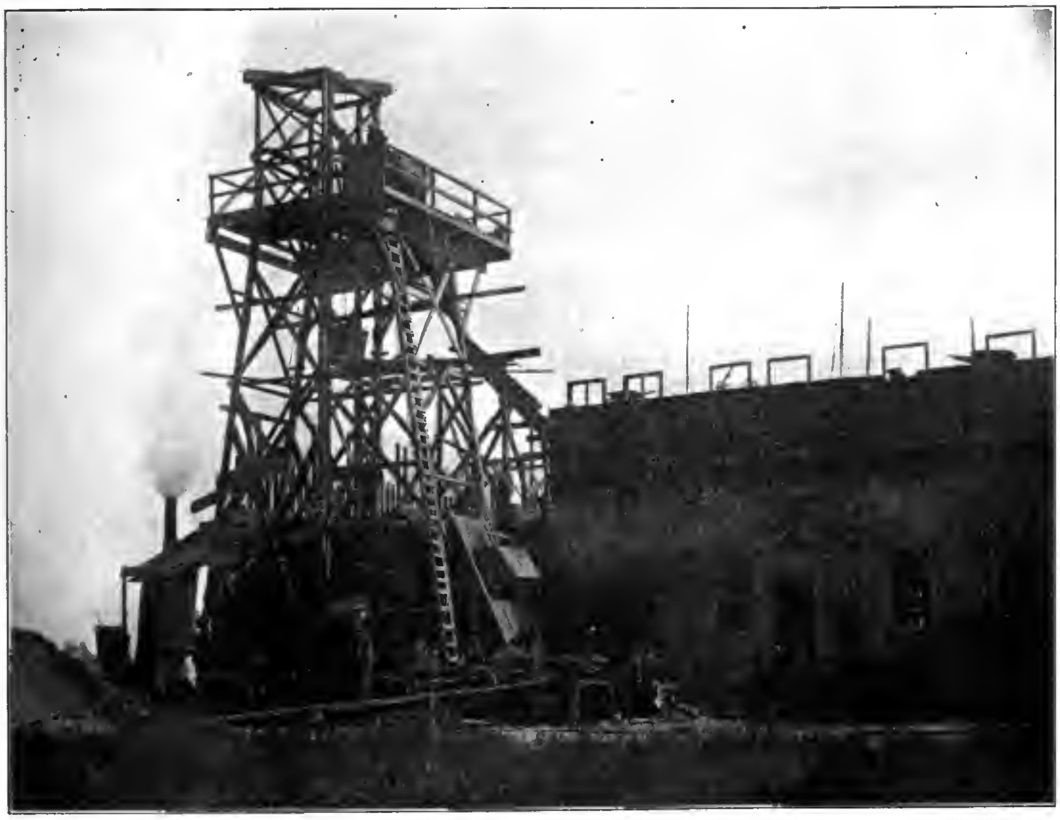
Steel Reinforcement in Brickwork is advocated by an architect of York, England, who has carried out a number of experiments with brick walls, in which the joints contain galvanized wire netting in the mortar. As a result of the experiments many claims are made for this type of construction, some of which seem a bit far-fetched, such as the assertion that by reinforcing its mortar joints, brickwork can be rendered as monolithic as reinforced concrete. On the other hand, the reinforcement of brick-work, when skillfully done, adds materially to the resistance of the walls to collapse after cracking. Probably a good many readers of The Engineering Record are aware that the brick walls of the famous Palace Hotel, of San Francisco, were reinforced by iron straps on the joints, and one reason that the masonry stood so firmly was unquestionably the presence of this reinforcement.

The New Plaster Mill of the American Gypsum Co.

The new plaster mill of the American Gypsum Co., situated three miles from Port Clinton, O., on the main line of the Lake Shore & Michigan Southern Ry., is 65 ft. wide, 270 ft. long and 35 ft. high from top of foundation walls to the plate of the building. It is constructed in skeleton form entirely of reinforced concrete.

The building was originally designed in steel with corrugated siding for walls, enclosing several very large steel storage bins with runways connecting the bins at various levels, but owing to the poor delivery quotations on the steel, it was decided to construct the entire building and the bins and runways of reinforced concrete. The resulting structure is absolutely fireproof, and the owners do not intend to carry any fire insurance at all, either on the building or equipment.

The price, as usual, was a consideration that had to be dealt with, and as the building originally designed in steel was covered only with corrugated siding, the use of brick or heavy concrete outside walls for the reinforced concrete building was out of the question. The contractors therefore decided to construct it in the skeleton form, using very thin reinforced concrete outside walls.



Concrete Mixing Outfit for Plaster Mill Mounted on Flat Car.

All foundations for building and machinery were built of concrete composed of one part Portland cement, three parts lake sand and six parts of 2-in. ring broken stone. The foundation walls, except those for basements, are 9 in. thick and are carried up to the ground floor, approximately 5 ft. above grade. This 5 ft. to floor level is filled in with the earth from the excavations and broken gypsum rock from the mine. In the heavy kettle foundation about 70 per cent. of it was composed of this rock laid in courses to within 16 in. of the top of foundation.

The building is divided into panels, 16 ft. across the width of building and from 9 to 24 ft. lengthwise of the building, the varying spacing lengthwise being due to the machinery required for the mill.

The floors at ground level over the basements in most cases support very heavy jaw crushes. The floor slabs are 6 in. thick, reinforced with ½-in. rods on 6-in. centers, and are approximately of 8-ft. span, between beams of 18 to 20-ft. spans. The runways throughout the building were designed to support a load of 80 lb. per square foot, except in special cases where there was machinery to be taken care of.

All of the outside walls above the ground floor are 4 in. thick, designed to resist a wind pressure of 60 lb. per square foot. The first 16 ft. of wall rests directly on top of the 9-in. foundation walls and the upper section of 14 ft. is carried on wall girders, joining all the exterior columns together and forming a belt around the building. The upper belt or plate, 30 ft. above the ground floor, was run at the same time the last section of wall was run, and all the steel reinforcement for the roof beams was placed at the same time, so that it would be securely anchored at the ends. The centering for the walls was made of wood panels 5 ft. high and 8 to 10 ft. long, bolted together with ½-in. bolts threaded at both ends. After the concrete had set 60 hr. the bolts were driven out and used again when raising the panels. Special care had to be exercised in raising the panels so as not to crack the walls, the concrete being green and the walls thin.

At the 16 and 30-ft. levels, cross struts were carried over to the interior columns in very much the same manner as for a steel frame. The struts are 12 in. square at the 16-ft. level and 10 ft. square at the 30-ft. level, with just sufficient reinforcing in each to take care of its own load, with a factor of safety.

The columns supporting these struts also supported the beams. Running lengthwise of the building, the columns, in most cases, were 12 in. square, reinforced with one 1⅛-in. rod in the center. The columns supporting bins were of sections varying from 16 to 24 in. square and reinforced with eight 1-in. rods, fastened together with hoops 12 in. on centers. These hoops were ⅜ in. in diameter, and each hoop was wired to every rod very carefully. The outside wall columns or pilasters were run in sections with the wall and reinforced with one 1-in. rod set 9 in. from the outside of the wall.

The beams are of rectangular section and support shafting, motors, dust bins and runways. The method used for securing the shaft bearings to beams proved to be very efficient; it was accomplished by a timber of the size and length required and fastened either on the top, side or bottom of beams with U-shaped iron clamps and the bearings bolted or screwed on to the timber.

All of the bins except the finish material storage bins have flat floors resting on beam construction supported by columns. The floors of bins are all approximately at the 16-ft. level, reinforced with ⅝-in. rods, on 5-in. centers in both directions for spans between beams 8 ft. 9 in. center to center; the walls of the bins extend to the roof plate in all cases. In several cases the end walls of bins form part of the outside wall of the building. The thickness of bin walls in most cases is 8 in. reinforced with ⅝-in. rods 6 in. on centers vertically, and ¼-in. rods horizontally 12 in. on centers.

The finish material storage bin, 65 ft. wide by 40 ft. long, supported on twelve columns 20 in. square, is designed with arch floor construction, the arches being 16 ft. span, 6 in. thick at the crown, reinforced with ¾-in. rods 12 in. on centers wherever bending occurs. The haunches form beams which are supported every 10 ft. by one of the columns. The outside walls are 18 ft. high, 12 in. thick from bottom to top, and are reinforced with ¾-in. rods vertically on 9-in. centers for the first section of 12 ft., and ½-in.

rods on 9-in. centers for the next section. The outside walls for this bin were run with 3 per cent. of Sandusky waterproof cement added to the concrete while mixing to insure an absolutely waterproof wall.

The roof of the building is the usual type, the first slope being a 1/3 pitch and the roof of the monitor nearly flat. The running of the concrete on the first pitch was somewhat difficult, as it had to be floated smooth and worked up the incline practically by hand. However, after the forms were stripped the under side presented a very even and smooth surface. The roof slabs are 3 in. thick, of 8 ft. span, reinforced with 3/8-in. rods on 7-in. centers with 1/4-in. distributing rods on 12-in. centers.

After the roof had been run about 18 days the concrete base was covered with a three-ply composition roof, cemented to the concrete with a roofing cement. After the roof had been down about two months, although not entirely completed, a very severe wind storm wrought havoc with the roof covering. The edges of the covering along the eaves of the building had not been securely fastened, and for this reason all of the roof covering of the monitor, or approximately 9,000 sq. ft., was carried away, although it had all been cemented to the concrete base. This same wind wrecked several other buildings throughout the country, and undoubtedly gave the 4-in. walls and the entire mill a very severe test, as the velocity was about 77 mi. per hour.

All of the concrete for the building above the ground floor was composed of a 1:2:4 1-in. ring broken stone mixture, using lake sand and Excelsior Portland cement furnished by the Cleveland Builders' Supply Co.

The steel rods used for reinforcing varied in size from 1/4 in. to 1 1/4 in. in diameter, and between 80,000 and 90,000 lb. in ultimate tensile strength. The 4-in. outside walls were reinforced with 1/4-in. rods in both directions. The outside wall columns and interior frame columns are reinforced with one 1 1/8-in. round rod. Special reinforcing for beams and girders was required, as in most cases they did not have floor slabs to help take care of the compression. All steel reinforcing was very accurately placed and wired before the concrete was run.

The most important factor entering into the construction of the mill was considered to be the vibration, as in buildings of this class it is generally very noticeable. The mill has been in operation since the first of the year and up to date has not developed any signs of weakness or fracture from this cause. There is a very great deal of noise in the building produced by the crushers, grinders, elevators, conveyors, and especially by the tumbling of rock in the steel rotary dryers, 80 ft. long, all of which tends to cause a slight quiver in all parts of the building, that can only be sensed by placing one's ear against one of the members or the wall. This, however, can never cause any damage.

Another remarkable test which has been going on ever since the building was started is caused by the blasting of gypsum rock in the mine directly under the building. The shock of these blasts can sometimes be felt in the neighboring houses about one-half mile from the shaft. The bottom of the shaft is about 50 ft. below the surface.

The concrete mixing and placing was one of the most interesting features of the job, as the equipment, consisting of a mixer, elevating tower and hoist, was placed on a 33-ft. flat car, which taveled alongside of the building.. The sand, stone and cement were all placed in the slip bucket at the rear of the tower and hoisted to the mixer platform and dumped. The water for mixing was controlled by a man standing in front of the mixer. The same man dumped the contents of the mixer into a side dumping elevator bucket. The entire batch was then hoisted to the top of the tower and discharged into a steel hopper, from which it could be spouted the entire width of the building, a distance of about 75 ft. from the center of the tower. When working under the best conditions, it only required eleven men to mix, place and tamp the concrete, including the hoisting engineer and one man carrying cement. The best day's run of the mixer on floor work was 90 cu. yd. in 10 hr.

The amount of lumber required was approximately 460,000 ft. B. M. The percentage of waste lumber was very great, because the building was of skeleton construction and lacked typical details. The lumber for surface work was No. 2 pine shelving, bought at $16 per M., and would not stand hard usage.

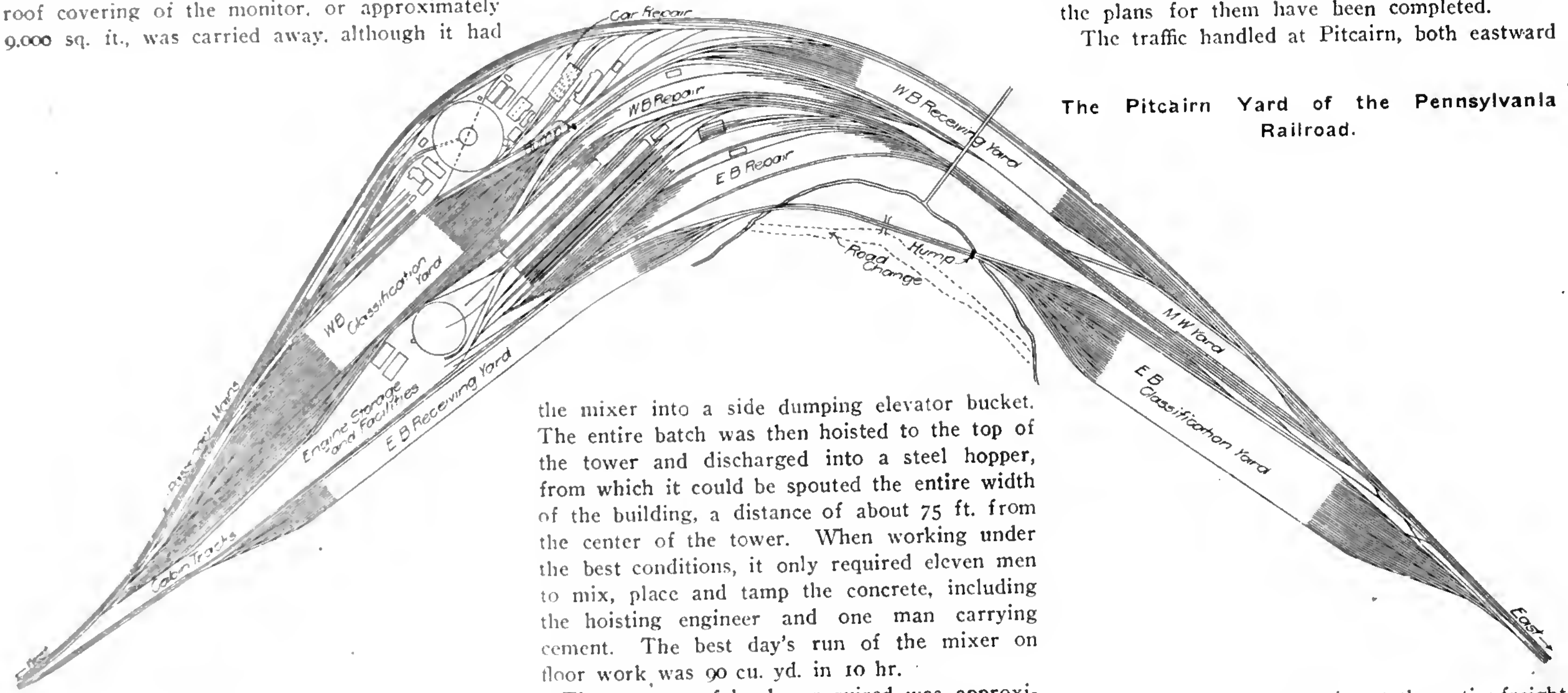
The entire building was designed and erected under the direction of Mr. W. S. Ferguson, chief engineer of the Carey Construction Co., of Cleveland, O., the contractors for the building. Mr. F. W. Griswold, engineer of the American Gypsum Co., had general supervision of the entire plant.

THE SALVING OF THE "SUEVIC," the 550-ft. White Star liner wrecked off the Lizard last spring, has been successfully accomplished. The uninjured part was first cut away and towed to Southampton. The cutting was done by exploding gelagnite cartridges, ranging from 2 to 10 lb., laid close to the outside of the plates in canvas covers and fired electrically. At Southampton the jagged plates and framing were cut away and preparations made for attaching the new section of the hull. The latter was made at Belfast and, according to "The Engineer," was to be launched and floated to Southampton Oct. 5. There the new 180-ft. part will be joined to the other in a dry dock.

The Pitcairn Yard of the Pennsylvania Railroad.

The Pennsylvania R. R. is at present making extensive improvements in its freight yard at Pitcairn, Pa., 15 miles east of Pittsburg, which were undertaken in order to increase the capacity of the eastbound yard and of the engine and car repair facilities. The westbound yard at the present time has a capacity of about 2,900 cars, and the eastbound receiving and classification yards a capacity of about 1,500 cars, the eastbound advance yard holding about 684. The total capacity of the yard when the new eastbound yard and the new car and engine facilities and transfer tracks are completed will be approximately 7,800 cars, exclusive of running tracks and short connections between the various buildings of the mechanical plant. The total length including the eastbound advance yard is about 15,000 ft. The work on the new yard is now in progress and track is being laid in the classification end, but the new motive power and car repair facilities and the additional transfer storage tracks may not be built for some time, although the plans for them have been completed.

The traffic handled at Pitcairn, both eastward



The Pitcairn Yard of the Pennsylvania Railroad.

and westward, represents almost the entire freight movement of the Pennsylvania R. R. in the Pittsburg district, which requires distribution and transferring from one branch or division to another. The total movement amounts to 4,000 cars per day, divided about half and half between eastbound and westbound traffic. A considerable part of this originates with or is intended for the large steel and rolling mills and manufacturing plants in the Pittsburg district, and this has necessitated the assignment of classification tracks for the sole use of freight for these industries.

Although the traffic movements in the two directions are about equal in the number of cars and in the proportion of loaded to empties, there is some difference in the classification requirements, though not sufficient to make any radical change in the operation of the two yards. Twenty-seven classifications are required in the eastbound movement and 33 for the westbound, the cuts averaging 2 cars eastward and 1 1/2 cars westward. The tonnage ratings in both directions allow train lengths running from 40 to 50 loaded cars, or 80 empties, and these train lengths naturally have affected the lengths of tracks in the classification and advance yard.

The yard is situated in a valley through which runs Turtle Creek, a muddy stream that rises rapidly in the spring and carries a large volume of water. The creek, forming the boundary of

the yard on the north, and the hills, about 300 ft. high, on the south, effectually check the expansion of the yard in these two directions. The creek originally flowed along the base of the hills now occupied by tracks and its bed was thrown 1,500 ft. to the north when the yard was first constructed. The east and westbound passenger mains, the through line between Pittsburg and New York, are carried beside each other along the north of the yard, the westbound main following for some distance the bank of Turtle Creek. Only a few tracks to accommodate the coaches for the Pittsburg suburban traffic, the terminus of which is Pitcairn, are placed north of the passenger mains, and are operated independently of the freight movement in the main yard.

The center of the yard is on a curve or series of curves, the total central angle of which is approximately 68 deg. The east end of the eastbound receiving yard is on a 2-deg. curve, which compounds near the end of the exit ladders into a 4-deg. 45-min. curve. This is followed through the yard by a tangent which ends in the beginning of the classification tracks in 3 to 4 deg. curves, depending somewhat on the direction of the ladders. This yard hugs along the base of the hill on the south, and the passenger mains gradually depart to the north until the maximum width of the yard becomes 1,600 ft. The passenger mains forming the northern boundary of the yard going eastward from the end of the main tangent start on a 2-deg. 45-min. curve when nearly opposite the car repair roundhouse. This compounds near the Pitcairn station into a 1-deg. 50-min. curve and finally into a 30-min. curve alongside of the westbound receiving yard. The tracks of any particular group are as far as possible on tangents and the curvature is thrown into the throats between groups. This, however, was not possible in all cases and consequently the west end of the westbound receiving yard and parts of the car repair and transfer tracks are on curves.

The westbound receiving yard contains one ladder feeding 16 tracks, averaging 62 cars each, and having a total capacity of 968 cars. Exit from it is by means of 2 ladders, 10 tracks on one and 6 on the other. A thoroughfare is maintained around the yard to allow ready access to the transfer or shop tracks without delay in the receiving yard. Two tracks connect with the exit ladders which lead over the hump, where the 2 scales are located, to the gravity classification yard. The latter contains 29 tracks with a capacity of 60 cars each, divided on 4 ladders, and 5 shorter tracks for preferred freight. The total capacity is 1,900 cars.

Alongside the 2 inner ladders are thoroughfare tracks on which the locomotives which bring the car riders back to the hump are operated. Each locomotive is fitted with poling car and the thoroughfare on which it runs, being located alongside the ladders, can be used as a drill track for poling such cars as may stick on the switches. This provision allows of the uninterrupted use of all tracks whose head blocks lie between the hump and a stalled car, since it is not necessary to send an engine in over the ladder, the grade being so designed that a car once freed from the switches is quite certain to have no difficulty in running along the open track. Under the older method of sending an engine in over the ladder, all of the tracks in that particular group are often put out of service until the engine has finished its work and backed out over the hump.

The switches in this yard until a year ago were thrown by hand, but this method has been superseded by an electro-pneumatic system installed by the Union Switch & Signal Co. A switchboard built in 5 banks, with 12 sets of controlling push buttons to a bank, is located at the hump, and at the present time with 42 switches in operation is easily handled by two men. Hand operation of the switches under present traffic requirements would require 11 men, the system therefore effecting a saving of nine men on each shift. Each switch is controlled by two push buttons, above which is a dial indicating the position of the switch, whether opened or closed. The cut slips are handed to the switchboard operators, and no difficulty is found in throwing switches as fast as the cars can be pushed over the hump. The maximum number of cars classified under the new method in 12 hr. is 1,400, while with hand operation 600 cars was the maximum obtained for the same period. Fifteen car riders are employed, and a similar number will probably be required in the new eastbound yard.

The present starting grade on the hump has been found satisfactory, though originally a lighter grade was used. The grade of the first 100 ft. is 3½ per cent., of the next 200 ft., 2½ per cent.; the next 700 ft., extending to the end of the ladders, 1½ per cent.; the following 900 ft., reaching about the middle of the yard, ½ per cent., and the remaining 1,000 ft., extending to the beginning of the exit ladders, 0.2 per cent. The ladders themselves are on a 0.1 per cent. down grade.

The tracks in the classification yards are on 13-ft. centers, excepting where the poles for the arc lights are set, in which case 17 ft. is used. The yard is well lighted by night by lights without reflectors placed along the ladders and the thoroughfare tracks. Access for pedestrians to the portion of the yard lying south of the westbound tracks is had through a twin concrete passage directly under the hump and at the grade of the car repair tracks.

Between the westbound yard and the passenger mains is one part of the car repair plant, consisting of a roundhouse for housing cars which are being overhauled, and the various auxiliary shops for blacksmith, machine, carpenter and paint work. The principal part of the car repairing facilities, however, lies between the east and the westbound yards, and it is in this portion that the proposed improvements in buildings and tracks are to be made. There will be two distinct groups of repair tracks, the westbound having eight tracks with a combined capacity of about 340 cars, and the eastbound 13 tracks with a capacity of 480 cars. These tracks are connected with the receiving and classification yards of the west and eastbound movement by thoroughfare tracks, so that cars can be interchanged without interfering with the other business of the yard. In the repair yards the tracks are alternately on 15 and 24-ft. centers, an extra track of standard gauge with dead ends being placed in the wider space to afford means of conveying repair materials on low push cars to points where needed.

The transfer facilities are very extensive and are demanded by the great volume of freight which requires changing from through to local cars or such other transfer as is usual in a yard of this description. The eastbound transfer storage tracks when completed will have room for about 260 cars and the westbound tracks, eight in number, a capacity of 200 cars. In addition to these there will be four tracks holding about 100 cars, which can be used either for shop or transfer storage. The transfer tracks, in the same manner as those devoted to car repairing, are connected by thoroughfares with both of the receiving and the classification yards, so that access is had to them from the receiving yard, and from them to the end of the classification yards without interfering with the normal handling of freight.

There are at present two 800-ft. transfer sheds in use, each 40 ft. wide and surrounded by platforms. It is proposed to extend one of these sheds 320 ft. and build a platform of the same length adjoining the other. Two open transfer platforms, each 15x1,115 ft., will also be built. For the transfer of heavy freight a 50-ton and two 5-ton cranes, spanning four tracks, will be installed.

A novel arrangement for transferring freight from damaged bottom dump cars is also planned It will consist of a track elevated 22 ft., beneath which will run a track on the ground level. The damaged cars will be pushed up a 2½ per cent. incline on to this elevated track and dumped into the cars standing on the track below. This elevated track is level for 400 ft. In addition to this arrangement two tracks, each 1,160 ft. long, are provided for transferring from a damaged to a good-order car, such materials as can be shovelled or easily handled and do not need separation to different branch roads.

A considerable increase in engine facilities is planned in connection with the improvements, but the work has not yet been begun. The area now devoted to engine storage tracks and part of the present eastbound yards will be entirely rearranged so as to afford ample room for the motive power department. Seven tracks, each 360 ft. long, located west of the engine roundhouse, will be built first and a large area adjoining these tracks will be left for future extensions. The present roundhouse has 46 stalls, and there are large machine and blacksmith shops for making the repairs usual at a large engine terminal. Seven or eight new buildings are proposed, including a large bunk and store house, 65x180 ft. in plan. The inspection and ash pits are also to be increased in size.

New Eastbound Yard. The eastbound yard is divided into receiving, classification and advance groups. The first two groups of the old yard are now being replaced by the new yard lying to the south at the foot of the hill, and when these are completed the total capacity for eastbound movement will be about 3,300 cars, 915 in the receiving yard, 1,700 in the classification and 680 in the advance yard. The receiving yard lies opposite the westbound classification yard and is separated from it by the engine and car repair tracks. The classification yard is east of the westbound receiving yard, the entrances of the two being about opposite each other, and the advance yard, being still farther east, is entirely out of the main-yard area. The throat between the receiving and the classification track has been made very long, about 1,400 ft., this being necessary to throw the classification yard as far as possible beyond the hill which curves here to the north and ends in a neck through which a wide cut has been made to accommodate the yard entrance.

The receiving yard has 13 tracks, each about 3,050 ft. long, with a capacity of 76 cars each. Six of them are on one ladder and seven on the other, while the last track is devoted to running purposes. The classification yard has 26 storage tracks with an average capacity of 66 cars each, arranged on five ladders. Four thoroughfare tracks have been provided, two of them placed between adjacent pairs of ladders, one alongside the remaining ladder, and the last on the extreme south side of the yard. These thoroughfares will be used, as described for the westbound yard, for operating engines hauling poling cars, which will perform the double duty of freeing such cars as stick on the switches and returning the car riders to the hump.

The receiving yard is on an ascending grade of 0.7 per cent., which at the beginning of the exit ladders changes to 1.4 per cent., and continues at that rate through the throat until within 200 ft. of the hump. The starting grade on the hump for the first 100 ft. is 3½ per cent.; for the next 200 ft., 2½; for the next 800 ft., 1½;

for the next 2,300 ft., 0.4 per cent. From this point there is an ascending grade of 1 per cent. for 800 ft., where the tracks connecting the classification and advance yards attain the same elevation as the main-line tracks. This arrangement of grades puts all of the ladders on a 1½ per cent. grade, and this fact combined with the use of poling cars on the drill track alongside the ladders will insure against cars sticking and giving trouble on the switches. The centers to be used are the same as in the present westbound yard, 13 ft., except between those tracks where the poles for the electric light wires are placed, the centers here being 17 ft. The lighting of the yard has been given special consideration, and as a result of the experience gathered in the westbound classification yard the arc lights have been placed not only along the ladders, but throughout the entire yard.

The advance yard contains six tracks with a total capacity of 680 cars, each track being long enough to hold two loaded trains.

The drainage of the yard has proven quite a troublesome question, and has necessitated four distinct drainage channels through the yard. As stated before, Turtle Creek originally skirted the hills which now form the southern boundary of the yard, and the changing of its course to its present location makes it necessary to convey by artificial means the water draining from the hills and through a number of small draws. At the west end of the yard a drainage ditch 10 ft. wide and about 6 ft. deep has been constructed to carry a stream from one of the draws and discharge it into an 8-ft. arch culvert leading under the tracks to Turtle Creek. The ground which will be occupied by the new engine facilities is too low to drain by gravity, and for that reason a pumping system will be installed. Suitable catch-basins and drains will be provided to convey the water from the low area to a sump, 25 ft. in diameter and 25 ft. deep, built of concrete. Part of this sump will be partitioned off into a chamber in which two pumps, one electrically and the other steam driven, will be installed. The pumps will be started automatically by means of floats, the electrically driven pump being relied upon for the major part of the work and the steam-driven held in reserve as an auxiliary. From the sump the water will be forced through a 24-in. cast-iron pipe to Turtle Creek. The pipe was laid under the network of tracks by opening up a ditch of the length of two sections of pipe and completing it before carrying the work farther. The ground through which the pipe runs was of such a nature that it was not deemed safe to lay the pipe without a foundation, and for that reason it has been constructed on a layer of concrete 34 in. wide and 5 in. in depth. After it was in place and caulked it was completely surrounded with a concrete covering just sufficient in thickness to cover it well on all sides. Another drain pipe, 36 in. in diameter, runs through the area which is to be drained by the pumping system just referred to, but is on such a grade and at such a depth that it can carry only the water collected at the foot of the hill.

Continuing eastward through the yard, another drainage system is encountered, near the hump of the new eastbound classification yard. It consists of two 36-in. cast-iron pipes laid side by side and draining three small draws. The water is delivered to these pipes from the points where it is collected by an open concrete drain 2½ ft. deep and 4½ ft. wide. About 600 ft. from the end of the classification yard a double 3x4-ft. box culvert has been built to care for the drainage of that portion of the yard. A ditch 2,500 ft. long collects the water and carries it to the south end of this twin box. Between the eastbound classification and advance yards Brush Creek crosses the right-of-way through a six-track, three-span masonry bridge. The spans are each 25 ft., with a 9-ft. rise, the springing line being 8 ft. above the bed of the creek.

Ample provision for fire protection has been made by water mains throughout the entire yard, hydrants being placed at convenient intervals.

The Construction of the New Yard.—The work on the new eastbound receiving and classification yards was started in April, 1906, and at the present time the tracks are laid in the receiving end, but the grading is still in progress for the classification tracks. The greater part of the receiving yard is constructed on a fill from 8 to 25 ft. high, rising toward the east end of the yard in order to attain the proper elevation for the hump. The material for this fill is secured from the heavy cut at the entrance to the classification yard. The latter lies partly in the cut referred to and partly upon filled ground, the cut in one place running to the maximum of 70 ft., and the fill from 5 to 30 ft. The total excavation is 1,175,000 cu. yd., of which 804,282 yd. are in the large cut above referred to.

The material encountered is principally shale, which disintegrates upon exposure to the weather, but which had to be blasted for rapid removal. A light layer of mixed soil, sand and gravel overlies the shale, which is about 25 ft. thick, and beneath the latter is a bed of low-grade lime-stone. The holes used for the blasting were drilled by three Star portable drilling machines, and in all cases went down to the grade it was desired to secure at the point where they were sunk. The holes averaged between 35 and 40 ft. in depth, the maximum being about 70 ft. The diameter of the holes was 6 in. Where solid rock was encountered eight Ingersoll-Rand steam-driven drills were used. Large masses of stone and shale which could not be economically broken up by hand were mud capped. Soil was removed by Bucyrus 70-ton steam shovels, two working on each side of the hill through which the throat of the yard has been cut. After the major part of the work was completed, but two of the shovels were required to complete the work, and these are still in operation. The earth and rock were removed by 3-yd. side dump cars running on 42-in. tracks, and wherever possible these cars were operated in good sized trains so as to avoid delaying the shovel. In order to do this it was necessary in one case to cut a bench of considerable length on the side of one of the hills in order to back a long train of dump cars on to it and thus save time over the other method of merely backing a few cars at a time alongside the shovel. The first cut of the shovel was taken in the hillside at the sub-grade level and the soil merely thrown to the opposite side, thus forming a bench upon which the narrow-gauge track was laid. The work was continued in the customary fashion, the narrow-gauge track being moved laterally as fast as the fill outside of it was completed. The work has required the use of 17 narrow-gauge locomotives and 180 side-dump cars. The contractor for the work is H. S. Kerbaugh, Inc., Philadelphia.

The Nelson Street Viaduct, Atlanta, Ga.

In connection with this work it has been necessary to make a road change about 2,000 ft. long and to construct an arch beneath the throat between the receiving and the classification yards in order to connect the highway with an overhead bridge spanning the old yard. The arch is of masonry 46 ft. long, with a span of 30 ft. and a rise of 7½ ft. A track running off to the right at the east end of the eastbound classification yard has necessitated a change of the channel of Brush Creek, and this was done by means of a steam shovel working in the new bed of the stream. Another piece of work done at the same time, but independent of the new yard construction, was a retaining wall of concrete at a change in the course of Brush Creek alongside the advance yard. The wall is 5 ft. high, 3½ ft. thick and 1,400 ft. long. It is composed of 1:2:5 concrete with dredged sand, and gravel up to 1½ in. in diameter. The material was mixed in a Smith mixer mounted alongside a track on the north side of the creek; although the retaining wall itself is on the south bank. This arrangement requires all of the concrete to be wheeled across the creek, and for this reason light timber runways were thrown across from bank to bank at three different points, and the mixer moved opposite these as the work progressed. The advantage of keeping the mixer on the north bank was that only one class of material, the mixed concrete, was wheeled across the water, whereas if the mixer had been placed on the south bank the sand, gravel and cement would all have had to be taken over the creek separately.

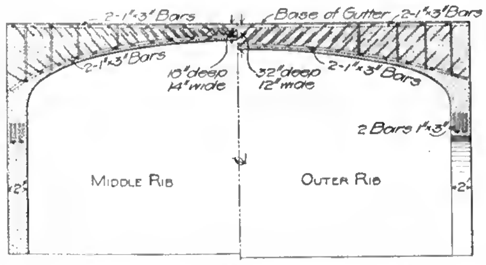
The construction of the new yard is in charge of Mr. N. F. Brown, assistant engineer, Pennsylvania R. R., Pittsburg, Pa.

The Nelson Street Viaduct at Atlanta.

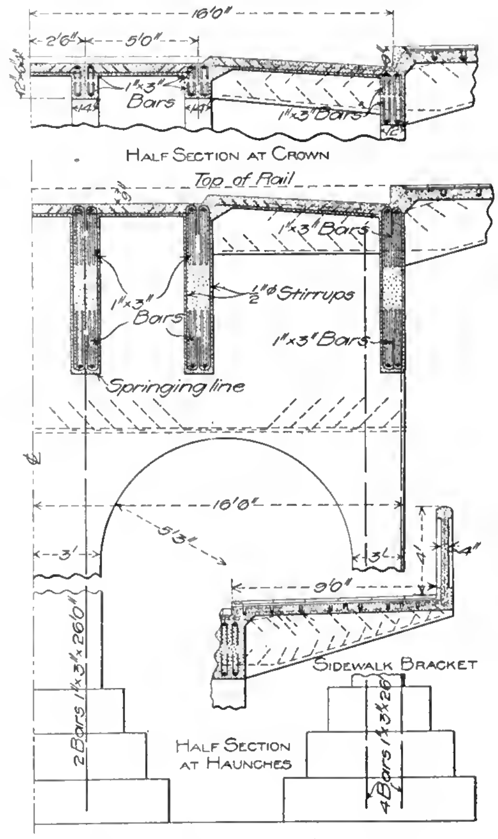
The old steel viaduct, which formerly carried Nelson Street, Atlanta, Ga., over the yards of the Southern Railway, recently has been replaced by a reinforced concrete structure 479 ft. 3¼ in. long, made up of ten flat arch spans, seven of which are between 40 and 50 ft. in clear span, the remaining three having spans of 75 ft., 53½ ft., and 20 ft. 5⅝ in., respectively. The width of the new viaduct from center to center of outside arch ribs is about 32 ft. This is the width of the roadway proper on which is carried vehicular traffic and in the center a double-track street car line. Outside the roadway on each side is a 9-ft. sidewalk carried by reinforced concrete cantilever beams, as shown in accompanying illustrations. The clear headroom over the main and freight yard tracks is 21 and 18 ft., respectively. From one end the roadway rises on a 2 per cent. grade for 100 ft.; then it meets a vertical curve 40 ft. long; and the remaining 339¼ ft. is on a 2 per cent. downgrade to the other end. In the yard the viaduct crosses over two canopied freight platforms, inbound and outbound respectively, one of which may be seen in an accompanying illustration.

The arches are of the ribbed type, reinforced with Kahn trussed bars and built continuously through the supporting piers. There are six ribs supporting each span, four in the center spaced 5 ft. on centers under the street car tracks and the two outside under the curb lines of the driveway. The cantilever beams supporting the sidewalks are 10 ft. on centers and are attached to the two outer ribs on each side. The ribs are designed to support: The dead load imposed by the concrete and road materials, assumed as 140 lb. and 100 lb. per cubic foot, respectively; 100 lb. per square foot live load on the sidewalk; 100 lb. per square foot or a 15-ton moving road roller on the driveway; and a succession of 40-ton electric cars on the track ribs.

Five successive spans over the freight yards, ranging from 40 ft. ⅛ in. to 44 ft. 2¾ in. in length are typical. In these spans each of the four ribs under the car track is 14 in. wide and 18 in. deep at the crown, while those under the curb lines are 12 in. wide and 32 in. deep at the same point. The depth in each case includes the 6-in. floor slab which was built continuously over the ribs in the same manner that the latter were built through the piers. Each rib in these spans is reinforced in both intrados and extrados with ribs with ½-in. transverse bars 18 in. on centers. Between the outside rails and the curb line the reinforcement is ½-in. transverse rods 15 in. on centers. The 5-in. sidewalk slabs have ½-in. longitudinal rods 15 in. on centers. Over the four center ribs the floor slab is depressed about 4 in. to afford room for the street car rails, the tops of which are flush with the 4-in. wood block pavement. The reinforcement of the cantilever sidewalk brackets and the concrete railing is in-



Sections of Ribs of Typical Span.



Cross Sections of Typical Span.

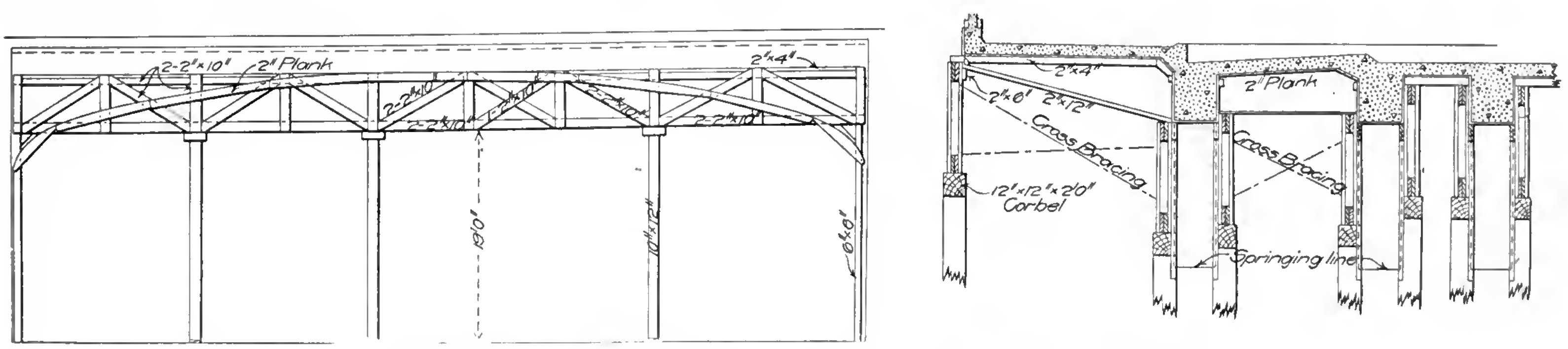
wide each, while the middle one has a width of 6 ft. Each leg rests on separate stepped footings carried down to a maximum depth of 6⅔ ft. below the top of the rails. The reinforcement in the piers of the typical spans consist of two 1x3-in. bars placed just above the soffit plane of the arch openings and four 1x3-in. bars in each pier leg extending from the bottom of the footings up to the floor slab.

The construction of centering for most of the spans presented no problems of unusual difficulty. Two spans, however, 47 and 75 ft. long, over the main line tracks had to be constructed without interrupting or endangering traffic on any of these tracks. This prevented the placing of the usual intermediate falsework between the piers and necessitated carrying the centering on wooden Howe trusses arranged as shown by accompanying sketches. The concrete was prepared in a No. 1 Smith mixer, a 1:2:4 mixture being used for the arch ribs and floor and a 1:3:5 mixture for the piers and footings. The stone was crushed in an Aurora crusher, driven by a 15-h.p. Frick engine, and was hoisted into bins from which it was drawn out as needed on a platform at the mouth of the mixer. The latter delivered to skip cars which were hoisted up an inclined track to the deck of the bridge by a Lambert single-drum hoist taking steam from the crusher engine boiler. On the bridge the skip cars were switched on to the proper track by a turntable. The entire contract involved the placing of about 2,500 cu. yd. of concrete and 100 tons of reinforcing steel. Work was begun May 1, 1906, and was completed January 1, 1907.

The viaduct was designed by the Trussed Concrete Steel Company, subject to the approval of Mr. D. W. Lum, chief engineer of maintenance of way, Southern Railway. Mr. W. W. Griffin, of Atlanta, was the contractor.

Perforating a Well Casing in Position.

Drilling apparatus has been used by Messrs. Merryweather & Sons, Greenwich, England, in sinking an artesian well. The well, which was lined with 12-in. pipe, had been driven through a water-bearing stratum in the hope of securing a more abundant flow at a lower level. This hope was not fulfilled, and it was decided to tap the stratum that was first penetrated. The well casing had cut off this flow, and it was necessary to perforate the pipe by drilling from the inside. Two drills, to each of which was keyed a bevel gear-wheel, were mounted horizontally,



Elevation and Section of Centering for 75-Foot Span, Nelson Street Viaduct.

two 1x3-in. Kahn bars arranged in general as indicated on an accompanying diagram. Toward the ends of each rib, where the shear prongs of the bars in the intrados and extrados do not meet, ½-in. stirrups are used as shown. The top rib bars are continuous through the piers, the ends of successive rods lapping at the centers of the spans. In general this system of reinforcement is characteristic of the other spans, though it differs in detail owing to variation in span and size of arch ribs.

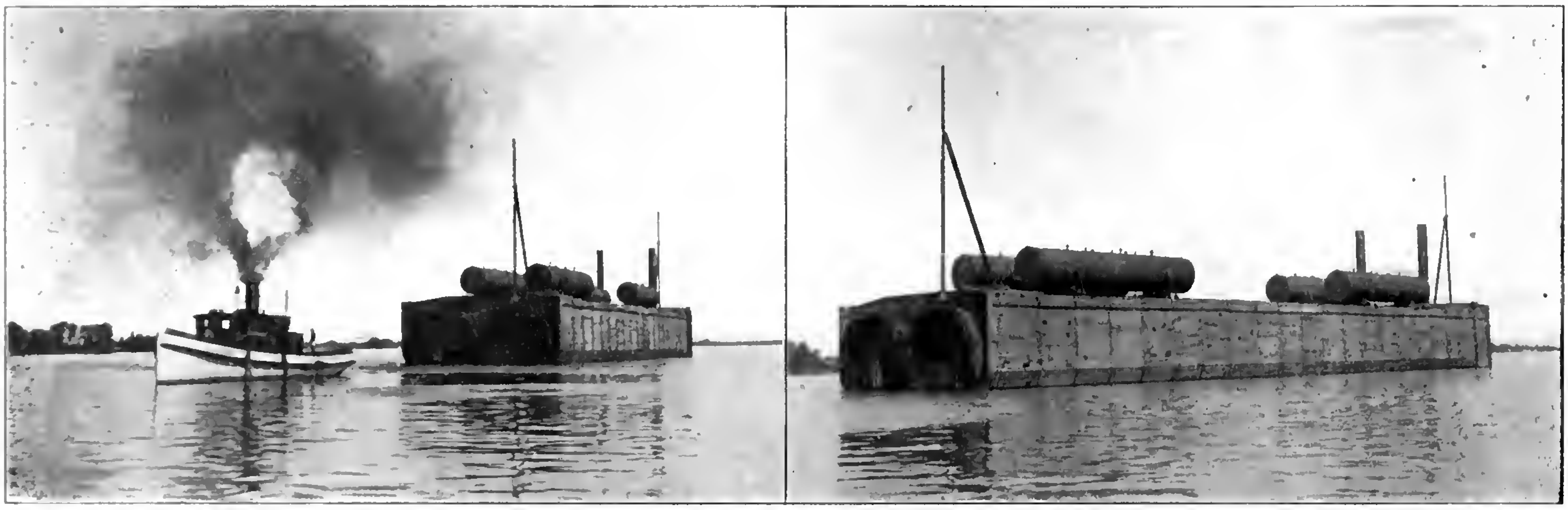
The 6-in. floor slab is reinforced over the track dicated on the drawing. Where the beam opposite the bracket is omitted, as it has been where the position of the piers prevented its construction, the upper rods of the bracket are extended into the floor slab and the lower rods are tied into the outside arch rib.

The piers in the freight yard, where the clearance is 18 ft., are 2 ft. thick, while those supporting the higher spans over the main track are 3 ft. thick. Each pier is pierced with two arched openings 10½ ft. wide, three legs being thus formed. Of these, those on the outside are 3 ft.

pointing in diametrically opposite directions, and a third bevel gear-wheel, keyed to the vertical boring rod, meshed with these two. To feed the drills the inner ends of the drill shafts were threaded, and each carried a miter wheel tapped to fit the drill shaft. Another wheel on the vertical shaft engaged these wheels, and, the gear ratio of this set of wheels being different from that of the driving gears, as the boring rod turned the drills revolved more rapidly than the threaded spindle wheels, and so were fed forward.

The Detroit River Tunnel Caissons.

The general design of the Detroit River tunnel was illustrated in The Engineering Record of Feb. 17, 1906, and details of the method of construction finally adopted were explained in the issue of March 2, 1907. There are to be two tubes, 20 ft. in interior diameter and 26 ft. 4 in. apart on centers, leaving a clearance of 3 ft. between them on the center line. Each tube has a riveted steel shell 23 ft. 4 in. in diameter, the pair of them for each section being placed in a long pontoon, which also serves as a mold or form to retain the concrete, which will be filled in around the steel shells after the section has been sunk into place in the trench dredged for it. The upper part of the trench is excavated by a dipper dredge, and the lower part by a clam-shell dredge provided with a specially designed bucket. The subaqueous portion of the tunnel will consist of ten sections like that illustrated, each about 260 ft. long. The shells on top of the section are air chambers, which are used in sinking the tubes, an operation which it is planned to carry out as follows: Inlet valves in the bottoms and outlet valves in the upper part of the bulkheads are opened, so that water enters through the former and air escapes through the latter, causing the tubes to sink slowly until the outlet valves are submerged. The latter are located so as to retain a certain quantity of air above them, which gradually escapes through vent valves, operated from the attendant scows. Finally enough additional water is admitted to sink the tubes below the surface, until the air cylinders on top commence to be submerged and maintain the tubes in a horizontal position, preventing them from sinking farther until their buoyancy is overcome. The air cylinders are ballasted by admitting water ballast or expelling it with compressed air, until the combined weight of the tubes and the cylinders produces a tension of only about 10,000 lb. on the lines attached to each end of the section. It is thus maintained in even balance and gradually lowered to the bottom under perfect control, without danger of severe stresses or distortion. The tunnel is being built, under the supervision of Mr. W. S. Kinnear, chief engineer of the Detroit River Tunnel Co., by Butler Bros.-Hoff Co., of New York City. The general plan followed is a modification by the contractors of a plan suggested by Messrs. W. J. Wilgus, H. A. Carson and W. S. Kinnear, the committee which originally studied the project for the New York Central interests. The committee outlined four different methods of construction which would be acceptable, and permitted the contractors to suggest modifications, or entirely different plans.



Tunnel Caisson for Twin Tunnels under the Detroit River.

A By-Product Charcoal-Iron Plant at Marquette, Mich.

The Marquette, Mich., charcoal-iron plant of the furnace department of the Cleveland-Cliffs Iron Co. is fully equipped to reclaim a large percentage of the by-products from the smoke produced in the manufacture of the charcoal used in the plant. The latter has an average daily output of 125 tons of first grade charcoal pig-iron, which is produced by a single blast furnace. A group of eighty-six bee-hive brick charcoal kilns, a number of buildings in which by-products are made from the smoke and a large central power station supplying steam and power are also included in the plant. The iron-ore used in the manufacture of the charcoal iron is delivered from the mines of the company at Ishpeming and Negaunee over the Lake Superior & Ishpeming Ry. The latter was built, and is operated for handling iron-ore from mines in the Marquette district to docks on Lake Superior at Marquette. The construction, equipment and operation of this road were briefly described in The Engineering Record of Aug. 31, 1907. Switching connections are extended into the plant from the Marquette & Southeastern Ry., an allied line which extends along the site of the plant. The large quantities of wood required in making the charcoal used in the manufacture of the iron are also delivered by rail from extensive forests reached by the Marquette & Southeastern Ry., and by the Munising Ry., a second allied line.

An outline general plan of the plant, showing the relative location of the principal parts of the latter, is given in an accompanying illustration. The iron-ore is delivered to a large stock house containing a number of elevated storage pockets. In front of this house are the blast furnace and a casting house, the central power station and the auxiliary buildings of the plant. In the rear of the stock house are the charcoal kilns, and back of them, the group of buildings in which the by-products are made from the smoke produced from these kilns during the manufacture of charcoal.

The ore stock house, 100x300 ft. in plant and 44 ft. to the eaves line, has sheet-iron sides and a corrugated sheet-iron roof, carried by steel roof trusses. Two switch tracks are extended longitudinally through it on trestles, at a height of 25 ft. above the floor. One of these tracks is over a row of fourteen ore storage pockets, with a capacity of 100 tons each, which are along one side of the building. The other is approximately on the center line of the building and is intended to deliver ore to piles on the floor of the building in case the mechanical equipment installed for handling ore from the storage pockets to the blast furnace is out of commission.

The ore is handled from the storage pockets to the base of a steep incline leading to the top of the blast furnace, in electrically-operated scale hopper cars. A 36-in. gauge track extends the length of the row of storage pockets in a pit depressed slightly below the floor of the building. A system of tracks also extends to the charcoal kilns. Each of the cars operated on this system of tracks has its hopper-shape body arranged so it can be swung on a weighing-scale frame carried by the car truck. These cars are equipped with street railway motors and controllers. Power is taken from a double trolley supplied with current from the central station. The cars each have half the capacity of one of two skips in which the materials are hoisted up the incline leading to the top of the blast furnace. The charcoal and the lime used for flux are delivered to these charging skips in two-wheel iron carts on transfer cars handled by electric locomotives.

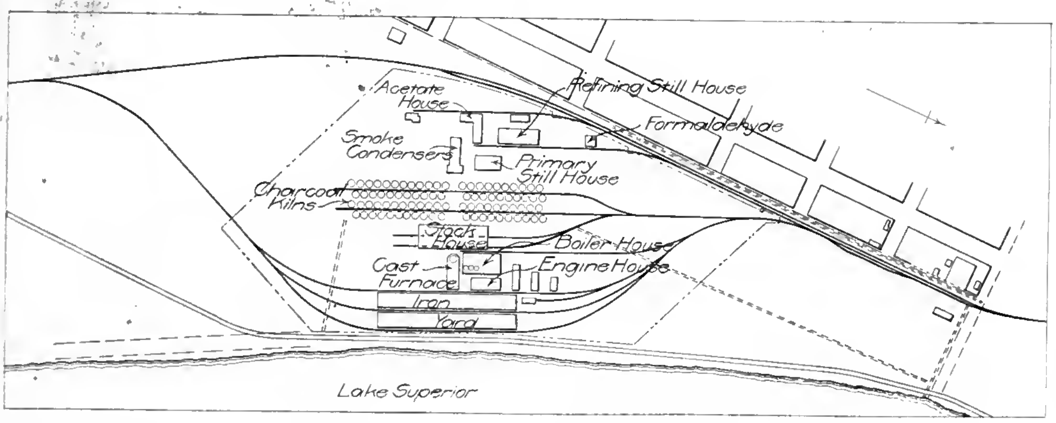
The blast furnace is at one end of the cast house, the latter being 50x155 ft. in plan. The furnace is very similar in arrangement to the modern blast furnaces in which iron-ore is reduced to pig with coke, and it is operated in practically the same manner as are those furnaces. It is 12 ft. in diameter and 70 ft. high. A large blowing engine in the central power station supplies heated air blast to it at a pressure of 8 to 12 lb. per square inch. The gases driven from the top of the furnace are utilized in firing part of the boilers in the central station, and also three 17x70-ft. Cowper Roberts brick-lined stoves through which the air blast is passed before reaching the furnace. The charcoal and iron-ore are placed in alternate layers when the furnace is charged, but, as in the coke-fired process, a fire is always maintained. Four heats are drawn from the furnace every 24 hr., two heats during the day and two during the night.

This blast furnace has made a phenomenal record for charcoal practice, since it has been in continous operation for over four and a half years. This record, however, is eclipsed by the Gladstone furnace of the same company, which has been in continuous operation for over six years and seven months. These records are the more remarkable when it is considered that the average blast of charcoal furnaces in Northern Michigan averages something less than two years. These long blasts are due to the fact that the furnaces are equipped with the Farrell bosh jacket, used in connection with the Gayley bronze bosh plates. The Farrell jacket absolutely prevents the tipping or sagging of the bosh plates and the moving of

the bosh brick through expansion or contraction.

The floor of the cast house is a deep bed of lake sand into which the iron is drawn from the furnace. One central ditch, or furrow, extending the length of the building from the tapping hole of the furnace, is thrown up in this sand. Latteral transverse furrows are taken from this main furrow at intervals of about 6 ft., and a row of smaller, secondary longitudinal furrows, each 54 in. long are taken from each latteral, thus forming a complete gridiron of furrows.

The transverse lateral furrows are at succeedingly lower levels, receding from the furnace, so those closest to the latter are filled first when the cast is made. The molten-ore is drawn freely from the furnace into the furrows until slag appears in it, when a skimming gate is placed in the central furrow near the furnace. As the proportion of slag increases this gate is gradually lowered, the iron being heavier passes under it, while the slag is diverted to one side into a ditch leading to an open area at the side of the building. Meanwhile, as each lateral and the secondary longitudinal 54-in. laterals leading from it are filled, a loose paddle-shape iron gate, coated with fire clay, is thrown into the connection with the main furrow to cut off the supply from the latter. The iron in the 54-in. laterals is broken from the main laterals while hot with hand sledges. The whole mass is then cooled by sprays of water applied from overhead perforated pipes along the side of the building. When sufficiently



General Plan of Charcoal Iron Plant.

cooled, the iron is removed and preparations are made for another cast.

The central power station comprises a 90x168-ft. boiler house and a 50x130-ft. engine house. The boiler house contains twelve five-drum Stirling water-tube boilers, each with 3,412 sq. ft. of heating surface. Eight of these boilers are in a row along one side of the boiler house, and operate at 140 lb. pressure; the remainder are in a second row along the other side and also operate at 140 lb. pressure. The boilers in the row of eight are each equipped with a Murphy stoker for coal firing, but are fired chiefly with gas from the blast furnace and with liquid tar and oils furnished from the by-product portion of the plant. Such coal as is used is delivered at the boiler house in cars, from which it is dumped into a track hopper. The coal passes from the latter through a coal crusher and thence into a Link-Belt overlapping-bucket conveyor that elevates it to a row of storage bunkers over the row of eight boilers. The tar and oils used under the boilers are quite fluid, and are supplied through nozzles under a pressure of 100 lb. They are delivered to the boiler house through brass pipe lines, as they attack all metals, except copper. The blast furnace gases and the tar and oils can be fired separately or together, as desired. The boilers in the row of four are fired with furnace gases, tar and oils and coal breeze.

The boilers are all operated on induced draft and are served by a Green economizer with 13,340 sq. ft. of heating surface. The induced draft is supplied by either of two 5.5x14-ft. fans, each driven by a separate 12x16-in. direct-connected simple condensing engine. A 12x40-ft. steel stack serves all twelve boilers.

The feed water for the boilers is supplied from a hot well by either of two Prescott compound condensing 9x18x12x9½-in. pumps in the engine house. All other units in the engine house are also operated condensing, the condensed water being delivered to the hot well. Condensation from the chemical plant is also returned to this well. The feed-water connections to the boilers are made at the front end of the latter, but all feed-water supply lines are in duplicate, and duplicate connections are provided at the boilers.

A 22-in. steam-supply main under a pressure of 140 lb. is extended overhead from the boiler house to the buildings in which the by-product processes are carried on, large quantities of live steam being required in these processes. A 12-in. steam-supply main, also under a pressure of 140 lb., extends from the boiler to the engine house; and an 8-in. auxiliary steam line is extended to this house for emergency use. All of the boilers in the boiler house are connected so steam can be supplied from any of them to any of the mains.

The blowing engine in the engine house which furnishes air blast for the furnace is a Southwark cross-compound condensing unit, with 22x36-in. and 46x36-in. steam cylinders, and two 48x48-in. air cylinders. The two sides of the unit are disconnected so either side can be operated separately in case the other is out of service. This arrangement assures a continuous supply of air to the furnace with the one unit. The latter is served by a Weiss counter-current condenser, with a capacity of 24,000 lb. of water per hour. This condenser also serves the other steam-consuming units in the engine house. Circulating water for it is obtained from the general distribution system of the plant.

Electric current for operating the industrial railway system, for lighting and for driving motors in various parts of the plant, is supplied by two 150-kw. 220-volt direct-current Westinghouse generators, each direct-connected to a 16 and 27x16-in. compound-condensing automatic vertical Westinghouse engine. Either of these two units is capable of carrying the load on the station, so they are operated singly at alternate intervals.

The engine house also contains three horizontal 11½, 18 and 30x24x20¾-in. triple-expansion condensing Prescott pumping engines, each with a capacity of 5,000,000 gal. These pumps supply water from an intake in Lake Superior to the general system of the plant, at a normal pressure of 60 lb. per square inch, but can operate against a pressure of 180 lb. for fire service. Any two of them are capable of furnishing the water required, the third being held in reserve.

The eighty-six kilns in which the charcoal is made are arranged in four parallel rows, twenty-one in each of two rows and twenty-two in the other two. These kilns are 30 ft. in diameter and are arranged much the same as an ordinary brick kiln. Various kinds of wood, including hard maple, elm, beech and tamarack, are used in making the charcoal. This wood is all obtained about 60 miles east of Marquette, where extensive forests are to be found. As practically all of the wood in a tree can be utilized, very little waste is occasioned. The wood is delivered to the plant on standard-gauge flat cars, 260 cords, or about 17 cars, being furnished to the charcoal kilns each day. A switch track is laid between each two side rows of the kilns, and the latter have doors on the side next to the track, so the wood can be placed directly in them from the cars.

The wood is placed in the kilns in regular rows and layers, in order to utilize the capacity of the kiln as fully as possible. On the average, however, about 5 per cent. of the space in the kiln cannot be filled. After the kiln is charged, the wood is fired and the charging door is closed tightly with brick masonry, to prevent oxidation of the carbon in the wood. The kiln is then allowed to burn out, which requires from six to eight days, the wood shrinking about 20 per cent., on the average, during that time. When a kiln has been burned, it is allowed to cool, after which the charcoal is handled directly to the charging hoppers of the blast furnace in the two-wheel iron carts on the electrically-operated transfer cars.

Every kiln in the group has a smoke flue connected to a main flue leading to the by-product portion of the plant. These flues are each arranged with a damper, so any kiln can be completely isolated. The draft in the flues is induced by seven 70-in. copper fans, each driven by a 15-h.-p. motor. The smoke being conveyed by the main flue to a series of fifty-six cooling towers in which it is reduced to a liquid. These towers are large wooden, vertical surface condensers supplied with water from the distribution system of the plant. The liquified smoke is delivered to settling tanks in which the tar and oils, which make up about 3 per cent. of it, settle to the bottom, being heavier than the remainder. When the contents of a tank are completely settled the lighter liquids at the top are drawn off and delivered to the by-product buildings by a centrifugal pump driven by a water wheel operating on the water discharged from the condensers. The tar and oils are then pumped to the boiler house by a motor-driven centrifugal pump, as no attempt has been made as yet to refine them.

The lighter liquids are pumped to a 60x112-ft. building containing a number of large stills in which a secondary separation is made. The distillate from these stills is delivered to a 66x182-ft. refining still house, while the residue is utilized in producing lime acetate. The lime is added to the liquid in large mechanically-stirred mixing tanks in the primary still house, after the first distillation is made. The residue from the second distillation is conveyed to a 38x96-ft. building containing a long steel-plate drying floor, heated from beneath, on which the moisture is driven from the acetate. Rotary kilns, similar to cement kilns, have been tried for this process, without success. Equipment is also being installed to make lime acetone as a by-product of the lime acetate process.

The liquids delivered from the primary still house to the refining still house are passed through a series of stills in the latter, the final product of which is wood alcohol. This is produced in various grades up to 99½ per cent. pure. A further refinement is made in a separate 48x96-ft. building in which pure formaldehyde is made.

Mr. Wm. G. Mather is president and treasurer of the Cleveland Cliffs Iron Co. Mr. Austin Farrell is manager, and Mr. Geo. J. Slining is chief engineer of the furnace department.

The Panama Canal Relief Map at the Jamestown Exposition.

By Charles H. Johnson.

Early in January, 1907, the authorities at Washington decided to construct at the Jamestown Exposition a large relief map which should show the Panama Canal as finally planned, together with the topography of the surrounding country. After some correspondence the writer was selected to undertake the actual construction, finally receiving orders early in March to proceed to the Exposition via Washington. The office end of the work was in charge of Mr. Ralph Whitman, then on the staff of the Isthmian Canal Commission, who had collated all available information in regard to the topography and placed it on a large map of the route of the Canal, scale 1 = 50,000, taken from the report of the Commission of 1905, and mounted on cloth.

On arriving at the site of the work on March 11, the space allotted to the model was found to be covered with contractors' shanties, one being in the process of demolition. The labor situation was bad, wages for common labor being $1.75 for eight hours, and the labor very scarce and inefficient. Cement finishers were almost impossible to obtain and wanted 50 cents an hour. Stone and cement for the concrete were bought from one of the large contracting firms doing work at the grounds, and were taken from cars on a track alongside the work; sand was obtained from the beach, about 200 ft. away.

After looking the situation over the map was laid out, the dimensions being 122 ft. east and west and 50 ft. north and south, its axes corresponding with the center lines of two of the government exhibit buildings, its horizontal scale being 1 = 2,000. The ground at the site was level; excavation showed, first, 1 ft. of top soil mixed with roots, then about 3 ft. of sandy clay, then 18 in. of sand, then clay at ground-water level. It was decided to make sea-level on the map about 2 ft. below the natural surface of the ground, so that by grading up the spoil to form a raised walk around the map visitors would be sufficiently above it to see over the tops of the hills.

Some Greeks were put to work stripping off top soil and excavating for the Atlantic Ocean. A search for cement finishers produced a couple of negro helpers or second hands, who were willing to work for $2.50 a day and stayed with the work to the end. The Greeks proved unsatisfactory and were discharged after about a week, their places being filled by negroes, who were, on the whole, very satisfactory labor. One white man, at $60 per month, was hired to run rod, hold tape, assist on carpenter work, etc., and, with the writer and the negroes, varying from 6 to 12 in number, constituted the entire working force.

As soon as a sufficient area had been stripped work was started on laying out the Atlantic Coast line. The first method used was by setting up a plane table at one of the corners of the relief map, setting the edge of the alidade rule through the corresponding corner of the paper map and the point to be staked out, then scaling the distance and setting the corresponding point on the ground. This method proved to be too slow and was discarded in favor of one, developed by the writer, which was as follows: The paper map was ruled off in rectangles corresponding to 20x30 ft. on the ground, then a piece of tracing cloth the size of one of these rectangles was ruled off in squares corresponding to 1 ft. square on the ground. The tracing cloth was laid on one of the rectangles on the paper map, the corners of the corresponding rectangle on the ground were staked out, and poles, marked off in feet, were laid 1 ft. apart, parallel to one side of the rectangle. Then noting where the coast line crossed the lines of the tracing, a line was drawn on the ground through the corresponding points of the poles. When the coast line had been thus marked out the clay was carefully cut away with a mattock and the bottom of the ocean leveled off 6 in. below sea level, thus allowing 3 in. for concrete and 3 in. for water.

As soon as two or three hundred square feet of subgrade was ready the concrete was laid, the base being 2½ in. thick, one part cement, three parts sand and six parts gravel or broken stone, mixed fairly wet. The top was ½ in. thick, mixed one part cement and two parts sand, and was troweled to a smooth finish when it was to be covered with water. After the bottom of the Atlantic had all been laid work was started on the land, the hill tops and rivers being located

The Relief Map of the Panama Canal at Jamestown.

by the same method as the coast line. Stakes were set to the proper grade for the hill tops, the river valleys were chopped out of the clay, being tested frequently for grade with the transit as the work proceeded, then the country between the hill tops and the rivers was modeled in to correspond with the contours on the paper map, and concreting begun.

The vertical scale was set at 1 = 333, a vertical exaggeration of six, after several scales had been tried and this had seemed to be the most effective and natural. In finishing the land surface, practically all of which on the Isthmus is covered with a very dense forest of low growth, the attempt was made to get a finish which would have the same appearance as the real country were the latter viewed from a balloon at a sufficient height to make it appear the same size as the map. This effect was obtained by beating the surface of the concrete after it had been floated and partly set, first with a board set with wooden knobs and then with a block of wood and an irregular surface covered with battered tin.

When the map was about half completed work was started on the concrete wall surrounding it. This wall showed 5½ ft above the sea level of the map on the inside and 2½ ft. above the surface of the walk on the outside; it was 12 in. thick and paneled on the outside. The panels were 16 in. high, about 5 ft. long and 2 in. deep, the moulding above the panels being 6 in. wide. By making the panels this length it was possible to divide the wall into 12 sections, exactly alike, and one set of forms was used for the entire work. The inside forms were in two pieces, one 12 ft and the other 18 ft. long, the full height of the wall, and were built of inch boards nailed to 2x4 in. verticals spaced about 2 ft. on centers. The outside forms were built in panels, one form for each panel, and were 2 ft. 9 in. high, the concrete being brought to the level of the bottom of the forms with slip boards. The forms were held in place by stakes at the bottom of the inside forms, through ties of telegraph wire at the bottom of the outside forms, and board ties about 6 in. above the top of the forms. The wall concrete was one part cement, three parts sand, six parts gravel, mixed wet. The forms were pulled the morning after a section of wall was finished, and the exposed surface plastered with a thin coat of one to two cement mortar brought to a floated finish. The top of the wall was given a granolithic finish.

When about half of the map and surrounding wall had been completed a start was made on the painting. The land surfaces were sized and painted one coat of flat green, shaded off dark and light to give the proper hill and valley effects, the rivers being lined out in light blue. The bottoms of the oceans and lakes were stained blue, with light blue shading close to the shore. The paint stood all right, except when put on cement not thoroughly dry, when the first rainstorm turned it light yellow.

Three concrete boxes were built outside the wall, 2 ft. 6 in. square in plan, with the top flush with the top of the walk around the map. A 1-in. iron pipe was connected with the water main and run into one of these which was located at the head of the Chagres River. This furnished the water supply to keep the lakes and oceans at the proper level, the water flowing down the Chagres, filling Lake Gatun and then overflowing into the Atlantic and through the canal into Sosa Lake and the Pacific. A 1-in. pipe under the locks permitted the draining of

Lake Gatun, which, together with that of the other bodies of water, had to be done every fortnight. The outlet boxes for the Atlantic and Pacific were supplied with 6-in. earthenware drains connected with the sewer. The outlet was in the bottom of the concrete box and was stopped with a wooden plug sawed off at the desired water level and having a central hole, which took care of the overflow during rains. When it was necessary to drain the oceans the plugs were pulled, and when replaced were made tight by shaking sand around them.

The accompanying photograph gives a very good idea of the appearance of the finished map. The cost of construction was about $4,000.

A Bad Case of Rusty Steelwork.

A steel freight shed about 80 ft. wide, 200 ft. long and 22 ft. high to the eaves was built in 1878 at an Atlantic port and has since been exposed to salt atmosphere and moderately high wind. During recent construction operations, a portion of the framework was exposed and it was found that the feet of many of the columns were badly corroded, as indicated by the accompanying photograph of one of them, where the flanges broken away were merely kicked out by one of the laborers. At this point the thickness of the flange had been reduced from 3/8 in. originally to a minimum of 1/8 in., the remaining metal being soft and spongy. This extreme corrosion did not, however, exist to a very great height and was greatly diminished at a distance of 4 ft. above the base. A lighter had recently been in collision with one of these posts, which bent 3 or 4 ft. of it without breaking it, although its condition was the same as that of the one shown in the engraving.

The posts were only 8 in. wide and were braced merely with a 4-ft. kneebrace strut at the top. The cross-sections were built up with a single 8x1/4-in. web plate and four 3x2½x3/8-in. angles, and if ever exposed to the assumed wind pressure of 20 lb. per square foot, must have sustained a high total stress. It is remarkable that the structure has so long served and is still in service and not very much distorted. It is evident that considerable water leaks through the eaves and, following the column to its base, collects there to a certain degree and exposes this part of the metal to excessive corrosion. Little or no evidence of proper painting or other care of the steel work could be observed.

Book Notes.

The interest shown in the public works of Frankfort, Germany, is so great that the city engineer, Herr Koelle, has prepared an excellent "Guide to Some of the Public Works" of that city. It is a handsome book of 79 pages, printed in English, French and German editions. The book takes up in turn the growth of the city and its extensions, the streets and roads, the street cleaning methods, the sewerage and sewage disposal, the water supply, the harbor works, the bridges, and the systems followed in laying out new parts of the city. A large number of excellent illustrations are provided and the salient features of each subject are stated concisely so that the visitor can readily grasp them.

In view of the rapidly growing use of hollow concrete blocks as a building material the publication of a thoughtful paper by Mr. E. S. Larned, entitled "Regulation and Control of Concrete Construction," is decidedly timely. The author points out at the outset that while cement is a very important element of concrete work of any sort, nevertheless the other materials with which it is combined and the manner of mixing and placing those materials and the forms to contain them are also of prime importance, and should be submitted to the same inspection and study by competent persons as are usually required of the cement. This is not so well appreciated by architects and builders who use concrete blocks as is desirable. In order to afford a basis for discussion of the subject Mr. Larned then outlines a set of specifications for the materials for such blocks and the methods of mixing, moulding and curing them. The paper has been printed for free distribution by the Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, and deserves a wide circulation.

In these days of widespread concrete construction for works formerly executed in brick or stone masonry, there is some danger of overlooking the many merits of these latter materials. Attention may well be called, therefore, to an excellent pocketbook of rules, directions and tables, bearing the title of "The Building Mechanics' Ready Reference." The author is Mr. H. G. Richey, a superintendent of construction of United States public buildings. The volume explains the different classes of masonry, the

Badly Corroded Foot of Wall Column.

methods of carrying on work and of estimating quantities, various practical features useful to masons, gives numerous tables of the properties of building stones and other materials employed in connection with them, and furnishes a large variety of tables useful in connection with masonry construction. The author's long experience in supervising the erection of different grades of buildings for the federal government has naturally made him familiar with masonry work in many parts of the country, and many of the hints he gives are likely to be of interest to those who consider themselves in complete touch with all that is known in one section, but have not become familiar with the way work is done in other parts of the country. Special mention should be made of the excellent character of the illustrations, which are well chosen to make clear many things connected with masonry and the methods of constructing it which cannot be explained in words. (New York, John Wiley & Sons, $1.50.)

A useful handbook on the principles and methods of warming buildings has been prepared under the title of "Principles of Heating," by Mr. Wm. G. Snow. The book is apparently intended for the use of steam fitters and others who wish to have a practical guide to the design of satisfactory installations, and is not an elaborate theoretical treatise. The heating power of fuels and the construction boilers and heaters are taken up in the first chapter. In the second chapter the use of gas, oil and electricity for heating is discussed. The third chapter goes into the details of the capacity and fuel consumption of heating boilers and describes methods of testing furnaces. The next three chapters are devoted to a consideration of the phenomena that take place in heating and cooling air and in warming by direct radiators, and to the computation of radiation for direct warming and for use with blower systems. Information is also given concerning the methods of heating water and computing the size of coils for the purpose. The ninth chapter is a discussion of the flow of steam in pipes, the methods of computing the sizes of steam mains for different systems of heating, the selection of exhaust pipe sizes and the effect of back pressure on engines. The next chapter is an explanation of the methods of designing hot water mains, while the last chapter is devoted to vacuum and vapor systems of heating. On account of the interest now shown in such systems, the space devoted to them is considerable and probably more information is given regarding such methods of warming than is available in any other single book. Throughout the volume the author has laid special stress on the application of the heat-unit method of design. (New York, David Williams Co., $2.00.)

A "Hand-Book of Steel Reinforcement" has recently been prepared by the engineers connected with the American Steel & Wire Co. It opens with an explanation of the position which concrete now holds among engineering materials and then takes up the use and properties of reinforced concrete. Afterwards the cost of the material is discussed and there are chapters on the strength of concrete, steel for reinforcing, the protection of metal imbedded in concrete, fire protection, the modulus of elasticity and other properties of concrete, the methods of bonding old and new concrete, the effect of freezing and methods of finishing the surfaces of concrete. These chapters are mainly derived from various standard works. They are followed by tables of the weights, areas, sizes and other features of triangular and square mesh reinforcements, a specialty the company is now pushing and the advertisement of which in a mild way is evidently the main purpose of the book. These tables are followed by others giving the safe bending moments, weights and thicknesses of slabs and panels, with diagrams of the same data for the benefit of those who prefer to work from them. The manner in which the tables are prepared is explained at length and information is given concerning the various sizes of wire that can be used in slabs. The tables are based on a working stress of 16,000 lb. per square inch in steel, and a 1 : 2½ : 5 Portland cement concrete. The book does not take up the design of columns, beams or girders. (Chicago, American Steel & Wire Co., $2.00.)

The last number of the "Mitteilungen ueber Forschungs arbeiten," published by the Society of German Engineers is a monograph by Dr. R. Biel on the nature of the operation of centrifugal pumps and ventilators, "die Wirkungsweise der Kreiselpumpen und Ventilatoren." It is the author's belief that satisfactory information concerning these principles can be derived only from a study of experimental data, from which general laws can be deduced. Accordingly he opens this monograph with a statement of what has been done in the subject heretofore and an explanation of the theoretical fundamentals, after which he takes up in detail a series of experi-

ments with machinery of this class. Complete data are given regarding these trials and they are followed by a series of discussions concerning the important facts indicated by the test results. The monograph is published at 1 mark by Julius Springer, Berlin, who also publishes at the same price the author's thesis submitted for the degree of Doctor of Engineering at the technical academy at Charlottenburg. This is a remarkably interesting discussion of the loss of head attending the flow of liquid and gaseous fluids. "Ueber den Druckhöpenverlust bei der Fortleitung tropfbarer und gasförmiger Flussigkeiten." The first part of the thesis is a discussion of the critical points at which the curves of loss of head are interrupted, and the second part is an investigation of the loss of head in pipes when the velocity exceeds the upper critical point. This investigation leads the author to suggest a new formula for the loss of head, $h = LR\ (av^2 + bv)$, where h is the loss of head, R is the hydraulic radius, v the velocity and a and b are coefficients selected from diagrams based on experimental results which are tabulated for ready comparison. The third and final section of the thesis is a discussion of the application of the formula to open channels and streams.

Letters to the Editor.

Lattice Bars.

Sir: Mr. Horace E. Horton in a letter regarding "Lattice Bars in the Quebec Bridge," which appeared in your issue of Sept. 28, states, "The relation of lattice to the member is not specified anywhere in any general specification. That the individual lattice with its rivets should have some relation to the stress of the member surely appeals to us as reasonable since the failure of the Quebec Bridge, and yet no one has ever put in print anything that has come to my notice on the subject."

In an article on wrought iron columns, published in the "Lehigh Quarterly," June, 1891, the writer made a suggestion which he shortly afterwards incorporated as a clause in the New Jersey Steel & Iron Co. specifications as follows: "The lattice bars shall be so spaced that each channel between lattice connections shall be stronger than the column considered as a whole, and their size shall not be less than would be obtained by treating the column as a lattice girder supported at the ends and loaded at the middle with a load equal to 3 per cent. of the total compression on the column."

Henry S. Prichard.

Beaver, Pa., Oct. 4.

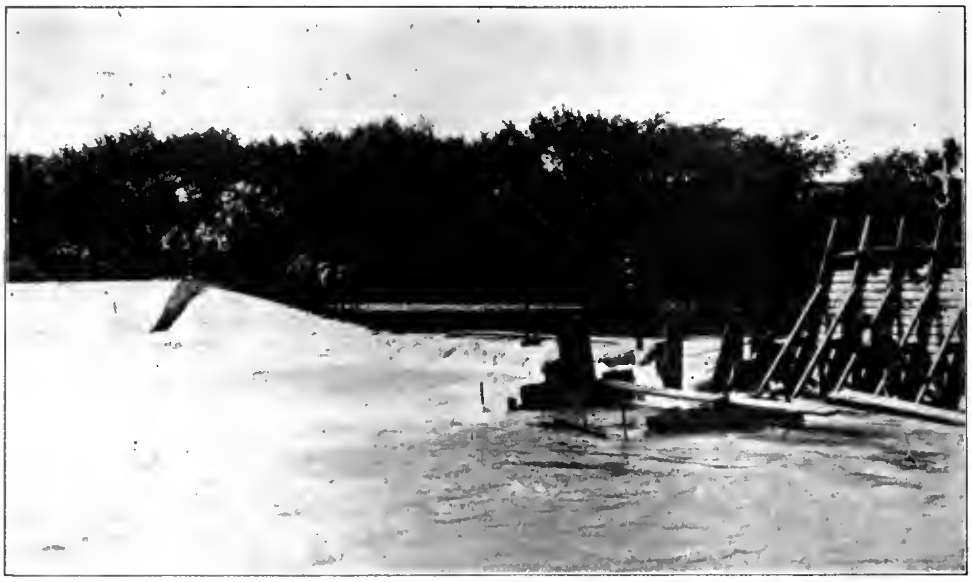
An Undermined Dam.

Sir: In your issue of November 24, 1906, there was a letter by the writer illustrating a reinforced concrete dam of original design which was being built at Dayton, O. The method of construction and a typical cross-section of the dam were there shown. At that time the dam was completed to within about 50 ft. of the end. The part left open was a deep channel, with a gravel bed. A large valve had been built into the completed part near the end, the intention being to pass the normal flow of the river through this while closing the end. The whole uncompleted end was then enclosed with a cofferdam, the top of which was several feet below the crest of the dam. The cofferdam was completed and the work progressing nicely, the water meanwhile flowing through the valve, when a sudden flood overtopped the cofferdam and undermined the end of the completed structure, which rested only on gravel. As a result about 25 ft. of the dam broke off and gradually dropped perpendicularly, thus remaining in line with the rest of structure. The broken piece contained the valve, and this had not been damaged. High water continuing, the work was temporarily abandoned, with the intention of resuming it this last spring. Litigation put off the renewal of the work until this fall, and it was then decided to leave the sunken piece in the river bed and build over it.

Instead of now constructing a cofferdam enclosing the whole of the open end and high enough to cause all flood water to flow over the crest of the dam, only the abutment end was enclosed, leaving an open gap of about 6 ft. between the cofferdam and the sunken part, the top of which was now slightly below water and about 7 ft. below the crest of dam. Into this abutment end a new valve was to be built, and then the gap was to be enclosed and filled in, thus completing the dam. Work was proceeding slowly when another flood came, and the water in its mad rush about the ends of the submerged part undermined some more of the dam, and a piece about 20 ft. long broke off, as shown in the accompanying photograph. The submerged end has fallen upstream, is badly out of line, and work is again at a standstill. The part submerged is the first piece that broke off, and the water is here over 20 ft. deep and getting deeper. Upstream a short distance the water is comparatively shallow.

If the dam had been commenced from the end that is now being put in very little trouble would have been experienced, for the river is very shallow on the completed side of dam. If the first flood had not occurred the dam would have been completed in about two weeks, but it seems that the contractors were taking chances on floods, with the present results. A small additional cost would have built a cofferdam of sufficient height to have avoided the first break, with its costly after results. Yours truly.

Dayton, Sept. 30. Edward Balbach.



An Undermined Dam at Dayton.

Wire Rope for Concrete Reinforcement.

Sir: Referring to the description of the reinforced concrete reservoir appearing on page 312 of your issue of Sept. 21, 1907, is not the use of steel cables for reinforcement very bad practice, on account of the permanent and material increase in length and decrease in diameter which takes place in steel ropes subjected to high tension? While he knows of no tests of the kind, the writer would expect to see concrete beams reinforced by wire ropes fail under loads which such beams would carry with safety if ropes were replaced by steel rods of corresponding number and diameter, especially so, if the ropes were new and did not have most of the stretch taken out of them by repeated high stresses.

Possibly second-hand wire ropes long in use under heavy loads would not be subject to further material increase in length and decrease in diameter, but surely the theories of reinforced concrete design are quite complicated enough without introducing and adding the stretch of a wire rope to the uncertain ratio of elasticity existing between steel and concrete.

In the design in question the steel cables are apparently stressed about 20,000 lb. per square inch, neglecting all tensile strength in concrete. This is a pull quite sufficient to produce a material stretch in a new wire rope, quite apart from the elasticity of the metal therein. In defence of the design in question, it may be said that there is no beam action and that the total stretch of the cable will be so uniformly distributed that there will be no visible resulting cracks in the concrete. We are not at all certain that the last assumption about the stretch is true. Quite generally, we think, it would not be true. Messrs. Westinghouse, Church, Kerr & Co. are such an able and reputable engineering firm that one is led to anticipate that there were some exceptional conditions justifying the design in question. Any general use of wire ropes in reinforced concrete would certainly result in many failures. Moreover, the item of cost is entirely against it. Yours truly, J. L. Campbell.

El Paso, Tex., Sept. 29.

Cost of Riveting.

Sir: The cost of machine riveting is hard to get at, as so many conditions enter. Generally speaking, however, as a machine will drive rivets as fast as they are fed to it, the chief cost is that of handling the work. This varies with the class of work, heavy and bulky work being, of course, harder to handle. Assuming $4.50 a day for the labor (exclusive of heater), if a machine drives some 700 or 800 rivets per day, the cost for labor, power and general charges will be from 5/8 to 3/4 cents per rivet.

Pneumatic hammer rivets in ordinary shop work will cost hardly less than 1 1/2 cents per rivet for similar charges. To be very conservative assuming only 1/2 cent saved per rivet, there is $1,000 or $1,200 saved per year. As a matter of fact, much larger returns generally result, for, if you double the machine rivets driven per day, the cost per rivet is practically cut in half and the savings are enormous.

This comparison applies only to an air machine, which, for 2,500 rivets, takes about the same amount of air as one pneumatic hammer. For hydraulic driven rivets several hundred dollars additional must be allowed per year for power.

Chester B. Albree Iron Works Co.

Allegheny, Oct. 2.

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Of this issue of THE ENGINEERING RECORD 14,500 copies are printed. Total circulation for 1907 to date, 611,500 copies, an average of 14,560 copies per week.

TABLE OF LEADING ARTICLES.

The Power Load as an Equalizer of Output.

In the central station industry the growth of the power business has modified the conditions of current generation to a remarkable extent, enabling the machinery to be utilized at hours when it would otherwise stand idle and altering the shape of the load curve beyond all precedent. There is a lesson in this for the general power producer, although in an industrial plant the conditions are greatly narrowed, in comparison with the operating flexibility of a well-designed central station. The influence of the power load on a large scale appears daily in plants like that at Niagara, Montreal and other great centers of electrical generation or distribution.

The ordinary load curve of a lighting plant is characterized by a pronounced peak in the late afternoon or early evening, necessitating the maintenance of considerable extra generating capacity throughout the day and raising the fixed charges correspondingly. The results which can be secured by a judicious cultivation of power business are little short of remarkable in a large system, measuring their effect upon the load peaks. In Montreal, for example, the connected power load aggregates 37,000 h. p., and the connected lighting load 30,000 h. p. On a typical summer day last August the total output of the Montreal Light, Heat and Power Co.'s stations was held within a close average of 25,000 h. p. from 7:30 a. m. to 6 p. m., except during the noon hour. The mean variation in load was less than 4,000 h. p., and the lighting peak of 8 p. m. did not reach the maximum of the day load. Doubtless these results could not be duplicated in the winter season, but they show the value of a large distributed motor load in any plant which caters to a considerable lighting business.

Impermeable Concrete.

One of the most desired characteristics of concrete at the present time in connection with its physical resistance to the results of loading is impermeability to water. Although the ultimate compressive resistance of the strongest concrete is far below that of the best natural building stones, it is high enough to meet the exacting requirements of masonry in most engineering structures, and its lack of tensile resistance is effectively cured by steel reinforcement. In spite of the fact that its real merits, intrinsically of a high order, have at times been greatly exaggerated and grossly overworked by ignorant and ill-judged advocates, concrete is rapidly becoming one of the most valuable of all our structural materials for engineering purposes, if, indeed, it has not already reached that position. It is employed in many cases where its main function is that of carrying loads, but at the same time where the quality of real impermeability would add greatly to its value. This is not only true in an extended range of engineering structures, such as dams and aqueducts, but also in its application to buildings both en masse and in blocks. If concrete could be given a truly impermeable character its value would be greatly enhanced and its field of usefulness would be even more rapidly extended that at present.

The great obstacle heretofore experienced in making concrete waterproof has been its highly porous character. With the dry mixtures used in times past, the porosity of concrete was excessive and not the least of the many advantages accruing to the use of wet mixtures is the greater solidity or density conferred upon the mass. A wet mixture not only causes all portions of the mass to run together in greater solidity but it enables the finer materials of the aggregate to flow freely and thoroughly into the spaces between the coarser particles, thus producing a much more nearly continuous and dense interior mass. This means obviously a greatly reduced permeability to water or a much enhanced capacity to resist seepage through it. In fact, if the cement were ground sufficiently fine to enable it and the finest parts of the sand to enter freely into all the interior spaces of the aggregate, a waterproof material under high intensities of pressure would result; but the wettest mixtures which it is possible to use neither eliminate all the air bubbles nor fill all the interior spaces. However, much care may be taken in securing a thorough and intimate admixture of the component parts, all porosity is not eliminated and some seepage results under pressures of forty to sixty pounds per square inch or even less.

If suitably mixed concrete could be put under a high pressure before the initial set takes place, so as to squeeze out all air and surplus water, should there be any, in much the same way as molten steel is compressed, in order to produce grades of that metal of special value, it is altogether probable that the resulting density would be sufficient to secure essential impermeability under very high heads. This obviously is impossble, but some recent investigations appear to indicate that there may be other simple means of attaining the much-desired quality of impermeability. In a discussion by Mr. Richard H. Gaines of the paper presented to the American Society of Civil Engineers in April of the current year by Messrs. W. B. Fuller and S. E. Thompson, there are set forth some results of tests made to determine the effect of the addition of certain substances on ordinary concrete mixtures. In the search for materials which may enhance the waterproof character of concrete it is clear that none must be used which will prejudice the resistance or durability of the mixture. Mr. Gaines, who is the chemist of the New York Board of Water Supply, shows that the addition of small percentages of alum solution and fine clay to Portland cement mortar and concrete enhances greatly the impermeability of the mixture and that both compressive and tensile resistances were increased. Although the number of the tests was relatively small and the life of the test specimens was not long enough to settle conclusively such a question as that under consideration, the results obtained show that the line of investigation followed is worthy of being carried further in order to determine just what value may be attached to the mixtures of such materials as were employed with the usual proportions of cement, sand and gravel or broken stone in the manufacture of mortar and concrete.

It has been indicated by tests that, contrary to the former opinions of engineers, the presence of small percentages of fine clay of a suitable character and properly mixed does not necessarily injure the strength of concrete, and it has also been shown that the same mixture may aid in attaining more nearly waterproof qualities. Up to the present time, however, investigations of this kind have not been carried far enough to give quantitative results of sufficient range for practical purposes. It has generally been considered that the effect of fine clay in reducing the porosity of concrete was wholly mechanical, but the modern view of physical chemistry, so to speak, may disclose a different significance to the results of use of fine clay for such a purpose. With the modern wet concrete mixtures, the presence of the clay is asserted by Mr. Gaines to induce a colloidal action which is apparently aided by such a solution as that of alum, so that the result is a modification of the interior mass, tending to eliminate ordinary porosity.

There is nothing new in the employment of an alum solution as well as various soap solutions to afford concrete a certain degree of impermeability to water, but the purpose hitherto has been to produce an impermeable surface rather than an impermeable mass, which the results of Mr. Gaines' experimental work appear to indicate as attainable. The great advantage of securing an impermeable or waterproof mass of concrete over superficial effects is so clear as to need no comment. This observation is especially pertinent to all reinforced concrete work, in which it is of the first importance to protect the steel reinforce-

ment from corrosion. It is to be hoped that in its investigations connected with the construction of the Catskill aqueduct, the Board of Water Supply will extend its investigations thoroughly into the field indicated by the results already obtained by Mr. Gaines. At the present time it is difficult to imagine any greater benefit to be conferred upon all classes of concrete work than to find some simple and effective method of making it waterproof under reasonably high pressures. Such an investigation should also include tests with hydrated lime and the various proprietary waterproofing compounds now extensively used, some of which seem to be giving good results when added to the usual concrete mixtures.

The Cost of Industrial Service.

A peculiar feature of many industrial organizations is the difficulty with which actual operating costs are determined for separate departments or classes of service. Questions of engineering are so often involved in these problems that it is worth while to consider some of the weak spots in the study of costs, especially in technical plants. It is very important for some of these organizations, particularly public service corporations under the fire of popular criticism, to be able to determine with a fair degree of accuracy what it costs to serve different classes of customers. Such information may be withheld from publication advisedly, but if a company does not know what its service costs in detail, it is certain to be misunderstood by outsiders. The idea is widely held that failure to figure detail costs of service covers abnormal profits. The central station ought to know fairly closely what it costs to serve a suburban customer in comparison with a heavy consumer in the business district, and the telephone company ought to have some reasonably good method of finding out what party line service costs it as compared with private line service. The manufacturing plant ought to know pretty closely the total operating expenses and fixed charges, either in its different departments or for a given class of products.

It must be admitted that the determination of such costs is a complex problem in many instances. The mere fact that two kinds of coal are burned in different furnaces in a plant, for example, means that every pound burned must first be weighed and charged against the proper process or furnace, if the fuel cost in each furnace or process is to be known. This simple case is often overlooked, and the total amount of each kind of coal burned recorded without reference to the use which was made of it. Perhaps it is guessed what each process took in fuel, but the total figures are generally given alone in such cases, or lumped in the total of the entire operating expenses of the plant. The fact is that the combined experience and judgment of the accountant and the engineer are needed in all but the simpler problems. The classification of accounts needs the scrutiny of the technical staff before it is established as a standard method of analysis.

The engineer can help in securing these segregated costs more than is often realized by the commercial man. Financial problems are closely associated with the planning of all important tasks in engineering, and the money side must be recognized in operation, no less. Just as in buying materials and equipment the engineer can save the non-technical purchasing agent endless trouble if he is consulted at difficult junctures, so can he help the auditor and the bookkeeper in unravelling the intricacies of new technical combinations and relations in a growing industry. In the routine determination of costs the engineer can make certain that proper methods of measuring power, of counting and weighing materials, and of figuring labor costs are practiced. As a general rule, a physical separation of materials, supplies or products at the right time in the manufacturing process is the fundamental requisite for the securing of an accurate basis of cost calculation. This is the task of the betterment engineer and the production expert in a great many cases, but it is within the province of the regular engineering staff of a company to provide the necessary facilities for keeping an accurate count or measurement of the substances and agents pressed into its services and to be included in the separated operating expenses of the organization.

General expenses and fixed charges deserve the examination of the engineer in many of these companies, no less than pure operating expenses. The actual amounts of money diverted to this or that use is not the point at issue so much as the principle by which the charges are made. Knowledge of construction and replacement expenses can often be supplied by the engineering staff with far greater accuracy than is obtained from non-technical clerical figures. Arbitrary assumptions are no doubt often necessary in estimating general and fixed costs, and here technical knowledge of the conditions of a given industry is a valuable check upon the errors in judgment natural to the clerical department obliged to deal on its own initiative with involved relations between processes and employees.

The Utilization of Peat.

The renewed interest shown in the utilization of American peat bogs may possibly be traced to the activities of the American Peat Association, organized largely by members of the technical staff of the United States Geological Survey. This new society will hold its first meeting at the Jamestown Exposition the last of this month, and at that time we shall probably have an opportunity to learn more definitely just what degree of practicability there may be in the proposed utilization of peat in this country. According to a report by Mr. M. R. Campbell to the U. S. Geological Survey, there was not any very marked interest shown in the subject. About the usual number of companies were organized and glowing prospectuses were issued, but little or nothing was done toward the development of the peat industry in general. Many of the plants that were in operation experimentally in 1905 closed down during the year, he states, so that at the end of 1906 it is probable that there were fewer plants in operation than at the close of 1905.

According to Mr. Campbell's report, three companies have worked on an experimental scale in 1906 in this country. The Winter Park Electric & Fuel Co., in Orlando, Fla., which uses the Leavitt machine; the Wolverine Peat Fuel Co., near Vicksburg, Mich., which uses the Dolberg machine, and the Lamertine Heat, Light & Power Co., near Vicksburg, Mich., which uses a machine of special type owned by the company. The method of handling the peat is essentially the same in the three plants, namely, digging from bog either by hand or machine; transporting in car or conveying apparatus to mill; disintegrating in mill; molding into bricks, and finally drying by natural exposure until the water is reduced to about 15 or 20 per cent. The Winter Park Electric & Fuel Co. has departed from this practice slightly, as it now dispenses with the molding into bricks, simply dumping the disintegrated peat on the ground and letting it dry in irregular masses, which later are broken with hammers into lumps. This is reported to give excellent satisfaction; it is cheaper, though it requires more space for storage. A very complete plant, that of the International Fuel & Power Co., is nearly ready for operation at a bog located not far from Ogdensburg, N. Y. It is built on a large dredge, and the progress of the peat through the machine from the time it leaves the bog until it is delivered in the form of briquettes is entirely automatic. The bog is located on the east side of Black Lake, in a position that makes dredging operation easy. The peat is raised from the bog in bucket conveyors, dropped into the hopper of a disintegrating machine, passed through steam-jacketed pipes to drive off moisture, and then, while hot, is briquetted under immense pressure. The product, according to the claims of the company, contains less than 5 per cent. of moisture.

The reasons for the interest in this problem of utilizing peat are discussed at considerable length in the "Electrochemical and Metallurgical Industry" of the current month. The chief reasons are on one side, the enormous extension of peat deposit areas, at present practically worthless, and on the other side the undeniable fact that peat, according to its chemical composition, contains so considerable material values and energy values that their recovery would be highly desirable. But the process of recovery should be cheap, its cost should certainly be considerably less than the amount of the values to be recovered. This is the great difficulty. We might compare the peat problem with a very low-grade ore proposition. As long as high-grade ores are available, low-grade ore propositions are not very attractive. But in recent years we have seen great changes in the attractiveness of such propositions in the case of several metals, both as the result of the scarcity of high-grade ore and of the advances made in the metallurgical art. The peat problem may be considered from the same point of view. There have been considerable changes in recent years in the object aimed at as well as in the means for handling the peat.

In the old peat problem the object was to convert the peat into fuel suitable for both domestic and steaming purposes, this fuel to be shipped to consumers to compete with coal. In the new peat problem the object is to erect plants in the peat districts themselves for recovery of the values. Two essentially different means are available. One is dry distillation for the production of coke, with recovery of the by-products. The other is using the peat in gas producers for the production of power, also with recovery of by-products. With respect to the by-products, the nitrogen content of the peat is significant, since it is possible to recover it in form of ammonium sulphate; in view of the rapidly increasing importance of the artificial fertilizer industry the fixation of the nitrogen in peat is certainly as attractive a problem as the fixation of atmospheric nitrogen. Concerning the coke produced from dry distillation of peat it is to be pointed out that its quality naturally depends on the composition of the raw peat, especially its ash contents, but that its freedom from sulphur should go a long way to make peat coke desirable for metallurgical purposes. Finally, as to the desirability of producing cheap power from peat there can hardly be any disagreement of opinion. If power can be produced cheap enough there will be uses for it even in peat districts which have not yet any industry.

All the essential troubles with peat are due to its content of water and to its porosity. Much has been done in the construction of suitable machinery for kneading and treating the peat, so as to mold it and remove a considerable portion of the water. For the dry distillation of peat, the enormous advances which have been made in by-product coke ovens for the dry distillation of coal are of direct importance. Finally, as to the development of power from peat, the whole idea of doing this has become possible only through the development of the modern gas pro-

ducer and large gas engine. It is evident there are vast possibilities, but it should not be amiss to finally sum up what has been actually achieved.

The Electrification of the Erie's Rochester Division.

The comprehensive description by Mr. W. N. Smith, of the electrification of the Rochester Division of the Erie R. R., printed last week, has a double interest in that the line in question was not only the first to use single-phase motors in regular railway traffic, but also utilizes for this traffic power transmitted at 60,000 volts from Niagara.

By a combination of energy and good fortune, too, the road went into operation some months ahead of the electric system of the N. Y., N. H. & H. R. R., on which work had been long in progress. It is a capital example of the easy applicability of single-phase high voltage traction to existing steam roads, leaving the freight service undisturbed, to be taken up later if desirable The system involves many novelties and many very ingenious features of construction. To begin with the high-tension transmission line, one finds here an unusual type of construction, forming an ingenious compromise between the ordinary pole line and the tower system which has of late come into extensive use. It employs an A frame for the support of the wires, composed of two heavy cypress poles united at the top. In virtue of the extra support thus given the normal span is lengthened to 220 ft., thus greatly decreasing the number of insulators.

The lightning protection is also out of the ordinary, horn arresters being installed at every fifth pole. It is, of course, early to speak of the efficiency of this particular feature, but the horn arrester, although somewhat insensitive, has given a good account of itself on some of the important lines on the Pacific Coast and requires little attention, a great virtue in case of its use on pole lines. At the sub-station the lightning protection is more elaborate, consisting of three horn arresters in series, grounded respectively through a concrete column, an electrolytic arrester and a copper fuse wire. The special feature of the sub-station arrangements is the ingenious utilization of the three-phase-two-phase transformation, the two resultant single-phase currents being transmitted over the two nearly equal sections of the road to the north and south of the sub-station respectively. The actual working conductors thus fed are of No. 000 ground copper, carried by a catenary bracket construction. An interesting feature of this is that each steel bracket is permanently grounded to the rails, so that the failure of an insulator means a dead short circuit, the intention being to avoid any danger of poles burning off and obstructing traffic in case of a partial ground. Another safety precaution adopted is the abolition of practically all telegraph and telephone wire overhead crossings, such wires being taken under the track by cables. In a few cases, to which cables could not be conveniently applied, a basket construction of guard wires has been used to obviate any chance of crosses with the high-tension trolley wire.

On the motor car the equipment consists of four 100-h.-p. motors with Westinghouse electro-pneumatic control. Many ingenious details have been here introduced to provide for safe and certain operation. The service undertaken over the 34-mile line is based on the use of motor cars capable of handling a single trailer when desirable, at an average schedule speed of 24 miles per hour. There are 6 regular stations on the line and 22 flag stations, at some or all of which stops are to be made, so that to maintain schedule a flexible speed control such as this system furnishes is highly important. Experience has already shown that the electric trains can be made to hold the schedule rather better than the steam trains which they have supplanted. The operation of the four classes of trains employed, viz., electric, steam passenger, through freight and local freight, over a single-track road such as the Rochester branch is, involved some complications, but these have been successfully overcome.

Of the technical problems arising for solution in this plant one of the most serious was the interference produced by the current upon telegraph and telephone lines in the vicinity. On an ordinary transmission line such trouble is not formidable, for by proper transposition the inductive effects can be reduced to comparative insignificance. On this single-phase system with track return, kept in electrical instability by the shifting of the load both the electro-dynamic and electro-static effects were very noticeable, especially the latter. No suitable means of eliminating the trouble by working upon the line itself was found, but it did prove practicable to remove the baneful influence by providing the telegraph relays with fairly high resistance discharging shunts. This obviated the necessity of complete metallic circuits for the telegraph service. Such circuits are now in general use for telephone work, and if properly installed give good service, even in proximity to a single-phase line. This result is very satisfactory, since the question of interference from such systems has been a matter of no small concern. Altogether the engineering work on this Rochester division of the Erie seems to have given suitable solutions for a good many of the practical problems of single-phase teaching, and will probably lead to a freer use of the system than has heretofore been judged discreet.

Notes and Comments.

Rail Corrugations have been investigated by a committee of the American Street and Interurban Railway Engineering Association, and its inquiries show a great variance in the experience with these troubles. It appears that corrugations have been observed in different types of rails, and that the length affected ranges from a yard to several hundred feet. Sometimes the corrugations have appeared within a few months after the rails were laid, and in other places they were detected only after the rails had been in use a number of years. The length of the individual corrugations is 1 to 15 in., and their depth is sometimes as much as 3/16 in. Apparently deep girder rails are most liable to become corrugated. Seven companies have detected corrugations on the outer rails of light curves, one company on the inner rail of light curves, and three companies in straight track. Braking seems to have little effect in causing them although three companies find corrugations where brakes are applied most frequently.

The Excavation Records being made at the Isthmus of Panama are of the most gratifying nature. The total excavation for September was 1,517,412 cu. yds., which not only exceeds the amount taken out in any previous month, but all estimates for a month. These figures include about 36,000 yd. of material taken outside of the canal prism in accessory work, but work on the prism exceeds by nearly 207,000 yd. the excavation of the prism for August. This record is particularly remarkable for the fact that nearly 12 in. of rain fell during September, a slight excess over the rainfall in August and nearly 3 in. more than that in July. The relocation of the Panama Railroad is proceeding rapidly, and during August over 65,000 yd. of material were placed in the new embankment. The general indications are that the excavation from now on will considerably exceed the rate necessary to keep pace with the construction of the locks and dams, to the promotion of which Colonel Goethals is now devoting special attention. These conditions are noteworthy because heretofore the rainy season has been looked upon as a probable check to the forward progress of excavation work. The fact that such records have been made is to be accepted as conclusive proof that the stories of dissension among the Commission's employees are without basis, for no such progress would be possible were dissension rife.

The Manufacture of Public Opinion concerning engineering works of the greatest magnitude was well described recently by witnesses in the investigation which the Public Service Commission is making into the affairs of the Metropolitan Street Railway of New York. It is perfectly well known that public opinion on engineering works is so manufactured, although very few of those signing petitions or attending mass meetings know the extent to which they are manipulated. For one reason or another some corporation, city or state may find it desirable to have a certain kind of undertaking pushed forward rapidly or else hindered as much as possible. The ways in which it proceeds to arouse the interest of the public to its way of thinking are manifold. In the special case referred to, a lawyer was employed who succeeded in having petitions signed by many thousands of people in favor of certain rapid transit plans, one of these petitions being signed by over a million residents of Greater New York. It is, of course, possible that a great many of these signers of these petitions thought they were acting voluntarily in the matter, but the contrary was the case. The same lawyer who engaged people to circulate these petitions assisted in forming various associations of citizens in different sections of the city for the same purpose, the expenses in every case being comparatively small when the enormous interests involved were considered.

The Condition of the Ship-Building Industry in the United States is outlined in a report of the Census Bureau just completed. In 1880, according to these figures, there were 2,188 ship-building plants in the country, while in 1904 there were but 1,097. In the former year the capital invested was approximately $21,000,000, but in 1904 the investment had increased to $121,600,000; the number of employees increasing from about 21,000 to nearly 51,000 in the same period. The value of the work done was about $37,000,000 in 1880 and about $83,000,000 in 1904. The changes have been largely due to the shutting down of small plants building wooden vessels and the great development of the steel ship industry. Since 1900 there has been an increase of over 50 per cent. in the production of boats under 5-ton rating, due to the development of gasoline engines for such craft. About three-fourths of the total value of the products of the ship-building industry in 1904 came from establishments in the Atlantic and Gulf districts. Although the number of ship-building plants in the Great Lakes district was nearly double the number in the Pacific Coast district, the output of the latter was slightly greater than that of the former. Although the number of vessels of 5 tons and over launched during 1904 was 167 less than the number launched in 1880, the tonnage had increased 40½ per cent. during this period. The average value of the vessels launched in 1880 was not quite $8,000 whereas in 1905 the average value was $32,700.

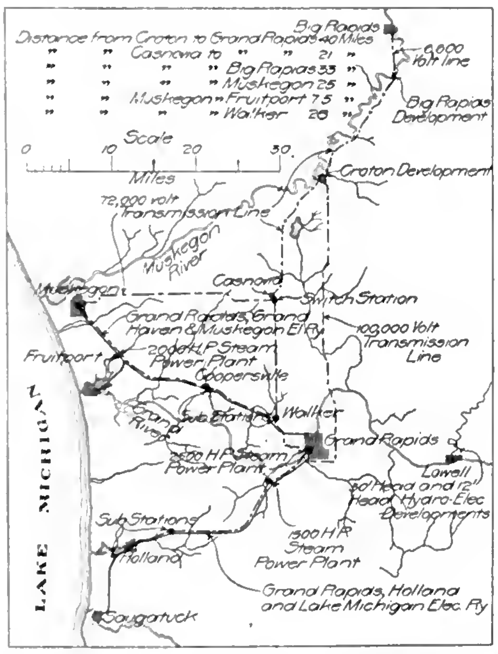
THREE LOW-HEAD HYDRO-ELECTRIC DEVELOPMENTS IN MICHIGAN.—PART I.

Three low-head hydro-electric developments, involving a number of similar features of design and construction, have been placed in service recently in the southern and western parts of Michigan. Two of these developments are a part of the system of the Grand Rapids-Muskegon Power Co., of Grand Rapids, Mich., and the third was built by the Commonwealth Power Co., of Jackson, Mich. The financial interests of these two companies are allied, but their generating systems and the fields of their operations are entirely distinct. Electric current is generated by the former company in two steam-driven stations and by four hydro-electric developments. The steam-driven installations are part of existing systems that were acquired by the company; two of the hydro-electric developments are on the Muskegon River, and the other two are on the Flat River, a tributary of the Grand River. The Commonwealth Power Co. operates seven hydro-electric stations, one on the Grand River and six on the Kalamazoo River.

The Grand Rapids-Muskegon Power Co. supplies power to operate two interurban electric railway lines which enter Grand Rapids; to the Grand Rapids Edison Co.; to several large factories in Grand Rapids and Muskegon; and for commercial lighting in Big Rapids, Coopersville and Grandville. The location of the various generating stations and transmission lines of this company, and of the two interurban railways supplied with power by it, is shown in an accompanying map of the district covered. The two hydro-electric developments on the Muskegon River are at Croton and near Big Rapids, 43 and 58 miles, respectively, from Muskegon, which is at the mouth of the river, and 40 and 50 miles from Grand Rapids. Power is transmitted from both stations to Grand Rapids and to Muskegon. The two developments on the Flat River are at Lowell, 18 miles east of Grand Rapids, to which the power generated in them is transmitted. One of the interurban electric railways extends from Grand Rapids to Muskegon, and the other from Grand Rapids through Holland to Saugatuck, on Lake Michigan. A 2,000-h.-p. steam-driven station on the Grand Rapids-Muskegon interurban system and a 1,500-h.-p. steam-driven station on the Grand Rapids-Saugatuck line are connected with the general distribution system. The company also controls dam sites on the Muskegon and Grand Rivers, which, including those already developed, will produce an ultimate capacity of 60,000 h.-p.

The Muskegon River is the longest river in Michigan, its general course being from the north to the south. The river has its source in Higgins and Houghton Lakes, which have a combined area of about 50 square miles. The entire catchment area of about 1,800 square miles above the Big Rapids dam has a clay subsoil, overlaid to a depth of about 10 ft. with sand and gravel, and is mostly covered with a growth of scrub pines and oak. The rainfall is therefore largely absorbed by the soil and is delivered slowly to the streams. The course of the river from the north to south, together with its considerable length, causes thawing of the snow in the Spring to begin at the mouth of the river, and to proceed northward gradually, so considerable Spring floods due to a quick thaw over the entire watershed are uncommon. This normal absence of spring floods and the slow delivery of the rainfall to the streams makes the variation between high-water and low-water flows comparatively small. In fact, the minimum flow of record at the Big Dam is 700 second feet, which occurred Sept. 2, 1907, while the maximum is 5,000 second-feet, occurring in March, 1904. Practically the same stream-flow conditions also exist at the Croton development, where the total watershed above the dam is approximately 2,300 square miles. The variation between the minimum and maximum flows is proportionately somewhat greater at this dam than at the Big Rapids dam, however, as the Little Muskegon River, with a watershed tending toward a more rapid discharge of the rainfall, enters the main river between the two dams. The relatively high minimum flow and the uniform flow throughout the year, together with a rapid fall in the middle section of the river, indicate the value of the stream for power developments.

Croton Development.—The development at Croton, which is the more important of the two on the Muskegon River, renders available a head of 40 ft., and contains equipment with a capacity for developing continuously 14,400 h.-p. It was built at a bend in the river, where the valley is 600 ft. wide, with a bank a little over 40 ft., high on one side and one 120 ft. high above the water on the other side. The works that make up the dam embrace essentially the following: A waste-gate section, 238.75 ft. long, which is built of concrete and is at one side of the river valley; a power house, 160 ft. long, that adjoins the outer end of the waste-gate section; and a hydraulic-fill embankment, 200 ft. long, extending from the power house to the high bluff on the opposite side of the valley. One of the chief features of the design of the dam, and of the dams at the other two developments to be described, is the use of flood gates of sufficient capacity and so arranged that the pond above the dam is maintained at a constant level throughout the year. These flood gates are of the Tainter type, built of steel, each gate being 20 ft. wide and 12 or 13 ft. high. Another feature of the hydraulic design common to all three developments is that the water is discharged from the waste gates into a tumble bay, from which it spills over a low concrete weir into a waste channel.



Map Showing Hydro-Electric Developments and Transmission Lines of the Grand Rapids-Muskegon Power Co.

The site of the development at Croton is underlaid at a depth of 20 to 40 ft. below the surface by a stratum of hardpan, deposits of sand, gravel and clay overlying this hardpan. A continuous row of steel sheet piling was driven far enough into the hardpan under the waste-gate section and the power house to form an effective cut-off; this row of piling was also continued from the power house across to the opposite side of the valley, under a corewall in the embankment. The waste-gate section and the power house are carried largely by round wooden piles driven to the hardpan. They were both built on a flat at one side of the river channel, almost without encroaching on the latter. After they were finished the river was diverted through temporary openings in the waste-gate section and the hydraulic-fill embankment was built across the channel.

Waste-Gate Section.—The waste-gate section contains eight Tainter gates, each 20 ft. in width, and a log sluice, 40 ft. wide, that is controlled by a 40 x 3.5-ft. movable crest, or bear-trap dam. Four of the Tainter gates are on each side of the log sluice, the adjacent gates being separated by heavy concrete piers. The normal water surface in the pond above the dam is at Elevation 135.5, while the upper edge of the gates when closed is at Elevation 136, and the water in the tail race is at Elevation 95. The gates seat on a spillway which has a hollow reinforced-concrete gravity section. The details of the design of this spillway, the arrangement of the tumble bay and the concrete apron for the waste-way channel below the dam are shown in an accompanying cross-sectional elevation through the waste-gate section of the dam. The base of the downstream edge of the spillway is 45 ft. 8 in. from the upstream edge of the crest of the weir which forms the tumble bay. The crest of this weir is 7.5 ft. above the heavy reinforced-concrete floor of the tumble bay, this floor being continuous with the base of the dam. A concrete wall is continued from the piers on each side of the log sluice to the overflow weir, thus separating the tumble bay into two parts. Each of these parts has three 12-in. circular weepers connecting it with the tail race, so by closing the four Tainter gates on either side of the log sluice, the corresponding part of the tumble bay can be drained and the under side of the hollow spillway section entered from it.

The bottom of the waste-way channel below the gate section is protected by a reinforced-concrete apron that extends downstream for 200 ft. from the overflow weir of the tumble bay. The bottom of the log sluice is on a slope of 8 in. to the foot, a vertical curve connecting it with the apron protection for the waste-way channel. The retaining walls on each side of the sluice are also continued 20 ft. downstream from the overflow weir of the tumble bays so the flow through the sluice and that over the weir at each side of it are separated. A reinforced-concrete wall, extending downstream to the end of the protection apron separates the waste-way channel and the tail race of the power house. This wall is reduced in height from a maximum of 35 ft. at the power house to 10 ft. at the downstream end, and largely prevents back water in the tail race.

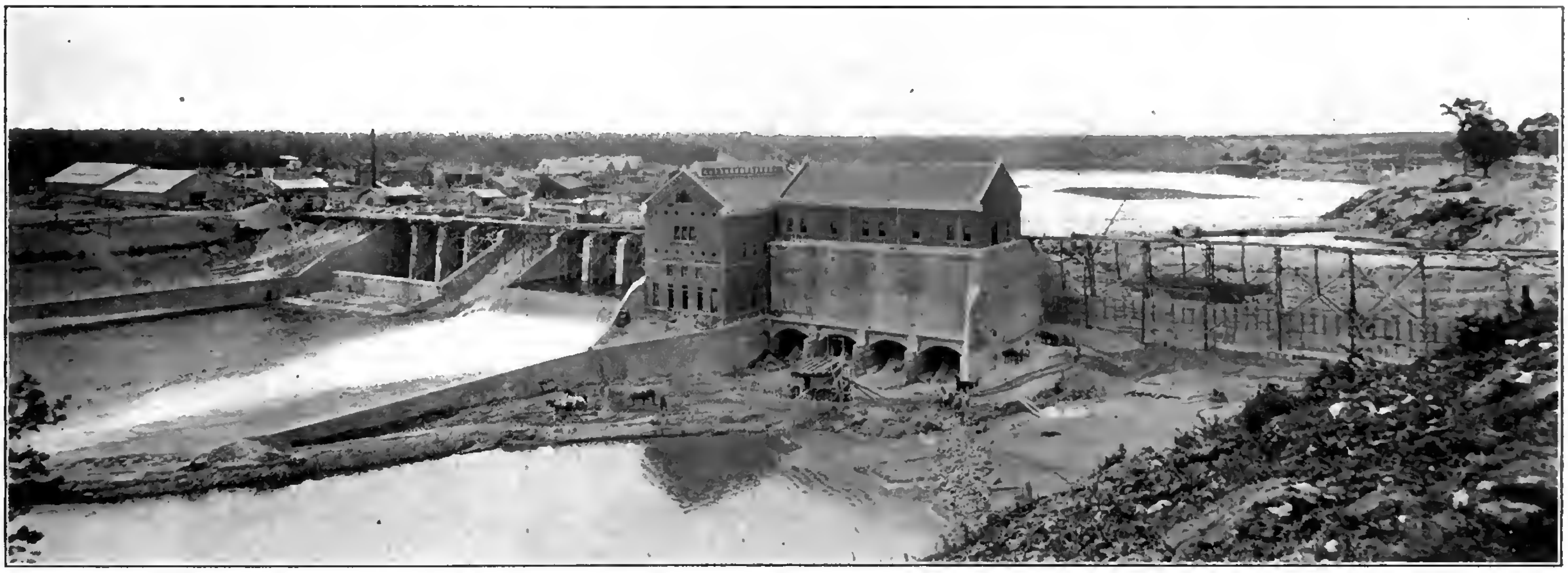
The Tainter gates were specially designed for the three developments that are to be described herewith. Each gate swings on two bearings, one on the pier on each side of the opening which it controls. These bearings are on 6-in. cold-rolled, turned, steel pins, that are imbedded in the piers. The frames of the gates are trussed across so these pins are only required to extend about 1 ft. from the face of pier, thus eliminating the usual bearing at the center of the gate and the necessity of providing a long, heavy steel shaft to extend the width of the gate.

Each gate is fitted along the lower edge of its face with a heavy oak block, which, when the gate is lowered, seats on a wooden sill carried by a 15-in. channel imbedded in the crest of the spillway of the dam. This arrangement makes a

watertight joint, that it is considered will rarely have to be renewed. The joints between the ends of the gates and the surface of the piers between the gates are made practically watertight by attaching 5-in. strips of 3-ply rubber belting to the edge of the upstream face of the gate in such manner that the belting overlaps the end of the gate and bears against the face of the concrete pier.

The gates are raised and lowered by a motor-driven hoisting crab that travels on a 24-in. gauge track of 12-in. I-beams laid the length of the waste-gate section on the piers between the gates and covered with a light section of reinforced-concrete so as to bridge the openings between these piers. This crab consists essentially of an eight-wheel truck, 18 ft. long, that carries a 4-h.-p. motor, worm-geared, through reductions to a horizontal shaft having a grooved drum attached to each end of it. One of these drums is built as a right-hand and the other as a left-hand screw. Each gate has a shackle attached to it at both ends near the bottom of the face, these shackles being arranged so chains can be hooked into them and wound around the drums of the hoisting crab. An 8,000-lb. pull can be exerted on each of these chains by the crab, so the gates are easily handled by the latter. Bearings on this shaft are attached to the leaf at intervals of 6 ft. At about 6-ft. intervals intermediate with the bearings carrying the leaf are thrust bearings against the shaft, which are seated on heavy castings in the top of a concrete ledge under the hinge. The base of each of these thrust bearings is arranged with an adjusting screw so all the bearings may be brought into alignment.

Earth Embankment Section.—The earth embankment between the end of the power house and the side of the valley opposite from the waste-gate section contains 104,000 cu. yd. of sand and gravel that was sluiced into it hydraulically from the high bluff on that side of the valley. This embankment is 20 ft. wide on top, 40 to 60 ft. high, and has a slope of from 2½ to as much as 6 to 1 on its upstream side, while the slope on the downstream side is between 2 to 1 and 4 to 1. The concrete core wall in the embankment is 12 in. thick and is heavily reinforced. It rests on the line of steel sheet piling which forms the cut-off at the base of the dam. The wall is located at the line where the surface of the pond intersects the embankment, projecting 2 ft. above the water level to serve as a wave protection. With this arrangement the greater part of the embankment remains practically dry, to the stream and parallel with axis of the dam. The portion of the substructure of the building in which the turbines are placed is divided by transverse walls into four penstocks, each containing a pair of turbines for each unit. These penstocks are each 22 ft. wide and rise to a height of 33 ft. above the top of the heavy base on which the turbines are set, and in which the draft tubes for the latter are formed. The upper two-thirds of the front end of each penstock is open the full width of the penstock to form an entrance from the pond above the dam. These openings are each protected by an inclined rack, within the penstock, which intercepts floating debris. A heavy boom is also extended from each side of the log sluice in the waste-gate section to the sides of pond to divert logs and large floating debris over the sluice. Stop-log grooves are placed in both sides of each penstock, immediately in front of the rack, in order that the penstocks may be shut off separately. Light steel-frame gates, faced with planks and divided horizontally at the middle, are operated in these stop-log grooves. These gates are handled by a hoisting block running on an I-beam trolley suspended from the roof trusses of the house over the penstocks. The upper half of each gate can be hung on hooks on the side



General View of Croton Development Showing Embankment Being Sluiced into Original River Channel.

Power to operate the motor is obtained from a supply line laid in a conduit buried in the concrete, plugs for making connections being placed at suitable intervals along the gate section. Two hoisting crabs are provided, in order to be certain of one, if the other is out of commission. Both crabs are also arranged with wheels, fitted with grips, so they may be operated by hand in case both motors are out of service, or no current is available.

Movable Crest Dam.—The movable crest dam is set in a depression built in the top of the spillway of the waste-gate section. It has a leaf, 6 ft. 10 in. wide and 40 ft. long, which turns on a shaft in a hinge along the upstream edge, thus permitting the downstream edge to be raised and lowered through a vertical travel of 3.5 ft. The leaf is raised and lowered by two sets of motor-operated worm and spur gears which drive two hoisting drums on a main shaft extending across the opening controlled by the movable crest. Two chains, one attached to each end of the leaf, are wound around these drums, the latter being grooved, one as a right and the other as a left-hand screw.

An 18-in. I-beam extends the full length of the 6-ft. 10-in. leaf, and is attached to the front edge of the latter.

The leaf turns on sections of 3-in. steel shaft. giving it much greater stability than if saturated, while the line of sheet piling prevents seepage under the embankment.

Power House.—The power house is an L-shape structure, with the axis of the stem of the ell coincident with the axis of the dam. The stem of this L-shape building is 65 x 141 ft. in plan and has a heavy concrete substructure carrying the penstocks and containing the draft tubes for the water wheels. The leg of the ell is 44 x 80 ft. in plan, and contains the electrical equipment. This part of the building has hard-burned, red-brick walls, surmounted by a roof of glazed, green tile carried by steel roof trusses, the appearance of the exterior being very satisfactory. A low house, with the same kind of walls and roof, covers the penstocks.

The generator room of the power house contains two 3,600-kw. revolving-field 30-cycle 6,600-volt three-phase Westinghouse generators. Each generator is direct-connected by a 12-in. shaft, 110 ft. long, to four pairs of 45-in. Samson turbines, of the center discharge type, which are in the adjacent penstocks. The units operate normally at 225 r. p. m., but are designed to run without injury at double that speed with no load. The shafts are each also designed to carry 8,000 h.-p. continuously.

The shaft of the main units is at right angles wall of the penstock house, when it has been lifted out, and the lower part is arranged to stand beside the upper part, both parts being placed in these positions for storage by the hoist.

The downstream ends and the sides of the penstocks are of reinforced concrete. These ends are semi-circular, with the reinforcement in them carried backward and downward into the base of the penstocks at an angle of about 45 deg. with the horizontal to overcome any tendency of shearing in the concrete. The sides and ends of the penstocks are designed so any one penstock may be emptied safely while the others are filled.

Each pair of turbines has a draft tube, leading to the tail race, formed in the heavy base on which the penstocks stand. The arrangement of the units normal to the stream, and the location of the corresponding pairs of turbines for both units on the same transverse line in the penstocks, necessitated a special and unusual design of these draft tubes. The upper part of the draft tubes for the pairs of turbines of the units on upstream side are as ordinarily built, but these tubes flare out at the bottom, so a draft tube for one of the pairs of turbines of the downstream unit can be placed in line with each of them. This increase of section is made

in such a manner that the water discharged from the upstream turbine in each case passes on both sides of the draft tube for the corresponding downstream pair of turbines, the velocity of the water where the discharge from the two tubes join being the same, to eliminate as fully as possible any agitation at this point.

The shafts of the two units pass through large glands in each of the division walls between the penstocks, and in the wall between the end penstock and the generator room. These glands are each carried by a heavy cast-iron diaphragm attached to a frame of I-beams and channels imbedded in the walls. The frames for the various glands of each unit are anchored together by heavy iron rods extending from one end to the other of the row of penstocks. The glands are practically watertight, so any one penstock may be drained and entered without interfering with the operation of the turbines in the remainder. Stop-log grooves in each penstock between the corresponding turbines of the two units also permit the downstream turbines to be cut off without stopping the turbines of the upstream unit in the same penstock. Any pair of turbines on either shaft can also be disconnected so the other turbines between the pair in question and the generator may be continued in service.

Two Type N Lombard governors are provided for the four pairs of turbines to each main unit. These governors are placed on the floor of the generator room, where they are belted to the main shafts of the units. One governor controls the operation of two pairs of wheels and the second one the other two pairs, but both are arranged to operate simultaneously.

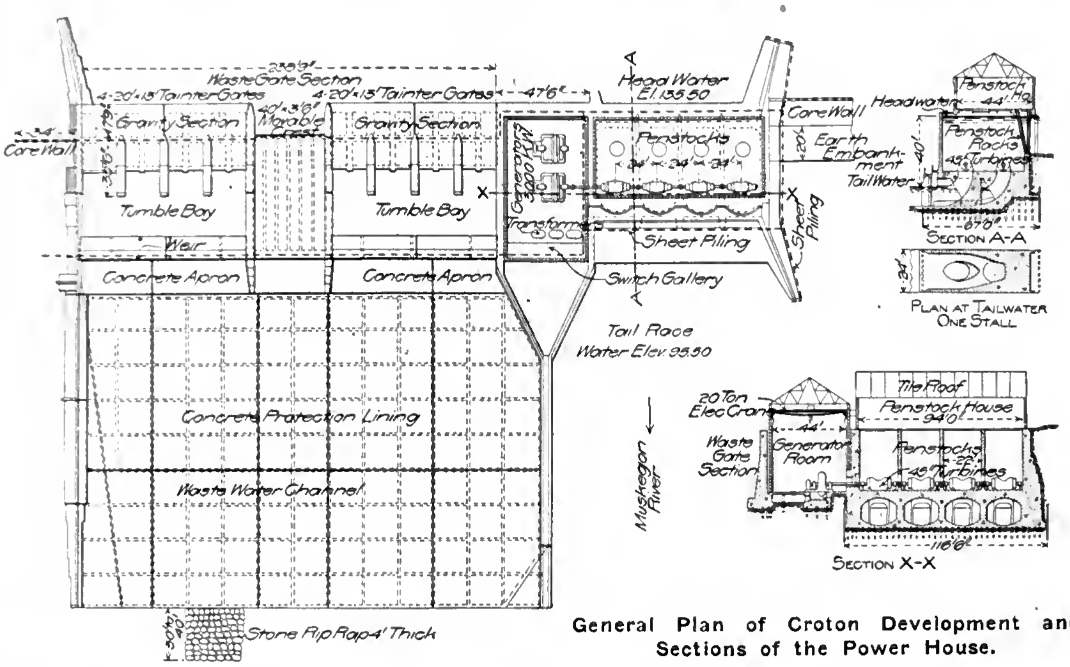
A complete mechanically-forced lubricating feed system is also provided for the bearings of the turbines of each unit, the bearings under water being of lignumvitae. Each of these systems consists essentially of a supply cylinder carrying a piston on a screw, by which heavy oil may be forced into small storage tanks under pressure. The supply cylinders and storage tanks are in the generator room on a bracket gallery against the wall which separates that room from the penstocks. The storage tanks are connected to a pipe header from which a separate lateral pipe is carried to each of the four bearings on every pair of turbines. These lateral pipes are each fitted with a quick-opening valve, which is opened for a short time when oil is to be supplied to a bearing, thus insuring a positive feed.

Excitation current for each main generator is furnished by a 40-kw. 125-volt direct-current generator on the shaft of the unit. The field winding of the generators is so proportioned that with constant speed, constant separate excitation and 100 per cent. load factor, the load may be varied from the normal rated capacity to no load with a voltage rise of not more than 8 per cent. At the normal rated current and voltage, and with 100 per cent. load factor, the efficiency of the generators is guaranteed to be at least 93 per cent. at half load; 95 per cent. at three-quarters load; 96 per cent. at full load; and 95.5 per cent. at 50 per cent. overload. Unusual care to prevent excessive temperatures in the generators under continuous operation was also observed in the design.

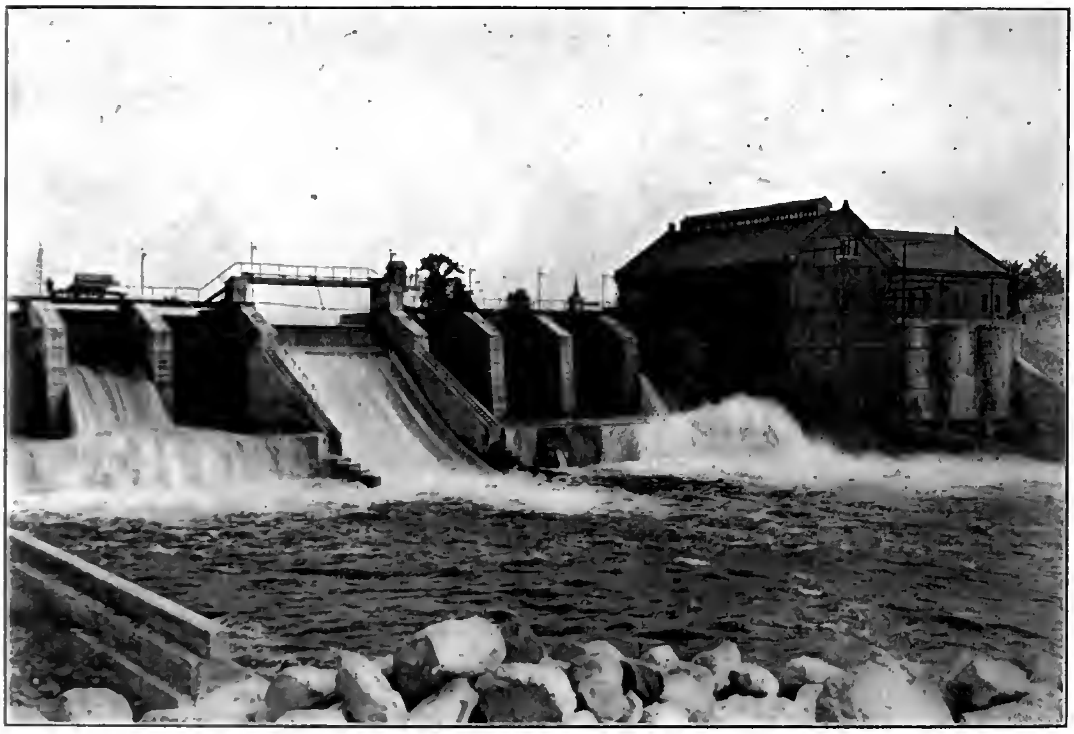
The 6,600-volt current delivered by the generators is stepped up to 72,000 or 100,000 volts for transmission to Muskegon and Grand Rapids by three 3,000-kw. 30-cycle oil-insulated water-cooled transformers, placed at the downstream end of the generator room. The transmission lines leading from the power house will be described later.

The operation of the generators is controlled from a two-panel switchboard at level of the generator room floor. Motor-operated oil switches, also controlled from this switchboard, are provided for the high-tension bus-bars and connections. These switches are in separate fireproof cells, and the bus-bars are all in separate fireproof compartments.

Construction of Croton Development.—The works which make up the Croton development were built on force account by the owner, the Grand Rapids-Muskegon Power Co., under the direction of Mr. J. B. Foote, general superintendent and electrical engineer, and Mr. William G. Fargo, designing and supervising engineer, in charge of the work. Mr. Daniel L. Davis was resident superintendent and Mr. Benj. T. Weston was resident engineer during the construction.



General Plan of Croton Development and Sections of the Power House.



Close View of Waste Gates and Log Sluice at Croton.

In order to facilitate the delivery of supplies and materials, a standard-gauge railroad, 6 miles long, was built from the Pere Marquette Ry. to the site. Standard-gauge switching connections with this branch railroad were extended to all parts of the storage yards at the works, these extensions being carried down on inclines so the turbines and electric machinery could be delivered close to the power house. Standard-gauge cars were handled on these inclines by electrically-driven hoists without any difficulty. A stationary gantry for a cross-travel trolley carrying a 10-ton chain hoist was built over one of the side tracks for unloading heavy material and machinery.

The construction plant for the work included two No. 1 Vulcan turntable pile drivers, two drop-hammer pile drivers, one ½-yd. and two ¾-yd. cubical mixers and a number of derricks, pumps and smaller equipment. All of this equipment was operated by motors, except the turntable pile drivers, which were operated by steam. A 9 x 11-in. motor-driven air compressor, with a capacity of 130 cu. ft. per minute, was also installed in a temporary boiler house on the low bank of the valley. This compressor furnished power for operating two riveting hammers, a chipping hammer, a reversible wood-boring machine and four forges in a blacksmith shop. The compressor and tools, exclusive of the motor and air tank, cost $600.

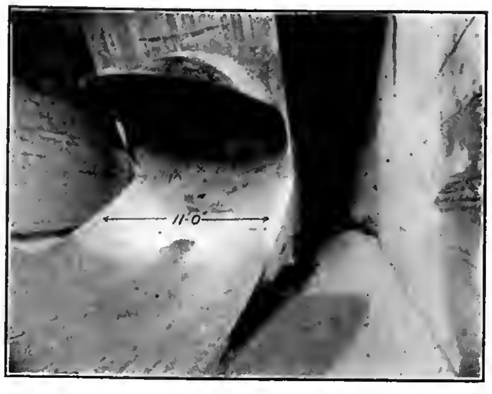
The electric power required to drive the various motors was supplied by a temporary 6,600-volt line extended to the site from the Big Rapids development, which had been completed before construction was started at the Croton dam. A 72,000-volt transmission line, extending from the Big Rapids development to a switch station, with one branch leading to Grand Rapids and a second

branch to Muskegon from this station, passes the site of the development at Croton. The 6,600-volt line was carried on temporary brackets placed on the poles of this high tension line. The 6,600-volt current was stepped down to 440 volts by water-cooled transformers at Croton for use in the construction plant there.

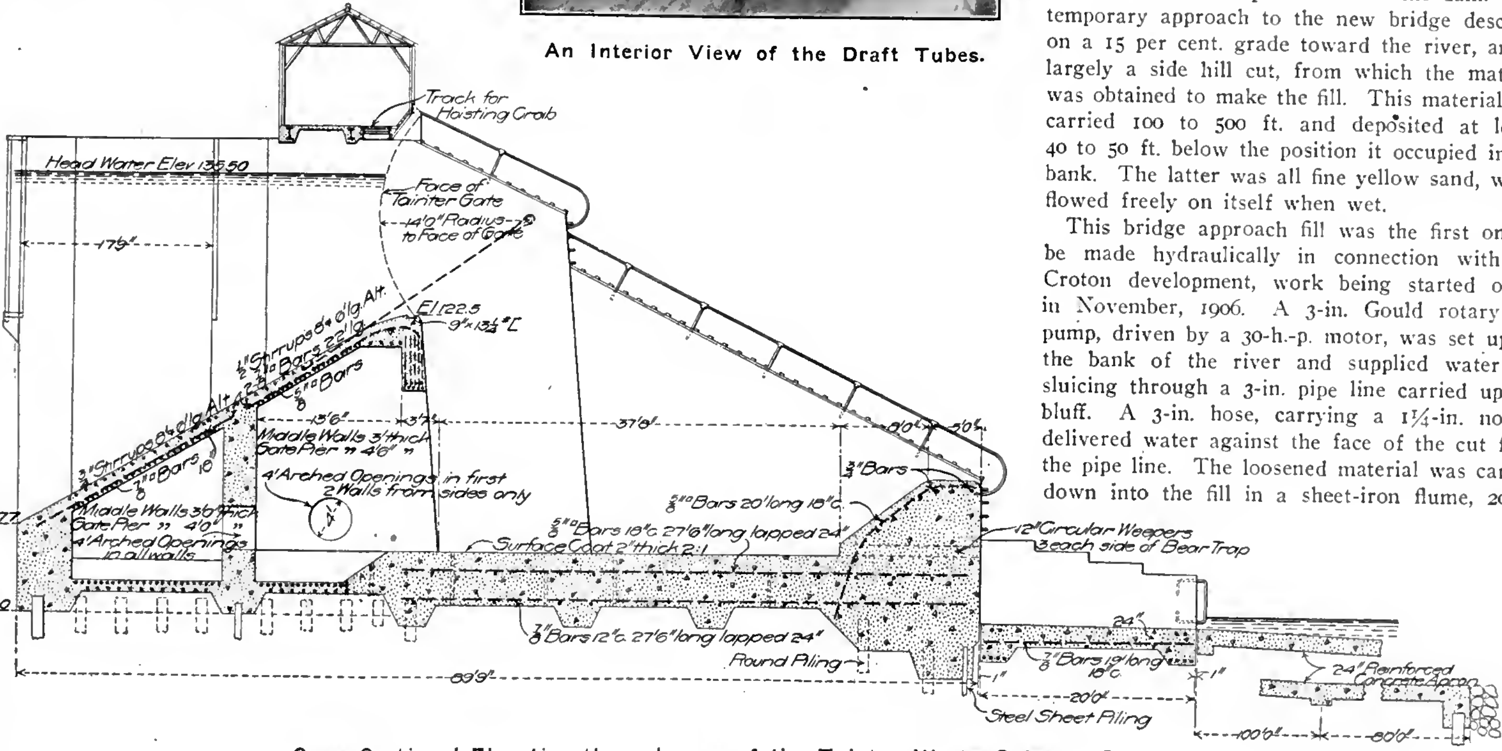
Concrete.—In all, about 20,000 cu. yd. of concrete were used in the dam. This concrete was made in varying proportions, depending on the purpose for which it was to be used. Newaygo Portland cement and unscreened pit gravel were used in all of the concrete. This gravel contained about the proper amount of sand, the voids in it ranging from 14 to 18 per cent. The gravel was obtained from a pit along the branch railroad about a mile from the dam, and was brought to the work in 5-yd. bottom-dump cars handled in trains of 10 cars each, by a standard-gauge locomotive.

A concrete mixing plant was erected near the end of the waste-gate section of the dam, in line with the axis of the latter and back on the edge of the low bluff on that side, about 40 ft. from the limits of the concrete work. The two ¾-yd. motor-driven mixers were set up in this plant so that they would dump into cars on tracks about level with the highest point of the concrete in the dam. A storage for gravel was erected over the mixers, the gravel being delivered into a track hopper at the side of the plant from cars on the standard-gauge railroad, from which hopper it was raised to the storage bin by a bucket elevator. The cement was stored in a shed in the rear of the mixing plant. An incline was extended from this shed up to a working platform around charging hoppers over the mixers and the cement was hauled up a track on this incline on flat cars handled by an electric hoist.

A temporary pole trestle was extended from the mixing plant to the opposite side the valley, crossing the latter on the axis of the dam. This trestle carried two 24-in. gauge tracks, on which ½-yd. Koppel dump cars were pushed by hand to deliver concrete to any part of the work. The concrete was dumped from these cars on the trestle through chutes leading down to the point where it was to be deposited. The concrete work was carried on through the winter of 1906-07, some of the most important parts of it, such as the reinforced semi-circular ends of the penstocks, being placed with the temperature below zero. During the prevalence of low temperatures, the water used in mixing the concrete was heated and a jet of live steam was turned into the mixers, with the result that the concrete was delivered hot from the latter, and retained sufficient heat to permit a considerable set to take place before it became cold enough to freeze after it was placed. Live steam was also piped to all parts of the work and was used for thawing ice from the forms and for other purposes. The steam required for this work was furnished by a 60-h.-p. boiler set up in a house near the mixing plant, the motor-driven compressor also being installed in this same house. No salt was used in the water except in a few heavy walls where no reinforcing steel occurred.



An Interior View of the Draft Tubes.



Cross Sectional Elevation through one of the Tainter Waste Gates at Croton.

The longer reinforcing rods which required bending were heated in a special forge, adjacent to the blacksmith shop, so they could be bent readily. This forge was a heavy slab of concrete, 6 ft. wide by 15 ft. long and 2 ft. deep, with three longitudinal troughs formed in it. A perforated pipe was buried under the bottom of each of these troughs, and air was supplied from the compressor through these perforated pipes. The long rods of high carbon steel were readily heated in this forge and could be bent to templets without trouble.

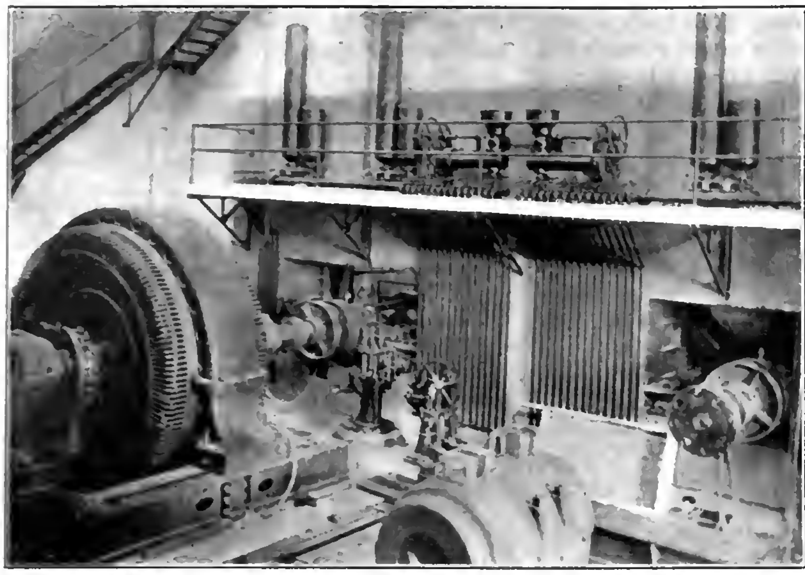
Sluicing Operations and Plant.—After the waste-gate section and power house were practically finished, the river was diverted from its channel between the end of the power house and the high bluff on that side of the valley, and passed through a row of six 7 x 9-ft. openings which had been left in one end of the bottom of the waste-gate section. This diversion was accomplished by rock-filled timber cribs sunk across the channel about 300 ft. above the power house. A low fill of long slope was then made under water on the upstream side of the crib by hydraulically sluicing material into the channel from the high bluff. After this upstream fill had been finished, the channel downstream from the cribs was filled, and the embankment section of the dam was carried up with material sluiced down from the bluff. The temporary closing cribs, when faced with a sluiced fill on the downstream side, were made nearly tight under a head of 15 ft. of water. The water which seeped through and accumulated between the temporary and permanent embankments was removed by a motor-driven 4-in. centrifugal pump running less than a quarter of the time. The possibility of making tight fills with material deposited under water by hydraulic sluicing is thus shown.

In addition to the 104,000 cu. yd. of material deposited in the channel closure and the embankment section of the dam by the hydraulic sluicing process, a fill containing about 20,000 cu. yd. of material, which was required as an approach to a highway bridge just below the dam, was made in the same manner. This highway formerly crossed the river on a bridge about a quarter of a mile upstream from the dam. The temporary approach to the new bridge descends on a 15 per cent. grade toward the river, and is largely a side hill cut, from which the material was obtained to make the fill. This material was carried 100 to 500 ft. and deposited at levels 40 to 50 ft. below the position it occupied in the bank. The latter was all fine yellow sand, which flowed freely on itself when wet.

This bridge approach fill was the first one to be made hydraulically in connection with the Croton development, work being started on it in November, 1906. A 3-in. Gould rotary fire pump, driven by a 30-h.-p. motor, was set up on the bank of the river and supplied water for sluicing through a 3-in. pipe line carried up the bluff. A 3-in. hose, carrying a 1¼-in. nozzle, delivered water against the face of the cut from the pipe line. The loosened material was carried down into the fill in a sheet-iron flume, 20 in. wide on the bottom and with vertical sides 5 in. high. This flume was laid on the ground as the cut advanced on the 15 per cent. grade.

The pump and pipe line were set up by two men in two days. With the exception of the labor cost of handling 3,000 cu. yd. of material out of the cut and putting it into the embankment forming the approach to the bridge, no exact records of the cost of making this embankment were made. Four men with the outfit described moved out of the cut and put it into the embankment between Nov. 15 and 20, 1906, the 3,000 cu. yd. of material on which cost data were kept. The four men who did this work each put in 40 hr. at 20 cents an hour, and a foreman was also required for 40 hr. at 25 cents an hour, making a total of $42, or 1.4 cents per yard for labor.

The sluicing outfit used in building the embankment section of the dam included a pumping plant on the bank of the river downstream from the embankment, a pipe line leading from this plant up to, and along the top of the bluff which forms the bank of the river, hose connections from this pipe line to the face of the excavation and flumes leading from the latter down into the embankment. The top of the bluff



Mechanically Forced Lubricating System for the Water Wheels.

Interior of Penstock Showing Four Pairs of Turbines of a Set.

was yellow sand underlaid at various depths with hardpan and clay. A large percentage of the material in the embankment is sand, however, as under the pressures that were available the hardpan and clay could not be loosened readily enough to sluice.

The pumping plant was comprised of seven Underwriter's rotary fire pumps, one 5-in. Gould, two 3-in. Gould, two 6-in. Gould and two 6-in. Rumsey, all belt-driven by electric motors. Although these pumps were not the most efficient or desirable that might have been obtained for the work to be done, they were used because they were on hand and were readily adapted to be operated by the available motors. While the rotary pumps give good satisfaction for intermittent service of short duration, such as for fire purposes, they are not adapted for the hard, continuous service required in sluicing operations. On this account, an average of 50 per cent. of the pumps were out of order and undergoing repairs the greater part of the time, the breakdowns being for the most part in the gears and cams. For this reason, in future work, of this kind, it is intended to employ either a direct-connected turbine pump, or some other efficient type not subject to frequent breakdowns.

The pumps were placed in a 20 x 24-ft. shed, built on the edge of the river bank so it projected over the bank sufficiently to permit the suction pipes of the pumps to be dropped directly into the water and reduced the suction lift to not more than 8 to 10 ft., as the pumps of this type do not operate satisfactorily at greater lifts. The four 6-in. pumps were set in a row close together and had their discharge pipes connected to a 10-in. header, with the motors on the opposite, or land side of the building. These pumps were designed to run at from 200 to 250 r. p. m.; at the higher speed they should produce a pressure of about 100 lb. at the pump and each deliver 1,125 gal. per minute. In order to run them at this capacity and pressure, assuming their efficiency to be 50 per cent., it would require 140 h.-p.

The first fill above the closing crib across the channel of the river was made with one of the smaller pumps mounted with its motor on a scow. The discharge pipe from this pump was connected by a flexible joint with the force main on land in order that the scow could rise as the pond was filled by the closure of the openings in the crib. The pump used in making the cut and fill on the highway was also set up separately from the main plant.

The force main leading from the pumps in the plant set up for the sluicing outfit used in making the embankment section of the dam was a 10-in. spiral-riveted pipe, with a gate valve between each pump connection to this pipe and with one of these valves beyond the last pump. This pipe line was extended along the face of the bluff about 1,000 ft., being reduced successively to 8 in., and then to 6 in. by wrought-iron pipe with screw connections. Tees with 4-in. outlets for laterals and hose connections were placed in the pipe lines at convenient intervals, 4-in. iron body-gate valves being placed at these tees.

The nozzles used at the face of the excavations were mostly for 4-in. hose, and tapered in 24 in. to an opening 1¼ or 1½ in. in diameter. This taper was uniform, the nozzled end being machined and polished inside for about 2 in. from the tip. Each nozzle was clamped to a 2 x 10-in. plank, about 12 ft. long, that was pivoted to a standard similar to the jack used by a wagon-wheel painter, only heavier. This simple device served the purpose of a more heavily-constructed monitor, or giant, such as is generally used for higher pressures and larger pipes and nozzles. With this arrangement, one man handled each nozzle and was assigned a helper who moved the hose and kept the flumes in shape near the nozzle. Where the grades were sufficient, two men for each line of hose were all that were required in the pit. With such an outfit and the pressure at the nozzle 60 to 80 lb., it was impossible to handle any material more compact than sand and gravel; but, with larger nozzle openings and pressure of 150 lb. at the nozzle, hard clay and loose shale rock may be moved readily.

The nozzles were usually worked in pairs, the force of their streams being concentrated at the bottom of the face of the excavation. In places where the sand was underlaid by clay or hardpan, no special headworks were necessary to divert the water and loosened material to the flumes; but, in sandy and gravelly soil, it was necessary to have a converging box, or a series of boards set up in the form of a V to start the flow into the flumes. The water would cut only a slight channel in the pure clay under the sand and gravel, and as these channels did not seem to be deepened by continued use, they

View of High Bank from Which Material was Sluiced.

Two Nozzles in Operation against the Face of a Cut.

were excellent for sluicing purposes. The nozzles were not used for forcing material along the channels or flumes except when the materials became clogged in the latter.

The flumes were for the most part made of No. 12 gauge black iron in 30-in. semi-circular sections, 10 ft. long. These flumes, including the bending, cost 2¾ cents per pound, or 49½ cents per linear foot of flume. In all, 850 ft. of the flumes were required. The sections of the flumes when lapped 6 in. on an 8 per cent. grade, were tight without any calking or fastening whatever at the joint. Wooden flumes were tried, but they were rapidly cut out by the grinding action of the material carried by the water, although after four months' constant use the iron flumes showed but little wear.

The sluicing work was commenced at the distant end of the pipe line, where the first closure of the river channel was made and where the bluff was lowest. The force main could thus be shortened as the work progressed toward the pumping plant. The total height of the bluff above the finished embankment was 75 ft. On account of the grades required for the flumes, however, the actual face against which the streams from the nozzles were directed did not

TABLE 1. COST OF PLACING MATERIAL IN EMBANKMENT SECTION OF CROTON DAM BY HYDRAULIC SLUICING METHODS.

Cost of Equipment and Materials.	
Two 6-in. Rumsey underwriters rotary fire pumps (new)	$840.00
Two 6-in. Gould underwriters rotary fire pumps (second-hand)	750.00
430 ft. 10-in. No. 16 gauge spiral riveted pipe, cost 60 cents a foot when new, second-hand, 45 cents	193.50
400 ft. 8-in. wrought-iron pipe and fittings (new)	436.45
414 ft. 6-in. wrought-iron pipe and fittings (new); 120 ft. 4-in. wrought-iron pipe and fittings (new)	272.00
Material bought second-hand, including all fittings for the 10-in. line, also 6-in., 8-in. and 10-in. fittings for pumps; 150 ft. 4-in. rubber hose and nozzles; 350 ft. of 30-in. No. 12 gauge flumes used two months on another project	800.00
500 ft. No. 12 gauge 30-in. flume	250.00
Pulleys, belting, 3-in. cotton mill hose and other sundries	200.00
	$3,741.95

Charge 50 per cent. of this total to next job, leaving $1,870.98, to be divided by 104,000, which was total number of cu. yd. of material handled, gives the proportionate cost of plant per cubic yard of material moved, as $0.018.

Items of Labor and Supplies.	
Labor from pay roll, total	$3,774.61
Teams (removing stumps and stone, handling flumes and trestle timber)	248.56
Straw	18.00
Oil, waste, pumps repairs and sundries	118.83
Total	$4,160.00

$4,160, divided by 104,000, cu. yd. of material handled, gives 4 cents per cubic yard of material moved, as cost of labor and supplies.

Power.	Kw.-hours.
Power measured at meter at Big Rapids dam, 18 miles from Croton	138,008
Deduct for line and transformer losses and for power used for other purposes at Croton	46,008
Net power used by pumps of sluicing plant	92,000

92,000 kw.-hours at 1 cent = $920.00, which divided by 104,000 equals $0.0088 per cubic yard of material moved.

Recapitulation of Cost per Cubic Yard of Material Moved.	
Cost of plant	$0.018
Labor and supplies	0.04
Power	0.0088
Motor rental	0.0012
Total cost per cubic yard of material moved, as measured in cut	$0.068

exceed 40 ft., and for the most part was about 30 ft. The greatest distance to which material was moved in the flumes was 800 ft. The flumes were carried on the ground to the edge of the bluff and then to the point where the material was discharged on light pole trestles. They were generally laid on 8 or 9 per cent. grades; but, on some of the longer flumes the grade was reduced toward the end to 5 and 6 per cent. With grades of less than about 6 or 7 per cent., trouble was always caused by stoppages in the flumes, which required one man to about every 50 ft. of flume to prevent. The yellow sand, common to all the pine country of northern Michigan, that was handled in the flumes, will run readily on itself at grades of 10 to 12 per cent. when forced along by the action of water running down a slope.

As the material was deposited at the end of the flume line it tended to form a cone, with the slope depending on the kind of material. The surface of this cone when made up of sand and gravel, seemed to be drained immediately so that it was possible to walk dry shod over the material while it was being deposited. In order not to completely drain the material as it was being deposited, two lines of flumes were used together in order to keep the center of the fill, low, arrangements being made to remove the water at the farther end. In this way a pool of water and soft material could always be maintained between the two points at which material was being deposited by the flumes. In other cases, the fill was deposited against a temporary dam at the end of the slope in order to prevent the water being drained away too quickly, thus giving the material a chance to settle more compactly by being placed under water. The finished slopes of the embankment at 2 to 1, or 3 to 1, were made by placing boards at the bottom of the slope as the latter was started, and by using straw to prevent the water from undermining these boards. As the work progressed the straw and boards were moved up the slope. Toward the end of the fill where the water to be removed was more concentrated, it became necessary to use brush and a crib work of small poles, 2 or 3 in. in diameter, to retain the soft material at the proper slope.

The detailed costs of building this embankment by the hydraulic sluicing method are given in the accompanying table, from which it may be seen that the total cost, including all expenses, averaged 6.8 cents per cu. yd. of material delivered into the embankment, as measured in the excavation from which it was removed. This exceedingly low cost of handling material, as compared with other methods, is one of the most favorable features presented in operating a sluicing plant. Mr. W. G. Fargo, under whose direction the work was carried on, states, however, that a plant of this kind is also particularly valuable as a means of moving material from a high to a low level, where it would be very expensive to handle teams on the steep return grade, and that it is quite satisfactory for depositing material in water, such as in filling a pool or a river channel.

(To be continued.)

THE JUNGFRAU MOUNTAIN RAILROAD in Switzerland will be extended from the Mer de Glace to the summit. The extension, including a 2½-mile tunnel, will be 4 miles long.

The Manhattan Bridge Pedestal.

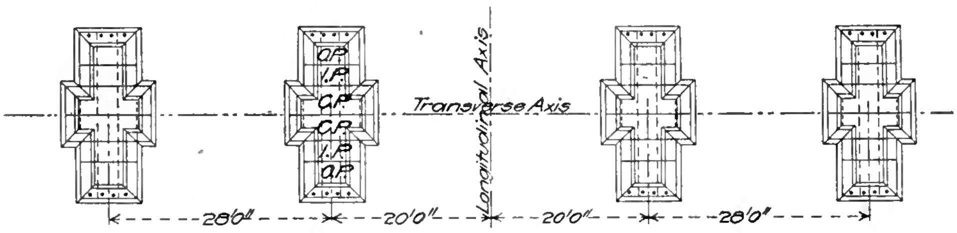
The Manhattan suspension bridge across the East River at New York, between the Williamsburg Bridge and the Brooklyn Bridge, will have, including approaches, a total length of 6,854 ft., and the steel superstructure between anchorages will weigh about 42,000 tons, nearly 19,000 tons of which will be comprised in the 1,470-ft. center span and the two 725-ft. side spans. The center span with a clearance of 135 ft. above mean high tide and the two side spans are double-deck structures 120 ft. wide over all, carrying eight lines of railroad tracks and trolley tracks, two side-walls and one 35-ft. roadway, and are proportioned for a regular live load of 8,000 lb. per lineal foot or a congested live load of 16,000 lb. per lineal foot. They are stiffened with two lines of riveted trusses 24 ft. deep, which are suspended at panel points about 18 ft. apart by four 1¾-in. steel suspender ropes from four main cables 21 3/16 in. in diameter, each composed of 9,472 parallel galvanized wires .192 in. in diameter. The cables are supported on massive cast steel saddles bolted, with 28 2-in. bolts, on top of vertical towers 281.89 ft. high.

Each tower consists of a single transverse bent with four vertical posts rigidly connected to the pier masonry and intended to spring 8 in. in either direction from the center line at the top parallel to the bridge axis with variations of temperature and loading. Each tower weighs about 12,500,000 lb., and each post is made in 14 lengths, each of which is shipped from the bridge shop in two or more pieces of 64 tons maximum weight. Each post has a closed rectangular cross section with 4 interior webs perpendicular to the bridge axis. The dimensions vary from 5 x 10 ft. at the top to 12½ x 33 ft. at the base, where it is seated on a riveted steel sectional pedestal 42 ft. 4 in. long, 21 ft. 10 in. wide and 5 ft. 5 in. high over all, which weighs 190 tons.

It was originally intended to make each of the eight pedestals of cast steel weighing about 380,000 lbs., and composed of six sections bolted together through vertical transverse webs. Owing to the difficulty and delay likely to be experienced in securing and finishing steel castings of these dimensions and shapes it was decided to substitute riveted steel for cast steel in the pedestals which were, however, to retain their original outline and dimensions. They were accordingly redesigned to have about the same weight and corresponding details to those of the castings and have been made by the Bridge Co., for the same pound price as was allowed for the original design.

The pedestal is proportioned to distribute uniformly over 695 sq. ft. of the surface of the pier masonry a maximum vertical load of 20,580,000 lb. produced by the congested live load of 16,000 lb. per lineal foot over the full length of the bridge. The maximum stress in the outer edge of the pedestal is produced when one-half of the main span and one of the side spans is entirely covered by the congested load and the remainder of the bridge is entirely unloaded. This corresponds to a possible deflection of 2 ft. at the top of the tower and although it is not considered probable that this will ever occur, the pedestals are designed to resist the extreme stresses.

The reaction of the masonry under one edge of the pedestal is a maximum of 64,000 lb. per square foot and the corresponding up-lift on the opposite edge may reach 9,000 lb. per square foot, equal to a total up-lift of 334,000 lb. In designing the pedestal it was at first arbitrarily divided into six sections for convenience of manufacture and shipment. The joints between them being located so as to most advantageously receive and transmit the stresses. The general



Location of Main Pier Pedestals of Manhattan Bridge.

outlines were adapted to cast steel construction and to conform with the architectural requirements.

The pedestal is finished on the upper and lower surfaces and on the abutting faces and the different sections are joined together by large horizontal bolts through their vertical webs. Section No. 1 has a maximum vertical load of 6,900,000 lb., which at an assumed coefficient of friction of 25 per cent. will develop 1,725,000 lb. friction with its base plate. The horizontal component of the maximum bending moment in the post produces a total horizontal stress of 3,700,000 lb. at the base of the pedestal.

In order to prevent the possibility of transmission of this stress to the masonry and consequent tendency to rupture the latter, the pedestal is seated on a bed plate made with three full-length longitudinal rolled steel plates 56 in. wide and planed on one side from a thickness of $1\frac{1}{8}$ to $\frac{7}{8}$ in. These plates are seated directly on the accurately dressed upper surface of the pier masonry to which they are connected only by eight $2\frac{3}{4}$-in. anchor bolts coarse-threaded their entire length and grouted in 4-in. holes 11 ft. deep in the pier masonry. These anchor bolts also pass through the base plates of the pedestals and the nuts at their upper ends engage saddle plates on riveted distributing members attached to the pedestal webs. Except for these bolts there is no connection or splicing between the pedestals and the base plates. Under maximum loading the bed plates act as outside splices to the base of the pedestal section developing the tensile strength above mentioned of 1,725,000 lb., which subtracted from the total horizontal stress, leaves a remainder of 1,975,000 lb., which is provided for by the eighteen $2\frac{1}{2}$-in. flange bolts.

The pedestal was designed with its main ribs in the planes of the post webs and virtually forming continuations of them with faced butt joints and splices generally made with double field riveted or field bolted cover plates. In addition to these webs there are provided exterior transverse longitudinal and diagonal webs or extensions to distribute the load over the entire horizontal surface of the wide long base plate. In all cases the connections of the pedestal webs to the webs of the posts were designed to take their proportionate share of the maximum post loads.

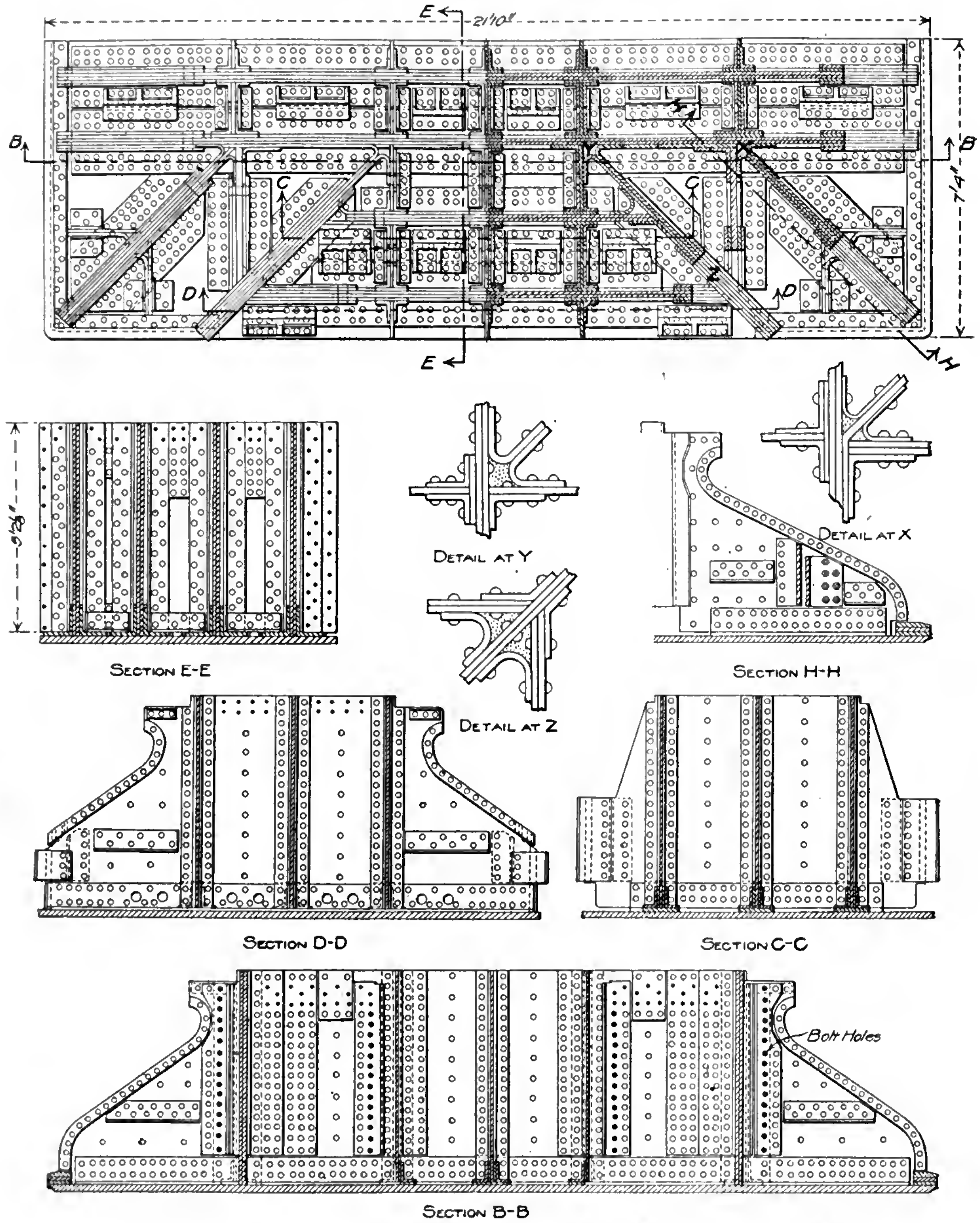
In the two end sections of the pedestal the ribs parallel to the bridge axis are made with continuous full-length webs and were treated in design and computation as simple T-shaped girders with flanges made by the sole plate. The intersecting ribs were made in short sections at right angles to and web-connected with these and are cantilevered beyond their outer faces. The tension in them is designed to be entirely taken up by the sole plate and the compression by the bearing on the web connection.

The diagonal ribs are made up with four web plates, 2 of which extend for a long distance parallel to the longitudinal ribs, riveted integral with them. The other two web plates are bent short to form oblique web connection angles. The rivets are proportioned to provide for all vertical shear and horizontal stress due to the maximum bending in the post. It was arbitrarily assumed that all rivets resisting bending stress were located within 12 in. of the tops of the ribs and it was assumed that the vertical stress is resisted by the remaining rivets in the whole area of the webs. By these assumptions the resultant stress in the upper rivets is reduced to a minimum of ordinary unit value. The remainder of the rivets, of course, receiving low unit stresses.

All of the ribs in the outer edges of the first section of the pedestal are calculated by the methods used for reinforced concrete beams, assuming that all tension is carried through the base plate and that the compression is received by the remainder of the cross sectional area of the member. All rivets are 1 in. in diameter and all rivet holes are drilled from the solid without punching. All spaces between the pedestal ribs will be filled solid with concrete extending up to the man-holes in the post webs. In order to relieve as much as possible the stress on the pedestal base plate and to assist in the distribution of stresses, horizontal angles are riveted to the faces of the webs with their horizontal flanges projecting into and embedded in the concrete.

The pedestal has no regular cap plate and the connection angles on the upper edges of the pedestal ribs, which are notched to receive it.

Each pedestal is divided into six sections by vertical joints transverse to the bridge axis as indicated in the general location diagram which also gives the position of the anchor bolts and shows the cornice and a corresponding stiffener rim around the base plate. The end, intermediate and center sections of each pedestal are symmetrical about its center line transverse to the bridge axis and have respective weights of 31, 19 and 41 tons. The center section has an 80-in. x 2-in. base plate 21 ft. 10 in. long and has in all 24 web plates from ⅝ of an inch. to 1 in. in thickness and 53 in. in maximum width which are riveted together in sets of 2 or 3 to form the



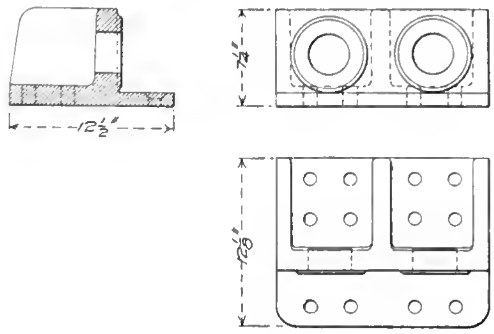
Center Piece C. P. of Manhattan Bridge Pedestals, Weight 41 Tons.

foot of the vertical post has no horizontal base plate. The spaces between the ribs are therefore unobstructed to give clearance for the vertical cover plate, splicing the post webs and pedestal ribs together. The upper edges of the pedestal ribs are, however, connected around the outside by a horizontal cornice of incomplete I-shape cross section made with a $15 \times 2\frac{1}{4}$-in. horizontal web, one $7 \times 5 \times \frac{3}{4}$ in., one $6 \times 6 \times 1$ in., and one $8 \times 6 \times 1$ in. flange angles as indicated in the cross sectional details. The web plate is bevelled for drainage on the upper face where the heads of the flange rivets are countersunk. It is made in sections up to 14 ft. long with mitered joints and is riveted to special flange rim. The flange angles are chiefly $8 \times 8 \times \frac{7}{8}$ in. The curved and inclined outer edges of the ribs are reinforced with double pairs of 3×1 in. flats and the spaces between the bent web connection angles and the ribs are filled solid with slow setting iron rust cement.

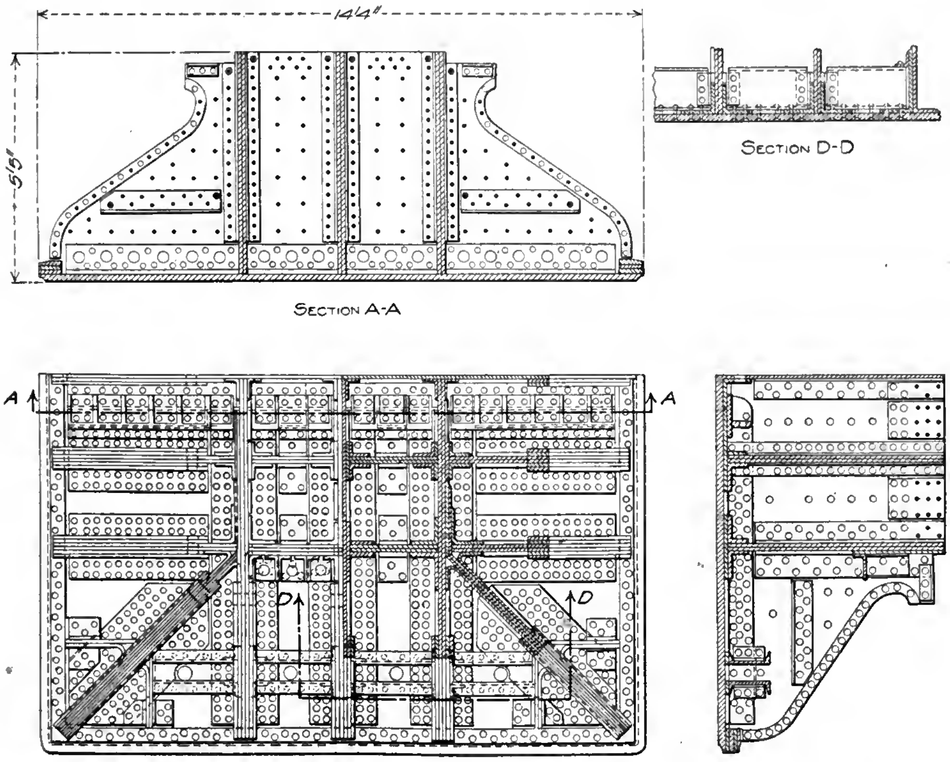
The intermediate section of the pedestal has a 59 x 2-in. x 14-ft. 4-in. base plate and is of comparatively simple and regular construction as indicated in the general assembled diagram. The end section of the pedestal is of complicated construction and has a 107 x 2-in. x 14-ft. 4-in. base plate with web plates 1 in. and ¾ in. thick riveted together in pairs to form the ribs except for the few horizontal bolts connecting the ver-

tical webs of adjacent sections of the pedestal which have nuts taking bearing on the faced surfaces of cast steel blocks riveted to the base plates of the pedestals. The blocks are made for 2, 3 or 6 bolts each, and all of them have unsymmetrical T-shaped cross sections stiffened by transverse webs dividing it into pockets for each bolt. They weigh from 145 to 475 lb. each.

The tower piers have long been finished and the anchorage piers are nearing completion, the 4,948,000 lb. of structural steel in them having already been delivered and set. The fabrication of the remainder of the super-structure has been in progress for several months at the bridge shop and when the erection was commenced in July, 12,887,000 lb. of steel for the towers and 3,770,000 lb. of steel for the pedestals had been delivered to the shops and 2,040,000 lb. of finished tower and pedestal sections had been delivered to the storage yards at Bergen Point, whence it is forwarded daily as required for erection in the super-structure which it is expected will continue simultaneously at both main piers. All of the pedestals have now been completed at the shops and erected. The separate sections were delivered by barges and unloaded by a floating derrick which places them on top of the masonry where they were rolled to position and set by hydraulic jacks.



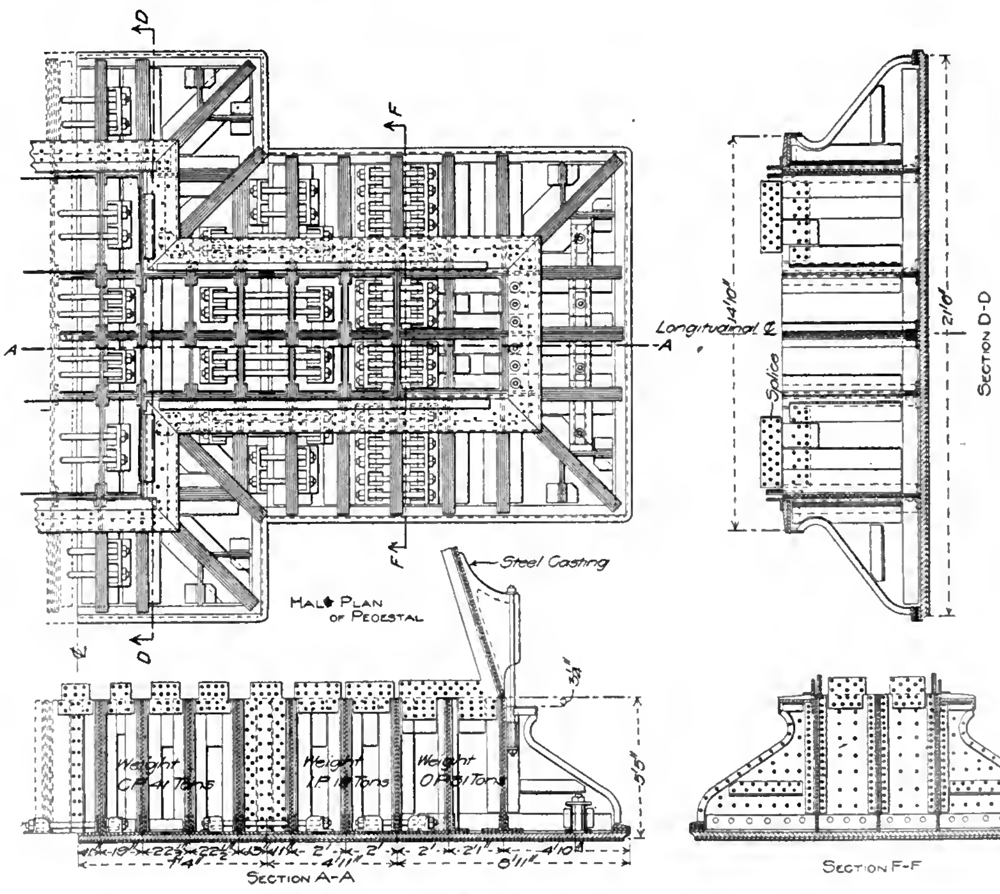
Casting for Splice Bolt.



Outside Piece O. P. of Manhattan Bridge Pedestals, Weight 31 Tons.

The cables are supported over the towers by eight cast steel saddles 11 ft. long 5 ft. 11 in. wide and 3 ft. 4½ in. high over the anchorage on eight sectional cast steel saddles, which are 30 ft. long, 5 ft. wide and 4 ft. high, seated on 60 segmental cast-iron rollers 9 in. in diameter. The saddles, rollers and 4-in. thick bed plates have to be planed, besides which there are 2,500 cast steel cable bands 3 ft. long made with flanged halves bored to a diameter of 21 3/16 in., 2,500 suspender sockets and as many 5-in. cast steel nuts, each weighing 50 lb., and all requiring to be faced or threaded or both. This makes an aggregate of about 2,000,000 lbs. of steel castings with single pieces weighing up to 31,000 lb., and involving a large amount of machine work. The contractors found that although it was comparatively easy to place the orders for the castings there was great difficulty in securing any promises to finish them within a reasonable time and that very high prices were demanded for the machine work. As the contractors already possessed a 50 x 150-ft. convenient and well-lighted machine and repair shop at their Crotch Island quarry in Maine, which was well equipped with steam, pneumatic and electric power, and with abundant ordinary tools, they decided to install there some special machine tools and finish all the castings themselves. They have accordingly purchased from Manning, Maxwell & Moore a 10 x 7 x 18-ft. Betts Machinery Company's planer and a 120-in. horizontal boring mill of the same make, a Dressers' radial drill, a large Cincinnati railroad shaping machine, a 22-in. Reed lathe, and a very heavy combination bolt machine for cutting threads on the 5¼-in. suspender sockets and tapping the nuts and a horizontal emery wheel grinder for spot facing small bearings. These tools have already been installed at the shops and the castings will be shipped to and from the shops by schooner at a freight cost of from 80 cents to $1.00 a ton for each 450-mile trip between the shops and New York City. Careful estimates indicate that a saving of at least $25,000 will be made on the cost of finishing the steel casting besides the great advantage of having the work under the direct control of the contractors and avoiding unnecessary delays and uncertainties.

Several plans have been devised for handling the work in such a manner as to expedite it and greatly economize the cost. Instead of boring the cable bands they will be clamped concave side up, in sets of 10 on the table of the planing machine and they will be dressed by high-speed steel tools with segmental cutting edges set to the exact radius and revolved transversely by a worm gear enabling them to finish the entire cylindrical surface with single cuts, moving at the rate of 22 ft. per minute and taking a chip about ¾ in. wide. The bands will be arranged in two parallel rows on the planer bed and while the concave surface is being finished, side tools will plane one set of lugs after which they will be reversed and the other set planed. A similar device will be used for planing the segmental surfaces of the 480 rollers. Twenty patterns have been made from the 2,500 suspender sockets and they will be finished after the cable saddles and rollers are completed. Over 300 tons of castings are now at the shops from whence the first finished lot has already been shipped back to New York.



Half of Assembled Pedestal; Weight of One-half 90 Tons.

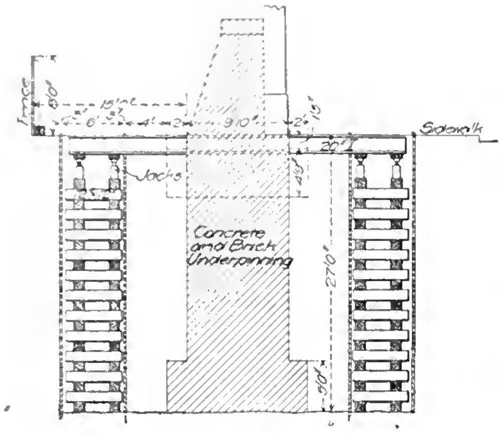
The bridge is designed and constructed under the direction of the Department of Bridges, New York City, Mr. James W. Stevenson, commissioner. Mr. O. F. Nichols, consulting engineer, and Mr A. Perry, assistant engineer, in charge of design. The Ryan-Parker Construction Co. is the general contractor, the riveted super-structure is fabricated by the Phoenix Bridge Company and erected by the Terry & Tench Construction Co.. The cables will be manufactured and erected by the Carbon Steel Co., Mr. Holton Robinson, chief engineer.

Water Purification at McKeesport.

The water purification works now under construction at McKeesport, Pa., are unusual on account of the necessity of softening as well as filtering the supply. The water is drawn from the Youghiogheny River, with a small additional amount from driven wells. Both river and well water contain a large amount of sulphates of lime and magnesia, requiring the use of caustic lime and soda ash, the former neutralizing the carbonic and sulphuric acid and the latter reducing the natural hardness and that added by the caustic lime. The plant has a nominal capacity of 10,000,000 gal. per day. It is a circular building 177 ft. in diameter in the basement, 92 ft. on the ground floor and 64 ft. on the second floor. The water is divided when it enters the plant, a large part flowing directly on its way, while a smaller part passes through lime saturators. This saturated solution is then mixed with the raw water in a channel leading to the mixing tanks, and the passage of the mixture through these tanks completes this part of the process. The water then flows to settling tanks where it is clarified, the stay of the water in the mixing and settling tanks being varied according to the character of the mineral matter. The various tanks and channels are arranged in a circular manner, the inner one being a waste channel from the filters and softening plant, the next one the channel for conveying water from the lime-saturating tanks to the mixing tanks, the next one being the mixing tanks themselves, the next one the channel for conveying water from the mixing tanks to the settling tanks, and outside of all the settling tanks. Outside of the settling tanks is a channel which carries the softened water to the mechanical filter plant containing six beds of 1,000,000 gal. capacity each. The plant was designed by Mr. Alexander Potter, and is being constructed under his supervision, all portions of it being of reinforced concrete.

Underpinning a 400-Ton Piet.

The portion of the double-track subway of the Philadelphia Rapid Transit Ry. located in City Hall Square, is very near the Pennsylvania R. R. Terminal Station, where the excavation was carried through sand and gravel to a depth of about 30 ft. adjacent to one of the piers supporting the train floor and side roof of the depot and estimated to carry a total load of about 400 tons on its 14 x 20-ft. base. The pier was of brick and granite above the surface of the ground and had a rubble footing about 9 ft. deep, seated in the dry earth.



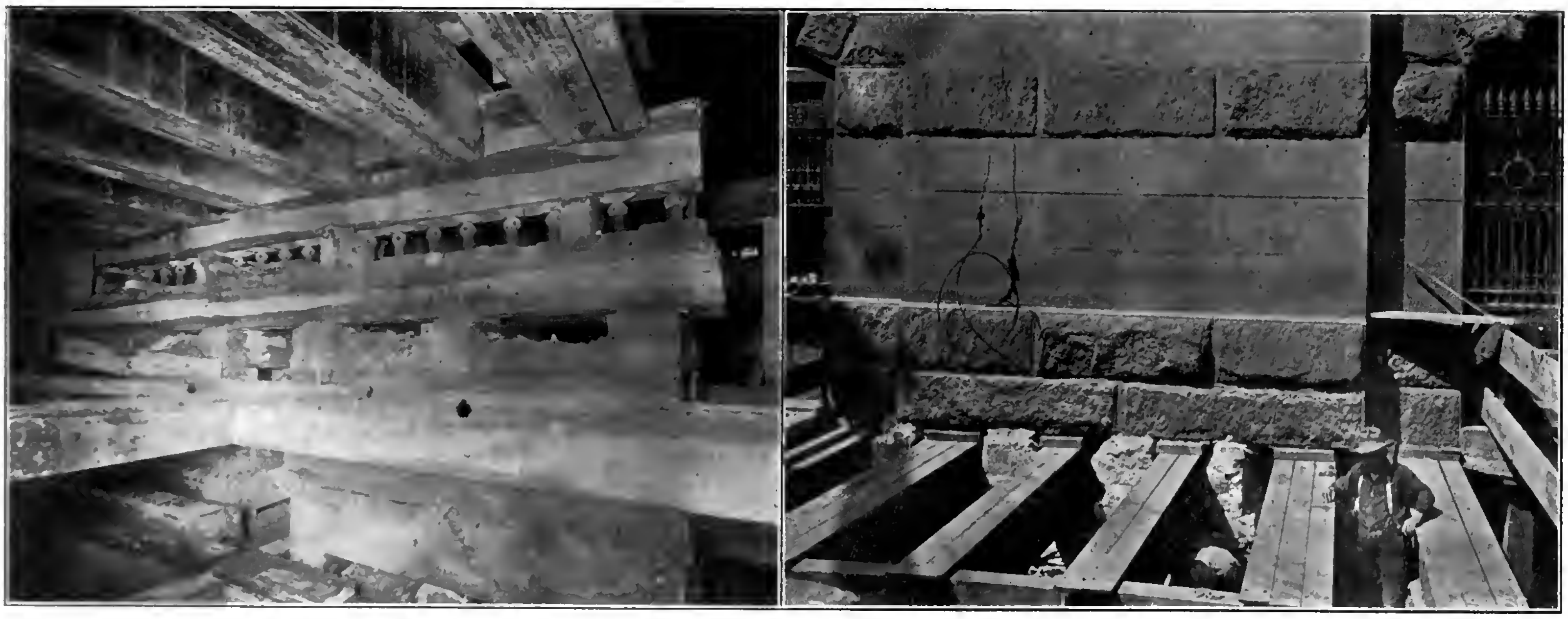
Method of Underpinning Pier.

A sheeted trench was excavated to 6 in. below subway grade on both sides of the pier and from it tunnels were cut through the footing wide enough to receive six groups of transverse I-beam needles and still leave sufficient rubble between them to support the load until it was transferred to the needles. Each needle beam consisted of two or three 20-in. 70-lb. I-beams, 26 ft. long, 16 in all. On the inside of the building the needle beams were supported on longitudinal sills on cribbing in the trench, 12 ft. on centers from the pier. The crib footings had a sufficient area to reduce the pressure on the surface of the ground to about 6,000 lb. per square foot. The opposite ends of the needle beams projected correspondingly about 12 ft. beyond the front of the wall and were seated on a 12x16-in. longitudinal sill supported by a similar cribbing.

About 20 jack screws were set under the sills at each end of the needle beams and were simultaneously operated to transfer the weight of the pier to the cribbing without perceptibly raising the pier. Alternate spaces left between the jack screws were filled with blocking on which pairs of wedges were driven as fast as the screws were operated so as to take up all slack and provide solid bearing competent to carry all the load and prevent any vertical movement should the jack screws fail under stress.

Excavation under the needle beams was carried down between the cribs to sub-grade and a new concrete foundation for the pier was built there clear of the needle beam supports and was carried up nearly to the lower flanges of the needle beams. Brick piers were built up between the needle beams nearly to the base of the masonry pier and engaged it in the usual manner with pairs of capstones separated by steel wedges and grouted in position. After their completion the jack screws were slacked off, releasing the needle beams, which were removed and the spaces they had occupied were filled with brickwork built up as here described. The new foundations contained about 90 yd. of concrete and together with the needling was built in about 22 days by an average force of 17 men.

The work was executed by Henry Sheeler & Sons, Chicago, as subcontractors to the E. E. Smith Contracting Co., general contractors for the City Hall section of the subway. The plans and operation were under the approval and supervision of the Philadelphia Rapid Transit Railway Co., Mr. W. S. Twining, chief engineer; Mr. Charles M. Mills, principal assistant engineer, and Mr. Frank R. Fisher, resident engineer.

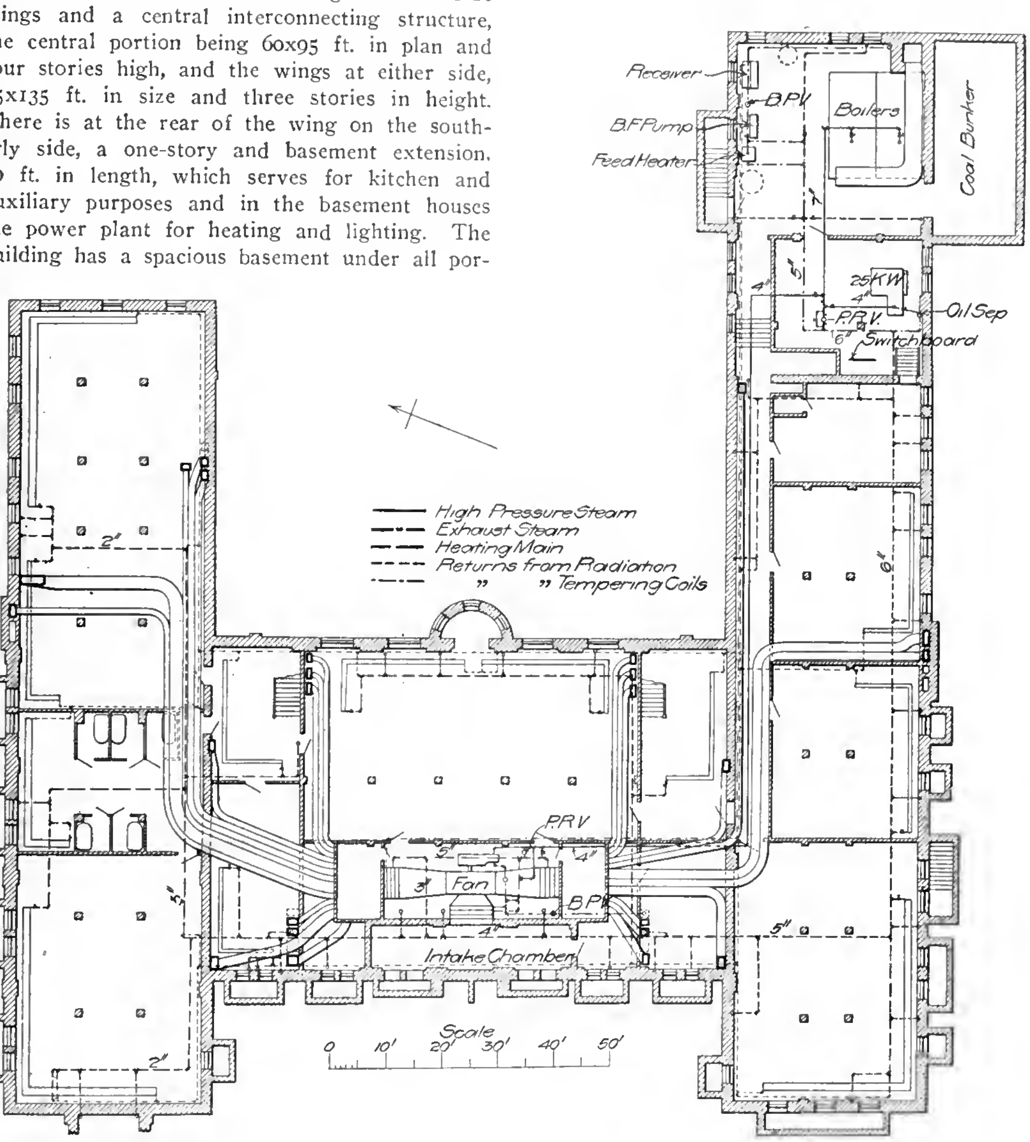


Needlebeams through Pier Footing and Jacks Used in Underpinning a 400-Ton Pier.

Coal Mining in Illinois during 1906 produced 41,180,100 short tons, or 7.9 per cent. more than in 1905, ranking second only to West Virginia. In anticipation of the suspension of operations which took place on April 1 the Illinois mines were operated to their fullest capacity for several months prior to that date, and the shortage due to the suspension was, to a great extent, provided for. After operations were resumed in June the intensity of labor among the mine workers was considerably greater than usual. This is shown by the fact that the average daily output per man was 3.13 tons in 1904, 3.29 in 1905 and 3.49 in 1906. According to the U. S. Geological Survey, a large part of the increased efficiency in labor was probably due to a greater use of machines for undercutting coal. In 1906 there were in use in the coal mines of Illinois 1,048 machines, and the machine mined product was 11,585,419 short tons, against 882 machines and a machine-mined product of 8,697,547 tons in 1905, and 643 machines and 7,110,902 tons in 1904.

Heating System of the St. Francis Home, Detroit, Mich.

The St. Francis Home for Orphan Boys is an orphan asylum that is being built near Detroit, Mich., by a Catholic organization of that city as a memorial to Bishop John S. Foley. It is located in a district known as Highland Park, about one mile beyond the northern city limits on Woodward Ave., where a large tract of land was secured for the grounds. An imposing structure of considerable size has been built of brick wall-bearing construction, with hollow-tile floors on steel beams and tile roofs, which provides dormitory and educational facilities for 300 orphans and the requisite number of teachers and attendants. The building has two side wings and a central interconnecting structure, the central portion being 60x95 ft. in plan and four stories high, and the wings at either side, 35x135 ft. in size and three stories in height. There is at the rear of the wing on the southerly side, a one-story and basement extension, 60 ft. in length, which serves for kitchen and auxiliary purposes and in the basement houses the power plant for heating and lighting. The building has a spacious basement under all por-



Mechanical Plant in Basement of St. Francis Home, Detroit, Mich.

tions, the first floor being from 3 to 4 ft. above grade, and there are attic spaces over both of the side wings.

The building occupies a particularly exposed location and has large areas of wall and window glass exposure, so that the problem of heating was one of considerable magnitude. In addition, ventilation is necessary in the greater part of the building owing to the number of dormitories, school rooms and other public rooms which will be occupied by large numbers of persons. Accordingly a scheme of heating arrangement was chosen which combines hot blast heating for all of the pubic parts and rooms which will, at times, be extensively occupied, such as the dormitories, the large dining-room, the chapel, etc., and direct radiation for the heating of all smaller rooms and for auxiliary heating in the larger public rooms. A feature of the installation is the use of hot blast heating in the dormitories to the entire exclusion of direct radiation, this being particularly feasible as the ventilation is essential at night when the large numbers of beds in them are occupied and, as the rooms are not occupied in the day time, no heating is required except at night time; the heating requirements are similar to these in the school rooms, no heating being required when they are not occupied, and they are accordingly fitted for indirect hot blast heating only, there being, in fact, no direct radiation above the second floor in the south wing and above the first floor in the remainder of the building, excepting in the toilet rooms in the central portion.

The heating installation is accordingly a simple one, insofar as direct radiation is concerned, there being but two radiators each on the third and fourth floors while the radiation on the lower floors is comparatively small in amount, excepting on the second floor of the south wing where a number of smaller rooms are individually heated. The total amount of direct radiation installed in the building is 4,450 sq. ft., comprising 3,600 sq. ft. in cast-iron radiation and 850 sq. ft. in pipe coils, while the total heating surface for the hot blast systems amounts to about 6,800 lineal feet of 1 in. wrought iron pipe. The distribution of the direct radiators is such that the greater part of those on the first floor and all surface in the basement, which consists of ceiling pipe coils, are supplied by convenient connections from the ceiling steam distribution mains in the basement, while the radiation on the second floor is supplied by 17 risers that are of comparatively small size and rise to the second floor level only, excepting two that supply toilet-room radiators of the two upper floors. The direct radiators, where depended on solely for the heating of the smaller individual rooms, are proportioned to counteract the heat loss from walls and windows upon the usual thermal unit basis, and are placed in the usual arrangements under window sills in all cases. They are of the Rococo and Perfection types of cast-iron radiation built by the American Radiator Co., and are fitted with Crane Co. supply valves and Monash air valves, which connect to a system of drain piping leading to the basement. The pipe coil surface for heating the basement rooms comprises a total of 1,700 lineal feet of 1½-in. wrought-iron pipe, which is distributed in 14 sections of sizes from 75 to 250 lineal feet each. These units are distributed along the outer wall lines of the basement rooms near the windows which rise to the ceiling line and are proportioned with regard to the rooms heated on the thermal unit basis similar to the other radiation.

The heating, both direct and indirect, is operated with low-pressure steam supplied partially from the exhaust of the steam-using machinery of the power equipment of the building, with provisions for supplementary live steam supply from the high-pressure system, when necessary. The steam-using machinery installed at the building consists of a 25-kw. electrical generating unit and two pumps for boiler feeding and condensation return purposes which are located in the power plant at the rear of the south wing and the engine driving the fresh air supply fan in the front portion of the basement. These units are all connected to a common exhaust main in the ceiling of the basement which serves as the source of heating supply for both direct and indirect radiation, relief to the atmosphere being provided by a 5-in. extension from the boiler room end of the main, through a back pressure valve, to an exhaust head above the roof of the power plant extension and through a 3-in. extension of the fan room division of the main similarly through a back pressure valve to a roof exhaust head. The three groups of machinery deliver steam into the main through oil separators to keep the heating system free from lubricating oil, that in the fan engine exhaust being a 4-in. separator while 5 and 3-in. separators are used in the generator engine and pump connections. This exhaust main is a 6-in. line throughout the basement of the east wing to the point of connection with the generator engine and reducing valve for live steam supplementary supply, beyond which it extends as a 5-in. line to connect with the boiler feed water heater, the pumps and thence to the atmospheric relief connections; near the front a 5-in. branch extends from the main across to the north wing of the building through which connection is made to the fan engine division of the system. The latter connection is, however, but 3 in. in size, as it is calculated that the fan engine will always, when running, supply all or nearly all of the steam that will be needed for the indirect heating coils and the 3-in. connection is intended principally for supplementary supply. This fan room main is a 5-in. line into which the 3-in. delivery connection and the 4-in. engine exhaust delivers, and there are also live steam supplementary connections at this point also for additional heating capacity if required.

The direct radiation is, owing to the short length of the supply risers, operated on the one-pipe system with a system of returns by gravity from a number of points in the supply main. The risers supply but 1 or 2 units on each floor level, and, owing to the comparatively small amount of surface required, are of but 1½ and 2-in. pipe for the 15 risers that are carried to the second floor level; only two of the risers, which are carried up to supply toilet-room radiation on the third and fourth floors, are of 2½-in. pipe. The connections from the risers into the supply mains are made for the greater part at an angle of 45 deg., with ample provisions

for expansion of the main and connections, and the risers are firmly anchored to the steel work of the building by clamps near their bases permitting expansion in an upward direction. In most cases the risers are run concealed in recesses or chases provided for them, and the radiation branch connections are run exposed above the floor except where the distance between the riser and the radiator is such that sufficient drop is not available above the floor, when the connection is made on the ceiling of the floor below. These connections are so arranged that there is a pitch between the radiator and the riser connection of at least ¼ in. per foot when the riser is hot and expanded, and the branch connections are so made that the riser may freely expand without moving the radiator. With this system of returns the risers drain directly into the steam supply main which is pitched in the direction of the flow of the steam and is drained at convenient points and at the ends, through hydro-static seals to the return main; these seals are return or U-pipe connections, 6 ft. in length, in which the condensation accumulates and prevents direct steam communication from the heating supply main to the return main, these seal pipes are fitted with flanges so that they may be readily disconnected for inspection and cleaning and also have drain cocks for drawing off the condensation accumulated. In addition to these at the ends of the mains and all branches there are similar water seals at the basis of all risers which are more than 20 ft. from the connection to the supply main so that drainage to the latter would be difficult, and all of the ceiling pipe coil heating surfaces in the basement are similarly drained to the return main.

The condensation from the direct radiation is, as above stated, returned to the boiler-room by gravity, a 3-in. return line being carried on the floor of the basement to all parts of the building paralleling the steam supply mains. Into this all of the drainage seals of the direct radiation system are connected, the heating coils of the indirect systems being connected into an independent return line with discharges through steam traps to permit of the use of high pressure steam in the coils if necessary. This return line from the direct radiation has a full size extension from its receiver tank end to connections with the two boiler units of the plant, permitting the direct radiation to be operated with the gravity return whenever the fan apparatus, the pumps and other high pressure machinery are not in use. The radiator air valves connect through ¼-in. lines to ½-in. risers paralleling the steam supply risers and the air risers in turn connect into a system of ¾-in. air mains in the basement which extends to the catch basin to discharge any water of condensation that may pass the air valve. All of the heating piping, both for steam supply and return, is covered with 85 per cent. magnesia sectional covering, canvas jacketed and banded, which ranges from ⅞ in. in thickness on the smallest pipes to 1½ in. on the larger pipes.

The indirect heating system is operated by a single large blower unit which is located in a 14x48 ft. room in the front portion of the basement, having a fresh air intake through the space under the porch of the front entrance and deliveries connected to numerous galvanized iron ducts leading into brick flues rising to the upper floors. The blower is a ¾-housed double-discharge steel plate fan of the centrifugal type, built by the American Blower Co., which is designed for a delivery of 22,400 cu. ft. of air per minute with a speed of the wheel of 200 r. p. m. The wheel is 7 ft. in diameter by 4 ft. in width, and is directly connected at one end with a simple vertical steam engine of the enclosed self-oiling type which was supplied also by the company building the fan. This engine has a 10x12-in. cylinder and is designed to operate the fan to its maximum capacity with steam at an initial pressure of 35 lb., and exhausting against a back pressure of 5 lb. per square inch, it being the intention to utilize the exhaust from this engine in the indirect heating coils at all times during the heating season when the fan is operated. Steam is supplied to the engine by a 4-in. line extended from the high pressure header in the boiler-room to the fan room where it has connections to the heating coils and a 3½-in. branch with steam separator to the engine throttle valve.

The fan has its intake through an 8x36-ft. space under the front entrance porch of the building which space may also serve to accomodate an air filter, if air filtration should at any later time prove necessary. Into this chamber two windows open from the outside, having free areas of about 20 sq. ft. each, and they are fitted with tight closing sash which may be shut in case it is desired to close down the fan system in cold weather. In the connection from this chamber to the fan casing, there is installed a tempering coil containing 2,250 lin. ft. of 1-in. pipe, which is disposed in three 4-row sections, in order to facilitate the adjustment of the surface to the heating requirements. The fan discharges through an arrangement of two plenum chambers, one at either end of the fan room from which the delivery ducts to either side wing of the building are supplied, a connection from each of the two horizontal discharge outlets of the fan leading to one of the plenum chambers with an enlargement of the casing near the latter containing a reheating coil. These reheating coils each contain two 5-row sections of 1-in. pipe having a total amount of surface equal to that of the tempering coil, the arrangement of pipes in these heaters as well as also in the tempering coil being such that a free passage for air between pipes 1½ times that of the cross-sectional area of the duct connections is secured. Air mostening connections are installed in each of the plenum chambers, consisting of ½-in. pipes, 10 ft. long, which are drilled with large numbers of 1-32-in. holes and connect with the low-pressure steam mains for delivery of vapor to the hot air blast.

Each of the three heating coils have two Monash air valves to prevent air binding, and they are, as above stated, supplied with steam from the exhaust steam system with returns independent from those of the direct radiation in order to permit of their operation with high pressure steam if required. The exhaust steam from the fan engine will always be utilized in the heating coils in cold weather, the fan engine exhausting through a 4-in. line with oil separator into a 5-in. low-pressure receiver-header in the fan room, into which is also connected a 3-in. branch from the low-pressure heating main from the power plant for purposes of reserve supply. This header has 3-in. branches to all of the heating coils and has in addition three 2-in. connections from the high-pressure steam main for live steam supplementary supply if required; two of these high-pressure connections lead direct to the header, one through a 3x6-in. reducing valve for low-pressure supplementary supply, and the other a by-pass direct, while the third is carried beyond and connects into the branch which feeds the tempering coil, this arrangement being made to permit of delivering high-pressure steam to the tempering coil independent of the supply to other coils. These heater coils have a separate system for condensation return to the receiving tank in the boiler room consisting of a 2½-in. line into which each of the coils discharge through a 2-in. Morehead trap. This permits an extra pressure to be carried on any or all of the heating coils without interference with the low-pressure direct radiation system.

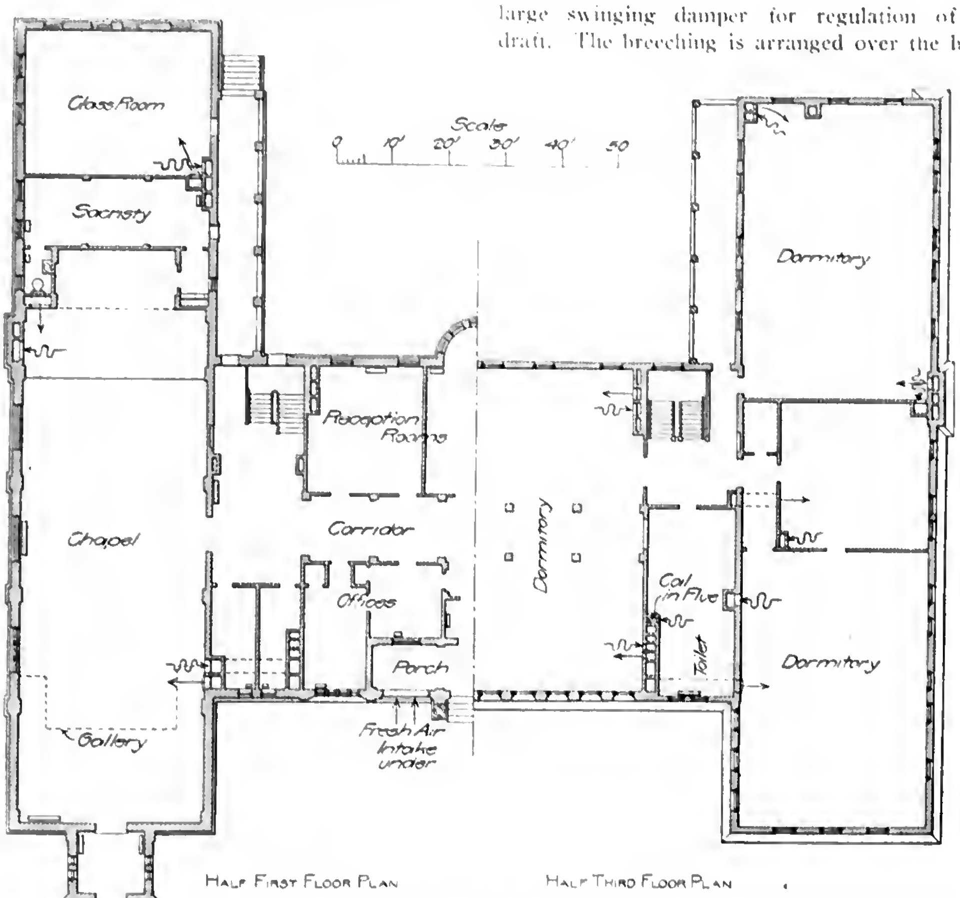
The plenum chambers are 8x12-ft. air-tight enclosures partitioned off in either end of the fan room, from the outer walls of which the air delivery duct connections are made. Of these there are 11 originating in the south chamber to supply rooms in the south wing and 13 from the north chamber to supply the north wing, making 24 delivery ducts in all. The chambers are built of 9-in. brick walls which are carried up to within 4 in. of the basement ceiling and there covered with tops of No. 16 black iron stiffened with angles. Each of the chambers has also a horizontal partition or diaphragm at a level of the base of the heater coil, the upper portion for the heated air from the reheating coils, and the lower portion for tempered air direct from the fan, suitable mixtures of the two being obtained by dampered openings in the diaphragms. The delivery ducts are for convenience of erection installed of a uniform depth of 20 in. for all widths, securing thus a uniform head-room throughout all portions of the basement, and range in width from 10 to 24 in., according to the capacity. Six of them are 10-in. width, 10 of them 12-in., 2 each 14, 16 and 18 in. in width and one each 20 and 24 in. wide. The ducts are all built of No. 24 galvanized iron, thoroughly braced and they are all laid out with easy bends of long inside radius, ending in a sweep sheets in the form of one-quarter circles at the bases of the masonry flues through which delivery is made to the upper floors; these sweep sheets are of No. 16 galvanized iron extending the full width of the flue with flanges securely driven into the joints. Every duct connecting with either of the plenum chambers is fitted with an air gate or damper by means of which the connection can be entirely closed off when the room supplied is not in use, the gate consisting of a No. 18 galvanized iron diaphragm so pivoted and mounted that it can be set for one-third opening, one-half opening or other adjustment as desired.

Ventilation is applied to all rooms on the downward system, the air supplied being delivered to outlet registers near the ceiling or at considerable elevation above the floor, while all exhaust connections have intake registers at or near the floor line. All registers both for fresh air outlets and exhaust, are fitted with screens of narrow flat wire of 1¼-in. mesh which are mounted on wall frames of the reverse bevel pattern, and all fresh air outlets have in addition diffusers attached which are adjustable and may be set to spread the air into any portion of the room desired. The amounts of air supply provided for each of the rooms served were designed with reference to the heat loss by both the exterior exposure and the change of air in ventilation, the amount of air required for ample ventilation being thereby secured. The duct lines are proportioned for comparatively low velocities, the average velocity of flow being but 500 ft. per minute in the duct lines and flue risers, which velocities are further reduced in the outlet register connections.

Provisions for exhaust registers have also been made in all of the rooms fitted for indirect heating in order that free circulation of air in these rooms may be secured for ventilation purposes. Systems of masonry flues are incorporated in the building construction in arrangement similar to that of the fresh air supply risers which have register openings into the rooms served at their bases and rise to hooded outlets above the roof. The flues have galvanized iron sweep sheets at their bases, similar to the fresh air supply risers, and the register openings are similar in construction and size to those for fresh air supply to the various rooms. No dampers are provided in these flue connections, closure, in case the

ventilating systems are shut down, being effected by the usual register dampers. The exhaust flues, connections and registers are similar in size to those of the fresh air supply system, for capacity of exhaust equal to that of supply, but no mechanical exhaust equipment has been provided, these vent flues operating by natural draft. Exception to this occurs only in the toilet-room vents, in which rooms positive changes of air were desired regardless of the operation of the fresh air supply system. For this purpose aspirating coils or stacks were installed in the flue from each of the large toilet-rooms at either side of the central portion of the building, the coils each consisting of two 9 sq. ft. colonial sections of cast-iron radiation which are placed in the vent flues just above the inlet openings.

The power plant of the Home is located in the basement of a 30x60-ft. one-story extension at the rear of the south wing of the building, the first floor of which accommodates the kitchen and culinary department of the building. The basement space is divided into a 34-ft. section accommodating the boilers, pumps and auxiliary equipment and a 25-ft. section for the engine and electrical generating equipment. The floor is depressed about 9 ft. below grade, giving a clear head-room of 14 ft. in both rooms and ample daylight lighting is provided by side windows above the grade line. A stairway opening on the inner court side provides for access to the boiler-room from the outside for machinery parts, etc., and on the opposite side there is an underground storage bin, 15x34 ft. in plan, built of concrete retaining walls alongside of the boiler-room with floor on level with that of the latter room and covered over the top with a 7-in. reinforced concrete slab. This arrangement of bin greatly facilitates the storage of coal, coal being delivered to the same by driving coal wagons directly on to the roof of the bunker and discharging through coal holes. The bunker has a capacity of about 150 tons if filled to the roof and coal is handled to the boiler room by wheeling from a door at the forward end conveniently located opposite the firing floor in front of the boilers.



Ventilation of Chapel and Dormitories.

The equipment of the power plant consists of two 70 h.-p. return tubular boilers with space available for a third unit, which supply steam for the heating of the building and for the operation of a 25-kw. electrical generator unit in the adjoining room. The boilers are set in a substantial brick setting on the side of the room adjoining the coal bunker with a 10-ft. firing floor at the front and a 5-ft. space at the rear for blow-off and breeching connections, while a space of 10 ft. is left at the opposite side for a possible future unit and the auxiliary equipment of pumps, feed water heaters, etc. The boiler furnaces are fitted with shaking grates for hand firing which were designed for operation with bituminous coal. The products of combustion are removed to the stack by a 34x40-in. iron breeching, built of No. 8 sheet steel and heavily covered with asbestos blocks and fitted with a large swinging damper for regulation of the draft. The breeching is arranged over the boiler fronts to facilitate extension to a future third boiler unit if additional capacity should be needed.

The boilers are of the fire tube type with 60-in. shells, 14 ft. in length, and each contain fifty-four 3½-in. tubes. They were built by the Gem City Boiler Works, and designed for operation with a working pressure of 125 lb. per square inch. They are without domes, but are fitted with 7-in. perforated dry pipes, 7 ft. in length, through which steam is delivered to the nozzles. Each boiler has three nozzles, one 2 in. in size for connection to an auxiliary steam line in the boiler-room, a 6-in. nozzle at the middle for the main steam header connection and a 4-in. nozzle at the rear for the safety valve. The outlet from the latter is piped to deliver into the stack through a 5-in. vapor line. The boilers are fed through 2-in. branches from a 2½-in. feed line carried over the boiler fronts and each has a 2-in. blow-off connection from the rear end of the shell connecting to a 2½-in. line which delivers into a blow-off tank in the rear portion of the boiler-room. The blow-off tank is a circular cast-iron receptacle 36 in. in diameter by 36 in. deep with a 3-in. vent pipe carried up through the roof and it has a 4-in. overflow connection to the sewer in the adjoining street with check valve and an auxiliary connection to a catch basin in the boiler room floor which may be used in case of water backing up in the sewer; this catch basin is drained by a 2-in. ejector which is installed to raise any water from this source or from boiler-room drainage into the sewer.

The boiler-room auxiliaries consist of two pumps and a feed water heater, one of the pumps a plain boiler feed pump and the other a receiver pump for the return of condensation from the heating system. The pumps are both brass-fitted duplex pumps with 6x4x6-in. cylinders and the condensation receiver is of the usual type fitted with float valve for the automatic control of the pump, the suction connection to the receiver pump being tapped for a cold water chilling or condensing connection to condense vapor and chill the returns if coming from the heating system too hot. This boiler feeding equipment is supplemented by an injector of 150 h.-p. capacity which has connections to the cold water supply and delivers to the main boiler feed header. The feed water is heated in a closed tube heater which is designed to heat 3,000 lb. of water per hour from 40 deg. F. to 200 deg. with exhaust steam at ½ lb. pressure; it contains 40 sq. ft. of heating surface, made up of 1½ in. brass tubes No. 13 gauge, and is so connected that the water heated by it may be delivered either to the boilers or to the hot water service of the plumbing system. Steam is supplied to the pumps and injector by a 2-in. auxiliary boiler-room main which connects with the 2-in. nozzles on the boilers, connections also being made from this line to the domestic water heater for use with high pressure steam to the exclusion of exhaust if desired.

The water supply from the boilers is derived principally from the condensation returns from the heating system, with make-up from the city water system.

The electrical generating equipment consists of a 50 h.-p. simple horizontal engine, direct connected to a 25-kw. direct current multipolar generator which is operated at 220 volts for lighting and power service in the building. The engine is a simple automatic engine of the heavy duty self-oiling type, built by the Atlas Engine Co., and is designed to deliver full capacity with an initial steam pressure of from 60 to 90 lb., and a back pressure operating non-condensing of 5 lb. per square inch, when operating at 300 r. p. m. It is supplied with steam by a 4-in. branch from the 7-in. boiler-room high-pressure header and exhausts through a 5-in. connection with oil separator into the 6-in. basement exhaust and heating main. The engine is fitted for close regulation and is capable of withstanding an overload of 25 per cent for an extended period. The generator is a 220-volt direct current multipolar machine, supplied by the Fort Wayne Electric Co., which similarly has an overload capacity of 25 per cent., for an extended period without overheating. The electrical system in the building to be operated comprises 850 16-candle power lamps, distribution to which is made on a wiring system having 87 circuits and 359 outlets in the various parts of the building.

The building was designed and the power plant and heating and ventilating equipment laid out by Stratton & Baldwin, architects, Detroit, Mich. Mr. F. F. Van Tuyl was consulting engineer for the power and heating and ventilating equipments.

Fly-Wheel Insurance Rates have been decreased 20 per cent. by one of the casualty companies in case the power plants are equipped with an approved engine stop and speed limit system. The company has found that such apparatus affords such a degree of protection from accidents that its use in any plant should be recognized by the reduced rate mentioned.

Granite-Top Macadam Pavement in St. Paul, Minn.

University Ave., in St. Paul, Minn., was paved with granite-top limestone macadam for a length of three miles last year, and the same pavement is now being laid on the portion of the street extending from the end of this work to a point near the city limits. This street is the main thoroughfare between St. Paul and Minneapolis, a large volume of all kinds of traffic being tributary to it. It has a clear width of 120 ft. from lot line to lot line, and is paved to a width of 69 ft. A double-track street railway is placed in a 17-ft. strip at the center, thus leaving a 26-ft. roadway on each side.

The cross-section of the street and a detailed cross-section of one of the 26-ft. roadways are shown in an accompanying illustration. The 6-ft. walk on each side of the street abuts against the lot lines, providing a parking, 19.5 ft. wide between it and the curb. The curb is of Kettle River sandstone, 5 in. thick at the top, when dressed, and is set on a sand foundation. The macadam has a total thickness of 12 in. at crown, and at the quarter points of the distance between curbs, and of 9 in. at the gutter. The soil on which the macadam is laid directly, after the grading has been done, is quite sandy and of considerable carrying capacity.

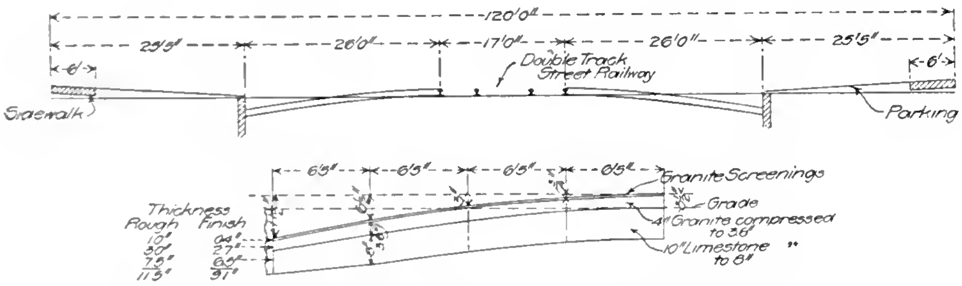
The macadam is laid in three courses, a footing course of crushed limestone, a wearing course of crushed granite and a finishing coat of limestone screenings. During the laying of each of the three courses of stone a quantity of Westrumite, a proprietory liquid preparation, is applied, the intention being to apply 1 gal. of the preparation to each square yard of pavement. This preparation is a liquid compound which makes an emulsion in water and has peculiar qualities for laying dust.

The limestone in the footing course of the macadam is required to consist of pieces which will pass a 2½-in. ring in their greatest dimensions and none of which shall be less than 1 in. in the smallest dimensions. This stone is placed to a depth of about 9½ in. at the crown and quarter points of the street and 7½ in. at the gutter. On it is spread a sufficient amount of limestone screenings to fill the voids. The stone is then sprinkled with water and rolled with a 10-ton roller until an even surface is produced. A ½-in. layer of limstone screenings saturated with a 50 per cent. solution of the Westrumite is then applied, after which the course is rolled until it is thoroughly compacted, sprinkling being done during the rolling with a 10 per cent. solution of Westrumite. The footing course finished in this manner is intended to have a full depth of 8 in. at the crown and quarter points and of 6 in. at the curb.

The wearing course consists of New Ulm, Minn., granite, crushed so all pieces will pass a 1½-in. ring, but none of them less than ½ in. in their smallest dimensions. This crushed granite is placed to a depth of 4 in. at the crown and quarter points of the street, and 3 in. at the gutter before rolling. Prior to and during the rolling the stones of the course are thoroughly sprinkled with a 10 per cent solution of the Westrumite.

Limestone screenings, saturated with a 50 per cent. solution of the Westrumite are then spread over the course to a depth of 1 in., or so as to fill all interstices, and are then rolled thoroughly. During this rolling the screenings are sprinkled with a 50 per cent. solution of the liquid compound, at least 2 quarts of the latter being used to the square yard of surface. The granite and the layer of screenings are intended to have a depth of fully 3.6 in. at the crown and quarter points of the street, and of 2.7 in. at the gutter, when finished. After the roadway is finished to the required thickness, it is sprinkled four times with a 15 per cent. solution of Westrumite. These sprinklings necessitate the use of about 1 quart of the liquid per square yard of surface; sufficient intervals are allowed between the sprinklings to permit the previous application to become thoroughly dry.

The space between the car tracks is paved by the street railway company according to plans approved by the city. In this work, however, no Westrumite was used, except in applying the top layer of crushed granite, and the limestone screenings.



Cross-Section of Macadam Pavement on University Avenue, St. Paul.

During the year it has been in service, the pavement built by the city has been very satisfactory under the heavy traffic which it carries. The surface has been sprinkled about once in 10 days during the summer, and is as free from dust as is a street regularly sprinkled with water several times a day. At the same time, this portion of the street is so far from the center of the city that it is impracticable to sweep it regularly.

The macadam was built at a cost of $1.40 a square yard, including the cost of the proprietary compound, but exclusive of grading, curbs, and so forth.

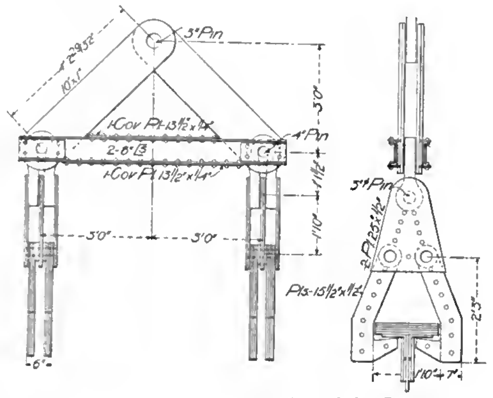
The plans for this pavement were prepared and carried out under the general supervision of Mr. L. W. Rundlett, commissioner of public works of St. Paul. Mr. A. B. Starkey, assistant commissioner of public works, who personally directed the execution of the work, supplied the data from which these notes have been prepared.

An Engineering College for Chinese Students is to be opened at Tongshan, China, by the Imperial Railway management in conjunction with the Chinese Engineering & Mining Co. Accommodations will be provided for about 140 students.

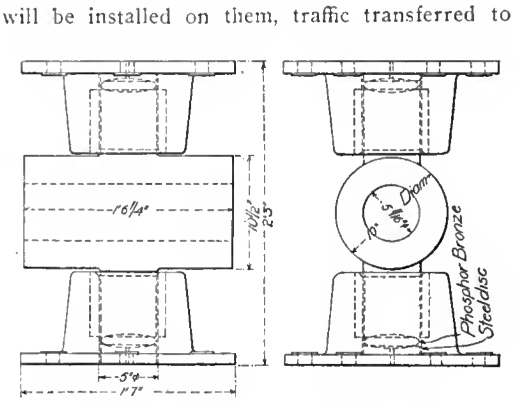
Erecting Six-Track Plate Girder Bridges With a Derrick Car.

Improvements now being made on the Harlem Branch of the New York, New Haven & Hartford R. R. include the abolition of grade-crossings at many points by the elevation of the two existing tracks, the addition of two new tracks and the building of sub-structures for these four tracks and to provide for two more tracks of the New York connecting railway which will hereafter be installed. In some cases the crossings are made with single spans and in more cases with a long center span over the street and two short approach spans over the sidewalks. The maximum widths of crossings are 100 ft., and the maximum length and weight of girders are 80 ft., and 60 tons respectively.

The concrete piers and abutments are built in two successive sections approximately symmetrical about their center lines. The first section includes about one-half of the substructure adjacent to the present low level double track and as close to it as will allow clearance for trains. These portions are made to accommodate three tracks and after their completion two tracks will be installed on them, traffic transferred to them from the low level tracks and the latter abandoned. The present low level tracks will then be removed and the remainder of the substructure completed on the side previously occupied by them. Finally, the super-structure for the third and fourth and for the fifth and sixth tracks will be erected on the completed substructure. The bridges are made with double track units, each of them consisting of three girders. Most of the girders have through floors and are 14 ft. 4½ in. apart on centers.



Lifting Device for Derrick Car.



Connection at Top of Mast.

A contract for the fabrication of structural steel has been awarded to the Pennsylvania Steel Co. Another contract for the erection of 18 spans has been awarded to the Lucius Co., which has designed and constructed a special derrick car intended to erect the girders with the maximum safety, rapidity and economy and to be suitable for erecting miscellaneous railroad girders after the completion of this contract. The car and its equipment weighs about 80 tons and has a boom 52 ft. long which can swing through a horizontal arc of 180 deg., with a capacity of 45 tons at a radius of 36 ft. 6 in., and of 60 tons at a radius of 23 ft. 6 in. In service it requires a vertical and horizontal clearance of 40 and 20 ft. respectively and when dismantled for transportation has a height of 12 ft. and a width of 9½ ft.

The car body is 9½ ft. wide by 55 ft. long and is of massive construction with six full-length longitudinal plate girders. A riveted pedestal about 7½ ft. long, 9½ ft. wide and 3 ft. high is seated on the forward truck to receive the mast and boom. It is of very strong cellular construction made with longitudinal and transverse web plates ½ and ¾ in. thick, reinforced by very heavy flange and web-stiffening angles. In the rear it has two horizontal pins 4

in. in diameter serving as pivots for the feet of two inclined posts 32 ft. ft. long on centers which are pin-connected at the top to form the triangular A-frame or mast.

The boilers, water tank and coal bunkers are installed over the rear truck and the hoisting engine is located between the trucks. The inclined posts of the A-frame are made with pairs of 18-in. built channels latticed, and are rigidly connected by a transverse horizontal strut at the bottom and by a riveted box at the top which receives the steel casting for the hoisting and topping lift tackles. The A-frame is maintained in vertical position by a pair of inclined struts and by a pair of 1¾-in. wire cable back stays with turn buckle adjustments, pin-connected to forged links engaging the top of the mast and the body of the car and the outside girders in the car body near the rear truck. The inclined struts are a pair of 12 x 12-in. timbers 25 ft. long with pivoted connections to the car body and to the mast about 12 ft. below its upper end.

At the top of the mast two flanged vertical cast steel cylinders are bolted to the riveted box and receive the trunnions of a horizontal cylindrical casting 10 in. in diameter and 18 in. long which is bored through its axis for a 5-in. pin engaging a pair of short links which connect to it the large special steel blocks containing the sheaves for the hoisting and topping lift tackles.

Special lifting devices are provided for handling the 60-ton girders; each of them consists of two pairs of riveted hooks suspended from the extremities of a horizontal beam 6 ft. long. Each hook is made with four thicknesses of 15½ x ½-in. sheared plates riveted together. The lower ends are slightly bevelled so as to take bearing at their extremities only where they engage the under sides of the top flanges of the girders between rivet heads which prevent them from slipping longitudinally. The upper ends are bored for 3-in. pins engaging three vertical connection plates, each of them made with two 25 x ½-in. sheared plates riveted together. The upper ends of the plates are pin-connected to a shackle made with a 3 x 3-in. steel bar, the loop of which engages a 4-in. pin through the end of the transverse beam. The beam, 7¼ ft. long over all, has a closed rectangular cross section made with two 8-in. channels and two 13 x ¼-in. flange cover plates and is suspended from the tackle by two links about 4¼ ft. long on centers which are made with pairs of 10 x 1-in. sheared plates engaging a single 3-in. pin which connects them to the tackle. This device weighs about 3,000 lb., is very easily and quickly adjustable and is considered to be very safe.

Derrick Car Ready for Service.

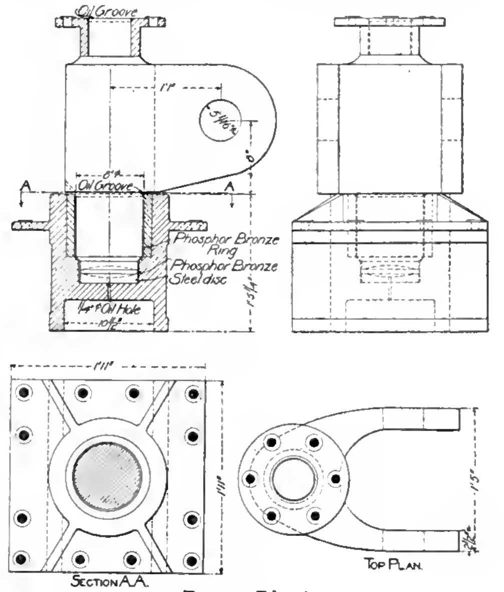
The 24 x 24-in. boom has a rectangular cross section made with two built channels having their flanges turned inward and latticed. It is field spliced in the middle with web and flange cover plates bolted on. Near the middle of the outer section it is provided with pin connections for transverse swinging tackles. The rectangular water tank has a narrow coal bunker on each side which partly enclose the boiler and carry about 2 tons of coal. The tank has a capacity of 500 gallons which with the coal is equivalent to about a 4-days' supply for the derrick engine thus making it independent of a tender car.

The cast steel foot block for the boom is made to offset it 26 in. on centers, from the mast, thus allowing it to revolve through a complete horizontal semi-circle. It consists, as shown in the detail, of three parts, the jaws, the pivots, and the bearings. The jaws have a 5-in. horizontal boom pin offset 13 in. from the center of the vertical pivot about 8 in. in diameter. The upper end of the pivot is secured by a horizontal plate in the pedestal and the lower end has a concave bearing on a double convex phosphor bronze disc seated on a hardened steel disc. The casting is secured to the riveted pedestal by twelve 29/32-in. turnbolts.

The hoisting and topping lift tackles respectively have ¾-in. and ⅞-in. steel ropes rove over six 24-in. sheaves in special steel blocks with self-oiling bronze bushing and ⅜-in. separating plates which were built by W. W. Paterson & Co., Pittsburg. The tackles are operated by a special 75 h.-p., 12 x 16-in. engine, designed by the Lucius Co., and built by the National Hoisting Engine Co. It is able to hoist a 24,000-lb. load on a single line at a speed of 100 ft. per minute and all of its operating levers are concentrated on a single quadrant rack so that they can be handled by one man.

When in service the derrick car is located on the end of the high level track near the top of one of the abutments of the span to be erected. The rear trucks are anchored to the track by ordinary hook clamps operated by adjustment screws. The front truck is blocked up and if necessary the rear end of the car floor is clamped to the forward end of a loaded flat car, thus increasing the stability. The girders are successively brought alongside, on the flat cars in which they have been shipped from the bridge shop, and are lifted clear by the derrick which swings them off from the car and lowers them to the ground in front of the abutment transverse to the railroad track. Afterwards the derrick car in the same position lifts the girders successively to the top of the abutment, revolves them 90 degrees and lowers them to their final position on the bridge seat. Ordinarily, one double track span is erected complete in about 1½ days with a total force of 8 men. The through spans have trough floors shipped in 5-ton sections field riveted at splices by Boyer pneumatic hammers using air from a Franklin compressor of 300 cu. ft. per minute capacity in an attendant box car.

It takes about half a day to dismantle the car for transportation, which is done by revolving the mast backward into an inclined position with the rear ends supported on blocking over the engine. The struts and back stays are disconnected and transverse braces are disconnected from the mast and are loaded on the derrick car. The boom is lowered to a horizontal position on a flat car in front of the derrick car and is disconnected from the mast and the middle splice unbolted if necessary. After transportation the car can be put in service in about half a day.



Boom Pivot.

The Inclined Railway at Lyon-Croix-Rousse, France, has recently been equipped with an electrical operating system to displace the original steam plant with which the cars were formerly operated. The incline is 1,500 ft. long, with a grade of slightly more than 17 per cent., and the cars are operated by a pair of 18-ft. drums, each working a single cable, which are now connected through a single-gear reduction drive to a 250-h.-p. direct-current motor supplied with current at 600 volts. The cable is operated at a speed of about 15 ft. per second and the train, consisting of a baggage and a passenger car, weighing about 20 tons net or 34 tons fully loaded, requires about 340 h.-p. to accelerate. An economic feature is the use of a storage battery of 275 ampere-hours capacity for emergencies and to assist in starting, and into this battery current is returned from the motor as the train is running down the incline, by connecting the motor as a dynamo and charging through a booster set.

The Rehabilitation of the Tracks of the Chicago Street Railway.

An ordinance passed by the city council of Chicago early in this year requires the interests controlling the street railways of that city to rehabilitate practically their entire systems within three years from the time this ordinance became effective. This immediate rehabilitation includes the complete reconstruction of the tracks of a large percentage of the total mileage in the city, the provision of an adequate number of modern cars to properly handle traffic, and the installation of sufficient additional electrical-generating equipment so power to operate the various lines satisfactorily can be furnished. After the expiration of the first three years, the remaining lines are to be similarly rehabilitated until the street railways in the whole city have been placed in a satisfactory operating condition. The same ordinance also covers a number of features concerning the franchises under which the street railways are to be operated and other relations between the street railway interests and the city.

The ordinance has been accepted by the Chicago City Ry. Co., which owns and operates the lines on the south side of the city, and this company has already carried on a large amount of work according to requirements set forth. The Chicago Union Traction Co., which operates the systems on the north and west sides, will doubtless also accept the ordinance as soon as the interests controlling that company can adjust their finances satisfactorily.

This rehabilitation of the three systems which embrace all the lines in the city is being done by, and at the expense of the street railway interests, under the direction of a board of supervising engineers consisting of Messrs. Bion J. Arnold, chairman, Charles V. Weston, representing the city, Harvey B. Fleming, representing the Chicago City Ry. Co., and John Z. Murphy, acting for the Chicago Union Traction Co. Mr. Arnold is chief engineer and Mr. George Weston is assistant chief engineer of this board.

The Chicago City Ry. Co. had rebuilt in the neighborhood of 6 miles of track on October 1, and had over 10 miles of track reconstruction under way at that time. An average of about one-third of a mile of single track is being laid each day by this company, and with favorable weather one-third of the total mileage to be reconstructed in the first three years will be finished in 1907, although the work was not started until late this season. The Chicago Union Traction Co. is also carrying on a large amount of track reconstruction according to the standards specified by the board of supervising engineers, in order that this work will be properly done in case the interests of this company are adjusted so the ordinances can be accepted by it, as will undoubtedly be done.

Three types of track construction have been adopted by the board of supervising engineers for use under different conditions. Although these three types have been practically standardized, a few minor changes are to be made in them, so the board has decided not to make public the details of the different types. At the same time, the general features of the latter have been supplied to this journal. A standard girder rail, the cross section of which is shown in an accompanying illustration, is used in all three types. In one type the rails are laid on steel cross-ties, imbedded in concrete, and in the other two types on wooden cross-ties, also imbedded in concrete; the difference between the two types in which wooden cross-ties are used appears largely in the construction of the sub-base on which the track is laid.

The steel ties are of the standard 4½-in. Carnegie girder section. They are placed on a heavy sub-base of concrete and are imbedded in a layer of concrete, which is continued 2½ in. above the base of the rails. In some of the work that has been done these ties were spaced 5 ft. apart on centers, but in most cases they are 4 ft. apart on centers, and it is probable that the shorter spacing will be adopted as the standard. Sawed wooden ties, 6 x 8 in. in cross section, and 7 or 8 ft. long, are used. They are also imbedded in a layer of concrete, which for one type of track is laid on a sub-base of crushed stone and for the other on a sub-base of concrete. These ties are spaced 4 ft. on centers.

The chief feature of all of the track construction is that the sub-structure is designed to be unusually permanent, and is built so the rails may be renewed with comparatively little difficulty and without disturbing the substructure. Tie plates are used on both the steel and the wooden cross-ties. The rails are attached to the steel ties by a special clip, which can be removed and replaced readily, and which was designed for use in connection with this work. Screw spikes are used to attach the rails to the wooden ties, with the belief that the life of the latter will thus be considerably prolonged.

The standard grooved rail used in all of the track reconstruction was designed specially for the conditions existing in Chicago. This rail weighs 129 lb. per yard, and is rolled by the Lorain Steel Co. Although the section of the rail is generally the same as that of several grooved girder rails which have been used in various cities in this country, it differs essentially in several important features. After making a long series of studies of the effect of wear on previous rails of this type, considerable metal was added to the outside of the head just above the top of the web, as these studies indicated that an increase in section at that point would add materially to the serviceable life of the rail. The thickness of the metal directly under the groove has also been increased for the same reason. The outer edge of the rail is beveled, and the pavement is finished ¼ in. below the top of the rail on that side. The head of the rail can thus be worn down until the flange of the car wheels ride on the groove before the treads of the car wheels reach the pavement. The slope on the outside edge of the head of the rail thus increases the permissible wear to a maximum, with a wheel tread not exceeding 2¾ in. The groove has been designed for cars with wheels having ⅝-in. flanges, with a possibility of an increase to ¾ in. While flanges of this width are scarcely suited for high-speed interurban cars, and some criticism has been offered against the adopted type of groove, the latter was designed strictly for traffic conditions in Chicago, where few, if any, high-speed interurban cars enter the city.

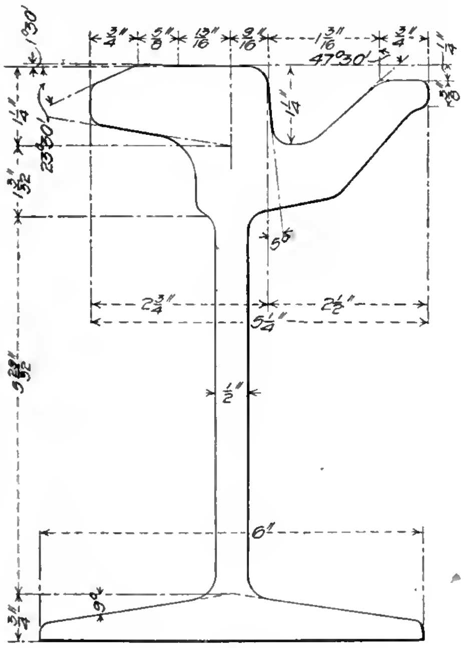
Two other conditions also had to be met in designing the grooved portion of the head of the rail, first, a groove which would prevent the wheels of vehicles entering it, and second, a groove which would be self-cleaning, was desired. As both of these conditions cannot be perfectly fulfilled by the same groove, a compromise has been made between them in this case. The rail is rolled so the extreme outer lip of the groove is ¼ in. below the top of the head of rail. The granite paving blocks used between the rails are laid so their tops are ⅛ in. higher than the outer lip of the groove, with the result that the paving will hardly wear below this lip. The wheels of behicles can therefore readily enter and leave the tracks, while the shape of the groove is such that it will be nearly free from dirt.

A Stretch of Track with Steel Ties Ready for Substructure.

Track Construction Methods.—The methods followed in the reconstruction of the two tracks of the line on Cottage Grove Ave. are more or less typical of the manner in which work has to be handled on the heavy traffic lines. This line is one of the most important in the system of the Chicago City Ry. Co., extending southeast from the downtown business district for about nine miles to a connection with a line leading to South Chicago. Throughout practically its entire length it passes through a densely built-up residence district and connects with numerous important cross-town lines. It was completed prior to 1890 and was operated as a cable road until last year, when an overhead trolley was installed. As is common with a very large percentage of the total mileage in the city, the old rails on this line had not been renewed for years and scarcely any repairs, other than those which were absolutely essential, had been made during the long period that the city held the settlement of the various street railway franchises in abeyance. These conditions, combined with the use of the long, heavy cars which were installed last year after the line was electrified, had put the tracks in very bad shape, so the track and the upper part of the sub-structure are being removed and replaced by the type of track having steel cross-ties that has been recommended by the board of supervising engineers.

The reconstruction work is handled in sections, a single track of each section being rebuilt at a time. On this particular line the traffic is so heavy that it is impracticable to divert it all over one track, even for short distances, so a third temporary track, laid on the pavement at one side, is used to carry the cars of the regular track that is out of service. On some other lines traffic from one track has been diverted over a parallel line, but on Cottage Grove Ave. several conditions combine to make that arrangement also impracticable, so the temporary third track is essentially necessary.

The cable formerly used to haul the cars over this line operated in a concrete conduit under



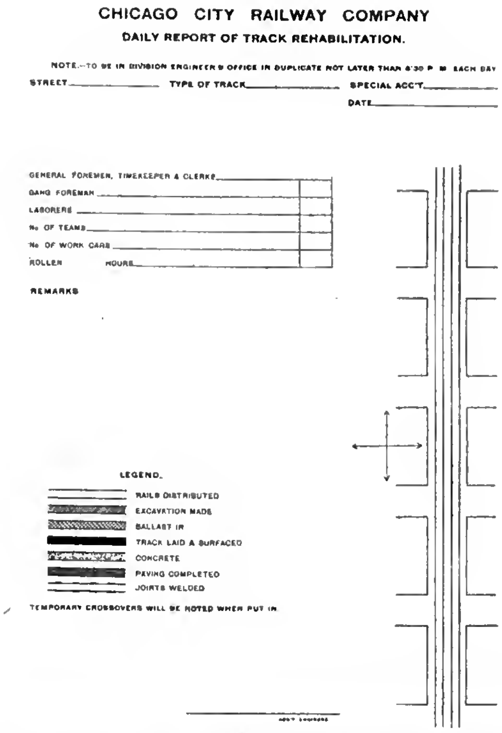
Standard Grooved Rail Section.

the center line of each track. The rails were carried by chairs on iron brackets, or yokes, cantilevered out on each side of the heavy concrete conduit. The rails, chairs and part of the yokes have to be removed and a considerable part of the conduit has to be cut away before the new track can be built. This preliminary work is handled with considerable difficulty, particularly the cutting out of the concrete, which has been done thus far by hand with cold chisels, picks and so forth. Arrangements have been made, however, to install a number of Little Jap pneumatic hammers for use in cutting the concrete, the power for these hammers to be supplied by portable compressor outfits.

The excavation for a track is made and the sub-grade is prepared for considerable distances, depending in length on local conditions, before any concrete work is done. The ties are then laid in the excavation and are blocked up to their regular positions, after which the rails are attached to them. The layer of concrete on which the ties rest and in which they are imbedded is then laid up to 2½ in. above the top of the ties, except at the joints, where it is stopped level with the top of the ties in order to permit the rails to be welded later without disturbing the concrete.

The concrete is produced by a mixer outfit mounted on a frame carried by two four-wheel car trucks. This outfit was built specially for use in this work by the Drake Standard Machine Works, of Chicago, and is operated over the rails as they are blocked up in place before the concrete is laid. The frame of the outfit is 48 ft. long and is built of structural steel. A standard Drake concrete mixer is mounted under one end of the frame where it can discharge the concrete directly into place under and around the ties and rails. Concrete materials are supplied to the mixer by a flight chain conveyor which runs the full length of the frame, the materials being shoveled into the conveyor from storage piles on the pavement on the roadway side of the track.

The concrete is made in the proportions of 1 part cement, 3 parts sand and 6 parts broken stone. These materials are piled along the track in such manner that as they are shoveled into the conveyor they are in the proper proportions for the concrete. This is accomplished by first placing a layer of sand of a predetermined depth and width on the pavement, and over that a layer



CHICAGO CITY RAILWAY COMPANY

DAILY REPORT OF TRACK REHABILITATION.

NOTE.—TO BE IN DIVISION ENGINEER'S OFFICE IN DUPLICATE NOT LATER THAN 6:30 P. M. EACH DAY

STREET_____ TYPE OF TRACK_____ SPECIAL ACC'T_____

DATE_____

GENERAL FOREMEN, TIMEKEEPER & CLERKS_____

GANG FOREMAN_____

LABORERS_____

No. OF TEAMS_____

No. OF WORK CARS_____

ROLLER HOURS_____

REMARKS

LEGEND.

RAILS DISTRIBUTED

EXCAVATION MADE

BALLAST IN

TRACK LAID & SURFACED

CONCRETE

PAVING COMPLETED

JOINTS WELDED

TEMPORARY CROSSOVERS WILL BE NOTED WHEN PUT IN.

Daily Report Blank.

of broken stone and then a layer of cement. The sand and stone are delivered in wagons, from which they are dumped directly in place on the pavement, the layer of sand being kept considerably in advance of the stone. The required width and depth of the sand and stone is measured by templates, while the number of bags of cement to be used is determined by computation. By following this method the materials are readily placed in the piles in the proper proportions, with a minimum amount of rehandling after they have been delivered.

The materials are shoveled from the measured piles into the conveyor by from 10 to 15 men, depending on conditions. The frame of the mixing outfit was placed 51 in. above the top of the rail, in order to permit the men shoveling materials into the conveyor to straighten up each time they lift a shovelful, with the result that they can work at a higher rate of speed with less fatigue than though the frame was lower so they could not stand straight each time. A row of sheet metal deflectors, placed along the opposite side of the conveyor from the shovelers directs the materials into a trough in which the chain travels. These deflectors are arranged so they may be placed on either side of the conveyor, depending on the position of the shovelers.

The conveyor is a wide-link chain, which on its lower run travels in a cast-iron trough, carried by two Z-bars, attached to the main frame, and on the return run is carried above this trough on three loose spools. The conveyor delivers the materials directly into the hopper of the mixer and has operated with excellent results.

The mixer, which is of the pug-mill, continuous-feed type, is placed on the longitudinal center line of the frame. The concrete is discharged from it on an apron, which extends the width of the track just above the rails. It is distributed and tamped in place by six to eight men, who are required to work very rapidly to keep pace with the machine. The blocks on which the ties and rails are held up in position until the concrete is placed are removed under the alternate ties just before the concrete reaches them; the dead load of the track being carried by the remaining blocks gives the concrete an opportunity to set, as cars are not turned over the track for several days after the concrete has been laid.

The mixer is gear-driven by a 30-h. p. motor, which also drives the conveyor. While running 8 to 10 h. p. is fully sufficient for these purposes,

Concrete Mixing Outfit Used in Placing Track Substructure.

but on starting considerably more power is required for a short period. The car is propelled by two 75-h. p. street railway motors, placed on the rear truck, as a low-front truck, taken from an old trailer car had to be used under the front end, in order to provide room between the axles of the truck and the frame of the car for the mixer. Power for all three motors is obtained from the trolley.

The amount of concrete track substructure laid in a day by the machine depends largely on the rapidity with which the excavation and the sub-grade can be prepared. Under average condi-

tions, however, 750 ft. of substructure will be finished in a 10-hr. day, requiring about 250 cu. yd. of concrete. When the machine is delivering that amount of concrete 10 shovelers can supply it with materials. The machine has been in almost continuous service since the latter part of August and has produced such good results that the Chicago City Ry. Co. has purchased three more of the machines for work of the same kind.

The work that has been done on the other lines of this company is all handled in a manner similar to the methods which have been described, although on most lines traffic is diverted from the track under reconstruction to another street, or on lines with light travel the traffic is all turned over one track for short distances. The track reconstruction is carried on by separate gangs of men, about 2,500 men being employed in this work by the company. Each gang is under the immediate direction of a general foreman, thoroughly experienced in street railway track construction, and an assistant engineer has general supervision of the gang. These assistant engineers are all under Mr. W. F. Graves, who is division engineer in charge of track reconstruction for the Chicago City Ry. Co.

Each assistant engineer reports daily to the division engineer the general features of his work. One of the blanks used for these reports is shown in accompanying illustration, from which the method of recording the location of the construction gang on any street for any day and of indicating the amount and kind of work done each day is evident.

The organization of the board of supervising engineers is separated into several divisions, Mr. R. F. Kelker, Jr., being division engineer, and Mr. C. E. Thomas assistant division engineer of track and roadway. Under this division is a corps of engineer inspectors, who follow closely the construction and report daily to the division engineer the progress and other features of the work.

Although the track reconstruction, as well as all the other rehabilitation work, is carried on at the expense of the street railway company, the cost of this work is to be added to a previously agreed valuation of the whole street railway system, and the city will have to pay this total value if it eventually acquires the systems, as maintenance, depreciation, repairs and renewals are provided for in the meantime by special funds supplied from the gross earnings. The detailed cost of the reconstruction is therefore very carefully kept independently by the company and by the board of supervising engineers. A large amount of cost data is thus obtained, which, aside from its value as a means of arriving at the total outlay, furnishes an excellent basis for estimating the expense of future work and for checking operations from day to day.

AN UNUSUAL PIPE CONTRACT is now being finished for the Texas Co., of Beaumont, by the Youngstown Sheet & Tube Co. This contract calls for nearly 600 miles of 8-in. full-weight iron pipe, requiring over 50,000 tons of puddled iron plate. The line will cross a long stretch of alkali territory and accordingly every pipe has been heated to 350°, dipped in a bath of asphalt and then placed in a drying oven. The pipe will be used in carrying oil from Indian Territory to a Gulf refinery. The contract is interesting, not only on account of its size, but also because it has been filled with iron rather than steel pipe.

A Year's Experience with Gas Engines.

A paper presented to the American Street & Interurban Railway Engineering Association by Paul Winsor, Chief Engineer Motive Power and Rolling Stock, Boston Elevated Railway Co.

We have now been operating our gas-engine plants over a year. We have two of these plants, both of them generating direct current and feeding into our overhead system in multiple with our steam-driven power at stations. They have been operated most of the time by two 8-hr. watches from 7 a. m. to 11 p. m. and shut down from 11 p. m. to 7 a. m. The following figures and statements apply to our Somerville power station. I give no figures for our other plant as it has not yet been accepted. The Somerville power station has the following equipment: one pair of Loomis-Pettibone gas producers, with the usual auxiliaries; two 600-b.h.p. Crossley gas engines, each two cylinder, four cycle; two 350-kw. Crocker-Wheeler generators. This plant was started in May, 1906, and since then has given continuous, reliable and satisfactory service. There have been no shutdowns, no accidents, and no failures.

GAS ENGINE OPERATING CONDITIONS AT SOMERVILLE STATION IN 1907.

	Jan.	Feb.	March.	April.	May.	June.	July.	Total.	Average.
Kw.-hr. generated	204,080	175,200	192,250	202,870	118,640	35,770	60,170	988,980	....
Total lb. coal, including coke	391,223	364,817	405,050	401,150	234,705	90,991	124,452	2,012,388	....
Lb. coal per kw.-hr	1.917	2.081	2.120	1.975	1.979	2.542	2.065	....	2.034
Lb. coal per b. h. p. hour	1.322	1.436	1.426	1.363	1.365	1.755	1.425	....	1.404
Sta. load factor based on 16 hrs. per day and 7 days per week	58.8%	55.9%	55.3%	60.4%	34.2%	10.6%	17.3%	....	41.6%
Eng. load factor	84.2%	86.0%	87.4%	82.3%	78.3%	73.3%	82.8%	....	83.3%
Gen. load factor	99.3%	101.3%	103.0%	97.1%	92.4%	86.5%	97.7%	....	98.35%

The fuel has been soft coal, the same as used in our steam stations, mostly run-of-mine Pocahontas. The economic results are shown in the accompanying table.

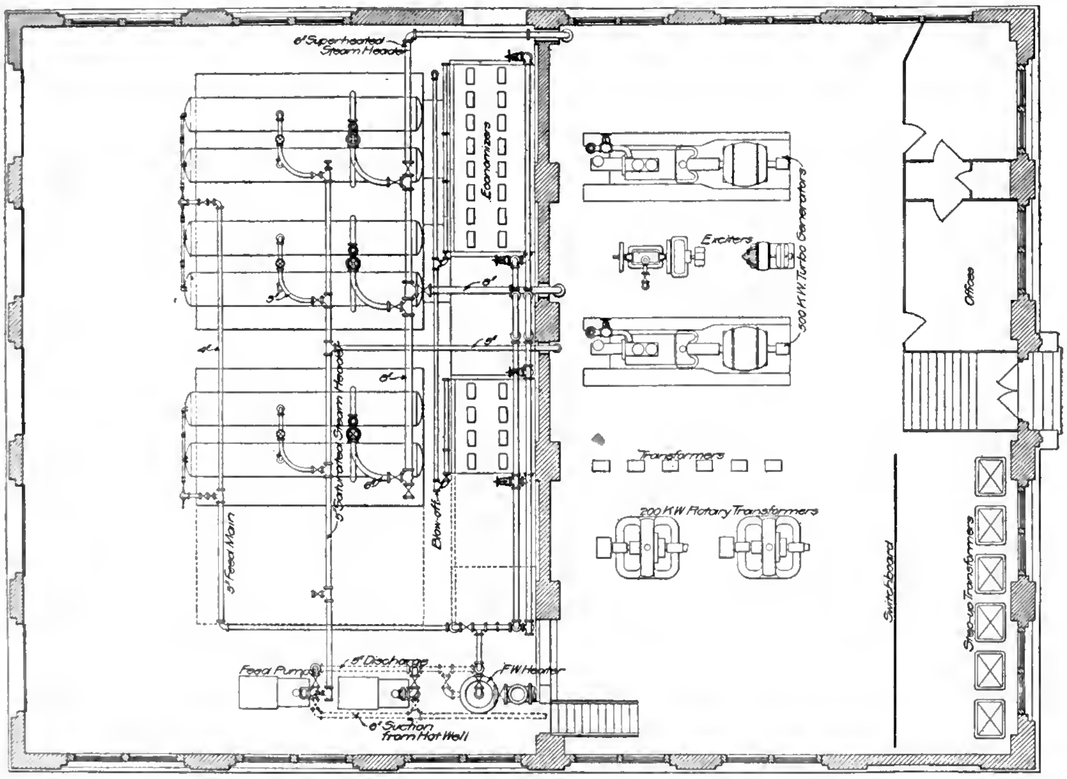
These are the results from actual service and include all the fuel used for power, heating, etc., and the auditor's usual 1 per cent. to make his books balance.

We have used a great deal of water for scrubbing the gas and for cooling purposes. The average amount has been 281 lb. per kilowatt-hour. When we bought this water, as we did for a few months, our water cost about twice as much as our coal. We have been, since Nov. 21, 1906, pumping this from a very dirty brook by means of two-stage centrifugal pumps, electric driven, and filtering it through a pressure sand filter. This outfit has been entirely satisfactory and has given us no trouble. The suction lift is 12 ft. and the pressure at the pumps, 30 lb.

The discharge of water from the gas scrubbers is very dirty, being full of floating lampblack, and is altogether too black to put back into our dirty brook. A sand filter basin 246⅔ sq. ft. in area and tile under-drained, removes all the lampblack, so that we are turning back into the brook cleaner water than we take out.

Our ignition current is from 14-volt motor generators and a floating storage battery and we have no trouble with the outfit. The igniters are make-and-break, two to each cylinder. These igniters had originally platinum tips, which cost a great deal and gave considerable trouble. We have been running now four months without any platinum and with less trouble.

During the first months, back fires and pre-ignitions were much too frequent, occurring almost every day. Lowering the compression on one of the cylinders, changes in the igniters, and experience have reduced these troubles, so that we now go two or three weeks without a single one.



Plan of Power Plant of the Gulfport and Mississippi Coast Traction Co.

This plant has proved absolutely reliable. It can be put into service any time in less than five minutes, much quicker than can our steam plants. It can carry good loads and do it continuously. Each unit has carried 450 kw. (652 b.h.p.) for an hour, with swings to 495 kw (717 b.h.p.).

For the first seven months of this year this plant used 2.034 lb. coal per kw.-hour, while our steam plants averaged 3.477 lb. per kw-hour, a saving of 41.5 per cent. One of our smaller steam plants, containing three 200-kw. compound condensing engines, used 4.414 lb. per kw.-hour; this gas station used only 46.1 per cent. as much.

Personally, I believe that a gas-engine plant, making its own producer gas, will operate at least as reliably as a steam plant and will use from 30 to 60 per cent. less fuel, depending somewhat on the size of the gas plant, but principally on the size of the steam plant.

The drawbacks to the gas plant are, in my mind: First, cost, approximating $200 per kw. when rated so as to have a 33⅓ per cent. overload capacity; second, small size of units, the largest gas engine now built being only of about 3,000-kw. capacity.

Power Plant of the Gulfport and Mississippi Coast Traction Co.

By Earl F. Scott, M. Am. Soc. M. E.

The power plant of the Gulfport & Mississippi Coast Traction Co. is located at Gulfport Miss., for the purpose of furnishing power for the interurban electric road connecting the towns along the Mississippi Coast, and furnishing light and power for the towns of Gulfport, Biloxi and Pass Christian.

The building is of fireproof construction throughout and designed to be pleasing to the eye. The exterior is stucco finish. The building is designed to give plenty of room around the machinery, and is well arranged as to the general mechanical lay-out.

The turbines are of the Westinghouse-Parsons type of 500-kw. capacity, and are direct-connected to three-phase 60-cycle, 2,300 volt Westinghouse generators. There are two machines in the original design of the plant, and sufficient room has been provided for future additions in both the turbine room and boiler room.

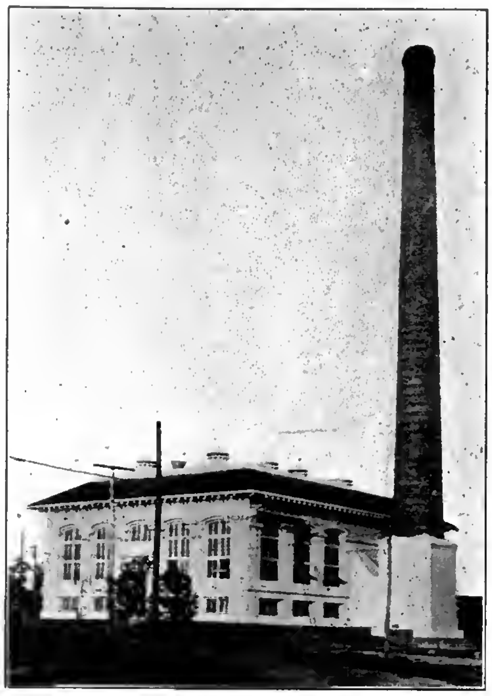
There are two exciters, one steam and one motor driven, each of 60-kw. capacity and arranged so that either may be used at will. The stream-driven machine is direct connected to a standard Westinghouse engine, and the motor-driven unit is direct-connected to a three-phase 60-cycle motor.

Under each turbine between the foundations is placed a Worthington surface condenser. Each condenser has 2,400 sq. ft. of cooling surface, in order to maintain 28 in. of vacuum with a 30-in. barometer, with condensing water entering at 80°. Each condenser is fitted with inner air coolers, to which the rotative dry vacuum pumps are connected. The vacuum pumps are Worthington make, 6 x 12 x 12 in., and arranged so that either pump may be operated with the opposite condenser.

Underneath each condenser and connected to the hot well, there is a Worthington 1½-in. two-stage turbine pump direct-connected to a three-phase induction motor for pumping out the condensed steam. These pumps discharge into a large hot well from which the boiler feed water is taken.

The salt condensing water is brought in from the sea through 20-in. cast-iron pipe by a 10-in. Worthington centrifugal pump direct-connected to a Westinghouse engine. The water after passing through the condensers is returned to the sea in a similarly arranged 20-in. pipe and discharged below low-tide surface in order to get the advantage of the syphon effect.

The condensing water is brought to within 200 ft. of the plant through an open concrete canal of about 80 ft. cross-section area, which begins at deep water, about 2,000 ft. distant, and terminates in a large circular basin from which the 20-in. pipe takes the water.



Gulfport Power Plant.

The present boiler capacity of the plant is 1,038 b. h. p., made up in three units of 346 h.-p. each, set in one double battery and a half battery with the necessary foundations and openings for a future boiler of the same type and capacity. The boilers are Babcock & Wilcox make, with wrought steel headers, and are capable of carrying 200 lb. steam pressure. Each boiler is fitted with the standard Babcock & Wilcox superheater arranged so that superheated steam can be taken off independent of saturated steam. The boilers are fitted with Roney stokers and arranged with overhead coal bunkers having a capacity sufficient for a 48-hour run.

The coal and ashes are handled by Jeffrey coal conveying machinery, fitted up with coal crushers and the necessary automatic machinery to reduce the manual labor to a minimum. The ashes are run from the furnaces by gravity through ash hoppers into the basement underneath the boilers and there taken up by the conveying machinery.

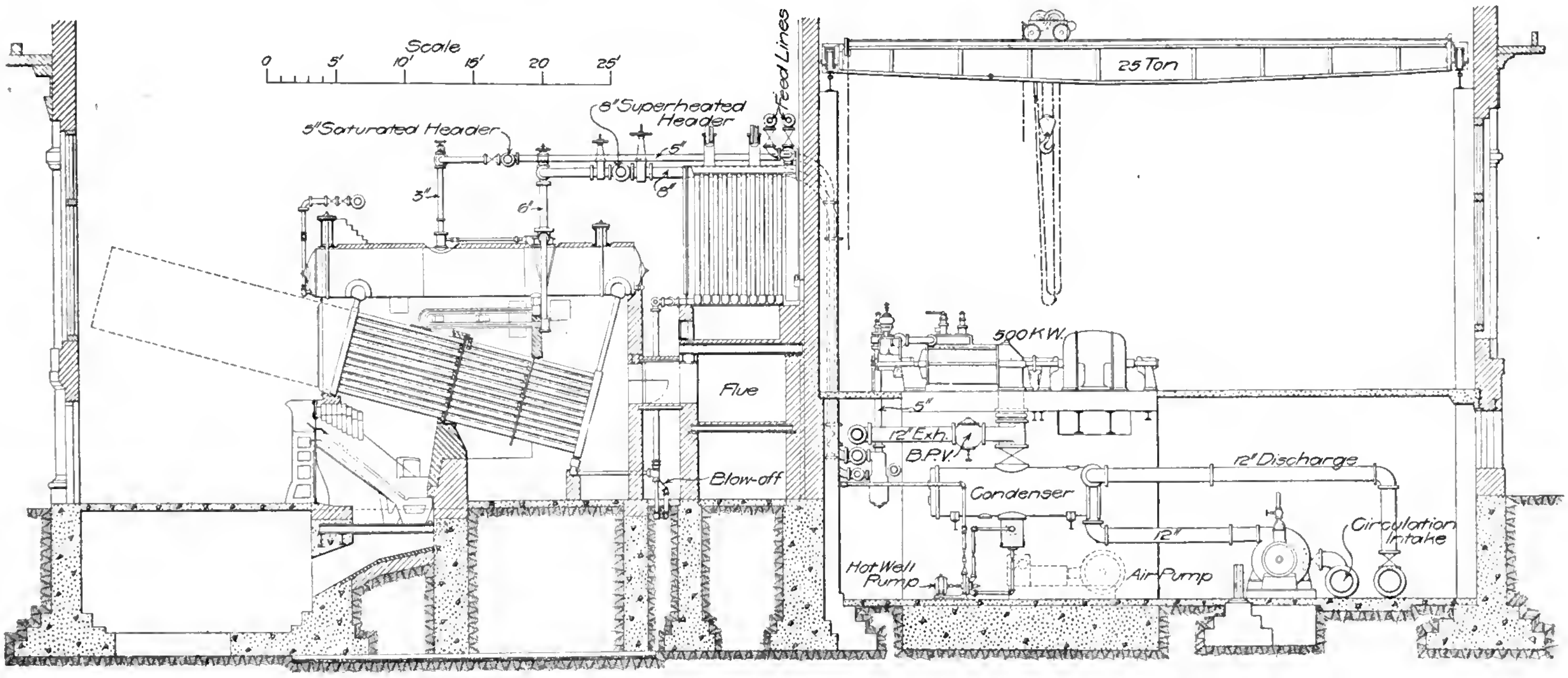
Back of the boilers are the Green fuel economizers. These are arranged so that the gases from each boiler can pass through or go around the economizers to the stack. The Custodis stack is 8 ft. in diameter and 175 ft. high and connected to the boilers with brick breeching.

There are two Worthington boiler feed pumps, 12x7x10-in., of the packed plunger pattern, and built for 200 lb. pressure. The pumps were selected of large size in order to be able to handle the feed for the total plant after it has increased to double its present capacity. The pumps are arranged in tandem and connected so that either may be operated at will.

In the pump discharge there is a Goubert closed heater of 1,800 h.-p. capacity. The heater is direct-connected to the main exhaust header and arranged so that the exhaust from the auxiliaries passes through it at all times. In case the turbines are running non-condensing, their exhaust will also pass through the heater.

The pipe system is laid off in two separate and independent lines for superheated and saturated steam respectively.

The superheated steam line is fitted at each boiler with a Foster automatic and hand stop emergency non-return valve, and these valves are so arranged that through a pilot valve they can be closed down instantaneously from either the firing floor or turbine room, making the steam lines absolutely under the control of the engineer.



Cross-Section of the Power Plant of the Gulfport and Mississippi Coast Traction Co.

From these valves the main steam header is connected by long radius bends. There is a large header running the full length over the boilers and near the center and at one end this header is branched off and run to the basement below the turbine room floor. The two branches run into a secondary main header which is hung from the basement ceiling and at convenient points the branches are taken off for the turbines. On each branch to the turbines is placed a Stratton steam separator to prevent any water of condensation from being carried over to the turbines on starting up. Both the main header and sub-header are arranged with fittings and blank flanges so that future extensions can be made without causing any serious delays.

All flanges on the superheated steam header

are Van Stone slip joints. One point regarding this line is of interest; the line is fitted up with Goetze corrugated copper gaskets and during one year's continuous operation, there has not been a joint that has required attention.

The saturated steam header is run similar to the superheated steam header, but not fitted with automatic stop valves. The same design of a main header over the boilers and a sub-header in the basement is carried out, and from the header in the basement branch lines are run to all auxiliary machinery which is placed in the basement. Steam for the boiler feed pumps is taken off the main header over the boilers. A reducing valve is placed near the main header, on the branch connecting the main and sub-header, in order to reduce the boiler pressure from 100 to 100 lb. for the auxiliaries.

From special tees under each turbine, the atmospheric exhaust branches are run. In each branch at the tees is placed a Blake automatic exhaust relief valve. Each branch runs into the main exhaust header, thence to the heater and outboard exhaust, terminating with a Swartout exhaust head.

The three main headers in the basement are suspended from the turbine room floor underneath each other. The hangers for these are made up with turnbuckles so that each header is independent of the other.

The feed pumps are piped up so that water can be taken from a large hot well placed in the basement, into which the condensed steam from the turbine flows, or through this hot well the boiler water can be obtained from a natural flowing artesian well, which furnishes an abundance of water if the plant should be run non-condensing. By means of a float valve, water from the well is added for make up.

The discharge for the feed-water lines is arranged so that the heater and economizers can be run at the same time or separately, or the pumps may deliver direct to the boilers cutting out both the heaters and economizers.

All fittings for steam lines and feed water lines are Crane's extra heavy flanged fittings, the valves are Chapman make, extra heavy where required, and designed for the different types of service. Live steam lines and feed water lines are covered with 85 per cent. Keasbey & Mattison magnesia covering, and exhaust lines with asbestos air cell covering.

All pipe work in the boiler room is suspended from the roof trusses by adjustable rods, and in the basement from the ceiling.

The circulating pumps are primed by the rotative dry vacuum pumps through a 2-in. pipe which connects to the highest point of the circulating system and runs to a point about 34 ft., above this and thence down to the pump. The priming pipe has this high loop in it to prevent salt water from being drawn over into the pumps. It requires about fifteen minutes to prime the pumps by this method when there is no water in the system. There is no foot valve on the 20-in. main suction pipe.

The only feature about the piping of the auxiliary machinery that requires mention is the by-pass connection on the rotative dry vacuum pumps. These pumps are connected so that either pump may be operated with either condenser.

The generators furnish 2,300-volt, 60-cycle, three-phase current. From the generators it is conducted to the main switchboard and through generator panels to the 2,300-volt busbars. Part of this current is then taken through step-down transformers from 2,300 volts to 380 volts and fed to the alternating current end of two 200-kw. rotary converters, being converted to 550 volts direct current. This 550-volt current is fed direct into the trolley circuit. Another portion of the 2,300 volt alternating current from the high voltage busbars is fed into the primary lighting circuit, extending through the city of Gulfport and also into the transmission line which extends both ways from Gulfport to Biloxi at one end and Pass Christian at the other end. This high-tension circuit is constructed of bare aluminum stranded wire of about 75,000 c. m. cross-section, and is designed to supply the intermediate lighting service along the coast between Pass Christian and Biloxi.

Another portion of the 2,300-volt current is conducted through step-up transformers and raised from 2,300 volts to 13,200 volts alternating current. This is conducted on a high-tension transmission line, constructed of three bare aluminum stranded wires of about 50,000 c. m. cross-section to the sub-stations located at Biloxi and Pass Christian, Miss., where it is reduced through step-down transformers to 380 volts and 2,300 volts alternating current. The 380-volt current is carried direct to the alternating current end of two 200-kw. rotary converters similar to those at the main station. The 2,300-volt current is used for lighting service in the two towns. Both the 2,300-volt and the 13,200-volt transmission lines are three-phase and constructed in triangular form with 36-in. separation of each leg.

The pole line is constructed of 35-ft. creosoted poles, with creosoted cross arms, 11-in. locust pins and Locke high-tension insulators. The trolley circuit consists of two 4/0 grooved lines in parallel with 6-in. separation between running wires and is hung on a 9-ft. Richmond flexible bracket, 20 ft. above the rail. This trolley circuit is designed to furnish ample capacity in the trolley wires without carrying an additional feeder to reinforce the line. High-tension transmission lines are protected at intervals and at both main station and sub-station with low-equivalent lightning arresters, manufactured by the Westinghouse Electric & Mfg. Co. The system is arranged with disconnecting switches at both sub-stations and main station, so that it is possible in case of emergency to feed the rotary converters at both sub-stations through the 2,300-volt line, this giving in a measure a duplicate transmission line.

The rotary converters to be used on this system are designed to start with a small motor mounted on the end of the main armature shaft, this doing away with the violent fluctuations in the line when starting the rotary converter from the alternating current end.

The plant has been in operation about twelve months and in every respect given entire satisfaction. The turbines have been run as long as four months continuous without showing any defects at all, and carrying 50 per cent. overload without trouble. The condensing apparatus has maintained 27½ and 28-in. vacuum at all times without the least strain and the boilers have given entire satisfaction, and in every case responded to over-load peaks without undue strain.

After twelve months of operation, the demand for electric current has exceeded the capacity of the plant so much so that at present the company has signed contracts for the installation of one 1,500-kw. Westinghouse turbo-generator, the necessary auxiliary condensing machinery and additional boiler capacity. The present building will accommodate all of this, anad the installation will be easily made, as all preparations were made for extension in the original designs.

The electrical part of the plant was installed by the Westinghouse Electric & Mfg. Co., under the supervision of Mr. F. D. Gatchell, and the boilers, auxiliary machinery and pipe work were laid out and installed by A. M. Lockett & Co., Ltd. of New Orleans, La., contracting mechanical engineers. The contracts for the new machinery have also been given to these companies.

Care of Electric Railway Tracks.

A paper presented to the American Street and Interurban Railway Engineering Association by George L. Wilson, Engineer, Twin City Rapid Transit Co.

Interurban Track.—The conditions of the interurban roads located, as all such roads should be, on a private right-of-way, approach closely those of steam roads. Many of the methods used in steam road practice, as the result of years of experience, are required for electric roads.

Grading, ballasting, construction of bridges, culverts and crossings, care of roadbed and track follow the same lines. The standard works of reference on these subjects apply with slight modifications to the care of electric roads and should be diligently studied by those in charge of permanent way.

The maintenace of the earlier and cheaply built electric roads has demonstrated that it is economy to have electric roads built with well-ballasted track; ties and rails put in as perfect condition, in regard to surface and alignment, as possible. Then the object in view is to preserve them in the same condition.

Following the purpose of keeping the track in perfect condition, which includes drainage, care of switches, crossings and side-tracks we come to the care of the right-of-way, cleaning from snow in winter, maintaining fences, public crossings and the making of the company's property attractive to the passengers.

It should be remembered that the principal business of electric roads at present, and probably for a long time, is the transportation of passengers, whose comfort and interest are constantly to be kept in mind.

The removal of rubbish, weeds and unsightly objects of all kinds, including advertising signs, from the vicinity of the tracks is a proper part of the care of the roadway.

Company property should be neatly arranged when stored, and the land owned by the company along the line and at stopping places ornamented with grassy slopes, vines and shrubbery.

At terminal or waiting rooms there should be flower beds and grass plots, instead of ragged grounds and piles of debris. Otherwise, waste grounds can be so improved that there is something of interest to attract the passenger's attention at every point.

This is looking some distance ahead for new lines, but it is practical to do a little, month by month, and year by year, until the right-of-way becomes a boulevard or parkway.

All passenger transportation lines find it desirable to make their routes as attractive as possible. A sloping hillside cut may, by the proper planting of shrubs, be made beautiful, with their flowers in summer, and gorgeous with the autumnal foliage. A rocky bank is not of itself attractive, but partly covered with vines it becomes an interesting feature.

Steam suburban roads have done considerable along this line, and the lot of the commuter has been cast in pleasant places thereby. The great trunk lines of the country are working to the same end. Through the Eastern States many of the roads pay a great deal of attention to the making of their station grounds attractive. The annual circular of a transcontinental line offering cash prizes to its station agents for the best station flower gardens is attractively illustrated and directed to "Our Fellow Workers among the Flowers."

The aim of every electric road must be to have its patrons attracted and interested along the way, that the route may seem both short and pleasant and the trip one to be repeated.

With the care of interurban track it is proper to consider the men as well as the roadway. The growth of railroads, both steam and electric, has required more men than are to be found in the

track crews. It is a fact that track labor has been recruited from the lowest paid classes, with the result that ambitious workmen have largely gone into other lines.

Our first railways and public works generally were built by the sturdy Irish immigrant, who rose soon to more remunerative employment. To-day the mass of employes have no apparent interest in, or regard for, the quality or amount of work they perform. In many cases the foremen and officials can only communicate with them through interpreters, and there is an absolute lack of loyalty to the interest of the employers. This must be changed if the best results are to be obtained.

It is not necessary that a track crew should be skilled mechanics, but if track, switches, frogs and all appliances are to be in the best working order men of a fair amount of ability and some mechanical skill are required.

To obtain this end the conditions must be such that an intelligent laborer can make a decent living and have a steady income. Work should be planned so as to be distributed through the year as far as possible, in order that there may be constant employment for a nucleus of good men.

Let the men from bottom to top have an interest in the results of their work and in the efficiency of the section or division where they are employed. Make them feel that it is their company and that they are a part of the whole machine. The question of keeping skilled laborers who will do good track work is at the bottom of the maintenance of track and the most difficult problem.

All interurban track should be patrolled daily, at least, and this brings us to the track-walker and his duties. This position is above that of laborer and next to that of foreman. A skilled trackman who is sober and industrious and who can be depended upon to see that splices and bolts are in adjustment, drains and culverts open, who will detect any spreading track or broken rails, see that farm gates are kept closed and stock off the track, in fact, be a general inspector and caretaker, is an important person. It is in a great measure to his fidelity that the safety of cars and passengers will be due.

City Tracks.—On city tracks the care of the roadway, besides the keeping of rails, switches and curves in good order, includes more or less of cleaning, sprinkling and snow removal. In order to determine the practice of different companies and for a guide for future operation, inquiries on these subjects were sent to fifty leading companies. From their reports the following notes have been prepared:

In the matter of cleaning the space occupied by tracks on paved streets the general practice is that the municipality bears the entire expense, as the theory is that the cars do not bring dirt onto the street, and the cleaning of the entire paved roadway would have to be done and the expense borne by the city if there were no tracks.

The fact of the tracks being in the street does not entail additional expense on the city. This view has been upheld in the courts, and it appears that refuse and things left on the streets by pedestrians, teams and by storekeepers, who often dispose of litter by throwing or sweeping it into the roadway, should be taken care of by the city authorities. Inquiries on this subject were made of fifty companies in all parts of the country, and of forty-six replying and operating 8,469 miles of track, with a tributary population of 13,241,000, it appears that forty-one, operating 6,706 miles of track, pay no part of the street cleaning expense.

In a few cities the railways bear a part of the street cleaning expense, this being done either voluntarily or by charter requirement. In these cases it should be considered as a contribution or a part of the amounts paid in by way of taxation.

The following are among the prominent companies which assist the cities in this matter:

Chicago Union Traction Co., Chicago City Railway Co. and South Chicago City Railway Co.; cost $123.60 per mile for cleaning and sprinkling in 1906.

Columbus.—On 79 miles of single track, within city limits, partly on unpaved streets, cost for cleaning and sprinkling was $13,000 in 1906; cost per mile of single track, $164.55.

Pittsburg.—Company pays for proportional part of street occupied by tracks.

New Orleans.—Pays for sweeping one street only.

New York City.—Pays for sweeping Broadway only, from Bowling Green to 15th St.

Twin City Rapid Transit Co.—Pays for sweeping its track allowance in St. Paul and Minneapolis; 86.12 miles of single track in 1906 cost $23,475.55; cost per mile, $272.56.

As street sprinkling is found to be carried on satisfactorily by sprinkling cars, it is believed that the cleaning of the track allowance can be done economically and satisfactorily with sweeping machinery which will take up the debris, place it in a receptacle and take it away to proper dumping grounds. This is an important subject for the companies which pay for cleaning their track allowance.

In the large majority of towns the street sprinkling is taken care of by the municipal authorities, without reference to the street railways, no part of the expense being paid by the companies. Returns from 24 companies, operating 4,768 miles and having a tributary population of 10,156,000, show this condition: Companies operating 3,356 miles sprinkle tracks only with tank cars; of these the practice is so mixed that it is difficult to know how much mileage is sprinkled. In general, it appears that the more important streets are the only ones sprinkled. This is done under requirement of state law or city ordinances. The cities are required to furnish water without charge, though in some places the company is obliged to pay for the water—in one case 6 cents per mile of track.

The business of sprinkling the whole of the roadway from tank cars has been developed to quite an extent; one outside company owning cars makes contracts with cities for sprinkling the roadways, and has 250 miles of streets covered. The railway companies operate the cars for a price per car-mile. The authorities of the cities report that the service is very satisfactory. The railway officials report that this plan gives good results and, while the returns are small, the conditions, on the whole, are satisfactory.

A number of cities pay the railway companies directly for this same kind of service. Prices received by the company for this work vary from 7 to 17 cents per car mile, 10 cents being about an average. The cost to the property owners per season is about 10 cents per foot of street, or 5 cents per front foot.

The tank cars used are of a variety of types, from the plain rectangular box to the cylindrical sheet iron tanks, operated either directly by gravity or as pneumatic sprinklers, having the tank under air pressure. The capacity is from 2,500 to 6,000 gal.

Four thousand gallons will sprinkle some six miles of tracks or three miles of entire roadway. Any statements of this kind are rather indefinite, depending upon so many conditions. A better idea of the work done is to say that in actual practice one car making four trips per day will care for eight miles of street.

While the returns for the service are small, the indirect benefits are of as much or more value. The freedom from dust not only decreases the expense of repairs to car machinery and gives a better contact between rail and wheel, but also, by more comfortable conditions for passengers, increases the pleasure of riding and other traffic so much that managers consider the expense more than met by increased revenue.

The use of oil for laying dust on some streets and for the roadbeds of railways has been extensively advocated. It has been tried by a number of roads. Some consider its use satisfactory, but the greater number have not put it into extensive use. The heavy asphalt oils of California appear to give the best results, while in the Central and Eastern States a so-called "roadbed" oil prepared by the Standard Oil Co. has been used more or less experimentally for ten or twelve years.

Among the steam roads that have used oil are the Boston & Maine, Boston & Albany, Central Railroad of New Jersey, Long Island Railroad, Delaware & Hudson, Santa Fé, Chicago, Burlington & Quincy, Oregon Short Line, Chicago & Alton and the Southern Pacific, the last the most extensively, having used it for five or six years on about 900 miles of road.

In practice the roadbed is sprinkled with about 2,000 gal. per mile for the first application. After the first dressing the quantity may be lessened to 600 or 1,000 gal. per mile annually, though some parties claim that two applications annually are needed. The sprinkling appliances used and the process are claimed to be controlled by a Chicago firm, which charges a royalty of $10 per mile for its use for the first application, no charge being made for subsequent sprinklings.

Few electric roads have used oil. The Los Angeles Pacific reports its use on unpaved city streets and states that three coats per year are desirable. At 60 cents per barrel, the cost per mile of double track is $100. San Francisco reports its successful use on macadam streets outside the city limits. The Brooklyn Rapid Transit Co. is experimenting with 20 miles of track on its suburban lines on private right-of-way where the pleasure riding is very heavy and the roadbed of sandy material.

From the reports of roads using oil it appears that managers of the steam roads, at least, do not consider its use profitable, and there is no general movement to adopt it. On electric roads on private right-of-way or on macadam outside of built-up sections of cities it may prove to be economical where the oil is obtained at a low price, especially on sandy roads leading to pleasure resorts. The accompanying memoranda in regard to the practice and cost may be of interest:

Boston & Maine R. R.—Has used oil in 1899; covered about 400 single-track miles; uses 2,000 to 3,000 gal. per mile; price of oil, 2.75 cents per gal.; average cost, $100 per mile.

Boston & Albany R. R.—Made experiments for three years, 1898-1900; used 2,000 gal. per mile first year, 600 gal. second year, 1,000 gal. third year; cost per gallon, 2.75 cents; cost per mile of track, $80.

Central R. R. of New Jersey.—Will use oil on Sea Shore Line for dusty season; uses apparatus constructed at its own shops; pays a royalty for the process.

Long Island R. R.—Use oil on crossings; cost, $125 per mile; use 600-gal. tank cars; oil costs 2.4 cents per gal.; 600 gal. used per mile; results on cinder and gravel ballast satisfactory.

Delaware & Hudson R. R. Co.—From 1896 to 1900 oiled road from Saratoga to Plattsburg, 188 miles; used roadbed oil prepared by the Standard Oil Co.; price, 2.75 to 4.75 cents per gallon; for 2,000 gal. per mile cost was $100; kept dust down, but its use has been given up; 1,000 gal. per mile every other year would be sufficient.

Oregon Short Line.—Reports using a little oil on a branch line, which kept down dust till track was ballasted.

Brooklyn Rapid Transit Co.—Reports that some track on private right-of-way has been sprinkled for two years; will sprinkle 20 miles in 1907; results satisfactory.

Chicago & Alton R. R. Co.—Use crude oil at 3 cents per gallon for sprinkling road crossings only; stone ballast on rest of road and does not need it.

Southern Pacific R. R. Co.—Has used oil for five or six years: 900 miles of track oiled; may use up to 4,000 gal per mile; pays $10 per mile royalty.

San Francisco Electric Railway Co.—Uses oil on macadam streets, but not inside city limits.

Los Angeles Pacific Co.—In Los Angeles on unpaved streets an occasional coat of oil is applied; generally, oiled streets are sprinkled three times per year; cost, $100 per mile of double track.

The universal practice with reference to snow is to keep the tracks open for service by the use of plows and sweepers during and immediately after each snowfall. The snow thus deposited on the rest of the roadway is left, as far as it can be done, without impeding travel. At crossings and congested points in business districts all companies assist in removing snow as promptly as possible by the use of car and team.

When it is necessary to remove snow from roadway the companies generally pay the cities one-third or one-half the expense incurred on the whole street. In some cases the cities and railway companies divide the streets, the railways taking care of a sufficient number of them to make up the same area as their total track allowance. One company takes one side of the streets and changes sides annually. This is reported as working well in a city of 60,000 people.

In many cities no separate account of this expense is kept, and, owing to the fact that conditions vary so widely between Southern and Northern locations, no satisfactory comparison of costs is practical.

Figures given show results of $17.41 per mile of single track in a city of 175,000, with 140 miles of track in the Central States for an average winter. In Chicago, 1906-'07, the cost was $41.13 per mile of single track for the Chicago City Railway Co., while in Milwaukee, 85 miles away, but a very small expense was incurred. Another lake city, Detroit, reports $35 per mile for an average winter. Duluth gives $45.45 for an average winter. Toronto reports on 98 miles of single track in 1904-'05 a cost of $102.04 per mile for one-third of street area. Providence, R. I., reports a cost of $148 per mile of single track in 1906 and 1907. Here all snow over 4 in. deep is removed.

Deflocculated or Acheson Graphite remains indefinitely suspended in machine oil, and in consequence some engineers are turning their attention to its special uses as a lubricant. Prof. C. H. Benjamin states in the "American Machinist" that he has found the effect of adding deflocculated graphite to oil to be very noticeable. He has made many tests with such a mixture and with the same oil used alone. With one or two exceptions, the addition of the graphite has at once reduced the friction and increased the life of the lubricant. The graphite improved all the varieties of mineral oils which were tried. One-third of 1 per cent. of graphite was tried with two grades of oil under different loads and reduced the coefficient of friction with the better oil about 20 per cent. and with the poorer oil about 23 per cent. One-sixth of 1 per cent. of graphite had a slight effect in reducing the friction of a standard engine oil, and this is apparently about the minimum quantity that can be used with any advantage. It also seems from his tests that the use of this grade of graphite with water has a tendency to prevent rust.

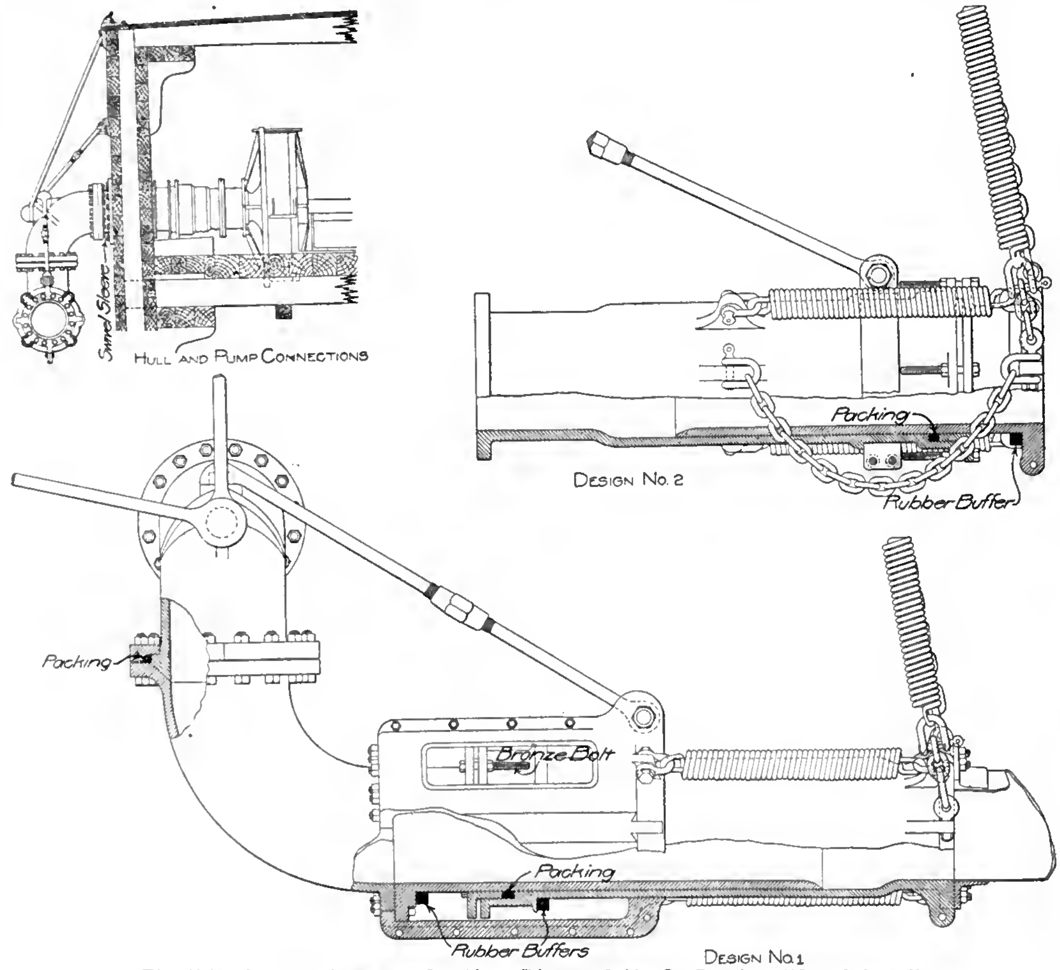
A New Flexible Connection for Suction Pipes of Dredges.

The expense, delays and inefficient service attending the use of rubber suction hose in the suction pipes of sea going suction dredges for the purpose of providing a flexible connection between the rigid portion of the suction pipes, which trail along the bottom being dredged, and the hull of the dredge, have been very detrimental to the successful operation of these vessels.

The rubber hose for an 18-in. suction pipe costs about $500, not including the cost of the flanged nipples and other fittings attached to the hose. While occasionally these sections of hose render service for several months they frequently fail within a few weeks. The inner tube or lining often becomes detached from the walls of the hose within a short time and the contraction of the hose, under the usual vacuum of 25 in., constricts the passage, and the usual irregularities increase the friction so much that the maximum efficiency of the pumps can rarely be attained. When the hose begins to leak it generally has to be replaced at once with another one. It often happens that several sections of hose fail within a short period of time, and unless an unusually large supply is on hand to replace them the work of the dredge may be delayed several weeks awaiting a new supply. The material of which the hose is constructed deteriorates rapidly, especially in warm climates, hence the inadvisability of keeping a large supply on hand.

The device shown in the accompanying drawing was designed to replace the rubber hose and obviate its disadvantages.

The usual swiveling sleeve in the line of the suction pipe leading from the pump, passing through the side of the vessel and made air tight by a stuffing box, is made use of in the customary manner. To the outer end of this sleeve is attached an elbow of 90 deg., which in turn is connected to another elbow of 90 deg. by a swiveling joint of special construction which is self-explanatory on the drawing. To the latter elbow is attached a telescopic section of pipe which may be arranged either as shown in Design No. 1, or in Design No. 2, on the drawing. The movement of this section of pipe within itself is under the control of springs as shown and responds to torsional as well as longitudinal stresses. The normal position of the pipe when at rest is as shown on the drawing. Under tension it has a maximum extension of 14 in., and under compression, as when the vessel retrogrades while the drag is on the bottom, as some times occurs, this section of pipe can collapse 8 in. from the position shown on the drawing, or a total of 22 in. from extreme extension. It will be seen that this device permits the drag to accommodate itself to irregularities of the bottom and to change its relative position with respect to the vessel as the demands of practical work require, without bringing undue stresses upon the several portions of the pipe or upon the vessel. In practice it has been found that it meets the conditions imposed much better than the rubber hose.



Flexible Connections on Suction Pipes of U. S. Dredge "St. Johns."

The dredge "St. Johns," which has two 18-in. dredging pumps, had one of these connections of Design No. 1, on her port suction pipe when she began work on the shoals at the entrance to the St. Johns River, Florida, Oct. 20, 1906. Another connection of Design No. 2, was put in service on the starboard side on April 12 of this year. No repairs whatever have been required to either connection and no delays have in any wise been occasioned by them. The swivel joints of both connections have required no attention since they were installed, and remain air-tight. The stuffing box of the telescopic portion of the first connection has been repacked once, the other not at all. During the time between the installation of the first connection and that of the second, four sections of rubber hose were worn out on the star-

board side. During the period from Oct. 20, 1906, to July 1, 1907, this dredge removed nearly 500,000 cu. yds. of ocean drift sand and carried it to sea an average distance of 3.6 miles. From May 16 to June 15 of this year, during which time the weather did not materially interfere with the work, the dredge removed 96,028 cu. yds. Work was done with one crew and was carried on during the daytime only.

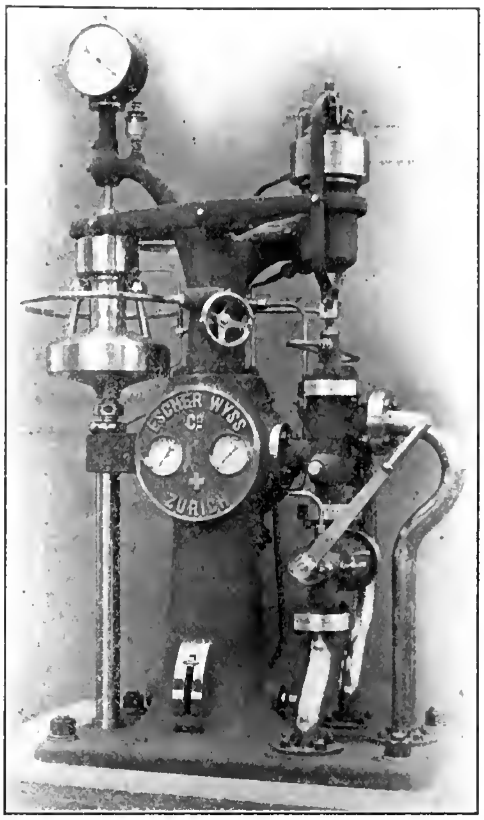
A ball-and-socket joint is now being used on some sea-going suction dredges in place of the rubber hose. As compared with the connection here described, the ball-and-socket joint appears to have the following disadvantages: The joint being rigid longitudinally, severe stresses are brought to bear upon the pipe and its connections when the drag encounters unusual obstructions in the bottom, or when the vessel settles backward in a sea-way while the drag is down. In order to provide the latitude of motion required in practice, as when transverse winds or currents prevail or when the vessel suddenly changes its direction for any reason, the ball-and-socket joint must be of large cross-sectional area or the passage will be constricted when the pipe is near its limit of transverse motion. This produces a considerable irregularity in the passage, causing an interference with the free flow of water through the connection If, through inattention, the pipe is permitted to swing, with respect to the vessel, beyond the limit afforded by the ball-and-socket joint, the joint or the pipe or both are apt to be broken. Such contingencies have occurred and the accidents mentioned have resulted in practice. The lower position of the suction pipe, where it connects with the swiveling elbows, in the device here described, permits the pipe to swing somewhat farther under the turn of the bilge of the vessel without damage than with the more direct alignment given by the ball-and-socket joint.

The device is original with Mr. J. A. Sackett, chief assistant engineer to Major Shunk, U. S. Engineer Officer in charge of the Florida district, and he designed all the details of the completed apparatus.

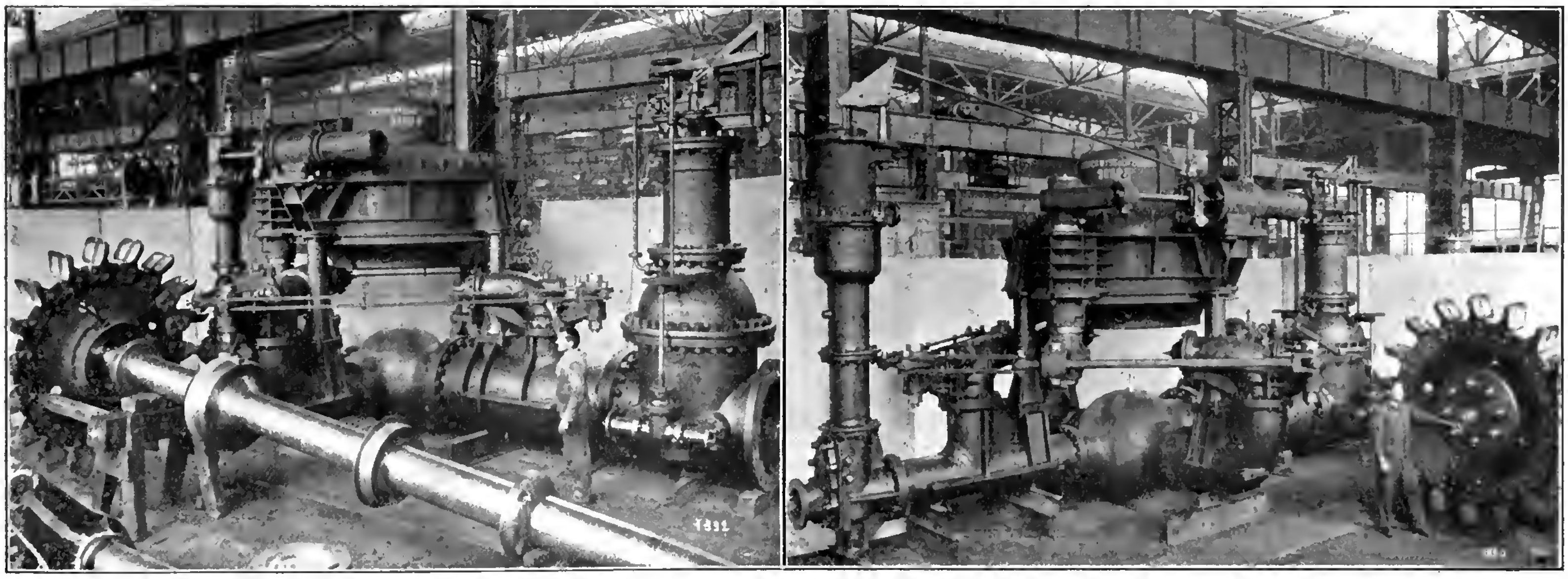
A Large Icebreaker has been recently launched at the yards of Sir W. G. Armstrong, Whitworth & Co., Ltd., England. This vessel, which was built for the Government of Finland, is 220 ft. long, 47 ft. wide and 28 ft. 2 in. deep. She has a propeller at the bow as well as at the stern. The forward propeller gives increased maneuvering power and assists in the breaking of ice by disturbing the water under it.

Large Impulse Wheels for a Brazilian Hydro-Electric Station.

The Rio das Lazes hydro-electric station of the Rio de Janeiro Tramway Light & Power Co., which is to have an initial installation of 54,000 h.-p., consisting of six 9,000-h.-p. units, was referred to briefly in The Engineering Record of Aug. 17, 1907. Since then, Mr. R. Weber, formerly chief engineer of the Escher, Wyss & Co., of Zurich, Switzerland, under whose direction the water wheels were designed and built, has furnished the accompanying views of one of the 9,000-h.-p. wheels set up in the shop, and of the automatic governor furnished for each wheel.



Governor for Impulse Wheel.



Two Views of Impulse Wheel of Nine Thousand Horse-Power Capacity.

A concrete dam, 115 ft. high and 92 ft. thick at the base, was built at a series of falls on the Rio das Lazes, 56 miles from Rio de Janeiro, to develop a storage reservoir for the station. Two 8-ft. riveted steel supply lines, about 6,000 ft. long, lead from this dam to a cross receiver near the power house; a 12-in. and six 36-in. pipes extend from this receiver to the station, at which the total head varies from 950 to 1,000 ft. These pipes are all of welded-steel plates; the thickness of the plates for the 36-in. pipe varies from 0.4 to 0.7 in. and that of the 12-in. pipe from 0.25 to 0.3 in., depending on the head. The receiver is connected with a small service reservoir at the same elevation as the main storage reservoir, this small reservoir acting as an equalizer to maintain and regulate the flow in the supply lines.

At the power house each 36-in. pipe line connects with the penstock of a 9,000-h.-p. vertical-shaft impulse wheel. The 12-in. pipe connects to the penstocks of two 500-h.-p. horizontal-shaft impulse wheels. The main wheels are each direct-connected to a revolving three-phase 50-cycle 6,000 h.-p. Westinghouse generator, the units being designed to operate at 300 r. p. m. The 500-h.-p. wheels are each direct-connected to direct-current generators, which supply excitation current to the main units and operate at 500 r. p. m.

Each main wheel has four variable-orifice needle nozzles through which water is supplied to the runner of the wheel. The operation of these nozzles is controlled by a special type of oil-pressure governor of the fly-ball type, which was designed by Mr. Weber. This governor is geared to the shaft of the unit, and actuates a valve in a pipe supplying oil to a cylinder that directly controls the position of the needle nozzles. Each wheel is also provided with a relief valve which is connected to the governor in such manner that it is only opened when all, or a relatively large percentage of the load on the generator suddenly drops off. Dependence for speed and pressure regulation is placed entirely in the governor and the relief valve, respectively, as the nozzles are not deflected. The whole arrangement is therefore water saving, since the relief valve is wasting water for a few seconds only when the load is decreasing rapidly.

The field of each 6,000-h.-p. generator being mounted on the same shaft as the runner of the wheel, each unit has but two steady bearings, the field being on an overhang of the shaft at the top and the runner on an overhang at the bottom. A maximum thrust of about 100,000 lb. is developed in each unit, and is carried by a thrust bearing of the oil-pressure type. This bearing is located between the two steady bearings, oil being supplied to it at a pressure of about 150 lb. The oil required for this bearing, and that necessary to operate the governing mechanism is supplied by a pump to each unit. These pumps are each driven by a small impulse water wheel.

The wheels of the main units have a guaranteed efficiency of 82 per cent. at full load. The

governor is guaranteed to prevent a speed variation of more than 10 per cent. when the full load is suddenly thrown off, the difference in speed between full load and no load being only 2 per cent. The relief valves will prevent an increase of more than 3 per cent. in the water pressure in the penstocks.

The runners of the impulse wheels of the exciter units are mounted on an overhang of the shaft of the direct-current generators. Each of these wheels has a single needle nozzle, controlled by an oil-pressure governor similar to those for the main units.

A Machine for Tunneling in Shale.

Numerous attempts have been made from time to time to build a machine which could be used to bore tunnels through rock without requiring explosives. While a small machine for this purpose has been reported to be operating successfully in Colorado, so far as this journal has been informed no such machines of any size have ever delivered satisfactory results in actual service. The latest attempt to perfect a machine to bore a fair-size tunnel has recently been abandoned, although the mechanical defects to be overcome were apparently not insurmountable. The Engineering Record has been supplied with considerable data concerning this machine, which are presented herewith, although no information regarding the place where the machine was tried can be made public.

This particular machine was designed to operate on the principle of a stone planer. The tunnel in which it was set up for a trial is being driven through shale rock. It has a finished diameter of 8 ft. and is lined with 12 in. of concrete. The machine consisted essentially of a 10-ft. cylinder, 48 ft. long and built of steel plates, carrying a revolving disk at the front end to which were attached the planer knives, or tools, the driving machinery being distributed through the cylinder. The disk at the front end of the machine was mounted on a hollow steel shaft, 4 ft. in diameter and about two-thirds the length of the cylinder, contained in the latter. This shaft was concentric with the cylinder and turned in two heavy bearings, one toward each end of the cylinder, which were carried by heavy frames attached to the steel shell.

Four 65-h.-p. electric motors in the cylinder, operating at 500 r.p.m., drove the shaft at a single revolution per minute through a set of gears. The front end of the revolving disk on the forward end of the shaft had six very heavy cast-steel arms radiating in the form of a flat truncated cone from a hub at the center. The planer tools were attached to these radiating arms. These tools were made of a special grade of tool steel and each had a cutting edge about 2 in wide. They were pitched about 2 in. apart so the 2-in. annular cuts made by them were separated by 2-in. rings of stone that were not planed off, but broke away as the cuts were made on both sides of them. The tools were so placed at different angles with the arms which carried them as to facilitate the cutting with the smallest amount of power. The face of the bore was taken out in the form of a truncated cone of the same pitch as the arms carrying the tools, and with a uniform diameter of 10 ft. 4 in.

The rock as loosened by the tools varied from a small amount of fine dust to pieces 6 to 8 in. in their maximum dimensions, the majority of the muck being about an average between these two extremes. The loosened material was picked up by buckets attached to the rim of the disk, and delivered to a traveling conveyor-belt that extended through the hollow shaft carrying the disk, to the rear end of the machine. These buckets radiated from the center and extended through the rim of the disk. Some of the rock loosened by the cutting tools fell directly into them, and the remainder was picked up from the bottom of the cut by them. The buckets were shaped to dump from their inner ends when they were in the highest position, the material falling through a hopper directly on the conveyor belt. As considerable dust was formed at the face when the machine was in operation, a fine spray of water was directed continuously against the face.

The conveyor belt was geared to the same shaft to which the shaft carrying the disk was geared, so it started and stopped with that shaft. The belt delivered to the boot of a bucket elevator at the rear end of the machine. This elevator raised the material and dumped it into a long narrow storage hopper suspended from the top of the cylinder. Enough clearance was made between the bottom of this hopper and a working platform in the cylinder so small cars could be run under the hopper and filled, four independently-operated gates permitting four cars to be filled simultaneously. Arrangements were made to carry cars to the surface by a freight elevator in the shaft from which the tunnel was driven.

The machine was arranged to make an advance of 2 ft. before it had to be moved forward. The shaft carrying the disk on which the planer tools were mounted was automatically pushed ahead by four positive-feed screws which bore through rollers against the rear face of the disk. These screws were geared to the 4-ft. shaft, so their rate of feed was controlled by the speed of the latter. Split nuts engaged the screws directly and could be released at will when the 4-ft. shaft was to be withdrawn into the cylinder. In order to provide for the travel of the shaft the various gears on the latter were made a little more than 2 ft. wide.

The machine rested on two pairs of high-power pneumatic jacks while in operation, one pair near the front and the other near the rear, both pairs being on the center line of the bottom of the tunnel. Eight pneumatic jacks, in two sets of four each were placed radially, to keep the machine in alignment while it is in motion. One set of jacks was placed toward the front end and the other toward the rear end of the machine, the four jacks of each set being placed one at each of the four 45 deg. points. The shafts of these jacks were all controlled independently so the course of the machine could be altered readily by manipulating them.

Two tandem-compound high-power pneumatic jacks were used to push the machine ahead. One of these jacks was placed along each side of the cylinder on the horizontal diameter of the cross-section of the latter, and toward the front end of the machine. The shafts of both jacks extended to the rear of the machine where they bore against a heavy built-up steel ring that is carried loosely at the end of the cylinder. This ring could be brought to bear against the sides of the machine with sufficient force to furnish a blocking base for the heavy moving jacks.

The motors driving the machine were operated from a switchboard at one side of the rear of the conveyor belt near the rear end of the machine. The various pneumatic jacks were operated by valves grouped together on the opposite side of the end of the conveyor belt. The operation of the machine could thus be controlled entirely by two men.

After the machine had been set up in the shop for trial runs, it was partially dismantled and shipped to the site, where it was re-erected in a chamber that had been built along the line of the tunnel adjacent to the bottom of the shaft. This erection was handled with less difficulty than might be imagined, although it had to be carried on in very congested quarters. The interior of the cylinder of the machine was almost completely filled with gears, jacks, shafts and so forth, a narrow man-way along each side of the revolving 4-ft. shaft being the only space not occupied.

The machine was arranged to cut at the rate of 1 in. a minute, but the rate of cutting could be changed quickly if materials of varying density were encountered. With ordinary tunneling methods the shale is of such nature that it would all have to be loosened by blasting before it could be removed, which would result in a large amount of breakage outside the lines of the tunnel as prescribed by the plans. This space would have to be filled with concrete, without pay, and it was considered that the saving of this extra concrete that could be made in the tunnel through the use of the machine would more than defray the cost of the latter.

A complete and exhaustive trial of the machine in the tunnel demonstrated that progress satisfactory to the engineers in charge of the work could not be made with it, so it was abandoned and removed, in order that the tunnel could be driven by ordinary methods. This journal has not been authoritatively informed to what cause the failure of the machine is to be attributed, but local reports indicate an inability to mesh simultaneously the sleeve nuts on the four positive-feed screws which bore through rollers against the face of the disk carrying the cutting tools, with the result that this disk could not be maintained normal to the axis of the tunnel.

The Para Harbor Improvements.

The Para harbor improvements, which have been undertaken under a concession from the Brazilian government furnish an instructive example of the valuable assistance private capital can render in the most important public works of a national nature, provided those furnishing it are assured of reasonable treatment. One of the notable commercial movements taking place today is the development of the great rubber district in the upper part of the Amazon valley and the improvement of transportation facilities so that the products of the east slopes of the Andes may be sent eastward instead of westward over the mountains and by a circuitous route to Europe. This development of the Amazon valley is a natural result of the growing importance of the Brazilian rubber trade, which has surpassed that in coffee of late, and has led to a better appreciation of the other resources of the valley. This has an area more than twice that of the Mississippi and discharges about three times as much water into the sea 65 miles to the east of Para, the port of this great district. The present port facilities of this city are admittedly inadequate for the existing business and would be a serious check on that of the future, so the government has granted a concession to parties with whom Dr. E. L. Corthell of New York is interested to build a modern port and collect port dues. In case the latter do not yield 6 per cent. on the investment, the government practically obligates itself to make up the deficiency. There will be a dredged entrance channel 1,000 ft. wide and deep enough for 10,000-ton vessels extending from deep water to the main quay, a distance of about 1.8 miles. The quay will have a rubble foundation and concrete superstructure, and will be equipped with fixed and movable electric cranes, warehouses, coal-handling plant, railway tracks and all other facilities needed to handle the business in the most economical and speedy manner. The construction will be carried out by S. Pearson & Son of London and Messrs. Schneider of Paris, and it is expected that the first section will be completed and put into service about 1912.

Book Notes.

The excellent collection of "Mechanics Problems for Engineering Students," prepared by Prof. Frank B. Sanborn, has been revised and enlarged. The book contains a great variety of problems drawn from regular engineering work to illustrate the principles of work, force and motion in a more interesting way than by the usual abstract exercises. It is a book equally useful to the teacher and to the ambitious student. (New York, John Wiley & Sons, $1.50).

The sixteenth annual edition of "Hendricks' Commercial Register" contains the names and addresses of over 350,000 parties covering the building, engineering, mechanical, railway, electrical, mining and metallurgical industries, classified under more than 31,000 headings. The publishers make no charge for fully classifying any firm's business, and the work is done solely with a view to answering completely all reasonable questions with which a reader turns to such a volume. Special attention has been paid to classifying the names so that the lists are equally useful to the purchasing agent or the catalogue distributor. For example, all parties having a machine shop or foundry are classified under the head of "Machinists and Founders" for the use of those desiring a mailing list of these trades, and each party is classified under heads covering every variety of its products, so that the names are available for the use of a purchasing agent. The book is the result of evolution from a list of the building trades which had only 1,648 classifications. From this small beginning in 1891 it has steadily grown in scope, size and accuracy, until it is recognized to-day as one of the best trade lists published. (New York, S. E. Hendricks Co., $10.00).

A new edition, the fifth, of Mr. Austin T. Byrne's "Treatise on Highway Construction" has been brought out, with about 120 pages of additional information. It has the same merits and defects as previous editions. Some of the information is practically obsolete, such as that relating to cement and concrete, and there are many sentences and paragraphs which are certainly not in harmony with the opinions held by some experienced paving specialists. On the other hand some of the chapters are particularly comprehensive and reliable. This inequality in the character of the contents can hardly be avoided, however, in a new edition of a book on a branch of engineering changing so rapidly as that under consideration. The great strides made during the last five years in the chemical technology in asphaltic cements, the progress in the construction of broken stone roads, the development of treated wood blocks and the improvements in asphalt blocks only recently undertaken, have rendered paving an interesting subject of study to those fortunate enough to become acquainted with what is taking place. As a result of this progress there is particular need of thoroughly revising books relating to paving work; Mr. Byrne would have done well, therefore, to have thrown away much more of the obsolete material in his book and to have condensed other parts. The book would have lost nothing of its encyclopædic character and gained in reliability; there is so much valuable information in the book, arranged so well for quick reference, that the next revision ought to be conducted thoroughly, so that the merits of the large amount of valuable matter are not overshadowed by the out-of-date or erroneous portions. (New York, John Wiley & Sons, $5.00).

Prof. Geo. C. Shaad, of the Massachuetts Institute of Technology, has written a good general manual of the engineering features of power stations and transmission. His purpose has not been to furnish a complete treatise, but merely to provide a general discussion which is accurate and at the same time not so technical that none but a graduate of an engineering college can read the book to advantage. The volume, which bears the title "Power Stations and Power Transmission," opens with a discussion of the location of the stations and the selection of the system of generating and transmitting the power. The general design of steam and hydraulic plants is then briefly outlined, after which the electrical equipment is explained. This section is followed by one on station buildings, records and office management. The whole first part is thus a well-balanced description of what may termed the generating end of the power plant. The second part is devoted to power transmission, and will be found particularly useful by those engineers who wish to obtain a general knowledge of the methods of designing this portion of a general power development undertaking. The author takes up in turn the methods of calculating the size of conductors, the various losses in transmission and the construction of the various parts of the line. This section of the book has been well prepared and may be profitably read in particular by those who have to take up for the first time such work. (Chicago, American School of Correspondence, $1.00.)

The young man who goes from a preparatory to an engineering school frequently finds the transition a disastrous one, largely because he has not been taught to make independent use of what he has learned. Hence there is a growing appreciation of the fact that the transition should be accompanied by training in the application of the knowledge gained in the preparatory school, in order to make the student realize that he has acquired an increased mental power, to review the work of the preparatory school in an interesting manner, and to give an outlook over the work of the engineering college. As a rule the preparatory work is least satisfactorily done in mathematics, and in order to remedy this defect, Prof. P. A. Lambert, of Lehigh University, has written a little book on "Computation and Mensuration," as a review of algebra, geometry and trigonometry and an introduction to their applications. The book assumes that the student has free access to his text-books on the branches mentioned and no attempt is made to prove formulas derived in such text-books. The book is an excellent introduction to a college mathematical course, particularly as it gives information concerning approximate and graphical methods of computations which are not ordinarily taught in preparatory schools. (New York, The Macmillan Co., 80 cents.)

Although the development of grinding and lapping in recent years has been one of the most interesting features of machine shop practice, very little has as yet been published concerning this and there is no general handbook on such work. Mr. Joseph V. Woodworth has accordingly rendered a distinct service in writing his manual bearing the title of "Grinding and Lapping." The book is in five sections. The first takes up the conditions, rules, methods, processes and attachments for accurate grinding and the use and preparation of abrasives. The second section is on laps and lapping; it discusses the construction and use of tools and processes for finishing gauges, tools, dies and machine parts to accurate dimensions. The third section is on the use and operation of grinding fixtures and jigs, for finishing repetition articles of metal, small hardened and tempered steel parts and special work. The fourth section is on hardening and tempering interchangeable tool-steel parts of delicate structure, which require to be ground and lapped afterwards. The fifth section is a table of the percentage of carbon that crucible steel parts of tools should contain, temper colors to which they should be drawn and degrees of heat for giving them proper tempers. In many respects the book is one of the most interesting contributions to our American works on machine shop practice, and the fact that almost all of it describes methods followed by the author or designed by him adds to the value of the text. Throughout the book there are references to experience with various methods of grinding and lapping which are decidedly instructive. (New York, Hill Publishing Co., $2.00.)

Letters to the Editor.

Cost of Hauling Farm Products to Market.

Sir: In the first article in your issue of Sept. 28, you mention me by name as having criticised some statistics published by the U. S. Department of Agriculture concerning the cost of hauling farm products to market, which reminded me of another investigation I partially completed some months ago and laid aside for lack of time; but as it is not likely to be completed soon, I will present a summary of it here, as it bears upon the matter to which you referred.

The Road Inquiry Office of the United States Department of Agriculture, under date of April 4, 1896, published in Circular 19, the data received from 1,061 counties. The conclusion is that in 1895 it cost the farmers $662,000,000 (70 per cent. of $946,314,665.54) to haul the crops of that year from the farm to the market.

Under date of Feb. 28, 1907, the same Department in Bulletin No. 19 of the Bureau of Statistics, publishes the data on Cost of Hauling Crops from farms to Shipping Points received from 1,894 counties. The conclusion of the later, and more elaborate, investigation is that in 1905 the cost of hauling twelve leading farm crops was $84,684,000. Of course, these twelves crops are not all that was hauled to market; but they must constitute the major part of the farm products. One of the points upon which I have been waiting for additional information is the magnitude of the other crops, but so far I have been unable to get any light.

On the face of the returns, the cost of hauling crops from the farm to the shipping point in 1895 was almost eight times as much as in 1905; but statistics of the same Department show that the weight of the seven leading crops in 1905 was a trifle more than double that of 1895. Therefore we may fairly conclude that the cost of hauling the crops to market as given by the first circular is practically sixteen times as great as that stated in the later Bulletin.

There are four serious errors in the last investigation, each of which tends to make the conclusion too large.

1. The question asked for the "usual medium load for each of the principal products." The mean between the heaviest and the lightest load may differ greatly from the average of the loads actually hauled, since the bulk of the products are hauled when the roads are in better than average condition. According to the U. S. Bulletin the average load of corn in Illinois is 2,754 lb., while the Illinois Agricultural Station in Bulletin No. 50 published the statistics for marketing 311,845 bush. of corn, which shows that the average of loads actually hauled was 62 bush. If this was all shelled corn, the average load was 3,468 lb.; and if it was all unshelled corn, the average load was 4,400 lb. As doubtless the most of the corn was shelled, the average load was probably only a little greater than 3,468 lb.; but even the 3,468 lb. is 21 per cent. greater than that stated in the U. S. Bulletin.

2. The cost to the farmer of a team and driver is assumed to be "the price for which teams are hired for any purpose." Of course there is a great difference between the actual cost to the farmer of a man and team hauling crops to mar-

ket, and the price paid for driver and team to work, say, at railroad grading, or hauling a highway bridge to its site. Judged by the estimates of 310 farmers in 76 counties in Illinois, reported in the Illinois Bulletin mentioned above, the price assumed in the U. S. Department Bulletin is about 24 per cent. too large.

3. The question asked for "the greatest distance of haul by any considerable number of farmers," and the assumption was made that the answer to this question represented the radius of the tributary area. This procedure overlooked the fact that for many places there is one direction from which produce is hauled much farther than from other points of the compass; in other words, this method measures to the end of the pan-handle to find the area of the pan. The U. S. Bulletin states that the average length of haul for corn in Illinois is 5.7 miles, while by the Illinois Bulletin referred to above the average length of haul in marketing over 300,000 bush. of corn as reported by 316 farmers in 76 counties was 3.2 miles. Apparently then for this reason the results in the second U. S. Bulletin are about 44 per cent. too large.

4. The amount of wheat hauled by wagons from the farm to the mill is not included in the statistical returns, but this item is estimated and then added. This esimated correction is distinctly equivalent to saying that a trifle more than one-third of all the wheat not used for seed is hauled in wagons to the local mill. The amount thus added is almost one-sixth of the total weight of all other crops, and hence any considerable error in this item will materially affect the final result. I have looked for statistics by which to check this estimate, but have found nothing of value. However, in view of the great quantity of wheat that is exported unground and also of the large amounts that are ground at Minneapolis and other milling centers, it can not be that more than one-third of the wheat not used for seed is wagoned to the local mill.

If we correct the results of the second U. S. Bulletin as stated in paragraphs 1, 2 and 3 above, the actual cost will be about 44 per cent. of that stated, not counting the error referred to in paragraph 4. The cost of hauling crops from the farm to the market stated in the first U. S. Bulletin is then about thirty-six times the value given in the last bulletin, provided we assume that the latter value includes substantially all the farm products. If we should allow 25 per cent. for the omitted crops, and should neglect the error in the opposite direction referred to in paragraph 4, the results in the first U. S. Circular would still be twenty-seven times too great.

Of course the above method of "correcting" statistics is not mathematically exact, but it is certainly sufficient to show the absurdity of the first circular referred to. Unfortunately that investigation has been largely used in discussions of wagon-road economics, and the only object of this communication is to show its utter unreliability. The hope is that with these very erroneous statistics out of the way, a more rational consideration of good-road problems may prevail.

Ira O. Baker.

Champaign, Ill., Oct. 4, 1907.

The New Waihee Canal.

Sir: The completion of the new Waihee Canal on Maui adds another important irrigation work to the sugar industry of the Island of Maui and the Territory of Hawaii. The new ditch provides first, for the irrigation of the several thousand acres of new land of suitable quality for the successful cultivation of sugar cane, heretofore arid and utilized only as pasture land; second, for a permanent supply of water for the cane lands already under cultivation; and third, for conveying the freshet water of the Waihee Valley to storage reservoirs where it is conserved for irrigation purposes, thus augmenting the normal water supply derived from the Waihee, Waiehu, Iao and Waikapu streams.

The division dam and head-works of the canal are located just below the famous Aliele Falls in the Waihee Valley, at an elevation of 649.5 ft. above sea level and 2½ miles up the valley. The cement-lined ditch from the dam and head-gates is located along the south bank of the Waihee Stream on a bench wall above the flood line, passing almost immediately through Tunnel O, 320 ft. in length. The conduit extends some 2,000 ft. to the portal of the next tunnel and thence continues, still tunneling the mountain spurs and high ridges forming the foot hills of the high mountain range of West Maui, spanning the deep gulches by flumes and skirting along and through the cane fields by open ditches to the north bank of the Iao Valley near the town of Wailuku, for a distance of approximately six miles. The original contour survey showed nine miles, making a saving of three miles of conduit by the present line as constructed. It next crosses the valley by pipe line and continues by easy curves and long tangents through the cane fields of the Wailuku Sugar Co. to the Waikapu Valley in open ditch, thence by tunnels and cutting under the Waikapu Stream, again following the grade contour through the new lands of Waikapu and Puuhele Plains, where many new reservoirs are located.

The conduit consists of 22 tunnels, having a total length of 16,539 ft.; 39 flumes aggregating 2,764 ft.; 35,549 ft. of open ditch, and 1,253 ft. of pipe, making a total of 56,105 ft. or 10.62 miles.

Of the 22 tunnels, the longest is 2,246 ft., located in the Waihee Valley, and the shortest is in the Waiehu Valley, making the average length of all the tunnels approximately 750 ft. The dimensions of the tunnels are as follows: Bottom width, 5.5 ft.; center height, 6.5 ft.; side height, 4 ft., with width of 6.5 ft. at the spring of the arch, making a cross section similar in outline to a horseshoe.

All of the tunnels are cut to a true line and uniform grade of 0.25 per station of 100 ft. or 13.20 ft. per mile, except the first tunnel, which is of a smaller cross-section and has a grade of 3 ft. per 100 ft. and is cement lined and arched with concrete. About 40 per cent. of the tunnels are lined with concrete and cement plaster to prevent loss of water by seepage and caving where the rock is soft and porous.

The cutting of tunnels was all done by Japanese labor, the contract prices ranging from 85 cents to $5 per foot, according to the material cut, the location and the length of the tunnel. Eighteen months were required in cutting the longest tunnel, 2,446 ft. in length. Very hard rock was found. Compressed air and percussion drills were used in four tunnels. The formation in the long tunnels was principally of lava rock of alternate strata of aa and pahochoe, with a slight dip to the sea.

The flumes, 39 in number, vary in size according to grades and capacity required, 3 x 4, 4 x 4, 4 x 6 and 4 x 7 ft. The waterways are constructed of redwood lumber with trestle and floor system of northwest lumber.

The open ditch varies in cross-section and grade to comply with the conditions of soil and capacity, being designed to carry the maximum capacity without cement lining. Approximately 20 per cent. of the open ditch has been cement lined on bottom and sides.

The steel pipe line crossing the famous Iao Valley is 1,253 ft. in length and 3 ft. inside diameter, conveying the water under the bed of the Iao Stream and delivering it into a cement basin 13 ft. in diameter, thence through a tunnel 439 ft. in length to a permanent weir, where the total flow of the canal can be accurately measured at all times.

Waihee Dam.

Weir on Main Canal.

Headgates.

The capacity of the conduit is 45,000,000 gal. in 24 hours, or 69.81 cu. ft. per second, after making liberal allowance for seepage and evaporation.

Construction on the canal was commenced in March, 1905, and completed in June, 1907. The construction of the canal was the result of an exchange of land and water rights on the part of the Wailuku Sugar Co. and the Hawaiian Commercial & Sugar Co. in settlement of their respective rights to the waters of the Iao Valley, which had been in litigation for years past. The cost of the canal in round numbers is $160,000.

The writer has been chief engineer of the works from start to finish, locating and designing and constructing the works of the Wailuku Sugar Co., of Wailuku, Maui, Brewer & Co., of Honolulu, Agents. Mr. George B. Sturgeon, now of Oakland, Cal., was assistant engineer, with location and the principal portion of the construction work.

Jas. T. Taylor,
Member American Society C. E., Consulting Hydraulic Engineer.

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Of this issue of THE ENGINEERING RECORD 14,500 copies are printed. Total circulation for 1907 to date, 626,000 copies, an average of 14,588 copies per week.

TABLE OF LEADING ARTICLES.

The Status of Wireless Telegraphy.

The other day, with a considerable and not unjustifiable blare of trumpets, it was announced that the Marconi transatlantic service was definitely established between the Port Morien and Clifden stations, the former near Glace Bay, the latter on the coast of Ireland. From this time on, it is stated, the wireless system will be in regular competition with cable service. At this point in the history of wireless it may be well to run over some past happenings to gain thereby some idea as to the real status of the art, and some notion of its usefulness in the immediate future. Far be it from this journal in any way to dim the lustre of William Marconi's achievements; he deserves well of the world as the practical pioneer in a new art. Yet it cannot be denied that wireless telegraphy as a whole has not yet fulfilled the promise of its beginnings and has at times been a grievous disappointment. The Engineering Record hopes that this latest effort marks the beginning of a period of uniform success and only occasional failure, instead of rather uniform failure enlivened by brilliant and inexplicable successes.

Wireless telegraphy has had in its short life a singularly checkered career. Nothing more uncanny and weird than this system of annihilating space had ever dawned upon the world save the lurid and cometary blaze of promotion which has followed in its trail. It is now more than five years since the first alleged transatlantic messages flashed across the speculative horizon. Just what really happened at this period few know and none are likely to tell for years to come. It seems to be well established that signals from shore to shore were actually transmitted and received, but there were disquieting rumors of the use of the old reliable cable for the messages of congratulation which have never been adequately disproved.

Whether connected messages via wireless were received at this time or not, it is certain that their transmission was little better than fortuitous. It is simply unthinkable that even a moderate regularity of success would not have promptly been followed by some serious effort at doing business, with a less delay than five years at least. Instead, there have been dismal failures of wireless transmission, at very moderate distances even over water, failures that do not of course score heavily against the future of the method, but merely show that the art is not yet upon a sufficiently sound theoretical basis to eliminate the frequent interference of the unforeseen. Mingled with these there have been brilliant successes, at times by all the varieties of the wireless systems in vogue. The cruise of the "Carlo Alerto" did much to restore the confidence that had been shaken by the first transatlantic fiasco, by proving that readable messages could cover distances at least comparable with the width of the Atlantic. Later installations on naval and merchant vessels have co-operated with shore station in some very long transmissions rising at times to a couple of thousand miles and more, although not with much regularity. It has not been unusual of late for an Atlantic liner to keep in touch with one shore or the other throughout her voyage. Most attempts at wireless working have been greatly handicapped by quite insufficient energy supply, and there is every reason to suppose that increasing the available power as Marconi has done in his recent stations will enable the reliable range of transmission to be greatly increased. Whether he has increased this range to the width of the Atlantic the trials now in progress will presently prove. When business men settle down to using the system as an ordinary means of communication its success will be firmly established, and that may be within a very short time.

It is hard to set a limit to the applicability of wireless in view of the distances that have already been covered. The most serious practical question at present is that of interference. Each wireless system has made its claims of syntonic operation, but The Engineering Record does no conscious injustice to anyone in saying that such claims have not yet been shown to rest upon any firm foundation. Interference has been the practically invariable rule whenever two systems have been within reasonable striking distance of each other. It would be interesting, for example, to know the truth about the colossal hoax which was apparently perpetrated on Marconi the other day in the alleged message intercepted from Manila announcing the safe arrival of the U. S. S. Philadelphia, which worthy craft has been securely moored in Puget Sound for the last three years. It is altogether reminiscent of the famous dispatch from Major Reflipe W. Thenuz perpetrated during the Spanish war. So long as the longest practicable waves are necessary to carry the energy sufficient for a long transmission, and everyone undertaking long distance work must push toward this limit of practicability, there seems to be no reasonable chance of avoiding interference. Something could perhaps be done were all wireless stations worked as a harmonious whole with spheres of influence connected in definite ways, but at present this unity is very far from being secured. This much is certain, however, that at the present time wireless telegraphy can, if systematically utilized, make all the seas familiar ground. It would be well within the range of feasibility to net the earth with international stations so disposed that no ship could be out of instant touch with shore. For instance, the Atlantic could be easily covered from Newfoundland, Bermuda, Barbadoes, the Cape Verde Islands, and the Azores in the northern waters, and Ascension, St. Helena, Trinidad and Tristan d'Acunha in the southern, co-operating with shore stations. Such a conquest of the waters would be of vastly greater solid benefit than any of the sensational feats which are so tempting to the imagination. Meanwhile success to Marconi in his present efforts and may he fully succeed!

Heating and Ventilation Tests.

It is doubtful if any branch of mechanical engineering practice offers a more fertile field for investigation at the present time than heating and ventilation. The design of an important installation of this character involves many assumptions as to the leakage coefficients, radiation losses, and aid friction expected; and while a great deal of excellent work is being done in this line, as the results in many installations show, there is certainly need of more definite knowledge of the conditions which insure success or failure in specific plants. Taken in itself the heating problem is much less difficult to solve in most cases than the securing of good ventilation, but the two are bound so closely together that they ought not to be considered separately either in designing or testing the performance of individual plants. Failure to appreciate the particular conditions of plants from both standpoints has injured the reputation of heating and ventilating practice not a few times in the judgment of the general public, which estimates the performance of an installation by its personal feelings and comfort rather than by quantitative tests.

In a branch of engineering where so many uncertainties are involved, or at least so many assumptions, the accumulation of a large quantity of test data is essential, beyond the usual extent, to the harmonizing of theory and practice. Many engineers are collecting this kind of information for their own private use, and of course much of it is rightly considered as personal stock in trade. At the same time, there is great need of bringing the technical considerations of the work down to a more generally available form, and the presentation at this time of two or three exhaustive paper by men in practice on specific problems in heating and ventilation, either in the technical press or be-

fore the engineering societies, would stimulate progress and be widely helpful in breaking down the eccentricities of a highly individualized practice. No matter how fully data may be published, on complex work of this kind, the value of judgment can never be replaced by the mere possession of formulas and constants. The right use of the latter with knowledge of their limitations must invariably be largely settled by experience. When these are supplemented by tests, real progress lies close at hand.

The range of tests possible in a heating and ventilating installation is very broad, and in many commercial instances only the fundamental issues can be determined. The quantity of air supplied per capita per hour, the quality of the supply and the temperatures obtained in the principal rooms are essential to any proper appreciation of the working of an installation. Combined with these factors in the comfort of the users of the premises is the question of operating economy, expressed more or less indirectly by the size of the coal bills. It is quite as important to keep a daily log of the heating plant as to prepare and submit regular operating records of a power installation to its owners, though in many quarters this is not yet fully realized.

As soon as one begins to measure the quantities required in a heating and ventilating test he must realize that scientific accuracy is a very difficult thing to secure. Temperature measurements can, of course, be carried to great refinement, if desired, but accurate determinations of air velocity and volume are not easy to make. An error of even 2 or 3 per cent. in the velocity measurement means the inclusion or exclusion of a large volume of air when multiplied by a considerable duct area in a building seating several thousand people. The calibration of anemometers is sometimes attempted by timing with a stop watch the speed of an observer traversing a known distance with an instrument in his hand, but it is a question if such a calibration can be relied upon to any considerable extent. Certainly for an accurate test upon a plant moving scores of thousands of cubic feet of air per minute, the anemometers used should be calibrated by physical laboratory methods. In some tests air velocities measured in one or two representative ducts have been taken as bases of operation throughout the entire installation, particularly where the ducts are not readily accessible. Such assumptions are dangerous to make if accurate figures are desired, and in any test carried out thoroughly as far as it goes, the data secured will show the velocity of air at every outlet which is essential to the proper operation of the system installed.

Fan speeds measured with a tachometer and not taken from the manufacturer's name plates are equally essential. One of the most important interpretations to be made from a heating and ventilating test when forced or induced draft is employed is the relation of fan speed to the volume of air delivered. Even if the exhaust from the fan engines be delivered to the indirect heating coils, the supply of the necessary quantity of air per capita per hour calls for the adjustment of fan speeds in relation to the external temperature and weather conditions; and in the case of variable speed motor-driven fans, the saving in power gained by not operating at abnormal speeds in relation to the requirements is well worth securing.

Air discharges in outlet ducts furnish helpful data in almost every case where the test is carefully made. The effect of damper adjustments, both automatic and manually operated, is interesting to study in a concrete installation, especially in plants where mixing dampers are in service. In this connection, the sensitiveness and speed of automatic themostat control deserve more attention than they ordinarily receive. In tests of refrigerating systems the response of the regulating valves to slight changes in temperature is almost always carefully watched, and no less of a working examination should accompany a heating test, whether the test be on a newly completed or a long established installation. Complete temperature readings in all the vital portions of a heating and ventilating system are imperative if correct deductions are to be made. The mean of several readings per duct or per room is none too good an index of the varying conditions to be expected in practice.

For the majority of cases the purity of the air can be sufficiently well determined by the phenoephthalein lime-water test, in which the time required to eliminate the pink color in a carefully prepared solution is noted when the solution and the air sample are brought into intimate contrast. According to Coyne's method, this time with a properly prepared solution is indirectly proportional to the amount of carbon dioxide present. Nothing short of a chemical analysis will show the accompanying atmospheric impurities in an air sample, but in the absence of any fixed standard of impurity other than the carbon dioxide figure, this simple test is doubtless acceptable enough for all but the most disputed cases. No heating or ventilating system can eliminate the dangers of atmospheric pollution from bacteriological causes, but in securing the presence of a low percentage of carbon dioxide the engineer helps to keep the standard of vitality at a high point per capita. Hence no test of the general value of a heating and ventilating system is complete without careful approximate measurements of the carbon dioxide present. The cleanliness of the air supply is well worth noting in such tests, by reference to scrubbing and washing apparatus when the installation contains such equipment.

On the heating side the most thorough study of a plant calls for an evaporation test on the boilers, with separate calorific determination of the fuel, and close checking of weights before the efficiency of steam application can be known. Given these boiler data and knowing the heat distributed in the steam supply, a fair check upon the efficiency can be obtained by weighing the returns and noting their temperature on the feed water side of the system. Where the run of piping through tunnels or walls is considerable before the direct radiators are reached, it may be necessary to make separate tests of radiation losses on known lengths of pipe in order to make the necessary deductions from the total heat units supplied to the distributing system. Where both direct and indirect radiation are tested at the same time it is necessary to separately measure the effect of changes in each system if the performance of either is desired in detail.

It is evident upon very limited consideration that the range of quantities and inter-relations open for actual research in heating and ventilating systems is almost unparalleled in the field of mechanico-physics. In the preceding paragraphs only the more important quantities and measurements have been mentioned. The working out of heat losses in detail, the study of the heat conducting and radiating characteristics of different types of apparatus, and of varying forms of wall, ceiling and floor construction, the analysis of resistance in ducts as affected by curves and elbows, the study of air leakage under different conditions of weather, and the consideration of fuel consumption in relation to the plant design and conditions of operation, furnish ample scope for research activities. Still another reason for the practice of heating and ventilating tests is to make sure from time to time that the installation is being handled as well as possible. It frequently happens, especially in school houses and other public buildings, that while a heating plant may start in economically, changes in the use of rooms, alterations in the buildings, or sometimes corrupt political practices place burdens upon the system which it was never designed to meet. The light which a test by a responsible engineer throws upon the conditions obtaining in a heating plant often points the way toward radical economies, either in the purchase and use of fuel, or the handling of the plant itself.

The Great Inland Waterway.

An unusual role has been played in the history of Chicago by zoological circumstances. For a considerable time many residents of the inland metropolis were accustomed to consider the proper representation on the city's shield to be a cow rampant, surmounted by a kerosene lamp. But it looks now as though this familiar blazon must be exchanged for an ursus couchant, for our honored chief magistrate, having at last found and slain that bear in the Louisiana canebrakes, has emerged from his seclusion, elated and happy, to tell the people of Vicksburg that no American president could spend his time better than by seeing for himself just what a rich and wonderful region the lower Mississippi Valley is. He has also acquired the "set purpose to do everything that in me lies to see that the United States does its full share in making the Mississippi River a part of the sea coast, in making it a deep channel to the Great Lakes from the Gulf." In the study of the subject which he evidently gave it in company with the engineering specialists who assembled to conduct the siege operations of bruin, he ascertained that with one-tenth of the effort spent by the people of Holland in taking two-thirds of their country out from under the ocean, the United States can remove the incomparably rich bottom land of the lower Mississippi from all fear of flooding by the Mississippi River, by a high and broad levee system. The matter is settled, moreover, that the deep channel and the high and broad levees shall be built. The president intends to start the project on principles that will prevent mistakes, extravagance and misapplication of effort. "I shall have no small difficulty in persuading some people," he stated at Vicksburg, "of the wisdom of a policy such as that I advocate, a policy that means the expenditure of money, a policy which must continue over a long course of years. If that policy is tainted in any way by jobbery or folly, it will be immeasurably more difficult to carry it through. What we must look out for is the action of the men, probably well-meaning, who in their anxiety to serve some particular district, will try to divert what should be a national effort to deepen a great national highway into a succession of efforts spread out so thin as to make all ineffective."

It is instructive, indeed, to observe the energy with which our honored chief magistrate has thrown himself into the cause of a deep waterway from the Great Lakes to the Gulf. The fact that the majority of leading engineers of the country are by no means convinced of the desirability or even the actual financial practicability of such an undertaking apparently has no influence in checking his unqualified support of the project. The mere fact that it seems to lack this support from those most competent by training to appreciate the problems involved and the

interests to be served by an enlarged channel will doubtless render the president's help extended to the advocates of the undertaking more vigorous and outspoken. We have all observed the great fondness he has displayed toward minority engineering opinions. And the fact that the desirability of a deep waterway from Chicago to the Gulf is at the present time advocated mainly by those who are least competent by training to express an opinion on the subject, or else by those who have an axe to grind, will doubtless be taken as merely an indication of the necessity of an educational campaign on his part.

In making these observations, there is no intention of asserting that an improved waterway from the Great Lakes to the Gulf will not be useful. It goes without saying that some use would be made of such a channel immediately upon its completion. The question at issue is whether the channel will be worth the expense, and, so far as The Engineering Record has yet been able to learn, there is no proof that money spent for a 14-ft. channel would not be about as well used in providing a game preserve near the White House. But this does not mean that a thorough study may not indicate the desirability of some kind of improvement. If the president's advocacy of a deep channel results in a thorough study, it will have been a national service. If that study is made by competent men, who are unbiased by the complications involved in the disposal of the sewage of Chicago by the method of dilution, the country will be thankful indeed. At the present time it seems hardly possible to differentiate between the people who desire to have a waterway for the purpose of navigation and those who believe that in some way or other the Trustees of the Chicago Sanitary District should be allowed to take a large amount of water from the Great Lakes for the disposal of the sewage of the community about the end of Lake Michigan.

Elsewhere in this issue will be found a summary of an important report made by Mr. Rudolph Hering, who designed the Chicago drainage canal, to the Trustees of the Sanitary District advocating the extension to the Calumet region of the method of disposal by dilution which the Trustees desire. He states that the anticipated lowering of the water lake level due to the diversion of the 14,000 cu. ft. per second from the lower end of Lake Michigan into the two canals for sewage disposal purposes will not occur, provided the works advocated by the International Waterways Commission are constructed at Sault Ste. Marie. This opinion is a direct contradiction of that reached by the members of the International Waterways Commission. The question is therefore thrown open to debate and the president is faced with the necessity of deciding between an international engineering commission representing the Dominion of Canada and the United States, and an individual engineer. Even assuming that the figures made by Mr. Hering are correct, and this journal does not attempt to pass an opinion on this disputed matter, the president must decide whether the desirability of permitting the city of Chicago to continue the use of a method of sewage disposal which is unnecessary although it may be financialy advantageous, is to outweigh the desirability of increasing the navigable depth of water throughout the Great Lakes, for if water is not diverted for the disposal of Chicago sewage, it will manifestly be available for improving the navigation from Chicago to Buffalo. The problem, therefore, is merely one of the relative interests served by the two methods of using the water.

Along with the disposal of the Chicago sewage, must also be considered the practicability of using for navigation this water turned into the drainage canals. It is fairly well recognized that the hope of sea-going vessels using the proposed waterway from Chicago to the Gulf is founded more on dreams than facts. The type of vessels which are best adapted for sea-going navigation and for use on inland waters are so radically different that the most to be expected from such a proposed channel is a growth of the fleet of shallow-draft vessels now using the Mississippi and its tributaries. Until more facts are ascertained than are now known, any arguments regarding the transportation possibilities of such vessels in competition with railway lines must inevitably be based on so many assumptions that the time spent in making or listening to them will be very largely wasted. Those who believe that a great waterway is needed from the Gulf to the Great Lakes will do more for this cause by securing all definite information bearing on the subject than by indulging in generalities. The cost of such a waterway is so enormous and its construction will extend over such a long period of years that the nation ought, under no circumstances, to be committed to it until every phase of the subject has been thoroughly investigated by competent, unbiased specialists.

The Engineering Record's New Home.

Elsewhere in this number will be found a brief description of the structural features of the new home of The Engineering Record. Many requests for information concerning this building have been received during the past year, but on account of the novelty of some of the details of the design and the special conditions which arose during the preparations of the plans for the structure, it was considered best to defer any detailed description for a paper for the American Society of Civil Engineers. This paper has been written by Prof. Wm. H. Burr, who designed the structural portion of the building, but there are certain comments which should be made in amplication of it. The structure, which is known as The Thirty-Ninth Street Building, was erected by a subsidiary corporation of the McGraw Publishing Company, the owner of The Engineering Record. Its primary purpose is to afford a home for the company and its affiliated printing corporation. Until the structure was erected and occupied, the printing of the company's various publications and books was done in three independent printing offices, and many difficulties are inherent in any such method of issuing large journals every week in editions equal to those of the McGraw publications. By bringing the printing, accounting, business, editorial and advertising departments of the company into a single building, the service that can be rendered by the company is materially bettered. To raise this service to the highest practicable degree it was desirable to have a structure readily reached from all parts of the city where engineers, contractors, city departments and manufacturers' offices are located, and it was equally desirable to have this building near the branch postoffices where second-class or "newspaper" mail matter is received. This narrowed the selection of a site materially and finally resulted in the selection of land on West 39th St., within about three minutes from Times Square, one of the central points of the city. This location is very near the new terminal station of the Pennsylvania R. R. now under construction, and also the Grand Central Station of the New York Central Lines, at both of which places mail matter of the second-class is either received now or will be received. The McGraw Realty Company has also arranged for the use of one floor and part of another floor of the new building as the "Times Square Sub-Station" of the New York Post Office, so that under its own roof there will be excellent facilities for expeditious handling of all mail matter other than that of the second class.

The site selected for the structure is an expensive one and the property in the vicinity is rising with great rapidity. In consequence of this condition ordinary business prudence made it advisable to erect a large building of an attractive appearance, well provided with the customary facilities of a modern office building. Three floors of the building must be occupied by the printing plant, and as the running of rotary presses is likely to cause vibrations, the design of the structure had to provide for the deadening of all such tremors. After an examination of many buildings containing printing presses, it was evident that a steel-cage structure of the height of the proposed building, about 150 ft., would probably tremble while the presses were running more than was admissible in a high-grade office structure, while a reinforced concrete building would probably be free from such vibration. A building of reinforced concrete, which is able to carry such loads as those imposed by printing plants on many of its floors, has to be of unusually heavy construction, and the mass due to the use of so much concrete acts in an efficient manner in absorbing vibration.

After the preliminary plans were worked out, it was found that a structure of the kind best adapted for the desired height could not be erected under the existing building requirements and be a good business proposition, so it became necessary to take up with the Bureau of Buildings the problem of designing columns which would be satisfactory to the Bureau and at the same time be of sufficiently moderate cross-section to leave enough room in the lower floors to render the latter useful for business purposes. Under the old regulations of the Bureau very large columns would have been required, and the proposed structure using such columns would have been a business impracticability. Probably the most interesting feature of the building is the type of columns finally adopted, which is fully described in Professor Burr's paper.

Another feature of the structure to which attention may be called is its exterior. Objections have been raised to the use of concrete in buildings on account of the impracticability of giving it a satisfactory exterior appearance. In some structures in New York this alleged defect has been avoided by using brick facings, and in buildings elsewhere the concrete surface itself has been treated in various ways more or less satisfactory. The Thirty-Ninth Street Building had to be as attractive as possible, and after a prolonged study it was finaly determined to use a sort of stucco of Portland cement and marble dust, which has been employed very successfully for several years in the vicinity of New York. This is a comparatively new proprietary process and the results of its application in The Thirty-Ninth Street Building are very satisfactory. At the present time the building is not entirely completed in some of the minor details, and it is undesirable in consequence to publish at this time illustrations of its appearance now. It may be stated, however, that the expectations of the company concerning it are fully met, and the many novelties, large and small, which were adopted on the advice of Professor Burr and his associates have proved uniformly satisfactory. While the structural novelties are explained in the paper in this issue, the general appearance of the building, the admirable lighting of the various floors on account of the unusual window space and other features which need not be mentioned at this time can only be appreciated by a personal visit, which the company cordially invites all its friends to pay to its new home.

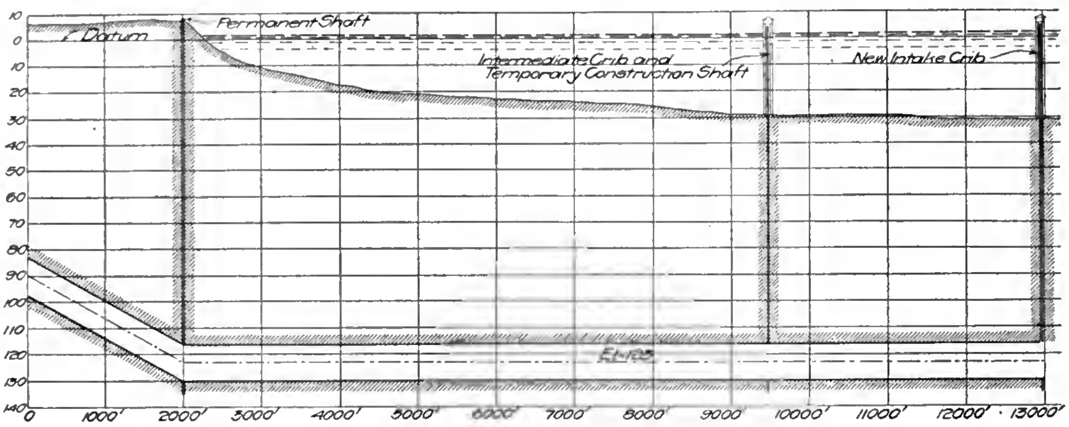
AN UNUSUAL PLANT FOR CONSTRUCTING A SUBMARINE TUNNEL AT CHICAGO.

A noteworthy installation of contractor's plant has been placed in service recently by George W. Jackson, Inc., in connection with the construction of the lake section of a new tunnel for the water-works system in Chicago. This tunnel, generally known as the Southwest Lake and Land Tunnel, is to have a total length of approximately 10 miles, extending from an intake crib about 11,000 ft. off-shore in Lake Michigan from 68th St. to the southwestern part of the city. The intake crib of the new tunnel is adjacent to the intake crib of an existing water tunnel which leads to a pumping station near the foot of 68th St., the shore end of the lake section of the new tunnel being at the foot of 73d St. Based on experience in the construction of the 68th St. tunnel, and on a number of borings made prior to the location of the new tunnel, it is expected that the latter will be entirely in limestone bed rock. The finished cross-section of the tunnel will be a 14-ft. circle for about 2¼ miles from the intake crib to a point where a 9-ft. branch is taken from it. From this branch the section will be reduced to a 12-ft. circle, which continues for some distance to a division of the tunnel into two 9-ft. branches. The tunnel is to be lined throughout with concrete, which is to have a minimum thickness of 1 ft., so the excavation for the lake section is required to be at least 16 ft. in diameter, and involves the removal of something over 125,000 cu. yd. of solid rock from the tunnel bore.

The center line of the land sections of the tunnel are 100 to 110 ft. below the ground surface, the latter being only 8 to 10 ft. above the mean water level in the lake. The tunnel drops on a 1.75 per cent. grade for 2,000 ft. adjacent to the lake, and then continues on a level grade in the lake section, the center line of this section being at a uniform depth of 123 ft. below the mean lake level. The section, which is being constructed by Geo. W. Jackson, Inc., has a total length of 12,180 ft., about 10,800 ft. of which is off-shore under the lake. A permanent shaft, 14 ft. in diameter inside the concrete lining, is placed at the point where the grade of the tunnel begins to rise, approximately 300 ft. from the shore of the lake. The intake crib at the outer end of the tunnel, which is also included in the contract, will be connected with the tunnel by a shaft, 11 ft. in diameter inside the concrete lining.

The lake section of the tunnel will be driven from at least four headings, one in each direction from the foot of the permanent shaft near the edge of the lake, and one in each direction from a temporary construction shaft, 7,500 ft. off-shore. It is also probable that some tunnel driving will be carried landward from the shaft at the intake crib. An unusually complete and extensive plant that has been installed to handle this tunnel-driving is expected to permit the work to be carried forward, day and night, practically without hindrance from the weather, or from rough water in the lake.

Aerial Tramway.—The unique feature of this plant is an aerial tramway, which is an adaptation of the type frequently used in mining districts to handle ore over considerable distances. This aerial tramway has a total length of 8,000 ft., extending from a head house over the permanent shaft on shore to a crib and head house erected at the top of the temporary construction shaft in the lake. It is carried at an average height of 35 ft. above the water by 24 four-leg steel towers, spaced approximately 300 ft. apart. This tramway will entirely preclude any necessity for tugs and scows that would be required to handle the materials excavated from tunnel, to transport men between the shore and the shaft, and to deliver supplies to the latter. The advantage to be gained by overcoming in this manner any dependence on floating equipment can scarcely be appreciated without a knowledge of the weather conditions in the locality and of the rough water which prevails in the lake along this shore during a large part of the year. Around the south end of Lake Michigan high winds are frequent at all seasons, even during fair weather, and in the winter these high winds often continue for several days, while in the summer local storms contribute an added danger. These atmospheric conditions, coupled with the comparatively shallow depth of the lake over the tunnel, cause much rough water, which renders impossible the operation of scows and tugs for considerable periods at a time. In fact, during at least five months of the year practically no reliance could be placed on floating equipment for the service required. At the same time, a very large saving in time, labor and power will be made possible by the operation of the tramway, as compared with the operation of tugs and scows, between the intermediate shaft and the shore. Furthermore, all of the limestone to be removed from the tunnel headings driven from the foot of the intermediate shaft can be saved, and after being crushed is worth $1 to $1.10 on the cars, whereas if an attempt was made to handle this rock from the intermediate crib on scows the rock could scarcely be unloaded at the shore at a reasonable cost, and would more economically be towed out and wasted in the lake. Although these are the chief advantages to be gained in operating the tramway, various others of considerable importance are presented, which in the aggregate render a successfully operated tramway a most economical installation.



Profile of Lake Section of Southwest Lake and Land Tunnel.

An elevation of one of the towers on which the tramway is carried is shown in an accompanying illustration, the towers all being the same. The controlling factors of the design of these towers were the rigidity and stiffness necessary to resist the force of the high wind and rough water to which the whole tramway will be subjected in the open lake. In providing for these conditions in the construction of the towers, a large factor of safety over the maximum load of 8,000 lb. that may be brought on each tower by the tramway is obtained.

Each tower has an extreme height of 30 ft. 5 in. and is 12 ft. square at the base, its four legs converging from the base to the top, as the corners of a pyramid, the tower being 1 ft. x 2 ft. 1 in. in plan at the top. Each leg of the tower consists of a 3½x3½x⅜-in. angle, the four legs of the tower being quite completely cross and sway-braced, as shown in the accompanying illustration, to obtain the necessary rigidity and stiffness.

Each leg of the tower is carried by an extra-heavy built-up steel pile, designed specially for this purpose. The tops of all of these piles are at the same elevation, 5 ft. above Chicago datum, which is about 1 ft. below the mean water level of the lake. The depth of water in the latter increases gradually from about 6 ft. close to the shore to 33 ft. at the outer end of the tramway, the average depth in this distance being 25 ft. The piles carrying the towers were built in lengths varying from 22 to 49 ft. and were driven by a floating pile-driver outfit practically to refusal in the hard blue clay which forms the bed of the lake over the whole site of the tramway, except near the shore, where an overlying stratum of sand and gravel occurs. The cross-section of each pile forms two sides of a hollow square, 12⅞ in. on a side. Two general sections of the piles were built, one for those from 22 to 43 ft. in length, and the other for piles up to the maximum length of 49 ft. Both sections are unusually heavy and are arranged to produce an exceptionally rigid column. The four piles of each tower are fastened together at the top by a pair of diagonal tie rods, and at the water level by two pairs of 2-in. rods, also placed as diagonals. A frame of 12-in. channels, 11 ft. 11 in. square, is also placed horizontally inside the four piles carrying each tower, 6 ft. below the surface, and is lashed to each of the four piles.

The tendency of the towers to tip, due to unbalanced loads on the tramway or other cause, is prevented by six inclined braces to each set of four piles for a tower. These braces are all attached at the water level, and each extend down to an anchorage set in the bed of the lake. Four of them are each at one end of the two diagonals of the square formed by four piles. These four inclined braces on the diagonal lines are 6x6x¾-in. angles, in lengths varying from 14 to 36 ft., depending on the depth of water at the different towers. Each of these angles is lashed to the pile for which it is a brace by a chain rove through holes punched in the angle and in two ½x6-in. reinforcing plates riveted to the upper end of the brace. Each of these four braces are placed at an angle, which brings its lower end 9 ft. from the base of the tower, where it is rigidly fastened to two short pieces of ½x6-in. plates, attached upright in a horizontal plane to two 6x½-in. plates, 15 in. long, which were set vertically their full length in the hard clay by a diver. This arrangement of plates at the base of each brace was provided more as a bearing for the brace to react against when a load is thrown on it than as an anchor.

The other two inclined braces to each set of four piles carrying a tower are on the axis of the tramway, on opposite sides of the base of the tower. These braces each consist of a 9-in. 21-lb. I-beam, reinforced by two 6-in. channels,

one on each side of the web. Each of these braces is attached loosely at the top through a 2-in. pin connection to a 12-in. I-beam placed horizontally between the pair of piles on the adjacent side, the connection being on the axis of the tramway. The lower end of each of these two braces to a tower is attached to a 6-ft. piece of 5-in. 6½-lb. channel, placed normal to the brace and imbedded in the bottom of the lake, to provide a reaction for the brace, the same as in the cases already cited. The lower end of each of these braces on the axis of the tramway is 12 ft. from the piles on the corresponding side of the tower, the length of the braces varying from 15 ft. to about 37 ft., depending on the depth of the water at the towers.

The construction of the towers and the arrangement of the piles on which they are mounted produce a structure for carrying the tramway cables that has already shown itself to be capable of withstanding the heavy seas and high winds which frequently prevail along the shore of the lake. No special protection against ice other than that afforded by the sub-structure of the towers as they stand has been provided, and it is not believed that any such protection will be required.

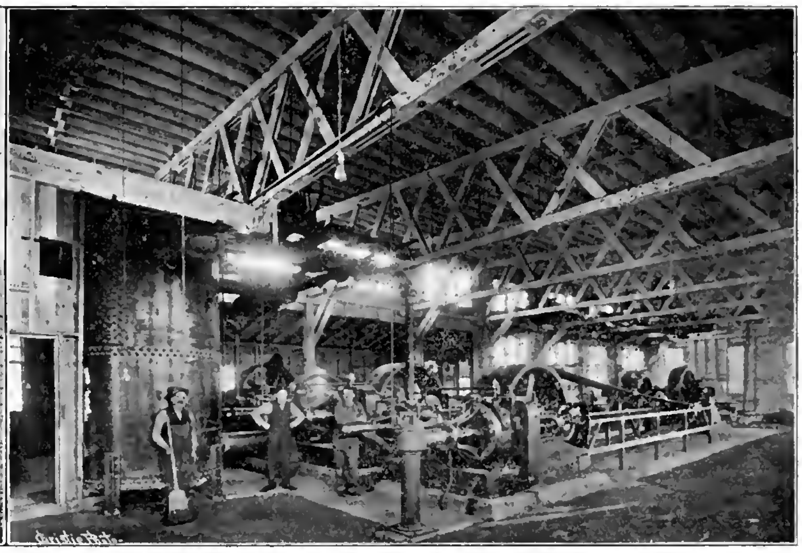
The tramway proper consists of a 1⅜-in. wire track, or carrying cable, and a ⅞-in. traction or trolleying cable on each side of the towers. Buckets are hauled out to the intermediate shaft on the carrying cable on one side of the towers, and back on the carrying cable on the other side by the traction cable. The carrying cable is of a special flat strand type, which permits the buckets to ride very easily, and has unusually good wearing properties. A saddle on each end of a 10-ft. cross arm at the top of each tower supports the carrying cable. The traction cable on each side of the towers runs normally on an 8-in. sheave wheel on the end of a second cross arm on each tower. This second cross arm is 9 ft. 2 in. below the upper cross arm, and rises in the space between the two arms when attached to a bucket.

The tramway buckets are built of steel, each bucket having a working capacity of 10 cu. ft., or 1,000 lb. of rock. They are each suspended on a carriage having two 16-in. grooved wheels, which run in tandem on the carrying cable. The carriage also has an automatic grip that clutches the traction cable, the latter having a normal traveling speed of 300 ft. per minute when the tramway is loaded. Under regular operating conditions about fifty of these buckets can be in service on the tramway and will be spaced 300 ft., or one tower length apart.

The rock excavated from the headings driven from the intermediate shaft will be hoisted to the surface in tunnel cars by a steam-driven 8,000-lb. freight elevator, designed specially for this service, and will be dumped from these cars into an elevated storage bin in the second story of a 76-ft. octagonal head house that has been erected on a large rock-filled timber crib, placed over the site of the shaft. The rock will be delivered from this bin, which has a capacity estimated to be equal to about 48 hr. output from the two tunnel headings, when in full operation, directly into the tramway buckets, and carried by the latter to a storage bin in a head house over the shore shaft. The terminal of the tramway at the shore end is in a second story of the head house there, the two carrying cables being connected by a loop telpherage track. As the buckets enter the building the grip on the traction cable is automatically released, so the buckets can be handled readily while on the telpherage track. The storage bin is in the first story of the head house, and the rock will be dumped from the buckets into a hopper in the floor over the bin. This dumping will probably be done by hand, although the carriages of the buckets are equipped so they may be arranged to dump automatically on reaching the hopper. The latter will be on the entrance side of the telpherage loop at the end of the tramway, and as the buckets are passed around to the opposite side of the loop, to be sent out again, the grip is automatically attached to the traction cable.

Passenger Car For Service on Tramway.

View Toward Shore From Intermediate Shaft.



Interior of Central Construction Power Plant.

The second story of the head house over the shore shaft contains switches connecting with the telpherage terminal loop of the tramway, which switches have sufficient capacity to store all of the buckets installed. The off-shore terminal of the tramway, like the in-shore one, is also a loop telpherage track, with switch connections for storing buckets. The tramway dips down to about 25 ft. above the water at the outer end to enter the head house over the crib at the intermediate shaft.

Several enclosed cars that are provided for transporting men between the intermediate shaft and the shore are also stored on these switch connections in either head house when not in use. These cars were designed specially for the service in which they will be used and will each carry four passengers. Their bodies are oval in cross-section, being 4 ft. long, 5 ft. high and 3 ft. 3 in. wide and have a light steel frame covered with sheet iron. The entrance is through a door in one side, which closes tightly, so the only openings when the car is on the tramway are two portholes in one side of the body; a seat for two people is provided at each end of the car, so the latter makes a comfortable conveyance in any kind of weather. The carriage by which the car is suspended from the carrying cable of the tramway is very similar to the one used on the buckets, except that it is much heavier.

The 1⅜-in. carrying cable is continuous, the two ends each being attached through a take-up to a separate anchorage at the shore head house. These take-ups each consist of a pair of triple tandem blocks rove with a ¾-in. wire cable, which is wound on a drum driven by a worm-gear that can be operated by one man. These ¾-in. cables are attached to the main cable, but the latter is also attached to the anchorage as a precaution. In the head house over the intermediate shaft the carrying cable passes around a heavy frame on a 4-wheel truck, which is safely anchored, but can be moved along the axis of the tramway as tension or slack is required in the carrying cables.

The tramway is driven by a 25-h.-p. alternating current motor, which runs at 600 r.p.m., about half the capacity of this motor being required when the tramway is in operation. The motor is geared to a large drive wheel for the traction cable, the wheel being equipped with automatic grips, which reduce the wear on the cable to a minimum.

The cables, buckets and special apparatus for the tramway were furnished by the A. Leschen & Sons Co., of St. Louis, Mo., and were installed under the direction of Mr. B. C. Riblett, chief engineer of that company, by the regular forces of the contractor. The steel towers and the piles on which they stand were all fabricated in the extensive bridge and steel shops of Geo. W. Jackson, Inc., on the north branch of

the Chicago River. The steel piles were also all driven and the towers erected by the contractor's regular forces.

Shafts.—The permanent shaft on shore, from which headings will be driven in both directions, will have a total depth of 145 ft., a sump, 5 ft. deep, below the invert of the tunnel, being placed at the bottom of it. Although the shaft is to have a finished idameter inside the lining of 14 ft., for construction reasons it was driven 21 ft. in diameter at the top, and will have a diameter of 16 ft. at the bottom before the lining is placed. Bed rock at the site of the shaft is at a depth of about 65 ft. The top 20 ft. of the soil overlying the rock is fine lake sand that runs like quicksand when wet and is very compact; under this sand is a 25-ft. stratum of blue clay, varying from quite soft at the top to fairly stiff at the bottom, where it grades off into a medium hard clay, below which is a stratum of hardpan and boulders directly over the rock.

The lake being only 300 ft. distant and about 10 ft. below the ground surface, the construction of a shaft of the required diameter in the running sand was a particularly hazardous undertaking, but was handled without difficulty, by using Jackson steel sheet piling. This piling consists of standard channels and I-beams, the channels being arranged in pairs, which are placed alternately with an I-beam between each two pairs. In this case standard 12-in. 20.5-lb. channels and standard 12-in. 31.5-lb. I-beams, all in 40 ft. lengths, were used. The webs of the I-beams were bent slightly to fit the curve of the shaft, but otherwise standard sheeting was employed.

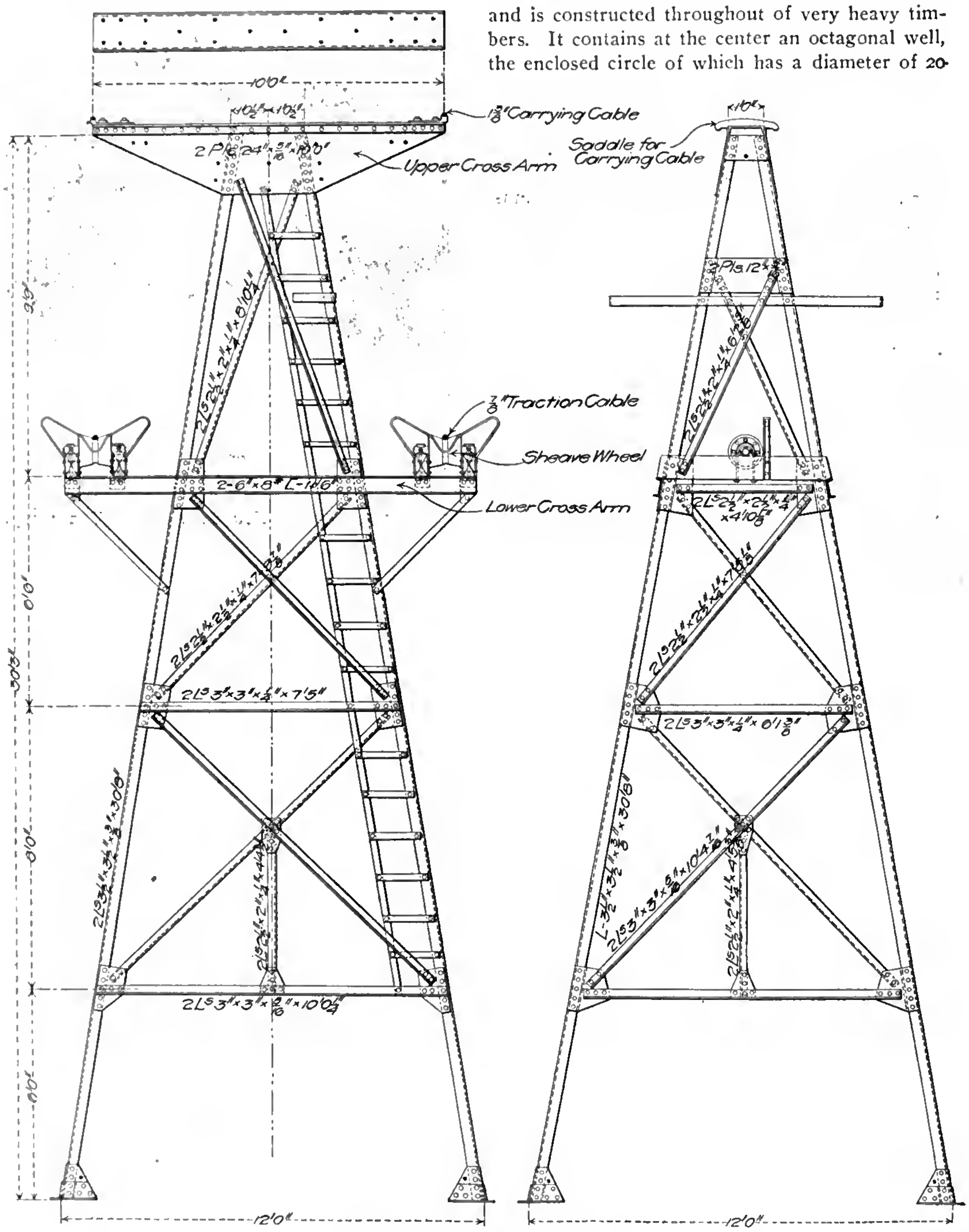
After the shaft had first been excavated to the ground-water level, at a depth of 5 ft., a template, 21 ft. in diameter and built of steel angles, was laid on the ground to serve as a guide for driving the piles. A portable turntable pile driver, having 80-ft. leads and a 5,000-lb. steam hammer, was used in sinking the piles. A stiff-leg derrick, with a 70-ft. boom, handled the piling from cars on a railroad switch that was laid along one side of the shaft, and also swung them into position for driving. The piles were first driven in a complete circle to a penetration of about 12 ft. The driver working on the outside then drove to the full depth enough piles on one side of the circle, so it could be moved inside the latter and sink the remainder from one position. The piles were all driven without any trouble, although in a few instances a water jet was used to assist the hammer. Seventy piles were required to make the complete 21-ft. ring, which has a circumference of 65.97 ft. It was contemplated that some difficulty might be experienced in closing the circle, but the last pile formed a perfect closure. The driving was done in three working days by five men, on an average, 131 lin. ft. of piling, or 1,600 sq. ft. of sheeting, being driven each day.

When the sheeting had been driven the sand, clay and so forth were excavated by hand from the area enclosed by it and were handled out in buckets by the derrick. Although the head of water on the sheeting when the excavation reached the stiff blue clay, which is practically impermeable, was at least 25 ft., only a few small leaks through the piling had occurred, and these were readily stopped by dropping clay and sawdust into the space enclosed by the pairs of channels of the piling. The excavation was carried to the bottom of the 40-ft. piling without any braces whatever, the piling having sufficient stability to maintain itself as the lining of this 21-ft. circular excavation against the heavy pressures brought against it. Below the bottom of the piling the excavation was sheeted with a steel casing, which was placed in 6-ft. sections, one telescoping inside the other, as the material was removed. The shaft was thus carried down to rock at about 65 ft. below the ground level and then left to stand for several weeks pending the installation of the balance of the construction plant. During this period a No. 2 Nye pump, working about one-sixth of the time, removed the seepage into the shaft, as the steel sheeting was practically free from leaks with the full head of water against it.

The two-story head house over this shore shaft is 46x65 ft. in plan and contains the terminal of the tramway on the top floor and a rock storage bin on the first floor, as has been stated. The rock from the tunnel headings driven from the shaft over which this house is built will be hoisted in tunnel cars by an electrially operated 8,000-lb. elevator in the shaft and dumped into the storage bin. An eletrically driven rock crusher is to be installed in the first story of the building to crush the stone for market. The crushed stone can be loaded directly into the cars on a railroad switch along one side of the head house, or the run-of-mine stone can be loaded into these cars. As more than 125,000 cu. yd. of rock will have to be removed from the tunnel and passed through this head house, the handling of the rock after it reaches the storage is alone a very large undertaking.

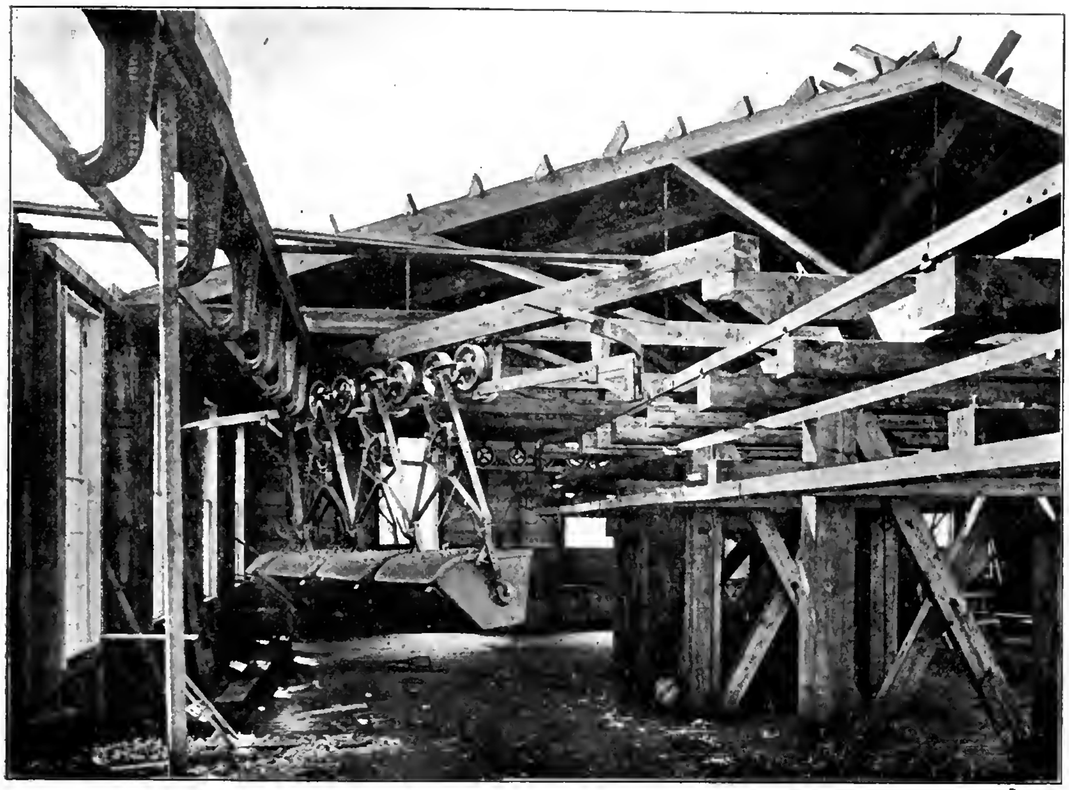
The bottom of the intermediate construction shaft in the lake is to be 137 ft. below the mean lake level, the water varying from 33 to 36 ft. in depth at this shaft, under different barometric conditions. Rock is at a depth of about 60 ft. below mean water level and is overlaid by 27 ft. of material varying from hardpan immediately over it to soft blue clay at the surface of the bed of the lakes. A heavy rock-filled octagonal timber crib, with an inclosed circle having a diameter of 76 ft., has been placed concentric with the shaft and carries the head house for the latter. This crib has a total height of 65 ft. and is constructed throughout of very heavy timbers. It contains at the center an octagonal well, the enclosed circle of which has a diameter of 20 ft., and around this well are the pockets for the rock fill. The sides and bottom of these pockets are made practically watertight to 12 ft. above the water level by 3-in. oak sheeting, thoroughly calked.

The shaft is to be encased down to the rock with Jackson steel sheet piling, which is carried up 9 ft. above the water level, making the total length of the sheeting 69 ft. The circle enclosed by the sheeting is 20 ft. in diameter to a depth of 46 ft. and 12 ft. in diameter below that depth. The large circle at the top is formed by sheeting of the same size and weight as that used in building the shore shaft, and is in 51-ft. lengths,



Details of Tramway Towers.

which have a penetration of 9 ft. into the clay bed of the lake. This sheeting has been successfully driven, and at the time these notes were prepared the space between it and the walls of the well of the crib were being filled with packing material, in order that the water might be pumped out of the area enclosed by the sheeting, and the excavation be carried down sufficiently to permit a second set of sheeting to be driven for the smaller circle. The top of this



Tramway Buckets on Telpherage Switches in Head House Over Shore Shaft.

second set of sheeting, which consists of 5-in. 6½-lb. channels and 9-in. 21-lb. I-beams, is to overlap the bottom of the upper set about 2 ft., thus forming, together with the material between the two, a joint that should be perfectly safe, as it is 7 ft. below the surface of the bed of the lake.

The crib was built in a slip in the Calumet River at South Chicago, about three miles from the site. After it had been completed it was loaded with rock until it drew about 20 ft. of water, and on a day when quiet water was practically assured it was towed to place by three tugs in about three hours. It was then guyed in position and the rock filling required to sink and anchor it was placed. About 500 cords of stone were placed in the ballast pockets by two derrick scows, which completed this work in two days, although the crib was safely anchored 11 hours after it reached the site. A foundation of piles had been driven previously in the bed of the lake at the site and were sawed off at the surface of the clay, and the crib settled into position on this foundation without a mishap.

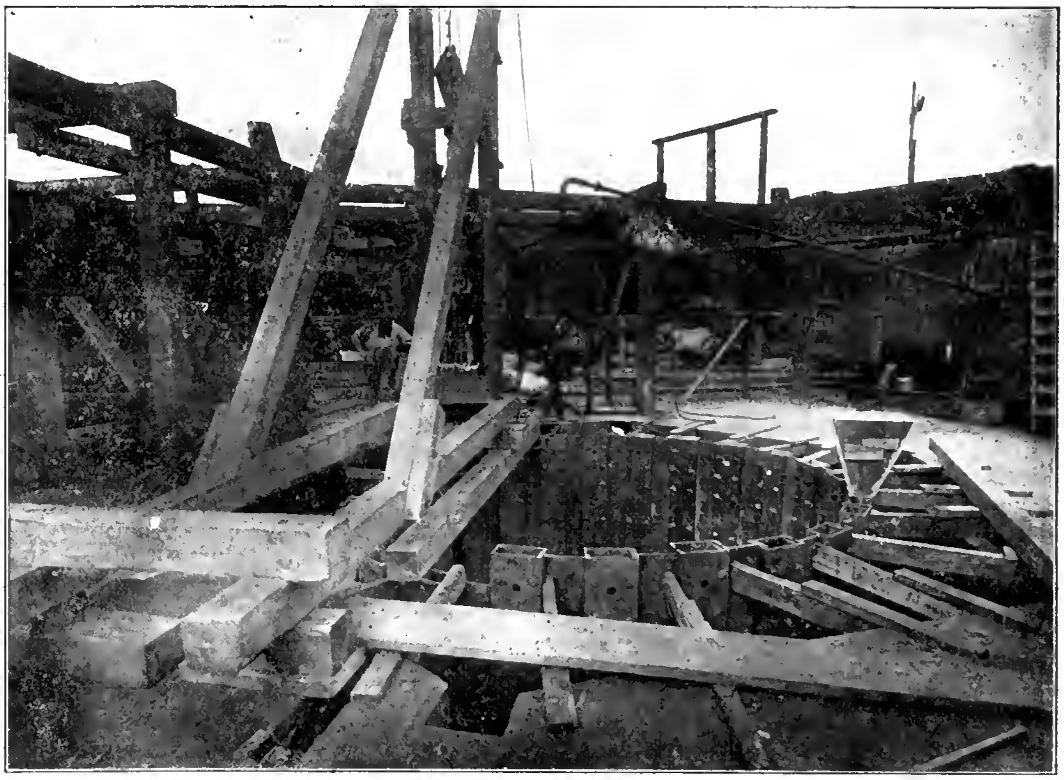
Central Power Plant.—A most complete central power plant, including a machine shop and a blacksmith shop, has been erected adjacent to the shore shaft, to supply power for operations in the tunnel and at the two shaft head houses, and for such other purposes as are necessary. The plant is in a 50x165-ft. frame building of unusually substantial construction for such purposes. A 25x50-ft. blacksmith shop is placed in the rear. In one corner of the front end of the main building is a row of four separate 12x21.5-ft. rooms, which provide a general office, an office for the contractor's engineers, an office for the city engineers and a bath and toilet room. The remainder of the building is one large room, which is free from columns, the roof being carried by light wooden trusses with a clear span of 50 ft.

These trusses are of quite simple and satisfactory construction. They are built entirely of 2x8-in. and 2x10-in. plank and 1-in. iron rods, without requiring any framing and very little cutting, all of the latter having been done with a hand saw. One truss was laid out so a complete set of pieces could be cut for it, then these pieces were used as patterns, from which the material could be cut for the whole series of trusses. The trusses each contain about 20 ft., board measure, of lumber to the linear foot and weigh approximately 3,500 lb. They were therefore easily erected with a light gin pole equipped with hand blocks.

All of the equipment in the power plant is driven by electric motors operating on power supplied from the commercial circuits of the Commonwealth Edison Co. This power is received as 3-phase 4,400-volt alternating current and is stepped down to 440 volts for use in the plant by a bank of transformers along one side of the building. A 250-kw. direct-current generator, direct connected to an alternating-current motor, is also installed to furnish direct current at 250 volts for operating the elevator in the shore shaft, electric locomotives in the tunnel headings, and so forth.

Four motor-driven Ingersoll-Rand air compressors, with a combined capacity of approximately 4,000 cu. ft. per minute, have been installed in the power house to furnish air to operate rock drills at the face of the excavation in the tunnel headings. These compressors are all compound duplex machines. Two of them, with 14¼-in. and 22¼-in by 14-in. cylinders, each have a rated capacity of 841 cu. ft. of free air per minute, when operating against 80-lb. pressure, and are each belt-driven by a 150-h. p. General Electric motor. The other two, with 16¼-in. and 25¼-in. by 16-in. cylinders, each have a rated capacity of 1,205 cu. ft. of free air per minute, when operating against 80-lb. pressure, and are each belt-driven by a 200-h. p. General Electric motor. These motors are each equipped with a starting device within the frame of the machine.

The four compressors all deliver into either of two 6 x 12-ft. upright receivers in the building. A 10-in. pipe header is extended from these receivers to the adjacent shore shaft, where a 9-in. line is taken off, and a 7-in. line, 8,000 ft. long, is continued out to the intermediate shaft in the lake. The 7-in. line is flanged spirally-riveted steel pipe from the shore line to the intermediate shaft and is placed on the bottom of the lake, with flexible joints to provide for variations in grade. This pipe is designed for a working pressure of 200 lb. per square inch and weighs about 9 lb. to the linear foot.



Steel Sheeting Driven to Form 20-Foot Circular Shaft at Intermediate Crib.

The entire compressor equipment has been placed in one central power plant on shore and a pipe line carried in the intermediate shaft, rather than to transmit electrical power to that shaft to drive a compressor there, for two principal reasons. First, no space was available in the head-house over that shaft. This head-house and the crib on which it stands are very large and expensive, but the provision of the addi-

tional space required for a compressor would have involved an increase in the cost of building a larger crib which would not have been in keeping with the advantage to be gained. On the other hand, the operation of two separate compressor plants would have occasioned double the expense for attendance that is required by a single central one. Furthermore, advantages for ventilating the tunnel headings which are afforded by the one central installation could not be obtained with two separate plants.

It is contemplated that 24 to 30 air drills will be worked in the two headings to be driven from each shaft, and on this basis the 4,000 cu. ft. per minute of air capacity that has been provided might appear to be more than is necessary. It was held, however, that the provision of more power than is generally considered to be required would preclude any possibility of shut-downs of the extensive plant due to one compressor being out of service. Another great advantage of the large amount of available air power is the ability to clear the gases from the headings after a blast. Arrangements will be made to deliver the full output of all four compressors at the face of the excavation in a heading directly following a blast. This will undoubtedly greatly reduce the delays which are occasioned under ordinary circumstances by waiting for the gases to disperse, and will also clear the atmosphere so thoroughly that the laborers at the face can deliver more efficient results when they return to work again.

Direct-current electrical power for operating the locomotives to be used in the headings driven from the intermediate shaft and for pumps in the latter is transmitted on two bare copper wires carried on insulators on the center line of the top cross arms on the tramway towers. The elevator for this shaft is arranged to be driven by a steam engine, in order that the men in the headings may be hoisted to the surface whether current is available or not. Alternating current for lights in the head house of the intermediate shaft, in the tunnel headings driven from the latter and for a light at each of the tramway towers is carried from the central power plant by a pair of insulated wires on the top cross arm of the towers. A regular nautical signal lamp is also maintained on each tower as an added precaution. A very powerful searchlight, mounted at such a position slightly to one side of the inshore end of the tramway that it can be thrown the full length of the latter, greatly assists in operating the tramway at night, as well as affording an additional safeguard to shipping.

A quite complete machine shop has been installed in the rear end of the power plant building. This shop includes a drill, a 12-in. 8-ft. lathe, a 22-in. planer, a radial drill with a 12-ft. arm, a pipe threader, a steel saw and a grindstone. All of this equipment is driven from line shafts by a 25-h.-p. motor carried on a bracket suspended from a roof truss. A smaller motor would have sufficient capacity to drive these various machines, but the larger one was installed in order to have enough power to start the motor-generator set. The equipment in this machine shop, and in the blacksmith shop, which contains two 6-ft. forges, a small air-driven trip hammer, an emery wheel and a radial drill, permits practically all repairs to the construction plant to be made at the work. Repairs that cannot be handled by this equipment will be made in the bridge and steel works of Geo. W. Jackson, Inc., so all dependence on outside sources for such work is avoided.

The Southwest Land and Water Tunnel is being driven under the supervision of Mr. John Ericson, city engineer of Chicago. Mr. G. F. Samuels is engineer in charge for the city. Mr. Geo. W. Jackson, president and chief engineer of Geo. W. Jackson, Inc., has personally directed the installation of the construction plant and will supervise the operation of it.

Harbor Work at Huron, Ohio.

The United States Government is at present making improvements in the harbor of Huron, Ohio, a small city on the south shore on Lake Erie near Sandusky. The Huron River was originally obstructed by a sand-bar at its mouth, which closed it to navigation, and in 1826 the first project for its removal was adopted. This provided for two parallel timber jetties 90 ft. apart, extending into the lake from the river bank. These jetties were lengthened and repaired from time to time, and the channels finally deepened by dredging to 16 ft. Altogether, up to June 30, 1905, the United States Government had expended $269,908.95 on the project, and in addition considerable dredging had been done by local authorities.

The existing project was authorized by the River and Harbor Act of March 3, 1905, and provides for a channel, with a depth of 20 ft. It utilizes all of the west jetty which was serviceable, extending it 240 ft. and terminating it at a pierhead 50 ft. square. A similar pierhead was constructed 300 ft. easterly from the extremity of the west jetty and is now being connected to the shore by a rubble mound breakwater, which extends from the pierhead to a point 1,200 ft. east of the present east jetty. Upon the completion of the work the latter is to be removed. The west jetty has a length of 1,741 ft., and the breakwater when completed will have a length of 1,756 ft.

The west jetty consists of 1,109 ft. of timber cribs, 582 ft. of timber crib with concrete superstructure and 50 ft. for the pierhead. The old timber cribs were used as far as possible in the improvement work. They were built at different times and differed materially in details of construction, varying in width from 16 to 24 ft. The bottom of the lake at this point is a stiff clay, and the cribs were sunk in trenches excavated in this material, without the usual rip-rap foundations. The cribs have settled considerably and lost their true alignment.

Where the old cribs were capped with the new concrete superstructure the cribs were cut down to 3 ft. below mean lake level, and a line of concrete blocks was set on both the river and harbor sides of the jetty. These blocks were aproximately 4 by 4 ft. and of sufficient length to span from one cross timber of the crib to the next, about 8 or 9 ft. To give a proper alignment to the superstructure it was frequently necessary to give these blocks irregular forms instead of the cross sections originally designed. The space between the concrete blocks was filled in with rip-rap and surmounted with concrete placed in mass to a height of 6 ft. above mean lake level. The pierhead of the west pier was given a height of 14 ft. above datum, to provide a foundation for a lighthouse.

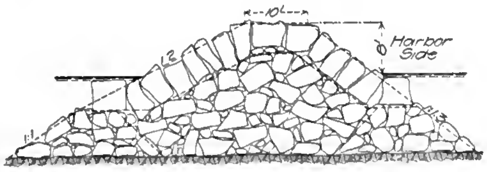
Anchoring the Construction Crib; and Passenger Car at Land Tower of Tramway.

The breakwater, or west jetty, consists of a rubble mound of quarry-run stones covered with large placed stones. On the harbor side the slope is one on one from the bottom to 12 ft. below mean lake level, and one on two to the top of the structure, which is 8 ft. above datum. The width of the top is 10 ft.

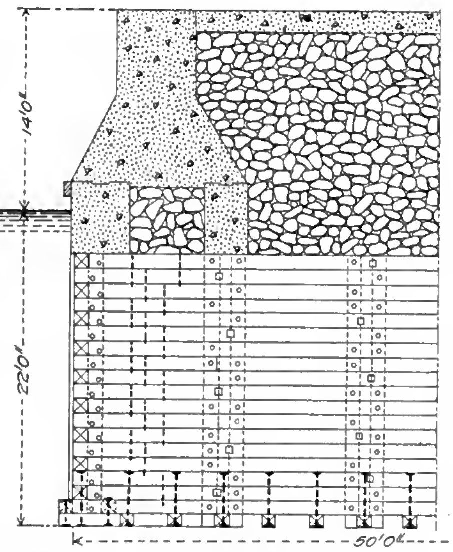
The average weight of the quarry-run stones of which the jetty is built is 1½ tons, running all the way from 200 lb. to 5 tons in individual pieces. The specifications required that no stones should have a thickness of less than 1-3 its greatest dimension. The placed stone is aproximately rectangular in shape, with no angle sharper than 60 deg., or more obtuse than 120 deg., weighing from 4 to 10 tons. The specifications require it to be set close with a derrick on the best and largest bed, adjacent stones not to be farther

apart than 18 in. The stones are set to break joints and tie the work together as far as possible, and on the slopes none vary more than 12 in. from the adopted outline. The lowest outside row of the placed stones on each side is set flat, with the tops of the stones as near as possible at mean lake level, while the remainder of the covering stone is placed edgewise.

In constructing the breakwater the contractor built a private storage yard near the shore end of the jetty and adjacent to the tracks of the Wheeling & Lake Erie R. R., and a track was laid from this storage yard out onto the jetty, being lengthened as the work progressed. An Interstate Engineering Co. 8-wheel locomotive crane weighing 65 tons and having an 80-ft. boom handles all of the stones from flat cars run out on the jetty behind it. For a time this crane also



Rubble Breakwater at Huron.

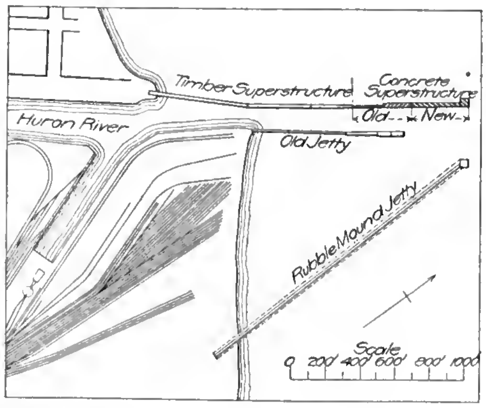


Half Section of Pierhead at Huron.

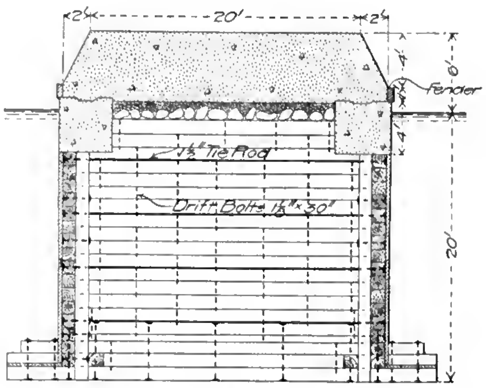
switched the cars back and forth from the yard to the jetty, but as the breakwater reached a length of 700 ft. a small locomotive was placed in service, to prevent the large loss of time due to switching by the crane. In extending the breakwater the crane throws the quarry-run stone into the water in advance of the work, until the rock is built up to about 1 ft. above the water for about 30 ft., sufficient to lay one section of track. The top of this new section is leveled off with small rip-rap, and upon it are laid track stringers carrying closely spaced ties. The top of rail is aproximately $2\frac{1}{2}$ ft. above the level of the lake.

About eight days are required to fill one of these 30-ft. advance sections of the breakwater. When the track is in place on the new section the placed stones are set on each side of the jetty, leaving the track clear. This method is being followed on the entire length of the structure, and after it is joined to the pierhead the crane will work backwards, setting the placed stone over the portion now given up to the roadbed. Some of the placed stones have weighed as high as 14 tons, while a great many have been used which weigh 10 tons, the average being about 5. The average day's work for 8 hr. is about 200 tons of quarry-run and placed stone combined, and the maximum tonnage for one day, consisting entirely of quarry-run, is 454 tons. The estimated weight of stone in the entire breakwater is 63,500 tons. The usual force required in filling the breakwater consists of a superintendent, a foreman, an engineer and a fireman on the locomotive crane, the locomotive crew and three laborers. When the riprap is being placed and the track laid an additional force of laborers is required. The contractor for the work is Hunkin Bros. Construction Co., of Cleveland. Most of the stone is limestone from Bellevue, Ohio, 26 miles from Huron, though a small quantity of sandstone has been obtained from North Amherst, Ohio.

While this work has been in progress the Wheeling & Lake Erie R. R. have constructed two basins near the mouth of the Huron River and propose to construct a third one opening into the harbor behind the breakwater. The basins have a depth of 21 ft. and are enclosed by timber retaining walls. The material excavated from the



Plan of Huron Harbor.



Concrete-Topped Crib at Huron.

larger basin was used to fill a marsh forming part of the company's property north of the tracks of the Lake Shore & Michigan Southern Ry.

The work is being carried on under the direction of Lieutenant Colonel C. McD. Townsend, Corps of Engineers, U. S. A.

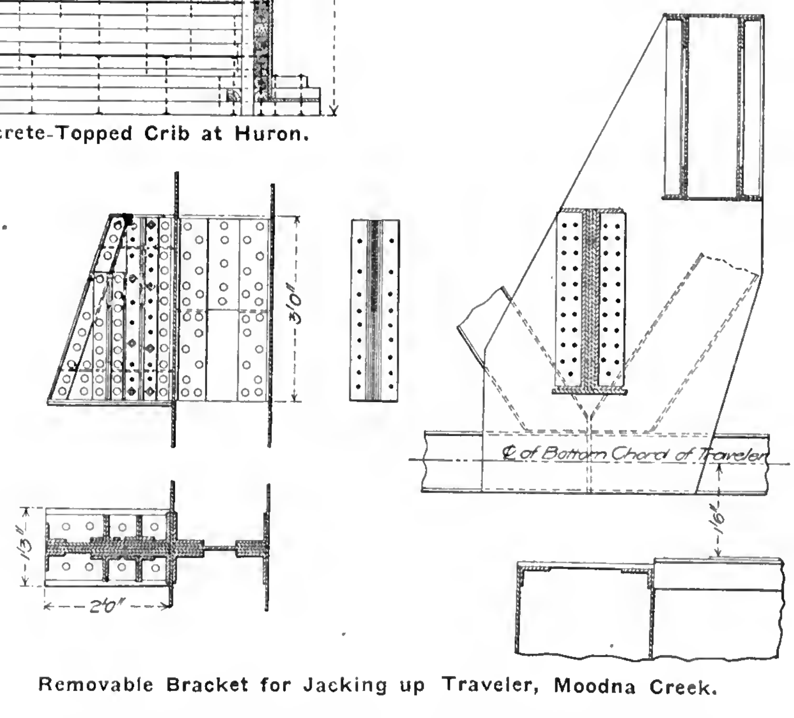
The Electric Locomotives being used in the Simplon Tunnel are troubled with excessive condensation, affecting the insulation, due to the difference in temperature in the tunnel and outside.

The Erection of the Moodna Creek Viaduct.

The Erie & Jersey R. R. viaduct across Moodna Creek, New York, is 3,200 ft. long and about 182 ft. high, and is composed of alternating 40 and 80-ft. plate girder spans supported on steel towers as described in The Engineering Record of July 6, 1907. As now under construction, it contains about 4,000 tons of steel and will carry a single track, but it is designed for future conversion to a double-track structure by the addition of two more lines of plate girders and column reinforcements amounting to about 1,750 tons of additional steel work.

The longitudinal girders $5\frac{1}{2}$ ft. deep and 9 ft. deep are of ordinary construction, web-connected at the ends to double transverse plate girders 10 ft. deep which are riveted across both faces of the battered tower columns. The end sections of the webs are shop-riveted to the columns and have field riveted cover splice plates, field riveted to the ends of the 13-ft. long center section. The maximum towers are 5 stories high with the panels X-braced in both faces but have horizontal struts at panel points only in the transverse plane. In the tallest tower one column in each bent has a roller bearing on the pier masonry. Expansion ends are provided for the 80 ft. girders about 240 ft. apart where they have a sliding bearing in a pocket attached to the web of the transverse girder, all other girder bearings are fixed.

The viaduct was erected by a steel traveler designed also for use in the construction of other extension works now in progresss for the Erie R. R. system. The overhead traveler is a simple rectangular framework 200 ft. long, 30 ft. high and $19\frac{1}{2}$ ft. wide on centers, which weighs about 100 tons. It is designed as a cantilever with an 80-ft. overhang and booms projecting from its extremities with sufficient length and capacity to handle tower members 120 ft., or 2 spans distant from the end of the completed structure. It is of special and rather peculiar construction, differing materially from ordinary travelers in the method by which it is supported from and advanced on the finished structure, in the provision made for handling through it unloading and lowering the members of the viaduct and in the plans for utilizing it for other purposes and realizing a heavy salvage after its work in erecting these viaducts is finished.



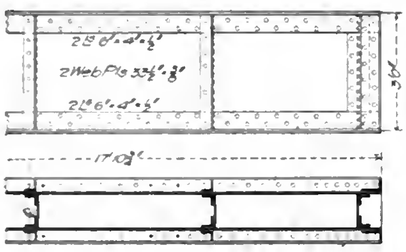
Removable Bracket for Jacking up Traveler, Moodna Creek.

It consists essentially of a riveted Pratt truss span with riveted members throughout and with

lateral bracing only in the planes of the top chord. There is no transverse connection between the bottom chords nor between the members of the trusses except what is afforded by the sway-brace frames, 12 ft. deep, and temporary wooden studs replaced and removed as necessary during erection. A clearance generally 18 ft. wide and 18 ft. high is thus provided through the traveler to allow for car service and the handling of material through it from end to end. This clearance is reduced to 15 ft. vertical by the overhead hoisting engine platform, 43 ft. long, built between the trusses at the rear end of the cantilever. It is not, however, diminished by the duplex-geared girder crane of 15 tons capacity and 16½ ft. span which runs on tracks made with I-beams 100 ft. long to the outer end of the traveler.

When in service the traveler is supported at panel points L0 and L6 at the rear extremity and on the last completed bent of permanent structure with pin bearings in ordinary shoes and pedestals, the latter being seated on the top flanges of the transverse girders of the viaduct towers. At each bearing the traveler is anchored by vertical bolts with nuts at both ends bearing against the bottom chords of the traveler and the bottom flanges of the transverse girders in the viaduct. When the traveler is advanced, temporary transverse plate girders are connected to vertical posts 1 and 6 a little above their lower ends and the traveler is lifted by jacking up under them and then lowering it to supports on special trucks that travel on the regular permanent track of the viaduct.

Each traveler truss consists virtually of a com-



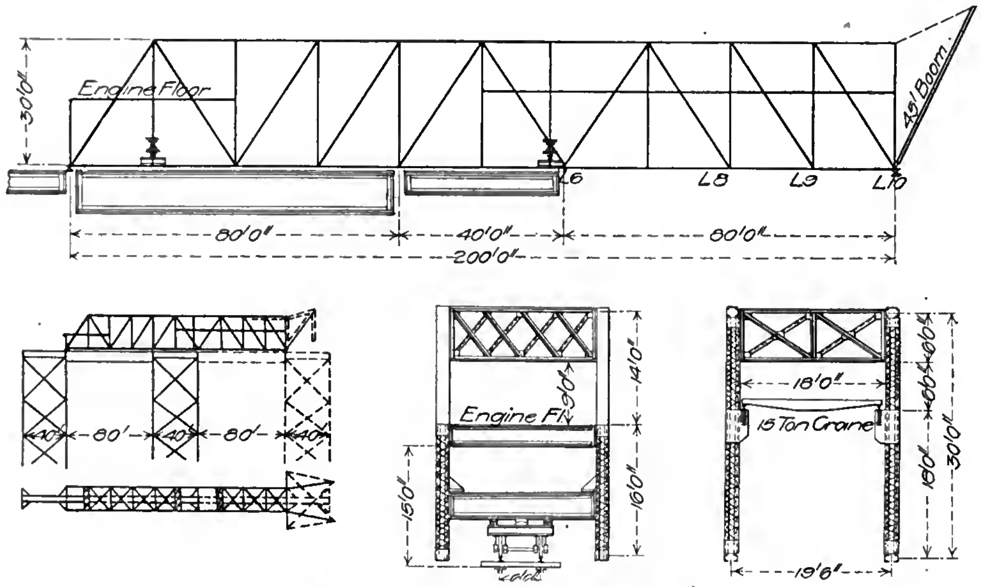
Detachable Lifting Girder.

plete 120-ft. truss and an 80-ft. truss, equivalent to four of the eight panels of the viaduct truss, with their bottom chords pin-connected together at panel point 6, the forward bearing over the last completed bent of the viaduct. The top chords of the two trusses are connected by a horizontal tension member U5 U7 taking the stress from the cantilever to the anchor arms. The trusses are designed so that after their service in the erection traveler is completed the 80-ft. trusses can be extended to make duplicates of the 120-ft. trusses and all together the four trusses will suffice to make two spans of ordinary 120-ft. highway bridges.

The traveler is of very simple construction with standard details and workmanship according to the Erie Railroad specifications. It is built with medium steel, all rivets are ¾-in. in diameter and holes are punched without reaming. The top chords and end posts are each made with a pair of 10-in. channels and a 17½ x ¼-in. cover plate. The bottom chords are made with a pair of 12-in. channels, latticed on both flanges, and the vertical and diagonal members are made with pairs of channels latticed and bolted at both ends between jaw plates shop riveted to the webs of the top and bottom chords. The transverse sway-brace struts are like lattice girders 6½ and 12½ ft. deep, the former being completely shop riveted and the latter having their members shipped loose and bolted together and connected in the field. The top lateral diagonals are single angles, one of which is continuous across the panel and the other is cut to clear it at intersection and spliced across and connected to it by a bolted flange cover plate.

Each main bearing is made with a 3½-in. pin engaging the double webs of a riveted shoe bolted to the bottom chord of the truss and having three alternating bearings in a cast-iron shoe with horizontal transverse guide strips engaging the edges of the top flange of the transverse header girder of the finished viaduct over the center of the viaduct column. Three bearings are provided for each truss, one at the rear end, one at the inner end of the cantilever and one at the outer end of the cantilever, to engage the advance bent of the tower as soon as it is erected.

At L1 and L6 the bottom chords of the trusses are spliced with web cover plates which project far beyond the top flanges to form jaws providing for the connections of the vertical and diagonal posts, and also receiving, on their inner faces, very heavy brackets to take the reactions of the hydraulic jacks used to lift the traveler from its bearings to the truck and from the truck to its bearings. These brackets are 3 ft. deep with a lower horizontal flange 2 ft. long and a very heavily reinforced web, and are each attached with 42 bolts.



Cantilever Viaduct Traveler Used at Moodna Creek.

The vertical posts at U1 and L1 have wide longitudinal vertical plates riveted to their inner flanges beyond which they project with open holes to receive the connection bolts through the transverse end plates of the carrying girders G1. These girders are 17 ft. 10¾ in. long, out to out, and have two 35½x⅜-in. webs 10¼ in. apart in the clear which are connected by five equidistant transverse diaphragms and have four 6x4x½-in. flange angles. The three intermediate diaphragms are set at the points where the girder takes bearing on blocking on the moving truck, and are proportioned to reinforce it for the concentrated shears at these places.

Each moving truck has six double flange wheels with their journal boxes bolted to the bottom flanges of two pairs of 15-in. longitudinal I-beam sills 7 ft. long and 6½ ft. apart on centers. These sills carry across their top flanges a single transverse girder 10 ft. long made with three 15-in. I-beams bolted together with cast-iron separators. Three pairs of longitudinal yellow pine cushion blocks on the top flanges of this girder give bearing against the transverse carrying girders G1. The vertical posts at the outer extremities of the cantilever trusses serve as masts for 45-ft. wooden derrick booms with fittings made at Erie Railroad machine shop. The total weight of the traveler is about 200,000 lb., and it is proportioned to carry a concentrated load of 30,000 lb. at the extremity of each cantilever truss.

After completing two panels of the viaduct the traveler is advanced until panel points L6 are centered over the last transverse tower bent completed. Hydraulic jacks are then set on the tops of the transverse girders with their upper ends engaging the lower flanges of the lifting brackets at panel points L0 and L1 and are operated until the traveler is lifted clear of the cushions on the trucks. The trucks are then withdrawn and the jacks are slacked off to lower the traveler to bearing on its shoes and pedestals and it is anchored to the viaduct by sixteen 1-in. vertical rods 6½ ft. long, engaging the bottom chord as already described. The two bearing girders G1 are then detached and placed with the trucks at one side, out of the way. The viaduct members are then brought inside the traveler by cars on the material tracks which deliver them to the girder crane, and the latter carries the material for the respective towers out to position and lowers it, to be swung into place by auxiliary tackles, and then while the bent is securely guyed brings out the 80-ft. girders and seats them on it.

After these are connected the bearing and anchorage for the extremity of the traveler at points L10 are adjusted on top of the transverse bents and the remainder of the materials are brought by the tower and the girder crane to the derrick booms on the end of the traveler, which completes the erection of the tower and sets the 40-ft. girders on it. The girders G1 are lowered and reconnected in their former positions, the trucks are brought out and placed under them and the hydraulic jacks are set under the lifting brackets again and raise the traveler clear of the trucks to which it is lowered, the jacks released and the traveler advanced 120 ft. as before and so on. The movement of the traveler is thus accomplished easily and quickly on the material track, and the bearings on the center lines of the trusses over the tops of the tower columns utilize the full width of the viaduct notwithstanding that the latter is only equipped with a single pair of girders close together for a single track.

The Erie Railroad construction department is under Mr. J. M. Graham, vice-president, and Mr. Francis Lee Stuart, chief engineer, under whose direction the viaduct was designed by Mr. Mason R. Strong, engineer of bridges and buildings, with the assistance of Mr. F. A. Howard, assistant engineer of bridges and buildings. The erection has been done by the Bridge and Building Department, under the charge of Mr. W. H. Wilkinson, inspector of bridges. The steel work was fabricated by the McClintic-Marshall Construction Company.

FUEL OIL ON LOCOMOTIVES is largely used in Mexico, where about 4,000 bbl. are now consumed daily, it is stated, on the Mexican Central Ry. alone. More locomotives are now being fitted with oil burners as a result of the satisfactory experience in the past. The oil costs about $1.10 per barrel, giving a material saving over coal.

A Favorable Report on the Calumet Drainage Canal.

On Oct. 19 Mr. Rudolph Hering submitted a report to the Trustees of the Chicago Sanitary District which will unquestionably be the leading argument they will use in their endeavor to secure permission from the Federal authorities to turn 4,000 cu. ft. of lake water per second into the drainage canal in addition to the 10,000 cu. ft. per second which the International Waterways Commission has approved. It will be recalled that Messrs. Hering & Fuller were retained by the International Waterways Commission to report on certain features of sewage disposal in the Calumet District lying south of Chicago, and that their report was in favor of septic tanks and sprinkling filters. As Mr. Hering was the engineer who designed the main features of the Chicago drainage canal, this report has been regarded by a good many people as indicating a change of opinion on his part concerning the methods of sewage disposal advisable for the district about the lower end of Lake Michigan. In order to counteract any such view, in all probability, the Trustees of the Sanitary District retained him to report on the most desirable method of disposing of the sewage of the so-called Calumet sub-division of the Sanitary District without causing a nuisance or any pollution of the lake water, irrespective of previous recommendations or legal restrictions. He was requested by the Trustees to take a comprehensive view of the problem, so that any recommendation he made would be in line with what appears to him to be the proper solution of sewage disposal problems in the distant future. He was also requested to furnish estimates of cost and any attending benefits that would be associated with whatever method he recommended. The conclusions in his report are as follows:

The Calumet Subdivision is the term used for that part of the Sanitary District lying south of 87th street, because for the territory north of that street provision for sewerage already exists or has been planned. The Calumet River passes through its southern part and resembles both in ordinary and flood discharges the Chicago River before its flow was reversed. There is also a low divide a few miles to the west, beyond which the drainage flows into the Desplaines River at Sag, and thence to the Mississippi River. Much of the territory is already provided with sewers, which take both sewage and rain water, except a small area at Pullman, where these waters are separated.

The lowness of most of the area makes it necessary for much of the sewage and rain water to be pumped. At 95th street, near the mouth of the river, there is a pumping station for this purpose. Under flood conditions sewage enters the lake, which in the future, and perhaps already, must endanger the wholesomeness of the water at the Hyde Park intake of the Chicago waterworks.

There are two methods available for properly disposing of the sewage in the Calumet region, so as to prevent the pollution of the water supply of the city and prevent any nuisance in the river or on land. One of these methods is purification by means of septic tanks and sprinkling filters, the other is by repeating the method now used in Chicago and building a canal from the Calumet River across the low divide to join the present sanitary canal at Sag, and by reversing the flow of the Calumet River to carry in it sufficient water to dilute the sewage properly. Whenever this flow is less than required, the deficiency is supplied from the lake; whenever it is greater, the excess flow goes to the lake. To guard against the sewage being carried into the lake at such times, it is necessary to build intercepting sewers to discharge it into the canal and not into the river.

At the request of the International Waterways Commission, the various "available methods of disposing of the sewage of the Calumet area, other than by dilution," were studied and sprinkling filters recommended as "being the cheapest, both in cost of construction and operation, and accomplishing an adequate degree of purification." Under the instructions of the Sanitary District Trustees, Mr. Hering has now compared this method with the dilution of the sewage in the Calumet-Sag canal.

The dilution method was studied by experience gained during its application in Chicago, since the sanitary canal has been opened. The canal was originally designed to carry 10,000 cu. ft. per second, sufficient to dilute the sewage of 3,000,000 persons. Above Summit provision for this population is being made; below Summit the canal is now capable of carrying 14,000 cu. ft. per second, but between Summit and Sag it is proposed to carry only 10,000 cu. ft. per second, and at Sag to receive 4,000 cu. ft. per second through the proposed sanitary canal from the Little Calumet River. This project will protect the lake water from receiving any sewage, Mr. Hering states. It will permit controlling the proper flow in the canal at all times and dilute the sewage of 1,200,000 persons in the same manner as the main canal now built.

In order to compare the two projects, it is necessary to know their true values, which must be based upon their cost and collateral advantages. A most important item for those who pay the taxes is the cost. This is obtained from a balance between expenses and receipts. The expenses should be stated as the total annual cost, made up of operating expenses and fixed charges for interest and other items. The receipts should be given as the returns from the sale of products. There is no money returned from the sprinkling filters, as their product has no value. But there is a return from the dilution project, because the flow of 4,000 cu. ft. per second can drop 66 ft. and develop 22,500 efficient horse power. This earning power produced by the money spent in building the canal to supply the water is an asset as much as if it had been built especially for water power purposes. It is an asset as much as the products yielded from mineral land originally bought from the government and as much as rent secured from a building.

Mr. Hering gives the accompanying table, showing the net annual cost of the two methods of disposal for a population of 300,000 in the Calumet region, and a future population of 1,200,000; these figures are based upon the use of sprinkling filters and upon the Calumet-Sag canal, first, for its actual cost, second, its cost with a return for power at Lockport, and third, with a return for power at both Lockport and Joliet. This table indicates that for an early population of 300,000, the canal project would cost annually about one-third as much as filters, and for a population of 1,200,000 about one-quarter as much, not considering any value which the canal may have for the purpose of navigation. The table further shows that when the population is 1,200,000, the presumable annual cost of the canal project, even without any returns from the sale of power, would be $136,600 less than that of sprinkling filters. Even a material variation in the cost would not alter the general conclusion that the canal is the cheaper project, Mr. Hering states.

The cost comparison alone would decide which project is the more desirable one for the citizens of Chicago, if there were not objections apparently more or less serious that have been raised against the Calumet-Sag project. These objections can be satisfactorily answered, Mr. Hering reports. The most important of them are stated below.

Annual Cost, Including Operating and Fixed Charges.

Installation for a Population of	Sprinkling Filters.	Calumet—Sag Canal. Cost of Canal Alone.	With power at Lockport.	With Power at Lockport and Joliet.
300,000	$360,240	$656,900	$384,100	$128,800
1,200,000	900,300	763,700	490,000	235,600

A question has arisen as to whether it would not be more economical to utilize the main canal and its feeders to their full capacity for the central district of the Chicago metropolis through which it runs, and to erect sewage treatment works for all the more distant parts, such as the Calumet region. The annual cost of works for carrying out this suggestion would be $122,000, considering an income from the additional flow of 4,000 cu. ft. per second. But this expenditure does not provide any relief whatever for the Calumet area, the cost of which, for filters, can be taken at $600,000 per annum when the population in the district is 700,000, while the cost of the Calumet-Sag project would be only $175,000 per annum.

The most important objection comes from the International Waterways Commission, which says that the diversion of 14,000 cu. ft. per second would lower all of the lakes from 6 to 8½ in., and that the cost of restoring the original depth would be about $12,500,000. It grants the diversion of 10,000 cu. ft. per second without further question for sanitary purposes, whatever the effect upon navigation may be, but recommends that the government of the United States prohibit the diversion of any further amount. Should the Sanitary Canal cause the lowering of the lake levels stated above, the prohibition would certainly be in the interest of Chicago no less than those of the entire lake region. It seems evident to Mr. Hering, however, from a study of the facts in the case, that whatever lowering would be caused by the diversion through the sanitary canal is already almost completely compensated by work partly done, or recommended to be done, by the Commission at Sault Ste. Marie.

The Commission has recommended the establishment of a low-water level in Lake Superior of 601.7 ft. above tide, to be held by regulating works, and a high water-level of 603.2 ft., or 18 in. higher. The lowest annual mean level of Lake Superior occurred in 1879, and was 601.43 ft. The most protracted low-water period since 1860 occurred between the years 1888 and 1893. During this period the lowest annual mean discharge at Sault Ste. Marie was 57,420 cu. ft. per second in 1892.

Computing from these facts the depth of storage necessary, after allowing this discharge to continue down the lakes, to furnish in addition a continuous flow of 14,000 cu. ft. per second to be diverted into the Mississippi Valley at Chicago, Mr. Hering finds this depth to be 21.6 in. If we add this depth to the lowest annual mean level of Lake Superior, which, since 1860 was 601.43, we get an elevation of 603.23, or but a trifle higher than the high water level recommended by the Commission. Therefore, its recommendations, if adopted, would create by storage during high water in the lake, Mr. Hering asserts, almost the entire flow of 14,000 cu. ft. per second desired by Chicago for its two sanitary canals, without lowering the lakes in the least, nor requiring any expenditure for restoring the original depths of the harbors, channels and canals of the lake system.

Other countries spend large sums of money for water storage to increase the flow of rivers. Our Great Lakes, Mr. Hering points out, are the most magnificient storage reservoirs of the world, high above ocean level and large enough to send, by gravity, great amounts of water to

the sea in two directions for the benefit of commerce. Assuming now that there cannot be an injury to navigation in the Great Lakes from the diversion in the proposed sanitary canals, a few collateral facts of the Calumet-Sag Canal over the use of sprinkling filters are mentioned by Mr. Hering

A final disposition of sewage by at once diluting it with a sufficient quantity of running water has the advantage, he states, of simplicity in operation, and is therefore always preferable to any method of treatment because it requires less attention, care and labor, and from a sanitary point of few, is quite as satisfactory, if the sewage is properly mixed with the diluting water and not used as a potable supply until actual oxidation has made it safe.

As yet the least expensive method of sewage treatment has not been developd to a final state. No municipal plant of sprinkling filters has yet been operated in America, although several are now under construction. We may, therefore, expect that experience, particularly in northern climates, may indicate some desirable modifications, Mr. Hering states, although we expect them to be only slight and in southern climates insignificant. On the other hand, the dilution method of sewage purification being the prevailing one and the oldest one in use, is thoroughly known as to what it can do and what it cannot do. We may, therefore, consider its works to be more permanent, Mr. Hering asserts. Even if the comparison of cost, simplicity and permanence, contrary to fact, had all indicated no distinct advantage for the dilution project, the present case introduces a feature which constitutes a decided advantage in favor of the Calumet-Sag canal. Its size, location and moderate current necessarily combine to make it available for a navigable waterway connecting Lake Michigan with the present sanitary canal at Sag. That there is already a marked tendency to concentrate heavy and bulky freight at the Calumet River is shown by the fact that, while the tonnage of the Chicago River has remained almost constant for 18 years, the annual increase of tonnage of the Calumet River has been quite rapid and is now more than half of that in the Chicago River.

If regulated for slack water navigation, it is well known that silt-bearing rivers have the disadvantages of perpetual dredging. If regulated for large quantities of lake water to materially augment the flow, such dredging will be much reduced and cause a permanent advantage. This view is endorsed and amplified by a remark made in Chicago in 1906 by General O. H. Ernst, Corps of Engineers, U. S. A., who said: "In a future not remote, larger amounts of water (than 10,000 cu. ft. per second) may be needed for sanitary purposes, and channels deeper than 14 ft. will then become practicable in the open alluvial portions of the Illinois River."

After weighing carefully all the advantages and disadvantages of the two propositions, it is Mr. Hering's opinion that the proposed Calumet-Sag Canal is not only the more economical one for disposing of the sewage of the Calumet region, but that it has still other advantages of more or less weight.

Sinking Viaduct Piers with Hydraulic Jacks.

The double track Market St. viaduct of the Philadelphia Rapid Transit Co., joins the Schuylkill River Bridge on a curve and the end tower, carrying a part of the approach span, has two piers, the most heavily loaded of which has about 13½ tons dead and 49½ tons maximum live load. They are located about 60 ft. beyond the water line and were sunk about 40 ft. through miscellaneous fill to coarse gravel with steel cylinders 4 ft. in diameter and 60 ft. long.

An excavation about 10 ft. wide and 30 ft. long was made adjacent to the masonry abutment, and was sheeted down about 10 ft. to water line on three sides with 2x10-in. vertical planks driven against horizontal rangers 5 ft. apart, strongly braced with transverse struts. An 8x12-ft. horizontal platform of 10x10-in. timbers laid on pairs of transverse 12x12-in. girders were set, one on each side of each cylinder pier center and provided with four vertical 1½-in. rods about 12 ft. long with their lower ends passing through the platforms and girders and bearing against the under sides of the latter with nuts and washers. The upper ends passed through 12x16-in. longitudinal horizontal timbers 10 ft. long and took bearing on their upper surfaces with double nuts and heavy cast-iron washers.

Between the rods a 16x16-in. transverse timber, 5 ft. long was seated across the tops of the lower timbers and connected to them with two pairs of 1½-in. bolts, engaging four 5-in. saddle plates on the tops and bottoms of the timbers. A pair of horizontal longitudinal 12-in. I-beams about 20 ft. long were set on the center transverse line of the bents with their top flanges between the pairs of 12x16-in. timbers with their top flanges bearing against the lower surfaces of the 16x16-in. upper timbers, and served as reaction girders for sinking the cylinders.

The platforms were loaded with more than 50 tons of pig iron, and a hydraulic jet was inserted in the cylinder, jacking beams were placed across its upper end and on them were seated a pair of 50-ton hydraulic jacks engaging the lower flanges of the reaction girders. The jet was moved around the interior of the cylinder close to the cutting edge and its scouring action combined with the pressure of the jacks, each operated by two men at its lever, gradually forced the cylinder into the ground while the sand and water overflowed its upper edge, was collected in a sump and drained by a steam pump.

When the first section was driven to the surface of the ground the jacks were removed, a second section was bolted to it through interior flange connections, the jacks were replaced and operations repeated until both cylinders were sunk 6 ft. farther, after which a third section was added, and so on until the continuous steel shell entered the gravel stratum and was pumped out. Men then entered, cleaned and leveled the bottom and rammed the dry 1:3:5 concrete with which the cylinders were filled.

The fill contained so many boulders and other obstructions that about two days were required for sinking each section of a cylinder, but the cylinders for both piers were sunk simultaneously. This method of sinking is, of course, not unusual in building construction, but in this case the conditions were difficult and it was believed that a considerable economy was effected by using this method instead of the ordinary pneumatic caisson method. The work was done by John Monks & Sons, New York, Mr. Chas. Deans, engineer, under the direction of the engineering department of the Philadelphia Rapid Transit Co., Mr. W. S. Twining, chief engineer, and Mr. Chas. M. Mills, principal assistant engineer, and Mr. Frank R. Fisher, resident engineer.

Jacking Down a Pier Cylinder for a Viaduct.

Reaction Beam for Jacking Down a Cylinder.

AFOKONIN is a new dust-preventing material described in a recent report from Consul Norton at Chemnitz. He states that it is a mixture of heavy residual oils obtained in the distillation of coal tar with high-boiling hydrocarbons. The product thus made is prepared for use by heating it in iron kettles, like those employed with asphalt, to temperatures ranging from 212° to 250° F. It is then sprayed evenly over the roadway with a special sprinkler, which operates under such high pressure that the liquid penetrates the upper layer of dust. As a result a compact shining black coating is said to be formed which has no odor and is dustless. This material has been used on the macadamized streets of Leipsic to some extent.

The Reinforced Concrete Work of the McGraw Building.

A paper by William H. Burr, in the "Proceedings" of the American Society of Civil Engineers for October, 1907, to be presented Nov. 20, 1907.

The McGraw Building is a true reinforced concrete structure—the latest type of buildings of that general class. It is on the north side of West 39th St., between Seventh and Eighth Aves., in the city of New York, in that district which has already felt the stimulating influence of the new Pennsylvania R. R. Station in process of construction a half dozen blocks to the south. This part of the city is undoubtedly destined to become a great business center, where substantial buildings of the highest type will be required in order to meet the demands of the development of that vicinity.

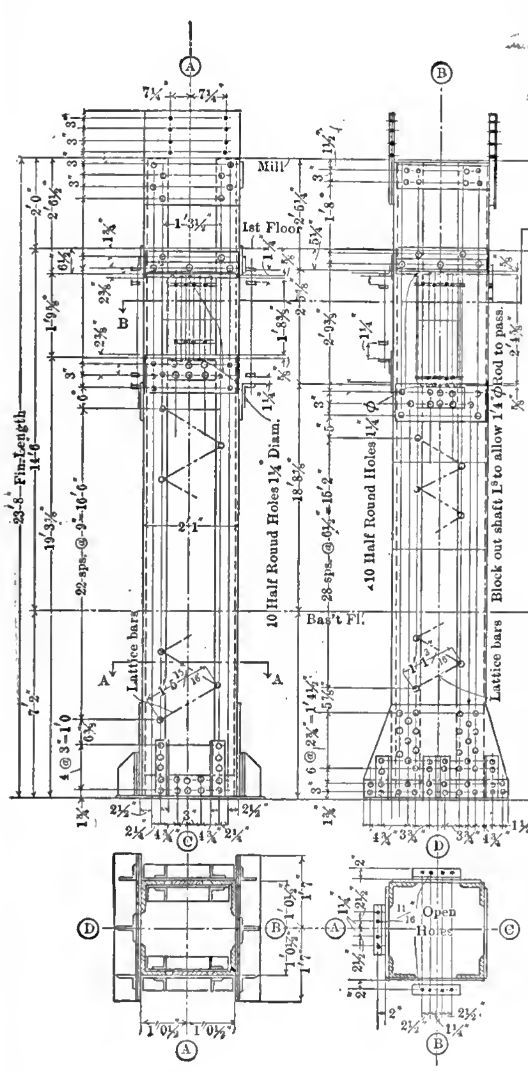
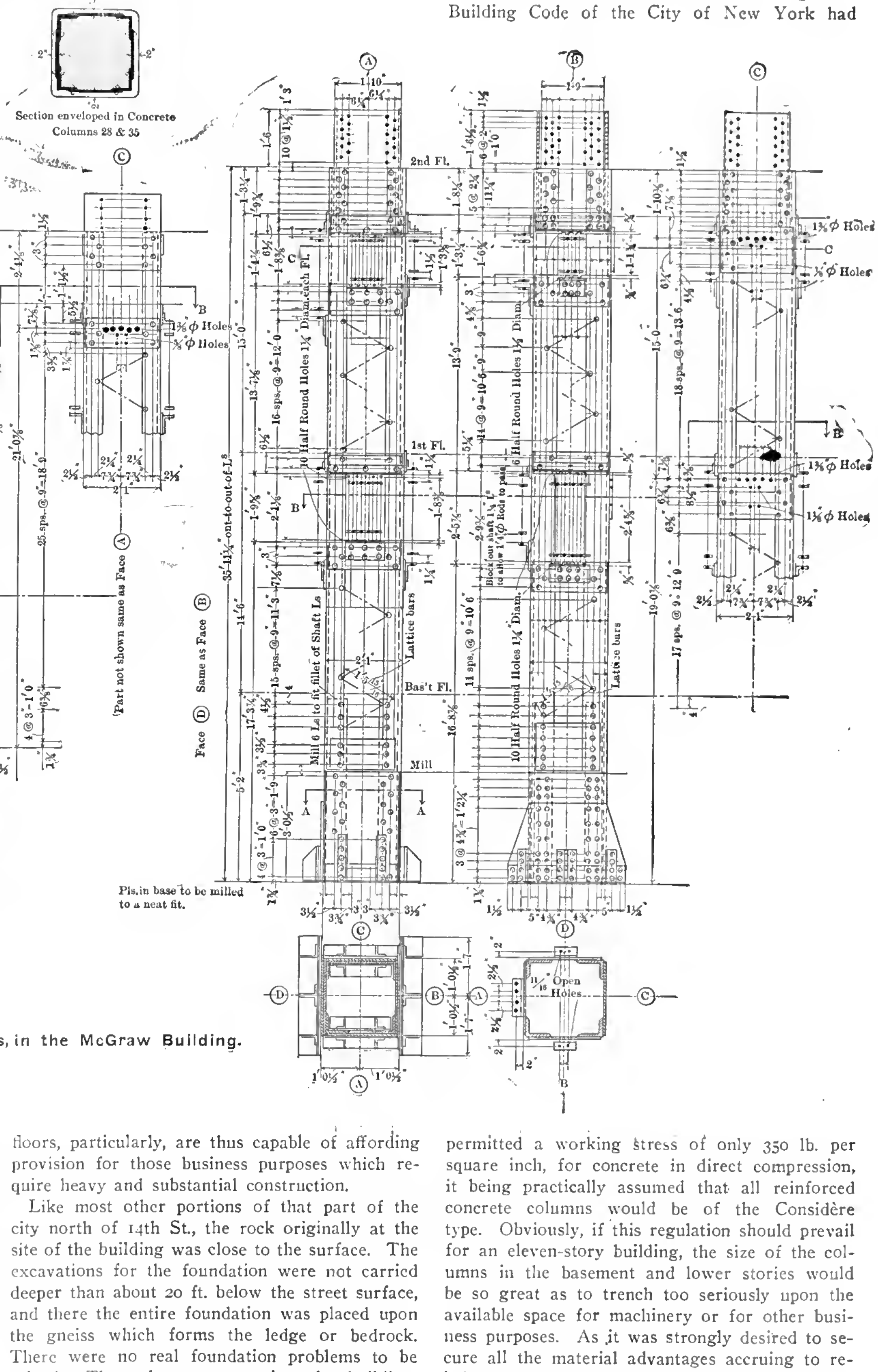
The building has a frontage of 126.3 ft. on 39th St., and a depth of 90 ft. It has eleven stories. The height of the roof is 145 ft. above the ground floor, or nearly 150 ft. above the street, or, finally, 159 ft. 6 in. above the basement floor. While, therefore, it is far from ranking among the tallest sky-scrapers of the city, it is to be classed among the high business buildings of Manhattan Island. Its height is much greater than has heretofore been considered practicable for a purely reinforced concrete building, i. e., a concrete building without iron or steel columns.

It has been constructed for the McGraw Realty Co. primarily to accommodate the business of the McGraw Publishing Co., whose publications include "The Engineering Record," "Electrical World" and "Street Railway Journal." At the same time is was designed to accommodate not only the printing presses of the McGraw Publishing Co., but any other similar business requiring the operation of heavy machinery or the storage of heavy goods in bulk. It was imperatively necessary, therefore, that the building should be designed and built so as to afford the greatest possible resistance to the vibration of heavy machinery, and possess to an unusual degree both rigidity and durability. It is also fireproof to such an extent that the McGraw Realty Co. may reasonably be its own insurer. While the building is admirably adapted to office use, its lower floors, particularly, are thus capable of affording provision for those business purposes which require heavy and substantial construction.

Like most other portions of that part of the city north of 14th St., the rock originally at the site of the building was close to the surface. The excavations for the foundation were not carried deeper than about 20 ft. below the street surface, and there the entire foundation was placed upon the gneiss which forms the ledge or bedrock. There were no real foundation problems to be solved. The columns supporting the building, and the retaining or area walls around the basement, were all founded upon the same ledge, under the requirements of the Building Code of the City of New York.

In order to meet the exacting requirements for the unusually substantial structure required by the McGraw Publishing Co., it was decided to design the building for a live load of 250 lb. per square foot for the first and second floors, 200 lb. per square foot for the third floor, 150 lb. per square foot for the fourth floor and 125 lb. per square foot for all the other floors above the fourth, and with a live load of 60 lb. per square foot for the roof. All parts of the floor beams and girders, therefore, and the columns, were designed to sustain, under the requirements of the Building Code, the actual weight of the structure and the live load specified above.

Prior to the submission of this design the Building Code of the City of New York had permitted a working stress of only 350 lb. per square inch, for concrete in direct compression, it being practically assumed that all reinforced concrete columns would be of the Considère type. Obviously, if this regulation should prevail for an eleven-story building, the size of the columns in the basement and lower stories would be so great as to trench too seriously upon the available space for machinery or for other business purposes. As it was strongly desired to secure all the material advantages accruing to reinforced concrete structures, it became necessary to design such columns as would be of much smaller cross-section than those of the type heretofore prevailing. Two procedures were available: one was to use a substantial quantity of

Steel Reinforcement for Typical Columns, in the McGraw Building.

steel in the form of an ordinary steel column suitably designed for this purpose, and the other was to use the concrete in such a way as to justify a much larger working stress per square inch than that prescribed in the Building Code. These requirements are met in an eminently satisfactory way by the columns of the type used. All columns throughout the building are composed of an interior filling of concrete combined with steel angles latticed in the ordinary manner of built steel columns. The interior columns and most of those in the exterior walls are built with four angles, with the usual riveted lattice or lacing bars on the four sides of each column. In the case of a number of the exterior columns it was necessary, for the attainment of unavoidable structural ends, to use a column of elongated cross-section with eight steel angles of the same general type as those in the interior, which, with the concrete filling, form a column of two cells, so to speak, rather than one. The plans accompanying this paper show fully and clearly this arrangement of the combined concrete with steel angles and lacing bars. In all cases the steel angles, with the corners of the angles turned out, were spaced as far apart as the extreme outer dimensions of the completed column would permit.

In accordance with the requirements of the Building Code, there is a thickness of 2 in. of concrete outside of the steel angles. This 2-in. shield of concrete is assumed to carry no load whatever; its function is simply that of fireproofing, i. e., to protect the steel against the immediate heat or flames of any fire that may start in the combustible materials at any time stored in the building, or of a conflagration in an adjoining building. The concrete within the exterior dimensions or outline of the steel angles is available for carrying a compressive or column load. As it is completely embraced or surrounded by the steel angles and lacing bars, it is steel "banded" in the most effective manner possible. Its enclosure in the steelwork of the column is so rigid, manifestly, that lateral strains under column loads must be greatly reduced—in fact, nearly prevented—within any ordinary limits of loading. Such concrete, therefore, is largely prevented from the usual yielding of that material under compression, and its compressive carrying capacity is increased. This is not only obvious from the condition of the concrete in these columns, but that view is confirmed by the comparatively few results of tests of concrete columns of this character. When, therefore, the plans of these columns were submitted to the Bureau of Buildings of the City of New York for examination and final approval, a special regulation was made permitting the concrete to carry a maximum working load of 750 lb. per square inch within the exterior limits of the steel angles, the exterior 2 in. of concrete, as stated previously, being considered simply a fire-protecting shield. This increased permissible load upon the concrete is coupled with the further provision that the cross-section of the steel in any column at any floor shall be sufficient to carry the entire dead load above that section without stressing the steel to more than 16,000 lb. per square inch.

The use of the steel, in load-supporting condition, as a long column independent of the concrete, and at the same time forming a rigid banding member for the latter, with the consequent increase of permissible working load on the concrete, reduced the size of the columns in the basement and lower stories to dimensions quite consistent with the desired convenient and economical use of the clear floor space. Columns of this general type combine with their high carrying capacity, great convenience in erection, for their steel sections may be erected ahead of the concrete work and afford convenient supporting members for the adjoining forms or for other erection work. The lacing bars, rivet heads, and other projecting column details act positively in creating a firm and complete hold or bond between the steelwork of each column and the concrete enclosed within it. This feature of these columns compels the steel and the enclosed concrete to act as a unit, and this action is enhanced by placing all the lacing bars in one direction inside the steel angles, the other set being placed outside, as shown on the plans.

The Building Code requires the ratio between the moduli of elasticity for the steel and concrete to be taken as 12. Hence, as the permissible compressive working stress in the concrete was taken at 750 lb. per square inch, the corresponding working stress in the steel would be 9,000 lb. per square inch.

The largest columns (in the basement) have exterior dimensions of 29 x 29 in., but, at the eleventh story, the exterior dimensions are reduced to 14 x 14 in. These columns were built in sections of a length equal to the combined height of two stories, i. e., 25 ft. The extra metal involved in this procedure was too small to be of practical consequence, and the expense of half the joints, if a change of section had been made at every floor, was saved. Much time was also gained in the erection of the steelwork. The abutting ends of the column sections were faced, and the joints were made by suitable splice-plates. Where there was a change in the exterior dimensions of the steelwork, full-strength splices were made by riveting suitable short-angle sections on the interior of the splice-plates of the lower part of the joint. These details are also shown on the plans.

The ratio of the area of steel section to that of the concrete for the various columns varied from 10 per cent. in the basement where the steel carries about 57 per cent. of the total load to 3½ per cent. in the ninth floor where 30 per cent. of the total load is carried by the steel. The requirements of the Building Code for a design of this type raises the percentage of steel to much higher values than in ordinary concrete-steel work.

Table 1 shows the number and sizes of steel angles used throughout the main columns of the building.

The design of the floors, in general, is quite similar to that usually found in buildings of this class, although there are certain important details which do not come under that observation. As the plans indicate, the spacing of the columns is such as generally to divide each floor into panels 21 ft. 9 in. by 14 ft. 8 in. between centers of columns, the clear span of the main girders between columns being 14 ft. 8 in. less the width or diameter of the column section. The clear span of the floor beams between the main girders is 21 ft. 9 in. less the width of these girders. These prevailing lengths of spans of the beams and girders were modified at a few points in each floor to accommodate such features of construction or details of floor space as stairways, elevator shafts and similar details.

As the plans indicate, all floor-girder and beam reinforcement was of round steel rods, of sizes running generally from ¾ to 1⅜ in. in diameter. These rods were grouped in one plane on the tension side of each beam or girder. As a rule, every alternate rod was bent upward at the end of each span so as to rise within about 2 in. of the top of the concrete, from which point it continues through either the main girder or the adjoining column, as the case may be, into the adjoining span well toward the quarter point of the latter. By these means, true continuity of beams and girders was secured in every case. In addition to this, the end of each rod was bent down, forming a right-angled turn, with an arm from 2 to 3 in. long, thus insuring a rigid bond or connection with the concrete. This main detail, formed by carrying the rods through the girders and columns, is an important feature in securing continuity and rigidity in the general construction of the building. It is believed to be one of the most important details of the best design of reinforced concrete building construction, and it should be secured either in the manner adopted in this building or by some other procedure of at least equal excellence.

The proper spacing of these reinforcing rods was secured by suitable supporting details throughout the length of the beams and girders themselves and by notches cut in angle-brackets riveted on the columns where they joined the latter members. At the columns, rigidity of connection was secured by bolting clamps through the angle-brackets just named and jamming the rods by tightening the nuts against those brackets. This secured an exceedingly strong metal connection between the reinforcing rods and the steel columns, aside from the further rigidity produced by the concrete mass of the intersecting columns, beams and girders. These details, shown on the plans, were designed with care for the purpose of securing the strongest possible steel connections between the beams or girders and the columns, it being one of the main purposes to attain rigid continuity between floors and columns, and floors and outside walls. It is believed that unusual stiffness and strength have been given to this building by these means.

All beam and girder computations required by the floor designs were made in accordance with the provisions of the Building Code of the City of New York, the usual common theory of flexure formulas for concrete-steel beams being used.

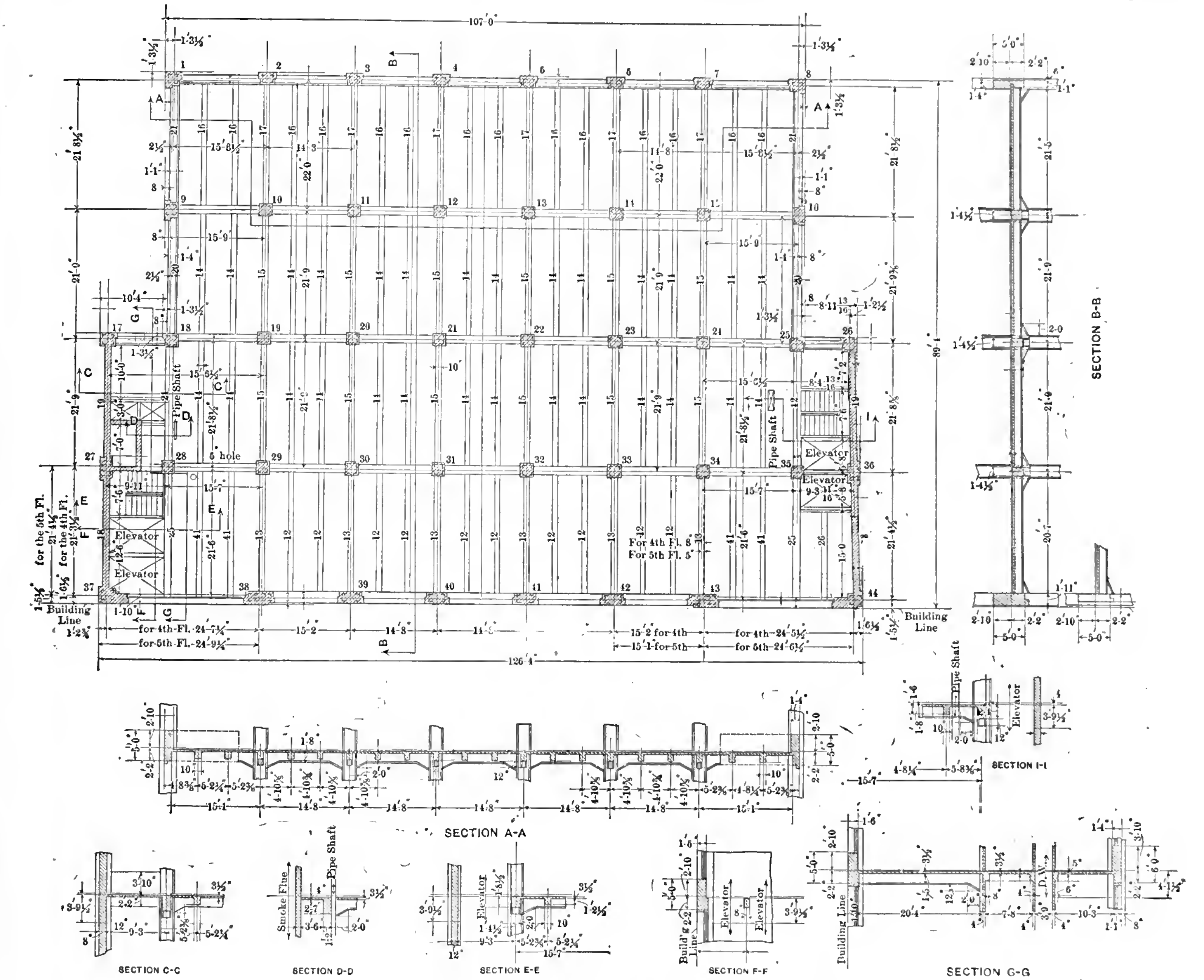
TABLE 1. SIZES OF STEEL ANGLES IN COLUMNS, AND OUTSIDE DIMENSIONS OF STEEL COLUMNS, *i. e.*, BACK TO BACK OF ANGLES.

Floor.				
11	4 L's, 2½ x 2½ x 6/16 in. 10 x 10 in., b. to b.	4 L's, 3½ x 3½ x 9/16 in. 10 x 10 in., b. to b.	4 L's, 2½ x 2½ x 6/16 in. 12 x 26 in., b. to b.	4 L's, 2½ x 2½ x ⅜ in. 12 x 26 in., b. to b.
10	4 L's, 3 x 3 x 7/16 in. 17 x 17 in., b. to b.	4 L's, 3½ x 3½ x 9/16 in. 10 x 10 in., b. to b.	4 L's, 3 x 3 x 7/16 in. 12 x 26 in., b. to b.	4 L's, 2½ x 2½ x ⅜ in. 12 x 26 in., b. to b.
9	4 L's, 3 x 3 x 7/16 in. 17 x 17 in., b. to b.	4 L's, 3½ x 3 x ⅝ in. 17 x 17 in., b. to b.	4 L's, 3 x 3 x 7/16 in. 12 x 26 in., b. to b.	4 L's, 3 x 3 x 9/16 in. 12 x 27 in., b. to b.
8	4 L's, 5 x 3 x 11/16 in. 18½ x 18½ in., b. to b.	" " " " " "	4 L's, 3½ x 3 x ⅝ in. 12 x 28 in., b. to b.	" " " " " "
7	" " " " " "	4 L's, 6 x 4 x ¾ in. 18½ x 18½ in., b. to b.	" " " " " "	4 L's, 3½ x 3½ x 11/16 in. 12 x 29 in., b. to b.
6	4 L's, 6 x 4 x 16/16 in. 20½ x 20½ in., b. to b.	" " " " " "	4 L's, 5 x 3½ x ⅝ in. 12 x 30½ in., b. to b.	" " " " " "
5	" " " " " "	4 L's, 6 x 6 x 13/16 in. 20½ x 20½ in., b. to b.	" " " " " "	4 L's, 5 x 3½ x 11/16 in. 16 x 32 in., b. to b.
4	4 L's, 6 x 6 x ⅞ in. 22 x 22 in., b. to b.	" " " " " "	4 L's, 6 x 4 x 11/16 in. 16 x 33½ in., b. to b.	" " " " " "
3	" " " " " "	4 L's, 8 x 6 x ⅞ in. 22 x 22 in., b. to b.	" " " " " "	4 L's, 6 x 4 x 13/16 in. 16 x 35 in., b. to b.
2	4 L's, 8 x 6 x 1 in. 24 x 24 in., b. to b.	" " " " " "	4 L's, 6 x 4 x ⅞ in. 16 x 36½ in., b. to b.	" " " " " "
1	" " " " " "	4 L's, 8 x 6 x 1 in. 25 x 25 in., b. to b.	" " " " " "	4 L's, 6 x 4 x 16/16 in. 16 x 38 in., b. to b.
Basement	4 L's, 8 x 6 x 1 in. 25 x 25 in., b. to b.	" " " " " "	4 L's, 6 x 4 x 16/16 in. 16 x 38 in., b. to b.	" " " " " "

While the parabolic law of variation of intensity of stress in concrete beams results in a trifling economy of material, it is less rational and simple than the usual straight-line law of variation, and the latter is more nearly accurate.

The Building Code of New York does not permit the condition of perfect continuity of beams to govern the design of reinforced concrete floor beams and girders. It is permitted, however, to consider the maximum bending moment of such beams, when uniformly loaded from end to end, as the total load multiplied by one-tenth of the span, rather than one-eighth of the span as would be taken were the beams simply supported at each end. This is a widely used method for continuity, in favor of which much can be said. It is extremely doubtful whether perfect continuity is attained in any case, but it is certain that a material advantage is secured over the condition of a beam simply supported at each end. The one-tenth rule, as it may be called, is a reasonable compromise.

Another condition insisted upon in the design of this building was a metallic provision for taking the end shears of beams and girders. By referring to the plans there will be observed inclined portions of the round steel reinforcing rods to which attention has already been called. In every case there is sufficient steel in these inclined portions of rods to take the total end shears multiplied by the secant of the inclination rods to a vertical line without stressing the steel to an unsafe extent. While the tension in the steel produced in this manner, ignoring entirely the shearing resistance of the concrete, is higher than would normally be prescribed, it is far below the elastic limit, and forms a safe provision for the entire end shear in case any exigency should arise producing such a break in the concrete as practically to destroy its capacity for shearing resistance. In addition to this condition, there is sufficient concrete also at the ends of beam and girder spans to carry the shear at an intensity of 50 lb. per square inch of concrete section as permitted by the New York Building code. This, also, has been considered one of the essential details of a concrete-steel building designed for a heavy and otherwise fatiguing service.



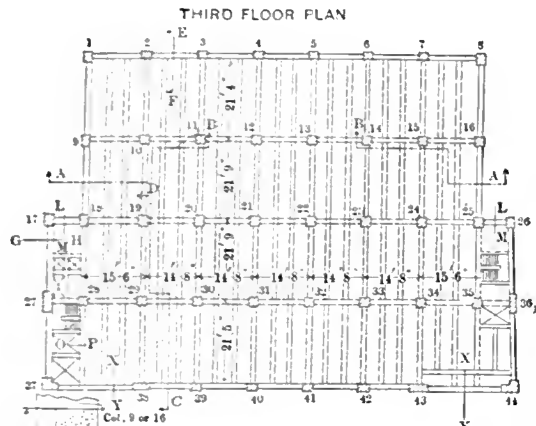
General Plan and Sections of Typical Floor, McGraw Building.

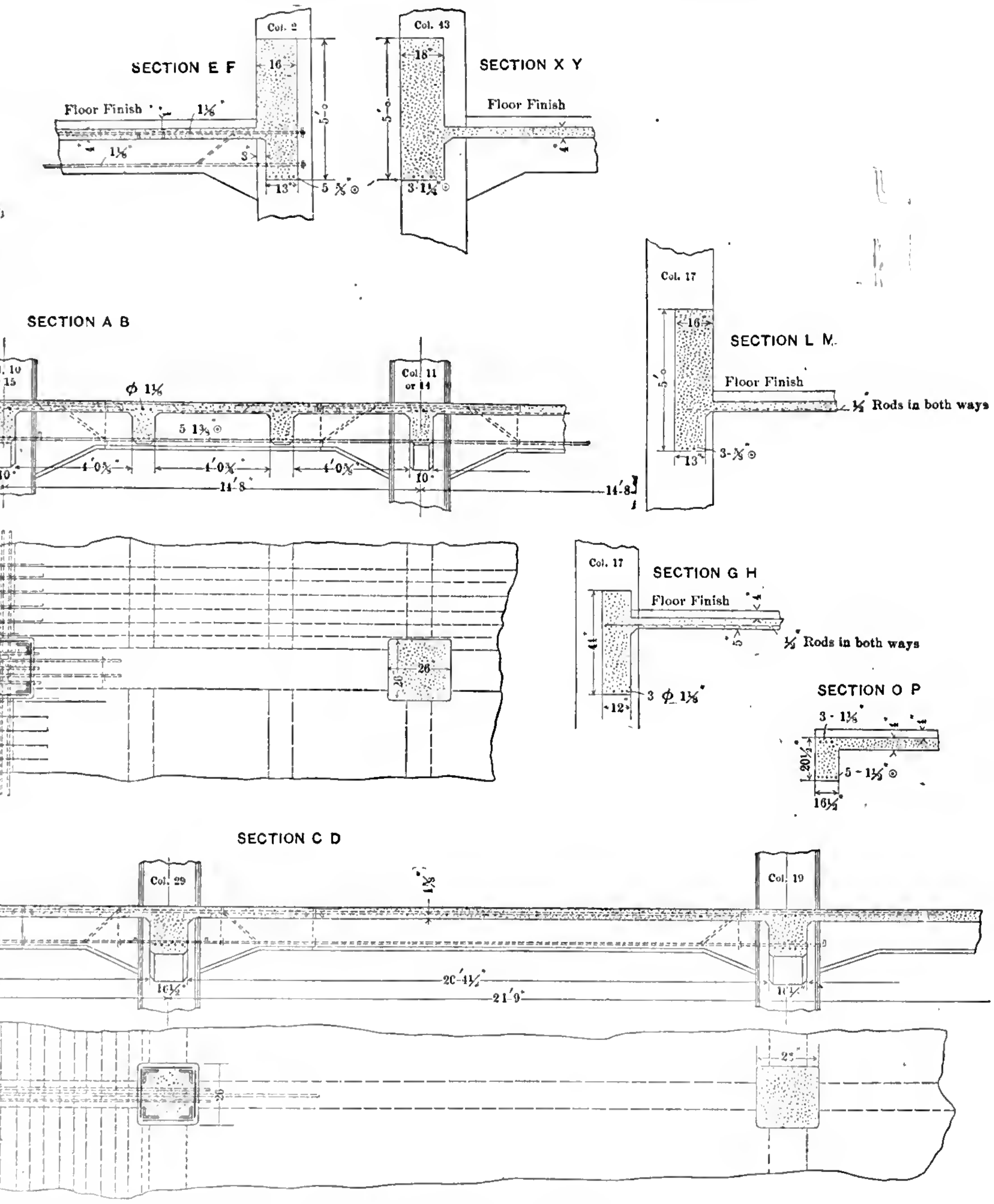
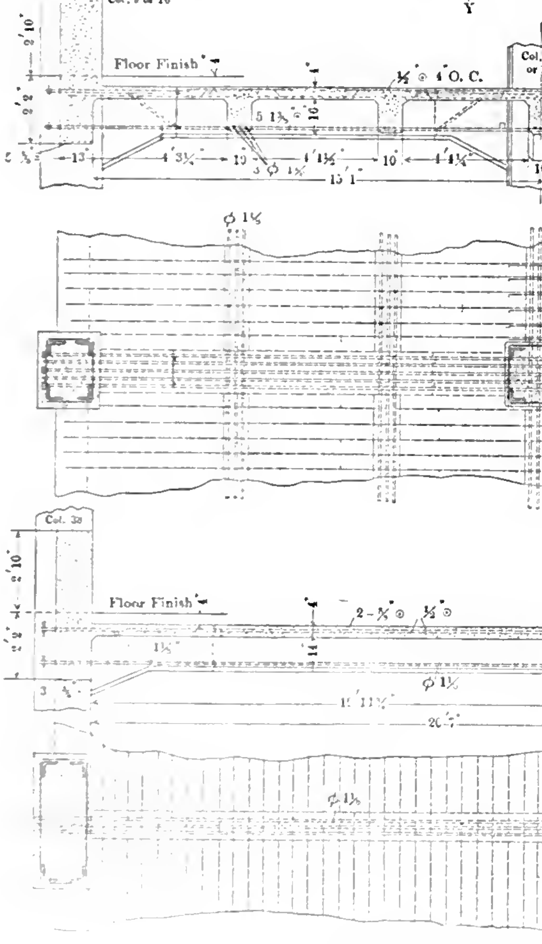
The floor slabs spanning the spaces between the floor beams are 4 in. thick in the lower floors, carrying the heaviest loads, and 3½ in. thick in all the higher floors. Their reinforcements are ½ and ⅝-in. rods, long enough to extend over a number of panels or spans so as to make these also continuous. Their general design is similar to that of the floor beams and girders. As the distance apart of the centers of the floor beams is about 5 ft. 2 in., the clear span of these floor slabs varies from about 4 ft. to a little more than 4 ft. 4 in., according to the thickness of the adjoining floor beams on either side of the span.

The proper design of the wooden forms or moulds for a concrete steel building, in order to secure expeditious and economical work, is the most difficult part of the entire undertaking, and the principal improvements to be made in it are those which pertain to perfecting a proper system of construction of the forms and their ready handling. The quantity of lumber required in them, and the carpentry work necessary in making repairs consequent upon their use and re-use for successive floors, and in their supports, constitute far larger items of cost than might at first be supposed. If these costs are to be reduced, as they must be for heavy concrete-steel construction of the best class, the principal study of the engineer must be directed to this particular part of his work. While these ends may not and probably have not been completely attained in this instance, the system of forms used gave excellent results in the quality of the concrete produced, and led to reasonable economy and efficiency. The weight of concrete and the relatively large quantities used in such individual members as beams, girders and columns make heavy forms imperative and substantial support necessary.

The details of the timber forms for the floor beams and girders where they meet the column forms require especial attention. A proper design of the parts where the floors and columns join will result in great economy in the details of the forms. If the shapes of the exterior surfaces of the concrete are complicated and require-

careful fittings of the column and floor forms, expensive carpentry work will be required wherever a column pieces a floor, whereas simply shaped concrete surfaces will eliminate that work and greatly expedite the construction. Similarly, it is highly desirable that there shall be as few changes as possible in the exterior dimensions of the columns. If exterior column dimensions could be retained unchanged from basement to roof, it would make possible complete uniformity of the details of column and floor forms throughout the entire building, eliminating a great amount of fitting and carpentry work otherwise unavoidable.



Plan and Sections of Typical Floor Beams and Girders Showing Steel Reinforcement.

It is obvious that it is essentially impossible to retain uniform exterior column dimensions throughout the series of floors from the bottom to the top of the building, but the most scrupulous care should be exercised to make these changes as few as possible and in such a way as to reduce to the utmost extent changes of details in the forms.

A reference to the plans will show that the floor forms between the beams consisted of large shallow boxes with truncated corners between the sides and the bottom. They were placed bottom up on stable supports and separated by the thickness of the adjoining floor beams at the sides and by the thickness of the main floor girders at their ends. The bottom of the opening between the adjoining sides of any two of them was then suitably closed with planks or boards so that when the concrete was finally poured over their tops to the thickness of the floor slabs, the desired paneling of those slabs between the beams and girders was secured. It is imperative, for expediting the work, as well as for economy, that these box forms for the floors shall be constructed so that they may be removed readily after the concrete becomes sufficiently hard. To secure this important result, such forms must be readily collapsible at both ends and sides, and, at the same time, they must be substantial enough to hold the wet concrete without distortion and so well made that they may be handled in removing from one floor and replacing on a higher one without sensible damage. This constitutes one of the most essential points in the design of these forms, which, in this case, were collapsible although perhaps not as freely as might be desired. When the forms stick to the concrete in the process of removal laborers use sledges and iron bars, driving the latter between the new concrete and the forms and making a fulcrum of the former. This results in seriously marring what might otherwise have been a highly satisfactory concrete surface. The same general observations apply to the forms for the columns. Whenever the art of reinforced concrete construction is brought to the high state of excellence which it must ultimately reach through a proper design of the forms, making their erection, support and removal expeditious and free, the labor bills for the work and the repairs of the forms themselves will be so greatly reduced as to give this class of construction material economic advantage.

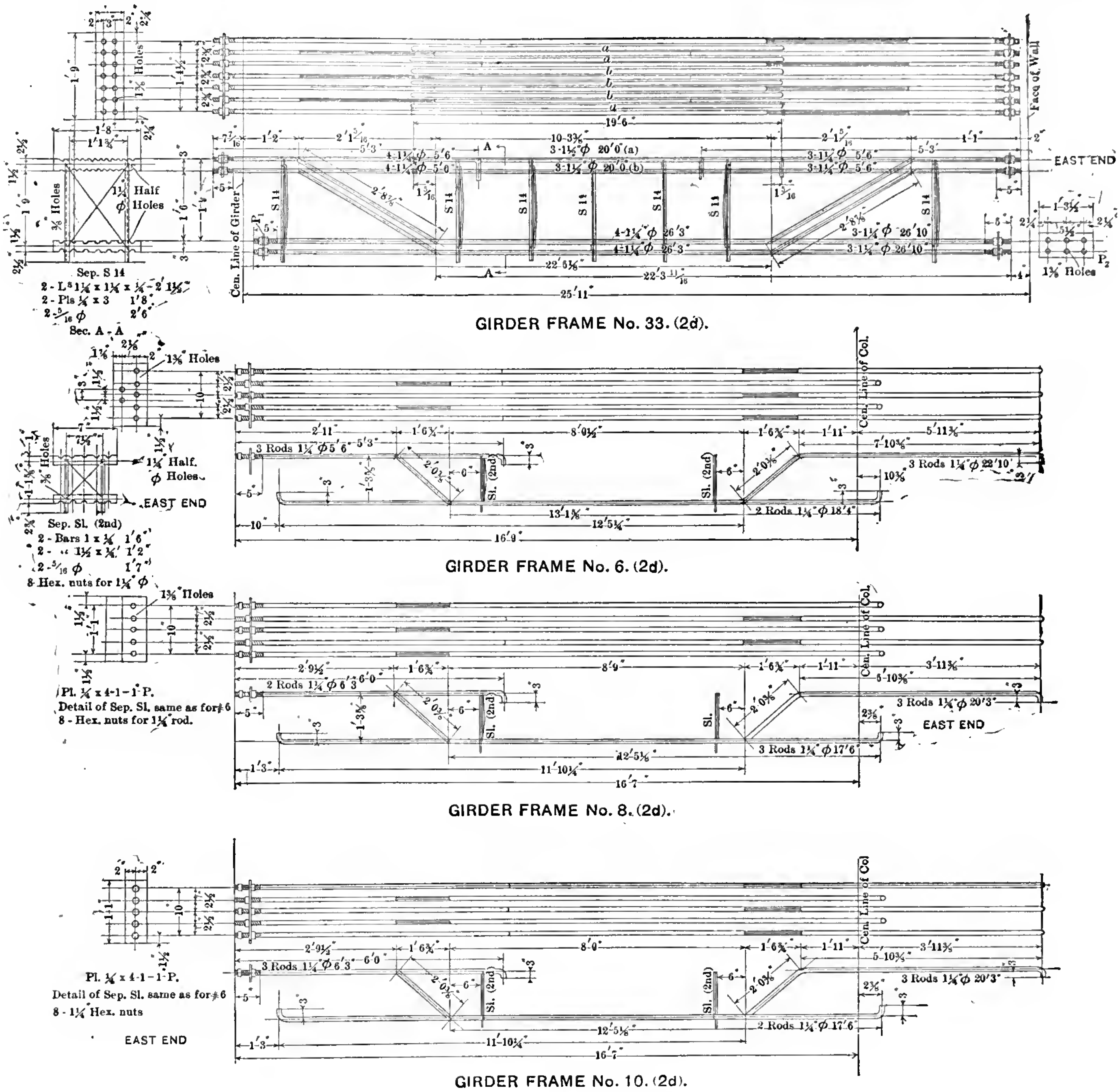
The length of time which the forms should remain in place supporting fresh concrete will depend on the temperature, and hence on the season as well as on the character of the work designed. It is clear that, with the substantial steel reinforcement of the columns of this building, a minimum of time would be sufficient for the column forms, but as it was not convenient to remove the latter until the floor forms were also ready to come down they were all kept in place for at least 19 days. Three entire sets of forms for floors and columns were made, so that, while concrete was being poured for the uppermost floor being constructed, the two stories immediately below were still supported by the timber forms. The lowermost set of forms was then taken down and placed above the freshly formed concrete last put in place. In this manner the forms could be left in place long enough to satisfy the requirements of even the Winter season.

The concrete work of the building proper was begun in the basement in September, 1906, and the concrete parapet walls on the roof were carried on almost uninterruptedly throughout the Winter. A few of the coldest and stormiest days of the Winter were sufficiently severe to cause the work to be suspended for the day. When it is remembered that from the latter part of January until the early part of March the weather

was phenomenally severe, it is demonstrated by actual experience that reinforced concrete building work may be conducted under proper conditions through a New York Winter without material interruption.

After the completion of the lower two or three stories, when the organized force had become accustomed to the character of the work and the sequence of operations required, the average rate of progress, including the delays and occasional interruptions caused by the Winter weather, was about twelve calendar days to a story.

From the early part of December to the latter part of March the window openings of the story below the floor in process of construction were closed with canvas, behind which, distributed over the entire floor, salamanders burning coke were constantly kept in operation. These salamanders were to some extent concentrated under the freshly poured concrete. By these means entirely satisfactory temperatures could be maintained, so that the retarding influence of the frost on the setting of the concrete was to a great extent eliminated, except for the fact that occasionally the top surface of the fresh concrete was frozen. The warmest air produced by the salamanders would rise to and remain in the overhead cellular spaces of the timber floor forms and act there with a high degree of efficiency.



Steel Reinforcement of Typical Girders, McGraw Building.

In connection with the operation of the salamanders below the fresh concrete, the top of the latter, as fast as poured, was always protected by a covering of hay or canvas, or both. These protective measures were scrupulously enforced throughout the winter with entirely satisfactory results. Indeed, there was no evidence to be found throughout the whole building to show that any part of the concrete whatever was affected injuriously to the slightest extent by the frost. During a considerable portion of the winter a few salamanders were kept burning in the second floor below the work in progress.

All the construction work of the building was carried on from a high central temporary timber tower running from the basement to a height of nearly 75 ft. above the roof. This timber tower was 31 ft. square and built with 10x10-in. yellow pine spliced corner posts properly braced. Each 10x10-in. corner stick carried a derrick boom 75 ft. in length. These derricks were first placed low down on the tower, and then raised from time to time to elevations required by the progress of the work. The booms were long enough to command the entire area of the work, and had a sufficient swing or reach to pick up material, including sections of the steel columns, delivered in the street in front of the building, and put it in its proper permanent place. The hoisting engines were placed in the basement, and steel cables ran from them up to the derricks.

It was a question at first whether the cost of this tower and derricks was justified by the amount and character of the work to be done, but they were found to be fully justified and well adapted to their purpose. It was probably as economical and expeditious a method as could have been devised for handling the materials and serving the work. As the building was carried up, the work within the limits of the tower was completed, with the exception of the points where the corner 10x10-in. sticks pierced the respective floors where enough free room was left for the operating cables. After the concrete work was finished the tower was taken down through the succeeding floors of the building, and the holes left for the corner posts were filled.

There was nothing unusual about the character of the materials used throughout the building. The material and workmanship of all the steelwork were supplied and manufactured under Cooper's Specifications. The Portland cement used was the Dragon brand, and it was tested and supplied under the standard specifications recommended by the Special Committee of the American Society of Civil Engineers. The sand, broken stone and gravel were supplied by different parties about the city of New York. Some of the broken stone came from the north, down

the Hudson River, and most of the sand and gravel came from Long Island. Throughout the building proper, 3/4-in. broken stone—trap rock and limestone—was used, with the exception of considerable quantities of gravel in which no pieces had a greater maximum diameter than about 3/4 in. In some of the larger masses of the retaining walls and other similar parts of the foundation and basement of the building, 1 1/2-in. broken stone was used.

The proportions of the concrete for the entire building were: One of cement, two of sand, and four of broken stone or gravel by volume. The consistency of the concrete was very nearly or quite wet enough to be that termed semi-liquid, so that it was truly "poured" into all forms for columns, walls and floors. Such a consistency of concrete is imperative for reinforced concrete construction of this class. It enables the concrete to form an intimate and dense matrix around the steel reinforcement, and produces a most excellent quality of material. While the concrete was being poured laborers with long thin sticks continually agitated the fresh concrete in order to release all air bubbles and insure a dense and continuous product and the best possible bond with the embedded steel. There was no sensible excess of water in the concrete, but it was practically semi-liquid—too thin even to quake. The results throughout the entire work, in this respect, have proved to be in the highest degree satisfactory. The total quantities of the principal materials used were: Cement, 8,500 bbl.; sand, 3,000 cu. yd.; broken stone, 4,300 cu. yd.; gravel, 1,066 cu. yd.; steel in angle columns, 655 tons, latticed; steel in round reinforcing rods, 507 tons.

Ornamental Foot Bridge in Bronx Park.

A handsome foot bridge of rubble masonry has been constructed recently in the New York Botanical Garden, Bronx Park, New York City. It is 110 ft. long from face to face of the abutments and is made up of three 20-ft. and two 16-ft. spans, one of the latter being at each end of the bridge. The piers have a uniform thickness of 7 ft. and are 29 ft. wide at the base and 27 ft. wide at the level of the springing lines, above which level they are curved in gracefully to meet the parapet walls. The arches are segments of circles and their thickness is uniformly 2 1/2 ft. The parapet walls are 2 ft. thick and rise 3 ft. above the top of the foot path at the crown points of the arches. Weep holes are provided at each pier and a 6-in. layer of concrete, covered in turn with asphalt waterproofing, is laid over the entire upper surface of the arches and piers.

The bridge is built entirely of material selected from the old stone fences in the park which are gradually being destroyed. The stones forming the parapet walls and the exterior surfaces of the arches and piers were specially selected and disposed to make the best possible appearance. The facing stones of the arches are placed radially anad by selecting stones decreasing in length from the haunches to the crown, with a keystone at the center, a pleasing effect was obtained at little expense. In constructing the arches, to prevent the mortar from running down and entirely filling the interstices between the soffit stones, the latter were bedded in a layer of sand laid on the centering; when the centering was removed the sand dropped out and the outer surfaces of the stones were free from mortar as was desired. The bridge was designed and built under the direction of the Department of Parks, Borough of the Bronx, New York City, of which Mr. Martin Schenck is chief engineer, and Mr. W. P. Hennessy is assistant engineer.

Gas-Power Central Station of the Duquesne Light Co., Pittsburg, Pa.

A paper read before the American Institute of Electrical Engineers, Pittsburg Branch, by Norman C. MacPherson.

Although the territory now supplied by the Duquesne Light Co. was already covered by the distribution system of another company. there seemed to be room for further business for a central station securing the advantages of more uniform regulation and distributing directly from the center of gravity of its load, thus obviating the first cost, the maintenance, and the losses of long transmission lines. Work was begun on June 28, 1906, and by October 5 the power station and distribution system were far enough completed to start regular 24-hour service. During the following six months the service increased so rapidly that the station is now heavily loaded and running on an excellent load-factor. The service consists of residential and commercial lighting and power, and these merge into a load having an exceptionally long hour evening peak and a fairly even day load. The 60-cycle generators are wound three phase, star connected, and the distribution is partly underground and partly overhead to standard 2,200-volt transformers, which in turn are connected to 110/220-volt secondaries.

The power station In the choice of site and equipment, several factors had to be carefully considered.

a. Proximity to electrical "center of gravity."

b. Coal supply for steam or gas plant.

c. Natural gas supply for gas plant.

d. Water supply for condensing or cooling purposes.

The power house site chosen—near the junction of Penn avenue and the Pennsylvania Railroad—is approximately the center of the system, extending as it does about two miles in every direction from this point. Although the Pennsylvania Railroad passing the property offered excellent fuel facilities, the absence of a natural supply of water in the East End practically barred a steam plant. The high pressure pipe line of the Pittsburg Natural Gas Co., delivering 24,000,000 cu. ft. of gas daily to the mill district of this city, passes within 1,000 ft. of the power house site, and this fuel was finally decided upon for its availability and cheapness. Should the natural gas ever fail or reach a prohibitive price, a producer plant will be erected on the company's adjoining property, the coal used being elevated from the Pennsylvania Railroad tracks. In this case the present engine equipment will be retained, as it is entirely adapted to either natural or producer gas—a good illustration of the flexibility of power gas work. In the building proper—a sub-station fire-proof structure of brick, concrete and steel—the one feature out of the ordinary is that the entire building is devoted to generating machinery, no boiler or producer room being necessary. When complete with four units, the station will total about 3.7 sq. ft. per rated kilowatt, a low figure for a plant of only 720 kw. capacity.

Generating units. Each of the two generating units at present installed consists of a 3-cylinder, vertical, single-acting gas engine, with cylinders, 18 in. in diameter by 22 in. stroke, running at 200 r. p. m., direct connected through a flexible spring coupling to a 180-kw., engine-type, 60-cycle, alternating-current generator. These units are of standard construction and include the very best features for obtaining satisfactory parallel operation, uniform speed under variable loads, continuity of operation, and low operating expense.

Auxiliaries. The auxiliaries include apparatus for supplying compressed air for starting the engines, 4-volt and 110-volt direct current for ignition purposes, 110-volt direct current for exciting the main generators, and water for cooling the engines.

Compressed air supply. The compressed air supply for starting the engines must be independent of the engines themselves, as it must be ready for use when the rest of the station is "dead." For this purpose, a small horizontal, single-acting gas engine is used, which is belted to a two-stage compressor; for breakdown purposes, a separate compressor is installed, belted to a countershaft which in turn can be driven by either of the main engines. The supply of air normally needed for starting the engines, is stored in two 16-in. cylindrical tanks at 200 lb. pressure. In addition, four more of these tanks, each controlled by its own valve, have been installed, which, as they are not to be drawn from except for emergency work, constitute a reserve for the engine-driven compressor. The six tanks total 102 cu. ft., or over ten times the cylinder displacement of one engine.

Ignition current. For initial ignition, there has been provided one set of primary "dry" batteries and one set of storage batteries, either of which is sufficient to operate the plant for some time. For ordinary use, however, a motor-generator set has been provided, taking current for its motor from 110-volt, direct-current, exciter bus-bars, and delivering from its shunt-wound generator, direct current of the same voltage. This supplies current to the ignition points which are operated in series with suitable resistance lamps. The storage batteries, however, are connected inside the lamps and work directly on the ignition points, thus allowing the batteries to "float" on the circuit, at all times fully charged and ready automatically to furnish the ignition current in case of accident to the motor-generator. Whenever necessary the 110-volt exciter circuit can be thrown directly on the same resistance lamps, but this has the drawback of permanently grounding the one side of the field winding of the alternating-current generators.

Excitation. The direct-current excitation for the main generators is provided by two 110-volt, compound-wound dynamos, either of which has sufficient capacity for both of the main units. These exciters are direct connected to induction motors which, in turn, are fed directly from either set of main switchboard bus-bars. These motor-generator sets are also provided with pulleys for belt connection to a countershaft which, in turn, can be run by either of the main engines through friction clutches. This clutch and belt device is occasionally a decided convenience in different ways, but its normal and important use is only for a few minutes, namely, after an accident has deadened the main alternating-current switchboard bus-bar. In this case the first main generator secures its excitation by means of an exciter set driven by its belt; the main generator is then switched on the bus-bars and supplies current to the induction motor of the other exciter set. Next, the exciters are paralleled, the load transferred to the second exciter, and finally the friction clutch driving the first exciter set is released.

Cooling water. The simplest method of cooling the cylinder jacket is, of course, to use fresh water directly from the city mains; this method, however, is rather expensive, and a circulating system has been installed which permits the use of a given quantity of city water over and over again until its temperature is too high. For this purpose, a two compartment concrete tank has been constructed on the roof of the building, provided with overflow and risers, connected with engines and city water piping. In these roof tanks a sufficient amount of surface cooling has been obtained to reduce the quantity of water required by the plant to about one-half of that needed without this circulating system, and this

proportion will be still further reduced by a simple form of cooling tower now being constructed on the roof. For emergency use, it is proposed to employ well water, although impurities will not permit its steady use. The jackets do not work under full pressure head from the tanks, about 35 ft., but deliver into a supplementary tank located on the mezzanine floor of the engine room, giving about 5 ft. of pressure head on the engine jackets. This is sufficient to provide solid water at all points and to prevent air pockets. From this tank a centrifugal pump, driven by a 3 horse-power induction motor, delivers this water to the roof tanks.

Piping. The engine exhausts are carried out though the building walls with easy bends, and then rise 40 ft. to clear the roof. As water is used in the exhausts, these risers are drained near the engines. A simple steam exhaust head capping each riser completely deadens the exhausts, thus avoiding the difficulty sometimes experienced with gas plants located in residence territory.

The gas is delivered at the power house at about 15 lb. pressure, but this is reduced to 8 ounces before being metered. This pressure is further lowered to 2 ounces by the regulators furnished with each engine. Ample storage capacity in the shape of liberal piping, has been provided on both sides of the engine regulators to insure a moderately uniform flow of low pressure gas.

Parallel operation and regulation. As this is a 60-cycle, polyphase plant, carrying a mixed load of lights and motors, it is apparent that good voltage regulation is necessary and that satisfactory parallel operation is an indispensable feature. The very fact that the plant is able to give so good a quality of service is proof that the parallel operation bugaboo held over the gas engine for years, has been driven to cover especially with direct-connected 60-cycle generators. These units are paralleled in precisely the same manner as the ordinary steam unit, on an "opening throttle;" that is, the new unit is brought slowly up to synchronism with the one in service, and after the switches are closed, the throttle is spun open. There is an important advantage, however, over a steam engine of ordinary construction; namely, that the tension of the governor spring may be easily changed by hand while the engine is running, thus changing its speed and consequently its load also. As a matter of fact, instead of altering the governor spring, a pair of springs at the mixing valve working against the governor spring is adjusted, thus securing the same result. This adjustment, consisting simply of a pair of thumb screws, gives an opportunity to bring up the load on the new unit as slowly or as rapidly as desired, and to any point. Thus the fresh unit may be given more than its share of the load for a time to relieve the temperature of the other; or should an igniter on either engine give trouble, the load may be dropped to two-thirds rating without taking the unit out of service. This adjustment is also sometimes used to bring the engine into synchronism. The effect of a misfire in one of the cylinders is never noticeable on the line, except when the misfire continues for several cycles, which is rare. Naturally, it induces some little surging between the two machines, owing to the temporary disablement of a cylinder, but the shock is readily absorbed by the spring coupling and does not show the slightest tendency to throw the engine out of step. In general, the regulation from this plant is fully as good as could be expected from any steam plant, and is entirely due to the method of controlling the quantity of mixture by the governor, which is a fundamental feature of the 4-cycle gas engine.

Ignition. This is one of the most vital points in gas engine work and should receive careful attention from both the designing and operating engineer. There should be at least two separate sources of ignition current continuously available, which are provided for here by the small 110-volt shunt-wound generator and the set of 4-volt storage batteries, as before described. Only one case has occurred where an engine has been shut down from the loss of igniter current, and this was due to a ground in the conduit between igniter switchboard and engine. This occurred in spite of the precaution of running all wiring through loricated iron conduit. A few spare igniters are always kept on hand, and it is only a few minutes work to replace a disabled one. If, however, these are changed regularly and cleaned, as they should be, they give very little trouble. On these engines there is a device for changing the point of ignition while running. It is very necessary in gas engine work that ignition take place at the proper point, otherwise inefficient combustion shown by a badly distorted card, will result. But a good engineer can very readily determine whether the ignition is at the right point merely by the sound of the explosion. Should the gas change in quality for any reason, the ignition can be readily adjusted, as well as the mixture, in a few seconds, without in the least disturbing the running of the engine.

Starting. One very great advantage of gas engine work is the absence of standby losses after the engine is shut down, unlike the steam plant where there are condensation, radiation, and stack losses. The gas engine may stand for an hour or a month without incurring any losses whatsoever, and yet be in readiness for starting within a minute or two of the signal; but a steam engine must be warmed up and "turning over," previous to loading. In the Duquesne plant, compressed air is used for starting the engines. A supply several times greater than that actually required is aways kept stored in steel tanks at 150-lb. pressure. A single air valve controls each engine, and as soon as the air is turned on, the engine automatically comes up to speed, usually in about 45 seconds, so that the unit may be loaded within about one minute from the start, or at least two minutes. This is evidently a good feature in case of emergency spare units.

Station Efficiency. A power station is, in one sense, only a machine for converting the potential heat energy of fuel gas or coal into electrical energy. The efficiency of conversion depends almost entirely upon the type of plant. With steam engines, 4 pounds of coal per kilowatt-hour may fairly be assumed to be well above the average results obtained in lighting plants of less than 1,000 h.-p. capacity. Now 4 lbs. of bituminous coal of 14,000 B. t. u. per lb. (equal to 53.3 cu. ft. of natural gas of 1,050 B. t. u. per cu. ft.), is equivalent to a heat consumption of 56,000 B. t. u. per kilowatt-hour at the switchboard, or an absolute thermal efficiency (1 h. p. = 2,545 B. t. u.) of 6.1 per cent. between the coal pile and switchboard.

Curves were prepared to show the fuel consumption of the Duquesne Light Company's engines, and display the total hourly gas per engine, the gas per kilowatt-hour and the absolute thermal efficiency from gas to electricity. The "total gas" curve, from which the others were calculated, was determined by reducing the actual station records to the equivalent performance of a single engine, and was checked up by a number of readings taken at various loads. We will tabulate for illustration, the values for two different engine load-factors; namely, 40 and 80 per cent. These are extreme limits—a plant requiring five engines to carry its peak load should be able to operate at an average engine load-factor of 80 per cent. and a plant requiring two engines for its peak load would probably run with an average engine load-factor of 40 per cent.

Summarizing the tabulation, we find that natural gas of 1,050 B. t. u. per cu. ft. will give a kilowatt-hour on 21.2 cu. ft., with an average engine load-factor of 40 per cent.; if the engines can be run on an average load-factor of 80 per cent., the gas required will be only 15.2 cu. ft. per kilowatt-hour. These values can be reduced, for sake of illustration, to equivalent pounds of coal having 14,000 B. t. u. per pound; namely, 1.7 and 1.23 lb. per kilowatt-hour, respectively. If it is desired to compare these results with steam data expressed in terms of indicated horsepower these values will be approximately 0.96 and 0.78 lb., respectively.

Engine load-factor.	Cu. ft. gas per kw-hr.	B.t.u. per kw. hr.	Absolute efficiency of unit (gas to electricity).	Equivalent coal —B.t.u. basis— Lb. per kw-hr.	Lb. per i.h.p.-hr.
40%	21.2	22,200	15.35%	1.7	0.96
80%	15.2	16,000	21.4%	1.23	0.78

The comparison of the fuel consumption of the steam station described above, (operating on an equivalent of 53.3 cu. ft. of natural gas per kilowatt-hour) with the gas rate of a gas engine station which lies somewhere between the limits of 21.2 and 15.2 cu. ft., is a striking illustration of the great fuel economy of the gas engine, and is, in itself, a measure of the relative thermal efficiencies of the two methods of developing power from natural gas.

Cost of Power. All the various items entering into the cost of power are, at present, difficult to obtain in segregated form, but have been estimated as closely as possible from two different prices of gas.

	25c. Gas. % of total.	25c. Gas. Cents per kw-hr.	15c. Gas. Cents per kw-hr.
Fuel gas	47.6	.440	.264
Wages	28.3	.260	.260
Supplies—			
Oil waste 11.3			
Water 9.0			
	20.3	.187	.187
Repairs	3.8	.026	.026
Totals	100.	.913	.737

This estimate, based upon the present load-factor and the complete plant, shows a total operating cost well under 1c. per kilowatt-hour for the highest priced gas, and 0.75c. for the lowest.

In the near future, this will be somewhat lowered by a reduction in the cost of water due to the cooling system mentioned above. Such a low cost shows the possibility of developing a large daylight power load, which feature appeals strongly to electric light managers.

It is difficult to compare these fuel costs per kilowatt-hour with those of ordinary steam plants, as so much depends upon the character of their service and apparatus, but a large number of electric light plants under 1,000 horsepower will have a fuel consumption varying between 4 lb. and 8 lb. of coal. It is also fair to assume that their expenses, outside of the fuel item, will not differ materially from those given above (in a great many cases their wage item will materially exceed 0.26 per kilowatt-hour).

On this basis, then, natural gas at 25 cents per 1,000 cu. ft. is competitive with coal at $2.20 per ton, on a consumption of 4 lb. per kilowatt-hour, also with $1.10 coal, on the basis of 8 lb. per kilowatt-hour. Similarly, 15c. gas is competitive with coal at $1.32 per ton with a coal consumption of 4 lbs. per kilowatt-hour and with coal at 66c. a ton on a consumption of 8 lb. per kilowatt-hour.

Conclusion. It is well to keep clearly in mind that a gas power station can utilize to better advantage a larger number of generating units than can a steam station. The reason for this is that the gas engines are practically as efficient in small as in large sizes, and that the cost per kilowatt, and floor space occupied per kilowatt of rating, is likewise nearly uniform. Consequently, it is better to split up the station capacity as much as possible, thereby enabling the operator to fit his units into the load curve and obtain a better efficiency for the station. The available space

power will also be better distributed, and this multiplicity of units more readily provides for the possibility of losing an igniter. With one unit running, the disablement of one cylinder amounts to 33 per cent. of the rated capacity; with two units running this deficiency amounts to 16.6 per cent.; with three units, the deficiency is reduced to a little over 11 per cent. of the total capacity in operation. With four units running, the deficiency is but 8 per cent., which can be readily taken care of by the overload capacity of the remaining cylinders.

General experience with the Duquesne Light Company's plant thus far indicates that good service, combined with low operating costs, may be expected if proper attention is given to keeping the equipment in good working order. It is true that inexperienced or careless men cannot get the best results from a gas equipment, but with an experienced, active engineer in charge, the equipment is as trustworthy as a steam plant.

Mr. J. R. Bibbins contributed the following discussion of the paper:

One of the most important is the question of relative spare capacity. In planning a new station, this question arises right at the outset after the problematical load curve has been determined upon—how many, and what size of units will be installed. Although one or two units yield the simplest form of plant, when one considers the average running efficiency the unit will give under the given load-factor it is a different matter.

In a recent study of this point, a 1,000-kilowatt maximum load curve was assumed with 1, 2, 3, 4 and 5 service units and a single spare unit. By "blocking in" the engine curves corresponding to the actual capacity in service at a given time, the average load on the engine was obtained in per cent. of its rating, this being obtained by integrating both load and engine curves. Thus the relative heat consumption under average running conditions was obtained. For this particular load curve the first three unit combinations worked out best in horizontal units, the last two in vertical. For five units this condition works out to an average heat consumption of less than one-half that required by a single unit; in other words, an efficiency of twice as great. As to the cost of spare capacity for the single-unit plant, we must provide a spare unit equal to the running capacity—100 per cent., two units, 50 per cent., etc., down to 20 per cent. for five units.

It may be contended that the relative heat consumption and the cost of spare capacity are only small factors in the final solution of the problem, but this is not the case. The modern gas engine requires, in the larger sizes, a type of construction which does not permit of very great reduction in cost over smaller sizes which embody the vertical self-contained construction. It thus develops that the price of a large gas-engine unit is very little lower than that of a medium-sized unit. Again, we find that the heat efficiency of the large unit is but very little higher than that of the smaller sizes, due largely to the inherent properties of the combustion cycle rather than to any precise refinement in design or construction which so clearly disclose the character of steam engine construction. Analyzing the labor cost in the station, we find that with the compact, self-contained, vertical unit, this item is very nearly the same as for equivalent horizontal capacity. Thus the problem practically reduces itself to that of relative operating efficiency and investment in spare units with the result above noted.

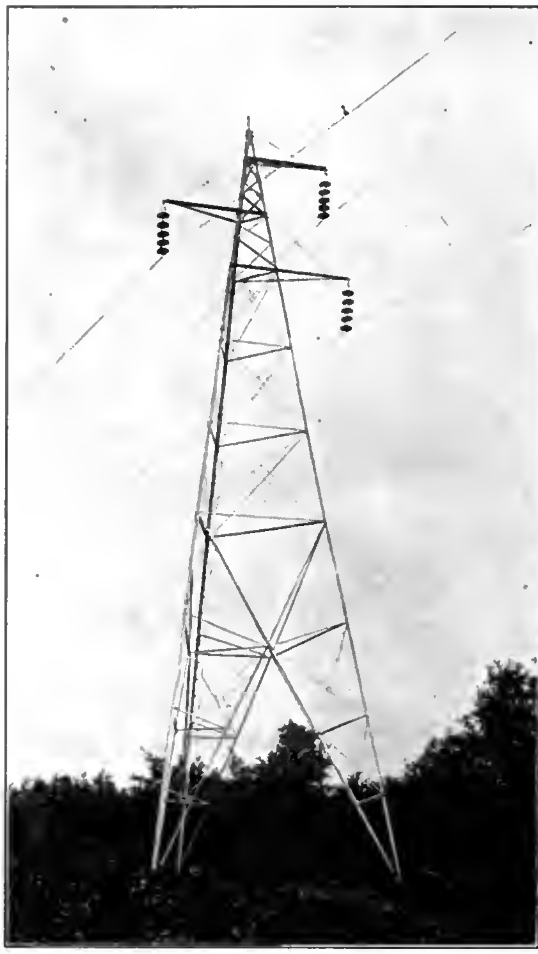
On the question of spare units we may assume as a possible contingency that an igniter will give trouble at some time. This throws a certain part of the engine out of service, but does not necessarily disable it. With one unit running, the loss of an igniter would cause 25 per cent. loss of power, and with five units, 6.6 per cent., but on the standard overload ratings each engine cylinder is capable of delivering 10 per cent. overload continuously. This overload capacity thus comes to the rescue of the disabled igniter. With two running units in the plant, we will barely be able to carry full load; with three units the extra capacity will tide us over; with five units the plant will develop 2.7 per cent. in excess of the rating in spite of the disabled igniter.

An overload capacity of 10 per cent. seems small compared with the similar capacity of a steam engine or steam turbine unit. While a steam unit gives its best economy at full load or under, the economy of the gas engine increases up to the maximum load, which makes it desirable to rate the engines and operate them as close to maximum as is permissible, and while the gas engine has a decided advantage for steady central station service, it is somewhat at a disadvantage on rapidly fluctuating loads. This, however, may be overcome by the use of a storage battery. A system has recently been devised by which the generator load may be held practically constant while the e tire fluctuating load may be taken up by the battery. This is accomplished by a load regulator, a simple instrument of the relay type, installed on the switchboard and operating in connection with the booster. In a recent test with this system, the external load was instantly varied through a range equivalent to 300 per cent. of the generator capacity, yet these variations were entirely absorbed by the battery, and the generator kept within a few per cent. of its rating, irrespective of the suddenness or the violence of the fluctuations. This instrument is particularly useful in gas engine work as it permits full loading of the unit with impunity whereas it might be necessary to reduce the average loading to one-third of the rating in order to take care of the fluctuations.

Denatured Alcohol to the amount of 1,744,272 gal. was produced in the United States during the first six months of this year. The free alcohol law took effect Jan. 1, 1907.

Three Low-Head Hydro-Electric Developments in Michigan.—Part II.

Big Rapids Dam Development.—The Big Rapids development, 18 miles up the river from Croton, is at a point where the river valley is 800 ft. wide and 40 to 50 ft. deep. The dam renders available a head of 40 ft., which is utilized by equipment having a total capacity of 6,000 h.-p. The dam consists of an earth embankment, with a concrete waste-gate section built in it, toward one end, and a power house also built in it across the original channel of the river, which was at one side of the valley. The whole site is underlaid by hardpan that is covered with coarse sand and gravel. At the power house, in the channel of the river, this overlying sand and gravel was 20 to 50 ft. deep, but graded off in depth toward both sides of the valley, the flood-gate section being built directly on the hardpan. A continuous line of steel sheet piling, extending entirely across the valley under the site of the dam, was driven into the hardpan far enough to form a complete cut-off wall in the sand and gravel, and is carried into the sides of the valley to prevent leakage around the ends of it. The embankment contains a 10-in. reinforced-concrete core wall, built on this row of steel piling; the latter is also at the upstream limits of the concrete in the gate section and the power house. Some of this steel piling was driven to a depth of as much as 56 ft., the long pieces being spliced. The core wall, like the one in the embankment of the Croton dam, is located so its top is at the intersection of the surface of the water in the pond and the slope of the embankment. The power house is carried entirely by wooden piles driven down to the hardpan. The substructure of the power house is also enclosed on all four sides by sheet piling, driven to the hardpan, the row of steel piling forming the upstream side of this enclosure and wooden sheet piling the other three sides. The



Tower of 100,000-Volt Transmission Line.

Strain Insulators at a Change in Grade.

wooden piling consists of 6 x 8-in. and 7 x 9-in. tongue and grooved timbers, in 12 to 26-ft. lengths.

The embankments of the dam were made by teams and scrapers, most of the material being obtained from a borrow pit on the power house side of the valley. This material is largely all sand and gravel similar to that used in the Croton dam. The embankments have slopes of a 2 to 1 on the downstream side and of 3 to 1 or flatter on the upstream side.

Waste-Gate Section.—The waste-gate section, with a total width of 150 ft., is arranged practically the same as the waste-gate section of the Croton dam. It contains six Tainter gates, each 20 ft. wide and 12 ft. high, three of which are on each side of a log sluice, 6 ft. wide. These gates are raised and lowered by motor-driven hoisting crabs, the same as those described in connection with the Croton development. The spillway on which the gates seat when closed is a hollow reinforced-concrete dam, of the same general design as the one at Croton, the water falling from it into a tumble bay formed by an overflow weir, 69.5 ft. downstream from the gates. This tumble bay is divided into two parts by the walls forming the sides of the log sluice. Each of these parts is arranged with outlets so it can be drained when the three gates discharging into it are closed. The retaining walls on both sides of the waste-gate section are extended downstream for 240 ft. from the gates, forming a waste-way channel, 180 ft. wide. A second row of steel sheet piling is placed across this channel just below the tumble bay, and for 50 ft. from the latter the bottom of the channel is protected by rock-filled timber cribs, with the filling in these cribs grouted. The bottom of the remainder of the channel enclosed by the retaining walls is protected by a concrete lining.

Power House.—The concrete substructure of the power house is 50 x 95 ft. in plan, with its center line normal to the axis of the dam, and has concrete wing walls extending up and downstream from both ends of it. The power house proper is a brick structure 40 x 50 ft. in plan on the downstream end of this substructure. It contains two 3-phase 30-cycle 6,600-volt revolving field Westinghouse generators, each direct-connected to two pairs of 45-in. horizontal center-discharge Samson turbines in one of two open steel-plate penstocks of the Rickey type, which are erected over the upstream end of the substructure. The units operate at 225 r. p. m., each generator being capable of developing the full 3,000-h.-p. capacity of the four turbines which

connected to the shaft of the main unit, furnishes excitation current for each generator. A Tirrill regulator is provided to control the voltage of each generator. The operation of each set of two pairs of turbines is controlled by a Type N Lombard governor, belted to the main shaft of the unit.

The 6,600-volt current delivered by the generator is stepped up to 72,000 volts for transmission to Muskegon and Grand Rapids by three oil-insulated water-cooled transformers in a separate 28 x 40-ft. fireproof building on the side of the valley, about 50 ft. from the power house. The busbars in this building are in separate fireproof compartments and all connections to them are provided with special hand-operated oil switches, in fireproof cells.

When the development was completed the turbine plant was tested in place under the supervision of Professor Gardner S. Williams, of the University of Michigan. The power output of the generators was measured electrically, while the water was measured over a 112-ft. steel-crest weir, according to Francis' directions and formula. The testing of the electric equipment was in charge of the Electrical Testing Laboratories of New York. The results obtained agreed essentially with the turbine makers guarantees.

Inclined racks placed across the open upstream end of each of the penstocks intercept such floating debris that passes under a log boom in the pond which is arranged to direct the debris through the log sluice in the waste-gate section. These racks consist of $\frac{1}{4}$ x 3-in. bars bolted together in sections and carried by a frame of structural steel shapes. Stop-log grooves are also provided in the sides of the penstocks, in front of the racks, so the openings may either one be closed. These stop-logs are handled by one of the hoisting crabs used in operating the Tainter gates, the track for the crabs being extended from the waste-gate section into the house over the penstocks. This house is a frame building with sheet iron sides and roof, which is provided to protect the men clearing the racks, or working on the stop-logs.

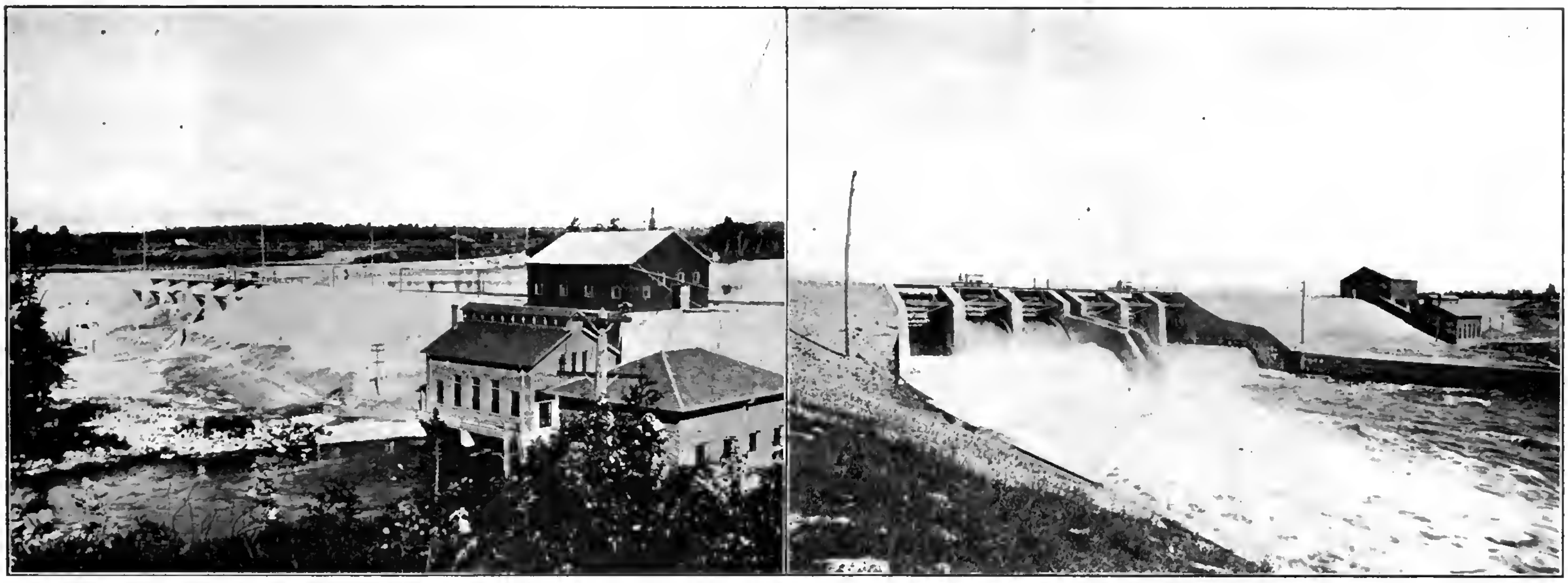
A draft tube for each pair of turbines is formed in the concrete base of the substructure, the two draft tubes of each two pair of turbines discharging into one of the two parts in which the tail race is divided by a longitudinal wall under the building. The draft tubes are lined with steel plates and are designed to deliver the water to the tail race quietly. The bottom of the tail race is protected by a concrete apron that extends 20 ft. downstream from the substructure, a row of wooden sheet piling being driven under the

of piling which were along the sides of the latter.

Construction of Big Rapids Dam.—The Big Rapids dam was also built on force account by the Grand Rapids-Muskegon Power Co. under the direction of the same engineers mentioned in connection with the Croton project, except that Mr. N. F. Johnson was superintendent in charge. The construction plant was assembled during the winter of 1904-05, and active work was begun March 1, 1905, the generators being placed in operation on March 15, 1907. The construction plant was essentially similar to that used at the Croton dam, except that it was all steam-driven; the construction methods employed were also very similar to those followed on that work. The river was allowed to follow its channel until the work had been carried up to it on both sides, when it was diverted through temporary openings in the waste-gate section until the power house was finished. The water was then turned through the penstock and the temporary openings in the waste-gate section were closed.

This dam required 18,000 cu. yd. of concrete, in which natural bank gravel, obtained immediately at the site, was used. The plant for handling the gravel and concrete was very similar to the one at Croton which has been described, the gravel being delivered in scrapers directly from the pit to charging hoppers at the mixing plant. The cement used in the concrete was shipped in cloth sacks in January and February and was hauled $1\frac{1}{2}$ miles from the railroad in sleighs on the snow. It was stored in 40 x 90-ft. sheds, with a one-third pitch batten roof, covered with tar paper, in the usual manner of lumber camp construction. The floor of this shed consisted of two courses of 6-in. poles, laid on the ground, the second course being at right angles to the first. These poles were covered with about one foot of loose straw, on which was placed a single layer of tarred roofing felt; the sacks were then piled five high on end on this felt. No cement was lost by caking, and in fact, the only cement that showed effects of dampness was that on top, which gathered some moisture from the air, and caked in places to a depth of about $\frac{1}{2}$ in. If tarred paper had been put over the tops of the sacks, it is believed that even this small amount of caking would probably not have occurred.

Transmission Lines.—When the Big Rapids development was made a transmission line, carried by poles, was built from the dam to a switch station at Casnovia, 33 miles from the dam; one branch of the line was extended from this station to Grand Rapids, 21 miles, and a



Two Views of the Big Rapids Development.

line passes close to the Croton development, the generating equipment of which is connected with it. The line has been operated satisfactorily at 66,000 volts and will be operated at 72,000 volts in the future. Power is delivered to three sub-stations, one in Muskegon, one near Grand Rapids and one in that city.

Michigan and Idaho cedar and Southern cypress poles, 45 to 60 ft. long and placed 40 to the mile, carry the three conductors of the transmission line, which are No. 2 solid copper wire. These wires are carried by Locke insulators, 14 in. in diameter and 18 in. high, at the corners of a 72-in triangle. These insulators are mounted on two cross arms carried by the poles, wooden pins being used on straight-line work, and iron pins at angles; all pins are 18 in. long and are 2 in. in diameter at the shoulder. A No. 6 iron wire, grounded at every fifth pole for lightning protection, is carried by the upper cross arm on the poles.

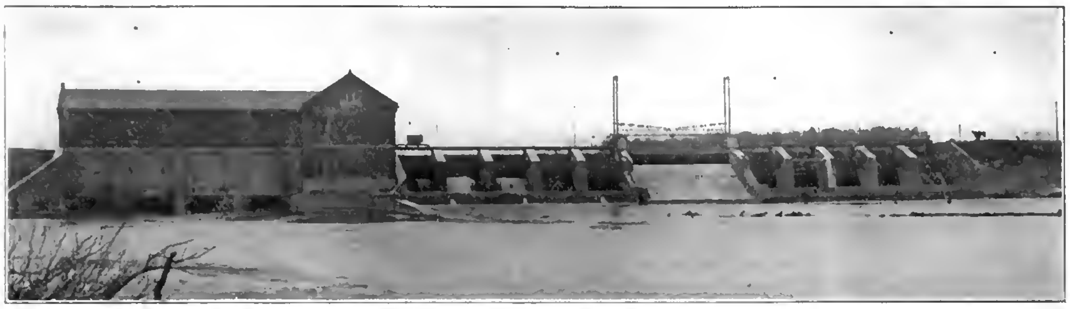
A second transmission line, 35 miles long, is being built from Croton directly to a sub-station in Grand Rapids and will be operated at 100,000 volts. This line will be entirely distinct and separate from the original one, so a duplicate line between Croton and Grand Rapids will be provided when it is completed. Interruptions to the transmission system between these two points, due to the local thunderstorms, which occur in this section, will thus be avoided largely, since a disturbance affecting one line would very probably not affect the other.

The new line is carried by triangular steel towers, 40 to 60 ft. in height, which were built by the Aermotor Co. These towers are placed about 500 ft. apart, and have each leg anchored to a 3-in. steel angle, 7 ft. 10 in. long, buried in ground. The angles are incased in concrete to prevent the corrosion that would probably take place rapidly in the porous sandy soil. These angles are each extended about 10 in. below the bottom of the concrete in which they are encased, to provide a ground for the transmission line. The three conductors are equivalent to No. 2 wire, being stranded copper wire with a hemp center. They are carried by suspension insulators on cantilever arms at the top of the tower. These insulators each consist of five umbrella-shape porcelain sections, 10 in. in diameter, having two interlinked semi-circular holes, through which tie wires that attach the sections together are passed. These holes are so arranged that the tie wires which pass through them exert a compression strain on the porcelain. In case a section breaks, the tie wires remain intermeshed, and as the sections are in series, and have a factor of safety, the remaining sections prevent a ground. A strain insulator, consisting of disks with grooved flanges, the mechanical and electrical features of which are essentially the same as in the umbrella-shape sections, is used at turns and at various intervals to support and anchor the line on curves and in similar places.

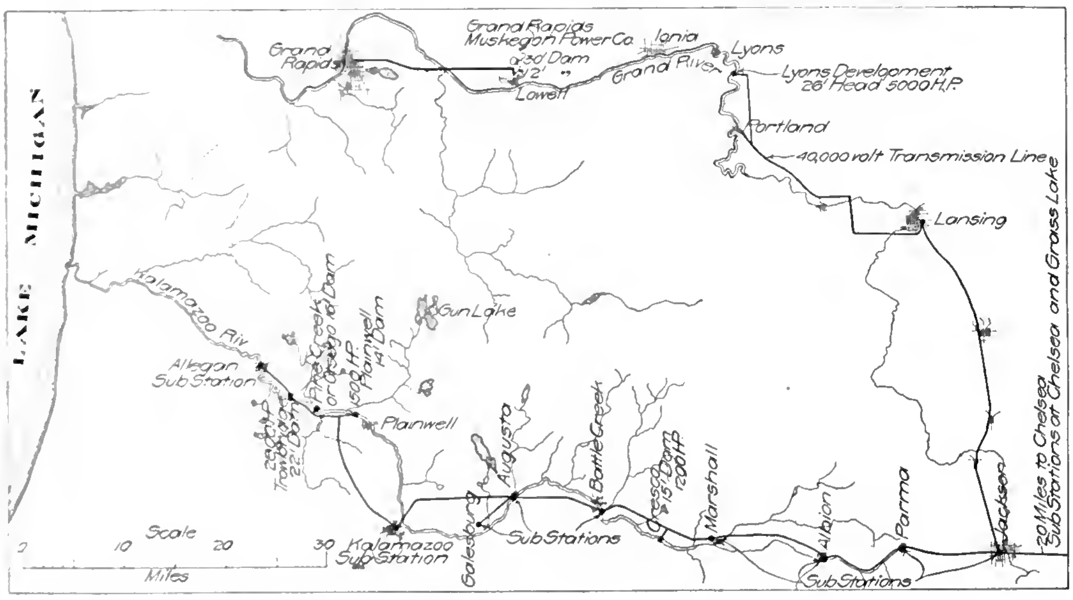
The angles to which the legs of the towers are anchored were encased in concrete at the mixing plant at Croton, and were distributed along the line by railroad shipments and in wagons, after the concrete had set, each complete anchor weighing about 275 lb. A set of removable forms, built for casting the concrete around the angles, proved very satisfactory. The cross section of this enclosing concrete is an ellipse with 4½ and 6-in. axes. One 3-in. 4-lb. channel and several short reinforcing rods, fastened horizontally near the bottom of each main angle as anchors, are also enclosed in a disk of concrete, 5 in. thick and 1.5 ft. in diameter, which is cast with the column enclosing the main upright angle. The form for the concrete columns consists of No. 16 black sheet iron bent to the shape of the column, and divided on the long axis of the cross-section of the column into two parts; these parts overlap at the joints and are held together by four hinged clamps of ¼ x ½-in. band iron. The form for the disk of concrete at the base is also made of No. 16 black iron, and has a collar at the center which slips into the column form to a tight fit. These forms are set up in groups, with the base down, on a platform close to the mixer so they can be filled with concrete readily. This work is thus handled quite economically, while it would practically be impossible to make provisions for mixing the concrete and placing it around the anchors at each tower.

The Lyons Development.—The Commonwealth Power Co. of Jackson, Mich., by which the development on the Grand River near Lyons was recently completed, also owns and operates six hydro-electric developments on the Kalamazoo River. The location of these various developments and of the transmission lines extending to the cities served by them are shown in an accompanying map. All of the developments supply power for public service systems in Lansing, Jackson, Battle Creek, Kalamazoo and Allegan and intermediate towns. Interurban electric railways extending from Jackson to Kalamazoo, Jackson to Lansing, Lansing to St. Johns, the local street car lines in Jackson and Lansing, and that part of the Detroit United Rys., from Jackson to Ann Arbor, are also supplied with power from the generating stations of this company.

The Lyons development is a few miles above the low flat stretch of the river which extends from Ionia to Lake Michigan. The catchment area of 1,750 square miles above the development is largely clay soil; hence, severe floods occur, while during periods of drought, the minimum flow drops to about 200 cu. ft. per second. The



General View of the Lyons Development from the Downstream Side.



Map Showing Plants and Transmission Lines of the Commonwealth Power Co.

dam develops a head of 26 ft., and is built entirely of reinforced concrete, excepting a short embankment at both ends. In order to provide a passage for flood water, without materially raising the surface of the 1,775-acre pond, ten steel Tainter gates, each 20 ft. wide and 13 ft. high, are provided in a waste-gate section at one end of the dam. Five of these gates are on each side of a sluiceway opening, 60 ft. wide, in which a movable crest, or bear-trap dam of that width is operated. The arrangement and design of the Tainter gates are the same as for those of the Croton development. These gates are also raised and lowered by worm-geared, hand or motor-operated portable hoists of the same type as those used at Croton.

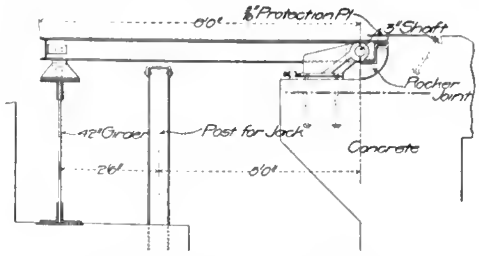
The details of the design and construction of the 60-ft. movable-crest dam in this waste-gate section are similar to those of the movable-crest dam at Croton. The Lyons dam has a movable leaf, 8 ft. wide and 60 ft. long, which turns on a shaft in a hinge along its upstream edge, thus permitting the downstream edge to be raised and lowered through a vertical travel of 5 ft. The leaf is counterbalanced by two 20,000-lb. weights, one of which is placed in a compartment in the dam beyond each end of the movable crest. The leaf is raised and lowered by two series of worm and spur gears, each driven by a 10-h.-p. motor and operating in connection with the counterweights.

A built-up steel girder, 42 in. high, extends the full length of the 8-ft. leaf, and is suspended from the front edge of the latter by hinged joints. These joints permit the girder to remain in a vertical plane at any position of the leaf, the verticality being maintained by a parallel-motion arrangement. When the leaf is at its lowest position with its upper surface horizontal, its weight and the load on it are carried by the girder, the latter resting on the bottom of the depression in which the movable crest is set. When the front edge of the leaf is raised to the full height of its travel, it is also carried by the girder, which is blocked up on jack screws set on steel posts projecting above the bottom of the depression under the crest.

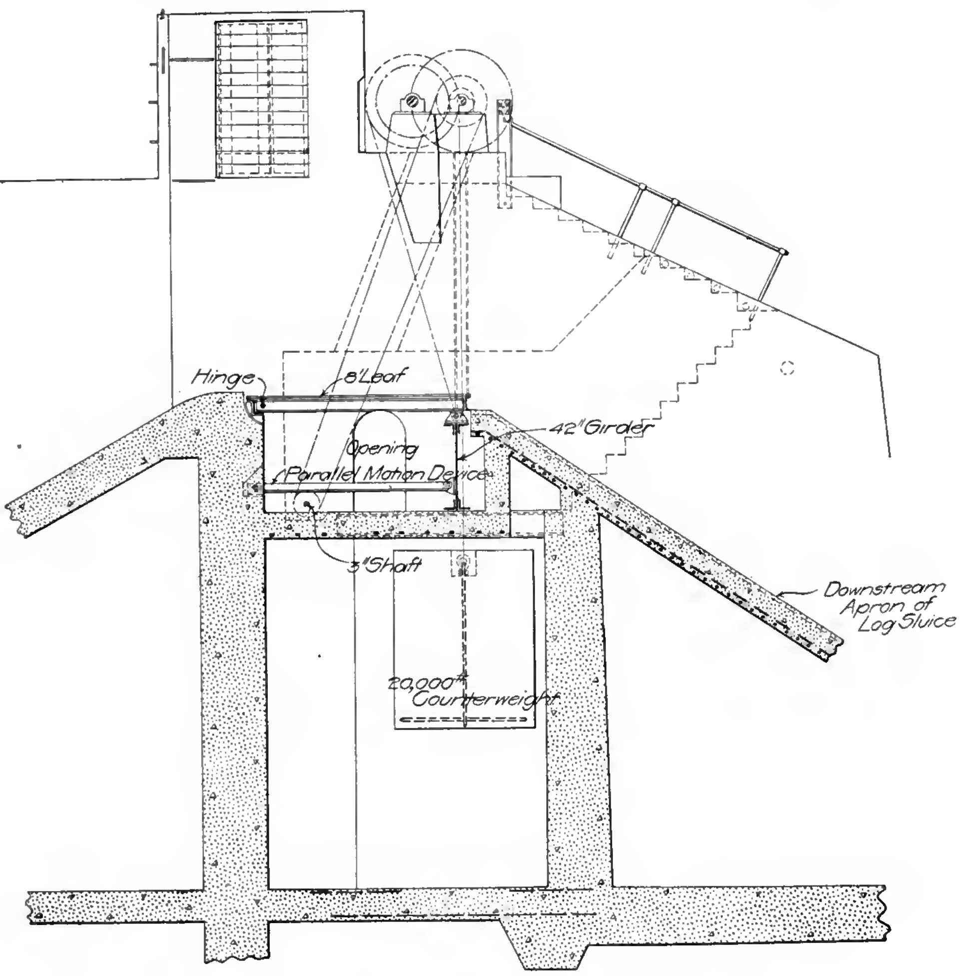
The 60-ft. opening controlled by the movable

crest is spanned by a two-leaf trunnion foot-bridge. Each of the leaves of this bridge can be turned sufficiently on a trunnion, on the guyed steel tower that carries it, so the 60-ft. opening is practically unobstructed when the two are open. The leaves are raised by cables on hand-operated worm winches.

Power House.—The power house adjoins one end of the waste-gate section and is L-shape in plan. The construction and arrangement of the Lyons power house is very much the same as in the case of the power house at Croton. The long axis of the power house proper is normal to the axis of the dam, with a row of four pen-



Detail of Movable Crest Dam.



General Arrangement of Movable Crest Dam at Lyons.

stocks forming the stem of the ell. It contains a single 3-phase 30-cycle 6,600-volt revolving-field 2,500-kw. General Electric generator, direct-connected to four pairs of 50-in. center-discharge Samson turbines in the penstocks by a shaft 138 ft. long, that is normal to the direction of flow through the dam. The whole arrangement of this equipment, including most of the details, is very similar to that of the equipment in the power house at Croton.

Construction of Lyons Development.—The construction of the dam at Lyons was started in March, 1906, and the equipment was placed in service in March, 1907. The foundation throughout is a hard clay at a depth of from 6 to 15 ft. below the surface of the river, so no piles or sheet piling was used under the dam, although some of the wing walls at the ends of the dam, and the dividing wall between the tail race and the waste-way channel from the Tainter gates are on piling.

Power for all of the construction plant used at the Lyons dam, except one steam shovel, was furnished by a 500-volt direct-current generator supplied with steam from a 200-h.-p. plant. Coal for this plant was hauled three miles from the cars by teams. The steam shovel was used in making the excavation required to provide a waste-way channel for the flood-gate section.

The material removed from this excavation was handled in 4-yd. dump cars which were hauled out of the pit on an incline leading through the dam by means of a motor-driven hoist. Motor-driven hoists were also used on the derricks. The concrete mixing plant at this dam was located at the land end of the waste-gate section,

Table 2. Cost of Placing Material in Embankment Section of Lyons Dam.

Labor and Coal Cost.	
Setting pumping plant, labor on house for same, placing pipe, etc.	$531.38
Labor at power house	577.20
Labor at pump house	486.60
Sluicing labor, building flumes and trestle	3,117.50
675 tons of coal	1,687.50
	$6,400.18

Earth moved from pit, 23,400 cu. yd., = $0.273 per cu. yd. for labor and coal.

Cost of Sluicing Plant at Lyons Dam.	
2 6-in. rotary fire pumps, new; 1 5-in. rotary fire pump, second-hand	$1,300.00
Pipe fittings, trough, etc.	1,200.00
Lumber and sundries	500.00
Total first cost	$3,000.00
Less salvage, on sale of plant	1,800.00
Cost to be charged to this work	$1,200.00

$1,200 divided by 23,400 = $0.0513, cost of plant per cubic yard of earth moved.

Labor cost per cubic yard of earth moved	$0.273
Plant cost per cubic yard of earth moved	$0.0513
Total cost per cubic yard of earth moved	$0.3243

Ran 45 24-hr. days, Dec. 5, 1906, to Feb. 20, 1907.

and was quite similar to the one used in constructing the dam at Croton; the methods for handling concrete from this plant to various parts of the work were also the same as used in building that dam.

The power house proper was built on the edge of the river channel, the waste-gate section extending across the flats to the low bluff of the river back of it; and the penstocks, 100 ft. out into the original channel of the river, on the other side. Beyond the penstocks an earth embankment, about 150 ft. long, extends to the high clay bluff that forms the river bank on that side. This embankment contains some 23,000 cu. yd. of material that was placed during December, 1906, and January, 1907, with a hydraulic sluicing plant.

Hydraulic Sluicing at Lyons Dam.—The operation of a hydraulic sluicing plant for making an embankment during the winter months in this climate was contemplated with much anxiety. As suitable filling material was difficult to obtain otherwise, without a long haul, and as the pumps required were on hand, the plant was set

A Close View of the Movable Crest Dam at Lyons.

up and started late in November, 1906. The bank of the river from which the material for the embankment was obtained is a clay bluff, about 70 ft. high, capped with about 10 ft. of sand and gravel. The clay was so tough and compact as to be very expensive to handle by ordinary sluicing means, so the fill was made almost entirely from the sand and gravel overlying it. As the bluff did not have a very steep slope, several expensive trestles were necessary to carry the flumes in which the material was handled from the face of the excavation to the fill. These trestles and the difficulties from ice made the cost of the fill much above that usual for such work, when more favorably situated and carried on in warmer weather. The sluicing plant was stopped when the temperature approached zero, with the result that when it was started again the face of the bluff, being saturated with water, had frozen to a depth of several feet meanwhile and had to be blasted. Even at the cost of 33 cents per cubic yard for the material moved out of the sluicing pit and deposited in the embankment under these most unfavorable conditions, as shown in Table 2, it is to be doubted whether any other method of moving material into the fill would have been less expensive. At any rate, the sluicing plant was certainly a valuable aid in making a fill so the river could be quickly closed, and also at times of flood during the two months it was in intermittent operation, in raising the cofferdams used in the construction of the penstocks.

The general offices of the Grand Rapids-Muskegon Power Co. are at Grand Rapids, Mich. Mr. W. G. Fargo is hydraulic engineer for the company and was supervising engineer during the construction of the Big Rapids and Croton developments. Mr. J. B. Foote is electrical engineer for the company and Mr. Anthony J. Bemis was manager during 1905 and 1906. Mr. J. B. Foote is general superintendent of the Commonwealth Power Co., which has its general offices at Jackson, Mich. Mr. W. G. Fargo was consulting hydraulic and supervising engineer to the company during the design and construction of the development at Lyons.

The Benguella Railway, Africa.

The Benguella Ry. is one of the most interesting undertakings of its sort now under construction in Africa. It starts from Lobito Bay in Portuguese Angola and follows the coast to Benguella, whence it runs inland to Katanga in Belgian Congo. The total length is about 800 miles; 50 miles are in operation, 200 miles under construction, and surveys and plans are completed for another 250 miles. Lobito Bay has an excellent harbor which is now being improved so that the large steamers of the Union Castle, Elder, Dempster and other lines can be accommodated. Katanga is the center of a remarkable mineral district. About 8,000 men are now employed on construction, and it is expected that 4,000 more will be engaged very soon. At one point on the line it is necessary to use a rack railway for about 1¼ miles, and there is some rocky country where heavy earthwork is necessary. These are about all the difficulties encountered except one very dry territory, where it has been found advisable to use camels for transport during construction. The work is being done by Griffiths & Co., with Sir Douglas Fox & Partners and Sir Charles Metcalfe as consulting engineers.

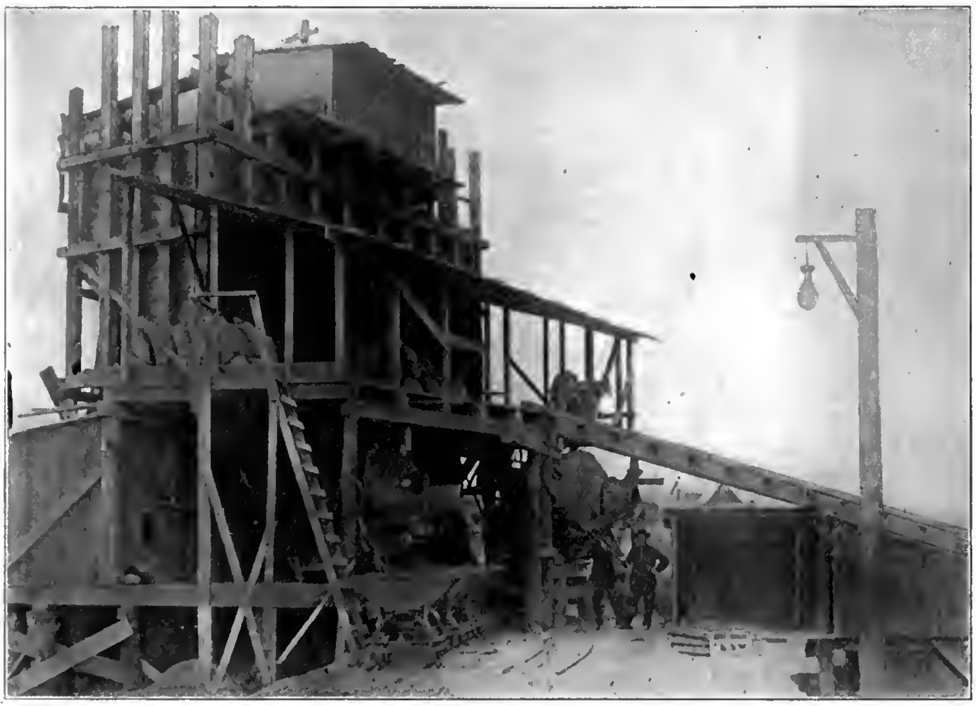
The Total Production of Coal throughout the world in 1906 has been estimated at 1,106,479,000 short tons, of which the United States produced 414,157,000 tons. In 1906 the United States produced 43.7 per cent. more coal than Great Britain and 85 per cent. more than Germany.

Heating and Ventilating the Commercial National Bank Building, Chicago—Part I.

The new Commercial National Bank building is an eighteen-story steel frame office building that has recently been completed on the northeast corner of Adams and Clark Sts., Chicago, Ill., fronting 181 ft. on Adams St., and 190 ft. on Clark St. It is a structure of large size, with a basement and sub-basement and rises 300 ft. above the level of the sidewalk. Its exterior has been treated in granite and terra cotta throughout, while the interior is elegantly finished in mahogany and white marble. The structure is supported on caisson foundations, of which there are 82, ranging from 6 ft. in diameter to 10½ ft., that extend down about 110 ft. to bed rock. The greater part of the second and third stories and the basement are devoted to the needs of the Commercial National Bank, while the upper floors from the fourth to the eighteenth inclusive, are devoted to rented offices. A feature of the interior arrangement is the concentration of all the toilet rooms for the rented office floors, together with a barber shop and a ladies' retiring room, on the eleventh floor. The building has a floor space on each of its three lower floors of over 32,000 sq. ft., and on each of the upper floors of about 25,000 sq. ft., owing to a light and ventilation court rising from the third floor level to the top, which makes a total floor area of over 470,000 sq. ft., exclusive of the basement and sub-basement.

The extensive mechanical plant required for the operation of the building service is housed in the sub-basement and a portion of the basement, the greater part of the former and nearly half of the latter floor being thus utilized. The sub-surface floors have additional space excavated underneath the sidewalk areas, the basement 190 x 195 ft. in size, having a total floor area of over 37,000 sq. ft., while the sub-basement, which was excavated only to within about 60 ft. of the easterly wall, owing to difficulties encountered with the foundations of the Marquette Building adjoining, has a floor area of nearly 27,000 sq. ft. Each of these floors has a ceiling head-room of only about 13 ft., on account of which the boiler room, 72 x 98 ft. in size, in the northwest corner on the Clark St. side, and the engine room, 58 x 85 ft. in size, adjoining at the rear, were carried up from the sub-basement through the basement floor level in order to secure the needed additional head-room to accommodate overhead piping and to facilitate the handling of the machinery. The remaining portions of the sub-basement are devoted to the hydraulic elevator equipment, ventilating apparatus, other auxiliary machinery, a machine shop and storeroom and locker rooms for the employees of the building, while on the basement level there is, in addition to the boiler and engine room, considerable additional ventilating equipment.

The power plant of the building has been installed with a complete equipment for all classes of service, embracing 4 boilers, aggregating 1,400 h.-p. in capacity, for steam generation; an electrical generating equipment of 650 kw. capacity, an extensive hydraulic elevator plant, refrigerating machinery and pumps. The exhaust steam from the plant is utilized for the heating of the building. The boilers are of the Sederholm type of fire-tube boilers, built by Chalmers & Williams, and are installed in four 350-h.-p. units, arranged in separate settings on the east side of the boiler-room with space reserved for an additional future unit to be installed at the south end if required. The boiler units are brick set, the settings being covered with vitrified asbestos, and each is equipped with a Greene chain grate stoker. The arrangement of units is such that there is a 10 to 12-ft. space at the rear of the settings for blow-off piping, steam mains and smoke breechings, a 16-ft. firing floor in front of the stokers and 7½-ft. spaces between settings as necessitated by the arrangement of building columns. The front portion of the boiler-room is occupied to a width of 16 ft. by a coal storage bunker, 88 ft. in length, which has a capacity of over 700 tons of coal. Arrangement has been made for delivering coal to the plant by way of the Chicago freight subway lines, a branch of which has been constructed from Clark St., underneath the boiler-room; from cars on the subway line the coal is dumped into a receiving hopper from which a bucket traveling conveyor, built by the Link Belt Machine Co., Chicago, elevates the coal to the storage bunker. The coal is also mechanically handled from the bunker to the stoker hoppers by means of screw conveyors which transfer it into small circular hoppers above the stokers, fitted with adjustable spouts. The ashes are dumped from the furnaces into a pit below the boilers which has connection with a tunnel leading to the branch track from the subway line, through which the ashes are delivered by special ash cars to cars of the tun-



Concrete Plant at Hydro-Electric Development at Lyons, Mich.

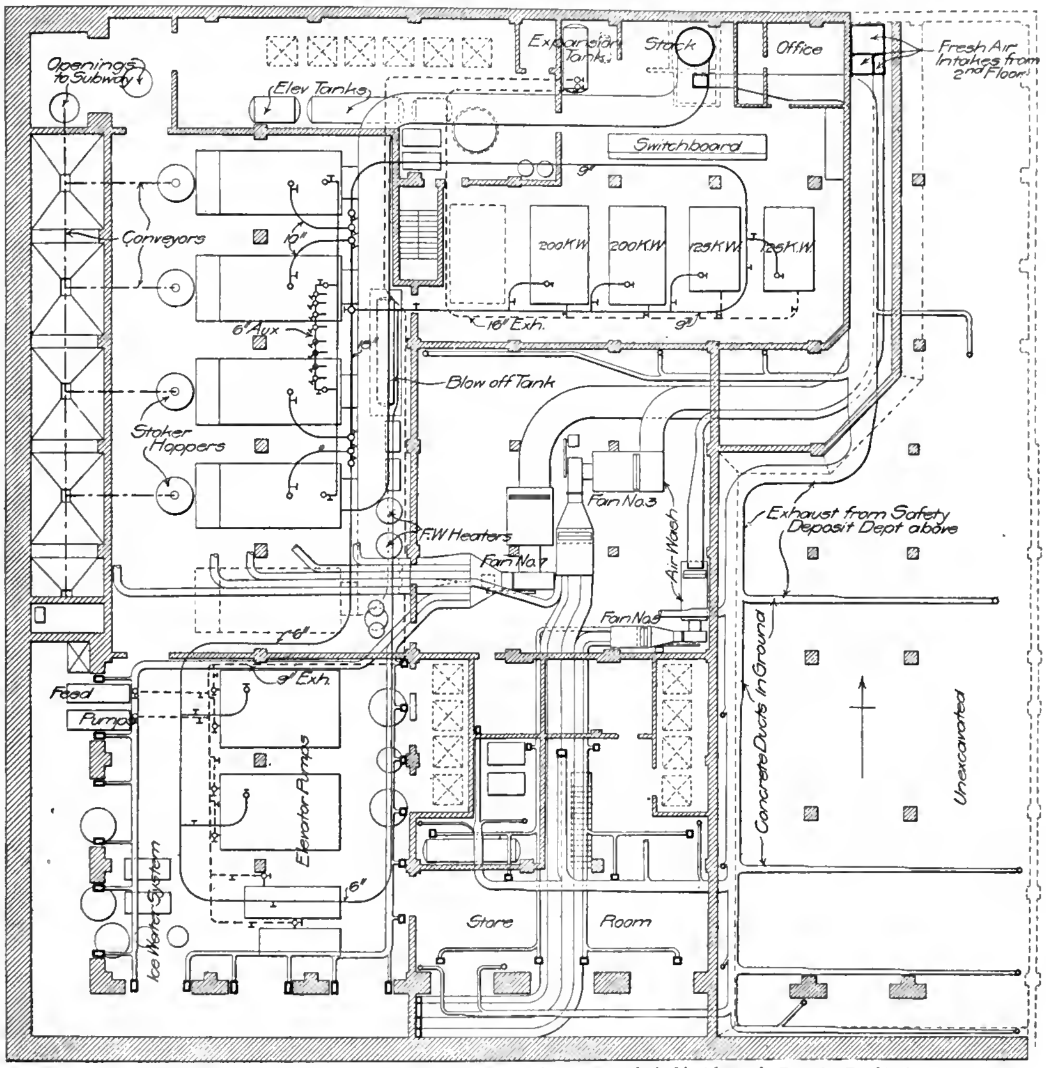
nel line for removal. The products of combustion are removed from the boilers by a steel stack, 90 in. in diameter, that rises to the roof, a height of 350 ft. above the grates. Connection is made from the settings to the stack through a rectangular iron breeching carried on the ceiling at the rear of the boilers and both the breeching and the stack are lined throughout, the stack with a 2-in. lining of vitrified asbestos, supplied by the Chicago Fireproof Covering Co.

As the exhaust from the steam using machinery of the power plant is used largely for the heating of the building, the feed water supply is principally of condensation return from the heating system, with make-up from the city water mains as required. The condensation return lines from the heating apparatus and low pressure apparatus connect at the rear of the boiler-room into an 8-in. valved header, which in turn makes connection to each of the two open feed-water heaters which are provided for preheating of the boiler feed before delivery to the boilers. These heaters are Webster Star vacuum heaters and purifiers, each having a capacity of filtering and heating 30,000 lb. of water per hour from 45° to 210° Fahr. These heaters have connections to the 12-in. exhaust main extending over them from the pumproom to the expansion tank at the rear of the engine-room. The boilers are fed by an equipment of two Worthington duplex pumps of the outside center packed plunger type, which are brass fitted throughout for the handling of hot water, and each is designed for a capacity of 30,000 lb. of water per hour with a piston speed of not over 25 ft. per minute, so that each pump is capable of feeding the entire boiler equipment under normal conditions of service. They are located at the north end of the pumproom and have connection to suction and delivery lines in duplicate, the mains being so valved that one pump may deliver from the feed-water heaters to one or more boilers, and the other from the surge tank to the other boilers, or in any other combination desired. One of the feed mains, known as the hot-water feed line, is fitted with a Worthington meter by means of which the feed delivery to the boilers is measured. The blow-off system of the plant consists of a 4-in. blow-off header at the rear of the settings with 3-in. connections to the mud drums of each boiler unit and a 6-in. delivery connection into a large blow-off tank in a pit at the rear of the settings; this blow-off tank is a cylindrical steel tank 3 ft. in diameter by 13 ft. long, and has a 6-in. overflow to the sewer, so located as to maintain in the tank sufficient water for partially cooling the blow-off discharge as received. The vapor from the hot discharge is removed by an 8-in. vapor line which is carried up above the roof through a pipe shaft alongside of the smoke stack and terminates with an exhaust head.

The piping systems of the plant consist of a ring or loop header for the high pressure steam and two large single exhaust lines for the low pressure exhaust. The high pressure ring main originates in an 18-in. header located 9 ft. above the floor, at the rear of the boiler settings, with 8-in. long-radius pipe bend branches to each boiler unit, valved at both header and boiler nozzles; delivery connections extend up and into the engine-room as a 9-in. loop main and into the pumproom as a 6-in. loop main, the ends of these two loops meeting at the rear of the boiler-room and there being connected to the middle of the high-pressure header by a 9-in. cross connection. The main header is of mild steel with flanged joints and copper gaskets and is designed for 300 lb. test pressure. The loop main is sectionalized by globe valves at the middle and gate valves at either end of the 18-in. main header, and by globe valves so placed in the engine and pumproom loops as to enable all the more important steam-using apparatus to be supplied from either of two different directions, through independent connections from the header. The entire high-pressure line is dripped by a gravity return drip line which parallels the mains and delivers to the boilers through a connection at the rear of the settings. Steam for the auxiliary machinery, including pumps, etc., is supplied from a 6-in. auxiliary header over the boilers that is distinct from the main high-pressure header, being connected to the boilers through the safety valve nozzles; from this header branches extend to the feed pumps, to the hot water heaters for house service, to the vacuum pumps, to the stoker engines, and to the roof for melting ice which may form in the down spouts during the winter, and a 6-in. line to the expansion tank for live steam make-up to the heating system when the exhaust steam supply is insufficient. The exhaust steam system consists of a 16-in. ceiling line in the engine-room and 12-in. line from the pumproom which connect with the steam using units and deliver each independently to the expansion tank at the rear of the engine room, which forms the basis of the low-pressure steam supply to the heating system. Thomas Acme grease extractors in these exhaust lines near the tank remove oil from the exhaust steam.

The steam-using machinery of the power plant consists principally of electrical generating units and the elevator pumps, all of the ventilating fans, the air compressors, the refrigerating machines and other auxiliary apparatus being driven by motors. There are four electrical generating units installed, consisting of vertical compound engines direct connected to Western Electric Co. multipolar generators, two of which units are of 125-kw. capacity, and the other two of 200-kw. capacity, while additional room has been reserved for the addition of another 200-kw. unit if future demands for power should require. The engines are of the vertical cross-compound automatic cut-off type, built by the Bates Machine Co., and are supplied with steam by 5-in. and 6-in. branches respectively, with Cochrane separators, from the 9-in. overhead loop in the engine room, exhausting through 8 and 10-in. branches into the 16-in. overhead exhaust line. The elevator plant of the building embraces 14 passenger and one freight elevator, which are hydraulically operated and require two compound high-duty pumps, which normally take care of the full elevator load, a compound duplex pump of capacity equal to either of the high-duty pumps for reserve purposes and a night pump of half this capacity. The high-duty pumps are Chalmers & Williams cross-compound duplex pumps with Corliss steam valve gear and have 15 and 25x7⅞x24-in. cylinders. There is in addition a jack pump installed for operation in connection with the freight elevator in lifting safes, and machinery, and heavy loads.

Heating System.—The building is heated throughout, above the first floor, by direct radiation, for which a total of 51,463 sq. ft. of direct radiation has been installed, exclusive of the tempering coils of the fresh air supply systems, the fresh air supply being raised to the temperature of the interior of the building before delivery. The radiators, supplied by the American Radiator Co., are installed in the usual locations under window sills, a standard arrangement having been adopted embracing two units to each wall panel of three windows, which is found to most easily accommodate the sub-divisions of floors into various office groups. The standard distribution is one 48 sq. ft. and one 24 to 30 sq. ft. radiator to each panel of three windows, the larger radiator being installed where partitions come so as to limit one unit to two windows, and the smaller unit where only a single



Power Plant in Sub-Basement of the Commercial National Bank Building.

window is served. The radiators are installed in general in 26-in., 2-column units, excepting in the first, second and third stories, where 32 and 38-in. 2-column radiators are used, and in the main entrances, where 44-in. 4-column units are installed. Sky-light exposure is encountered to a considerable extent only above the main banking floor, where at the fourth floor level, a 58x92-ft. skylight fills the area at the base of the light and ventilation court between the two upper wings of the building; this glass exposure is counteracted by 28 pipe coils of 1¼-in. pipe, each coil containing 50 sq. ft. of surface. Radiation in all parts of the building is proportioned to maintain temperature to 70° Fahr. when the outside temperature is 10° below zero, for which an average of 2,450 sq. ft. of radiation has been installed on each of the floors above the first. The first floor contains 3,196 sq. ft. of radiation, including that in the entrances, while the skylight coils have 1,400 sq. ft.

Steam is supplied on the one-pipe system to all of the radiation above the first floor by an overhead distribution system, which consists of mains in the attic and down supply risers, while the radiation on the first floor is supplied independently by a system of distributing mains on the basement ceiling. The low pressure heating supply originates as above stated, in the expansion tank into which all exhaust steam from the power plant is delivered. From this a 6-in. connection extends to the basement distribution system for supply to the first floor radiation and a 16-in. supply main to the attic to supply the overhead distribution system. The latter supply main is carried up a pipe shaft alongside of the smoke stack enclosure at the rear wall of the building to the attic space above the eighteenth story, and there connects through an expansion loop to a system of horizontal distribution mains, which divides into a number of branches of 6 and 8-in. mains that supply different groups of risers along the various side walls of the building. The 6-in. basement supply main supplies radiation on the first floor only, tapering to 5 in. and thence to 3 in. in size as branches are taken off. Other steam supply connections from the expansion tank consist of a 5-in. line to the skylight coils above the main banking floor, an 8-in. line to the tempering coils of the fresh air supply systems, and a 7-in. connection to the hot water heaters of the plumbing service. The exhaust steam supply to the expansion tank from the steam-using machinery is supplemented by a 6-in. connection from the auxiliary high pressure steam header in the boiler room with two Davis pressure reducing valves. One of the valves adjacent to the high-pressure header, reduces the pressure of the live steam supply from the boiler pressure of 150 lb. to 15 lb. and the other next to the expansion tank reduces from 15 lb. to atmospheric to augment the low pressure supply automatically in case of deficiency of the exhaust steam. A feature of the low-pressure piping connections is to be noted in the use of a separate 16-in. riser to the top of the building for purposes of atmospheric relief to the exhaust steam system in case of back pressure, instead of utilizing the main 16-in. supply riser to the overhead heat distributing mains; the back pressure valve is here located at the expansion tank, from which the atmospheric relief riser is carried up above the roof through the pipe shaft alongside of the 16-in. steam supply riser and terminates with an exhaust head.

The down-feed risers supplying radiation on the upper floors are 80 in number, the greater part of which are 2½ in. in size, and supply from 440 to 700 sq. ft. of radiation each, the average amount supplied from each 2½-in. line being about 500 sq. ft. There are 62 of the 2½-in. risers, while of the remainder two are 4-in. lines, seven are 3-in. lines, and nine 2-in. lines; these all decrease in size toward the lower floors as radiator supply branches are taken off, the greater part of them being carried down to the basement as 2-in. lines, with the exception of the 2-in. risers, which decrease to 1½ in. at the base. The 4-in. and 3-in. risers occur principally in the corners of the building and exposed locations and carry 750 to 1,240 sq. ft. of radiation each, the average amount carried per 3-in. riser being about 850 sq. ft.; the 2-in. risers are used behind the elevators on the Clark St. side and in certain locations on the upper floors, and carry on an average about 300 sq. ft. each. Owing to the length of the risers, approximately 270 ft., they are all erected in four sections with anchorages to the building structural work at midpoints of each section and expansion loops or joints midway between anchorages; the expansion joints or loops occur at the fourth, tenth and sixteenth floors in each riser, while the anchor points for the sections thus formed occur at the second, seventh, thirteenth and attic floor levels. Wherever possible the loop type of expansion joints was provided for, but in a group of five 2-in. risers at the rear of the shafts of the six elevators rising from the Clark St. entrance, lack of space necessitated the packed sleeve type of slip expansion joints. As the radiation is operated on the one-pipe system, all radiator branch connections are given a uniform slope from the radiator to the riser against the flow of steam and are so located that they cannot be trapped by movement of the riser in expansion; these radiator branches are of 1¼-in. pipe for radiators up to 50 sq. ft., 1½-in. pipe for units having between 50 and 85 sq ft., while 2-in. pipe is used to supply all units up to 120 sq. ft. All of the low-pressure piping and risers are covered with H. W. Johns-Manville moulded asbestos sectional covering, ¾ in. in thickness, the covering extending on all risers from cups provided to support it up inside of the floor sleeves above; all exposed risers are covered with air-cell covering.

Condensation returned from the radiation is collected by two systems of gathering mains on the ceiling of the basement, one of which connects with the bases of the down-feed risers, and the other with the steam supply mains in the basement to supply the first floor radiation. The former is installed in three divisions, each consisting of a 6-in. line connecting with risers in different sections of the building, while the latter is laid out in two sections, one a 3-in. line extending to the front part of the building, and the other a 1½-in. line to the rear. Other condensation return connections consist of a 4-in. return line from the tempering coils of the fresh air supply fan systems, a 3-in. return from the skylight coils, and a 1-in. return from the downspout heads to which high pressure is supplied at the roof. These returns all connect into the 8-in. condensation header in the boiler room, which has a 4-in. connection from either end to the two open feed water heaters. All of the return lines have check valves near the header and between these and the header, gate valves. To insure positive circulation of steam in the heat distribution mains the Paul vacuum system has been installed, consisting of a system of air piping, connecting with the air valves on all radiator units and terminating in the boiler room where connection is made to the usual exhauster apparatus used with this system. The air piping system has been extensively sub-divided so that the shutting down of a portion of the apparatus will not interfere with the successful operation of the remainder, and connections are also made from this system to the feed water heaters and hot water heater to prevent air binding in them. The heaters are also arranged for operating in summer time when the heating equipment is not in use.

The mechanical plant was designed by the architects of the building, D. H. Burnham & Co., of Chicago, under the direction of Mr. John D. Small, chief mechanical engineer. Thomas & Smith, Chicago, were contractors for the heating system and power plant piping, and designed the details.

(To be continued.)

The Soft-Coal Producer Plant at Pasco, Wash.

The town of Pasco is a division point on the Northern Pacific Ry., and is located near its crossing of the Columbia River. At present there are about 1,000 inhabitants, one-half of whom have located there during the last eighteen months. The Pasco Light & Water Company, composed chiefly of Spokane men, has installed a gas producer plant to furnish to the town both water and light and some small quantities of power.

The water obtained from wells in this region is markedly alkaline, and is undesirable for use in steam boilers. The Light & Water Company pumps its water from the Columbia River and delivers it to the town and to the tanks of the railway company. The question of track convenience and franchise stipulations made it necessary to place the power house near the railway yards, close to the town. On the other hand the pumping station is located as near the river as high-water conditions permit.

The power house is a frame structure boarded up with rustic finish on the exterior; the engine and dynamo room is ceiled to protect the running parts as much possible from the fine sand and grit which is carried by the winds in the dry season.

As shown in the plan, the power house is compactly arranged. The producer is of the suction type, built by the Smith Gas Power Company especially for bituminous and lignite coal. A sawdust purifier is added as an extra precaution to prevent carrying over tar to the engine. This is a Rathbun three-cylinder vertical type gas engine of 100 h. p. capacity. It is belted to the generator, a General Electric 75 kw. three-phase alternator, operating at 2080 to 2300 volts and 60 cycles per second. The exciter has a capacity of 3.5 k. w. and is belted to the generator.

The switchboard consists of two standard panels of the General Electric design. One is the generator panel equipped with three alternating current ammeters, one alternating-current voltmeter with potential transformers, receptacles and plugs, a direct-current field ammeter and switch, exciter rheostat and control for the generator rheostat and oil switch. The other is a two-circuit feeder panel equipped with one ammeter and an oil switch for each circuit. One side of this panel controls the lighting circuit, which is three-phase three-wire primary and single-phase three-wire secondary, 115 volts. The other side controls the pump circuit, three phase 2080 volts.

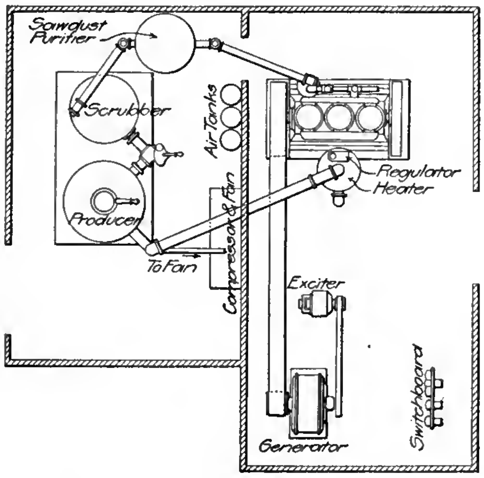
The pump house is situated on the river about 7,400 ft. from the powerhouse. A 40 h.p. three-phase induction motor directly on the line at 2,080 volts operates the pump. The line consists of three No. 8 B. & S. hard-drawn bare copper wires spaces 14 in. between centers. The pump is a submerged triplex with a capacity of 400 gal. per minute. It is mounted as shown in the illustration at the bottom of a concrete well and the motor operates the working head above by means of a belt.

A test was made of the plant immediately after its installation. The proper load was put upon the generator by means of a water rheostat to give the engine its full rated load. For a portion of the time the plant was operated at part load only, running the pump to fill the pipes. This load varied from 22.1 to 29.5 h.p. as the head in the pipes increased. The test lasted seven hours and showed the consumption of 696 lb. of coal

for 512.9 h.-p.-hr., or 1.35 lb. of coal per h.-p.-hr. The local cost of coal brings the fuel cost per h.-p.-hr. to about 0.3 cent. The coal used was a washed lignite nut coal and contained considerable earth and clay.

Book Notes.

The British Fire-Prevention Committee, 1 Waterloo Place, London, has issued a "red book" describing tests of a hydrant fitted with an "adaptor" for automatically putting the hydrant into action. The "adaptor" is described as a device whereby any fire hydrant, cock or tap may be made automatic in action, enabling an operator, by simply grasping the hose attached to the device and running with it to the scene of a fire, to have at hand a supply of water without the necessity of unscrewing the valve in the ordinary manner. The construction of this device, which is made by W. Featherstone & Co., Rochester, England, is illustrated in the report. The "adaptors" tested were fitted to 1-in. and 2½-in. hydrant valves, the water supplied for the smaller hydrants being under a pressure of 8 to 25 lb.



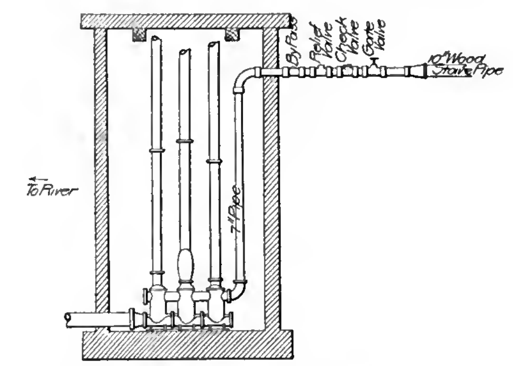
Plan of Producer Plant at Pasco.

per square inch, that for the larger valves varying from 40 to 45 lb. Seventeen tests were made in all, which are fully described in the report.

The excellent manual on "Stereotomy" by Profs. A. W. French and H. C. Ives has been so successful that a new edition has been prepared, in which the typographical errors of the first edition have been corrected and a number of changes made. The book is one of those practical manuals equally useful in the classroom and the engineering office. The authors state that they have drawn their material from previous books, but they deserve credit for making such good use of it and for the well-selected examples of actual structures that are used for illustrating the principles and methods explained in the text. The book is essentially a description of the procedure to be followed in designing the stone work of all kinds of engineering and architectural structures, and the instructions for preparing templates and drawings are thoroughly practical. (New York, John Wiley & Sons, $2.50.)

An excellent book on the most important machine tool and its uses is "Modern American Lathe Practice," by Oscar E. Perrigo. It gives an outline of the evolution of the tool, describes its use for various classes of work, and illustrates the different types of lathes used in American shops. A gratifying feature of the volume is the absence of catalogue pictures, for every illustration was made specially for the book. There are five chapters on lathe design, two on lathe work, two on engine lathes, and others on lathe attachments, rapid change-gear mechanisms, lathe tools, tests, heavy lathes, high-speed lathes, special lathes, regular turret lathes, special turret lathes, and electricall driven lathes. The book is a comprehensive treatise of reliable character and will be found of value by all who are interested in its subject. (New York, Norman W. Henley Publishing Co., $2.50.)

While a large amount of information is available concerning the engineering features of heavy electric traction on railways previously using steam locomotives, such installations are so recent that practically nothing has been published concerning the operation of these lines. Accordingly the 190-page book on the subject forming a section of the "Street Railway Journal" of Oct. 12 is a unique volume. A careful study was made of the methods used on the New York Central & Hudson River R. R., the Long Island R. R., the West Jersey & Seashore R. R., the West Shore R. R., the New York, New Haven & Hartford R R., the Erie R. R., and the Interborough Rapid Transit Co., and Mr. Philip Dawson contributed an article on what has been done in England and on the Continent. This information will be of great value not only to the officials of steam railways who are contemplating electric traction, but also to the managers of electric traction companies The latter have worked



Concrete Pump Well of Pasco Plant.

out their problems along certain lines, but as the high-speed electric road is the outgrowth of the city line it is not surprising that the conclusions reached by their officials differ from those obtained when the same questions are taken up from the steam railway standpoint and when the electric railway is operated as part of a large trunk line. The book is beautifully printed and profusely illustrated, and is an unusually important contribution to the publications on heavy electric traction. (New York, Street Railway Journal.)

Some day a great novelist will awake to the possibilities of irrigation as the central theme for a powerful story, and people will be amazed to learn from him what a tremendous influence it plays in every-day life in some sections. The facts are all at hand for him, in the dry statistics of government reports, in the laboriously deciphered hieroglyphics of the Pharaohs showing that upon it depended the glory of their dynasties, in the translations of Hammurabi's cuneiform inscriptions proving that it was perennial irrigation which made ancient Chaldea a great nation, and in the writings of Sir William Willcocks and others who have not only taken part in the great national irrigation works of to-day, but have studied those of the ancient nations. It is a fascinating study as a factor in civilization, wholly apart from those technical features that appeal only to the engineer, and it is noticeable that engineers who have played an important part in great irrigation undertakings, in their books on the subject generally introduce unknowingly a certain flavor of special interest on account of the intimate relation between works and striking results that marks such enterprises. The great Chenab canal in India, for example, has turned some two million acres of waste land in India, on which a very small nomadic population existed precariously, into the bountiful home for a million people. This special feature of books on irrigation is marked in Sir Hanbury Brown's "Irrigation; Its Principles and Practice as a Branch of Engineering." The author's long service in such works in India and Egypt enables him to speak as one having authority and not as the scribes. In setting forth the subject he has drawn on this knowledge, particularly that gained in Egypt, for illustrations and examples, and the result is a book of deep interest, particularly at this time, when irrigation in the United States is at last beginning to receive due recognition. To engineers, the great merit of the book lies in the fact that it is on irrigation, and the design of high dams, and other works of a special character is left to treatises on such subjects. It opens with a chapter on what irrigation has done and is doing in many countries, and the subject is handled in a way that arouses regret that this part of the book was not published in some magazine of wide circulation, for the information of the general reader. The essential features of basin and perennial irrigation are pointed out in two chapters, and there are some notes on the "duty" of water, introduced at this place in order that this important feature of irrigation work may be understood at the outset. The author uses the term to indicate the amount of irrigation water ought to accomplish and not what it actually does in any case, thus giving the word a more restricted significance than it usually has in the United States. The fourth chapter, on sources of supply whence water may be obtained, contains some interesting notes on India's irrigation methods and the extent to which it is possible to extend irrigation in Egypt, given to illustrate the general principles laid down. A chapter on dams and reservoirs is introduced next, in which the author deals mainly with the purposes of such works and their general features. It is followed by one on weirs and barrages, containing a large amount of interesting information concerning works of this nature in India and Egypt. In building many of these works unusual conditions were encountered and a chapter on methods of construction is given for the purpose of bringing together in one place all notes on the subject; these relate mainly to foundations, and the account of the methods on constructing dams and weirs on gravel, clay and sand foundations deserves special attention. The chapter on canals and drains is particularly interesting for the emphasis laid by the author on the importance of providing means for draining the irrigated land as well as for bringing water to it. An omission to make any reference to methods of lining canals to prevent seepage seems rather surprising to an American reader on account of the special interest shown in the subject in the United States at the present time. The various masonry works along the line of irrigation canals are described in a chapter explaining the purpose of regulating works, fall, syphons and aqueducts, illustrations of notable structures being given. The methods of distributing water, assessing the charges for it, and of administration in various countries are explained in one of the most instructive chapters in the book, and it is interesting to learn from it how universal has been the experience that some measure of public control over water for irrigation is necessary. Two chapters are devoted to flood banks, river training and navigation, and there is a particularly good chapter on agricultural operations and reclamation works. The book as a whole is particularly timely for American readers and should prove of much value to those who desire a general knowledge of irrigation. (New York, D. Van Nostrand Co., $5.00.)

Letters to the Editor.

MISUSE OF DERRICK CARS.

SIR: An accident that took place about a fortnight ago during the erection of a bridge on the Nickel Plate road over the Cuyahoga River again calls attention to a grave misuse of derrick cars often made. In this particular case a 50-ton car was being used to lift a pedestal weighing about 10 tons. It was raised and then the boom of the derrick swung around to the side. As it swung, the car tipped slowly but steadily to such a degree that those nearby were alarmed and shouted to the men on the car to turn the boom back again. They continued to revolve it, however, and suddenly the car was overturned off the deck span on which it was standing, and the men were killed in its fall.

It would hardly be worth while calling attention to this accident were it not for the fact that bridge erectors are constantly taking chances of this sort. A few months ago an unusually powerful derrick car was built for handling very large girders. It was a special machine and the designer naturally watched its operation during the first few days it was in service. Although he had perfect confidence in the car, the manner in which it was employed in lifting high loads at right angles to the track on which it stood filled him with serious apprehension, and as a result he warned the owners of the car in writing against attempting any such feat. Even when a derrick car is supported by jacks under the outstanding arms on either side, its base is so narrow that a heavy load lifted far out on either side is likely to overturn it. No trouble is experienced in lifting such loads ahead of the car on account of the long wheel base, and the freedom from trouble when the boom is in such a position is likely to cause an unwarranted feeling of safety in the ability of the car to stand up when lifting heavy loads at the side of the track. I think it would be well for your journal to call attention to this dangerous condition.

Very truly yours,

ERECTOR.

CONDITIONS ON THE ISTHMUS OF PANAMA.

SIR: Your little note in your issue of last week concerning the conditions at the Isthmus of Panama is interesting to me, for it shows that the official reports contained in the "Canal Record" are appreciated in your office. Fortunately the grumblers at the Isthmus have now been largely returned to the United States, whence they never should have gone to take part in canal work. It is a fact that the conditions on the Isthmus are by no means those to which a number of the younger engineers and other employees were accustomed. They went to the Isthmus evidently expecting it to be a sort of glorified picnic ground. They were disappointed and in some cases their families were put to much inconvenience. These people have all very naturally expressed their adverse opinions of the conditions. On the other hand those of us who have been accustomed to work in the field in different parts of the United States have almost without exception been satisfied with the manner in which the government is endeavoring to make us comfortable. The line of the ditch is a good ways from home and it takes money and men to build houses and carry on large camps. It also takes time, and inability to appreciate the importance of this last factor is the primary cause of most of the complaints that were formerly current concerning the canal work.

Where new work is being started it goes without saying that the accommodations for some of the men are naturally cramped. This is so on every large piece of construction with which I was ever acquainted. I have been forced to sleep under shacks many times while camps were being constructed, and accordingly the temporary accommodations provided on the Isthmus on new work did not seem at all out of the ordinary, except as they were somewhat better than those that are usually provided in the States. Nevertheless, some young men, whose experience on construction had been obtained wholly in connection with municipal work, considered themselves terribly abused by being obliged to sleep in cramped quarters for a few weeks. I noticed that it did little good to endeavor to explain to them that the conditions were only what they would encounter in the United States under similar conditions, for out of their experience in the vicinity of cities where plenty of quarters was always available, they have proceeded to criticise everything that has been done for their comfort in a very silly manner.

In the camps that have been established for some time, the accommodations have been far better than those provided by the average contractor, while the attention paid to sanitation is really remarkable. The medical supervision of all the men leaves nothing to be desired, and any engineer who wishes to become familiar with construction under tropical conditions and is not afraid to live away from the bright glare of the electric lights along Broadway cannot do better than to join our force. We have plenty of opportunities for recreation, and various amusements are being arranged as opportunity arises. In fact, from all I can learn, the only organization which at all compares with our own in the general attempt to get together in the most sociable way is that of the Board of Water Supply of the City of New York. Our organization is a good deal larger than that, and naturally there are more grumblers in it. I doubt if you ever saw an organization of 250 people in which there was not more or less jealousy, and a few of the class which is never happy without grumbling. Our staff is so big that we have a good many of these people; we are accustomed to them and pay no attention to them, for we know that they are not happy without grumbling, and many of them are otherwise good fellows and work hard. But the kicks they make are apparently misunderstood among the people at home, and it is for this reason I am sending you these few comments.

Very truly yours,

ON LEAVE.

IMPERMEABLE CONCRETE.

SIR: Your editorial discussion on impermeable concrete in the issue of Oct. 19 is interesting to the writer on account of the strong intimation it gives regarding the usefulness of a certain amount of clay in concrete mixtures. This is a subject that has been debated so much of late that until really accurate experimental work is carried on, such as that which Mr. Gaines is evidently conducting, the view that any engineer will take of it is likely to be based on his personal predilections and limited observations, rather than on any careful sifting of all evidence. It will doubtless be recalled by many who had an opportunity to hear the discussion of the subject at the Asheville convention of the American Society of Civil Engineers that the use of alum and other substances has been adopted successfully to render concrete watertight, while some engineers have long claimed that a moderate amount of clay was of value for the same purpose. There is, of course, a great difference in the qualities of clays and consequently statements regarding this material have to be accepted with a mental reservation in each case that the term covers such a wide variety of substances that the information is of only very general value.

I do not recall that any experiments prior to those of Mr. Gaines have been made to ascertain the effect of a combination of alum or some other similar substance and clay with the regular concrete materials. In fact it may be questioned whether the experiments on which Mr. Gaines has based his statements in the "Transactions" of the American Society of Civil Engineers have been carried far enough, and my own belief is that it is very desirable in investigations of this nature to defer the drawing of any precise deductions from such results until the experiments have included many series of tests which vary between themselves by a modification of only one or two factors, so that the effect of changes in those factors can be fully determined. It seems to be true, however, that the use of alum and clay under certain conditions may yield a very watertight concrete, and there are other substances for which similar claims can be made. Hence I would suggest that it might be advisable for you to discuss the extent to which impermeable concrete of this character can be safely applied. We can all agree with your statements that waterproof concrete is highly desirable material for engineering purposes, but it seems to me that in any discussion of this nature it is very desirable to bear in mind that waterproof concrete is, after all, concrete, and must be regarded like any other artificial stone.

The investigations that are being made by Mr. Gaines are evidently conducted with a view to ascertaining, among other things, the availability of various substances to render concrete in long aqueducts impermeable. Aqueducts are generally sufficiently covered by earth or otherwise protected against the weather to be free from any material changes in temperature. The problem presented by concrete under such conditions is very different from that presented by a long retaining wall holding back a bank of earth or loose rock likely to be fully saturated with water during a considerable portion of the year. In the former case there is no tendency to crack, while in the latter there is every tendency for cracking to occur. In the former case water is likely to cause trouble only by percolating through interstices of the concrete. In the latter case the temperature changes are likely to cause fissures into which considerable quantities of water may enter and there freeze, causing a bad shattering of the concrete in numerous places. Consequently it is manifest that the problem of water-proofing in the two situations is wholly different. I mention this difference because it seems to me that there may be a tendency to require impermeable concrete for situations where other water-proofing is a far better protection. It has long seemed to me that where long concrete walls or floors are exposed to the direct outside air and are resting against earth containing water, the only safe water-proofing method lies in the use of some of the so-called "membrane" processes. These have sufficient flexibility to protect the concrete from water even when the concrete becomes cracked.

Between these two extreme cases lie many in which the judgment of the engineer must naturally decide what kind of process must be adopted in order to secure an impervious wall or floor. Unquestionably there are situations where the temperature conditions may render a perfectly stiff and stony material like concrete so free from the likelihood of cracking that water-proofing by rendering it impermeable is safe to use. It is for this reason that the methods are so important and that all investigations of them should be encouraged. Nevertheless, it is far more important for most classes of engineering work to obtain a thorough knowledge of methods of water-proofing concrete which will keep the walls impermeable after the concrete has cracked, for most concrete work with which the engineer has to do is subject to such cracking.

Very truly yours,

C. E.

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Of this issue of THE ENGINEERING RECORD 16,000 copies are printed. Total circulation for 1907 to date, 642,000 copies, an average of 14,591 copies per week.

TABLE OF LEADING ARTICLES.

Cooling Tower Tests.

Although but a small percentage of power plants include a cooling tower in their equipment, the absence of a continuous and suitable supply of condensing water and high cost of fuel not infrequently combine to induce plant owners to install apparatus for the artificial cooling of the circulating water and the return of as much as possible of it to the condensers. In such plants it is quite as important to find out whether the cooling tower is operating efficiently as it is to run down wiring losses and minor leaks in steam pipes and traps, and the failure to keep cooling tower records on daily station log sheets may lead to considerable losses in the form of excessive coal or water consumption. Purchased water is decidedly worth saving in a large plant, and even a small station dependent upon a limited natural supply and forced to buy boiler or circulating water will run up quite a bill in the course of a year if the water is not economically handled. In one of the Boston elevated gas engine plants the cost of purchased water exceeded the cost of fuel prior to the securing of water by the company from a neighboring brook. The illustration simply indicates the importance of the water question, even under careful management.

The designs of cooling towers vary so widely, from the home-made apparatus often constructed by ingenious operating engineers to the carefully finished equipment of the manufacturing companies, that it is obvious the tests made in any given installation must be governed largely by local conditions. Certain fundamental data are required, however, in any comprehensive test which aims to show the fitness of a cooling tower outfit for its work. If time and facilities permit, the physical quantities collected and their resulting analysis can be made very extensive.

The temperature of the circulating water as it enters the condenser is the most important index of the performance of the cooling tower. Taken in relation to the temperature of the outside air, the supply temperature is of great interest as affected by the season of the year and the weather prevailing at the time. It ought to be clear to every operating engineer that the conditions must be known which may modify the action of a cooling tower installation if the best operating results are to be secured. Thus, in the jet condenser plant, the injection water and part of the condensation are mixed and pumped together through the cooling tower cycle. Here the make-up water required to replace the loss by evaporation in the cooling tower may come either from the hot well, or from a metered service, perhaps, in extreme cases. In figuring the quantity of circulating or injection water required to be passed through a cooling tower in a given run allowance must be made in a test of high accuracy for the assistance given by the engine exhaust. Fortunately for simplicity of testing, the cooling tower and the surface condenser plant afford a much easier equipment to study, for here the exhaust and the circulating water are, of course, never intentionally mingled.

A thorough test of the efficiency of a cooling tower will obtain the volume of air supplied by the fans, if the installation be of the blower type; the temperature of entering and departing air, and if possible its relative humidity, and the height of the barometer; the power consumption and speed of the fans, determined from kilowatt-hour records on the motors or indicator cards from the engines; the quantity of water passed through the condenser circulating system, and if feasible the amount of make-up water; and the load upon the engines or turbines together with the condenser vacuum maintained. There is room for much research in connection with the reduction of operating expenses through a diminished pumpage and decreased fan movement, and in many cases the study of the effect of different arrangements of spraying and scattering the water drops in the cooling tower tank itself will richly repay the engineer who takes the trouble to go into the subject. Ingenuity will be required to confine the physical quantities which are to be measured in most instances, and the determination of meter accuracy, pump slippage, anemometer errors, and the like call for first-class work. Small errors in temperature and humidity measurements carry heavy weight in the final results, and failure to estimate the amount of external water supplied in cases where the cooling tower tank is utilized for general drainage purposes leads to inaccurate conclusions. The power plant which can be operated more economically without a cooling tower than with one, because of cheap or free water, or low cost fuel is fortunate, because it thereby avoids an extra complication in equipment. When the conditions require special cooling outfits, their careful observation and occasional test are essential for the best results in the way of keeping costs low.

Hydraulic Developments at Low Head.

The Engineering Record has recently published descriptions of several power plants which are notable for the clever utilization on a fairly large scale of very moderate head. The water powers of the United States are of a very variable character. In the Rocky Mountains and westward are found, in the main, rapid streams which can be utilized at very high head with tolerable ease. Heads of four or five hundred feet are common and those of a thousand feet or more by no means rare. The engineering work of development in such cases is frequently very simple, residing mainly in the system of conduits necessary for a relatively small volume of water. The dam is often merely a deflecting wall to turn the stream into the sand boxes. A few such high heads are found in the lower Appalachian region and fewer still elsewhere. Throughout the Middle West, however, the water powers, relatively few in number, are almost all at low head, say from 40 ft. down, and their utilization is correspondingly troublesome, involving long dams and a vast amount of material to be handled. The Michigan plants described in this and the last two issues are of this character. The two upon the Muskegon River are notable not only for their construction but from the fact that in this region the highest point yet touched in transmission voltage, 72,000 volts, has been reached. The stream itself is possessed of some valuable properties not usually found in rivers fed from more mountainous regions. A relatively flat drainage area, fairly well wooded, gives the stream an extraordinarily steady run-off. The maximum flow recorded, at least in recent years, is only about 8½ times the recorded minimum. When one considers that in the Connecticut River, a typical Eastern stream, this ratio is nearly 100:1 the vast difference in conditions is obvious.

In consequence of the favorable flow conditions it was practicable in both the Muskegon plants considered to make free use of earth embankments with mere core walls of reinforced concrete for large sections of the dams, using concrete construction only for the waste gate portions. In case of the Croton development no inconsiderable part of the material was moved by hydraulic sluicing, a process quite out of the question on most streams, while in the Big Rapids development the earth was mainly handled by teams and scrapers and the core of the dam was merely a 10-in. reinforced concrete wall built over sheet steel piling. In each case the waste gate section was of concrete, and the water passes from the gates into a tumble bay and thence over a low concrete weir into the waste channel. Another common feature is the use of Tainter sector gates on the waste gate portion, thus giving complete control of the head over a considerable range of variation. This evolution of the flashboard idea seems singularly well fitted for its work and is readily applicable to many cases in which, particularly at times of low water, the head must be kept at the highest available point and must be dropped for self-preservation at times of flood. The normal head in each case is

about 40 ft. The third of the plant considered, that near Lyons, on the Grand River, has less favorable natural conditions, the drainage basin being of clayey soil and giving a quick run-off, with much larger variation of flow than on the Muskegon. Here the dam was almost wholly of reinforced concrete, also equipped to the use end just noted with Tainter gates aggregating in cases less than 200 ft. in width. There is also, as at the Croton development, a spillway with a movable shutter. The head, however, is only 20 ft.

In each of the three plants, the usual trouble incident to low head was encountered. As such that a somewhat complicated wheel plant was necessary to give the requisite speed to the generators. It is open to question, indeed, whether too much was not sacrificed to a desire for a generator of large output. Four pairs of turbines, as in the Croton plant, united to their load by 110 ft. of 12-in. steel shafting, certainly strikes one as excessive duplication and does not favor, to put it mildly, great hydraulic efficiency. The Big Rapids plant has generating sets of more simple design and one might well hazard a guess that they will be more satisfactory in operation. The Lyons plant from its lower head has more excuse for extreme design, yet it seems hardly necessary to have installed four pairs of turbines, for the sake of driving 138 ft. of shafting and a single generator. Doubtless the generator cost was lowered, but will it pay in the long run as regards the entire plant? In none of these plants, fortunately, was there need of going to vertical shaft construction of which several examples have been recently seen. The vertical shaft does, indeed, enable one to keep the generating room above high water mark, but it is liable to cause extra cost for attendance on account of the step bearings. The plants here considered play an important part in the economy of railway and power development in southwestern Michigan, both in interurban railway work and in the ordinary work of electrical supply. The networks of which they form a part are rapidly growing in importance, and to the engineer are of peculiar interest on account of the extreme high voltage work which is being carried out. The completion of the 100,000 volt line from the Big Rapids plant will mark the beginning of a larger sphere for electric power transmission and will serve as a sort of trial horse for various immense projects elsewhere that require the highest voltage that can be made available.

Standardizing Power Station Records.

To a company operating several power plants in different parts of its territory, the importance of accurately comparing the performance of the various stations is unquestionable, if the best possible records in low power cost are its object. It seldom occurs, however, that the conditions in the different plants are alike in complete detail, even in cases where the plants are supplying power for the same kind of service. The installation of a number of plants rarely occurs at the same period with the same company, and differences in the design and arrangement of generating machinery are sure to creep in if the company takes advantage of the progress in the field of power equipment which is so striking a feature of modern mechanical engineering. Thus it may easily happen that a single street railway system will be supplied with exactly the same kind of power from a dozen different plants in which the individual machines run the gamut from the steam turbine to the vertical, marine type engine, and from the belted non-condensing auxiliary steam engine to the producer gas engine direct connected to its special generator. All this may occur in a single city, and when the range of plants operated by one central organization extends through different parts of a country, the problem of comparison becomes still more difficult.

Before the operating figures of scattered plants can be interpreted, a system of records must be standardized which will enable comparisons to be fairly made. Local conditions exert a profound influence upon the cost of power production, and a place must be provided for the setting forth of these, if just comparisons are to be made possible. Whether the records are to be made on a daily, weekly or monthly basis, the points in common between the different plants must form the basis of log sheet and record blanks from which comparisons are to be worked out. The greater the similarity in equipment, the more easily can the sheets be standardized. If the power generated in one plant is used for a single service and that in another for several kinds of application, it will be necessary to include a certain space on the form which can only be used by the station of varied duties, and which must be left blank by the plant to which the headings do not apply. To a narrow mind an unused space on a record blank looms large, but to the eye of discrimination and to the sense of proportion it becomes of slight importance whether all the items are alike in type, so long as the essential conditions of each case are presented.

In dealing with a number of plants under the same management two main objects are present: First, to compare the plants one with another in relative efficiency and general performance, and second, to employ as far as is practicable, the same blanks and forms in each. Unless one uses a sheet of mammoth proportions it is scarcely possible to incorporate the details of the daily log on a single form for several stations, though sometimes a large sheet is of great advantage in comparing the fluctuations of a single very important item. Thus, a street railway company operating eleven plants found it helpful to plat on a single sheet the total load upon its stations between 5 and 6 p. m. each day in the year, and the resulting curve of maxima required a wall space about 7 ft. long for its proper display. Compared with the afternoon peak loads of the previous year plotted beneath, the curve gave a valuable hint of the motive power requirements long before they actually came to pass. The same company also used to advantage a single blank which showed the maximum momentary station load, and the average hourly load throughout the entire day, with the number of machines in circuit from hour to hour in each plant. Space was provided to show during each of the three operating shifts in each plant the numbers of the engines, generators, boilers, gas producers and condensing apparatus not available for service, with a brief designation of the coal quality.

On a general comparison sheet there are a large number of items which can be recorded, regardless of the character of the machinery in each station. Among these are the total hours each station was operated, the total fuel consumption, the total power output in kilowatt or horse-power hours, the fuel consumption per unit of total output, the quantity of oil, waste and water required, the maximum load, duration of interruptions, repairs made, special inspections, weather, temperature of outside air, barometer and average temperatures and steam pressures. Some of these items would clearly be encumbrances upon a sheet where hydro-electric plants are listed beside steam driven or gas stations, but even here the practice of leaving inapplicable spaces blank is better than the multiplication of separate station records. In general, a large number of hour to hour readings in different plants and of many quantities, cannot well be listed on a comparison sheet, but the averages, maxima, minima and totals can be, to great advantage. To list all the items which can be profitably included in a general comparison sheet would require the space of a small catalog, but the above outline shows how wide the range may be, especially if one goes into performances on the unit basis.

In the matter of standardizing the forms of log sheets to be used in daily operation in each of a group of plants, the main consideration is to provide enough columns under each class of unit to enable both the largest and the smallest station to use the same kind of sheet. Daily report blanks for single plants necessarily must conform more closely to the local conditions than summaries of the performance of whole stations. For this reason it may in some cases be desirable to establish one form of log for one type of plant, such as fuel-burning installations, and another for hydro-electric stations. Among the items which can be employed to advantage on a standard form of record are, the hourly load curve; the hourly operation, banking or reserving of boiler units; the hourly temperatures and pressures, continuity of prime mover and generator service; names of men on duty each shift; use or non-use of auxiliary apparatus from hour to hour; outputs per unit and per feeder, the latter optional on a separate record if highly complicated; emergency happenings, inspections, receipt of fuel, machinery and supplies; service interruptions, voltage readings, supplies on hand and apparatus crippled. The use of a standard size of sheet with uniform dimensions for all plants, clearly printed and well arranged in headings tends to facilitate comparisons no less than the inclusion of the proper items. It is not to be expected that record forms will remain unchanged from year to year, but when these changes occur, they should be made by issuing a new series of records for the whole group of plants instead of attempting to get along with both old and new forms at the same time.

Some Considerations in the Design of Elastic Arches.

The design of elastic arches or arch ribs as they are more frequently called in early engineering literature had not been the subject of much consideration prior to the introduction of reinforced concrete. The capacity to resist tension given to that material by steel reinforcement adapts it admirably to the design and construction of arches with the added excellence of a grace of outline and proportions scarcely attainable in ordinary masonry. The extension of the recent application of reinforced concrete in the construction of arches of all practicable lengths of span makes it not only desirable but almost imperatively necessary to acquire a clear view especially of any doubtful points of design.

The theory of the inelastic arch considered as a series of blocks of unchanging form and perfect joints is one of the oldest analytic or graphical procedures in engineering, but the complete theory of the elastic arch has been considered only for a comparatively few years, in spite of the fact that Rankine set forth some excellent features of treatment in his original works. The full general scheme of treatment is now to be found in many authoritative works to which, as they are so well known, it is not necessary to make any special reference, but there are some considerations regarding rather the extent to which the treatment is to be carried than any detailed question of that treatment which are worthy of careful reflection.

The usual method of design conveying simply the application of the common theory of flexure involves the neglect of any change of form of the rib due to the effects of loading, as are constantly recognized. In spite of that recognition, however, it is an open question how far ... that

neglect is permissible. Obviously in comparatively long spans and small depths of rib the omission to give weight to the elastic distortion of the rib might mean a material error although it might rarely be a dangerous one. In short spans and under ordinary circumstances of design the recognition of this elastic deformation might properly be considered an unnecessary refinement, but there is a limit to which that neglect can be carried, although it may not be possible to make a definite assignment of that limit. This elastic deformation clearly results from both the bending of the rib and its shortening, due to direct compression, both of those influences leading to deflection. That deflection in turn changes the position of the closing line in the case of a continuous rib and modifies the bending moment correspondingly. Practically the same general condition results in the case of a rib with jointed ends, although the closing line is not changed in position. It is not a matter of any sensible difficulty to make the proper allowance for these elastic deflections. The difficulty arises rather in determining the conditions under which the necessary allowance should be made.

Another point of what may be termed important doubt arises in connection with a proper provision for the change of temperature which the material of an elastic arch may experience from one season to another. While probably the majority of engineers may accept a high estimate in range of temperature in this latitude there are others of extended experience in this class of work who believe that the subject of temperature allowance is much over-worked. It is clear that the mass of a reinforced concrete arch supporting a roadway platform above it with a body of water underneath cannot possibly be subjected to the same amount of temperature variation as an articulated steel structure. A range of 100° to 120° Fahr. is not unfrequently considered in connection with steel bridges, but there is little or no reason to believe that any such extreme range can take place in an arch. Indeed if the arch has much span and corresponding mass it would be more reasonable to assume that the extreme range may not be more than 20° to 30° from the mean. It requires but few computations to show that in an arch rib of comparatively small rise the assumed range of temperature variation may play a very important part in the computed stresses, and yet in some existing structures of this character where the atmospheric seasonal changes are great there appears no evidence of the corresponding intensities of stress. Where the rise of the rib is comparatively great these considerations become of much less importance although they are still material. There is still lacking a large amount of highly desirable data of this character.

These observations indicate some of the more important open questions in the design of elastic arches, although there are others, such as spandrel walls continuous with the supporting arches, which are frequently more or less troublesome to the designer. The construction of some long span elastic arches now in progress, as well as those already standing, when subjected to proper observation, could be made to supply much useful data of the kind indicated, and it is much to be desired that requisite observation should be made in the interest of this important field of engineering construction.

A Discussion of Steam Turbines.

At the recent Atlantic City convention of the American Street and Interurban Railway Engineering Association three papers on the steam turbine were presented by representatives of as many manufacturers, each covering different features of turbine use. As the power plants of traction companies have alone rivaled central stations as sources of information concerning steam turbine practice, it was but natural that these prime movers should receive special attention at the convention, and in the three papers some helpful indications of present tendencies in the use of turbines can be perceived. For example, Mr. St. John Chilton, of the Allis-Chalmers Co., recommends in one of the papers a steam pressure of about 150 lb. as being the most economical in the operation of turbines, stating that a greater saving may be effected by the use of a small amount of superheat than by increasing the initial pressure above that amount. He remarks that an increase in pressure to 175 lb. results in a gain of but 2 per cent in steam economy, an additional 3 per cent being gained in an increase to 200 lb., against which should be placed the increased cost of piping, boilers and possibly of the turbine itself. He brings out the point that a higher vacuum is not required with turbines than with reciprocating engines, but that the turbine can utilize high vacuum to better advantage. The difference in economy within the range between 6 and 3 in. absolute terminal pressure is approximately 5 per cent per inch, the rate of increase of economy proceeding at a greater ratio as the terminal pressure goes below 3 ins. The use of superheated steam increases the economy, but the increment of saving becomes smaller as the superheat is increased, the reduction in steam consumption with 50° F. superheat approximating 7 per cent., with 100° F. 10 per cent., and with 150° F. 12.5 per cent.

Another feature of turbine operation was brought out by Mr. A. H. Kruesi, of the General Electric Co., namely, the adaptability of the turbine to the loads that arise on interurban and heavy traction systems operating relatively few cars on infrequent headways. The test of a 9000-kw. turbine by the Commonwealth Electric Co., of Chicago, showed water rates of from 12.9 to 13.6 lb. per kw.-hour on loads ranging from about 50 to 150 per cent. of the rating. This the author mentions as representing the "highest attainment thus far reached in the generation of power from steam." He shows that steam at the pressure and superheat employed in three tests referred to and expanded to 1.5 ins. absolute terminal pressure would give an economy of 9.27 lb. water per kw.-hour in a theoretically perfect engine or turbine with a generator of unity efficiency, and that the turbine in these tests has atained an efficiency of 76.4 per cent. of that theoretically obtainable, which "indicates that we are approaching the practical limit of perfection in the production of power from steam." On the subject of pressure, vacuum and superheat, Mr. Kruesi's statements agree with those in Mr. Chilton's paper. In the matter of superheat the suggestion is made that much of the trouble which has attended the use of superheated steam is due to the want of elasticity in the parts affected, it being probable that water may exist under certain conditions with superheated steam, the resulting variations in temperature, due to the spraying of heated surfaces, being enormously increased thereby. Changes in design of pipe fittings, valves, boilers and superheaters to care for this factor are suggested in order to permit of higher degrees of superheat. Improvement in economy arising from better vacuum is mentioned as that most easily attained, and an improvement in condensing equipment the easiest manner in which to lighten the duty on the boilers.

A recent development in turbine power plant designs, exemplified in the station of the Fort Wayne & Wabash Valley Traction Co., was explained in a paper by Mr. J. R. Bibbins. The station handles a combined railway and lighting load, as is fairly common with companies of its character. The author shows the manner in which the lighting load makes up for the early morning deficiency in the railway load, the latter usually falling off in the evening as the lighting load increases, and although the two systems are independent as to generators and turbines, steam is supplied to meet the average load of both systems, resulting in a much more effective working of the boiler capacity. Relating to this subject of improvement of efficiency with betterment of the load factor, the author presents curves showing the effect of the load factor on operating costs under the conditions obtaining at Fort Wayne. These curves show that an increase in low load factors brings greater increase in efficiency than a corresponding increase in higher load factors.

The Fort Wayne station is of peculiar design, consisting of a two-story building with the generating machinery on the second floor over the boilers, allowing simple, short and direct steam piping, with continuous upward slope from boiler nozzles to turbine throttles and barometric jet condensers entirely below the exhaust outlets of the turbines. While the remaining features of the design are those commonly found in stations of approximately this capacity—7,000 kw.—yet there is an absence of engineering frills for securing the highest possible efficiency, this being compensated for by lower capital cost. This low first cost, as well as the small area of station per kilowatt capacity, are the two important features of this type of station as brought out by the paper. The general arrangement, that of turbines and generators on a second floor above the boilers, accomplishes the second—small ground area, while it aids materially in the first—low cost. The cost of the building is certainly low—10.97 per kilowatt, figuring the ultimate capacity of 8,500 kw. It is shown that with larger boiler units a more compact arrangement might be made, while it is quite possible that with a demand for stations of this type a boiler could be obtained giving a narrower battery. The arrangement, while an ideal one for steam piping requirements, is also conducive to low cost of piping, this charge being about $2.50 per kilowatt. Economizers were not considered necessary on account of the low cost of fuel. Mechanical stokers are used, both to provide forcing capacity and to reduce labor cost, the present saving in labor being estimated at about $16 per shift of twelve hours. Barometric jet condensers are used, the condenser head being suspended beneath the turbine. A vacuum of 26.5 to 27 in. at full load is maintained in warm weather, the cost of the condensing equipment being only about $2.50 per kilowatt, including pumps and piping. The turbines are of the Parsons type, part of the generators being 25 cycle and part 60 cycle, for the railway and lighting load, respectively. The exciters are direct connected to the turbines, and while adding 2.6 per cent to the cost of the main generating unit, represent a saving of 20 per cent. as compared to the cost of independent exciting units. The operating costs, considered strictly alone, are not especially low, but are expected to reduce with the better load factor which will be the result of contemplated extensions in the traction lines. The labor cost is fairly low, being 0.12 per cent. per kw.-hour at present. Taking into consideration, however, interest, taxes and depreciation, the total power cost, including these items, is quite low, being 0.79 per cent. per kw.-hour with the present load factor of 24 per cent. Curves are presented showing that with 33 per cent. load factor this total cost will be reduced to 0.57 per cent., and with a possible load factor of 50 per cent. to 0.41 per cent. per kw.-hour. This low total cost of course is possibly due to the very low cost of the completed power station, which is shown to be but $66.25 per kilowatt, exclusive of land. Interest and taxes are taken as 7 per cent., while a sinking fund of 4.2 per cent., equivalent to 6.43 per cent. depreciation, is allowed in figuring total cost of power.

HEAVY FOUNDATIONS FOR THE NEW STEEL WORKS AT GARY, IND.

The soil conditions at the site of the immense new steel works of the United States Steel Corporation at Gary, Ind., are such that comparatively little difficulty is experienced in securing perfectly stable foundations for the heavy structures and machines which are included in those works. The blast furnaces, the machinery and equipment and the ore-handling docks and storage piles for the works are being built, however, on a scale that has never been undertaken heretofore, with the result that foundations and footings of unusual magnitude are required. The site of the works is along the shore of the extreme southern end of Lake Michigan, where a stratum of fine, clean lake sand, from 30 to 60 ft. in depth, covers the surface. The original ground level was a succession of alternate sand dunes and hollows, parallel to the shore line of the lake, with an average height of about 20 ft. above the water level in the latter. Under this sand, at a depth of 30 ft. below the lake level is a stratum of good clay which increases in hardnesss with the depth. The ground-water level rises on a slope of about 2 in. to 100 ft. going inland from the lake. The foundations and footings in many instances extend below the water level, but the heavy continuous bed of fine sand precludes any necessity of deep foundations, or of special provisions to carry the heavy loads imposed by many of the various structures.

The principal work required to prepare the site for the construction of the steel works was to level the sand dunes and the hollows to a uniform height of about 20 ft. above the lake level, although considerable areas are also being reclaimed from the lake, which is shallow along the site. While the leveling work was largely all done in advance of the construction, the sites of several large buildings and other structures were either excavated at the time, or were left until such time as they were to be utilized. The preparation of the site of the works, which is nearly a mile square, in this manner required great quantities of materials to be moved, but the excellent foundations afforded render this grading work an undertaking entirely of magnitude, rather than of difficulty.

The new works are to include sixteen blast furnaces, which are to be in a row parallel to a harbor about 6,000 ft. long and 250 ft. wide; These furnaces are being built partly on reclaimed land and partly on existing ground. A complete description of the plant and methods used in constructing the harbor was published in The Engineering Record of Aug. 17, 1907. Between the harbor and the row of furnaces are large traveling bridges for unloading ore from the vessels, rehandling bridges, ore storage piles, and pits for the charging skips of the furnaces. On the other side of the furnaces are the various buildings of the works, chief among which, from the standpoint of heavy foundations, are a blowing-engine house, a building for electrical generators and five large buildings for open-hearth furnaces. The foundations for most of these structures are massive concreae built directly on the sand. This concrete is all made in the proportions of 1 part cement, 3 parts limestone screenings and 6 parts crushed limestone. Universal and Newago Portland cement are used; the screenings vary from fine dust to pieces 1/4 in. in extreme dimensions and the crushed stone will all pass a screen with 2-in. meshes but be retained on one with 1-in. meshes.

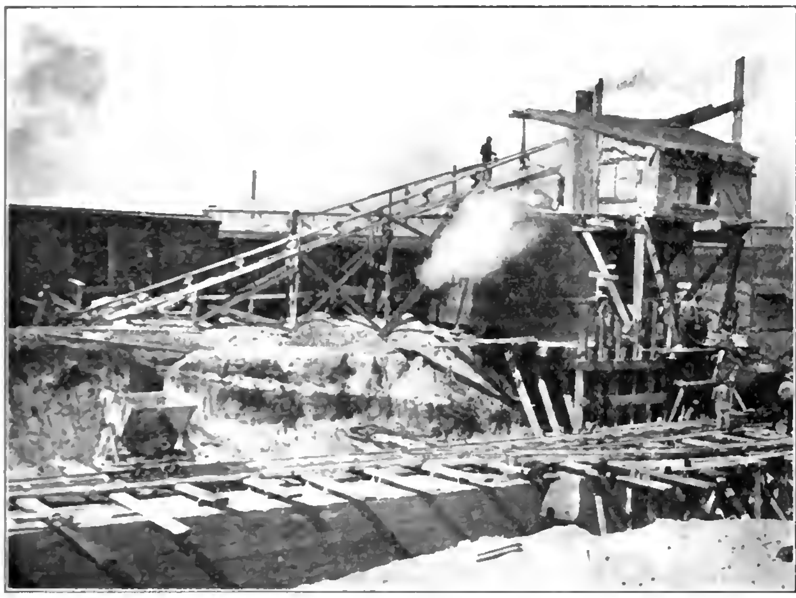
The construction of the greater part of the foundations that have been put under way is being carried on by Messrs. Lanquist & Illsley, general contractors, of Chicago. The plant and methods used in handling and mixing the great volumes of concrete in these foundations and footings have been specially developed to conform with the conditions presented. Railroad switching connections are in all cases extended directly to the work under way in order that plant and materials may be delivered expeditiously. In most cases the opportunity has also been afforded to handle the work in a logical manner. These conditions, and the great quantities of concrete to be placed in comparatively small areas render central mixing plants, with a large amount of equipment for handling the materials to, and the concrete away from these plants, the most productive and economical arrangement that could be made.

One general type of mixing plant has been adopted, and six of these plants have been erected adjacent to the heaviest work. Briefly, each of these plants embraces a belt conveyor, which delivers the concrete material from cars on a switch track to a mixer in an elevated tower; the mixer discharges into steel dump cars on portable narrow-gauge tracks extended to various parts of the work, or into bottom-dump buckets running on cars on these tracks to derricks which handle the buckets to place in the forms. The details and arrangement of these plants have been altered to suit conditions, but in all cases mechanical equipment has been used to eliminate manual labor as far as possible, and this equipment has been adopted in such form that it will handle the materials and concrete rapidly and in the most effective manner.

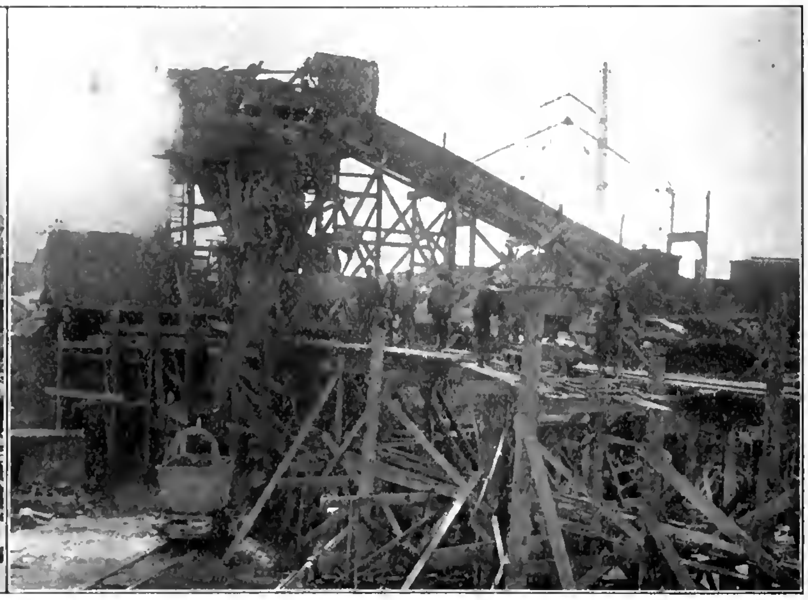
The foundations and footings for the blowing-engine house and the electrical generating station are among the most massive in the whole steel works, and the mixing plants that have been used during their construction are good examples of the general type. The blowing-engine house is approximately 135x600 ft. in plan, and will contain ten large blowing engines, operating on gases from the blast furnaces. The electrical generating station, of about the same size in plan, will contain fifteen gas-engine-generator units, each rated at 2,000 kw. These two buildings are adjacent, their longitudinal center lines being parallel.

The substructure of each building has as a base a monolithic concrete slab, about 135x600 ft. in plan and 5 ft. thick, or containing in round numbers, 15,000 cu. yd. of concrete. On this slab are built the foundations for the large blowing engine and generator units. These units are to be placed closely together in both buildings, so that but little space is available between the foundations of adjacent units; in most cases also the foundations extend from one side of the substructure to the other, a narrow space being left along on each side of the row of foundations, between the latter and the concrete walls, which are carried from the heavy base slab up to the superstructure walls. The foundations for the blowing engines are particularly heavy. The bottom of the 5-ft. base slab on which these foundations are built is at Chicago city datum, or about 1.5 ft. below the mean water level in the lake and 20 ft. below the finished ground surface. The foundations rise to 23 ft. above Chicago datum, or 18 ft. above the base, and are 40x80 ft. in plan in extreme dimensions. In the substructure of the electrical generating station the heavy base slab is at the same depth below the surface as in the blowing-engine house, and the foundations for the units in the station are about as heavy, each being, in general dimensions, also 40x80 ft. in plan and 18 ft. in height above the base slab.

The concrete for the substructure of each of these buildings was practically all mixed in a separate plant, although during the final work on the station substructure concrete for that work was furnished from the plant at the blowing-engine house. The arrangements and methods of operating both of these plants are so similar that a description of the plant for the substructure of the blowing-engine house will suffice for both.



Concrete Mixing Plant for Heavy Walls of Ore Bins.



Mixing Plant Delivering to Cars at Three Elevations.

This plant was erected at the inland end of the building, where two switch tracks could be extended up to one corner of the building without interfering with operations on the latter, or with any of the other large construction work which is under way on all sides. A heavy timber tower was built at the middle of the end of the building, in the edge of the excavation for the substructure, a platform for the mixer being placed in this tower at about the existing ground level. A charging hopper, having sufficient capacity for some storage, was built in the tower over the mixer. The hopper was divided into two compartments, one for crushed stone and one for screenings, and is placed so its top is 20 ft. above the ground. A small charging hopper for the cement was also placed over the mixer, at a lower level.

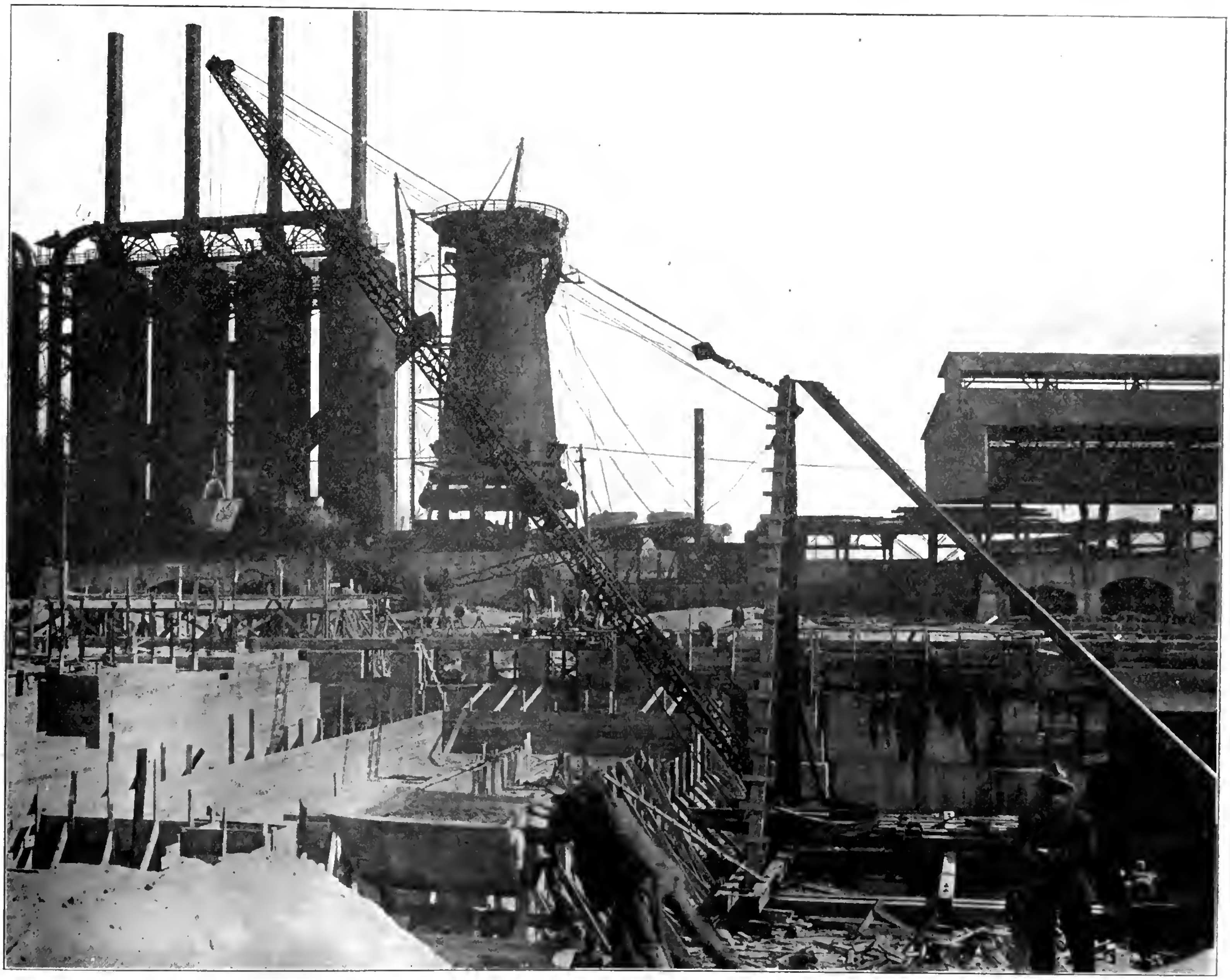
The cement, screenings and crushed stone are delivered from cars on the two switch tracks to these elevated hoppers by belt conveyors. A horizontal belt conveyor is placed in a frame between the two tracks, which are 16 ft. apart on centers. This conveyor is low enough to permit materials to be discharged on it from Williamson side-dump cars on both tracks with a minimum amount of shoveling. The horizontal conveyor is 300 ft. in length so seven cars can be placed along it in a string on one track, one car for cement, two for screenings and four for crushed stone. Portable platforms are extended from the floor of the car to an opening in the top of the frame carrying the conveyor in order that the screenings and stone may be shoveled on the latter without loss.

The horizontal conveyor is a 28-in. belt traveling at a speed of 300 ft. per minute, and has a rated capacity of 60 cu. yd. an hour. It discharges the materials at the end on an inclined 24-in. belt conveyor, extending up to the charging hoppers, into which the materials are delivered by it. A swinging baffle board is arranged over the hoppers in such manner that when screenings or stone are being handled they can be diverted into their respective hoppers. A man on the mixer signals to the shovelers in the cars whether screenings or stone are wanted, both classes of material, of course, being supplied to the charging hoppers separately. The cement is delivered in sacks which are handled from the car to the conveyor at any time whether stone or screenings are being handled. A man stationed near the top of the conveyor picks the sacks from the latter and places them on a short chute leading to a platform around the cement hopper. After the sacks are opened on this platform, the cement is poured into the charging hopper by hand.

The concrete mixer installed in this plant and also in the other plants on the work was designed specially for this work by the contractor. Essentially, it is of the continuous-mix pug-mill type, with an automatic feeding and measuring device. The latter has a short, solid cast-iron cylinder, with a series of four rows of pockets in its outer face; this cylinder is placed to a fairly close fit in a drum over one end of the drum of the mixer. The materials are fed into the mixer from the charging hoppers through this measuring device, the pockets in the cylinder of the latter being proportioned so the proper quantities of cement, screenings and crushed stone are supplied. The mixer and the measuring device are driven by the same engine, so the ratio between the rate of supply and the rate of mixing are constant, but may be varied.

The mixer is driven by a sprocket chain on a 40-h.-p., double-cylinder, steam engine. The conveyors are also driven by this engine, power being transmitted to them by a wire-cable rope drive. The engine is fitted with a reversing-motion link so the mixer and belts can be turned backward in case of an emergency. This arrangement has been found particularly satisfactory since it permits large stones, bolts and the like that occasionally become lodged in the mixer or belts to be removed without difficulty. Steam is supplied to the engine by a 60-h.-p., locomotive-type, boiler set up at the side of the plant the idea being in the choice of both engine and boiler to have ample power for all demands.

The arrangement of tracks for handling concrete in the dump cars and buckets from the mixer to place was altered from time to time to suit conditions as the work progressed. The 5-ft. base slab under the substructure was nearly all finished before work was started on the engine foundations. In order, however, to hasten the beginning of work on the latter, a section of the slab 20 ft. in width was carried forward on each side, from the mixing plant to



Derrick with 115-Foot Boom for Handling Concrete in Heavy Foundation Work at Gary, Ind.

the opposite end of the substructure, after which the closing section at the middle was finished back toward the plant. This arrangement permitted an earlier installation, at the end farthest from the mixing plant, of a large derrick for handling the bottom-dump buckets used in placing the concrete in the upper part of the foundations.

The concrete in the base slab and in the engine foundations up to a height of 5 ft. about the slab was all delivered in the side-dump cars running on portable track, which extended from the mixing plant to the point where work was in progress. Above that height the concrete was placed from the bottom-dump buckets by the derrick. The portable track, of which the contractors have in the neighborhood of 10,000 linear feet on the whole work, was built in 15 ft. lengths by the Arthur Koppel Co. The cars are of the standard 1-yd. Koppel side-dump design having steel bodies, steel frames and ball-bearing wheels. Concrete is also dumped from these cars into the forms for the side walls of the substructure by placing an inclined deflector at the top of the form.

The bottom-dump buckets were designed by the contractors and have a capacity of 1½ cu. yd. each. Their bottoms are made in one piece which is hinged at one side and is locked in place at the other side by a hook clamp that is easily loosened when the contents are to be dumped. The sides of the bucket all converged toward the bottom in order to facilitate the removal of the concrete.

While concrete was being placed in the base slab the portable tracks were blocked up on the finished work, the cars being dumped on one side of the track, which was shifted as the work progressed. Within 150 to 200 ft. of the mixing plant the cars were pushed from the latter to place by hand. At a distance in excess of that the cars were drawn in pairs by a horse to the point where concrete was being laid. After work had been started on the engine foundations tracks were laid on temporary trestles extending over the forms for the foundations at a height of 12 ft. above the top of the slab. Later, as the walls around the substructure were being built tracks were laid from the mixer at a third level, 18 ft. above the slab and were continued along the tops of the forms of the walls. Finally, the lowest level of track was also utilized to deliver concrete to the derrick in the bottom-dumping buckets. The work was prosecuted in such sequence, however, that the concrete was being handled in all four ways simultaneously. The mixer discharged directly into the cars at the lowest level at first; then as the work at the higher levels was started a short bucket elevator, driven by the mixer engine, was installed in the discharge chute leading from the mixer, in order to deliver the concrete to those levels without requiring the mixer to be placed on a high expensive tower, which would also have necessitated longer inclined conveyors leading to the charging hopper. The chute into which the bucket elevator discharged was arranged with hinged deflectors so the concrete could be diverted into secondary chutes leading to the different levels.

When the mixing plant for the substructure of the electrical station was discontinued an incline was built from the second level of tracks at the mixer for the substructure of the blowing-engine house, up over the forms for the side walls of this substructure to a connection with the highest level tracks for the other substructure. The cars were drawn up this incline by a hoisting engine, and were fitted with a simple brake so two men could ride them down the incline with safety.

Except in the vicinity of the mixers the portable tracks at all three levels in both these substructures were laid singly, but were arranged with passing tracks which enabled several cars going in both directions to be in service on the single track. The arrangement of the tracks at the mixer permitted four cars to be set in position to receive concrete, thus avoiding any delay by waiting for cars. The latter could also be brought to and taken away from the mixer without interfering with the cars in position at the mixer. This method of arranging tracks to facilitate the delivery of cars to and from the mixer and to permit the operation of the largest economical number of cars on the running tracks, has been carefully and fully developed in a similar manner in connection with all of the mixing plants that have been built. At the same time, even with this complete system the output of the mixing plants is limited chiefly by a lack of ability to remove the concrete as fast as it can be produced.

The derrick used in handling the bottom-dump buckets in which the concrete is delivered to it for the upper parts of the engine foundations was also designed for this particular work by the contractors. It has a 40-ft. latticed steel mast with four wooden stiff legs and a bull-wheel. The boom is 115 ft. in length, which is believed to be one of the longest, if not the longest boom of this type that has been built. It is made up of four 6-in. steel angles, placed at the corners of a 24-in. square and latticed together. A platform on heavy timber sills carries the derrick and the double-drum 50-h.p. Monaghan hoisting engine used to operate it. The platform sills are on rollers running on the portion of the base slab of the substructure which has been finished, so the derrick can readily be moved.

The completion of the upper part of the engine foundations, for which the derrick delivers the concrete, was started at the end of the substructure farthest from the mixing plant, the derrick being placed far enough from that end so it could just reach the work in the latter. As the foundations were finished up to the derrick the latter was moved back until the work was completed about 50 ft. from the one end. Meanwhile, the lower part of the foundations in the rear of the derrick had been built nearly to mixer plant; the derrick is to be turned around so it can be used to finish this section of the foundations, after which it will be dismantled and the foundations in the closing section built from tracks by dumping from the cars.

The equipment, arrangement and operation of the other five mixing plants which have been built, and particularly of the plant for the substructure of the electrical station, are very similar to those of the plant that has been described. The equipment for all of them is practically the same, while the arrangement has been varied in details to suit the locality. The horizontal run of the belt conveyors is placed in the same manner as in the case of the one described, although in some of the plants only a single switch track is available. The position of the inclined run of the conveyors is governed by the proximity of the switch tracks to the mixing plant, as it has been found that a grade of 4 in. to the foot is the steepest at which crushed stone can be handled on the belt. The construction and arrangement of the mixer tower, however, is the same in all the plants; the general conditions governing the arrangement of the tracks on which the concrete is delivered from the mixer have been explained.

Horizontal Conveyor Belt for Delivering Concrete Materials from the Cars to a Mixing Plant.

The method of handling the work on the different heavy foundations is varied from the program followed in connection with the substructure of the blowing-engine house in order to suit local conditions. The work on the foundations for the substructure of one of the open-hearth furnace buildings will illustrate some of the changes that have to be made. These buildings are each 165x1,200 ft. in plan, their substructures having as a base a solid slab of concrete 2½ to 3½ ft. thick and 165x1,400 ft. in plan, the base being extended beyond both ends of the building. On this base are erected the massive concrete foundations for the open-hearth furnaces, for the columns of the building and for the heavy equipment in the latter. In executing this work a mixing plant was first set up at one end of the building and delivered concrete for most of the building subsructure for a distance of 1,000 ft. from it. Then, in order to permit the erection of the superstructure to be started, the mixing plant was moved to the opposite end of the building, where it remained until the work was finished.

The sequence of operations on this building were much the same as on the one already described. Two traveling stiff-leg derricks with 35-ft. steels masts and 100-ft. steel booms were installed to handle the bottom-dump buckets used in placing the concrete in the upper part of the foundations, after the base slab and the lower part of the foundations had been placed from cars. These derricks were built prior to the construction of the one with the 115-ft. boom, the satisfactory results secured in their

operation having much to do with the installation of the one with the longer boom. At the same time it should be noted in this connection that these derricks handle about 2½ tons as maximum loads, their great advantage being in their long range at comparatively low heights.

The walls which carry the traveling ore unloaders and the rehandling bridges, and those along the ore storage bins parallel with the row of furnaces, all of which walls are parallel and close together, contain large quantities of concrete. The walls for the ore unloaders are 17 ft. wide at the base, 18 ft. high and 8 ft. wide on top; one leg of the rehandling bridges is carried by one of the walls for the unloaders, while the other leg is carried by a wall 17 ft. wide at the base, 10 ft. high and 8 ft. wide on top. The walls for the ore bins are not so high, but are more massive. A section of all these walls, 2,400 ft. in length, is being built by Messrs. Landquist & Illsley, who have erected two mixer plants for this work. In building the wide sections of the walls two parallel portable tracks are provided for the operation of the dump cars to and from the mixer plants. On the narrow sections of the walls single tracks with turnouts at frequent intervals are employed.

The quantities of concrete that are required to provide foundations for the principal structures of the new steel plant that are under construction are enormous. The contractors whose plant and methods have been considered herewith have already placed over 200,000 cu. yd. of concrete since they commenced operations in July, 1906, and their work will involve approximately 350,000 cu. yd. in the aggregate, besides requiring the handling of over 500,000 cu. yd. of sand. There is, furthermore, a large amount of concrete required in the other structures, buildings, dock walls and so forth in the steel works, not covered by their contract in addition to which may be included the concrete used for the municipal works of the town of Gary. These works were fully described in The Engineering Record of July 20, 1907.

Practically since the inception of operations the contractors have had in operation three to four mixing plants. The actual normal output of each of these plants is in the neighborhood of 350 cu. yd. per 10-hr. day, although occasionally a plant will deliver 450 cu. yd. in that time. In order to keep the plants in operation 30 to 50 cars of cement, screenings and stone have to be delivered each day. The materials are all furnished by the management of the steel plant, and due to an excellent system of switching which is followed, very little delay is experienced in delivering them. The stone and screenings are brought to the works in special trains directly from the extensive quarries of the Dolese & Shepard Co.

The design and construction of the new steel plant are under the direction of Mr. G. G. Thorp, vice-president of the Indiana Steel Co.; Mr. A. B. Neumann is chief engineer, and Mr. W. P. Gleason is superintendent of that company.

Fuel Requirements in the vicinity of Boston are responsible for a decided novelty in the Atlantic coast-wise coal trade. The New England Coal & Coke Co. has under contract three 11-knot steam colliers which will replace sailing vessels in the coal trade from Virginia. The sailing colliers are often delayed for many days at a time in rounding Cape Cod, and as a result there are threatened shortages in fuel supplies and congestion at the unloading points when heavy weather continues for some time. The new steam colliers are designed to carry 7,200 tons each, and are to be fitted with appliances permitting them to be loaded and unloaded in 6 and 10 hr. respectively.

New Reinforced Concrete Regulations in Philadelphia.

The following regulations of the Bureau of Building Inspection of Philadelphia in regard to the use of reinforced concrete were approved by Director Henry Clay, of the Department of Public Safety, on October 8.

The term "reinforced concrete" shall be understood to mean an approved concrete mixture reinforced by steel or iron of any shape, so that the steel or iron will take up all the tensional stresses and assist in the resistance to compression and shear.

Before a permit to erect any reinforced concrete structure is issued, complete specifications and drawings shall be filed with the Bureau of Building Inspection, showing all details of the construction, size and position of all reinforcing rods, stirrups, etc., and giving the composition and proportions of the concrete.

The execution of the work shall be performed by workmen under the direct supervision of a competent foreman or superintendent.

Reinforced concrete construction will be accepted for fireproof buildings of the first class, if designed as hereinafter prescribed; provided, that the aggregate for such concrete shall be clean, broken, hard stone, or clean graded gravel, together with clean siliceous sand or fine grained gravel; should the concrete be used for flooring between rolled steel beams, clean furnace clinkers entirely free of combustible matter, or suitable seasoned furnace slag may be used; when stone is used with sand gravel it must be of a size to pass through a 1-in. ring, and 25 per cent. of the whole must not be more than one-half the maximum size; and provided further, that the minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be 2 in. on the bottom and 1½ in. on the sides of the said beams and girders. The minimum thickness of concrete under slab rods shall be 1 in. All reinforcement in columns to have a minimum protection of 2 in. of concrete.

All the requirements herein specified for the protection of steel and for fire-resisting purposes shall apply to reinforced concrete flooring betweeen rolled-steel beams as well as to reinforced concrete beams and to entire structures in reinforced concrete. Any concrete structure or the floor filling in same, reinforced or otherwise, which may be erected on a permanent centering of sheet metal, of metal lathing and curved bars or a metal centering of any other form, must be strong enough to carry its load without assistance from the centering, unless the concrete is so applied as to protect the centering as herein specified for metal reinforcement.

Exposed metal centering or exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and a plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and properly secured, as approved by the Chief of the Bureau of Building Inspection.

All concrete shall be mixed in a mechanical batch mixer to be approved by the Bureau of Building Inspection, except when limited quantities are required or when the condition of the work makes hand mixing preferable; hand mixing to be done only when approved by the Bureau of Building Inspection. In all mixing the material shall be measured for each batch.

When hand mixing is done under the aforesaid limitations, the cement and fine gravel or coarse sand shall be first thoroughly mixed dry and then made into a mortar by gradually adding the proper amount of water. The crushed stone or gravel shall be spread out to a depth not to exceed 6 in., in a tight box or upon a proper floor, and be sprinkled with water as directed; the mortar is then to be evenly spread over the crushed stone, and the whole mass turned over a sufficient number of times, to effect the thorough mixing of the ingredients.

All forms and centering for concrete shall be built plumb and in a substantial manner, made tight so that no part of the concrete mixture will leak out through cracks or holes, or joints, and after completion shall be thoroughly cleaned, removing shavings, chips, pieces of wood and other material, and no debris of any kind shall be permitted to remain in the forms. All forms to be properly supported and braced in a manner to safely sustain the dead load and the load that may be imposed upon them during construction

The reinforcing steel shall be accurately located in the forms and secured against displacement.

Concrete shall be placed immediately after mixing.

Whenever fresh concrete joins concrete that is set, or partially set, the surface of the old concrete shall be roughened, cleaned and spread with cement mortar, which mortar shall be mixed in proportions of one of cement to two of sand.

Concrete shall not be mixed or deposited in freezing weather, unless precautions are taken to avoid the use of material covered with ice or snow or that are in any other way unfit for use, and that further precautions are taken to prevent the concrete from freezing after being put in place. All forms under concrete so placed to remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

Concrete laid during hot weather shall be drenched with water twice daily, Sunday included, during the first week. The broken stone, if hot and dry, must be wet before going to the mixer.

The time at which props or shores may safely be removed from under floors and roofs will vary with the condition of the weather, but in no case should they be removed in less than two weeks; provided, that column forms shall not be removed in less than four days; provided further, that the centering from the bottom of slabs and sides of beams and girders may be removed after the concrete has set one week, provided, that the floor has obtained sufficient hardness to sustain the dead weight of the said floor and that no load or weight shall be placed on any portion of the construction where the said centers have been removed.

The concrete for all girders, beams, slabs and columns, shall be mixed in the proportions of one of cement, two of sand or fine gravel, and four of other aggregates as before provided. The concrete used in reinforced concrete-steel construction must be what is usually known as a "wet" mixture. When the concrete is placed in water it must be placed in a semi-dry state.

Only Portland cement shall be permitted in reinforced concrete constructed buildings. All cement shall be tested, in carload lots when so delivered or in quantities equal to same, and report filed with the Bureau of Building Inspection before using it in the work. Cement failing to meet the requirements of the accelerated test will be rejected.

Soundness, Accelerated Test.—Pats of neat cement will be allowed to harden 24 hours in moist air, and then be submitted to the accelerated test as follows: A pat is exposed in any convenient way in an atmosphere of steam, above boiling water, in a loosely-closed vessel, for 3 hours, after which, before the pat cools, it is placed in the boiling water for 5 additional hours.

To pass the accelerated test satisfactorily, the

pats shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

Such cements, when tested shall have a minimum tensile strength as follows: Neat cement shall, after one day in moist air, develop a tensile strength of at least 150 lb. per square inch; and after one day in air and six days in water shall develop a tensile strength of at least 500 lb. per square inch; and after one day in air and 27 days in water shall develop a tensile strength of at least 600 lb. per square inch. Cement and sand tests composed of one part of cement and three parts of crushed quartz shall, after one day in air and six days in water, develop a tensile strength of at least 175 lb. per square inch, and after one day in air and 27 days in water shall develop a tensile strength of at least 240 lb. per squre inch. These and other tests as to fineness, set, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers, may, from time to time, be required by the Bureau of Building Inspection.

Walls.—Reinforced concrete may be used in place of brick and stone walls, in which cases the thickness may be two-thirds of that required for brick walls as shown in the Schedule, Section 18 of the Act of Assembly No. 123, of the Commonwealth of Pennsylvania, approved June 5, 1901, provided the unit stresses as set forth in these regulations are not exceeded.

Concrete walls in such cases must be reinforced in both directions in a manner to meet the approval of the Chief of the Bureau of Building Inspection.

Steel.—All reinforcements used in reinforced concrete shall be of standard grade of structural steel or iron of either grade to meet the "Manufacturers' Standard Specifications," revised February 3, 1903.

Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(*a*) The common theory of flexure to be applied to all beams and members resisting bending.

(*b*) The adhesion between the concrete and the steel is sufficient to make the two materials act together.

(*c*) The design shall be based on the assumption of a load four times as great as the total load (ordinary dead load plus ordinary live load).

(*d*) The steel to take all the tensile stresses.

(*e*) The stress-strain curve of concrete in compression is a straight line.

(*f*) The ratio of the moduli of elasticity of concrete to steel:

Stone or gravel concrete................1 to 12.
Slag concrete ....1 to 15.
Cinder concrete ....1 to 30.

The allowable unit transverse stress upon concrete in compression:

Stone or gravel concrete.........600 lb. per sq. in.
Slag concrete ....400 " " " "
Cinder concrete ....250 " " " "

The allowable unit transverse stress in tension:

Iron ....12,000 lb. per sq. in.
Steel ....16,000 " " " "

The allowable unit shearing strength upon concrete:

Stone or gravel concrete..........75 lb. per sq. in.
Slag concrete ....50 " " " "
Cinder concrete ....25 " " " "

The allowable unit adhesive strength of concrete:

Stone or gravel concrete.........50 lb. per sq. in.
Slag concrete ....40 " " " "
Cinder concrete ....15 " " " "

The allowable unit stresses upon concrete in direct compression in columns:

Stone or gravel concrete.........500 lb. per sq. in.
Slag concrete ....300 " " " "
Cinder concrete ....150 " " " "

The allowable unit stress upon hoop columns composed of stone or gravel concrete shall not be over 1,000 lb. per square inch, figuring the net area of the circle within the hooping. The percentage of longitudinal rods and the spacing of the hoops to be such as to permit the concrete to safely devolp the above unit stress with a factor of safety of four.

When steel or iron is in the compression sides of beams the proportion of stress taken by the steel or iron shall be in the ratio of the modulus of elasticity of the steel or iron to the modulus of elasticity of the concrete provided that the rods are well tied with stirrups connecting with the lower rods of the beams; provided, further, that when rods are used in compression, the approval of the Chief of the Bureau of Building Inspection must be obtained.

In the design of structures involving reinforced concrete beams and girders, as well as slabs, the beams and girders shall be treated as T-beams, with a portion of the slab acting as flange in each case. The portion of the slab that may be used to take compression shall be dependent upon the horizontal shearing stress that may exist in the beam, and in no case shall the slab portion exceed twenty times the thickness of the slab.

All reinforced concrete T-beams must be reinforced against the shearing stress along the plane of junction of the rib and the flange, using stirups throughout the length of the beam. Where reinforced concrete girders carry reinforced concrete beams, the portion of the floor slab acting as flange to the girder must be reinforced with bars near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

In the execution of work in the field, work must be so carried on that the ribs of all girders and beams shall be monolithic with the floor slabs.

In all reinforced concrete structures special care must be taken with the design of joints to provide against local stresses and secondary stresses due to the continuity of the structures.

Shrinkage and thermal stresses shall be provided for by the introduction of steel.

In the determination of bending moments due to the external forces, beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor slabs, when constructed continuously, and when provided with reinforcement at top of slab over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than $WL/10$ in cases of square floor slabs which are reinforced in both directions and supported on all sides, the bending moment may be taken at $WL/20$; provided, that in floor slabs in juxtaposition to the walls of the building the bending moment shall be considered as $WL/8$, when reinforced in one direction, and if the floor slab is square and reinforced in both directions, the bending moment shall be taken as $WL/16$.

When the shearing stresses developed in any part of a reinforced concrete building exceed under the multiplied loads the shearing strength as fixed in this section, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded, provision must be made for transmitting the strength of the steel to the concrete.

Reinforced concrete may be used for columns in which the ratio of the length to least side or diameter does not exceed 15. If more than 15 diameters the allowable stress shall be decreased proportionally. Reinforcing rods that are introduced for lateral stresses must be tied together at intervals of not more than the least side or diameter of the columns.

Longitudinal reinforcing rods will not be considered as taking any direct compression.

The contractor must be prepared to make load tests in any portion of a reinforced concrete building within a reasonable time after erection, and as soon as may be required by the Chief of the Bureau of Building Inspection. The tests must show that the construction will sustain a load equal to twice the calculated live load without signs of cracks.

Systems of construction differing from the standard already approved and tested, may be required to pass a load, fire and water test, as present in Section 2 of the Act of Assembly, No. 236, of the Commonwealth of Pennsylvania, approved April 25, 1903.

The Chief of the Bureau of Building Inspection may, from time to time, issue such modifications to these regulations as may be found necessary to conform to modern practice.

General Appearance of Retail Coal Pockets at Hoboken.

Glass Telegraph Poles are to be manufactured in a factory recently built at Grossahmerode, Germany. An architect, of Cassel, has been granted patents in Germany and other European countries and in the United States for a machine to be used in their manufacture, according to United States Consular Agent Gustav C. Kothe, of Cassel. The glass is reinforced by wires suitably disposed. These poles, it is believed, will be particularly adapted for use in countries where wooden poles are quickly destroyed by insects or climatic conditions. The Imperial Post Department of Germany has ordered these poles for use on one of its telephone or telegraph lines. A pole 23 ft. long costs about $6 now but the regular selling price for market quotation has not yet been announced.

A Modern Retail Coal Pocket.

By Charles J. Steffens, Manager Guarantee Construction Co., New York.

The past few years have shown a marked advance in many branches of engineering, but none more marked than in that of the mechanical handling of materials. With the steadily increasing cost of labor, especially in the larger cities, it is becoming more essential as time passes that the labor cost at plants of every description be reduced to a minimum, and this requirement has resulted in the development and improvement of labor-saving appliances. While many technical articles have recently appeared on the subject, especially in connection with the handling of coal and disposal of ashes at the large power stations now being erected or recently completed, little has been written of the mechanical handling of coal at the retail yards. When one considers the enormous tonnage required to supply the inhabitants of any large city, the importance of this problem may readily be appreciated.

Simple as it may appear to design a plant of this character, yet in reality, if the plant, when completed, is to result in a minimum cost for operating expense and a minimum amount of breakage to the coal handled, it involves close study of the local conditions and a thorough knowledge of the various appliances for handling coal which are now on the market.

To the retail dealer there are but three ways of increasing his profits and thus meeting competition. The cost of coal at the mines is a fixed charge, as also is the freight, and these he cannot alter. His profits therefore can only be increased by a reduction of expenses after the coal is delivered at his plant, and this may be accomplished by reducing the percentage of coal broken in handling, by improved facilities which will enable him to handle his output at less expense, and by reducing the amount of waste product of his plant, consisting of screenings.

While it is true that the local conditions vary, and that no rule may be made which would apply to all cases—while in some instances an elevated trestle is undoubtedly the most economical form of plant—yet in general it may be said that the elevated pocket best suits the requirements of modern conditions. In a plant of this character, if properly designed, coal may be taken from the cars, loaded into the pocket and screened and delivered to the trucks at a cost which should not exceed two cents per ton, and is often more nearly 1½ cents. A plant of this character will cost when completed approximately $6.50 per ton of storage. This would, of course, include all foundations and machinery.

One of the largest retail coal firms in the east is the Jagels, Bellis Co., of Hoboken, N. J., who handle about 250,000 to 300,000 tons of coal per year and have several plants located in Hoboken, Jersey City and Weehawken. One of these plants is at 15th and Bloomfield Streets, Hoboken, N. J., of which a picture is given. Coal may be received by either rail or water, and the plant being within three blocks of the ferry to New York, the location leaves little to be desired.

At one side of the picture may be seen the hoisting tower, which forms the northerly end of the plant and is connected to the pocket by a timber trestle. At the south end of the pocket is a wooden bridge, spanning the street and extending to the elevator towers, where coal is taken from the cars. Beyond the elevator is a steel bridge over the tracks of the Hoboken Shore Road and connecting with the power-house of the Public Service Corporation, which the Jagels, Bellis Co. supplies. A screen pocket is located near the hoisting tower and here the screenings from the chutes of the pocket are resized for commercial use. The office, which is two stories high, is located opposite the south end of the pocket.

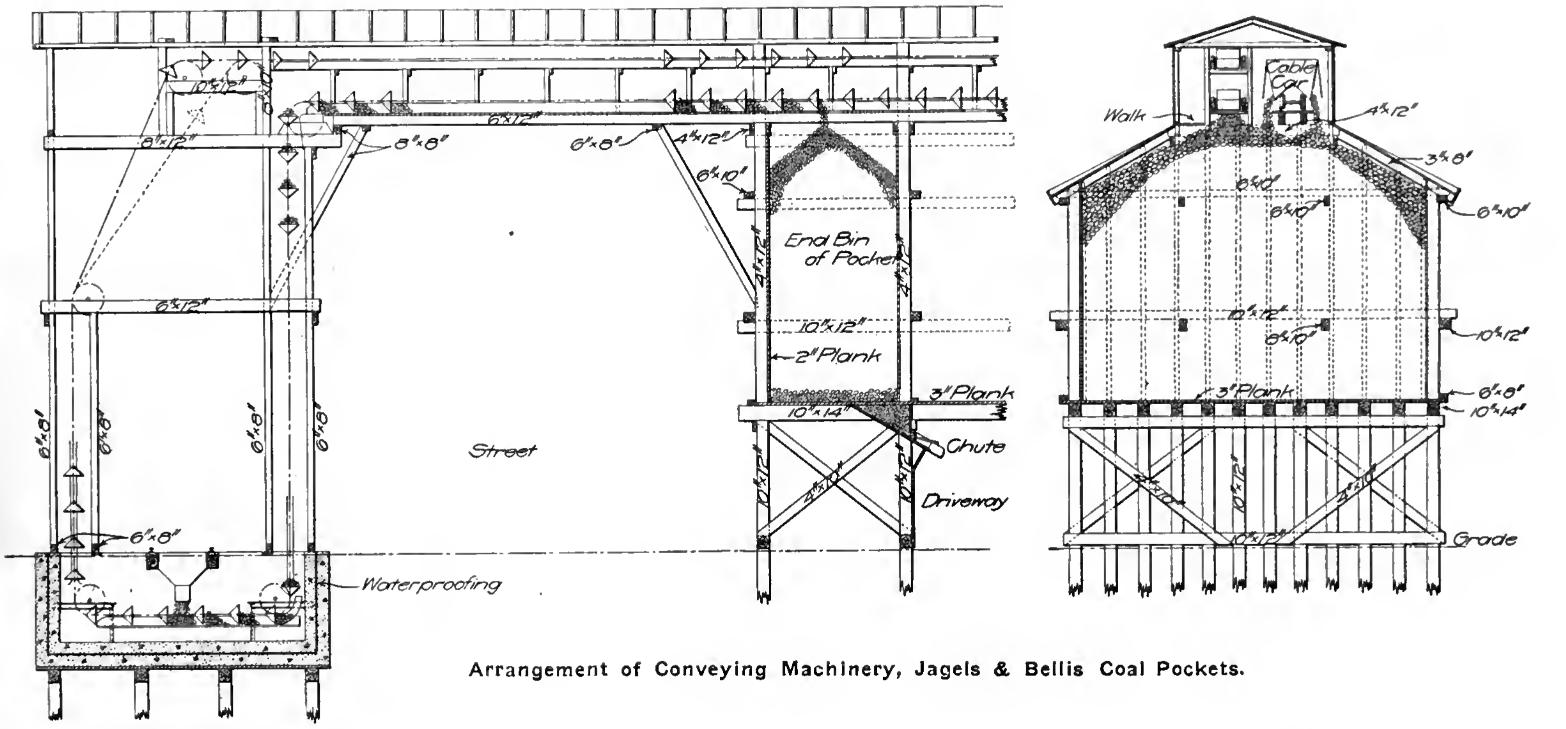
The pocket is built of long leaf yellow pine, the foundations being spruce piles driven to such a depth as to secure a penetration of not more than 2½ in. under the last five blows of a 2,000-lb. hammer having an effective fall of 10 ft. Rows of posts under the pocket and supporting the floorbeams are spaced 12 ft. apart, thus providing alternately for a 12-ft. driveway and a 12-ft. space for storage of dust from the delivery chutes. These chutes are so arranged that about 90 per cent. of the coal may be drawn from the bins and delivered to the trucks without shoveling.

The pocket is 145 ft. in length and 31 ft. in width, with a depth for 21 ft. of coal in the bins, thus giving a capacity of approximately 3,000 tons if the coal is trimmed by hand or 2,700 tons without trimming. The floor is elevated 12 ft. from the ground so that the trucks may be driven underneath and there loaded. Eleven bins are provided for storage of the commercial sizes of anthracite, no bituminous coal being handled through the pocket.

At the southern end of the pocket is a public roadway, beyond which is the siding for delivering coal cars, and at this siding are located the elevator towers and also a small engine and winch used for moving cars along the tracks. The illustration shows a view of the tower and operation of the elevator.

The elevator is arranged to take coal from a steel trough under the track hopper and carry it horizontally to the end of the track pit, then vertically to a level with the top of the bins, and from this point horizontally over the street and to the north end of the pocket, with provision for discharging into any of the various bins as it passes along. Buckets are V-shaped, 24-in. long, 20 in. wide and 10 in. deep, and are spaced every 36 in., being bolted between two strands of chain composed of steel links of 18-in. pitch with a pin connection for the links. Four-inch rollers are provided on the pins, the rollers being so constructed that they may be automatically oiled by a suspended oiler while the machine is in motion.

The trough along which the coal passes on the horizontal run is made of No. 10 gauge steel and is provided with a discharge gate at the center of each bin, the gates being operated by a rack and pinion connected to an 18-in. handwheel. In order to avoid the breakage due to coal falling from the trough to the bottom of the bins, break preventors are provided under each discharge gate. These are so constructed that the coal is retarded in its fall, striking baffle plates so arranged that the greatest vertical drop for the coal is 2 ft.



Arrangement of Conveying Machinery, Jagels & Bellis Coal Pockets.

At the north end of the pocket is a machinery room in which is located a 25-h.-p. direct-current 500-volt motor which runs at the speed of 1,100 r. p. m. The motor is geared down to the head-shaft of the elevator, the head-shaft being fitted with an equalizing gear to prevent the uneven motion of the buckets, which would otherwise result from having an 18-in. pitch chain. The elevator speed is 90 ft. per minute and the capacity is 60 tons per hour.

As the height of the tide rendered it necessary to make the track pit at the foot of the elevator waterproof, it was constructed in the following manner: Piles to support the weight of the pit were first driven, after which sheet piling of 2-in. plank was driven to a depth of 12 ft. and the earth excavated. A sump hole was also excavated adjacent to the pit, and a pump installed to keep down the water during construction. The piles were then cut off and capped with 12 x 12-in. yellow pine over which a 3-in. plank floor was laid, after which the outer walls

and floor were constructed of concrete 12 in. thick. When this had hardened, the inner forms were removed and all holes pointed up, after which waterproofing was applied, consisting of six layers of single-ply tar roofing felt, each layer as placed being coated with coal tar pitch, applied hot. The inner concrete walls and floor were then constructed, these being of the same thickness as the outer walls. This pit has been found thoroughly satisfactory and absolutely watertight.

Delivery chutes and gates, for loading the trucks, are made of sheet steel, each chute being provided with a screen 2 ft. wide and 3 ft. long over which the coal passes as it is discharged to the trucks. The size of mesh used in these screens for the various sizes of coal is as follows:

Pea, 3/16 in.; chestnut, 1/4 in.; stove, 3/8 in., and egg, 1/2 in. The chutes will discharge at the rate of one ton per minute, if the gates are fully opened. Dust and small coal which passes through the screens are taken away at intervals and resized at the screen pocket which is located at the bulkhead.

The hoisting tower, at the northerly end of the plant, is also constructed of yellow pine, the lower part being formed into a bin with a capacity of about 300 tons, for the storage of bituminous coal. Bituminous coal is also stored on the ground under the trestle which connects the hoisting tower and pocket. The tower is 22 ft. square and 75 ft. high, with foundations of concrete, which rest partly on the crib and partly on piles.

Equipped with a one-ton clam-shell bucket which is operated by a 10 x 12-in. double-cylinder steam engine, the tower is capable of handling 60 tons of coal per hour. All coal hoisted by the bucket is discharged into the receiving hopper at the head of the hoist and on a level with the engineer's platform, so that the engineer may, at all times, see the bucket. On this level are also located the engine and the boiler.

When anthracite coal is being hoisted, the receiving hopper discharges into an auxiliary hopper on the level below and from this the coal is loaded into cable cars which run through the pocket and discharge to the bins.

Bituminous coal may be taken from the receiving hopper and by-passed through a chute to the storage bin below, or it may be passed through a crusher between the receiving and auxiliary hoppers, then into the auxiliary hopper and be conveyed to the Public Service Corporation's power-house by means of the cable cars.

In order to secure a uniform and satisfactory feed to the crusher, an apron feeder is located under the receiving hopper. The feeder is 24 in. wide and about 4 ft. long, running at a speed of 30 ft. per minute. The head shaft is geared to a countershaft, and this in turn driven from the line shaft. A tight and loose pulley on the belt drive provides for stopping the feeder when it is desired to handle coal without passing through the crusher.

The crusher is of the two-roll type with removable teeth fitted to 18 x 24-in. rolls, and is operated at a speed of 180 r. p. m., being driven from the line shaft by means of a 10-in. double leather belt. The belt pulley on the line shaft is fitted with a clutch so that the crusher may be cut out when desired.

Starting from a point under the auxiliary hopper and passing over the bins of the pocket, then over the bridge and to the power-house of the Public Service Corporation, is a car system of the shuttle type consisting of one-ton, steel, side-dump cars on a narrow-gauge track.

Three pulleys on the line shaft, the outer ones tight and the center one loose, are connected by two belts to a jack shaft on which are three similar pulleys. One of these belts is crossed and the other open, so that by means of a belt shifter the jack shaft may be caused to revolve in either direction, thus reversing the motion of the cable and cars.

Cars are automatically dumped over the bins so that when the tower is in operation, it requires an engineer to hoist coal and his assistant to load the cars and operate the belt shifter. Power for the feeder, crusher and car system is furnished by a 30 h.-p. 500-volt direct-current motor at a speed of 975 r. p. m. The motor is geared to the line shaft in the tower and is on same level as tracks of the car system.

At the north end of the plant, near the hoisting tower and on the bulkhead line, is a screen pocket 12 ft. wide, 30 ft. long and having a depth of 15 ft. in the bins, which are elevated from the driveways similar to the arrangement for the storage pocket.

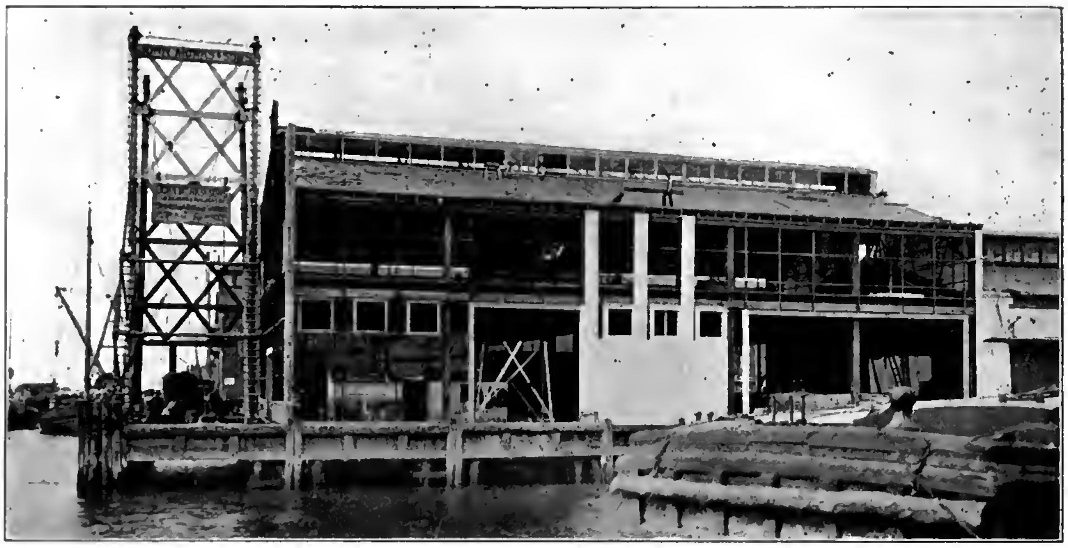
Small coal and dust which has passed through the screens of the chutes under the pocket is carted to the screen-house and there discharged into a small pit. From this point it is handled and sized automatically, being hoisted by a centrifugal discharge bucket elevator, with 5 x 7-in. malleable iron buckets, to a revolving screen 42 in. in diameter and 8 ft. long. The screen is mounted on trunnion bearings and covered with wire cloth, the mesh of the various sections being such as to size for dust, buckwheat and pea; chestnut and any other larger sizes pasing out over the end of the screen. Each size, as it is separated by the screen, is discharged into its proper bin from which it may be loaded to the trucks for delivery. Both screen and elevator are driven by a 7½ h.-p. motor.

THE EFFECT OF COMPRESSED AIR on health has lately been under investigation by two English engineers, who submitted themselves to some heavy pressures during the tests. A steel chamber was built, according to "The Engineer," in which the pressure was frequently raised to 75 lb. per square inch, without serious effect on the experimenters. Other tests showed that it is possible for a man to endure a pressure of 92 lb. per square inch without unpleasant results, provided that, first, at least twenty minutes are allowed for taking off each 15 lb. of pressure, the decompression being at a uniform rate; and, secondly, that the capillary circulation in every part of the body is maintained by muscular action during decompression. The only inconvenience under the pressure noted was a little temporary neuralgic pain in the arms. The studies further led to the belief that the longer the exposure, the longer and more uniform should be the decompression.

Reconstructing a New York Pier Shed.

The river end of the shed occupied by the Clyde Steamship Line on Pier 36, North River, New York, has recently been replaced by a modern steel structure of about the same width and about 10½ ft. higher. The new structure, about 114 ft. long and 73 ft. wide, is seated on the old wooden pier and has six transverse bents designed in accordance with recent practice for the construction of steel pier sheds. Each bent is about 32 ft. high to the eaves, and 54 ft. high over all, including the monitor, 5 ft. high. It is two stories high with the second floor 20 ft. above the deck of the pier and nearly 10 ft. in the clear below the lower chords of the roof trusses. The second floor is carried by a plate girder 6 ft. deep in each bent and both girders and roof trusses are supported entirely by the wall columns, leaving the interior of the shed unobstructed by intermediate columns.

Each bent is made with two 12 x 12-in. I-shape wall columns and a riveted triangular roof truss with a span of 73 ft. out to out and a center depth of 13 ft. 9⅜ in. The trusses are field



Traveler Revolved 90 Degrees and Stored on End of Reconstructed Pier.

riveted through vertical flange angles to the tops of the columns and are knee-braced with pairs of angles shop riveted to the lower chord gusset plates at the first panel points. The end panel is reinforced by a pair of angles back to back, inclined to the horizontal, which connects the gusset plates at panel points and materially stiffens the truss there. The 12-in. web plate of the 6 x 12-in. T-shape top chord is wide enough to provide connections with all the web members of the truss except at the center and ends where it is spliced to wide gusset plates. Pairs of angles are used for the bottom chord and single 2½ x 2½-in. angles are used for all of the web members, except at the center and quarter points of the span where pairs of 3 x 3½-in. angles are used to make a star shape cross-section.

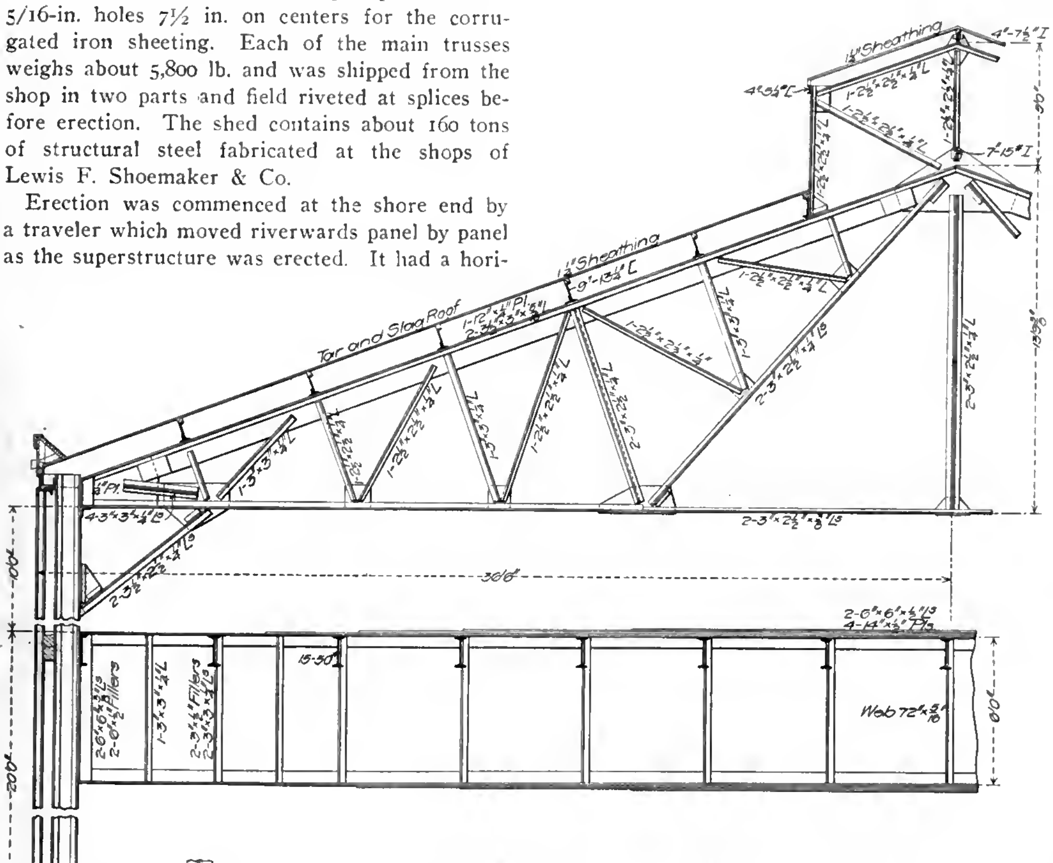
There are 12 lines of 9 x 13¼ lb. purlin channels on the main roof and three lines of 4-in. beam and channel purlins on the monitor frame 11 ft. 4½ in. apart which are supported on the main trusses and intermediately by the purlins. The purlins are secured to the rafters by short angle iron clips and have 2 x 2-in. nailing strips on their top flanges to receive the 1¼-in. sheathing boards covered with 5-ply of tar and slag roofing. The roof boards are finished at the eaves with a vertical fascia board and an inclined gutter board over which the water-proofing is flashed up to make an eaves trough. Vertical 4-in. I-beams are furred out 4 in. beyond the outer faces of the columns to provide frames for the large doors about 18 ft. square which occupy 3 of the panels in each side of the building. The

other two alternate panels have windows in the upper part and are sway-braced with 7/8-in. diagonal rods corresponding to the two sets of lateral rods in the same panels of the roof trusses.

The floor beams have web plates 5/16-in. thick and duplicate top and bottom flanges each made with a pair of full length 6 x 6 x ½-in. angles and four 14 x ½-in. cover plates from 26 ft. to 56 ft. long. The web is divided into 5-ft. panels by pairs of 3 x 3-in. vertical angles to the upper ends of which are field riveted the webs of 15-in. 50-lb. I-beam stringers with the top flanges bearing against the top flanges of the floor beams. Nailing strips on top of the stringers support the double plank floor clear of the rivet heads in the floor beam flange.

The end and side walls have 4-in. I-beam studs from 5½ to 7½ ft. apart and 2 x 2 ¼-in. horizontal angles from 4 to 4½ ft. apart punched with 5/16-in. holes 7½ in. on centers for the corrugated iron sheeting. Each of the main trusses weighs about 5,800 lb. and was shipped from the shop in two parts and field riveted at splices before erection. The shed contains about 160 tons of structural steel fabricated at the shops of Lewis F. Shoemaker & Co.

Erection was commenced at the shore end by a traveler which moved riverwards panel by panel as the superstructure was erected. It had a horizontal platform made with longitudinal and transverse sills braced to a pair of vertical masts about 65 ft. high and 20 ft. apart which were braced together with horizontal struts and triple intersection diagonals. Each mast had a 60-ft. 10-ton boom with which the columns of each bent were simultaneously erected. The columns remained supported by the booms until the floor girder was hoisted by tackles suspended from the masts direct, and set in position and connected to them, after which the booms were released and erected, the longitudinal stringers bracing the incompleted bent to the last finished bent. Finally the booms erected the roof truss and held it in position until connected to the columns and braced by the purlins which were hoisted by hand. A total force of 26 men including two gangs of riveters were required to operate the traveler and assemble and connect the steelwork. After erecting the last bent the traveler was revolved 90 deg. around a vertical axis and was left standing on the outer end of the pier as shown in the engraving until it was convenient to move it bodily on a lighter for the erection of another pier shed. The pier was designed and erected by John Monks & Sons, Mr. John W. Ripley, chief engineer of the structural department.



Half Cross Section of Reconstructed Pier Shed.

The Mechanical Plant for the Construction of the Tauern Tunnel in Austria.

In 1901 the Austrian State Railroads began the construction of three new lines which were planned to strengthen the commercial position of Austria and secure for the city of Triest, on the Adriatic Sea, a larger share of that part of the export trade of Austria, Germany and Italy, which now goes mainly by way of Hamburg, Genoa and Venice. The new lines connect the heart of Austria by short hauls with Triest and with the connection to the German railroads, and while facilitating passenger traffic from Germany and all parts of Austria to the famous health and scenic resorts, will also have a deep influence upon the freight traffic, since they shorten the distance from Triest to Salzburg by 43 per cent., the distance from Triest to Munich, 28 per cent., from Triest to Leipzig, 20 per cent., and from Triest to Berlin 17 per cent.

The standards on all three lines are very high and require much heavy cutting, long bridges and viaducts and quite a number of tunnels. Much of their total distance lies in mountainous country. One of the lines, that from Klagenfurt to Triest has no less than 32 tunnels, one of which, the Karawanken Tunnel, is 26,166 ft. or about 5 miles long, and another, the Wocheiner Tunnel, is 20,796 ft. or about 4 miles long. The second line running north from Selztal has a tunnel 15,648 ft. long and the last of the new roads, the Tauern Bahn, has the longest tunnel, 27,970 ft. or about 5 1/3 miles. The mechanical plant described was used at the last mentioned tunnel.

The first two of the new lines, and practically all of the work on the last line, with the exception of the Tauern Tunnel, were completed by the first of this year. The Tauern Tunnel, however, was not finally cut through until last July and at the present time the finishing touches are being put upon it. The remainder of the Tauern line has been in operation since September, 1905, and the entire line will be in use on the completion of the tunnel. The latter lies in the Tauern Mountains in Tyrol, a few miles south of the famous watering place, Bad Gastein.

The tunnel was driven simultaneously from both portals, at Boeckstein on the north, and Mallnitz on the south. The work was started first in 1901 at the north portal, the beginning at the south portal being purposely left over to the following year. The original mechanical installation at the north portal consisted of two ventilating fans driven by a 120-h.-p. water turbine and two Brandt twin reciprocating high pressure pumps, for furnishing water to the hydraulically-operated rock drills, driven by a 200-h.-p. water turbine. The machine shop, a blacksmith shop for caring for both hand and machine drills and an electric lighting plant completed the installation. All of the machinery was driven by water power, the total developed approximating 350 h.-p.

The ventilating fans have a diameter of 59 in. and a capacity of about 40,000 cu. ft. of air per minute. The turbine driving the high pressure pumps for supplying water to the drills makes 200 r. p. m., and transmits its power to the reciprocating pumps through gearing engaging on a crank shaft. The water is put under a pressure of 1,500 lb. per square inch and is led into the tunnel through a 3-in. pipe which is reduced to a 2-in. pipe near the face of the work. From the latter it is delivered to the drills through a flexible pressure hose.

The Brandt drills make from 5 to 10 r. p. m., and have a total pressure on the drill rod of 26,000 lb. In the exceptionally hard rock encountered in the work the daily progress was about 17 ft. in 24 hr., and the maximum progress about 24 ft. in the same time.

The final installation of the plant just referred to was not completed until September, 1903, and the work had scarcely been taken up in full force when a bad flood in the valley ruined part of the dam of the water power system, carried away some of the supports of the high pressure water pipe so that in places distances as great as 262 ft. remained suspended between supports, and flooded the power plant. The stream, which originally had crossed over the tunnel but which had been confined in an artificial channel, returned to its bed and broke through the roof of the tunnel with a flow of approximately 140 cu. ft. per second. The damage, however, was quickly repaired and the work again taken up with full force.

The entire original installation of machinery was of a temporary character, it being intended to add to it as the demands became greater. The building, however, in which the equipment was housed had been designed to take care of the entire final plant. It was the intention to make the increase in the equipment toward the end of 1904 and at the same time to let out the work by contract, but various circumstances caused the delay of both until December, 1905. A contract was then let to Redlich Bros. & Berger for the entire excavation of the remainder of the tunnel at both portals. As a result of this delay in increasing the size of the plant, the original installation, which had been designed to last but two years, had to be used for over three years, and an investigation was accordingly made to learn what steps should be taken to make it last until the tunnel was finally completed. In this investigation advantage was taken of the studies upon the ventilating equipment which had been made at the Wocheiner Tunnel. The figures showed that the original plant could pull through until the load on it was lessened by the new installation and then continue to give service till the tunnel was completed by substituting larger pipes in the ventilating system and reducing somewhat the rate of drilling and the lighting during the winter

of 1905. The theoretical result of this investigation was fully borne out by experience, for though the original plant was heavily overworked, it kept the excavation moving until the new plant was installed.

Previous to the installation of the new equipment a zone of soft rock was encountered, which not only delayed the work considerably, but made it dangerous. Through this section the only timbering found necessary in the tunnel was used.

In increasing the size of the plant it was determined in as far as possible to use the machinery from the three large tunnels which had already been completed on the other new lines. At the same time the equipment was so planned and arranged as to give the most economical results and reduce operating expenses. Similar plans were made at the same time for the installation at the south portal of the tunnel, the machinery here, too, being all second-hand, such repairs and changes being made as were necessary to secure satisfactory and economical operation.

It was estimated that about 19,500 ft. of the tunnel would be driven from the north side and the figures derived from the earlier experience at the same tunnel showed that three more groups of two centrifugal fans each and large ducts up to 31 in. in diameter were necessary. The two new sets were arranged so as to be driven either by water power or by three-phase current motors, the turbines being used in the summer when there was plenty of water, and the motors in the winter. This required the installation of a steam plant, the generator for supplying the ventilating motors being driven by a 300-h.-p. steam engine. Coincident with the installation of the new machines, changes were made so that great flexibility was secured in operating the plant. The fans were arranged so that all could be made to discharge directly into the ducts leading into the tunnel, or could be connected in series so as successively to raise the air pressure.

On account of the already large demands upon the water supply for power, drinking water, and the hydraulic drills, electric drills were adopted for the increase in the driving equipment, instead of Brandt hydraulic drills. For this purpose a steam engine driving a 2,000-volt three-phase current generator was installed in the plant at the tunnel portal and a high tension line strung in the tunnel to a point where a static transformer, which stepped down the current to 250 volts, was installed. The electric drills were first tried on the hardest rock encountered in the small heading and when using about 6 h.-p. were able to advance the heading about 7 ft. per day of 24 hr. This rate did not compare favorably with the progress of the Brandt hydraulic drills which operated in the broader bottom heading, but the difference in the two was not great when the fact that the hydraulic drills used about 20 times the power of the electric drills was figured into the problem. In order further to guard against failure of power during the winter months when water is apt to be scarce, the pumps for supplying the Brandt drills were equipped with a reserve steam engine of 200 h.-p.

The drinking water for the installation was secured from springs in a small creek and stored in a reservoir 377 ft. above the level of the mechanical plant at the north portal. This elevation was sufficient to force the water as far as needed in the tunnel without pumping.

Hauling in the tunnel was done by three types of locomotives. In the finished full section near the portal an ordinary steam locomotive was used, and operated as far into the tunnel as was allowable without seriously fouling the air. Beyond this point and stretching close up to the work in progress electric locomotives were used, the current being supplied from a generator driven by a 200-h.-p. engine. In the heading and the part of the tunnel where work was in progress the hauling was done by small benzine locomotives.

The current for electric lighting was first supplied by a small generator driven by a 20-h.-p. turbine, but as the work progressed another generator, also turbine-driven, was added. These two not proving sufficient toward the end of the work, an additional machine was belted to one of the steam engines that was carrying only a light load. Both arc and incandescent lamps were used.

The entire new equipment was obtained from the dismantled plants used in driving the tunnels on the other new lines.

Installation at the South Portal.—The plant at the south portal, at Mallnitz, was essentially different from the one at the north portal, and much more simple. About 1,500 h.-p. was available in a stream close to the portal and the construction of the necessary work for utilizing it was begun 1904. The dam, canal, and the forebay are entirely built of concrete. From the forebay the 36-in. flanged pipe, 870 ft. long, leads the water to the power house. There are two turbines, each of 615 h.-p. driving 512 KVA. generators. The turbines are of the Pelton type with high pressure oil governors. The generators are direct connected 3-phase current machines, from which the current is transmitted at 6,000 volts over a line about four miles long. Connections are made to the main transmission line for driving an inclined railroad and an elevator up the mountain side. At the mouth of the tunnel the current is stepped down in a transformer room in the power house building.

The difference in conditions at the two portals caused an entirely different development of the ventilating system. There were two different ways of looking at the problem: if the fans were of as low pressure as possible in order to save in the amount of power used, correspondingly large ducts would be required in the tunnel, with the result that the tunnel profile would be restricted; whereas, on the other hand, space might be saved in the tunnel by using smaller ducts, but the amount of power used would naturally be larger. The limited amount of water power available on the north side prompted the use of the former of these two solutions, while on the south side where power was plentiful and cheap the second solution was considered the better. Moreover, the plant at the north portal had to supply fresh air for a length of tunnel of about 6 km., whereas that of the south portal supplied only 2½ km. At the north portal there are over 3,000 ft. of ducts with a diameter of 800 mm., and others of 750, 700 and 500 mm., while on the south side all of the ducts are 500 mm. in diameter.

Brandt hydraulically operated drills were used entirely on the south side of the tunnel. The pumps for supplying the water were driven by three-phase current motors, three in number, all of them being belted to one main shaft which drives the pumps through sets of gears. The haulage in the tunnel and from the south portal was done entirely with electric locomotives which together with the necessary generators, transformers and transmission line equipment, were brought over to the Tauern tunnel after the completion of the Karawanken Tunnel.

The increase in the size of the installation at the north portal was a difficult matter, and the method of making the change was worked out so as not to delay the work in the tunnel. The excavation was carried on by two shifts, each working 8 hr., the one during the day and the other during the night, leaving 4-hr. periods of rest between the two shifts. The change of the shifts, putting the night men on days and vice versa was done every second Sunday and the work was then allowed to lie idle for 24 hr., from Sunday morning to Monday morning. It was planned to make the necessary changes on one of these Sundays and to have the new installation in working order in time for the day shift Monday morning. The work consisted in tearing out part of the large ventilating duct, the removal of the concrete drains from the high pressure pumps, changing the position of the coolers for the ventilating system and the connections between the pressure pumps and the wells, the installation of the connections for the new fans and the various valves, the setting of the new machines and the changing of the positions of the old ones, and the installation of measuring instruments in the ventilating ducts. All of the work that it was possible to do before disturbing the old equipment was finished before the night shift left the tunnel at 6 o'clock Sunday morning. At that time the entire plant was shut down and the work of removing the old structure commenced, the order and method of so-doing being determined beforehand. The changes were made without accident and the new installation put under full load experimentally at 20 minutes before 4 o'clock on Monday morning, 20 minutes ahead of the time determined for the completion of the work.

The installations were described in a paper by Karl Brabbée before the Society of Austrian Engineers and Architects, from which these notes have been taken.

A Mine Draining Plant in England.

An unwatering plant that possessed some interesting features was installed last year at the Lindal Moor iron mines, near Ulverston, England. The mines were abandoned about four years ago, partly because the plant then in operation could not cope with the water, which at times rushed in at the maximum rate of 7,000 gal. per minute, the dry-weather flow being 4,000 gal. per minute. When pumping ceased the mines rapidly became flooded. The shafts available for pumping purposes were all so small as to make the plant design difficult. The plan adopted was to use electrically-driven, high-lift centrifugal pumps, so arranged that the motors and pumps could be lowered down the shafts as the water receded. A power plant consisting of three steam turbo-alternators was especially erected for the work near the top of the shafts, and supplied three-phase alternating current at 3,300 volts. The shafts at the Diamond pit were vertical, measuring 6 ft. square, and in them two pumping outfits were installed, capable of raising 1,000 gal. per minute against a total head of 680 ft., the motors having an output of 315 h.p. at 1,480 r.p.m. The pumps were three-stage, and the entire apparatus was enclosed in a structural iron frame. The weight of each set, including the suspension cable, electric cable and its column of water was 22 tons. At the Berkune pit, the shafts, which were also vertical, measured 5 ft. 3 in. by 3 ft. 5 in., and the pumps were of the five-stage type, each delivering a maximum of 1,000 gal. per minute against a head of 540 ft. The Lowfield shafts were inclined at an angle of 43°, the pumps in them each designed to deliver 4,000 gal. per minute against a head of 395 ft. To permit rapid operation some of the pumps were arranged so that only some of the impellers were used while the heads were low, and thus discharged nearly 200 per cent. of their normal output. The pumps worked in series when necessary to overcome the high heads. The equipment was described in "Engineering," from which these notes have been taken.

The Hydro-Electric Development in the St. Mary's River at Sault Ste. Marie, Mich.

The Edison Sault Electric Co., of Sault Ste. Marie, Mich., a lessee of water rights from the Chandler-Dunbar Water Power Co., of that place, has recently placed in service a low-head hydro-electric generating station built in the rapids at the head of the St. Mary's River. The latter is the outlet of Lake Superior, and forms the international boundary between Canada and the United States. The development is on the American side, immediately off-shore from the government ship canal and two locks, and about 2,000 ft. downstream from the international railroad bridge over the river. The rapids in the river introduce a fall of about 20 ft. from the railroad bridge to a point 1,800 ft. below the power station, their total length being about three-quarters of a mile. Under present conditions the development renders 16 to 17 ft. of this head normally available, while 3 to 4 ft. additional head could be secured by the acquisition of additional rights below the station. The entire flow of water over the American side of the rapids, with the exception of the small quantity required to supply the two government locks can be utilized for power development.

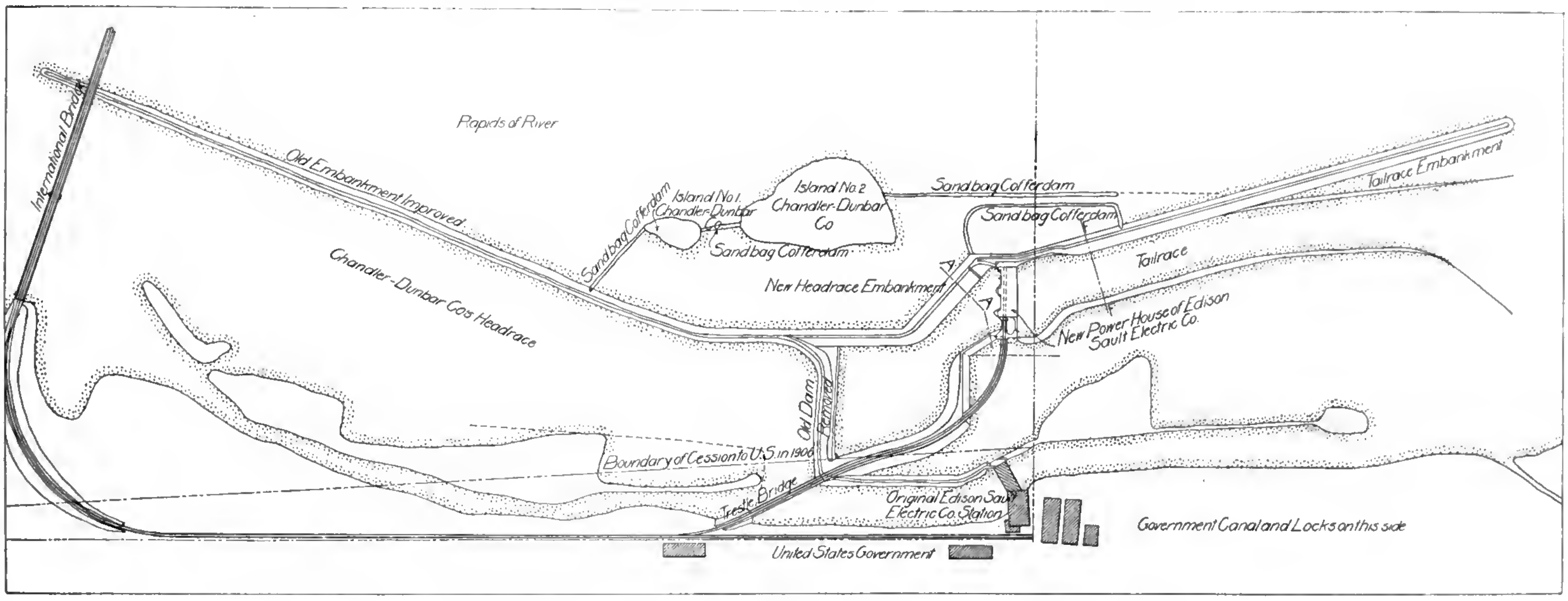
The power company has an existing hydro-electric station 300 ft. in-shore from the new station. The equipment of this original station is antiquated, and as the land on which the latter is situated was recently ceded to the government by the company, the old station is to be abandoned. The government contemplates the widening of the ship canal and the construction of a large new lock on this recently acquired land and on other land immediately downstream from it. The in-shore end of the new power house is 250 ft. from the boundary line of the government land, the original intention being to build a paper mill on this intermediate site. As the canal and lock works may eventually be still farther extended toward the river, however, this strip of land will not be developed. In fact, to provide for possible further extensions of navigation facilities, the owners desired to construct the power house the width of one canal lock further from shore, but the necessary permission, though approved by the United States Engineers, was overruled by the Department of Justice on account of a pending suit brought by the Lake Superior Corporation in the name of the United States, this suit being conducted by the attorneys of the Lake Superior Corporation. The suit has been decided by both the United States District Court and the United States Court of Appeals in favor of the Chandler-Dunbar Co., so it is now contemplated that the power house may be built out to the international boundary line, about 1,350 ft. beyond the existing off-shore end. The present installation has therefore been designed on the basis that the ultimate station will have wheel capacity sufficient to utilize practically the entire flow of the American side of the rapids, and an equal waste-weir capacity, available when the wheels are shut down.

A head-race, about half a mile in length, was provided for the original station by constructing an embankment down-stream from the international bridge, and 250 to 400 ft. from the existing shore line. The general location of this head-race, as well as its relation to the new works, is shown in the accompanying general plan of the latter. This original embankment was built with the expectation that an off-shore development would eventually be undertaken, and a dam was accordingly built across the head-race 400 ft. above the old station, with a narrower head-race continued to that station from the dam. This dam has been removed and a forebay for the new station provided by extending the head-race between two embankments as shown in the accompanying general plan of the development.

The original head-race embankment was a rock, gravel, clay and sand fill, which has been raised and strengthened with material from the excavation for the station building and for the tail-race leading from the latter. The new embankments which form the forebay of the station are also earth and rock fills, protected with dry stone walls, and adjacent to the building with a 12-in. face of concrete. A tail-race is extended about 1,100 ft. downstream from the station building. This race was built partly in excavation and partly between two embankments. The embankment on the river side of it is a rock, gravel, clay and sand fill similar to the original embankment of the head-race, which has stood for 15 years and is practically water tight. Various sections of these different embankments are shown in one of the accompanying illustrations.

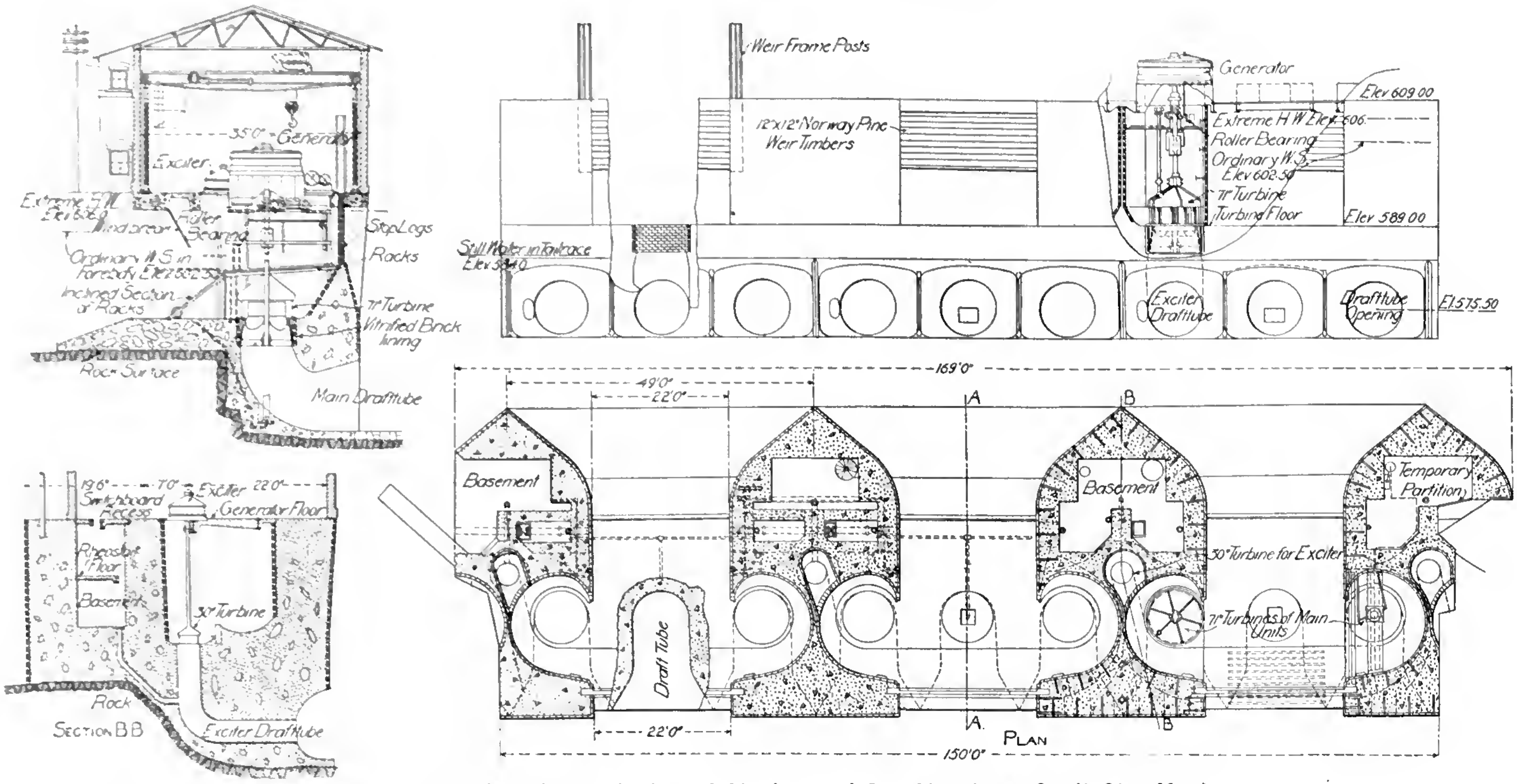
Bed rock at the site is overlaid by 8 to 10 ft. of gravel and boulder deposits, with intervening layers of clay. In general, the embankments were built on this bed of gravel and boulders, although on the forebay side of the embankments the rock was stripped back 10 to 12 ft. from the face of the embankment slope. Where the 12-in. concrete facing was used, it was laid against dry stone walls and bonded into the latter with strips of ⅛x2-in. band iron. The head-race embankments ordinarily have a head of 18 ft. against them, but show practically no leakage. The normal head on the tail-race embankment varies from 4 to 6 ft. at the station building, to about 1 ft. at the downstream end.

The power station building has a monolithic concrete substructure, built on bed rock, and a brick superstructure. The portion of the substructure that has been completed is 49x169 ft. in plan, providing space for nine main water-wheel units. It is arranged, however, so it can readily be extended at either end. The brick superstructure has been erected over two-thirds of this substructure, that is, to cover the space for six main units. It is built with temporary ends, in order that it may also be extended in either direction. Two of the main units have already been placed in service, a third is being installed and the other three will be acquired as needed. These units each consist of a 60-cycle. 3-phase, revolving-field, 450-kw., 4,000-volt, General Electric umbrella-type generator, direct connected by a vertical shaft to a 71-in., 750-h.-p. special vertical Samson turbine, operating at 100 r.p.m. Each unit has four steady bearings, one each above and below the generator and above and below the turbine. A roller thrust bearing just below the generator is supported by an I-beam girder, and carries the entire vertical load of the revolving element and wheel. This roller bearing is fed with oil by gravity and has thus far proved very satisfactory in service. The upper steady bearings are also supplied with oil by gravity, the lower ones being of wood and submerged. For the middle wheel of each group of three, provision has been made for a hydraulic step bearing instead of the roller bearing, if found more desirable.



General Plan of the Water Power Development at Saulte Ste. Marie, Mich.

The arrangement of the main units is shown in the accompanying plan and cross-sectional elevations of the substructure. Three water wheels are supplied from each penstock opening that leads into the building from the forebay. These penstock openings are 22 ft. in the clear and have a free water surface at the top. The heavy concrete piers which separate the adjacent penstocks have cutwaters carefully molded to reduce the disturbance of approach to a minimum, while their bottoms are also sloped at the entrance to secure the same result. One main water wheel is placed on the center line of each penstock, with one of the other two wheels of each group of three in a pit in the pier on each side of the penstock. The sides of these pits are built to deliver the water to the whole periphery of the wheels in them with the smallest possible frictional loss of head. The draft tubes



Cross-Sections, Elevation and Plan of Station and Sub-Structure, Sault Ste. Marie.

are formed in the concrete, and are designed so the water is delivered quietly from the units. Either of the side units may be shut off from the balance of the penstock by stop planks across the entrance to its recess, while the whole penstock may be closed by a floating bulkhead across the opening.

Each three main units are provided with an exciter unit consisting of a 75-kw., direct-current, umbrella-type generator, direct connected to a 30-in. vertical Samson turbine. The water wheel for each exciter is in a separate pit in the pier on one side of the penstock for the group of which it is a part. This chamber is connected with one of the main wheel pits, and is supplied through the latter with water from the penstock. In order to reduce the friction head, the pit for the wheel of each exciter unit is carefully located in reference to the chamber for the wheel of the main unit, and its sides are molded so the water is delivered to the wheel with little loss of head.

Although the low speed of the wheels necessitated larger-sized units than are usual, the arrangement of the wheels more than compensates for the increase in the width of the building that otherwise would have been occasioned. Furthermore, it permitted a rigid requirement of the government for waste openings to be met readily. This requirement stipulated that provisions must be made to pass through the building at such time as the wheels in any penstock are shut down the same quantity of water that would be carried over a section of the river of the width of the penstock. This was accomplished by building in the upper part of the downstream side of the substructure, a wasteway opening for each penstock, the openings being closed normally with 12x12-in. stop logs.

Each wasteway opening is 22 ft. in width, the same as the penstock opening. The lower edge is a weir, with its crest at such an elevation above the bottom of the penstock that when the opening is unobstructed the discharge over the weir will be equal to that of 49 linear ft. of river cross-section, 49 ft. being the distance between the center lines of the penstock piers. A groove for the stop logs is built into the concrete at each end of the opening. The stop logs are handled by a 15-ton motor-driven traveling crane, carried, in the superstructure, by a runway on steel columns. In order that the waste weirs could be conveniently placed in the sides of the substructure, and the stop logs closing them still be accessible to the crane, the downstream face of the substructure was built on a slight outward batter, so the floor of the superstructure cantilevers over that face.

A rack for intercepting and diverting from the wheels all floating and frazil ice and other debris is placed across each penstock. The lower section of this rack makes an angle of about 45 deg. with the horizontal, and extends from the bottom of the penstock to above the level of the top of the wheel casing. The top section of the rack is nearly horizontal and extends over the casing of the middle wheel, from the top of the inclined section to the waste weir. A vertical rack is placed across the entrances to the side wheel pits, above the inclined rack, to protect the wheels in these pits. By opening the upper part of the waste weir a strong current can be created near the surface of the water, which it is expected, will, to a very considerable extent, carry with it through the center of the penstock, the floating ice and prevent the stoppage of the side wheels, and the closing of the racks below.

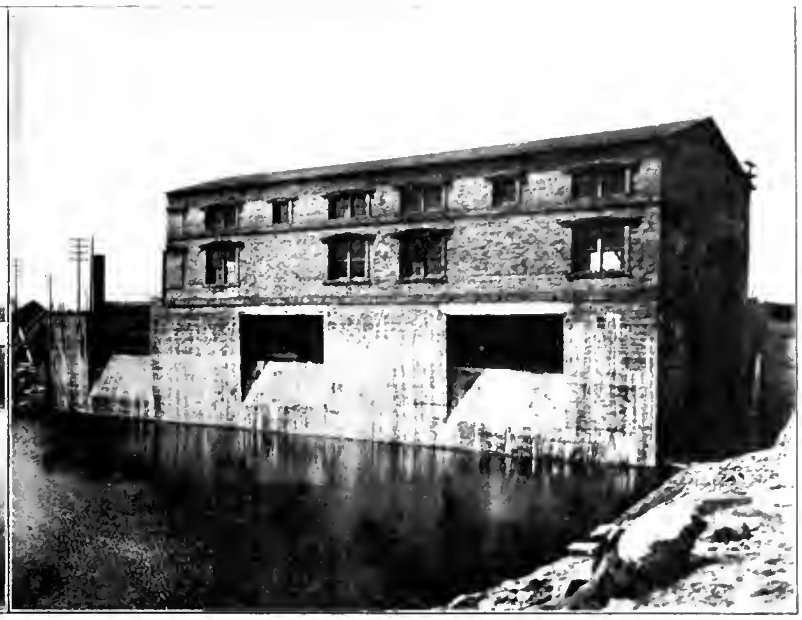
The water wheels are each regulated by a Type D Lombard governor mounted on the floor over the wheel pit. Each governor is driven by a bevel gear on the shaft of the revolving element of the unit which it controls. The gate shaft of the water wheels is operated by the governor through a wire-cable rope drive.

The upstream ends of the piers between the penstocks are hollow, and provide basement space for oil storage, rheostats and a toilet. A spiral

Rapids from End of Tailrace Embankment.

Electric Locomotive Used in Construction.

Station Building from Upstream Side.



Station Building from Downstream Side.

iron stairway leads down into each of these small basements, which are drained by 8-in. pipes connected to the draft tubes of the exciter units. The rheostats are placed on mezzanine galleries in order to protect them from possible dampness in the bottom of the basements.

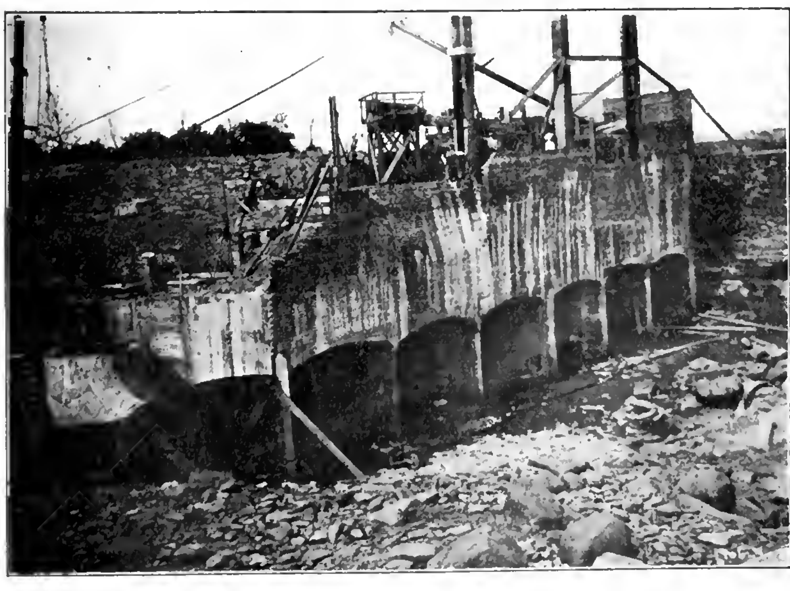
A four-panel switchboard in a wire tower recess on the upstream side of the building is provided for each group of three generators and their exciter. Lightning arresters and static discharges are placed in each wire tower, from which transmission lines lead out of the station. Current is transmitted at 4,000 volts and is stepped down to 220 volts for commercial lighting and is transformed to 500 volts direct current for power.

Construction.—The construction of the development was all handled under considerable hazard, and parts of it with serious difficulties. The sites of the forebay, the station building and the tail race were all covered with water from 2 to 6 ft. deep, which was flowing at a velocity of from 7 to 15 miles an hour. Two islands, that occur off-shore and just upstream from the station building, broke the force of the current over the rapids, so heavy sand-bag cofferdams could be built from the existing head-race embankment to these islands, and downstream from the latter, to a point well below the station building. The fall of the river was sufficient to enable all of the site, except about 850 ft. of the 1,100-ft. tail-race embankment, to be unwatered, and the construction handled in the dry. Such water as leaked through the cofferdams was removed by electrically-operated centrifugal pumps. The excavation of the tail-race was also carried on in the dry, as the construction of the embankment on the river side of it was advanced.

The spoil from the tail-race excavation was largely sand, clay, gravel and boulders, while the excavation for the power house was nearly all in rock. Practically all the material taken from these excavations was used in strengthening the existing head-race embankments, and in building the new embankments for both the head and tail-races. It was moved in 1½-yd. cars running on 24-in. gauge tracks laid from the excavations up to the grade of the embankments. These cars were handled by home-made electric locomotives, which operated with great satisfaction in doing this work, and also in delivering construction materials to the building. Each locomotive consisted simply of a four-wheel truck carrying a 30-h.-p. Northern motor, equipped with an ordinary street-car controller and the necessary starting resistances. Power was obtained from an overhead trolley wire supplied with direct current at 500 volts from the existing power station. The motor was designed to operate at 450 r.p.m., but it was geared to both axles of the truck with sprocket wheels and chains which reduced the speed to satisfactory limits. As thus equipped, the locomotive could readily haul five loaded 1½-yd. cars up a 6½ per cent. grade. It could also handle a train of cars, either on a grade or on the level, with considerable speed, thus enabling a large output to be maintained. One of the chief features in favor of it, however, was that it only weighed about three tons, so no heavy concentrated loads were brought on the tracks. The latter were used at first, in fact, with the cars drawn by horses. They had 20-lb. rails and 4x6-in. ties, which permitted them to be shifted readily, and required very little work to put them in running shape after being shifted. The trolley wire brackets were carried on overhanging arms on uprights fastened to the end of long ties, so the wire was moved with the track, without difficulty.

The concrete in the substructure of the station building was made in two different mixtures, depending on the location; one, in the proportion of 1 part cement, 2½ parts sand and 5 parts broken stone, and the other 1:3:6 of cement, sand and stone. In places where massive concrete was required, boulders up to the size of an ordinary bucket were imbedded in the concrete. Alpena Portland cement, river sand and crushed stone from the excavation for the station building, mixed with an equal quantity of crushed drift boulders, were employed.

An electrically-driven Smith mixer was erected in a tower close to the site, where it could be supplied with materials conveniently. The sand was brought to the lower end of the head-race site in barges, from which it was delivered to the mixer in dump cars hauled by one of the electric locomotives. The stone from the excavation was broken in an electrically-driven crusher set up at the work, and was delivered to the mixer in cars. The cars were hoisted by



Views of Tailrace End of Draft Tubes during Construction.

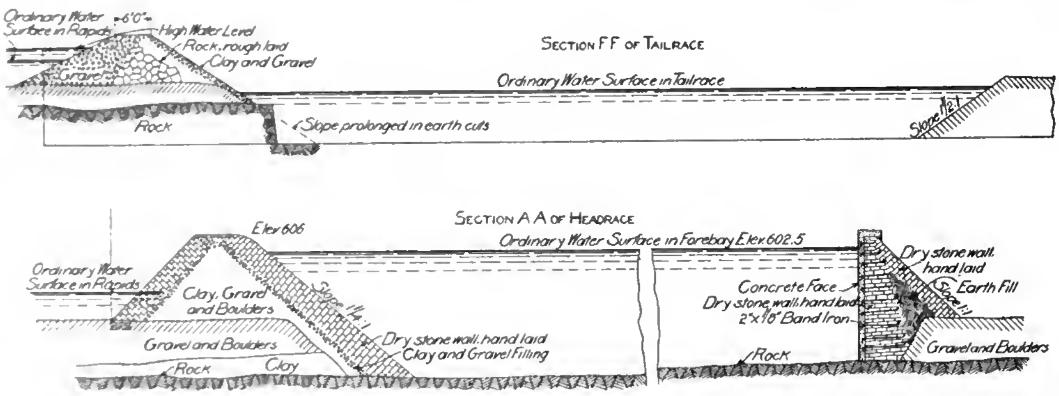
an elevator to a platform around the charging hoppers over the mixer. The latter discharged into side-tip buckets handled by derricks directly to place, or to stationary hoppers which supplied chutes leading down into the work.

Customary wooden forms for the concrete were almost entirely replaced by a single course of paving brick placed as a veneer to the concrete. The brick were laid in cement mortar and were built up to conform to the outlines of the concrete by using templates. The thin brick walls were carried up about 3 ft. ahead of the concrete, thus giving the mortar time to set before any load was brought on them. The brickwork was tied into the concrete with iron rods, placed at various intervals on different parts of the work, depending on the conditions; where tension might occur during construction it was reinforced by two strands of ⅛-in. telegraph wire laid in every fourth joint. It was found the brick forms handled in this manner were much cheaper and more satisfactory than wooden forms. The saving in their favor was particularly great in connection with the intricate curves and surface on the piers and in the wheel pits. One of the accompanying views of the draft tubes under construction shows relatively how the brick was carried up ahead of the concrete work.

Owing to the shape of the draft tubes the forms for them were first built up entirely in wood. The curves and the varying cross sections of these tubes made this form work very difficult and expensive in places, but the forms were built so as to be of service for further extensions. The centering for the forms was made of 2x12-in. plank carefully cut to templates; these centers were lagged with ½x2-in tongue and grooved flooring, cut and dressed to produce the warped surfaces of the draft tubes. After the first of the latter had been built with forms made in this manner it was found that equally good results could be secured at much less expense by replacing portions of the wooden lagging with wire-screen cloth covered with heavy canvass. Accordingly, the balance of the main draft tubes and those for the exciters were built with forms partly covered in that way.

The construction of the tail-race embankment was the most hazardous part of the whole project, so far as construction is concerned. The water over the site of the embankment was from 5 to 6 ft. deep and had a current of at least 15 miles an hour in places. Notwithstanding these conditions, the embankment was completed without much difficulty. This embankment is a continuation of the outer embankment of the forebay, so the track used on the latter could be extended out on it as the work advanced. The largest stones and boulders from the excavation were first delivered in the dump cars and dropped over the end of the track until the force of the stream was broken. Many of these stones and boulders, having 1 cu. yd. or more of volume, were carried away before the desired results could be obtained. As fast as the current was reduced sufficiently, smaller stones were brought out and dumped, and finally the rear or tail-race side was finished off with gravel and sand. The embankment has a minimum width of 6 ft.; the slope on the tail-race side was made 1½ to 1, and that on the river side, 2 to 1. Although little clay was used for this embankment, it is practically water tight, and after having been in place for a year and a half shows no evidence of weakness.

Mr. Alex. Dow, of Detroit, Mich., is president and general manager of the Edison Sault Electric Co. The other officers are all of Sault Ste. Marie and are as follows: Mr. Wm. Chandler, vice-president; Mr. D. B. South, secretary; Mr. S. G. Carlton, treasurer, and Mr. S. E. Peel, superintendent. Gardner S. Williams, of Ann Arbor, Mich., professor of civil engineering at the University of Michigan, as consulting engineer to the company, prepared the plans for the development and supervised the execution. Mr. Arthur Adams was resident engineer in charge for Professor Williams. The masonry construction, the excavation and the embankments were handled on a percentage basis by the MacArthur Bros. Co., of Chicago. The hydraulic apparatus, which embraces several special features designed for this plant by Professor Williams, was built by James Leffel & Co., of Springfield, Ohio, and the electrical equipment by the General Electric Co. The Standard Roller Bearing Co., of Philadelphia, furnished the roller bearings on the generators. All of the equipment and apparatus was installed by the employes of the Edison Sault Electric Co., working under the direction of the engineer.



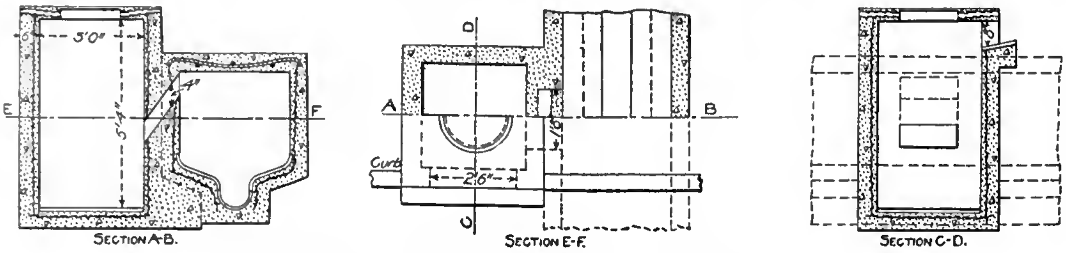
Sections of Headrace and Tailrace Channels, Sault Ste. Marie.

A Steam Motor Car has recently been put in service and others are being built by the Intercolonial Railway of Canada. In general appearance these cars resemble the combination passenger and baggage cars often seen in this country but the space reserved for baggage in such cars in this motor car is occupied by a locomotive boiler and coal bunkers. The locomotive is four-wheeled, and its wheels take the place of the regular passenger car truck at one end of the car. The car is 66 ft. long over the end sills and has a seating capacity for 52 persons. The locomotive is rated at about 200 h.-p. and is designed to give a speed of 25 miles per hour on a 1 per cent. grade. The cars are arranged to run either end first. Besides the boiler room and the main passenger section there is a baggage room and a smoking compartment.

Reinforced Concrete Sewers in Staten Island.

The Borough of Richmond, of the City of New York, includes all of Staten Island, which has a triangular form, with a maximum width and length of 7 and 14 miles, respectively. Its area is about 57¼ square miles. The island is hilly inland, but the shore land slopes back gradually for some distance, and is in many cases only a few feet above the elevation of mean high water. The hills are, in general, wooded or overgrown with brush and practically unsettled, but around the shore there are many villages. The total population is about 77,000. For many years the increase of population on the island has been very slow, but since the island became a borough of New York a more rapid increase has been noted, and it is considered probable that eventually the greater part will be well built up. The sewers of the borough are being designed, therefore, to meet the expected future conditions.

About 35 sewerage districts have been laid out, covering the entire island, but some of these districts are as yet only tentatively fixed. The districting has, of course, been determined by the topography; in general, it is expected that one main trunk sewer will serve as an outlet for each district. In some districts there are old separate sewers, and these, when in good condition, have been preserved, but the new sewers are all designed on the combined system. Up to the present time four main trunk sewers have been completed and two more are now under construction. Of these, three are interesting, on account of the somewhat unusual sections necessitated by the slight difference in elevation between the general ground level near the outlet and mean high water level, and the fact that the law requires all house sewage to be discharged beyond the pier-head line. Though a detailed topographical map of the borough, which will serve as a basis for designing street and sewerage systems, is being prepared, by methods described in The Engineering Record of July 20, 1907, this work is still in an incomplete state, and in designing the sewers it is necessary in many cases to make surveys to determine the most advantageous street grades and elevations of inlets and manhole tops as well as to fix the sewer grades.

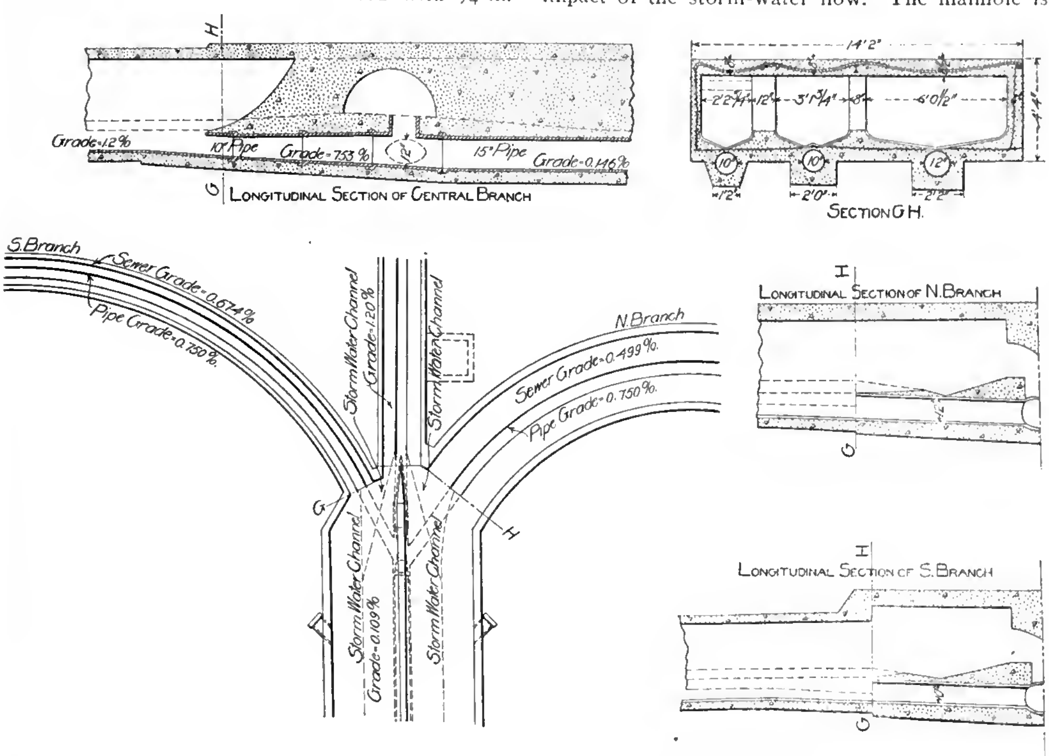


Catch-Basin for Flat-Top Sewers in Staten Island.

In order to avoid the expense of carrying the heavy construction of the main trunk sewers out to the pier-head line the expedient has been generally adopted of discharging the storm-water flow at the bulkhead line and carrying the dry-weather flow out the required distance through a cast-iron pipe supported on piles braced for rigidity. Where the difference in elevation between mean high water and the ground level requires a flat-top section, the invert is generally made nearly flat, also, except that in the center a depressed channel is provided for the dry-weather flow. The grade of the storm-water overflow is arranged so that sewage will not enter it, except during rainy weather, when the sewage will be so diluted as to become inoffensive.

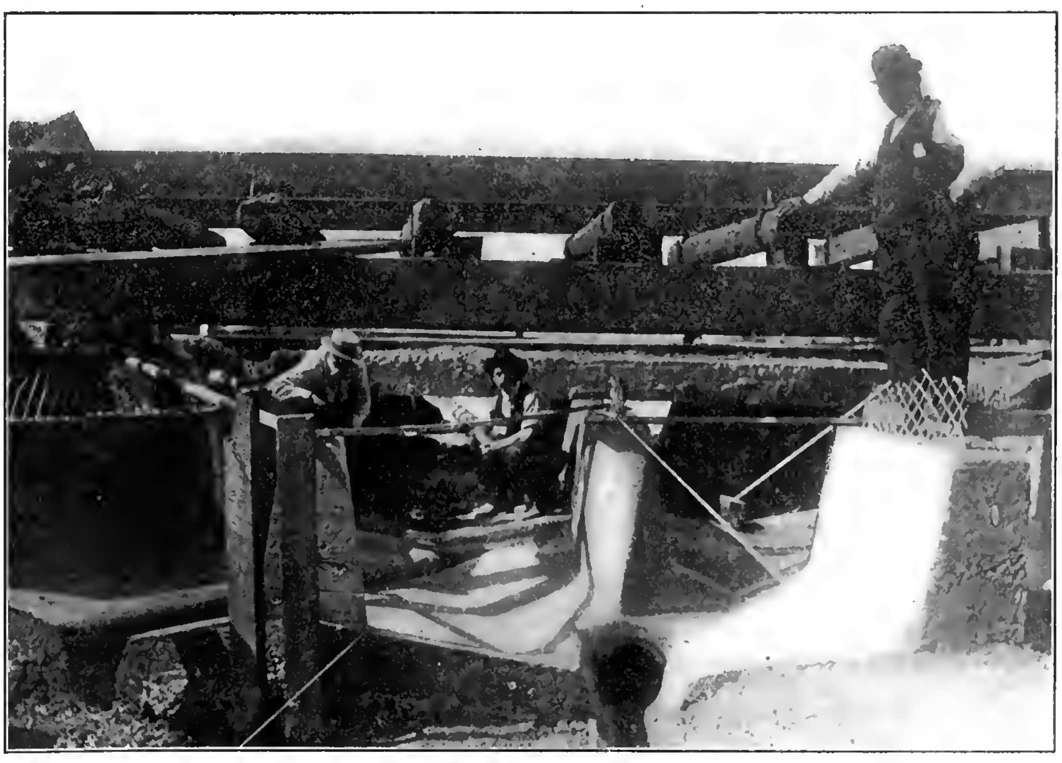
Trunk Sewer for District 6 A.—The trunk sewer for Sewer District 6 A, in the Fort Wadsworth section of the Borough, covering an area of about 366 acres, is now under construction.

The outlet end of the main sewer is at the bulkhead line, or at Sta. 5+10, according to the survey; from this point to Sta. 8 the sewer has, except for a few feet at the outlet end, in general a semi-circular invert 6½ ft. in diameter, lined with vitrified brick, and a flat reinforced concrete slab roof, the under surface of which is 2 ft. 8 in. above the springing line of the inverted arch. The side walls are vertical and are reinforced with No. 10 expanded metal, as indicated on an accompanying cross section. The roof slab is 8 in. thick and is reinforced with ¾-in. "old style" Johnson bars, both transversely and longitudinally, the former being placed 6 in. on centers and the latter 18 in. on centers. Over the top and on one side of this section of the sewer there is practically no covering material, the land being in general below the level of the roof slab. The sewer is close to the property line, and filling material cannot be placed on the property side; a covering of earth is to be placed on the top of the sewer and the street graded up, and to retain this in place the free wall on the property side has been carried up 8 in. above the top of the roof slab to form a curb. The flat-top section is laid on a grade of 0.823 per cent.



Junction at Upper End of Outlet Sewer, District 2A.

At Sta. 8 there is a reducer and the sewer changes to a circular section, 6 ft. 4 in. in diameter. This section continues to Sta. 15 on a grade of 0.881 per cent., the cover in this distance ranging from 0 to about 13 ft. At Sta. 15 there is a junction of two egg-shaped sewers, 4 ft. 6 in. by 6 ft. 9 in. and 3 ft. 10 in. by 5 ft. 9 in. These enter the circular outlet sewer on curves of 34 ft. and 36 ft. radii, respectively, and extend at right angles to the line of the outlet sewer in opposite directions. Just beyond this junction the 4 ft. 6 in. by 6 ft. 9 in. sewer enters a drop manhole, which was designed to reduce the steep grade and consequent excessive velocity of flow. These branches run back into the district to collect the flow from vitrified pipe and small reinforced concrete laterals. In design these egg-shaped sewers present no unusual features; the invert is in all cases lined with vitrified brick; in smaller sizes 1-3 split vitrified pipe forms the lowest part of the invert. The arch ring in all sizes is reinforced with No. 10 expanded metal. House connections are provided on all branches, placed about 20 ft. on centers on each side of the sewer.



Junction of Sewers above Outlet, District 17 A, Staten Island.

The drop manhole is built of brick and concrete, as shown in an accompanying cross-section, and is 24 ft. deep from top to bottom. The difference in elevation between the entering and leaving inverts is 8½ ft. A 20-in. cast-iron bypass pipe, arranged as shown in the drawing, is provided to handle the dry-weather flow, which is thus led quietly from one sewer to the other without the spattering which would prevail if the bypass was not provided. The flow through the bypass also forms a water cushion at the bottom of the manhole and breaks the heavy impact of the storm-water flow. The manhole is designed so that when the sewers are flowing two-thirds full or more a whirlpool will be formed in the vertical shaft, thus protecting the walls of the latter from the rush of incoming water. The bottom of the manhole is paved with trap rock blocks and has a sharp slope, as shown, to insure a good initial velocity of flow. The regular manholes, which are placed at changes of grade and at intervals of about 200 ft., where the grade is uniform, are built of concrete up to the level of the springing line of the sewer arch and above that point of brick.

To carry the dry weather flow the required distance from the end of the main sewer about 220 ft. of 20-in. cast-iron pipe is provided. Beginning at a point 22 ft. above the end of the main sewer the form of the invert is changed from semi-circular to a form designed to fit and enclose the circular end of the cast-iron pipe. This change is made in a distance of about 15 ft. The cast-iron pipe extends into the main sewer 7 ft. The pipe is carried 14 ft. beyond the end of the large sewer on a concrete apron, which consists of a 20-in. concrete slab reinforced near its upper and lower surfaces with expanded metal and carried by side and end walls, which enclose the supporting material and extend down 5¼ ft. below the top of the apron.

Beyond the apron the pipe is supported by pile bents 12 ft. on centers, two piles to a bent 2½ ft. on centers. Transverse caps, 10x12 in., slightly cut to fit the pipes, support the latter, which are securely strapped in place with galvanized iron bands. Guard pile bents are placed midway between the supporting bents, the piles of these bents being 4½ ft. on centers transversely and securely braced, both longitudinally and transversely.

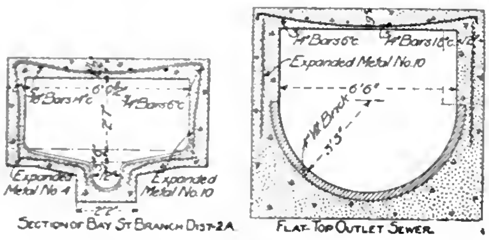
All the excavation for this sewer is being done by hand, but the methods of handling the spoil vary somewhat. For the greater part of the outlet sewer the depth of the trench required was in general only a little more than the depth of the sewer. The spoil in this stretch was thrown out by hand and but little sheeting was required. The 3 ft. 10 in. by 5 ft. 9 in. branch, however, for about 700 ft. is 19 to 25 ft. below the street. The construction of this part of the sewer is rendered particularly difficult by the unstable character of the clayey soil and the presence of a double-track street car line in the street. Where the work is in progress the cars are operated over a single track, the other having been taken up to make room for the trench. Two-by-ten-in. plain plank sheeting in 14-ft. lengths is used, two lengths being necessary to reach the bottom of the trench. Waling pieces are placed about 5 ft. on centers and are heavily braced to withstand the excessive pressure due to the passage of street cars and the weight of the earth. The sheeting is driven with a 100-lb

McKiernan steam driver. The ground water which seeps into the trench is carried away by two lines of 4-in. drain tile, one line of each side of the main sewer. These drain lines are extended as the work progresses and reach from the present point of construction to the outlet of the main sewer.

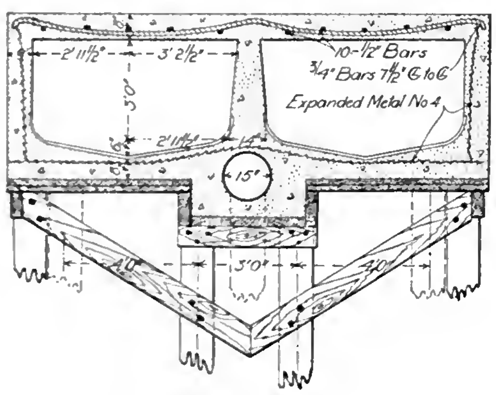
The spoil is shoveled into Hayward buckets, which are hoisted by a cableway and delivered over the completed sewer as back-fill. The cableway, which is 300 ft. long, was supplied by the Carson Trenching Machine Co. It is operated with a Lidgerwood engine and boiler mounted on a four-wheel truck platform, which also carries the A-frame headtower. The truck wheels run on plank runways.

The concrete, which is a 1:2:5 mixture of Phœnix Portland cement, Cow Bay sand and crushed trap rock, is mixed by hand on a platform spanning the trench and is delivered to place in buckets.

For the egg-shaped sewer now under construction wooden forms of the usual type are used for the invert and steel centers, supplied by the Blaw Collapsible Steel Centering Co., are used for the arch ring. The steel centers are greased slightly with linseed oil to prevent the adhesion of the concrete, and a very smooth surface has been secured by their use. They are drawn in 25-ft. sections, made up of ten 2½ lengths.



Sections of Staten Island Sewers.

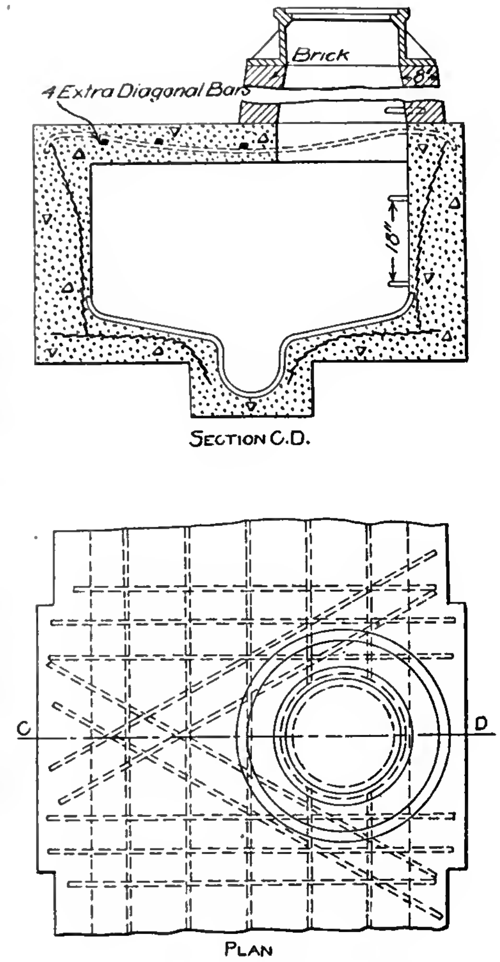


Outlet Sewer, District 2 A.

Trunk Sewer for District 2 A.—District 2 A, in the Tompkinsville section of the island, comprises about 155 acres. A great part of this area is very hilly, so much so indeed that 11 drop manholes are required in 1,500 ft. of sewer, the grade of the sewer being designed to limit the velocity of flow to 12 ft. per second when flowing full. On the other hand, Bay street, an important street in this district, paralleling the water front, is very low, being for some distance only 5 to 9 ft. above mean high water.

At the junction of Elizabeth and Bay streets two main branch sewers coming from opposite directions in Bay street meet another branch coming down from the hills in Elizabeth street, and the three join and are carried on in Elizabeth street to the bulkhead line, a distance of about 600 ft., by the main outlet sewer. Each branch sewer has a flat-top section, with vertical sides, and the invert sides slope gently toward the center, where a depressed channel is provided to carry the dry-weather flow. The section of the larger branch sewer in Bay street, which is shown in an accompanying illustration, is typical of the section of the other branches, the approximate sizes of which are shown in the section GH, taken at the junction point.

The outlet sewer has a twin-branch flat-top section and a 15-in. pipe conduit for the dry-weather flow. The storm-water section of each branch is 5 ft. 11 in. wide and about 3 ft. high, though both width and height vary slightly, as is shown in the cross section. The roof slab is reinforced both transversely and longitudinally with steel bars of the sizes and spacing indicated. The outside walls and floor are reinforced with expanded metal. The inverts are surfaced with a 1-in. coat of artificial stone, composed of equal parts of cement and trap rock screenings, applied and troweled to a smooth surface as soon as the rough work has set sufficiently to allow it. Pile foundations of the form shown are provided throughout the whole length of the outlet sewer.



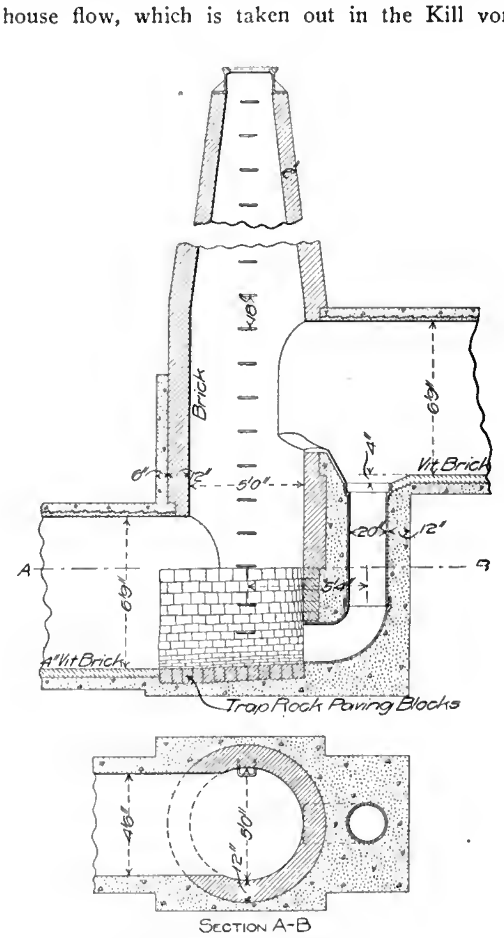
Manhole on Flat-Top Sewer.

About 300 ft. from the bulkhead line the sewer is crossed nearly at right angles by the double-track line of the Staten Island Rapid Transit R. R. The top of the roof slab is about 16 in. below the base of the rails, and the sewer is designed to carry the weight of the tracks and the live loads on them. The thickness of the roof slab is increased to 14 in., and it is reinforced transversely with ⅞-in. bars, 6 in. center to center, and longitudinally with ¾-in. bars placed in the same relative position as the longitudinal bars in the section illustrated. The thickness of the side walls is also increased. Batter piles are placed on the north side of the sewer under the east-bound track and on the south side of the sewer under the west-bound track to resist the thrust due to braking trains on the track.

The dry-weather flow will be carried from the end of the main sewer to a point 439 ft. beyond by a 16-in. cast-iron pipe line, supported on piles in the same manner as has been described in connection with the trunk sewer for District 6 A.

Owing to the low level of the main outlet section of this sewer a large part of the construction work has to be carried on during periods of low tide. The excavation was made by hand, the trench being made wide enough so that sheeting was not required. The piles were driven with considerable difficulty, owing to the presence of a large amount of old cribbing and riprap; the penetration, for the same reason, varied greatly, the maximum and minimum being about 42 and 12 ft., respectively. But little concrete has been placed as yet in connection with this work; Pennsylvania Portland cement is used with sand and trap rock in the same proportions as for the Fort Wadsworth sewer.

Trunk Sewer for District 17 A.—District 17 A, in the Elm Park section of the Borough, is served by three sewers, which are brought to a junction just above the outlet, to collect the house flow, which is taken out in the Kill von Kull by a 12-in. cast-iron pipe, supported on piles in the usual manner. The three main branch sewers are of the flat-top and depressed-channel type, very similar to those under construction in Tompkinsville, and the junction is much like the one to be built at Elizabeth and Bay streets.



Drop Manhole, District 6 A.

The outlet is of the twin-branch flat-top sort, each branch being about 2½x6 ft. It is crossed just below the junction point by a double-track street car line. The cover at this point is practically zero, and the rails are embedded in the rail-top of the sewer, so that the rail heads only 5 in. above the top of the slab. The outlet was constructed without interrupting traffic on the car lines.

The depressed channels of the sewers in this section are lined with sections of vitrified half pipe. This proved an aid to construction, for the pipe, with its bedding of concrete, was laid a little way ahead of the rest of the work all the time and served to drain the trench. The forms used were wooden, of the usual type. Building paper was laid over the top of the flat-top forms to give a smooth finish; this made it possible to use rough lumber and still secure satisfactory results. Phœnix and Atlas cement was used and Johnson "new style" bars. The concrete was mixed by hand.

To meet the same conditions that necessitate

flat-top sewers special catch basins and manholes have been designed. The manholes are built in general of brick, and the basins of concrete reinforced with expanded metal. Illustrations showing sections of a manhole and basin are given.

The engineering work for construction in the Borough of Richmond is under the general direction of Mr. Louis L. Tribus, Commissioner of Public Works and consulting engineer, and Mr. Theodor S. Oxholm, engineer in charge. Mr. L. W. Freeman, assistant engineer, has direct supervision of sewer work. The designs for the sewers described were prepared by Mr. Victor H. Richelt, assistant engineer. Messrs. Joseph Johnson's Sons, P. Hart & Sons and James Conley are the contractors for the sewers in Districts 6 A, 2 A and 17 A, respectively.

Foreshore Improvements at the Chalk Cliffs, England.

Foreshore improvements have been completed at Brighton, England, to check the erosion of the local chalk cliffs. The cliffs are 75 to 125 ft. high and have been cut back during the past eleven years at the rate of about a yard per year, according to "The Engineer," London. A highway and several public buildings on the cliffs were endangered in consequence. The foreshore consists of practically bare chalk, but there was apparently plenty of traveling material and a good supply of sand just below low-water mark. Accordingly it was decided to erect a series of groins perpendicular to the face of the cliff and extending to the low-water line to intercept the moving shingle and cause the formation of a protective covering over the chalk. They are made of 16-in. square columns between which are 6-in. concrete slabs. The columns are 5½ ft. on centers for the first 200 ft. from the face of the cliff and 7 ft. for the remainder of the distance to the low-water line. Their clear height above the chalk increases from 2½ ft. near the low-water mark to 8 ft. near the cliff. Grooves are formed in them to receive the slabs which are dropped into place and grouted fast. The slabs are formed in units 1 ft. high and not more than two or three units are placed at first; as the shore builds up more will be added. The columns are set in holes in the chalk and where necessary 10x10-in. concrete struts are built for additional support. Messrs. Owens & Case, of Westminster, are the engineers for the work.

THE COAL PRODUCTION in Pennsylvania in 1906 was 200,575,617 short tons, of which 71,282,411 tons was anthracite. This is an increase of 2.3 per cent. over the production in 1905. In mining this coal, there were 557 men killed and 1,212 injured in the anthracite mines, and 477 killed and 1,160 injured in the bituminous mines. In both classes of mines the major cause of accident was falling of the roofs. The State produced 48.4 per cent. of the total coal mined in the country during the year. These figures are furnished by the United States Geological Survey, which states that the rapid growth in the production of bituminous coal during recent years compared with that of anthracite forms one of the most interesting features in the statistics of coal mining. From 1876 to 1880 the average production of soft coal in Pennsylvania was 1.41 times that of anthracite, while from 1901 to 1905 the bituminous production was 4.08 times that of the other. In explanation of this change it is stated that for a number of years anthracite has been practically eliminated as a fuel for manufacturing purposes, and has been used almost entirely for domestic purposes in Eastern states. And now, even for domestic purposes, coke and gas are competing more and more with anthracite in the larger cities and towns.

Tests of Gasoline Engines Using Alcohol.

A brief mention has already been made in these pages of the elaborate tests made by Prof. C. E. Lucke and Mr. S. M. Woodward to determine the behavior of internal combustion engines using both gasoline and alcohol as fuel. The report is a profusely illustrated pamphlet of nearly a hundred pages, giving the details of many tests with eight engines of different types. The information regarding the tests themselves is too complex in its nature to be given satisfactorily in abstract, but some of the general statements in the report and the authors' summary of their conclusions are as follows:

The objects of this investigation may be put under two heads:

First, to determine whether gasoline and kerosene engines can run on alcohol as fuel. This involved the manipulation in making the engines run on alcohol, the measurement of the maximum powers of the engines when using alcohol and other fuels and last the relative consumptions of the different fuels.

Second, to determine the improvements desirable in engines manufactured especially for alcohol.

The engines used were: No. 1, a 15-h.p., 2-cylinder, vertical, 4-cycle gasoline engine; No. 2, a 6-h.p., horizontal, 4-cycle gasoline engine; No. 3 a 6-h.p., horizontal, 4-cycle gasoline engine; No. 4, a 6-h.p., vertical, 4-cycle gasoline engine; No. 5, a 6-h.p., horizontal, 2-cycle kerosene engine; No. 6, a 40-h.p., 4-cylinder automobile gasoline engine; No. 7, a 40-h.p., 4-cylinder automobile gasoline engine; No. 8, a 2-h.p., vertical, 2-cycle marine gasoline engine. The last three, of course, were high-speed engines.

Gasoline and kerosene are most easily examined by their specific gravities but since each is a mixture of numerous lighter and heavier oils, a constant density is not a guarantee that the composition may not change sufficiently to affect the action of the fuel in an engine.

Commercially pure grain or ethyl alcohol is sensibly pure except for the water which may be mixed with it. In this country alcohol is described according to its strength by stating the percentage of absolutely pure alcohol, by volume, which exists in the mixture of alcohol and water. Thus, 90 per cent. alcohol means that if the alcohol present could be separated absolutely pure, its volume would be 90 per cent. of the volume of the actual mixture of alcohol and water.

In France the strength of alcohol is described as in this country, but on the other hand, in Germany the strength is always expressed as percentage of alcohol present by weight.

In the statistics relating to alcohol, issued by the Commissioner of Internal Revenue, quantities are stated in "proof" gallons. A proof gallon contains 50 per cent. alcohol by volume, the remainder of the mixture being water; hence, a quantity of alcohol when stated in proof gallons is expressed by a number just twice as large as it would be if stated in gallons of 100 per cent. alcohol.

The denatured alcohol which may be used in engines in the United States must be prepared as follows, according to the regulations of the Commissioner of Internal Revenue: To 100 volumes of ethyl or grain alcohol of a strength not less than 90 per cent. there must be added either 10 volumes of methyl or wood alcohol and one-half of 1 volume of benzine or 2 volumes of methyl alcohol and one-half of 1 volume of pyridin bases. The substances added to the grain alcohol will probably not be of uniform quality, and hence there will be some variability in the properties of the denatured alcohol which will affect its use as a fuel.

The heat of combustion of the various petroleum oils varies between 19,000 and 21,000 B.t.u. per pound and 20,000 is used as an average value. The experimental value for pure alcohol is about 12,700 B.t.u. per pound.

By the formula for ethyl alcohol, C_2H_5OH, its molecular weight is 46. For the complete combustion of 1 molecule of alcohol the 2 atoms of carbon require 4 atoms of oxygen to form carbon dioxide and the 6 atoms of hydrogen require 2 atoms of oxygen, in addition to the 1 atom present, to form steam, thus making 6 atoms of oxygen in all to be supplied. The weight of the 6 atoms is $6 \times 16 = 96$. Hence complete combustion of 1 lb. of C_2H_5OH requires $96 \div 46 = 2.086$ pounds of oxygen. In 1 lb. of pure dry air there is 0.230 lb. of oxygen, so that the combustion of 1 pound of C_2H_5OH requires $2.086 \div 0.230 = 9.06$ lb. of air, or about 119 cu. ft. of pure air at a temperature of 60° and at sea level. If the alcohol contains water, 1 pound of the alcohol-water mixture requires less air than that stated. If the air is moist, 1 pound of it contains slightly less than 0.230 lb. of oxygen and hence more air would be required. In an actual engine the amount of air is proportioned to the amount of vapor, not by any exact measurement of either, but by trial to secure either the best results in maximum power or in minimum fuel consumption.

As with all substances which liquefy at ordinary temperatures, there is a definite limit to the amount of alcohol vapor which can exist in a cubic foot of space at any given temperature. Assuming the laws for perfect gases to hold, at any given constant temperature the weight of alcohol vapor present in a cubic foot of space is proportional to its vapor pressure and is usually measured or represented by this vapor pressure.

The vapor pressure of saturation increases rapidly with the temperature, and the values as determined by experiment for alcohol and some other substances at various temperatures are given in Table 1.

When different gases or vapors exist simultaneously in the same space, if they have no chemical action on each other, each one acts by itself just as though no other gas were present. But it is to be noted that in such a case the pressure as measured by a barometer column or pressure gauge would be the sum of the separate pressures due to the air and due to the alcohol vapor. If moisture were present it probably would have some effect on the alcohol-vapor pressure, because water and alcohol have a certain affinity for each other.

TABLE 1. VAPOR PRESSURE OF SATURATION FOR VARIOUS LIQUIDS, IN MILLIMETERS OF MERCURY.

Temperature. °C.	Temperature. °F.	Pure Ethyl Alcohol.	Pure Methyl Alcohol.	Water.	Gasoline.
0	32	12	30	5	99
5	41	17	40	7	115
10	50	24	54	9	133
15	59	32	71	13	154
20	68	44	94	17	179
25	77	59	123	24	210
30	86	78	159	32	251
35	95	103	204	42	301
40	104	134	259	55	360
45	113	172	327	71	422
50	122	220	409	92	493
55	131	279	508	117	561
60	140	350	624	149	648
65	149	437	761	187	739

Since alcohol, as used commercially, is always mixed with some proportion of water, a combustible mixture formed by the vaporization of such alcohol may become saturated with water vapor before it is saturated with alcohol and this may retard the complete vaporization of the alcohol. Such a state is more likely to occur if the air originally contains a considerable amount of water vapor—that is, if the relative humidity is high. In such a case a temperature higher than 72° would be necessary to maintain the required amount of alcohol vapor in the mixture.

In order that alcohol may change from a liquid

to a vapor, it must receive a large amount of heat either from the air with which it mixes or from the metal parts of the carbureter with which it comes in contact. The hotter these parts the more quickly the alcohol can absorb the requisite amount of heat. But if the air is too hot there is danger that the mixture of air and alcohol vapor produced may be too rich in alcohol and some of the vapor must remain unburned. Still, if the air be moist, or the alcohol contain water, or the time allowed for vaporization be too short, the temperature of the air must be higher than 72° to form a proper explosive mixture.

Air at any temperature will take up some alcohol vapor, and the higher the temperature the quicker it will take up the amount necessary for the best explosive mixture. In the case of incomplete vaporization, some of the fuel may be carried along as spray, which may or may not be vaporized in the cylinder on the compression stroke. If not, it certainly will be vaporized after the explosion of the rest. It would seem desirable, therefore, to heat considerably the air supplied to an alcohol carbureter. But too much heating of the air will bring about a bad effect on the engine, because it will make the charge hotter at the end of compression, and thus decrease the weight of the charge in the cylinder. The horsepower of the engine, other things being equal, will be decreased in direct proportion as the density of the charge is lowered by this heating, so that heating of the air before carbureting is good for complete vaporization, but bad if carried too far in its effect on power reduction.

The following general conclusions are drawn as a result of the investigations reported in detail above:

(1) Any gasoline engine of the ordinary types can be run on alcohol fuel without any material change in the construction of the engine. The only difficulties likely to be encountered are in starting and in supplying a sufficient quantity of fuel, a quantity which must be considerably greater than the quantity of gasoline required.

(2) When an engine is run on alcohol its operation is less noisy than when run on gasoline, its maximum power is usually materially higher than it is on gasoline and there is no danger of any injurious hammering with alcohol such as may occur with gasoline.

(3) For air-cooled automobile engines alcohol seems to be especially adapted as a fuel, since the temperature of the engine cylinder may rise much higher before auto-ignition takes place than is possible with gasoline fuel; and if auto-ignition of the alcohol fuel does occur, no injurious hammering can result.

(4) The consumption of fuel in pounds per brake horsepower, whether the fuel is gasoline or alcohol, depends chiefly upon the horsepower at which the engine is being run and upon the setting of the fuel supply valve. It is easily possible for the fuel consumption per horsepower-hour to be increased to double the best value, either by running the engine on a load below its full power or by a poor setting of the fuel supply valve.

(5) These investigations also showed that the fuel consumption was affected by the time of ignition, by the speed, and by the initial compression of the fuel charge. No tests were made to determine the maximum possible change in fuel consumption that could be produced by changing the time of ignition, but when near the best fuel consumption it was shown to be important to have an early ignition. So far as tested the alcohol fuel consumption was better at low than at high speeds. So far as investigated, increasing the initial compression from 70 to 125 lb. produced only a very slight improvement in the consumption of alcohol.

(6) It is probable that for any given engine the fuel consumption is also affected by the quantity and temperature of cooling water used and the nature of the cooling system, by the type of ignition apparatus, by the quantity and quality of lubricating oil, by the temperature and humidity of the atmosphere, and by the initial temperature of the fuel.

(7) It seems probable that all well-constructed engines of the same size will have approximately the same fuel consumption when working under the most advantageous conditions.

(8) With any good small stationary engine as small a fuel consumption as 0.70 lb. of gasoline, or 1.16 lb. of alcohol per brake horse-power-hour may reasonably be expected under favorable conditions. These values correspond to 0.118 and 0.170 gal. respectively, or 0.95 pint of gasoline and 1.36 pints of alcohol. Based on the high calorific values of 21,120 B. t. u. per pound of gasoline and 11,880 per pound of alcohol, these consumptions represent thermal efficiencies of 17.2 per cent. for gasoline and 18.5 per cent. for alcohol.

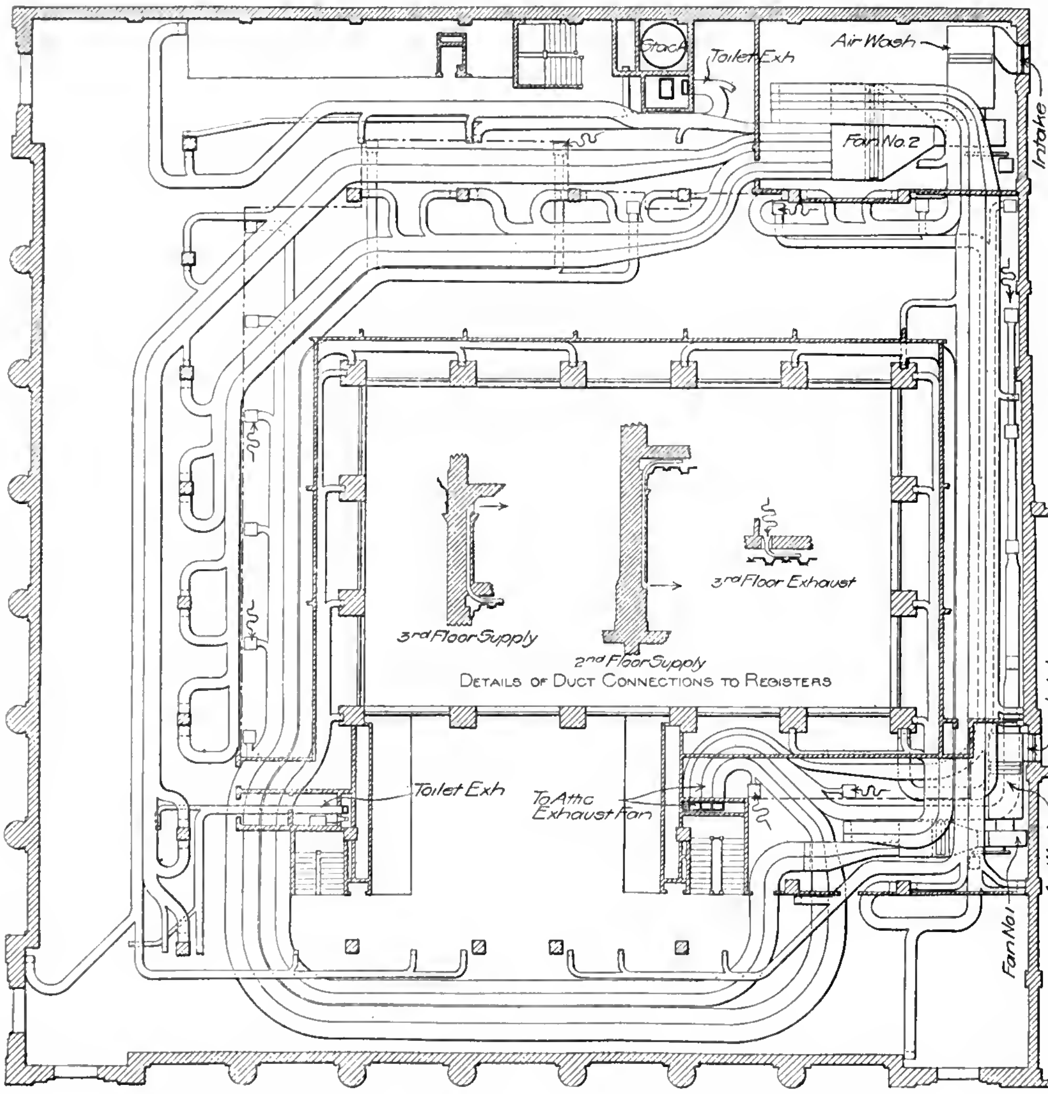
But calculated on the basis of the low calorific values of 19,660 B. t. u. per pound for gasoline and 10,620 for alcohol, the thermal efficiencies become 18.5 for the former fuel and 20.7 for alcohol. The ratio of the high calorific values used above is, gasoline to alcohol, 1.78. The corresponding ratio of the low calorific values is 1.85. The ratio of the consumptions mentioned above is, alcohol to gasoline, 1.66 by weight, or 1.44 by volume.

THE HIGH COSTS OF OPERATION at Poplar, England, near London, are reported to be the cause of the coming removal to Scotstown, in the Clyde Valley, Scotland, of the large shipbuilding and engineering works of Yarrow & Co.

Heating and Ventilating the Commercial National Bank Building—Part II.

Ventilation.—Mechanical ventilation has been provided for the lower floors of this building to a considerable extent, in addition to the usual exhaust ventilation from toilet rooms, the extensive banking offices and safety deposit department of the Commercial National Bank being fitted for both fresh air supply and exhaust ventilation, while separate ventilating systems are installed for the basement and sub-basement storage and auxiliary rooms, the engine room, the boiler and pump room, and for hot blast in the building entrances in winter weather. For this service seven fresh air supply fan systems have been installed, having an aggregate capacity of 142,330 cu. ft. per minute and three exhaust fans of an aggregate capacity of 41,515 cu. ft. per minute. An interesting feature of the ventilating installation is the use of air-washing systems for all fresh air supplies, except that to the engine and boiler and pump rooms, allowing air intake connections at low levels through the side walls of the building without unpleasant results from the dirt and dust that would otherwise be obtained from this source. Ventilation is effected by admission of fresh air at points in or near the ceilings of the rooms supplied, while foul air is exhausted through registers at or near the floor line, and the air supply is tempered automatically by thermostatic control. Both tempering and reheating coils are used with the supplies having air wash systems and tempering coils only for the two systems fitted with cheese-cloth filters.

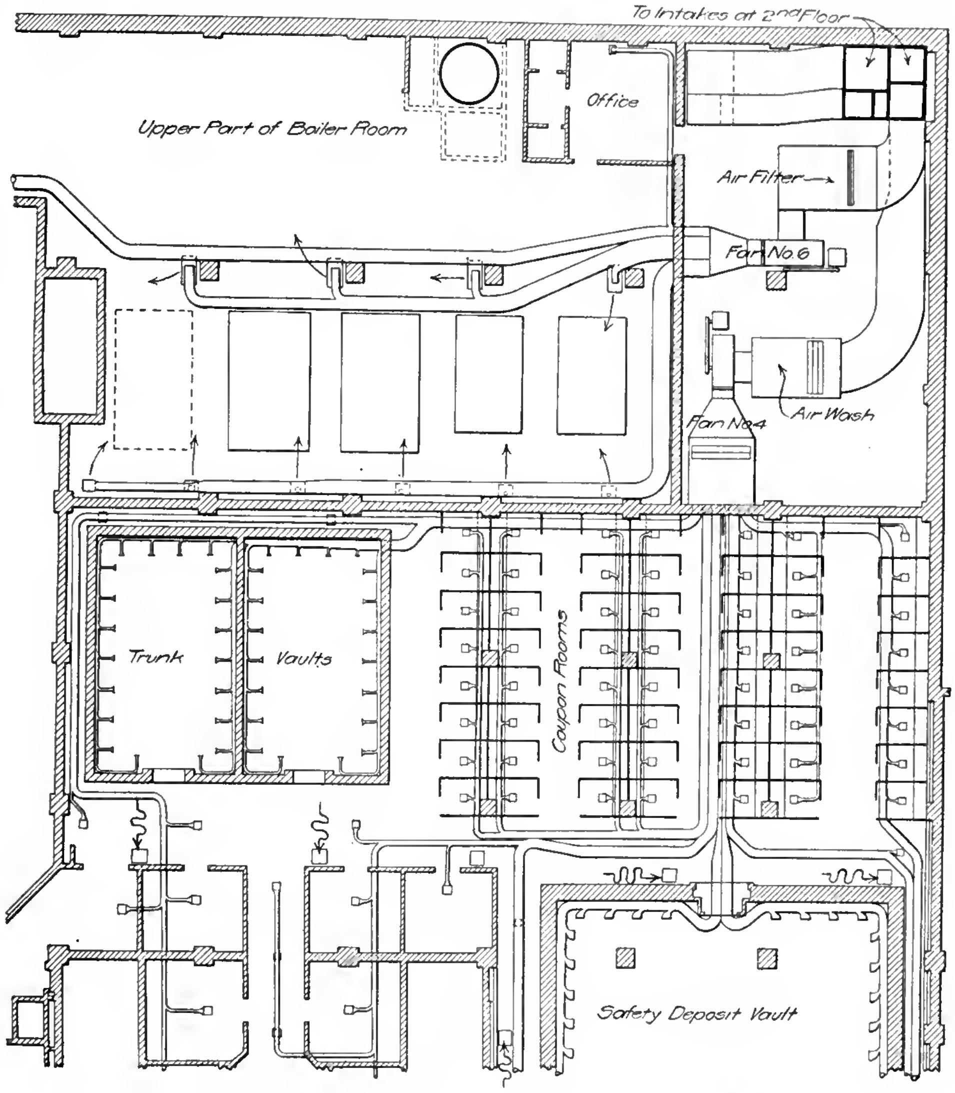
The ventilating services in the different parts of the building are sub-divided and separately operated so that each is entirely independent of



Ventilation of the Bank Division, Commercial National Bank Building.

the other at all times. The banking division which occupies the second floor, the mezzanine and the third floor is supplied with fresh air by two fan equipments, one for the second floor and mezzanine, and the other for the third floor, both of which are located in enclosures at the east side of the third floor convenient to direct intakes through the outside walls to open court spaces. The safety deposit department, which occupies a large portion of the basement, is ventilated by an independent fan equipment located at the northeast corner of the basement with an extensive system of distribution ducts extending principally to the confined spaces and small coupon rooms in the basement, while the street entrances are served by hot blast equipment in the sub-basement for use in winter weather. The remaining spaces in the basement and sub-basement, such as store rooms, printing office, etc., as well as also the engine room and the boiler and pump rooms have each independent fresh air supply systems, although owing to proximity to steam using machinery, no tempering coils are installed in the fan intakes, and cheese-cloth filters only are used for cleansing the air supply. All exhaust ventilation is operated by fan equipments in the attic, separate systems being installed for exhaust from the safety deposit department, the third story of the bank division, and from the toilet rooms and janitor's closets on all of the upper floors. The use of separate systems, prevents the communication of odors from the mechanical plant or toilets to other parts of the building.

The principal dimensions of the ventilating equipment installed are presented, together with capacities of the fans and of heating coils, in the accompanying table. Each separate system has an extensive amount of distributing duct work, the arrangement of which and the location of outlets are well shown in the accompanying floor plans of the building. System No. 1, supplying the third story of the bank division, delivers air into a corridor surrounding the upper portion of the court space underneath the skylight covering the main bank floor area, delivery being made through 16 registers on the inner sides of building columns at this level. System No. 2, which is confined to the second story and mezzanine of the bank division, delivers air through four registers to the mezzanine gallery, through 10 outlets in the president's, directors' and other private offices and through 41 openings to the main banking division. The arrangement of these supply registers is such as to thoroughly distribute the air delivered, and these systems were designed to change the air approximately three times per hour in the banking division.



Ventilation of the Safety Deposit Department in Basement.

Provisions for exhaust ventilation from this division are made upon the third story level only, in the floor of which there are distributed 18 exhaust registers, 20 in. square, each designed to remove 700 cu. ft. of air per minute; these registers are installed in the outer portions of this floor level where partitions prevent free communication with the large central court space of the main banking division.

In the safety deposit department a somewhat greater proportion of supply is provided for, owing to the more confined spaces ventilated. Here is a safety deposit vault approximately 45 ft. square, to which 1,690 cu. ft. is supplied per minute through 26 register openings, two trunk vaults, 18 x 32 ft. in size each, each of which receives 910 cu. ft. per minute through seven outlets, 56 coupon rooms with separate supplies, which receive in the aggregate over 10,000 ft. of air per minute, and a number of committee and office rooms, which with the main corridor, receive the remaining 3,600 cu. ft. of the supply. The exhaust ventilation provided for from this division is, as will be noticed from the table, somewhat in excess of that for supply, there being a large number of exhaust registers distributed in the floors of the main room, the corridors between the coupon rooms and offices, the committee rooms, offices and toilet rooms. They are so distributed in the relation to the supply register outlet as to effect a positive circulation in all parts. It is to be noted that there are no exhaust vent connections to the vault, circulation being had only at such times of the day when the main vault doors are open. The exhaust fan equipment for this division is, like that for the third floor of the banking division, located in the attic to which duct connections are made through the sub-basement and a 36x42-in. flue extending up the pipe shaft to the attic space alongside of the smoke-stack enclosure. The proportions for supply and exhaust are such as to cause a complete change of air about four times per hour in this department.

Of the remaining systems, that for the main floor entrances was installed solely for the supply of hot blast at the outside entrances in severe winter weather for the purpose of diffusing with the cold air admitted and preventing cold drafts through the corridors. This system is necessarily simple, having a double duct connection to the main entrance to the building from Adams St. and a single duct to the Clark St. entrance. In the Clark St. entrance there are two registers delivering 3,000 cu. ft. per minute, and in the main Adams St. entrance, eight registers having a capacity of 12,000 cu. ft. per minute. These capacities were selected arbitrarily in view of the expected usage of the different entrances and the tempering of the cold drafts admitted thereby. The basement and sub-basement system, No. 5, is the smallest equipment installed, and supplies a printing shop, about 75 ft. sq. in the front corner of the basement with about 3,500 cu. ft. per minute, distributed through ten register outlets, while the remainder goes to a number of store rooms, locker rooms, etc., in the sub-basement, for the employees of the building. The engine room and boiler and pump room systems are each large equipments, intended solely for the supply of cold fresh air to the heated machinery sections and have extensive

Ventilating Equipment—Commercial National Bank Building

System.	System No.	Size of Fan, ft.	Wheel Width, in.	Speed. r.p.m.	Capacity, cu. ft. per min.	Motor, H.P.	Heating Coils. No. of Sections and Lineal ft. of 1-in. Pipe. Tempering.	Reheating.	Air Wash Systems. No. of Spray Heads.	Gal. per Min.	Area, sq. ft.	Pump Motor, H.P.
Bank, 3d story, supply	1	4½	23	306	12,480	7½	3-600	2-600	?	75	32	1½
Bank, 2d story, supply	2	6	40	259	31,745	20	2-1075	4-1200	36	185	76	2½
Street entrances, supply	3	5	23	300	15,000	12½	3-825	3-825	20	125	40	1½
Safety deposit dept., supply	4	5	23	349	17,200	15	3-950	4-325	24	125	39	1½
Basement and sub-base, supply	5	4½	9	344	5,500	5	2-350	2-225	9	75	18	1
Engine room, supply	6	6	35	234	25,750	15	.....	.....	...	...	...	...
Boiler and pump room, supply	7	5½	40	321	34,655	30	.....	.....	...	...	...	...
Safety deposit dept., exhaust	8	5	28	300	18,370	12½	.....	.....	...	...	...	...
Bank, 3d story, exhaust	9	4½	26	267	12,600	7½	.....	.....	...	...	...	...
Toilet rooms, exhaust	10	4	22	332	10,545	7½	.....	.....	...	...	...	...

systems of distributing duct work for diffusing the air thoroughly through these rooms. These systems are each proportioned to change the air in the rooms served about ten times per hour for the comfort of the workmen, the outlets being distributed alongside of building columns and along the side walls on either side, as indicated in the plan drawing. A considerable amount of exhaust is effected from these rooms by the boiler furnaces and also by the pipe shaft and enclosure around the steel smoke-stack which rises to a hooded outlet at the roof.

The remaining system, No. 10, serves to exhaust foul air from the toilet rooms on practically all floors of the building. In the lower floors numerous toilet and locker rooms are ventilated from the sub-basement to the second floor mezzanine, above which there is only a janitor's closet and a small men's toilet served on each of the floors, excepting the eleventh story in which the large public toilet rooms of the building are located. For the latter service extensive gathering duct connections are installed, there being an exhaust register located in the rear of each of the toilet enclosures of the extensive groups. This system exhausts about half of its capacity from the toilets below the fourth floor, and over 2,600 ft. per minute from the eleventh floor toilet rooms, while on the other upper office floors, there are uniformly two vent registers to each floor, one exhausting from a janitor's closet and the other from a small men's toilet, and in a number of cases connections to private toilets in special office suites, each of which draws at the rate of 50 cu. ft. per minute.

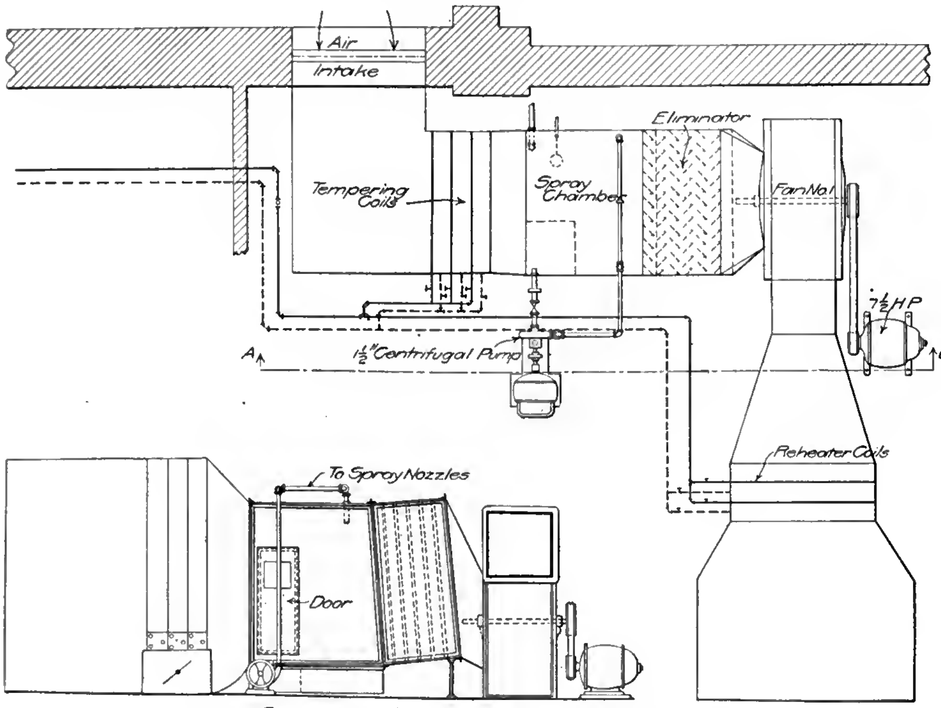
The fan equipments for these ventilating systems are, as above stated, located in three separate groups, those for the banking division fresh air supply on the east side of the third floor, the remaining fresh air supply fans in the sub-surface floors, and the exhaust equipment in the attic above the eighteenth floor. This arrangement of the fresh air supply apparatus was due in part to the use of the air wash systems which renders the locations independent of consideration as to points of intake of outside air. The two fans on the third floor have intake through ordinary windows opening into open courts at the rear of the building, while those located in the sub-surface floors have intake through ducts carried up to special screened intake openings at the rear corner of the building on the second floor level. In all five equipments fitted with air washing systems, there is in the intake connection a tempering coil for the purpose of preheating the incoming air sufficiently in extreme winter weather to prevent freezing of the spray of the air wash, after which the air is passed to the spray chamber. The air washing apparatus is of the Acme type, furnished by Thomas & Smith, Chicago, which has been previously described in these columns, and consists, in each case, of the spray chamber in which the air passes through an unbroken sheet of water spray and between the latter and the fan intake, a separator or eliminator, for preventing entrained water being carried along in drops into the fan intake. The spray chamber is an enlargement over the intake duct so as to greatly reduce the velocity of the incoming air, and in it are mounted on a pipe framework spray nozzles so placed as to effectively distribute the spray; the nozzles used are the Thomas No. 6 bar lock, circular spoon brass nozzles which are fitted for easily freeing themselves in case they are clogged by obstructions coming through the water piping. The eliminator consists of a series of narrow vertical baffle plates with hooked edges which are so placed as to cause the passing air to take a tortuous path and, as the entire eliminator chamber is inclined slightly upward toward the fan the moisture from the passing air is arrested by the baffle plates and forced downward toward the base of the chamber, where it drains back into the catch basin underneath. The water for the spray is used over and over continuously for a number of days at a time, being recirculated for this purpose by a motor-driven centrifugal pump. The catch basins all have service water supply connections with float valve control to maintain the water level against evaporation by the passing air and all pump suctions have double strainers to prevent obstruction of the piping. The principal details of one of the air washing equipments is shown in the accompanying illustration of the third story system, No. 1.

The fans, which were furnished by the B. F. Sturtevant Co., are of the centrifugal exhauster type with top horizontal discharge casings, and are all belt driven by slow-speed electric motors, operated from the power circuits of the building, which motors were supplied, together with those operating the circulating pumps of the air wash systems, by the Western Electric Co., Chicago. A feature of the duct connections to the fans is the use of canvas boots at the delivery outlets to prevent communication of vibration from the fan casings to the duct work. The boots consist of sleeves of No. 6 duck, 2 ft. in length, well sized and painted, bolted air-tight between the fan outlet and the reheater casing or duct line. The duct work systems are well fitted with dampers, tight closing dampers being installed in all of the intake connections near the outer walls and also for by-passing all heater coils for the purpose of reducing the temperature of the air delivered. At all branches in the duct lines, there are installed adjustable air splits which may be adjusted from outside of the duct to control the amount of air passing in the branches. The duct lines are fitted with cleaning holes, 10 in. square, located at all curves and at all branch connections to main duct lines. The ducts are of galvanized iron construction, heavily braced when greater than 256 sq. in. in cross section and are built of No. 22 gauge metal for lines of 4 sq. ft. area and larger, and of No. 24 gauge for smaller lines. Covering is applied to the duct lines only on the engine room and boiler and pump room systems, and between the intakes and tempering coils of the remaining fresh air supply systems, the covering being of ½-in. asbestos air cell blocks, lapped and canvas covered. The engine room and boiler and pump rooms system filters consist of screens of 1/16-in. mesh wire netting mounted on iron frames over which the cheese-cloth is tightly stretched, each screen being arranged to slide on rollers in independent grooves so that they may be easily removed for cleaning.

The heating stacks installed in all of the fresh air supply systems except those for the engine room and boiler and pump rooms, are of the cast-iron base type, installed in amounts of lineal feet of 1-in. pipe, indicated in the accompanying table, and were furnished by the American Blower Co., Detroit, Mich. Both tempering and reheating coils are installed in from 2 to 4 sections to enable adjustments of the heating surface to be made in accordance with the requirements of the rooms supplied, and all are fitted with by-pass dampers under thermostatic control for securing the desired temperature of delivery. The temperature controlling apparatus for the fresh air supply systems, which together with that for the control of the direct radiation, was supplied by the Johnson Service Co., is especially designed to maintain the temperature of the air delivered at 70° under all conditions. The control is, in the case of the fresh air supply systems, applied to the by-pass dampers underneath the coils while for the direct radiation, thermostats in the rooms controlled operate motor valves on the steam supply connections to the radiators.

The banking quarters of the building are equipped with a complete system of wiring for call bells, telephones, watchmen's service, telegraph, clocks, etc. A pneumatic tube system for transmission of documents, telegrams, etc., between the various departments was also installed by the Lamson Consolidated Store Service Co. The plumbing and sewerage was installed by M. J. Corboy, and that portion of the drainage below street sewer level is disposed of by a duplicate pneumatic ejector system installed by the Shone Co. Foundations for all machinery were installed by H. A. Bishop & Co., Chicago. The electrical equipment, including generating apparatus, was installed by the Brennan Electric Construction Co., of Chicago, and the elevator equipment by the Otis Elevator Co. The refrigerating plant which is installed for cooling water for the drinking fountains in the hallways is of the absorption type built by the Carbondale Machine Co., Carbondale, Pa. A vacuum sweeping system has also been installed by the Vacuum Cleaner Co.

The ventilating equipment was designed by the architects of the building, D. H. Burnham & Co., of Chicago, under the direction of Mr.



SECTION A-B

Typical Air Washing Equipment, Commercial National Bank Building.

John D. Small, chief mechanical engineer. Thomas & Smith, Chicago, were contractors for the heating and ventilating systems.

A Long Rope Tramway.

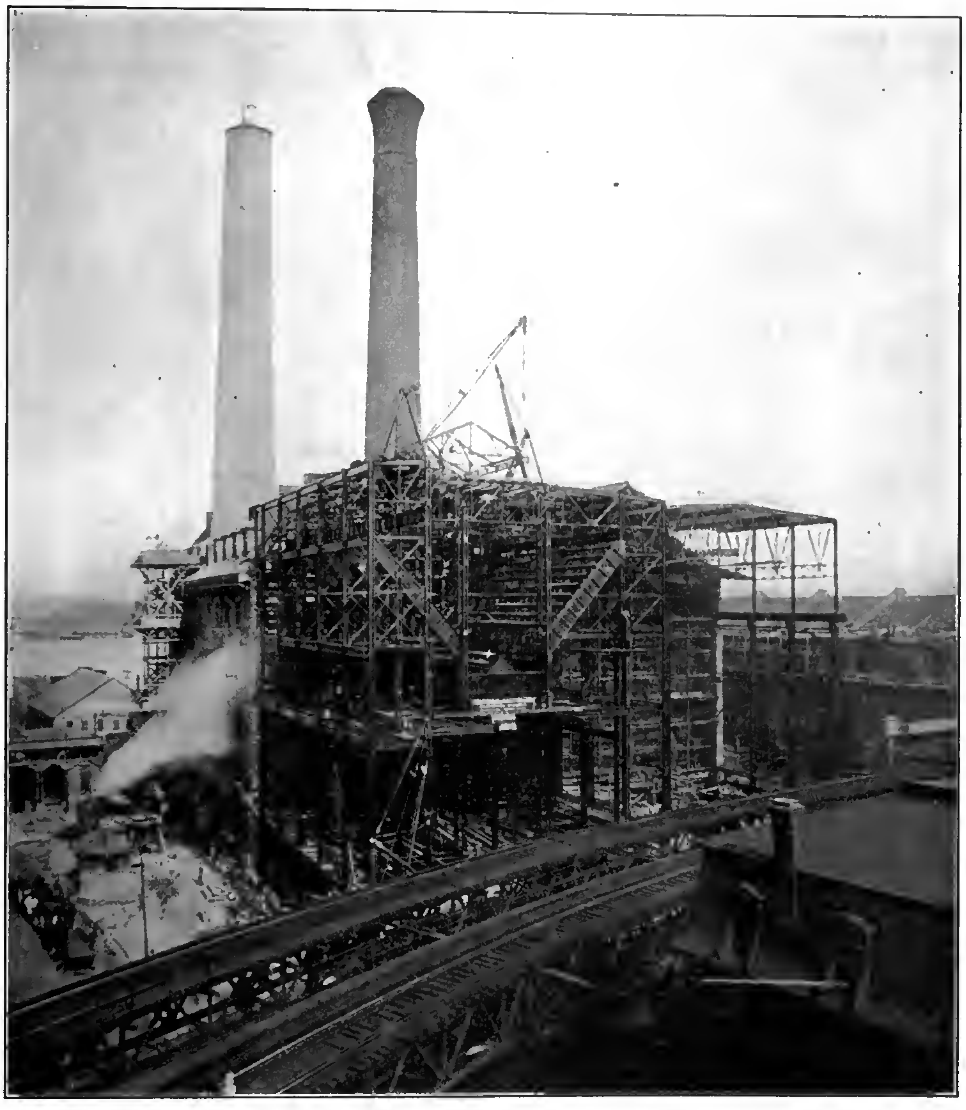
A rope tramway 4 km. long and overcoming a difference in elevation of 1,819 m. has been supplied by Ceretti & Tanfani to the Italian military authorities for building a fortress in the Italian Alps. The line starts at Cesana, where the power and loading station is placed. The first section is 1,230 m. long and runs to a station 484 m. above the lower terminal. Between these two stations are several intermediate supporting stations, the maximum distance between them being 400 m. The tramway cable for loaded buckets on this section of the line is a steel rope 24 mm. in diameter, and that for empty buckets is 18 mm. From the second main station there is a span 1,250 m. long, rising 750 m. to the third main station, from which the third section, 1,350 m. long, rises 585 m. higher to the upper terminal station. The tramway cables for the two upper spans are 28 mm. in diameter for the loaded cars and 24 mm. for the empty cars. The cars are hauled by a steel rope 20 mm. in diameter driven at a speed of 1½ to 2 m. per second by hydraulic power. The cars or buckets attached to the hauling rope are spaced 480 m. apart and each of them is rated with a carrying capacity of 400 kg. The tramway is in continuous operation, requiring 55 h.-p. and handles about 144 tons daily. It is stated to have cost about $60,000.

A Freight Movement of 8,630 cars in 24 hrs. is reported as having passed Lewistown Junction on the Pennsylvania R. R. on Sept. 29.

Erecting a Heavy Steel Building with Jinniwinks.

The Boston Elevated Ry. Co. has recently experienced a shortage of power and retained the Stone & Webster Engineering Corporation to investigate their power plants. The report recommended present relief by extensions aggregating about 12,000 kw. for the power stations at Lincoln Wharf, Boston; at Sullivan Square, Charlestown, and at Harvard Square, Cambridge.

The principal power station, at Lincoln Wharf was illustrated and described in The Engineering Record of August 17, 1901. It has a massive steel framework 92 ft. high from foundation line to top of main columns and consists of a one-story engine house 67 ft. 8 in. wide, and a parallel and adjacent boiler house 82 ft. 8 in. wide and three stories in height below the coal bunkers. The engine house has only two longitudinal rows of columns, one of which is on a center line between the two houses and serves for the boiler house also. In the boiler house there are six longitudinal lines of columns, including the one common to the engine house and in the engine house there are only two lines including the same common columns. All of the columns are arranged in transverse bents 17 ft. 7½ in. apart except at the outer end and form three 20-ft. center aisles and two side aisles about 10 ft. and 12 ft. wide in the boiler house and leave a single unobstructed floor space of the full width of the engine house. The coal bunkers 60 ft. wide, extend the full length of the building, and are nearly 60 ft. high from the foundation line to the bottom of the bin. They are made with horizontal transverse bottom girders 20 ft. long and inclined side girders about 35 ft. long over all supporting lines of longitudinal I-beams and tied together at the foot by horizontal eye-bars and at the top by the roof trusses, both passing through the bin. The roof trusses are riveted lattice girders about 6 ft. deep and 60 ft. long for the boiler house and 16 ft. deep and 67 ft. long for the engine house.



Erecting Lincoln Wharf Power House Extension.

In order to increase the boiler capacity it has been found necessary to extend one end of the building with a full width addition occupying a trapezoidal area 150 ft. 4 in. wide by 118 ft. 2 in. long on the long side, and 59 ft. 1½ in. long on the short side, including four regular transverse bents of framework and three special bents at the oblique end. The design was the same as that of the original structure except that it was made somewhat heavier to provide for increased loads, but the erection methods were different and are of interest on account of their simplicity and economy, and of the rapidity and successful results obtained by them.

It was at first intended to erect the new superstructure entirely with overhead movable derricks. Accordingly two steel jinnywink derricks were erected on the roof of the old part of the building and commenced operations by unloading the material from trucks and erecting it complete for the first panel, after which they moved forward on the steel work and erected the next two panels in the same manner.

As the building is situated in a congested part of the city where the street traffic is heavy and cannot be obstructed or interrupted, and as the sidewalk and elevated railroad structures come close to the building lines, it was impracticable to store any materials outside of the building or even to have trucks standing long there while being unloaded. It was therefore necessary to handle the steel work as fast as it was received, and in order to permit the rapid erection demanded by the rush order, it was also necessary to store material in advance of erection inside the building lines.

A guyed steel derrick with an 80-ft. mast and a 70-ft. boom was set up near the middle of the lower floors so as to command practically the entire area of the building and unloaded the bulk of the material. It also erected the columns, beams and girders up to and including the economizer floor on which it stored the material for the upper part of the structure.

Above the economizer floor the structure was erected by the jinniwink derricks moved forward on the completed panels and erecting the members of the framework from the bottom upward exactly as viaducts are erected by overhead travelers. After the completion of the boiler house, a 100-ft., 10-ton steel boom with a special Chicago foot block was set at the foot of one of the intermediate columns in the side wall of the boiler house near the middle of the extension so as to command practically the entire area and height of the engine house, and with it the engine house framework, consisting merely of the one row of wall columns and the roof trusses and connecting members, was erected.

The foot block was made with two 12-in. channels 15 in. long, with their webs 6 in. apart and their flanges turned inwards and riveted to two 12x¾-in. cover plates. The channel webs were punched for four 1-in. horizontal bolts through 12x12-in. horizontal timbers fitted between the projecting edges of the cover plates and forming the cantilever girder anchored to the steel framework of the building and supporting the boom beyond the outer face of the column which was utilized for its derrick mast. The cover plates were bored in the center for a 3-in. vertical pin with a 24-in. grip the upper end of which has a solid collar and engaged a cast-iron knuckle block with eccentric lugs bored to receive the 2½-in. horizontal boom pivot pin.

The jinniwink derrick had steel sills seated

on loose track timbers laid on the upper tier of beams and girders in the boiler house and were readily advanced by pushing forward by hand. The minimum erection gang of six men operating each jinnywink being sufficient for this purpose. The lead lines of their tackles were taken around snatch blocks to the capstan heads of two double-drum American Hoist & Derrick Co.'s engines located on the ground on opposite sides of the building.

The jinniwinks were simply small movable steel derricks of 7 tons capacity, weighing about 3,000 lb. each. The framework consisted essentially of a transverse and a longitudinal horizontal sill forming a T-shape base supporting two inclined shear legs in a vertical plane and one inclined back leg, with a 40-ft. boom pivoted at the intersection of the sills. Most of the members of the framework were made with pairs of 8-in. channels, back to back, latticed, and a second, shorter, transverse sill was attached to the extremity of one of the T-pieces to enable the jinniwink to be moved across open spaces between girders. The length, width and height of the framework were about 20, 12 and 16 ft. respectively.

Neither the guyed derricks or the 100-ft. boom were moved during erection, the latter being arranged to utilize one of the columns of the building for a mast. The field rivets were driven by Chicago Pneumatic hammers operated by air from an Ingersoll-Sergeant compressor. The work was very efficiently executed by a force which, when all six riveting gangs were at work with the erectors, numbered only about 40 men.

The building weighed about 900 tons and the contract for it and for the other two power house extensions was awarded Feb. 15, 1907. It provided that the shipment of steel from the shops must be commenced May 1st, erection commenced May 15th, and the erection of the framework so far advanced that the wall columns should be finished, riveted and painted in readiness for the construction of the wall masonry by July 1st. A bonus was offered for the completion of this work 15 days sooner than contract limit and another and larger bonus was offered for its completion 30 days in advance of contract time. The 30 days bonus was earned with two days to spare for the Lincoln Wharf Power House and with about two weeks to spare for each of the other power houses.

The work was designed and its construction carried on under the direction of the Stone & Webster Engineer Corporation. The contract for the steelwork was awarded to L. F. Shoemaker & Co. The structural steelwork was fabricated at their Schuylkill Bridge Works plant and the erection was directed by Mr. L. D. Rights, contracting manager.

An Automatic Ore-Weighing Machine, said to be the largest yet constructed, has been shipped from England by Messrs. Samuel Denison & Son, Ltd., to the Canadian Northern Ontario Ry. Co., for use at the Parry Sound coal depot of that line. The capacity of the machine is 800 tons per hour. The ore is delivered to a special belt conveyor, 36 in. wide, which travels at a speed of 600 ft. per minute. A continuous weighing apparatus operates in conjunction with the conveyor and a recording indicator shows the total net weight of ore handled in any predetermined period, the tare being deducted automatically. The weighing apparatus operates once every four seconds. The return run of the conveyor belt drives the recording mechanism and controls the weighing, so that slipping on the driving wheel and changes of speed of the belt travel do not affect the accuracy of the results, which, according to "The Engineer," are correct within one-half of one per cent. The English Board of Trade has sanctioned the use of these machines.

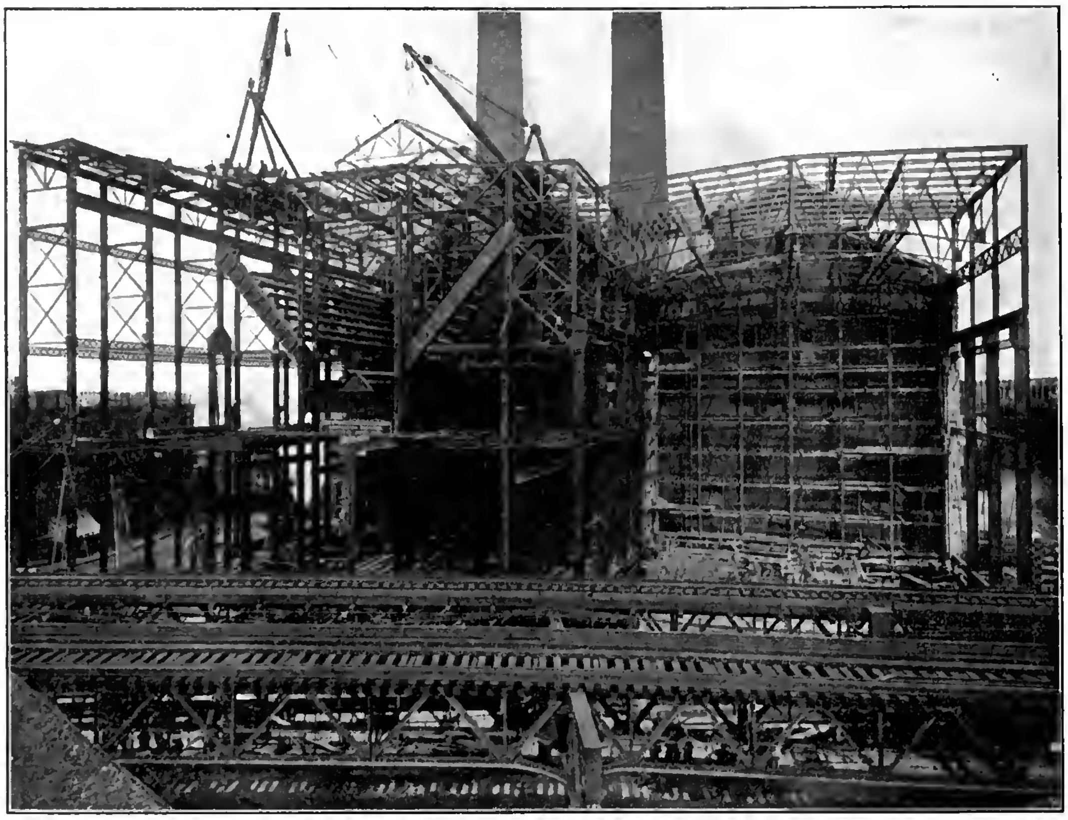
The Bracing of Trenches and Tunnels.

The sheathing and bracing of trenches and tunnels in dry and water-bearing materials were treated under the general subject of bracing in a paper on October 16, before the American Society of Civil Engineers. The paper, which was by Mr. J. C. Meem, was entitled, "The Bracing of Trenches and Tunnels, with Practical Formulas for Earth Pressures," and was printed in the Society's "Proceedings," Vol. xxxiii, p. 599. The following abstract gives the main points of the theoretical considerations of the paper.

The term "sheeting" is taken by Mr. Meem to mean that class of sheathing which is set in or driven coincidentally with the excavation. That class of sheathing which is driven ahead of the excavation or beyond its final limits, is referred to as "sheet piling." The general question of earth pressure, in connection with its action on sheeting and bracing, Mr. Meem believes has never been developed so as to reconcile the theoretical with the practical conditions, and he develops a practical basis for effecting an approximate reconciliation between the actual conditions of stability of earth and the theoretical formulas or resultants arising therefrom.

In all his experience, Mr. Meem has used the diagram, Fig. 1, for calculations of earth pressure, whether applied to retaining walls or to sheeting and bracing. If $B\ C$ be the line of the sheeting, and $D\ C$ the natural slope of the earth, b being the angle of repose, then the mass of earth causing pressure against the line, $B\ C$, is contained within the triangle, $D\ B\ C$. The weight of the earth in this triangle rests on $D\ C$, and its thrust is transmitted to $B\ C$, not through the toe of each layer at the foot of its slope line, but by the arching effect of this earth between the lines, $B\ C$ and $D\ C$. For purposes of calculation, it is probably not far from correct to assume that a line, $A\ C$, bisecting this triangle, $D\ C\ B$, measures with $B\ C$ an area equivalent to the weight transmitted as thrust against this line, $B\ C$. Also, it is true that the center of pressure against $B\ C$ is where a perpendicular from the center of gravity of the triangle, $A\ B\ C$, meets this line.

This assumption is going contrary to the general theory, which assumes that earth pressure acts along the line of rupture and parallel with that line, and is therefore greatest at the toe, but this theory is not borne out in actual practice, and all closely-sheeted, well-braced trenches invariably show a heavier pressure at the top than at the bottom. Any attempt to assume a theoretical condition which is contrary to this fact must be of little value to engineers in making practical calculations. Many retaining walls have been built from designs based on this theory; and Mr. Meem believes that it makes little difference, practically, which form of reasoning is applied to retaining walls. It does, however, make a vast difference which form of reasoning is applied to a braced trench, or to a concrete wall reinforced horizontally; and, while Mr. Meem does not contradict this theory, if based entirely on a theoretical condition of frictionless material, he does advise against its use in ordinary practice.



Jinniwink Derricks in Final Position on Boiler House Roof.

In other words, if it be assumed that $D\ C$ is a solid plane, and that the triangle, $D\ C\ B$, is filled entirely with particles which are absolutely without friction, and therefore the weight of one upon the other transmits accumulatively the weight of all entirely and directly to the bottom, then the truth of the theory noted above cannot be controverted. Such a condition, however, does not exist, and earth pressures and aqueous pressures are not similar; for, in dealing with ordinary materials, it is impossible to proceed with any practical calculations without taking into account the frictional resistance of these materials and their arching effects, which render it virtually impossible to consider their action as in any way allied to hydrostatic action. For instance, Mr. Meem has repeatedly observed where trenches have been sheeted from B to E, Fig. 1, and the excavation has been continued below E without sheeting, that cutting excavations have been made in loams, clays or moist sands back along the line, $E\ M$, by the use of light poling-boards driven in under the toe of the sheeting at E, without disturbing the stability of the mass above. If this sheeting had been so poorly put in as to cause the stability of the mass to be disturbed, it would have manifested itself by the continual dropping of masses of ma-

terial from above, rather than as a constant pressure, as would have been the case had the material been full of water or absolutely frictionless. And, if any small holes should be left between these poling-boards in absolutely dry sand, it would "bleed" in through these orifices just as the sand runs into an hour-glass, until the hole had gone to the top of the excavation, but at no time would there be observed any continuous pressure which could be defined in any way as equal to the entire weight of the sand from the bottom to the top over the unsheeted area.

It may be, as Mr. Meem has frequently observed, that the lower part of a trench may be left unsheeted, as from E to C, and for a considerable distance longitudinally in clays and moist sands, without disturbing the stability of the face, E C, and yet more or less heavy pressure may be observed in the bracing above. This can only be explained on the theory of the arching effect of the material above, one buttress of the arch being B E, and the other D C. If this be correct, there can be no doubt of the action being wedge-like, with the center of pressure opposite the center of gravity. Any engineer who has had to do with excavations must be aware of the fact that pressures are frequently developed in the top braces and rangers while men are excavating with impunity beyond the limits of

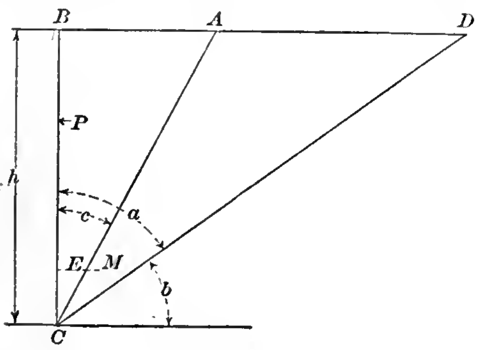


Figure 1.

the sheeting at the bottom of the trench. It is possible, also, at any time to cut or remove the bottom sheeting (except in dry sand) for a considerable percentage of the vertical distance from the bottom, and for indefinite lengths, without interfering with the stability of the bank above, provided the sheeting is removed without jarring. Any practical man, however, will admit that it would be suicidal to remove any one of the braces near the top of the excavation, particularly after the ground had stood for any considerable time.

The practical application of the foregoing will now be shown, and the formula be demonstrated. Let b (in Fig. 1) = the angle of repose, $a = 90° - b$, $c = a/2$, h = height = B C, and w = weight of 1 cu. ft. of earth.

Then, the area of $A\ C\ B = h \times h \tan. c \div 2$, and the weight of the mass of earth causing pressure on $B\ C = w\ h^2 \tan. c \div 2$.

The resultant pressure of this mass would occur at two-thirds of the height, or at P, in Fig. 1.

In the case of a well-sheeted and braced bank, there would be no overturning moment, but there would be a thrust, represented by the general tendency of the triangle, A B C, to slide along the line, A C, and therefore move out and exert pressure in a horizontal direction.

To understand this more clearly, it might be well to assume that the lines, B C A and D C A, are blocks of ice which are held in place along the line, D C, by their weight impinging on this line, and on the line, B C, by a rigid strut bearing against that line at P. If the pressure at P be slightly released, the whole triangle, B D C, will slide along D C and assume a new position. If, again, A B C be taken as a solid wedge bearing against a solid block, A C, and the wedge be forced down, then, in order that it may be resisted most effectually at any one point, this resistance should be placed at P. Or, in a word, Mr. Meem believes that the action of earth pressure in properly braced trenches is more closely allied to that of a coherent solid than to that of an aqueous or frictionless mass.

Mr. Meem believes that there is a limit of depth beyond which it is not possible to brace a trench against the pressures which would be developed, and he believes that this limit could be defined by a simple practical calculation, depending, of course, upon the nature of the soil through which the trench was dug. For example, if a trench be sunk 20 ft. and stopped, the pressure developed at the 15-ft. level will not be excessive, whereas if it be continued to 60 ft. the bracing will have to be heavily reinforced at the same 15-ft. level; and, if the trench be carried down to an indefinite depth, no bracing would eventually be able to withstand the pressures at this same point, owing to what may here be described in a homely way as the "topheaviness" of the bank. Anyone who has had to do with deep trenches or tunnels, however, must realize that an exposed face of earth is under no more

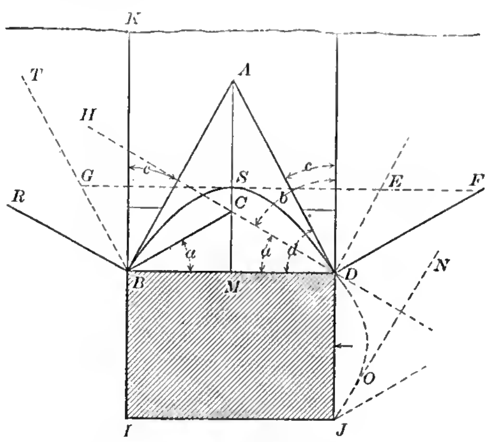


Figure 2.

pressure at the bottom of the deepest trench or tunnel than it is at the bottom of a shallow one.

As an illustration of this several of the bottom plates of a lined tunnel which had been driven at a depth of about 70 ft. by the shield method, were removed, exposing a face of moist sand. The latter was in as quiescent and undisturbed a state as though the exposure had been made only a few feet from the surface.

The danger in sheeting a trench arises mainly from three causes:

a.—In driving the sheeting carelessly and allowing slips to occur behind it; or, in the case of clayey soils, not properly guarding against voids which may occur behind the sheeting. The natural tendency of earth eventually to fill these voids causes slips, which develop not only the full pressures theoretically provided for, but frequently, by reason of the shock incidental to the velocity of slip, cause increased pressure to impinge against the sheeting and incidental bracing.

b.—In not fully tightening the braces by the use of wedges driven practically to refusal; and

c.—Because strata of quicksand may be uncovered in ordinary soil, thereby developing hydrostatic and unbalanced pressures on the sheeting and causing stresses not properly provided for.

There appears to be no controversy as to the generally accepted theory and formula in connection with bracing and sheeting and its relation to earth pressures in subaqueous or other soils so saturated as to be under hydrostatic pressure. If h equals the depth of saturated soil against a sheet pile and w is the weight of 1 cu. ft. of water, then the weight against a pile with a width of 1 ft. would be $w\ h^2 \div 2$, and the overturning moment $w\ h^3 \div 6$, taking the center of pressure at a point one-third above the base.

The next question taken up by Mr. Meem was earth pressures on tunnels or subterranean structures, where it is necessary to consider the other side of the pressure areas noted in the development of the formulas for pressures in open trenches.

Referring to Fig. 2, if it be assumed that B D J I is a tunnel (the area of which will be taken as a square, in order to simplify the assumptions), and that H D or D F is the natural slope of the earth above this tunnel then a = the angle of repose, b = the complement of the angle of repose, and $c = b \div 2$.

As a first assumption, it is unquestioned, of course, that all earth contained in the triangle, B C D, necessarily presses directly on the roof of the tunnel. And if the assumptions made at the beginning of this paper are true for open trenches, then it is also true that all the earth contained in the triangle, A C D, bears directly upon the line, C D, and therefore all this weight likewise is transmitted to the tunnel and all the pressure of the earth in the triangle, A D L, goes to the line, L D, arching itself somewhere below the triangle, B A D, in a curve approximating the line, B S D, so that, in a well-braced tunnel, the only pressure on the roof would be that due to the weight of the material below this line. In order to be consistent and carry out the line of reasoning in the original assumption, however, provision must be made for the pressures of all the material in the triangle, B A D. No pressure beyond the lines, B A and A D, can be transmitted to the tunnel unless the ground contains water in such quantities as to make the pressure hydrostatic. Of course, if the tunnel is a subaqueous one, the pressure on the line, B D, for purposes of practical calculation, must be that due to the hydrostatic head of the water measured by its depth to the line, B D, and by the width of the tunnel opening.

Returning again to earth pressures free from excess of water, it is found, of course, that the larger the angle, a, the greater is the resultant pressure upon the tunnel. It is possible that some may argue from this that the greatest pressure will occur in clayey soil where the earth stands vertically. This supposition, however, is erroneous, because, any soil which will stand vertically and continue to stand vertically under any circumstances must be considered in the same way as solid rock, and cannot be properly classed as material for which bracing is necessary. As a matter of fact, however, clays are treacherous soils for tunneling, and frequently develop pressures by squeezing or sliding horizontally, for which it is difficult to provide.

If, now, it be assumed that the square, B K L D, is made up entirely of blocks of ice (or frictionless solids) having an angle of repose of 90 deg., the full weight of this material would have to be provided for in bracing across the tunnel roof, B D. If, on the other hand, a material, such as dry sand, be considered, in which the angle of repose is very flat, the arching effect of this material comes more greatly into play by reason of its tendency to slide along the angle of repose, and therefore, the condition of least pressure that can come upon a tunnel in dry ground is where the angle of repose of the superimposed material is least, always providing the material is held by close sheeting. In a word, then, the greater the angle of repose the greater the pressure to be provided for, and this leads to the conclusion that dry sand of a small angle of repose would prove the best material for tunneling if it were possible to sheet and brace the roof absolutely without disturbing its equilibrium. In practice, however, it is, of course, impracticable to drive a tunnel through sand of any kind without having some movement of ma-

terial, and the dryer the sand, the more likely it is to run through any opening in the sheeting.

Here, again, it may be of interest to note that if a frictionless material could be imagined, resting in a trough made by the prolongation of the lines, *R B* and *D F*, measuring the angles of repose, allowance would probably have to be made for the full pressure of the weight of all the material contained within the prolongation of the lines of rupture, *B T* and *D E*. Assuming a case where a tunnel is so close to the surface that the arching effect is lost, for instance, if in Fig. 1 the surface of the ground be taken at *G E F*, it is probable that there would be obtained not only the full pressure of the ground directly above the opening, but an increase due to the lines of rupture, *B T* and *D E*. Therefore, Mr. Meem thinks it is always wise to discontinue tunnel operations when the surface of the ground intersects, or nearly intersects, the perpendicular line, *A M*; and it is within the reasonable limits of good practice to tunnel when the surface of the ground is fairly well above the point, *A*. It may also be of practical interest to note that any longitudinal trenching should always be avoided if possible over the line of a tunnel while it is being excavated owing to the consequent destruction of the key to the arching effect of the ground.

As to the actual pressure: Let l = the width of the tunnel; $A\ M = h = l \times \tan.\ d \div 2$.

Then the area, $B\ A\ D = l\ h \div 2$, and, assuming that a = 34 deg., then c = 28 deg. and d = 62 deg.; and the tangent of d = approximately 2; and l, of course, = h.

The area, $B\ A\ D$, therefore, becomes $l^2 \div 2$, and $w\ l^2 \div 2$ = the total weight per lineal foot of tunnel, where w = the weight of earth per cubic foot.

As to side pressures, the pressure against the sheeting, *D J*, continues along a line of rupture, *J N*, stopping at some indefinite point, which, for practical purposes, may be taken at *O*, and making the only actual pressure in closely-sheeted work approximately within a line measured by the curve, *D O J*. An excess allowance covering conditions of sheeting, ground, etc., in which judgment is a large factor, should be used in all calculations relating to the question of side bracing, to give a proper factor of safety in connection with this somewhat indeterminate quantity.

As to the question of shaft bracing, Fig. 3 is a cross-section of a square shaft of an area sufficiently small to give the surrounding earth a tendency to arch itself horizontally, it being very probable that such a shaft of reasonably small dimensions and driven as here shown will develop pressures somewhat as indicated by the circumscribed circle. It appears to be reasonably fair to assume that a circular shaft of not too large diameter, driven in dry ground or moist sand, will arch itself so that very little pressure is exerted on the bracing in excess of that originally developed in making the sheeting and bracing tight. This excess pressure is small and indeterminate in actual practice, and may be measured by the intersection of the lines of the arching effect in a horizontal plane and the lines of rupture in a vertical plane, and somewhat as shown in the vertical section in Fig. 3. This pressure varies, of course, in direct proportion to the care with which the sheeting was originally placed. In view of this, it is true, both practically and theoretically, that a small shaft may be driven to any depth without developing any greater pressures below than are found near the surface. As soon, however, as the shaft becomes so large that the horizontal arching effect is destroyed, the action of the pressures becomes the same as the bracing in an open trench, and therefore it would be impracticable to sink to any great depth a shaft the dimensions of which were such as to put it in the same category as trenches.

Mr. Meem showed a photograph of an underpinning pit sunk to a depth of about 18 ft. by the use of horizontal or well-diggers' sheeting. The bottom of this pit is at the level where ground water has been struck, and is there sheeted with interlocking steel sheet piling driven some 5 ft. into the ground to bring its toe well below the sub-grade of the adjoining excavation for which the underpinning is required. This pit can now be pumped out and excavated without danger of bringing in sand, and can then be filled with concrete to form a proper foundation for supporting underpinning timbers. Mr. Meem has personally supervised the work of sinking numbers of similar pits for different purposes, some to depths of 45 ft., without other bracing than the horizontal sheeting noted above, each set alternately bracing the other. It is also known that pits of this character, and not more than 5 ft. square, have been sunk by well-diggers to a much greater depth than those noted without using any bracing other than the sheeting of the character described above.

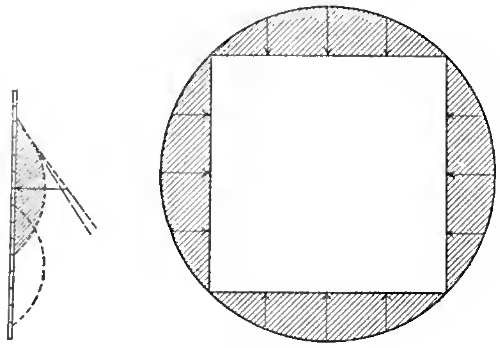


Figure 3.

Mr. Meem believes that the practice of lining circular manholes with masonry walls the thickness of which increases with the depth is not consistent with good designing, and that a circular shaft may be safely designed with a masonry wall which has the same thickness at an indefinite depth as it has near the surface.

The remainder of Mr. Meem's paper illustrated and discussed a few general types and methods of sheeting and bracing, including subway work near the surface and various types of tunnel work.

In closing, Mr. Meem stated that he had written the paper for two main reasons: First, he believes that the subject of bracing and its relation to earth pressures is not properly provided for in the ordinary data and formulas and he hopes, either in this paper or in the resultant discussion, that the question may be established beyond controversy, and on a basis which will be of practical value to engineers and contractors. Second, Mr. Meem believes that insufficient consideration is given to the subject of bracing by engineers in general, it being ordinarily deemed sufficient to leave this question to more or less intelligent foremen; and, while it is not intended to impeach in any way the intelligence of any foreman, it is thought that the subject is one requiring more engineering consideration than is ordinarily given to it.

The Concrete Ties which were placed in the track of the Chicago & Alton R. R., near Lockport, in 1905, are stated to be wearing well, although subject to a heavy traffic. The ties are of the type designed by Mr. G. H. Kimball, of Detroit, and consist of blocks of concrete 3 ft. long, 7 in. high and 9 in. wide. Two of these blocks are connected by a pair of 3-in. channels so as to form a tie of dumb-bell appearance. The rails are carried on top of the concrete blocks by pieces of hardwood, bolted to the concrete and receiving the regular rail spikes.

Book Notes.

A little book which will be helpful to railway surveyors is Messrs. E. F. Hauch and P. D. Rice's "Tables of Quantities for Preliminary Estimates," a title that is a bit misleading, for nearly all the contents relate to a single method of calculating the volume of an embankment. The method followed by the authors is based on a cross-section triangle having for its sides the slopes of the embankment, and for its base the natural transverse slope of the ground. In the tables these slopes are ¼:1, ½:1, ¾:1, 1:1, 1¼:1 and 1½:1. From the area of this triangle was deducted that of the isosceles triangle having for its base the roadbed width, and the remainder was multiplied by 100/27 to give the results in the tables. The tables were checked by a method explained in the book. The roadbeds for which tables are given have widths of 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32 and 35 ft., and for each width and side slope the volume of the section is given for center heights varying by 1 ft. from 1 to 50 ft. There are also tables of toe slopes, cubic yards in 100-ft. sections from the sum of the end areas, decimals of a mile expressed in feet, acreage for a 100-ft. right-of-way, equivalents of chains in feet and feet in decimals of a chain, and fractions of an inch in decimals of an inch and a foot. (New York, John Wiley & Sons, $1,25.)

An important contribution to the published information on industrial disturbances is the volume on "Strikes and Lockouts" forming the report of the U. S. Commissioner of Labor for 1906. It is a book of nearly a thousand pages giving the results of an investigation of this subject for 1901-1905 inclusive and summaries covering the period from 1881 to 1905 inclusive. In the 25-year period there were 36,757 strikes and 1,546 lockouts lasting more than one day. Strikes occurred in 181,407 establishments and lockouts in 18,547, making a total of 199,954 places affected in this way. The number of employes thrown out of work because of strikes was 8,703,824, and the number of those locked out was 825,610, making a total of 9,529,434 people, exclusive of those who were idle on account of shut-downs, which resulted in other industries than those in which these troubles were actually occurring. Of the 36,757 strikes, 69 per cent. were ordered by labor unions, and of the 181,407 establishments involved in strikes, 90 per cent. were included in strikes ordered by labor unions. The average length of a strike was 25.4 days. The employes succeeded in winning all their demands in 48 per cent. of the establishments, partly succeeded in 15 per cent. and failed to win anything in the remaining 37 per cent. Lockouts lasted 84.6 days on an average. They resulted wholly in favor of the employers in 57.2 per cent. of the establishments involved, were partly successful in 10.71 per cent. and failed in 32.09 per cent. The most common cause of strikes was a demand for more wages, which alone was at the bottom of 32 per cent. of these disturbances and was a partial cause of about 8 per cent. more. The cause next in importance was a demand for recognition of unions and union rules. Over half of the lockouts were caused by a refusal to recognize union demands. Over a quarter of all the strikes and over a third of all the establishments they affected were in the building trades. About 25 per cent. of the strikers were in Pennsylvania, 21 per cent. in New York, 13 per cent. in Illinois, 6 per cent. in Ohio, and 5 per cent. in Massachusetts. The volume contains a great mass of statistics on the subject, and also a large amount of information regarding strikes and lockouts in other countries. (Washington, Department of Commerce and Labor.)

The fifth edition of Mr. Edward Wegmann's "Design and Construction of Dams" has been thoroughly revised so that the new theories of the design of masonry dams and the many important recent structures of both standard and novel character are explained. This edition contains 93 more pages, 39 more plates and 45 more figures than appeared in the edition of 1904, and a considerable part of these additions give information not readily found elsewhere. The book has been regarded for so many years as one of the standard American engineering treatises that it is hardly necessary to give any long review of its contents, which cover all types of fixed and movable structures for impounding water. (New York, John Wiley & Sons, $6.00.)

Letters to the Editor.

Rock Tunneling Machines.

Sir: In the number of your paper for Oct. 19 I was very much interested in the article on the machine for tunneling in shale. I send you a photograph of a small section of the tunnel which the machine bored before it was removed. The total distance bored was about 2 ft. We all regretted very much the failure of the machine to carry out the work.

Yours truly,
H.

A Reinforced Tile Wall.

Sir: As bearing on the note in your paper of Oct. 12 concerning reinforced brickwork, I would call your attention to a test of a partition wall in the Criminal Court Building, Berlin, designed by me while chief engineer of the Lolat Concrete-Steel Construction Co. of that city. The belief that brickwork containing steel reinforcement was about as "monolithic" as reinforced concrete led me to propose such material about four years for some 170,000 sq. ft. of partitions. The wall built for a test consisted of two thin walls of porous brick or tile. Running lengthwise of the wall at four of the longitudinal joints were ⅜-in. rods, two rods being used to each of the three upper sets of reinforcement and four in the bottom set, which was in a joint close to the floor. The wall was tested by laying transverse I-beams across the top and suspending a platform from their ends on each side, and then loading the platforms. This wall was one of seven submitted in competition, and although it contained the smallest amount of steel it had the highest test load. In fact, it was impossible to cause any cracks or marked deflection by any load that could be applied.

Yours very truly,
O. Gottschalk.

Chicago, Oct. 18.

Restricting Competition on Local Work.

Sir: From investigations of the past records of public work, we are of the opinion that proposals for public work are not advertised in over 20 per cent. of the work let. The lack of this publicity causes little, if any, competition, and it permits a few local contractors to take work at high figures, and also permits illegal combinations between a few local contractors, resulting in the pooling of bids at the city's expense. In our work in something over 130 municipal plants, we have always adhered to the policy of advertising the work in some engineering and contracting papers. An investigation of Oklahoma and Indian Territory records show twelve waterworks plants installed in the last year, none of which were advertised except in the home paper, the work going to a combination of two or three contractors whose engineer withholds the publicity of the letting.

We are writing to suggest the advisability of a certain movement on the part of engineering and contracting papers to attempt to get legislation in the different States, compelling the advertisement of public work in engineering and contracting papers. This could especially well be taken up with the new State of Oklahoma, where laws will soon be made pertaining to public work. We believe, however, that similar legislation could be recommended and passed with slight opposition, and perhaps no opposition, for representatives from the cities would realize at once that this would result in saving much to the cities.

Knowing that you are interested in this matter, we would be pleased to receive your ideas and any suggestions you may have along this line.

Very truly yours,
Burns & McDonnell.

Kansas City, Oct. 22.

[The opinions of The Engineering Record on this subject have been stated at considerable length on several occasions, the last time on July 4, 1903. Assuming that a failure to advertise proposed work in journals of wide circulation is due only to a desire to restrict competition to local contractors, which is generally the case, it follows that such a plan simply results in throwing large contracts into the hands of people without resources for handling them. Local contractors of experience and business standing can underbid outside contractors on works up to the limit of their resources, and it is noteworthy that where large works must be done and outside firms are given the contracts they generally engage local sub-contractors and workmen and buy their supplies locally so far as practicable. It is far better for a community to advertise all large works and thus have them constructed by a company of experience and financial resources than to let the works to local parties who do not know how to carry them on and do not have the financial standing necessary to handle such extensive operations. Letting such works to local parties without outside competition is simply giving them a business education at the expense of the taxpayers without any good resulting to the city or citizens.—Editor.]

Cut by Tunneling Machine.

The Importance of Steffan and Boltzmann's Radiation Law.

Sir: In a forthcoming bulletin entitled "Study of Four Hundred Boiler Tests, with Deductions," the Steam Engineering Division of the United States Geological Survey treats of the lately developed and proven law of Steffan and Boltzmann regarding the total radiation of heat (including light) from a hot to a cold body.

It was formerly thought that the amount of heat radiated was proportional to the temperature difference. Inasmuch as former experimental work was done at low temperatures the error of this assumption was very small. But of late years, since interest has arisen in the quantitative investigation of high temperature furnaces, it has become important to think with the true law in mind. This law of Steffan and Boltzmann states that if two infinite plane surfaces are close together, or, better yet, if a ball is inside a hollow sphere, all surfaces being in all cases of the same material, in the same state of surface finish—this law states that the rate of heat radiation from the hotter to the cooler surface is:

Rate of radiation $= K\ (T_1^4 - T_2^4)$.

Where $K =$ a constant for any particular set of bodies and surfaces $T_1 =$ the absolute temperature of the hotter body, $T_2 =$ the absolute temperature of the colder body.

The above equation is equivalent to stating that each body radiates heat and receives heat by radiation; that the rate of radiation from each body is proportional to the fourth power of its absolute temperature; and therefore that the net amount of heat given up by the hotter body to the cooler one is proportional to the difference of the fourth powers of their absolute temperatures.

The above mentioned forthcoming bulletin giving a "Study of Four Hundred Boiler Tests, with Deductions," makes a number of applications of this law. Some similar applications are given below.

In a Heine water-tube boiler having the lower row of tubes over the furnace completely encased in clay tiles, excepting about 3 ft. at the rear end, over the combustion chamber, this exposed 3 ft. of tubes absorbs heat not only from convectional contact with the gases entering the boiler, but also from intense radiation from the white-hot combustion chamber walls and bottom.

The soot covering of the water tubes is of a different surface and finish from the surface of brick and slag constituting the combustion chamber walls and bottom; nevertheless, the above equation will hold approximately, and a couple of examples are given to show the enormous increase of this radiation factor with rise of combustion-chamber temperature.

Example 1.—Let the soot on the exterior of the water tubes have an average temperature of 1239° F.—a dull red heat. Adding 461° F. to get the absolute temperature, we have $T_2 =$ 1700°.

Assume the rear furnace temperature to be 2039° F., a rather poor condition of operation. Adding 461° to 2039° we have $T_1 = 2500$. Then, net heat received by tubes per second from furnace bottom and sides $= K\ (T_1^4 - T_2^4) = K\ (2500^4 - 1700^4) = K\ (30{,}710{,}400{,}000{,}000)$.

Example 2.—Let the average soot temperature be 1239° F. or 1700° F. absolute as before.

Then $T_2 = 1700°$. Assume that the average rear combustion-chamber temperature is only 500° higher than in Example 1; that is, 2539° F., a medium temperature; then $T_1 = 3000°$.

Then, net heat received by tubes per second from furnace bottom and sides $= K\ (3000^4 - 1700^4) = K\ (72{,}647{,}900{,}000{,}000)$.

Example 3.—Assume as before $T_2 = 1700°$ absolute and raise the furnace temperature another 500° F. to 3039°, which would be wall tempera-

ture in quite a hot furnace. Therefore, $T_1 = 3500°$.

Then, net heat received by tubes, etc. $= K (3500^4 - 1700^4) = K$ (141,710,400,000,000).

SUMMARY OF EXAMPLES.

Dropping the constant K and the last twelve figures of every answer, we have,

Furnace Temp.	Tube Temp.	Number to Which Net Radiation is Proportional.
2039° Fahr.	1239° Fahr.	31
2539	1239	73
3039	1239	142

The heat absorbed from radiation practically doubles with every 500° increase in combustion-chamber temperature.

As a matter of fact the temperature of the soot on the tubes rises a little as the furnace-wall temperature rises, and it is also a better radiator of heat than is the brick wall. Nevertheless the above examples are substantially correct.

The above calculations give no idea as to whether the percentage of heat received by a boiler from radiation is the larger or smaller portion of the whole. In the "Study" mentioned some numerical calculations are given, determined by two independent methods of approach. The results are probably right within 20 per cent.

It is evident, in the case of an ordinary multitubular boiler burning smokeless coal right under the boiler shell, that perhaps half of the heat enters the water from a radiation source. Even in water-tube boilers it may be about 20 per cent.

In locomotive boilers the firebox may sometimes absorb perhaps 30 to 50 per cent. of the total heat absorbed, most of this 30 to 50 per cent. being due to radiation.

The engineers of the Steam Engineering Division were recently much surprised at the magnitude of thermometric errors due to radiation when measuring the temperature of dry gases. If the bulb of a thermometer have a chance to "look out-doors" when in a hot chamber surrounded by a flowing stream of hot gas, it may read twenty or thirty degrees low at the moderate temperatures of 500 or 600° F.; nor does the "window" have to constitute a very large percentage of the chamber walls in which the bulb is situated. Two thermometers a little over an inch apart in the same long chamber, swept by the same stream of hot air, were found to read nearly 100° apart; a third one farther along, carefully closed in, read nearly as high as the first one. All the instruments were carefully calibrated and were repeatedly interchanged.

In superheated steam work such errors are very persistent. It is no easy matter to get the temperature of a flowing stream of superheated steam within 10° of the true temperature. It may be said that under such circumstances the thermometer bulbs are always colder than the steam; the only question is, how much? This fact alone will explain away many troubles engineers have had in working with superheated steam and other permanent gases.

In determining the temperature of flue gases in boiler practice the errors due to radiation of heat from the thermometer bulb are usually large. Unless the bulb is carefully protected from radiation by two or three concentric chambers around it, it is likely to read dozens of degrees low. A moment's reflection will make it evident that all surface ordinarily "visible" to the thermometer bulb is hundreds of degrees colder than the gases (and than the bulb). This is true of the brickwork, the adjacent water tubes and steam drums, the stack and the sky above.

The measurement of the temperature of a permanent gas is a high art.

WALTER T. RAY.

DIAGRAM FOR REINFORCED CONCRETE BEAMS.

SIR: In your issue of July 27 of this year you published an abstract of the report of the British Joint Committee on Reinforced Concrete, containing certain formulas recommended by that Committee for use in proportioning reinforced concrete structures. I am sending you herewith a diagram showing certain relations in those formulas, which may be of some interest to your readers.

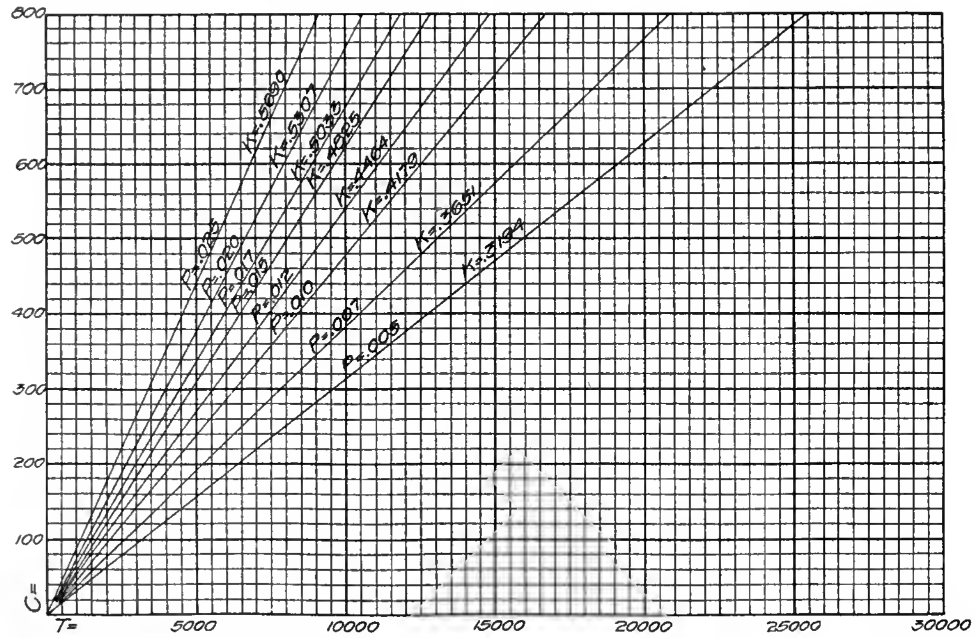


Diagram for Reinforced Concrete Beams.

In this diagram C is the compression in the extreme fiber of the beam, expressed in pounds per square inch; T is the tensile stress in the steel, expressed in pounds per square inch; P is the ratio of the area of steel to the area of concrete, and K is the ratio of the distance of the neutral axis below the extreme upper fiber to the distance of the center of gravity of the steel below the extreme upper fiber. The ratio of the coefficient of elasticity of steel to the coefficient of elasticity of concrete is assumed to be 15.

Yours very truly,

GEO. T. PRINCE.

A FORMULA FOR LATTICE BARS.

SIR: In your issue of October 12, Mr. Henry S. Prichard has a letter on stresses in the lattice bars of columns. I send herewith some notes on a formula that will give, I think, approximate results.

Let L be the length of the column in feet, A the area of its section, Q the section modulus for the axis Y Y in Fig. 1, r the least radius of gyration in inches, l the length of the column in inches, w the load per linear foot of the column as explained below, r' the radius of gyration for the axis Y Y in Fig. 1, and n the distance of the extreme fiber from the axis Y Y.

The New York law gives the following formula for the pressure in pounds per square inch, $15{,}200 - 58\ l/r$, or if l is in feet, $15{,}200 - 696\ L/r$. If L is very short then we can use 15,200 lb. per square inch, and under this assumption evidently $696\ L/r$ may be taken as the stress per square inch due to bending in the column. Calling this stress S',

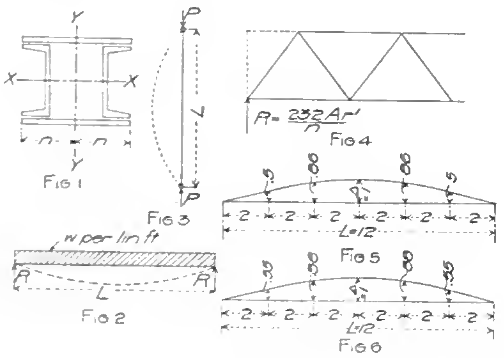
$$S' = 696\ L/r'.$$

If the column is put in a horizontal position and a load w per linear foot is applied, it would tend to take the shape shown by the dotted line in Fig. 2. If the column is pin-connected top and bottom and a load P is applied, it will take the shape shown by the dotted line in Fig. 3, or approximately the same curve shown in Fig. 2. Therefore we may assume that the bending in the column is the same as would be caused by an evenly distributed load as shown in Fig. 2. Then $w\ L^2/8$ is the bending moment in foot-pounds, or

$$12\ w\ L^2/8 = \text{Bending moment in in.-lb.}$$

But $m/Q = S''$

where S'' is the stress per square inch due to bending.



Lattice-Bar Diagrams.

Hence $12\ w\ L^2/8\ Q = S''$. But $Q = Ar'^2/n$ and therefore $S'' = 12\ wl^2/8\ Q \times n/Ar'^2 = 3\ wL^2n/Ar'^2$. But $S' = S''$, therefore $696\ L/r' = 3wL^2n/2Ar'^2$ and $w = 464\ Ar'/Ln$. Hence R in Fig. 2 is found from the expression $R = 464\ Ar'/Ln \times L/2$, and $R = 232\ Ar'/n$.

Having found the end reaction R it is easy to find the stress in a lattice bar by treating it the same as a lattice truss, see Fig. 4. If the column is fixed at both ends, the bending moment will be $wL^2/12$, which gives

$$R = 348\ Ar'/n.$$

A comparison of the two curves in Figs. 2 and 3 may now be made.

The curve shown in Fig. 3 is a sinusoid whose equation is $y = \Delta \sin n\ \pi\ (x/L)$. (See Merriman's "Mechanics of Materials," 1894 edition, p. 115). In the case considered $n = 1$, and if we assume $\Delta = 1$, the equation reduces to $y = \sin \pi\ (x/L)$. If we plot this curve, using 12 for L, we get the coordinates shown in Fig. 5.

Referring now to Fig. 2, we have a parabola, and if we plot this curve we get the coordinates shown in Fig. 6.

By comparing Figs. 5 and 6, we see that they are approximately the same. When Δ is very small, which is the case in columns, we can therefore safely say the two curves are alike.

Yours truly,

W. W., PEARSE.

NEW YORK, Oct. 19.

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Of this issue of THE ENGINEERING RECORD 15,000 copies are printed. Total circulation for 1907 to date, 657,000 copies, an average of 14,600 copies per week.

TABLE OF LEADING ARTICLES.

The Denatured Alcohol Situation.

In the last issue of The Engineering Record the Department of Agriculture's recent tests of gasoline engines with alcohol as fuel were briefly described. In spite of the denatured alcohol law and the interest it excited, the results up to date have been inconsiderable so far as fuel uses are concerned. It is somewhat unfortunate that wood alcohol remains still the chief material used in the denaturing process, since when used in so large a proportion as 10 per cent. it is a considerable item of expense, while the pyridin bases employed if the amount of wood alcohol is reduced are not produced in material amount in this part of the world. This rather complicates the situation if one attempts to get alcohol from the cheapest present source, i. e., the refuse of cane sugar production. In the sugar producing countries alcohol can undoubtedly be made at a figure which would permit its importation and denaturing at a price which would put it into immediate competition with gasoline. It is therefore much to be desired that a more convenient and cheaper process for denaturing should be authorized if one can be found.

As regards the results obtained with alcohol in gasoline engines, they are upon the whole very encouraging. Of course there is no getting around the fact that gasoline has a higher thermal value than alcohol, gallon for gallon, in the ratio of nearly 3 to 2. Obviously alcohol must be obtainable at about two-thirds the price of gasoline to put it in full competition merely on the basis of fuel cost. With gasoline at the prices now current in this country such competition in the gross, as it were, is for the present unlikely. But nevertheless the use of alcohol should be encouraged as an automatic check on increase of price in gasoline. This substance being practically in the hands of a monopoly such a check is exceedingly important, lest the price should suddenly be put up, let us say to the much higher figure prevalent abroad. As regards net value for the purposes of its use, alcohol has a much better situation, especially as regards its employment in automobile engines. The gain in its use is two-fold; first, it gives somewhat greater power in an engine of given size; and, second, it burns far more cleanly. As regards the first count, one can therefore build a somewhat lighter and smaller engine for the same output. This is a distinct help for one of the prevalent vices in automobile design is excessive weight for the motive power carried. A heavy engine means heavy supports. Incidentally the lessened danger of auto ignition when using alcohol makes it easier to use air-cooled engines which still further lightens and simplifies the structure. Further the much cleaner combustion of alcohol lessens the danger of overheating and the chance of serious friction from the accumulation of soot in the cylinders. Gasoline is of complicated and variable composition and its tendency is to leave hard carbonaceous residues unless the combustion is exactly what it should be. And proper combustion in automobile operation is very difficult to maintain.

For these reasons there would seem to be a strong probability that the use of alcohol would tend to materially lessen repairs, an improvement which is very greatly to be desired. In spite of the fact that gasoline engines as now made can be used with alcohol the researches described last week make it pretty clear that some minor changes in carbureters and compression, and perhaps in ignition are desirable in an engine to be used exclusively with alcohol. It is to be hoped that some of the more enterprising automobile makers will take up the question and be prepared to furnish first class alcohol engines if desired. The gain in the abolition of the unpleasant odor of gasoline is a material one, too, especially in cities where many malodorous machines are now in use. If some of the large makers would thus take hold of the question and arrange to keep in stock denatured alcohol in the large centers, a considerable gain would be made. Even now Cuban alcohol could probably be denatured and imported at a figure that would not be at all prohibitive.

As regards the use of alcohol in ordinary stationary engines the possible gain is less. Such engines can be run under fairly uniform conditions of combustion, and a little extra weight is of small moment. With the introduction of small gas producers, too, giving less fuel cost even than gasoline, there will be a tendency to confine the use of stationary gasoline engines to very modest sizes so that they will become relatively less important. Still if the production of cheap alcohol once gets fairly under way there is a good chance that the price can be brought to a figure that will encourage its use, especially since in some parts of the country the transportation charges on gasoline are considerable, while alcohol may be of local manufacture. At all events the automobile side of the matter may easily rise to considerable importance, and it is earnestly to be hoped that the work will be rapidly pushed along.

Interpreting Power Plant Tests.

Whatever may be the object of a test of a commercial power plant, the interpretation of the results secured is unquestionably the most important part of the whole task. Too little emphasis has been laid in the past upon the analysis of test results, in comparison with the pains bestowed upon the test apparatus, its arrangement and readings. To secure consistent figures from a more or less complicated outfit of inter-related machinery during a service trial requires a high order of technical knowledge, but to dissect the detailed columns of test figures obtained in the field and marshal them in groups for or against a given policy in design, construction or operation, calls for the most experienced judgment of the trained engineer.

Without carefully obtained test data it is, of course, almost impossible to draw correct conclusions. No sensible engineer would minimize the need of accurate readings and full records of all unusual conditions arising during a test—and few tests are run off under commercial conditions without the presence of disturbing factors which a pure theorist would overlook in planning the work. To the outsider one day looks very much like another in a plant handling routine service, but the operating man inside the station walls realizes that even in such a uniform business as handling the morning and evening rush hour loads of a street railway system on two successive days in the same season of the year, contingencies and differences in hourly conditions are bound to keep him on the anxious seat until the peak load has been passed. Granting such points as this, however, does not for a moment lessen the responsibility of those who are to interpret the data secured.

The practice in some companies requires the testing engineer to submit comments upon his experiment data when presenting the figures to his executive officers. Such a course need not in any way vitiate the analysis of the figures which the higher officer may bring to bear, and in many cases it opens the way toward a much closer co-operation between the head of a department and his subordinates. It is easy for young engineers to fall into the error of assuming that everything needful has been done when a set of test data has been carefully tabulated. If heads of departments would more generally encourage the presentation of critical comments with their subordinates' test figures, even in minor investigations, there is no question that many valuable suggestions would thereby be placed on file, instead of overlooked or lost, as is too often the case. In matters like counting stores and checking up carload shipments figures speak for themselves; but in a power plant test a correct interpretation requires full knowledge of the conditions and arrangements obtaining at the time.

Among the sources of inaccurate deductions from test records are failure to separate different kinds of output in relation to the station load

as a whole, omission of instrument, tank and scale calibrations, and consequent calculation of costs without reference to the accuracy of the readings, absence of calorific determinations upon representative fuel samples, neglect of atmospheric and weather conditions in studying the results of chimney and blower performance and failure to appreciate the load factors and efficiencies of individual machines contrasted with the station as a whole. In order to interpret the results of an extensive test on a large plant it is very desirable to know what similar equipment may be expected to do and what it has done in other installations; and if the plant which has been tested is to be modified in arrangement or operating methods the hours of service of each important unit need to be studied quite as carefully as the possible sources of energy loss in the chain of events between the coal bunker and the bus bar. The condition of the apparatus with regard to repairs and depreciation, its performance at different seasons of the year under varied load conditions, the number of men on the operating shifts and their personal equations all need to be considered before any sweeping change in station design or methods of handling is carried into effect. It is a great mistake to make a hasty decision to modify a plant's equipment in the light of a single test taken by itself without relation to daily records of service. If a test shows the existence of unfavorable conditions it is far better to endeavor to improve the economy of the existing installation then to tear out important parts of it on the strength of a single test interpretation. Sweeping changes are better the result of both tests and corroborative operating experience.

The British Machinists' Agreement.

Few things have occurred of late in the manufacturing world so instructive as the agreement recently signed between the Engineering Employers' Federation and the representatives of the three leading machinists' trade unions in Great Britain. The history of this agreement is worth consideration. For some time prior to 1897 there was a dispute between employers and employees in the machinery industries of Great Britain over the eight-hour day. The unions had been fairly well organized long before that date, and consequently the fight they put up could be readily directed by central authorities. On the other hand the employers were without any association for a considerable time. Each man was striving to enforce his own ideas in his own way and as a result there was a long-drawn-out struggle disastrous for the machinery trade of the country. During that time the United States and Germany obtained a large amount of business which would naturally have gone to Great Britain, and neither men nor employers gained materially by the strife. A national trade union fighting against dissociated manufacturers has always a great advantage. The struggle can be confined to those places where the conditions are most favorable to the union and work can be continued in places where the union has little to gain, so that funds for the strike can be contributed by the men of one district to those of another. Owing to this former lack of agreement among employers, shop rules and methods differed widely in different parts of the country, and in consequence the cost of production of the same kind of output varied widely. The disturbances prior to the strike of 1897 brought this fact home to the manufacturers very vividly, and as a result the Engineering Employers' Federation was formed, which in 1898 successfully demanded and enforced practically uniform conditions in all parts of the kingdom.

When the Federation and the unions drew up their first agreement nine years ago, there still remained a very bitter feeling on the part of some of the representatives of both sides of the warring interests. Since the representatives have become better acquainted in the course of their duties in settling differences of opinion between employers and employees, a very much better feeling has arisen. The old days of the influential blatherskite have largely passed away, and at the same time a tremendous pressure has been put upon the employer who says he will be hanged if he will allow anybody to dictate how he shall treat his men. The trade unions have sent their best men to represent them in conferences with employers, and the latter have sent tactful representatives to these meetings. Both sides have been the gainers in consequence, and there is now a feeling of mutual respect between the two parties, which is a favorable sign of industrial tranquility and a better appreciation of the obligations of all concerned in the engineering trade. This is well shown in the new agreement between the two parties.

Under the terms of this agreement the members of the Federation agree not to interfere with the proper functions of the union and the latter agree not to interfere with the employers in the management of their business. This is a sort of general statement which has definite meaning only in the light of the subsequent clauses of the agreement. These are important on account of their explicit nature. For example, it is specifically provided that every employer may employ any man, and every workman may take employment with any employer, whether the workmen or the employer belongs or not to a trade union or to the Federation respectively. Furthermore the trade unions recommend all their members not to object to work with non-union workmen, and the Federation recommends all its members not to object to employ union workmen on the ground that they are members of a trade union. Moreover, no workman will be required, as a condition of employment, to make a declaration as to whether he belongs to a trade union or not.

The old source of controversy over piece work seems to be pretty well eliminated by the terms of the agreement. Employers and their men are entitled to work piece work under certain conditions. The first of these is that the prices to be paid shall be fixed by mutual agreement between the employer and the men who perform the work. The second condition is that each workman's daily pay is to be guaranteed irrespectively of his piece work service. The third condition is that overtime and night shift allowances are to be paid in addition to piece work prices on the same conditions as already prevail in each workshop for time work. As regards overtime, both the Federation and the unions agree that systematic overtime is to be deprecated as a method of production and that when overtime is necessary the following conditions should be observed so far as possible. No union workmen shall be required to work more than 32 hours overtime in any four weeks after full shop hours have been worked, allowance being made for time lost through sickness, absence with leave, or enforced idleness. On the other hand the agreement specifically states that overtime ought not to be restricted in cases of breakdown, repairs, alterations for employers or their customers, trial trips and repairs to ships, and cases where urgency or emergency enter.

The rating with respect to pay is one of the most important features of the agreement. Under its terms employers have the right to employ men at rates of wages mutually satisfactory to both parties. In fixing the rates of skilled workmen the employer is expected to pay attention to the prevailing rates in the district for fully trained and skilled men. The unions disclaim any right to interfere with the wages of the men other than their own members, but, under the agreement, have the right in their collective capacity to arrange the rate of wages at which their members may accept work. General alterations in the rate of wages in any district are to be negotiated between the employers' local association and the local representatives of the trade union or unions concerned. The agreement concerning apprentices is an unusually sensible one. It provides for no recognized proportion of apprentices to journeymen but authorizes the unions to bring forward for discussion the proportion of apprentices generally employed in the whole federated area. This means, probably, that where more apprentices are employed than customary, the union shall have the right of talking the matter over with the employers. The agreement further states that the apprentice shall be afforded facilities for acquiring a practical knowledge of the branch of trade he adopts and shall be encouraged to obtain a theoretical knowledge of it so far as circumstances permit. This is already the practice in a good many of the leading British works, where apprentices are required to attend evening classes and in some cases are rewarded by prizes for specially meritorious work. The agreement also specifically provides that employers have the right to select, train and employ those whom they consider best adapted to the various operations carried on in their workshops and to pay them according to their ability as workmen. The employers have full discretion under the agreement to appoint men they consider suitable to work all their machine tools and to determine the conditions under which they shall be worked.

The most important section of the agreement is probably that which provides for avoiding disputes. Many employers have an extreme dislike to receiving union representatives and in some places men are reluctant to go to their employers with a grievance lest they be discharged. In the new agreement just signed due weight has been given to these conditions. Deputations of workmen will be received by their employers by appointment for mutual discussion of any question in the settlement of which both parties are directly concerned, or it will be competent for an official of the trade unions to approach the local secretary of the employers' association with regard to any such question, or it shall be competent for either party to bring the question before a local conference to be held between the local association of employers and the local representatives of the trade unions. Local conferences are to be held within twelve working days from the receipt of the application by the secretary of the employers' association or of the trade union. Failing settlement at a local conference it shall be competent for either party to refer the matter to the executive board of the Federation and the central authority of the trade union concerned. The agreement provides that there shall be no stoppage of work, either partial or general, but work shall proceed under the current conditions until the procedure indicated has been carried through. The agreement specifies who shall be considered local officials of the union, and refuses to permit an employer who declines to employ trade-union men to sit in the central conferences composed of members of the executive board of the Federation and members of the central authority of the trade union, called to consider questions which the local conferences cannot decide.

The new agreement has two significant features. The first is the centralization of authority on the part of both employers and trade unions. The men who are intrusted to represent each party to such an agreement will naturally feel the weight of their responsibilities, and will be

less inclined to act hastily concerning controversies that may affect the entire industry in which they are interested throughout the kingdom. This centralization of authority is simply another indication of the tendency of the times and must be accepted as inevitable and probably as advantageous. The other important consideration to be observed is the added security given to the workmen on account of the Employers' Federation standing between him and any arbitrary and unreasonable employer. The day of the all-around mechanic has practically disappeared. A man may learn to run one or two tools, but that is about all. If he becomes a planer hand he will probably remain a planer hand for life, going from one shop to another and doing different kinds of work at them, but still working on a planer. As a result of this condition he cannot shift so readily from one employment to another as could the man who worked in the old-fashioned way. He naturally must seek some measure of protection and there is no way which furnishes such protection as the well-managed trade union. It is a fact of the deepest social significance, therefore, that the full recognition of the leading British trade unions engaged in the machinery industry, which is accorded by the agreement under consideration, has met with approval rather than criticism by the most conservative organs of the employers of such labor. Let us hope that all parties to this new agreement will live up to its spirit of fairness and mutual consideration, so that the British engineering trades may regain the strength and vigor they possessed ten years ago.

Engineering Education in France.

It has generally been understood that the system of education in the Polytechnic School and the School of Mines of France was a matter of great pride to French engineers. Accordingly it is surprising to learn that there is a feeling of considerable doubt among them of the advisability of the theoretical instruction in these institutions. The vice-director of the School of Mines at Paris, M. André Pelletas, is among those who recently have expressed a fear that the instruction was too much along the lines of higher mathematics. These views have been held for some time by engineers who have not had the advantage of a polytechnic education, but their recent confirmation by men who graduated from the great national schools and have since achieved distinction is attracting considerable attention. The Polytechnic School is the leading French technical institution, its graduates being ranked above those of the Central School of Arts and Manufacturers, where a more practical training is given. The graduate of the Polytechnic School has a certain distinction which helps him to obtain employment and tends to facilitate his advancement. The officials of the French railways are largely drawn from the ranks of the graduates of this school and most of the technical staff of the national government were educated at this institution, which, indeed, was established in 1794 to furnish specially trained men for government service.

The course of instruction at the Polytechnic School is largely mathematical, and the other portions of it are influenced considerably by the consideration that many of the students enter the army. The graduates of high standing have a large number of openings in the state service from which they may choose, while the men at the lower end of the class have to take what is left after their superiors have made their selection. The range of these positions is something astonishing. In the army, there is a choice between the artillery and engineering branches. In civil life there are situations in the state mining departments, the bureau of bridges and highways, on river and harbor improvements, in lighthouse construction and maintenance, in the supervision of state monoplies of tobacco, matches and powder, in the inspection and the technical and commercial administration of railways, in the postal and telegraph service, in naval architecture, on hydrographic surveys and in various other lines of work which it is hardly necessary to enumerate. In order to equip the polytechnic graduate for many of these positions it is necessary for him to attend a further course of study in some other school. His highly theoretical training has been so deficient in practical subjects that a three-year course at the Mining School is therefore essential. Some of the students at the Mining School do not attend the Polytechnic School before they take up the practical courses of the former, but they are not ranked so high as the Polytechnic graduates. At the Mining School they study various practical subjects and at the same time, however, have to review the higher mathematics which they learned at the first school. As a result of the long period of education and their army service, the average of the graduates of the Mining School who also studied at the Polytechnic School is about 28 years.

The critics of this system of education assert that a large part of the time spent at the schools is practically wasted. They believe that the graduates would be just as well educated in every sense of the term if they pursued advanced theoretical subjects to a far smaller degree. They also believe that a feeling of general distrust of the national technical educational system is arising. The managers and technical directors of many of the largest industrial works are drawn from the graduates of the schools named, and there seems to be a sort of understanding among them that the men promoted to the higher positions in their works should be other graduates of the same schools. Consequently a young man whose education has not included a course in the Polytechnic School, who has shown great ability in working up through any department of the industry with which he is connected, suddenly finds his advance to the highest positions blocked in favor by somebody who has shown by no means the same ability as himself.

It is interesting to notice that these severe criticisms of French engineering educational methods are not from those who have failed to achieve distinction but from eminent graduates of the schools themselves. If half of what they say is true, and certainly their standing warrants the acceptance of everything they assert as an accurate presentation of actual facts, then it is high time for a reform. The situation, in fact, resembles in many respects that in Great Britain some ten years ago, when the educational methods there were so severely shaken up by some of the leading scholars of Great Britian. The rumbling of that disturbance even echoed through the United States and The Engineering Record can bear witness to the fact that some three or four years ago the British mathematical reforms were the subject of widespread interest in the United States.

Notes and Comments.

MR. GEORGE WESTINGHOUSE has the sympathy and good wishes of all Americans who delight in good work well done. For the second time in his career financial troubles are interfering with some of the great enterprises he founded and has carried on. He met the first crisis successfully, and carried forward the many enterprises in which he was interested until at the present time there are thirty-one Westinghouse companies in this and other countries, having a total capital of $120,000,000 and an annual output estimated to be worth about $90,000,000. Some 38,000 men are employed by these companies in twenty-four factories, turning out products of every sort. The air brake which has made high-speed railway traffic possible, the introduction of automatic block signals to increase the safety of railway travel, the introduction of natural gas in the Pittsburg district, the development of electrical apparatus, particularly of alternating current apparatus, the development of steam and gas engines and many other things too numerous to mention, lie to his credit. All of these things have been pushed forward manifestly for some other purpose than personal gain. Any ordinary business man would have been satisfied with the success achieved in one of them, but the incentive of genius made it impossible for Mr. Westinghouse to withhold his hand from anything where he saw a chance to do good work. What he has done in the last few years has been of so much benefit to the world that there is every reason for anticipating more achievements by his compelling force. At the present time, while he is facing the difficulties of unsnarling the financial tangles of the affairs of some of his companies, he has the sympathy of all who appreciate in any degree what great contributions he has made to the nation's prosperity, and how much may still be expected from his creative genius.

A RAILROAD ANNOUNCEMENT which has attracted little attention during the period of financial strain just passed was that of the sale of the Port Chester and the Westchester roads to the New York, New Haven & Hartford Railroad Co. These electric projects attracted much attention a year or more ago. They were looked upon as the beginning of real rapid transit in the section immediately northeast of New York City. One of them, at least, was begun in good faith for the purpose of building up a suburban transportation business in Westchester County and the Borough of the Bronx. The absorption of both companies by the New Haven road puts an end to all prospect for the time being of any competition in passenger traffic in the district in question. Whether this clinching of a monopoly will be to the detriment or to the advantage of the people served remains to be seen, although this journal is of the opinion that advantage rather than disadvantage will result. Both of the proposed roads had a rather unsatisfactory termination near the end of the Lenox avenue subway, while the New Haven road will hardly be satisfied with any such crossroads terminal. Probably very few people know just what the New Haven company proposes to do, but it seems reasonably certain that such a great corporation will never be satisfied without its own station in the Borough of Manhattan, even if it has to build a great subway system to attain its purpose.

THE CURTAILING OF EXPENSES ordered by the Pennsylvania Railroad directors during the coming year is something which should occasion no surprise. That road has been spending money for a number of years with a lavish hand; in fact, some people have looked with apprehension upon the great expenditures that have been made. A large part of the work for which these great sums have been paid out is now practically complete, and a heavy reduction in construction expenses can be made without affecting traffic to any extent. In view of the present financial troubles and the prospect of tight money, which a year of presidential election always presents, there is manifestly every incentive of going slowly for the next few months. It is understood that those works which affect the public convenience in any direct way will be pushed along with the same vigor as in the past, but that undertakings mainly to the advantage of the company will be checked until the normal condition of affairs is again assured.

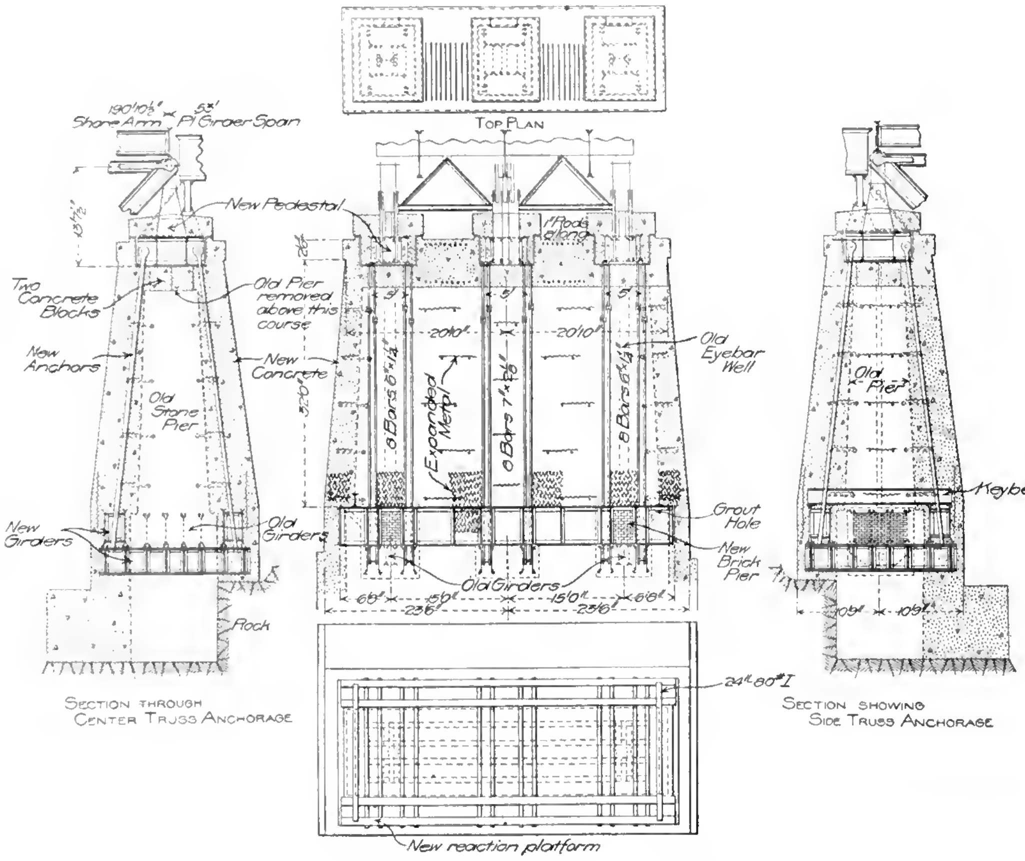
THE RECONSTRUCTION OF THE ANCHOR PIERS OF THE POUGHKEEPSIE BRIDGE.

The double track bridge over the Hudson River at Poughkeepsie was, when built, one of the first and most important long-span high railroad bridges in this country and was one of the first examples of cantilever erection. It has a total length of 6,747 ft. and a height of 212 ft. from the surface of the river to the base of rail. There are five main spans of 525 to 548 ft. lengths, besides high steel approach viaducts, with spans of 53 to 175 ft. The sub-structure is of ashlar masonry, with the river piers supported in deep water on very long footings. The superstructure is of steel and was proportioned for a live load on each track, consisting of two coupled locomotives, each with four 24,000-lb. axle loads, followed by a train load of 3,000 lb. per linear foot. After many years of constant use and hard service it was found that the bridge structure needed extensive reconstruction to endure the present heavier traffic and provide for a live load increased to 45,000 lb. on each locomotive axle and 3,600 lb. train load per lineal foot.

After a careful inspection and the study of alternate plans, it was decided to build additional columns in the viaduct towers, to provide new trusses and reinforce the existing trusses in the longer approach spans, to replace the short approach spans with new plate girders and to add a new line of center trusses between the old trusses of the main spans and new towers to support them. It was also necessary to make extensive alteration in the masonry and to provide entirely new and increased anchorage for the ends of the anchor-arm trusses. A general outline of the work was published in The Engineering Record of Oct. 28, 1905, and was followed on Aug. 18, 1906, by a description of the very novel and interesting methods used in replacing the short spans of the viaduct at a great height without the use of falsework. Since then work has progressed on the longer viaduct spans, on the main spans and on the substructure, and this article will describe the difficult and hazardous operation of reconstructing the anchorage piers and anchorage system while the bridge was under traffic.

The original west anchorage pier was about 48 ft. high, 7 ft. wide and 36 ft. long at the top and 11 ft. wide by 41 ft. long at the base, and had footings seated partly on the solid rock and partly on an inclined stratum of clay. Four longitudinal plate girders 4 ft. deep and 36 ft. long were built into the lower part of the masonry and served as a reaction platform for two vertical chains of eyebars, one in the plane of each truss, which passed between the girder webs and were connected to transverse bearing girders at each end. When the pier was constructed the bearing girders and portions of the reaction girders above them were left exposed in rectangular chambers 6 or 8 ft. long on each side, communicating with vertical wells about 2 ft. square to receive the anchor chain eyebars. The chambers were entirely closed at the bottom, and no access was provided to them through tunnels or in any other manner, but the vertical wells were left open at the top, thus exposing the eyebars and girders to the atmosphere and to rain and snow, but still leaving them inaccessible, as the space in the well was not sufficient to provide entrance for inspection or painting. Water accumulated in the undrained and unventilated chambers, and when a recent thorough inspection of the substructure was made it was found that the condition of both masonry and iron work required very prompt and extensive repairs and reinforcement.

The foundations were not considered satisfactory for modern requirements, and it was decided to improve them and to add materially to the mass of the pier masonry and increase its effective value for anchorage purposes by enclosing the old pier with a thick shell of new concrete thoroughly bonded to the former structure and arranged to greatly increase the anchorage load on the reaction platform. New anchor bars and reaction girders were provided, making the construction of the pier almost entirely new, except that part of the weight of the old structure was retained to provide for the negative reaction. The condition of the masonry and iron work was such that great care had to be taken to prevent any possibility of weakening it. The work thus became very delicate and hazardous and was conducted with the utmost skill and precaution.



Anchorage Pier with New Eyebars and Additional Reaction Girders.

In the reconstructed anchor piers the old reaction girders remained bedded in position in the base of the masonry and served merely to distribute a portion of the increased upward reaction against the old masonry. Three sets of new transverse girders are set in the lower part of the pier, projecting at both ends beyond its outer face so as to form cantilevers, receiving on their upper flanges two sets of longitudinal box girders, one on each side of the pier close to the old masonry. The latter form a reaction platform, on which is built a large amount of new concrete facing, enclosing the old pier and nearly doubling its volume. This arrangement greatly increases the available amount of counterweight in the pier and transfers it to the combined system of old and new reaction girders, which are connected to new pedestals, receiving the ends of the anchor arm by means of inclined adjustable eyebars bedded in the new concrete outside of the original limits of the pier.

The foundations were reinforced by the construction of a concrete buttress 11 ft. wide, 50 ft. long on the east, or down hill, side of the pier, which was carried down about 20 ft. to the foot of the old masonry to extend it and give it a much greater stability against displacement over the inclined surface of the rock. It was built in short sections in sheeted trenches, so that only a small part of the old masonry was disturbed at any given time, and the stability of the pier was considerably increased before any attempt was made to cut the old masonry.

After the inspection and drainage of the old anchor pit a few face stones were removed at the bottom of the pier, and sufficient masonry was cut out to give access to the chambers in which the transverse girders already mentioned were located. The masonry was in such a condition that hesitation was felt in cutting much of it away before additional support was provided, and piers of hard burned brick were therefore built with great accuracy and care between the reaction girders and carried up to bearing against the masonry which formed the roof of the chambers. Sufficient space was left at one end of the chamber for the bricklayers to retreat downward between the yoke girders, and the brick piers were underpinned by concrete placed in forms in the planes of the trusses between the transverse girders. Afterward oblique holes were drilled through the outer wall of the pier to the vacant part of the chamber, and thin, fine concrete under pressure was forced through them from the exterior to fill all cavities between and around the brick work and consolidate it with the old masonry to form solid supports, encasing the girders and carrying the positive reactions down to the footings.

The next operation was to cut horizontal transverse holes through the masonry at the center of the pier and under each of the old trusses of the bridge just below the bottom flanges of the old longitudinal reaction girders. In these holes the new transverse or yoke girders were placed and blocked up to the required height. Steel wedges were then very carefully driven between their top flanges and the bottom flanges of the old reaction girders, insuring a solid contact between them.

There were in all six transverse girders, each of them being a box girder 3½ ft. deep, 2 ft. wide and 19 ft. long over all. They projected about 4 ft. beyond the face of the old masonry at each end, forming cantilevers, on which were

seated, each side of the pier, a longitudinal reaction girder, with a rectangular cross section made up of two 5-ft. plate girders, 43 ft. long and 30 in. apart on centers, web-connected by vertical transverse diaphragms. New anchor bars, inclined somewhat from the vertical, were connected to both extremities of all the transverse girders by 6-in. pins and were enclosed in wooden boxes to give them clearance from the concrete.

In order to key the new concrete to the old masonry a 24-in. 80-lb. transverse I-beam, 18 ft. long, was seated on the tops of the longitudinal girders at each end of the pier, with its web solid against the old masonry and the flanges on one side seated in slots cut to receive them in the pier. Horizontal holes 2 in. in diameter and 1 ft. deep were drilled in all faces of the piers in pairs about 3 ft. apart horizontally and 5 ft. apart vertically, and in them were wedged 1¼-in. anchor bolts 4 ft long, some of them passing through the webs of the 24-in. I-beams, and all of them intended to bond the new concrete to were carried over the pier and independent of it.

This removed the positive loads from the pier tower, after which the top of the pier was cut down about 10 ft., and the upper surface dressed to receive a pair of 2-ft. 10-in. by 5 ft. moulded concrete blocks 83 in. wide, with narrow vertical slots on their opposite faces to clear the old anchor eye-bars when they were set on opposite sides of it, with their slotted faces in contact, thus forming a single pedestal. The concrete blocks, already hardened, were competent to receive their loads immediately without waiting a long time for the concrete to age, as would have been necessary if it was built like the remainder of that in the pier, in moulds. At the west end of the bridge conditions were different, and traffic was maintained across the anchor pier, from the approach to the anchor arm in another manner. The first span of the approach viaduct there is a 58-ft. plate girder, the river end of which was temporarily supported on a falsework bent, releasing the pier and tower. One panel of 8x16-about 6,000 lb .per square inch was developed in the eye-bars. This amount was calculated to be sufficient to produce a compression in the masonry a little greater than the maximum amount of upward reaction and thus maintain a slight initial stress in the masonry, even when the tension in the eye-bars is maximum and preclude the possibility of upward motion of the pedestals.

The well holes around the new anchor eye-bars were grouted, and forms were built enclosing the shoe and the space between them and the exterior forms was concreted, completing the top of the pier, except around the shoes. The wells around the shoes were lined with tar paper, and forms were built around them on top of the pier and filled with concrete, entirely enclosing the shoe and forming a cap over the anchorage bars, which is separate from the main body of the pier, and can, if necessary, conform to a vertical movement of the anchorage bars without transmitting shearing stresses or any danger of pro-

East and West Anchor Piers of the Poughkeepsie Bridge after Reinforcement.

the old pier. Sheets of expanded metal were laid across the projecting end of the anchor bolts, and the pier was enclosed in a form in which 2x8-ft. vertical sheets of expanded metal were placed near the lower part, as indicated in the accompanying illustrations. The forms were filled up to the height of the eye-bar adjustments with 1:3:5 Giant Portland cement concrete, deposited very wet, and the spaces around the old anchor bars were grouted up to the same height.

The pier was thus in a condition to sustain the computed negative reaction of 479 tons. In order to provide for the positive reactions during the transfer of connections from old to new anchorages, falsework bents, intended to support the new center truss of the east anchor arm during erection, were built at panel points of the main trusses, and the double transverse bent under the first panel point from the anchorage was extended to receive both old trusses, which were wedged to bearing on it, thus affording them support independent of the pier. On the opposite side of the pier falsework was erected to carry the approach span, and was connected, over the top of the pier, with the double bent by means of 24-in., 80-lb. longitudinal I-beam stringers, on which the railroad tracks in. longitudinal stringers was supported at one end over the falsework, and the opposite end on the end floorbeam of the anchor arm, and carried the tracks over the top of the pier.

All traffic on the bridge was suspended during one Sunday, and loaded cars were run on the anchor arm to provide a counterweight larger than the maximum negative reaction in the old anchor bars, thus releasing them. The anchor bars were cut off flush with the tops of the concrete blocks by pneumatic drills, boring through them edgeways holes of a diameter nearly as great as the thickness of the bars. The sides of the bars were nicked opposite these holes, and they were broken off, the pins backed out of their upper ends, and they were removed. The removal of the old eye-bars provided clearance for the placing of the new riveted steel shoes about 8 ft. wide and 9 ft. high, which overhang both sides of the pedestal blocks, and were pin-connected immediately to the new anchor bars at both ends, the connection to the anchor arm truss being made with an upper center pin. The driving of these pins restored the anchor piers to its original functions and permitted the withdrawal of the counterweight on the anchor arm.

The next operation was the tightening of the anchor eye-bar sleeve nuts until a stress of ducing cracks in the main concrete of the pier, while at the same time it forms a weatherproof cap over the well.

The work on the pier was necessarily slow and costly and was accomplished by an average working force of 30 men in about 80 days. The reconstruction of the east pier was substantially the same as that described for the west pier, except that the dimensions of the pier were different, and it was surmounted by a tall steel tower supporting the end of the anchor arm.

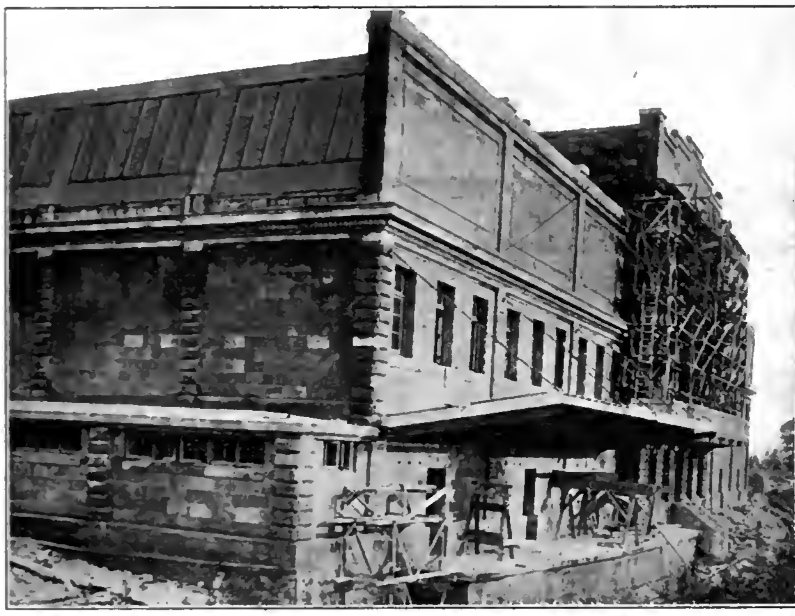
Additional interest is given this construction because it is believed to be the first built-in bridge anchorage. It has been heretofore considered imperative to provide anchorages with inspection wells or chambers, which leave some of the steel exposed to corrosion or possible injury. In such cases proper maintenace is likely to be difficult or impossible and is often neglected, and in several instances serious deterioration of the structure is known to have resulted. In this case it was decided to meet the problem squarely at first and assume final responsibility once for all by providing the most thorough protection and sealing it up. This may be radical, but is considered to be justified by the results of the opposite method.

In the reconstruction of the bridge Mr. Mace

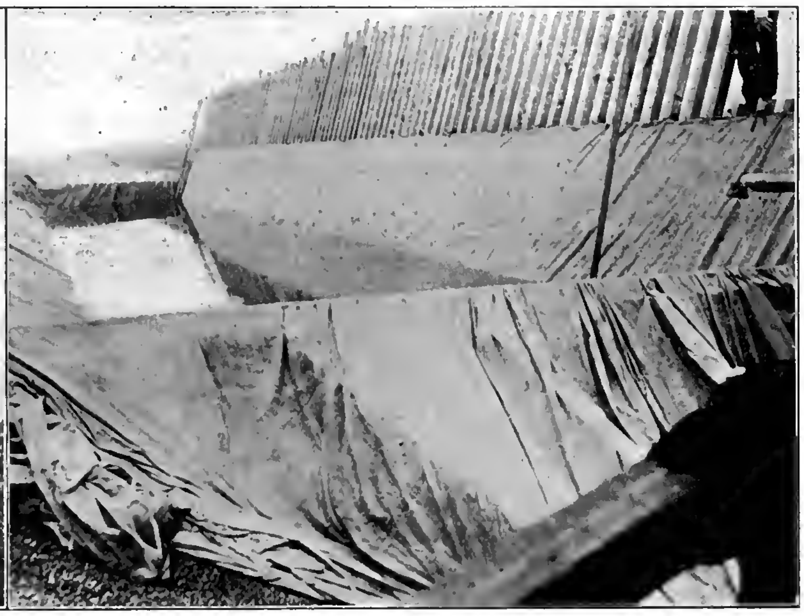
Moulton was consulting engineer for the railroad company. Mr. Paul Wolfel was the engineer in charge of design for the American Bridge Co. The methods and operations of erection were developed by Mr. S. P. Mitchell, who executed the work under a sub-contract from the American Bridge Co

A Concrete Building for a Chocolate Factory.

A large chocolate factory under construction at Stamford, Conn., for Stollwerck Bros., present some unusual features of design among which are a reinforced concrete saw-tooth roof and framework and cement block walls. The structure is 500 ft. long and faces the north with its east end close to the bank of the Mill river. Counting from the west end, 100 ft. of the factory is 200 ft. wide; the next 100 ft. is 50 ft. wide; the remainder has a width of 100 ft. The long 100-ft. section is divided longitudinally by three lines of interior columns into four 25-ft. bays each of which is covered by a roof bay. Transversely the factory is divided into ten sections or "buildings," each of which has a separate entrance extending somewhat in front of the building proper, with toilet and shower bath rooms on each side, as shown in an accompanying illustration.



Office Section of Stollwerck Factory.



Water Test of Saw-Tooth Roof.

The exterior treatment was made extremely simple in order to avoid the necessity for making an undue number of special blocks, as this type of construction is only economical where standardization can be secured to a considerable extent. The facades are relieved by rustic piers, and crowned by a modillion block cornice, over which rises the front slope and the saw-tooth roof. There are no windows in the main building except in the part given up to office use on the west front, all the light for the factory rooms being obtained from skylights in the saw-tooth roof

The foundations rest on gravel 26 ft. below the level of the basement which extends under most of the buildings. The part of the basement under the two center bays is unused, except for shafting and piping, and without a floor and high tides sometimes rise 2 ft. in it. The basement along the north and south side and across the east end is divided from the rest by 3-in. walls and floored with a 5¼-in. slab, forming dry passageways, one of which on the north side is occupied by the rope drive system.

The main floor in general is designed to carry 300 lb. per square foot, though in Building 1, at the extreme east end where the boilers are placed, several girders and beams are designed to support a load equivalent to 1,200 lb. per square foot of floor area.

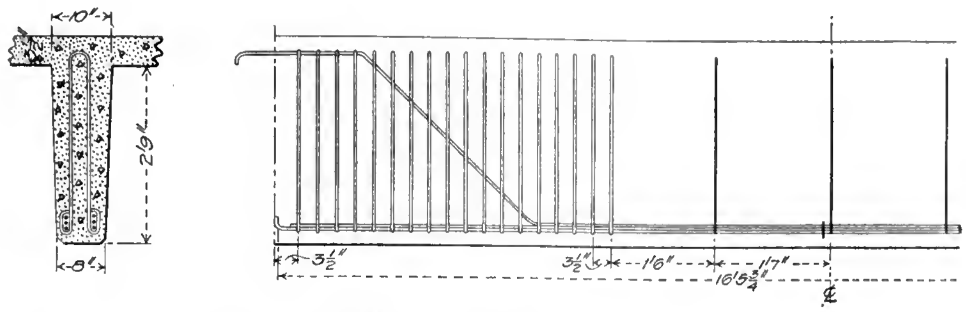
The general arrangement of the columns, girders, and beams supporting the main floor, which extends throughout the greater part of the factory, is shown in an accompanying floor framing plan. It will be noted that the floor in the center bays is carried by longitudinal girders and transverse beams which divide the slab into panels about 5½ x 25 ft., while over the outside bays the slab rests on the wall foundation, on longitudinal girder 10, and on two lines of longitudinal beams carried on 9 x 9-in. columns set in the basement passageways.

Referring to the framing plan, girder 2, on the longitudinal center line of the factory, is 33 in. deep, not including the 3½-in. floor slab, and tapers from 8 in. thick at the bottom to 10 in. at the under surface of the slab. It is reinforced with two 1 1/16-in. and four 1⅛-in. round rods and with 5/16-in. stirrups placed in general on 3½-in. centers, as shown in one of several accompanying diagrams. Girder 10 along the inside of the outside bays, has the same sectional dimensions as 2, but is reinforced with two ⅞-in. and four 15/16-in. round rods and has fewer 5/16-in. stirrups. The transverse floor beams, numbered 1, are 25½ in. deep, 6 and 8 in. thick at bottom and top respectively, and have four 1-in. round rods and 5/16-in. stirrups on 3½ to 18-in. centers. Beam 17 is 23¾ in. deep, not including the floor slab, which is 5¼ in. thick in the outside bays. It is reinforced with two ⅞-in. and two 15/16-in. rods and with 5/16-in. stirrups. The floor over the basement passageways is reinforced with ½-in. rods on 5-in. centers. In the center bays the reinforcement is ⅜-in. rods 4½ in. on centers.

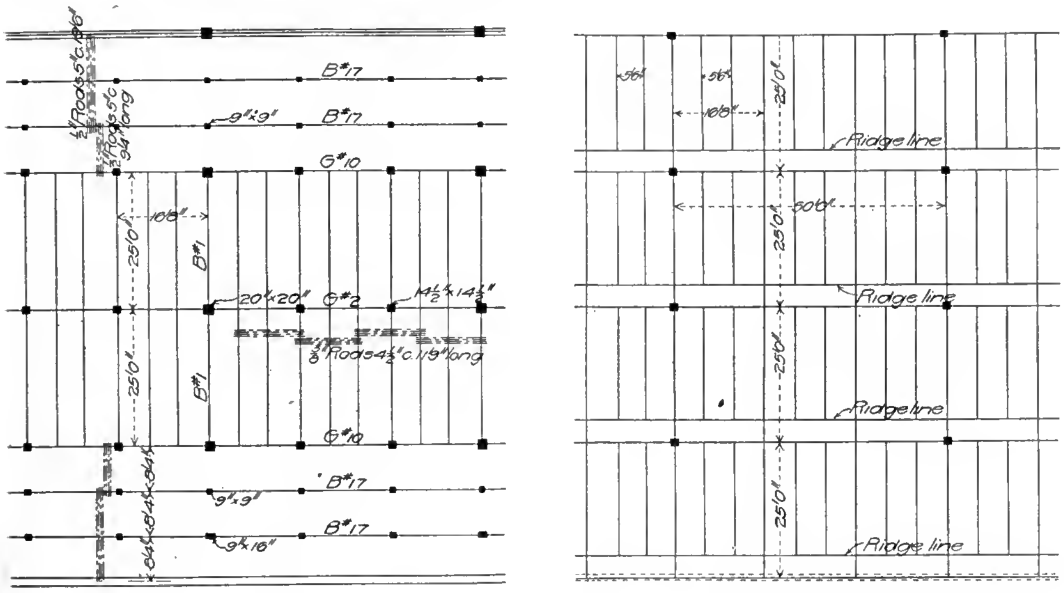
The principal columns extend through the main floor, supporting it and the roof as well, and have a clear height of 24 ft. 8 in. from the top of the floor to the under side of the roof girders. They are 20 in. square below the main floor and 15 in. square above it and have as reinforcement eight ⅞-in. round rods surrounded by 5/16-in. ties at 15-in. intervals. The end wall columns have the same section as the interior columns, but only half as many vertical rods. On the south side of the factory the regular wall columns are replaced by the heavier interior columns to provide for the addition of more bays in that direction. In the outside line of short columns in the north basement passageway every third one is 9 x 16 in. instead of 9 in. square. These heavier columns extend 12 ft. above the main floor and carry part of the weight of a 5-ft. by 7½ to 8¾-ft. reinforced concrete hot air duct which extends the entire length of the factory along the north wall. This duct is supported in 50-ft. spaces by the columns mentioned and, in a few cases, on the block division walls between the buildings; where the duct is carried on these walls a 6-ft. reinforced concrete lintel is provided in each wall to distribute the load. The duct has register openings in its top and bottom and in its free side. Its top serves as an inspection walk through all the buildings.

The saw-tooth roof is supported in 50-ft. spans by longitudinal girders 1 ft. wide and 51 in. deep carried on the several lines of columns. Each span is reinforced with sixteen 1-in. bars and with 5/16-in. stirrups arranged as shown in an accompanying diagram. These girders are intersected at intervals of 16 ft. 8 in. by the roof trusses which are made up of the long and short rake roof beams connected at their lower ends by tie beams. The beams in the short rake also serve as mullions between the skylights. Between each pair of truss beams in the long rake are two intermediate roof beams which are attached to the valley and ridge girders. The arrangement of these beams and girders is shown in an accompanying partial roof plan and the reinforcement is indicated on a section drawing. Special attention is called to the method of locking together the rods in contiguous tie beams at the intersection marked B. This was done by turning the tie beam rods through a quarter-turn so that the right angle bends at their ends hooked in opposite directions about the upper rods of the mullion beams. The upper ends of the latter rods are attached to the ends of the bent rods in the long rake beams by a wired splice.

The concrete used in the framework and roof is a 1:2:4 mixture of Vulcanite Portland cement and washed beach sand and gravel. The sand and gravel is delivered in boats at the east end of the building where it is loaded into two-wheel hand carts with a steam hoist and hauled to storage piles about 200 ft. from the river in front of Building 2 and near the mixer. The latter, a No. 3 Ransome machine, is mounted on an elevated platform and delivers to wheelbarrows or two-wheel carts on the ground. Above the mixer are measuring hoppers and above these are two bins for sand and gravel with a combined capacity of 30 cu. yd. These are supplied from the storage piles by stiff-leg derrick operated by a Lidgerwood three-drum hoist. A 60-h.-p. Ames boiler supplies steam for the mixer and hoisting engines. A platform elevator, operated with a Lidgerwood hoist and handling two



Floor Girder, No. 2, Stollwerck Factory.



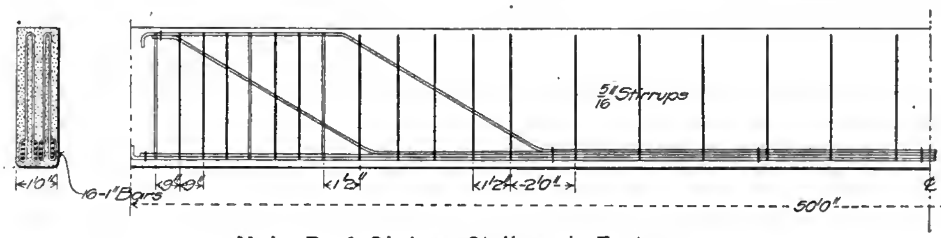
Part Plan of Floor and Roof. Stollwerck Factory.

carts or three wheelbarrows, delivers the concrete to platform runways at suitable levels to serve the various parts of the work, and is moved westward as the work progresses.

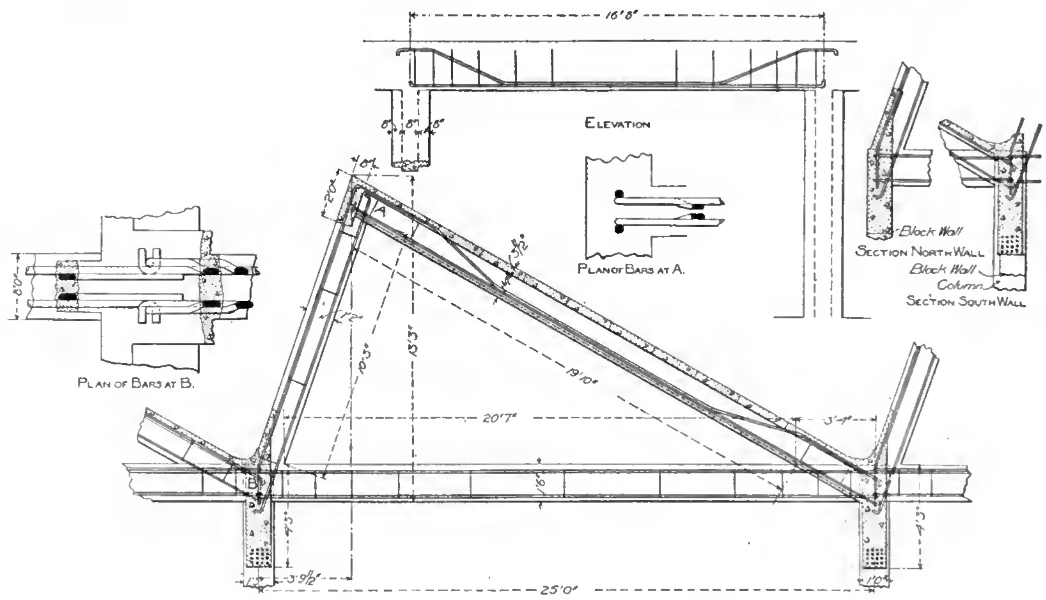
The unit system of reinforcement was used throughout the structure in the beams, girders and columns. This system, which has already been described in detail in this journal, involves the fabrication of the reinforcement for each girder or column into a unit in the shops of the contractor. These units are delivered on the work ready to be placed in the forms, each unit bearing a mark indicating its proper place in the structure.

In constructing the saw-tooth roof the columns were poured first; then the centering for the lower roof slab, the main girders, tie beams, mullions and all other roof beams was erected, 4 x 6-in. vertical posts thickly set and carefully braced being used for supports. The concrete for the lower roof slab and all the beams and girders was poured at once, the work being carried forward by a force of about thirty men who completed on the average one 50-ft. section over one bay in a day. The upper roof slabs were made and placed in 5½x25-ft. panels and covered with tar and gravel roofing. Copper flashings are provided at all projections and openings.

The ornamental cornice along the facade of the building was run on metal lath in place on the main girder at the top of the block wall, the attachment being made by means of brackets fixed in the girder at 2½-ft. intervals. These brackets are formed of three pieces of 2x2¼-in. angles. Two of these pieces project from the face of the girder horizontally near its top and bottom, the one at the top extending out further than the one below. The outer ends of these pieces are connected by the third piece with which slopes diagonally downward and inward. The upstanding leg of each diagonal piece is pierced with four ⅜-in. holes through which are strung ⅜-in. round rods.



Main Roof Girders, Stollwerck Factory.



Section of Saw-Tooth Roof, Stollwerck Factory.

The wall blocks are made of a 1:2:4 mixture of Atlas Portland cement and washed sand and gravel and were formed in a machine made by the American Hydraulic Machine Co.

Two separate load tests were made on the saw-tooth roof. In the first test bags of sand were piled in the valley in the form of a pyramid with its apex at the center of the girder. The total load of 84,800 lb. was applied in such a way as to produce a bending moment on the girder equivalent to that produced by the dead load plus four times the live load which the roof was calculated to sustain. The deflection of the girder at the center under this load was 0.20 inches. The second test load was extended over two adjacent girders for the purpose of testing one of the columns. The method of loading was different from the first test, water being used instead of bags of sand. A canvas bag lined the interior of the valley and was supported by planking along the skylights and at each end. The length of the trough thus formed was 100 ft., and its section was triangular, the sides being parallel to the slope of the roof. The pocket thus formed was filled with water to a maximum depth of 5¾ ft., a total load of 332,000 lb. being thus applied. This was equivalent to four times the calculated live load over an area of 100 x 25 ft. The deflection of each girder at its center under this loading was 0.10 in. Upon the removal of the load the girders recovered almost entirely.

The peculiar virtue of the system of loading adopted in the second test lies in the absolute mobility of the load which prevents the arching effect which sometimes occurs when a very heavy load is applied in solid form. It would be expensive to apply this method of loading in a single test unless the material of which the water-tight receptacle was made could be used afterward for some other purpose, but where a number of tests in series are contemplated it would probably be as inexpensive as the ordinary system of loading.

The architectural drawings for the factory were prepared by Mr. Ernest Flagg, architect, New York City, and the structural designs were prepared and the work is being executed by Messrs. Tucker & Vinton, of New York City, Mr. R. L. Bertin, chief engineer. Mr. P. H. Trout, superintendent of construction.

OPEN-HEARTH STEEL RAILS have recently been ordered by the Great Western Railway Co., of England, the first British company to place a contract for such rails.

Six-Tracking and Reconstruction of the Harlem River Branch of the New York New Haven & Hartford R. R.

The Harlem River Branch of the New York, New Haven & Hartford R. R. runs from a point near the junction of the Harlem and East Rivers in the Borough of The Bronx, New York City, northward beyond the limits of the city to New Rochelle, where it joins the main line. The latter runs westward at this point to Mount Vernon, where it connects with the New York Central & Hudson River R. R., and thus secures an entry into the Grand Central Depot in the heart of Manhattan. The Harlem River Branch carries a very heavy freight traffic which is received and dispatched at the Harlem River Station on car floats which connect with the various railroads in New Jersey, running west from the Hudson River. Considerable freight originates, too, in the territory neighboring the southern end of the Branch, the banks of the Harlem and the East Rivers affording particularly advantageous sites for industrial establishments. The passenger traffic, consisting entirely of suburban travel to various points in the Borough of The Bronx, already a very heavy one, has been increasing rapidly owing to the marked development of this portion of New York City during the past few years. At the Harlem River Station, the southern terminus of the Branch, there is no rail connection of any kind, the passengers transferring as a rule to the Third Avenue Elevated System in order to reach the business part of Manhattan Island, while the freight, that requires transfer to other roads, is handled by car ferries.

A steady increase in passenger and local and through freight business caused the adoption of broad plans for improvement, which are now being carried out. Before starting reconstruction the road had two tracks from the Harlem River Station to Pelham Manor and four tracks from the latter point to the junction with the main line at New Rochelle. The present work consists in four-tracking the road from the Harlem River Station to the Oak Point Yard and six-tracking the remainder of the line, at the same time making such changes in the layout of the stations, in the yards and in the grades both of the railroad and of the intersecting streets as were necessary to realize the greatest efficiency from the new plans and make unnecessary any future rearrangement of street crossings.

At the present time there are car ferry transfer bridges both at the Harlem River Station and at the Oak Point Yard, but when the latter has been fully developed the use of the transfer bridges at the former station will be discontinued, only such freight as originates locally at the industries on the Harlem and East Rivers being handled on the line south of the Oak Point Yard. New transfer bridges, and additional tracks are being constructed at the latter point so as to handle all of the through freight traffic.

Four of the tracks in the six-track section will be used for passenger service, the two outside ones of the four for local, and the two inside ones for express trains. The two tracks to the south are for freight traffic.

There are thirteen passenger stations on the Harlem River Branch, two of them having been established since the reconstruction was started. All of the old stations are being replaced with handsome structures differing in design to suit the location. At the local stations there will be but two platforms, one on the outside of each local passenger track, and at the express stations one local platform along the outside of the local track nearest the station building, and two island platforms, one between each pair of passenger tracks of like movement. Access to these platforms is had through reinforced concrete subways under the tracks.


Part of Former Two-Track System.

Coincident with the other improvements is the change of grade in order to eliminate railroad crossings at street level. At the south end the railroad tracks are on a fill and the streets which cross the line are spanned by plate girder bridges, while on the north end the tracks are at about the level of the surrounding land and the streets cross the right of way on overhead highway bridges. There are 56 bridges in all, in a total distance of 11½ miles, the length of the Harlem River Branch, the spans varying from 44 to 197 ft. Plate girders are used for the short spans and riveted through truss bridges for the long spans. The alignment has also been benefited in the improvement work, the additional property being purchased so as to make easement possible.

There are two crossings of navigable streams, the Bronx River and Pelham Bay, which will be crossed on Scherzer rolling lift through bridges. The channel spans will be 70 ft. in the clear between the fenders protecting the piers. The length of the crossing over Pelham Bay is about 1,600 ft., for which a pile trestle is being built. Near the south end of the branch at Port Morris, provision is being made for the future construction of the tracks of the New York Connecting R. R., which is to cross over the East River from Long Island.

The work was started in October, 1905. Provision was made for maintaining both the passenger and the freight traffic during construction by shifting the running tracks at the south end to one side while the fill was being made, and while the abutments and piers were being built for the bridges. Practically all of the material for this fill was obtained from the largest cut on the line, at Hunt's Point, 85 per cent. of the material being rock, some of it very hard and grading down to a soft disintegrated schist.

The plan on the fill section is to complete the abutments and bridges and roadbed for three tracks, two for running purposes and one for work trains, before abandoning the temporary tracks, which at the beginning of construction were placed to one side in order to allow the fill and bridge work to be carried on. From the present rate of progress it is probable that trains will be put on the fill within the next six or seven weeks. At the north end of the work where the tracks follow, in the main, the level of the surrounding ground, the running tracks were shifted so as to accord with the best methods for handling the work under the local conditions.


Fill and Completed Abutments at Port Morris.


Completed Abutments at White Plains Road.

The sections for the piers and abutments have been made very heavy on account of the treacherous nature of the material along the right of way. Much of the land is very low and is entirely underlaid with marsh and swamp deposits. At the south end piles had to be driven for all of the abutments and piers, their length varying from 25 to 50 ft., in order to reach rock. The average length was about 35 ft. The driving at the surface is very easy for 10 to 15 ft., beyond which a somewhat harder material is encountered for a distance varying from 5 to 10 ft., followed by hard driving and then rock. In some places fills of miscellaneous character were encountered which gave considerable difficulty in driving. Some of these were of rock fill, others of ashes and garbage wastes. The wisdom of selecting the heavy sections was proved after the fill had

been started, when the weight of the deposited materials squeezed out the muck on either side into humps and ridges 5 to 6 ft. high.

The formula for the width of the abutment where earth alone is to be retained is ⅓ of the height, plus 3 ft., and where the earth fill carries tracks, ⅓ of the height plus 4 ft. The tops of the piles are sawed off level and the concrete placed over them for a depth of 1 ft. The footing is reinforced with old rails running parallel to the length of the abutment. In addition to the vertical piles, batter piles are driven to secure greater stability.

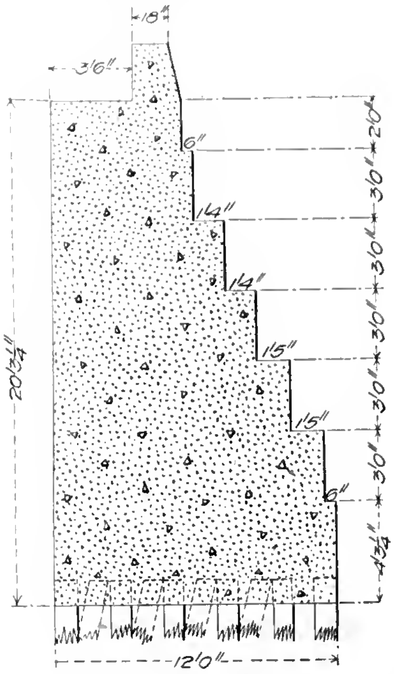
The concrete for the abutments and piers is a 1:3:6 mixture, the rock being trap from the Connecticut quarries. For the bridge seats and copings 1:2:4 is used. Both Alpha and Lehigh Portland cements are used. The concrete was all mixed in 1-yard mixers placed conveniently at the work, and was put into place with bottom dump buckets, handled by stiff-leg or guyed derricks.

In Pelham Bay Park, the city authorities objected to the use of concrete, and stone was therefore used for the abutments of the bridges within the Park limits.

The angles at which the streets cross the right of way and the fact that in some cases a number of streets meet at the railroad necessitated some long bridges and abutments. The Bronx and Pelham Parkway crosses the right of way at a sharp angle, and the abutments and piers are being built for a width of roadway and footwalks of 400 ft. This made it necessary to build the abutments 780 ft. and the piers 710 ft. long. The railroad will provide a bridge 80 ft. wide. At another point, West Farms Road, East 180th St. and Adams St. join at the right of way and are carried over the tracks on a skew plate girder bridge, the abutments for which are respectively 333 and 318 ft. long.

Small toe walls were necessary in places to prevent the slopes going beyond the right of way line, and in one case along the Bronx River, a retaining wall with a maximum height of 15 ft. above high water and a length of 220 ft. was necessary.

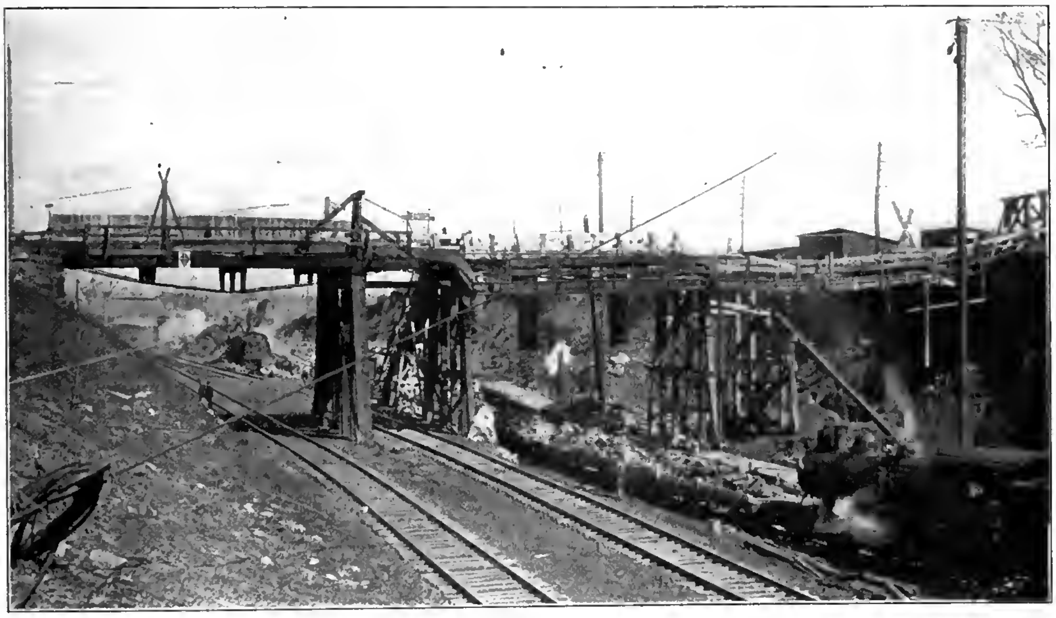
Most of the new passenger stations are constructed with their floors at the level of the tracks, but in some cases are being built overhead. The platforms are to be 700 ft. long and are to be paved with concrete, cement finished. The stairways leading from the station buildings to the subways under the tracks and from the subways to the platforms are to be built of reinforced concrete, the steel consisting of 1-in. corrugated rods. The rods in the walls and the floor are on 12-in. centers in both directions, and in the roof on 12-in. centers transversely and on 4½-in. centers longitudinally. The inclined rods in the roof, shown in the illustration, are on 12-in. centers. The station buildings are to be of different designs in order to harmonize with the local surroundings, some of them of stone, some of brick, and some of concrete.



Abutment for Railroad Bridge.

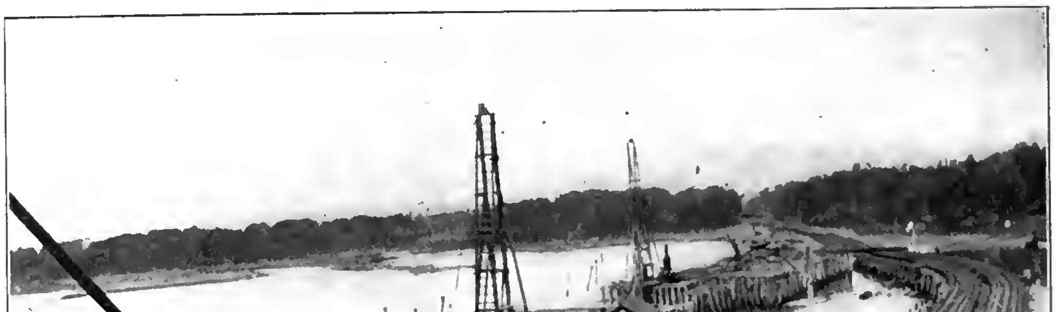
The freight business along the line has been cared for by reconstructing the yards already in operation, and by adding others where necessary. These are merely large enough to handle the local business. The main freight yard of the branch will be, as is the case now, the Oak Point Yard. This is to be entirely reconstructed and increased in size, with a view to handling all of the through traffic, to and from the car ferries.

The tracks are laid on 13-ft. centers, except where station requirements and the crossing structures at Bronx River and Pelham Bay necessitated greater distances. The sub-grade, as shown in an accompanying illustration, is crowned from both sides to the center of the six tracks and is covered with rock ballast, the maximum depth of which at the sides of the six-track roadbed is 20 in. below the top of tie. Creosoted white pine ties are being used exclusively, and carry rails which weigh 100 lb. to the yard. About 3,800 cu. yd. of trap rock ballast are required to the mile for the six-track roadbed. The maximum curvature of the center line of the six-track system on the new alignment is 4 deg. 55 min., and the maximum grade is 0.65 per cent., at the point where the road goes up onto the fill at the south end. The greatest difference in grade between the new and the old lines is about 12 ft., in the cut, already referred to, at Hunt's Point.


Hunt's Point Cut, Showing Temporary Highway Bridge and Old Main Line Tracks.

At a number of the streets crossing the right of way the railroad company is building new sewers, reconstructing old ones and providing suitable protection, from the heavy loads of the new filling material and the traffic, for some of the others which are already built. The new sewers are of reinforced concrete, some of them circular and others of an approximately rectangular section.

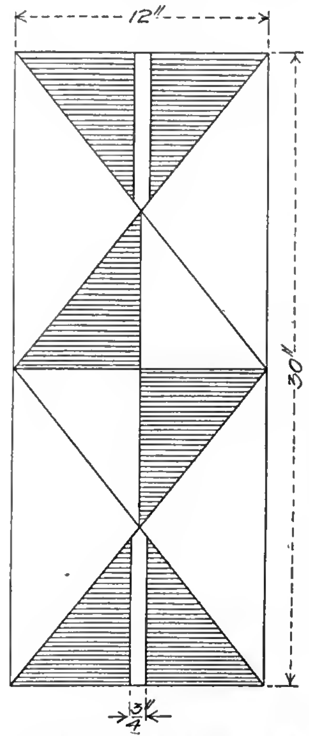
The Bronx River will be crossed on Scherzer rolling lift through bridges made of three leaves, each accommodating two tracks. The bridge and the river are at a considerable angle, and in order not to make a jog in the river so as to secure a right-angle crossing, or in lieu thereof, put a curve in the railroad, it has been necessary to step back the three leaves successively, each leaf being a right-angled one. This has necessitated complicated abutments and piers. The clear channel between the fenders, which are straight throughout their length, is 70 ft., 26 ft. more than for-


East End of Pelham Bay Trestle under Construction.

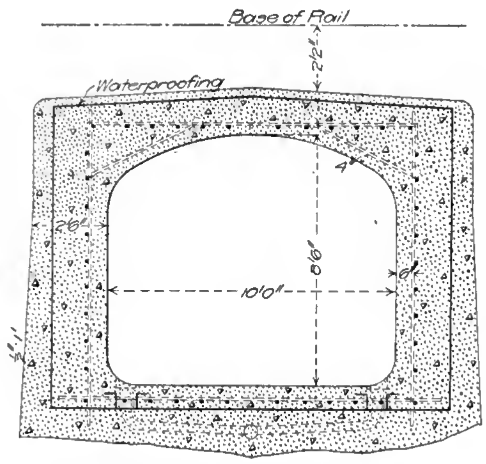
merly. The piers and abutments were founded either upon rock or upon good gravel beds. No great difficulty was found in building them, but the rock sloped sharply in places the distance from the top of the pier to the foundation in some cases being as much as 30 ft. more at one end than at the other. The footings are of 1:2:4 concrete, but the superstructure from a point well below the lowest tide level to the bridge seats is of granite. The concrete was placed under water by means of bottom dump buckets. The old bridge at this point was a center pier swing bridge of the through plate girder type carrying four tracks. The method of removing it was explained in an article of The Engineering Record of June 29, 1907. In order to accommodate the traffic during construction a temporary 2-track trestle and a 2-track jack-knife draw-bridge have been built immediately south of the permanent site.

Pelham Bay Bridge and Trestle. The crossing of Pelham Bay consists of a pile-bent trestle 1,600 ft. long, near the center of which is the Scherzer rolling lift bridge, consisting of three leaves for two tracks each. There are 150 bents in the trestle, each containing 36 piles, 2 ft. 9 in. on centers transversely to the center line of the railroad. The bents are 10 ft. apart longitudinally. The bracing of each bent consists of 3x10-in. diagonals on each side of the piles, running from the horizontal bracing at mean low water to the cap. In order to reduce the unsupported column lengths the bents are braced together by 12-in. longitudinals, just above mean low water elevation. In order to prevent swaying longitudinally on either side of the draw-span those bents on the curves at each end of the trestle. In order to guard against any possible error, all of the data necessary for the construction, such as angles, plusses and offset distances, were carefully computed and checked and then embodied in tabular form in a large layout plan, which, in addition, contains a plan and an elevation of the trestle. The plan of the trestle shows the angles of all of the hubbed lines used in connection with the work, the P. C.'s and P. T.'s of the curves on the center line of the six-track system and of the north and south pairs of tracks, the number of each bent and the plusses of each bent, both on the permanent stationing and on the base line which was laid down for construction purposes. The trestle is on a grade at both ends and level at the center, with a vertical curve on each side of the draw-span. For this reason the cut-off of each bent and the data for the vertical curves are noted on the elevation of the trestle on the layout-sheet. The tables give the elevations and descriptions of the construction bench marks, the data for the curves at both ends of the trestle and the angles and distances for locating each of the bents on the curves from the base line. The data for running the curves is given separately for the six-track dimensions as shown have been used for distances up to three-quarters of a mile. The design of the targets as well as the computations and the method adopted in laying out the trestle, are due to Mr. L. D. Fouquet, who is in charge of both the Pelham Bay and the Bronx River crossings for the railroad company.

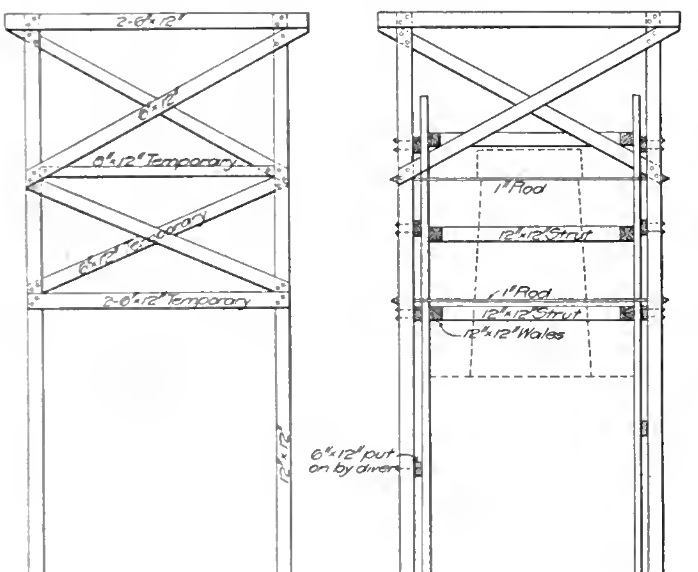
The building of the foundations and piers for the Scherzer rolling lift bridge proved a troublesome undertaking. The bed of the bay consisted of soft muck, which had to be removed. Solid rock was found at varying depths from —18 to —29, the elevation of mean low water being —5.1, and of mean high water +2.1. The entire site was dredged clean down to the rock by the International Dredging Co. Very accurate and com-



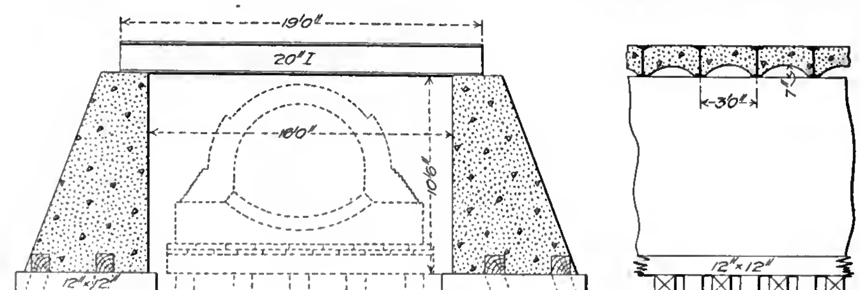
Surveying Target Used at Pelham Bay Trestle.



Passenger Subway under Tracks.



Original Bent and Section of Completed Cofferdam.



I-Beam Protection for Bungay Street Outlet Sewer.

special 4x10-in. bracing in vertical planes parallel to the direction of the track has been placed on the six bents on each side of the lift bridge.

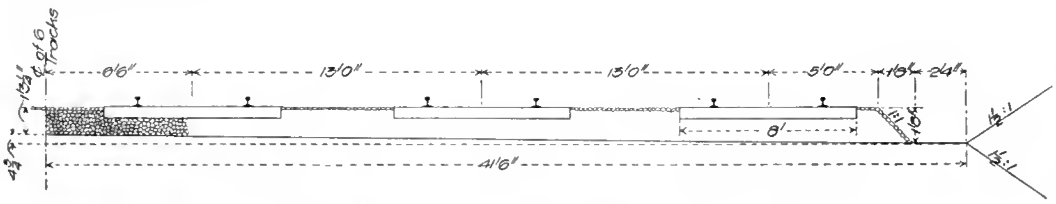
Both ends of the trestle are on 3 deg. curves. The tracks are laid in three pairs of two tracks each, the distance between the two tracks of a pair being 13 ft., and between the adjacent tracks of two different pairs 23 ft. The deck of the trestle is 12.9 ft. above mean high water. The piles in the portion of the trestle west of the draw vary in length from 22 to 50 ft., and east of the draw from 50 to 80 ft. They were driven to a ½-in. refusal, with a 5-ft. drop of a 3,000-lb. hammer. The piles are of long leaf yellow pine, with 8-in. tips and butts not less than 12 in.

The laying out and construction of a trestle of this magnitude required very careful work and close supervision in order to get the piles in each bent in a good line, to preserve the proper distances between the bents and between the individual piles and to secure the proper angles for center line and for the north and south pair of tracks, the deflections being noted both for foresight and backsight.

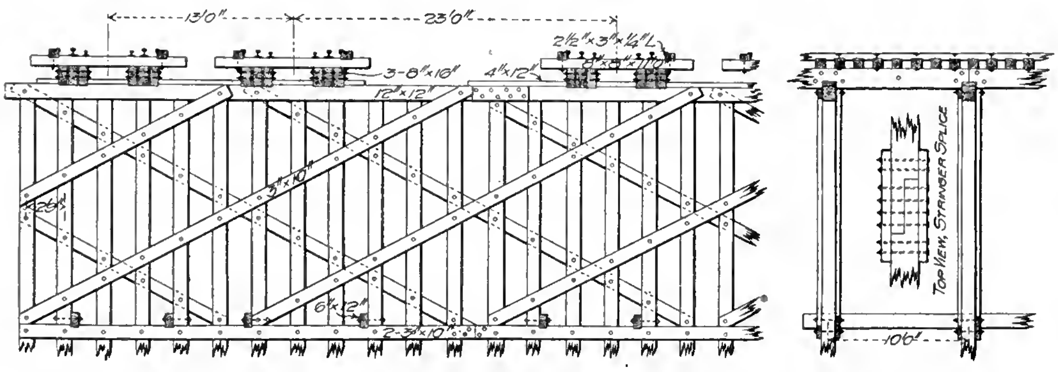
The center line of the six-track structure was first laid out and permanent hubs driven in secure places on each shore on the prolongation of the tangent. A base line was then laid down south of the structure, and on it the temporary trestle for accommodating the traffic during construction was built. From this trestle and the base line the entire new structure was laid out, the line for each bent being sighted from two nails driven in the deck of the temporary trestle. Permanent targets were placed above the hubs on shore on the center line of the permanent structure, on the base line and on the longitudinal center lines of the abutments and piers for the Scherzer rolling lift bridge. These targets, the design of which is shown in an accompanying illustration, were adopted as a result of a series of trials and have given entire satisfaction. The plete soundings were then made by means of long gas pipes, in order to determine the topography of the rock bottom. With the data from the soundings, elevations, both transverse and parallel to the length of the abutments and piers, were platted, and stout frames for the cofferdams were constructed according to these profiles. These frames, after being placed in their proper positions, were loaded sufficiently to sink them to a bearing on the rock, and the cofferdam sheeting was then placed inside the framework. The framed bents when put in position contained temporary braces and struts, which were removed after the bents were lined up and when the sheeting was placed. The upper 6x12-in. clamps and braces were removed while the sheeting was being set and were then replaced. One of the illustrations shows a bent in the original condition and the completed cofferdam. As soon as the sheeting was set a diver was sent down inside the cofferdam and cleaned the rock perfectly by means

of a jet of water, the washings being removed by a 12-in. centrifugal pump. The concrete was then placed under water by means of bottom dump buckets, the cofferdams serving as a form for the footings. When the latter had reached their proper height the cofferdam was pumped out, and the surface of the concrete carefully leveled for beginning the granite work for the piers. At the completion of the latter the nuts were taken off of the bottom rods and the cofferdams removed.

In the early stages of the masonry work precautions were taken to prevent the floating of the cofferdams, and the consequent disturbance of the concrete footings which plugged their bottoms. The head of water on the outside of the cofferdam in high tide was sufficient to more than counterbalance the weight of the concrete, providing the cofferdam above the latter was pumped out. For this reason the cofferdams were flooded at high tide until sufficient of the granite masonry had been placed to overcome the upward pressure due to the head on the outside of the cofferdam.



Half Section of Roadbed for Six-Track System on Harlem River Branch.



Half of 36-Pile Bent and Side View, Pelham Bay Trestle, Harlem River Branch.

The six-tracking work and the other improvements are being done under the direction of the engineering department of the New York, New Haven & Hartford R. R., Mr. E. H. McHenry being vice-president, in charge of engineering, and Mr. Edw. Gagel, chief engineer. Mr. R. M. Berrian, assisted by Mr. M. S. Jameson, was in charge of the work from February, 1904, until August, 1906, since which time it has been under Mr. W. B. Leonard, assisted by Mr. I. D. Waterman. The contractors are Messrs. Daly and Holbrook.

Tests of Concrete Blocks taken from the stock of the National Hydraulic Stone Co. of Baltimore have recently been made by Mr. Allen S. Crocker, M. Am. Soc. M. E., of Rochester, N. Y. There were seven specimens tested, one of which could not be broken by the testing machine which has a capacity of 200,000 lb. The other blocks had an average strength of about 2,907 lb. per square inch. The blocks were made on machines built by the Fisher Hydraulic Stone & Machinery Co., and only one of the specimens had been dampened more than twice within the first week after it was made. This one had a strength of 4,103 lb. per square inch. The lowest strength of any block was 1,178 lb. per square inch, due to the fact that the block was shipped when only 3 days old and had no water from that time until tested at 19 days age. The blocks were made of 1:8, 1:10 and 1:12 mixtures, and had bearing surfaces of 14 sq. in. or more.

Sewage Disposal Plant at Kew Beach, Toronto, Ont.

At the recent convention of the American Society of Municipal Improvements, Mr. C. H. Rust, city engineer of Toronto, read a paper on the sewage disposal plant at that portion of the city known as Kew Beach, situated at the eastern limit on the shore of Lake Ontario and solely a residential district. The level of the ground is only a few feet above the level of the lake and the soil sandy underlaid with clay. The property owners have been for some time asking for drainage, but owing to the municipality of East Toronto procuring their water supply from a point about three-quarters of a mile east of this district, and to the objection of the Board of Health to allowing crude sewage to be deposited in the lake, is was necessary to adopt the sewers and purification works as described. The drainage area of this district is one hundred and eighty-five acres, containing a population of approximately 10,000 during the summer months.

To ascertain the consumption of water a meter was placed upon this district, and it was found that the actual consumption per head in twenty-four hours was 16 gallons.

The main sewer is laid along the lake front at a depth varying from 2 to 9 ft. below the lake level and is constructed of 16 and 10-inch cast-iron socket pipes. All sewers from the north discharge into this sewer and at a point midway between the outfall and the summit is constructed pumping station No. 1, raising the sewage from the low level sewers from the east and north into the high level sewer which gravitates to No. 2 pumping station where the sewage is raised into the disposal works. These pumping stations are constructed of concrete and are circular in plan with a partition wall in the centre and have a reservoir space of 3,200 gal.; and each contains a duplicate set of pumps and motors, No. 1 consisting of two 5-h.-p. alternating vertical motors and two 4-inch submerged centrifugal pumps and No. 2 consisting of two 7½-h.-p. alternating vertical and two 4-in. submerged centrifugal pumps. Motors and pumps are automatically controlled by the rise and fall of the sewage in the reservoir.

The shafts of the pumps are connected direct onto the armature of the motors without any bevel gearing, which practically eliminates all noise whilst operating.

The disposal works consist of three septic tanks and twelve bacteria beds, constructed from plans designated by the Cameron Septic Tank Co. and operated by the gear patented by them.

The works are erected on the shore of the lake about 200 feet from the water's edge, and are supported by 10-in. piles driven 16 ft. through the sand and into the hard clay and surrounded by tongued and grooved sheet piling driven 14 ft.

The construction of these works is of concrete in the proportion of seven of broken stone and sand to one of cement.

The three septic tanks are each 100 ft. x 14 ft. x 7 ft. 3 in. deep at the low end with a total capacity of 183,750 gal. They are covered with a 3-in. concrete roof, made in the proportions of 4½ of broken stone and sand to one of cement and reinforced with 3-in. mesh, 10-gauge expanded metal. At 6 ft. 6 in. centres are 9x6-in. concrete beams supporting the roof, reinforced with ¾-in. Johnson's corrugated steel bars. An inlet channel feeds the three tanks at the high end, each one of which can be operated independently from this channel.

The distribution of sewage into the tanks takes place through one 8-in. pipe, thence through four 12-in. openings, 3 ft. above the bottom of the tank, which accomplishes a maximum flow of sewage with a minimum amount of disturbance. At the low end of the tanks thirteen 4-in. outlet pipes are built into the wall, 2 ft. 7 in. below the water line, connecting with the cleansing chamber and outlet channel. From here the main effluent carrier is built into the wall of the bacteria beds in line with the outlet channel of the septic tanks and runs the whole length to the end of the beds and has three branches at regular intervals, each feeding one set of 4 beds.

There are 12 bacteria beds, 3 sets of 4 each having a combined area of 1,860 square yards. Each bed is 50 ft x 28 ft. x 4 ft. 6 in. deep and is filled 4 ft. deep with furnace slag varying in size from ¼ in. to 1½ in. On the floor are laid 14 lines of 3-in. weeping tile collectors, discharging into a 9-in. main collector, and 6 in. below the surface of the slag are 6 lines of 6-in. weeping tile distributers fed by a 9-in. main distributer. All discharge pipes terminate in one common chamber from which a 15-in. main filtrate carrier is laid down to the lake, the last 30 ft. being supported on piles.

The sewage is raised to a height of 22.5 ft. at pumping station No. 2, into the inlet channel, which is below water line and extends to a point beyond the inlet to septic tank No. 3. From this inlet channel the sewage is admitted into each tank required to be operated through the submerged openings.

The effluent from the tanks flows through the submerged outlets and through the effluent chamber, which arrests any solid matter which may find its way through the outlet pipes in time of excessive flow and thence into the outlet channel.

The semi-clarified sewage now flows along the main effluent carrier and on to the automatic distributing gear from which it is distributed to each bed in turn through its admission valve. The discharge valve will be closed meanwhile so that the interstices of the filtering material will be filled with the tank effluent. The effluent remains in the contact beds for a period of about two hours, according to the rate of flow. The discharge valve will then open, when the filtered effluent escapes, drawing down after it a supply of air into every crevice of the contact bed. The latter will then drain and aerate whilst the remaining contact beds of the set are filling, after which it will again be filled in turn. This method of working renders the contact beds self-cleaning so that they retain their purifying power unimpaired.

The alternate filling and emptying of the contact beds is effected automatically by means of the alternating gear in the following manner: As soon as bed No. 1 is filled, a small quantity of filtered effluent overflows from its discharge well into a float chamber, lifting the float, at

the same time opening the admission valve and closing the discharge valve of bed No. 2. When bed No. 2 is filled, this operation is repeated, the flow of tank effluent is diverted into bed No. 3 and the discharge valve of bed No. 1 is opened and its contents are allowed to discharge.

The construction involved the carrying out of 12,262 ft. of 9-in. pipe; 1,509 ft. of 12-in.; 1,349 ft. of 15-in.; 2,451 ft. of cast-iron pipe; 32 manholes and 982 junctions. The average depth of the sewers was 8 ft. 9 in. A great deal of the work was in sand charged with water involving constant pumping.

The cost of the works was as follows:

Sewers and pumping stations	$37,755
Pumping plant	3,185
Disposal works	13,079
Piling, etc.	5,119
Slag, 2,500 cu. yds. at $1.50	3,750
Automatic distributing gear	4,000
	$66,888

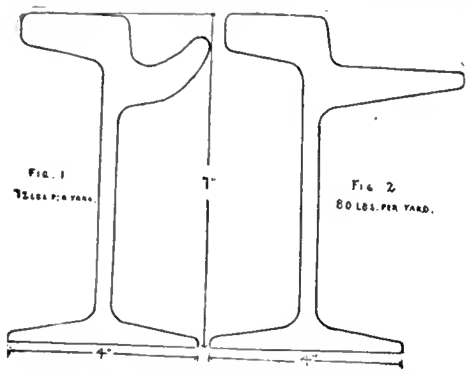
It was found after the slag had been in the beds some time about 10 per cent. of settlement took place. The works have been in operation since April and the effluent so far has been very satisfactory.

The Use of the T Rail in Cities.

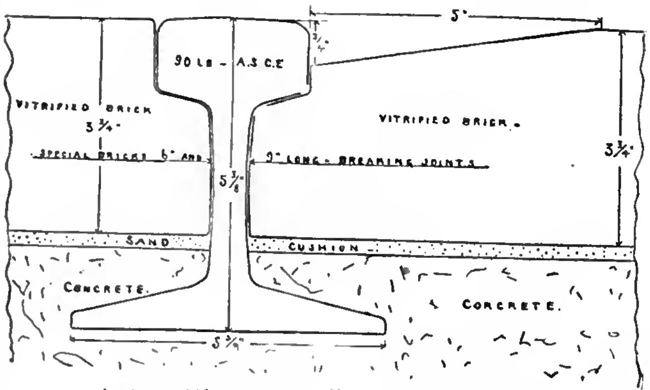
The oft-discussed question of permitting the use of T rails in cities was the subject of a paper read before the recent convention of the American Street and Interurban Railway Association by Vice-President C. Gordon Reel, of the Kingston Consolidated Railroad Co. He pointed out that in the horse-car days the equipment was so light and speeds so leisurely that the problem of a proper track was easy of solution. It was expected that wagon traffic of all kinds would follow along the car tracks and so city ordinances usually required that the street railroad companies make proper provision for the accommodation of vehicular traffic. With the introduction of electricity weights and speeds were increased enormously. The trend of development has been steadily to approach nearer and nearer to steam railroad standards. With the increase in weight of equipment and increase of speed, the grooved and girder rail sections soon demonstrated their inability to carry the car traffic without rapid deterioration. The inefficiency of these sections was due not to the light weight so much as to their unscientific design. The vertical web of the rail was usually directly under the flange of the wheel so that the weight of the car would be carried on a sort of projecting shelf. This unsymmetrical loading was more than the rails could stand. They pounded down rapidly at the joints and could not be held to gauge. The companies with which Mr. Reel is connected were unfortunate enough to build with 7-in. grooved and girder sections shown in the diagrams. These rails were structural wrecks at the joints long before they were worn appreciably.

In other cities similar sections have been used which overcome the inherent weakness in design by brute strength so to speak; that is, they are rolled in weights up to 150-lb. per yard, which would seem absurd to steam railroad men, especially in view of the very much heavier rolling stock used by the steam roads. It is self-evident that a proper section should not be inordinately heavy and should carry its load with no tendency to moving sideways, and furthermore that the track should stand solidly in place without having to strap the rails together every few feet. All T rails fulfill the first two requirements, but the standard steam railroad sections would seem to serve better than the high T sections in regard to lateral stability. Just what is gained by using a high T is hard to understand, still Mr. Reel is willing to concede that, in view of the experience in some of the larger cities which use this rail, there is a chance for an argument between high T sections and standard T sections. Personally he would prefer to pay more per ton for standard sections than for high T sections, although under ruling prices the high T cost considerably more per ton than standard T sections.

When it became necessary to renew the tracks in Kingston, Mr. Reel looked over the experience of other companies and concluded that the T rail was in every way more desirable than the grooved or girder rail and proceeded accordingly. To make sure he laid an experimental piece of track using 90-lb. Am. Soc. C. E. standard rail. This gave such good results that an order was



Rails Formerly Used at Kingston.



Latest Kingston Rail and Special Brick.

placed for several hundred tons in 60-ft. lengths with a view to extending the construction. After the rails were delivered a bitter opposition was engineered by interests which formerly owned one of the roads and who seem to be sore because the present owners have been successful. It was argued that if, when they built the road, it was necessary to use an iron lip, unless the new owners used the iron lip, ruts would form along the track. The only difficulty about this point was that it was not necessary, in the first place, to use any iron lip because experience proves that there is no greater tendency for a rut to form along a T rail than along the outer edges of a grooved or girder rail. They also used letters from city engineers of New York, Brooklyn and Albany, stating that no T rails were used in those cities. This argument we easily answered by asking our opponents to produce letters from cities where T rails had been used. The fact that they produced letters from places where they had not been used was certainly no evidence against their use. After a lot of misrepresentation and personal abuse in the newspapers the company finally got consent from the city to lay T rails in two rather important streets with the stipulation that if, after the end of a year, the city authorities so desired we would remove them and substitute the old rails. Another feature which had to be overcome was a bill introduced in the legislature intended to prohibit the use of the T rail entirely in the State of New York. Whether or not this bill had any connection with the Kingston opposition or was merely a coincidence Mr. Reel was unable to say. In any event the bill was easily defeated and was never reported from the committee.

Since the installation of this 90-lb. standard construction in the two streets referred to, the company has been granted permanent permission without any restrictions to use this 90-lb. standard T rail in the most important streets in the city.

The construction first proposed has been amended as shown in the illustration, using a special form of brick outside the rail as well as inside. It will be noted that the brick on the inside goes up on the head of the rail to such a distance as to barely give room enough for the wheel flange. In this way the obstruction in the street will be much less than though the brick projected under the head of the rail and very much less than any form of grooved or girder rail. It is now standard practice to use only ordinary brick. On the outside the brick is merely laid flush with the rail, and on the inside it is tucked under the head.

The gist of the whole T rail matter seems to Mr. Reel to be that street railway tracks are beginning to be built to serve the companies which build them and the patrons of these companies, rather than every truckman who stubbornly insists on following the car tracks instead of staying out in the roadway where he belongs. If this driving along the tracks served any economic end it might be tolerated, but it does the truckman no good and interferes with the rapid movement and comfortable transportation of countless thousands of more important people.

Cinder Disposal in a Roundhouse.

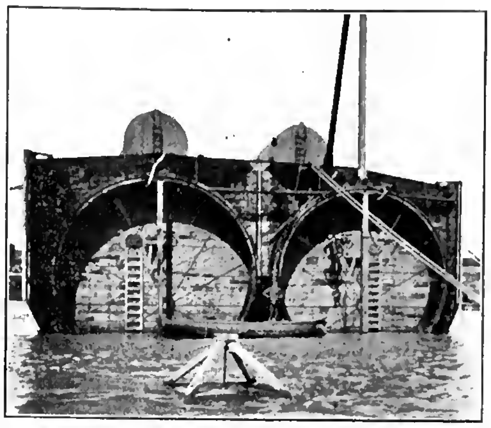
A novel roundhouse with 44 stalls has been built at Dilworth, Minn., by the Northern Pacific Ry. Co. to improve the winter service of locomotives. The object in the design has been to avoid the necessity of sending a locomotive to the cinder pit after a run, for by saving this time the terminal expenses of an engine are reduced. When a number arrive at a terminal at about the same time on a cold day, the last to reach the pit loses much time before its fire is knocked out. At Dilworth the locomotive is run directly into the roundhouse, and does not go to the outside cinder pit unless every stall is occupied. There is a pit under each stall and in a depressed part of the pit containing water are two perforated pans about 72 x 30 in. in size to receive the ashes. The fires will be allowed to die out gradually before being dumped, or after they are cleaned they will be banked, thus saving coal wasted in the ordinary procedure. When the engine leaves the stall, an electric hoist traveling on an overhead track will run over the pan, lift it up and carry it to a cinder shed. This is merely one of the stall spaces into which cinder cars are run to receive the ashes from the pan. There are two pans in each stall so that two engines can use the pit before the ashes need be removed. It is expected that from $1 to $5 will be saved in this way on each engine handled at the new roundhouse.

STATE FORESTRY WORK made great strides during 1906, according to the U. S. Forest Service. Ten States have State forest reservations, and in five of them the removal of mature timber from such public lands is now permitted, thus showing the growing appreciation of a fundamental principle of forestry. Over twenty States have forest officers.

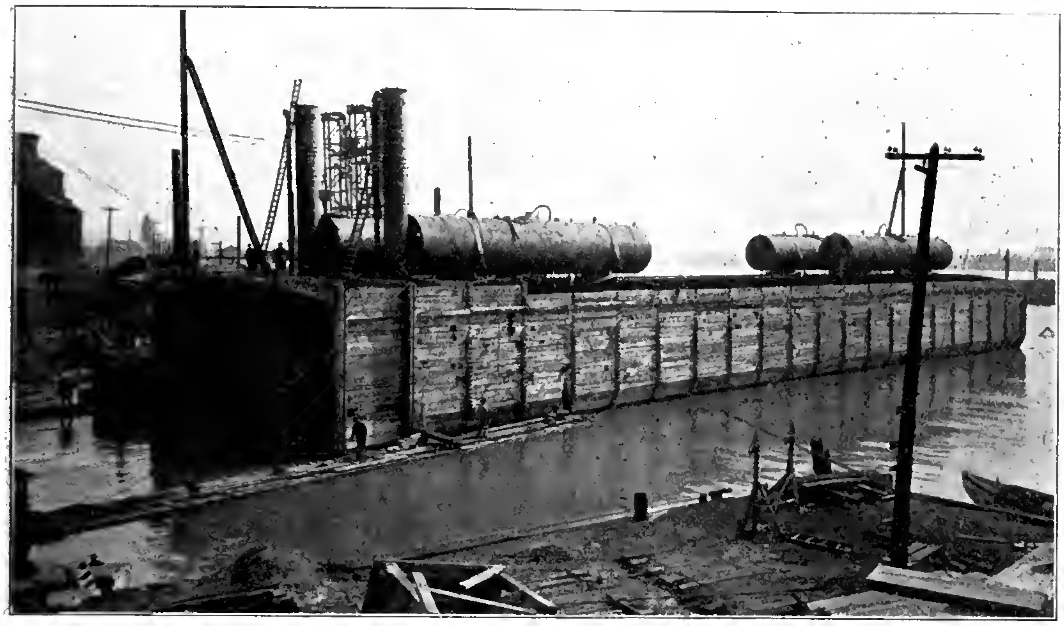
Sinking the Detroit Tunnel Tubes.

The river section of the double-track tunnel under the Detroit River is 2,622½ ft. long, and has a maximum depth of 41¾ ft. from the roof to the surface. It is built in water subject to slight variation of level with an original depth of about 144 ft., and a maximum current of about 6 miles in the center of the river, which is navigated by a very large number of steamboats and sailing vessels. The tunnel is of steel and concrete construction as described in The Engineering Record of March 7, 1907, and is being built in a deep trench dredged in the bottom of the river.

The tunnel is divided in ten equal sections, 262½ ft. long, for which the steel framework is assembled on shore, launched, towed to position, sunk in the trench, united by successive joints and concreted to form a continuous structure. The adoption of this method saved an initial difference of about $2,000,000 between the contract price for it and for the alternative plan of a tunnel constructed by ordinary shield driving methods. It is also built at an elevation of 15 ft. above the minimum necessary for the shield-driven structure and thus eliminates many hundred feet of shore approach tunnels, reducing the grades, and avoiding operation and construction expenses which, capitalized, would amount to about $2,000,000 more. This shows a balance of about $4,000,000 in favor of this construction which, in its details and in the method of execution is novel, although the idea of first constructing a tunnel and then sinking it below the surface of the water was proposed many years ago by the late John C. Trautwine.



Tubes and Sheeting as Launched.



Tubes at Commencement of Sinking Operations.

In this construction the fundamental principles are to avoid ordinary tunnel excavation, to reduce to the smallest practicable amount divers work, and to provide a permanent protective exterior concrete casing which first serves as a shelter in which the permanent tunnel can be built and inspected advantageously and economically under atmospheric pressure.

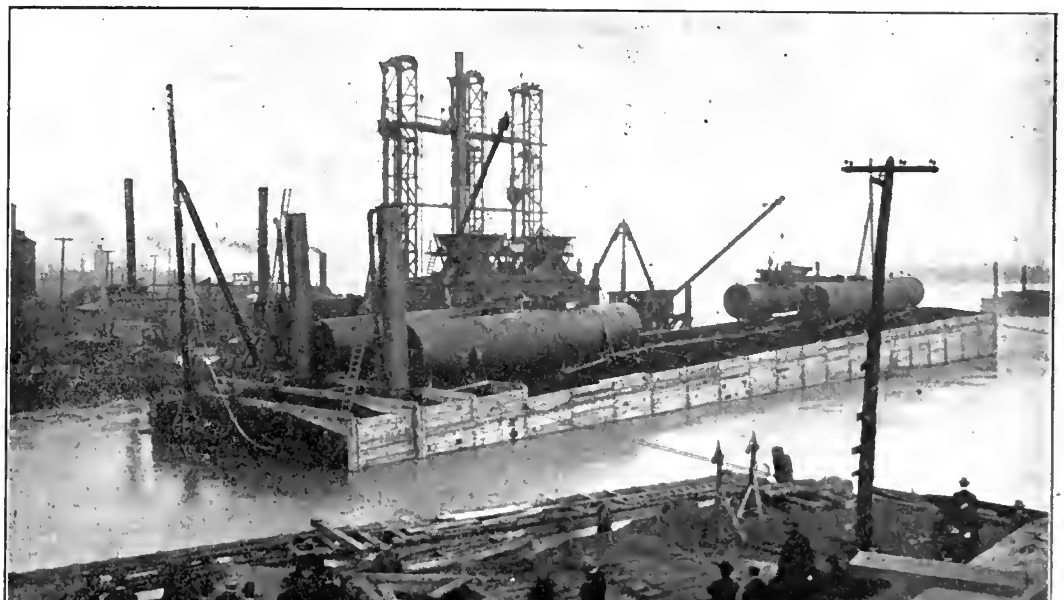
The finished structure consists of two parallel concrete tubes 20 in. thick, 20 ft. in internal diameter and 26 ft. 4 in. apart on centers. They have exterior steel shells, 23 ft. 4 in. in diameter, and are enclosed in a monolithic mass of concrete, about 56 ft. wide and 32 ft. deep.

The steel tubes are built in sections 262½ ft. long and are connected by exterior transverse vertical steel diaphragms 12 ft. apart which are 55 ft. 8 in. long and 30 ft. 10 in. deep with their edges stiffened by pairs of flange angles. The vertical and inclined outer edges of the diaphragms are sheeted with horizontal planks permanently enclosing the tubes like the sides of a bottomless scow and serving, after the tubes are sunk, for the exterior walls of a mould to retain the concrete jacket and prevent the large loss that would otherwise accrue from its lateral extension to fill the open trench if it were deposited without a mould. The tubes, diaphragms and sheeting were assembled and completed on shore and launched like a ship, towed to the site, sunk to position in the trench, coupled together by divers, the exterior concrete deposited under water through tremies and the inside concrete steel tunnel rings will be constructed in the water-tight tubes thus provided.

On the Detroit side of the river the approach is now being constructed by ordinary tunneling excavation methods and about 700 lin. ft. of trench has been excavated in readiness to receive the steel and concrete construction of the submerged portion. The junction with the land tunnel is made in a slip, sheltered from navigation and from the river current where the original depth of the water was about 26 ft., and the excavation was made to a depth of about 45 ft. below the surface by means of a dipper dredge with a 2-yd. bucket working on 1:1 slopes in the hard blue clay. Below a depth of 45 ft., the excavation is continued with 1:½ slopes by means of a clam-shell dredge with a special 2-yd. bucket, designed by the G. H. Williams Machinery Co., Cleveland, O. The jaws of this bucket have a width of 12 ft. when opened and in the hard, tough clay encountered cut off a 6-in. layer from the upper surface and roll it up like a carpet as the bucket closes. The average capacity of the dipper dredge is about 2,500 cu. yd. in 10 hr., and of the clam shell about 600 cu. yd.

It was at first proposed to secure the vertical alignment and uniform bearing of the steel tubes by driving foundation piles in the bottom of the tunnel trench and cutting them off accurately at the required level. It was finally decided that the same result could be more satisfactorily obtained without pile driving by the use of steel grillages supporting the ends of the tubes on the bottom of the trench. Accordingly there are provided for each section of the tunnel two grillages 42 ft. long and 38 ft. wide made with two 12-in. longitudinal and twelve 12-in. transverse I-beams, framed together and web-connected with their top and bottom flanges flush. In each corner of the grillage there is riveted a short vertical 6x6-in. angle to which is bolted an 8x8-in. vertical timber 6 ft. long with a sharpened point, projecting 5 ft. below the bottom of the grillage.

Pin-connected vertical rods 1 in. square, in convenient lengths of about 20 ft. are detachably connected to the corners of the grillage and suspend it symmetrically in a horizontal position under the bottom of the concrete barge. As the latter is only 35 ft. wide, the ends of the grillage project beyond both sides and the vertical rods pass up between pairs of horizontal cantilever beams projected to receive them upon the deck of the barge. The upper ends of the suspension



Tubes Commencing to Tip.

rods have long threads cut on them and the nuts engaging them take bearing on the cantilever beams and enable the grillages to be lowered accurately to position in the bottom of the trench.

Divers then descend and place on the square upper ends of the 8x8-in. vertical timbers a pile driver hammer running in special leads attached to the grillage. The hammer is then operated to drive the vertical post about 5 ft. in the bottom, bringing the grillage to the exact required level and thus providing for the accurate support of the tunnel tubes. Concrete is deposited around the grillage beams by the tremie tube, thus supporting them solidly and giving an extended bearing on the bottom of the trench to distribute the weight of the steel tubes and reduce the pressure to the proper unit values. Divers level off the top of the concrete so as to insure clearance below the upper flanges of the beams and the grillages are ready to receive the tunnel tubes.

The steel tubes are being built by the Great Lakes Engineering Works at their ship yard in St. Clair about 60 miles above the tunnel site. Each pair with its diaphragms and wooden sheathing, weighing in all about 800 tons are assembled and riveted up complete on several transverse supports, each of which contains four sets of loose timber blocking about 4 ft. high and is seated on ordinary launching ways inclined about 1:8 from the horizontal. The ends of the tubes are temporarily closed with solid wooden watertight bulk-heads and as the tubes are launched transversely the sets of blocking move down toward the water on the fixed timbers of the ways and when they reach the lower ends of the latter collapse successively until the tubes strike the water. This method of launching is a modification of that universally used in the ship yards on the great lakes.

After launching, a pair of horizontal longitudinal 10-ft. steel air cylinders 60 ft. long are temporarily attached to the top of each end of the pair of main tubes symmetrical with reference to them. A vertical access shaft 4 ft. in diameter and 32 ft. high is also attached at one end of each of the first pair of main tubes to serve as a manhole providing entrance to the interior after the tubes are submerged. In this condition the tubes have a draft of 4½ ft., with the diaphragms projecting 3 ft. farther down, and are towed 60 miles to the site and moored to pairs of anchors on the up and down stream sides. These anchors are of special design, built of steel and concrete, and weigh about 8 tons each, submerged.

The first pair of tubes was moored in a slip protected at one end from the current, which at the other end had a velocity of only about 1 mile an hour. At each end of the downstream side of the tubes was attached a single 2-in. manila hawser led through a snatch block on the anchor and another on an adjacent steel buoy of 5 tons buoyancy and then supported on a line of buoys carrying it to the capstan head of a hoisting engine on the concrete barge moored alongside the tube.

The moorings on the up-stream side of the tube were the same except that the 1¾-in. steel anchor cables were not connected to buoys, but led directly from the anchors to 8-part tackles rove with 2-in. manila line and operated by capstan heads of the same hoisting engines on the concrete barge. Provision is made for attaching four more sets of tackles and anchors to the up-stream side of the tunnel sections as they extend farther and farther into the river and the velocity of the current increases to 4 and 6 miles per hour. The mooring was found to be so efficient that the tubes could be adjusted quickly to within a very few inches of position by overhauling and slacking the lines.

As the first pair of tubes had to be sunk about 63 ft. special provision was required for locating them accurately under the surface of the water and was secured by providing at each end a riveted steel column about 50 ft. high temporarily seated on the center line on top of one of the tubes at each end and thoroughly braced by diagonal rods and struts. The column was conspicuously painted with alternate red and white marks, giving an accurate vertical target for leveling as well as centers for alignment.

The 35x155-ft. concrete barge 10 ft. deep was moored alongside the tubes to serve as a tender and its two 65-ft., 8-ton derrick booms were found very useful in handling the tubes and for various auxiliary services.

The tops of the shore ends of the first pair of tubes are provided with a seat for the cofferdam which will be sunk on it to make connections with the adjacent ends of the shore tunnel. Each tube is provided at the quarter points of its length with an inside removable wooden transverse vertical diaphragm reaching from the center of the tube to the top and forming a sort of trap which when sealed by the water rising in the tube as the latter is submerged, prevents the air from moving freely from one end of the tube to the other.

At 2.53 P. M., October 1st, men stationed on outside platforms, bracketed to the bulkheads in the ends of the tubes, opened four 14-in. valves in the bottom of the tubes allowing the water to enter them as the air escaped through openings provided for the purpose.

The tubes commenced to sink very uniformly and steadily at the rate of about 4 in. per minute until they were about two-thirds submerged when the extra weight of the access tubes, which had an unbalanced effect of about 24 tons, caused them to pitch downward more at that end.

This movement, gradual at first, was clearly perceptible at 3.53 P. M., and increased more rapidly thereafter until at 4.02 P. M., the river ends at the shore end air cylinders were partly submerged, and at 4.10 P. M., their upper ends were scarcely half way above the water. About this time their buoyancy began to overcome the unbalanced load of the tube and as the latter gradually righted themselves to a horizontal position, the shore end air cylinders ascended and the river end cylinders descended until at 4.37 both of them assumed the same horizontal position with their upper surfaces about 10 in. out of water.

The main tubes and their diaphragms and sheathing were thus floating in perfect equilibrium below the surface of the water and the efficiency of the air cylinders and the accuracy of their proportioning was abundantly demonstrated. When they were designed it was uncertain whether the sheathing would be made of hard or soft wood and a considerable discrepancy in weight, which might be expected to vary from 36 to 60 lb. per cubic foot was thus encountered and was provided for by the volume of the air cylinders. Green maple planks which weighed about 60 lb. per cubic foot were finally used for the sheathing and the air cylinders had to sustain the maximum weight. The inlet valves were closed and as it was growing late the tubes were left moored in position over night.

Before the tubes were sunk timber cradles were built on the upper surfaces of their air cylinders at both ends and on each of them was set a 6-ton counterweight made with two cross tiers of I-beams bolted together in a convenient manner. Each of these counterweights was provided with a bridle attached at each corner and secured to the hoisting tackle on one of the derrick booms of the concrete barge alongside.

On October 2d, the inlet valves in the bottoms of the air cylinders were opened and water enough admitted to cause the cylinders to be almost entirely submerged. The boom tackles were overhauled allowing enough additional load from the counterweights to be applied to overcome their remaining buoyancy, and slowly sink them, followed down by the partly supported counterweights. Evidently this motion could be arrested at any moment by hoisting on the tackles which would cause the tubes to rise upward.

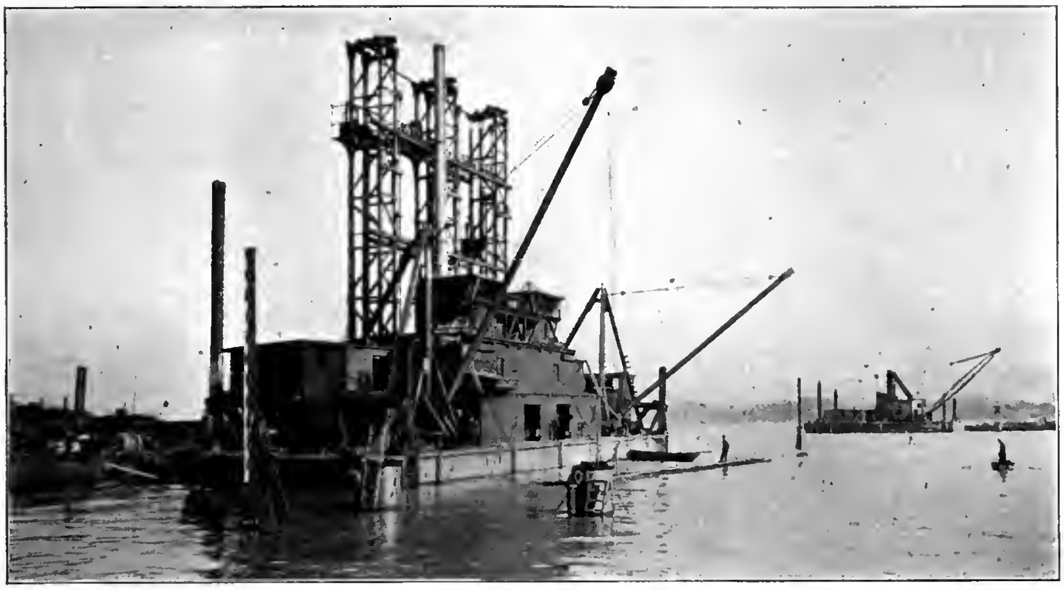
Tubes near Maximum Inclination.

During the sinking the maximum lateral displacement of the tubes from their center line was about 2 ft. When they were within a few inches of the bottom their vertical motion was stopped and they were easily set by adjusting the mooring tackles to within 2 in. of their required alignment. The tubes were allowed to sink to bearing on the steel grillages and sufficient water was admitted to the air cylinders to give a reaction of about 10 tons, under which it was very easy to pull them with the mooring tackles until their position was exact.

The total time required for filling and submerging the tubes was 1 hr. 43 min., and the computed time was 1 hr. and 45 min. Sinking the tubes from the surface of the water to their position on the grillages occupied about 30 minutes. The work was done with a total force of about 30 men, and was considered so satisfactory that no changes have been planned for the next pair of tubes which it is expected will be sunk before Nov. 15.

Soon after the tubes were seated on their grillages, the concreting underneath and around them was commenced and the concrete was deposited by the three 12-in. tremie tubes 80 ft. long which are suspended in three square towers on

the concrete barge and can be raised vertically clear above the surface of the water or lowered to rest on the bottom of the trench. Sand and gravel is dredged at Port Huron, 75 miles away, and delivered by scows to the concrete barge where it is unloaded by clam-shell buckets and deposited in elevated hoppers discharging on inclined screens which separate the sand and gravel and deliver them by gravity to hopper bottom bins with bottom gates through which they can be run into the charging hoppers of one 1-yd. and two ⅔-yd. cubical concrete mixers.



Tunnel Tubes in Position on Grillages in Trench, with Tops of Access Shafts Visible.

Bags of Alpha and Peerless brand Portland cement are delivered by a belt conveyor to the concrete charging platform and the mixed concrete is discharged from the machine into tilting buckets hoisted from 5 to 70 ft. in the tremie towers, to which are bolted guides for the bucket elevator. At the required height the bucket is tripped by a trigger which causes it to dump directly into the funnel at the top of the tremie tube, after which the bucket automatically reverses and is lowered for another batch and so on.

The tremie tubes were proportioned to discharge their contents within 5 minutes after it leaves the mixing machine so as to avoid all danger of set in the concrete before being placed, and the dimensions thus obtained have been found very satisfactory and have enabled the concreting to progress at the rate of 30 to 36 cu. yd. per hour for each tremie, giving very excellent results in water 72 ft. deep. This is considered notable since it is believed to be the first instance in which concrete has been successfully deposited by tremies at a depth of more than 45 ft.

All danger of breaking the seal at the foot of the tremie tube is avoided by the use of a telltale which constantly indicates the height to which the concrete rises above the foot of the tube on the outside. This consists of a 12-in. ball with a specific gravity a little greater than unity, which is suspended alongside the tremie tube by a wire passing through a vertical pipe and led around a sheave at the top of the tube to a counterweight and index which constantly registers the position of the ball on a scale alongside. It is found that the height of the concrete outside immediately adjacent to the tube varies from 6 to 12 in. above the bottom of the tube and that the moderately wet concrete flows almost horizontally about 10 ft. each way from the bottom of the pipe.

The water will be pumped out of the tunnel tubes by an electrically-driven Gould centrifugal pump in the bottom of each at the foot of the access shaft, which discharges through a 10-in. vertical pipe carried up outside to avoid obstructing the shaft.

After the tubes are firmly settled on their grillages, water is admitted into the air cylinders, reducing their buoyancy enough to relieve the strain on their connections to the tubes. They are then disconnected by divers and air being forced into the cylinders the water is expelled and they regain their buoyancy, rise to the surface and are installed on another set of tunnel tubes and so on.

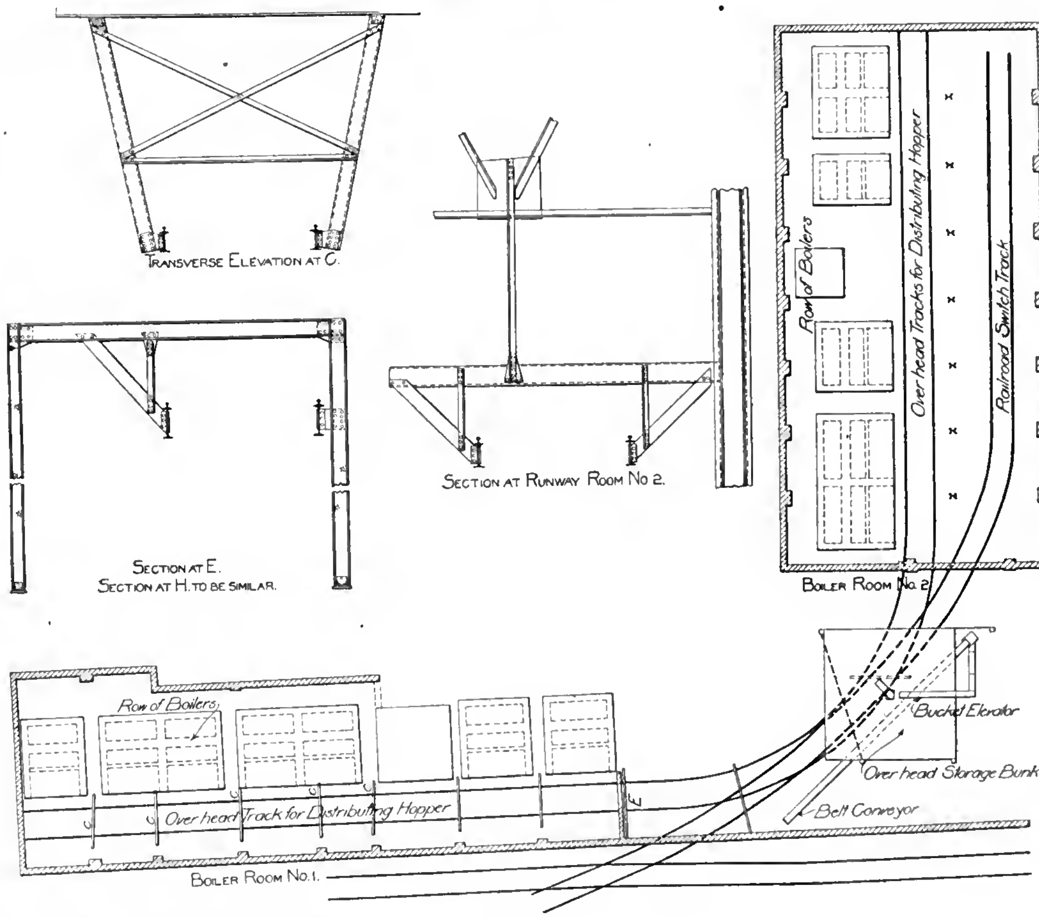
The tunnel is being built under the supervision of Mr. W. S. Kinnear, chief engineer of the Detroit River Tunnel Co., by Butler Bros.-Hoff Co., of New York City, under the personal supervision of Mr. Olaff Hoff. The design for the subaqueous section was made by Mr. Olaf Hoff, of the contracting firm, and was approved by the board of engineers consisting of Mr. W. J. Wilgus, Mr. H. A. Carson and Mr. W. S Kinnear. The Dunbar & Sullivan Dredging Co. are sub-contractors for the dredging.

An Unusual Coal and Ash-Handling Equipment for a Power Station.

The extensive by-product works of Armour & Co. are nearly all centered in a group of large factory buildings at Thirty-first and Benson Sts., Chicago. The great quantity of heat and power required by many of the processes in the various buildings is all supplied from a single central station, which replaced a number of separate mechanical plants in the different buildings when it was completed about three years ago. This station is specially designed to meet the many unusual demands for heat and power brought about by the by-product processes, such as the manufacture of soap and glue. Live and exhaust steam for heating are piped to the different buildings, but the mechanical equipment in all of the latter is driven by electric power generated in the central station.

The central station is contained in three buildings, a generator and engine house and two boiler houses, all of which are interconnected. The general arrangement of these buildings is shown in one of the accompanying illustrations. The two boiler houses form two sides of a hollow square, with the generator and engine house inside this partially enclosed space. As is shown in the plan, the adjacent ends of the boiler houses do not come together, but a connecting building has been erected over the space between them.

These houses contain thirteen Stirling water-tube boilers with a capacity of about 5,000 h.-p. Part of the boilers were formerly hand-fired, and the remainder were equipped with chain-grate stokers, which were also supplied by hand. Coal was delivered on a railroad siding that extends along the side of one house and on a second siding extending the full length of the other house, directly in front of the boilers. It was shoveled from cars on these sidings to firing floors in front of the boilers and from the latter into the furnaces. The ashes were hauled out of the basement in wheelbarrows operated on inclines extended to the firing-room floor. When the de-



Plan of Boiler Houses and Coal-Handling Equipment, Armour & Co.

cision was made to install mechanical equipment for handling the coal and ashes, arrangements were also made to equip the hand-fired boilers with chain-grate stokers, in order to eliminate as fully as possible all manual labor in the coal handling. The boilers are therefore all served by the new coal-handling installation, which is designed so it is common to both houses.

Essentially, the coal-handling equipment consists of a large overhead storage bunker, in the connecting building between the two boiler houses, and a hopper, carried by a crane traveling on a track suspended from the roof of this building and of the two houses, in which the coal is delivered to the boilers. The ashes are handled from a space under each boiler furnace to a storage hopper over the siding by a pneumatic exhaust system in which the only moving part is an exhaust fan.

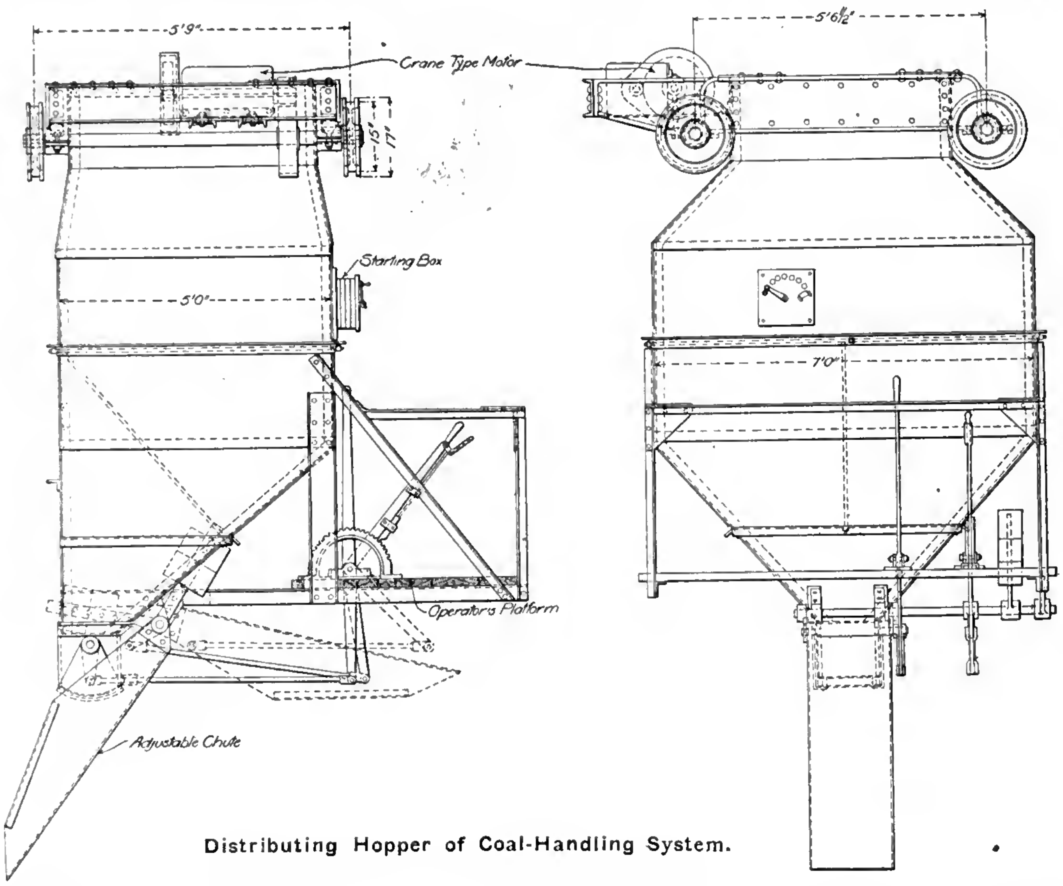
The coal is at present delivered into the connecting building between the two houses on cars on the railroad siding, and is shoveled from these cars on a horizontal belt conveyor, 55 ft. long between the end pulleys. Coal can also be shoveled through windows in the side of the connecting building on a second belt conveyor along that side which delivers to the one along the track in the building. The siding is on a 35-deg. curve at the latter conveyor, so the apron between the conveyor and the sides of the cars had to be built to meet this condition. The coal is delivered from the end of this conveyor through a crusher into the boot of a bucket elevator, or directly into the elevator boot by by-passing the crusher. The bucket elevator, 65 ft. 7 in. between the sprockets, is practically vertical, and is driven by a 7½-h.-p. motor, which also drives the belt conveyors. The elevator delivers the coal into the overhead bunker at one side of the latter, a horizontal run of a broad link chain serving as a distributer to carry the coal across the bin as it piles up on that side.

While this is the present method of filling the storage bunker, arrangements have been made to install a clam-shell bucket on a trolley on the roof of the building so the coal can be hoisted to the bunker from cars on the track at the side of the building by this bucket. As screenings are burned almost exclusively under the boilers in the two houses, this arrangement can be used, except when run-of-mine coal is received and has to be passed through the crusher. The men now required in shoveling coal from the cars to the conveyor belt can thus also be eliminated.

The overhead storage bunker is 32 ft. square in plan at the top and has a capacity of 400 tons. It is carried by four steel columns, two of which are each at a corner, while the other two had to be placed at a considerable distance from their corners to provide space for the switch track and the belt conveyor. The bottom of the bunker is built as a hopper with an undercut gate controlling the outlet.

The traveling hopper in which the coal is distributed from the storage bunker to the boilers has a capacity of 7 tons and is supplied from the undercut gate at the bunker. The four-wheel crane which carries this hopper runs on an overhead 5 ft. 9 in. gauge track. This track extends the length of the single row of boilers in each boiler house, a 55-ft. radius curve in the building between the ends of the two boiler houses connecting the track on tangent in the latter. The track consists of two 25-lb. T-rails carried by 15-in. I-beams. These beams had to be suspended in different ways, as the roof of one boiler house is carried by steel rafters, while the other boiler house roof is on steel trusses designed to carry overhead bunkers, and in the connecting building special supports were required.

The sides and ends of the distributing hopper had to be converged at the top, in order to permit the four-wheel truck carrying the hopper to be shortened sufficiently to travel around the 55-ft. radius curve without difficulty. The truck is built of structural steel shapes and carries a doube-flange traveler wheel at each corner, the pairs of wheels being 5 ft. 6½ in. apart on centers, which is the same wheel base as used for the trucks of heavy interurban railway cars. The truck passes readily around the curve in the track on which it travels, the hopper, in fact, being loaded from the overhead bunker while on the curve. The hopper is propelled along the track by a 9-h.-p. crane type motor, geared in the ordinary manner to the axle of one pair of wheels. This motor is designed to operate at about 850 r.p.m., thus giving the hopper a traveling speed along the suspended track of about 260 ft. per minute. The motor is controlled by a starting box mounted on one side of the hopper where it is within reach of an operator on a platform carried on that side of the hopper. Two of the traveling hoppers are provided, one for each boiler house, but a single hopper is used to supply coal to both of the latter and the second one is held in reserve.



Distributing Hopper of Coal-Handling System.

The operator on the platform carried by the hopper controls the undercut gate on the storage bunker, and also an undercut gate on the hopper, by a lever for each gate at the platform. As the gate on the hopper is opened and closed, the lever operating it simultaneously lowers and raises, respectively, a hinged chute extending to the charging hoppers of the stokers. These hoppers of the stokers have been enlarged to hold two tons each. When the distributing hopper reaches a stoker to be supplied with coal, the chute is lowered and the distributing hopper moved slowly along the track until the stoker hopper is filled, without spilling any coal. The distributing hopper is then moved along to the next stoker to be supplied. Working in this manner one distributing hopper has demonstrated that it can easily supply coal to the thirteen boilers, and give the man who operates it sufficient time to operate the pneumatic ash-handling system.

The coal-handling equipment was designed by Messrs. Orton & Steinbrenner, commercial engineers, of Chicago, and was manufactured by the C. O. Bartlett & Snow Co., of Cleveland, Ohio.

A tunnel, 8 x 8 ft. in cross-section, was built the length of both boiler houses, under the floor in front of the boilers, to provide in each case for a 10-in. pipe header of the ash-handling system. Each header is connected to the ash pit of each of the boilers in the row served by it. The 10-in. headers both terminate in a specially-constructed separator placed close to the roof in one of the boiler houses. An 18-in. pipe leads from the separator down to a 40-in. exhaust fan on the floor below and thence up to a free exhaust above the roof.

The connection to each ash pit from the header is ordinarily closed; when ashes are to be removed from a pit, a plug in a tee on the connection is removed and a small hopper is inserted in order that the ashes may be pulled into the connection readily. The two headers are connected with the separator on diametrically opposite sides near the top. They are both extended into the separator by an elbow with the open end down, so the ashes are discharged to the bottom of the separator. The connection between the fan and the separator is taken out at the top of the latter. With this arrangement the inflow of ashes and air is not only directed to the bottom of the separator, but also has a much higher velocity than the upward outflow of air, due to the relative cross-sectional areas of the inlet pipes and the separator. A spray of water, directed from a nozzle in the top of the separator, is continuously played on the ashes as they enter, which, together with the difference in velocity between the inflow and the outflow, results in the ashes being completely deposited in the bottom of the separator. The ashes are drawn from the separator through a pipe controlled by a continuous discharge gate of the revolving pocket type. This gate is always sealed to prevent the admission of air and is turned by a small motor. A storage bunker, with a capacity of 60,000 lb. of wet ashes, is placed immediately under the separator, where its contents can be discharged through an under-cut gate, operated from the boiler room floor, into a car on the switch-track on that floor.

This installation of pneumatic ash-handling equipment has operated with complete satisfaction during the brief period it has been in service. The Economic Engineering & Construction Co., of Chicago, by which it was designed and

installed, has also furnished the same equipment to a number of other power plants, in which it is operating with surprisingly excellent results. A velocity such as is furnished for the equipment that has been described, by the fact that is a part of the latter, will lift paving brick from the ash pits and deliver them to the separator. In fact, in a test of an installation of this kind recently made by the engineering department of the Western Electric Co. bricks were carried 200 ft. in a horizontal pipe and elevated to a separator 110 ft. above the ash pits.

It is expected that the ash-handling system in this plant will not have to be operated more than four out of the twenty-four hours to handle all of the ashes produced by the furnaces of the thirteen boilers. Following the practice that has been evolved in operating previous installations, the equipment will probably be operated for short intervals at a time, as the contents of an ash pit can be removed very quickly. The man who operates the coal distributing hopper will therefore also be able to operate the ash-handling equipment, since the latter requires only a small amount of labor involved in pulling the ashes into the portable hopper placed on the connection to the ash pit.

The central station in which the installations that have been described were made is operated under the direction of Mr. C. W. Brown, chief engineer of the station and of the works supplied with power by it.

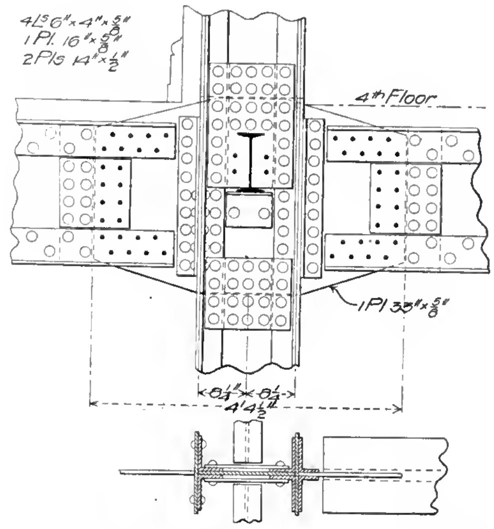
Temperature Changes in Pipe Tunnels.

Cracking from temperature changes has not occurred in a 750-ft. concrete subway having a 350-ft. branch, in which steam, water and air pipes have been run, according to a committee report to the recent convention of the Association of Railway Superintendents of Bridges and Buildings. The tunnel is 4½ ft. wide, 3 to 5½ ft. deep, with side walls and bottom 12 in. thick and a 4-in. cover slab of reinforced concrete, which is used for trucking materials between different buildings. No provision for expansion was made in the walls or bottom, but joints were made in the cover by cutting through the concrete at every 5-ft. joint in the sheets of reinforcement before putting on the top surfacing. The temperature in the tunnel has ranged from 110° to 175° during the last three years, during which no cracks have been observed in the concrete.

A STEAM DRIVEN TURBO-GENERATOR of the Curtis type, having a normal capacity of 20,000 h. p., has been ordered from the General Electric Co. through the Pacific Coast office.

The German-American Insurance Building, New York.

The new steel cage office building for the German-American Insurance Co. is a 20-story and basement building, about 273 ft. high from the curb to the roof, located at the intersection of Liberty St. and Maiden Lane, adjacent to the congested banking district in lower New York. It occupies a trapezoidal area, about 19 ft. wide at one end and 62 ft. at the other end, with fronts of 128 ft. on Liberty St. and 137½ ft. on Maiden Lane. The superstructure is supported on twenty rectangular concrete piers, carried down to hardpan about 40 ft. below the curb in wooden pneumatic caissons. At the wide end of the lot there are two very large piers, each supporting 4 columns; at the narrow end there is a single full-width pier, supporting four columns, and all intermediate columns are each supported by separate piers. The column loads, of a maximum of 1,800,000 lb., are transmitted to the concrete pier through I-beam grillages, which extend the bearings sufficiently to reduce the unit pressure to 30,000 lb. per square ft. on the concrete.



Connections to Column 21 at Fourth Floor.

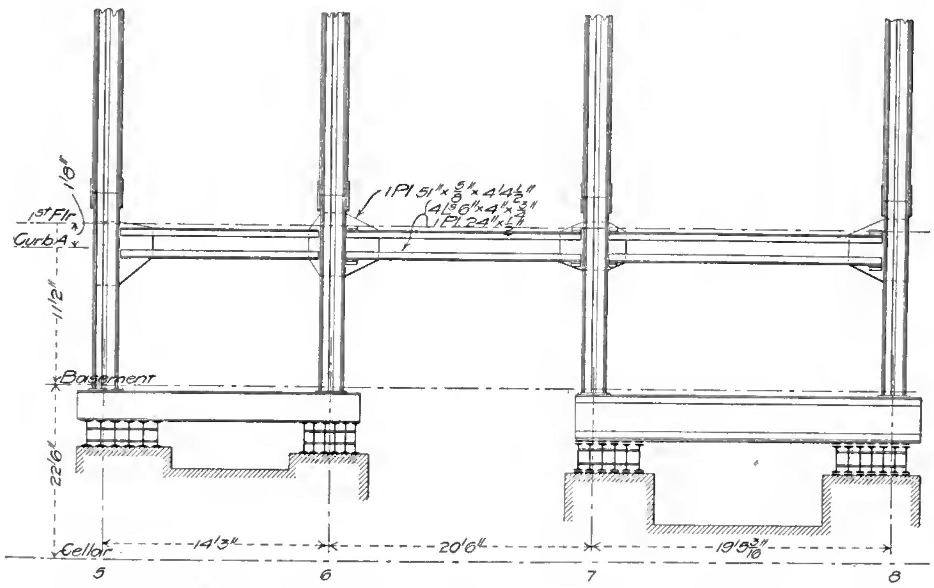
The largest loads carried by the intermediate columns are 940,000 lb., which are transmitted from the column base to the grillage through three distributing beams 5½ ft. long, each of which is made with a pair of 15-in. 45-lb. channels, riveted together back to back to provide thicker webs for the heavy shear than could be secured in single I-beams. The channels are seated across the top flanges of eight 12-in. 35-lb. I-beams, 5½ ft. long, connected together with six tie rods and gas-pipe separators. The beams are set in the usual way on a ¾-in. layer of grout, and the interstices between their webs are filled with concrete, which is extended to enclose them with a minimum thickness of 3 in.

At the ends of the building there are three groups of 4 columns each, seated at the corners of the piers on grillages symmetrically arranged so that the center of gravity of the system corresponds with that of the pier. As the centers of all wall columns are located 22 in. from the building line, it is impossible to make them concentric with the grillages or with the piers, and they are seated on the short arms of transverse cantilever girders, with their fulcrums on the center lines of the grillages, which in turn are either central or symmetrical with the piers.

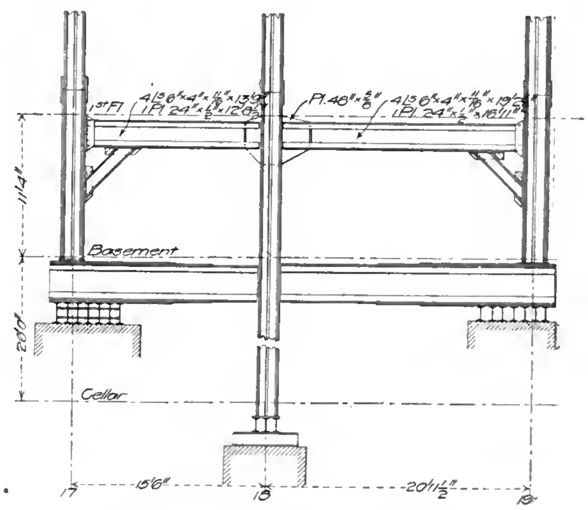
At the narrow end of the building the three last transverse bents of the framework are made with two columns each, which are seated at the opposite extremities of double cantilever girders, the upper flanges of which are 3½ in. below the basement floor line. In these bents the columns are from about 16 to 24½ ft. apart on centers, the respective girders are about 4 ft. longer over all than the distance between centers of the columns, and the distances between centers of their bearings on the grillages is about 2 ft. less than the distances between centers of columns, thus making each girder consist of two short cantilever arms connected by a long anchor arm. Each girder is composed of two independent plate girders, about 3 ft. deep, with single or double cover plates on their top and bottom flanges.

Where the building is wider each transverse bent contains three or four columns, from about 14 to 23 ft. apart on centers. In the wide bents the transverse cantilever girders are not continuous across the full width of the building, but are arranged in two different ways, both of them corresponding to the construction already described over the wall piers, but varying at the inner end. In the three-column bents the inner ends of the girders abut against the opposite faces of the interior columns and are field riveted to them several feet above their bases, which are carried down to a lower level than are the wall columns. This arrangement conforms to the construction of the interior piers, with their tops 3 or 4 ft. below the cellar floor, and of the wall columns, with their tops correspondingly close to the basement floor, which is 26 ft. above the cellar floor.

In some of the four-column bents in the wide part of the building the cantilever girders in the side panels are like those already described in the three-column bents, with the inner ends connected to the exterior columns between the basement and cellar floors, and with the girder essentially continued across the center panel by means of a 20-in. I-beam, with its top flange flush with the top flanges of the girders. Other four-column bents



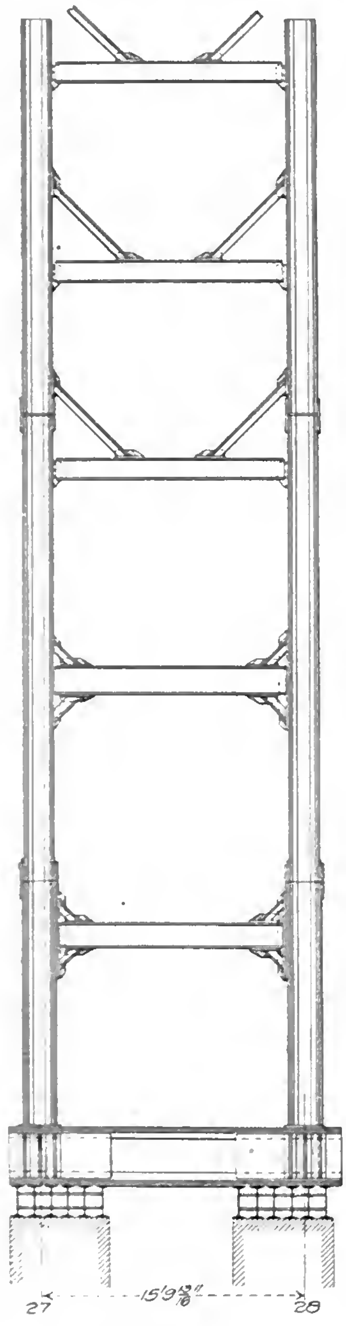
Transverse Section at Wide End of German-American Insurance Building.



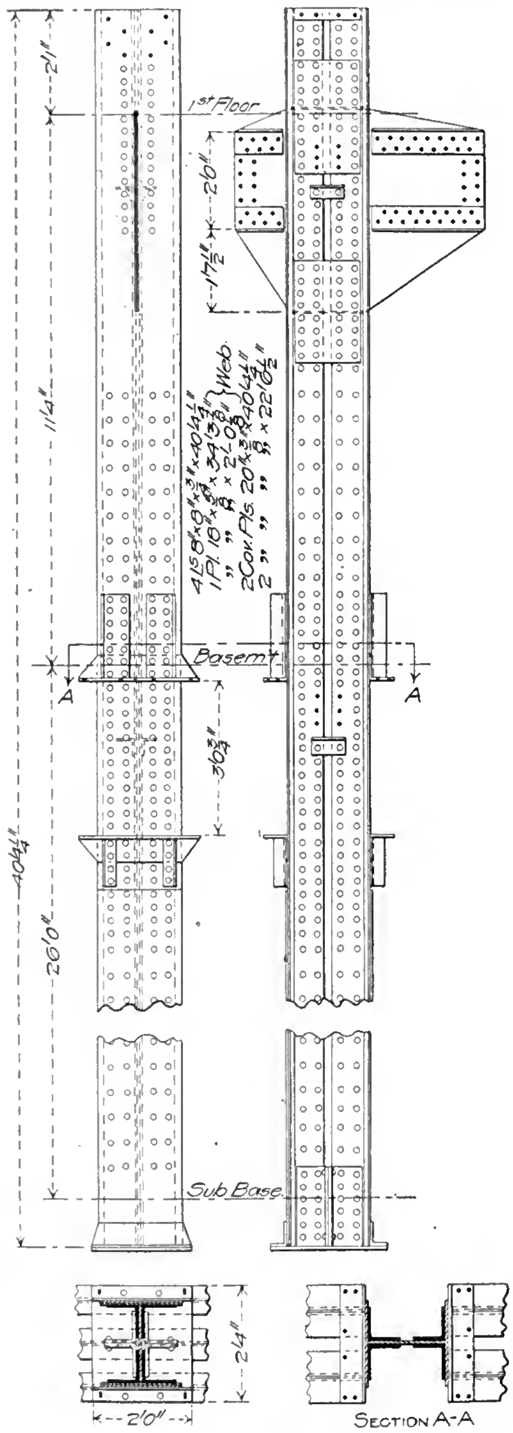
Intermediate Transverse Section.

are made with the cantilever girders quite symmetrical about their center line and supporting the interior columns on their top flanges the same as the wall columns. In this case the interior columns are not connected, and there is no floor beam across the center panel below the first floor above the top.

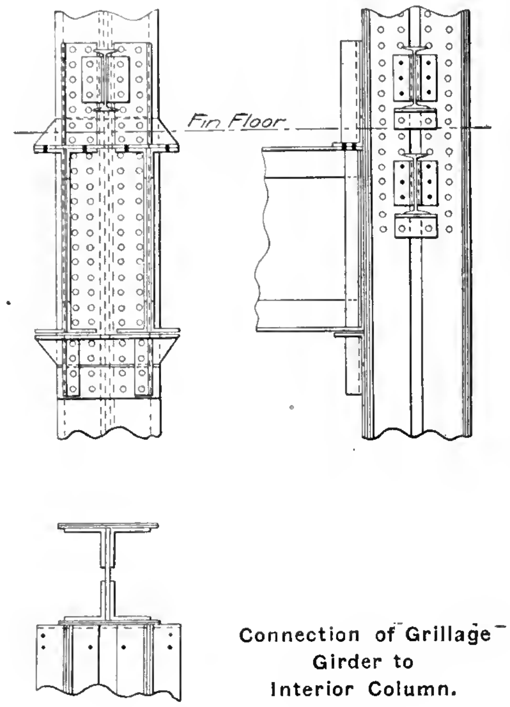
It was assumed that the mass of the building, the stiffness of its walls and the rigidity of the regular connections are sufficient to resist the horizontal stresses in longitudinal planes produced by the assumed wind load of 30 lb. per square foot. Transversely, however, the building is so narrow that special wind bracing was introduced in every bent, and the details were arranged to facilitate shop riveting, to eliminate as much as possible field riveting, to cause the minimum obstruction to the windows and to conform with



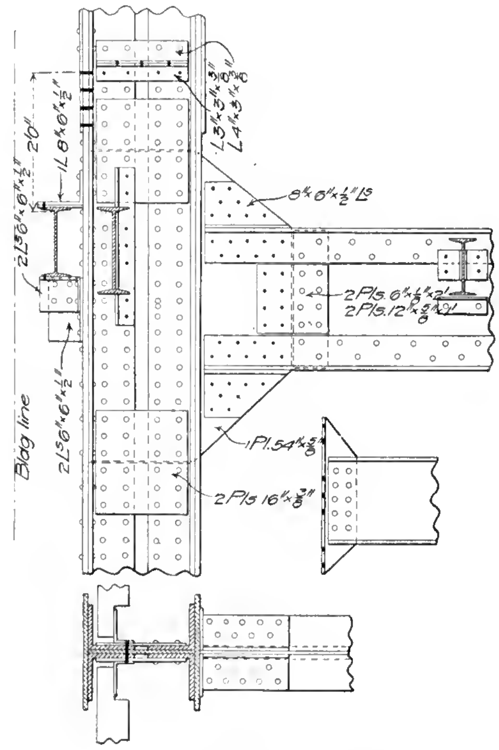
Wind Bracing, Narrow End.



Lower Section of Typical Column 18.



Connection of Grillage Girder to Interior Column.



Wind Brace Connections.

the requirements of the general architectural treatment.

In all panels there are horizontal struts just below the floor line, which increase in depth and cross-section from the top downward. All of them are knee-braced to the columns at both ends; in most cases the knee-braces are formed by deep, vertical gusset plates integral with the column web and projecting beyond both top and bottom flanges of the horizontal struts. In some cases, however, these are replaced by entirely detached knee-braces.

In the end panel the transverse struts are omitted above the 15th floor, and from the 15th floor to the 3d floor, inclusive, the struts are made with a pair of channels having vertical connecting angles to the columns and provided on the upper side only with knee-braces, made of a 6x3½-in. angle. At the first and second floors the struts have short detached angle braces on both top and bottom flanges, which are connected to the columns through the same vertical angles that engage the webs of the strut.

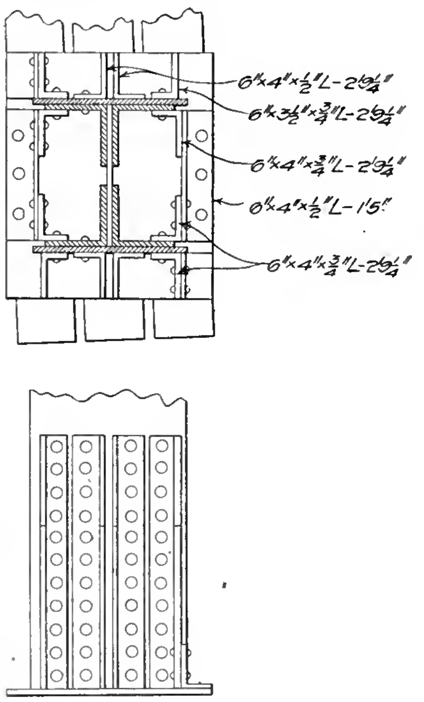
All other transverse bents have channel struts without knee-braces at the 16th and 17th floors, and below that have struts made with pairs of plate girders and solid gusset plate knee-braces to both top and bottom flanges, except in some cases at the first floor, where in one two-column bent and one three-column bent the lower flange only is knee-braced with pairs of 12-in. channels. The minimum plate girder struts are made with four 3x3x⅜-in. flange angles and one 24x⅜-in. web plate. The maximum have four 6x6x13-16-in. flange angles, and one 24x½-in. web plates, or four 6x6x13-16-in. flange angles, and a 36x½-in. web plate, and are connected to the columns with 66x⅝x35½-in. gusset plates.

The walls in the street fronts of the building are carried at every story on I-beams, bracketed out from the face of the columns and abutting on the center lines of the latter. They are 15 in. deep, except at the third floor, and in one panel of the first floor, where they are 20 in. deep. Above the second floor all of them are knee-braced at both ends with single 6x3½x⅜-in. angles at 45 deg. with the top flanges. Below the third floor all of these knee-braces are omitted, except in the end panels and in one special first floor panel, where there are also two long knee-braces to the center point of the second floor wall girder. In the lower end panels the knee-braces are made with 12-in. channels, and in the basement the lower flanges of the wall girders are braced with single 6x3½ in. angles.

All of the columns have I-shaped cross-sections, made up with a web plate and four flange angles, with or without cover plates, as required for different loads. At the floor points the regular column webs are cut to clear short sections of wider web plates, which are shop riveted between the column flanges and project beyond them far enough to provide gusset plates punched for field rivets in the ends of the transverse girder braces. Where the braces are plate girders their webs

are cut to clear the column webs and are spliced to them with cover plates, while the flange angles project across the column webs, and in some instances have additional connection angles riveted to their outside flanges to develop the full strength of the angles.

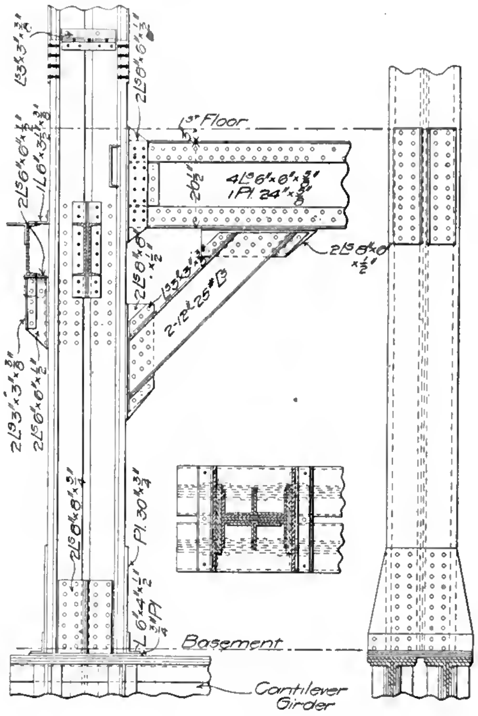
The details of the wall columns are clearly shown in the engravings of their connections with the transverse braces. They are of simple construction, spliced just above floor level with jaw plates, shop riveted, to the lower ends of the upper sections of the columns and with horizontal angles riveted to the webs of both columns. Columns 23 and 24 are seated on the top flange of the basement cantilever girder, to which they are connected by rivets through horizontal transverse flange angles at the lower edges of extended web plates, reaching across the full width of the girder. Two pairs of 8x8-in. vertical angles, back to back, are riveted to the lower end of the web and faced to bearing on the top of the girder so as to thoroughly distribute the column load.


Base of Column 2.

Columns No. 10 and 11 receive the ends of the basement cantilever girders one story above their pedestals, and the heavy upward reactions are transmitted to them through double rows of rivets in 2 vertical 8x8-in. angles, riveted to the inside of the webs of the girders. Transverse angles riveted to the column face also form reaction seats for the upper flanges of the girders and are reinforced and their loads distributed somewhat through the column by 8x8-in. vertical angles, faced to bear against their horizontal flanges. The lower flanges of the girders are also seated on horizontal shelf angles, riveted to the column faces and reinforced with small vertical angles milled to bearing on their outstanding flanges in the usual manner.

Column No. 2, in the party wall at the end of the building, is seated directly on a group of three distributing I-beam girders. It has a wide base extended to cover the full width of the I-beams and distribute the load upon them and stiffened by 12 vertical angles, riveted to the extended side plates at the base of the column in pairs back to back on the center line of the web and at the corners of the base plate. The interior columns are of very simple construction, with horizontal shelf angles engaging the top and bottom flanges of the connected girders and vertical web-connection angles for the I-beam floor beams, which are also, for convenience in erection, seated on bottom flange shelf angles.

Throughout all the floors the I-beams are placed longitudinally and are from 4 to 5 ft. apart, with spans of about 18 ft. In the basement they are connected directly to the transverse cantilever girders, with the top flanges of the beams flush with those of the girders. In the basement they are generally single 12-in. 31½-lb. I-beams, except in some cases where they are made with a pair of 12-in. channels riveted together back to back, in order to provide spaces between their webs for the connection of hanger plates. The upper floor beams are nearly all 10-in. 25-lb. I-beams, connected directly to the columns at panel points and intermediately web-connected to the transverse girders which serve as wind braces, as previously described.



Detached Knee-Braces at Columns 23 and 24.

Messrs. Hill & Stout are the architects and Post & McCord are the general contractors for the steel work.

Foundation Reconstruction of unusual difficulty has been carried on for some years at Winchester Cathedral, in England, under the direction of Mr. T. J. Jackson. The original Norman church was built in the eleventh century on the edge of a peat bog 7 ft. thick, covered by a bed of chalky marl washed down from the surrounding elevations. The early builders encountered water at a depth of about 10 ft. and were unable to go deeper, so they drove some short oak piles and laid their foundations on them. When the presbytery and first bay of the lady chapel were undertaken, at the end of the twelfth century, it was necessary to go out into the bog farther. The water kept the builders from excavating below 10 ft., and at that depth they constructed a platform of trunks of great beech trees. This foundation has been gradually sinking, the vaults have been disturbed, and this part of the building has split off from the Norman portion. These sinking walls have been underpinned, down to a gravel bed underlying the peat at a depth of 16 ft., by concrete foundations put in place with the help of divers, who were employed in order to avoid the danger of settlement attending any attempt to pump water from the peat. The older Norman portions of the cathedral are now being partly underpinned in the same way, but other necessary repairs, such as iron ties to hold together some of the old walls must be deferred until more funds can be raised.

Removal of Manganese from Deep Well Water.

The "Journal für Gasbeleuchtung und Wasserversorgung" for Aug. 17, 1907, describes an interesting experience with manganese in the water supply of Arad, in the southern part of Hungary, where Rudolf Hajek is the director of waterworks. The city lies at an elevation of 348 ft. above the sea, and like others in that region suffers from a lack of good drinking water. In 1895 some test wells were driven in the diluvial strata to a depth of 328 ft., and assurance was given by the Municipal Chemical Institute, after having analyzed the water, that a good supply, satisfactory in quality, could be obtained at a depth of 138 ft. Accordingly works were built to take the water from wells at this depth. Although the chemical analyses had shown that the water contained only slight traces of iron, with no mention at all of manganese, the builders, Messrs. Hughes & Lancester, of London, advised that the water be aerated and filtered in order to prevent incrustation of the pipes. Sufficient aeration was obtained from the compressed air used for lifting the water, and the Fischer system of sand filtration was installed.

The wells, which were 9 to 12 in. in diameter and 132 to 138 ft. deep, were sunk in a line at right angles to the direction of the flow of the underground water. By means of compressed air, at 3.5 atmospheres, the water was lifted at the rate of 600,000 to 720,000 gal. per day. 1.5 cu. ft. of air at atmospheric pressure being required for each cubic foot of water. From a small receiving reservoir into which the water was thus pumped, there was a gravity flow to the filter beds. The filtered water was collected in a pure-water reservoir, holding 16 to 24 hours supply, and from this reservoir the water flowed by gravity to a pumping station, 300 ft. distant, where high-duty pumps sent it through two 14-in. force-mains 23,000 ft. long, to the distribution system of the city.

The works were put in service about the end of 1896 and for a number of months operated without trouble, but at the end of the first year the water drawn from the taps began to have a yellowish-brown color, which was especially marked whenever the circulation in the pipes was increased by sudden draft occasioned by the use of water for street sprinkling, fire service, or the like. A vigorous system of flushing was resorted to in order to prevent this trouble, and at the same time some investigations were begun to ascertain its cause.

These investigations showed that the water from the deep wells before and after filtration was perfectly clear. A large amount of iron oxide accumulated on the filter. There was practically no deposit in the concrete pure-water reservoir after one year's use, but in the pipes which conveyed the water from the pure water reservoir to the pump well, and in the force mains from the pumping station to the distribution system, where the velocity of the water was only 0.85 ft. per second, there were found numerous brown flocks on the upper surface of the pipe. On the bottom there were deposits about 0.04 in. in thickness. The service pipes, which, with a few exceptions, were of 1-inch galvanized iron pipe, contained very little deposit, although, in a few cases, the inside diameter was reduced considerably by incrustation. But the galvanized iron strainers of the water meters were found to have their holes almost completely choked with a yellowish-brown mass, though the strainers made of copper or brass were but little stopped up.

In 1903 samples were sent to the London chemist, Mr. Bertram Blount. He found that the suspended matter contained 71.02 per cent. of manganese dioxide (MnO_2), and 5.95 per cent. of manganese oxide (MnO), although the Hun-

garian Chemical Institute failed to find a trace of manganese in samples taken under the same conditions. The investigations showed that the trouble was not due to iron, which was present in the water only to the extent of 0.025 part per million, but rather to the compounds of manganese which had been reported as existing only in traces. This manganese did not separate out in the quiet water of the reservoir, but the deposits were greatest on the vertical rough sides of the pipes, and on the screens of the meters in similar places.

The trouble was found to occur intermittently, and was found to be greatest after periods of heavy rain. The reason for this was made clear by a study of the local geological conditions. The underground water at Arad flows from east to west, coming from the direction of the Carpathian Mountains 15 to 20 miles distant. Between the upper diluvial stratum and the lower stratum from which the well water is derived, there is a clay bed about 45 ft. thick which separates the two. The dip of the strata is such that the lower water-bearing stratum outcrops at the Carpathian Mountains, and it is known that at this point manganese is very abundant. In fact, manganese compounds often lie upon the surface of the ground exposed to the rains. The dissolved compounds thus find their way into the ground and to the wells at Arad.

From the location of the manganese deposits in the pipe, it was thought that the trouble could probably be avoided by installing a pressure filter at the end of the force mains, but it did not seem practical to do this. The most feasible plan seemed to be to place a filter at the lower end of the force main just outside the pumping station, and this was accordingly done. The results fully justified the expectations, and during the last 32 months the water in the city has been clear, while the street mains have not had to be cleaned, examinations showing that they were in no way incrusted. The pressure filters were furnished by Bell Bros., of Manchester, England, and this particular system is said to have been used because of its low cost and its simple operation. The filters are cleaned once in 10 to 25 days, and it is said that from 13,000 to 21,000 gal. of water are used each time for washing.

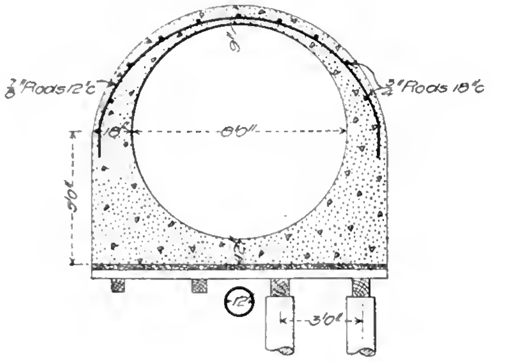
Experiments which were made on a small scale showed that by the addition of milk of lime to the well water, which has a hardness of 140 parts per million, a more complete separation of the manganese compounds could be obtained, but thus far it has not been necessary to resort to the use of chemicals. Had they known originally that this water contained manganese, it is probable that the design of the works would have been quite different with respect to the filtration of the water.

AN ENORMOUS TUNNEL on the proposed canal between the Rhone River and Marseilles is reported in European papers to have been approved by the Bureau of Bridges and Highways of the French government. The tunnel is to be 4⅜ miles long, 72 ft. wide and 46.6 ft. high, and is estimated to cost $6,900,000.

The Ingleside Sewer, Borough of Queens, New York City.

A large, circular, reinforced concrete trunk sewer is now being built in the Borough of Queens, New York City, which will serve ultimately about 1,200 acres in the Ingleside district of that borough. Ingleside is a suburb of Flushing, and, while it is now only partially settled over most of its area, these conditions will soon be changed by the influx of population which will follow the improved transportation facilities soon to be afforded by the East River tunnels and new bridges. The surface of this district is flat or gently rolling, and the general elevation above mean high water varies between 10 and 110 ft.

The Ingleside sewer, which is to carry combined storm-water and house-sewage flow, has its outlet on Flushing Creek, a small creek which empties into Flushing Bay, on Long Island



Section of 8-Foot Sewer.

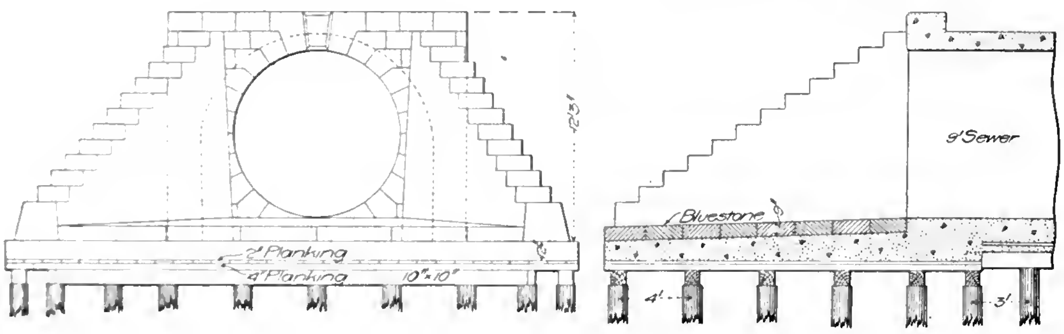
Sound. To comply with a State law, which prohibits the discharge of crude sewage into Flushing Bay, a cut-off has been provided near the outlet, where the dry-weather flow will be diverted through a 24-in. pipe and led to a disposal plant: this cut-off will be referred to later. The storm-water flow will be discharged directly into the creek, the dilution when the cut-off becomes inoperative being sufficient to make this admissible.

The work now under contract involves the construction of 725 ft. of 9-ft. sewer, 1,580 ft. of 8 ft. 9 in., 1,007 ft. of 8 ft., 774 ft. of 6 ft. 6 in., 810 ft. of 6 ft., 1,830 ft. of 5 ft. 3 in. and 245 ft. of 2 ft. 6 in. A special outlet portal will also be built.

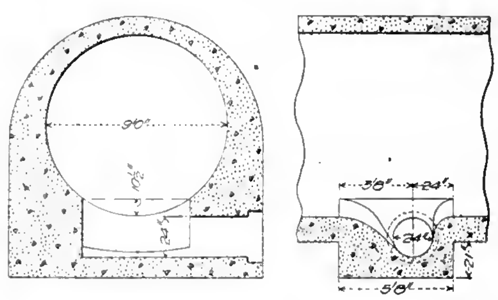
The sections for all sizes of the sewer, down to and including the 5 ft. 3 in. size, are alike in form, the outer sides of the invert below the springing lines being carried down vertically to meet the plane of the base. Ransome bars are used throughout as reinforcement, the transverse bars in all the larger sizes being bent to a three-centered curve, as shown in an accompanying cross-section of the 8-ft. sewer. Pile foundations are specified, to be used where necessary, but so far no piles or planking have been required. A sub-drain of 12-in. farm tile, laid as the work progresses, drains the trench without difficulty.

The outlet portal is designed to distribute the flow of storm water and prevent erosion near the mouth of the sewer. This portal consists of a 12-in. slab of concrete extending about 17 ft. in front of the mouth of the sewer, to form an apron, with a flaring wing wall at each side, as shown in accompanying sketches. The concrete apron is paved with 9-in. bluestone slabs, and the inside faces of the wing walls have a 2-in. facing of special mortar made of one part of cement, one part of sand and 1½ parts of granite dust. This facing mortar is placed at the same time as the body of the concrete. To divert the storm water into the channel of the creek the downstream wing wall forms an angle with the axis of the sewer 10 deg. greater than that formed by the upstream wall. The angles formed by the wing walls with the axis of the sewer are 30 deg. and 20 deg., respectively. Piles and planking, arranged as shown in the sketches, support the portal.

The dry-weather flow cut-off will be placed just above the outlet portal and will consist of a transverse depression in the main sewer, into which the sewage will drop and from which it will be carried away by a 24-in. pipe leading to the sewage disposal plant, to be constructed later on a site already secured near the outlet. The details of this cut-off are shown by accompanying sketches. With a cut-off of this type the flow to the disposal plant would continue uninterruptedly, even though the quantity of storm water entering the sewer diluted the sewage so greatly as to make the direct discharge of the mixture into the bay permissible. To avoid operating the disposal plant unnecessarily and to save the expense of constant attendance, which would be necessary with a manually-operated cut-off, an automatic cut-off will be placed on the 24-in. pipe outside



Elevation and Section of Ingleside Sewer Portal.



Dry-Weather Cut-Off.

the main sewer, so that as the storm-water flow increases the flow to the disposal plant will be gradually and automatically reduced and finally stopped entirely.

At this time the 9-ft. sewer, except a short length near the outlet, has been completed, and work is in progress on the 8-ft. 9-in. section. The trench is excavated with pick and shovel, and the spoil is hoisted and delivered in 1-yd. Hayward buckets as back-fill over the completed part of the sewer by a Carson conveyor, operated by a Lidgerwood engine and boiler. This conveyor, which is one of the standard type manufactured by the Carson Trench Machine Co., consists of a series of A-frames spanning the trench and supporting a hanging rail, on which a hoisting carriage is drawn back and forth by cables. The A-frames are placed 16 ft. apart on centers, and each leg of each A-frame has a double-flanged wheel placed in a vertical plane parallel to the axis of the sewer. A line of light rails on each side of the trench forms a track, on which the whole conveyor, including the platform carrying the boiler and engine, runs. On the work in question the entire conveyor is about 300 ft. long. The soil in which the trench has been excavated thus far is gravelly and very firm, so that close sheeting has not been required.

The concrete, which is a 1:2:4 mixture of Alsen Portland cement and Cow Bay sand and gravel, is mixed by hand on a platform beside

the trench and delivered to place through sheet-iron pipes. Hand mixing was adopted on the first part of the work because certain conditions prevented the economical use of a mixer. A Smith machine is on the ground, however, and will be used for the greater part of the work. For forming the crown and invert, sheet-steel centers of the standard type supplied by the Blaw Collapsible Steel Centering Co., are used. These are handled in 30-ft. sections, made up of 5-ft. lengths braced with rods equipped with turnbuckles in the usual manner. A mixture of kerosene and slush grease is used to lubricate the surface of the centers. Special care is taken to insure the construction of the invert at the proper grade, and to this end steel pegs are driven into the foundation slab, at 25 ft. intervals, while the concrete is still green, the tops of the pegs being exactly at grade. In addition to these there are the usual grade stakes outside the trench. The center line of the sewer is given by a double row of stakes, one on each side of the trench, the stakes in each line being at 25-ft. intervals and 25 ft. from the center line of the sewer.

Invert Forms in Place, Ingleside Sewer.

The curved transverse rods are bent by a blacksmith, assisted by two laborers. Each rod is first run through a three-roll tire-bending machine, such as is commonly used in wagon shops. After the rods have been roughly bent in this manner they are tested on a wooden template and brought to exactly the right shape by blows with a sledge. In general, 60 or 70 rods can be bent in an 8-hr. day, and the results secured by this method have proved very satisfactory. In placing the rods in the trench they are hung from a ridgepole over the center of the invert and wired securely in place in the usual manner.

The work of the Bureau of Sewers in the Borough of Queens is under the general direction of Joseph H. De Bragga, superintendent of sewers, and Mr. J. H. Johnson, chief engineer. The plans and specification for the work described were prepared by Mr. Alberto F. Schreiner, assistant engineer. Mr. William L. Pyne, assistant engineer, is in charge of construction. Messrs. P. J. Murray & Bro., Brooklyn, are the contractors, Mr. A. B. Nichols, superintendent.

Construction Methods in the Second Bergen Hill Tunnel of the Lackawanna R. R.

The second Bergen Hill Tunnel of the Delaware, Lackawanna & Western R. R. lies parallel to and with its center line 51½ ft. south of the center line of the present tunnel, which carries all of the traffic of the railroad from the West to Hoboken, N. J. The work on the new tunnel has been in progress since March of last year, and the rock excavation is approximately 40 per cent. completed at the present time. A general description of the traffic conditions at Hoboken and of the designs of the new tunnel were published in The Engineering Record of January 12, 1907.

Bergen Hill runs in general parallel to the Hudson River, and the tunnels, which lie in a general east and west direction, have their east portals about a mile west of the river front. The completed section of the new tunnel will be 30 ft. wide and 23 ft. 5 in. above the base of rail to the crown of the semi-circular roof arch. It is being driven through a very hard trap rock. The new tunnel will be lined throughout its entire length with concrete.

For construction purposes, as well as good ventilation after the tunnel is in operation, the work has been divided into sections by open cuts and air shafts. The two open cuts and the three shafts bear separate series of numbers, the shaft and the cut nearest the east portal being each called No. 1. In the construction work the cuts play the more important part, because from them headings are being driven in both directions, allowing the work to be carried on with full force at six different points. The shafts, on the other hand, though used to some extent for hoisting excavated material, are of more value in assisting ventilation, both during construction and future operation, by enabling the smoke from the blasts and the locomotives to be drawn off quickly.

Each of the open cuts is 80 ft. wide and 100 ft. long, and the shafts are 30 ft. wide and 10 ft. long. The open cuts are wide enough to take in both the old and the new tunnels, so that the four tracks are exposed, and cars can be switched from the one to the other to facilitate the removal of rock from the new tunnel during construction. The shafts, however, are wide enough to take in only the new tunnel, their axes being placed vertically over the center line of the latter.

The center of open cut No. 1 is about 1,650 ft. west of the east portal of the tunnel; center of open cut No. 2 is about 1,500 ft. beyond open cut No. 1, and the west portal is about 1,100 ft. from open cut No. 2. The three shafts are placed about midway of the divisions made in the tunnel length by the open cuts. The total length of the new tunnel is 4,280 ft., the same length as the present one.

The contract for the original construction of the tunnel was let to the William Grace Co., and work was started in March, 1906, the drilling being done with electrically operated drills. Air drills were later substitued on the work, and on April 15, 1907, the contractor gave up the work, and since that time it has been carried on by the railroad company. The work of sinking the open cuts was started simultaneously with the opening of the approaches to the two portals, in March, 1906, and the shafts were sunk in time to meet the headings driven from the portals and the open cuts, though in the case of shaft No. 1 headings were driven from it for a short distance in each direction.

The work has been carried on by two different methods, illustrated in the accompanying drawings. One method consists in driving a top heading, having a width of 16 ft., symmetrically on each side of the center line of the tunnel, and a height of 8 ft., the roof approximating the outside line of the rock excavation. The other method is a combination of heading and bench excavation, in which the heading is driven 28 ft. wide and 8 ft. high, its end being at least 25 ft. in advance of the rest of the work. The headings are driven by placing the drill holes in the regular fashion, and the benches in the second method are blasted off by holes drilled vertically for the full depth of the bench. About 29 holes were required in driving the small top headings, the depth of the holes being from 7 to 8 ft. In blasting off the bench eight holes are placed in a line transverse to the axis of the tunnel.

In driving the top heading each shift consists of 5 drill runners and 5 helpers, 10 muckers, 2 foremen, a water-boy and a hoisting engineer and a signal man for the derricks. For driving the full heading, where the steam shovel was used, 10 drill runners and 10 helpers were required; 16 muckers, 2 foremen, 2 men for carrying drills to and from the blacksmith's shop and a water-boy. In using the traveling derrick for mucking, the force was 2 foremen, 6 drill runners and 6 helpers, 13 muckers, 2 drill carriers and a water-boy. In addition to this force, where rock had to be hoisted up through the open cuts, a hoisting engineer, a signal man and a dump man were required for operating the derrick and teams for disposing of the spoil on the surface. In the east portal headings an engineer and brakeman were required for handling the narrow gauge locomotive and a crew for the steam shovel. Work is being carried on night and day in two 10-hr. shifts. Almost all of the drills are sharpened in an Ajax Junior drill sharpener, though some are sharpened by hand.

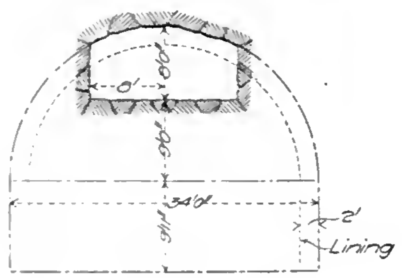
The work in the heading extending from the east portal has been carried on entirely by the heading and bench method, opening the full section at once. A standard gauge track is laid

along the north wall of the tunnel for the use of a Marion steam shovel. Alongside of this track are two narrow gauge tracks, on which are operated 3-yd. dump cars, hauled by a dinky locomotive. The track farthest from the steam shovel, used for pushing in the empty cars, is extended up close to the face of the work and a switch cut in to the other narrow gauge track a short distance back toward the portal. The empty cars are pushed forward by hand beyond the switch to the face of the work and after being loaded are hauled out by the dinky locomotive which runs over the narrow gauge track next to the steam shovel. The cars are hauled out through the east portal to a trestle where they dump into standard gauge Hart convertible dump cars in which the spoil is hauled to Hog Mountain, on the other side of Bergen Hill, to be crushed for ballast. At the present time the full section of the tunnel has been excavated between the east portal and shaft No. 1. As stated above, a short distance of top heading was driven in each direction from this shaft, but now that the full section is completed east of the shaft the heading and bench method will be used. continuing with the steam shovel and the narrow gauge track utilized in the section already completed.

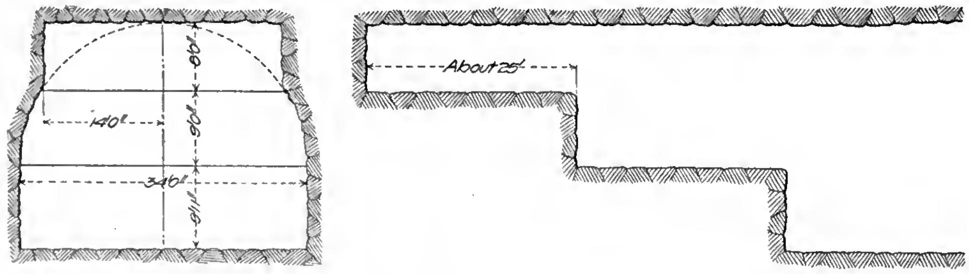
The tunnel driving from open cut No. 1 has been entirely by the top heading method, the work westward from the cut being started in March and eastward in June of this year. Up to October 1st, 462 ft. of the small heading had been driven eastward and 876 ft. westward. The bottom of the cut has been carried down to the sub-grade level on the south side for the new tunnel, but on the north side the rock has merely been removed from the top of the old tunnel, the arch as yet being undisturbed. As soon as the arch of the old tunnel is removed a cross-over can be built from the tracks in the old tunnel into the new one and the spoil hauled away in standard gauge dump cars as is now being done in open cut No. 2. All of the spoil from open cut No. 1, from the excavation of the cut itself and the driving of the headings in both directions, has been hoisted to the surface in scale pans by a derrick placed on the side of the cut and dumped into wagons which hauled it about 650 ft. to a crushing plant, which supplies all of the stone for the concrete lining of the cuts and the tunnel.

Shaft No. 2 was sunk in time to meet the top heading coming west from open cut No. 1, and the muck was hoisted up through it instead of being hauled back and hoisted through the open cut. The derrick is so placed that it can swing the scale pans from the shaft and dump them directly to the storage pile alongside the crushing outfit. The top heading, which was started by driving west from open cut No. 1, had, on Oct. 1 advanced 325 ft. beyond shaft No. 2.

The tunneling operations from open cut No. 2 were started in March of this year by driving top headings in both directions and after the one to the east had advanced 80 ft., and the one to the west 100 ft., the use of the full section method was adopted. On October 1st, 1907, the latter had been pushed 245 ft. westward from the cut and 200 ft. eastward. This cut has been carried down to the sub-grade level of the new tunnel and the arch of the old tunnel has been removed and a cross-over installed on which standard gauge dump cars are run into the new tunnel for hauling away the spoil. Previous to the removal of the arch of the old tunnel, however, all of the material excavated in sinking the cut and driving the headings was hoisted in scale pans to the surface and hauled away in wagons. The cross-over runs from the old tunnel into the west headings of the new tunnel. At the present time two standard gauge tracks are laid in the heading west from the cut and one of these tracks, the one against the south wall of the new tunnel, is continued backward, beyond the cross-over to the old tunnel, into the east heading. A small derrick mounted on a flat car works on the northernmost of the two standard gauge tracks in the west heading and hoists the scale pans into which the muckers load the shattered rock, and dumps them directly into standard gauge Hart convertible dump cars on the other track. These dump cars are handled directly by a locomotive, switched over into the present tunnel and hauled to Hog Mountain, where the rock is crushed for ballast. The heading has not been pushed far enough westward to allow tail-room for switching cars backward beyond the cross-over into the east heading. For this reason the muck in the east heading is loaded by hand into scale pans running on low push cars. These cars are brought out into the open cut and a derrick at the surface lifts them from the push cars and dumps them into one of standard gauge cars standing on the cross-over.



Top Heading Method.



Combination Heading and Bench Method.

Shaft No. 3 was sunk for purposes of ventilation, the only rock that was hoisted out of it being removed in sinking the shaft.

The operations from the west portal had been carried on since the beginning in full section by the heading and bench method, using a derrick car similar to that which is now working west from open cut No. 2. The excavation from the west portal has been discontinued for a period of about four weeks in order to get in a section of tunnel lining near the portal where some bad roof was encountered, the tunnel driving meanwhile being prosecuted by the top heading method and the muck thrown back into the portion of the tunnel where the full section has been excavated. Three hundred and fifty-six feet of the full section have been driven and the top heading on October 1st extended 276 ft. further. The two headings, that eastward from the west portal and the one west from open cut No. 2 will meet this month. On the completion of the section of lining a steam shovel will be run into the heading from the west portal and the work carried on in the same manner as described for the east portal.

Up to October 1st of this year, 1,748 ft. of top heading and 1,499 ft. of the full section had been driven, this being approximately 41 per cent. of the excavation. At the present rate the full section should be blasted out by September of next year. The work has been considerably held back by the restriction of blasting periods. No blasting is done at night and during the day it has been confined to four periods by the train schedule, so as not to interfere with the traffic through the old tunnel. The blasting is done at three periods in the morning, at 7, 9:45 and 10:50, and in the afternoon at 2:30. Immediately after the shots have been fired, an inspection car is run through the old tunnel and with the aid of acetylene lights the brick arch and side walls are carefully inspected. During the entire time that the work has been in progress no damage has been done to the old tunnel. The arch of the old tunnel consists of seven rings of brick laid in cement mortar and such is its strength that in removing it at the open cuts it has been necessary to use heavy wedges to dislodge the brick.

About 31,000 cu. yd. of concrete will be required for the tunnel lining.

In order to assist in the removal of the brick arch from the old tunnel, lagging was placed on the intrados of the arch. It consisted of 4-in. timbers held in place by old rails bent to the curve of the arch, the rails being carried by sills and posts against the tunnel walls.

Ingersoll-Sergeant drills are used entirely on the work. In the blacksmith shop the cylinder of an air drill has been mounted on a standard and is used as a steam hammer for welding broken shanks of drills. A 125-h.-p. Ames engine and a 25-h.-p. Atlas engine are used for driving direct current generators which supply current for lighting the tunnel and for the motors of two electrically operated derricks. The crusher already referred to is a Scholl Climax jaw crusher. The compressor plant is situated a short distance west of the west portal of the tunnel, and contains four compressors, three of the Ingersoll-Sergeant Class A piston inlet type with a capacity of 1,200 cu. ft. of free air per minute each and one McKiernan Drill Co. compressor with a capacity of 1,200 cu. ft. Steam is generated by nine locomotive boilers, with a combined capacity of 800 h.-p.

The work is being carried on by the forces of the Delaware, Lackawanna & Western R. R., under the direction of Mr. L. Bush, chief engineer. Mr. F. L. Wheaton is in direct charge, assisted by Mr. O. H. Kellogg.

COAL PRODUCTION in the United States is classified by the Geological Survey in some recent statistics which show that in addition to the anthracite produced in Pennsylvania, 50,400 tons were mined in Colorado in 1905, and 60,300 tons in 1906. New Mexico produced 24,400 tons in 1905, but none in 1906. This is all the anthracite production in the country, but semi-anthracite was reported from Pennsylvania, Colorado, Indian Territory, Virginia, Montana and Arkansas. Bituminous coal was produced in 27 states and territories in 1905 and in 24 in 1906. Semi-bituminous coal was mined in 17 states and territories, West Virginia leading. Wyoming is in the lead in the production of lignite, over 70 per cent. of the coal from that state being so classed. The so-called black lignites of the Rocky Mountain states are distinct from real lignite or brown coal and are termed sub-bituminous coal by the Geological Survey. Wyoming leads in producing this variety, Colorado is second and New Mexico third. The principal producers of true lignite or brown coal are Texas and North Dakota. The comparatively small amount of cannel coal was from Kentucky, Indiana and West Virginia.

Coal and Ash Bins.

The cost of handling coal and ashes is often an expensive item in the operating expenses of a power station, and it has been found that even in the smaller plants the design of coal and ash bins may have an appreciable influence on maintenance charges. This subject was discussed at some length by Messrs. H. T. Campion and Wm. McClellan in a paper on the "Influence of the Design of Railway Structures on Economy of Operation," read at the recent convention of the American Street and Interurban Railway Association, from which the following notes are taken:

In the suspended, or catenary type, the structure requires frequent painting and, to insure a reasonable long life, a lining is demanded. This lining is usually built of concrete in which a metal mesh should be placed to prevent, as much possible, the cracks which arise, not only from temperature variations, but also from alterations in the shape of the structure due to load changes. If long life and low maintenance is to result, the effect of this alteration in shape due to change of load must be carefully looked after in design. Water draining over coal forms an attacking sulphurous acid. Should cracks and fissures develop in the concrete lining, this acid will enter, not only corroding the steel structure but also eating its way into the more porous concrete and possibly neutralizing its alkaline properties.

In the rigid type of bunker, we have other conditions to guard. The typical sketch of this type which is shown has steel for the main supporting members because the loads, or their resulting movements are so great as to make the entire use of concrete inadvisable on account of the great bulk necessary and the expense entailed by its added dead load on the foundations of the structure. The principal danger to be guarded against is its tendency to crack from temperature changes, opening it to the dangers enumerated in the case of concrete linings of steel bunkers, and, furthermore, causing unsightly leaks in the boiler room. There is also the abrasive action of the falling coals on the surface of the concrete.

The last item can be guarded against by applying to the inner surfaces of the structure a hard, well-rubbed granolithic surface which, if properly applied, will resist such abrasion as a comparatively soft material as coal will cause.

The first objection, temperature cracks, can and should be taken care of in the design. The units of the structure should be in short lengths and a water-tight joint can be provided in a number of ways. An accompanying illustration shows one simple and effective way of making a joint.

It is difficult to give any accurate comparison of costs of the two types of bunkers. There is, of necessity, great variation owing to difference of size, design, and amount and kind of coal passing through. The life of the unlined bunker with average coal will be perhaps eight to ten years. Messrs. Campion and McClellan took down one and found, by drilling, the metal shell reduced more than one-half in thickness in this time. Maintenance on the rigid concrete type and on the lined catenary type is practically zero, though the rigid type has somewhat the advantge. Depreciation on the rigid type and concrete lined type is practically zero.

What is more surprising, however, is the great lack of attention given to economical handling of coal for hand-fired boilers. Frequently an overhead bunker is advisable. If not, the scheme shown in one of the accompanying cuts is very useful and inexpensive. A series of bins is built using the boiler room wall for one side. The illustration is self-explanatory.

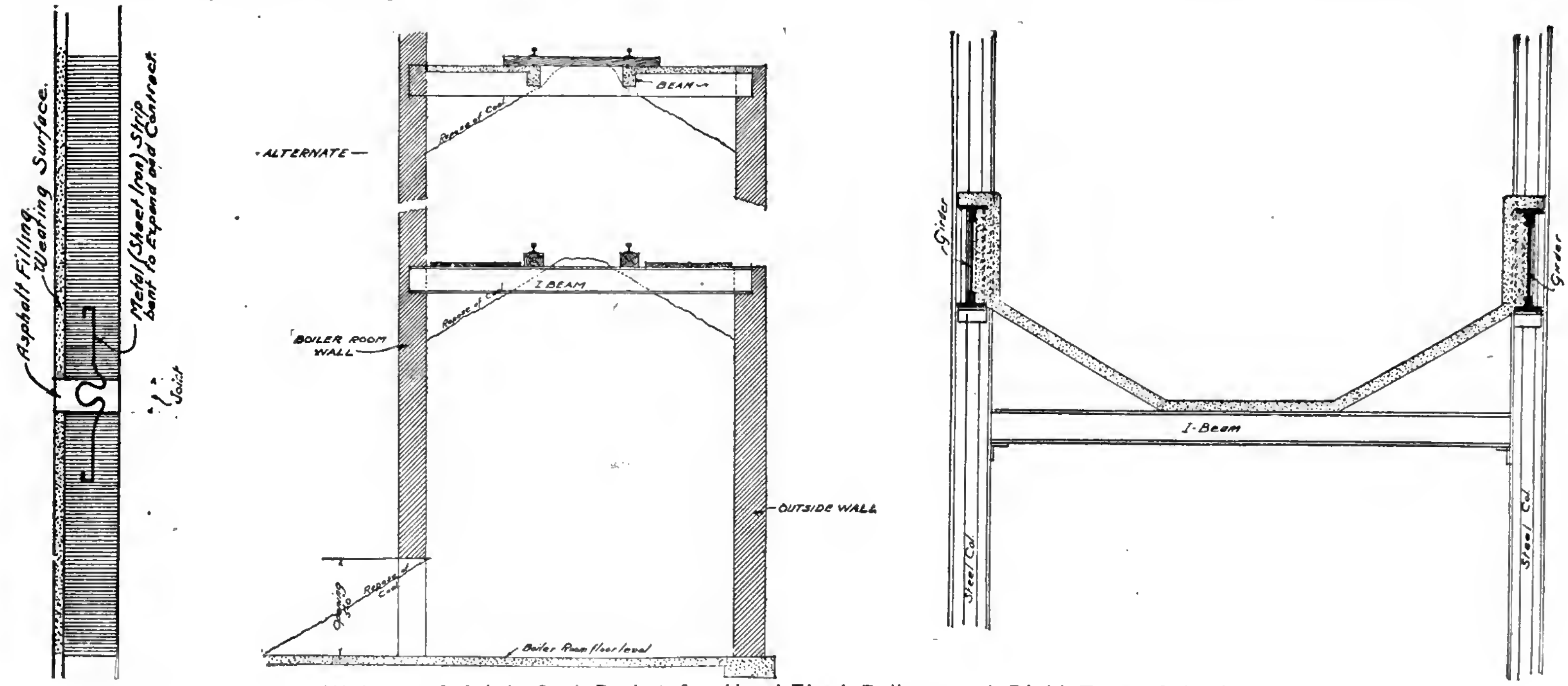
In the handling of ashes, there often could be much improvement.

Where the ashes drop directly underneath the boilers, pockets can be most effectively and economically constructed of concrete and made a part of the boiler room floor structure, leaving a comparatively clear basement for the handling of ashes, either by the industrial railway method or by some conveying scheme.

In some cases, pockets of this description have been lined with fire brick but the temperatures are so much under the point where concrete loses its water of crystallization that it seems an unnecessary expense to spend money for this purpose.

In storing ashes removed from the boilers for final disposal at such times as best suit the operating conditions of a railway, reinforced concrete ash bins have been almost universally adopted on account of the fact that metal structures are not only costly but have a very short life under the trying duty of containing coal ash with its high percentage of corrosion acids.

These concrete structures too can be arranged in so many ways to suit local conditions, that they meet requirements that no other material could. Their cost varies considerably on account of location, height, and ratio of wall, floor, and roof area to cubical contents, but a range of from 30 to 50 cents per cubic foot of contained space will cover most cases. In large structures, the price may be even lower, but as no maintenance of the structure is required, the first cost is the last cost.



Waterproof Joint, Coal Pocket for Hand-Fired Boilers, and Rigid Type of Bunker.

Mechanical Spreader for Roadway Screenings.

A contract for bitulithic pavements covering about one mile of street is now being executed in Providence, R. I., by Warren Bros. The streets have an electric car track in the center and the deep girder rails are seated on continuous concrete longitudinal stringers. On each side of each rail there are two rows of granite blocks. Narrow strips of concrete are placed outside each outer row to retain the hot tar or grout which is poured between the blocks, and the remainder of the surface is covered with the usual bitulithic finish. The fine screenings are liberally applied and the residue swept off.

A quick and uniform distribution of the screenings is secured by a ¼-yd. steel rectangular hopper mounted on two wheels and pushed by hand over the surface of the pavement. A circular opening about 4 in. in diameter in the bottom of the hopper is closed by a sheet steel cone about 2 ft. in diameter with a vertical axis projecting above the top of the hopper where it is miter-geared to a small horizontal transverse shaft operated at the opposite end by a sprocket chain engaging the axle of the wheels on which the hopper moves.

The cone has a vertical adjustment controlled by a lever engaging a row of notches in a guide bar attached to one side of the hopper. By this means it can be raised or lowered to regulate the amount of screenings delivered from the hopper through the annular opening between it and the cone and distributed around the circumference of the cone. Short radial ribs project above the surface of the cone on the lower edge between which the screenings are discharged uniformly in all directions as the hopper is pushed rapidly over the pavements, causing the cone to revolve.

STEEL STRUTS AND BEAMS for lining tunnels have been used for 12 to 15 years by the Susquehanna Coal Co., in Pennsylvania. The consulting engineer of that company, Mr. R. V. Norris, designed a form of gangway support consisting of posts of channels with an I-beam cap. The members are put together with pins and wedges, and the posts rest on cast-iron bases, which enable the whole construction to be taken down or to be adjusted very quickly. Some of these frames have been exposed to constant contact with mine water but they show little sign of corrosion, although the only protection given them has been a good heavy coat of paint from time to time.

A Long Plate Girder Bridge.

The main line of the Lehigh Valley R. R. crosses the Susquehanna River at Towanda, Pa., on a double-track skew bridge with 14 deck plate girder spans about 26 ft. clear of the water and about 5 ft. clear of high water. The sub-structure consists of two abutments and 13 piers, all of concrete founded on rock and most of them skewed about 50 deg. with the bridge axis. In the superstructure there are 56 nearly duplicate plate girders from 110 ft. to 129½ ft. long over all with their transverse and lateral bracing.

At each end of the bridge several spans form chords of a 3½ deg. curve and in the middle of the bridge they are on a tangent symmetrical with the bridge axis and carry the tracks at a level grade about 38½ ft. above low water level. They are made of soft steel designed according to the railroad company's specifications for a maximum load on each track of two locomotives each with 200,000 lb. driver load on a 15-ft. wheel base followed by a train load of 5,000 lb. per lin. ft. For the longest span the dead load is assumed at 2,600 lb. per lin. ft., and for the shortest at 2,400 lb. The maximum flange stress is 290,000 lb. and the maximum end shear is 308,600 lb.

On the curved section the maximum top lateral diagonal stress is 44,000 lb. wind stress and 16,000 lb. centrifugal force, resisted by two 6 x 4 x 9/16-in. angles at a 10.6 sq. in. area and secured at the end by sixteen ⅞-in. field driven rivets. In the tangent spans the centrifugal force disappears and the 44,000 wind stress is provided for by two 4 x 3 x 9/16-in. angles with a cross-section of 5.76 sq. in. The minimum diagonal stress is 1,800 lb. resisted by a single 4 x 3 x 7/16-in. angle. The vertical transverse frames at the skew end are made with pairs of 5 x 3½ x ½-in. angles and with pairs of 4 x 3 x 7/16-in. angles at the intermediate skew points. At intermediate tangent points they are made with single 5 x 3½ x ½-in. angles.

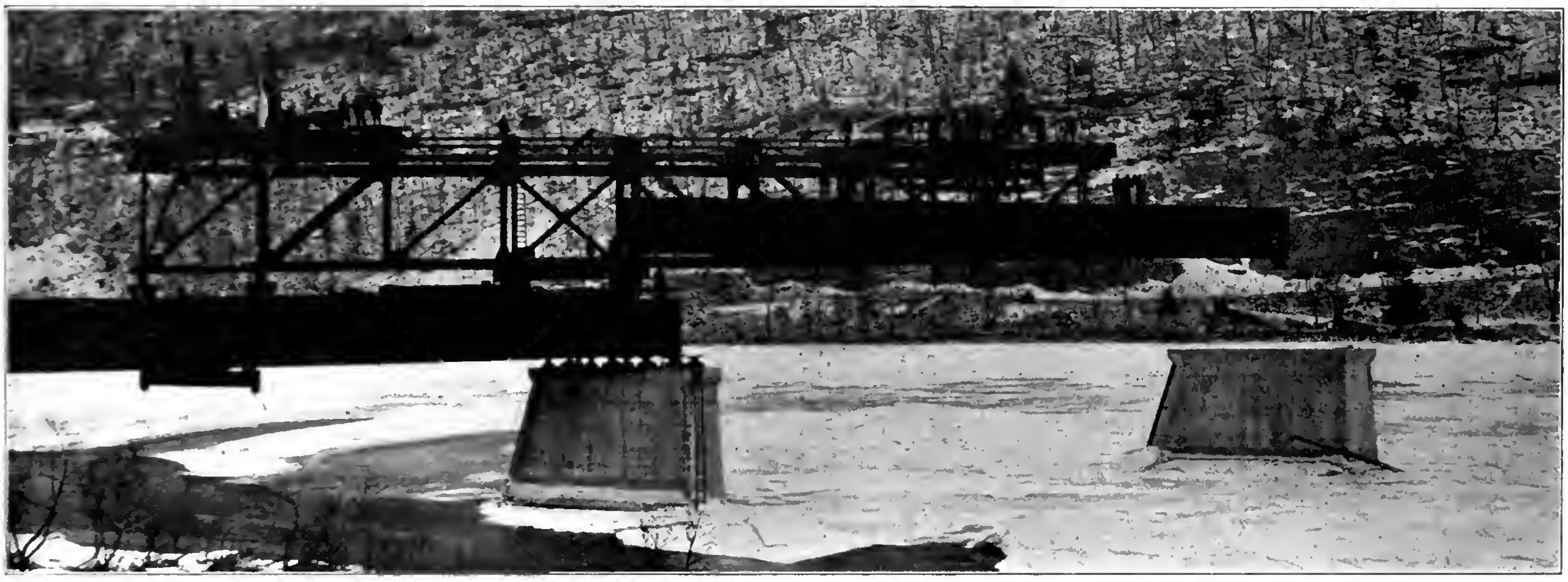
The long girders have a 120 x 9/16-in. web in lengths of 18 to 24 ft. spliced with four vertical rows of shop driven rivets through pairs of 13 x ¾-in cover splice plates 7 ft. 4 in. long. The webs are assembled to provide a cambre of ¾ in. at the center point. In each flange there are two 8 x 8 x ¾-in. angles spliced about 99 ft. from one end with an 8 x 8 x ½-in. cover angle 3 ft. long. The splices are staggered on opposite sides of the webs and in the top and bottom flanges. The flange has also a pair of 16 x ⅝-in. side plates made in two pieces each and spliced at the same point as a flange angle.

The top flange has one full-length 23 x 9/16-in. cover plate, 84 ft. 3 in. long; one 67 ft. 9 in. long and one 23 x ½-in. cover plate 49 ft. 9 in. long. The bottom flange has four 23 x 9/16-in. cover plates, the longest of them being 95 ft. 9 in. long. Pairs of 6 x 4 x ½-in. angles and fillers divide the webs into panels of 6 ft. except at the ends where they are slightly irregular and over the bearing are reduced to 2 ft. 9½ in. reinforced with four pairs of angles.

A 20 x ¾-in. sole plate 3 ft. long is countersunk riveted to the bottom flanges at each end, and to it there is secured by eight 1¼-in. bolts a cast-steel shoe with a continuous half-hole bearing for a 4½-in. pin 25 in. long between centers. At the expansion end a pedestal similar to the shoe inverted engages the same pin with a clearance of ¼ in. between it and the shoe and is seated on a nest of seven segmental rollers 6¼ in. in diameter, slotted at the center to engage 2¼ in. guide ribs projecting from the bottom of the pedestal and from the top of the bed plate. The 36 x 37½-in. bed plate is planed on the upper face to a thickness of 1 in., and has riveted to the longitudinal edges Z-bars about 7¾ in. high which protect the ends of the roller nest and engage the upper surfaces of the base plate of the pedestal, thus excluding snow and rubbish to a large degree from the bearings. The bed plates are seated on sheets of lead ¼ in. thick and similar sheets are provided under the fixed end pedestals, which differ from those at the expansion ends in that they are made enough higher to compensate for the absence of the rollers and bed plates and allow the masonry seat to be finished at the same height at both ends. The 129 ½-ft. girders are 126½ ft. long on centers of bearings and weigh 113,000 lbs. each. The total steel weight of the bridge is 7,500,000 lbs.

The bridge was erected by an overhead cantilever traveler running on the completed spans and projecting far enough in advance to set the girders of the succeeding spans in position on the substructure. The traveler virtually consisted of a 147-ft. lattice girder span, with trusses 23 ft. apart and 18 ft. deep on centers and connected by overhead bracing in the planes of the top chord thus allowing clearance for the girders to pass between them from end to end over a single lower chord transverse strut about the middle of the span. The lattice girders were divided by vertical members into 21-ft. panels, each of them braced with a single diagonal, and one truss was set one panel in advance of the other to correspond with the skew of the substructure. The lattice girders had rectangular top and bottom chords, each made with a pair of 15-in. channels back-to-back, having web connection plates shop riveted to them and projecting beyond their inner flanges to receive the vertical and diagonal members field bolted to them.

The transverse beams connecting the upper ends of the vertical post support longitudinal beams which provide tracks for carriages with hoisting tackles operated by two engines on a top chord working platform at the rear of the traveler. The traveler was nearly balanced on wheels at four lower chord panel points near the center of the girder and was partly counterweighted by the hoisting engines and their boilers and supplies. When in service the traveler was moved out to the end of the last completed span with its forward end projecting beyond the center of the next span. The rear end lower chord panel points were blocked up from the finished span and were securely anchored to it by a yoke made with vertical screw rods and the horizontal transverse girder connected to them and taking bearing on the bottom flanges of the permanent girders. The girders for the next span were delivered on three cars each inside the rear end of the traveler and were unloaded and moved forward by the trolley hoist which lifted them clear of the cars, moved them forward and lowered them to their final position on their pedestals. By this method the use of falsework was eliminated and the girders were unloaded and erected at the same operation, by a comparatively small force of men. The traveler was adapted to be easily assembled and taken apart and shipped back to the shops for future use, thus making it a permanent tool.



Girder of the Lehigh Valley R. R. Bridge at Towanda, Pa., Suspended from Traveler Overhang.

The bridge was built and erected by the Phœnix Bridge Co. Mr. John Sterling Deems, chief engineer, and Mr. A. B. Milliken, superintendent of erection.

The Aluminum Cell or electrolytic lightning arrester is one of the most recent developments in the field of high-tension transmission lines. The property of this cell in allowing free flow of current in one direction and but slight flow in the opposite direction, until the applied voltage reaches a certain critical value, is used to permit static charges to be freely dissipated to the earth, while high resistance is offered the opposite flow. Each cell will withstand 250 to 280 volts alternating, and arresters for high voltages are constructed of a multiplicity of cells with a "horn" air gap of merely sufficient opening to assist in suppressing an arc. The arrester then serves as a safety valve to the system, taking no current at the operating potential, but discharging any abnormal high potential, so that the circuit potential is not materially disturbed.

Punishment for Waste of Well Water in California.

Early this year, the California legislature passed a bill to prevent the waste of water from the artesian wells that are such an important source of supply for domestic purposes and irrigation in some parts of the State. The law is a drastic one, and naturally enough has led to a suit by J. L. Elam to test its legality. This has been settled by the following unanimous opinion of the California Court of Appeal, delivered by Judge Allen:

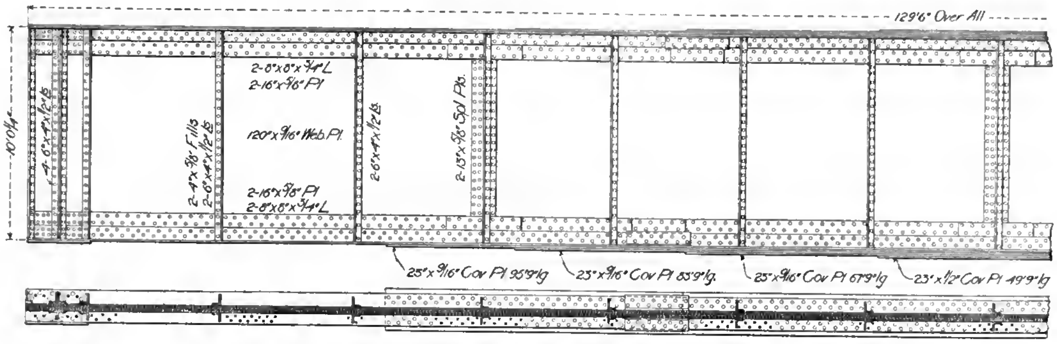
This is an application for a writ of habeas corpus presented by petitioner, who alleges that he is restrained of his liberty under a commitment issued upon default in payment of a fine assessed against him for a violation of the act of the Legislature approved March 6, 1907 (St. 1907, p. 122, c. 101), entitled "An act to prevent the waste and flow of water from artesian wells, and prescribing penalties therefor, and defining waste and artesian wells."

It is petitioner's contention that this statute is violative of the Constitution of the United States and of the Constitution of the State of California, and in conflict with the general laws. Section 1 of the act under consideration provides that an artesian well which is not capped or provided with mechanical appliances for arresting the flow of water therefrom is a nuisance, and the owner of the land upon which the same is situated is declared guilty of maintaining a nuisance if he suffers it to remain so uncapped or unprovided with mechanical appliances for arresting the flow, and any person maintaining such nuisance, or causing or permitting water to unnecessarily flow from such well, or to go to waste, is guilty of a misdemeanor. By Section 2 an artesian well is defined to be an artificial hole made in the ground through which water naturally flows from subterranean sources to the surface of the ground. By Section 3 waste is defined to be the causing, suffering or permitting the flow from an artesian well to run into any bay, pond or channel, unless used thereafter for the beneficial purposes of irrigation of land or domestic use, or into any street, road or highway, or upon public land, unless it be used for the irrigation thereof or for domestic use or the propagation of fish. It is further provided that, when water is run upon land for irrigation purposes, if more than 10 per cent. thereof be allowed to escape therefrom, the same shall constitute waste. Section 5 provides a penalty for the violation of any of the provisions of the act.

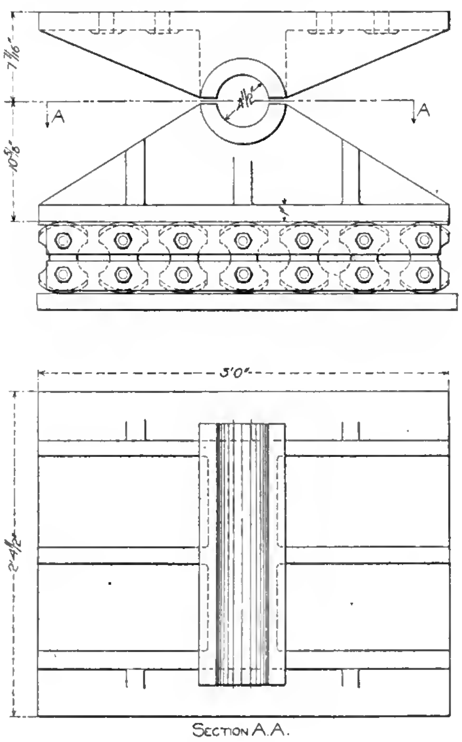
The first point made by petitioner—which is that the act is violative of the fourteenth amendment of the Constitution of the United States, which provides that no State shall "deprive any person of life, liberty or property without due process of law, nor deny to any person within its jurisdiction the equal protection of the law," and of article 1, section 1, of the Constitution of this State, which provides that "all men are by nature free and independent, and have certain inalienable rights, among which are those of enjoying and defending life and liberty, acquiring, possessing and protecting property," and of section 13, article 1, which provides that no person shall be "deprived of life, liberty or property without due process of law"—seems to have been met and demonstrated to be untenable by the Supreme Court of the United States in the case of Ohio Oil Co. v. Indiana, 177 U. S. 190, 20 Sup. Ct. 576, 44 L. Ed. 729.

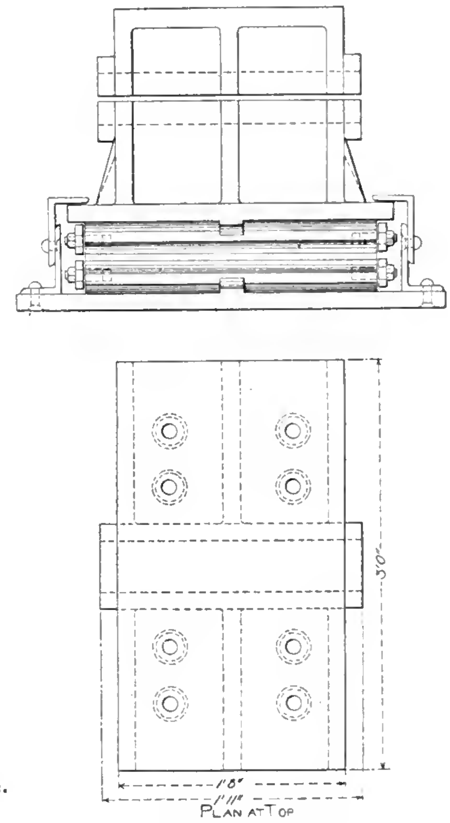
By that case it is established that water, oil, gas and all fugitive substances held in their natural subterranean reservoirs are exceptions to the general rule establishing absolute ownership in the proprietor of the surface of all that lies underneath; that these minerals, being migratory in their nature, having no fixed situs, are a part of the soil only so long as they are on or in it, but after they escape and go to other lands the title of the former owner is gone; that it follows therefore that no one owner of the surface of the earth within the area beneath which these minerals move can exercise his right to extract from the common reservoir in which the supply is held without diminishing the source of supply as to which all other owners of the surface must exercise their rights; that, in consequence of the nature of the deposits, of their transmissibility, of their interdependence, of the right of all, and of the public at large, the State could lawfully exercise the power to regulate the right of the surface owners among themselves to seek to obtain possession, and to prevent the waste of the products in which all the surface owners within the area wherein they were deposited, as well as the public, had an interest. "No devesting of private property under such a condition can be conceived, because the public are the owners, and the enacting by the state of a law as to the public ownership is but the discharge of the governmental trust resting in the state as to property of that character." This water, the ownership of which until actual possession is acquired being in the public, or at least that portion of the public who may own the surface of the soil within the artesian belt, is subject to a reasonable use only by those interested therein.

This reasonable use is determined in Katz v. Walkinshaw, 141 Cal. 134, 70 Pac. 663, 74 Pac. 766, 64 L. R. A. 236, 99 Am. St. Rep. 35, to be the use of such amount of the subterranean water "as may be necessary for some useful purpose in connection with the land from which it is taken." The conditions existing in this state with reference to the necessity for the conservation of irrigating waters are most clearly set out in the case last cited, and the reasons for the rule restricting the use clearly shown. Whenever a landowner exceeds this reasonable use, he is appropriating to himself that which belongs to others who are entitled to a like use, and to that extent is obstructing the free use of property so as to interfere with its comfortable enjoyment, and which, by sections 3479 and 3480 of the Civil Code, is declared to be a public nuisance. Whatever right one has, even in his own, is subject to that established principle that his use shall not be injurious to the rights of others, or of the general public. This act therefore relates to waters, the right to the use of which is common to a large portion of the community, and affects the general public right. Legislation in relation thereto affects the public welfare, and the right to legislate in regard to its use and conservation is referable to the police power of the state, which is declared in Ex parte Whitwell, 98 Cal. 78, 32 Pac. 870, 19 L. R. A. 727, 35 Am. St. Rep. 152, to be "the power to make laws to secure the comfort, convenience, peace and health of the community." "The police power deriving its existence from the rule that the safety of the people is the supreme law, justifies legislation upon matters pertaining to the public welfare, the public health, or the public morals." Ex parte Drexel, 147 Cal. 766, 82 Pac. 429, 2 L. R. A. (N. S.) 588. It is settled law that all



Part Elevation of a Girder of the Lehigh Valley R. R. Bridge.





Expansion Bearing of Lehigh Valley Bridge.

property is held subject to the exercise of police power, and that provisions of the Constitution declaring that property shall not be taken without due process of law have no application in such cases. Odd Fellows' Cem. Ass'n v. San Francisco, 140 Cal. 230, 73 Pac. 987.

It is further contended by petitioner that the act violates section 21, art. 1, of the state Constitution, which provides that "no special privileges or immunities shall ever be granted which may not be altered, revoked, or repealed by the Legislature, nor shall any citizen, or class of citizens, be granted privileges or immunities which, upon the same terms, shall not be granted to all citizens"; and he endeavors to demonstrate this proposition by the assumption that the surface owners are not prohibited by this act from extracting from this common source of supply any quantity thereof by means of pumps, that no attempt is made to restrict the use after the same is so pumped, and that the waste of such water so pumped is not violative of the act, and illustrates the claimed distinction by the statement that certain gun clubs within the arid region are pumping large quantities of this subterranean water, by means of which duck ponds are filled and maintained, while other gun clubs whose ponds are fed by artesian wells are restricted in the use of the flow therefrom.

It may be conceded that the courts have recognized the right of gun clubs to practically create a monopoly in wild game over large areas of land, and have protected them in a so-called private proprietorship and limited dominion over such portions of the common property of the people of the state as they may induce to stay upon such reserves by feeding them and maintaining ponds therein. It may also be conceded that an exclusive right to hunt upon such preserves has also been held to be a species of property, and injunctions have been issued to prevent interference with the full exercise of such rights. Kellogg v. Kings, 114 Cal. 378, 46 Pac. 166, 55 Am. St. Sep. 74. But, while the maintenance of such duck ponds no doubt contributes greatly to the enjoyment of the owner of the hunting privilege, it will scarcely be contended that this is a use of the water which is beneficial to the land. Neither does it follow that because the courts have recognized such exclusive hunting privileges they must support the owners thereof in an encroachment upon another more necessary common right of the public, that of the conservation of the subterranean waters of the state for domestic uses and purposes of irrigation.

We are not to be understood in thus meeting the reasons of petitioner's argument as admitting that there is anything in the language of the act in question that would affect a gun club any more than an individual association, or incorporation. That one may show matters dehors an ordinance which is referable to the police owner that such ordinance by reason of particular facts and circumstances is unreasonable anl oppressive as to him is determined in Re Smith, 143 Cal. 370, 77 Pac. 180. No reason suggests itself why such right may not be recognized when the state has sought to exercise the same power; and, while courts may to a degree supervise such power, "they will not intereferc except where the case be plain that needless oppression is worked and constitutional rights invaded." In Re Smith, supra. Nothing appears upon the face of the act, or in the record on this application, from which it can be said there is any discrimination as to the class of persons who may violate the provisions of the law. No special immunities or privileges are granted to any club, clubs, persons, or persons. That some clubs may maintain their ponds by pumping, while others, more fortunate, have theirs maintained by artesian wells or running streams, or tide water from the ocean, in no way affects the question. As well might it be said that Legislative action affecting tide lands created special privileges or immunities because the duck ponds of the clubs relying upon tide water might be affected thereby.

As we have before attempted to show, no surface owner possesses the right to extract the subterranean water in excess of a reasonable and beneficial use upon the land from which it is extracted. Any additional extraction is not in the exercise of a right, if by such exercise the rights of others are injuriously affected. Nor can an appropriator take more water than he can beneficially use. Hence it follows that no discrimination is made between parties entitled to the exercise of a common right. Under the act in question, all may exercise their full legal right with reference to this water.

As to the right to use any portion of that which belongs to the public, legislative control is applicable, and if, as a matter of fact, public rights are abused by the improper extraction of this public water by means of pumps, it is presumable that the Legislature in the exercise of its proper functions will in due time arrest such waste. The game of the state belongs to the people in their collective capacity in a more general way than does the subterranean water within an artesian belt, yet no one will question the right of the state to restrict the manner in which fish may be taken from the water, whereby it is made a public offense to use a seine, while those who adopt the hook and line may take without offense. There is no special privilege or immunity granted to the man with the hook and line. The right to take at all, or in any particular season, either of game or any other thing public in its character, comes from the state and is subject to its regulation and control, and it is for the Legislature to say what reasonable restrictions are necessary for the protection of this public property. Ex parte Kenneke, 136 Cal. 527, 69 Pac. 261, 89 Am. St. Rep. 177.

It is further contended that this act is violative of subdivision 33, sec. 25, art. 4, of the state Constitution, which provides that "the Legislature shall not pass local or special laws in any of the following enumerated cases, that is to say: . . . in all other cases where a general law can be made applicable"; and also violates section 11, art. 1, which provides that "all laws of a general nature shall have a uniform operation." Assuming all that the petitioner claims for the act as to its establishment of a class, nevertheless "the true practical limitation of the legislative power to classify is that the classification shall be based upon some apparent natural reason, some reason suggested by necesity, by such a difference in the situation and circumstances of the subjects placed in different classes as suggests the necessity or propriety of different legislation with respect to them." Nichols v. Walter, 37 Minn. 272, 33 N. W. 802. "A law which operates only upon a class of individuals is none the less a general law if the individuals to whom it is applicable constitute a class which requires legislation peculiar to itself, in the matter covered by the general law, and which is germane to the purpose of the law." People v. Central Pac. R. Co., 105 Cal. 576, 38 Pac. 905.

It is obvious that different legislation is required peculiar to those whose lands are so situated with reference to the artesian supply that a natural flow results from a penetration into the subterranean reservoir. The distinction between wells having a natural flow and those not so constituted is natural, and reasonably indicates the necessity or propriety of legislation restricting the former class. The right to so legislate when the reason exists is determined in Pasadena v. Stimson, 91 Cal. 251, 27 Pac. 604, People v. Central Pac. R. Co., 105 Cal. 576, 38 Pac. 905, and People v. Mullender, 132 Cal. 221, 64 Pac. 299. This act operates uniformly upon every one owning lands upon which is located an artesian well of the kind and character specified in the act. "Section 11, art. 1, of the state Constitution, requiring all laws of a general nature to have a uniform operation, is satisfied when the law operates uniformly upon all persons standing in the same category, and upon rights and things standing in the same relation." Wigmore v. Buell, 122 Cal. 144, 54 Pac. 600.

It is further contended that a discrimination exists because of the provision which permits the maintenance of ponds for the propagation of fish, as distinguished from the maintenance of ponds for other purposes. The propagation of fish has always been recognized as a legitimate pursuit and as an effort to increase the food supply of the world, and the use of water therefor a beneficial use, which, like the use for irrigation or domestic purposes, is declared by the act to be the highest use to which this natural element may be applied. The Legislature has the right to determine what uses are superior in kind and to protect the same, and it is within its province to determine that certain uses of this public property are of a higher character and superior in right to other uses. This right is subject only to the constitutional limitations against discriminations. Having so determined, and no just criticism being applicable thereto, the value of such uses must be held to be established.

We are not called upon in this case to determine the legislative right to regulate or protect the extraction of this subterranean water for transportation or sale of those owners of the surface whereon the use of water is not required for those higher uses, nor of prescriptive rights asserted or claimed in such instances, but simply to hold that for the uses which have been determined subordinate the great subterranean water supply may not be applied to the detriment of the higher uses, and that legislation directed to the conversation of such water, as in this act, is not prohibited by any constitutional provision. "Every possible presumption is in favor of the validity of a statute, and this continues until the contrary is shown beyond a rational doubt. One branch of the government cannot encroach on the domain of another without danger. The safety of our institutions depends in no small degree on a strict observance of this salutary rule." In re Spencer, 149 Cal. 400, 86 Pac. 896; Sinking Fund Cases, 99 U. S. 718, 25 L. Ed. 496.

Writ denied.

Book Notes.

The eighteenth edition of the "Western Blue Book and Buyers Reference." It is a volume of over 700 pages, giving the names and addresses of architects, engineers, contractors and parties interested in supplies for mills, mines, foundries, iron furnaces, steel mills, quarries, machine shops, railroads and other engineering industries. The names are classed in two ways. In the first part of the book those of Chicago parties are omitted and the rest are grouped by states; the names then subdivided according to calling or industry. In the second part of the book, all the Chicago names are classified alphabetically according to calling or industry. This list gives not only the street addresses, but also the telephone numbers. (Chicago, Milton E. Lowitz Publishing Co., 66 Sherman St., $5.)

A book that will appeal strongly to engineers who have had to live in wild districts is Lieut-Col. J. H. Patterson's "The Man-Eaters of

Tsavo." The author was one of the leading engineers of the famous Uganda Ry. in East Africa, a piece of work described in several articles in this journal. As explained in one of those articles, the railway work was completely stopped for a long period by the forays of lions, which terrorized the construction camps. At one station they carried off 28 coolies in a short time, and finally they took the assistant superintendent of police out of a first-class car on one of the sidings. For a while the men slept in trees, the station water-tanks and freight cars until lion-proof iron huts could be built for them. Every means to prevent their ravages or to kill them failed until Col. Patterson took charge of the work. The many thrilling adventures which he had before finally accomplishing the task make a unique story in the history of railway engineering. The author has also traveled in many other parts of wildest Africa and a section of the book describes some of his experiences elsewhere than on the Uganda line. (New York, Macmillan Co., $2.50.)

The third annual number of the "Beton-Kalender," for the year 1908, is 74 pages larger than the last issue of this excellent pocket-book and contains many new features. For those unacquainted with previous numbers it may be stated that the book is in two volumes, each about 4 x 6½ in. in size. The first volume is cloth-bound, and contains a diary and tables and articles relating to general statistics, money, weights and measures, mathematics, surveying, the strength of materials, cost of construction, the theory of reinforced concrete beams, various regulations regarding reinforced concrete construction, requirements for Portland cement and tests of the material and a digest of patent law. The second volume is bound in paper and contains articles on all kinds of works executed in concrete, with and without reinforcement. All the articles are written by specialists, and the book is edited by Dr. F. von Emperger, editor of "Beton und Eisen" and well known to American engineers on account of his former activity in introducing the Melan arch in this country. In addition to a complete revision of the different articles in the former edition, some of them have been completely rewritten, the latter relating to the cost of works, staircases, theatrers, waterworks and sewerage. The official regulators include those of the Prussian and French governments of the current year. The book is invaluable to the concrete specialist who can read German. (Berlin, Wilhelm Ernst & Son, 4 marks.)

A valuable contribution to the records of American engineering is the two-volume "History of the Canal System of the State of New York, together with Brief Histories of the Canals of the United States and Canada," written by Mr. Noble E. Whitford and published as a supplement to the report for 1905 of the New York State Engineer. It is the first authoritative history of the first important engineering undertaking in this country, which began in 1793 with the construction of a small canal at Little Falls and is still being continued. The work was the training school of our first engineers and of many of the men of succeeding generations who followed them in important positions in the national life, as is well shown by an interesting collection of brief biographies of those who held the rank of assistant engineer or higher. The preparation of the history became necessary in connection with the work of the State Engineer's Department, and it is fortunate that Mr. Whitford was assigned to the work, for along with a knowledge of engineering subjects he has shown excellent judgment in the references to historical topics forming an essential part of his narrative. It is a most instructive record of engineering achievement, covering not only the existing canals, but also the abandoned canals, the canals built by private parties, and general studies of the effect of the canals on some features of State life, particularly the development of communities along the line of the Erie canal. The second volume contains engineering and financial statistics of the State canals, a bibliography of them, and a description of all the leading canals of the world.

It is not often that a reviewer of technical books has an opportunity to draw attention to a work which so well answers a very strong demand as does the "Principles of Reinforced Concrete Construction" by Professors F. E. Turneaure and E. R. Maurer, of the University of Wisconsin. Up to the present time there has been no American book which discussed reinforced concrete with the same authoritative thoroughness as Mr. Sabin goes over the subject of plain concrete in his treatise on "Cement and Concrete." While there have been a number of volumes on reinforced concrete none has answered the great demand for a thorough discussion of principles, for a large part of each of them is devoted to descriptions of structures and of methods of carrying on construction, already available in greater detail in the pages of the many journals devoting all or part of their space to concrete. The authors of this volume have followed the plan of covering in a systematic manner at the outset those principles of mechanics underlying the design of reinforced concrete, then bringing together the results of all available tests that may aid in establishing reliable coefficients and working stresses, and finally giving such information concerning actual designs as may be needed to make clear the principles involved. The properties of plain concrete and steel are explained sufficiently in the second chapter to give definite knowledge of their relation to the general subject in hand, and adhesion, contraction and expansion are discussed. The third chapter is a full theoretical treatment of reinforced concrete, in which empirical rules and methods are avoided so far as possible in order that the reader may acquire such a firm grasp of the real principles that he may appreciate the nature and effect of any approximate methods brought to his attention. The fourth chapter supplements the third by reviewing, in the light of the previous theoretical study, the results of the most important tests of beams and columns. Working stresses and economical proportions are taken up in the fifth chapter. The sixth chapter is an excellent practical summary of working formulas, diagrams and tables for use in designing beams, slabs and columns, so arranged that they can be employed without reference to any other part of the book. These six chapters take up 236 pages, and are followed by 77 pages explaining the application of reinforced concrete to building construction, arches, retaining walls, dams and miscellaneous structures. These chapters explain principles of design rather than details of construction and thus furnish just the information which is necessarily omitted in articles in technical journals. Special attention should be given to the authors' analysis of the solid arch rib, which they consider superior to the ordinary graphical methods, and may be shortened by simple graphical aids. The rather hasty examination on which these notes regarding the book are based shows it to be a conservative, safe guide. There are some things in it to which The Engineering Record does not agree, but these are things where differences of opinion will always exist. The authors are always on the safe side and the volume they have prepared deserves a warm welcome and thorough study. (New York, John Wiley & Sons, $3.)

Letters to the Editor.

Traffic on New York Streets.

Sir: Duirng the examination made by the Commissioners of Accounts of New York City of the administration of the pavements, etc., of Manhattan, and subsequent investigation by Governor Charles E. Hughes of New York State, it became necessary to know the quantity of traffic on representative avenues and streets. I was employed as consulting engineer on pavements, and among other matters reported to the Governor the traffic on several streets and showed its relation to the maintenance or neglect of the pavements. The heavy traffic streets in wealthy and influential districts, as Fifth Ave., are maintained in good order, whereas the lighter traffic streets in poor districts have not been kept in repair. Traffic records have heretofore been made for 10, 11 or 12 daylight hours. Therefore for purposes of comparison with previous traffic, I made records for 11 daylight hours on various streets. The heaviest traffic recorded in New York for 11 hours was on Oct. 14, 1907. It was 11,170 vehicles, weighing about 13,360 tons, on Fifth Ave. between 33d and 34th Sts., or 279 vehicles, or 324 tons, per foot of width of roadway for 11 hours. The traffic on First Ave. between 26th and 27th Sts. for 11 hours on the same date was 4,445 vehicles, weighing about 6,734 tons, which was about 79 vehicles, or 120 tons, per foot of width of roadway for 11 hours.

The accompanying tables show the traffic on Fifth and First Aves. for 24 consecutive hours. This is probably the first time that traffic for 24 hours has been recorded in any American city.

Vehicles in 24 Hours on Fifth Avenue, New York, Between 58th and 60th Streets. From Wednesday Noon, Oct 9, to Thursday Noon, Oct 10, 1907.

Hours.	Horse Vehicles. Av. Weight with Load. 1 ton.	2 tons.	4 tons.	Total Horse Vehicles.	Automobiles, Av. Wgt. 1 ton.	Total Vehicles.
12-1	437	69	30	536	230	766
1-2	421	107	20	548	184	732
2-3	296	60	11	367	142	509
3-4	583	86	24	693	331	1,024
4-5	661	88	17	766	400	1,166
5-6	537	42	9	588	329	917
6-7	484	46	1	531	275	806
7-8	156	60	3	219	115	334
8-9	165	37	3	205	54	259
9-10	122	12	0	134	75	209
10-11	119	9	0	128	70	198
11-12	117	13	0	130	71	201
Midnight	...	...	...	...	...	...
12-1	85	27	0	112	45	157
1-2	40	8	0	48	20	68
2-3	14	6	2	22	5	27
3-4	21	2	3	26	4	30
4-5	33	14	6	53	3	56
5-6	27	19	24	70	0	70
6-7	42	44	2	88	19	107
7-8	122	57	12	191	31	222
8-9	211	53	6	270	187	457
9-10	263	51	19	333	179	512
10-11	437	51	17	505	308	813
11-12	432	65	10	507	232	739
Totals	5,825	1,026	219	7,010	3,309	10,379

The estimated weight of Fifth Ave. vehicles and loads was 12,062 tons. The width of Fifth Ave. at the place of recording this traffic is 41⅓ ft. There were therefore 251 vehicles, or 292 tons, per foot of width per 24 hours. This can be regarded as an average weekday traffic on Fifth Ave. between 9th and 59th Sts. The Sunday traffic on Fifth Ave. is about one-fifth the weekday traffic.

The estimated weight of First Ave. vehicles and loads was 3,898 tons. The width of First Ave. at the place of recording this traffic is 56 ft. There were therefore 48 vehicles, or 69⅔ tons, per foot of width per 24 hours. This can be regarded as an average weekday traffic on First Ave. between 22d and 109th Sts. The Sunday traffic on First Ave. is very small; sometimes none is in sight for an hour or more.

Fifth Avenue, New York, has probably the most numerous, if not the heaviest traffic in total quantity, as well as per foot of width, found in any American city. It is exceeded by a few streets in Paris, London and Berlin. It is interesting to

note the large proportion of automobiles now in use.

VEHICLES IN 24 HOURS ON FIRST AVENUE, NEW YORK, BETWEEN 77TH AND 78TH STREETS. FROM WEDNESDAY NOON, OCT 9, TO THURSDAY NOON, OCT 10, 1907.

Hours.	Horse Vehicles Av. Weight with Load.			Total Horse Vehicles.	Automobiles, Av. Wgt. 1 ton.	Total Vehicles.
	1 ton.	2 tons.	4 tons.			
12-1	96	44	3	143	1	144
1-2	165	45	6	216	0	216
2-3	183	60	13	256	3	259
3-4	149	73	0	231	3	234
4-5	108	80	7	195	0	195
5-6	104	91	4	199	2	201
6-7	83	42	2	127	1	128
7-8	41	22	1	64	0	64
8-9	33	11	0	44	0	44
9-10	19	7	0	26	0	26
10-11	3	5	0	8	0	8
11-12	3	3	1	7	0	7
Midnight	...	...	...	...	...	...
12-1	0	0	0	0	0	0
1-2	1	0	0	1	0	1
2-3	4	2	2	8	0	8
3-4	14	10	1	25	0	25
4-5	16	5	1	22	0	22
5-6	45	10	1	56	0	56
6-7	58	41	4	103	0	103
7-8	95	24	12	131	1	132
8-9	102	58	20	180	0	180
9-10	134	52	23	209	1	210
10-11	129	71	20	220	3	223
11-12	116	48	13	177	2	179
Totals	1,701	804	142	2,648	17	2,665

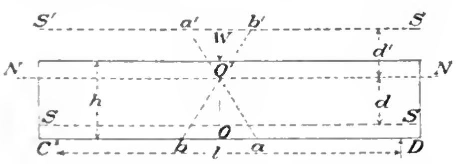
Records of street traffic help solve the paving problems of cities and should be made at reasonable intervals in every important city. The flow of traffic needs controlling, guiding and relief, not only on account of pavements but for other obvious reasons. J. W. HOWARD, C. E., E. M.

1 Broadway, New York.

THE DEFLECTION OF CONCRETE BEAMS.

SIR: In my work recently I was asked to compute the deflection of a reinforced concrete beam under a certain loading. As I have never seen any method for making this computation, it may be of interest to some of your readers to know of one which is at least correct for the assumption that the concrete takes only compression.

Given a concrete beam as shown in the diagram, reinforced with steel SS and having a con-



centrated load W applied at the center between the supports C and D, it is required to find the deflection of the beam at the point O due to the load W.

Knowing the amount of steel and h, the distance of the steel reinforcement from the top of the beam, the neutral axis NN can be located. For an infinitesimal length, $\Delta\, l$, ba represents the elongation of the steel and cf the contraction in the concrete after the application of the load W. If we replace the concrete compression side of the beam by a steel member S^1S^1 of the same area as SS and so placed as to maintain the neutral axis at NN, and if we properly increase W so as to produce the same stress, and hence deformation, in the steel SS for this hypothetical beam as for the reinforced concrete beam, we shall have a beam whose deflection can be readily calculated and will be the same as that of the original beam.

To do this make $d^1 = d$ and increase W by the ratio, (moment of resistance of hypothetical steel beam) to (moment of resistance of reinforced concrete beam). The moment of resistance of the hypothetical steel beam is $2d$(area of $S\ S$) (stress per square inch). The moment of resistance of the reinforced concrete beam is (area of SS) (stress per square inch) $(d + \tfrac{2}{3}\,k)$.

Hence $2d\ W \div (d + \tfrac{2}{3}\,k)$ is the load that will give the required deflection of the hypothetical beam. The required deflection is, therefore, readily obtained from the familiar formula for the deflection of a beam of uniform material and is given by the expression

$$[2d\ Wl^3 \div (d + \tfrac{2}{3}\,k)] \div 48\,EI.$$

In this expression I is $2d^2$ (area of SS).

Hoping that this may be of some interest, I am,

Yours sincerely,

ELI WHITE.

New York, Oct. 21.

HEATING AND VENTILATING TESTS.

SIR: As your recent editorial under the above title clearly shows, there is certainly a fertile field, as yet almost untilled, for the investigation of the present practice in heating and ventilation. But the problem in its entirety is exceedingly complicated, for the heating and the ventilation are interdependent. In any system the variables are so numerous as to greatly increase the difficulties. Attention must therefore be centered upon details and the engineering structure built up therefrom.

In any modern system of reasonable magnitude the fan will be found as a relatively positive factor in the movement of the air. As a basis for further investigations of complete systems, it appears that the fan should first receive consideration.

Almost without exception the manufacturers' ratings and incidental guarantees have been heretofore accepted as the measure of performance. Because of the great flexibility of the fan as regards possible changes in speed, volume, pressure and power, established conditions have been difficult to maintain, and hence departure from the results shown by the standard basis of measurement was to be expected.

Tests sufficient to meet commercial requirements in engineering and selling have been made by manufacturers and individual engineers, but, as your editorial suggests, the results have been kept secret and retained as personal stock in trade. In a rough way the information thus collected has appeared to serve the purpose. The failure of the purchaser to demand test before acceptance, and in reality, the lack of real necessity for such a test, have had much to do with the continuance of this policy. But the time is now at hand when methods of testing should be standardized; when exhaustive tests should be made, and the results become public property. The age of secrecy is passed; the leader in disseminating knowledge of this character may likewise be the leader in the commercial field.

For years the comparison of fans upon their capacity areas has been prevalent. That is, for each and every cased fan, with little consideration of its proportions or speed, it has been assumed that this capacity area was equal to one-third of the product of the diameter and the width of the wheel at its periphery. This area has represented the maximum over which maximum velocity and pressure could be maintained. In point of fact it varies with the width of the wheel, the number and curvature of its blades, and the proportion of its casing; it is influenced by the speed, and by the presence of one or two inlets.

Although to a limited degree the general effect of these variables is known to some manufacturers and engineers, there is no well defined public or private knowledge upon the subject. Even the best method of testing the independent blower is far from established or approved. The old-time method consists in providing the standard outlet in the casing with a tapering pipe, reduced at its end to an effective area equal to the capacity area as above described, and then taking pressure measurements by a single water gauge. Velocities, if low enough, were measured by the anemometer, which, however, was seldom accurately calibrated. If too high for the anemometer, they were calculated from the total pressure.

The tests on ventilating fans conducted a few years ago by Mr. D. W. Taylor probably represent the greatest accuracy in methods, instruments and measurements. They have been made public in "Transactions" of the Society of Naval Architects and Marine Engineers, but unfortunately not in a form to be essentially valuable to the average man. The Pitot tube was used with great care, and tests conducted upon numerous relatively small standard fans discharging through extended lengths of straight piping. But no general comparison of types and proportions of fans was made.

Tests made under either of the two preceding methods are concerned directly with the creation and measurement of pressure and velocity within the pipe.

An entirely different method consists in discharging the air into a large, air-tight chamber against a known maintained resistance, the practical extinction of the velocity therein, and its re-creation when the air is allowed to escape through an opening out of the line of direct discharge from the fan.

Results based upon the first method lead one to think in terms of the pressure produced by the fan to overcome resistance; the second brings first to mind the resistance to be overcome as a factor in determining the volume which a given fan may be able to deliver.

Between these, and possible other methods of testing, some choice should finally prevail in the engineering world as a fundamental basis for determining the performance of a fan. The relations and influences of static and dynamic pressures should be clearly understood. The proper methods, the proper instruments, and the proper calibration should be likewise established and figured.

Much of this work, particularly in the preliminary stages and in isolated detail, appears to lie peculiarly within the province of the technical school. Unity of purpose and concerted effort on the part of the leading schools would, through investigation for thesis and similar work, soon add materially to the fundamental knowledge we so much need. Aside from the general interest which any school should properly take in the matter, the existence of courses in heating and ventilation in many of the leading schools should furnish a reason for conducting the tests. It cannot be doubted but that broad-minded manufacturers would readily co-operate in any such effort.

Anything that would remove the present confusion in published or private tables of fan performance, and which would establish standard results for typical forms, would be a distinct gain to all concerned.

In the field of the disc and propeller fan, which is distinct in principle from the centrifugal type just under consideration, there is room for excellent work.

As a foundation for any series of investigations in fan performance, a reliable bibliography would be of inestimable value. Through society transactions, engineering periodicals, text-books, and the like, there is scattered much of real value. Unfortunately there is an excess of the unreliable, which should be carefully eliminated. A careful consideration of the residuum would avoid much duplication of effort, and clear the way for effective work. In all of this it appears that the technical school could play an effective part; the most vital results could be published in the name of the professors under whom the work was conducted, and who were generally responsible for its accuracy.

Manifestly a body like the American Society of Heating and Ventilating Engineers should be deeply interested in the subject. It has already done much to awaken interest, and promote investigation. Concerted, combined, systematized effort would bring eventual returns of great value.

Boston, Oct. 31. WALTER B. SNOW.

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Of this issue of THE ENGINEERING RECORD 15,000 copies are printed. Total circulation for 1907 to date 672,000 copies, an average of 14,609 copies per week.

TABLE OF LEADING ARTICLES.

Architecture and Landscape Work for the Catskill Water Works.

In these days of advancing culture in the United States, the local governmental authority charged with the construction of a great system of public works has a responsibility other than to make the system as a whole and the structures in detail useful and efficient in a utilitarian way only. With additional thought and skill in design, the visible structures of masonry and earth, with their landscape surroundings, can be made beautiful—a source of pleasure as well as a means for supplying a physical need. Frequently, too, these desirable results can be obtained at slight additional cost, and cases are not unknown in which intelligence properly applied has, in satisfying esthetic demands, secured practical economies. But even if it does cost somewhat more to make public works beautiful, the expenditure, within reasonable limits, is well justified. The older communities, having met their most urgent needs for bare necessaries, can afford such investments for the enjoyment of their citizens. Indeed, judicious expenditures of this sort are not an extravagance, for besides giving wholesome pleasure to the community that builds them, and its neighbors, fine public works may become a source of considerable indirect revenue. Without doubt, several European countries attract their thousands of tourists annually—and take toll from them—not alone because of beautiful scenery, but in part ,by reason of noble and attractive public and semi-public buildings, bridges and other works.

New York City has just entered upon the construction of, probably, the greatest system of water-works ever actually undertaken, and one of the most ambitious engineering enterprises of modern days. These works will bring water a hundred miles or more from the Catskill mountains, across country of unusual scenic charm and much variety of topography. In the valleys of the mountains, where thousands of New York City's residents spend their summer vacations, the impounding reservoirs will be created. Catskill aqueduct will traverse the broad and beautiful valleys of the Esopus, the Wallkill and the Moodna; will pierce the Highands of the Hudson in crossing the main valley of that river, and will continue southward east of the Hudson through the gentler hills and dales of Putnam and Westchester counties, where are many of New York's suburbs and country homes. Along this line are some fifty gatehouses, siphon chambers and other structures suggesting the aqueduct hidden below in trench, or tunnel or embankment. Some of these buildings will occupy most conspicuous sites, commanding in several instances hundreds of square miles of territory. They cannot be concealed; they should be made attractive.

At the terminus of the aqueduct, Hill View reservoir, a covered basin, can readily become a park with broad and pleasing prospects in many directions. Near the large town of White Plains, Kensico reservoir, of approximately 40,000,000,000 gal. capacity, will become an attractive lake of very irregular outline, extending into the valleys among the hills. Its dam, a masonry wall over 2,000 ft. long, on top and 150 ft. high above the surface of the ground, will occupy a site probably more conspicuous than that of any existing large masonry dam, if judged by the number of people who will see it daily. Only 25 miles from the heart of the city, at the terminus of a proposed park system, in the midst of a populous suburban region, it is in full view, at close range, of a railway carrying thousands of persons daily to and from New York. Large aeration plants may also be included in the system, throwing numerous jets of water into the air to considerable height, and there is to be a very extensive filtration plant, which, it is to be desired, may be made more pleasing in appearance than some works of this kind have been.

What opportunities are suggested here, with no light emphasis, for the architect and landscape engineer to co-operate with the water works engineer in creating works which will be the more creditable to all the professions concerned for such a union of technically trained minds! To these opportunities and obligations the Board of Water Supply has evidently not been oblivious. With the good sense displayed in other matters which it has been the pleasure of The Engineering Record to mention the Board has engaged in a consulting capacity for the guidance of its chief engineer and his staff in the design and construction of the visible portions of the works, the services of a landscape engineer and a firm of architects of the highest standing in their respective professions. In selecting these men, it has been stated, not only was care exercised to secure skill of the highest order, but also those qualities of personality which make it possible for men to co-operate. Indeed, but slight acquaintance with the staff of the Board is necessary to convince one that this idea of co-operation is one of the most dominant notes in the policy of the commissioners and the chief engineer. Assistants who have been trained along the lines of architecture and landscape work have been engaged as members of the engineering force, so that the details of all kinds of work may be elaborated and harmonized under the immediate supervision of the chief engineer.

Such excellent results have been achieved in recent years by similar association of architects and landscape engineers with civil engineers, that the wisdom of this most recent endeavor to do something better than the ordinary in the construction of water-works can not be gainsaid. It is to be hoped that the good example of New York and Boston and some other cities will soon become the usual practice, not only for water-works, but for all public works. The recently completed Metropolitan water-works of Boston now give ample justification in their most attractive appearance for judicious regard for the esthetic sensibilities of the community and the slight additional cost which it entailed. With this successful precedent fresh in mind, this journal anticipates with confidence an accomplishment which will be thoroughly creditable to the metropolis and a cause of pride to its citizens, if the men who are now so ably directing the works be allowed to continue untrammelled in their good policies.

Problems of Motor Application.

In view of the amount of engineering attention usually given to the purchase and installation of electric generating equipment, it is singular that problems of motor application are so frequently settled off-hand by owners of industrial plants. The ability of the average well-made motor to withstand abuse is, no doubt, partly responsible for this, and another reason for the quick decisions often made as to the kind of motor selected for a given duty is found in the subdivision of motor units necessary in the great majority of installations, whether individually or group driven. Then there is the question of first cost and delivery, which is naturally important to an establishment working under conditions of forced output.

It is an easy matter in simple problems of motor application to spend more time upon the selection than the case warrants, but in the choice of motor drives where several units are required, there are some fundamental points which should not be overlooked simply because it is about lunch time and because the motor salesman has quoted a good price on standard outfits. The amount of power, average and maximum, which the machine or group to be driven will require; the prospect of more machines being added to the load of each motor; the amount and range of speed regulation necessary; the character of attendance that can be counted on; the weight of the motor unit and cost of special construction to support it, if on a wall or ceiling platform; and the efficiency curves of the motors

offered should all be carefully considered. Too few manufacturers are possessed of data showing the percentage of time different machines are idle and the variations in individual power demands at different times.

The question of motor efficiency is of much more importance than is always realized. Motor design has developed to a point where certain efficiencies may be expected in certain types and sizes of machines, but unless a motor is selected to run at or near its normal rated output the greater part of the time, the benefit of a highly efficient design cannot be had, the cost of the motor becomes unduly great for the service rendered, and the cost of power lost in the distributing system and the expense of excess current generation at the prime movers above the normal, tend to defeat its economies, which the electric drive is generally capable of bringing about if properly installed.

Occasional tests made on working installations are found to throw considerable light on the motor situation and guide future decisions as to motor selection. On account of the extremely low maintenance cost of many motors in definite commercial service, there is often an absence of accurate repair records in plants where the most minute details of engine, boiler and generator maintenance are carefully kept. A policy of charging off motor repairs, however, enables the exact cost of the electric drive to be figured in different departments, and the expense of testing the starting current, speed and power consumption of service motors is almost nominal in comparison with the value of the data. Given a motor of large capacity installed in connection with a group drive, it is most essential to find out from time to time whether it is being seriously overloaded or not, either through changes in the operating conditions at the machines or through the addition of more machine units than the motor can properly handle at the maximum rate of production.

No question is of greater importance in the applications of electric motors to commercial service than the group contrasted with the individual drive. It is not the purpose of these comments to discuss the relative advantages of group and direct driving, but to emphasize the need of going into the question thoroughly in practice. Expert advice is more necessary here than in any other phase of the motor problem. Nothing short of a careful estimate of the total annual cost of each method, taking into account the installation and purchase expense, operating efficiency of each combination, flexibility value, probable reliability and repair cost, interdependence of departments, in brief, the total power cost at the motors per unit of manufactured product, will furnish a proper basis for a sound decision in motor selection.

Sheet Piling and Earth Pressure.

There are some puzzling questions which arise in connection with sheet piling as used for both small and large excavations, especially when the latter are of considerable depth. As a matter of fact, the bracing generally employed to hold the sheeting or sheet piling in place is designed more as a matter of judgment than of exact computation. The ordinary rational theory of earth pressure is based upon an assumed perfectly dry material composed of small grains, possessing no coherence among themselves. The standard quality of earth on which is based the usual theories of earth pressure is that of a fine granular mass, whose particles are free to move over each other except for friction, these particles assuming an exterior surface slope, under normal conditions, whose tangent to a horizontal line represents the coefficient of friction. This theory results in an intensity of pressure for a mass of dry earth which increases directly with the depth as does water pressure, but at a different rate. There are few structures whose design involves the use of formulas for earth pressure which have not been proportioned upon this theory if their treatment has been of a rational character; in fact, Rankine's and other similar theories have come to be standard for this entire field of construction. Although these earth pressure theories have been criticised for various alleged defects of more or less serious nature, the latest is probably one of the most interesting attacks of this kind.

In a recent number of the "Proceedings" of the American Society of Civil Engineers, Mr. J. C. Meem has presented a paper on "The Bracing of Trenches and Tunnels, with Practical Formulas for Earth Pressures," the main features of which were stated in The Engineering Record of Nov. 2. In this paper the author has set forth certain views as to earth pressure which are based on his observations in sheeted or sheet-piled trenches. He has observed that in many new excavations both the bottom and the bottom portions of the vertical sides remain stable in place even when not supported, while in the upper parts of the same trenches the material has exhibited such a tendency to motion as to produce heavy pressures against the sustaining sheeting with its braces, the excavated material not being dry sand. He assumes, therefore, in treating the laws of pressure thus disclosed, that the greatest earth pressures are near the top of the excavation, from which place they decrease to the bottom, where they are either actually or essentially zero. This obviously is fundamentally at variance with the ordinarily accepted law of earth pressure, which makes the intensity of that pressure zero at the surface and a maximum at the bottom of an excavation, with a uniform rate of variation between.

The difference between these laws is radical, as is recognized by Mr. Meem himself. If his views are correct, practically the whole body of present and past practice in connection with earth pressures is altogether wrong, except in the case of dry, sandy material, for which he would employ the generally accepted theory of earth pressure, the law of whose variation with the depth below the surface is similar to that of liquid pressure, i. e., the intensity varies directly as the depth.

Probably every experienced engineer who has had much to do with the design and construction of structures to resist earth pressure, has recognized the familiar fact that the standard theories of earth pressure are not supposed to be more than approximately correct for other materials than dry sand. There are, however, with equal probability, very few who would be willing to postulate with emphasis that the intensity of pressure against sheet piling and its bracing decreases with the depth of excavation, becoming zero at the bottom of the latter, and acquiring a maximum value in its upper part. It is true that in almost any excavation other than in dry sand, the material in its bottom stands stiff and undisturbed for a greater or less period of time after the excavation is completed. There is nothing uncommon about that; it is a matter of frequent observation.. A damp clayey or loamy material holding considerable moisture assumes under the heavy pressure of the superposed material a stiff, dense and firm condition, which disappears only after weathering, and much weathering in some cases.

If a trench or other excavation is to be quickly completed and refilled, insufficient time may elapse for such material to lose its moisture, and so to become friable or granular behind the sheeting and produce intensities of pressure of relatively high values. This is precisely what takes place in many excavations of magnitude. Material is frequently found capable of maintaining a vertical face for a considerable time even without the support of sheeting, but the instances are rare where such faces will not soon become dry enough to lose coherence and granulate to a marked degree, and slough off or fall away if unsupported, like any dry granular material in which the maximum intensity of pressure is found at or near the bottom of the excavation. Under such circumstances it certainly would not be prudent or safe to rely upon the temporary tenacity thus disclosed to hold long in position the sides of such excavations. It is a matter of common experience to observe the weakening by dessication of vertical earth faces, nor is it so very infrequent to experience the failure of sheeting with its bracing from this kind of a cause. The matter practically reduces itself to taking chances with these excavated faces and hazard reaching the refill before the material with its reduced moisture has an opportunity to assert its capacity for lateral pressure.

More than one instance of this character has resulted in failure. Experience with excavations in general has taught the important lesson that, except in comparatively few cases of unusually tenacious material, it is safer to assume that the relatively dry granular condition may prevail sooner than anticipated, and that in general it is prudent to accept the indications of the standard theories of earth pressure, if there is much at stake. In the more difficult and dangerous saturated or semi-saturated, materials, it takes but little experience to confirm the accepted laws of earth pressure and to realize that such earth pressure theories as that of Rankine are among the valuable technical assets possessed by the engineer.

Notes and Comments.

THE DETROIT TUNNEL OPERATIONS described in this journal last week and in previous issues are so novel as to deserve a word of comment. Several projects for constructing subaqueous tunnels have been proposed in which sections of the tunnel are built on ways, launched and towed to the place where they are to be sunk, but in this undertaking the various steps are unique in their conception. The forms are first sunk, then surrounded by concrete placed under water, and finally the forms are pumped out and lined with concrete without the use of compressed air. This procedure was first proposed by Mr. W. J. Wilgus, a fact that was unfortunately not stated in the article printed last week. Mr. Olaf Hoff, of the Butler Bros.-Hoff Co., the contractors, is in personal charge of the work and has elaborated the details in a most ingenious manner in order to carry out the contract successfully.

THE ARLBERG RY. ELECTRIFICATION, the most extensive undertaking of this nature now under way, affords an interesting example of the accuracy of some of the general statements in Mr. Armstrong's valuable paper reviewed elsewhere in this issue. This road, a single-track line, is understood to have more business than any other crossing the Tyrolean Alps, about forty trains moving over it daily in each direction. This traffic has congested the line many times annually during recent years and it has become necessary to double-track the road, an enormously expensive undertaking, or to provide means for hauling heavier trains at higher speeds. By adopting electric traction the capacity of the road can be increased 50 per cent. at a far smaller outlay than that for a second track. The consulting engineer for the work is Prof. C. L. de Muralt of the University of Wisconsin, who has selected

the three-phase system for this installation, a selection practically forced by the railway authorities' drawbar pull and speed requirements, which make it necessary to develop 3,000-h.-p. with a locomotive weighing not more than 60 tons. The current will be furnished by hydro-electric stations and on the down-grades the motors on the locomotives will act as generators, returning current to the line and saving a large sum otherwise required for power, in addition to reducing heavy wear of brake rigging.

The Enormous Arch of reinforced concrete, with its clear span of 710 ft., which is the central feature of the design for the Henry Hudson memorial bridge at New York prepared by Prof. Wm. H. Burr, is the boldest bridge project for many a year. The designer has been working out the details of the plans for more than a year, assisted by the engineers of the city's Department of Bridges, and the project is now before the Municipal Art Commission for its approval. It goes without saying that the designs will receive critical study by bridge specialists everywhere, for no masonry arch approaching it in span or resembling it in design, save as a miniature resembles a large canvas, has been worked out before. At one step, reinforced concrete construction has been advanced from the very conservative works of the past to a structure that probably represents the maximum limits of practicability of the material. The computations have been conducted with great thoroughness by Mr. Leon S. Moisseiff, of the Department of Bridges, whose analytical ability is widely known, and methods of building the structure have been developed sufficiently to demonstrate their feasibility. Those critics who pronounce a hasty judgment against the design will therefore probably find that their arguments have already been examined during the progress of the studies and have been met satisfactorily.

The Excavation Records which Colonel Goethals and his staff continue to make at Panama are astonishing. The September record was a gratifying achievement, but that of October is a complete surprise. During the month about 1,844,500 cu. yd. of material were taken from the canal prism, an increase of more than 23 per cent. over the record for September. The significant fact of this accomplishment was that during October the rainfall amounted to 17.1 in., as compared with 11.9 in. in September and 11.89 in. in August. In addition to the material taken from the canal prism about 24,300 cu. yd. were removed from accessory works, chiefly the excavation for the big locks. If excavation can be carried on at this rate during a month of such heavy rainfall, what may not be expected during the season when the working conditions are more favorable? That the best excavation records obtained under Mr. Stevens have been increased more than 75 per cent. during the month of the year worst adapted for such work is a pretty good indication of progress. Another thing just as important in one sense is the excellent result of Secretary Bishop's endeavor to do away with all needless causes of discontent on the isthmus. As chairman of the Commission's committee on grievances he hears every complaint and is able to make a thorough investigation of it. By means of the "Canal Record" which is distributed free among all employees whose names are on the "gold" roll, he has accomplished wonders in producing that feeling of common interest and united endeavor essential for the best results where large bodies of men are engaged. The present situation on the isthmus is certainly one in which the American people may take justifiable pride.

The Lack of Balanced Education afforded by courses in engineering colleges is discussed at some length in the recent annual report of President Schurman, of Cornell University. These courses suffer, in his opinion, from being exclusively in the field of mathematics and physical sciences. He believes that the modern engineer, to be truly educated, needs a training broader than science and its applications. He must have the liberal expansion of mind which comes from the study of literature, history and philosophy if he is to attain the highest rank. The problem, however, of teaching all the professional subjects made necessary by the advance of engineering practice necessarily makes the curriculum of the four-year course more and more technical and less place than ever remains for any of the liberal arts. As a result, President Schurman states: "All over the country men are graduating in the engineering courses with an ignorance of literature, history and liberal arts so dense that no proficiency in science and technology can save them from the charge of being uncultured, especially when, as so often happens as a necessary result of their limited reading of literature, they are unable to express themselves either in speech or writing in correct English prose." Consequently a five-year course is suggested as the next step to be taken for improving the education of engineers at Cornell. The extra time gained by the additional year is to be given up to humanitarian subjects, in order that the graduates may receive some measure of real education as distinct from technical training. This will be considered an advance by a good many of the engineers who hold that the next great step in elevating their profession will be in the broader education of those following it. Whether, however, the suggestion of Professor Schurman to add an additional year, and preferably two years, to the present course in order to incorporate liberal arts studies along with those of a technical nature should be preferred to the requirement of a course in the liberal arts in a college as a preparation for technical studies will certainly be a matter of debate. It must be recognized that in the West where technical education is largely conducted in state-aid colleges, the requirements for admission are extremely low in the elements of history, literature and the arts. While the technical instruction in all parts of the country is on a pretty satisfactory plane, the fact remains that the instruction in academic branches as distinct from scientific branches is by no means of such a uniform character. It may be better, therefore, to keep technical training such as is given in a four-year course in an engineering college an entirely distinct thing from the education in a liberal arts course.

Municipal Repair Plants for maintaining asphalt pavements in proper condition have been a subject of considerable controversy for a number of years. For some time this journal believed that the desirability of installing and carrying on such plants was questionable in many cities, particularly those where the management of public works did not rest in the hands of technically trained officials. The experience to date with such plants has been wholly favorable, however. The city of New Orleans is one of the largest which has tried such a plant and in the last report of Captain Hardee, city engineer, the operations for the past year are stated to have been entirely satisfactory. The mechanical equipment is complete in all respects and the stone crusher has furnished a large amount of broken stone for other than pavement purposes. The asphalt machinery has been worked every day during the year except Sundays, holidays and rainy days. During the 141 working days it turned out 88,947 cu. ft. of wearing surface mixture, the largest run in any day being 1,845 cu. ft. There has been no break-down whatever. The sum of $40,307 has been spent for all repairs made to asphalt pavements during the year, while under the old rates the city would have been obliged to pay the Barber Asphalt Paving Co. $114,500 for the same amount of work. The first year's saving due to the plant is, therefore, $8,000 more than the actual cost of the entire installation.

Financial Hysterics, like the recent exhibitions in a few places, are the same strange things seen when a crowded street car bumps good and hard into a substantial truck. Before the motorman and driver are well into their controversy concerning each other's character, ability and future abode, some of the passengers will have shrieked themselves into a frenzy or have fainted away. It isn't their fault and they will be mightly ashamed of themselves afterward; but for a time they make a disturbance all out of proportion to the danger, and everybody who sees them carry on is more or less upset. It is about the same when a policeman grabs a husky pickpocket and clubs him into submission. Some people who don't know what the row is about will vociferously condemn the wanton assault on an inoffensive citizen, while the fellow whose pocket was picked will be equally mad because he has to go to the station house to get his things back. A few weeks ago some of our good financial policeman fired out of several New York banks a few men whose absence from banking circles was considered desirable. The usual crowd collected at the noise of the row and started all sorts of baseless rumors. To cap the performance, a fool newspaper reported the next day that there was trouble in a great, sound financial institution. Immediately there were hysterics; a silly, reasonless exhibition just like the ladylike variety we all regard with pity. It has scared a good many timid souls through the country, however, but perhaps, after all, it was a good thing it happened. A few of us will have our money tied up for a time in suspended banks, but we will get it out again before long. In the interim we will learn to be a little careful of our pennies, which will do no harm. For some months brash persons will not have the means to rush headlong into big enterprises which cannot stand careful investigation, and some manufacturers may have to hunt around a bit for orders instead of selecting at leisure the best of the host urgently thrust into their hands. The trouble will be repaid if Congress will take the lesson of recent events to heart, as it seems likely to do, and repair our currency system. Such a wretchedly inadequate system would long ago have brought on a slow fatal decline if the basis of our national prosperity was not so vigorous that even this powerful irritant could do no more than produce an occasional itch. The present system is just about as elastic as a dry mud pie, and not much more useful. It now appears probable that this makeshift will be supplanted very soon by something as good in its results as the systems of Great Britain and France. The trouble we have had the last few weeks has been due mainly to lack of currency, and that was caused by the inability of our rigid banking law to render any help when a few men went crazy, shouted "thief," and scared timid people into the foolish belief that their money was safer under their pillows than in the banks. The bankers in a few cities have had a hard time with their frightened depositors, but if Congress will attend to its part of the job and the people at large will refuse to get scared when hysterical persons yell "ruin," this disturbance will be cured in short order.

A Column Connection.

The Structural Features of the Singer Building, New York.

The general interest aroused in the Singer Building by the widespread stories of the work of a steeple-jack on the top of its lofty flag-staff makes it desirable to bring together the leading facts concerning its structural features, already described in detail in many articles in previous issues of this journal. The building, at the corner of Liberty St. and Broadway, covers an area of about 24,000 sq. ft., with a main structure having a uniform height of fourteen stories, surmounted by a large tower 612 ft. in extreme height above the curb. It includes the old steel frame Singer and Bourne Buildings originally ten and fourteen stories high respectively, and their additions and extensions which have been combined into a single continuous structure with fronts of about 133 ft. on Broadway and 238 ft. on Liberty St. The old Bourne Building and the old Singer Building have grillage foundations on sand, the Bourne Building addition has reinforced concrete spread footings, and the addition to the Singer Building and its great tower have concrete pier foundations carried down by the pneumatic caisson process to rock at a maximum depth of about 92 ft. below the Broadway curb.

The building is of fireproof steel cage construction of the ordinary type, except that special provision is made to resist wind pressure in the tower. It is designed for office purposes and has a two-story curved mansard roof and flat deck corresponding with that of the old Singer Building. The tower, 63 ft. square at the base, has vertical walls faced with brick and limestone. It is located near the centre of the Singer extension with the front wall parallel to Broadway and about 30 ft. back from the curb line, so that the main building has the effect of a wide base about 200 ft. high for the tower shaft. The tower contains thirty-three principal stories above the main roof, making forty-seven stories in all, and terminates in a segmental dome springing from the thirty-eighth story and finished with a flat deck at the forty-second floor, carrying a lantern about 16 ft. square and 63½ ft. high, with a steel flag-pole rising nearly 36 ft. above it. The highest office floor is the fortieth, at an elevation of 524 ft. above the curb, and the lantern balcony, 562 ft. above the curb, is the highest point accessible to the public, while the summit of the small dome is 612 ft. and the top of the flag-pole is 668 ft. above the curb.

The numbering of floors adopted in this article differs somewhat from that used in the previous articles. On the architect's plans two stories, known as the ground story and messanine story, are not numbered, therefore what is called, on the architect's plans, the first story is in reality the second story. The mezzanine story, between the thirteenth and fourteenth stories, was not numbered, so that in the present numeration the story originally designated as the fourteenth becomes the sixteenth, and all stories above it are correspondingly changed from the former designation, numerals commencing at ground level.

The structural features correspond with recent practice for steel cage office buildings and are most interesting in the provisions for wind bracing required for the 30-lb. horizontal pressure assumed on the entire vertical surface of the building. There are 58 lines of steel columns with closed rectangular cross-sections, which support the beams and girders of the various tiers on horizontal connection angles field-riveted to their top and bottom flanges. In the fourth story one of the corner columns is carried on a triple web cantilever plate girder 30 in. deep and 18 ft. long, which receives a load of about 500,000 lb. and is anchored by bearings on the under side of brackets riveted to one of the interior columns. The columns have cast-steel bases distributing their loads over I-beam grillages covering the tops of the concrete piers. Tower columns have maximum combined loads of as much as 1,637 tons and have correspondingly massive lower story sections.

The heavy wind pressure is resisted by a system of 25 vertical panels of X-bracing between adjacent pairs of columns. Four panels terminate at the sixteenth story, sixteen panels in the corners of the tower are carried up to the thirty-fourth story, and the remaining five panels, between the interior columns of the tower, are carried up to the thirty-eighth story. In nearly all cases the wind bracing consists of full-length intersecting diagonals in each panel. All of the horizontal members are made of pairs of channels back to back, and the same construction is used for the diagonal members except in the highest stories, where the strains are lighter and single channels or angles are used instead. Some of the wind-braced panels are replaced in the lower stories with knee-braces instead of full-length diagonals. In the tower, the X-braces are arranged in alternate long and short vertical panels to clear the door and window openings.

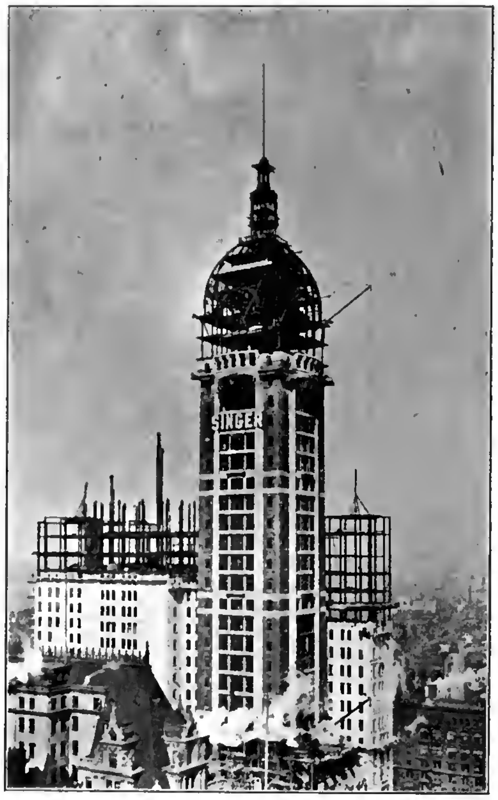
In all cases the wind braces are field-riveted to wide projecting connection plates shop-riveted to the columns. In many cases these occur on three faces of the same columns, making them extremely bulky and difficult to store or handle. The tower has 36 columns continuous through the fourteen-story building to a point 320 ft. above its roof at the foot of the dome 510 ft. above the curb.

The four center columns are continuous to the forty-fifth story about 580 ft. above the curb, where they support the light framework of the upper dome about 30 ft. higher. They have a total length of 579½ ft. each and a cross-section of 160 sq. in. at the bottom, while the others are only 499 ft. high, but have about the same cross-section. Eight of them are anchored with four 4½-in. vertical screw rods engaging pin-connected riveted links extending through the pier 40 or 50 ft. to its base, where they are secured to anchors cast into the concrete so as to develop the full weight of the pier, estimated at about 1,150,000 lb., and the enormous earth friction on its vertical sides to resist the maximum upward reaction of about 925,000 lb. developed by the overturning moment of the wind as described in The Engineering Record of May 4.

The four-story dome, 63 ft. in diameter at the base and 50 ft. high, has four hip rafters at the corner columns. Each of them is double and each part is made of a pair of curved 15-in. channels riveted together back to back. They are seated on diagonal beams in the thirty-eighth floor, and rise nearly vertical to the thirty-ninth floor, above which they curve inward to the forty-second floor, having gusset plate connections riveted between their webs for each floorbeam. They are made in two sections, field-spliced in the thirty-ninth story and connected at the fortieth and forty-second to cantilever floorbeams projecting beyond the four centre columns of the tower. In each face of the tower there are four intermediate curved jack rafters similar to the hip rafters between them.

The contract for the sub-structure was awarded September 18, 1906, and required that it should be completed ready to receive the steel superstructure in 110 calendar days. As soon as the old buildings were demolished, a timber platform 30 ft. wide was built on falsework bents from the Broadway front through the center of the lot nearly to the rear, and served for loading and unloading materials. It was provided near the middle with a two-story tower 28 ft. high, with clearance underneath for wagons, and had a 30-ft. steel extension with a 60-ft. 15-ton wooden boom at each corner commanding the entire area of the lot.

Wooden caissons of a maximum weight of 12 tons were delivered complete by wagons from the contractor's yard and were unloaded and set



Completed Tower Framework.

in place by the derrick booms, and the concrete piers were built like tall vertical shafts on their decks, before sinking was commenced, thus saving cofferdams and providing a great weight for forcing them into the excavation made later by men working under pneumatic pressure in the usual way. In this way, the thirty caissons were sunk a little below the surface of the hard pan and the excavation continued below them to rock for the concrete filling. The work was carried on continuously by two 150-men shifts in charge of Mr. Alexander Allaire, superintendent for the Foundation Company, contractors.

All of the structural steel was fabricated at the Milliken bridge shop, Staten Island, and shipped on lighters to pier No. 11 in the East River, where it was delivered on trucks to the Broadway front of the building and immediately unloaded by means of a derrick seated at first at street level and afterwards moved up with the steel work every second tier. The derrick was of special construction designed by the contractors and had a 75-ft. mast and a 65-ft. boom

of 40 tons capacity. Both mast and boom were round sticks of timber with cast-steel and forged steel fittings, and the mast was provided with connections for sixteen 1¼-in. steel guy ropes, only eight of which were used for this work. It weighed 10 tons and was equipped with ¾-in. wire-rope tackles for the hoisting and topping lifts which were rove with from nine to three parts, diminishing as the work advanced and the weight of the members decreased. The derrick was hoisted from story to story in the usual manner, first unshipping the boom and using it as a gin pole on the second floor to hoist the mast with. The entire operation required only about three hours and was accomplished by the regular force of erectors.

The steel was either assembled in final position as unloaded or was temporarily stored on the highest tier of beams until the columns and girders could be set. Occasionally bundles of small light pieces were temporarily stored on the bridge over the sidewalk. The heaviest member lifted was a 54-ft. section of one of the columns, which weighed 28 tons. All pieces were handled with chain slings. The main part of the building was erected at the rate of about two 250-ton tiers per week, and was completed up to the fourteenth story about June 1st with a maximum force of 200 men. The work was then practically suspended for nearly six weeks, and when resumed the tower was erected at the rate of four tiers in seven days, the heaviest tier weighing about 140 tons.

The erection of the tower was commenced at the seventeenth floor about the middle of July, and was completed Sept. 15th, about 2,000 tons of steel having been raised from 200 to 600 ft. during that interval. This part of the work was considerably delayed by the narrow width of the panels, which made it almost impossible to store more than one of the bulky column sections in each space, and by the awkward location of the column splices which, in order to clear the wide connection plates for the wind bracing, were placed almost midway between the floors and required the construction of scaffolds for field riveting.

View of Singer Building Tower during Erection.

After the completion of the main building up to and including the seventeenth floor, which serves as a roof deck, some of the wall columns in the Broadway front were continued from the fourteenth floor, where they terminated and the curved mansard roof rafters commenced, to the seventeenth floor at the level of the main flat roof by temporary steel columns braced in position. These carried steel girders and heavy wooden beams and planks forming a deck at the seventeenth floor level, which extended over the curved mansard roof and provided a substantial landing platform for the steel members used in the tower.

The 40-ton boom derrick was seated at this point and hoisted all steel members from trucks on Broadway, deposited them on the platform or delivered them directly to a similar derrick of 25-tons capacity that was carried up in the usual manner with the successive tiers of beams in the tower and erected the entire framework of the latter. Being located in the center of the tower the derrick mast was about 60 ft. from the Broadway front of the building and its boom was not long enough to command the trucks in the street below, hence material was hoisted at two operations as already described.

The 40-ton derrick hoisted from the street to the seventeenth floor, a little over 200 ft., in about 1½ minutes and was operated by a Lidgerwood engine permanently located on the first floor. The 25-ton derrick was operated by another Lidgerwood engine seated on the seventeenth floor and provided with steam from the boiler for their compressors. It had a maximum record of unloading and hoisting 400 tons of steel in 6 hours. The hoisting tackle for this derrick was rove with a spliced ¾-in. steel wire rope 2,500 ft. long and the lower block was provided with a 1,500-lb. cast-iron counterweight to assist it in overhauling. In its highest position on the fortieth floor, it hoisted materials from the landing platform on the seventeenth floor about 350 ft. in 3 minutes. It was moved up with every second tier of beams in the usual manner and was only out of service about 1½ or 2 hours for each operation. Each hoisting engine was provided with two gongs operated by electric buttons at their derricks, signals from which controlled all of the hoisting.

The sixteen columns in the tower were erected like those in the main building up to the base of the dome, above which the four center columns were first erected, together with their beams and girders, by the derrick seated on the thirty-eighth floor. The lower halves of all the curved dome rafters were then set in position and connected to the floor-beams and girders, bracing them with sufficient stability to maintain them until after the derrick was raised to the fortieth floor and erected the next section of the four center columns. The upper parts of the double hip rafters were then erected and their upper ends connected to the column framework of the tower, after which the intermediate jack rafters were erected, the first ones having their upper ends guyed until final connections could be made completing the framework of the dome. The derrick was not moved above the fortieth floor and in that position it erected all of the steel up to the forty-fourth floor, which is the second in the lantern and is about 47 ft. above the fortieth floor. The three last floors and the small dome extend to a total height of about 36 ft. more, and are composed of such light members that they were easily handled by breast derricks with windlasses raised by hand to the successive tiers.

Considerable delay and difficulty were experienced in the erection of the tower, dome and lantern on account of the narrow horizontal area for working and the consequent necessity of keeping the boom derrick topped up in an almost vertical position. Very great pains were taken here, as in the erection of the framework of the main building, to preserve the verticality of all columns as accurately as possible. This was accomplished by the liberal use of large numbers of wire-rope diagonals in the vertical panels between columns and floorbeams. As soon as it was erected, each column was carefully plumbed and if found at all out of vertical one, two or three diagonals were immediately attached to its upper end and adjusted by means of turnbuckles which maintained it rigidly in position until its splices and brace connections were riveted. This method was so successful that when the framework was completed to the full height of 612 ft. above the curb, the greatest deviation of the vertical columns in the elevator shaft was only ⅜ in.

There are about 220,000 field rivets, ¾ in. and ⅞ in. in diameter, which were driven with

twelve pneumatic hammers of the Chicago, Independent and Cleveland types. Air was compressed by two Ingersoll-Sergeant machines on the first floor which delivered through a 2½-in. vertical stand-pipe run to the top of the building and was provided with 2½-in. horizontal branches having ¾-in. outlets for numerous flexible hose connections at every story. Great pains were taken in fitting up, and all imperfect holes were reamed with Chicago Little Giant reamers, seven of which were provided for this job. The rivets were heated in oil furnaces provided with compressed air blast and were driven by five to nine five-men gangs who made a maximum record of 1,300 rivets in 8 hours for one gang and 2,450 rivets in 8 hours for two gangs.

The erection of the steelwork is now practically completed and the rigidity of the 6,000-ton mass is so great that no vibration has been observed by the workmen at the summit of the slender tower nearly 650 ft. above the column bases. The rapidity and efficiency of the steel erection has been largely due to the careful preparation made for receiving and handling the steel in exactly the required order and in erecting it without rehandling, the different members being swung complete to place in proper sequence without hesitation and the connections immediately made by men who were well-trained and competent to carry on the work with confidence and precision, wasting no unnecessary time and completing each operation in readiness for the next.

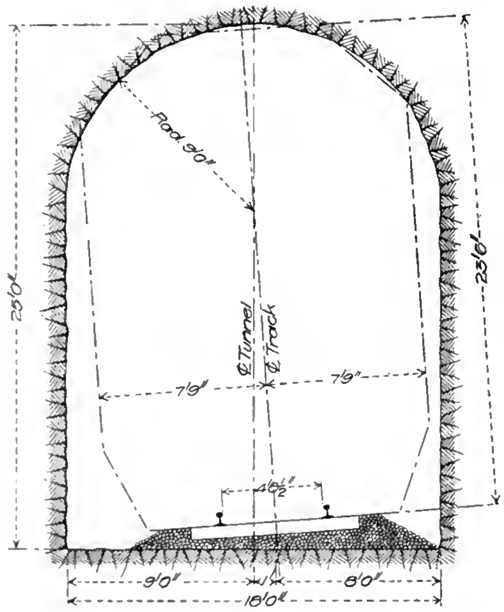
Great care was taken to maintain a constant rigid inspection of the work and of the condition of the building so that the scaffolds were always safe, the derricks in good order and no tools or materials insecurely placed or allowed to fall on the workmen below. Consideration was also had for the comfort as well as the safety of the workmen and a temporary electric passenger elevator was installed at the commencement of the work, as explained in a recent article in this journal, and its guides were extended as fast as the framework was erected especially to provide accommodations for the workmen, who were carried up and down in it to the rapidly increasing height of the building and thus saved much time and labor which would otherwise have been wasted in climbing ladders or stairs.

The steel erection is now practically completed and is entitled to the enviable distinction of two records, one for the great rapidity of construction and successful completion of a framework nearly double the height of any previous steel building, and the other for the execution of the lofty and difficult work without loss of life or a single serious accident, results which are most creditable to Mr. W. R. Waterbury, general superintendent of the steel erection for the contractors, and Mr. W. Craig, superintendent in charge.

The construction of the walls, floors, ceilings, partitions and the installation of the equipment followed as rapidly as possible after the erection of the steel work and was well advanced in the lower part of the building before the last of the many tiers of steel were in position. Heavy decks of the ordinary type were built over the Broadway and Liberty St. sidewalks and were used chiefly for storing stone and other material and for the occasional temporary accommodation of light pieces of steelwork. Underneath them elevated bridges were built to carry pedestrians while work was in progress for the vaults and sidewalks below, and two wide entrances were arranged to the interior of the building so that trucks could drive in, make a circuit and return continuously through the other as an exit without interfering.

All materials for interior construction were delivered by trucks which unloaded them inside the building, where a portion of the cement, fireproofing and other supplies was stored on the first and basement floors, but the greater part was immediately hoisted by four hod elevators to the stories where it was required. Floor construction was commenced April 15 and was carried on almost as rapidly as the steel erection, being maintained two or three tiers below the latter. All floors are made with National Fire Proofing Company's hollow tile flat arches and had Crown finish dispensing entirely with wood. Brick laying was commenced April 15th by John F. Brady & Co., and stonework for the exterior walls of the main building was commenced May 1st and for the tower August 25th. Exterior Kavanagh suspended scaffolds operated by the masons were used and all of the stone work was anchored by galvanized iron bars.

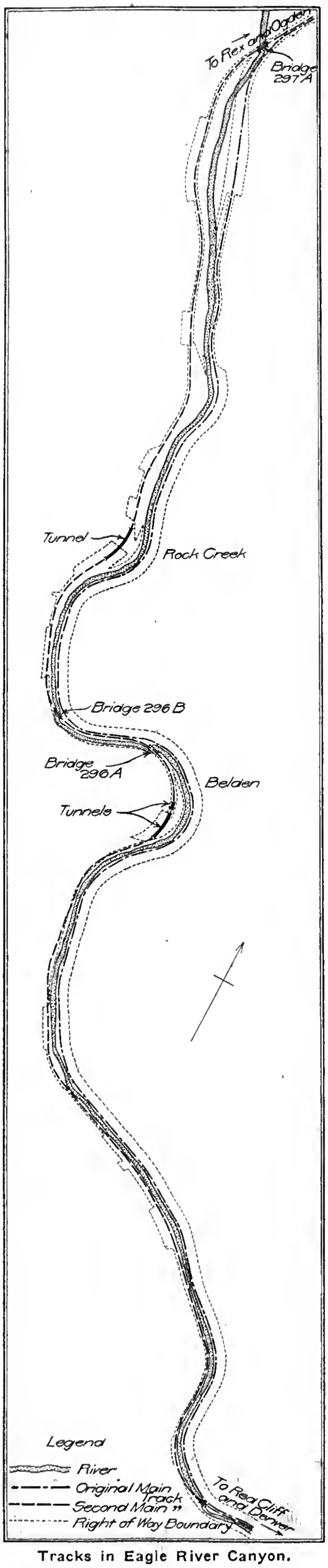
The trim is all pressed steel and the doors, window frames and sash are kalamined copper thus eliminating all woodwork except in portions of the old building. The windows in the court and up to the twentieth story of the tower are glazed with wire glass and all structural steel is protected by concrete or terra-cotta covering. The top of the building is waterproofed by the Hydrex Felt & Engineering Co. All construction was supervised directly by the architect's



Standard Tunnel Section, Eagle River Canyon, Denver & Rio Grande R. R.

office, no general contracts being awarded. Mr. Ernest Flagg is the architect of the building; Mr. O. F. Semsch, of his staff, chief engineer; Mr. Frank P. Whiting, general superintendent; Messrs. E. A. Rogers, H. J. Howell, and C. S. Heney, superintendents of the various sections. Messrs. Boller & Hodge are the consulting engineers for the structural iron, and Mr. Chas. G. Armstrong for the mechanical plant; R. W. Hunt & Co., inspectors of the structural iron; E. Kennard Thompson, inspector of foundation caissons.

PEAT-COKE MANUFACTURE by the Ziegler process has recently been started at Beuerberg, Bavaria. The peat is cut up, pressed and exposed to the air until evaporation has reduced its water to less than 25 per cent. of the whole mass. This peat is then placed in a retort for 18 hours. The coke is finally received in air-tight iron cars which are left for 6 to 8 hours to cool before they are discharged. Each retort yields during every 24 hours 8 to 10 tons of coke. The gas is passed through various tanks and towers in which the by-products are separated, and is then employed in assisting the retort process which could not even commence without the external application of heat.



Tracks in Eagle River Canyon.


Views in the Canyon Looking toward Belden from the East and the West.

Double-Track Work Through Eagle River Canyon, Denver & Rio Grande R. R.

The main line of the Denver & Rio Grande R. R. reaches the crest of the continent on the east by closely following the course of the Arkansas River from Pueblo to the headwaters of the Tennessee Fork. The main range of the Rocky Mountains is pierced at Tennessee Pass by a tunnel 2,572 ft. in length, the elevation of the highest point reached by the track being 10,239 ft. above sea level. On the Pacific slope the line follows the course of the Eagle River from its head to a confluence with the Grand River, thence down the canyon of the Grand to the mouth of the Gunnison River at Grand Junction.

The maximum rate of grade on the eastern slope is 1.42 per cent., which is also the ruling gradient between Pueblo and Tennessee Pass. The descent on the western slope is accomplished by the use of 3 per cent. gradients between Tennessee Pass and Minturn, a distance of 21 miles. West of Minturn the ruling gradient is 1.33 per cent. opposed to east-bound traffic between Glenwood Springs and Minturn, the gradient in control between Grand Junction and Glenwood Springs being 1 per cent.

Salida is a division terminal where are effected complete changes of locomotives, engine crews and train crews in both freight and passenger service. Minturn is a terminal for locomotives, engine crews and train crews in freight service, and for locomotives and engine crews in passenger service. Thus the portion of the main line between Salida and Minturn is an engine district for both freight and passenger service.

The short stretch of 3 per cent. grades between Minturn and Tennessee Pass necessitates the use of a large number of helper engines. The home of these helpers is at Minturn, to which point they return light after a trip to Tennessee Pass. This condition tends towards a congestion of traffic on the 21 miles of 3 per cent. grades, and on account of the rapid growth of both freight and passenger business, it has been found imperative to construct a second main track over a portion of the distance.

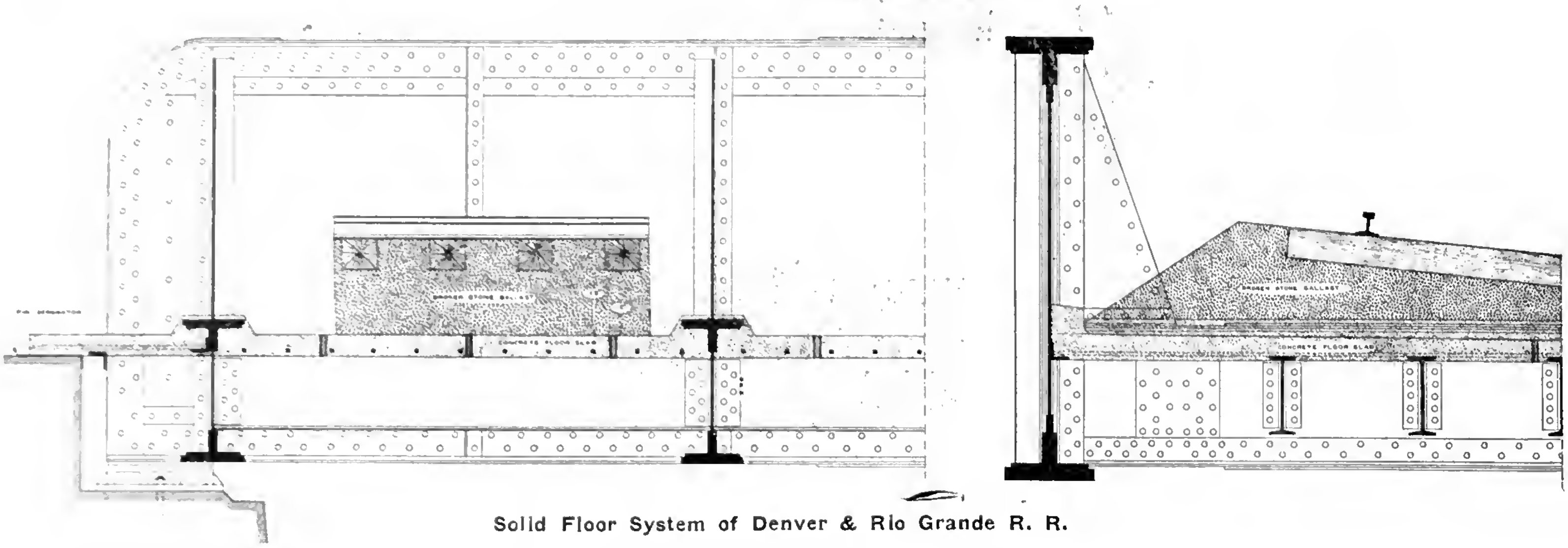
To facilitate the rapid dispatch of trains entering and leaving freight terminals the policy adopted some years ago was to construct double track for a short distance on either side and through the yards of such terminals. Hence in considering the matter of double-tracking a portion of the 3 per cent. gradient it was deemed expedient to extend the second track eastward from Rex, the easterly end of the existing double-track through the Minturn terminals, to Red Cliff, a distance of 5 miles. Perhaps, because of the peculiar topography of the country and the unusual physical characteristics of this portion of the line, a more difficult piece of double tracking could not have been undertaken.

In this portion of its course, Eagle River flows through a very narrow and sinuous canyon, in fact so narrow that it was found impracticable to parallel the old with the new track. Further complications in the existing congested condition of the canyon are occasioned by numerous patented lode and placer mining claims, a number of which are operated to a considerable extent. Accordingly it was deemed expedient to locate the line, for a greater portion of its length, on the opposite side of the river from the present track. In order not to exceed 10 deg. as the maximum curvature, five river crossings and three short tunnels were necessary in the 5 miles of line, but in this distance only three of the maximum curves were used. The tunnels and all of the bridges, except one, are on curves. The maximum gradient on the old track is 3 per cent., but this rate of grade not being continuous over the entire distance, it was therefore possible to use a maximum gradient of 2.3 per cent. on the new track. This reduction, though slight, is of especial benefit since the new track is for east-bound or up-hill trains.

As is usual in mining districts the right-of-way matters were somewhat complicated. The

Retaining Wall at Belden.

Track Location at Rock Creek.



Solid Floor System of Denver & Rio Grande R. R.

numerous claims with their surface improvements, tunnels and waste dumps necessitated rather tedious and laborious negotiations on the part of the railroad right-of-way agents. In some instances it was found advisable to construct retaining walls on the river side of the roadbed in order to provide ground space for mining operations.

The grading was performed by local Colorado contractors. An air compressing plant was installed at Belden, midway between the extreme ends of the work. From this plant compressed air was piped both ways to furnish power for the operation of air drills, which were used both in the tunnels and in the open cuts. The classification of pay quantities was as follows: Embankment, 135,220 cu. yd.; loose rock excavation, 115,315 cu. yd.; solid rock excavation, 153,705 cu. yd.; rip-rap, 2,670 cu. yd.; retaining wall, 6,190 cu. yd.; tunnel, 760 lin. ft.

The tunnels were all driven through solid rock without timbering or other lining, and are notable because of the large section, 18 x 25 ft. This large section was adopted in order to conform closely to the Denver & Rio Grande standard clearance diagram for steel bridges. Because so large a portion of the entire grading quantities consisted of rock excavation, the work was carried on through the winter months without serious inconvenience. Extreme vigilance in putting off blasts was necessary on account of the multitude of trains passing in such close proximity to the work, and the contractors are to be commended for the able manner in which the work of grading was conducted.

For the smaller drainage openings under the roadbed, cast-iron pipe and reinforced concrete box culverts were used. The river crossings necessitated one double track 48-ft. through girder, two single track 80-ft. through girders, and two single track 80-ft. deck girders. One span, an 80-ft. deck girder, occurs on tangent. All the remaining bridges are situated on heavy curvature.

The abutments were all constructed of plain concrete masonry, and, owing to the geological formation, no trouble was experienced with foundations.

The girders were designed for a reinforced concrete floor slab and track ballast, in conformity with Denver and Rio Grande Specifications for Steel Bridges, and as a result they are somewhat notable on account of their great weight. The ballast used is of the best quality of broken stone, and unusual care was exercised in order to secure a desirable character of concrete in the floor slabs.

Field riveting on bridges was accomplished by air power furnished from a flat car fitted up with a steam-driven air plant. The construction of concrete abutments and all other field work pertaining to the bridges and culverts was performed by company forces.

Denver & Rio Grande standard 85-lb. section rails 33 ft. long with plain four-bolt angle bars and flat bottom tie plates were used in laying the track. In order to easily secure a proper and uniform amount of space at the joints for variations in temperature the track was laid from Rex easterly or "up hill."

The entire work of construction was carried on without interruptions to traffic, and the new track was placed in operation for east-bound trains on Oct. 27 last.

The Union Pacific Gasoline Motor Cars.

For operation on its branch lines which do not furnish enough passenger business to be economically or satisfactorily handled with trains drawn by locomotives, and in order to give a more frequent service on other lines, the business of which will not warrant additional steam trains, the Union Pacific R. R. Co. has developed in its Omaha shops a remarkably efficient gasoline motor car.

This type of car, namely, the straight gasoline transmission, was chosen for the reason that it could be most satisfactorily operated in connection with steam freight service, and would be economical for a volume of passenger business too small even for electrical operation. Before undertaking the designs for the motor cars, a careful study was made of the various types of cars already experimented with or in use. In Europe, more headway has been made with the self-propelled car in a general way than in this country, where more attention is paid to the steam car. This is readily accounted for by the fact that the development of the self-propelled car has been largely by railway men, thoroughly acquainted with the steam locomotive and having a very limited knowledge of gas engine power.

In the investigations, two methods were available, one in which the engine transmits its power directly to the axle, and the other in which the engine drives an electric generator that furnishes current to motors connected to the axles. The latter was considered to have a number of objections, namely, additional first cost for generators, dynamos, storage batteries and controlling mechanism, and a great additional weight, loss in efficiency, and complication of electrical

Abutments for Bridges 296A and 297A on the New Second Track.

and mechanical problems. While the electrical transmission has the advantage of being able to drive more than one axle, the objections to the system so far outweighed the advantages in the opinion of the company's engineers that straight gasoline transmission was decided upon.

A four-wheel experimental car 31 ft. long, weighing about 40,000 lb., and equipped with a 100-h.-p. engine, was completed in March, 1905, and immediately put through a series of most exacting trials.

Although not intended for pulling trains, its tractive power was tested by attaching two passenger cars weighing together 112,100 lb. With this load the motor ascended a one-third per cent. grade, and also stopped and started several times on the grade without difficulty. With one car weighing 52,100 lb., it ascended a 1.6 per cent. grade at a rate of 11 miles an hour. After successfully making a trip under its own power from Omaha to Portland, Ore., and return, including the steep ascent of 27 miles on Sherman Hill, the motor went into daily service on one of the company's branch lines, 65 miles long, making the round trip daily.

As soon as sufficient experimental data had been secured through operation of this first car, and the management felt seasonably sure of the ultimate success of cars designed along these general lines, designs for an improved motor of greater capacity were worked out and up to the present time fourteen of these cars have been completed and put into operation, while there are still seventeen more to be completed during 1907.

The cars are 55 ft. long, with a seating capacity of 75 passengers. They weigh approximately 58,000 lb. They are provided with two four-wheel trucks, with 33-in. wheels, except the front driving wheels, which are 42 in. in diameter.

The car body is unique in many ways. Its rear end is semi-circular, to reduce to a minimum the air suction when the car is running, at the same time making a beautiful observation end, which is appreciated very highly by the passengers. At its front end, the sides of the car gracefully curve to a point, and the roof is curved down to the eaves, giving somewhat the appearance of the bow of an inverted boat. The object of this peculiar contour was to reduce to a minimum the air resistance when running at high speed.

In the tests made on the electric line between Berlin and Zossen in Germany, and also by the Electric Railway Test Commission, during the Louisiana Purchase Exposition, the great advantage of the wedge-shaped front end was demonstrated. These tests showed that the parabolic front offered only one-fourth the resistance that a car with a square flat end did. From the results obtained in these tests, the parabolic front end on the car would offer a resistance equivalent to 21.9 h.-p., while a plain flat end would offer a resistance equivalent to 87.5 h.-p. under the same conditions.

To secure the maximum strength in the car body, with minimum weight, and in order to have practically a fireproof car, the body is built wholly of steel. The prevailing type of roof used in wooden cars, with upper deck and ventilating sash, has been entirely discarded, and is superseded by a semi-elliptical roof, which, without sacrificing the comfort of the passengers, has been made 2 ft. lower than the old standard design. With this new tpe of roof, a car of great stiffness can be secured, with comparatively light steel posts and carlines, by uniting these parts into one piece of 2-in. channel section, extending from the side sill on one side, continuing around and down the other side of the opposite sill.

The underframe is unusually light and well braced. A single center sill is formed of an 8-in. I-beam with side sills of 6-in. channels. The body bolsters are of cast steel.

The round windows are a distinctive feature of this car, made in somewhat the same manner as the port-holes in a ship, only very much larger, and give promise of being brought into very general use in passenger car equipment in a very few years for the reason that they give an absolutely water and dust-proof window. The side wall of the car is only 2 in. through, in place of 6 or 7 in. as in the average coach, giving a more continuous view of the country to the passengers, and allowing the use of a wider seat, which increases the capacity of the car some 25 or 30 per cent.

The car is ventilated by a forced system of ventilation, fresh air being taken in at the top of the car at the front end, and distributed along the floor, the foul air being exhausted through ventilators in the roof.

The car is heated mainly by hot water coming from the cooling system of the engine, water being circulated through coils of pipe on both sides of the car. In summer, the engine jacket water is circulated through pipes under the car, and during the successive changes in temperature, the amount of water passed into the car for heating purposes is very nicely regulated.

The car is lighted by electric light or acetylene gas, the individual lamp system being used, placing a lamp over each seat, giving a beautiful clear light for reading, the light being behind an oval opalescent globe.

The interior of the car is finished in Cuban mahogany, the ceiling painted in soft colors pleasing to the eye. Comfortable upholstered seats are provided, suitable for seating three in a seat.

The engine compartment, as in all cars, is at the front, taking up about 12 ft. of space. The balance of the car is devoted to seating space for passengers. Two of the cars turned out have been built with a small baggage compartment back of the engine room. The entrance for passengers is at the side of the car, near the center, which does away with the necessity of rear-end vestibules, facilitates the loading of passengers, and when the car is running, the doors are closed and steps are not exposed to the elements.

The engines have six cylinders, connected in opposed sets of three cylinders each, so that the crank shaft receives three power pulsations per revolution. Although in general appearance the engines resemble somewhat the form used in automobiles, they are built with special reference to railroad service and the severe duty imposed upon them. The engine is located on the forward truck of the car between the bolster and the front or driving axle, and supported on the side frames of the truck. Eight spiral springs over the truck wheels carry the engine, while the car body is carried on elliptic springs under the truck bolster, thereby preventing all vibration in the engine reaching the car. The power transmission from the engine to the axle is through a 5-in. silent-running chain.

Two speeds only are used, one for starting the car, and the other thrown into commission after running about a car length. No power is transmitted through gears in the high speed, which is used 95 per cent. of the time, everything being locked, making a direct drive from the engine to the axle through the chain.

The engine is a reversible engine and can be run just as readily backward as forward. The speed of the engine is regulated by throttling the supply of gasoline, and this method has given the greatest satisfaction. Care has been used in designing inlet piping from the carbureter, to give an equal supply of vapor to each cylinder.

Compressed air is supplied through a pump driven by an eccentric on the main shaft of the engine, the air being stored in suitable reservoirs and being used for starting the engine, braking the car, the whistle, and sanding the rails. The reverse, throttle and spark advance levers are all conveniently located near the operator's post, as are also all air connections for operating the gear clutches; in fact, everything required in the handling of the car is located at either hand of the motorman. A straight air brake system is used, braking with 60 lb. brake cylinder pressure, while the main reservoirs carry from 110 to 150 lb. of air.

On the first seven cars a 100-h.-p. engine was used, having cylinders 8 in. in diameter with a 10-in. stroke. The eighth car and all cars following it are equipped with 200-h.-p. engines having cylinders 10 in. in diameter with 12-in. stroke. On a long-distance trial on the main line of the Union Pacific, a car equipped with a 100-h.-p. engine followed Overland Limited out of Omaha, running as second section of that train, leaving the depot ten minutes behind the first section. After covering 46 miles the motor car was continually held by the block of the limited train. A run of 153.6 miles was accomplished in 4 hours and 32 minutes, or 34 miles per hour. A maximum speed of 53 miles per hour was obtained.

One of the recent cars, with a 200-h.-p. engine, on Aug. 3, followed the Overland Limited out of Omaha and was held by her block continually. At Lexington, 220 miles from Omaha, the motor car was allowed to run ahead of the Overland Limited, and from Lexington to North Platte, with a clear track, she made a maximum speeds of 65 miles per hour, and went into North Platte 40 minutes ahead of the limited.

The cost of operation varies more or less with the length of the run the cars are making, and it is hard at this time to give any definite figures on operation, but the consumption of gasoline averages from 3 to 4 miles per gallon, according to the class of service and grades on line, making the cost of fuel in the neighborhood of $3.50 per 100 miles.

The original suggestion in regard to the development of a self-propelled motor car, was made by Mr. E. H. Harriman, president of the Union Pacific Railroad. Under the direction of Mr. J. Kruttschnitt, director of maintenance and operation, and Mr. A. L. Mohler, vice-president and general manager, this car was designed, built and developed to its present form at the Omaha shops under the personal supervision of Mr. W. R. McKeen, Jr., superintendent of motive power and machinery, and his corps of assistants.

A Chain and Bucket Dredge designed to raise 600 tons of material per hour from a depth of 66 ft. below water level was completed last summer for the port work at Rio de Janeiro, Brazil, according to "Engineering," London. The work on which the dredge will be used comprises 6,000 linear meters of quay wall, having a minimum depth of water alongside of 33 ft. at mean tide, and a channel 800 ft. wide and 33 ft. deep from the natural deep water. The dredge, which is named the "Affonso Penna," is 176 ft. long, 35 ft. in breadth and 13½ ft. deep. On account of the depth to which it will work and the difficulty of the material encountered, stiff clay, the ladder carrying the buckets is built very heavy. It is 130 ft. long and weighs 200 tons. The section consists of two fish-bellied girders, with both the flanges and webs braced together at short intervals by diaphragm plates. The main spur wheels which drive the tumbler of the bucket-chain mechanism are made with removable rims, which slip in case a bucket strikes an immovable object. The buckets are made very heavy and have cutting edges of high-quality steel.

Erecting Roof Trusses with a Tower Derrick.

Several years ago the steel framework of the freight shed at the Mount Royal Station of the Baltimore & Ohio R.R., Baltimore, Md., was rapidly and economically erected by a traveler which consisted of a simple 4-post wooden tower on top of which was mounted a stiff-leg derrick with a length and capacity sufficient to command all parts of the shed and assemble the different members which were temporarily braced or guyed until their final connections were made. The traveler was mounted on two flat cars furnished by the railroad company and was operated by a hoisting engine seated on one of the cars which together with the pile of old castings provided the counterweights for the derrick reactions. The traveler mast was independent of the tower post and was free to swing nearly 270 deg., thus giving a wide sweep to the boom. The traveler was run back and forth parallel with the axis of the train shed and was moved, with full load swinging from the boom, by lines operated by the capstan heads of the hoisting engine.

The traveler tower 25 ft. square and 30 ft. high was built throughout with 10x10-in. and 8x8-in. vertical and horizontal timbers and single ⅞-in. square X-brace rods in all panels, both vertical and horizontal. The corners of the vertical panels were knee-braced by planks bolted across the outer faces of the timbers. The boom was a 10x10-in. timber 50 ft. long connected to the foot of the tower and had a capacity of 5,000 lb. live load and 1,000 lb. dead load at a radius of 35 ft. The mast had a total height of 50 ft. above the boom seat and its upper end was braced with two 8x8-in. stiff legs run to the opposite rear corners of the tower. The principal stresses developed by the 6,000-lb. boom load were 6,000 lb. in the boom, 4,500 lb. in the topping lift, 5,400 lb. in each back leg, 5,050 lb. in the mast, 10,000 lb. in the front tower legs and 6,550 lb. in one of the tower diagonals. Two 6,000 lb. counterweights were required at opposite diagonals in the base of the tower and the maximum reaction there was 8,400 lb.

The overhead electric cables for the helt line railroad were carried over the site of the train shed, suspended from steel towers erected over the track. These towers consisting of four vertical posts X-braced close together longitudinally and connected at their tops by a pair of very light transverse lattice girders with clearance for train service below their bottom flanges. The cables were first temporarily supported on vertical wooden posts shown in the accompanying illustrations and arranged to permit continuous traffic with the electric locomotives. The electric cable towers were then removed by the derrick boom in advance of the erection, great care being taken to prevent men or materials coming in contact with the live wires. Later when the wires were transferred to the shed and suspended from its new roof trusses the current was temporarily cut off.

The material for the main shed was shipped direct from the bridge shops and unloaded at the site by a special boom rigged for that purpose on the rear lower corner of the traveler. With the aid of the traveler booms when necessary the members of the trusses were assembled in a horizontal plane on blocking on the ground and the splices were field riveted complete before the trusses were erected as single pieces. The erection progressed rather slowly on account of the delays due to the maintaining train service and to the danger and difficulty from the electric current in the live wires; but in some cases as many as four complete panels of the structure were erected in one day.

Tower Derrick Unloading Material and Erecting Assembled Roof Truss.

The Maryland Penitentiary has riveted roof trusses of about 50 ft. span seated on solid masonry walls 60 ft. high without openings. The material for the trusses was delivered in sections outside the building and was lifted over the walls and assembled and riveted on the ground inside the building to make the complete trusses which were erected by a wooden traveler about 60 ft. high. It consisted of a rectangular tower two panels high with the stiff-leg boom derrick seated on top at one corner and operated by a hoisting engine carried in the base of the traveler. All jack rafters and purlins were erected by the same boom and a 16-ft. cantilever working platform was extended from the top of the traveler in front for use in placing the numerous light T-bars in the ceiling. Roofs were built on two long wings of the building which were so situated that it was necessary to take the traveler to pieces after completing one roof and re-erect it for the assembling of the second roof. This was accordingly done and the steel work was rapidly erected without accident. The work was fabricated and erected by the Maryland Steel Co., Mr. C. F. Spinney, engineer.

A Sixteen-Mile Cut-off is about completed on the Baltimore & Ohio R. R. between Lodi and Nova, O., reducing the distance by more than a mile and eliminating some heavy grades and curves. This cut-off will complete the double-tracking from Youngstown to Chicago Junction.

The Hydro-Electric Plant of the Black Hills Traction Co.

By Samuel H. Lea, M. Am. Soc. C. E., State Engineer of South Dakota.

In the Black Hills of South Dakota are several streams of considerable size, which have their origin among snow-capped peaks and are fed by springs along their upper reaches, thus maintaining a constant and fairly uniform flow. These streams, in the course of their descent to the plains below, flow in narrow valleys and have a heavy fall throughout most of their length. These features are especially valuable for hydraulic power development; several water-power plants have been constructed, and others are projected on the streams among and adjacent to the Black Hills.

The Redwater River is a stream which is fed largely by springs, and which, having swift and steady flow in its channel, is but little affected by floods or freshets. It has a rapid fall along its entire course and is practically free from ice even in the coldest weather. It is, therefore, valuable as a source of power, both on account of the high power-head afforded by its rapid fall, and also because there is no danger to wheels or machinery from floating ice, as would be the case in a colder stream. This river has been utilized for power purposes by the Black Hills Traction Co., whose hydro-electric plant near the town of Spearfish, S. D., has recently been completed. This plant is a good example of modern hydraulic power construction, and it is thought that a description of it would be of interest. Before going into detail, however, a brief statement will be made concerning the use of water for beneficial purposes in South Dakota.

Under laws of South Dakota, the State has control of all the waters in the State, except navigable streams; and all applications of water to beneficial use in this State must be made under the supervision of the State Engineer. In each case of the appropriation of water a permit therefor must be obtained from the State Engineer's office. In the case of the construction of a dam and diversion works detailed plans of same must accompany the application for a permit and must be approved by the State Engineer. The writer, as State Engineer, is necessarily in close touch with all matters connected with the appropriation and diversion of water from the various streams in South Dakota, and is more or less familiar with the details of plans for hydraulic power development in the State.

Wood-Stave Pipe Line.

Typical View of Canal.

The point of diversion of the water is about 2¼ miles east of the South Dakota-Wyoming boundary; it is about 10 miles southwest of the town of Belle Fourche, in Butte County, South Dakota. The water is taken from Redwater River just below its junction with Crow Creek. The volume of water taken is about 150 cu. ft. per second; this is conveyed about 5½ miles through canal and flume to a forebay situated 4,480 ft. distant from the power house and 117 ft. in elevation above same. From the forebay the water is conveyed to the power house through a wood stave, steel banded pipe.

The power house is situated on the bank of the river, well above the ordinary high-water level of the stream at that point. The transmission line is carried across country through the town of Spearfish to Deadwood, and thence to various mines in the vicinity requiring power. The accompanying views are from photographs taken at various places along the completed work.

The dam for diverting the water into the power canal is a rock-filled log crib structure, 12 ft. wide on the top, and having an apron faced with 3 in. plank, extending 25 ft. downstream. The crest of the dam is 100 ft. long between the end cribs, giving a spillway of ample size. Anchorage to the underlying formation of clay was obtained by means of piles, driven to a depth of from 4 to 6 ft., and a row of sheet piling was driven along the upper face of the dam for a cut-off. On the upstream face of the sheet piling was placed a backing of earth, well puddled and with a broad base. The crest line of the spillway is 8 ft. above the bed of the river, and the total width of base is 60 ft. This construction has afforded satisfactory results and the dam is in excellent condition both as to water-tightness and solidity after over two years of use.

The intake has an entrance width of 16 ft., which narrows to 12 ft. at its connection with the canal. The flow of water is regulated by three valves, each 4x6 ft., placed at the head of the intake. No special precaution was considered necessary for preventing the passage of sand or silt, as the water is unusually free from floating detritus.

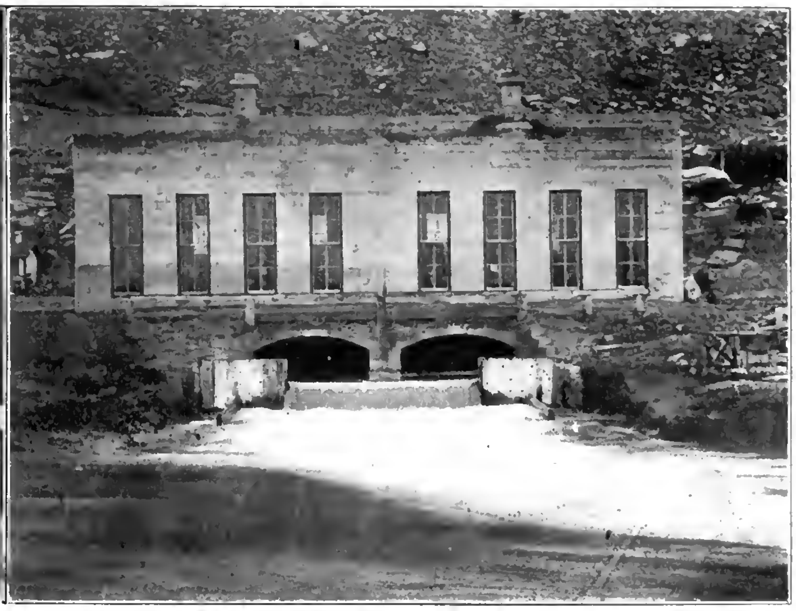
The canal is 12 ft. wide on the bottom with side slopes varying according to the nature of the material. It is designed to carry 4 ft. depth of water at a mean velocity of 2 ft. per second.

For the greater part of its length the canal was excavated in earth with side slopes of 1 to 1. Where rock was encountered the side slopes were made as steep as ½ to 1. In several places along the route where the ground was low, an embankment was made on the lower side of the canal line and the water was allowed to spread out and form a pond on the upper side. In this way considerable storage was obtained where most needed for taking care of peak loads.

At several points along the route streams and valleys are crossed and at these places the water is carried through a timber flume of rectangular cross-section. This flume rests on mud-sills spaced 6 ft. apart on banks; where openings are crossed, it is supported on pile bents, spaced 12 ft. apart, each bent containing three 12-in. piles. An interesting feature in its construction is the method used in connecting the flume with the canal at junction points. This is effected by means of a concrete apron which acts as a lining for the canal at the point of connection, and to which the flume is fastened by means of ¾x16-in. bolts at the sides and ¾x24-in. bolts at the bottom.

The forebay consists of a natural basin or reservoir into which the canal discharges. The lower end consists of an earth dam into which is built the upper end of the water conduit. Where surrounded by the dam structure the wood stave pipe is protected by a ring or covering of concrete. The entrance to the pipe line is protected by an inlet wall, with screen for preventing the entrance of foreign matter into the conduit.

From the forebay to the power house, a distance of 4,480 ft., the water is conveyed through a wood stave, steel-banded pipe 6 ft. in diameter. Just above the power house this 72-in. pipe is divided by a Y-branch into two 54-in. pipes which convey the water to two separate units. Each unit consists of a Pelton Francis turbine waterwheel, capable of developing 1,068 h.-p., which



Interior and Exterior Views of the Redwater Power Plant.

is direct connected to a 500-kw. Westinghouse generator, which runs at 400 r. p. m.

The wood-stave pipe is built of Washington fir. The staves of the 72-in. pipe are 2½x8 in.; those of the 54-in. pipe are 2x6 in. The pipes are banded with ⅝-in. steel rods, spaced according to pressure, with a factor of safety of four. A 38-in. riser is built just above the junction of the 72-in. pipe with the two 54-in. pipes, to relieve the pipe line of water ram.

The power house is a substantial masonry structure with the interior arrangement of machinery shown in the accompanying illustration. There are two main units, each with a capacity of 1,068 h.-p., as stated above, and two direct-current exciters, each having 35-kw. capacity at 125 volts. These are operated at 1,050 r. p. m., and are direct-connected by face couplings to 50 h.-p. water wheels of the same make as the large wheels. A 10-ton traveling crane is mounted on overhead runways. The governor is of a type made by the Pelton Water Wheel Co., of San Francisco, Cal. It is especially adapted to the Francis type of turbine, operating under high head, such as is used in this installation.

The transformer house contains seven 180-kw. Westinghouse water-cooled transformers, which raise the initial voltage of 440 to 24,000. The current is transmitted over a pole line a distance of 23 miles to Deadwood and vicinity for use in the mines and mills.

At a test run made at the plant in April, 1907, 1,683 h.-p. were developed on a switch board. The calculations are that the company will be able to deliver 1,200 h.-p. continuously at the end of its transmission lines.

An important factor in the efficiency of the installation, one which insures continuous service summer and winter, is the fact that about one-half of the water supply comes from Crow Creek, a stream which originates in springs less than one mile above the head works and whose water enters the canal at a minimum temperature of 46°, thus preventing the formation of ice in the canal during the coldest weather.

The company is a South Dakota corporation, owned almost exclusively by residents of the town of Spearfish. Mr. H. S. Vincent, C. E., of Deadwood, S. D., was the engineer of the company during construction, and Capt. R. M. Jones, of Denver, Colo., planned and installed the power station and equipment. Henry Keets, of Spearfish, is the president and manager of the company. To him is due the credit of promoting, organizing and financing the proposition and of carrying it to a successful completion.

When the fact is considered that all of the construction material and the heavy machinery used in this plant was hauled several miles over mountain roads from the nearest railway station, it is evident that the building of this plant in its isolated location, was an undertaking of some magnitude.

A Suspended Track Scale with a capacity of 200 tons has been installed for the Jones & Laughlin Steel Co. by the Standard Scale & Supply Co., Pittsburg. The levers are carried above the track by a steel structure, consisting of four gallows frames supported on concrete piers, which rise 5 ft. above the ground. The columns on each side of the track are braced by horizontal members and by X-bracing. Heavy knee-braces are provided between the columns, and the horizontal beams spanning the track to give transverse rigidity. The platform is 46 ft. long and its weight is carried to the scale levers on top of the steel frame by eight vertical rods. The advantage of the construction lies in the removal of the scale levers from the ground pit, where they are frequently affected by moisture and bad drainage.

Moving a Large Statue.

In the construction of the Philadelphia Rapid Transit Subway around City Hall Square it was necessary to excavate under the site of the equestrian statue of General McClellan, a tall and heavy structure, with a cut-stone base, on which was seated a heroic-size bronze statue, reaching to a height of about 25 ft. above the street and weighing about 75 tons. It was supported on an 8 x 14-ft. rubble masonry foundation, reaching about 7 ft. below the surface.

An excavation was made around the foundation to the bottom of its footing, and from it narrow tunnels were cut through the rubble masonry to receive twelve 12-in. I-beams, 20 ft. long, the outer ends of which were bolted together with separators, while the monument was still supported on the uncut rubble between the I-beams. The lower part of the monument was partly encased in wooden sheathing to protect the arrises of the stone work; wedges and packing were fitted to the upper flanges of the I-beams to provide bearing against the base of the monument, and jack screws were placed under their outer ends, reacting against timbers laid in the bottom of the trench.

The monument was lifted about 6 ft., care being taken to follow up the jacks with solid crib work piers. Ten or twelve lines of 2x10-in. planks were laid flat on the pavement, with 10-in. spaces between them, making a wide, thin grillage or distributing platform, across which were placed 12 x 12-in. timbers, 20 to 24 ft. long and 3 ft. apart on centers. At distances of about 7 ft. and 10 ft. from the street side of the center line longitudinal stringers, four in all, were laid on top of the timbers, each line consisting of two 2 x 12-in. planks in long lengths, one on top of the other breaking joints. On each pair of stringers 4 x 6-in. transverse pieces 4 ft. long were set about 18 in. apart, and occasional pieces were bolted to the stringers. On each of the two beds thus formed two ordinary 60-lb. T-rails, 30 ft. long, were laid about 2 ft. apart, and were spiked to occasional cross-pieces. The ends of these tracks projected over the excavation on each side of the monument and were supported there on cribbing.

About 20 solid steel rollers 3 in. in diameter and 30 in. long were arranged on each track placed a 12 x 12-in. longitudinal timber, 20 ft. long, with a 12 x ½-in. track plate on the lower surface to receive the roller bearings. The jack screws were simultaneous slacked off and lowered the monument about 3 in., until the projecting extremities of the needle beams took bearing on the longitudinal stringers, and the jacks were released and removed. A few of the jack screws were then set near the horizontal plane against the rear needle beam and the base of the monument, reacting against sills and inclined timbers seated on the ground, and the monument was gradually pushed forward on the tracks, the live rollers being constantly disengaged and removed from the rear and put under the front.

When the monument reached the front end of the track the second section of plank grillage was laid on the surface of the street, the ends fitted in each section, timbers were laid upon it, as already described, and a second section of track rails joined to the first. After the monument

Moving McClellan Monument on Rollers.

had advanced upon it the first section of track and grillage was removed and relaid in front, and so on until the monument had been shifted about 75 ft. to a place near the City Hall, where it did not obstruct traffic and could remain undisturbed until the completion of the subway.

At the site of the monument special bents of heavy columns and roof girders are introduced in the subway construction, and on them foundations will be built to receive the monument when it is convenient to return it by the method already described to its original position. The raising and moving of the monument was accomplished in about two weeks by a force of ten men, employed by Henry Sheeler & Sons, Chicago, sub-contractors under the E. E. Smith Contracting Co., the general contractors who executed the work on the City Hall section of the subway, under the direction of the engineering department of the Rapid Transit Ry. Co., of Philadelphia, Mr. W. S. Twining, chief engineer, Mr. Chas. M. Mills, principal assistant engineer, and Mr. Frank R. Fisher, resident engineer.

Storage Battery Cars for railway service, weighing 42 tons loaded, are reported in operation on the Prussian state railways for three short runs, the longest of which is 12½ miles.

Comparative Performance of Steam and Electric Locomotives.

At the meeting of the American Institute of Electrical Engineers on Nov. 8 an unusually valuable paper on the performance of steam and electric locomotives was presented by Mr. Albert H. Armstrong, of the General Electric Co. As a clear explanation of some of the fundamental reasons underlying the electrification of steam roads, it deserves careful study. In general, the possible saving in fuel through the adoption of electric traction does not in itself amount to enough to pay an adequate return on the investment to obtain it, and it is necessary to look for more important benefits. These are to be found, in the author's opinion, in a comparison of the characteristics of steam and electric locomotives. Such a comparison is made in the paper, which claims a superiority for the electric locomotive in general railway work, and suggests the possibility of making, with its adoption, radical changes in the methods of operation now necessary with steam locomotives.

Owing to clearances, it is seldom that a locomotive can work at more than 90 per cent. of the theoretical full stroke, and hence the maximum tractive effort at starting with lever in the corner will not be much greater than 88 per cent. of the theoretical tractive effort available with gauge pressure in the cylinders. The steam locomotive is limited as to maximum tractive effort by its engine design, and limited as to the speed at which this tractive effort is available by the capacity of the boiler to supply steam. Thus, assuming that the locomotive will give 88 per cent. of its theoretical tractive effort when starting, it is capable of providing but 80 per cent. tractive effort at a speed of 10.6 miles per hour (with the constants of the particular locomotive chosen for illustration), at which the boiler is giving its full output. Hence higher speeds can only be reached with a less cut off and a consequent reduction in mean effective pressure and tractive effort. Locomotive engines are generally designed to give their maximum tractive effort at 90 per cent. theoretical cut-off at a point corresponding to a coefficient of adhesion of approximately 22 per cent. of the weight upon the drivers; that is, at about slipping point of steam locomotives with good rail conditions. It is immediately evident, therefore, that the tonnage rating of the locomotive on ruling grade must be so proportioned that the maximum tractive effort called for will be less than the available tractive effort of the locomotive, in order to provide a small percentage, say, 10 or 15 per cent., for possible starting under maximum grade and load conditions.

On the other hand, the tractive effort of the electric locomotive is limited only by the adhesion between driving wheels and rail, and, aside from some 15 per cent. greater adhesion possible with the uniform tractive effort provided by the electric locomotive, it is possible with this type of motive power to take momentary advantage of abnormally good rail conditions or to derive full benefit from the use of sand; indeed, tests have been taken with electric locomotives showing as high as 35 per cent. coefficient of adhesion between driving wheels and rail. This point is emphasized, as with the greater tractive effort of the electric locomotive it becomes possible to give them a higher tonnage rating for the same weight upon the drivers than would be possible with steam locomotives operating over the same track profile.

The accompanying diagram was prepared by Mr. Armstrong to show a concrete case of a 22 x 30-in. steam locomotive of the simple type, equipped with 57-in. drivers, contrasted with both an alternating-current geared and a direct-current gearless electric locomotive, designed for the same tractive effort, both maximum and running, but for a higher speed. The contrast of these different speed characteristics brings out sharply the small speed variation with different tractive efforts delivered by the electric locomotives, this small variation being even more marked in the case of the direct-current gearless than in the case of the alternating-current geared motor, working at a lower iron saturation and giving a more sloping speed characteristic.

The steam locomotive chosen is typical of those in general use upon mountain-grade divisions, the tonnage rating in operation of this particular locomotive being such as to call for a tractive effort of 25,600 lb. on average grade and 33,200 lb. on the maximum ruling grade, occurring on a certain engine division, thus leaving a margin of 6,300 lb. above the demands of maximum tonnage on maximum ruling grade for starting the train from rest.

The maximum speed available at the different tractive efforts is a matter of boiler capacity, condition of boiler, quality of coal and efficiency of fireman. The first of these factors, the boiler

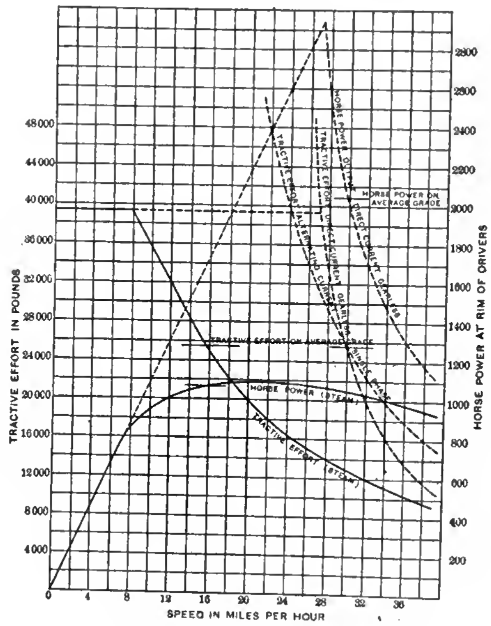


Diagram of Steam and Electric Locomotive Characteristics.

capacity, can be controlled by properly proportioning the design of the boiler to engine capacity, but there are three other factors which the locomotive manufacturer cannot control, and two of these factors constitute sufficient cause, Mr. Armstrong says, to warrant a considerable reduction in the theoretical rated capacity of the boiler. Thus, a locomotive in prime condition, carefully fired with coal of approximately 14,000 B.t.u., should be able to deliver full tractive effort at 10.6 miles per hour, but in practice it has been found that the average condition of boilers and the average firing curts the sustained boiler output down to not much more than 75 per cent. of its output under what must be considered exceptionally or momentary conditions. By sustained "output" is meant the output required while ascending the continuous up-grades on Western mountain divisions.

The locomotive characteristic in the diagram has been prepared on the basis of 75 per cent. of the possible boiler capacity, the general dimensions of the simple consolidation locomotive being as follows: Diameter of cylinders, 22 in.; length of stroke, 30 in.; diameter of drivers, 57 in.; heating surface, 3,397 sq. ft.; total weight of locomotive, 103.5 tons; weight on drivers, 93 tons; weight of tender, 61.5 tons; total weight locomotive and tender, 165 tons. This particular locomotive has been chosen for illustration, as it is the type in daily use on the mountain division of one of the largest Western roads.

Under the above conditions the theoretical tractive effort is 49,500 lb., of which 39,600 lb. is available at 90 per cent. cut-off. The contents of each cylinder is approximately 6.6 cu. ft., and, with four cylinders of steam per revolution and with steam weighing 0.41 lb. per cubic foot at 170 lb. cylinder pressure, each revolution requires 10.85 lb. steam. With 3,397 sq. ft. of heating surface there is a possibility of evaporating 6 lb. of water per pound of coal when burning 2 lb. of coal per square foot of heating surface, thus giving an available supply of 40,700 lb. of steam per hour when working boilers in prime condition at the full output, resulting from perfect firing, with good quality of coal. In practice, however, the available steam for sustained output would not be greater than 75 per cent., or 30,500 lb. per hour, thus giving full tractive effort at 46.8 revolutions of the drivers, corresponding to 7.93 miles per hour on a 57-in. driver. The "critical speed" of the locomotive is therefore 7.93 miles per hour when working at 75 per cent. of full attainable boiler capacity, and the coal consumed under such circumstances will be 4,360 lb. per hour, corresponding to 1.28 lb. of coal burned per square foot of heating surface, at which rate we would expect an evaporation of approximately 7 lb. of water per pound of coal consumed.

What might be termed the "performance capacity" of a steam locomotive may be worked out from the speed and tractive effort characteristics given in the diagram, using as a basis the 1,000 ton-miles trailing load moved per hour on a level or any gradient selected. The prevalence of 2.2 per cent. ruling grade on many Western roads perhaps justifies the selection of that figure for demonstration purposes; and the coal consumed, crew wages and maintenance charges may all be worked out from the basis of continuous operation per 1,000 ton-miles trailing load on 2.2 per cent. grade. The performance capacity obtained in this way is shown in an accompanying diagram.

Certain assumptions are necessary and are as follows: Cost of coal, $3 per 2,000 lb.; engineer, 50 cents per hour; fireman, 35 cents per hour; conductor, 40 cents per hour; three brakemen, 90 cents per hour; average mileage per locomotive per year, 36,500; total maintenance, including roundhouse charges, $5,000; maintenance per locomotive mile actually run, 13.7 cents.

The small speed variation of the electric locomotive and the fact that its motive power is separate from its unlimited source of power generation make it possible to consider radical changes in the method of moving freight, more especially on mountain-grade divisions. Steam railroading to-day is in reality steam locomotive practice, in that the speed possibilities of different track divisons are restricted to a large extent by the limitations of the steam locomotive. The only reason why it is common practice to run at very low speeds on mountain-grade divisions instead of continuing the high speeds in vogue on more level portions is because a steam locomotive cannot be built powerful enough to supply the heavy tractive effort required at any higher speeds than those now in vogue.

The one expense in train operation that is fundamental is the cost of fuel, this fatcor being influenced only by the economy of the fuel-burning plant. Other expenses, such as locomotive maintenance and crew wages, are affected entirely by the method of operation, and no radical departure from present methods is to be looked for until the coming of a type of motive power which offers possibilities not equally enjoyed by the steam locomotive. In general, it may be stated that the freight movement over mountain divisions is effected at very low schedule speeds, and the cause is evident from an inspection of the steam locomotive characteristic.

Except for the fact that curves are usually of shorter radius on heavy grades than on levels, there is no reason for the slower speed of trains, provided a type of motive power is available that is capable of supplying great draw-bar pulls at high speeds. It is just this characteristic which the electric locomotive possesses to an almost unlimited extent, and such locomotives can be built which are even more powerful and operate at higher speed than can be utilized at present.

The electric locomotive may be equipped with motors of several different types, each having characteristics best qualifying it for certain classes of work. The type to be adopted is a matter requiring full local knowledge of the conditions obtaining in each individual instance before a proper selection can be made. All three of the available motors, direct current, alternating current single-phase and alternating current three-phase, possess the one needed characteristic of great output per pound, and hence the arguments advanced for the substitution of the electric for the steam locomotive are general in character and do not apply strictly to locomotives equipped with any one type of motor to the exclusion of all others.

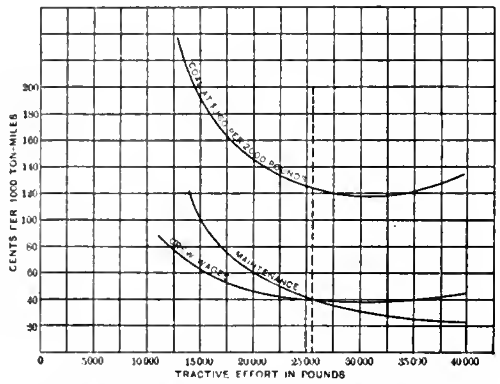
Returning to the direct comparison of the simple consolidation and electric locomotives, the diagram showing this comparison was plotted on the basis of a speed of 30 miles per hour for the electric and 15.4 miles per hour for the steam locomotive, giving in each instance a tractive effort of 25,600 lb. at the rim of the drivers. Though the electric locomotive could very readily be designed to give the same tractive effort at a higher speed, 30 miles per hour was assumed as the highest speed permissible, due to the alignment of the track on heavy grades. To plot a performance capacity curve for the electric locomotive certain further assumptions are necessary, as follows: Type of equipment, direct-current gearless motors; weight of total locomotive, 125 tons; weight on drivers, 100 tons; engineer, wages, 50 cents per hour; conductor, wages, 40 cents per hour; three brakemen, wages, 90 cents per hour; efficiency of transmission, rail to bus-bar, 70 per cent.; maintenance of locomotive, 5 cents per mile run. The train crew is so divided as to permit the location of a brakeman in the engineer's operating cab.

The cost of electrical power must in this instance be most arbitrarily assumed, owing to the widely different cost of coal, possibility of water-power, etc., obtaining in different localities. As the cost of coal for steam locomotives will also vary greatly as to price and quality, it has been assumed at $3 per 2,000 lb., and a cost for electric power of ½ cent per kilowatt-hour is based upon using the same price and quality of coal. As it is further assumed that an entire engine division of, say, 150 miles is to be electrified, it gives promise of a 24-hour load-factor of 50 per cent., and this figure has been taken. Approximating the first cost of installation of the generating station at $100 per kilowatt, and allowing 10 per cent. per year for interest and other fixed charges, the cost of power is brought up to possibly $0.0075 per kilowatt-hour at the station bus-bar. Other conditions obtaining will in a given instance modify the figures arrived at, but for purposes of demonstration $0.0075 is a conservative estimate, and such a figure is needed to compare the cost of power with the fuel item in steam-locomotive performance.

The effect of increased speed on cost of operation is clearly shown by comparing the performance capacity curves of the steam and electric locomotives.

It will be observed that the reduction in the operating expenses is effected in the two items of crew wages and maintenance of locomotives, and that the cost of fuel remains practically unchanged. This is as it should be, as the cost of fuel in the case of steam locomotives or power with electric locomotives is the only fundamentally necessary expense in train movement. Overcoming train friction and raising a train up grade against gravity represents useful work performed, and this work is accomplished at an expenditure of approximately 4 lb. of coal per horsepower-hour at the drivers with simple engines and 2.66 lb. of coal per horsepower-hour at the drivers with electric locomotives, including all intervening losses between rail and generating station bus-bar. The speed at which this work is performed, therefore, does not affect the cost of fuel or power, it being assumed that the motive power for the various speeds is so proportioned as to operate at the point of greatest economy.

While the diagrams of performance capacity indicate a certain relation among the three items of fuel, crew and maintenance expense, this is not the true relation obtaining in practical operation, for the reason that the values given in the curves assume continuous operation up-grade under the conditions outlined. Unfortunately, train crews must be paid full value per mile, whether the mile be up grade or down, and with steam locomotives there is also a considerable loss in fuel resulting from engines standing or running light, which must be also taken into account; hence, it becomes necessary to modify the figures arrived at, and for this purpose certain references must be made to current railroad practice on mountain-grade divisions, in order to arrive at the proper tonnage relations, schedule speeds, etc., obtaining in up-grade and down-grade operation.

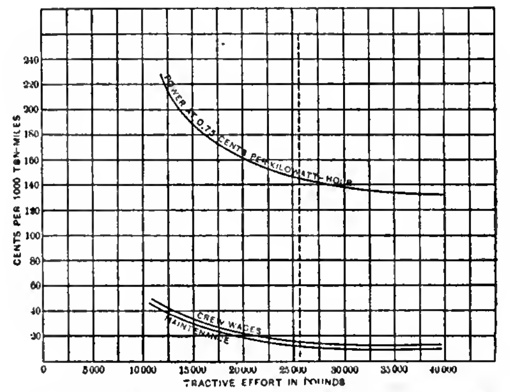


Performance Capacity of Simple Steam Locomotive on 2.2 per cent. Up-Grade.

The schedule speed on several mountain divisions is approximately 50 per cent. of the average running speed, and this figure is assumed in the following statement of cost of operating 1,000 ton-miles with steam locomotives, averaging the cost of up and down grade running. Owing to the higher schedule speed of electrically operated trains, resulting in fewer meeting points with the same tonnage handled, and owing to the absence of forced stops to take on fuel and water, etc., it is assumed that with electric motive power the schedule speed may be 60 per cent. of the running speed.

With the electric locomotive standing, or coasting down grade, there is no demand whatever made upon the generating station, and hence the only expense carried through these periods is that for train crew and a certain amount for maintenance. On the other hand, with the steam locomotive there is a considerable amount of fuel burned and water wasted when standing at sidings and when coasting. In the case of mountain railroading, with its frequent and prolonged delays, this waste may reach considerable proportions.

The following results of a carefully conducted series of tests will illustrate this point. Two test locomotives and trains were operated over a mountain division under regular service conditions, steam and fuel consumption, duration of delays, etc., being carefully noted. The total work expended up grade was 5,700 h.-p.-hr. at the rim of the drivers, including allowance for 1.54 per cent. average grade and 7 lb. per ton track and curve friction. The total water evaporated on the trip, divided by the total horse-power hours, gave a steam consumption of 36 lb. per brake horse-power-hour at the rim of the drivers. Indicator cards taken upon the engine in question at all cut-offs up to 90 per cent. showed that the greatest steam consumption did not exceed 32 lb. per indicated horse-power-hour, or 35.5 lb. per brake horse-power-hour, allowing 10 per cent. internal engine friction. Values as low as 23 lb. of steam per indicated horse-power-hour, or 25.5 lb. per brake horse-power-hour, were recorded for the average cut-off of 40 to 50 per cent. used throughout the run. A third and fourth series of tests conducted up the same grade gave similar results, except that the values were slightly higher than those quoted, showing that there was a considerable loss of water unaccounted for by indicator cards and useful work performed.



Performance Capacity of Direct-Current Gearless Locomotive on 2.2 per cent. Up-Grade.

Operating down grade, it was necessary to accomplish 1,110 h.-p.-hr., on account of the somewhat broken profile, and again the water consumption showed on two trips 57.7 lb. of steam per brake horse-power-hour, and on two subsequent trips 66.5 lb., values entirely unaccountable on the basis of useful work performed.

During all tests the usual service delays occurred, and, as the traffic on the road in question was very much congested, these delays constituted a considerable proportion of the total elapsed time. In fact, during the runs up grade the trains were in motion but 66 per cent. of the total elapsed time, and down grade the trains were in motion from 52 per cent. down to 40 per cent. of the total elapsed time. As these delays were frequent and undetermined, it was necessary to maintain full steam pressure while waiting for the momentarily expected release from the block, hence the waste of fuel and water was considerable. Averaging this waste at 400 lb. per hour, at which low rate of consumption the water evaporation would approximate 10 lb. of water per pound of coal burned, or 4,000 lb. of water evaporated per hour, and reducing the total water consumption measured by the waste losses thus obtained, the steam consumption in eight different tests up and down grade ranged 34.7, 32.4, 28.1 and 25.3 lbs., etc., water per brake horse-power-hour. These values are fairly commensurate with results of indicator cards taken, and, with the type of engine used and under the operating conditions obtaining, an allowance of 400 lb. of coal stand-by losses per idle locomotive-hour seemed not too great a value to allow, and this figure has been taken in subsequent calculations.

Locomotive performance capacity curves may therefore be plotted which will show approximately the true relation between the several items of fuel, crew wages and motive power maintenance, under the given conditions. Such curves

are given in the paper and show that in practical operation the fuel expense approaches more nearly to the value of the other items considered, instead of being greatly in excess of them, as indicated in the theoretical performance curves, showing up-grade operation only. For operation on lesser grades than 2.2 per cent. all items are reduced, and the total and subdivided comparative costs are given in the accompanying diagram and table:

Comparative Operating Expenses per 1,000 Ton-Miles of Simple Steam and Electric Locomotives; Average of Up- and Down-Grade Operation.

Grade	½%	1%	1½%	2%
Steam Locomotives.				
Coal	15 cts.	25.5 cts.	38 cts.	53 cts.
Crew	13.5 cts.	24 cts.	36 cts.	50 cts.
Maintenance	10.5 cts.	17.8 cts.	26 cts.	36 cts.
Totat	39 cts.	67.3 cts.	100 cts.	139 cts.
Electric Locomotives.				
Grade	½%	1%	1½%	2%
Power	20 cts.	35.5 cts.	50.5 cts.	66 cts.
Crew	7.2 cts.	12.2 cts.	18 cts.	24 cts.
Maintenance	3.6 cts.	6.2 cts.	9.0 cts.	11.9 cts.
Total	30.8 cts.	53.9 cts.	77.5 cts.	101.9 cts.
Saving effected by electric operation.				
Grade	½%	1%	1½%	2%
	8.2 cts.	13.4 cts.	22.5 cts.	37.1 cts.

A study of the table shows that, while the percentage saving with electric operation is approximately the same whatever the ruling grade, yet the actual money saving is much greater on the heaviest grades. As about the same investment must be made in each case for distribution system, including third-rail or overhead trolley, sub-stations, etc., the inference must be drawn that heavy-grade divisions present a more attractive field for electrification than level sections, when considered from the purely economic standpoint. There are other items of saving and other reasons for electrification which may be more or less controlling in individual cases, but it seems possible to make the broad statement that the mountain-grade division offers a particularly attractive field for the electric locomotive, and its introduction should be the means of affecting such economies in both freight and passenger transportation as to pay a satisfactory return upon the investment required.

So far, the matter has been viewed from the standpoint of comparative operating expenses for a given tonnage moved. There is another argument for electrification which may in certain instances be of a much more controlling nature. Most of our mountain roads are single track, and transcontinental tonnage has so increased as seriously to congest these mountain divisions. The heavy trains of the plains, weighing 2,000 to 3,000 tons, must be split up into units of about 1,000 tons, in order that the present steam engines, operating double and even triple, may haul them over the heaviest grades. The slow speed obtainable makes the number of trains on a mountain division large, the meeting points frequent, hence however good the despatching system employed, there will of necessity be a considerable amount of lost time introduced. Add to this the failures of motive power being worked to its limit, and there is reason for the claim that the tonnage capacity of the mountain division will be greatly increased by the introduction of electrically hauled trains.

Lest the writer be accused of unfairness in selecting the simple engine for comparison, it is proper to touch upon the economies effected with the use of the compound locomotive and also by the introduction of such coal-saving devices as superheaters and feed-water heaters.

There is a saving of approximately 20 per cent. in water consumption per horse-power with the compound locomotive, but in spite of this generally accepted saving the simple locomotive still rules the mountain division, after repeated trials of the compound. Not being an ardent supporter of either type of locomotive, Mr. Armstrong leaves the battle of the simple and compound to their enthusiasts, commenting only upon the fact that, except in the case of the Mallet compound, the arguments for the compound are based upon fuel economy only.

The latest Mallet compound, weighing 413,000 lb., is the largest steam locomotive yet built and is of particular interest, owing to the enormous boiler which such a construction permits. With a total heating surface of 5,300 sq. ft., we should expect an evaporation of 63,600 lb. of water for a short period and possibly 48,000 lb. of water continuously. With a possible evaporation of 6 lb. of water per pound of coal, this would necessitate the burning of 8,000 lb. of coal per hour, requiring the best efforts of two firemen if maintained for several hours. Assuming a steam consumption of 22 lb. per brake horse-power-hour, such a locomotive should give a sustained output of 2,180 h.-p. at the rim of the drivers, and this with a weight, with tender, of approximately 300 tons, or three times the weight of an electric locomotive of the New York Central 6,000 type, giving the same horse-power output.

The two locomotives are, of course, designed for entirely dissimilar classes of work; but it is not unfair to compare them on a horse-power basis, as it is the huge boiler of the Mallet that is remarkable, and upon this basis the selling price of the machines is approximately the same.

The comparative cost of electric and steam locomotives is generally considered as very favorable to the steam units, but reversing the usual methods and comparing the cost of the electric with that of the steam locomotive or locomotives required to replace it may reverse the relations. The electric locomotive requires no more than casual inspection, can be side-tracked indefinitely and still be ready for instant operation at full capacity, can run 24 hours without a stop, if necessary, and all these advantages and others offer a guarantee for a much greater annual mileage than is possible with its steam competitor. Then, too, compare the cost of a group of steam locomotives (no single unit could be designed to give the output) capable of delivering even 4,000 h.-p. continuously with a single electric unit of this output, and the difference in cost is not great. It may be stated broadly that for a given gross annual ton-mileage moved, the cost of steam locomotives may be even greater than the cost of the electric units replacing them.

The term "horse-power" is perhaps not fully appreciated. When the statement is made that a certain electric locomotive is rated at so many horse-power output, it does not leave the impression it should. The horse-power output of a locomotive is a direct measure of its capacity to do work, and while the tractive effort available governs the tonnage of the trailing load, it is the product of the tractive effort times the speed at which it is available, or, in other words, the horse-power output, that measures the hourly tonnage capacity of the locomotive upon which the crew expenses of the entire train depends. Hence the great claim for recognition of the electric locomotive lies in its great horse-power output, that is, its ability to carry full tractive effort or to slip its wheels at speeds two or three times greater than can be done with any steam locomotive yet built.

Superheating promises something in fuel economy, as does the introduction of feed-water heaters. Such improvements, together with the adoption of the four-cylinder locomotive, either compound or simple, must necessarily call for more expense to maintain and less reliability in operation.

As against the reduction in fuel expenses promised by the use of the compound locomotive fitted with superheaters and feed-water heaters, the electrical engineer has the great possibilities offered by regeneration of power while electrically braking on mountain-grade divisions. The amount of power saved by this means may in certain installations amount to as great a percentage of the total as is the saving effected in coal expenditure with steam locomotives by compounding and providing superheaters and feed-water heaters. Such an electrical saving is, of course, restricted to heavy-grade divisions, but the feasibility of electric braking by regeneration is unquestioned. Indeed, with three-phase induction motors regeneration is automatic, the motors being perfectly reversible and returning energy when operating down grade, with no change whatever in their connections. Other types of motors may be adapted for regeneration, with slight modifications in the control system.

All of our railway managements have felt the need of establishing a so-called express freight service, comprising a light train operating at much higher speed than is the case with the bulk of the freight movement. It is well known that the cost per 1,000 ton-miles for moving express freight is very much higher than in the case of low-speed freight. An inspection of the diagram of steam and electric locomotive characteristics illustrates the reason for this. The steam locomotive is essentially a slow-speed unit when delivering its full tractive effort; that is, a tractive effort equal to 22 per cent. of the weight upon the drivers, and high speed is only obtained at the sacrifice of tractive effort. Hence a high-speed freight train is of necessity a lighter train than could be handled over the same profile by a given locomotive, and the crew and maintenance expense is therefore large. That such a class of service is nevertheless profitable, or at least necessary, is evidenced by the continuance of the practice and the proposed introduction of electric locomotives, in effect, makes all trains fast freights, gaining the benefits of such a service, without incurring the penalty of increased operating expenses inherent to steam operation.

Mr. Armstrong does not believe that the time is ripe for the electrification of steam roads at large; indeed, the electrical enthusiasts would be hard put to it if called upon to show reason for the electrification of many branch steam lines carrying a small tonnage at infrequent intervals. There are, however, certain divisions of steam railways which, either on account of their broken profile or heavy traffic, offer an opportunity to introduce a superior type of motive power which will effect such economies in operation as to provide adequate return on the investment required for the electrification. There are still other divisions where a much desired increase in the track-tonnage capacity can only be effected by double tracking so long as the steam locomotive is adhered to as the type of motive power used. Double tracking a mountain-grade division is often a matter of enormous expense, and electrification of the single track may relieve the present traffic congestion at a moderate cost.

On mountain-grade divisions the subject of regeneration with electric locomotives should receive very careful consideration, not so much on account of the saving in power which it may effect, but rather on account of the greater safety of operation, which it guarantees by eliminating the serious defects of holding trains on heavy grades by wheel and shoe friction. No attempt has been made even to approximate the saving effected in engine supplies, roundhouse expenses, elimination of water supply, with its often attendant expensive purifying outfit, and the many items incident to steam locomotive operation. The freight-car shortage problem itself is a very serious one at certain times of the year on some roads, and as the total freight-car mileage can be increased with the higher speeds provided with electric locomotives, it should result in the saving of a considerable expense now incurred for rental of foreign cars, or even increase the gross receipts by the movement of tonnage which more available cars would make possible.

At the conclusion of Mr. Armstrong's paper, the subject was opened for discussion.

Mr. W. J. Wilgus, in a letter discussing the subject, referred to the frequent mistake of overrating the electric locomotive, but expressed the belief that for reasons of economy it had come to stay, even though the primary considerations for its adoption were not economic. Thus far electrification of steam roads has been done for the sake of convenience in operation in tunnels and doing away with smoke and noise nuisances in cities. No practical data were available for basing a change from steam to electricity on purely economical grounds.

Now, however, these data have become available on account of the operation of the two systems side by side on the New York Central, and while the expectations for the electric locomotive have been surpassed by the results, the latter have at times been quite different from the predictions.

Mr. Wilgus stated that his experience indicates that M. Armstrong's figures of cost of current at the contact shoes is too low. In determining this cost not only must the fuel and operating expense be taken into consideration, but also the cost of maintenance, taxes, structures and allied charges for the whole installation.

The experience on the New York Central shows that in maintenance and fixed charges, the electric installation is the cheaper by 19 per cent. The simplicity of the electric locomotive has resulted in a time saving in terminals of 18 per cent. over the steam locomotive, while under the newer system the daily ton-mileage has increased 25 per cent. Of the total switching in Grand Central Station, 65 per cent. with steam locomotives was dead weight, while with electric locomotives it is 54 per cent. In the regular schedule service the saving in dead ton-mileage is 16 per cent.

The total saving of electric operation over steam for the summer months runs from 12 to 27 per cent., depending on the kind of service. In addition, the smoke nuisance has been eliminated in the Park Ave. tunnel, and the capacity of the Grand Central Station has been increased one-third.

Dr. Cary T. Hutchinson, in discussing the paper, expressed approval of the views of Mr. Armstrong and Mr. Wilgus, commending the paper as the best presentation of the problem thus far made. He emphasized the fact that all electrifications now operating have been special problems, aside from the question of economy of operation. The data on electric locomotives are too uncertain as yet for economical discussion of the problem. The regeneration in running down grade with the three-phase system and the consequent fixed speed were the reasons for the adoption of this system on one of the mountain divisions of a Western railroad.

Mr. N. W. Storer emphasized the fact that increased capacity of electric over steam operation is the most important factor of the problem. Electric locomotives can haul heavier loads at greater speeds, up heavier grades than steam locomotives. These factors will count most in causing the electrification of steam roads. The latter work will go on as fast as the manufacturers can supply the equipment, for the data derived from experience are now convincing. The three-phase system, Mr. Storer believed, had a decided advantage in having a fixed speed down grade, but believed that this speed might some times be greater than the curves and roadbed would permit. The single-phase alternating current system has a higher tractive effort at higher speeds than the direct current system. The adoption of the particular system, whether direct current, single or three-phase alternating current, will depend on local conditions.

Mr. W. S. Murray agreed with Mr. Armstrong that capacity is the keynote of the problem, but believed that increase in ton-miles and ability to handle this increase are better ways of expressing it. The actual service conditions on the New York, New Haven & Hartford show a large yearly saving of the electric over the steam locomotives. The machine efficiency of the two can practically be equated and therefore eliminated from the discussion, but the difference lies in the power back of the machine equipments. The saving per year in fuel and locomotive repairs due to electric operation on the New York division will be $562,470.

Mr. William McClellan pointed out that the costs of electrification are larger than were predicted. In order to extend electric operation more convincing figures than even now available must be presented to railroad men. It is difficult to capitalize the savings of electrification due to the abandonment of coaling towers, water tanks, ash pits, and other accessories to steam locomotive operation. Not until a complete engine stage is electrically operated will full and reliable data be available. Leaving these savings aside, Mr. McClellan thought that increased capacity, especially on steep grades, was the most important advantage of the electric locomotive. A good way to approach the problem in endeavoring to convince the railroad man is to show the capacity of electric operation, and then figure the cost for the same capacity if hauled by steam locomotives.

Mr. C. L. De Muralt spoke of a short road that had rached the limit of its capacity, and was considering the addition of two more tracks at a cost of $15,000,000. By electrifying the line at a cost of $3,000,000, the same capacity with the existing trackage could be secured as by the addition of two tracks with steam operation. The advantage of the electric locomotive lies in pulling heavy loads at three to four times the speed of the steam locomotive.

Mr. C. P. Steinmetz pointed out that the use of electric locomotives did not amount to a mere substitution for steam locomotives, but a readjustment of all factors to a new set of conditions. This readjustment must be made throughout the system in order to realize the greatest advantage from the new mode of operation.

HOLLOW TERRA COTTA BLOCKS will be used for the construction of the floors, interior partitions and roof of the Pennsylvania R. R. terminal, now under construction in New York City.

The Mechanical Equipment of the North American Cold-Storage Building, Chicago.

The North American Cold Storage Co. of Chicago operates a large, modern, fireproof cold-storage warehouse, for public use, on the North Branch of the Chicago River, near the junction of that branch with the South Branch to form the main Chicago River, and a short distance from the central business district of the city. Unlike most large cold-storage warehouses, which cover a broad area and are comparatively low; with the idea of reducing losses due to radiation, this building covers a relatively small area and is very tall, protection against radiation being obtained by thorough insulation of the side walls. The building is irregular in plan, being 60 ft. wide at one end, 80 ft. wide at the other and 162 ft. long, and has sixteen stories and a basement. The structure consists of two parts, an original section and an extension that has recently been added, the two parts forming a homogenous fireproof building with uniform floor levels. The original section has a structural steel

Engine Room of the Cold Storage Building, Showing One of the Ice Machines.

frame, covered with hollow tile for fire protection, arched hollow tile floors and brick side-walls. The extension also has a structural steel frame, which is incased in concrete for fire protection, and has reinforced concrete floor slabs. The columns of the buildings are all carried on independent spread reinforced concrete footings, designed to practically float on the soft blue clay that underlies the site.

A mechanical plant in the basement of the building furnishes refrigeration through an ammonia expansion and brine circulation system for all but two floors of the building, the first and the sixteenth, and electric current for power, lighting, freight elevators and other service. This plant was designed and built under peculiarly difficult conditions, owing to the limited head room in the basement, the location of the numerous columns of the building frame, the arrangement and extent of the spread footings which carry these columns, the proximity of the river and the necessity of going below the river level to provide space for boilers. These difficulties were all overcome, however, by special design and arrangement of various features of the plant, and the latter has been in satisfactory operation since the completion of the extension of the building, three years ago.

The mechanical plant and auxiliary equipment occupy the entire basement of the building, a

44 x 45-ft. boiler room being separated from the remainder of the basement by brick walls. The floor of this room had to be placed 5 ft. below the water surface in the river, and 12 ft. below the ground level. As the soil is filled ground, black river silt and soft blue clay, provisions had to be made to prevent water entering through the walls and floors. This was accomplished by lining the bottom and sides of the pit with sheet steel, the masonry floor and walls of the room being placed inside of this steel pit.

The boiler room contains two 350 h.-p. double-drum water-tube Cahall boilers, each having 3,750 sq. ft. of heating surface and operating at a normal pressure of 150 lb. Each boiler is equipped with a Cahall chain-grate stoker having 52 sq. ft. of grate surface. These stokers are both driven by a 3 h.-p. Northern motor, mounted on a bracket on one of the columns of the building frame. The motor operates at 450 r.p.m. and is belted to the driving shaft of the stokers. A automatically by a float set at the proper height in the sump.

Steam is taken from the rear end of the drums of each boiler by a full-sweep 8-in. connection leading to a 10-in. steam header suspended from the ceiling of the engine room. These 8-in. boiler connections are each fitted with an automatic non-return valve at the boiler and a gate valve at the header. The main header extends 39.25 ft. as a 10-in. main, and then as an 8-in. main for 28 ft., a 6-in. branch being taken off at the end of the 10-in. section. The header is anchored at the junction of the 6-in. branch with it, and all connections to the steam-consuming units have full-sweep bends to provide for contraction and expansion. A Cochrane steam separator is placed on the connection to each unit.

The principal equipment in the engine room embraces two large ice machines, two engine-driven generators, two motor-driven brine-circulating pumps, two motor-driven water-circulating

Direct-Connected Centrifugal Pumps for Circulating Water.

small steam engine is also held in reserve for operating the stokers. Coal is delivered to the building in cars on a switch track at the first floor level, and is dropped from the cars through chutes leading to a firing floor in front of the boilers. The stokers are supplied from the storage piles on this floor by hand.

The boiler settings extend flush up to the ceiling of the room, the boilers being specially designed so all steam and feed-water connections could be made at the front and rear ends of the steam and water drums. Feed water is supplied to the boilers through duplicate 1½ in. connections at the front. The steam and water drums are also each fitted with an Ashton safety valve, placed horizontally in the upper part of the front end of the drums. The mud drum of each boiler is connected to a 4-in. blow-off pipe, which rises 5 ft. from the floor level of the boiler room to the level of the water surface in the river, so the sediment from the mud drum is blown up-grade. The pipe is fitted with a valve in order that it can be drained into a sump after the boiler pressure is cut off. A 2-in. vertical Kingsford centrifugal pump, with a capacity of 125 gal. a minute when running at 500 r.p.m., removes all water that reaches the sump. This pump is direct-connected to a 1½-h.-p. vertical direct-current Northern motor, which is operated

pumps, two boiler-feed pumps, together with the necessary auxiliary apparatus and connections. With the exception of one ice machine, which was in a small plant of the original part of the building, all of this equipment was installed when the new plant was built.

The new ice machine is a cross-compound condensing Corliss unit, built by the Vilter Mfg. Co. The steam cylinders are 24.5 x 36-in. and 48 x 36-in., and the ammonia cylinders are 18 and 18 x 36 in. Ammonia is drawn from a large system of condensing coils in one end of the basement and delivered to the seventh and eighth floors by this machine. The old ice machine is held in reserve for use in case the new one is out of commission.

Two double-acting 11 x 12-in. triplex Gould pumps circulate the brine through the system of refrigerating pipes. These pumps each have a capacity of 1,000 gal. a minute against the combination of a static head of 125 ft., and a working pressure of 40 lb. The static head is maintained by an open pipe extending above the highest point in the system of circulating pipes, while the 40-lb. working pressure is the maximum required to force the brine through the system. The pumps are in duplicate, each of them having sufficient capacity to operate the system under maximum service requirements. Each pump is gear-driven by a 50-h.-p. variable-speed direct-current motor, operating at 750 r.p.m. The motor shaft carries a large and a small gear wheel, either of which can be meshed with the gear driving the pump. The small driving gear reduces the speed of the pump to 50 per cent. of that given by the larger gear, and the variable speed control permits the speed of the motor to be changed from one-half to full load; the pumps can thus be operated at as low as 25 per cent. of their rated capacity.

When the extension was added to the building plans were made to install a large electrically-operated butter-renovating plant on the top floor of the building. As the equipment of this plant would require considerable power, a 250-kw. 250-volt direct-current multipolar Northern generator was provided to supply the power necessary for it and for the remainder of the electrically-operated equipment in the building. This generator, which was calculated to carry the day load, is direct connected to a 13 and 16½ x 24-in. high-duty cross-compound condensing Buckeye engine. A 125-kw. 250-volt direct-current multipolar Northern generator, direct-connected to a 10 and 21 x 18-in. high-duty tandem-compound condensing Buckeye engine was installed to carry the night load. The butter plant has not been installed as yet, however, so the 125-kw. unit is used to carry the load at all times.

Circulating water for the surface condenser which serves the steam-condensing units, and for the ammonia condensing coils is furnished by either of two 6-in. horizontal double-suction Kingsford centrifugal pumps, each driven by a 50-h.-p. 250-volt direct-current Northern motor. One of these motor-pump sets operates at 750 r.p.m., and has a capacity of 1,000 gal. per minute, the other, operating at 850 r.p.m., has a capacity of 1,200 gal. a minute. Both of these pumps draw from a 5.5 ft. circular suction well under the basement floor, which has two 10-in. inlet pipes connecting it with the river. Each of these inlet pipes carries a tee connection at the river end in which are placed vertically two 4-ft. lengths of perforated 10-in. pipe, closed at the ends with blank flanges. The perforations in these pipes consist of three ⅜-in. holes per square inch of surface. As the river carries a large amount of silt and sediment these perforations are liable to become clogged, so provisions were made to clear them. A gate valve placed on the well end of the inlet pipes is closed when the perforations are fouled and a current of air under 80 to 100 lb. pressure is forced through the pipes.

The suction pipes of the pumps are not provided with foot valves, but each pump is fitted with a 2-in. connection from the steam header which is used for priming. The discharge for the pumps is arranged so water can be delivered to the ammonia coils and thence to the condenser, or separately to the ammonia coils and the condenser. The discharge from the condenser is returned to the river.

All of the steam-consuming units, except the boiler-feed pumps, are connected to a 16-in. exhaust main, which leads to a 4.5 x 12.5-ft. Blake surface condenser, with a capacity of 15,000 lb. of steam per hour. A 20-in. Cochrane oil separator is placed on this main near the condenser. The exhaust main is also provided with a by-pass leading to a free exhaust into the atmosphere, a relief valve on this by-pass protecting the exhaust system from excessive pressures.

The condensed steam from the condenser is delivered to a tank, suspended from the ceiling of the basement, by either of two 8 x 14 x 12-in. horizontal marine wet-and-dry Blake pumps, with bronze fittings through-out. The suspended tank serves as a hot well in the boiler feed-water system. This system includes a Cochrane water purifier, a Cochrane feed-water heater and two

feed-water pumps. The condensed steam is returned by gravity from the suspended tank to the heater, or directly to either of the feed-water pumps. The make-up water is supplied to the purifier from the city mains through a tight surge tank, a valve operated by a float automatically maintaining the water level in the purifier. Make-up water can be supplied to either pump from the purifier, or directly from the surge tank. The water level in the heater is automatically maintained at one height by a valve operated by a float in the heater. The water level in the heater is also at such height that the pumps draw from the heater until make-up water is required. The heater operates on exhaust steam from the condenser pumps, the feed-water pumps and small pumps which circulate the lubricating oil used in the plant.

A complete system for circulating lubricating oil is installed. Fresh oil is placed in a metal storage tank in the engine room near the boiler feed-water heater. A small reciprocating pump draws oil from this tank and delivers to a supply line connecting with mechanical lubricators on each of the main reciprocating units. Spigots are also placed on this supply line adjacent to the other main units. The drips from all of the units are collected and delivered to a tank in the boiler room by gravity. A second small reciprocating pump draws the dirty oil from this tank and delivers it to a Turner filter over the clean oil tank.

The foundations for the various large machines in the engine room had to practically all be designed specially. The spread reinforced-concrete footings for the columns of the building frame, which are irregular in size and shape, had to be kept separate from the foundations for the machines to avoid vibration being transferred to the building. In order to accomplish this result, a joint at least 1 in. wide was made between the column footings and the machine foundations. The shape and position of the footings required parts of the different machines to be set on heavy I-beams carried over the footings by the foundations; some of these beams also had to be cantilevered over the column footings from the machine foundations. All of this intricate foundation work was done in the basement after the building was completed, the excavations being made in the soft blue clay at about the river level.

The operation of the electrical generators and of the various wiring circuits in the building is controlled from a nine-panel switchboard at one side of the engine room. This board has a panel equipped with an indicating voltmeter and an indicating ammeter, for each generator. A totalizing panel equipped with an indicating ammeter and an integrating wattmeter is also provided. Two power circuits and three lighting circuits are controlled from separate panels, each having an integrating wattmeter. The total output of the generators and the amount of power supplied to each circuit is thus always on record.

The ninth panel on the board carries steam, vacuum, ammonia and back-pressure indicating gauges and recorders, so that all information concerning the operation of the plant is available at the one board. This panel also carries two electrically-operated revolution counters, which record the number of revolutions made by the ice machines. These counters are operated by an eccentric on the shaft of the machine, which makes and breaks a circuit including a solenoid on the back of the switchboard, the solenoid having sufficient power to move the works of the counter.

All except two floors of the building, the first and the sixteenth, are cooled by the refrigeration system. The lowest temperatures are maintained on the seventh and eighth floors, where 4° and 5° below zero Fahrenheit, respectively, can be reached. From the eighth to the fifteenth, and from the seventh to the second floors, the temperatures maintained are successively higher from floor to floor, the normal temperature on the fifteenth floor being 34° Fahr., and that on the second, 32° Fahr. A total of 904,200 cu. ft. of space is thus supplied with refrigeration.

Practically all kinds of food stuffs which have to be stored in cool rooms are placed in the warehouse. Local deliveries to the building and local shipments are made from the first floor by wagons and trucks. Out-of-town deliveries and shipments are also made from the first floor to cars on a switch track at one side of the building. Four electrically-operated Otis freight elevators carry goods from the first floor to every other floor of the building. Two of these elevators are placed in separate fireproof shafts at each end of the building, the shaft connecting at each floor level with a vestibule from which doors open into the cool rooms. These elevators each have an 8 x 10-ft. platform, and a normal capacity of 4,000 lb. With a load of 3,000 lb. all of them have a traveling speed of 150 ft. per minute. One elevator at each end of the building is also arranged with a back gear so it can carry a maximum load of 5,000 lb. at slow speed.

All power and lighting wire circuits throughout the building are in conduits. The switches on the lighting circuits are in cabinets placed on the wall of the vestibule entrance to each floor from the elevators. The incandescent lamps used in the cool rooms are enclosed in a second glass bulb, thus forming an air space between the two bulbs which largely reduces radiation of heat from the lamps.

The plans and specifications for the mechanical and electrical equipment of the building were prepared by Mr. C. A. Chapman, consulting engineer of Chicago, and the equipment was installed under his direction.

Forest and Rainfall Relations have been studied for a number of years by Dr. J. Schubert, director of the meteorological section of the Prussian Forestry School at Eberswalde. The observations were made at 17 stations in the forest, on the forest edge and in the open. The forest stations showed the greatest precipitation and those in the open the least, the difference being 5.2 per cent., which is about the probability of error in the results.

Switchboard and Main Ice Machine, North American Cold-Storage Building.

Requirements for Treating Wood Paving Blocks.

A paper read before the American Society of Municipal Improvements by Geo. W. Tillson, Chief Engineer of Highways, Borough of Manhattan, New York.

During the last few years wood pavements have attained considerable popularity in this country. Whether they increase or even maintain this popularity depends upon the ability of the blocks to withstand not only the action of street traffic, but that of time and the elements.

Wood has been used at intervals in street pavements for about seventy years, but never with any permanent success, if we except the present movement. This being so, it can pertinently be asked why should any better result be expected now. The answer is that there is one vital difference between the old and the present blocks, as the former were laid in a natural state while the latter are treated chemically.

Pavements wear out or rot out. If their material will not decay, the life varies according to the traffic imposed upon them. But wood in its natural condition is subject to decay and with no traffic at all will last only for a limited time. The object of the treatment then is primarily to prevent this decay. But all wood swells when exposed to moisture and contracts when subjected to heat. But if the pores of the wood can be filled with a substance that will prevent the absorption of water it can be kept stable in size, neither shrinking nor expanding during the varying changes in the weather. The object then of the introduction of chemicals is to prevent natural decay and maintain stability in size, so that a pavement will not bulge wet nor be full of loose joints when dry.

The question, therefore, is how can these objects be attained. It is generally admitted that the best agent for treating blocks is creosote oil. When the city of Indianapolis some eight or nine years ago began to lay treated wood pavements, it required the blocks to be first thoroughly dried and then impregnated with creosote oil weighing 8.8 pounds per gallon and to an amount equal to 10 lb. per cubic foot. But it is probable at that stage of the business not enough attention was given to the character of the oil or the actual quantity used, so that the first pavements buckled to quite a serious extent. The possibilities of a perfect wooden pavement were appreciated, however, and eventually successful pavements of this character were laid.

Some time later an Eastern firm took up the matter of treating wood blocks and instead of creosote oil alone, using a mixture of 50 per cent. oil and 50 per cent. rosin, and 20 lb. per cubic foot. The first pavement of this character was laid in Boston, on Tremont St., in 1900. I quote herewith from a letter received last month from an engineer in the Boston Street Department as to its present condition.

"I have just been and looked at the wood paving on Tremont St. About three years ago the upper end, perhaps a hundred feet long, was taken up and relaid with the old blocks, with open joints about the thickness of a lath, and grouted with cement and sand, as I remember it. That portion shows wear, the joints have widened and there is some irregularity of surface. The remainder looks very well. On the part most worn, that is near the middle of the street, there is a somewhat rolling surface.

"The pavement was laid in 1900, and it has worn very well indeed as a whole and is now in good, usable condition."

This is, without doubt, the best evidence that can be obtained upon this particular kind of pavement. In 1902 a street was paved with this material in the Borough of Brooklyn, New York. In addition to the above, the specifications required that the blocks, when treated, should sink in water, and after having been subjected to a temperature of 100° F. twenty-four hours, should not absorb more than 3 per cent. of water when immersed for an additional twenty-four hours, the idea being to specify a result rather than a method only. The absorption test was considered the most important, the other being preliminary only and an indication that the proper amount of the mixture had been used. No trouble was ever experienced with pavements laid by the city under these specifications.

As the use of wood spread over the country, different specifications were adopted according to the views of the different officials. Bearing in mind the objects to be attained by the treatment, the method that will produce that result economically is the best. With the constantly increasing price of all materials used in the production of treated blocks, it is of great importance that no surplus nor unnecessarily expensive material be used. The Borough of Manhattan, New York, probably has more of this treated pavement than any city of this country, and the salient points of the specifications under which the latter portions of them was laid are here given.

(4.) The blocks are to be treated throughout with an antiseptic and waterproof mixture, 75 per cent. of which shall be creosote or heavy oil of coal tar conforming to the specifications hereinafter set forth, and 25 per cent. of which shall be rosin conforming to the specifications hereinafter set forth. All parts of each individual block shall be thoroughly treated, and not less than twenty (20) pounds of the mixture per cubic foot shall be injected.

(5.) In preparing the blocks to receive the creosote mixture, they shall be placed in an air-tight cylinder, in which dry heat, or heat produced by superheated steam, is maintained and raised to a temperature of 215° F., for one hour, for the purpose of expelling moisture; the heat is then to be increased until it has reached 285° F., this heat being maintained for a period of three hours, or until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour, or until same has been reduced to 250°. A vacuum is then to be applied until about 26 in. is reached, and while under this vacuum the creosote mixture is to be run into the cylinder at a temperature of from 175° to 260° degrees, after which hydraulic pressure of not less than 200 lb. per square inch is to be maintained and raised until the individual blocks are treated throughout.

(6.) The creosote oil is to conform to the following specifications when tested, as follows:

(7.) The gravity at 68° F. shall be not less than 1.12. When distilled in a retort with the thermometer suspended not less than 1 in. above the oil, it shall lose not more than thirty-five (35) per cent. up to 315° C., and not more than fifty (50) per cent. up to 370° C. The oil is to be free from adulteration; it must not be mixed with or contain any foreign material.

(8.) The resin is to be solid resin obtained from pine. It is to be reduced to a fine dust by grinding and then incorporated with the hot creosote oil in a suitable mixing tank until the proper proportions are secured.

(9.) After treatment the blocks are to show such waterproof qualities that after being dried in an oven at a temperature of 120° for a period of twenty-four hours, weighed and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight is not to be greater than three (3) per cent.

(40.) Fine turnings from the block shall be placed in a suitable extraction apparatus and the oil completely extracted therefrom with ether or carbon bisulphide. The oil so extracted shall be placed in a suitable still and distilled. The portion up to 120° C., consisting of the solvent, is to be collected apart. The oil shall then be distilled up to 370° C. The creosote oil thus obtained must conform in all respects to the requirements of paragraph 39, subdivision 7.

(41.) The Engineer shall have tests and examinations made at the contractor's works of the materials and blocks proposed to be used, and reject any or all of such materials and blocks as he may consider not to be in compliance with the specifications. The Borough President shall appoint an inspector at the expense of the contractor, who shall inspect the lumber and other materials used in the manufacture of the blocks, and the treatment of the blocks; and he shall reject any of such material and blocks as he may consider not to be in compliance with these specifications.

(42.) The blocks will be carefully inspected after they are brought on the line of work, and all blocks which in quality and dimensions do not conform strictly to the requirements will be rejected and must be immediately removed from the line of work.

It will be noticed that the rosin used is only 25 per cent. and the specific gravity of the creosote oil is 1.12 which would give a weight of 9.4 lb. per gallon as against 8.8 lb. as in the original Indianapolis requirements.

In revising these specifications the writer modified them by specifying that the mixture used should contain not more than 75 per cent. of oil and not less than 25 per cent. of rosin, that pine blocks should weigh as much as water, black gum blocks 59 lb. per cubic foot and any other kind of wood at least 20 lb. per cubic foot more than the untreated. Also that the blocks should not absorb more than 3½ per cent. of water after having been dried for twenty-four hours at a temperature of 100 deg. Fahrenheit. He also changed the wordings of the clause stating the exact method of treatment by making it general in nature, so that a contractor can use any method he pleases provided that he uses the proper material in proper quantity and produces a specification block.

The words "not more" and "not less" were inserted because the author believes that with a correct proportion of rosin and oil there will be no trouble in making a block that will fill the requirements of the specifications. The weight requirement was made so as to ensure as certainly as possible that at least twenty pounds of the mixture is used. This is probably approximate only, but undoubtedly useful.

The writer was probably the person who first proposed the absorption test, and the preliminary drying was not only intended to drive off some of the contained moisture, but also to test the volatility of the oil used, and the idea was to subject it to a temperature that would produce a result equal to actual use. It was also believed that an absorption of 3½ per cent. was sufficiently severe.

In order to ascertain the present practice the writer has compiled from the specifications of the cities mentioned in the accompanying table the salient points regarding treatment and tests. The table represents the general practical differences of the cities in this country and can be considered as representative requirements.

It will be noticed that all of the specifications require creosote oil, and Indianapolis is the only one that does not require it to be mixed with something else. The Brooklyn specifications vary a little from the others in that they allowed as a substitute for resin "or any other suitable waterproofing material." One contract was laid with material other than resin, and up to the present time, although only three years have elapsed, the pavement has been satisfactory.

It should be the object of all engineers to reach the desired results in as economical a way as possible, and if 25 per cent. of resin is as good as 50 or, if none at all is necessary, it should be left out, as the addition of the resin makes quite an increase in the cost. It will be noticed also that all the cities but Minneapolis require 20 lb. of material per cubic foot, where Minneapolis calls for only 16. Of course, if 16 lb. are as good as 20, there is no necessity for putting in the extra 4 lb.

	Mixture				Tests	
City	Character	Pounds per Cu. Ft.	Specific Gravity of Oil	Kind of Wood	Weight	Absorption
Boston	Creosote oil 75 Resin 25	20	1.12	Long leaf yellow pine Southern black gum		3
Borough of Brooklyn	Creosote oil 50 Resin 50	20		Long leaf yellow pine	Greater than water	3
Indianapolis	Creosote oil	20	1.12	Long leaf yellow pine		
Minneapolis	Creosote oil 50 Resin 50	16	1.09	Long leaf yellow and Georgia pine; Norway pine; Washington fir; Tamarac		
Borough of Manhattan	Creosote oil 75 Resin 25	20	1.12	Long leaf yellow pine; Southern black gum; Norway pine; Tamarac		

It will also be noticed that, while the specific gravity of the oil called for in Boston, Indianapolis and the Borough of Manhattan is 1.12, no specific gravity is given for Brooklyn, and Minneapolis calls for 1.09. It can be said regarding the Brooklyn specifications that they were made several years ago, when the question of the oil was not as well understood as it is at present, and no wood block has been laid in Brooklyn for the past three years.

The question of the kind of wood also makes a difference in the treatment. All of the above specifications allow long leaf yellow pine; three allow Southern black gum, and the Minneapolis allow, in addition, Norway pine and tamarac, while Minneapolis also permits Washington fir. It can be easily understood that black gum, tamarac or fir, woods that contain no pitch of themselves, should require a different treatment than yellow pine. It will also be noticed that the only test specified for the blocks after they are treated is that Brooklyn requires the blocks

to be heavier than water, and Boston. Brooklyn and Manhattan require that they shall not have an absorption of more than 3 per cent. of water after having been dried for 24 hours and then immersed in water for an additional 24 hours.

The question of the specific gravity of the creosote oil is very important, and in order to learn something about the difference in the volatility of oils of different specific gravity a test of evaporation was made by the chemist of the Bureau of Highways, Borough of Manhattan, with the following result:

The experiment was carried out as follows: Approximately 50 grams of each oil was placed in an open cylindrical vessel having a diameter of 3 in. and 1¾ in. high. The oil was then subjected to a constant temperature of 120 deg. Fahrenheit for a period of 50 days, the oil being frequently weighed, as shown in the table below.

Four samples of oil were selected for these tests, two having a light specific gravity and two heavy oils. These oils when subjected to distillation had the following constitution:

No.	Specific Gravity	Creosote Oils: To 315° C Per Cent.	Creosote Oils: 315°-317° C Per Cent.	Distillate: Total to 370° C Per Cent.	Distillate: Residue Per Cent.
S— 997	1.055	82.5	8.5	91.0	9.0
S—1003	1.180	33.4	13.4	46.9	53.2
S—1008	1.065	83.1	8.5	91.6	8.4
S—1017	1.190	35.4	10.9	46.3	53.7

The amount in weight which these oils lost when maintained at 120 deg. Fahrenheit, in the number of days indicated, is shown in the following table:

CREOSOTE OILS.—Loss in Weight at 120 deg. F.

No. of Days	S-997 Sp. Grav. 1.055 Total Loss Per Cent.	S-1003 Sp. Grav. 1.180 Total Loss Per Cent.	S-1008 Sp. Grav. 1.065 Total Loss Per Cent.	S-1017 Sp. Grav. 1.190 Total Loss Per Cent.
1	13.3	6.2	10.9	3.8
2	20.2	8.1	18.2	5.7
3	26.8	10.7	24.2	7.4
6	41.1	13.3	39.1	9.9
10	53.1	16.0	49.7	12.1
15	58.9	18.1	54.4	15.0
22	63.4	19.1	59.1	15.8
29	67.0	19.6	61.9	16.2
36	69.1	20.3	64.1	16.7
43	70.9	20.8	66.1	17.3
50	72.3	21.2	67.5	17.6

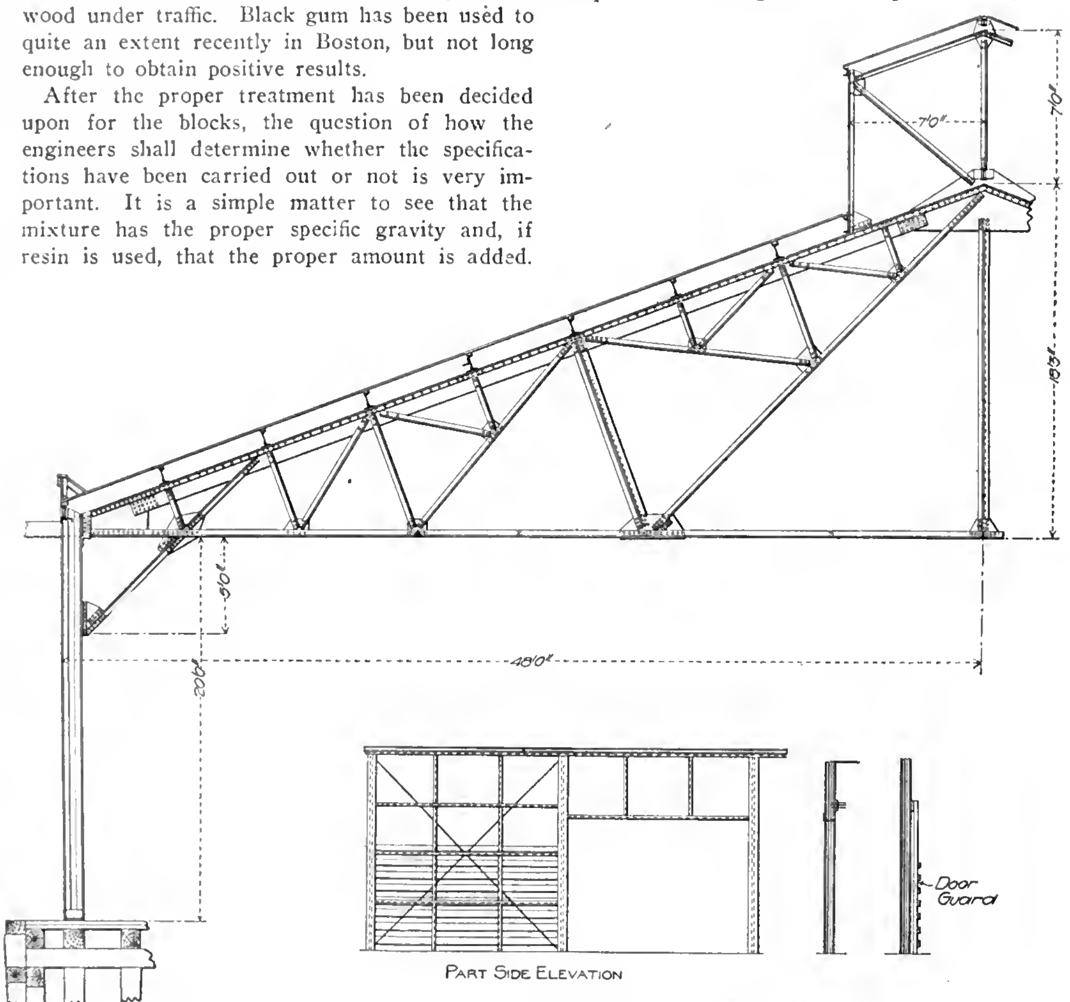
It will be noted that there is a great difference in the evaporation of the oils, both under high temperature and also the extended test of 50 days. Under the 50-day test, subject to a temperature of 120 deg. Fahrenheit, the oil with a specific gravity of 1.055 lost 72.3 per cent. of weight, while the oil with a gravity of 1.19 lost only 17.6. It must also be understood that a so-called creosote oil, with a specific gravity of 1.19, is an entirely different material from one with a specific gravity of 1.055; and it is questionable if, with the heavy oil, it is necessary to have the 50 per cent. of resin, or any at all. In fact, a great many engineers contend that the addition of the resin is injurious rather than beneficial. The object of the resin, theoretically, is as much, if not more, to preserve the creosote oil and maintain it in the blocks as it is to act as any preservative itself.

Referring to the different kinds of wood, the writer believes that it would be difficult to obtain an absorption of 3 per cent. or less with any of the non-pitch woods with so small an amount of oil as 20 lb. per cubic foot. A sample of black gum that had been kept in an office, under the ordinary temperature, for a year or more, that had been treated with 40 lb. of oil per cubic foot, was tested for absorption, under the usual conditions, and absorbed less than 2 per cent. of water.

All engineers will probably agree that the yellow pine wood of itself is the best material that can be used. But this material is growing scarcer and more expensive every year, and the government officials have been making experiments for some years, with the idea of obtaining other woods that would be equally as good, if possible. If, however, in order to get good results it is necessary to use more oil than with the pine, it might bring the cost of the cheaper woods equal to the cost of more expensive woods after both had been treated.

The 20-lb. treatment will cost approximately 45 or 50 cents per square yard for the mixture, and if an additional 20 lb. are added it, of course, increases the cost directly that amount. So that, at the present prices, with the same treatment, black gum has an advantage over the yellow pine of about 45 cents per square yard. This difference, however, might be more than overcome by the durability, or rather lack of durability, of the wood under traffic. Black gum has been used to quite an extent recently in Boston, but not long enough to obtain positive results.

After the proper treatment has been decided upon for the blocks, the question of how the engineers shall determine whether the specifications have been carried out or not is very important. It is a simple matter to see that the mixture has the proper specific gravity and, if resin is used, that the proper amount is added.



Half Elevation of Transverse Bent of Export Steel Pier-Shed.

The quantity of blocks put in the retort can be ascertained and the proper quantity of mixture used, so that the blocks will average the proper quantity per cubic foot. Of course, it will be impossible to be sure that each block has the required amount. When it comes, however, to applying the absorption test and the weight of the block, if that be specificed, another question comes up; that is, whether the blocks shall be tested at the works when they are just completed or at some subsequent time when delivered on the street, which may be some weeks or, very probably, in some cases, months. The contractors claim that the test should be made at the works and, if satisfactory, then they should be accepted at any time afterwards.

As the blocks are to be used in the streets for years, it would seem that they should be treated in such a way that they would stand the required test, even if not used for several months after having been treated, especially if heavy oils have been used and in the light of the experiment noted above. The heaviest oil lost, approximately, 18 per cent. after having been subjected to a temperature of 120 deg. for 50 days, which is an extremely severe test and one never possible to be reached on the street. If a block had been treated with 20 lb. per cubic foot and had lost 18 per cent. it would still have 16.4 lb. per cubic foot of the original mixture, which is more than the original requirements for the Minneapolis specifications. It would seem, therefore, to the writer, conclusive that the blocks should conform to the specifications when delivered on the street and not when treated.

The requirement for sinking in water, which was inserted in the Brooklyn specifications, was used more to give a quick test than for anything else, and it was found that if the pine blocks which were treated with a material that contained 50 per cent. of creosote oil and 50 per cent. of some other suitable material, almost every block that would sink in water would conform to the requirements in regard to absorption. This, however, in later experiments has not been found to be true, and, in many cases, blocks that would sink in water have not conformed to the absorption test. This may have been because the blocks were heavier originally; they did not take the treatment and absorb as much oil as the other blocks, and that when immersed in water would absorb more water. This is wholly speculative, however.

The writer believes that the question of treating wood paving blocks is one that is being investigated more at the present time than any other one kind of pavement, as he has received many inquiries regarding it during the past season. He also believes that it is a matter that neither engineers nor contractors have any positive knowledge of at the present time, and thinks it of great importance that the different cities investigating the matter should, in some way, give each other the result of their different investigations, so that in the end all cities might arrive at a good and satisfactory specification.

The question of testing the blocks is one of great importance, and it is absolutely necessary to arrive at some method of making the tests that will be as nearly positive as possible and perfectly satisfactory. And the object of writing

this paper has been, not so much to give information as to seek it and, if possible, to bring about the consummation above mentioned; that is, the getting together the ideas of the different engineers of the various cities and finally reach a result that will be satisfactory to all.

An Export Steel Pier-Shed.

The new deep-water pier for the Insular Dock Co., in San Juan Harbor, Porto Rico, is 420 ft. long by 100 ft. wide over all and has a wooden pile sub-structure and a steel superstructure. The design is of an ordinary type, and the construction is simple and is intended to adapt standard features and practice to the local conditions and the requirements for shipment. It is therefore interesting, not for novel or unusual construction, but as an example of a class of work likely to be undertaken in increasing amounts by American engineers and contractors.

The pier is located in a sheltered harbor, where there is a tide of 1 ft., and it is not exposed to unusually severe winds or to especially heavy impact from adjacent navigations. The substructure is made with yellow pine creosoted piles about 70-80 ft. long, driven through 50-60 ft. of water and soft mud to hard bottom. They are arranged in transverse bents 10 ft. apart on centers, with 23 bearing piles in each bent, all of which, except the three at each end, are 5 ft. apart. There are also two spur piles and two fender piles in each bent. The piles are capped with longitudinal 12 x 12-in. rangers, with butt joints, and 6 x 12-in. double side plates between bents. The piles are connected transversely by a pair of 6 x 12-in. horizontal ledger pieces at the top of each bent just below the longitudinal timbers. The floor is made with 4-in. transverse planks covered with 4 in. of concrete.

The 96 x 400-ft. steel shed is symmetrically located on the pier and has a height of 50 ft. 3 in. over all. It is made with 21 transverse bents, 20 ft. apart, connected with 21 lines of longitudinal purlins, two lines of longitudinal struts and nine sets of lateral X-bracing in alternate panels in the planes of the rafters. At one end of the shed there is a two-story house, two panels long, for office and administration purposes, and the remainder of the building is one story in height, with a monitor 7 ft. high and 14 ft. wide on the center line of the building, occupying 17 panels in length.

Each transverse bent has a triangular riveted main roof truss, 18 ft. 3 in. deep in the center, which is knee-braced and rigidly connected to the tops of the wall columns, 20 ft. high. The top chord or rafter has a T-shaped cross section made with a pair of 4 x 3½-in. flange angles and a 12-in. vertical web plate, to which the single and double angles forming the other members of the truss are riveted direct without connection plates, except at the feet and at the eaves. The truss members are to be shipped separate and field-riveted together in a horizontal plane on the ground and erected by derricks.

The columns have an I-shaped cross section and a horizontal base plate, bolted directly to the floor timbers. The trusses are connected by longitudinal struts at the peak and at the foot of the center vertical and by 18 lines of 7-in. channel purlins, bolted to angle clips on the top flanges of the top chord. Knee-brace plates riveted to the upper lines of purlins and to the top chords of the trusses serve also as connection plates to receive the feet of the verticals in the monitor frames at panel points. Intermediate monitor frames are connected directly to the purlins and carry three lines of 4-in. channel and I-beam purlins. All purlins have 2 x 3-in. nailing strips bolted to their top flanges to receive the 1¼-in. sheathing boards parallel to the top chords, which are covered with the ordinary tar, felt and gravel roofing.

A wooden gutter is formed at the eaves by a sort of fascia or cornice board flashed with the roofing. The eaves purlin has an L-shaped cross section made with two channels, one vertical and one horizontal, the latter serving as a frame for the siding and door casing. The fifth purlin from the eaves on each side is reinforced from end to end of the building by a 3 x 3 x ¼-in. angle riveted to the web of the channel to stiffen it for the longitudinal countenance of the lateral stresses. The lateral diagonals are 1-in. rods, with screw ends and nuts bearing on beveled washers.

The walls of the building are sheathed with corrugated iron, secured to studs and girts made respectively with 6-in. vertical channels and 2 x 2 x ¼-in. horizontal angles. The shore end is made special, with intermediate columns for the two large doors, and with an extension for a false front above the roof line. Between the one-story and two-story parts of the structure there is a special junction bent made with a horizontal 12-in. channel running across the full width of the building at the height of the eaves, 20 ft. above the floor, and supported by five intermediate columns. The side walls of the one-story part have six full-width doors, one in every third panel, with two windows above each door. In eight panels between the doors there are ⅞-in. round X-brace rods, corresponding in seven cases to the lateral bracing in the roof. In two of the center panels the diagonal bracing occurs where there is none in the corresponding roof panels.

Between the large side doors the inner faces of the columns are protected by freight fenders, consisting of eight horizontal lines of 2 x 8-in. planks, 8 in. apart, spiked to 3 x 4-in. vertical studs furred out 4 in. from the column, forming a pocket for the sliding doors. In the shore end of the building there are two large doors, two small doors and sixteen windows. At the river end there is one 14 x 16-ft. center door and one large window in the monitor. Most of the space in the side walls of the monitor is occupied by Berlin louvres, without glass. The total weight of structural steel is about 550,000 lb. The contract for the pier and shed was awarded to John Monks & Sons, New York; Mr. Richard A. Monks is the company's engineer on the dock, and Mr. John W. Ripley, engineer on the shed. The steel work was furnished by the Dietz-Waring Co., of New York.

A 1,200-Ft. Double Cableway for hauling coal and shale across a valley has been installed by Messrs. R. White & Sons, Widnes, England. There are four spans in all, the intermediate towers being 12 to 30 ft. high. The grades of the rope vary from 1 in 6½ to 1 in 2, the slope being upward against the loads. The loading terminal is about 10 ft. from the top of the colliery shaft, and a track runs from the latter to the loading terminal, sloping rapidly downward beyond the point, where the cableway picks up the cars. The latter weigh about 400 lb. each and carry a load of 800 lb. They are attached to the cableway carriers by stirrup-irons, which go under the box of the car. On reaching the discharge end they take the ground on a rising grade, exactly opposite to the arrangement at the loading end, and when on the level are automatically detached from the hauling rope. The small cars are dumped into railroad cars and sent back to the loading point on the return cableway rope. At the discharge end a tension-wheel is mounted on a trolley, which runs on a short track to take up the slack. The maximum capacity, according to "Engineering," of London, is 70 tons per hour.

The Sterilization of Treated Sewage.

At the present time there are few subjects more interesting to those engaged in research work in sanitary engineering than the sterilization of the effluents of sewage disposal works. The subject can hardly be termed one of immediate practical importance, except in a very few places, like Baltimore, where the existence of a great shellfish industry has made it obligatory to ensure an unusual degree of purification of the sewage before its discharge into Chesapeake Bay. In fact, the importance of sterilization will depend very largely on the results which may be reasonably expected from it and the cost of attaining these results, both of which factors remain to be determined. An instructive paper on the subject by Messrs. Phelps and Carpenter was printed in this journal on Jan. 19, 1907, and in the present article it is proposed to give an outline of investigations made by Messrs. Karl F. Kellerman, R. Winthrop Pratt and A. Elliott Kimberly, and described in a recent bulletin of the U. S. Bureau of Plant Industry.

Experiments upon the germicidal effect of copper were planned to include sewage effluents of different qualities, ranging from highly purified effluents from sand filters to the putrescible effluents from septic tanks. Westerville, the Boys' Industrial School, Lancaster, and Marion, Ohio, were selected for sub-stations, and a preliminary experiment upon fresh sewage was conducted at St. Mary's of the Springs, near Columbus, Ohio.

St. Mary's. St. Mary's of the Springs is a convent school of about 175 persons. The sewage is discharged into two tanks operated in series. These tanks are 10 ft. in diameter and about 6 ft. in depth to the flow line. Recent measurements indicate that the flow of sewage is in the vicinity of 12,000 gal. for a period of 16 hr., there being practically no flow after 10 o'clock p. m. The highly putrescent sewage discharges from the second tank into a small brook. It has been the daily practice of the health department of Columbus to apply copper sulphate to the sewage at the inlet of the second reservoir. The sulphate in a dry state is placed in a perforated pail, which is lowered into the liquid to a point opposite the discharge pipe from the first reservoir. The sulphate remains suspended here, exposed to the somewhat erratic solvent action of the incoming sewage; at times it is found that the entire quantity of chemical used for one day's dose is not completely dissolved in 24 hr. In making an examination of this plant samples of untreated sewage entering the second tank and of treated sewage leaving the second tank were collected at half-hourly intervals for a period of seven hours on two successive days.

From an average of 16 samples of effluent collected on two days the total number of bacteria to the cubic centimeter developing within 48 hr. at 20° C. was 5,600,000 for the raw and 65,000 for the treated sewage, giving a reduction of approximately 99 per cent. Platings of the treated effluent when incubated at 37° C. for a period of 24 hours averaged 250,000 colonies, of which 36,750, or 14.7 per cent., were acid-producing, the majority being *Bacillus coli.*

The cost of treating the settled sewage is practically the cost of chemicals and the cost of maintenance, as the construction costs for the plant are practically negligible. With copper sulphate at 6 cents a pound and a daily sewage flow of 12,000 gal., the expenditure for chemicals is 3 cents for each 1,000 gal., using 6 lb. of copper sulphate a day. The labor cost may be considered to be 25 cents a day. Similar plants applying copper sulphate in the proportion of 63 parts to the million to a sewage flow of 12,000 gal. would require about 6 lb. of copper sulphate daily, costing 36 cents a day. On an annual basis the chemical and maintenance cost would be about

$222.65. Capitalized at 5 per cent., this would represent an investment of $4,500.

For crude sewage much better results could probably be obtained by using 100 parts of copper sulphate to each million parts of sewage. For treating 12,000 gal. of sewage at this rate the expense would be 60 cents a day, or $310.25 annually, and the corresponding capitalization would be $6,200.

Westerville. The sewage plant at Westerville, Ohio, comprises two small septic tanks, which discharge, through an aerating device, onto six primary cinder filters, which in turn discharge upon two secondary filters. The plant at the present time is operated continuously, instead of upon the contact principle. The effluent from the primary filters is usually non-putrescible, but at times tends to become unstable and contains considerable crude organic matter. As the effluent from the primary filters was the more accessible, by suitable piping it was conducted through an orifice box, where the proper quantity could be diverted for the experiments with copper treatment, the excess being discharged over a waste weir.

The copper crystals were dissolved in barrels and conducted to an orifice box, where a constant head was maintained upon an adjustable orifice. The quantity of copper sulphate used in each test was based upon the computed flow of 41,000 gal. of effluent in 24 hours. At the point of entrance of the sewage effluent and the copper solution there was a small longitudinal baffle, serving to effect a thorough mixture of the chemical and the effluent. The time of contact of sewage and sulphate was slightly over one hour. It was the general practice to apply copper sulphate at a given concentration for two consecutive days.

At hourly intervals during the test bacterial samples of the sewage effluent were collected before and after treatment. Samples for chemical analyses were collected at hourly intervals, and the composite sample so obtained was subjected to chemical analysis. In addition, determinations were made in the field for free carbonic acid and for alkalinity before and after treatment.

The percentage of removal of bacteria grown at 20° C. varied from 95 to 59 per cent., depending upon the concentration of copper sulphate applied and also upon changes in temperature. The removal of bacteria developing at 37° C. was much more erratic than was the case at 20° C., the percentage of removal varying between 28 and 96 for total numbers and between 66 and 100 for acid-producing bacteria.

On the basis of treating daily 41,000 gal. of effluent from the primary contact filters, the initial cost of a plant for applying the germicidal chemical would be $70 in round numbers. Considering a satisfactory removal of pathogenic organisms to be produced by a concentration of 40 parts to the million, the daily quantity of copper sulphate required would be 13.7 lb.; the cost for chemicals would be about 82 cents, and for 2 hours' labor, 50 cents. The annual cost, with copper sulphate at 6 cents a pound and labor at 25 cents an hour, would then be $482.50. Capitalized at 5 per cent., this would represent an investment of $9,650.

Boys' Industrial School. The Boys' Industrial School is a State institution near Lancaster, Ohio, and has about 1,100 persons. The sewage is treated on 23 intermittent sand filters, which receive the crude sewage, which has been subjected only to rough screening as a preliminary treatment. The flow averages about 160,000 gal. in 24 hours. It was thought most practicable to apply the chemical to the entire effluent flow, carrying out the experiments with a view to learning the quantity of copper sulphate required to destroy coli-like organisms when the effluent was flowing at a maximum rate.

The quantity of copper sulphate applied at the beginning of the test was calculated to afford a concentration of 5 parts to the million. The rate of flow of the copper solution was practically constant at 0.75 gal. a minute, but the flow of the sewage effluent varied widely; consequently, the resulting concentration of copper sulphate showed the same variations. The concentration of copper sulphate applied was increased on each successive run until a maximum of 20 parts to the million was reached, based on a flow of 150,000 gal.

From the public health standpoint the treatment at Lancaster was more satisfactory than either of the two preceding cases. The more efficient action of copper sulphate at Lancaster is undoubtedly due to the better chemical condition of the sewage effluent, especially its greater freedom from organic matter and its freedom from carbonates.

The daily application of copper sulphate to the Lancaster sand filter effluent, with its flow of 160,000 gal. a day, would require 17.3 lb. of sulphate, and the cost of this chemical would be about $1.04 a day, based on applying 13 parts of copper sulphate to each million gallons of effluent.

The cost of constructing the Lancaster plant used in these experiments and capable of treating sewage at the rate of 160,000 gal. for six hours was $29. However, a fair estimate of the cost of a plant under practical conditions for continuous treatment would be about $92. The maintenance cost per annum on the above basis would be $1,109.50. Capitalized at 5 per cent., this would represent an investment of $22,000.

Marion. The sewage disposal plant at Marion, Ohio [Eng. Record, March 17, 1906], is a combination of septic tanks, contact filters and sand filters, handling about 600,000 gal. of sewage daily. The storage or contact period of sewage effluent and copper sulphate was determined to be about one hour. The solution was discharged at the rate of 2 gal. a minute.

At the present time the disposal plant is hand-operated in the daytime only, and it was during such normal operation that the copper experiments were carried out. From 7 o'clock a. m. until 10 a. m. practically no water is discharged into the effluent channel; hence all of the tests began at about 10 a. m. Samples were collected at half-hourly intervals.

The results of these experiments are somewhat disappointing. The degree of bacterial purification did not equal that obtained at Westerville, and, as at Westerville, a great increase in the quantity of copper sulphate applied caused but slightly increased efficiency. The chemical condition of the effluent at Marion was somewhat similar to that at Westerville, but the time of contact with copper sulphate was much shorter. As several investigators have shown, time of contact is a very important element in the germicidal action of copper, and the low bacterial removal is probably due to this factor.

The application of copper sulphate to the Marion sand-filter effluent, with a daily flow of 600,000 gal., on a basis of applying 20 parts of copper sulphate to each million gallons of effluent, would cost $6 a day for chemicals, and the cost of constructing a plant for applying the copper sulphate would be about $151. The cost of treatment annually on this basis would be about $2,920. Capitalized at 5 per cent., this would represent an investment of $58,000.

After completing the experiments with copper sulphate it was decided to experiment with the use of chlorine. In the case of certain hospitals it may be desirable to disinfect the crude sewage discharged from them, and this may be done satisfactorily by means of chlorine, without interfering with the subsequent biological phenomena of purification. Generally speaking, however, the proper function of germicides in dealing with a large quantity of sewage is that of improving the biological character of the previously chemically purified effluent. This chemical purification may be only partial, as in the case of the effluent from septic tanks, or complete, as in the case of a high-grade sand-filter effluent.

As the most inexpensive and practical source of chlorine for the experiments, calcium hypochlorite or bleaching powder was selected. This costs upon an average about 3 cents a pound, and in large quantities may be purchased for 2½ or 2¾ cents a pound. The strength of the commercial chloride of lime in bulk varies widely and, according to analyses of the commercial product purchased in Columbus, Ohio, ranges from 18 to 25 per cent. of available chlorine. The data of cost have been calculated on the basis of 2½ cents for a grade containing 25 per cent. of available chloride.

According to the experience gained at Lancaster and Marion, the preparation of the hypochlorite solution is an important feature in the successful chlorine treatment of sewage effluents. It was found that unless special precautions are taken in dissolving the bleaching powder, many large lumps which inclose chlorine remain and materially reduce the efficiency of a given weight of bleaching powder.

The method of preparation found to give the best results is as follows: A weighed quantity of bleaching powder is placed in a shallow box and covered with sufficient water to form a smooth paste. More water is then added until the heavier particles settle out, thus allowing the soluble and finely divided chloride of lime to be decanted. After decantation more water is added, the coarse lumps are broken up, and the process repeated until as much as possible has gone into solution. The importance of thoroughly mixing the chloride of lime solution and of grinding the dried chloride as fine as possible cannot be too strongly emphasized; otherwise a loss of from 10 to 30 per cent. may take place, especially in the case of low-grade bleaching powder.

Boys' Industrial School. The leading results obtained during the first series of chlorine tests at Lancaster indicated that the removal of coli-like organisms was practically 100 per cent., and the removal of total organisms, 99.8 to 99.9 per cent. In organic compounds the effluent under treatment was substantially similar to that found during the copper experiments, and the temperature of the effluent was practically at the maximum density of 4° C. In practically all instances by means of the iodo-starch tests residual chlorine was detected in the discharge after a storage of about three hours. The solution was discharged into the sewage effluent at the rate of 0.75 gal. a minute, and variations in the quantity of chlorine applied were made by changing the strength of the hypochlorite solution.

The cost of constructing a plant for treating the sand filter effluent of the Boys' Industrial School with chlorine may be taken at $92. Substantially the same plant could be used as in the case of treatment with copper sulphate. The annual cost, applying 4 parts to the million of available chlorine to a sand filter effluent flow of 160,000 gal., would be about $924. Capitalized at 5 per cent., this would represent an investment of $18,500.

Marion. The procedure adopted in the chlorine disinfection tests was substantially similar to that followed in the experiments with copper sulphate, but the rate of application of the disinfectant solution was increased to 3 gal. a minute. As the effluents from either the septic tanks or the contact filters could be diverted directly into the effluent sewer, experiments were planned with each of the three grades of effluents, from the sand filters, the contact filters and the septic tanks.

The effluent from the sand filters was first experimented with, and the quantity of chlorine applied during the three runs on the sand filter effluent was on the average 3.8, 3.0 and 1.5 parts

to the million. In the first two runs the sterilizing effect of the chlorine was sufficient to remove 98.8 and 99.7 per cent. of the total bacteria, 98.5 and 99.1 per cent. of bacteria developing on lactose-azolitmin agar at 37° C., and 100 per cent. of the acid-forming bacteria, respectively. The conclusion may therefore be drawn that Bacillus coli was not present in the treated effluent. On the third test with a chlorine concentration, on the average of only 1.5 parts to the million, the bacterial removals were 94.3 for total bacteria at 20° C., 99.2 for bacteria developing on lactose-azolitmin agar at 37° C., and 99.9 per cent. for acid-forming bacteria. The average of the platings at 37° C. in the case of the third run contained but one red colony. This, by full determinative tests, was found to be Bacillus coli. No residual chlorine was found in the disinfected sewage.

The effluent from the contact filters contained organic matter of a more putrescible character than did the sand effluent previously studied. The quantity of chlorine applied ranged from a minimum of 1.7 to a maximum of 14.5 on the first run; on the second run, from a minimum of 2.6 to a maximum of 20.4, and on the third run, a minimum of 2 to a maximum of 31.8 parts to the million. The quantity of sewage discharged varied widely at different times during the day, depending upon the amount of sewage held in the filter. At the end of a discharge the rate is very small, and during such periods, of course, the strength of chlorine applied was greatly increased.

The effect of the applied chlorine on the chemical character of the contact-filter effluent is similar to that produced in the sand-filter effluents. The average quantity of chlorine, 2.9 parts to the million, sufficed to remove 97.8 per cent. of the total organisms. The tests for Bacillus coli indicated that the contact-filter effluent contained about 20,000 to the cubic centimeter, but after treatment these organisms usually could not be detected in 0.5 cubic centimeter of the effluent.

In the second run, with an average chlorine application of 5 parts to the million, the reduction of total organisms was 97.6 per cent., that of bacteria developing at 37° C. on lactose-azolitmin agar was 99.5 per cent., and the removal of acid-forming bacteria was 100 per cent. Further, Bacillus coli usually was not found in 0.5 cubic centimeter of the treated effluent, while in the untreated effluent it was found in numbers averaging 15,000 to the cubic centimeter. The total organisms in the treated effluent were 1,600, and the total development at 37° C. was 370 to the cubic centimeter. No red colonies were found during this run.

On the third run, with an average chlorine application of 4.4 parts to the million, the total removal of bacteria developing at 20° C. was 99.8 per cent., the removal of bacteria developing at 37° C. was 99.4 per cent., and the removal of acid-forming bacteria was 99.9 per cent. The red colonies developing in the case of the untreated effluent contained 21,000 organisms to the cubic centimeter, while in the treated effluent only 3 were found. The tests indicated that Bacillus coli usually was not present in 1 cubic centimeter, although found in the untreated effluent approximately 20,000 to the cubic centimeter.

The tests for residual chlorine in the treated effluent were generally negative.

Attention was next directed to the application of chlorine to the effluent from the septic tanks. The addition of approximately 5 parts of chlorine to 1,000,000 parts of septic sewage did not suffice to effect a very material removal of either total bacteria or fermenting organisms. The total bacterial removal ranged from 36 to 88 per cent. A higher concentration of chlorine produced only a slight increase in efficiency. At the highest concentration tested the acid-forming bacteria in the applied sewage were 100,000 to the cubic centimeter and were reduced by the chlorine treatment to 51,000, showing an average reduction of 49 per cent. The indications are that with the quantity of chlorine applied the removal of bacteria is by no means as complete as is desirable. Tests for the presence of residual chlorine in the treated effluent were carried out, but were negative in every instance.

An effort was next made to learn the efficiency of greatly increased amounts of chlorine. Such information would appear to be of considerable importance in connection with the disinfection of hospital sewages at times of epidemics in cases where sedimentation alone is the only permanently available means of treating the crude sewage. To this end six experiments in the chlorine treatment of septic sewage were made, the amount of chemical applied ranging from 7.3 to 48.5 parts to the million. The experiments at these higher concentrations were conducted substantially as those already discussed.

About 25 parts to the million of applied available chlorine were sufficient to remove a substantial proportion of coli-like organisms, although a complete removal of Bacillus coli was not accomplished. In the runs in which the concentration of the applied available chlorine was increased to a maximum average of 48.5 parts to the million the removal of Bacillus coli was found only slightly greater than in the case of the application of 25 parts to the million of available chlorine. In this connection it should be noted that the suspended matter in the septic effluent increased considerably, and this probably in large part explains the low removals obtained with the increased quantity of applied chemical. Observations made during the experiments at Marion emphasize the great effect of the periodic discharge of a septic effluent charged heavily with suspended matters. At such times, no doubt, the absorption of the chlorine is very great, and presumably the organic matters in suspension in the septic effluent destroy a considerable part of the disinfectant added.

The cost of constructing a plant for treating the several effluents studied at the Marion sewage plant may be taken as $151, exclusive of arrangements for supplying water to dissolve the chloride of lime. This estimate allows for continuous treatment at a rate of flow of 600,000 gal. in 24 hours.

The cost of applying 4 parts to the million of available chlorine to the sand filter effluent is $730 annually. The total annual cost, including labor, but excluding the cost of supplying water for preparing the chlorine solution, would be about $1,620, on the basis of an effluent flow of 600,000 gal. daily. Capitalized at per cent., this would represent an investment of $29,000.

The cost of applying 5 parts to the million of available chlorine to the contact filter effluent would be about $2.50 a day, requiring 100 lb. of the chemical. The total annual cost, including labor, but excluding the cost of supplying the water for dissolving the germicide, would be about $1,640. Capitalized at 5 per cent., this would represent an investment of $34,000.

Assuming 25 parts to the million as a fair average figure for the disinfection of the septic effluent, provided the same is at all times free from abnormal amounts of suspended matters, the total annual cost, including labor, would be about $5,300. Capitalized at 5 per cent., this would represent an investment of about $106,000.

In view of the importance attached to chlorine absorption by previous investigators and the fact that a fixed relation between the chlorine and the oxygen consumed, respectively, would be of marked value in the practical control of sterilization with chlorine, it was decided to inquire into the chlorine-oxygen relation for conditions at Lancaster. Especially was this important, since a complete removal of Bacillus coli was obtained by the use of slightly less than 5 parts of chlorine to the million, and also since there was noted the presence of residual chlorine after a three-hour storage of the treated effluent.

It appears that under conditions obtaining in some experiments chlorine up to 7.5 parts to the million would be absorbed from the sewage effluent in about 45 minutes, and that chlorine in concentrations of 10 parts and over would be detected in the treated effluent at the end of four hours. Additional experiments showed entirely different results, however; in one instance, a chlorine concentration of 75 parts to the million could not be detected at the end of one hour.

In continuing at Marion the study of the absorption of chlorine by organic matter and the possible relation between such absorption and the oxygen absorption shown by the standard oxygen-consumed process, there were carried out 48 separate experiments. These experiments dealt with the question of chlorine absorption and used, respectively, sand filter effluent, contact filter effluent, septic sewage and crude sewage, each being prepared at different dilutions by the addition of tap water.

From the results of the studies the following conclusions are drawn:

(1) The ratio of chlorine consumed to oxygen consumed in a five-minute period of contact bears no constant relation to the oxygen consumed by the five-minute boiling method.

(2) The concentration of applied chlorine affects the quantity of chlorine absorbed, the absorption at a concentration of 100 parts to the million being fully double that at 50 parts to the million.

(3) Increasing concentrations of chlorine up to 250 parts to the million increase the quantity of absorbed chlorine very materially, but above this there appears to be very little increased absorption even with a chlorine concentration of 500 parts to the million.

(4) Increasing the period of contact to two hours effects but little increase in the ratio of chlorine consumed to oxygen consumed, except for the higher chlorine concentrations of from 250 to 500 parts to the million.

(5) The actual amount of chlorine absorbed in five minutes by the several liquids tested, under concentrations of chlorine of 50, 100, 250 and 500 parts to the million, ranged as follows: Crude sewage, 24 to 148; septic sewage, 41 to 160; contact filter effluent, 42 to 80, and sand filter effluent, 33 to 68.

(6) The absorption of chlorine apparently is largely dependent upon the organic content of the liquid treated, increasing materially as the oxygen consumed of the effluent increases, but not in a definite ratio.

(7) For the same concentration of applied chlorine the ratio between the chlorine consumed and the oxygen consumed appears to increase as the organic matters decrease.

(8) The readily oxidizable matter in the septic sewage studied apparently causes a rapid absorption of chlorine, increasing the chlorine-oxygen ratio, especially in the case of the lower concentrations.

A STRANGE WELL exists at Riverside Park, Logansport, Ind. An 8-in. pipe was first sunk about 80 ft. and inside it a 5-in. pipe was carried down lower. Fresh water from a limestone stratum comes up between the two pipes, while water which tastes and smells strongly of hydrogen sulphide comes up through the 5-in. pipe from a lower stratum. The sulphur water flows at the rate of a gallon a minute from the drinking fountain over the well, while the fresh water flows with a somewhat smaller volume from a pipe about 20 ft. distant. There is a similar well about 15 miles north of Cincinnati, but the latter is non-flowing.

The Proposed Dock System of Newark.

Attention was called some months ago in the Current News Supplement of this journal to the fact that steps were being taken to improve the facilities of the city of Newark for handling water-borne shipments. The project is an old one, but it is only recently that it has taken definite form. The location of the city is such that it can enjoy excellent facilities for shipping at a small expense compared with the benefit to be derived from the cost of the work. The preparation of the plans for the improvements has been entrusted to Mr. James Owen, who has made a study of the subject for many years. The plan he has prepared is shown in the accompanying diagram and the following notes are taken from his report recently submitted to Mr. M. R. Sherrerd, city engineer of Newark.

At the present time one-third of the area of Newark, known as the Meadow Section, is practically undeveloped, although the population on the higher land within the city limits increased from 10,000 to 300,000 during the last century. The manufacturing interests of the city are diversified and there is a large business between the city and New York. The city manufactured in 1905 products to the value of $150,000,000, but its exports by water were only $3,711,364. In the year ending June 30, 1907, the exports had decreased to $1,685,113, although there is no doubt that the total volume of manufactures had increased. Mr. Owen considers that it is probable that $14,000,000 of manufactured products are sent from Newark to New York for transfer into vessels.

The dock facilities of the city of New York are all occupied and an extension of such facilities has become imperative. Various methods of relief have been suggested, but Mr. Owen believes that none of them are equal to the development of docks along the Newark meadows, where railway facilities are far better than on Long Island. By developing the meadows in the manner indicated, Mr. Owen believes that Newark may acomplish the same result that Glasgow obtained in developing the River Clyde. This was changed from a sluggish shallow stream to a broad river by artificial means entirely. The value of the import and export trade of Glasgow during 1905 was over $200,000,000. In view of the desirability of a further accommodation of the trade of Newark itself and the probability of the creation of entirely new business, Mr. Owen believes that the plans submitted form a good, sound business proposition.

The diagram shows the general outline of the works. It is proposed to occupy an area one mile wide and three miles broad. In the center of this tract is the canal itself, 1,000 ft. wide and 30 ft. deep, extending from the dock line on Newark Bay nearly to the westerly end of the tract. On each side of the canal is a system of slips similar in design to the most approved dock construction of this country. The bay front outside the limits of the canal will also be developed in a similar way, and on the westerly end of the canal are a series of slips and piers for coal handling, for domestic and foreign use.

In determining the depth of the canal, the fact that the facilities must be adequate for foreign trade and foreign vessels, make at least 30 ft. desirable. It will accordingly be necessary to dredge a channel in Newark Bay for a distance of about a mile to a point where the 30-ft. depth in that body of water is attainable.

The arrangement of the piers and slips is based on a width of 250 ft. for the slips and 150 ft. for the piers. Each pier in the canal will be 1,200 ft. long. The piers on the bay front in the canal will be 1,500 x 150 ft., and the coal piers will be 1,500 ft. long. On each side of the bay front slips for transfer floats are provided for direct New York trade, or for transfer to railways not having access to the proposed development. It will be noticed that the piers are not laid out at right angles with the canal itself but diagonally, an arrangement which gives an easier access from the piers to the canal. Docks for barge accommodation are also included in the lay-out for the purely local trade from the Passaic and Hackensack Rivers and New York Bay. The total length of the pier frontage is 115,000 ft. or 22 miles, equalling the dock frontage on both sides of the Passaic River from its mouth to Rutherford.

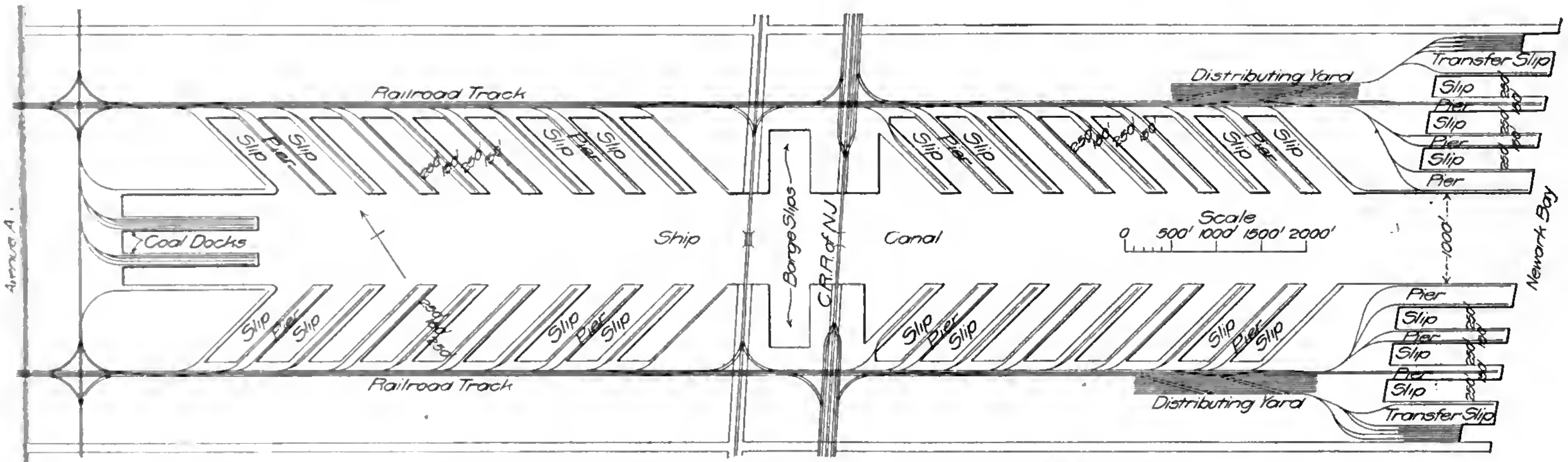
The width of the canal and the proportion of length and width of piers and slips have been settled only after careful consideration of the probable public requirements at this particular location, and from the experience of other places. The width of 1,000 ft. in the canal will give ample room for through communication in the canal and the complete handling of the largest vessel likely to enter it. The length of the piers has been determined from the experience in New York and Brooklyn and elsewhere, and gives room for two or three ordinary vessels, thus giving the greatest rental value for a minimum of expense for construction.

One of the most vital points in the whole plant is the method of communication with the country at large. There are four things to be considered, water communication, which the works are proposed to facilitate; railroad communication in all directions; trolley communication for local car service, and highway facilities for immediate delivery of freight. On the tract in question or immediately adjacent to it are the lines of the Pennsylvania, Lehigh Valley and Central of New Jersey railroads. The plan provides a system of tracks and switches with connection for one or two car tracks on each pier, so that any car at any given point can be taken to any other given point in the system, or be transferred to any of the trunk lines. Two assembly yards have also been designed, and directly connected with them are transfer slips for cars to be hauled away in any direction by water.

Two highway connections are designed as part of the system, one at the west end of the lay-out and one at the center. These highways can be constructed with tracks on them for trolley service.

In addition to the necessary strip of land required for complete access to every point of the development, it is proposed to reserve a strip of land extending nearly 1,000 ft. in width on each side of the piers and slips for future use as may be required, such as for warehouses for storage and for manufacturing plants which may find the facilities favorable for any specific industry. It is believed that this reservation is of the utmost importance in order to complete the system, and the land may be brought to grade by using the material excavated in the main channel in the bay and in the canals and slips.

The construction of these works is stated by Mr. Owen to present no difficult engineering problem. The surveys recently made show an average depth of about 10 ft. of black meadow soil and under this a deposit of unknown depth consisting of sand and clay. All the material excavated can be used to advantage in the construction of the piers and wharves, and by a judicious selection of such materials for different requirements great economy can be attained.



The Proposed Dock and Canal System on the Newark Meadows.

Concrete Fly-Wheels are reported in the "Engineer," of London, to be in use at the Zwaartkoppies pumping station of the Rand Water Board, near Johannesburg. The supply is derived from twenty bored wells, 150 to 210 ft. deep, operated in pairs, to balance the working parts of the pumps. The two wells of each pair are about 120 ft. apart. The pumps are of the plunger type, the diameters of the plunger and cylinder being 10 and 14½ in., respectively, and the length of stroke 36 in. Both pumps for each pair of bore holes are driven from one crank shaft through a gearing by an electric motor. On each shaft is an 8,000-lb. 14-ft. fly-wheel, with a reinforced concrete rim. A cast-iron boss is secured to the shaft, and into this sixteen arms, each made of 4-in. iron pipe, are screwed. Near the outer ends of the arms a ring of ¼-in. iron plate is secured with lock nuts, and around the extreme ends of the arms is fixed a second sheet-iron ring, which forms the periphery of the wheel. The space between the two rings is filled with 1:1½:3 concrete. The concrete rim is reinforced with four ¼-in. rods. The rim alone weighs about 6,000 lb. As the wheels make only 20 r. p. m., their use involves no risk of serious accident, and they are reported to have proved very satisfactory.

A Six-Span Highway Bridge at Catskill, N.Y.

A six-span reinforced concrete highway bridge, over Catskill Creek, having a total length of 450 ft. between the abutments, was finished during the past summer at Catskill, N. Y. The bridge has a clear roadway of 25 ft., a walk of 6 ft., and provision for a single street car track. Each arch has a span of 69 ft. and a rise of 8 ft. 6 in., the thickness at the crown being 16 in., and at the haunches 3 ft. 3 in. Four of the piers are 6 ft. wide, while the center pier is 12 ft. wide. All of them rise about 14 ft. from the footings to the springing line of the arch.

The spandrel walls retain a solidly tamped earth filling on which the roadway is laid. This consists of a slab of concrete paved with Catskill brick. The footwalk has a granolithic finish. The hand rail on each side of the bridge is of simple design, consisting of a rail of concrete cast in place and carried on rock-finish balusters set rather close together.

The centering for the arches was supported upon bents built without sills, the posts being cut of proper length to conform with the rock surface. Six bents were required for each span. They consisted of five 10x10-in. posts cross braced by 3x8-in. timbers. The centering consisted of five framed ribs parallel to the axis of the bridge, and carried upon the bents on wedges. The bottom chords of the centers were of 8x14-in. timbers, while the top chords consisted of three 3x12-in. boards. The framing was of 8x8-in. material. The rib carries 3x9-in. stringers placed transversely on 2-ft. centers and on them was laid longitudinal lagging of 1-in. dressed lumber in 12-ft. lengths. The timber for the centering and bents was obtained from the old bridge.

The work was started in August, 1906, and before cold weather set in the abutments, piers and three of the arches were completed. Work was then suspended during the winter until April of this year, when it was again taken up, the structure being finally finished early in July. The quantity of concrete in the structure is about 4,000 cu. yd., and the total contract price was $43,250.

Six-Span Highway Bridge over Catskill Creek at Catskill, N. Y.

The arch reinforcement consists of twisted steel rods, the longitudinal rods being of 1-in. material on 2-ft. centers, and the transverse rods of ½-in. material on 2-ft. centers. The reinforcement of the hand rail consists of two 1-in. twisted steel rods in the base and one 1-in. rod in the hand rail. The spandrel walls contain no reinforcement except immediately over each pier where two 1-in. twisted rods have been placed to prevent cracking in the railing due to settlement of the piers. The latter have no reinforcement.

The concrete for the arches was a 1:3:5 mixture, made with crushed limestone and trap and Catskill Portland cement. The railings are of a 1:2:4 mixture. All of the concrete was cast in place except the balusters, which were made at the contractors' plant in Hackensack, N. J. A Ransome mixer was used in making all of the concrete at the bridge site.

No especial difficulties were encountered in the construction of the bridge, and though the creek rises rapidly at times, the contractors were fortunate in escaping any serious floods. An old bridge which spanned the creek at this point was removed before beginning the new structure. During construction the traffic was diverted to a bridge lower down on the creek. All of the piers are founded on solid rock.

The bridge was designed and built by the F. R. Long Co., Hackensack, N. J.

An Unusual Boiler Plant is in use at the Moran ship building plant at Seattle, Wash., consisting of a battery of 12 vertical fire-tube boilers arranged in a circle around a refuse burning furnace by which they are heated. The boilers are 5 ft. in diameter by 18 ft. high and the circle is 19 ft. in diameter. The refuse burning furnace has a large conical grate. The space within each boiler constitutes the combustion chamber from which the gases pass down and thence up through the boiler tubes to the chimney, a large conical shell covering all the boiler tops and terminating in an 8 ft. stack. The refuse, consisting of slabs, sawdust and waste material from the saw mill, is fed to the furnace from a large elevated hopper, into which it is delivered by a conveyor from the mill. The entire boiler plant is easily attended by one man on each shift. The saving over the use of coal, at present prices in Seattle, is stated in the "Marine Review" to be over $100 per day.

The Artesian Water Supply of Australia.

By C. O. Burge, M. Inst. C. E.

There is such an extensively utilized artesian area in the United States that it is of interest to learn what is being done in this work in other parts of the world. Recently nearly all the inhabited parts of the Commonwealth of Australia have been blessed with ample rains, and in consequence a boom in production of all kinds has followed. In former times such occurrences there led to the extraordinary delusion that drought would never recur, and few steps were taken to provide against it. Railways were more or less rapidly pushed into the interior, forgetful of the prime necessity of giving them something to do in those almost regularly recurring periods when, as regards the inland districts especially, the rainfall was much below the average, and crops and stock suffered seriously. To any one who has once ridden over these drought-stricken plains of Australia the recollection is vivid indeed. Boundless vistas, with stunted bush and bare brown surface below, and above the prodigal sun and the brassy sky, for months unsoftened by even a fleecy cloud; skeletons of sheep all around the dying flocks, which are scarcely able to reach food or water, if either could be found; the trunks of the shadeless gum trees, gnawed for food by the gaunt rabbit, too weak to run from under the horse's feet; and all this with the deceptive mirage spreading out, in the distance, lakes of visionary water, with trees and rocks reflected in its shining surface—all these are things never to be forgotten.

The want of prevision which has prevailed so much in Australia has never existed in India, the natives to the best of their ability providing irrigation works on an extensive scale in remote ages, and the British adding to them by the magnificent works which, side by side with the construction of railways, have given an ample return for the large capital expenditure incurred. As an instance of what is here stated, New South Wales, the greater part of the area of which is subject to these periodical droughts, has practically done nothing, commensurate with its wants and capabilities, in the conservation of surface water, beyond surveying and reporting, until a few months ago, when a great scheme for the utilization of the Murrumbidgee River waters was decided upon. This will undoubtedly reclaim a large area of possibly drought stricken, though otherwise fertile, land. Victoria, though her needs are not so great, owing to a generally more regular rainfall, has been somewhat more vigorous in the past, but, taken as a whole, irrigation has been exceedingly neglected throughout Australia. The future prospects of the commonwealth, therefore, are all the more hopeful now that some substantial efforts in this direction are being made, showing that if, generally, a prosperous career has, so far, been the characteristic of the Southern Continent of the British Empire, how much more will this be the case under the newly awakened condition of its inhabitants as regards the value of water.

Among these substantial efforts are the utilization of the artesian water which has been going on for some time in Queensland and New South Wales, and, though the quantity of water from bores is insignificant, as compared with that from surface supply, and though it is limited to the artesian area, large as that is, yet a great deal has been done chiefly in the direction of watering stock. An ideal artesian basin is only to be found where the water-bearing strata dip in the middle of the area, outcropping all round at a higher level than that of the surface at the sites of the bores. Most of the artesian basins known throughout the world, however, are not of this ideal character, there being a break in the continuity of the porous outcrop somewhere, leaving a leakage, which more or less seriously draws away some of the supply otherwise released by

the bore. The great artesian basin of Australia is of this latter type, the intake beds outcropping along its eastern and northeastern sides only, while the remainder of the water-bearing formation leaks into the Gulf of Carpentaria or is hidden under the superficial deposits forming the plains of the interior of the states.

With a map of Australia before us we can easily trace the boundary of this great area. Beginning at the southwestern coast of the Gulf of Carpentaria, it runs irregularly southward to the 25th parallel of latitude, thence westerly to about 133° east longitude, thence south to the 31st parallel, along which it bears easterly, but with many indentations, to near the town of Dubbo, in New South Wales, which is the southeastern limit. The eastern and northeastern boundary, from which the chief supply comes, is roughly parallel to the east and northeast coast, about 150 miles from it in New South Wales, and over 200 miles in Queensland, joining the coast again about 100 miles from Cape York, on the eastern side of the peninsula of that name.

The greater portions of this area are in Queensland, 376,000 square miles, and in South Australia, 110,000 square miles, but in the latter it is mostly in an undeveloped and unexplored territory, while the smallest portion, 83,000 square miles, included in the area in New South Wales, is a settled, though not populous, district. The area of intake beds is about 50,000 square miles in Queensland, and 18,000 square miles in New South Wales. Victoria and Western Australia are both outside the area. Except for a strip about 100 miles wide on the eastern and northeastern side, the area is within the zone of 20 in. annual rainfall, and further inland of the 10-in. zone, and it is the character of these zones to absorb and evaporate much of the rain falling on the surface. The Murrumbidgee, the Lachlan, Darling and other rivers are much larger in the middle of their course than at their outlet, where they join the Murray, the water spreading out into lagoons between these points and being lost largely by evaporation.

To return, however, to the artesian area. This has, in the opinion of some experts, ocean outlets not only at the extreme north, as shown by the description of the area given above, but also to the great Australian Bight, to the south, but the latter view is disputed, and Professor Gregory, of Melbourne, opposes it. In his recent work, "The Dead Heart of Australia" (1906) he says: "The only available outlet is northward over a rock barrier into the Gulf of Carpentaria, or possibly eastward to the South Pacific. The fact that the main artesian basin has no regular outlet and is enclosed by a rim complete to west and south, and has only a narrow shallow lip to the north, and perhaps another to the east, shows that the deep central waters are old accumulations. The wells are the modern artificial outlets from a vast reservoir, which is almost entirely enclosed, and the waters discharged from it must have been collected during the course of centuries and probably of past millenniums. Nature has stored up a vast but probably a limited supply in a safe underground reservoir. That water, if prudently used, would probably last till Central Australia were so well occupied that it could afford to provide a more costly supply." As to leakage from the basin, Mr. Pittman, the government geologist of New South Wales, points out that any accumulation of water, underground or surface, must eventually become salt, unless it has an outlet, due to dissolution of saline matter from rocks or soil, and that, therefore, all artesian basins affording potable water must have leakage.

A recent interesting and voluminous paper on the artesian resources of New South Wales, by Mr. Percy Allan, M. Inst. C. E., M. Am. Soc. C. E., read at the University of Sydney, and the valuable annual reports of Mr. J. B. Henderson, M. Inst. C. E., hydraulic engineer for the Queensland government, enable fairly up-to-date figures to be given on this subject. The first bore in New South Wales was in 1879 on the Killara Station, between Boweke and Wilcarmia, which, though successful, was on a small scale, being only 140 ft. deep, but the owner of Kerribee Holding, near Bourke, followed with one of 1,073 ft., yielding 350,000 imp. gal. per day. The government started work in 1884, and up to the date of the latest figures there are 412, of which 41 have been failures. Of these bores, 130 have been put down by the government. The deepest bore in the state is that at Dolgelly, near Moree, 4,068 ft. deep, but the finest example, taking the flow into consideration, is the Euraba bore, in the same district, at a depth of 4,005 ft., giving a flow of 1,097,420 imp. gal. per day, the finishing diameter being 6 in. Mr. Allan gives the following average example, occurring at Rowena, near Walgett. This bore was sunk to a depth of 2,669 ft., at a cost of $11,880, having a flow of 924,990 imp. gal. per diem, which, by means of 41 miles of distributing channels, constructed at a cost of $4,051, including headworks, divisors, drops and culverts, waters 55,405 acres. The total cost was about $16,195, the benefit derived, according to experts, being about $1,920 per annum. The rate charged was equivalent to 0.022 cents per 1,000 imp. gal. The temperature of the artesian water at the bore mouth varies from about 78° to 135°, not always according to depth, but exposure to the atmosphere quickly reduces it, as a rule. However, the district being largely in the hottest part of New South Wales, the temperature of the air is occasionally higher than that of the water. The present writer once used, in the hot season, the baths at Moree, supplied by artesian water at 110°, from a depth of 2,793 ft., and could not make up his mind whether the air or the water was the cooler or more refreshing, or, perhaps metaphorically, which was the frying pan and which was the fire.

In Queensland the government was first in the field at Blackall, and there are now over 1,130 bores, of which about 11 per cent. were put down by government. Many inland towns are now supplied with water from artesian bores, among others Blackall, Cunnamulla, Aramac, Charleville and Roma. The deepest bore is that at Bimerah, which was sunk 5,045 ft., but the supply is small, while the aggregate amount of sinking for the whole state is upwards of 225 miles. The highest flow from any single well is 4,000,000 imp. gal. in 24 hours. Trouble, of course, arises from the presence of alkalis in both states, this being, according to Mr. Henderson, inimical to plant life when over 30 grains per imperial gallon are found. The mineral salts in these waters generally exceed those in the artesian supplies of America, but, on the other hand, the soil in the latter, within the districts served, is more impregnated, and the combination is frequently greater than in Australia.

It is, however, generally agreed that, with some exceptions, on account of quantity and quality, artesian water in Australia is not suitable for irrigating crops, except on a very small scale, but immense possibilities are in view from its provision for keeping stock of all kinds in good condition at all times, and in preservation of life in times of drought. A bore with a flow of 1,000,000 imp. gal. per diem, while only capable of properly irrigating some 400 acres, will provide sufficient water for stock purposes over an area of about 80,000 acres. Extending right through New South Wales, in all directions, are strips of country from half to one mile wide, reserved by the government from private sale or use, through which stock travel from one part of the state to another and feed. Where these intersect artesian country, bores are provided at the public expense, there being an average of one bore to 1,280 acres of the reserve. Including these, and summarizing, there are in New South Wales, according to latest figures, 114 successful government bores, serving 2,122,254 acres, and 257 private ones, the scope of which, if in proportion, would bring the total up to 4¾ millions of acres, the stock on which are served by artesian water. In Queensland, whether it is by ill luck or bad management, the proportion of successful to the total number of bores is much less than in New South Wales; 596 constitute the number of the former, these being mostly in private hands. The total daily flow is estimated at nearly 400 million imperial gallons. Though agriculture has been making great strides lately in Australia, the pastoral industries still are, and for many years to come will be, the chief basis of the prosperity of the commonwealth. Hence, it is interesting to know that a still only partially developed adjunct to the unrivaled wool supply of the world which she affords, is available over such a large area as that described in this article.

Book Notes.

The "Proceedings" of the third annual convention of the National Association of Cement Users is a volume of 340 pages of information of the highest value to engineers, architects and contractors. A report of the convention was published in the Current News Supplement of this journal on January 19 of this year, and it is consequently unnecessary to review the contents of the book at any length at this time. It is particularly valuable for the information it gives on the artistic treatment of concrete, waterproofing and concrete block manufacture, although many other subjects are taken up. The association is essentially one for the interchange of information relating to the practical use of concrete, and its "Proceedings" bear witness to this fact throughout. The editing of the volume has been done by the president, Mr. Richard L. Humphrey, who has eliminated irrelevant matter and repetition of ideas with much skill, thereby increasing the value of the contents to the busy reader. (Philadelphia, National Association of Cement Users, Harrison Building; $3.)

About a year ago the Minister of Public Works of France issued a set of regulations concerning the construction of reinforced concrete works. The reprints that have been made of that circular contain many typographical errors and for this reason it is rather gratifying that the first part of the important work entitled "Recueil des Types de Ponts pour Routes en Ciment Armé," by Messrs. N. de Tédesco and Victor Forestier, contains the full text of the circular and the official instructions concerning it. The regulations in question unquestionably form one of the most important indications the engineer has concerning safe design in reinforced concrete, but they are necessarily somewhat vague in many respects, so as to allow the designer an opportunity for meeting individual conditions and following personal inclinations. The object of this work under review is to explain the application of the regulations to the design of highway bridges of 4, 6, 8, 10, 15, 20, 25 and 30 meters span. In the computations for these structures, the authors have endeavored to follow the spirit of the regulations and to utilize those methods of computation which give maximum economy without entailing too elaborate calculations. The book is probably the most complete explanation of the application of such important reinforced concrete regulations that has yet been attempted. In addition, it gives all the details of a large number of computations that cannot

fail to be useful to those who desire to study the methods of design recommended by the authors. This study is much facilitated by an atlas of plates giving to a large scale the drawings of the various bridges referred to in the text. These are essentially working drawings and are executed in an excellent manner. (Paris, Ch. Beranger, 15 Rue des Saints-Peres, 25 francs.)

The attention of all interested in the teaching of mathematics in engineering schools is particularly drawn to the first volume of "A Course in Mathematics," by Prof. F. S. Woods and Prof. F. H. Bailey, of the department of mathematics in the Massachusetts Institute of Technology. This volume is the most important American outcome of the deep impression recently made by the advocates of a reform in the methods of teaching mathematics. Such instruction may be viewed from two distinct standpoints. If the purpose of the instruction is to introduce the student to mathematics as a branch of pure science, in which he may later carry on research work, the best method may possibly be different from those adapted to acquainting a prospective engineer with one of the most useful helps science has to offer him. It is generally held to-day that without any sacrifice of accuracy the methods of instructions best adapted for the mathematical classes in a technical school are those which carry forward at the same time various branches. In the old methods of instruction it was customary to finish algebra before taking up analytical geometry, to finish analytical geometry before taking up the calculus and to finish the calculus before beginning mechanics. As a result of this it was only students with good mathematical memories who were able to appreciate as fully as desirable the relations between the various branches. Such a plan is entirely abandoned in this new course, which, it should be stated, was prepared at the invitation of Prof. H. W. Tyler, head of the mathematical department of the Massachusetts Institute of Technology, and has received the benefit of his criticism. In the first volume, which alone has appeared as yet, there is an introductory chapter on methods of elmination, including the use of determinants. The student next takes up the methods of plotting functions, and is thus introduced early in his course to this valuable practical method of understanding an equation. The study of the algebraic polynomical, including the analytic geometry of the straight line, the more important theorems of the theory of equations, and the definition of a derivative comes next. This enables the student to obtain early an introduction to the principles of the calculus, which is particularly desirable. The study of the algebraic function in general is next taken up, and in doing so the student's knowledge of analytic geometry and calculus is enlarged by new applications of the principles previously stated. Simple integrations are also introduced at this time. Curves are taken up and the student is introduced to this interesting portion of analytic geometry without being confused by the idea that it relates solely to conic sections. After this, the study of elementary transcendental functions is begun and finally the year's course closes with a study of the parametric representation of curves, polar co-ordinates and curvature. It will be noticed that no work in three dimensions is taken up in this course, that being deferred for the second year. It has already been stated that the book is primarily for the use of engineering students; it may be questioned, however, whether the student who takes up mathematics as a branch of a liberal education will not find this method of approaching the subject more satisfactory than the traditional one of attacking one branch at a time. The relations between the several branches taught in undergraduate courses is so intimate that it is safe to say only a student of exceptional natural mathematical ability can acquire so good a knowledge by pursuing one branch after another as by taking them up in the way outlined by Professors Woods and Bailey. It should also be stated for the benefit of engineers who wish to review their mathematical studies that this volume will be found an excellent help for the purpose. It is clearly written, well printed and illustrated, and contains a large number of examples which will be particularly helpful, for it is a well-known fact that a thorough comprehension of a mathematical method is only possible after it has been applied in the solution of a well selected set of problems. (Ginn & Co., Boston; mailing price, $2.40.)

A book that should prove instructive to a wide circle of readers is the "Balancing of Engines," by Mr. Archibald Sharp, who has already contributed a paper on certain features of this subject to the "Proceedings" of the Institution of Civil Engineers. Some ten years ago the methods of balancing were mainly of importance to locomotive designers, but since then there is hardly any prime mover in which balancing has not become prominent. When alternating current generators came to be operated in parallel, the balancing of steam engines at once attracted general attention, and during the last two years everybody interested in automobiles knows that the most debated subject is the relative advantages of six and four-cylinder engines, which depend primarily on the balance of the two types. Up to the present time about the only volume discussing the subject in a detailed manner has been one by Prof. W. A. Dalby, and this smaller work by Mr. Sharp is consequently of particular importance. It is much simpler than the book referred to, and employs graphical methods to a greater extent than the work by Prof. Dalby; the difference in the assumptions made at the outset of the two discussions may lead the reader to believe the results in the two treatises are different, although the difference is only apparent. The volume is unusually thorough, beginning with the primary phenonoma of motion and force and the preliminary theorems in mechanics which are essential for a proper understanding of the problems and methods of balancing. The inertia forces of revolving and reciprocating masses, the inertia forces of second and higher orders, and the transverse couples due to connecting rods are discussed at length. Engines with cylinders in different longitudinal planes receive especial attention. The author then takes up in turn the kinetic energy of pistons and connecting rods, the torque on crank shafts, primary and secondary balances, and finally the displacement of engine frames due to unbalanced forces and couples. There is a special chapter on the engines best adapted for various purposes, considered with respect to their balance, and finally the author gives a forecast of the future development of large gas engines. To make the work as useful as possible to students, a series of exercises, with answers in some cases, is appended at the end of most of the chapters, some of these questions being taken from the papers set at the qualifying examinations of the Institution of Civil Engineers. Some portions of the book are entirely new, others are taken from the author's paper previously mentioned, and the author expresses his especial indebtedness to the work by Prof. Dalby. On account of the widespread interest in the subject, the appearance of a book by one who has made such a specialty of it, is particularly timely. (New York, Longmans, Green & Co., $1.75.)

Letters to the Editor.

TEMPERATURES IN BEEHIVE COKE OVENS.

Sir:—Can you refer me to any information on the temperatures in beehive coke ovens, both inside the oven and on the back of the retaining walls? I am interested in the design of a concrete oven and will appreciate any information you can give me on the subject. Yours truly,

E. HORTON JONES.

Dawson, N. Mex., Oct. 9.

[There is very little information available in the usual sources of such data concerning the temperatures of coke ovens. Probably tests to determine them have been made, but they have not been recorded for ready reference. The temperature within a coke oven of the by-product type, as shown by tests reported by Dr. Schniewind in Sydney and Mr. Hilgenstock in Germany, probably does not much exceed 1,800° Fahr. at any time during the coking operation. It does not necessarily follow, however, that this is the maximum temperature in a beehive oven. In the latter the heating gas burns under the arched roof, heats the brickwork of the roof and the heat is reflected upon the charge of coal beneath. Therefore, the temperature of the roof is very probably higher than that of the charge itself. In the same way, in a by-product oven, the gas burns in the flues, heating the coking charge by transmission through the oven walls. The heat in the flues is unquestionably higher than any temperature the coking charge itself will reach.

In a general way, it may be said that the inside of a beehive oven in full operation will be light red to orange in color, though the heat is not always so great as this. Refractory materials of excellent quality are needed for the roof of a beehive oven, but this is particularly because the hot walls are quenched by water from a hose when the coking of a charge is finished, the sudden cooling being very severe upon any quality of fire-brick as may be imagined. Concrete is manifestly bound to fail if used for a lining. Just what is meant in the inquiry by the temperature "on the back of the retaining wall" is a little indefinite. If it means the temperature at the outer surface of the firebrick lining of the oven, this is probably a low red temperature, or even hotter, depending on whether the bricks are exposed to the air or covered with masonry. In conclusion it might be said that inquiry among oven operators shows that the only way of testing a new form of construction is to build a few ovens and operate them regularly.—Editor.]

THE OCEAN PIER AT LONG BEACH, CAL.

Sir:—It is a problem of no mean proportions to build an ocean pier of any considerable length, and one that will endure, on the Pacific coast. In the first place, storms coming from the northwest, west or southwest, sweep full force against the coast, having no bar to encounter. In the next place, these storms are frequently of great violence and roll up tremendous seas against the shore line, and it takes a very solid structure to withstand their force when exposed to it. Again, there are very powerful undertows on the Pacific coast, and there are, therefore, strong submarine forces to be resisted in ocean pier construction, at the same time.

Yet, along the California coast quite a number of piers of this class are maintained. Some are designed for the handling of freight and passengers, while others are mere pleasure wharves located at popular seaside resorts. One of the most substantial and up-to-date piers of the latter class is at Long Beach, a resort that gets the great bulk of its patronage from Los Angeles and contiguous region. It was designed by, and constructed under the supervision of Mr. Howard C. Holmes, of San Francisco.

It is composed of a wharf and a double-decked approach. The wharf is 100x300 ft., while the approach is 1,299 ft. long and 32 ft. wide.

The water at the outer line of the wharf is 30 ft. deep at low tide, and both wharf and approach are supported by reinforced concrete piers, after Mr. Holmes' well-known patent. The longest cylinder pier used on the construction is 56 ft. in length, and the piers generally are driven from 10 to 18 ft. into the ocean bottom, which is composed of sand. They are all 4½ ft. in diameter, and those supporting the wharf proper are placed 16 ft. apart on centers.

The approach is built of bents, 20 ft. on centers, consisting of two 12-in. I-beams for caps, supported by two reinforced concrete cylinder piers. The stringer system supporting the main deck consists of 4x16-in. Oregon pine timbers, on 2-ft. centers, excepting under the line of posts supporting the upper deck, where 12x16-in. sills are placed to support the superstructure. The outside stringers are of 6x16-in. Oregon pine timbers, and these with all of the above-mentioned stringers, are attached to the double I-beam caps, with cross-clip and I-bolt fastenings, thus avoiding boring and framing the stringers. Both sides of the approach are lined with heavy hand rails supported by 6x6-in. posts placed 10 ft. on centers. The middle of the roadway is used for teaming; and there is a walk on either side, 6 ft. wide, for promenading and fishing.

The upper deck of the approach is 21 ft. wide and 13½ ft. between decks. The upper deck is supported by 12x12-in. posts on 10-ft. centers, having 19-ft. spans in the clear. The main cap of the posts consists of 12x16-in. timbers tenoned into the posts. The deck is sheathed with a double layer of cedar planking. The stringer system consists of 3x10-in. Oregon pine timbers, 2 ft. on centers. The outside stringers are composed of 6x10-in. timbers. The hand-rail on either side of the upper deck consists of 4x8-in. timber supported by 6x6-in. posts, 10 ft. on centers.

Ornamental braces from main posts to main caps supporting the upper deck, materially strengthen that part of the structure. The brace is in the form of a bracket built up of 4x4-in. angle irons placed back to back, the whole forming a very rigid brace, and at the same time obstructing the roadway in the minimum. The upper deck is sway-braced longitudinally with 4x10-in. timbers.

In order to make the structure as attractive to the eye as possible, it is painted throughout. The sub-structure is of a deep maroon with cylinder hoops painted black for an agreeable contrast. On the main roadway all railings and exposed woodwork are painted a rich olive green, while the hurricane deck is left dead white. At the end of the pier proper is a pavilion patterned after a Swiss chalet. In this pavilion every afternoon an instrumental concert is given at the expense of the city of Long Beach. Surrounding the pavilion are refreshment booths and space for those who desire to fish from the wharf. The wharf is also arranged for the mooring of vessels of any size.

This wharf has now withstood the fury of the Pacific gales for four years without showing a sign of weakness, although the waves sometimes break to a height of 24 ft., and the sands underlying the sea are at times plowed up to a depth of 13 ft. by the powerful undertow.

Yours truly, H. A. CRAFTS.

RELATIONS OF THE PUBLIC SCHOOL TO THE INDUSTRIAL TRADES.

Sir:—The engineering public is at the present time deeply interested in matters relating to education in industrial lines. The old time apprentice system has been worn threadbare; in fact, it has almost ceased to exist. Modern manufacturing methods tend only to the making of the specialist in machine tool operation, or in hand work. Excessive specialization has thus prevented the development of the all-around mechanic, and what is more vital still, of the broadly experienced, competent manager of men, the foreman or superintendent. Sporadic instances have appeared during the past few years where manufacturers have sought to establish effective means of giving their young employees a more general knowledge of the specific industry than can be obtained through any of the ordinary channels. Privately-maintained trade schools have bent their efforts to supplying the opportunity for those to learn who really want to learn a trade.

The public schools have assuredly been lacking in their ability to cope with the problem. The manual training school has laid the foundations for the engineering professions rather than for the mechanical trades.

With this exception, vocational training has been practically non-existant in the public schools, and even direct preparation therefor has formed a meagre part of the curriculum.

But it is now generally recognized that the concerted effort of the municipality and the commonwealth is necessary to provide what the middle, the so-called working classes, so much need, namely, education in particular trades.

It is not surprising that Massachusetts should be taking the lead in this movement. Through a Commission on Industrial Education, it is working out plans by which vocational schools may be established and maintained at the joint expense of city and state. Evening schools are already operated under these conditions.

But particularly interesting, as indicative of the trend in education, are the changes which are now being made in the school system of Boston. A radical move has been made in the reduction of the elementary school course from nine to eight years. This will provide for an earlier entrance upon industrial training.

There has been a distinct change in the ideals. Teachers are no longer to measure their success by the number of pupils that reach a certain fixed and traditionary standard of scholarship. Success will rather be judged by ability to provide work of such a nature that all of the scholars not grossly indolent can reach a satisfactory standard: To have twenty per cent. of a class fail to pass is full proof either that the work is not adapted to the class, or that the teacher is inefficient, and yet in many classes, the percentage of failure has risen to thirty-five or even forty per cent.

It is boldly asserted by the Superintendent that "if now and then a pupil should fail to do the work, it would perhaps be justifiable to say that he is not qualified to profit from high school instruction, and that he should be excluded from the school; but when twenty-five per cent. of all pupils in the high schools of the city fail to do the work required, a course of exclusion cannot be successfully defended. These pupils are as justified in demanding high school instruction adapted to their needs, as are the pupils who find it possible to do the work now offered."

Consideration is therefore being given as to how the high school needs to be modified in order to make pupils meet the present standards. Investigation has shown that out of two thousand boys seeking employment, nearly fifty per cent. would have remained longer in school could they have been taught even the rudiments of a trade.

Already a Girls' High School of Practical Arts has been established, with a course of study four years in length, with conditions of admission and graduation equivalent to those required in the regular high schools of the city. Its purpose is to give a greater opportunity for development of that type of pupil whose talents lie more in lines of doing and expression than in lines of acquisition.

The High School of Commerce is just entering upon its second year. This is definitely a vocational school, seeking to give the most effective preparation for participation in commercial life.

For many years it has been impossible to admit to the Mechanics' Art High School all of the pupils applying for admission. The facilities are now being largely increased. It is manifest that the ideals of this school will need some adjustment in order that the training may be made more definitely vocational.

It is recognized that efforts to incorporate industrial training in the elementary schools must still be looked upon as experimental. To this end changes are being made in the courses in certain districts under which certain boys will be given a much larger proportion of industrial training than is provided in the regular course.

The evening schools continue to give more or less vocational training. The teachers realize that a great many people are seeking industrial and technical instruction in correspondence schools. In fact, the Director frankly states that "the instruction pamphlets published by some of the correspondence schools on technical subjects are superior to anything I have seen in public school text books."

To rival such instruction in the evening schools, or in day schools devoted to vocational training, would manifestly entail large expenditures for equipment and maintenance. The problem is, however, simplified by the attitude of the state through its Commission on Industrial Education. In accordance with the law, and under the supervision of this Commission, municipalities may be in part reimbursed for such expenditures as they may make for the maintenance of industrial schools. This Board is instructed to consider and report upon the advisability of establishing one or more technical schools or industrial colleges, providing for a three or four years' course of extended training in the working principles of the larger industries of the commonwealth.

The Commission already expresses its belief that for pupils of fourteen or fifteen years of age, four years' instruction might be provided, so that the first two years would cover general shop instruction relative to mathematics, drawing, natural science, and English, and that the work of the last two years, or which could be gradually completed during a longer period in the evenings, or on the part-time system; meaning part of the time in the factory or shop, and part of the time in school during working hours, whether in the same day or at intervals of several days, or even weeks, by pupils who were obliged to go to work at sixteen, should give the shop instruction for particular trades. The Commission intends to provide effectively for evening pupils, and to make every effort to secure the co-operation of employers, to the end that part time courses for apprentices may be established in the proposed schools.

The efforts in Massachusett and other states will be watched with much interest, in contrast to those being made in the trades themselves, under the direct supervision of the employers. It is reasonable to anticipate that eventually the best results will be obtained through a harmonious combination of effort; the public schools laying the foundation, and the respective trades furnishing the superstructure. C. E.

Boston, Nov. 7.

LIGHTHOUSE CONSTRUCTION is being conducted under great difficulties at the Ar-Gazeck reef on the French coast near Ushant. The late Eugène Potron left £16,000 toward the construction of this light, which the government undertook to build. During 1904 the swiftness of the currents prevented more than 52 hours' work on the foundation, more than 206 hours in 1905, and more than 152 hours in 1906. During three years, therefore, only 51 days of 8 hours were available for the work.

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TABLE OF LEADING ARTICLES.

Back-Lash in Engineering Education.

President Schurman's call for a broader training for engineers, upon which brief comment was made last week, ought to arouse active interest and should lead to reforms. To put the matter plainly, a four-year technical course taken from the datum plane of the ordinary collegiate admission requirements fails to put the graduate where he ought to be. Modern science has expanded so rapidly that the best training of the engineer demands more time than is now comfortably available for it. And at present the difficulty is becoming every year more serious. There is a strong feeling among thoughtful educators that for a man to make the best of himself he must have something more than mere technical details in his college course, and the available time is scant even for these details, as the courses are generally arranged. President Schurman's remedy is boldly to increase the length of the course, taking five to six years for it instead of four. Two other ways leading to similar results are open; first, raising the admission requirements; or, second, making the technical course proper essentially post-graduate as Harvard University has done in the case of the Medical School. All these roads lead to practically the same point, a substantial increase in the total time required for a thorough engineering education. It does not seem probable that those who are to be educated will take kindly to the proposition, which will start the young man in independent work at the age of twenty-five to twenty-seven, instead of at twenty-three or so.

Technical education has, as a rule, been built up from the earlier non-technical work in no very systematic way. Courses have been piled one upon another until the aggregate has become burdensome. And going back of technical training, the same kind of unsystematic, time wasting aggregation, bad even if carefully done, burdens the earlier years of preparation. Before adding one or several years to the total, would it not be wise to go down the line and eliminate the back-lash in the mechanism so that the student can be pushed steadily forward, on a piston lift as it were, instead of being pried and jacked up over the present irregular and rather rickety falsework? In the lower schools it is hardy too much to say that indirection reigns supreme. Solemn-visaged "educators" prate by the hour about "natural methods," quite forgetful of the fact that a very large part of the intellectual advance of the human race is due to its success in improving upon these methods. The sad result is that, almost from the beginning of school life, the victim is being dragged over roundabout paths. Nowhere is this tendency more conspicuous than in the study of mathematics, the foundation of engineering. Two or three years of school time are wasted, for example, in pottering over utterly useless ramifications of common fractions. How often does the practical (or theoretical) engineer for instance, have to add 7119/1153 and 419/831, or reduce 0.114 71/79 to its vulgar terms? All the common fractions needed in any proper arithmetical work could be taught the boy of average intelligence in six months of schooling—for the rest leave it to the symbolic treatment of algebra later.

Algebra, which is the basis of all higher mathematics, should be brought into action as soon as its methods direct to the path of least resistance. Why waste brain energy in doing arithmetical "stunts" when algebra was devised for the especial purpose of making them needless? And, similarly, why deal in the further study of algebra with problems which belong fairly in the domain of trigonometry or analytical geometry or calculus? Such indirect methods are not even defensible as mental discipline, since the effort put upon them could be better spent in acquiring facility in attacking the same problems by more practicable routes. Analytical geometry and calculus are not difficult save as they demand facility in algebra, and were a really modern and scientific course in practical mathematics laid out the student, without spending an extra hour of time, would reach college with the elements of these branches thoroughly ground in and with the ability to pick the right method for the problem in hand as instinctively as he would grab the right club out of his caddy bag. As it is in mathematics, so is it elsewhere. If boys learned English grammar instead of wandering through the devious bypaths of so-called "language lessons," there would be fewer complaints of the incapacity of college students to write intelligently their mother tongue. Even more objectionable and time-wasting than these zig-zags along the path of learning are the gay excursions up educational blind alleys. If boys parsed more sentences and painted fewer pansies, learned more history and less rum-and-nicotine physiology they would come up as engineering freshmen with less need for apologies.

There is at least a year of worse than useless educational back-lash, even up to the time when the boy reaches the so-called high school. Here more trouble awaits him. As a rule, the teachers in these upper grades are competent and hard-working, but incapacitated by being cramped between the pressure of the college above and the wallow of the educational theorists below. There has been in the last two or three decades so large an increase in the elective possibilities of college entrance requirements that the demands upon the preparatory schools are very severe. The desire for so-called "enriched" courses, a species of effervescence from the grades below, has put many a stumbling block in the straight path through to the college, and the resulting deficiency in essentials often throws up upon the college a burden of training properly belonging in the preparatory school. The net result is that the student enters upon his serious work about a year behind time, and has then too little time for both a general and a technical training. The first step toward broadening and strengthening the technical courses is the expurgation of tommyrot from the lower schools and the alignment of the preparatory schools for straightforward serious work, such as is done by the better German gymnasia. When this is done there will be a material increase of available time in the university. A broader course there is highly desirable, as President Schurman says. If the time set free in the manner just indicated is not sufficient for such broadening, an extra year may have to be added, but a year saved and well utilized ought to bring about a great change for the better. It would certainly be a step of dubious expediency to lengthen the university course without an attempt to strengthen its foundations.

The Modern Highway.

It has become generally recognized, both at home and abroad, that our highways, as they have been constructed in the past and even the best macadam roads of to-day, will not withstand, without rapid deterioration, the concentrated motor traffic to which they have been subjected since the advent of the automobile. The necessity for some radical change which shall involve an improved method of construction or the introduction of some means of protection and preservation is so apparent that the subject is receiving very general attention. But a short time ago in France the Minister of Public Works was authorized by the Cabinet Council to take the initiative in calling an international congress to consider the maintenance of roads suffering from motor traffic and for devising some means for adapting them to the new conditions which they must meet, and an equal interest has been taken in the subject in England. Massachusetts, always a pioneer in such directions, has devoted much attention to the problem of the protection of its elaborate system of highways and parkways, and what has been done there has been watched with the greatest interest. No one has recently gone over the Revere Beach Parkway, a stretch of three and a half miles in the suburbs of Boston, without remarking on its excellent surface and entire freedom from dust. In the same way the manner in which the dust has been suppressed

on Commonweath avenue and on the park roads under the Boston Park Department, by the application of oil emulsions, has attracted attention. As to the cost of these undertakings, and that of their maintenance, there has been a great curiosity, which has been recently satisfied by the facts given in a series of papers presented last week before the quarterly meeting of the Massachusetts Highway Association in Boston, an abstract of which appears on page 570 of this issue. These data are of extreme interest to all who construct, maintain or use our roads, and they speak for themselves, but there are one or two points to which particular attention should be drawn. The very startling fact is announced and confirmed by several observers in Massachusetts that a macadam road of the best form of construction when subjected to motor traffic will last, at the most, when unprotected in any way, but two years, while, under less favorable conditions, near Lynn, a mile of almost perfect roadway had to be resurfaced after a year. The importance of the problem of maintaining the highways of that commonwealth is, therefore, apparent, even if the state of affairs is not as serious in other localities in regard to which as complete data are not available.

That something can be done to prevent the destruction of macadam roadways by the application of tar and similar substances, and at a cost which is not prohibitive, is very convincingly shown by the data in regard to the Revere Beach Parkway and the macadam roadway in Lynn. The cost of the treatment of the former averaged but 7.3 cents per square yard in 1907, while the maintenance of the work of 1906 averaged, for the entire surface, only 3.5 cents. At Lynn, the cost of tarring was 8.7 cents. With greater experience and with better facilities for working, this will, no doubt, be reduced. The results are such as to encourage further trials. Data in regard to the further cost of maintenance, after two or more years have elapsed, will be looked forward to with much curiosity.

It is of interest to note that roads with gravel surfaces are pronounced more satisfactory for motor traffic than macadam as constructed in Massachusetts, that such roads are more susceptible to treatment with oil, and that gravel or even sand is regarded as superior to crusher screenings as a covering for the tar after it is applied to the road. In France, it must be remembered, sand or the sweepings from the road itself, as it is cleaned before the tar is put on, is the material in use, although it is not spread until at least twenty-four hours after the tar to permit of its absorption. The Massachusetts practice of following up the tar at once with screenings cannot be the best unless the application is so thick that it is sufficient to work up through the screenings under traffic, and such an amount was suggested by one of the speakers.

Massachusetts has done nothing, however, in the way of tar macadam, with the exception of a small experiment of three or four hundred yards in Watertown, and data are sadly needed as to the value of this form of roadway. As properly constructed in England, especially with slag and crude coal tar on the Thames embankment, it has given some satisfaction. Recent experiments in this direction in New Jersey will be watched with care, and will, perhaps, enable us to determine whether the treatment of the broken stone for the second course and for the surface with tar before it is rolled will repay the additional expense involved. It certainly gives the road more elasticity and makes it, to a certain degree, more waterproof.

Another very striking point brought out at the meeting is the great relative economy attained by the Boston Park Department by the use of oil emulsions, as compared with water, in suppressing dust on the park roads, the saving being in the neighborhood of 50 per cent., or $333. per mile, while a distinct binding effect is observed in the surface, as the oil accumulates from the numerous sprinklings.

The papers read at the meeting are a most valuable contribution to the problem of the protection of our roadways and the suppression of dust, and are worthy of very careful study on the part of our road engineers.

The Conservation of Water.

The California case reported a fortnight ago in The Engineering Record, wherein the right of the State to regulate the use of artesian wells was affirmed, awakens a train of thought of serious import. The day is not far distant in which the water supply for the purposes of power and irrigation must be conserved with no small degree of care, and the privileges of individuals must be subordinated to the welfare of the community. In the arid portions of our country long strides have already been taken in this direction. It is hard for those who dwell in a well-watered region to realize how vital is the issue. Those, however, who have seen deserts in California or Navada or Idaho turn at the magic touch into marvellous gardens understand the significance of the decision just rendered. Fancy the situation were all the world arid save for the help given by the mountain snows and a few precious showers. If the ingenuous speculations of Professor Lowell be true, the inhabitants of Mars must have a code of water laws more complete than anything for which this planet can furnish a symbol. It may take well nigh measureless time for the earth to lose its water vapor, molecule by molecule, but the time is already in sight when the diminishing coal supply and the extremes of flood and drought due to denudation will combine to demand action for self-preservation.

One of the features of the California case was the attempt to defy the authority of the State by hiding behind the poor overworked misconstrued Fourteenth Amendment. It furnishes a strange example of an enactment made within the memory of the jurists who interpret it to serve a specific purpose, which they and all men understand, and which has been applied chiefly not to the protection of the grievously oppressed, but to the bare use of individual or corporate adventurers halted by the arm of the Law in attacks upon the rights of the community. In this instance, fortunately, a decision of the United States Supreme Court furnished a precedent directly applicable and affirming the rights of the community in subterranean water by whomsoever the overlying strata might be held. The common rights in "great ponds" and in navigable streams seem also to be beyond the grasping reach of individuals, and the common interest of riparian owners in other streams has been over and over confirmed by statute. It may be pertinent to go a step further and to inquire how far a man is at liberty, for his own private gain, to damage his neighbor's water supply. Has a perverse holder of land the right to injuriously deprive his neighbor of the natural flow of the stream? To press the question home is the holder of a portion of a watershed not liable for the use he makes of it if that use injures others, and is not the State well within its rights in restricting such injurious use? In the case here considered the Judge stated, "it is settled law that all property is held subject to the exercise of the police power," and this power has been repeatedly exercised to protect all those things in which the community has a contingent interest.

In the case of the water supply for power or irrigation, such interest has been clearly and fully recognized. Would it not be well within the proper powers of the State to prevent such indiscriminate denudation of the watershed as would injuriously affect the natural flow of a stream? The questions of fact in such a case may be somewhat intricate. In some instances denudation is permanent unless checked by deliberate reforestation, in others the effect is temporary and the damage is in part naturally repaired. Yet the situation to-day is a serious one, taking the country as a whole, and it is certainly pertinent to inquire whether there is not some more prompt and effective way of preventing irreparable damage than by creating forest reserves. It seems to be well established that the value of forest lands is enhanced by careful management, and not a few large owners of such lands are working them with due regard to the future. If cutting is done in accordance with the principles of sound forestry, the damage to forested watersheds is negligible and the situation may even be improved. It looks very much as if there were a fair opportunity for the State to step forward and say to those holders of forest lands who misuse them: "You shall not so deal with your holdings as to damage the rights of the community to the natural flow of its streams, any more than you are at liberty wantonly and injuriously to divert these streams where they pass over your holdings." The State of New York has done well at last to conserve its public lands and hydraulic rights. Why should it hesitate to prevent damage to these rights by the misuse of private lands? Forestry laws cannot be regarded as confiscatory, but only as regulative, and in the existing state of affairs they seem absolutely necessary to the future welfare of the community, which, however neglected by individuals, it is the duty of the State to guard.

The Proposed Henry Hudson Memorial Bridge at New York.

The proposed Henry Hudson Memorial Bridge as a masonry structure with its main feature a reinforced concrete arch of 710 ft. clear span is one of the boldest ideas of modern engineering. It was described in the Current News Supplement of the last issue of The Engineering Record. While it is not impossible that some of the minor architectural features of this new design may be criticized, it scarcely seems probable that such dignified, graceful and structurally effective plans for this great memorial bridge will fail of approval of the Art Commission. It does not often happen that the natural features of a location afford such a remarkable opportunity for a monumental bridge as do the surroundings at Spuyten Duyvil, and although various types of structures may harmonize with the setting of the bridge site, there can be no question that the masonry arch is one of the best. The massive dignity of the masonry arch, simply treated so as to give well-balanced and graceful proportions, combines both beauty of outline and structural force. The Bridge Department of the city has therefore acted with sound judgment and good taste in adopting a homogeneous composition of the masonry type, after being convinced of its structural practicability for such a large span.

The monumental character of masonry construction has been fully recognized for centuries, but never before in such a striking manner. The topography at the chosen crossing of Spuyten Duyvil valley affords an opportunity for giving the main arch a relatively great rise, which permits the use of a much longer span than would otherwise be feasible. It has been assumed by some engineers that the limit of length of an arch of masonry of any kind is about reached in

existing structures; in fact, it has been assumed in some cases that it would not be feasible to build even a reinforced concrete arch of a materially greater span than about 350 ft. In reaching this conclusion, the influence of a great rise has obviously not been sufficiently recognized. The 220-ft. clear span of the Cabin John bridge held for many years the primacy of length, then came two European masonry spans of 275 and 295 ft., followed closely by the 256-ft. concrete arch in Philadelphia. Apparently no engineer has satisfied himself that far longer spans of stone and concrete arches than those mentioned were entirely practicable where the local conditions afford the required rise.

It would probably be quite feasible to construct a granite arch of the span and rise found in the proposed Henry Hudson Memorial Bridge, but such a structure would be enormously heavy and prohibitively costly. A thoroughly effective combination of steel and concrete, however, makes the design of this 725-ft. span, from center to center of springing joints, a matter of ready computation and relatively low cost. The basis of such an important problem in design is obviously to combine the steel and concrete so as to develop completely the supporting capacity of the former. As indicated in the description of the plan published last week, it would seem that the most effective feature of the design of the main arch as a structure is the manner of distributing the steel throughout the great reinforced concrete rib. Each unit of four steel angles is thoroughly latticed to form a steel column in itself, and all units are so tied and braced together throughout the entire mass as to constitute not only an effective steel rib, but also a continuous interior banding of the concrete, so as to enhance largely its resisting capacity. This latter feature is in its effect the same as that which governed the design of the compression members of the Thirty-Ninth Street Building from which this journal is issued. The principle of binding together a mass of concrete and thus increasing its carrying capacity by an artificial system of steel running through all parts of it, and at the same time creating thereby a perfect column effect with that steel, is essentially new and in the highest degree effective. It gives to the resulting combination of materials the toughness or tenacity of steel construction with the ordinarily low percentage of steel in reinforced concrete, and permits the use of concrete under the most advantageous conditions yet devised for that material.

The criticism has been made by a New York newspaper that the great arch of this new plan is too experimental to satisfy the requirements of assured safety in such a public work. A 725-ft. arch is certainly unprecedented, but so is any advance on what has hitherto been accomplished. While the proposed construction is bold, it is based upon tried details and processes, and is only an adaptation of proved materials and procedures, established by successful use in actual construction, to a structure whose dimensions exceed those of any masonry bridge already built. It is not in any sense experimental. The general type of reinforced concrete arch has already been employed time and time again, and there is no substantial reason whatever why it should not be employed in this special instance, to which it is so eminently adapted. Reinforced concrete has now been so extensively and successfully used for so many years that its permanent place among the best structural materials available to the architect and engineer is conclusively assured.

The Bridge Department has proceeded with wisdom in providing for four subway tracks below the roadway floor. A rapid transit route has already been tentatively laid out with a view to using this structure, and it is bound to become a part of one of the rapid transit routes to the north of Manhattan Island. It would be a grave mistake to build this bridge without ample provision for subway tracks and the additional cost involved, whatever it may be, is more than justified, it is demanded for a pressing public need. The main architectural treatment of the plan is excellent, to the engineering eye, in that it is simple and dignified. This observation is particularly applicable to the provision made for the subway tracks. In fact the whole project is thoroughly monumental in character and, if executed, will probably rank among the finest public works of the present time.

The Time Element in Industrial Efficiency.

Efficiency of production depends upon many factors. The cost of material, the expense of transportation within the plant, cost of power and of labor must all be cut to the lowest point consistent with reliable and prompt service if the work of the establishment as a whole is to be effective to the maximum pitch possible with each particular combination of men and equipment. In the power plant a single bad leak in a high-pressure main carrying superheated steam nullifies the economy of the best boilers and engines, and in the industrial plant, where power is but one element of production cost, failure to keep the stock moving from process to process invites an economic waste that may easily be several times as important as the exact make of turbines or gas engines qualified to produce a kilowatt-hour on the smallest coal consumption. The sense of proportion was never more needed in the conduct of large industries than to-day.

It would be idle to deprecate efforts to solve any single problem of production economy. A dollar saved at the coal pile is as valuable as a dollar saved in labor otherwise wasted, but the largest leak should be stopped first. A case in point is found in the years of study given by engineers to the perfection of prime movers, generators and switchboard appliances in the face of the complex uncertainties of the boiler plant. The day has come when the cutting off of half a pound of coal per kilowatt-hour by the scientific study of boiler installations, relations of draft and grate design to fuel quality, and the frequency and manner of firing is considered of even more importance than the reduction of one or two pounds in the steam consumption. Both ends of the plant now stand a fairly even chance of receiving proper study by order of progressive executives. The parallel in the large industrial plant follows in the enlargement of the engineering staff's analytical duties to cover the entire range of production from the storehouse to the side track. In some plants a separate development may be needed to study the problems of production efficiency, but whatever be the form of the organization, there is no doubt about the value of technical methods in the analysis of processes, including both graphic and tabular records.

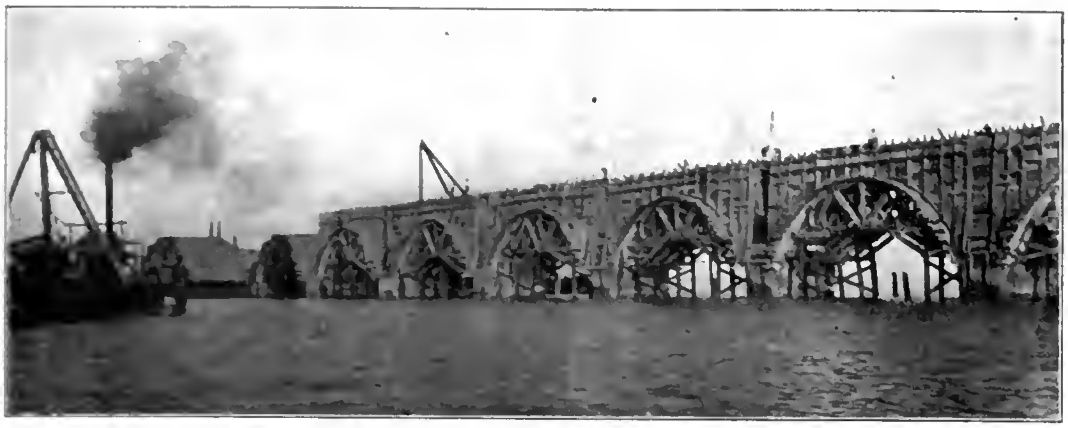
In approaching the general problem of production betterment from the standpoint of the engineer, the time element will often be found the most indefinite of all the factors which enter manufacturing cost. Cost of material and power, as well as administrative, sales and general expenses and fixed charges in the investment may be accurately ascertained; and the cost of labor will be known fairly closely with first-class accounting. A surprising absence of accurate data as to the average time each process and handling of the stock ought to require is very generally felt by the investigator in this field, however. Personal opinion will advance estimates enough from department heads, but there is rarely the same careful tabulation of processes by minutes and seconds, allowing for reasonable steadiness of application on the part of the employee, that there is, for example, in the collection of power costs per department and per piece handled.

It is easy to argue that stop-watch tests on separate processes give little indication of the continuous rate of production which may be expected from a shop force occupied in the manufacture of duplicate parts of machinery, and there is no question that a more intense rate of production will be expected if the results of stop-watch tests alone form the data from which output rates are to be established. On the other hand, the stop-watch test sets a limit, and if averaged over a long series of operations will be of great assistance in additions of separate departmental periods, taken in conjunction with counts of pieces turned out per day or week. Space forbids the extended pursuit of this theme, but the fact remains that the stop-watch test sufficiently repeated by the engineer investigating economy of production has in numerous instances brought to light conditions of surprising inefficiency at some stages in the manufacturing cycle, particularly in the fields of inter-department transportation and assignment of the product to its proper place at the machine tool. It is certainly no more arbitrary to establish an average time in which a piece of work instantly repeated should be turned out by machine tools and transferred from one department to the next over a fixed course than it is to settle the maximum turning speeds of a given tool steel in the high-speed lathe for a fixed quality of stock. The attention given to forcing production by the adoption of high-speed tools, the rebuilding or replacement of machine frames for heavier strains, the use of abrasives in place of cutting tools and the perfection of hoisting facilities are all moves in the direction of time economy, which affects both labor, cost and works capacity.

More accurate registration of time cards is desirable in many plants, for experience at the bench and tool clearly shows to every close observer the opportunity for gross inaccuracies to enter here. In a plant devoted to the manufacture of a single product, the time card presents less chance of serious average error, but in an establishment where the work varies in type, as in the manufacture of boilers of different styles, a time card error of 15 minutes multiplied among several caulkers or riveters is a point worth rectifying at the prevailing prices of skilled labor. The actual sum in a particular case may be small, but the point is to secure the most accurate figures of cost per job consistent with the conditions, eliminating every readily apprehended error. Closer bids can be made for this quality of data.

Aside from the attractiveness of time-saving through careful study of the legitimate duration of separate processes and the shortening of these when feasible, enforced by proper supervision, there accrues from such investigations valuable knowledge of the capacity of departments to handle rush orders. When the delivery is the deciding point on a contract, the ability to figure production times without a heavy estimated margin for contingencies may be worth the cost of several years' routine observation of production rates from the analytical standpoint.

The Conservation of Natural Resources, which is so generally recognized as an important national problem, will be discussed next May at the White House. The President has invited all governors of States, members of Congress and the Inland Waterways Commission to meet then for a consideration of the subject from every point of view.



Spandrel-Wall Forms in Place

THE LONG KEY VIADUCT.

Description of a Two-Mile Reinforced Concrete Railway Viaduct.

By Wm. Mayo Venable, Division Engineer, Florida East Coast Ry.

The first and longest of the viaducts on the Key West Extension of the Florida East Coast Ry. is approaching completion. All of the piers are in, and there remain but a few arches and the filling in of the space between the spandrel walls in a part of the structure before trains can be run over it. This work, it is expected will be finished in time to allow trains to run to Knights' Key by Jan. 1, 1908. The actual concrete work will be finished about the last of November.

The Long Key viaduct is unique. It carries the railroad across an opening between Long Key and Conch Key, where the water varies in depth from 9 to 17 ft., and the tide flows from the Ocean to the Bay or the Bay to the Ocean with a velocity of from four to six miles per hour under ordinary conditions of weather, and with vastly greater velocity during storms or high winds. The velocity under severest conditions is difficult or impossible to compute, for the water from the Bay is actually picked up by the wind when a hurricane visits this region, and carried in the form of spray so swiftly that it cuts the face of a person exposed to it, and a man cannot look against it.

A storm of this character, blowing from the side of the Bay of Florida, occurred during the construction of the viaduct in October, 1906. There were then in place a number of piers, but no arches. All cofferdams and falsework were demolished, but the piers remained intact, justifying their design as capable of resisting the greatest possible attack that can be made upon them from the side of the Bay. From the Southeast, or Ocean side, the exposure is greater, the water being deeper. A liberal allowance has been made for the greatest possible wave that may come across the channel that lies between the keys and the reef, which interposes between the shallower waters about the viaduct and the Atlantic Ocean.

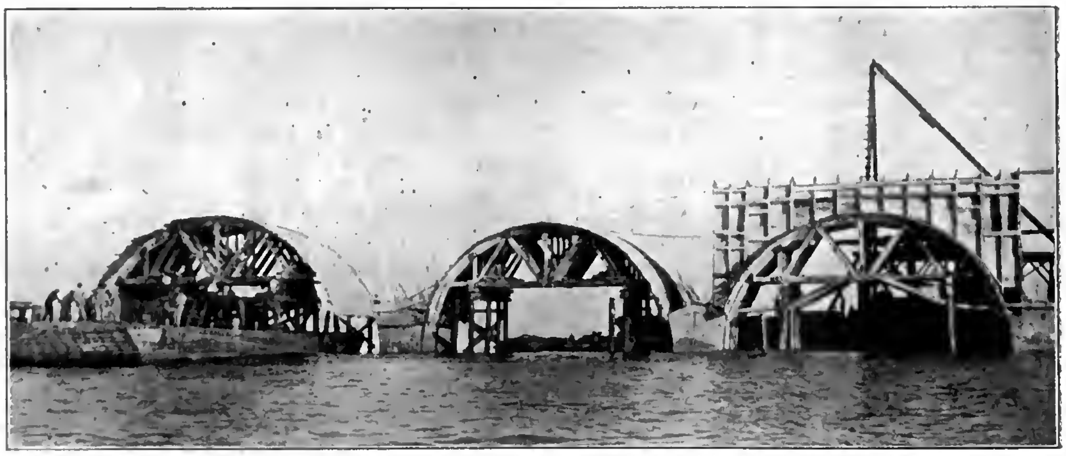
The top of the viaduct is 30 ft. above mean low water. The structure consists of a series of one hundred and eighty concrete arches, heavily reinforced with steel rods, with soffits of semi-circular section. The radius is 25 ft., making the full span 50 ft. from pier to pier, and the height above mean low water 25 ft. Spandrel walls are built on each side of the arch, and rise to a height of 5 ft. above the soffit. Between these walls the space is filled with sand and marl dredged from the vicinity of the viaduct.

The bottom is a coraline rock, encrusted with a surface of harder material, somewhat like that which forms around a geyser. For the most part the bottom was comparatively clean, but in places it was covered for several feet in depth with a deposit of marl and sand. When the crust, which varied in depth from 4 in. to more than a foot, was broken through, softer material was encountered, which, though requiring blasting for its removal, was comparatively easy to penetrate with a drill, or even allowed of driving piling in the ordinary manner.

The situation and the conditions being unique, the methods adopted were likewise peculiar to this work and this locality. It was decided in the first place to conduct the work with a floating equipment, in spite of the obstacles of tide and the possibility of storm during a part of the year. All supplies and materials were of necessity brought to the work by water, and the facilities for storing them as well as using them had to be provided. Most of the supplies were brought to the work from Miami, Fla., a distance of more than eighty miles, by stern-wheel steamboats of the Mississippi River type, a number of which were bought by the company at the inception of the work. Piles and lumber came from the same port. Broken stone was brought in schooners all the way from New York, discharged at Knights' Key dock, constructed for the purpose of receiving such materials at Knights' Key, where boats drawing 19 ft. of water may be unloaded. From the dock the stone was conveyed to the work on barges, towed by the stern-wheel boats, the haul being about twenty miles. A considerable quantity of broken stone was unloaded into the water in a favorable location and reloaded for use later. Gravel for concrete in piers and seals was brought from Mobile; cement from Germany and New Jersey; sand from Bears' Cut, near Miami. Thus a very wide area was tributary to the construction.

The method of placing the piers, while simple, was perhaps the most interesting and unique feature. The piers were of sufficient section to carry the thrust of the arches, to which they were firmly anchored by the reinforcing steel, so that they were inseparable from the superstructure. The reinforcing of the viaduct consists of two sets of ¾-in. Ransome rods, one set imbedded in the concrete near to the soffit and passing from pier to pier, and the other set imbedded in the outer portion of the arch and likewise extending from pier to pier. These two sets of rods are properly spaced and held the right distance apart by spacing rods, which likewise add some strength to the structure. Considerable steel is also used in the spandrel walls, both to prevent them from forming surface cracks and to make them add to the strength of the structure as a whole. As an additional precaution against several of the arches being demolished in case one should be destroyed by any accident, every fifth pier is made thicker than the others. The reinforcing not only joins every pier to the adjacent arches, but it is so disposed as to join all arches and piers in one continuous structure, so that any shock delivered to the viaduct at any one point would be transmitted to a number of piers. There are no breaks or hinges in the structure from one abutment to the other, a distance of about two miles.

The method of placing the piers, to return to the subject of construction, was unique. Briefly stated, it consisted of lowering cofferdams to the rock bottom, the cofferdams being open at both top and bottom. Within the cofferdam after it was lowered and the bottom cleaned of sand or marl, was deposited through pipes a layer of concrete from 2 to 5 ft. in depth, according to the depth of water. This concrete was allowed to set, and the cofferdam pumped out to allow the placing of the form for the pier, and the subsequent work of concreting the pier. As the cofferdam sometimes rested upon marl or sand when first lowered, and sometimes rested on clean rock, and as there was a strong current, due to the tide, which changed direction while the preparation of the pier for sealing and the sealing were in progress, considerable trouble was encountered in executing this work, especially at the commencement, when the best methods had to be discovered. An attempt will be made to describe these processes with sufficient detail to make them understood in a general way, and to indicate some of the difficulties.



Placing Arch Centers and Spandrel-Wall Forms.

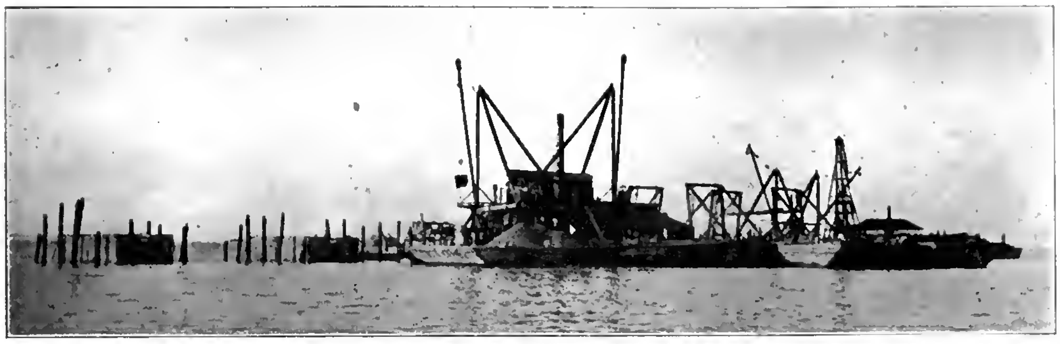
It was contemplated to anchor the piers to the bottom, either by blasting into the bottom or by driving piling into it to take up the shear that might be imposed between the base of the pier and the rock bottom, which was often quite smooth, though uneven. Of these two methods that of driving piling was preferred, although it was not definitely known before the work was undertaken that it would be found practicable. It had the advantage of not disturbing the hard crust of the bottom, of requiring less material,

and of leaving a bottom easier to clean of loose material. It was found practicable, and piles were driven by a floating driver for every pier as well as to support the arch centers for every arch. Many piles for mooring purposes were also put down, and a number for temporary docks and other incidental structures.

The method of driving piles was as follows: A steel shaft, some 25 ft. long and 6 in. in diameter, was provided at one end with an enlargement to form a punch 8 or ten in. in diameter. The other end of the shaft was fitted with a socket to take a short piece of piling as a buffer between it and a steam hammer. This punch was swung upon the pile-driver, and was placed in position in the leads at each point where a pile was to be driven. It was then driven into the rock by the steam hammer, from one hundred to five hundred blows of the No. 1 Vulcan hammer being required to secure a penetration of from 3 to 6 ft., according to the hardness of the rock. In some places it was found impossible to secure over 18 in. penetration, this being insufficient to support a pile. In other cases, though such were rare, after one or two blows of the hammer the punch would fall 6 to 12 ft., as if it had broken through the crust into a cavity. Holes like these, when encountered, were found to be of very small section, as the punch placed only a foot or so from a position where it fell after being struck might refuse to be driven more than a foot or so. They appeared to be pipes in the coral bottom, filled with nothing but water.

When the desired penetration of punch was secured, the punch was withdrawn from the hole, a process by no means easy until special rigging was made for it. The form of the punch also was an important factor in the ease with which it could be withdrawn. The pile was then placed in the hole prepared for it, and driven home with the driver, requiring from twenty to fifty blows. Many of the piles were cut to proper length before being driven and driven with a follower, so that they did not show above water until the cofferdam was lowered around them, sealed and pumped out for the pier work.

The cofferdams were made of four pieces,—two sides and two ends, constructed so that they could be taken apart at the corners by the removal of long pins. Each piece was composed of timbers lagged with pine planks 4 x 8 in. by 16 ft., and calked with oakum. The four pieces were assembled by a derrick on a barge, which, with a companion barge, was called the catamaran. The corners were made tight by canvas held across the uncalked joints by nailing strips. The completed cofferdam was then run out on timbers between the two barges, raised by blocks so as to swing free from the timbers and allow of their removal, and then lowered to the bottom in the proper place. It was then anchored in place by pull jacks and chains fastened to the guard piles or arch bent piles around it. Six jacks were used for each cofferdam.

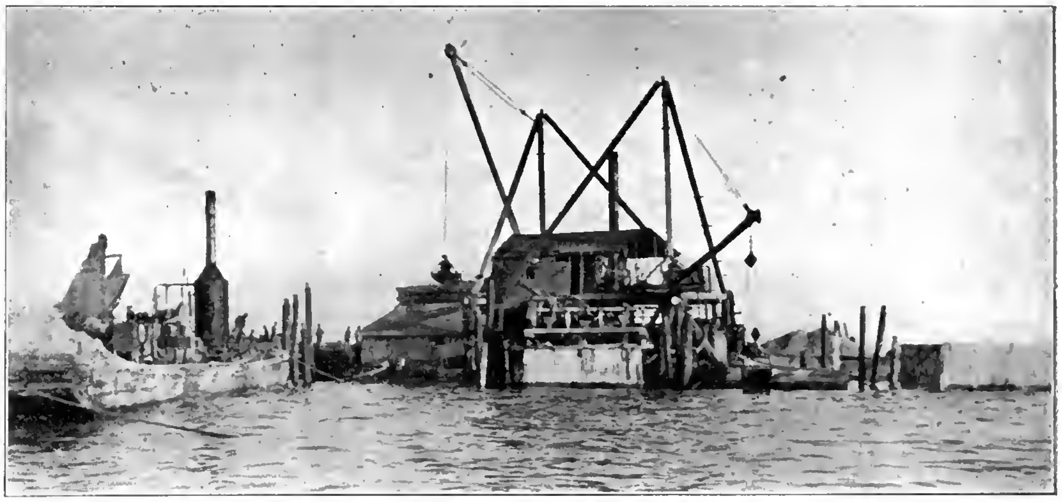


Plant Ready to Place Concrete in Sealed Cofferdams.

When lowered in place, the cofferdam was protected against the tide washing underneath it by lowering sacks of sand around it, or by dredging sand to bank up around its bottom, when this was practicable. Its interior was then cleaned on the bottom by pumping out any marl, sand or seaweed with a centrifugal sand pump, after the material had been loosened by jetting. Failure to properly close the bottom against the tide, or washing away of the protecting sacks at the turn of tide, which sometimes occurred in spite of precautions, resulted in washing out a part of the cement from the seals subsequently placed. With the proper closing of the bottom of the cofferdam the greatest difficulty was experienced.

The sealing was done through three 8-in. galvanized iron pipes, mounted on a car which ran on a track placed on the cofferdam. Each pipe was provided with a hopper at its upper end, and mounted in such a manner that it could be readily raised and lowered by two men who were charged with that duty, so as to feed the concrete to the bottom without allowing the water to enter the pipe during the process of sealing. This was very hard work, and required skill and conscientiousness on the part of the men. Lack of skill in placing the concrete resulted in inferior sealing, owing to the concrete being deposited in such a way as to wash out a portion of the cement. The concrete itself, for seals, was mixed in the proportion of one and a half parts of cement to two of sand and four of gravel, and allowed to set an hour after mixing before being shoveled into the hoppers. All of the mixing was done by machine.

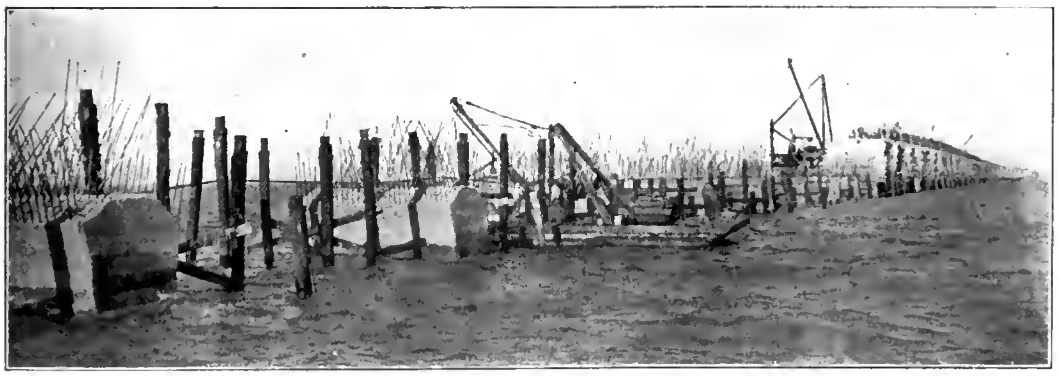
At the beginning of the work seals were allowed to set three days before the cofferdams were pumped out to place the pier forms; but later only two days were required. When pumped out, the cofferdams allowed men to descend, cut off the piles projecting through the seal at the proper height, place the pier form and the reinforcing rods. The concrete was then placed by one of the work-barges equipped for this purpose. It was mixed in the proportions of one part of cement to two of sand and four of gravel.



View during the Sealing of a Cofferdam.

The work-barges employed for concreting were especially designed for this work. They contained a concrete mixer, with hoppers for sand and gravel, and two derricks, one for hoisting material into the hoppers and one for removing the concrete from the mixer to the work. These derricks were mounted with their bases about 16 ft. above the deck, and they had booms 50 ft. long, so that they were capable of placing the concrete wherever it was wanted, in piers or any part of the superstructure. They were likewise equipped with pumping outfits and electric light plants, for the work of concreting proceeded both by day and by night.

A few days after a pier was concreted the cofferdam and forms were removed, and at any convenient time thereafter the work of placing the arches was undertaken. This work on the arches was practically independent of the work on the piers, and was conducted with different men, different barges, and to some extent dif-



Finished Piers, with Anchor Rods for Arch Reinforcement.

ferent materials. While in the piers only German cement was used, in the superstructure either German or American cement was permitted. The hesitation about using American cement in the piers was on account of doubt as to its ability to resist the action of salt water. The arches were concreted with a mixture of one part of cement, three parts of sand and five parts of broken stone.

In the arch-work the first step was the placing of the center. The centers, of which thirty-three were used in the construction of the entire one hundred and eighty arches, and left in good condition at the end of the work, were first assembled in the place where they were first to be used; but thereafter they were floated forward intact and placed for the arches by the use of jacks. After the centers were placed the spandrel wall forms were erected. These were made in panels, there being sixteen inner and sixteen outer panels to each arch. The panels were re-used many times, but they did not have the lasting qualities of the centers, being much damaged in removal. A small section of the spandrel wall form over each pier was built in place each time.

The concrete was placed in the arch ring and the spandrel wall at the same time, being commenced over a pier and carried out on each side thereof over the adjacent arch centers. Thus, an arch ring would be built in two operations, the first consisting of placing the concrete from one pier to a point about one-third of the distance around the arch ring, and the second beginning at the other pier and completing the other two-thirds of the arch. The place where these two operations formed a joint was selected so as to secure the least deflection of the forms during the placing of the concrete due to the loading. The method was very successful.

The spandrel wall forms were removed at any convenient time after the concrete had set, it being the policy to remove a form only at the time that it would be needed ahead, so as not to encumber a barge with it until it was needed. The arch centers were left in place thirty days, to insure complete setting before loading. Thus a less number of spandrel wall forms was required, but these were in constant need of repairs.

After the forms were removed the space between the walls was cleared of all litter except such concrete material as spilled into it during the process of concreting. This material was used to bank about the drain tile that was placed in the top of the pier to drain the space between the walls. Thereafter the space was filled with marl and sand, material readily available in the vicinity, and at a portion of the viaduct so located that it could be dredged and deposited in place with a single operation of a clamshell bucket. But for most of the viaduct it had to be dredged in one place and barged and rehandled into place between the walls. Some experimenting was done to determine the suitability of this material for this purpose, with gratifying results.

The handling of this work, many miles from any city, and far from any labor market, as well as from any depot for machine supplies, was in many respects more difficult on account of the isolation than the physical obstacles. The force employed on the viaduct varied from five hundred to eight hundred men after the work was under way. These men were for the most part recruited in New York, that is the laborers, many of the skilled men coming from other places. Quarters and subsistence had to be provided, and transportation from the camp to the work each day. The towage of the barges of material to the machines that were to use them was in itself a considerable problem, as was the acquiring and maintaining of a plant of such peculiar character, intended for use a short time only. The fact that this viaduct is itself but a part of a road containing equally unusual and difficult construction in other places, all under the same management as regards construction, and dependent upon the same transportation facilities, introduced elements not ordinarily met in equally heavy construction.

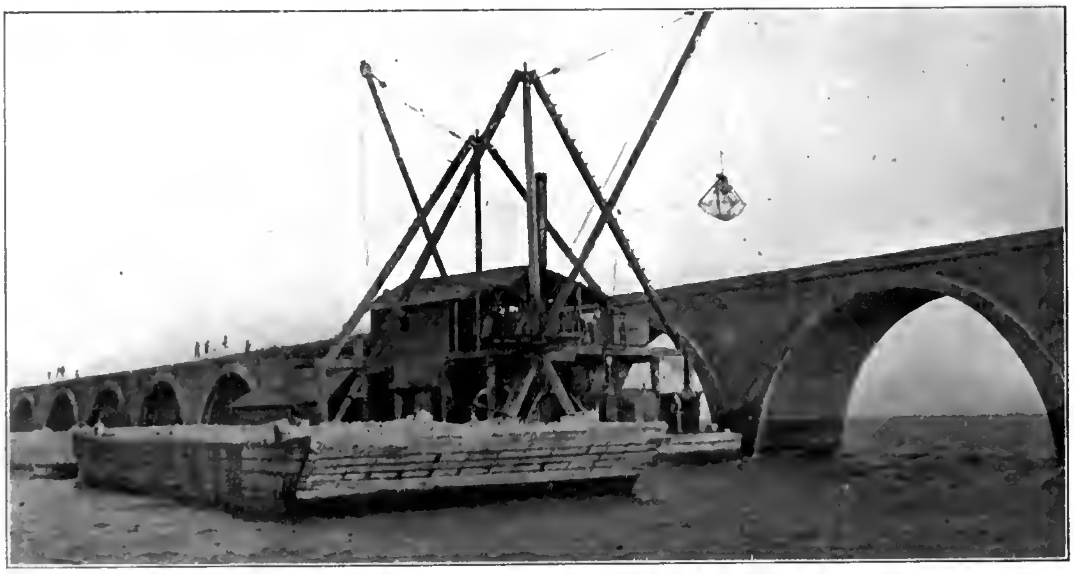
The camp provided was in a picturesque grove of cocoanut trees on the Southwest end of Long Key, formerly known as one of the worst places for mosquitoes on the Keys, but converted by clearing and some draining into a delightful spot.

Long Key Camp, Seen from the Water Tank.

The land is but slightly above mean high water, and at times portions of it have been overflowed; but it has been kept in perfect sanitary condition, and no sickness has been known to originate there. Water for domestic use is brought from the Everglades, and is most pure and wholesome. Before railway communication was established in October, 1907, water, like everything else, was brought by boat, but now it is brought in tank cars. A well organized subsistence department, with headquarters in Miami, supervises the issue of food supplies over the whole of the road and procures the necessary skilled help in that department. At Long Key there is a bakery with a capacity of one thousand loaves of bread a day.

View of the Camp from the Viaduct.

As all know, the enterprise is the peculiar interest of Mr. Henry M. Flagler, and owes to him its inception and the means of carrying it into execution. In execution, his interests are represented by Mr. J. R. Parrot, Vice-President of the Florida East Coast Ry., and the constructing engineer, Mr. J. C. Meredith, who has immediate charge of all matters, both of design and construction, of the extension from Miami to Key West. The writer's connection with the work is as division engineer, in immediate charge of the Viaduct construction. He took charge in this capacity in September, 1906, at which time a few piers had been placed, but no arches. Mr. M. F. Comer is general foreman, having been connected with the construction work from its start.



Work-Barge Placing Filling between Spandrel Walls.

The Filtration of the Croton Water Supply of New York.

On March 28 of last year Mr. I. M. de Varona, chief engineer of the Department of Water Supply, Gas and Electricity of New York City, submitted to the Commissioner of the department a report reviewing previous recommendations for the filtration of the Croton water supply and advising the construction of filter beds above the roof of the eastern basin of the Jerome Park reservoir. In order to settle definitely the practicability of the plan, a further appropriation was made at Mr. de Varona's request, in order to make more complete studies and plans than the previously available funds permitted. Messrs. Rudolph Hering and George W. Fuller were retained as consulting engineers, Mr. William B. Fuller was appointed engineer in charge of filtration and a staff organized under his direction. An examination of all possible sites for filters showed the decided superiority of Jerome Park to all others, and plans for works there were developed in a general way, described by Mr. de Varona in a report about a year ago. Since that time the work has been completed, and last week he submitted his final report.

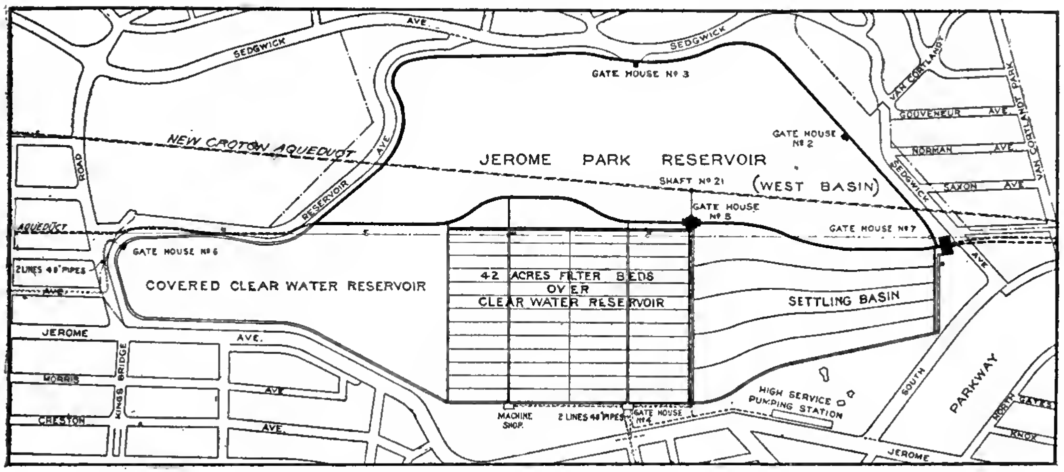
The research work on which the decisions were based in part was conducted at two testing stations. One was built by the Department to furnish information concerning the best rate of filtration of the Croton supply, and the other was constructed by private parties to demonstrate the value of the ozone treatment.

The Department's station essentially consists of sedimentation basins 10 ft. deep, 71 ft. by 25 ft., arranged by baffles in a series of compartments to represent as desired a period of sedimentation of from 4 to 60 hours. The filters consist of two rectangular beds, each about 15 by 30 ft., and having an area of about 1/100 of an acre. The filtering medium consists of about 26 in. of Cow Bay sand, having an effective size of 0.21 mm. and a uniformity coefficient of 2.62. The sand layer is supported by four layers of graded gravel of an aggregate depth of 16 in. Beneath these gravel layers are tile pipes to convey the effluent to the outlet, where the rate of filtration is governed by means of a series of calibrated orifices. The filters are equipped with gauges and indicating apparatus for recording all necessary data. A laboratory and set of coagulating devices are also provided, together with an adequate staff for operating the plant, securing samples and making analyses as directed. The laboratory building is about 18 ft. by 42 ft., and is located over and at the westerly end of the filter and sedimentation basins. The analytical work included both bacteriological and chemical analyses, as well as the ordinary tests to record the color and turbidity of the water before and after treatment.

The contractor for the testing station got the various devices in working order in March, 1907, since which date the tests have been carried on practically without interruption.

Just to the west of the experimental station the United Water Improvement Co. of Philadelphia erected a frame building and placed therein the necessary apparatus for a demonstration of their method of water purification. Work on this building began in December, 1906, and the first ozone was made on Jan. 12. Ozone was first used in the sterilizing tower Jan. 31. Essentially their method consists of the introduction into the water to be purified of a mixture of air and ozone, whereby the organic matter present is oxidized and bacteria killed.

Their plant consists of a mechanical filter of the Hungerford type, which treats water for the removal of its turbidity. The water so treated is then pumped to the top of a 38-ft. stack, 22 in. in diameter, and flows downward through the stack, while in the opposite direction there rises a mixture of air and ozone, admitted to the bottom of the stack by a special strainer or spreader. Reaching the bottom of the stack the water flows into a vertical pipe and rises to nearly the top of the stack, in order that the stack may be kept at all times full of water. The amount of water, air and ozone may be varied to meet the special conditions of the applied water.



Plan of the Proposed Filter Plant for the Croton Water Supply, New York.

The air is first cooled by passing through a refrigerator, to remove its moisture, as dampness causes trouble in the ozonizer. After this first refrigerating process, the cooled air is drawn into the ozonizer of the H. Blanken system, where, by means of an alternating current of 10,000 volts, 60 cycle, a portion of it is transformed into ozone. From this ozonizer the mixture of air and ozone is drawn by a compressor and forced into a pressure tank, from which is supplied the upward current of air and ozone in the sterilizing stack.

Aside from its magnitude, the Croton one differs from the majority of filtering projects, Mr. de Varona states, in that it deals with water supply from very large impounding reservoirs and not with the water taken from a muddy river, into which flows the sewage of various communities above the intake. The Croton water is distinctly easier to filter than many other supplies now being filtered in this country, except, perhaps, the supplies at Reading, Pa., New Haven, Conn., and a few other small plants. Some filters for water drawn from rivers, containing considerable sewage, silt and clay, have been generally operated at the rate of from two and one-half to three million gallons per acre daily, but carefully conducted investigations at the Lawrence Experiment Station of the Massachusetts State Board of Health, and at Cincinnati and New Orleans, and practical experiences at Reading, show that double those rates are entirely feasible for water less impure and, in fact, the investigations above mentioned, combined with the experience at Springfield, Mass., and at Zurich, Switzerland, show that a rate of ten million gallons per acre is feasible, provided the water is given a proper preparatory treatment. In the consideration of the Croton filtration project, much attention has been given to the use of a high rate of filtration from the view point of economy and efficiency, as judged by an adequate removal of disease germs, color, turbidity and objectionable tastes and odors.

A ten-million gallon rate per acre, as compared with a five-million gallon rate, obviously means a great reduction in the construction cost, which, in the present case, is represented by the difference between estimates of $7,600,000 for the higher rate and $11,500,000 for the lower rate. Many of the pipes and appurtenances would not be affected by these rates, but the filters themselves would be only one-half as large if the higher rate is feasible. The rate of filtration does not materially affect the quantity of water filtered between cleanings of the sand surface or the time required for a single cleaning, as the frequency of cleaning is inversely proportional to the rate of filtration. In other words, a higher rate means that a filter is out of service for a much greater portion of the time for purposes of cleaning and a much greater reserve area of filtering surface is required with the ordinary method of draining the water from the sand layer, scraping off the surface layer of clogged sand and filling the filter again before starting. For a project as large as that for the Croton supply, this reserve area of filters to compensate for the periods when the filters are out of service for cleaning is of much importance and has caused a careful study to be made of the improved methods of cleaning the filters.

The better the quality of an unfiltered water, the easier and cheaper it is to filter and the higher is the permissible rate of filtration. Studies have been made along this line to ascertain the benefits of sedimentation with and without the aid of coagulants as a preparatory treatment for filtration.

Forty-five runs were made prior to the preparation of the report on the filters of the experimental station, with different rates of filtration, different periods of sedimentation and different kinds of application of coagulants, covering all possible conditions. The results of these experimental runs show that, with adequate preparatory treatment by sedimentation and coagulation at those times when the water in the aqueduct is very muddy or highly colored, rates of filtration up to ten million gallons per acre daily are thoroughly safe and feasible for a well designed filter plant operating upon the Croton water.

Within the limits of three to ten million gallons per acre daily, there was no measurable difference in the bacterial, chemical or physical quality of the effluent or any substantial difference in the volume of water filtered between cleanings, due to the rate of filtration. The initial loss of head increased in direct proportion to the rate of filtration, and with a ten-million gallon rate approximated one foot with a medium fine sand.

Sedimentation did not ordinarily prove to be of assistance during the period of these investigations, but undoubtedly there are times, especially in the winter and early spring, when the amount of mud or turbidity in the water will be sufficient to make sedimentation a distinctly helpful adjunct to the filtration plant. During these tests the bulk of the suspended matter in the water was due to algae growths, and these did not subside to any very great extent.

Studies were made both in the laboratory and in the operation of the basin and filters as regards the need and best manner of coagulating the Croton water. It was found impracticable to remove the color and other matters from the Croton water by the aid of lime and sulphate of iron unless applied in quantities prohibitively expensive. Sulphate of alumina in quantities averaging

about one grain per gallon would effect a decided improvement in the quality of the filtered water for about eight months during the average year. During the remaining four months of an average year this treatment would be unnecessary. The cost of this coagulant would average about $1.10 per million gallons, and for this application a sedimentation basin will be provided, holding at least seventeen hours' flow, in order that the bulk or larger portion of the coagulated matter may be deposited before reaching the sand beds. The entire elimination of the coagula by sedimentation cannot be accomplished, nor is it desirable, and a considerable quantity of very tiny particles of alumina hydrate would pass from the sedimentation basin to the filters, where it would be removed at the surface of the sand layer.

After the filter got in normal condition, in April, the quality of the effluent regularly has been satisfactory as regards freedom from bacteria, turbidity and vegetable tastes and odors. The color or vegetable stain has been removed to an average extent of about 25 per cent. This removal would leave a noticeable color in the effluent for some eight months during the average year, and at times the discoloration would be very pronounced, when the water received no treatment other than by sedimentation and by filtration, as provided under our plans as already outlined.

In accordance with the adopted rate of ten million gallons per acre, it is entirely practicable with 42 acres of sand filtering surface to filter the present nominal carrying capacity of the two aqueducts, namely, 400 million gallons daily.

In the course of the investigations it was of the utmost importance to determine the most effective and economical method of washing and cleaning the sand, and for this purpose repeated trials were made of the Brooklyn method, successfully employed in a small scale under Mr. de Varona at the filter beds in Hempstead and Forest Stream, which offers some advantages over the usual method by scraping the sand, removing it, washing it and replacing it in the filters; and numerous trials have also been made of the Blaisdell machine for washing the filters without removing sand or throwing the filter beds out of commission.

The Brooklyn method consists essentially of allowing the water above the sand to drain until a depth of only about one inch remains above the sand surface. Outlets just above the sand surface are then opened and water is applied at one end and allowed to flow across the bed, the direction of flow being guided in these experimental filters by boards set on edge in the sand layer. As the water flows over the surface of the sand the layer is raked by men standing upon the sand surface. The depth of water flowing over the sand during this raking operation is about two inches. The raking and flow of water are continued until the water leaving the filter is practically clear. Water is then applied in the usual way and filtration resumed.

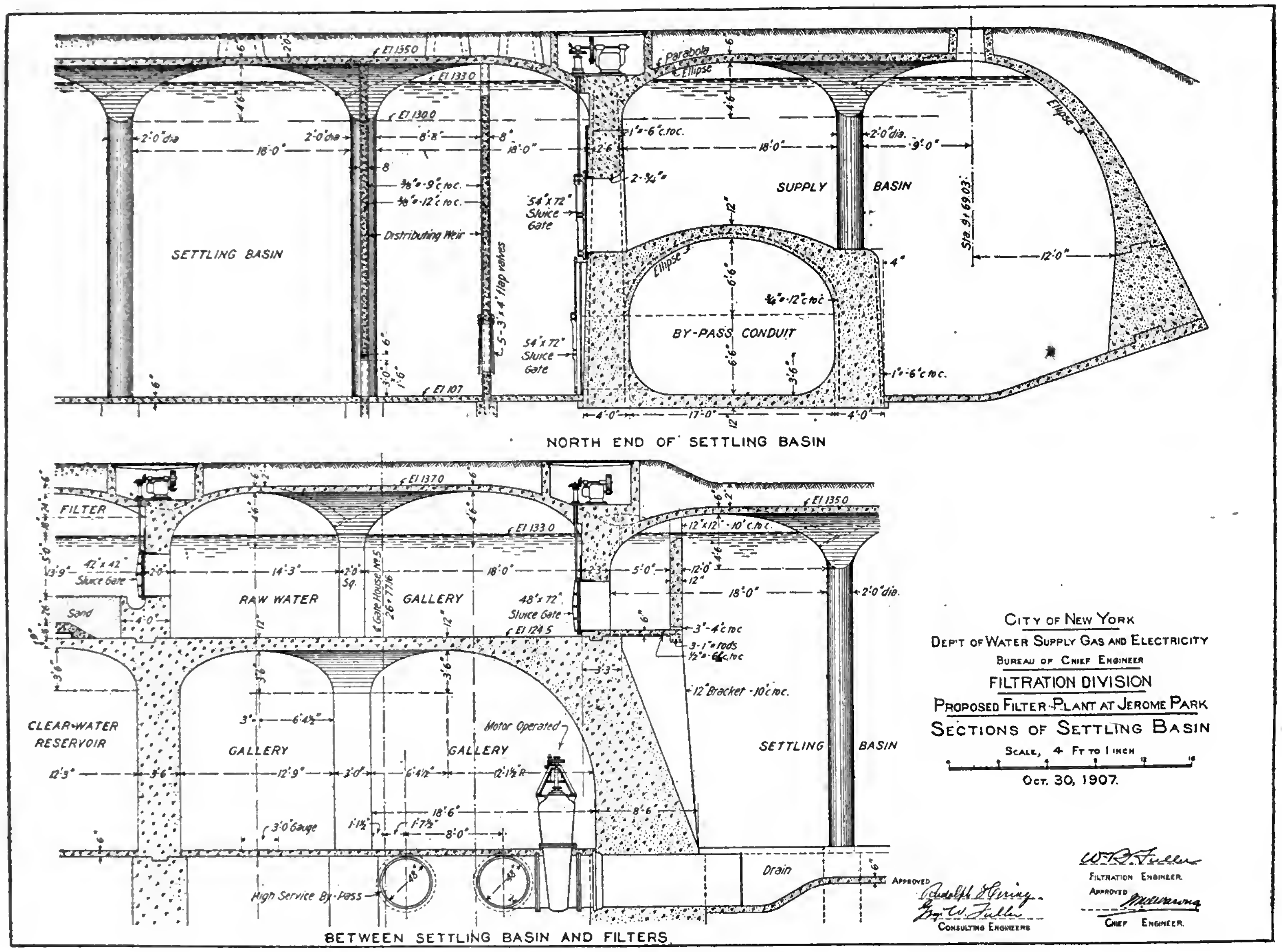
The Blaisdell machine, as here proposed, consists essentially of hollow revolving rakes incased in an inverted box, the whole apparatus being submerged and moved by suitable machinery from one end of the bed to the other. In its operation water is forced through the rake teeth into the sand layer, to be cleaned, to any desired depth, while the rakes revolve, and the dirty water is pumped from the enclosed box. If this machine be used there is no need of draining and refilling the filters or removing the sand.

The results obtained from these trials show that either the Brooklyn method or washing by the machine are cheaper than the method hitherto adopted of scraping the sand, washing it and replacing it. The filters have been so designed that either the Brooklyn method or washing by the machine can be adopted for a sand layer with a comparatively uniform size of grain.

Owing to its efficiency in destroying germ life without injuring the water, ozone has for some time been favorably and extensively discussed in this country and abroad, as a possible adjunct of filtration, and some small plants have been installed and at times operated in Europe, but not with favorable results. The drawbacks hitherto to the adoption of ozone have been the unreliability of action and prohibitive cost of operation.

The United Water Improvement Co. made a proposal to install an experimental ozone plant at Jerome Park, claiming that whereas the usual production of ozone by other methods had not exceeded 16 grains per kilowatt-hour, with their new ozonizer they could readily obtain 85 grains of ozone per kilowatt-hour, thus bringing the cost of the process within practical limits. They also claimed that the system of a silent electrical discharge in their ozonizers absolutely secured continuity of action and reliability of operation.

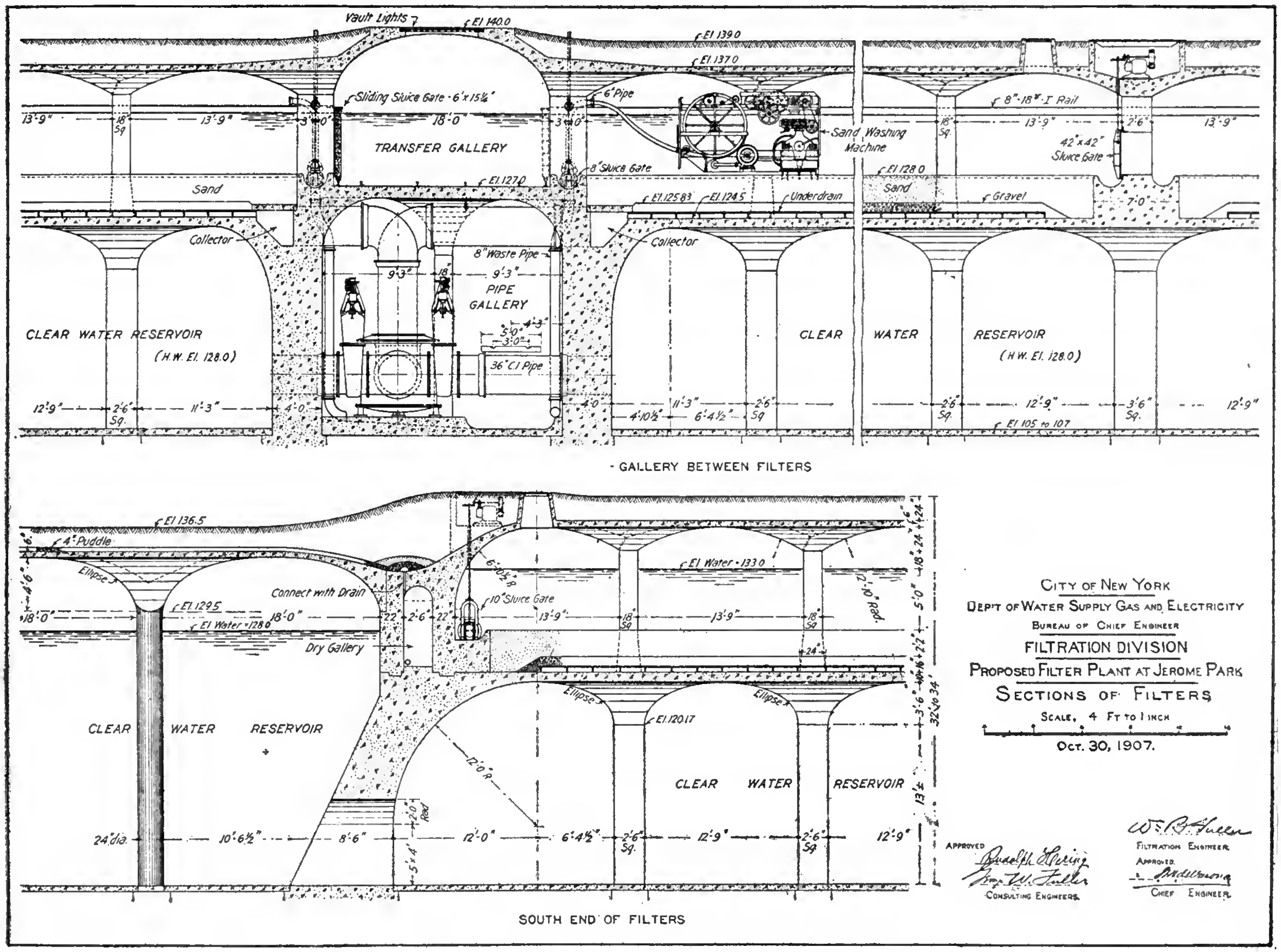
Permission was given to this company to install, at their expense, a plant for the purpose of testing the merits of their method, the experiements for that purpose being, under the terms of the agreement, conducted under the immediate direction



Sections of Settling Basin for the Proposed Filter Plant for the Croton Water Supply.

and supervision of Mr. de Varona and his staff. After the completion of their preliminary tests, he was officially notified by the company that the plant was ready for his tests, which were conducted from May 7 to May 31, 1906, after which date no further tests were made and the company ceased to operate the plant, and have been ordered to remove the same in accordance with the agreement.

The experiment showed that of the current used, about one-quarter was consumed by the refrigerating machine, one-quarter by the transformer and ozonizer and one-half by the compressor. It appeared that the color might be reduced from about 15 to about 5 and bacteria from about 100 to about 7, by the use of about 3,500 grams of ozone per million gallons, with an expenditure of about 800 kilowatt-hours. With electrical energy costing 2½ cents per kilowatt-hour, it appeared that under the conditions of the experiments the process was costing about $20 per million gallons, of which perhaps $5 represented the cost of ozone and the other $15 were chargeable to drying the air and pumping it into the water. During the whole time that the plant was in operation, it did not run a single day without stopping, a fact of itself sufficient to demonstrate the impracticability of using the proposed method of ozone purification as an adjunct of the filtration plant, regardless of its cost.



Sections of Filters and Clear Water Reservoir for the Proposed Filter Plant for the Croton Water Supply.

The conclusions reached from the thorough and detailed study of this matter and the practical results obtained at the experimental stations, are summarized by Mr. de Varona as follows:

The eastern and unfinished section of the proposed Jerome Park reservoir, on which work was suspended about two years ago, which has an area of 135 acres, affords the most favorable site for the location of the filter plant. (See illustration.) The marked advantages of this site over all others, especially in cost of construction and operation, were fully discussed in his report of Oct. 3, 1906.

The proposed plant is to have a capacity of 400,000,000 gal. a day, which is equal to the nominal capacity of the two existing aqueducts, and about 85,000,000 gal. in excess of the present average daily consumption.

The proposed site has been excavated approximately to grade. The filter plant consists of a settling basin on the northern section, covering about 37 acres, the filters consisting of 102 filter beds covering about 48 acres of the central section, with an effective area of 42 acres, and a clear water reservoir which occupies the southern portion of the site, covering about 46 acres. The clear water reservoir extends also underneath the filter beds.

The water is now delivered at the Jerome Park reservoir through the new and old Croton aqueducts, the height of the water line in the latter being 3½ ft. lower than in the former. It is proposed to raise the water in the new aqueduct 1½ ft. above its present hydraulic grade, thus bringing it about 9 in. above the intrados of the crown at Jerome Park, and under these conditions the aqueduct will deliver about 310,000,000 gal. per day.

The water to be delivered through the old aqueduct, 90,000,000 gal. per day, will be lifted 5 ft. to deliver it to the filters. The water from the aqueducts will enter the west basin of the Jerome Park reservoir, the high water line of which will be kept at an elevation of about 133. and will be supplied to the filters through a distribution chamber from which it will flow to the settling basin over a weir about 600 ft. long, thus making a very even distribution of water into the settling basin.

The method of delivery through both aqueducts, as above stated, has been adopted not only to facilitate the design of the filter plant, but to secure the great additional advantage of allowing, when necessary, bringing the whole Croton supply, even at its maximum, after the watershed has been fully developed, through the new aqueduct, and to use the old aqueduct for whatever additional supply may be temporarily furnished from up the State before the completion of those works. The importance of this feature will be readily appreciated.

Under the proposed plan, the high water line on the clear water basin will be at an elevation of 128, so that 325,000,000 gal, of filtered water can be delivered at the Central Park reservoir with the latter full, and 75,000,000 gal. more through pipes already partly laid or about to be laid, without reducing the pressure either south of the Harlem River or in The Bronx.

Whenever it may be necessary to use a coagulant for the reduction of color, it will be added just before the water enters the distributing chamber.

The settling basin has a capacity equivalent to about 18 hours' flow and is divided into five compartments, any one of which can be shut and independently cleaned. The basin is about 1,200 ft. long and the velocity of water is only from

10 to 20 in. per minute. At the southern end of the settling basin the water passes over a gathering weir and enters a raw water distributing conduit extending 1,200 ft. long across the entire end of the filters. This water is allowed to enter the filters by means of sluice gates connecting directly with the filter space above the sand. There is no raw water piping of any description and the opening of these gates floods the entire 42 acres of filter plant above the surface of the sand, which will therefore present the appearance of a large pond. The filters are placed on groined arches above the clear water reservoir and are built of concrete, each filter being 0.4 acre in area and consisting of three bays, each 410 ft. long. The filter medium consists of 25 in. of sand supported by 9 in. of graded gravel, which, in its turn, is supported by a system of tile underdrains leading to the pipe gallery. The pipe gallery consists of a dry tunnel dividing the clear water reservoir, in which are placed the controllers for regulating the rate of filtration.

Above this tunnel the gallery will be flooded with water, and this portion may be used for transferring the washing machines from one bed to another, if it is decided to clean the beds with the machines. If the Brooklyn method of cleaning is adopted, the apparatus required will be floated along the transfer gallery to the beds, as required.

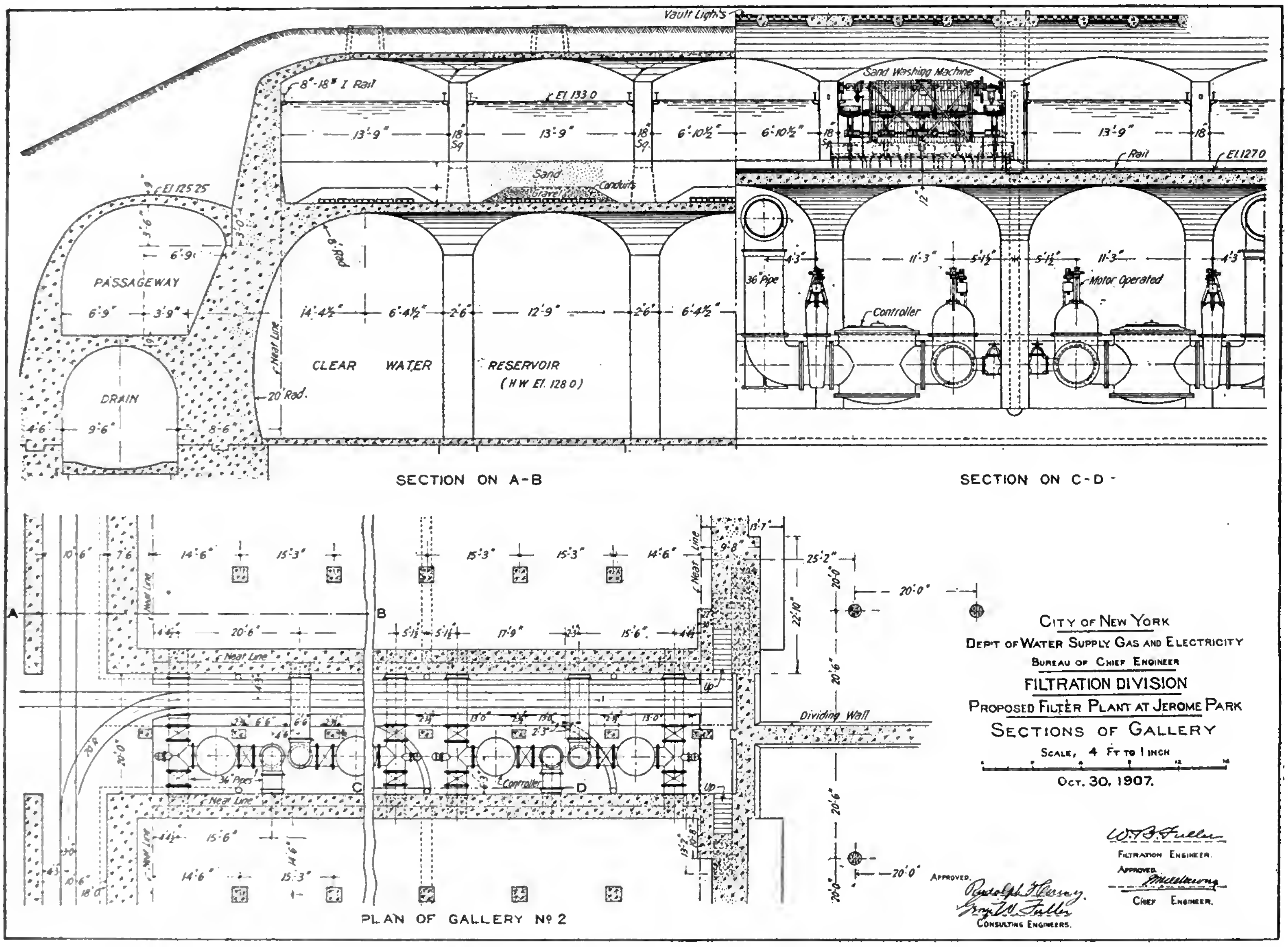
The clear water reservoir occupies about 46 acres at the southern end of the plant and is covered with groined arches. It has a capacity of 575,000,000 gal., including the basin under the filters, and the total storage capacity of the compensating basin, settling basin, filters and clear water basin is 1,785,000,000 gal. Advantage is taken of the two conduits in the present dividing wall of the reservoir to circulate the filtered water from the different divisions of the clear water reservoir, and also to bypass any of the clear water reservoirs if it is necessary to do so. These conduits convey the filtered water to a gate house, whence it is distributed to the city. The filters will be supplied with lines of rails on which a machine may be run, if desired, for the purpose of washing the sand, and each filter has also been designed so that the beds may be cleaned by the Brooklyn system, discharging into a drain connected with the city sewers.

At the end of one gallery there will be a distributing gate house and above this a chemical and bacteriological laboratory for the proper regulation of the plant. At the end of the other gallery there will be a machine shop for repairs to the mechanical equipment of the plant.

It is not proposed to cover the Central Park reservoirs, the use of which at present, Mr. de Varona states, causes a loss of pressure, because they will be abandoned for regular use when the Hillview reservoir is completed, and until then pipes can be laid from the Jerome Park reservoir sufficient to provide for the distribution for considerable less money than it would cost to cover the Central Park reservoirs, and these pipe lines will always be needed for the general distribution system. It is not proposed to cover the west basin of the Jerome Park reservoir, but to use it as a compensating reservoir, allowing the unfiltered water from the aqueducts to enter and circulate in this west basin before it enters the settling basin and filters.

The cost of the filter plant and covering of the reservoirs has been computed from detailed drawings at $7,600,000, which was the figure given in Mr. de Varona's previous report. In order to provide, however, a liberal allowance for contingencies, he deems it advisable to add about 12 per cent. to the above figures, making the total estimated cost $8,500,000.

The cost of maintenance has been estimated at $2.50 per million gallons, including expenses of operation, administration, laboratory, care of grounds, lighting, repair gangs and depreciation, but exclusive of interest and sinking fund charges.



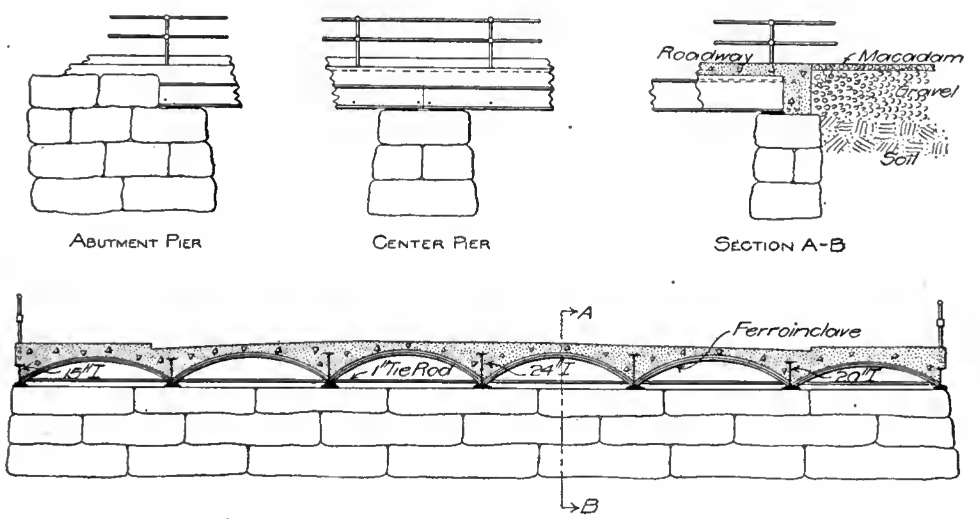
Sections of Pipe Gallery, Filters and Clear Water Reservoir for the Proposed Filter Plant for the Croton Water Supply.

Grade Change on the Canadian Pacific Railway.

The Canadian Pacific Ry. is building a new stretch of track on the west side of the summit of the Rocky Mountains, between Hector and Field. The present line is on a 4.4 per cent. grade and has a maximum curvature of 12 deg. Four miles of this track will be abandoned when the new line, 8¼ miles long, is completed. The new alignment has a maximum grade of 2.2 per cent., compensated, and a maximum curvature of 10 deg. The features of the new work are two loop tunnels, both on 10-deg. curves, and a 1.6 per cent. grade. One of them is 2,800 ft. and the other 3,200 ft. long. In each case, according to "The Canadian Engineer," the upper line crosses the lower immediately above the portal of the lower entrance to the tunnel, thereby doing away with an overhead bridge crossing. The rock excavation will be 400,000 cu. yd.

A Simple Highway Bridge.

The details of a very simple type of highway bridge recently constructed at Fort Plain, N. Y., are shown in the accompanying illustrations. There are two spans in this bridge, each of about 20 ft. These consist of I-beam stringers having curved Ferroinclave sheets sprung between their lower flanges. On top of the sheets was placed a mixture of 1 part of Portland cement to 2 parts of sand to a thickness of about ½ in. above the tops of the corrugations of the sheet, and then concrete mixed 1:2½:5 was laid to the required depth. After the concrete on the upper side had been put in place, the Ferroinclave was coated on the under side to a thickness of ⅜ in. with a mixture of 1 part of Portland cement, 3 parts of sand and half a part of hydrated lime. It will be seen that this type of construction is substantially that used for arched floors. The advantage of it for this particular bridge was that the work could be easily and quickly erected without the use of any centering, the Ferroinclave sheets themselves acting as centering. In order to drain the roadway, the slope was taken care of by increasing the thickness of the concrete upon the upper side and, in the gutters, pipes were run through the Ferroinclave sheets on either side at fixed intervals and the concrete on the upper side was placed around them, thus giving down spouts through the bridge itself. The bridge was built by the Brown Hoisting Machinery Co., Cleveland, Ohio.



A Simple Highway Bridge.

The Iron Ore Resources of the United States.

The iron ore resources of the United States are discussed in a report by Mr. E. C. Eckel, of the U. S. Geological Survey, which states that the Lake Superior District is assumed to have from 1,500,000,000 to 2,000,000,000 tons, and that this supply is being drawn upon at a rate which will pretty well exhaust it by 1950. The workable iron-ore reserves above the 1,000-ft. level in Alabama, Georgia, Tennessee and Virginia are estimated to contain 1,850,000,000 tons of red ore and 725,000,000 tons of brown ore. Adding to these quantities the ores at deeper levels in the four States and also the red and brown ores which occur in Maryland, West Virginia and Kentucky, and the magnetic ores of the other Southern States, it is considered probable that the total Southern ore reserve will amount to very nearly 10,000,000,000 tons, or about five times that credited to Lake Superior. These figures are issued to disprove the widely quoted assertion made in Sweden to the effect that the whole world has only 10,000,000,000 tons of iron ore which is yet unmined.

The Density of Pavements.

The importance of the density of a pavement as an influence on its durability was discussed in some detail by Mr. J. W. Howard in a paper read at the recent convention of the American Society of Municipal Improvements. It is particularly important, he pointed out, in all composition pavements, laid in monolithic or sheet form, such as asphalt and bitulithic. That which is densest is to be preferred, he stated, as is shown by the fact that the natural bituminous limestone or rock-asphalt pavement of Europe is denser, closer-grained and more durable than many, but not all, of the artificial asphaltic sandstones which are the principal asphalt pavements laid in American cities.

Density and consequent longer durability reduce the cost of maintenance, which in the end is the greatest cost because maintenance goes on forever. Asphalt mixture pavements, composed of sand, limestone dust and asphalt cement, too often lack density and are porous, according to Mr. Howard. In such cases they do not resist traffic nor weather as well as if they had the maximum density possible with proper mixture and compression. The bitulithic pavement he considers an example of concentration of as much mass as possible into a given space. It aims to assemble crushed stone so that there is a minimum of voids and it approximates the original solid stone from which the crushed stone is obtained. The density of the composition of bitulithic pavements combined with the density of hard stone used he considers as probably the principal reason for the degree of success which that special pavement has attained.

The same reasoning Mr. Howard applies to all other kinds of pavements, different bricks, different woods, and the like proposed for paving streets. Each kind of pavement, granite block, bitulithic, asphalt, and the others, is suited to certain kinds, locations and characters of streets. The knowledge of the comparative densities of these different materials, shown by tests in definite figures, helps determine what kind of pavement to use for individual streets and further helps determine which one of many granites, bricks and composition pavements offered is best for use in each case. Requirements of minimum density for each kind of pavement should be inserted in all specifications, he asserts, in order to help secure, in conjunction with other and usual requirements, the best possible pavements.

Two types of density are discussed by Mr. Howard. The first is the density of the pavement, including its voids, which he regards as the most important because it is of the actual pavement laid. It is the weight per unit volume of the given material, and can be expressed in pounds or as specific gravity of the pavement, dried before testing and with air but no moisture in the voids of the specimen. This density may be called volume-weight. The second density is the specific gravity of the materials of which the pavement is composed, exclusive of any voids present in the pavement.

To illustrate the two densities, one of the finished pavement and the other of the material, entering into the pavement, Mr. Howard mentioned certain Baltimore bitulithic pavement made of crushed stone so graded in sizes and assembled by mixing that a very small percentage of the volume is unfilled voids. He found a specific gravity of a large piece cut from the pavement to be 2.69, whereas the solid stone of the same kind as the crushed stone in that pavement had a specific gravity of 2.96. The pavement has about 9 per cent. less density than the stone which is its principal element. The first is the specific gravity or density of the pavement as laid, the second is the specific gravity of the stone used in that pavement. The asphalt pavements of the United States, as laid, vary in density as specific gravity between about 1.90 to 2.24, whereas the density of their main elements, sand and limestone dust, exclusive of voids, is between about 2.60 and 2.70. These pavements are therefore 15 to 25 per cent. less dense than their principal mineral elements. The requirement in specifications for some wood pavements, that the blocks when dry must at once sink in water, is a crude way of requiring that the wood must have a certain degree of density. It is better to express this by definite figures.

Valuable deductions at once follow, Mr. Howard says, from knowing the volume-weight of the pavement, including voids, and the density of its materials excluding voids. The density-grade (or percentage of density) and the void-grade (or percentage of voids) of a pavement can be found. The density-grade d is obtained by dividing the volume-weight w of a pavement by the density or specific gravity s of the materials of a pavement. This is the percentage of the pavement which is solid mineral matter which should be as large as possible. The void-grade v, obtained by subtracting the density grade from unity, which is the percentage of voids in the pavement, which should be as small as possible. For example, in the Baltimore bitulithic pavement referred to, $w = 2.69$, $s = 2.96$, $d = 91$ per cent., which density grade means that 91 per cent. of the pavement is solid stone, and $1 - d = v = 9$ per cent., which void-grade means that 9 per cent. of voids exist between the broken stone, which volume or space is filled with fine dust and bituminous cement. Asphalt, brick, wood and other pavements can have their density-grades and void-grades determined in the same manner.

Moisture in the University and Municipal Libraries at Ghent, Belgium, was so great that some parts were entirely abandoned, but it seems probable, according to U. S. Consul W. P. Atwell, of that city, that a new method of drawing humidity from walls (which he does not describe in his report on the subject) will make these rooms serviceable. The official experiments began July 14 and were completed Aug. 14. The hygrometrical degree of the air in the room, of approximately 1,200 cubic meters, where the different experiments took place, was 83° on July 13. At that time a strong moldy smell was found to exist. The greater part of the wall was covered with saltpeter, while the floor or pavement was almost continually wet. On Sept. 13, after testing the new system thirty days, the hygrometer was found to have lowered from 83° to 60°. The walls had become completely dry, and the saltpeter and smell had disappeared. The pavement was dry and remained so, while prior to these experiments it had always been moist.

Lowering a Large Pneumatic Caisson with Screw Rods.

The west river pier for the four-track Schuylkill River Bridge of the Philadelphia Rapid Transit Co. was built with a 20 x 80-ft. wooden pneumatic caisson, sunk 40 ft. to rock through water 16 ft. deep and a mud and silt bottom. On account of obstructions in the river and the long distance in which it would be necessary to tow it, it was considered undesirable to build the caisson in the usual manner on shore and launch and float it to position, and arrangements were made for constructing it vertically above its required position and lowering it to place under control.

As its location is adjacent and nearly parallel to the city bulkhead wall, the latter was utilized for a portion of its support and carried part of the working platform, on which materials were received and stored and part of the work was done. A pile platform about 42 ft. wide and 127 ft. long was built parallel to the bulkhead wall and about 58 ft. in the clear from it. This consisted of 17 transverse bents of four and six piles each, which were capped with transverse timbers and supported a deck of 4-in. plank.

The space between the platforms was bridged by 12 x 12-in. timbers, on which a working platform was placed, and the wooden caisson was built to a height of 10 ft., including the deck, and was calked and completely finished. Six heavy forged steel flat hooks were then attached to the cutting edge equidistantly on each side of the caisson, and their upper ends were pin-connected to vertical 2½-in. rods about 24 ft. long, close to the outer face of the caisson. The rods were threaded full length and fitted with nuts engaging steel bearing plates on the tops of 12 x 12-in. timbers about 3 ft. long, through which the rods passed with clearance. These timbers were seated transversely on the top flanges of pairs of 20-in. I-beams, 30 ft long, supported at each end, just beyond the vertical rods which passed between them, on four lines of longitudinal 20-in. I-beams, supported close to each side of the caisson by six timber cribs up to a height of about 7 ft. above the deck of the working platform.

Scaffold planks parallel to the caisson were seated on the lower flanges of the transverse I-beams, making working platforms for pairs of men, with 6-ft. wrenches, who first turned up the nuts on the long vertical rods sufficiently to raise the caisson, which had an estimated weight of 180 tons, and released the 12-in. transverse bridge girders on which it had been erected. These were removed, and then the men, working simultaneously by signal, slacked off the nuts, one revolution, or ½ in., at a time, until in about 12 hours the caisson was lowered 16 ft. In this position the south end of the caisson rested on timber cribbing in the foundation of an old pier of the wooden bridge formerly occupying this site. The caisson was sufficiently embedded in the mud at this end to permit the application of air pressure, which enabled men to enter and cut away the obstructions under the cutting edge, while the other end of the caisson was suspended about 10 ft. above the bottom. After the obstructions were cut away the nuts were slacked still farther, until the screws were relieved of all stress, and their connected hooks were lowered free of the cutting edge and disengaged from it, after which hooks, rods, I-beams and cribbing were all removed, and the caisson was sunk through soft material to rock by the usual methods. To facilitate handling the heavy wrenches a line was tied to each near the head and made fast to the screw 2 or 3 ft. above it. This safeguarded the wrench from being dropped and was of material assistance in carrying its considerable weight every time that it was released from the nut and moved back and turned for a fresh grip.

Lowering Pneumatic Caisson for West Pier.

East Pier Caisson Suspended from Girders.

The caisson for the east river pier of the same bridge was built nearly one year later in substantially the same manner as above described, and was then towed to the site and sunk in the usual way between guide piles. After this caisson was completed on its movable transverse girders it was suspended much as already described from overhead transverse I-beams, which in this case were seated directly on top of the cribs, without intervening longitudinal girders. This caisson weighed about 180 tons and was lowered about 12 ft. in 10 hours by a force of 36 men.

The piers were designed and built under the direction of the engineering department of the Philadelphia Rapid Transit Co., Mr. W. S. Twining, chief engineer, and Mr. Chas. M. Mills, principal assistant engineer. The work was executed by John Monks & Sons, New York.

An Elliptical Dome, 119 ft. on the major axis and 80 ft. on the shorter axis, was built about 1729 for the Church of Madonna di Vico at Vicoforte in Piedmont. Its existence was forgotten by architects until it was brought to their attention by an American traveler, Mr. L. M. Rossi. He was so charmed with this unusual edifice that he has written a book concerning it which the Macmillan Co. has recently published.

Tests of Track on the Pennsylvania Railroad.

Reports which have recently appeared concerning certain tests the Pennsylvania R. R. has been making on the West Jersey & Sea Shore R. R., near Clayton, N. J., have created an entirely erroneous impression. It has been stated that the company was racing steam and electric locomotives, with a view to determining the speed capacity of each type. The Pennsylvania R. R. has other, more accurate and much less dangerous, methods of testing the speed of locomotives than trying them out in such a manner as this. Furthermore the types of electric and steam locomotives which have been used in these experiments were not designed for speed.

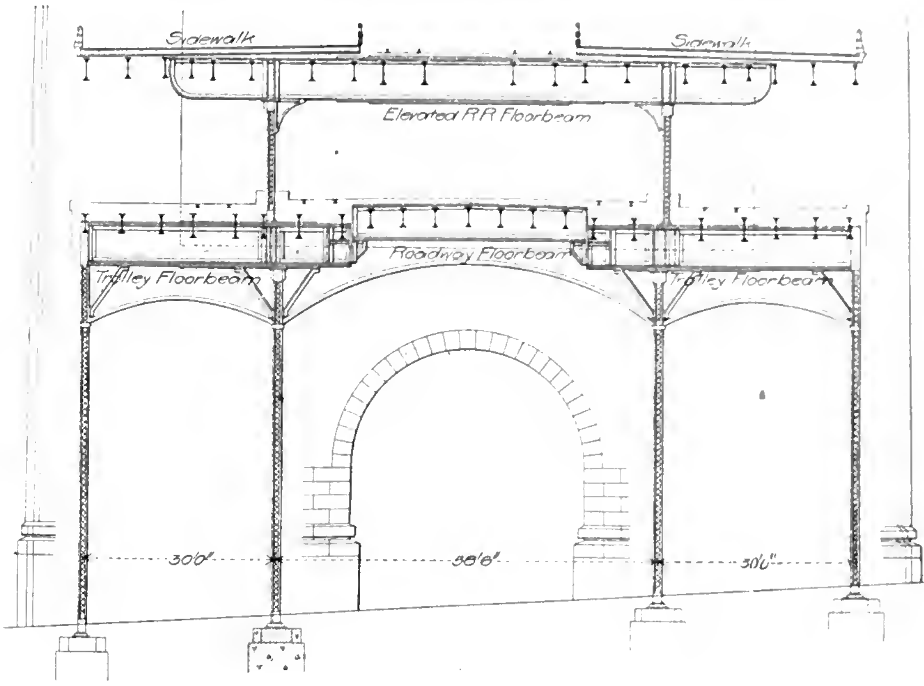
What the company is doing is this: Experience indicates that the operation of electric locomotives, owing to their lower center of gravity, has an effect upon the track different from that due to the action of steam engines. In order to ascertain the exact nature and extent of this pressure upon the rails the Motive Power Department has devised the apparatus which is being utilized at Clayton. A stretch of track about 166 ft. in length has been equipped with rails and cast steel ties, designed and made especially for this purpose. Instead of attaching the rail to the ties by spikes, a special form of block has been substituted which allows a slight movement of the rail as the engine goes over it. This movement registers the force with which the flanges of the wheels strike or press against the rails.

It is expected that a large number of experiments with this apparatus will show the company quite accurately what the effect is of either steam or different types of electric locomotives, moving at different speeds over either straight or curved track. Necessarily, to make these tests, the engines must move at different speeds. An electric apparatus has been devised to measure the precise amount of time elapsing while the different locomotives pass over this 166 feet of track, in order that in computing the effect upon the track the exact speed attained may be known. The steam and electric locomotives, however, go over the track at different times, and there is no element of contest as to speed between the two types. The matter of speed is purely incidental to the main purpose of the tests, which is to enable the company, in planning its electric installations in New York, to design a track so safe as to be absolutely secure against any form of locomotive that may be utilized.

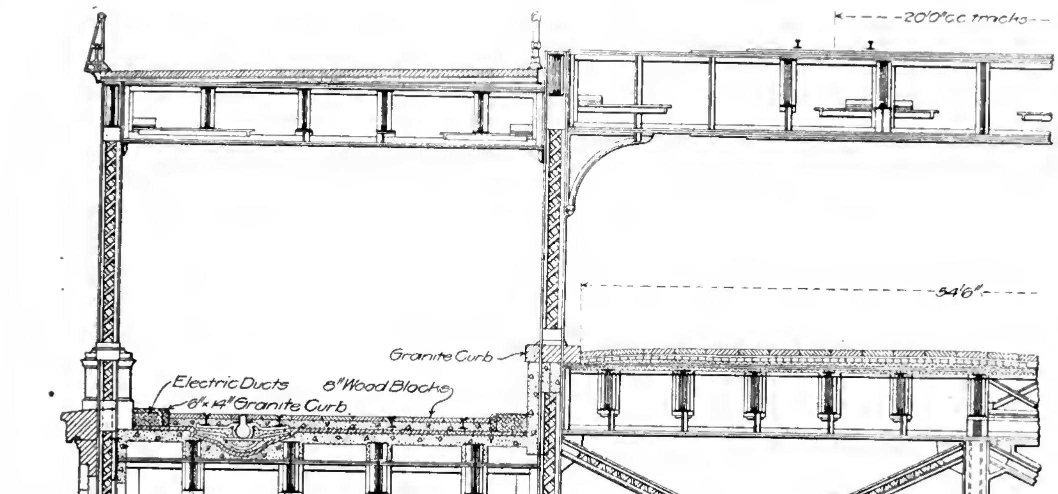
The Manhattan Approach of the Blackwell's Island Bridge.

The five main spans of the Blackwell's Island Bridge have a combined length of 3,724½ ft., a width over all of 86 ft., and a minimum height for a portion of each channel span of 135 ft. above mean high tide. They have, as described in various articles published from time to time in The Engineering Record, two lines of massive pin-connected trusses, 60 ft. apart, on centers which carry two decks, 15 ft. apart in the clear. The full-width upper deck provides for two elevated railroad tracks and two sidewalks, and is proportioned to eventually receive two more railroad tracks if necessary. The lower deck, 86 ft. wide, provides between the trusses for two Queens trolley tracks and a 36-ft. roadway. Outside of the trusses the symmetrical cantilever extensions are each proportioned to carry a single line of Metropolitan street car tracks.

The approaches are massive steel viaducts, connecting the shore ends of the anchor spans with the city streets at grade. They are built on tangents coinciding with the center line of the main span and provide for the same arrangements of decks and tracks, except as necessarily modified by the change of grade. They are, however,



Bent Adjacent to Anchor Pier.



Typical Transverse Half Sectional Elevation of Viaduct.

made considerably wider than the main spans, and although in the main conforming to standard high-grade bridge work, they are of somewhat unusual design and present features of interest, due to the efforts made to give them a monumental and artistic appearance, under difficult conditions and numerous imperative requirements that necessitated somewhat elaborate construction.

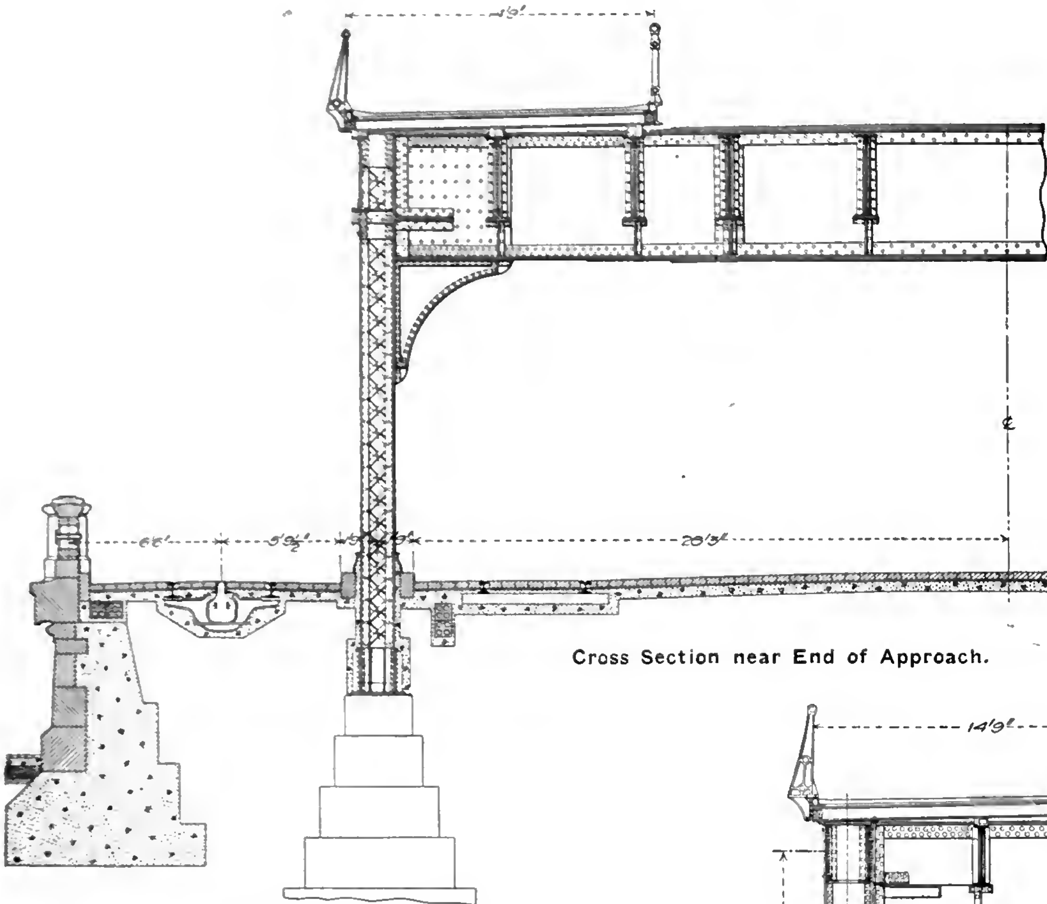
The Manhattan and Queens approaches are of very different character and construction, the former having a much more massive appearance and architectural treatment. It extends from a point between Avenue A and First avenue to Second avenue, two long city blocks, and occupies an area of about 1,070 x 230 ft. between curb lines. At Second avenue the main entrance occupies nearly the full width of this area, but the approach is soon reduced to a width of 120 ft., which is maintained up to the anchor pier, leaving spaces of about 90 ft. and 20 ft. on each side, which are paved up to the curb lines.

From the anchor pier, where the roadway is about 60 ft. above the level of the ground, the main deck is carried westward for 600 ft. on a steel plate girder viaduct, with 29-ft. spans, to a point where its height is only about 30 ft., and beyond which it is on a solid fill. Where it crosses First avenue a clear opening of 90 ft. is provided by a steel arch span, which carries the viaduct columns and is supported on massive masonry abutments. All of the steel work up to the lower deck is enclosed in granite and terra cotta, giving it the effect of stone masonry treated to represent slender arches between the bents of the steel work.

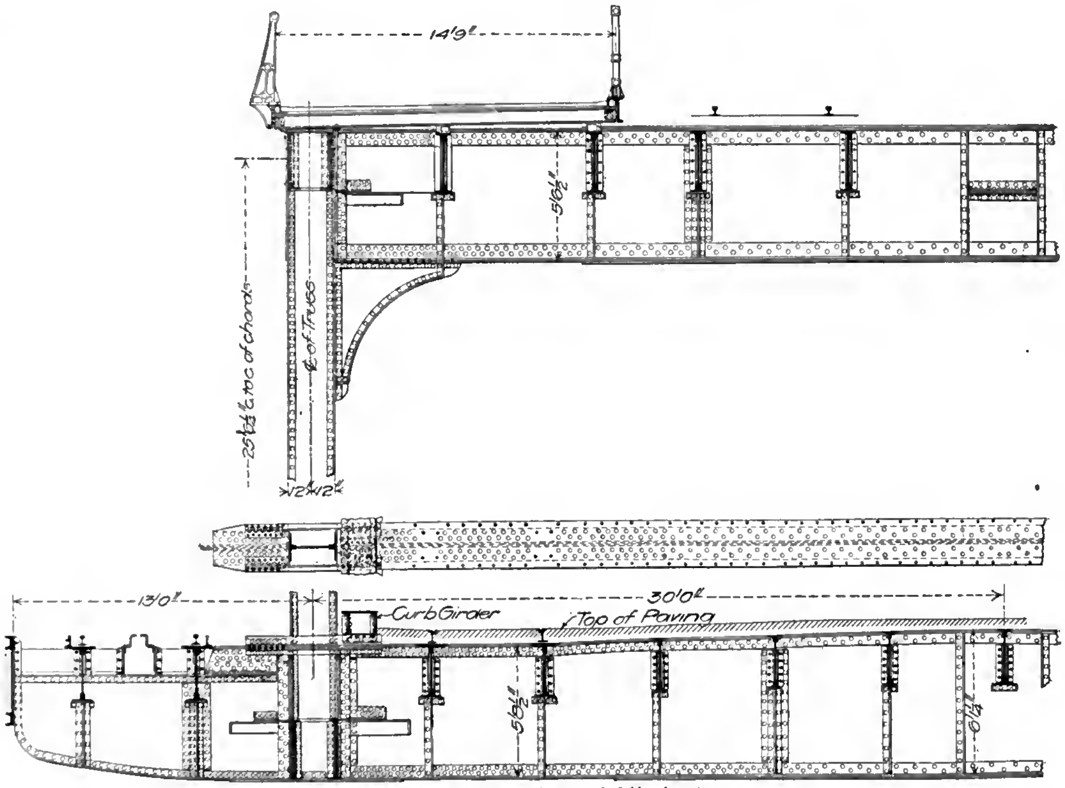
Each transverse bent has five vertical columns about 30 ft. apart, thus giving approximately equal spans for the longitudinal and transverse girders and dividing the horizontal plan into approximately square panels. Each of these panels is roofed about 25 ft. above the ground, with a waterproofed timbrel arch, which forms a false ceiling several feet below the solid roadway of the main deck, and provides underneath the viaduct an attractive sheltered space suitable for market and storage purposes.

The sidewalks are carried at the same grade as the roadway for a distance of about 100 ft. from the entrance, beyond which the grade increases, and they are carried by inclined longitudinal stringers, which gradually rise to the grade of the elevated structure at the anchor pier. The elevated railroad tracks from Second avenue are carried by inclined longitudinal stringers, which gradually rise to the grade of the elevated structure at the anchor pier.

The elevated railroad tracks from Second avenue are carried the full length of the approach on the second platform, which amounts to a plate girder viaduct, about 21 ft. high and 60 ft. wide, with 29-ft. spans. Each bent has two vertical columns 58.5 ft. apart on centers, which are seated directly on the tops of the intermediate



Cross Section near End of Approach.



Half Cross Section of Viaduct.

columns for the lower platform. The columns are continuous with those of the lower viaduct, but above the main floor are not enclosed in masonry, thus frankly revealing the steel construction and giving the effect of a light superstructure on a massive substructure.

The two outer tracks on the lower deck of the approach diverge from the center line of the bridge at a point about 300 ft. from the entrance and connect by reversed curves with the surface tracks in 59th street and 60th street, which are about 260 ft. apart. Adjacent to them on the lower decks are two more tracks for the Queens trolley cars, which toward the entrance descend below the roadway level to a subway station occupying a trapezoidal area 300 ft. long and 200 ft. in extreme width below the surface of the ground.

In the subway there are five loops, allowing for continuous car movements, with opportunity for safely and rapidly loading and unloading. In each of the spaces between loops double transverse stairways descend from the main platform to the subway station between tracks, thus giving access to all of the cars without the necessity of crossing the tracks. This station is designed to be eventually connected with the proposed subway line. The roof is supported on transverse I-beams and longitudinal plate girders, carried by riveted steel columns about 20 ft. apart and covered with vault lights and concrete slabs.

The transverse bents of the viaduct are sway-braced by solid-web knee-brace brackets under both ends of the elevated railroad girders, by detached knee-braces under both ends of the outer transverse girders in the lower deck, and by two panels of X-bracing between the three center columns below the roadway. Longitudinal bracing is provided by the main stringers and by wall girders connecting the outside columns and supporting the masonry between the tops of the arches and the parapet.

The wall girders consist of two pairs of angles from 3 to 13 ft. apart, and the space between them is divided into panels by vertical members and X-braced by single diagonal angles, besides which longitudinal knee-braces are run from the center of each panel to each column. The wall girders are made with pairs of 6 x 6-in. angles for the top and bottom flanges and for the web members, which are either zigzag or X-braces, according to the depth of the girder. Connection plates are riveted between the vertical legs of the flange angles to receive the members and project across the cover plates of the main columns, to which they are field riveted. The knee-braces have I-shaped cross sections, made with pairs of 4 x 3-in. angles, back to back, latticed.

The main columns have H-shaped cross sections, made with two built channels, latticed and connected by a center diaphragm. The center column extends to the lower deck only, and the four outer columns extend to the upper deck and are spliced just above the lower deck. Where they pierce the granite coping above the lower deck they are enclosed in a 4 x 2½-in. brass base, below which the interior of the column is filled with concrete. Except in three bents nearest the anchorage, all of the transverse girders are web-connected to the columns.

The longitudinal girders are spaced from 3 to 5 ft. apart under the sidewalks and roadway, besides one for each rail of each track. The roadway stringers support an 8-in. flat concrete slab, reinforced with transverse steel bars of 0.28 sq. in. cross sections, 6 in. apart, and longitudinal steel bars, 0.10 sq. in. cross section, 1 ft. apart, every alternate transverse bar being bent over the top flanges of the stringers. The upper surface of the concrete is covered with a ½-in. thickness of waterproofing, protected by a single course of red brick laid flat. On the bricks there is a 1-in. layer of cement mortar, in which the 4-in. creosoted wood paving blocks are laid.

The four transverse bents nearest the anchor pier are special and differ from the regular bents in the number and location of the columns and in the arrangement of the girders. Bent No. 1 is so near the anchorage that the sidewalk stringers can readily span from the anchorage to bent No. 2, and the regular transverse sidewalk girders are omitted, and the elevated railroad girders are made longer than the distance between their columns, so as to overhang them at each end. The center column supporting the lower deck is also omitted, and the two transverse girders in the outside panals are cantilevered 11 ft. beyond the interior columns, with notched seats on their ends to carry the extremities of a connecting center girder 26 ft. long.

Bent No. 2 differs from the typical bent chiefly in that it has an arrangement of cantilever transverse girders in the lower deck similar to that in bent No. 1, and that two auxiliary columns, making seven in all, are located under the extremities of the cantilever girders. Bent No. 3 resembles bent No. 2, except that the auxiliary columns are omitted. In bent 2 and 3 the intermediate upper columns supporting the upper deck are eccentric from the corresponding one supporting the lower deck.

In the regular bents the elevated railroad transverse girders, 58 ft. 6 in. long, have webs varying from 48 x ⅝ in. to 66 x ½ in., with 6 x 8 x ¾-in. flange angles, and three 18-in. cover plates of varying length and from 9-16 to ¾ in. thick. They are seated on solid-web knee-braces about 6 ft. deep, which give very rigid connections to the columns and provide for swaybracing without diagonals.

The side girders of the supper deck are 30 ft. long on centers of columns, have a 48 x ⅜-in. web plate, and in each flange two 6 x 6 x 9-16-in. angles and a 14 x ½-in. cover plate 22 ft. long. The ends are not knee-braced, but are seated on reinforced shelf angles and are thoroughly web-connected to the columns. The girders directly

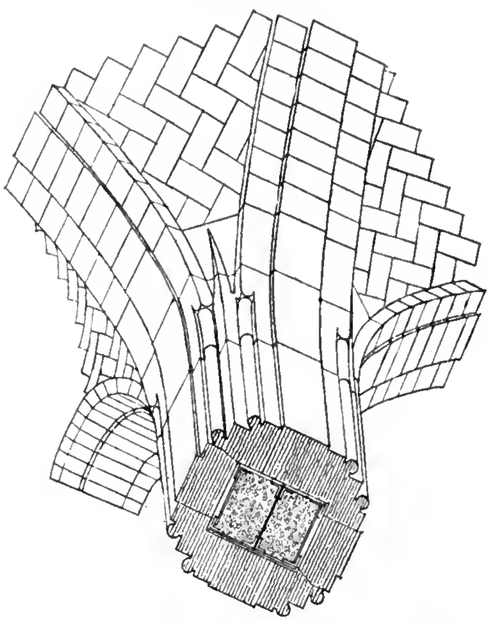
under these correspond to them, except in their dimensions, and that they have at each end a knee-brace made with a pair of 6 x 6-in. bent angles, riveted together back to back. They are 60 in. deep and have two cover plates.

The center transverse girder in the lower deck differs from the last described principally in having a single cover plate, and that it is made in two lengths, abutting in the axis of the bridge on top of the center column. There are also solid-web knee-brace brackets under both ends, which also serve as connections for the sway brace diagonals below the girder. The fixed ends of all longitudinal stringers are web-connected to the transverse girders.

The expansion ends of the roadway stringers are seated in pockets projecting from the face of the transverse girder webs and have their lower flanges supported by and are free to slide upon a horizontal bearing provided by the outstanding legs of reinforced shelf angles. Short angles are riveted to the under side of the top flange angles at the ends, with their outstanding vertical legs engaging the faces of the pocket angles, so as to provide sliding bearings and hold the girder firmly in transverse position.

The expansion connection of the elevated railroad stringers is the same as that already described, except that the seat in the lower part of the pocket is made with a curved stirrup plate riveted to the pocket angles and receiving a convex cast shoe, on which the bottom flange of the stringer rests.

The stringers in the outside panels of the lower deck are made with drop ends seated on the top flanges of the transverse girders, so that the stringer flanges are elevated sufficiently above the girders to give clearance for the yokes of the electric conduits between them. The expansion girders slide freely on the top flanges of the transverse girders and on horizontal bracket angles riveted to the web of the girder to engage lower flange connection plates.



Column Enclosed in Terracotta.

In transverse bents 10 and 15, which form part of the tower at the extremity of the First avenue arch, there is X-bracing below the lower deck. No other bents have transverse bracing to the ground. The feet of the columns are reinforced with vertical transverse diaphragms, making H-shaped cross sections, with wide vertical flanged cover plates stiffening the extended horizontal base plate, which is also reinforced by 12 short vertical angles riveted to the webs of the channels and to their cover plates, with their lower ends milled to bearing on it and thus distributing the column load over the full area of the top of its pedestal. The pedestals are webbed steel castings, 12 in. high and 48 x 52 in. on the base.

The arch at First avenue is made with five hingeless box plate girder ribs, with a rise of 13 ft. and a span of 100 ft. on centers. Each end of the rib is produced 5 ft. beyond the extremity of the 100-ft. span line to reach the skewback bearings concealed in the interior of the tower and thus increases the real rise and span to about 16 ft. and 108 ft., respectively. Each rib is made with a pair of built channels 48 in. deep, with latticed top and bottom flanges and webs 16 in. apart. Each channel is made with one 48 x 11-16 in. and one 36 x 11-16 in. web plates and two 8 x 6 x 11-16-in. flange angles.

The two ribs which carry the elevated railroad columns have much heavier loads and are made with correspondingly increased dimensions and materials. Their nominal rise for the 100-ft. chord is increased to 18 ft., and each channel is built with two 48 x 5/8-in. and one 36 x 3/4-in. web plates and two 8 x 6 x 3/4-in. flange angles. In all ribs the ends are heavily reinforced by double pairs of angles, with filler plates between them riveted together back to back on the outer faces of the web.

The ends of all arch ribs are faced normal to the curve and have an extended base plate, anchor bolted to a cut stone pedestal. Each rib is shipped in four sections, with radial butt joints at the crown and quarter points, which are thor-

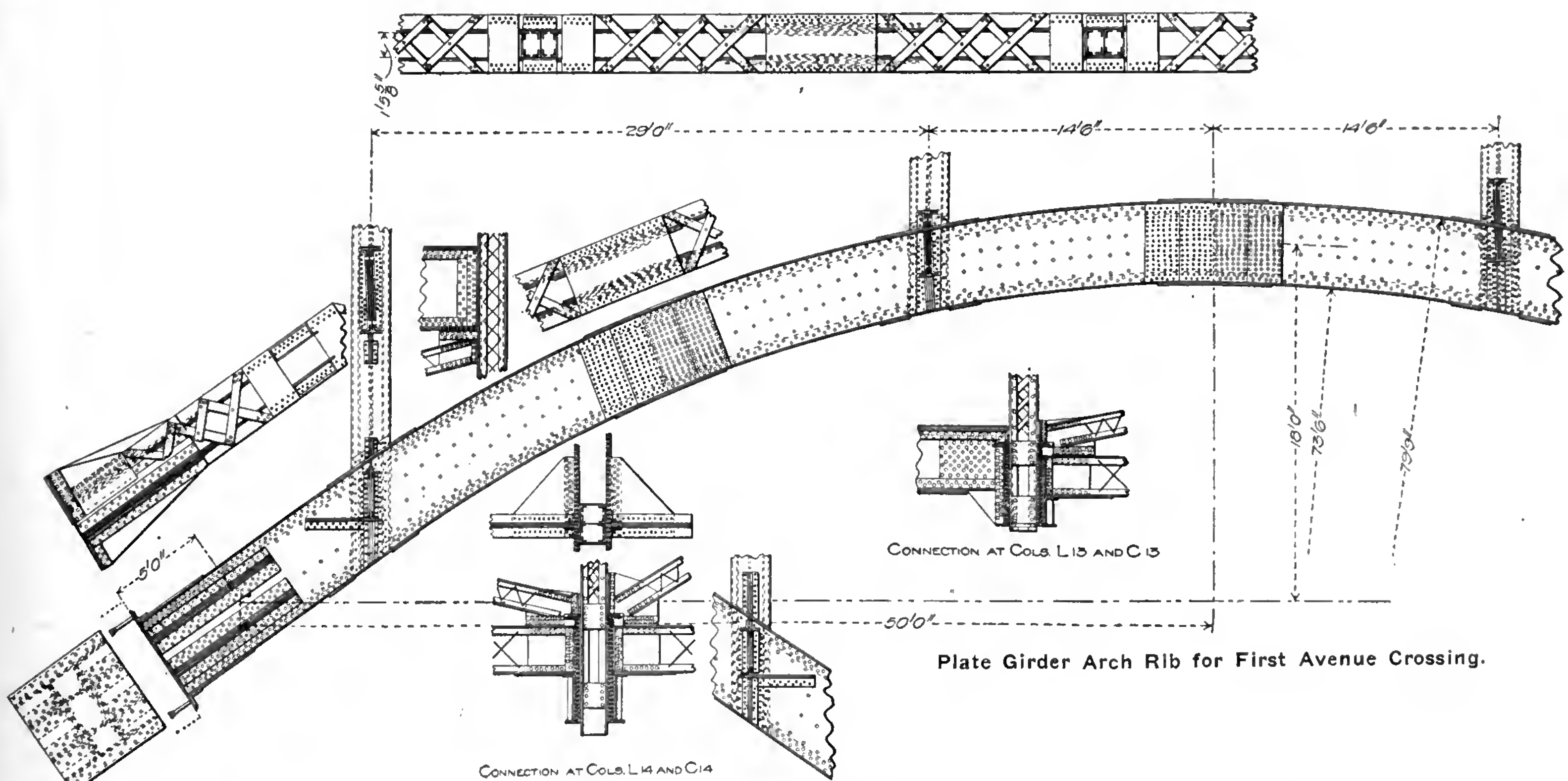


Plate Girder Arch Rib for First Avenue Crossing.

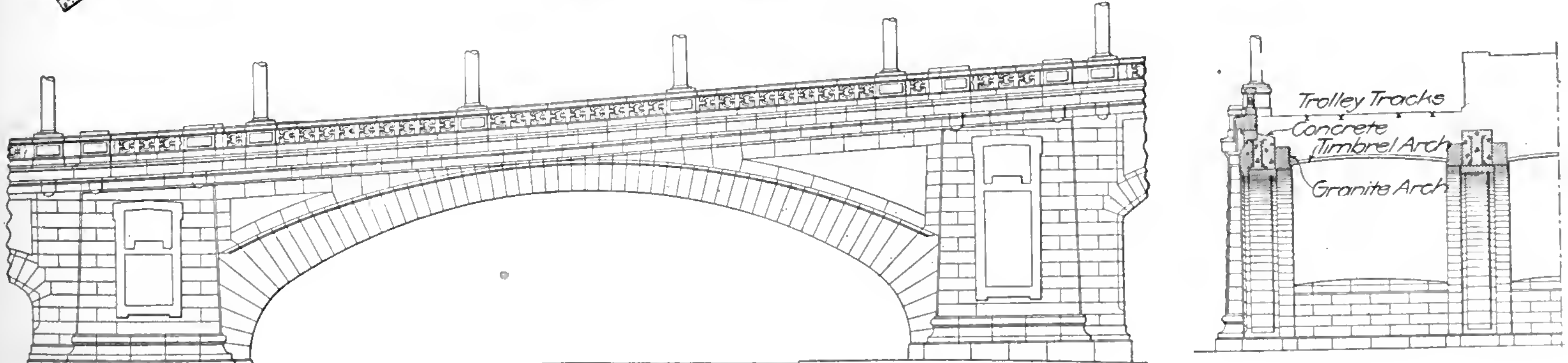


Plate Girder Arch over First Avenue.

oughly spliced with field riveted web and flange cover plates. Each rib carries four vertical columns, with its flanges field riveted between the webs of the rib. The quarter splices will be riveted before any floor weight is imposed on the span, but the crown splices will not be riveted until most of the dead load is carried by the rib.

The spandrel walls carried by the arch ribs will be built with ¼-in. vertical joints at the end bents, filled at first with asbestos felt and afterwards pointed with lime mortar. Each rib is to be enclosed in a solid rectangular mass of concrete and will be faced on the two vertical sides with granite voussoirs, anchored to it and provided with skew-back bearings, so that they really form independent, self-supporting arches. Thin flat soffit pieces of granite are also anchored to the rib to connect the two side faces and cover the intrados. Projections on the lower part of the side voussoirs receive and support the ends of the timbrel arches, which connect the main ribs and form panels of a ceiling between them.

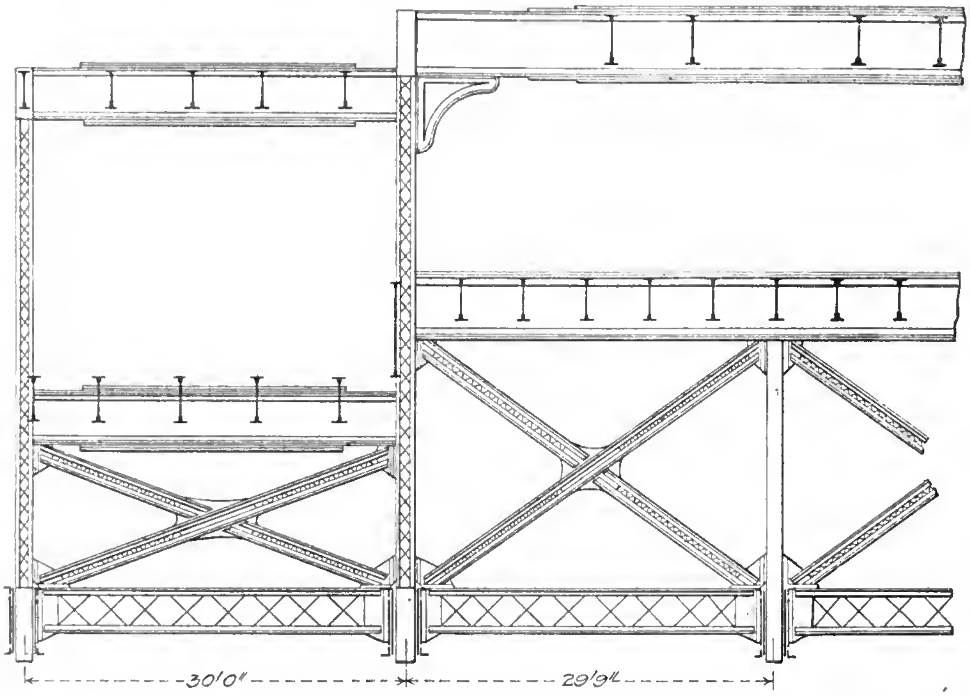
The lower portions of all columns are filled solid with concrete, and the columns are enclosed to the height of the timbrel arches with moulded terracotta blocks, which give them the appearance of cut-stone work, and are carried up to form skew-backs for the fascia arching and above them to divide the spandrel walls into panels, which between the arch and the parapet is filled in with ornamental tiles. The parapet is made with solid projecting courses, forming a cornice at floor level, and with ornanmental perforated courses, forming a massive balustrade.

The structure is proportioned for a maximum concentrated loading, and the specifications for material and workmanship of the different portions of the structure correspond in general to standard requirements. Concrete is made in three grades, namely, of 1:3:6 for the substructure, 1:2:4 for the upper part and 1:4:8 for cinder concrete as a filling under the floor. All concrete is machine mixed and thoroughly rammed and is made with Giant Portland cement, which in 40-ton or carload lots must show in the 28-day test average results 15 per cent. better than the 7-day tests for neat cement and 25 per cent. better than the 7-day test for 1:3 samples, besides developing the required minimum strength. All exposed granite work is finished with rock face, rough pointing, Pean hammering, or four cut. Rough pointed surfaces are uniform within ½ in.

All structural steel is made by the open-hearth process by either acid or basic methods, with the maximum percentages of phosphorous, sulphur, manganese and silicon limited to .06, —.04, —.06 and .10 per cent., respectively, for both, except for basic steel, which may not exceed .04 per cent. of phosphorous. All steel, except rivets, has an ultimate strength of 60,000 to 68,000 lb., elastic limit of 33,000 lb., elongation of 1,600,000, divided by the ultimate, and a minimum reduction of area at point of fracture of 44 per cent. Variations for weight are permitted, in accordance with the standard specifications of the American Society for Testing Materials. Rivet holes are drilled from the solid through materials more than ¾ in. thick and in other material are punched and reamed. All rivet holes are reamed with a special reamer making a 1-16-in. filet under each end of the rivet. All beam and stringer connections are reamed to cast-iron or steel templates ⅝ in. thick, with hardened bushings for all holes. Fluted reamers are not allowed. When hand rivets are unavoidable they must be driven entirely with 8-lb. hammers.

The concrete floor and roof slabs are waterproofed with hydrex felt or equal and coal tar pitch, which is also applied to the side walls of the subway stations. The concrete roadway and solid track floor are cast in position. The 1:2:4 reinforced concrete sidewalk slabs are cast in moulds in the contractor's yard and stored 30 days before using. They have a ½-in. wearing surface of 1:1½ Portland cement and sand, are laid on ½-in. mortar beds over the steel bearings and have ½-in. joints filled with 1:2 grout. Very complete specifications are given for the track construction conduits and electrical work. The principal quantities involved in the work include 35,000 cu. yd. of excavation, 6,000 cu. yd. of fill, 16,000 yd. of concrete, 110,000 cu. ft. of cut stone and 130,000 sq. ft. of terracotta. The estimated weight of the structural steel is about 12,000,000 lb.

The bridge was designed and its construction is being supervised by the Department of Bridges, of New York City, Mr. James W. Stevenson, Commissioner; Mr. C. M. Ingersoll, Jr., chief engineer. The contract was awarded May 21, 1907, to the Snare & Triest Co., Mr. Frank Miller, chief engineer, and Mr. J. C. Haine, resident engineer. The steel work is being fabricated at the Pennsylvania Steel Co.'s shop, and concrete is made with Giant Portland cement.



Half Transverse Section through Arch Span at Haunches, Blackwell's Island Bridge.

A Five-Span Bridge across the Rhine containing a center cantilever span of 678 ft., was completed during the present year. The bridge, which connects Homberg and Ruhrort, spans two canals, and a harbor basin, in addition to the river, and has a total length of 2085½ ft. The spans are 296¼ ft., 405¼ ft., 678 ft., 427½ ft. and 278¾ ft. The width is 54 ft., divided into two 8 ft. footwalks and a 38 ft. roadway carrying two electric railway tracks. The foundations, according to "The Engineer," London, proved a difficult task because of mines, which are still being worked, under the river, and their design was adapted so as to cause no danger to the workings. The cantilever arms are each 114 ft. long, and the suspended span, which is hung freely between them so as to expand and contract, is 450 ft. long. The total load coming on each of the two piers for the cantilever span is 9,194.6 tons, of which 1,782.8 tons is due to live load. The load on the foundations is about 11,800 lb., or 5.9 tons per square foot. The approach and anchor spans were built on wooden falsework. The cantilever span was built without obstructing the channel, except that a temporary timber pier was built in the center of the river to carry the suspended span during erection. The total cost of the structure, including piers, falsework and all expenses, was about $1,092,700.

Road Hardening and Dust Prevention about Boston.

At the regular quarterly meeting of the Massachusetts Highway Association on Nov. 12, road hardening and dust prevention were the topics considered. The first paper was read by Mr. John R. Rablin, engineer of the Metropolitan Park Commission, Boston. Mr. Rablin referred to the treatment with tarvia of 3½ miles of park roadway in Revere, Chelsea and Everett about a year ago, and stated that a test of this length of time, with attending severe winter conditions, enabled some judgment to be formed of the merits of the treatment. During the winter one portion of the roadway for a distance of about 2,000 ft. showed signs of scaling, the top surfacing of tar and screenings about ¼ in. in thickness breaking up and leaving the roadway in about the condition it was before treatment. This action he assumed was due primarily to the condition of the road on which the tarvia was placed, an excessive amount of binding material having been used in its construction, which prevented proper penetration. After the scaling the road remained in good condition, however, and seemed to derive some benefit from the treatment. One other section, 1,500 ft. long, appeared to have been lightly treated; that is, too little material was used, or it penetrated more rapidly or to a greater extent than ordinarily, as the larger stones of the road were not covered with the surfacing of tarvia and screenings. This road seemed thoroughly bonded and remained in good condition. Generally winter conditions had no bad effects, and the roadways have been clean and free from dust or mud.

In July, 1907, some other portions began to show the effects of wear, and during July and August about one-half of the 3½ miles treated in the fall of 1906, including the portion which scaled and the portion improperly treated, were re-treated with tarvia, and the balance of the 3½ miles patched where necessary. The average cost of the re-treatment was 6.4 cents per square yard. Considering the entire 3½ miles, the cost of maintenance of the tarvia surfacing, including re-treating and patching, was 3.5 cents per square yard.

During this year, about 90,000 sq. yd. of roadways have been treated with tarvia at an average cost of 7.3 cents, in addition to the maintenance of that laid in 1906. The cost of the different

jobs varied from 5.8 to 9.3 cents, the variation being due principally to the condition of the roadways treated, the cost of labor varying the greatest amount, and the cost of tarvia varying somewhat with the amount required for the different conditions of roadway. Some portions of this new work became uneven and rough on account of the bunching of the tarvia, attributed to a variation in the quality supplied. This condition did not lessen the effectiveness of the treatment, and in general the results of the use of tarvia have been satisfactory, the road surfaces being preserved practically dustless and mudless.

Various experiments were made during the year by the Metropolitan Park Commission in the use of oil on the roads, notably in the Charles River and Revere Beach reservations. These roads were treated with a petroleum product called "asphaltoilene," which is furnished and applied by the Good Roads Improvement Co., of Cincinnati. This material is a Kentucky oil with the naphtha and other volatile substances removed, leaving a heavy asphalt base, which is applied to the surface of the road in its natural state by the White oiler, a machine used in oil applications in California. This treatment requires a road in particularly good condition, either nearly new or newly resurfaced, and very little cleaning except the removal of loose dust is necessary. The cost of this work was 6 cents per square yard for the material and its application. The cost of cleaning was negligible.

Cost of Tarvia Treatment, Metropolitan Park Commission.

Roadway.	Work Done, 1907.	Total Cost.	Sq. Yds. Treated.	Tar Used, Gals.	Stone Used, Tons.	Cost per Sq. Yard. Labor.	Tar.	Stone.	Total.	Tar per Sq. Yd.	Stone per Ton.
Middlesex Fells...	Aug. 19-31.....	$1,403.74	15,000	8,846	234	$ .0318	$ .0383	$ .0234	$ .0935	.5897	.0156
Revere Beach Parkway.......	June 20-July 6..	912.33	12,780	4,087	219.6	.0200	.0250	.0260	.0710	.3200	.0170
Revere Beach Parkway.......	July 6-Aug. 17..	3,020.53	47,260	18,182	712	.0151	.0282	.0206	.0639	.3840	.0150
Winthrop Shore...	Sept. 23-Oct. 12.	1,635.95	23,500	10,845	256	.0215	.0324	.0157	.0696	.4615.	0109
Lynnway and Northern Circle.	Sept. 16-21.....	736.55	8,840	4,710	189.5	.0185	.0376	.0272	.0833	.5300	.0214
Revere Beach Reservation....	May 22-June 22.	1,315.37	22,825	8,955	359	.0107	.0282	.0188	.0577	.4011	.0167
					Avg. cost.	$ .0196	$0.0316	$ .0219	$ .0731	.4477	.0161

The Charles River road is about 1 mile long and is constructed with a gravel surface. An excessive amount of oil was used here on account of the uneven condition of the road, necessitating a week's closing to allow proper penetration. A light sprinkling of gravel was required in some places to absorb the surplus oil. This road has been in excellent condition since the work was done in June, 1907, and has required no watering and no repairs. Although the appearance was not very agreeable at first it appears that the excess of oil will enable the treatment to last another year if the frost does not injure it to any great extent.

About 17,000 sq. yd. of the Revere Beach drive was treated with this material. This road is a macadam, had been constructed 1 year, and was in very good condition. Too little oil was used, especially at the sides, on account of a fear of marring the appearance of the concrete gutters and edgestones. Therefore the road was not thoroughly bonded, and early this fall began to pick up a little. Another light treatment was given it where necessary and it is now in very good condition. Mr. Rablin considered this treatment effective in preventing dust and in bonding the road surface, especially with a gravel surface. The oil gives no offensive odor. In the Middlesex Fells Reservation 140,000 sq. yd. were treated with a mixture of water-gas tar and Kentucky oil similar to that just described. At the beginning of this work an emulsion with 25 to 30 per cent. oil was used, but Supt. Price experimented with the mixture of oil and water-gas tar; considered it cheaper and fully as good, and used it for the greater part of the work. This mixture is made in proportions varying from two barrels of oil and six barrels tar, to four of oil and six of tar, depending on the road condition. This mixture was heated by a steam coil and applied by a special attachment to a watering cart designed by Mr. Price. This treatment thoroughly lays the dust, remaining effective eight to ten weeks, but after that time further treatment is necessary. The method has little, if any, bonding qualities and does not prevent the roads from being stripped of their surfacing, the materials working into the gutters. The average cost of one application is about 4 cents per square yard.

In the accompanying table cost data for *tarvia treatment* of roadways by the Metropolitan Park Commission are given in detail:

The cost to maintain the Revere Beach Parkway (8,880 sq. yd. new) was $2,377.25, 67,434 sq. yd. being treated. The cost per square yard was $0.0351.

Mr. Rablin stated that the net cost of oil per gallon was 7.5 cents, and tar 3.5 cents. One gallon of the oil mixture would take care of 3 sq. yd. of roadway, on the average. On the Revere Beach Parkway from 0.5 to 0.75 gallons of asphaltoilene per square yard were required.

Mr. F. C. Pillsbury, division engineer of the Massachusetts Highway Commission, pointed out that the effect of automobile travel has been so injurious on the through lines of main roads between Boston and interior points that if any one of these roads were to be macadamized new today and then subjected to the automobile traffic of the past season, it would be necessary to resurface it in about two years, even under ordinary repairs. The Highway Commission concludes for the present that tarviating is the best method for protecting the surface of macadam roads, consequently at Lynn, Weston, Wayland, and other points this process has been used.

At Lynn a road extends across the marshes, and is much exposed to sun, wind and high-speed automobile operation. The result was that one year from completion of about a mile of almost perfect road, the highway had to be resurfaced. A month later tarvia was applied. An unusual expense was incurred in the removal of a crust formed by the fine stone and dust swept to the sides by the automobiles, and used for binder in re-surfacing. It was rolled down with saltwater, and when the surface came to be cleaned about 0.5 in. of this crust was found, which had to be loosened with harrows and picks and taken up with shovels. The portion of the road on which the tar was coolest when used made the best surface. In order to allow use of the road it was tarviated half at a time, but the result was a patch at the overlap. Since July 4 the road has shown practically no signs of wear, though subjected to probably as much automobile travel as any road in Massachusetts. The only repairs necessary have been at a few small spots, the largest not over 2 ft. long, where all the crust of mud was not removed.

On the Wayland road it was necessary to first patch and re-surface the entire macadam and clean it, which ran up the cost. At Weston the surface was better. It was found at Wayland that by rolling clean sand into the No. 2 stone on the surface, only a little more tar was used than on an old hard road. This disproved the idea that one could not tarviate on a newly re-surfaced road. The tar was used on the clean, new stone without spreading stone dust and water. The result has been better on the newly re-surfaced places. A number of experiments with sand and stone screenings were made for a covering material, but the best results were obtained with pea stone. All fine dust and floury material should be excluded.

At Wayland, as an experiment, a mixture of pitch was tried in the proportion of one barrel of pitch to three of tar, and one to four also. There was no apparent difference in the applying nor as yet in the wear.

The U. S. Government, through the Good Roads branch of the Department of Agriculture, working with the Commission, conducted some experiments on the Wayland and Weston roads. Mr. Prevost Hubbard, a chemist, of Washington, was in charge. Tarvia, coal tar, water-gas tar, rosin, salt and terra-colio were tried singly and in mixtures. The terra-colio, an emulsion of a crude oil preparation, has done very well as a dust layer in two applications. There seems to be little choice between any of these; possibly the mixture of coal and water-gas tar with rosin and salt may have the best qualities for wearing surface and dust laying. The water-gas tar was also used alone. It was spread on the macadam from a tank car and then covered with fine gravel and rolled. At first the tar and sand mixture became loose in patches, but it gradually packed down and now presents a very good surface, giving practically no dust. Careful records of weather and temperature were kept in all this work. The following costs were obtained:

	Length.	Width.	Area.	Cost per Sq. Yd.	Tarvia per Sq. Yd.
Lynn	0.78 in.	31.4 ft.	14,480 sq. yd.	$0.087	0.44 gal.
Weston ...	3.15 in.	15.0 ft.	27,720 sq. yd.	0.12	0.55 gal.
Wayland ..	2.25 in.	13.0 ft.	18,286 sq. yd.	0.215	0.55 gal. resurf.

The tarvia work at Wayland cost about 8 cents per square yard. At Lynn the road was near the coal tar company's base of supplies. The Commission used two heating kettles, heating four or five barrels of tar at once. An average of 1,000 lin. ft. or 2,000 sq. yd. a day with one gang was about the best that could be done in fair, dry weather. Mr. Pillsbury advocated the use of larger kettles, regular machines for heating and spreading the tar, as in France; cleaner sweeping, perhaps with a vacuum cleaner; securing uniformity of tar by test and inspection, and not beginning work before May 1 or continuing it after Oct. 1. He stated that the Warren Brothers bitulithic pavement seems to stand the wear of automobiles best, but at too high a cost. He doubted the permanence of a coating of tar on state highways, and suggested increasing the depth of the tar surfacing, either by forcing it farther into the stone when the roads are first built, by using compressed air, or by increasing the thickness on the top. Gravel roads show the effect of automobile travel much less than those of broken stones. Macadam filled with sand of proper quality is much less damaged by automobiles than macadam consisting purely of the clean stone with the binding material used merely on the surface. Mr. Pillsbury stated that he had not noticed any tarviated roads in a slippery state yet. His construction outfit consisted of two kettles, one pair of horses, twelve to fourteen laborers and teams to haul sand and stone.

The next paper was on dust suppression in the Boston Park Department in 1907, by Mr. John A. Pettigrew, Superintendent of Parks, read by Mr. Shea. From 12 miles of roadway treated with oil in 1906, the treatment was extended this year over the whole system of roads, about 44 miles in all, with satisfactory results, the dust being laid perfectly. The cost of the oil treatment is cheaper than watering. The cost of watering was computed a few years ago at $489 per mile of 30 ft. roadway on 182 days in Franklin Park, and $883 per mile of 30 ft. roadway for the same service on 230 days on Common-

wealth Ave. An average of $686.00 per mile is a very fair estimate for the entire system. From April 15 to Nov. 1 the cost of oiling has been $352.67 per mile of roadway 30 ft. wide, or 2 cents per square yard. The total amount used between the above dates was 1.49 pints per square yard. The dusty season is not quite over. There is a difference of $333 per mile in favor of the oil treatment. The watering practice is to water whenever the dust flies, if the temperature is not below 24° Fahr.

The asphaltum in the oil has a binding effect on the road surface, and less surface repairs are necessary. Less washing results from rains, and less gutter scraping is necessary. The softer footing on an oil-treated road is a benefit to horses, reducing the cost of shoeing. The oil is applied in the form of an emulsion. The first application of the season contains about 16 per cent. of oil to form a basis; renewals contain from 5 to 8 per cent. of oil, and are made in from 10 to 20 days, according to location and use of roadways. The emulsions are made by steam pumps, which do all the work of the transference and agitation of materials. To emulsify 2 barrels of oil, 18 lb. of common soap, at 4¾ cents a pound, are sufficient, with one barrel of water. This stock is taken on the work and supplies the ordinary sprinkling wagons, which do the work of applying the emulsion to the roads, the mixing in the sprinkling wagons being accomplished at the street posts or hydrants.

The Department is still in favor of a thin rolling cushion of coarse sand or fine screenings saturated with oil. This is, however, hard to maintain on curved roads, the swing of the wheels throwing it to the outer side of the curve. It is thought that this cushion releases the air suction below the tire, so destructive to the road binder. Fine or dead sand of a yellow color makes a pleasing surface, but if too heavily treated with oil an asphaltum surface will result, with tendency to scale. In the brief discussion which followed, Mr. Shea stated that the oil used is a Texas variety with an asphalt base, and that about two applications of sand were made during the season. The cost of sanding was not figured.

Mr. Charles W. Ross, Street Commissioner of Newton, then described experiments made in that city with road preservatives, chiefly on Commonwealth Ave. This thoroughfare, which is a continuation of the avenue of the same name in Boston, extends 5 miles through this residential suburb, and is divided into a north side used for teams, a central boulevard section used by trolley lines, and a south roadway, 36 ft. wide, used exclusively for automobiles. A section of 3,500 sq. yds. had hot tarvia applied during 1906, and went through the past winter excellently. Mr. Ross stated that the road was in better condition this year than last, and he attributed a smoothing down action on the tarvia to the rubber tires traversing it. Another section was laid with tarvia over an area of 28,843 sq. yds., at a cost on the average of 11 cts. this year. The road has a coating like india rubber. At Washington St., Newton Lower Falls, tarvia was used covered with ¼ in. sand and fine screened gravel, which gave better results than the flour of screened stone, which is dusty.

Asphaltoline was also successfully used on Commonwealth Ave. at a cost of 6 cents per square yard. Mr. Ross stated that oil does not save the surface of the road, but it stops the blowing off of dust. No complaint has been received from residents of Newton streets on which oil or tarvia has been tried. The cost of spreading Texas oil with machinery was 2.5 cents per sq. yard. A light coating of sand shaken on afterwards has been found to stop spattering. On another street in Newton the roadway was rolled with ¾-in. stone, and hot screenings mixed with 20 gal. of oil per cubic yard of screenings were spread with shovels. The work was done in June and the whole cost was 12 cents per square yard. The street has not been watered since.

Another experiment was tried on a section of Commonwealth Ave., where the roadway was worn down 2 or 3 in. lower at the centre than at the sides. A thin mortar made of 1 part Portland cement and 4 parts sand was swept upon the road with a broom at a cost of 7¼ cents per square yard. This has been in service, with very good satisfaction, since last June. The experiment was also tried of sweeping tarvia upon the cement to smooth it, and on a short section of roadway this has lasted well since the past summer season. A penetration of ¾ in. had been obtained with the tarvia put down a year ago. Asphaltoline went fully 1 in. into the macadam.

Col. Wm. D. Sohier, of Beverly, referred to the success of the calcium chloride treatment as a dust layer in Beverly last summer, and also outlined work done with oil. In using oil he urged

Openings Cut in Stack at Bissell's Point Preparatory to Wrecking It.

putting enough material on top to permit the oil to come up through it. He emphasized the importance of not applying the oil in cold weather unless it is heated, pointed out the necessity of sloping the road first, and stated that the oil should not be allowed to go within 18 in. of the gutters. About half a gallon of oil per square yard is ordinarily adequate. Col. Sohier warned the members against leaving an oiled roadbed over night without gravelling the surface, on account of the washouts incidental to showers. Better results can be secured with calcium chloride and water than with water alone.

Mr. George Kimball, Superintendent of Streets, Manchester, stated that he used a tar and pitch composition, proportions not stated, on the top surface, mixed with egg and nut stone. This was applied in wheelbarrows with a rake, and no mud resulted. Dust was considerably reduced. Good results had also been obtained with calcium chloride. He had oiled 23 miles of road at a cost of 6.5 cents per yard, including spreading the top dressing of crushed stone, and had secured 2½ in. penetration below the surface.

Mr. A. B. Cowdery, of Boston, stated that the treatment of hollows in the roadway with tarvia and stone dust might cause the bunches previously referred to, unless the roadway were carefully surfaced first. Tarvia will not be smooth if the screenings are coarse when rolled into it. He emphasized the proper methods of handling such work from the standpoint of the tarvia representative.

Mr. Benjamin P. Richardson, president of the Calcide Process Company, discussed the classification of roads according to traffic, and stated that main arteries over which automobiles are allowed to run between towns at unlimited speeds are not advantageous subjects for calcium chloride treatment. This treatment is at its best in cities and towns where there is a large percentage of foot traffic. The treatment is odorless and spotless. Last summer a test was made under the supervision of the Department of Agriculture on a road in the government grounds at Washington. The road originally was built of trap rock, patched with limestone and then repaired a second time with trap rock. The upper and lower stones had ground the limestone to powder, and this dust had destroyed the binding properties of the surface. The first treatment with calcium chloride was in July, and since that time but two or three applications have been made. The road is now in very satisfactory condition. At Hingham, Mass., the calcium chloride treatment has been found cheaper than water, leaving no dust and mud, keeping new macadam moist and holding it in dry weather.

At Beverly Farms last summer 9.69 miles were treated, with an area of 108,013 sq. yd. This was treated for five months; the road was 19 ft. wide and over it passes heavy traffic at high speed. In one day 1,182 vehicles were counted passing in 10 hours, including 692 automobiles. The calcium chloride was applied by a new patented method, which loads a 600-gal. cart with a concentrated liquor and deposits 100 gal. each into six tins at the standpipes by the side of the road; when the cart is empty it turns around and syphons 500 gals. of water to 100 gals. calcium into its tank at each standpipe. The diluted liquid is spread on the road and the latter process repeated at each standpipe until the six tins are emptied. About four times as much work can be done in this way with one cart and a pair of horses as by the old method. It was found by a number of tests that a 600-gal. cart would cover an average of 3,800 sq. yd. per load and spread 28 loads of water per day at a cost of 2.4 cents per square yard, with three coats of water per day for seven months. Calcium chloride can be applied for a seven months' season at an average distribution of twelve 600-gal. loads per day, at a total cost, including the chemical, of 3.5 to 4 cents per square yard.

THE ORE-HANDLING ARRANGEMENTS at the works of the Bethlehem Steel Co. are rather unusual on account of the fact that the trains on which the ore is brought to the work come in on tracks considerably higher than the storage yard. As a result of this topographical condition the ore cars are run into a rolling car dump at the top of the retaining wall which bounds the high-level receiving track. This unloader is a long cylinder into which two cars are run at a time; these are then locked in place inside the cylinder which is rolled sidewise so that the ore is dumped over the edges of the cars, falling into hoppers at a lower level. These hoppers are located above a track on which cars can be run to receive the ore and take it directly to the furnaces. In case the ore is not to go directly to the furnaces, another type of car is run under the hoppers and transfers the coal a few feet sidewise to a long trough of concrete, which has a cross-section at the bottom approximately the same as that of a grab bucket. From this trough the ore is picked up by a bucket suspended from an ore bridge 550 ft. long over all, supported by two traveling towers 247 ft. apart on centers. This bridge covers the whole stock pile and enables the contents of the bucket to be dropped wherever desired.

Wrecking a Brick Smokestack.

By Edward E. Wall., M. Am. Soc. C. E.

On Sept. 28, 1907, the Water Department of St. Louis, Mo., threw down a brick smokestack at the abandoned low-service pumping plant at Bissell's Point. This plant has not been used for twelve years or more, but was kept in repair and the boilers under fire for emergency use, until 1903, when the fires were put out and the buildings closed up. A year later the engines and boilers were sold and removed. The buildings are substantial and in good condition, but this stack had been badly cracked along its entire length above the base, originally caused by being struck by lightning many years ago. It was strengthened by six steel hoops evenly spaced throughout its length. Lately the cast-iron cornice at the top opened up at the joints, and it was decided to throw it down before some portion of it fell upon the adjoining tracks of the Burlington railroad. There was danger that a portion of it might become dislodged by the jar of passing trains and fall upon a car and cause a wreck.

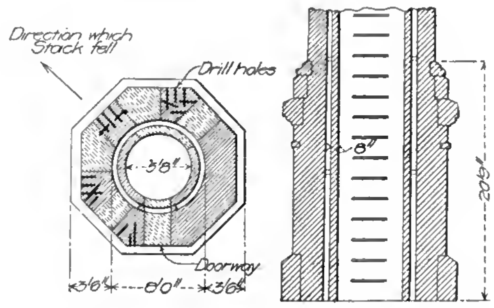
This stack was completed in 1871 and was built of hard hand-made brick laid in cement mortar. It stood at the southwest corner of the boiler house, about 10 ft. away, and not more than 15 ft. from the nearest railroad track on the west. There was about 45 deg. of available space to the southeast, where it could be thrown without causing any damage. This stack was octagonal in section, standing on a base of the same section 20 ft. 9 in. high, the walls of the base being 2 ft. 9 in. thick. The core wall was 8 in. thick, being separated from the stack wall by an annular space of 6 in.

The outside diameter of the base, exclusive of the stone trimmings, was 13½ ft., the stack above the base being 11 ft. in diameter and 8 ft. 8 in. just below the cornice. The total height above the ground was 127 ft. 4 in.

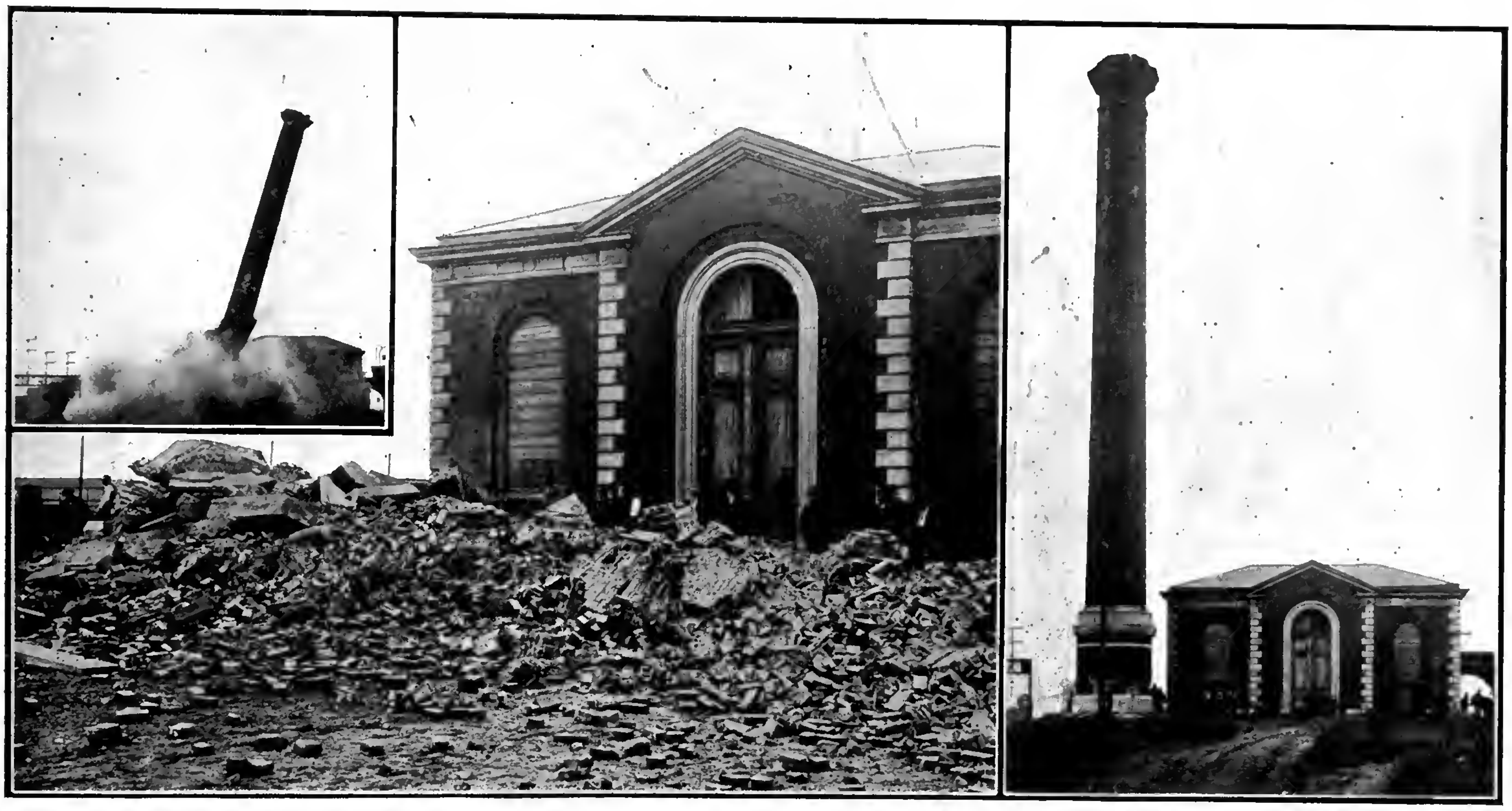
Four openings, approximately 36 in. wide by 24 in. high. were cut through the 2-ft. 9-in. brick walls of the base, as shown in the illustrations. There was doorway 2 ft. 3 in. wide and about 5 ft. high, built through the base on the north side of the stack, which left four piers supporting the stack between the openings. The core wall was cut entirely away for about one-fourth of its circumference on the south side. Nineteen 1½-in. holes were drilled in these piers, of depths ranging from 12 to 24 in., and loaded with two sticks of dynamite each, about 20 lb. altogether. Two of the holes in one of the central piers were drilled in the sides of that pier, sloping downward at an angle of 45 deg.

The brick masonry of the base was very hard, making the cost of cutting and drilling excessive. The total cost of labor and dynamite was $97. The salvage was only about 20,000 brick, owing to the fact that the masonry was so well bonded together that the bricks did not readily separate at the mortar joints. The space covered on the ground by the wreck was 146 ft. by an average width of 20 ft., and the farthest brick was found 185 ft. away. The cost of clearing away the debris was about $175.

No damage was done to the adjoining boiler house, and nothing whatever fell on the railroad tracks. The stack fell with its center line not more than 2 ft. from the location previously marked out for it.



Position of Holes Cut in Stack.



Views of the Brick Stack of the Bissell's Point Station, St. Louis Water-Works.

The Mont Cenis Route, the oldest of the Alpine through lines, is to follow the lead of the St. Gothard and Simplon routes and employ electric traction on its mountain division. Under the stress of the competition of the more recent lines, the French government has also double-tracked the approach to the tunnel on its side of the mountains and the Italian government will carry this double-tracking to Turin.

Instructions for Foremen.

A manual of rules for construction, prepared and copyrighted by John W. Ferguson Co., Paterson, N. J., and New York.

General Foreman.—A General Foreman will be placed in charge of each job, he will be responsible for the care of tools, material and the property of this company, and the maintaining of harmonious relations with the Owners, Architects and Sub-Contractors (in other words, he will be the representative of the Company on the particular work where he is employed and be responsible for the results obtained).

Other Responsibilities:

1, That all records are properly kept by Timekeeper.

2, To examine all plans (original or corrected).

3, That old plans are cancelled.

4, That only latest information is used in executing work.

5, To examine all letters, instructions and other information coming to job—initial same and give to Timekeeper.

6. That danger signs are placed at all Elevators and all persons prohibited from riding on them.

7, That "No Smoking" signs are put up and the rule enforced as soon as any carpenter work is started or where the Rules of the Owners prohibit smoking on their property.

8, That all street obstructions are properly guarded by red lanterns at night, and all city or other ordinances are observed.

9, That the watchman properly attends to his duties.

10, To enforce Book of Instruction and any special instructions.

Sub-Foremen.—Sub-Foremen will be responsible for the work under their immediate charge and the final result obtained and shall be subject to supervision and instruction from General Foremen.

Timekeeper and Material Clerk.—The Timekeeper will be subject to instructions from the General Foreman.

Responsibilities:

He shall keep all records neatly and accurate-

ly in books and on forms furnished by Main Office. He shall do other clerical work as required by Book of Instructions, or special instructions.

Regular Records:

1, All men employed, time worked by each and the distribution of labor.

2, Number of men employed by Sub-Contractors.

3, All materials received (including checking, as unloaded, or delivered).

4, All charges for extra work against Owner, or Sub-Contractors.

5, He shall file all instructions, letters, schedules, etc., in such manner as to be easy of access. He shall see that the General Foreman has initialed all such papers and shall himself initial them also, before filing.

6, All records, files, drawings, etc., shall be preserved and delivered to Main Office when job is completed.

7, Duplicates (carbon sheets) of all orders, letters, instructions, etc., must be sent to the Main Office.

Drawings:

1, All drawings shall be properly cared for and preserved.

2, They should remain flat (not rolled) and be easy of access.

3, Drawings made void by new drawings must be plainly marked in red pencil, "Void."

4, Void drawings must be kept in a place separate from all other drawings and must not be destroyed except by some one in authority from Main Office.

Contract Number, Headings and Job Numbers:

1, All time and material shall be recorded and reported according to the Headings supplied by, or approved by, Main Office. This is absolutely necessary and applies to everything.

2, Each General Contract will be given an individual number, which shall be used in connection with all orders, reports, etc.

3, The word "Heading" is used to designate the divisions of work under the General Contract; also each individual piece of extra work done in connection with each General Contract under the classification of Day's Work, Unit Price Work or Extra Contract Work. In addition to the Heading each item of Extra Work will be given a serial number called Job Number, to aid the Main Office when rendering bills for Extra Work. The same Heading with Job Number must always be used for the same division or piece of work.

4, It should be borne in mind always by General and Sub-Foremen and by Timekeepers that the men in Main Office who are keeping the books are not familiar with the construction work and accordingly must depend upon the written information from the job, to make necessary charges and credits.

5, Any work in Original Contract and about which Timekeeper has any doubt as to the proper Heading shall be reported to Main Office, with request for information.

6, If there is occasion to start Extra Work, before Main Office has stated what Heading to use, the Timekeeper shall use a distinctive Heading approved by General Foremen, and promptly notify Main Office. Such a Heading shall be written the same always, or until changed by, or any change approved by, Main Office.

Labor.—Time must be taken at least four times a day, at the morning and noon starting times, and the noon and evening quitting times.

Distribution:

1, A statement showing the distribution of all labor according to the Headings and Job Numbers must be returned to Main Office each week, ending on the day for closing the pay.

2, The statement must show the number of hours at each rate of pay which were spent on each Heading, whether on Original Contract or Extra Work, or to be charged to Sub-Contractors.

Material.—The General Foreman will be furnished by Main Office with the following:

Copy of each order for material.

List of materials as ordered with dates for delivery.

Foreman's bill showing where material is to be used.

If above or other information is not received promptly, it must be asked for at once.

1, The General Foreman must note particularly the time stated for the delivery of each lot or item of material and promptly notify the Main Office if he thinks the date is too early or too late.

2, The General Foreman will be held responsible for keeping himself supplied with material. He must not take for granted that it is going to be delivered at the time mentioned in the order, but shall make inquiries as to its shipment from time to time and look far enough ahead to insure its being on the job when required.

3, To be properly supplied with material, will insure rapid and economical work.

Care of Material:

1, Any material which can be damaged by being exposed should be properly protected.

2, Cement and lime should be stored in sheds and raised off the ground to prevent its being affected by moisture.

3, Kiln-dried lumber should be properly stored under cover, preferably in a shed, if not, it should be well protected by canvas or boards.

4, Light lumber, such as beams, plank, boards, etc., should be properly piled when received and when not used immediately should be "stuck" so that it may dry out and not become water soaked.

5, Brick should be put under a shed or well covered with canvas during the Winter months.

6, All hardware and small supplies should be kept under lock and key and only given out as required for immediate use.

Receipt of Material:

1, The General Foreman must give all material a General Inspection before it is unloaded, particularly from cars or boats. If he finds that it is not up to the quality contracted for, he must not permit it to be unloaded, but at once notify the party from whom it was purchased (and at the same time the Main Office) that the quality is not what it should be, so that an inspection can be made by the seller before the material is unloaded or used.

2, Material delivered by team should be accompanied by invoice or delivery slip in duplicate, one to be signed and delivered to driver, and the other signed and returned to Main Office. If invoices or delivery slips do not accompany material, receipts in duplicate shall be made out on the proper forms, and treated in same manner.

3, Brick, sand, stone or other material delivered in large bulk can be receipted for by the use of tickets for each load, with a receipt at the end of each day for the full amount delivered.

4, Invoices or slips for material must be marked with the proper Heading (if for original contract so state), showing where material is to be used.

5, Material delivered on cars or boats must be tallied or measured as unloaded.

6, A separate report shall be made for each car or boat showing date received, car number and initial or name of boat, so that Main Office may identify each lot.

7, When lumber has been passed by an Official Inspector, a reporting showing merely the number of pieces received is sufficient.

Record of Material:

A complete record must be kept in a book for that purpose of all material received with the dates and other information for identification. This is in addition to the invoices and reports made to Main Office. A separate page in the Record Book must be allowed to each firm supplying material.

Transfer of Material:

1, All material transferred from one job to another, or from the Original Contract to any item of Extra Work, must be accurately tallied, and a report made to Main Office of such transfer the same day.

2, The report must show the Heading from which the material was taken, and the Heading to which it has been transferred.

Shortage and Damage of Material:

1, The General Foreman should compare the total amount of material delivered with the amount ordered, so that any shortage may be noted at once and not found out when too late to avoid delay in the work.

2, Invoices or slips shall be marked before returning to Main Office, indicating any shortage, defects or criticisms.

3, All shortages or damage of materials must be reported without delay to the parties furnishing it, either by General Foreman direct or through Main Office.

4, If material is damaged in transit, claim must be filed promptly with the Agent of the Railroad Company, and he shall be requested to inspect the material before it is unloaded. The Main Office shall be notified at once by letter of such action.

Tools.—Each job will be furnished with an equipment of tools necessary for the execution of the work. The General Foreman must make a list of his requirements before starting the job, and be responsible for having all the tools required on hand before they are actually needed. The General Foreman will be responsible for their proper care and return when the job is finished, also that any necessary loss or damage does not occur. Any shortage or breakage must be accounted for.

In an Emergency, the General Foreman is authorized to purchase special equipment required, but he should endeavor to look far enough ahead so that what he requires may be supplied from the Yard or purchased by Main Office. Report must be made immediately upon the purchase of special equipment, noting the urgency which demanded it.

When the job is large enough a Storekeeper should be placed in charge of all tools, equipment and small supplies, who shall be held responsible for their general care and for any losses which may occur. In case it is advisable to employ a Storekeeper, the General Foreman should designate some one to look after the tools and equipment, to insure their being properly cared for and not lost, stolen or destroyed, or left lying around when not in use.

The General Foreman must see that the equipment of tools and scaffolding or material is not wastefully used, cut up or destroyed, and he cannot be too strongly impressed with the necessity of enforcing this rule, when a tendency to violate it is shown by any one in his employ. This should be done at the start and not after it has become a habit with some workmen.

Any part of the equipment which becomes damaged or unfit for use should be set one side separate from the other tools and returned to the Yard for repairs at the earliest possible moment. All the equipment should be kept in condition for use, by temporary repairs, if possible on the job.

Inspection of Tools:

1, If any tools are transferred to another job, report should be made promptly to Main Office so that the General Foreman can be credited for the tools. An original and duplicate slip should

be made out, the original being sent to Main Office, and the duplicate given to driver of team, who must have it signed by the person receiving his load. It should then be mailed to Main Office. (When shipments are made by Railroad, the duplicate slip must be mailed).

2, A correct account of all tools received and sent away from the job must be entered on Form headed "Tool Account," so that at any time during the progress of the work, just what tools are in use can be seen.

3, This record must be sent to Main Office promptly, when the job is finished.

4, Sub-Contractors must not be allowed to use this Company's tools, scaffolding or equipment, except where special arrangements have been made for such use. The General Foreman must see that the equipment, so loaned, is returned in good condition, and that any which may be lost or damaged are charged to Sub-Contractor.

5, General repairs of Engines, Boilers and heavy equipment not to be made on the job without special instructions.

6, The General Foreman should see that the equipment furnished him is in proper shape and if not, immediately report its condition to the Main Office.

7, General Foremen must examine and see that all material used for scaffolding, derrick blocks, etc., is in perfect condition. All scaffolding must be built of material selected for that purpose and it should be constantly examined to see that it is properly constructed and in proper condition.

8, All derricks must be carefully examined before being put in service and frequently examined to see that they are safe and in perfect working order. Derrick booms should be lowered and properly lashed and fastened when not in use.

9, All rope, blocks, chains and other appliances for handling material must be examined and none used which show the slightest indication of defect.

10, All ladders must be carefully inspected to insure their being in perfect condition, and sufficiently heavy for the use to which they are placed.

Paying Off.—General Foremen and Timekeepers must observe the following regulations in distributing the money on pay day and at other times:

Pay Day:

1, The General Foreman must be present when the men are paid, to identify them, and personally check each name on the pay-roll as the money is delivered to the man. After paying off, the pay-roll should be signed by both General Foreman and the man distributing the money, certifying that the names checked have been paid.

2, On pay day, the General Foreman must Compare Discharge Tickets with Unchecked Names on pay-roll and Envelopes left over and mark the letter "D" next names of discharged on payroll.

Envelopes Left Over:

1, A list should be made out immediately after paying off of the names and amounts of all the envelopes left over, on form headed "Report of Employees Unpaid," and the original of this list returned to Main Office with pay-roll sheet.

2, Each envelope retained by General Foreman shall be marked at once with the date of pay day, and Contract Number, and held by him until called for (not to exceed one week). If not called for in one week, the envelope with the money therein shall then be returned to Main Office.

Paying After Pay Day:

1, If a man calls for his pay within one week after pay day, he must sign a receipt for his pay on the special Pay Receipt Form provided for that purpose. This receipt must be sent to the Main Office promptly.

2. No money shall be paid to any one but the party to whom it is due, except upon a written order from said party, and the party receiving the money on such order must be properly identified.

3, The order must be sent to Main Office with the receipt of the party to whom payment is made.

4, If a man calls for his pay more than one week after pay day, his name and address should be taken and sent promptly to Main Office, stating the amount of his back pay. Upon receipt of such request Main Office will send a Special Pay Roll Check to the man at his address for the amount.

Pay Receipts:

The General Foreman will be supplied with books of Pay Receipts and should carry one in his pocket. He will fill out one of these and have it signed by each man discharged; also by men paid on job for previous week. The receipt must be sent at once to Main Office, and stub filled out and retained by Foreman.

Daily Reports.—The Daily Report must be made every day on a blank furnished for that purpose, showing the following:

Number of men employed in each class of work and where they are working.

Number of men working for Sub-Contractors.

Commencement of any particular part of work.

Receipt of Material for Sub-Contractors.

Time Sub-Contractors start and finish their work.

Receipt of important and special material.

Report of any accident or damage to work.

Condition of weather when work is prevented.

A special letter must accompany daily reports, covering important matters that cannot be embodied in the regular report.

Sub-Contractors.—General Foreman must inspect, and be responsible for, the quality of work done by Sub-Contractors. He shall see that proper progress is made, and that Sub-Contractor is given sufficient notice ahead of time as to when he is required on the job.

Sufficient notice does not mean one day's notice, but time enough for Sub-Contractor to secure his men and material.

Labor or material must not be furnished a Sub-Contractor except upon a written order, and daily charge slips signed for the same and sent to Main Office.

Accident Reports.—In the event of any accident, however slight, happening to any one on the work, whether in the employ of the company or not, it is absolutely necessary that a detailed report of such accident be made promptly in writing on the blank furnished for that purpose.

These reports, and all data connected therewith, must be written with Indelible Pencil.

If any accident, the report must cover all the facts in detail. In case the accident is of a serious nature, a complete statement must be obtained from the injured person and all witnesses, in writing, and their signatures to such statement, witnessed by a second party.

In case of accidents which are liable to prove fatal these statements must be sworn to before a Notary Public, and Main Office notified without delay. Photographs should be taken in such cases, if possible, before anything has been disturbed.

In case of accident of serious nature an investigation will probably be made by an Examiner, who should be given only the actual facts in the case. Any information beyond this must be procured by him from Main Office.

The General Foreman must see that tools, materials or equipment that caused the accident are removed if possible to his office, properly marked and preserved.

In case of doubt or any misunderstanding on the part of the General Foreman, Main Office should be consulted as to what information is considered necessary as a record of the accident.

Where the injured person remains at work, this must be stated on the Accident Report, and in cases where they are taken to the hospital, frequent inquiries must be made as to their progress and a report made immediately to Main Office. Main Office must be advised of the Return to Work of any person injured.

Car Demurrage.—All cars should be unloaded immediately, unless there is a good reason for not doing so as in case of damage or shortage, as a demurrage charge is made by the Railroads, for cars held more than forty-eight hours after they are placed on the siding.

A monthly time book may be used for recording the number and initial of each car (noting what it was loaded with), the date of its arrival, and the date it was unloaded. In case of a small job or only a few cars, this record can be kept in some other book, but a record must be kept in all cases.

Cartage.—Cartage for each class of material must be kept separate and a report made of the total cost of cartage of material when the hauling is completed. This report, together with a complete record of the distribution of all cartage is to be returned to Main Office once a month, and upon the completion of the job.

Diary.—A diary must be kept on each job showing a daily report of what transpires, such as:

Condition of weather.

Temperature (with thermometer readings at 8 a. m., 12 m. and 5 p. m., during the winter months).

Notation of visitors (Owner, Architect or any one from Main Office).

Starting of all divisions of the work.

Starting of work of Sub-Contractors.

Arrival of material, and of Outside Contractors not under our control.

Records of accidents.

Taking possession of the building by the owners.

Diary records should be briefly noted on Daily Reports.

Telephones.—Where the job is supplied with a special telephone it must be used only for business purposes. All calls made by sub-contractors or individuals must be noted and charges made against them. Post conspicuously, adjacent to the telephone, telephone numbers for Ambulances, Hospitals, Fire Department and Police Department.

Cement Bags.—Care must be taken to have all empty bags collected and kept dry with as little damage as possible so that they may be returned to the parties from whom the cement was purchased and due credit may be obtained by this Company. The General Foreman will be expected to account for any excessive loss from this source.

Main Office will furnish shipping tags and full instructions for the return of empty bags, but care must be used in every case that none but the bags marked with the respective company's trade or brand of cement mark are sent to them.

On making shipments Bills of Lading must be made out in duplicate, and both copies together with a material slip showing number of bundles and total number of bags shipped forwarded at once to Main Office.

Extra Work.—Any work not included in Original Contract, shall be known as Extra Work, unless Main Office should instruct otherwise, and will be done under the following classifications:

Extra Contract Work: Where a fixed amount covers all labor and material for the work under one Heading.

Unit Price Work: Where a fixed amount per unit of work covers labor and material, such as price per yard, per thousand, etc.

Days Work: Where the actual labor and ma-

materials are charged for at cost plus a percentage.

Authority for Performing Extra Work:

1, We should like to make it an invariable rule that Extra Work should not be started except upon properly written authority from Main Office in regular form, with Headings and Job Numbers designated. We recognize, however, that it is sometimes necessary to start Extra Work before receiving written authority from Main Office. In such cases General Foreman should call for written authority from Owner before starting the Extra Work, and should send to Main Office this written authority the day that he receives it.

2, If it should be necessary, in the judgment of General Foreman to start Extra Work upon being requested to do so by Owner, or his proper representative and without any written authority whatever, General Foreman should immediately notify Main Office, stating all the circumstances.

Reports of Extra Work:

1, When so requested a Daily Charge Slip for each item of Extra Day's Work shall be furnished to Owner, (unless so requested Daily Slips need not be made at all).

2, If Daily Slips are made a (carbon sheet) duplicate shall be made also, and held on the job until end of week, at which time they shall be attached to Weekly Charge Reports, and sent therewith to Main Office.

3, Weekly Charge Reports for labor, shall be made for each item of Extra Day's work. These shall show the class of labor (whether mason, carpenter, etc.), the number of hours worked of each class, at each rate of pay. They shall be sent to Main Office at end of each (pay) week.

4, If so requested (carbon sheet) duplicates shall be furnished to Owner.

5, Charge slips for material shall be made each month, or immediately when each item of extra work is completed, and shall show the quantities, kind of material and from where it came. These slips shall be sent to Main Office promptly.

6, A bill, on Extra Work Bill form, including labor and material for all Unit Price and Day's Work under its respective Heading and Job Number must be sent to Main Office as soon as any item of the work is completed.

7, In case such work extends over a period longer than one month, a bill must be returned to the Office at the end of Each Month, showing the amount of labor and material furnished for each individual item, such bill to be clearly marked "Unfinished."

8, Prices of material, when known, to be inserted in pencil in column designated "Prices"; only one item to be entered on a line.

9, Remember that the men in Main Office depend on these Extra Work Bills to charge the work against the party to whom it is furnished.

Sub-Contractors on Extra Work:

1, No Extra Work shall be done by a Sub-Contractor except upon an order in writing from Main Office. In case of Emergency, the General Foreman may order Extra Work, but must notify Main Office so that it can be confirmed immediately by a regular order.

2, No Extra Work shall be done by a Sub-Contractor except upon an agreed price either at a lump sum, or unit price for the labor and material. In the latter case the time and material must be checked daily and reported to Main Office.

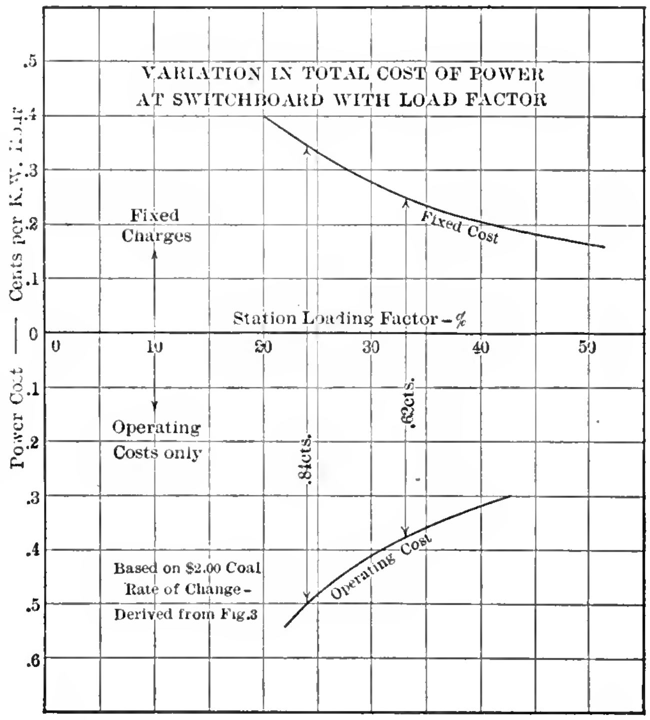
Orders by General Foreman.—In cases of necessity the General Foreman may order material and give an order for work to be done by Sub-Contracts, on Order Forms furnished for that purpose, sending a duplicate (carbon sheet) at once to the Main Office. On the carbon sheet write a full explanation of why and for what purpose the material was ordered, and the necessity for any item of work ordered of a Sub-Contractor.

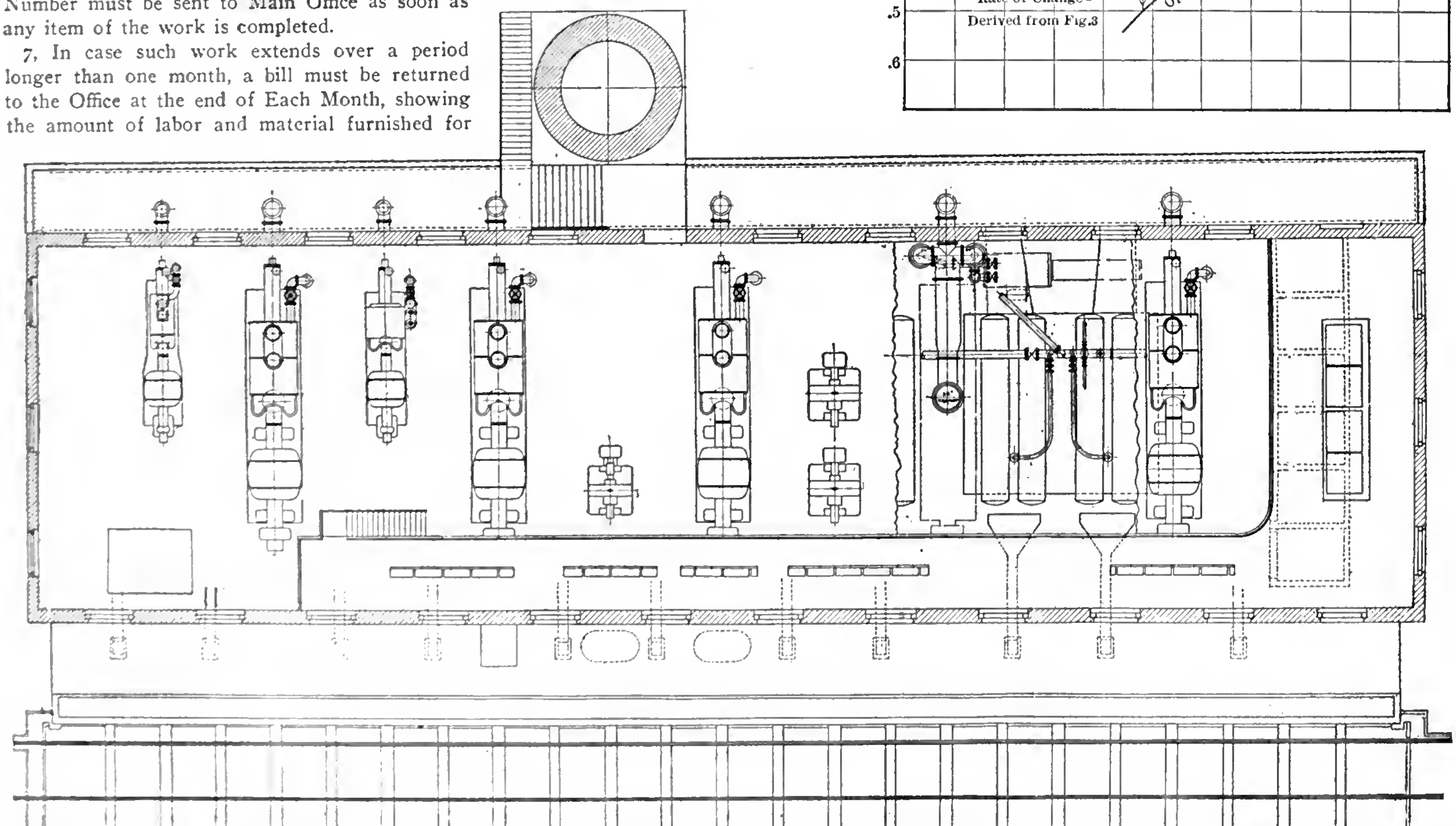
RELOCATION OF LINE on the Columbia & Port Deposit branch of the Pennsylvania R. R. has been recently completed along some thirteen miles of the Susquehanna River, which will be raised by the McCall Ferry power development. The new double track line had to be built on steep rocky bluffs, making the work so dangerous to trains on the old track at a lower elevation that regular service was entirely abandoned.

The Spy Run Station of the Fort Wayne & Wabash Valley Traction Co.

The Spy Run station of the Fort Wayne & Wabash Valley Traction Co. has been arranged along decidedly novel lines and presents an interesting example of the engineering possibilities of turbine plant construction. At the recent convention of the American Street & Interurban Railway Engineering Association, the station was described at considerable length by Mr. J. R. Bibbins, from whose paper the following account has been abridged.

Like many other similarly situated railway concerns, the company has adopted the policy of developing light and power business in connection with its traction system, serving both traction and lighting systems from a central power station, as previously outlined. In the city of Ft. Wayne, this business has assumed such proportions that nearly one-half of the new power station is devoted to 60-cycle lighting equipment, the remainder to 25-cycle equipment for traction pur-

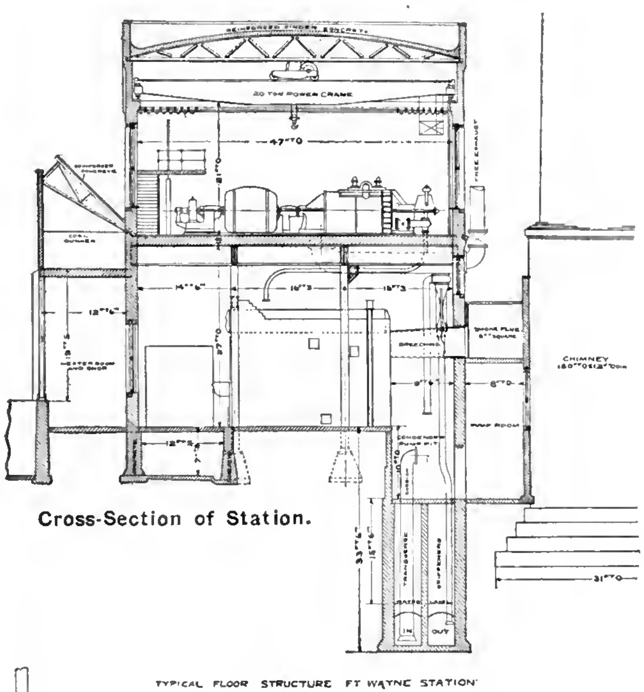




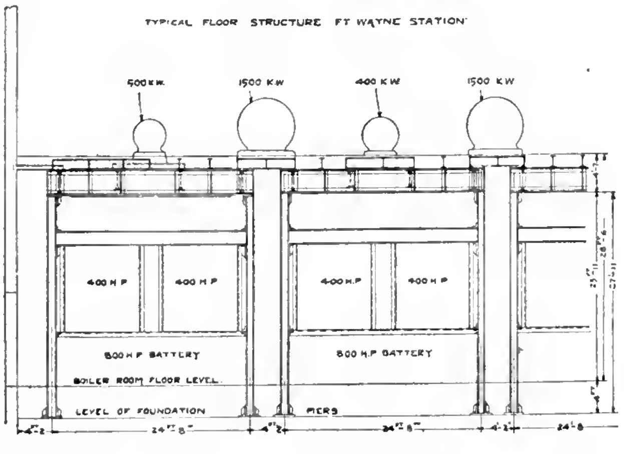
General Plan of the Spy Run Power Station of the Ft. Wayne & Wabash Valley Traction Co,

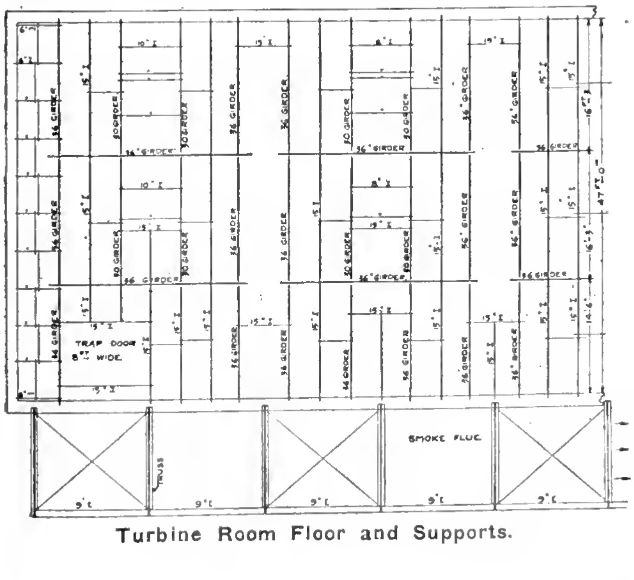
poses. High tension transmission lines parallel the railway from Fort Wayne to Lafayette, a total transmission distance of 112 miles from the source of supply. En route, the lines touch Wabash, Logansport, Huntingdon, Peru, and numerous smaller towns, in most of which considerable lighting business is available. Along this route are eleven rotary converter substations ranging in capacity from 200 to 500 kw., totalling 3,600 kw., or somewhat in excess of the present station generating capacity. But as the maximum demands from these substations do not superpose, owing to the distribution of cars, there results at the station an unusually uniform load for traction work.

The site chosen parallels a small stream—St. Joseph's river—from which the water supply is drawn for both feed and condenser purposes. Owing to the contour of the country, 25 ft. difference in level between river bed and station floor was unavoidable. A lower location would not only have introduced difficulties in coal trackage, but also would have endangered the station at periods of excessive flood, to which the stream is liable.



Cross-Section of Station.





Turbine Room Floor and Supports.

The principal features of the station may be summarized as follows: (1) A two-story, rectangular brick structure with side wings for the accommodation of auxiliary apparatus, coal bunker, machine shop and stores. (2) Generating machinery on second floor over boilers. (3) Structural foundation with concrete arch floor construction. (4) Independent barometric jet condenser—moderate vacuum. (5) Gravity conduit system for cooling water. (6) Independent, direct-driven exciters—common bus for each system. (7) Steam piping—simple, short and direct, with continuous upward slope from boiler nozzle to turbine throttle. (8) Sufficient superheater surface to maintain dryness, or moderate superheat at beginning of expansion in the turbines—100 deg. to 125 deg. at the boiler. (9) Mechanical stoking with gravity fuel feed. (11) 6,000-ton (two months') coal storage, served by gantry crane. (12) Steam-driven auxiliaries for feed heating. (13) System of forced ventilation for turbo-generators. (14) Fireproof transformer compartments, with transformers mounted on rolling trucks to facilitate removal. (15) Remote control oil circuit-breakers with time limit overload relays.

Essentially the station represents an attempt to produce a power property that will show to best advantage in the balance sheet with a medium price coal—one in which the absence of engineering "frills" for securing the highest efficiency, is compensated for by lower capital cost. This should be borne in mind in the discussion of the operating results later noted.

The building construction in turbine power plants is largely influenced by arrangement of boiler equipment. In this case it was apparent that a somewhat lower boiler capacity than usual would be required for the combined service. For moderate-sized units, a well-equipped boiler room requires from 2 to 2.5 sq. ft. per boiler horse-power, in some extremely compact arrangements, requiring as low as 1.5 sq. ft. per boiler horse-power. The Fort Wayne arrangement works out 1.75 sq. ft. per boiler horse-power. Assuming a capacity ratio of 0.6 boiler horse-power per kilowatt, the floor area then works out slightly over 1 sq. ft. per kilowatt for boiler room alone.

Now, for a fairly compact generating room in a station of this size, from 0.75 to 1.15 sq. ft. per kilowatt are required. But for the Ft. Wayne plant, some provision had to be made for the accommodation of direct-current sub-station apparatus. Assuming 1 sq. ft. per kilowatt as a reasonable area, we find that this practically coincides with the above boiler room area. The designer thus had two alternatives: First, a double decked power station, or, second, a building of twice the area with two equal-size operating rooms in parallel and under one roof, which arrangement would be preferable. From an investment standpoint, it is hardly open to question. As it stands, the building cost about $12.50 per kilowatt, including additions, which is by no means excessive.

Inseparable from this building arrangement is the question of structural foundations, which are entirely justifiable in the cases of steam turbines owing to the absence of cyclical movement arising from unbalanced parts requiring in the case of low-speed reciprocating engine the most rigid foundations. Moreover, there was ample precedent for this type of foundation structure, notably the two turbine stations of the Philadelphia Rapid Transit Co.

The floor structure of the Ft. Wayne station is shown in detail in an accompanying illustration. It consists of individual pairs of transverse plate girders extending across the building under each turbine bed plate. Short cross girders serve to tie the longitudinal girders together at column intersections, the whole forming bents or cradles between the several generating units. Box columns divide the building width into practically three equal spans, these columns rising between the several boiler batteries. Thus the weight of th generating machinery is distributed between two building walls and two rows of columns. Only in the case of the smaller machines and rotaries does any of the weight fall upon the areas intervening between columns. In order to insure even settling, the precaution was taken of carrying footings for both columns down to practically the same level so as to encounter homogeneous strata.

TABLE OF DATA OF POWER HOUSE.

Dimensions of building, ground floor plan (47 ft. by 177 ft. 2 in.)	8,340 sq. ft.
Dimensions of building, condenser room (9 ft. 6 in. by 177 ft. 2 in.)	....
Dimensions of building, pump room (8 ft. by 177 ft. 2 in.)	1,419 sq. ft.
Dimensions of building, heater and pump room (12 ft. 6 in. by 173 ft.)	2,160 sq. ft.
Total area of power house	11,919 sq. ft.
Total area of power house, single deck basis.	20,273 sq. ft.
Height boiler room, 28 ft. 6 in.; turbine room to crane rail, 21 ft. 7 in.	
Present capacity, 60-cycle, 3,500 kw.; 25-cycle, 3,500 kw.	7,000 kw.
Utimate capacity	8,500 kw.
Ultimate capacity, entire plant max. rated overload	12,750 kw.
Present substation capacity, 1,300 kw. ultimate	2,600 kw.
Present boiler capacity, 10—400-h.p.	4,000 bo. h.p.
Ultimate boiler capacity, 12—400-h.p.	4,800 bo. h.p.
Relative area—	
Station, ground floor plan	1.39 sq. ft. per kw. ult.
Station, single floor plan	2.39 sq. ft. per kw. ult.
Operating room (floor plan)	0.98 sq. ft. per kw. ult.
Operating room (exc. high-tension and sub-station equipment)	0.722 sq. ft. per kw. ult.
Boiler room (net floor plan)	1.74 sq. ft. per bo. h.p.
Total boiler room and bunker	2.19 sq. ft. per bo. h.p.
Boiler settings (24 ft. 8 in. by 23 ft. 5 in.)	0.725 sq. ft. per bo. h.p.
Relative boiler capacity, ultimate.	0.56 bo. h.p. per kw.

It is apparent from the illustration that the location of the large turbines was chosen so as to accommodate under each floor bent a single battery of boilers. With the small boiler units chosen, this, of course, provides a larger turbine room above than is necessary; but, by utilizing the excess floor space for substation apparatus, this disadvantage is largely overcome. The floor plan of the equipment arrangements shows to what advantage the space has been utilized.

It is noteworthy here that with larger boiler units, a far more compact arrangement would be possible with little increase in floor span between batteries.

This relative disposition of boilers and turbines evidently permits of the simplest form of piping. Strictly on the unit principle, this would involve but two bends, as shown in the cross-sectional drawing. The addition of an equalizing header running the length of the building then complicates the piping only to the extent of extra valves, fittings and hangers, resulting in: (1) Most direct path of steam from boiler to turbine; (2) Equalizing connection to compensate for varia-

tions in the rate of steaming of boilers in service; (3) Provision for most convenient distribution of boiler capacity to carry any load; (4) A cost of $2.50 per kilowatt for steam piping, complete.

In the normal operation of the plant, effort is made to keep those boilers in service nearest to the turbines in operation, thus giving the minimum distance of steam flow. When occasion arises, the plant may be operated on the unit system, valves in the header between the various risers being supplied for this purpose.

Superheaters were installed principally for the purpose of insuring thoroughly dry steam at the beginning of expansion in the turbine. Although the presence of moisture in the steam system is not encountered in normal operation, the precaution was taken of delivering steam from the boilers underneath and discharging it above the header, so that a continuous draining is provided from turbine throttle back to boiler. This is likely to be an advantage in starting a section of the plant that has stood idle for a time.

In the arrangement of the breeching, the main smoke flue might have been run inside the boiler-room walls, thus avoiding the breech connection shown in the cross-section. This, however, would have necessitated locating the condensers outside of the building. With the present arrangement, a 10-ft. space back of the boilers is ample for all condensing apparatus, and the space under the external smoke flue is utilized as additional boiler-room area for small auxiliaries, oil filters, and the like.

Superheated steam is provided direct from the main to all principal auxiliaries in the plant. This avoids an auxiliary steam main. According to customary practice, the auxiliary main draws its supply from opposite extremities of the steam system so as to avoid to the greatest degree possible a shut-down of auxiliaries. At Fort Wayne nearly the same security is provided by connecting auxiliaries directly into the steam main at different points. Thus boiler feed pumps are connected in duplicate to opposite sections of the steam main, each of which is supplied by at least four boilers. Similarly, condenser pumps are connected to the same section of the main as the turbines which they serve. If a turbine unit is disabled, the pumps will not, of course, be needed.

The absence of economizers will be noted. These were not considered necessary with coal at $2 to $2.50 per ton. For feed heating auxiliary exhaust steam is entirely relied upon, all boiler, service and condenser pumps, also fan and stoker engines contributing heat through the medium of open heaters. Exciters are direct-driven. Nevertheless, a feed temperature of 160 deg. to 180 deg. is obtainable during the day, and 200 deg. at night. This feed is drawn from the hot condenser discharge tunnel and delivered to elevated tank, which provides a static head on the heaters and are of sufficient capacity to supply the plant for three hours at full load. Similarly the heaters are elevated a few feet to insure a positive lift of feed pump valves. With this feed system, boiler cleaning is not necessary oftener than at monthly intervals.

Mechanical stoking was adopted not only to minimize labor cost, but also to provide ample forcing capacity for peak loads or emergencies. With Hocking Valley screenings, three men can handle without difficulty ten boilers, or 1,330 boiler horse-power each. Hand firing for the same capacity would require ten firemen and two water-tenders, or 400 boiler horse-power per fireman, a reduction of 60 per cent. Present boiler-room labor, averaging $11.75 per 12-hour shift, would be increased to about $28 per shift, providing 12-hour shifts could be maintained.

The character of river water had, of course, an important bearing on the design of the condenser system. Although carrying considerable sediment at times, the water is extremely soft and develops no hard scale even after many weeks of continuous running. This annulled the principal advantage of the surface condenser., viz.: return of pure exhaust steam for feed water. The 25-ft. difference in level between ground floor and low water made one of two condenser systems imperative: (a) Surface condenser with continuous pipe loop (balanced water column), with power-driven circulating pumps to overcome fluid friction. (b) Barometric jet condensers mounted near the level of turbine exhausts with tail pipes extending downward to the normal river level, with power-driven circulating pump to overcome excess barometric head.

With the former, dry vacuum pumps would be imperative in order to prevent the condensers from becoming air-bound, or losing their vacuum altogether through air leaks in the water system, thus adding another auxiliary. Moreover, the surface type of plant is extremely bulky and would have seriously interfered with the "double-decked" layout.

On the other hand, the barometric type fits particularly well into the scheme. The condenser head may be suspended beneath the turbine, where its most bulky part is out of the way. The tail pipes may then be carried down at any angle or turn sufficient to clear necessary obstructions. Thus the 9.5-ft. area way which would ordinarily be provided in the rear of the boilers is conveniently utilized as operating space.

With the arrangement employed, a difference of about 47 ft. exists between the condenser head and low water level. This, however, does not interfere with the operation of the condensers, as a partial void simply results in the upper part of the barometric column.

The use of twin condenser units permits the use of less bulky apparatus, and also makes it possible, in the event of the disablement of one side, to continue operation on the other with reduced vacuum. Long stroke reciprocating pumps were chosen for this purpose instead of high-speed centrifugal pumps, as being best suited to the high lift, 16 ft. With this type of pump, a small air chamber will suffice to carry over the moment of reversal without any dip in vacuum, which would otherwise accompany the non-uniform flow of injection water. This equipment without dry vacuum pumps yields a vacuum during warm weather of about 26.5 to 27 in. at full load, referred to 30-in. barometer. Its simplicity and ease of upkeep is apparent, especially in view of the low cost, about $2.50 per kilowatt, including pumps and piping, but no tunnel work.

Water is conducted to and from a screen house on the river bank entirely by gravity through a double-duct concrete conduit. At the river a double screen prevents debris from entering the intake, which is at right angles to the current, while the discharge is down-stream. This conduit system, of course, necessitated considerable excavation in the rear of the boilers. The two retaining walls were then reinforced at intervals by transverse stiffener arches sprung across the pit.

The Ft. Wayne plant uses normally about 100 tons of coal per day. In the provision for coal storage, an elevated bunker of relatively small capacity (400 tons) fulfils all requirements for gravity feed. Even this would tide the plant over a period of at least three days in case of failure of coal-handling apparatus. The main storage yard will contain about 6,000 tons—sufficient for two months' supply, but only about 4,000 tons is ordinarily held in stock, except in case of impending fuel shortage. The gantry crane serving this storage yard combines the function of unloader, crusher, elevator and distributor. Its efficiency is attested by the fact that while its normal capacity is considered to be one 50-ton car per hour, the operators have unloaded a 40-ton car in 16 minutes, and a maximum of eleven cars (500 tons) in a short working day. The crane is electrically operated from a controller tower by one man.

The two sections of the generating plant, 25-cycle and 60-cycle, are, of course, separated electrically, and each therefore controlled by a separate switchboard. Two additional boards control the rotary converter output for both 25-cycle and 60-cycle systems, the latter consisting of a direct-current power circuit for elevators and other intermittent power. A fifth board controls the exciters. With perhaps the exception of the exciters, the generating plant is quite standard throughout. In place of the usual steam-driven exciter unit, with motor-driven duplicate, each generating unit is provided with its own direct-connected exciter, all generating at the same voltage—125 volts. Each exciter has sufficient capacity to carry two generators. All may be connected to a common bus, as an emergency condition. Normally the 25 and 60-cycle exciters are separated to permit the use of independent voltage regulators.

Assuming the case of instantaneous fluctuating loads, the voltage regulation of a direct-connected engine-generator-exciter unit is not, of course, comparable with that of steam-driven exciters, due to cumulative drop in speed and voltage. Of the three systems (a) independent steam-driven exciter, (b) independent motor-driven exciter, (c) exciter-driven by prime mover, the first undoubtedly gives the best results. But with the use of the automatic voltage regulator, the three are brought practically to an equality.

This subdivision of exciter capacity assures uninterrupted service to a degree quite impossible with the usual arrangement of independent exciters, and almost to the same degree as the standby storage battery quite frequently employed as an insurance against current interruptions. With half the exciters in the station inoperative, there would still be ample capacity remaining.

These direct-connected exciters add 2.6 per cent. to the expense of the main generating unit. A detailed comparison of the total cost of the exciting plant, as compared to the cost of an inequivalent independent exciting plant, including reserve unit, shows some 20 per cent. in favor of direct drive.

All the generators draw their supply of ventilating air from a sheet steel duct running the length of the plant above and in front of the boilers. This has served its purpose, but a positive pressure fan has been installed as an auxiliary to accelerate the air flow during certain prevailing winds when the required draft is more difficult to maintain through the long supply duct. This system of positive generator ventilation has the advantage of maintaining low generator temperatures the year around, while by means of the fan auxiliary a large excess of air can be supplied to any of the units that may be for any reason abnormally overloaded. In other words, the fan blast may be regarded as a generator auxiliary. It makes possible greater generator overloads.

In some large turbine plants of recent design where considerable distance must necessarily intervene between switchboard operator and turbine throttle, it has been found desirable to control the running speed entirely from the switchboard by a small motor-driven mechanism connected to the governor. This system has undoubtedly advantages from an electrical standpoint in synchronizing and distributing load. Yet in compact stations such as Ft. Wayne, it seems a better plan to commission the engineer in charge with entire authority over the mechanical equipment, as is the case. All speed adjustments are taken care of at the individual governors by the engineer or from the switchboard.

Designers of large plants also tend to concen-

trate in a continuous return cooling and filtering system, the usual independent oil system used on these turbines. At Ft. Wayne, however, the independent system has been used, largely with the intention of isolating trouble in so important a function as the lubrication. Each turbine has its own oil pump, cooler and strainer reservoir, all of which apparatus is readily accessible from the engine-room floor. When desired, however, the oil may be entirely drained out of any of the machines into the filter below, where it is screened, washed and returned by a small steam pump.

In the final analyses of the ultimate cost of power, fixed or capital costs, of course, have an important bearing, and it is in this regard that the type of station described exerts its strongest influence. In the preceding discussion, it has been the object to show wherein the double-decked station has made the greatest advance along engineering lines. Owing to the absence of many refinements, it is evident that the maximum possible efficiency could hardly be obtained. In compensation, we should look for a considerable reduction in the capital charges in order to bring the total cost of the power generated to as low a point as would result from the use of a more efficient plant. This proves to be the case with the Ft. Wayne station.

Analyses of the total power costs from modern steam plants of 5,000 to 10,000 kilowatt capacity shows that the capital costs, including interest and depreciation, amount to about 50 per cent. of the total. For such high-grade stations, with thoroughly modern equipment, we should expect an investment cost of from $150 per kilowatt in the smaller, down to $100 per kilowatt in the larger sizes. In a few very large stations the investment cost has been less than $100 per kilowatt, but for stations under 10,000 kilowatt it very rarely occurs that the cost is below the above figure. The Ft. Wayne station is thus unique in having set a new standard for power-station cost which may well be emulated in cases where turbine machinery is applicable. The table shows the cost of the complete station, exclusive of substation apparatus, but including main line transformers—a total of $66.25 per kilowatt generating capacity.

In this summary, the building cost is naturally high, owing to the large amount of structural material necessary. On the other hand, boiler and condenser costs are extremely low, for reasons previously set forth.

Using as a basis the above costs, and the rate of variation with loading factor, the ultimate total cost of power at different loading factors may be predicted; in other words, the total financial result of station operation. The diagram has been prepared along these lines. Fixed charges are dealt with entirely above the horizontal line, and operating costs below. The total power cost, at a given loading factor, is then represented by the total vertical distance between the two outer curves. These fixed costs are based upon the following assumptions: (a) Bond interest and taxes, 7 per cent.; (b) sinking fund, equivalent to 6.43 per cent. depreciation, 4.2 per cent; (c) total fixed charges on capital cost, 11.2 per cent. Depreciation determined by summing the depreciation on the several parts of the plant, as follows: Building, 3 per cent.; boiler plant and coal-handling apparatus, 10 per cent.; condensing plant, 6 per cent.; generating plant, 7.5 per cent.; general average, 6.43 per cent.

Cost of Completed Power Station, 8,500 kw. No Substation Apparatus.

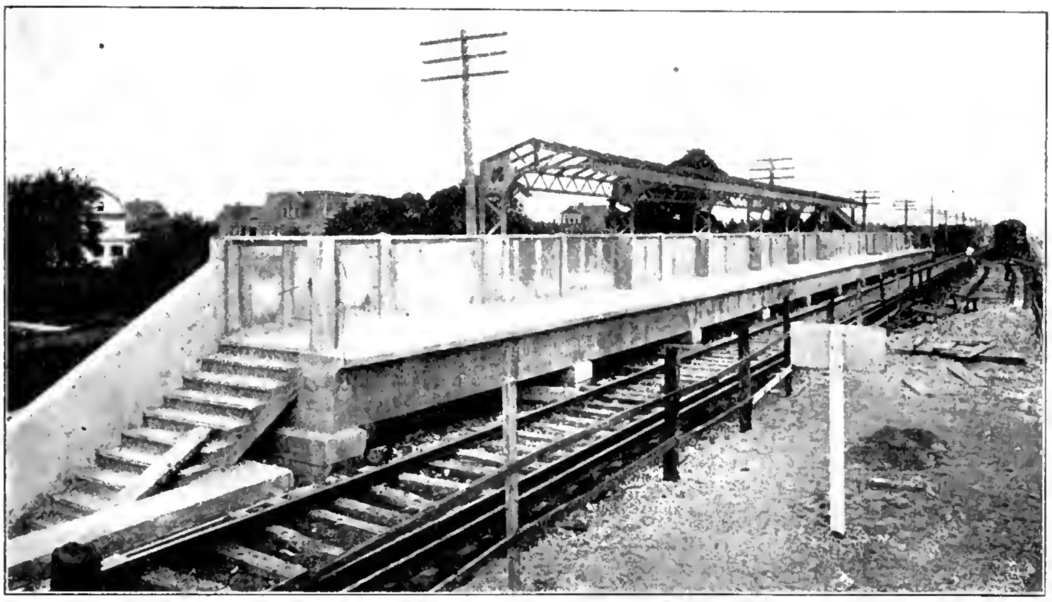
	Total.	Per Kw.
Building, including general concrete and steel work, galleries, coal bunker, smoke flue, condenser pit, coal storage pit, etc.	$93,217	$10.97
Generating plant, including turbines, generators, exciters, cables, switchboards, transformers and ventilating ducts	259,711	30.55
Boiler plant, including boilers, superheaters, stokers, piping, pumps, heaters, settings, breechings and tank	118,313	13.92
Condenser plant, including condensers, pumps, piping, free exhausts, water tunnels and intake screen	33,790	3.98
Coal-handling plant, including gantry crane, crusher, motors and track	7,990	0.94
Erection superintendence, engineering and miscellaneous	50,500	5.94
Total, excluding property and siding	$563,520	$66.25

From these curves the total cost of power at the present station loading factor, 24 per cent., is 0.79 cent per kilowatt-hour. At 33 per cent. loading factor the total cost would be 0.57 cent per kilowatt-hour, and at a possible loading factor of 50 per cent., 0.41 cent per kilowatt-hour. This, Mr. Bibbins ventures, is a result which it will be difficult to duplicate in any station of expensive construction burning the medium grade of bituminous coal at a cost in the neighborhood of $2.25 per ton. It is the ultimate result that proves the correctness of the engineering principles involved in the design of the station.

The Removal of a Rock Barrier in the river Clyde has just been completed. The "Elderslie Rock," as it was called, was a ridge 900 ft. long and 300 ft. wide extending obliquely across the river, and 8 ft. below low water. In 1880 the first steps were taken for its removal, the channel being given a depth of 20 ft. over it at low water. Subsequent work deepened the channel to 23 ft., and in 1903 it was decided to secure a depth of 28 ft. This work has now been completed, and in addition the channel, which was to have been 200 ft. wide, has been made 230 ft.

Concrete Fences on Station Platforms of the Brighton Beach Line, Brooklyn, N. Y.

Solid monolithic fences consisting of cement plaster covering Truss Metal lath have been built on the platforms of six of the new stations on the Brighton Beach Line, which is operated by the Brooklyn Rapid Transit Co., Brooklyn, N. Y. The improvements which necessitated the new stations and some general data regarding them were given in The Engineering Record of May 18, 1907. The platforms are of reinforced concrete slabs carried by beams and girders of the same material, and are covered with a granolithic finish. The fences referred to are the guard railings on the outside and ends of the platforms, the stations where they are used being on the embankment section of the road.



Completed Concrete Platform Fence on Brighton Beach Line, Brooklyn, N. Y.

The fences running the length of the platforms, which are 240 ft. long, are 4 ft. 6 in. high, and 2 in. thick, and are surmounted by a railing 4⅝ in. high and 5 in. wide. The reinforcement consists of Truss Metal lath of No. 28 gauge. It has a cross section of 0.18 sq. in. per foot of width and weighs 67 lb. per 100 square feet. The lath is 1 in. high, so that the minimum plaster thickness covering the metal on each side is ½ in., though of course the plaster entirely fills the convolutions of the lath.

The lath is carried in continuous sheets through the whole length of the fence, and is not broken at the posts. The latter which are on 10 ft. centers are reinforced with four ½-in. rods set deep into the concrete platform. The post is formed by two short pieces of lath bent in the shape of channels and placed around the reinforcing rods, one channel on each side of the continuous sheet which forms the reinforcing of the panels. The plaster has been similarly carried around the lower parts of the steel canopy supports by short pieces of lath bent in channel shape. The posts measure 9 in. long and 8½ in. wide at the base, tapering somewhat toward the top in the width. The railing is reinforced by two ⅜-in. rods running longitudinally and by a strip of lath laid horizontally.

The intermediate panels between the posts are formed by putting on an extra ½-in. thickness of plaster for the raised part of the panels.

The platforms were completely cast before the fences were started and blocking was inserted to form a trough in which the fences were to be set. After they had been built the joint between them and the platform was covered by carrying the 1-in. granolithic finish up a quarter round curve onto the bottom of the fence. The rods for the posts were set when the platforms were built.

In constructing the fences the lath was held in place by studding of 1-in. angles supported by braces. The plaster was then put on from the side opposite the studding, and after it had set the studding and braces were removed and the other side was finished. The plaster was made of one part of Atlas Portland cement, and two parts of sand.

The fences were erected by the Truss Metal Lath Co., New York, under the direction of the engineering department of the Brooklyn Rapid Transit Co.

Snow Loads on Roofs may considerably exceed the values usually allowed for them in designs, according to investigations made last winter by S. de Perrot, of Neuenburg, Switzerland. It was observed that after a heavy fall of snow, a succession of thawing and freezing periods followed by more snow produced masses of snow and ice 24 to 30 in. thick and weighing 70 to 100 lb. per square foot of roof, which is three to four times the value usually assumed. Several such accumulations of snow and ice were found to weigh 36 to 38 lb. per cubic foot.

The British Road Tarring Trials.

Brief mention has been made in this journal of the competitions carried out during the last year at Staines, England, by the Roads Improvement Association to ascertain the best substance to spray on roads as a dust preventive and the best machine for doing this work. The tests of the machines were made on roads of broken granite, flint and gravel, but the preparations were applied only on the granite road. The judges were men of the highest standing among British road engineers, technical chemists and automobile enthusiasts, who have just made their report, which the "Journal of Gas Lighting" has reviewed as follows:

After setting forth the circumstances which led to their appointment, the judges explain that unfavorable weather militated against the carrying out of the trials as originally arranged. It is generally accepted that an application of two coats of tar is necessary for preserving the surface of a road, and the judges were desirous of carrying out the trials under this condition; but this, for the reason mentioned, could not be done. It could not be expected, therefore, that the surfaces treated with one coat only would be durable; and the judges explain that the trials in respect of durability do not reflect on the machines competing. The final judgments and awards in the machine competition were based upon the machines only. However, in spite of the generally unfavorable nature of the weather, they say the results, on the whole, may be considered satisfactory, and much useful information has been obtained in connection with the comparative merits of the various materials used and of the methods of spreading them. They consider that enough has already been done to show that "machinery can be successfully applied for this purpose, and that by the use of such machinery tar spreading can be carried on with great rapidity after preliminary preparations have been made." The judges say the cost of spreading tar by machinery has worked out at a far lower figure than the cost of applying the same quantity of the material by hand.

Tar-Spreading Machines: Aitken's Patent Pneumatic Tar-Sprayer. The judges consider this to be a well constructed machine, possessing many important advantages. It is self-contained and can be moved rapidly from one part of the road to the other. It can also cover a considerable superficial area of road in a day's work. Its construction is solid and well thought out, and the cost of working and maintenance may be expected to be low. The judges believe that by the use of this machine, under the most favorable conditions, the actual cost of laying on one coat of tar in a sufficient quantity may be cut down to almost 1-50th of a penny per superficial yard, or with a road 6 yards wide to approximately £1 per mile. This includes everything that ought to be charged to the cost of the operation, interest and sinking fund on the plant employed, a fair sum for upkeep and ample allowances for fuel and labor, but is exclusive of the cost of tar. Though in point of rapidity of working and excellent mechanical construction the judges put this machine at the top of the list, in some respects the results of the spreading were not so satisfactory as in other cases. This arises from the fact that the distributor was not properly adjusted. The judges have decided to award the first prize of 100 guineas and the Association's gold medal to this competitor.

Emulsifix, Limited. This machine is of the nature of a special form of water-cart, having means for mechanically mixing tar and tar oil with a certain proportion of water, and spraying the road before the mixture has time to separate. Although the judges are informed that this competitor put an additional application on to the road shortly after the actual trials, yet little or no trace of the application was to be seen shortly afterward. It should be mentioned that this competitor intimated that it was impossible for his machine to use the standard tar as supplied by the Association to the other tar-spreading machine competitors; and, under the circumstances, the judges allowed him to bring his own material.

Johnston Lassailly Patent Tar Road-Binder. This machine consists of a separate portable boiler for heating the tar up to 200° C. or over, from which the heated tar is transferred to distributing carts fitted with trailing brushes for evenly spreading it. The work done by this apparatus was good. A heavier coat of tar was put on than in the other cases, and, chiefly owing to this, the durability of the coating has been greater than in the case of any of the other competitors. Against this must be set the consideration that the machinery is cumbersome to handle, the working consequently slow, and therefore more costly than that of other competitors.

Tarmaciser, Limited. Owing to an accident on the road en route to the scene of the trials, this machine was unable to compete. With a view of ascertaining its comparative merits, a special test was arranged and subsequently took place on the road between Swanley Junction and Farningham, in Kent. This trial was, of course, quite independent of the tests for the competition awards. The machine did not come up to its proof. It required a considerable amount of adjustment prior to starting, and then partially broke down while at work. Though there are probably possibilities for this machine, the judges are of opinion that it cannot at the moment be considered an entirely practical apparatus.

Tarspra, Limited. This company entered three machines. The first was a 700-gal. Thornycroft motor van, and resembled in some respects the Aitken machine. This competitor entered a 1,000-gal. van, which was drawn by a small tractor. The third machine entered was a 200-gal. cart drawn by horse power. In all cases the principle of spreading the tar was the same. All three machines worked well and spread the tar evenly. The 700-gal. Thornycroft motor van is well designed. The workmanship is not quite equal to the Aitken machine, and probably the cost of upkeep will be greater. It should be mentioned, however, that different sets of nozzles can be used with these machines, and the number of square yards covered per gallon of tar can be adjusted to suit the road surface or the wishes of the person treating the road. The judges have decided to award the 700-gal. Thornycroft Tarspra machine the second prize of 50 guineas and the Association's silver medal.

Thwaite Anti-Road-Dust System. This consists of a portable tar-boiler, which holds 300 gals. of tar, and this competitor's principle is to raise the tar to a high temperature, and consequently it does not require so much pressure to lay it on the road. The judges were impressed by the good working of this machine, which seems to be simple and effective. The first cost of the apparatus is very moderate, but operating costs are not so low as the Aitken or Tarspra.

Reeson's Patent Machine. This apparatus is for putting on a preparation of tar, but it was not entered for the tar-spreading machine competition. It consisted of a tank fitted with gravitation sprinkler and two rotary brushes. At a special test of this machine on the road between Swanley Junction and Farningham, Kent—at the same time as the special tests of the Tarmaciser were made—it worked satisfactorily, and was very favorably commented upon. The heating arrangement consisted of a Wells light burner, paraffin being the heating agent. The air pressure for this heater was obtained by means of a hand pump.

Preparations of Tar. The preparations of tar tested were of two classes—(1) those containing very little tar, and (2) those in which tar formed the main ingredient.

In the first class were the compounds "Crempoid R," "Crempoid D," "Ermenite," "Hahnite," and "Pulvicide." The results of treating the roads with all these compounds may be dismissed in a brief paragraph. Within a very short time after their application—*i. e.*, a week in the case of "Ermenite," a fortnight in the case of the "Crempoids" and "Pulvicide," and a month in the case of "Hahnite"—they had practically disappeared. The compounds have not the durability of tar, and the judges do not consider their use as economical. Moreover, complaints have been received to the effect that the dust raised from the sections of the roads treated with some of these materials is injurious to the eyes of those using the roads and to the frontagers living along their routes.

The preparations containing a large proportion of tar were, on the whole, very satisfactory. We deal with them in their order of merit.

Clare's Patent Tar Compo. This was applied to a quarter-mile section of road extending from the steam laundry at Staines to a point a quarter-of-a-mile eastward from the same laundry by one of the smallest of the "Tarspra" machines, similar in type to the 200-gal. one entered in the tar-spreading machine competition. This section of road, as regards dryness of surface, was approximately in the same condition as the other lengths. The macadam was in good condition. The quantity of the material appears to be 1 imp. gal. to 7 sq. yd., applied in two coats. At the price quoted by the competitor—3½d. per gallon delivered in London—and after making allowance for getting the material into position on the road, it works out, excluding the cost of spreading, for a coating of 7 sq. yd. to the gallon, at 0.57d. per square yard of road surface, or approximately £25 per mile of road 6 yd. wide. From the time of laying until recently it has been uniformly good, and is now in better order than any other portion of the road. The surface is wearing rapidly, especially in the center. The judges have decided that the Ballymenagh 100-guinea trophy and the gold medal of the Association for the best preparation of tar for road purposes be awarded to Messrs. Clare & Co., of Liverpool. The smell of the material is relatively evanescent and unobjectionable.

In the judges' opinion the success of the Clare Company's compo is greatly due to the fluidity obtained. When applied cold (as recommended by the manufacturers), as was the case on the Staines Road, the penetration was very considerable. In spite of this, the tar has body enough to hold together in a highly satisfactory manner the small dust-forming particles. Moreover, it has been ascertained that the cost of treating or adding to tar by this method is not considerable, and is far more than compensated by the extra penetration, as described above. The preparation flashes at ordinary temperatures, and special care must be exercised to avoid risk of firing during treatment.

Oil-gas tar was entered by the Gaslight & Coke Co. This material was applied to a length of road adjoining that of the Clare Co. by a special form of machine devised by the Gaslight & Coke Co.'s engineer, Mr. Reeson, which is commented upon under the heading of "Tar-Spreading Machines." This length of road is in a fairly good condition. Oil-gas tar probably penetrates deeper than anything else, but it does not form so durable a wearing surface, and consequently is not so great a protection to the face of the macadam as a good tar preparation. It is not a new substance and has in the past been used in various places, but the actual material entered by this competitor is understood to have been a specially treated

oil-gas tar, from which the more readily volatile and low-flash constituents of ordinary oil-gas tar have been removed. The smell of the preparation was penetrating and of the same character as that of ordinary oil-gas tar, but less strong and persistent. It would probably be very useful for the purpose of giving a first coat to a road, to be followed by one of coal-gas tar or similar substance.

T. G. Marriott's "Marbit." The third in order of merit of the competing preparations is "Marbit," entered by this competitor, but the condition of the section of the road treated is not quite so good as that of the first two named.

Tar Supplied by the Association. In addition to the competing preparations, it is necessary to make some mention of the various kinds of tar supplied by the Association for comparative purposes.

1.—This was a new crude coal tar, which had merely undergone the ordinary mechanical separation process, supplied by the South Metropolitan Gas Co. for the use of the tar-spreading machines on the Staines and Hounslow granite road and the Twickenham and Kempton Park flint road. The judges consider that, though this was a fair average specimen of tar, it did not yield satisfactory results unless applied in quantity in excess of that found necessary in the case of the Clare patent tar compo. One gallon of the Clare material has given an exceedingly good surface to 7 sq. yd. during the summer months, whereas in this case quite 1½ times the quantity is required to give equal results, which greatly affects the total cost of the completed operation.

2.—This also was crude coal tar which had undergone the ordinary mechanical separation process, supplied by the Reading Gas Co. for use in the tar-spreading machines at Ascot. It was far inferior for road purposes to that supplied by the South Metropolittan Gas Co. It was apparently unsuitable for spraying in the machines, probably owing to the foreign matter which it contained when it arrived in the tanks at Ascot.

3.—This was a "refined" or "freed" tar from the South Metropolitan Gas Co., and was kindly supplied by the company for experimental purposes free of cost to the Association. This was also laid upon the road by a 200-gal. Tarspra cart. This is a coal tar from which the water and naphtha have been distilled, and has a specific gravity of about 1.24. The distillation serves to remove the ammonia, which is an objectionable constituent of tar for road treatment, and the light oils. The cost of this tar is about ¼d. per gallon above the same company's market price for crude coal tar. The preparation answered well in the trial.

4.—This was an ordinary refined coal tar from the tar distillery, as supplied by Messrs. Burt, Boulton & Heywood, of Silvertown. This material was applied by a 200-gal. Tarspra cart, similar to the one entered in the tar-spreading machine competiton, on a section of the Staines and Hounslow granite road. The specific gravity is about 1.21. The net cost at the wharf is about 3d. per gallon. For some reason this tar did not answer quite so well as the somewhat similar preparation from the South Metropolitan Gas Co., but it was fairly satisfactory.

5.—This was a blast-furnace tar, supplied by Messrs. R. & A. Reid, of Glasgow. It was applied to a section of the granite road between Hounslow and Staines by a 200-gal. Tarspra cart. The tar is derived from blast furnaces using splint coal in the neighborhood of Glasgow, and therefore offers a supply entirely independent of gas works. Its specific gravity is 1.1, but it is highly vicious and needs considerable heating to make it sufficiently fluid for laying on the road. Its smell is rather objectionable and persistent. The cost in London is 2¼d. per gallon, but appreciably less in the North. In order of merit it comes after the refined gas tars.

Judges' Observations. Speaking generally, the whole of the machines tested showed considerable originality and forethought in design, and considering the short time the demand for this machinery has been before inventors, the results obtained are exceedingly promising. No doubt most of the machines exhibited can be improved, and when using the proper material in correct quantities they are all likely to give satisfactory results. Suitable tar compositions are practically insoluble, yield no matter liable to be washed away into the watercourses to pollute and to cause damage, nor should there be any considerable quantity of tar-dust ground off the road surfaces after treatment. The judges believe that the complaints made under this head previous to these trials have been due to the use of improper materials—that is, tar from which the more unsuitable compounds have not been extracted previous to it being used on the road. Now that this is understood, it is probable that most of these difficulties will disappear.

It will be noticed that little has been said in this report as to the Ascot experiments. The judges consider that this portion of the work was not satisfactory, for several well understood reasons. In the first place, the tar supplied from the Reading gas works was apparently unsuitable for spraying by machinery. Through some unexplained cause, a great deal of foreign matter found its way into the tar, which blocked the nozzles of the machines and caused very irregular working. Moreover, as regards the dampness of the road material, the road surface at Ascot compared very unfavorably with those at Staines nad Twickenham. Some heavy rain had fallen in the night previous to the experiments, and the road being greatly sheltered by trees the moisture did not dry out. It was therefore not to be expected that the tar would adhere to the surface of the road, and in consequence it could be seen that in many cases the tar, instead of penetrating, was lifted off by traffic in the form of a detached film, leaving the road unprotected.

Book Notes.

All engineers who keep in touch with technical writings in German and French will regret to learn that the Society of German Engineers has resolved to discontinue work on the "Technolexicon," the great technical dictionary in German, French and English, which it has been engaged in preparing for several years. The director of the society reports that the work has turned out to be far more expensive than anyone anticipated and the cost of carrying it through to completion within the allotted time far exceeds pecuniary resources available for the purpose. It has always seemed to this journal that the enterprise was one of such magnitude that it was hardly practicable on the scope proposed by the society, although the latter is the largest engineering body in the world. Few people who have not actually taken part in the preparation of a high-grade lexicon have any appreciation of the enormous amount of skilled work required to carry through such an undertaking, entirely apart from the labor of the technical experts who take part in the authorship. The society has not announced in what condition the matter is at the present time, and it is to be hoped that the work has progressed to such a state that some of the enterprising German publishers may be willing to take hold of the data already collected and publish a technical dictionary, not so comprehensive as that proposed by the society, but still more modern and accurate than those now available.

A book that will be found particularly valuable by all interested in public health has just been published under the title of "Sanitation of Public Buildings," the author being Mr. Wm. Paul Gerhard. This work is, in a sense, a continuation of the same author's well-known book, "Sanitary Engineering of Buildings," which is devoted largely to the sanitary work in dwelling houses, apartments and tenements. In the new book the author discusses the drainage, water supply, lighting and ventilation of hospitals, theatres, churches, schools, markets and abattoirs. While the book is a thoroughly practical one, it is also based on the most advanced theories accepted generally by sanitary specialists of Europe and this country. There is probably no other book in the English language which so thoroughly covers the subject of sanitation in public buildings as this. (New York, John Wiley & Sons, $1.50.)

Dr. W. K. Shepard, of the Sheffield Scientific School of Yale University, has prepared a volume of "Problems in Strength of Materials" which will doubtless be of material assistance to teachers of the subject. Nobody can hope to master a subject of this nature who is unwilling to spend time in solving well-selected problems, any more than a person can hope to become a lawn-tennis expert by reading a book concerning that sport. This is so well recognized in most schools that recitations are carried on very largely today by means of the solution of problems. This volume should be of material help to the instructor in helping him to obtain a wide range of such examples. In addition to the classroom use of the book, it should prove of value to those engineers who are accustomed to spend a little time every day in solving one or more exercises in branches of engineering work with which they are not directly connected at the time. (Boston, Ginn & Co., $1.30.)

About a year ago a review was printed in these pages of the excellent treatise on "Producer Gas," by Messrs. J. E. Dodson and A. T. Larter. Naturally enough this volume has been very warmly received by engineers and it has been accordingly necessary to bring out a second edition. The revisions which have been made have been mainly in the chapters relating to suction gas plants, although some new illustrations have been added in other portions and additions made in the text in many places. The book is unquestionably the most comprehensive work on the subject that we now have, and any engineer who contemplates putting in a producer plant for heating or engine work will find in the volume a large amount of useful information. (New York, Longmans, Green & Co., $3.00.)

Letters to the Editor.

Temperatures Destructive to Concrete.

Sir: We are rather interested in knowing the highest temperature that concrete construction has been able to withstand without cracking or crumbling. Can you secure this for us? Yours truly, Blaw Collapsible Steel Centering Co.

Pittsburg, Oct. 28.

[This inquiry was submitted to Prof. Ira H. Woolson, of Columbia University, who has kindly furnished the following information:

"Replying to the inquiry relative to the ability of concrete to withstand heat without crumbling or cracking, I would say that I have conducted a considerable number of tests in an investigation of this proposition in connection with the work of the joint-committee of the American Society for Testing Materials. The results of those tests were presented to the Society in three papers, the first in 1905, the second in 1906, and the third this past summer. The paper of this year was devoted largely to an investigation of the thermal conductivity of trap, gravel, and cinder concrete, as the work of the previous years had demonstrated that the non-conducting properties of concrete was the reason of its ability to withstand high temperatures.

"Although there were a few instances where trap rock concrete cubes were heated to a temperature of 1500° without showing serious deterioration in strength, my own judgment is that the result of all the work shows that if concrete is heated throughout to a temperature of 1000° to 1500° F., it has lost the major portion of its strength and is very likely to crack and crumble if allowed to stand undisturbed. This is particularly true of quartz gravel concrete. In many cases a thorough heating to a temperature of 750° will reduce the strength of the concrete to a large degree. On the other hand, it is a well known fact that concrete will withstand a temperature of 1500° or over for an hour or two when heated on one or two sides only, and will still be in excellent condition. The reason for this is plainly shown in the paper on thermal conductivity above referred to, in which it was demonstrated that a concrete could be heated on one face at a temperature of 1500° F. for an hour and the temperature of the interior two inches in from the heated face with a rise of only 200° or 300°.

"In that paper I drew the following conclusions from my investigations: First, that all concrete mixtures when heated throughout to a temperature of 1000° to 1500° F. will lose a large proportion of their strength and elasticity, and this fact must be well remembered in designing. Second, that all concrete has a very low thermal conductivity and therein lies their well known heat resisting properties. Third, that as a result of this low thermal conductivity, 2 to 2½ in. of concrete covering will protect reinforcing metal from injurious heat for the period of any ordinary conflagration (provided, of course, that the concrete stays in place during the fire). Fourth, that reinforcing metal exposed to the fire will not convey by conductivity an injurious amount of heat to the embedded portion. Fifth, that quartz gravel concrete is not a reliable or safe fire resisting aggregate."

There is so much interest shown just now regarding the effect of successive increases in temperature on the compressive strength of concrete that a series of tests with different grades of concrete subjected to different temperature up to 1000° will be likely to yield information of general value.—Editor.]

THE STATUS OF MANUAL TRAINING.

SIR: The letter from "C. E.," of Boston, on the relations of the public school to industrial education in your issue of Nov. 16 leaves the present status of manual training somewhat uncertain. In fact, in many minds there is not a clear differentiation between vocational and manual training. Through ignorance the former has been here and there regarded as superior to and the possible successor of the latter. In point of fact, however, the manual training school is accepted among leading educators as only one of the essential elements in a complete educational system, the vocational or trade school being recognized as entirely independent in purpose, organization, and curriculum.

Following close upon the report of the Superintendent of the Boston schools, referred to in the above-mentioned letter, there has just been made public a document which proclaims the status of the manual training school in general, and of the Mechanic Arts High School of Boston in particular. It is in the form of a report made at the request of an investigating committee known as the Finance Commission. That it must be accepted as authoritative, and is certain to attract wide attention, is evidenced by the names signed thereto. They are Charles W. Eliot, President of Harvard College; Henry S. Pritchett, late President of the Massachusetts Institute of Technology, and Rev. Fr. Thomas I. Gasson, who is President of Boston College.

The question propounded to them was as follows: "The City of Boston has, for the current year, a million dollars to spend in land for the Phillips district and various buildings. Taking into account the needs of both the elementary and the high school education, is it wise to spend approximately $500,000 out of this million in rearranging the present Mechanic Arts schoolhouse and erecting a large addition to it?"

In their reply the special committee assume as admitted the following fundamental principles regarding the conduct of public education in a municipality: (1) That it is the plain duty of a municipality, such as Boston, to support, and support generously, high school education as well as elementary education. (2) Under modern conditions, it seems equally clear that a municipality must support several kinds of high school education, adapted to the various needs and desires of its population. The city of Boston to-day supports Latin High Schools, English High Schools, the Mechanic Arts High School and the Commercial High School. All these give a general education, but guide their pupils in different directions.

In seeking to answer the given question, the Committee made an exhaustive examination of statistical information regarding cost of building, equipment, instruction, etc., as well as of records of graduates. But they recognized that their decision was to be based not alone on statistical data, but also on certain fundamental considerations concerning the character of the education provided by the Mechanic Arts High School. Its work is thus described:

"The Mechanic Arts High School is an institution in which the elements of the mechanical arts are taught in connection with a thorough academic course, rich in mathematical and scientific subjects. Its fundamental object is to promote general culture, but the specific training which it gives is excellent preparation for many mechanical pursuits. It teaches the principles and processes which underlie many trades; but it is in no sense a trade school. The time which is devoted to any branch of mechanical work is entirely inadequate to give the knowledge and skill required by a journeyman. Moreover, the educational value of a shop exercise is determined by the thought which the pupil must bestow upon it; consequently no operation is repeated mainly for the purpose of increasing skill; but a new problem is presented as soon as the difficulty of a given process is fairly mastered. The most important function of the school is to reveal to boys, through its many-sided activities, their dominant aptitudes and help them to lay a firm foundation for the work for which they are best fitted. It aims to discover how executive and creative ability can be most effectively stimulated, diversified and directed. This ability is one of the most important factors in our complex civilization. Some men show it by excellent work at the bench, others at the drawing board, and others as foremen, overseers, superintendents, engineers, or organizers of industries. The school which opens the door of opportunity in a wide range of industrial activities is vocational in the largest and best sense of the term. In this age, characterized by a marvellous development of industries based upon scientific and mechanical principles, such a school meets a highly important and pressing need of the community."

It is made evident that it is not a trade school, nor does it send out young men who are likely to become journeymen in the various trades. Its purpose is to give a general education, with such training in the mechanical arts as will suggest to its pupils industrial pursuits.

This purpose is manifestly entirely different from that of an industrial school or a trade school. For example, the new Franklin Union, and the Wentworth School to be established in Boston are to be schools in which the theoretical foundation of many trades is to be taught at night to such men, already in the trades, as desire such instruction. The committee assert that the existence of these schools, which are for entirely different objects from those of the Mechanic Arts High School, have no bearing on the question.

The records show that during its fourteen years of existence the graduates of the school have gone mainly into pursuits suggested by the mechanical instruction which they have received. Some of them have entered high-grade engineering schools and become engineers. A larger number have filled the position of draughtsman. Others have become foremen. In general a strong tendency has been developed to engage in those occupations which look toward the producing side of business life. A reasonably large number have come into executive places by proving their administrative ability in mechanical positions. Speaking broadly, the records of the graduates show that the school is accomplishing its purposes.

A considerable number of graduates of the school enter the Massachusetts Institute of Technology, although this number constitutes but a small percentage of all the students who enter the school. The records made by these students at the Institute have not in the past equalled those made by students from the best suburban high schools. It appears, however, that very few of the youths who enter the Mechanic Arts High School do so with the thought of going to a school of technology later. The choice of an engineering career is the result in most cases of the student's experience in the school, which inspires the ambition to enter an engineering profession.

The school is now attended by nearly eight hundred pupils, although only about three-fourths of that number are satisfactorily seated. In light of this fact, and of their general attitude toward the entire subject of manual training, the committee unanimously conclude:

1. That the Mechanic Arts High School fills a useful purpose by opening to the youth of Boston new ways toward good livelihoods.

2. That additional facilities must be furnished, if those boys who wish to avail themselves of this form of education are to have the opportunity to do so.

3. That this need is now more urgent than that of any other specific addition to the school system of Boston.

4. That it is, therefore, expedient for the city to proceed with the enlargement of the Mechanic Arts High School without delay.

This report, local though it is in its primary application, but rendered by educators of such recognized standing, must be accepted as fully establishing the present status of the manual training school as a vital element in our educational system. It distinctly differentiates between manual and vocational training, and recognizes the independent field for the introduction of educational courses looking to the development of the journeyman in the various trades.

WALTER B. SNOW.

Boston, Nov. 7, 1907.

THE AMERICAN COKE INDUSTRY during the last three years has been marked by a steady decrease in the consumption of coal per unit of coke, due for the most part to the development of by-product manufacture, in which the yield of coke from the coal is considerably greater than in the beehive oven. The figures for the calendar year 1906, compiled for the U. S. Geological Survey by Mr. E. W. Parker, show that the total value of coke produced was $91,600,000, the average value per ton being $2.52.

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TABLE OF LEADING ARTICLES.

The So-Called Panic.

It is unfortunate that a number of young men engaged on our daily papers have not learned to be a little more careful in their use of the English language. A somewhat careful observation of the news sheets of the country during the last fortnight shows that, in an attempt to be sufficiently sensational to make papers sell, conditions in the manufacturing and commercial world have been called by pretty hard names they by no means deserved. If the American people did not have an exceptional amount of common sense and were not thoroughly convinced that because a thing was stated in the newspaper it was not necessarily correct, we might have had a real panic on our hands. Nothing of the sort has happened because about all the people who have been hurt are those who, for one reason or another, have had their affairs so extended as to be unwieldly. A shipmaster who carries all sail too long has a good deal of trouble when the wind freshens with unexpected rapidity. A business man who was doing more than his capital warranted in flush times is likely to have trouble when such an exceptional period subsides to the normal. We have been having flush times for a number of years. They have been continuing for so long, indeed, that we have become accustomed to them, and have forgotten just exactly what is necessary when real normal conditions prevail. When mills are filled with orders so far ahead that new business is not wanted, as was the condition a year ago, affairs may truly be called booming. It is wholly unreasonable to expect them to continue to boom. We must expect to work harder than we have the last two or three years in order to accomplish as much, but it is difficult to see what reason there is for anticipating a panic. Certainly there is very little in view at the present time to warrant any such apprehension, and a misapprehension of some recent events, magnified in the newspapers, is the only thing that needs explanation just now.

In the first place there have been reports concerning the shutting down of some industrial plants. It is well to look at these things in a rational manner. A good many establishments have been running under the highest pressure for some years. Their machinery has been used by day and night forces until it is in great need of repair. More than a year ago The Engineering Record was informed by the managers of certain works that it would be necessary to shut down for repairs or their plants would drop to pieces, yet these same plants have been kept running all through the summer. Some of them are among the mills which have closed recently. They have not stopped solely because of business conditions, but because it is high time for repairs and renewals. Probably many more establishments would report the same condition of affairs. This is the beginning of the season when such work is done. Because production has been conducted under such extreme pressure during the last two years that these annual periods of recuperation have not been possible is no precedent for their continual omission. It is noticeable, moreover, that in a good many cases where these shut-downs have occurred that the American workmen are kept busy, at least in a considerable measure, and the men who have been turned off are the Italians and other Europeans who are taking advantage of this closing of the works to visit their native land. That is not a mere conjecture can be ascertained by inquiry at any shipping office.

There are a few manufacturers who are apprehensive and talking of closing down their plants entirely. It might be well for them to consider that any unnecessary retrenchment is likely, in view of the recent prevalence of unwarranted rumors of a panic, to be a cause of further hardening of conditions, rather than a remedy. "Every business enterprise which is making any unnecessary retrenchment," according to a recent address by Mr. Henry L. Doherty, "is adding just that much to the situation which is bringing about a threatened industrial depression." Mr. Doherty's connections are so important and so widely spread throughout the country that his further assertion that we are suffering merely from a lack of confidence deserves careful consideration. "United efforts on the part of the men of influence of this country could quickly restore the confidence which is lacking," in his opinion, "but unfortunately they have as yet no means of taking united action, no attempt has heretofore been made to do so, and of the numerous half-baked suggestions which have been offered as a cure, few, if any, would stand the analysis of proper logic."

It may be confidently asserted that the thing for business men, particularly manufacturers, to do at the present time is to form local associations for steadying the weak-kneed people in their vicinity. One good, strong local association of manufacturers in any city can accomplish a great deal of good. If the trouble which is now passing away had no other effect than to form these local organizations it would have accomplished a great deal. Manufacturers must stand together just as laboring men stand together. During the last two weeks there has been a pitiful exhibition of cold feet on the part of the bankers in some cities, particularly west of the Allegheny Mountains. Manufacturers should unite to prevent any such fright affecting them. It is entirely practicable for them to do so by simple means. A great deal of cash can be brought to light, when bankers are too scared to advance money on good security, by making a trust fund of these securities and issuing notes of small amounts against it, or something of this sort. There are plenty of men having small sums to invest who will come forward at such times, provided they are assured that responsible people are connected with this method of raising money. If an association of local manufacturers undertakes to raise funds for some of its members in this way, it is safe to say that a good deal of hidden money will be brought to light and the currency conditions will be so much improved.

It is the currency conditions that are mainly responsible for the present trouble. Some of these conditions can be changed only by Congress, and fortunately Congress seems to be willing to talk about the matter. Moreover, it will act just as soon as the influential men of the country call loudly enough for a reform. Congress has never failed to do this in the past and there is no reason to expect it will refuse to do so now. But all of the trouble has not been due to our rigid currency laws. Some of it has been caused by the hasty action of people who felt that a panic was coming and withdrew their money from the banks, hiding it away where it was of no use to them or to anybody else. This not only deprived them of interest and jeopardized the safety of their funds, but it also had a tendency to create a condition that might have become very serious. These people, most of them of small means, may be pardoned for their timidity. This cannot be said, however, of those banks which have shown the white feather before firing began. There is nothing so pitiful as a coward who does not even wait to see if the fight is going against him. The cowardice of some bankers during the last month is hardly to be believed. Instead of doing all they could to allay the sudden wave of unwarranted apprehension which swept the country, they did all they could to increase the uneasy feeling. They have hoarded away enormous sums of currency which should have been paid out to their customers in the usual banking ways, without regard to the fact that bank reserves are kept for the purpose of relieving sudden unexpected calls for large sums and not as ornaments for the annual balance sheets. Every bank owes an obligation to the community in which it is situated. Any bank holding more currency than its legal reserve is doing great harm to every business interest and merits no consideration whatever at the hands of merchants, manufacturers or labor. It is high time for manufacturing and mercantile interests to do no business with these lily-livered institutions which are no help to the community. Business men will do well to remove their accounts from such banks, to think twice before making any unnecessary reductions in their force of employees, and to form local associations to check still further the senseless scare.

Costs of Engineering Work.

The Commissioners of Accounts of the city of New York have been conducting during the past ten days an investigation of the conditions under which Contract No. 3 of the Board of Water Supply, covering the construction of the main dam, dykes and other works of the great Ashokan Reservoir was awarded some months ago. As was set forth in this journal there were five bids for this work. The law under which the Board of Water Supply is acting does not require the tender of the lowest responsible bidder to be accepted, but lays upon the Board the most serious responsibility of so awarding the contract as will, in its judgment, best serve the interests of the city. After carefully canvassing all the bids the contract was awarded to MacArthur Brothers Co. and Winston & Co., who were next above the John Peirce Company, the lowest bidder, the contract price being above the bid of the latter.

This investigation, like most other investigations of technical matters by city commissioners whose members know little or nothing about the things to be investigated, has already developed into a voluminous irrelevant examination, of the members of the Board and its engineering organization, but it has occasionally touched on things more germain to the real substance of the inquiry. After the usual efforts of lawyers under such conditions to discredit the the evidence of eminent engineers of twenty to forty years of active professional work, it has seemed to be one of the principal objects of the Commissioners of Accounts and their technical advisors to show that the unit costs of such earth and rock excavation and rolled embankments of selected material, are as susceptible of accurate estimation by the aid of information disclosed by wash and core borings and other preliminary examinations as the unit prices of standard grades of structural steel work. The physical environment of the structural shop is with rare exceptions steady and unchanging. The labor conditions are as constant as it is possible to make them, and the various classes of structural work produced may be fairly well determined under the specifications and contract plans. Such circumstances enable the cost of work to be predetermined, not with mathematical exactness but with reasonable accuracy for business purposes; hence, it may be argued by the layman, the estimated cost of any engineering work should be determined with equal accuracy under similar specification and contract plans, especially if the location of the work may be examined by prospective bidders and if the requisite borings have been made and other practicable means have been taken to secure the requisite information as to physical or other conditions affecting the work to be done.

All this appears plausible enough but any engineer of extended experience knows well how fundamentally misleading such plausibility may be, and usually is. It has been fully and forcefully brought out by the chief engineer and by the consulting engineers of the Board of Water Supply that reasoning from practically fixed conditions, such as those of the structural shop, to the erratic and indeterminable conditions of most of such great field constructions as those of the Board of Water Supply is both misleading and dangerous. If, for instance, the earth and rock excavation required for the Ashokan dam and the dykes, gate houses and other appurtenances of the reservoir in question, amounting to perhaps 2,000,000 cu. yd., were to be made under conditions practically equivalent to those which governed similar parts of the new Croton dam contract, it is reasonable to suppose that a fairly close estimate of cost for the former could be made, allowing for difference in the labor conditions at the two sites. A little familiarity only with the two pieces of work, however, is enough to show that there is no parity between them. Remarkably full examinations have been made at the site of the Ashokan work and enough has been disclosed there to show that the materials to be taken out are radically different from those at the Croton dam nor is there reason to suppose that the general physical conditions have any material similarity. The treatment of the rock foundation bed will have to be very different, the depths to which trenches for core walls will have to be carried is not certainly known, although probabilities have to be estimated, and the amount of water to be encountered and taken care of is exceedingly uncertain. In fact the general character of the conditions found at Ashokan, as at every other great work of the same class, is really unknown until the actual progress of the work discloses it. It is only the tyro in engineering, or the bookman, who would attempt to predict with accuracy the elements of cost of any of the great classes of field construction.

Both the engineer and the contractor must make estimates of cost under such circumstances as best they can. It is usually these great uncertainties of cost which make the corresponding divergencies in such estimates so often found among even experienced engineers and contractors, and exhibited frequently in the wide range of prices in competitive bidding. It is in this particular field of engineering that the well developed judgment plays the crucial part. The estimated unit costs in such cases are more largely matters of judgment than of carefully systematized analyses of other work of the same class. Most careful consideration must of necessity be given to prior contracts of the same kind, but comparisons must be made by the aid of and frequently radically tempered by judgment developed by experience; any direct reference without the qualification of such judgment is practically certain to be grossly misleading, and it has been frequently seriously misleading to contractors as was shown in the Jerome Avenue reservoir contract in New York. No attractive printed tabulations of preceding costs of other contracts can safely form the basis of sensible conclusions of the costs of these great field constructions; such sources of data are deceptive and dangerous unless cautiously handled. The law has wisely made the duty of awarding the Ashokan and other contracts of the Board of Water Supply, a matter of the best judgment of the Board guided by its experienced engineering organization, acting for the best interests of the city, and it is not good public policy to permit captious criticism of politics or the unscrupulous members of the daily press to frustrate the intent of the statute when it is efficiently followed in spirit and letter.

The Steel Rail Controversy.

The unsatisfactory results in service of the heavy-section steel rails rolled during recent years have brought forth from both the manufacturer and the consumer numerous suggestions of the causes of these results and of methods to prevent them. The representatives of the steel mills are united in the opinion that the number of actual rail failures has been greatly exaggerated. They consider such failures as have occurred to be due primarily to the fact that the standard sections adopted some years ago are not suited to the heavy rails required to carry the greatly increased train loadings, the tremendous volume of traffic and the higher speeds which have developed since then. They are of the further belief that improvements in the construction of track and equipment have not kept pace with the requirements presented by these changed conditions. The railway interests have generally conceded likewise that the present standard rail sections should be modified, and in numerous meetings of the various technical societies made up of, or including, railway engineers and operative officers as members, improved methods of track and equipment construction have been much discussed. These interests, however, attribute the unsatisfactory rails that have been produced to several more causes considered equally vital. Chief among them are, first, the failure to discard a sufficient amount of steel from the top of the ingot from which the rails are rolled; second, improper chemical composition of the steel; and, third, the physical weakness of the rails due to existing methods of manufacture.

The steel makers and the railway interests are not only agreed that the present standard section should be revised, but they are also in accord regarding the general plan to be followed in making the changes. For the heavy rails now regularly used on the main-line tracks of most railroads, the flange and web are held to be too light in proportion to the head. A proposed change, known as the Harriman sections, as well as another series, known as the Pennsylvania sections, both of which add considerable weight to the flanges and webs in proportion to the heads, and also have a narrower flange than the present standards, have been recommended by the rail committee of the American Railway Association. Since the rail manufacturers have made no protest against these findings of this committee, it is reasonable to assume they are satisfied with the action that has been taken, and, in fact, the decision of the committee followed consultation with the manufacturers.

The proposed changes have been suggested chiefly to overcome the difficulties of manufacture presented in rolling rails to the present standard sections. The latter have so much metal in the head in proportion to the web and flange that the head cools much more slowly than the balance of the rail, resulting in internal structural strains. The large proportion of metal in the head also requires the work of rolling to be executed while the steel is too hot to yield the most satisfactory results in structure. The improper balance of proportions in the parts of the rail affect particularly the high-carbon steel used in a large percentage of the rails now produced. The lighter head and the narrower, thicker flange of the proposed sections are expected to alleviate greatly this paramount difficulty of manufacture, and thus result in rails which will be mechanically stronger and better. Grounds for objections to a section with a narrower flange than that of the present standard might appear to be justified, due to a reduction of bearing area on the cross ties, if it were not for the fact that tie plates are now almost universally used by railroads having heavy rails, particularly where soft wood ties are employed.

While the manufacturers and consumers are more or less generally agreed concerning the changes which should be made in the standard sections for rails, they are widely at variance in regard to the percentage of steel that must be sheared from the top of the ingot to eliminate defects from piping. A committee of the American Railway Engineering and Maintenance of Way Association and one from the American Society of Civil Engineers have both recommended that a minimum of 25 per cent. should be discarded from the top of each ingot. The committee of the American Railway Association has discussed the rejection of a minimum of 20 per cent. of the ingot. The rail makers regard any such discard as an injustice, and as unnecessary. They also state that a rejection of 25 per cent. of each ingot will reduce the output of the mills by that amount, and will increase the cost of manufacture accordingly. As a matter of fact, a very carefully compiled record made

recently shows that in about a dozen of the largest rail mills in this country an average of from about 5 per cent. to about 14 per cent. of the ingot is discarded under the present methods. Freedom from piping danger may not be in exact proportion to the proposed amount of metal to be discarded, but it is evident that the proposed increase will not alter conditions so greatly as might first appear.

The chief controversy between the steel makers and the railway interests over the chemical composition of the steel now used is principally in regard to the phosphorous content. The consumers desire to limit the phosphorous to 0.085 per cent. The manufacturers contend that with the available ores this is an impracticable limit, and suggest 0.1 per cent. This contention may be well taken, but one steel mill on this continent is producing in the neighborhood of 150,000 tons of steel rails per year, which contain as a maximum 0.085 per cent. of phosphorous. These rails are made from ore purchased in the open market in this country, and have given and are giving satisfactory results in service.

The details of the existing methods of manufacture which produce physical weakness in rails are not easily defined. The reduction in the number of passes or times an ingot is put through the rolls to produce a rail doubtless has some bearing on the unsatisfactory results. The structural strains incident to the more rapid forcing of the steel into the rail section may account also for some of the numerous mysterious breaks which have occurred in apparently sound rails. On the other hand, the proportions of the present sections are probably somewhat responsible for the poor physical character. It is apparent, moreover, that sections with smaller heads would have the structure of the latter of more nearly the same character as the balance of the rail, due to the additional work which the heads would receive. The methods of paying the mill operatives according to the total output and other similar conditions also have a tendency to produce hasty work, which naturally may not be done with sufficient thoroughness. In other words, in the effort to increase production there is danger that the quality of the product has not been kept sufficiently prominent.

Whatever the merits of the contentions presented by the two interests chiefly concerned may be, it is certain that heavy rails which will give uniformly satisfactory service must be produced. If such rails cannot be manufactured at the existing prices, the steel mills should present the case clearly to the railway interests with the provision that they can and will meet the proper requirements at an increased cost, to be demonstrated. Action of this kind made in a reasonable manner would relieve the makers of responsibility. It would also forestall any grounds for government investigations and perhaps interference, which appear to be probable, and would likewise remove a strong argument for the reduction or removal of the tariff on steel rails, as has been widely advocated of late from various responsible quarters.

Repair Shop Expansion.

A modern industrial plant designed for the economical manufacture of standard products is almost always built with the idea of providing for future growth without undue expense. Remodeling of factory buildings is becoming less frequent, as comprehensive plans for expansion are originally laid down, and few owners begrudge the time taken by their architects and engineers to round out a logical scheme of development on paper before the earth is turned at the site of the new establishment. The power plant is located in or near the center of future distribution, and space is usually provided for a large increase in generating capacity without the erection of a new building; side tracks, passageways, spurs into buildings and the main structures themselves are put down in such a way that liberal growth can take place without hampering the usefulness of existing facilities. Even the foundations are often built for future tool locations, and the heating and ventilating problem in the larger plant is ordinarily met by an extension of the methods of solution found satisfactory in the first installation.

The conditions in a shop devoted to repair practice or other non-routine work are decidedly different. To foresee the line of development probable in such an establishment is far more difficult than to plan for the growth of a standard-product factory. In a repair shop attached to a particular industry alone the conditions are easier, although the development in every line of mechanical endeavor is so progressive in these days that expansion plans must be made on a broad basis if later conditions are not to find cramped and inefficient facilities at hand. Thus, in the electric railway field a new repair shop can be built to handle the present type of rolling stock with efficiency and space allowed for growth along present lines; but a wise design will consider not alone the probability of being obliged to maintain here an increased number of cars like the present units, but also the fair certainty of having to deal in a very few years with motors of perhaps 50 per cent. more power and cars of from 25 to 50 per cent. more weight than those of to-day, on any line or system where the competition to secure faster service or greater comfort is beginning to be felt. The probable growth of the industrial unit cannot be overlooked in the planning of expansion.

In the general shop for machines and metal repairs and for the development of varied iron and steel structures on special orders, the exact trend of future business can seldom be definitely postulated. Several points can be provided for, however, in the endeavor to meet the changed conditions anticipated. Ample power supply, absence of obstructive movements of stock against the normal course of internal handling, provision for plenty of natural light and continuous expansion of the heating and ventilating systems are essential to the avoidance of congestion. By planning the concentration of the heaviest class of machine tool work at one section of the building, as in the standard centre aisle swept by overhead crane facilities, the most indefinite future repair jobs on a large scale need cause few anxieties. Extension of the centre aisle for heavy work and expansion of the side bays for the lighter jobs will meet any probable conditions. When the design will not permit of symmetrical expansion, as in city shops, located on odd-shaped lots, the problem can sometimes be solved by reconstructing a portion of the bays devoted to the lighter work and turning these sections over to the heavy tools, which naturally are grouped together on the ground floor. It is a simple matter to relocate benches and speed lathes, small shapers, grinders and the less massive equipment of the ordinary machine shop, and sometimes a special mezzanine floor section can be built for this transfer. Interference of one job with another must be avoided like a pestilence, if economy of shop operation is to be retained in the growth of the works.

It is in changes of this character that the usefulness of the electric drive specially appears, for the independence of line shaft locations common to every electric system enables tools to be placed almost anywhere that the shop structure can support them. Even the group driving of machines by motors offers only less latitude in the re-location of equipment. Modern methods of electric lighting are equal to almost any demand from the shop foreman in the way of making the desert places to blossom with productivity, and the flexibility and economy of electric power never can do otherwise than facilitate expansion.

Notes and Comment.

Grade Crossing Elimination is work of such growing importance near most of our large cities that the article on an undertaking of this sort on the Boston & Albany Railroad, printed on another page, deserves special notice. There was nothing particularly novel about this work, nor was it so difficult as the grade crossing elimination carried out by the Lackawanna engineers in Newark. It is for this reason that prominence has been given to the description, for it will doubtless be helpful to a good many engineers in the future, who have to carry out similar improvements. The problems in any such case are two-fold, to handle the traffic and to transport materials. Where the right of way is limited in width, the successive steps in the construction must generally be planned so as to avoid interference with traffic so far as practicable, and this may make it necessary to put down retaining walls in very narrow trenches. Cableways are employed to advantage in such work, but it would seem as though they might be supplemented with good results by the narrow-gauge railways that are coming into more general use by our contractors and have been extensively employed on all kinds of foundation work by European contractors for many years. Where the speedy completion of the change in grade is desirable, which is generally the case, these light railways present features that deserve careful consideration.

Greater Pittsburg, a city of 38 square miles in area and a population of 550,000 is assured by the decision of the United States Supreme Court that the consolidation of Pittsburg and Allegheny was not contrary to the Constitution or to any federal laws. The decision defines in explicit terms the rights of a state over a city, as shown in the following extract: "The state at its pleasure may modify or withdraw all such powers, may take without compensation such property, hold it itself, or vest it in other agencies, expand or contract the territorial area, unite the whole or a part of it with another municipality, repeal the charter and destroy the corporation. All this may be done, conditionally or unconditionally, with or without the consent of the citizens, or even against their protest. In all these respects the state is supreme, and its legislative body, conforming its action to the state constitution, may do as it will, unrestrained by any provision of the Constitution of the United States. Although the inhabitants and property owners may by such changes suffer inconvenience, and their property may be lessened in value by the burden of increased taxation, or for any other reason, they have no right, by contract or otherwise, in the unaltered or continued existence of the corporation or its powers, and there is nothing in the federal Constitution which protects them from these injurious consequences. The power is in the state, and those who legislate for the state are alone responsible for any unjust or oppressive exercise of it." Particular attention is called to this opinion of the court of final jurisdiction of the nation, because of its significance in connection with many important engineering affairs. For example, the water, sewerage and park work about Boston, the water-works at New York and the drainage works at Chicago are not strictly municipal undertakings in some respects, although directly for the benefit of the cities concerned. There is a manifest tendency toward state commissions for larger public works.

GRADE CROSSING ABOLITION AT NEWTON HIGHLANDS AND NEWTON CENTRE, MASS.

By Walter C. Whitney, Assistant Engineer, Boston & Albany R. R.

The Boston & Albany Railroad Co., is just finishing the work of the abolition of grade crossings on that part of its line known as the Newton Highlands branch. This is a double-track line which leaves the main line at Brookline Junction about 1½ miles from the South Terminal Station and running out through Brookline, and Newton joins the main line again at Riverside, about 10 miles further out. The work to be described lies in that part of the city of Newton known as Newton Highlands and Newton Centre. New grades of the railroad and streets were specified in the decision of the commissioners which passed upon the general project, and were ordered by the Superior Court. The work being on a branch line on which the traffic is wholly suburban passenger, with only one freight train a day, heavier grades were permissible for the tracks than would otherwise have been the case. Owing to the location of Crystal Lake close to the tracks it was deemed advisable to depress the tracks very little at that place. This fact made it possible to divide the work into two sections. The retaining walls and abutments of the Newton Highlands or westerly section were built in 1905. In 1906 the steel work of the bridges was erected at Newton Highlands and the retaining walls and abutments were built at Newton Centre. This year the steel work is being erected at Newton Centre.

The general layout and scheme of the work was as follows: Starting at Sta. 189 of the location of the railroad, the tracks were elevated at the rate of 0.316 per cent. or 16.68 ft. per mile to the first street at Sta. 201, where the tracks were elevated a total of 6.30 ft. and the street depressed 9.70 ft. The new rail grade from Sta. 201 descended at the rate of 1.06 per cent. or 56.0 ft. per mile until the fill ran out at the old rail grade at Sta. 208. The depression of the tracks began at Sta. 208 and the rate of 56 ft. per mile was continued to Langley Road at Sta. 215, where the street was raised 8.23 ft. and the track depressed 9.60 ft. From Langley Road the tracks run level to Institution Ave. at Sta. 222, where the railroad cut was 9.00 ft. Institution Ave. crossed the railroad by means of a wooden bridge and the elevation of the floor of the new bringle is about 1 ft. lower than the old. From Sta. 222 to Sta. 236, the new grade ascends at the rate of 0.336 per cent. or 17.74 ft. per mile. At Sta. 226 Cypress St. originally crossed the tracks by a wooden bridge, but was so elevated that in the change the new elevation of the street where it crosses the tracks is over 6 feet lower than the old. The railroad was depressed 7.30 ft. Glen Ave. and Institution Ave. are both 40-ft. streets, Langley Road 60 ft. and Cypress St. 50 ft. At Sta. 236 Centre St. crosses the tracks on a skew of 20 deg. 6 min. The street was originally 50 ft. wide but was widened 6 ft. in connection with the work. Centre St. was raised 13.47 ft. and the tracks depressed 5.33 ft. These five streets comprise the Newton Centre section. The work of making the fill at Glen Ave. and the construction of the abutments at that place were done in 1905, the remainder of the work in 1906 and 1907.

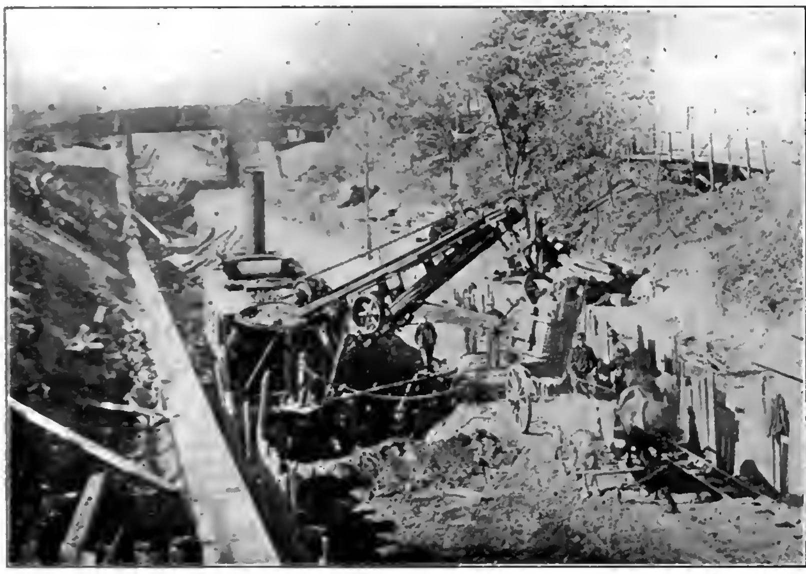
From Sta. 236 to Sta. 250 the tracks ascend at the rate of 0.41 per cent or 21.86 ft. per mile. At this latter station the depression of the tracks was only 5 in. and this point was made the dividing point in the steam shovel work between the two years' work. Rogers St. originally crossing the railroad at Sta. 247 was discontinued, and a new location given it at Sta. 251, where both abutments of the bridge are built on the face of a ledge. Rogers St. as relocated is 40 ft. wide. From Sta. 250 the tracks again descend, this time at a rate of 0.809 per cent. or 42.71 ft. per mile to Boylston St. at Sta. 277, passing under Hyde St. 40 ft. wide at Sta. 258 and Walnut St. 70 ft. wide at Sta. 266. Walnut St. is the main street of Newton Highlands, and the principal square is only about 100 ft. away from the railroad. At Hyde St. the tracks were depressed 6.25 ft. and the street raised 11.58 ft. At Walnut St. the depression was 11.80 ft., a part of Newton's boulevard system, is 90 ft. wide. The recently built Boston & Worcester Electric R. R. runs its cars over this bridge. At the time the line was built they were refused a crossing at grade with the railroad and passed over it by means of a wooden trestle. Piles were driven for the four bents nearest to the railroad, two on each side of the tracks, and these bents were so spaced that the concrete abutments could be built and the excavation for the railroad made without disturbing the electric car tracks, save for a small amount of rebracing that had to be done. From Sta. 277 the new grade ascends at the rate of 0.876 per cent. or 46.25 ft. per mile to Sta. 290, where it runs out at the old grade of the tracks.

The tracks in front of the Newton Highlands station were lowered 10.5 ft. and those in front of the Newton Centre station 9.5 ft. These changes of grade necessitated a remodeling of the depots to meet the new conditions. Both stations are of Milford granite and are about 30x75 ft. In both cases the change was made by building new foundations under the front and sides of the building, carrying them deep enough to be below the new subgrade of the tracks. Access to the station from the platform at Newton Highlands is obtained by two flights of granolithic steps, which start on the front at the two ends of the depot and come to a common landing in the centre of the station at elevation of the floor of the station. At Newton Centre, the station being nearer the tracks, there was not room on the front for these steps and a flight of granolithic steps was built at each end of the station and new doors built in the ends instead of on the front as formerly. Paths with a maximum grade of 12 per cent. lead from the streets at each station to the platform.

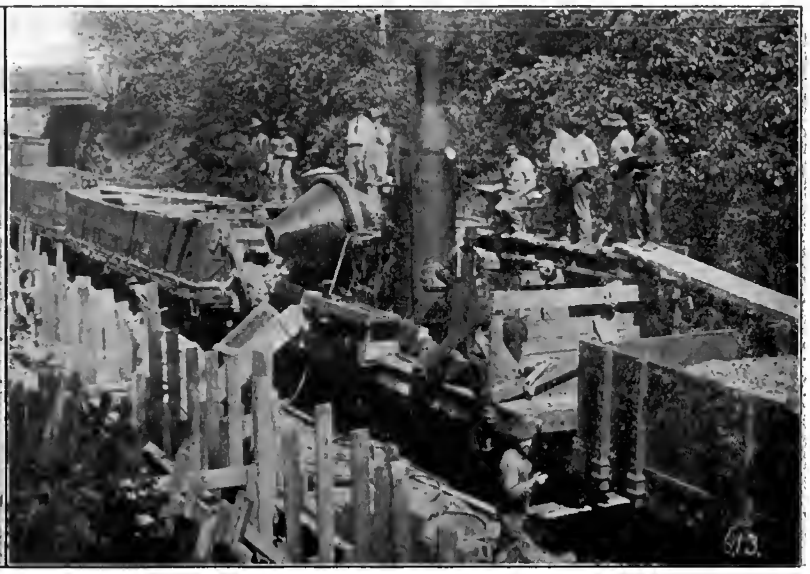
The platforms, in conformity with the standard of the Boston & Albany R. R., are of granolithic construction. The main platform slabs are 4 in. thick; the lower 3 in. is composed of 1:2½:5 concrete; the granolithic finish, 1 in. thick, consisting of 1:1½ mortar colored with 1 lb. of lampblack to each barrel of cement. The front curbing next the track is 24 in. deep and 7 in. thick and is tied to the main platform by two pieces of galvanized iron chain 12 in. long in each slab. The slabs are made to be as near 5 ft. square as is practicable. Where practicable the platform is given a pitch of ⅜ in. to 1 ft. Beneath and in the middle of both platforms a 24-in. drain of Akron pipe was laid to carry the water in the railroad ditch by the station.

At Newton Highlands the baggage is taken from the track level to the street by means of an elevator worked by hand. Outward baggage is also handled the same way. At Newton Highlands the baggage room is in the basement of the station, while at Newton Centre it is handled in a small building, also built of Milford granite and situated about 90 ft. from the station. Baggage coming from the trains is raised from the track to street level by means of a hand elevator. That which is to go on the train is transferred from the street to the platform by means of a granolithic chute.

The concrete work on both sides of the track is continuous from Sta. 209 to Sta. 239, and from Sta. 250 to Sta. 280. Where it was not necessary to build a retaining wall to hold the slope a low wall, called a ditch wall, was built to protect the foot of the slope from the anticipated large amount of ditch water to be taken by the depressed roadway. This wall is 2 ft. 6 in. high and is built so that the top of the wall is



Shovel Loading Teams for Street Fills.



Concrete Plant Discharging into Wall Forms.


The Newton Highlands Station before and after Lowering the Tracks.

level with the top of the rail. The ditch is 2 ft. 6 in. below the top of rail and the outside of the ditch at the face of the wall is about 8 ft. 2 in. from the rail. The ditches are all made 2 ft. 6 in. wide. The ditch walls have a foundation 3 ft. deep and are 2 ft. 6 in. thick, made of the same 1:3:7½ mixture of concrete throughout.

Spruce lumber was used throughout for sheathing and bracing, and for forms for concrete. Planks 2 in. thick were used for sheathing. Rangers and braces were usually 6x8 in., although in some cases 4x6 in. were used. For forms in 1905, 2 in. stock was used, planed on one side for face form, unplaned stock being used wherever the work would not be exposed to sight when completed. In 1906, 1 in. stock was used for forms but did not prove as satisfactory as the 2 in., it being much harder to keep it true to alignment and the finished surface, in general, being more uneven.

The planks and boards for face forms were fastened together into panels from 12 to 16 ft. long and 2 ft. 6 in. wide. This made it easier for the carpenters in putting up and taking down the forms. They were held in place by 2x4-in. uprights, spaced from 2½ to 4 ft. on centers. Before concrete was laid, the forms were gone over with a plane to remove any uneveness and open joints were stopped up with hard soap.

Lowering the ditches of the railroad a maximum of 14½ ft. at Newton Highlands, and 12 ft. at Newton Centre necessitated the lowering of all drains in the streets which crossed the tracks and some changes in tributary streets. Means also had to be taken to care for the surface water which would fall on the railroad slopes, and from there find its way into the ditches. Fortunately at Newton Highlands Boylston St. and Walnut St. were the only ones which had drains in them. At Walnut St. a new 40-in. circular concrete drain 1,500 ft. long was laid, which emptied into an open concrete drain which was laid 3,000 ft. further to South Meadow Brook. Entrance was made into this drain in both the railroad ditches by means of a special catch basin, in which was incorporated the invert of the 40-in. drain. Under the tracks two lengths of 40-in. cast-iron pipe was laid. This pipe was laid at night at different times so that there might be no interference with trains. At Boylston St. a 20-in. concrete drain was laid, the ditch water being taken care of by catch basins similar to those at Walnut St.

The new grade of the railroad at Crystal Lake being only about 18 in. above the level of the water in the lake, it was necessary to provide some safeguard so that in times of high water the tracks should not be endangered. This was done by building a concrete overflow at the east end of the lake next the tracks, so that should the water ever rise higher than the grade of the overflow the water may be carried off through a drain which passes under the tracks at Centre St. and thence through private lands 2,500 ft. to the lowlands. This drain is of concrete 48 in. in diameter, laid under and built in connection with a ditch wall on the north side of the tracks and carried under them by means of four lengths of 48-in. cast-iron pipe. As soon as the drain passes under the south abutment at Centre St., it is enlarged to 60 in., and is then built of concrete.

Langley Road was the only other street at Newton Centre in which there was a drain, and the work was done in a similar way there, the water from the ditches being taken care of by catch basins. All work on the drains outside of the railroad location was done by the City of Newton by day labor. Newton having the so-called separate system of sewers, the sewers in Walnut St. and Langley Road had to be lowered independent of the drains, temporary means being provided to maintain their flow.

The work at Newton Highlands was started in the spring of 1905, as soon as the frost was out of the ground. There being land enough south of the main tracks to permit it, a temporary line was built the whole length of the work, about a mile and a quarter. Single track was laid on this and the two main tracks abandoned or given up for construction purposes. A flagman was stationed at each end of the temporary track and a third man near the middle had charge of the train movements. The flagmen's cabins were connected by telephones and trains were allowed to enter the single track from either end only by order of the man in charge. There were fifty-two regular trains every day in both directions and to get a train in and out of the single track section necessitated two movements or orders by the man in charge. Often there would be three or four work trains in the section and orders would have to be given putting them into clear so that it was no unusual thing for from five to six hundred movements to be


The Newton Centre Station before and after Lowering the Tracks.

made in one day. All this was done for two years without a single accident and without any delays to traffic longer than a few minutes. Here delays were all caused by trains arriving at both ends of the single track at practically the same time.

At two places in this temporary track, trestles were built, one 368 ft. long, and the other 512 ft. long. These were built where there was not room enough to make the steam shovel cut to grade without undermining the temporary track. Piles were driven varying in length from 6 to 12 ft. They were capped by 12x12-in. caps on which were laid the 10x16-in. stringers. When the temporary track was completed, the traffic was transferred to it and excavation was started with the steam shovel, enough width being obtained on the bottom of the cut at the elevation of the new sub-grade to lay a track which would have clearance from the face of the walls and abutments on the north side. As soon as the steam shovels had a section of the cut completed, the contractor for the masonry work started work on the walls and abutments on the north side. When these had all been completed a track was laid at the new depressed grade, and, traffic being turned on to that, the temporary track was torn up and the steam shovel excavation was made under the site of the other or southerly track, after which the south walls and abutments were built.

The material excavated was disposed of in three ways. Wherever possible it was loaded on teams provided by the City of Newton and used in making the street fills. When this was not feasible, it was loaded on dump cars and used for raising the railroad grade at the fill at Glen Ave. The surplus material was wasted on the company's land at the west end of the work. At Newton Highlands one street, Walnut St., was kept open to teams all the time the work was being done. A temporary wooden bridge was maintained supported by wooden bents, and on the bridge abutments at different stages of the work.

At Newton Centre the right-of-way owned by the road was so narrow there was no room for a temporary track outside the others, as at the Highlands. All abutments and retaining walls on the north side were first built in a trench, the northerly track being given over to the use of the contractor and for construction purposes by the railroad company. All passenger trains were run on the southerly track, making single track in the same way as the year before at Newton Highlands. As soon as the walls and abutments on the north side were completed the same routine was gone through on the south side, the northerly track being used for single track. When the abutments and walls were all completed, which was late in the summer, single-track was again made on the southerly track and the steam shovels, one at each end, excavated about half way down to final sub-grade under the northerly track, this being as deep as they could go and have width enough on the bottom of the cut to lay a track and at the same time not undermine the southerly track. Traffic was now diverted to a temporary track laid in the cut as close to the walls on the north side as was possible, and the steam shovels then excavated under the southerly track to sub-grade. After this was completed traffic was again transferred to the southerly track and the excavation completed under the northerly one.

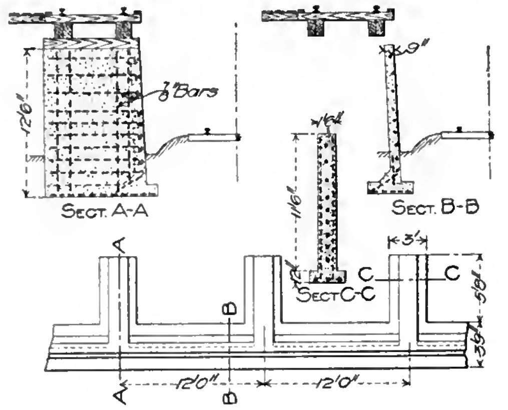
At Newton Centre two streets were kept open to the public all the time until the steel work was put on. Both crossed the railroad on overhead wooden bridges, and the change of grade of course necessitated new abutments and new bridges. One was originally supported on wooden bents and carried an electric car track. The foundation stones of the old bents were taken out and new timber supports put in reaching down to the new elevation of the sub-grade. The grade of the street at this place was lowered about 6 ft. so that it was possible to build the new abutments to their full height without interfering with the old bridge. The bridge was a wooden bridge resting on stone abutments. A temporary timber bent was put in front of the old masonry and carried down to the new sub-grade. The old abutments were then torn out by the railroad forces and the new abutments built by the contractor.

The various mixtures of concrete used on the work were as follows:

All foundation concrete, and that used in ditch walls, was one part of cement, packed in the original package, three parts of sand measured loosely, and seven and one-half parts of broken stone.

Main wall concrete and coping for retaining walls was one part cement, packed in the original package, two and one-half parts sand measured loosely, and six parts broken stone.

Wing-wall coping and bridge-seat concrete was



Coal Pocket Walls.

one part cement packed in original package, two parts sand measured loosely, and four parts broken stone.

Wall facing mortar consisted of one part cement and two parts sand specially screened.

Coping and bridge seat finish mortar consisted of one part cement and one and one-half parts specially screened sand.

The specifications required that the sand should be free from organic matter and should contain not more than 7 per cent. of clay or similar material. The sizes desired were preferably a mixture of coarse and fine, but no batch should consist of wholly fine sand, that is so fine that after having the coarse parts screened out by a No. 12 sieve, more than 50 per cent. would pass through a No. 50 sieve. No dead sand was allowed in the work. The larger part of the sand used both years came from the railroad company's pit at Riverside, about 4 miles from the work. It was provided in the contract for the work that the contractor should be allowed to obtain it there free of charge and it was transported from the pit to the work without cost to contractor. At Newton Highlands excellent sand was found in several places and was used in the work.

At Newton Highlands both broken stone and gravel concrete were used, the gravel being obtained directly from the excavation on the work. Its maximum size was specified as 3 in. At Newton Centre the nature of the excavated material was different, being either filling, peat, silt or hard pan. All the concrete laid at Newton Centre was broken stone. It was required to be free from dirt or dust other than that caused by crushing the stone itself. The size of the broken stone was specified as the entire product of the crusher, including dust, up to and including that which had passed through the crusher screen having a diameter of about 2 in. The amount of sand in the coarse mixture was made smaller than usual on account of the fact that the dust from the crusher, with the accompanying void-filling fine stone, was introduced with the crusher stone.

Hand-mixed concrete was laid in some of the smaller walls, but the bulk of concrete was machine-mixed. Two Smith mixers were used. They were mounted on a flat car hired from the railroad and could be easily transported from place to place as needed. The mixing train as made up consisted of a car of cement and one or more gondola cars each of sand and broken stone. A movable plank runway was laid on top of the gondolas and the sand and stone wheeled in wheelbarrows to the mixer. One of the illustrations shows this very well.

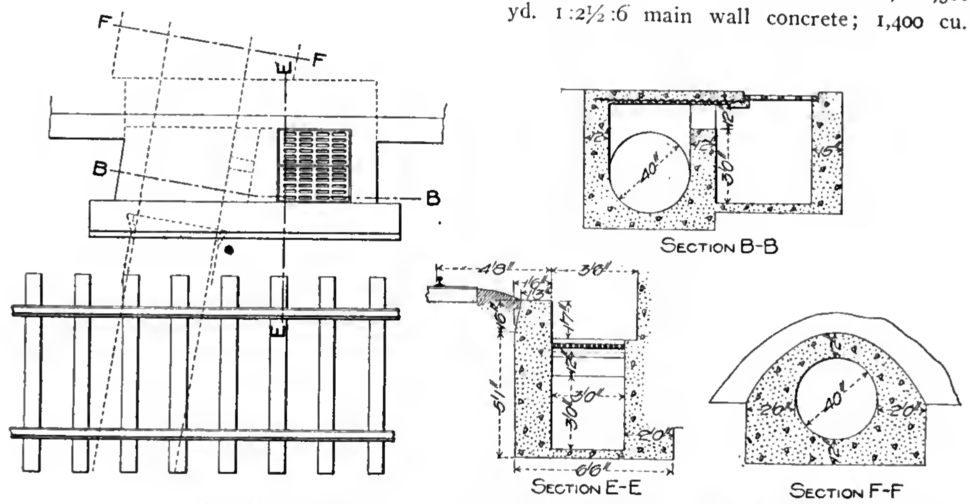
As a general rule the foundation concrete was deposited against the banks without the use of any forms where the nature of the material was such that sheathing was not necessary. Where sheathing was required the foundation concrete was deposited against the sheathing. A piece of plank was placed on the front of the foundation level with the top so that the concrete would be true to grade at the 6 or 12-in. step at the top of the foundation. This was necessary, as this step marked the bottom of the railroad ditch. After the foundation was laid the mixer was moved to another part of the work and the forms for the main wall were built. The moving of the mixer from place to place and the supplying of the two mixers with sand, stone and cement was all done by the railroad free of charge to the contractor and required practically continuous service of one engine and train crew. In depositing the main wall and coping concrete, it was either dumped direct from the mixer into the trench by means of a chute or was dumped onto a platform and then shoveled into place. The 1 in. of facing mortar was deposited at the same time as the body concrete. A metal plate about 8 in. wide and about 5 ft. long was used in placing the facing mortar. On one side of the plate were riveted four 1-in. angles about 7 in. long. A slight flare was given the upper edge of the plate and two handles provided for raising it. This, when placed next the form, insured that there was 1 in. of facing mortar and not several inches as is the case when no guide is used, or none at all in places as is the case when a ⅞-in. board is used. When the top of the plate was reached it was raised up by the handles, and being thin left practically no void to be filled.

In both years there was considerable ledge found in excavation for the walls and the roadbed. This was taken out by the contractor at a yardage price and he was allowed to use it in the walls and foundations as rubble in the concrete. Between different day's work these rubble stone were placed one-half in one section and the upper half left out of the concrete, so that it would help make a bond when the new concrete was laid on the old. When it was not possible to complete a wall at one day's work, horizontal level strips were nailed on the face forms and the concrete brought to the level of these and then stopped. This did away with the irregular streaks which are found on the face when the top of the concrete is left in a rough shape on the face at night. All of the concrete except that laid on an incline, as in wing walls and inclined copings, was what would be called a wet mixture. In some cases it was possible to lay the coping at the same time as the main wall, in which case the dowels were dispensed with. As a general thing, however, this was not possible and the top of the wall under the copings was given a downward, backward slope so that water would not remain on the outside near the face.

After the forms were removed the face was rubbed down and any irregularities chiseled off.

At Newton Highlands the finishing of the face was done as soon as possible after the forms were removed, but at Newtown Centre nothing could be done until after the steam shovel excavation was complete, which in some places was nearly six months later. The face was then thoroughly wet down with a hose and a thin mortar of one part cement and one part sand was applied and thoroughly rubbed in. The face was then smoothed with horizontal strokes of a whitewash brush to give a uniform appearance, free from streaks. This work was made continuous between expansion joints as far as possible, in order to avoid a streaky appearance.

On the south side of the Newton Centre freight yard there was a coal track 12 ft. from the inbound track and leading from it by a trailing point switch. The ground immediately south



Drainage Catchbasin, Boston & Albany Improvements.

of this track was from 5 to 6 ft. lower than the track, which was supported by a wooden cribwork laid on the slope. The coal was unloaded by shoveling over the sides of the cars and letting it fall down this cribwork slope. This was a costly and unsatisfactory way. The railroad was lowered about 6 ft. at this place, which brought the new elevation of the rail about level with the ground in the coal yard. It was decided by the railroad company and the owner of the coal yard that a reinforced concrete wall built to give the same effect as the ordinary wooden coal trestle was what was needed at this place.

The design as worked out consisted of 39 concrete piers 12 ft. on centres, which gives a trestle 468 ft. long. These piers are 18 in. thick 8 ft. wide and 12 ft. 6 in. high, reinforced with ⅞-in. twisted steel bars. The construction above the piers is the same as for a standard coal trestle. On the pier is laid a 10x12-in. hard pine cap, which supports the 8x16-in. hard pine stringers, four in number, two under each track, on which are laid the track ties. Between the piers a thin curtain wall was built to prevent the coal from falling onto the main track. This wall is 9 in. thick, and has a spread base of 3 ft. 9 in. in width.

After the work was started in 1906, it was found that for a part of the way under the wall the bottom was soft, so it was decided to put a pile foundation under a portion of the wall. Four 20-ft. spruce piles were driven under each pier and 9 in. of concrete was laid around the heads of the piles. This was done under a separate contract. The elevation of the coal track was made 4 ft. higher than it was before, and the approach to it is by a 4 per cent. grade. The approach track is laid on an ordinary concrete wall. The clear depth below the coal track rail to the ground beneath it is 12 ft., which gives a chance for teams to be filled by dumping direct from bottom dump cars or, when necessary to unload the cars, they can be dumped direct, and if a greater storage capacity is desired the coal can be shoveled over the sides of the cars. This is the case at the time this is written; coal is piled up on the yard side of the trestle so that it is level with the top of a coal car.

The work was done by contract on a unit price basis for earth excavation, for sheathing and bracing, for concrete, etc. The price for the various mixtures of concrete included the cost of the forms, as estimated by the contractor. The final total quantities on the work were as follows: 33,500 cu. yd. earth excavation; 2,500 cu. yd. rock excavation; 8,000 cu. yd. backfilling; 300,000 ft. B. M. spruce sheathing and bracing, placed and removed; 114,000 ft. B. M. spruce sheathing and bracing left in place; 6,600 cu. yd. 1:3:7½ foundation concrete; 16,500 cu. yd. 1:2½:6 main wall concrete; 1,400 cu. yd.

Constructing a Side Wall with Cableway at Newton Highlands.

1:3:7½ ditch wall concrete; 550 cu. yd. 1:2:4 bridge seat concrete; 230 cu. yd. cut stone for bridge seats.

The work in 1905 was done by Chas. R. Gow and John E. Palmer under the firm name of Gow & Palmer. The work in 1906 and 1907 by the Chas. R. Gow Co., of which company Chas. R. Gow is president. The excavation and all other work done by the railroad forces was in charge of the roadmaster, C. B. Lentell. The work was done under the direction of Mr. Walter Shepard, chief engineer, Boston & Albany R. R.. Mr. William Parker, division engineer, was directly in charge of the work. The detail plans were made by the writer, who also had charge of the line and grade work, estimates and construction work under the direction of the division engineer.

Sewage Purification at Hampton.

The method of sewage purification now employed at Hampton, England, is so favorably regarded by British engineers that some statements concerning it by Mr. Sidney H. Chambers deserve attention. He is the surveyor to the Hampton Urban District Council, and at a resent meeting of the Association of Municipal and County Engineers explained a marked change made in the operation of the system as follows:

The original method of working the Hampton contact beds was to exclude nothing from them, except the screenings, and to endeavor to retain the suspended matter in them, in the confident hope that all would be destroyed. The result was that, in 1902, after four years' operation, so much sludge had been removed from the beds, and so much was retained in them, as to give rise to the opinion that the original suspended solids had either suffered no diminution by biolysis, or whatever diminution had been effected had been made up from some other source. The opinion was confirmed two or three years ago by careful estimations and calculations, and more recently by estimating the total amount of sludge removed in washing the beds.

The present method of working the beds is to exclude from them the largest possible quantity of suspended solids, and as much of the colloidal matter as will readily be removed from solution by large surface contact, while at the same time the beds are so operated as to secure the disengagement and evacuation of as large a proportion as possible of those solids which have entered them, or which may be formed therein from the soluble solids. By this method of working the desolution effect is made evident, since the total amount of suspended matter leaving the beds is in excess of those gaining admittance thereto. The effect of this throwing out of suspended matter is, obviously, to minimize the accumulations, which necessarily must prolong the working efficiency of the beds.

Steel Water Mains 4, 6 and 9 in. in diameter have been used in the new works to furnish an additional supply to Teignmouth, England. The original plans of Mr. C. F. Gettings, the urban district engineer, called for cast-iron pipe, but a considerable saving was made by using steel pipe furnished by the British Mannesmann Tube Co., as the pressures carried are quite heavy, running up to 380 lb. at a river crossing.

Conditions along the Panama Canal.

From the annual report of the Isthmian Canal Commission, made public this week, and the "Canal Record," the official journal of the Commission, it is possible to form a good idea of conditions along the Panama Canal. During this year the entire personnel was changed, and to the vacancies left by the resignations of the former members were assigned three officers of the Corps of Engineers, United States Army; the Chief of Bureau of Yards and Docks, United States Navy; an officer of the Medical Corps, United States Army, and two civilians. Two important changes resulted from a combination of the positions of chairman and chief engineer on March 4, filled by Lieut.-Col. Geo. W. Goethals, and from the requirement that the Commissioners take station on the Isthmus, where they can be in direct touch with the work committed to their charge. The new Commission assumed its duties on April 1, 1907.

In order to utilize the services of the engineer members of the Commission in construction work and to secure a closer supervision of the details of the work, then rapidly expanding, through a head directly responsible to the chairman and chief engineer, the department of construction and engineering was subdivided into departments, each in charge of a member of the Commission, as follows: Department of excavation and dredging, department of lock and dam construction, department of municipal engineering, motive power and machinery, and building construction.

Excavation and Dredging.—This department of construction embraces the Culebra division, extending from the Chagres River to Pedro Miguel, the Chagres division, embraced between deep water in Lake Gatun and the Chagres River, the Colon dredging division, extending from Gatun to deep water in the Atlantic, and the La Boca dredging division, taking in all excavation between the La Boca locks and deep water of the Pacific.

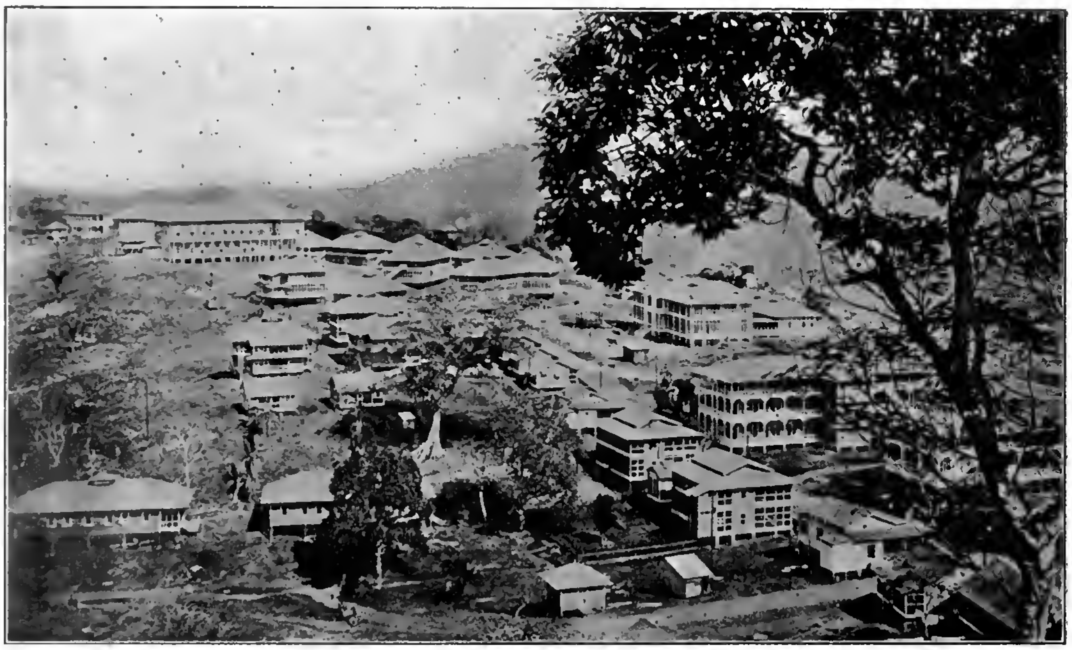
The Culebra division is practically 10 miles in length, and early in the wet season it was recognized that general supervision of all the steam shovels or all the trains of the entire division under one supervisor or superintendent was not productive of the best results in fixing responsibility in case any part of the work was not progressing satisfactorily, consequently a slight change in organization was effected on July 1. This consisted in subdividing the division into five construction districts, each under charge of a superintendent of construction, who is held responsible for the work in his district. Better results have followed with less friction.

The greatest difficulty found in maintaining the output during the rainy season is due to the dumps; the material being loose sinks under train loads after being wetted by the heavy rains causing considerable delay if not entirely preventing the use of the dump until it has dried out.

The total excavation in this division up to November 1 has been 11,221,730 cu. yd. The average haul of the dump trains is about 10 miles at present, but will be increased when the soil goes into the dams, as described later. On June 30 there were 3 45-ton shovels, 28 70-ton and 32 95-ton on the Isthmus. The number of cubic yards excavated per hour, while under steam, by shovels not engaged in preparatory work, averaged 68 for the fiscal year ending June 30, 1906, and 86 for the year ending June 30, 1907. Considering the total output in the Culebra division for the fiscal year, the average cost of the various items of expense have been as follows: Arbitrary, to cover cost of plant, $0.1200; blasting, .1451; excavation by steam shovels, .1081; transportation, .1942; tracks, .0830; dumps, .1548; general expense, .0193; total, $0.8245.

This does not include the material used in the repair of locomotives, steam shovels, and cars, nor does it include the cost of operating the air compressor nor the proportionate cost of administration and general expenses of the mechanical department, which makes repairs on plant for the Culebra division. These items have never heretofore been included in the cost of excavation in the Culebra division, but as they comprise a fair charge against this work, they will be included in the cost of work for the fiscal year ending June 30, 1908.

In the costs just given the total cost of blasting has been distributed among the total number of cubic yards of excavation, but to get the real cost it should be applied only to the material actually mined, 3,291,856 cubic yards, making the cost for blasting $0.2557 per cubic yard. In other words, other things being equal, the removal of rock, due to blasting alone, cost $0.2557 more than that of earth.



General View of Culebra, the Canal Headquarters.

The item entitled "Arbitrary, to cover the cost of plant," is a fixed charge added to the cost of excavation with the idea that this fixed charge added to every cubic yard of material excavated will, by the time the canal is completed, total a sum which will be equivalent to the original cost of the plant, repairs for the plant being included in the cost of operation.

On the Chagres division only preparatory work was done during the year, consisting of surveys and borings to determine the character and amount of earth to be removed. The Chagres River crosses the center line of the canal 23 times within the limits of the division. The differences of level between the river and portions of the division are such that whatever excavation in the dry is undertaken will be subject to more or less interruption from overflow during the wet season. As the rock portion of the cut can be removed or broken up by blasting more economically in the dry than in the wet, it is desirable that work be undertaken without delay; though the amount to be done is relatively not large, the conditions are such as to militate against rapid progress.

The Colon dredging division consists of the Mindi and Colon districts. In the former about 700,000 cu. yd. of material in the vicinity of Mindi Hills will be removed by steam shovels, this method being more economical since the borings made during the fiscal year indicate that a large percentage of rock is found in this locality; the remainder will be dredged. The necessary clearing and other preparations were made and excavation by steam shovel was begun toward the close of the year.

In the Colon district dredging operations were in progress throughout the year, the greater part in the vicinity of the dry dock slip and along the route of the old French canal as far as Gatun. The latter was done to make a navigable waterway for the transportation of the materials that must be taken to the site for the construction of the locks. The machine shop for the Colon dredging division at Cristobal was equipped during the fiscal year with many pieces of new machinery and is in good working order. Steps were taken to enlarge the dry dock so that when completed it will be capable of taking a vessel 298 ft. long, 50 ft. beam, and 15 ft. draft.

On the La Boca dredging division the surveys to determine the line of the canal were completed, and some dredging done. The machine shop at La Boca is fairly well equipped for marine work and has accomplished much in rebuilding and repairing floating equipment, such as clapets, launches, barges, and electric cranes.

Locks and Dams.—This department of construction embraces the Gatun locks and dam, the locks and dam at Pedro Miguel, the locks and dams at La Boca, meteorology and river hydraulics.

The locks are in pairs, each, as now proposed, with usable lengths of 1,000 ft. and widths of 100 ft., which there is some talk of increasing to 110 ft. The adopted project contemplates a flight of three locks at Gatun, a flight of two at La Boca, and one lift at Pedro Miguel. The report on the site of the locks made by Messrs. Noble, Stevens and Freeman, already printed in this journal, stated that all of the locks of the dimensions proposed will rest upon rock of such a character that should furnish a safe and stable foundation. Since this report was made last May careful borings have been continued over the entire area in order to secure a contoured plat of the rock surface with a view to the most economical adjustment of the locks to the site.

Subsequent to the adoption of the project, studies were begun of locks, gates, and sluiceways. From these studies the Commission finally decided upon the method of filling and emptying the locks and the number and type of gates. The gates are in duplicate and of the miter type, except that the rolling gate similar to that now in use on the Ohio River will be substituted for the duplicate set at the lower end of each sum-

mit-level lock. In addition there will be provided an auxiliary pair of gates at the lower end of each flight for use as cofferdams in case it may be necessary to pump out the locks, and it has been determined tentatively to adopt a swing bridge type of dam for emergency use. The designs for the locks and gates are progressing satisfactorily.

Gatun Locks and Dam.—Excavation of the lock site by steam shovels was begun in September, 1906. About 573 acres of the site to be occupied by the dam were cleared of timber, and a pile trestle was partially driven along the 30-ft. contour on the upstream toe of the dam for the purpose of depositing rock from Bas Obispo as an integral part of the dam. Contracts were entered into for two 20-in. pipe line suction dredges for construction use on the lower portion of the dam. The cross section of the dam has been slightly changed and the upstream slope made more gradual than that originally proposed.

Broken stone needed for concrete construction in the locks can not be obtained in the immediate vicinity of the site and a quarry of trap rock suitable for the purpose was located at Porto Bello. Surveys of the property were made, and contracts were entered into for furnishing the necessary rock-crushing plant and barges for transporting the product to Gatun.

At the Pedro Miguel locks and dam, besides the pits and borings to determine the character of the foundation, work was confined to excavating the lock site.

At the La Boca locks and dams only preparatory work has been in progress, consisting of borings at the lock site and along the lines of the La Boca-San Juan dam and the Sosa-Corozal dam, and for locating and constructing the necessary spillway. At the Sosa-Corozal dam preparations were made for the construction of trestles on the two toes of the dam from which material from Culebra cut is to be dumped. Between the two dumps thus made suitable material for the dam is to be placed. Arrangements were made for the construction of a diversion channel for drawing off water which interferes with the construction of the dam so begun.

Division of Municipal Engineering.—The work performed by this division during the fiscal year included the paving of streets and construction of water works and sewer systems in the cities of Panama and Colon, paving, roadmaking, grading, construction of waterworks and sewer systems, and miscellaneous work of a similar nature in the Canal Zone, necessitating an expenditure of $1,741,953, divided about equally between work in the cities of Colon and Panama and work in the Canal Zone.

In general, the work has been but a continuation of the plan inaugurated at the outset of American occupation of the Isthmus—to take such steps as were necessary to make the Isthmus sanitary, so as to further the work of building the canal.

The cost of work done in the cities of Colon and Panama will be reimbursed to the United States under the terms of contract entered into shortly after the expiration of the fiscal year, in which the United States is authorized to collect such water rates as are sufficient to reimburse itself, as above outlined. The cost of these improvements in the cities of Colon and Panama, covering work approved to date, will approximate $1,750,000.

Division of Motive Power and Machinery.—The work embraced the erection and preparation for service of machinery necessary in canal construction and its maintenance in good repair; the installation and operation of air-compressor plants; the performance of work in connection with electrical installations, and the manufacture and repair work for other divisions.

To date the following machinery has been erected and made ready for service: Sixty-three steam shovels, 284 locomotives, 2,076 dump cars, 18 unloaders, 13 bank spreaders, 33 unloading plows, 3 track shifters and 7 pile drivers.

This work has been done largely at the old plants at Cristobal, Gorgona, Empire and Paraiso. Work was commenced on new plants at Empire and Paraiso during the year, in order to provide for increased demands made on this division.

Building Construction Division.—For the accommodation of gold employees 656 quarters, both bachelor and family, were constructed, and for silver employees 335 buildings were erected, consisting of barracks, bath houses, cook sheds, family quarters and kitchens. For the sanitary department 33 buildings were constructed for hospital purposes. Larger office buildings were constructed at Empire and Ancon and additional office space afforded at Cristobal and Culebra. A school building was constructed at Culebra, and other buildings for similar purposes started at Gatun, Cristobal and Empire. Seven mess halls for the accommodation of American employees and 11 for European laborers were completed; a large hotel at Tivoli Hill was also built, together with quarters for help and baggage room. A machine and car-repair shed, machine shop, engine house, pattern shop and other structures for the manufacture and repair of machinery were completed and extensive plants at Paraiso and Empire were commended. Four clubhouses were constructed.

Of the 2,265 buildings which were received from the French Canal Company, 252 were repaired during the year and 113 destroyed. There are 678 of these buildings yet remaining to be repaired, remodeled or demolished.

Division of Material and Supplies.—The division of material and supplies, the head of which reports directly to the chief engineer, is charged with the purchase and the proper handling of all material and equipment needed in connection with the construction of the canal. The diversity of the work necessitates the purchase and use of a very great variety of equipment, material and supplies, including stock for repairs. All departments on the Isthmus rely upon this division to suppply their various wants, and every effort is made to anticipate requirements by frequent purchases in the United States based on estimates submitted by the different divisions or gauged by the rate of consumption of stock on hand at the various storehouses along the line.

A large amount of old French material, consisting of boilers, pumps, Decauville track, cars, locomotives, cranes and other material, has been repaired and placed in service. About 11,000 tons of this old French material were disposed of to dealers in the United States as scrap iron, and 4,000 tons of it were used as ballast by Panama Railroad vessels going north, when there was a shortage of commercial cargo.

Storehouses for the distribution of this material are located at Mount Hope (general storehouse), the dry dock, Cristobal, Gorgona, Bas Obispo, Empire, Culebra, Paraiso, Ancon and La Boca. Larger and more commodious storehouses are under construction at Empire and Paraiso. All storehouses carry as full a line of supplies as is carried at the general storehouse.

The New Panama Railroad.—The completion of the canal will necessitate the abandonment of the present main line of the Panama Railroad, and preliminary surveys for location of a new line on the east side of the canal have been completed. The location of the line was practically determined in March, and involves the excavation of 1,600,000 cu. yds. of material and the placing of 12,000,000 cu. yds. in embankments.

The main line at Gatun now passes over a portion of the site that must be occupied by the dam, and in order not to delay work on this structure it became necessary to commence so much of the new line around Gatun as would enable the abandonment of the existing line and permit construction of the dam upon this portior of the site.

Contract vs. Hired Labor.—The report of tł Commission discusses this subject at much leng' There is no question, the report states, that in t majority of cases in the United States work

Views before and after a Blast Displacing 29,640 Yards of Rock at Bas Obispo.
Four drill holes, 78 feet deep, were used and charged with 9,600 pounds of black powder.

contracted because it can be done cheaper by that method than any other. This is generally due to the fact that the contractor has on hand a construction plant which can be more cheaply hired than purchased anew. Where, in any particular case, either from the nature of the work or its location, the contractor must purchase machinery and appliances which, so far as he can forsee, will be practically useless on the completion of the work, or where the party having the work done can make use of the plant subsequent to its completion, the advantages of the contract system disappear.

As illustrative, the Government secured cheaper and incidentally better concrete work in its fortifications than was obtained by contract. The batteries are heavy concrete constructions requiring machinery for which the contractor could find little, if any, subsequent use. For the same reason the Government, in many cases, especially where the work was removed from commercial centers, was able to construct locks and dams more cheaply than could a contractor. In some instances, to overcome a combination of contractors, the Government purchased the necessary plant and accomplished results more cheaply than by contract; this is notably true in dredging operations, as recent legislation on the subject clearly indicates. It is not uncommon in the execution of comparatively large projects that the contractors have failed and the Government carried successfully to completion, by hired labor, the work undertaken by the contractor. Notable instances of the Government successfully completing work are the State, War and Navy Department building and the Congressional Library, Washington, D. C.

Omitting profits derived from subsistence and general stores, and assuming the hours of labor the same in both cases, it stands to reason that the Government, when warranted in making the necessary outlay for plant, can do work cheaper than a contractor, for no question of profits enters into consideration.

The question of Government work versus contract in connection with the Panama Canal has been discussed, and a conclusion reached in favor of the latter method because of certain stated advantages that are claimed to result. To those familiar with river and harbor improvements, erection of public buildings, lighthouses, etc., and with contracts under the Government the advantages set forth are not so apparent or real, according to the report.

It is claimed that contractors have under their control and at their disposal trained labor forces, and that by a combination of such forces, through an association of contractors, team work will result, thereby accomplishing the desired end more quickly. As a matter of fact, conditions seldom enable a contractor to maintain intact his entire organization on one piece of work for transfer to another; the completion of a job means the disbanding of the force, and though new work may bring to him some of his old men, a new organization must in each case be perfected.

The Panama Canal presents a piece of work unprecedented in magnitude, which must be done under conditions entirely different from similar classes of work in the United States. The work naturally divides itself into dredging, dry excavation, the construction of the locks and dams and the construction of the new Panama Railroad. There is no contractor or syndicate of contractors that by any combination could bring to the Isthmus an organization ready for team work on any of these units. While it is possible for several contractors to combine forces, assuming that a sufficient number of men can be gotten together in that way, there still remains the necessity for whipping this force into shape in order to secure an organization that will produce the team work so advantageous in the accomplishment of results.

From the United States the supply of labor is the same whether the work be done by contract or by the Government, and the character of the labor must be the same. So long as work is plentiful the dread of the Tropics will deter men from seeking work here in preference, and this is equally applicable to the contractor and the Government. An adequate supply of labor from the United States is not possible, and recourse must be had to securing it abroad. The records here show that no contractor can even attempt to recruit labor in the West Indies, and that great opposition will develop to any recruiting by authorized agents of the Commission if the labor procured is turned over to contractors. These island governments cannot be blamed for their hostility toward the latter because of their experience under the French, which left an indelible impression throughout the West Indies. A representative of the Italian Government has recommended to the authorities that Italian labor be permitted here for employment under the commission, but he is not favorably inclined to the control of such labor being vested with a contractor.

It is true that in some cases the contractor may have an acquaintance which will enable him to secure suitable men more easily than a government agent and, again, he may bring to a work a great experience, but, so far as the most important parts of the Panama Canal work are concerned, this advantage is not apparent. In any case, the knowledge of the specialist in the particular work that is to be done is the element that will accomplish the most satisfactory results, and, so far as dredging and lock and dam construction are concerned, the government's experience has been, if not greater, at least as extensive as that of any contractor or association of contractors that can be secured in the United States. For these units of the work the government's acquaintance is equally extensive, and experienced men can be drawn from the engineering force of the government. These three classes of work form the most important parts of the Panama Canal, and in their prosecution the government has the advantage. So far as relates to excavation in the dry by steam shovel and cars, the advantage ordinarily would be with the contractors, yet the government has secured and maintained an organization on the Isthmus that cannot be surpassed by any contractor, and, it is claimed, has perfected this organization in as short a time as, under the circumstances, could have been done by any association of contractors.

When the government does work in the United States the wage scale is determined by the amount paid for the same class of labor in the immediate vicinity; there is no pressure brought to bear on higher authority for any increase over the salaries or amonuts offered, and strikes are unknown. It is true that conditions on the Isthmus are such that demands for increase in pay are frequent, and that to accomplish what was denied by those immediately in charge of the work recourse has been had to higher authority.

Conditions on the Isthmus are peculiar. It is contended, apparently on reasonable grounds, that service in the Tropics saps the energy, and that a man is incapable, after a time, of performing the same amount of work that he would accomplish had he spent the same period in a cooler climate. This creates a desire to accumulate sufficient means to avoid the necessity of relatively harder work on the return to the United States, and it is a question that a contractor would be obliged to face as well as the United States. In some respects the government is in a position to handle the situation more satisfactorily than a contractor, as was plainly shown by the trouble with the steam-shovel men in May last.

Track Throwing Machine on the Tabernilla Dump.

The wage scale on the Isthmus is practically adopted, and a contractor would be obliged to maintain it. Under the recent decision that all questions of pay are to be left with the commission, this body is placed on as secure a basis relative to the constant demands for an increase as any association of contractors.

Experience has shown that continuity of construction is more apt to result in cases where the government undertakes the task than when it is turned over to contractors. This can be easily verified by an examination of the records (the number of failing contractors) to be found in the office of the Chief of Engineers. For all work done by hired labor continuity of work is merely a question of continuity of appropriations. It is true that continuity may be equally insured by turning the Panama Canal work over to contractors, if the contract is so drawn that practically all risks are assumed by the government, but why this should be done, at a considerable increase in cost, is not apparent.

To any one who has had experience with contracts on government work, the claim that letting a piece of work by contract is a reasonable assurance that it will be completed in a definite time is utterly untenable. On public works, including public buildings, it may safely be said

that in the majority of cases the time limit is exceeded. An examination of the contracts for material to be supplied the Isthmian Canal, so far as the time limits proposed by the contracts are concerned, will clearly show that there is no assurance of completion in a definite time of any contract, even though the contractors themselves, when fully cognizant of all the conditions surrounding the work, fix the time for the completion or delivery. It certainly cannot be supposed, therefore, that in an enervating climate, like that on the Isthmus, and with labor below that in the United States in efficiency, this time-failing record for contract work would be changed.

Reasonable definiteness in cost is usually obtained by contract, when based on unit prices and when all conditions of the work are fully known in advance, yet these unit prices are, as a rule, higher than would be the cost to the government should the latter possess the necessary plant. It is true that the contract which was proposed for the construction of the canal provided for the determination of time and cost by a board of engineers, but the conclusions on these points could be upset should conditions be found or met with unforeseen by that board. Experience on all works, even those based on more definite data than can be presented to contractors for the Isthmian Canal work, shows that the unexpected is always happening, and this seems especially true of the work here.

There is no question that there are a number of people who will always believe and contend that any piece of work done by the government could have been done as well and more cheaply if undertaken by contract, but an examination of the records will generally disprove such a contention. On the other hand, there is an equally large class who will contend to the contrary and claim, after the completion of the work that the reverse is true.

Work heretofore has been conducted on a non-partisan basis. The thinking class of American people fully realize the necessity for the Panama Canal and its early completion, and it is generally realized that this can be accomplished only by the application of business and non-partisan methods. This has generally been the case with all government work wherever undertaken, and the fact that the continuation of this policy may not continue along the same lines is hardly an argument strong enough to weigh in favor of contract work.

While it has been noted that contractors can usually do work cheaper because of plant already on hand, thereby saving the cost of new machinery, and because of greater familiarity with the class of work on which they are engaged, there are at times additional ways for securing the same results, namely (*a*) by paying lower wages, (*b*) by working their men longer hours, (*c*) by requiring a greater amount of work per hour from the men, (*d*) by giving them less expensive rations and quarters, in case employees are fed and quartered.

On the Panama Canal a contractor cannot anticipate profits from any of these sources. The work already done and in progress has fixed the wage scale, and a contractor would be unable to retain labor that might be turned over to him, nor could he secure additional men at less salary than already paid by the commission.

The government is now working foreign labor as many hours per day as is practicable in this climate, so the contractor could gain nothing more than the government has already acquired. So far as American labor is concerned, the eight-hour law is applicable, and so long as it remains in force it must be as binding on the contractor as on the government.

It is questioned whether he could get more work out of the laborers on the Isthmus than they now perform for the commission. This is a question dependent entirely upon the character of foremen employed, and he would have exactly the same class of men in this position, since most of the foremen now employed have previously been with contractors, and therefore have had their principal training on contract work. Moreover, the pace set by the laborers under the commission would fix the rate for the contractor.

Were all the work turned over to one contractor, or an association of contractors, the Commission would be obliged to maintain a supervisory force, and the feeding and quartering of these employees would determine the demands that the contractor's men would make upon him for accommodations. Moreover, a number of the dwellings that are now occupied by Commission employees would be turned over for occupancy by contractor's men, and any additional force would expect the same accommodations. Trouble would result, therefore, in case the contractor fed his employees on less expensive rations or quartered them less comfortably than the Commission; no saving could be made, and the Government would be obliged to foot the bills.

The Panama Canal work is naturally divided into—

(1) Excavation in the dry by steam shovel, including all of the Culebra division and part of the Chagres division. The construction of drainage and diversion channels would come under this heading.

(2) Excavation by dredges on the Colon and La Boca divisions and on part of the Chagres division.

(3) The construction of the dams.

(4) The construction of the new Panama Railroad.

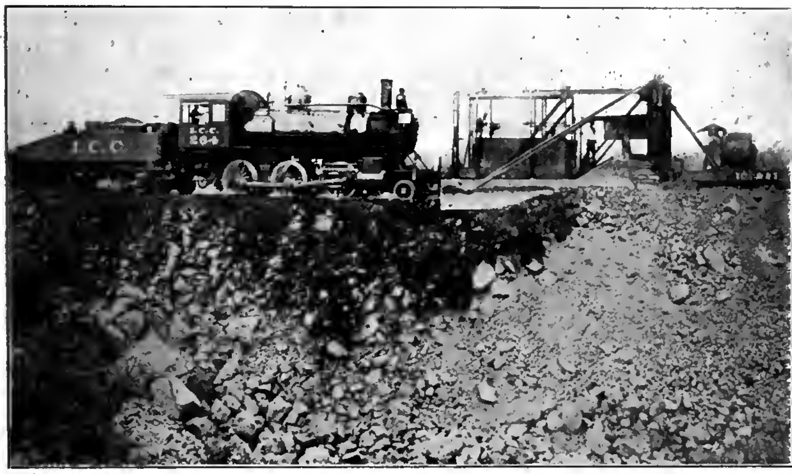
(5) The construction of the terminal facilities, harbor basins and breakwaters, if any.

(6) The construction of locks, gates and spillways.

The excavation of the Culebra division has already been undertaken by hired labor; practically all of the plant required for this work has been secured and paid for; a complete and thoroughly efficient organization for the same has been built up, and the Government is not hampered in any way in procuring the necessary labor for filling vacancies that arise. In the organization that has been perfected the higher grade men were formerly employed by contracting firms, and some of the number have been successful contractors themselves. The conduct of this work, therefore, has been along the lines usually followed by contractors. Under the circumstances no advantage would accrue to the United States by letting this piece of work to contractors, but on the contrary there would be not only additional expense, but a feeling of unrest and dissatisfaction engendered among the present employees materially affecting efficiency. Under existing conditions, therefore, contract work cannot be recommended for the Culebra division.

The Government has on hand, or under contract, all the dredges that will be needed for excavating such parts of the canal prism as can be most economically performed by this class of machinery. Experience in the United States has demonstrated that with such a plant in its possession no contractor or association of contractors can do the work as economically as can the Government. The Government agents are as familiar with this class of work as the contractors, and the necessary dredge crews can be obtained without difficulty. So far, therefore, as dredging is concerned, the Government should do the work and contracts for the same cannot be recommended.

The great problem in the construction of that portion of the canal included in the Culebra division is the disposal of the excavated material. In the main this has been disposed of at various localities favorably situated with regard to the cut. The systematic performance of the work and the necessity for additional material in completing other parts of the work have made it necessary to arrange for such a disposition in the future as will be most beneficial to the work in its entirety. The efficiency of the dams depends upon their having sufficient weight and tightness to impound the water without leakage and without danger to the stability of the structures. The weighty material, or rock, is to be furnished in each instance by material from the Culebra cut and the tightness is to be secured by the selection of suitable material to be obtained from the products of dredging. In other words the construction of the dams is so intimately connected, both with the excavation of the Culebra cut and the dredging, that if these two can be most economically and advantageously done by the Gov-



Spreading Material on the Corozal Dump.

Excavation on the Culebra Cut near Gold Hill.

ernment rather than by contract it naturally follows that the method adopted for the construction of the dams must be the same, namely, by hired labor under Government supervision and not by contract.

The survey of relocation for the Panama Railroad has been completed and it has been necessary to undertake the construction of the railroad in order to permit the removal of the present bed in the vicinity of Gatun, so that the construction of the dam at that point may be begun. The construction of the new line requires, among other things, about 1,600,000 cu. yd. of excavation and about 12,000,000 cu. yd. of embankments. The excess of embankments over excavation, about 10,000,000 cu. yd., is to be supplied largely, if not entirely, from material excavated from the canal prism, the embankments forming dumps for the material trains. Steps have already been taken for the development of dumps which will result in the construction of a part of the new roadbed at Miraflores, Pedro Miguel, Gamboa and Gatun, and plans have been prepared and proposals invited for a bridge across the Chagres at Gamboa. With excavation in the Culebra division to be done by hired labor under Government supervision, with the material therefrom to be used in the construction of the Panama Railroad, the intimate relation between the two necessitates the adoption of the same method of construction, namely, hired labor under Government supervision, in the consetruction of the new Panama Railroad.

The regulating works and spillways of the Gatun and La Boca dams are so dependent upon and intimately connected with the construction of the dams that whichever method is adopted for the latter must be made applicable to the regulating works and spillways, in order to avoid friction and difficulties that would result in case part were done by the Government and part by a contractor.

The Panama Railroad must be maintained and operated as a commercial line, and it must be utilized also for construction purposes in connection with the Culebra cut, the reconstruction of the railroad, the construction of the dams, and in addition it must transport all materials entering into the construction of the Pedro Miguel locks.

The difficulties that would result from a joint use of the Panama Railroad by a contractor and the Government at the Pedro Miguel locks disappear, however, for the locks at Gatun and La Boca, since both are accessible by water. Sand can be procured along the shores of the Pacific, and a suitable quality in sufficient quantity can also be obtained on the Atlantic shore of the Isthmus.

The success of the lock construction depends largely upon the quality of cement used, and there is no question that the Government should furnish all the cement. No contractor, or association of contractors, possesses the necessary plant for handling the enormous quantities of concrete required for these structures. Subsequent to the construction of the locks the contractors could have no further use for the machinery installed, even if the payment of freight for its return to the States were warranted. If the contractor furnishes the plant, the Government must pay for it in its entirety and in addition pay interest on the amount expended for its purchase. This plant can be procured more cheaply by the Government than by a contractor. As previously explained, if the Government furnishes the plant, the advantage of the contract method disappears. The contractor will have greater difficulty in securing the common labor needed than will the United States. The engineering force of the Government that has in the past few years been employed in the construction of such large quantities of concrete in various forms in the United States can be drawn upon to furnish the skilled personnel necessary for concrete work here. The acquaintance with competent men, for this class of work, is more extended on the part of the Government than on the part of the contractor.

These considerations lead to the conclusion that the locks can be more economically and advantageously constructed by the Government than by a contractor or association of contractors.

The gates and operating machinery can, it is believed, best be constructed by contract at the proper time.

The foregoing conclusions do not cover the proposed work on the Chagres division or the terminal facilities, harbor basins and breakwaters, as the surveys for the development of the amount of work and character of material involved in the Chagres division have not yet been completed, nor have the final plans for terminal facilities, etc., been finished.

No account has been taken of the question of sanitation, one very important to the successful prosecution and completion of work on the canal. Proper sanitation can be maintained more easily and satisfactorily with the Government in supreme control of the work than with a contractor, and this adds an additional argument in favor of the Government doing the work itself.

The relative advantages of the contract system versus hired labor under Government supervision in the construction of the Panama Canal are very different to-day from what they were two years ago, and were different then from what they were when the work was first undertaken. To one familiar with conditions on the Isthmus there can be no doubt at this stage of the work as to the advisability of continuing it by hired labor.

It is estimated that 80 per cent of the entire plant needed for the construction of the canal has been purchased or contracted for. Machine shops have been erected and equipped for making all needed repairs to the machinery now on hand or still required for the work. So far, therefore, as the plant and its care and repair are concerned, the Government is better equipped to carry on the work as advantageously and economically as any contractor.

Many thousand employees have been secured, and an effective working organization has been perfected, and the recruiting system put in operation is capable of furnishing more labor than can be advantageously used. The employees are well sheltered and, in general, well fed; the salaries paid are satisfactory and the work is progressing smoothly. A change from these favorable conditions in the method of prosecuting the work would disorganize all existing conditions and would undoubtedly increase the estimated cost and time of completing the canal.

The conclusion that the work can be done better, cheaper and more quickly by the Government has been reached only after free and full discussion by the various members of the Commission and the higher officials connected with the construction work, and after careful consideration of all sides of the proposition.

Labor, Quarters and Subsistence.—This department is charged with securing all skilled and unskilled labor and its assignment, according to the needs of the work. It is the custodian of all living quarters, allotting them to employees according to their standing as gauged by salary earned and in conformity with rules and regulations approved by the Commission.

It supplies furniture to quarters, delivers distilled water to residences, offices and shop, and is in direct charge of the delivery of all food supplies, including ice, bread and cold-storage articles from railroad stations or local commissaries to residences, hotels, messes and kitchens.

It polices the ground around camps and quarters, cleaning up waste and refuse material which is placed within reach of those charged with its final disposition. It also has charge of the lighting of the camps and of roads to and through them.

It operates the hotels, messes and kitchens for the accommodation of the employees of the different grades—the hotels for white Americans, the messes for Europeans, and the kitchens for the natives of the West Indies.

It keeps the service history of each individual employee in the general personnel record of which it is the custodian; issues by direction of the chairman all orders pertaining to leaves of absence, sick leave, resignations, discharges, promotions and reductions. It also authorizes the issuance of steamship transportation and special rates to which employees are entitled.

The skilled labor force is recruited in the United States. The skilled force on June 30, 1906, was approximately 2,500, and on June 30, 1907, actually 4,404. To increase this force 1,904 men and provide for the usual separations, due to sickness, resignations, etc., 3,038 men were brought from the United States during the year.

The unskilled force is brought from the West Indies and Europe. Recruiting agents are located in Barbadoes and Martinique, and a representative in Paris, France, to keep in touch with European labor conditions and with European emigration. On June 30, 1906, there were on the canal work 500 Europeans and 13,625 West Indians. June 30, 1907, there were 4,317 Europeans and 14,606 West Indians. To maintain this force of laborers, and also provide the Panama Railroad force of about 5,000 laborers, 6,899 Europeans and 10,947 West Indians were brought to the Isthmus—an average of nearly 1,500 men per month—to meet the demands of the work for common labor during the year.

At the close of the last fiscal year 1,129 houses were available for quartering employees of all classes, furnishing buildings for offices, hotels, messes, kitchens and storerooms. On June 30, 1907, 2,208 buildings were in use for the same purpose.

There are in operation 23 kitchens for the West Indian laborers, where a day's board is furnished for 30 cents and is made up of such food supplies as they are most accustomed to and prepared by cooks of their own country.

Zone Government.—The department of civil administration embraces the affairs of government of the Canal Zone, the courts, the office of the prosecuting attorney, and the divisions of revenues, posts, customs, lands, administration of estates, police, education, fire protection, and public works.

Governor Magoon left the Isthmus Sept. 25, 1906, when the duties of his office devolved upon the executive secretary until Nov. 17. The Executive order of Nov. 17, 1906, created the department of law and government under the general counsel, after which date governmental matters were handled in Washington by the general counsel through the executive secretary on the Isthmus. On April 2, 1907, an Executive order vested the authority of the chief executive of the Zone in the chairman of the Commission, and by order of the latter the duties were assigned to one of the Commissioners.

Under authority conferred upon the President by existing law to legislate for the Zone, the five municipalities into which the Zone was divided were abolished and administrative districts were created in their stead. The United States patent, trade-mark, and copyright laws were extended to the Zone; provisions were made for regulating insurance companies, for the registration of land titles, and the celebration of marriages. By the order of March 13, 1907, the Commission is authorized to enact, with the approval of the Secretary of War, ordinances relating to police, sanitation and taxation, and matters formerly regulated by municipal ordinances.

The Mechanical Plant of the Boston Herald.

By Howard S. Knowlton.

In the production of a modern daily newspaper time is so valuable that the use of machinery has almost entirely replaced the slow hand methods of publication formerly in vogue. The appearance of an extra edition on the streets a few minutes in advance of a competitor scores a commercial advantage which is made possible only by a mechanical equipment which eliminates so far as possible every doubling back in the production processes between the desk of the writer and the counters where the papers are delivered. The mechanical plant of the Boston "Herald," in its lately completed buildings, affords an interesting illustration of the dependence of such a newspaper upon the engineer in its regular and special output.

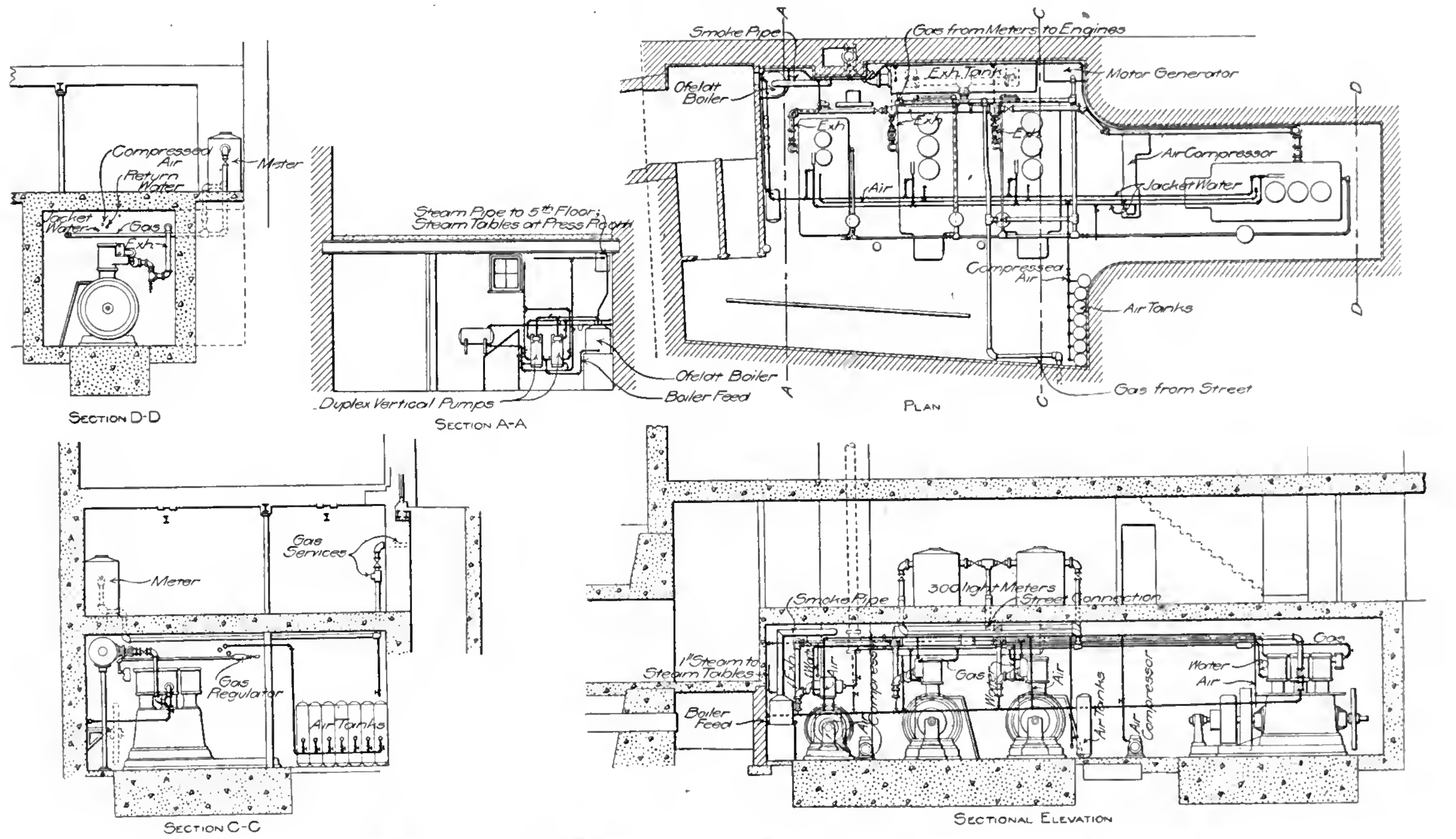
The main offices of the "Herald" are in a five-story building at 171 Tremont street. At the rear of the office or "Administration Building" is the "Mechanical Building," a five-story structure connected with the former by a tunnel and an overhead passageway. The entire mechanical plant, including the production building, the power installation, sub-basement of the administration building, heating equipment, machinery foundations, matrix and newspaper carriers and other apparatus, was designed by Mr. F. W. Dean, of Boston, Mass., mill architect and engineer.

The Administration Building houses a power plant in its sub-basement, the basement being used for the storage of supplies and paper rolls. The office of the mechanical superintendent, Mr. G. S. Ross, is also located in the basement, and a small repair shop is installed under the Tremont street sidewalk. On the street floor are located the counting room and advertising department, and on the upper floors are bookkeeping, auditing, special writing, executive and editorial departments.

The Mechanical Building basement is given up to stereotyping, a press room, a locker room and lavatory. On the street floor are the newsboys' section, the mailing and job-printing departments. The next floor is occupied by the circulation manager, art, engraving and color departments, the next by city and news editors, the reporting staff, department editors and library. The top floor is utilized by the composing room.

To make clearer the relations of the mechanical plant to the production process a brief outline of the order of events in the turning out of an item in printed form is given here. An entire page of 8 columns metropolitan size, including all display, may contain less than half a column set by actual hand labor. Motor-driven machinery is found at every step. As soon as an item has been written by a reporter, it is delivered to the news editor and then carried by an automatic conveyor to the copy-cutter's desk in the composing room, where it is divided into sections which are parcelled out among the operators of the composing machines. From the machines the sections are collected and a proof struck and read; after this the type is corrected and automatically forwarded to the make-up table, where it is inserted in its place in a full page of type. As soon as the form is locked up, it is shifted to a table on wheels, and rolled to a steam table, where an impression of the form, called a matrix, is made on specially prepared paper. In the old days the form left the composing room to be matrixed in the stereotyping room, but in the "Herald" plant the matrix alone is sent down to the stereotyping room between two belts running over opposed sets of pulleys. The form and matrix are subjected to a steam pressure of 80 lb. for 3 or 3½ minutes, which partly removes the moisture. Enough tables are provided to press all the matrices which can be molded in that time. The matrix is then dried for 15 seconds in a rotary gas roaster, and transferred to the stereotyping room in the basement, where a stereotype casting is made from the matrix in a casting box. The plate is then trimmed and routed by electrically-driven cutting tools and locked on the press, from which issues the folded and counted papers. The latter are delivered by a motor-driven conveying equipment to the mailing and sales departments. The operation of the casting boxes and the steam tables, the making-up of the forms and their transfer from point to point are the only hand processes employed from the time the paragraph is given to the compositor until it is in the stereotype plate. A plate may be locked on the press in less than 8 minutes after the form it reproduces is completed.

The power plant in the sub-basement of the Administration Building consists of four Westinghouse gas engines, each direct-connected to 230-volt direct-current generators. There are three 85-h.-p. 11 x 12-in., three-cylinder vertical engines, each driving a 55-kw. dynamo at 300 r.p.m., and one 9 x 11-in., 35-h.-p., two-cylinder engine driving a 25-kw. generator at 310 r.p.m. These outfits deliver current on the three-wire scheme of connections and are provided with balancing transformers. Richardson cylinder lubricators are used. The engines burn gas supplied from the mains of the Boston Consolidated Gas Co., which has a calorific value of about 550 B.t.u. per cubic foot. For starting the engines seven vertical air tanks working at 170 lb. are provided, with a single-acting compressor, chain-driven, by a 3½ h.-p. motor. These tanks discharge into a 1½-in. main with 1-in. branches to each engine.



Arrangement of Gas Engines and Piping in the Mechanical Building of the Herald.

Two gas connections from the street mains are provided, each being a 4-in. line. These are joined inside the plants and carried in a 4-in. line to the middle of a connection between two 300-light meters on the floor above. One meter is used as a spare. From the meters a 4-in. line delivers to the gas engines through 2-in. and 1½-in. branches, a gas regulator being provided on the supply side of each engine. The meters are by-passed with locked valve control for emergency use. The stereotype and composing departments are supplied from an independent street connection through a 3-in. line, and risers distribute this supply to the various floors. The exhaust pipes of the engines vary in size from 3½ to 4 in. and are brought together in an 8-in. connection which leads into a muffler tank in the engine room. From this tank the exhaust is carried in an 8-in. pipe to an outlet over the roof about 115 ft. above the grade of the sub-

basement floor. Each exhaust pipe is separately valved.

The engine-room also contains a 22-h.-p. boiler which supplies steam to the stereotyping beds and the matrix heaters. Water is sprayed into the exhaust pipe of each engine and into the exhaust main for cooling purposes, this water being taken from the jacket outlet pipes through a 3/8-in. line. The jacket supply comes from the city mains through a 3-in. pipe into the sub-basement, and is delivered to the engines through branches averaging 1½ in. in size. The discharged circulating water from the jackets is pumped around the building for use in lavatories.

Special provision was made in the plant for ignition. Each engine is provided with three dry cells and also with two storage battery cells, which are charged through a resistance from the 230-volt circuit at the switchboard. There is also a Westinghouse motor-generator set for ignition, consisting of a 1¼-kw., 110-volt dynamo driven by a 2.2-h.-p. motor. The engine room contains a switchboard 20 ft. long consisting of eight panels, with recording wattmeters, for each department, double-throw switches for each of the two sets of busbars installed on the rear of the board, ammeters, voltmeters and rheostats. Two of the panels are for generators, one is a totalizing panel with ammeter for the entire output, two are power panels, two are lighting panels, and one is a blank. Beside the general motor and lighting loads there are three electric elevators operated by the plant. Service is supplied to the manufacturing building through a reinforced concrete subway equipped with automatic sliding doors at each end.

The Herald buildings are heated by the steam heating plant of the Park Theatre through a 3½-in. underground pipe laid in a box of kyanized plank fastened together with copper nails. The pipe is covered with 85 per cent. magnesia, with a top dressing of Portland cement mortar. The various floors are heated by direct radiation. The returns from the steam heating system are carried back to the boilers through a 1-in. line.

The press room contains four Hoe sextuple presses and one Hoe color press. The floor is a terrazo pavement laid on 4 in. of Portland cement concrete. Each large Hoe press has direct connected to it a 50-h.-p. and a 4-h.-p. motor with Jenney control appliances. Five operations are provided on the push button boards which are located at several places on each press. The first starts the 4-h.-p. motor, turning the press at the slowest speed; the second button increases the speed and cuts in the 50-h.-p. motor, while the smaller motor automatically stops; the third button decreases the speed, the fourth is a bell signal button, and the fifth opens all circuits in emergency stopping. The starting boxes are motor-driven and automatically cut in resistance in case the power supply fails. The switches are mainly of the solenoid type, and seven-pole switches are provided to enable two presses to be run as one unit. The motors are installed in concrete pits below the floor, with trap door covers to enable them to be examined easily, and are compound wound to give the necessary starting torque. The total capacity of the plant is 375,000 eight-page papers an hour. The large double sextuple presses can each turn out a 96-page if necessary and can print one other color in addition to black. The color press is capable of printing seven colors at once, or black, and has a capacity of 75,000 eight-page papers per hour. The total capacity of the installation is 1,530 eight-page papers per hour per rated gas-engine horsepower in the generating plant.

Electric hoists are used in the press room to deliver the paper rolls to the presses, each roll weighing from 1,200 to 1,400 lb. and yielding from 9,000 to 11,000 papers. Rolls are brought into the press room from the storeroom by a traveling, hand-operated hoist, and a narrow-gauge track also connects the two rooms.

In the stereotype room the principal machine equipment is motor-driven. This includes a matrix roaster operated by a ½-h.-p. motor; three tail cutters, each driven by a 5-h.-p motor; two curved shavers, each driven by a 2-h.-p. motor; one flat shaver, driven by a 3-h.-p. Lundell motor; a jig saw and drill run by a 1-h.-p. Sprague motor; a flat router driven by a 1½-h.-p. motor; a bending machine, operated by a 2-h.-p. motor; two curved routers, driven each by a 2-h.-p. motor; and a saw and beveler run by a 1-h.-p. motor. Sump-drained water is pumped to the sewer by a 3-h.-p. Knowles triplex pump driven by a General Electric motor.

The machine shop beneath one of the sidewalks contains a speed lathe back-geared to a ½-h.-p. motor; a circular saw driven by a 5-h.-p. motor; an engine lathe run by a 1-h.-p. motor, back-geared, and an emery grinder driven by a ½-h.-p. motor. All motors are 230-volt Jenney machines unless otherwise mentioned.

In the composing room are 27 linotype machines, each direct-driven by a ¼-h.-p., 110-volt motor, with two sets of fields on each pole piece. These outfits are gear-driven and can be run at 70, 72 or 74 r.p.m. Some of the machines are provided with eight different faces of type, and average setting 8,000 ems per hour, with a maximum of 9,000. They have about three times the capacity of the earlier linotypes, being equipped with interchangeable magazines of type matrices from 5½ point to 12 point. Ten seconds suffices to enable the operator to shift from one magazine to the other. The act of taking his seat on the part of the operator starts the corresponding linotype motor and throws the incandescent lamp over the keyboard into circuit.

The copy carrier in the composing room is driven by a ½-h.-p. motor, and three copy carriers serving the proofreaders' desks are each operated by a ½-h.-p. Holtzer-Cabot motor. There are two matrix rollers, each run by a 3-h.-p. motor. The matrix endless belt conveyor to the basement is driven by a 2-h.-p. motor; a small lathe for linotype work is run by a ⅔-h.-p. motor, and a metal saw by a 1-h.-p. motor. Cuts are handled between the basement and the upper floors by a push-button elevator which automatically stops at any predetermined floor.

The engraving room employs two 220-volt arc lamps in series, taking 8 amperes, for photographic reproductions. There are also two powdering machines and two etching machines, each driven by a 3-h.-p. motor. A saw and trimmer is run by a 2-h.-p. motor and two flat routing machines, making 20,000 r.p.m, are each operated by a 1¼-h.-p. motor. In the mailing room four conveyors are back-gear-driven by 2-h.-p. motors, and in the job printing room are two job presses run by a ¼ and a ⅓ h.-p. motor and a ⅓-h.-p. motor-driven addressing machine. In its use of direct connected motors on separate machines and gas-engine generators supplied from city mains the Boston Herald plant is of peculiar interest to persons watching the extension of power into the field of newspaper production. It is to be hoped that the economy of the plant will be published at some future time by those responsible for its installation and operation.

Independent Fire Protection for its yards and buildings at Pittsburg and Altoona has been secured by the Pennsylvania R. R. by equipping its switch engines in those yards with fire pumps and hose. A system of whistle signals indicates the location of the fire and the engine crews are trained in the use of their fire-fighting apparatus. At a recent fire nine engines were at the fire within seven minutes after the alarm.

Some Disputed Questions concerning Steel Rails.

A discussion of some of the disputed questions regarding steel rails was recently presented by Mr. Franklin E. Abbott, of the Lackawanna Steel Co., in a paper before the Central Railway Club. The first portion of this paper related to the general methods of making rails, from the ore to the finished product, and need not be reviewed here. The discussion of the controversial questions may be condensed as follows:

Composition.—Chemical analyses of average Bessemer rail steel as made at present for heavy rails run about as follows: Carbon, 0.50 per cent.; phosphorus, 0.10; sulphur, 0.08; silicon, 0.12; manganese, 1.00; iron, 98.20.

The quantity of carbon can be controlled by the grade of spiegel used. The makers and users of rails are not exactly agreed as to what the limits in carbon should be. When a 70-lb. rail was regarded as a heavy section, carbon ran from 0.35 to 0.40, but when the weights of rails reached 100 lb. per yard, 0.60 per cent. carbon was called for, and in some cases the upper limit was fixed at 0.65 per cent. The higher carbon steel, 0.55 to 0.65 per cent., was also specified for lighter rails such as 80-lb. and 85-lb. The 80-lb. rail was an increase in weight of only about 14 per cent. over the 70-lb., but 0.58 per cent. carbon often called for in this weight rail was an increase of fully 45 per cent. of this element over the lighter section.

The reason for raising the carbon was to get more elasticity and better wear, which in a degree was obtained, but with it came more failures from breakage. It was then specified that phosphorus should be lowered about 0.015 per cent., making the limit not to exceed 0.085 per cent. This proposition seemed entirely consistent from a metallurgical and theoretical standpoint, but practically it cannot be obtained because of the ore conditions.

It is estimated that the available 0.085 phosphorus Bessemer ores in the United States are relatively small. If all the rail mills in this country were to undertake to fill, from American ores, the annual requirement of about 3,000,000 tons under 0.085 phosphorus specifications for Bessemer rail steel, that grade ore would be exhausted before provisions could be made to meet the yearly demand for rails made by any other process.

If open hearth steel is to succeed Bessemer, it will take a term of years and the expenditure of an enormous sum of money to build furnaces enough to provide the steel needed for rails alone. Before this could be accomplished it is more than probable that the 0.085 phosphorus Bessemer ores would run out, and with an inadequate production of open hearth steel, the railroads would have to either get along with a short supply, or import the tonnage lacking.

To avoid this apparent short cut to the end of good quality Bessemer rail steel, the makers insist that the phosporous limit shall be left as it has been for a number of years past, at 0.10 per cent., and a somewhat modified carbon content be used. It is entirely practicable to use enough carbon with 0.10 per cent. phosphorous ores to make perfectly sound, safe and serviceable Bessemer steel, and with that limit accepted, the manufacturers will be able to produce good quality Bessemer steel rails for many years to come.

The wear of the heavier section rails has not been all that the users expected, even with the proportionally higher carbon, and they are loath to make any recession in this hardening element, fearing that by so doing, there will be still greater loss from rapid wear. But the question

of safety must have first consideration, and neither the makers nor users of rails will be justified in adding hardening properties, to get increased service, that will place the material anywhere near the danger line of breakage.

There is a strong probability, however, that harder steel may be used if the shape of the rails is changed. How this may be brought about will be considered further on.

The next element in order in the steel composition is sulphur. This is of little consequence to the user of rails. Its effect is to make hot steel "hot short" and liable to pull apart, making flaws on the surface of rolled shapes. A limit of 0.10 per cent. can be handled very well, but it is always to the interest of the manufacturer that it should be lower.

Silicon has a quieting influence in molten steel when it is settling and cooling in the molds and makes it dense when cold. A limit of 0.20 per cent. is generally stated in specifications.

The quantity of manganese in rail steel will run from 0.80 to 1.10 per cent. Its effect is to make the hot steel tougher, overcoming some of the bad effects of sulphur, and thereby better adapted to rolling. It also makes the steel harder and better for wear, but if the quantity exceeds very much the upper limit noted it is liable to lead to brittleness.

Discard.—Another clause in standard rail specifications that is a source of some contention between makers and buyers of rails, reads as follows: "Sufficient material shall be discarded from the top of the ingot to insure sound rails." Under that agreement the buyers of rails can get, and do get, perfectly sound steel. The interpretation of the term sound in this case means entirely free from piping or spongy metal. Sound steel rails of standard composition are perfectly safe to use, and when the railroad companies have exercised their rights given by the specifications in their inspection at the mills, while rails are being made, and thereby obtained sound rails, they have done their whole duty toward themselves and their patrons, whose safety and welfare they are bound to protect.

But the question arises why do the railroad people, or so many of them, come up with a demand for more discard, in some instances asking for a fixed amount not less than 25 per cent. of the whole ingot. It is not a question of safety, but one of service. Under present specification, the rail mills must deliver to the railroads safe rails, that is to say, free from the danger that comes from piping. They are obtained by shearing from the top of the ingot sufficient material to insure sound steel. Then what would the railroads gain by doubling the discard if 25 per cent. should amount to that increase? They might get a larger percentage of better wearing rails than they now receive, but the gain would be purely in an economical sense, and not in one of safety. Therefore, the question of more discard after enough has been made to insure sound and safe rails is purely a commercial one, and can be disposed of between the railroads and the steel companies without giving cause for any anxiety on part of the traveling public.

Drop Test.—In addition to the discard sheared off the bloom, a crop end is cut off the long rail when it is finished, taken from the end toward the top of the ingot. This is about 6 ft. long and is used for a drop test. One such test piece is taken from every blow of steel. It is placed on steel wedge-shaped bearings, 3 to 4 ft. apart, and struck with a 2,000-lb. weight, falling 15 ft. to 22 ft., depending on size of rail tested. If the test piece breaks under the drop, all rails from blow represented by that test must be discarded.

This is the most satisfactory proof of the quality and strength of the rails that can be used. If the steel is brittle, it will be discovered by the character of the break. If piped, that condition can be seen in the fracture and will determine at once whether or not sufficient discard has been made at the shears to insure sound steel. If the metal is very soft, it will show by excessive deflection. It can be seen, therefore, that the drop test throws out many safeguards against passing defective or inferior material.

Section.—Another difficult part in the making of steel rails is in the section. In the first place, it has to be very close to mathematically correct. A finished rail is a simple looking thing when it is made, but there are a good many dimensions besides the length to take into account in getting it through the mill in proper shape. The ordinary rail section is made up of 17 separate and distinct dimensions, 9 of which are duplicated, making a total of 26 to be kept in order and held in their respective places when the rolling is under way.

The section is continually checked during the process of rolling. This is done by a steel template made to exact dimensions of one-half the rail divided by its vertical axes. The rail section is tested on both sides by the same template, and therefore each half is as nearly like the other as possible to make it. In checking rail sections, the inspector has to guard against either over or under size and always strives to maintain perfect symmetry. In this detail, a difference of 1-64-in. cannot be ignored and the wonder is how such ponderous and coarse machinery as constitutes a rolling mill can be so nicely adjusted as to accomplish such fine results. It is not easily done, and it should be remembered that the turning or shaping of rolls and the manipulation of steel through them when rolling is under way, is the most intricate part of the rail-making process.

One of the leading advantages to the manufacturer in the Am. Soc. C. E. sections is in the distribution of metal in its different members. In the head there is 42 per cent.; in the web, 21 per cent., and in the base, 37 per cent. There is but five points difference between head and base, and these are so much closer than many of the sections the mills were formerly required to make that they gave the Am. Soc. C. E. sections a cordial welcome and have always tried to further their use.

At the time these patterns were introduced an 80-lb. rail was regarded as a heavy section, and some engineers even doubted whether one so heavy could be used economically. The designers, however, evidently expected railroad track to grow, for they provided for 5 lb. per yard increase in weight till 100 lb. was reached, and then designed a 110-lb. pattern, apparently for a good measure.

Shrinkage.—The period during which the 80-lb. rail was regarded as heavy was not of long duration, for the railroad soon took on 85-lb. and 90-lb. sections and during the past few years a very considerable tonnage of 100-lb. rails have been made. The 90-lb. rail was an increase of about 12½ per cent. and the 100-lb. about 25 per cent. over the 80-lb. The users of rails naturally looked for a proportionate gain in wear for the additional steel bought. But this did not always obtain and led to the criticism that they were not properly worked; that they were rolled too fast and finished too hot. An effort was then made to incorporate in standard specifications what was called a "shrinkage clause." By this is meant that the rails when they reach the hot saw shall be at such reduced temperature that only a certain number of inches and fractions of an inch shall be allowed for the rail to contract in length from the temperature at the sawing down to 70. It was expected that if the mills could comply with this, the steel would come through the finishing passes at a lower temperature, and the colder rolled steel would give better wear.

It would be perfectly reasonable to look for those results from such conditions. But the difficulty of incorporating a shrinkage clause in general specifications and making it operative was found in the fact that rails cannot be brought to the hot saws at the same temperature in every mill. There are no two in which the shrinkage could be kept exactly alike, therefore, any fixed allowance in a general specification could not be made applicable in all places. The opposition to a definite shrinkage clause in specifications is raised on account of the insurmountable difficulties encountered in attempting to fix a temperature at which the finishing work shall be done in unbalanced sections.

As already stated, the Am. Soc. C. E. section, or any other tee-rail thus far made, has greater percentage of metal in the head than in the base. The head is in a mass with less radiating surface than the base. The base is not only smaller, but thinner, besides having a greater radiating surface. It can, therefore, be readily understood why there is considerable difference in temperature between head and base, when the rail goes through the finishing passes. The obect of a shrinkage clause was to improve the rail head by finishing at a lower temperature, but in an unbalanced section the base is likely to get too cold to work, or so hard as to cause damage of cracking the rolls, while the head may still be hot enough to admit of some reductions.

Cambering.—Cambering of the rails is made necessary to counteract the warping that takes place in cooling. The warping is due mainly to the shape of the section, and the rail is rarely perfectly straight when cold. Whatever warp or crook that may be left in must be taken out by cold straightening. This is done in a press under a slow-motion plunger by applying pressure on the rail centrally between bearings for 42 in. apart. The arrangement of this press has lately become part of a general specification, and for that reason should receive some notice in this connection.

It is pretty generally conceded by both rail makers and users that the strain and torture that rails have to endure in cold straightening are the most severe and most objectionable work in the whole manufacturing and finishing process. The impossibility of taking a bend or kink out of a rail without straining it beyond its sectional elastic limit makes the necessity of setting up internal stresses, working at cross purposes with the normally cold tension of the steel, unavoidable. To what extent these may be harmful to the rail after it is put into service cannot be definitely determined, but it is only reasonable to infer that they have some effect. The remaining work in finishing after the straightening is done consists of drilling, chipping, filing, etc., all simple mechanical or hand operations not likely to cause any injury.

Rail Usage.—It is not an uncommon occurrence for a panel of rails in first-class track to carry a load upward of 200 tons over its entire length in half a second of time or less. This enormous weight coming onto the rails in such a short interval causes a shock almost equal to a hammer blow. During this short space of time every foot of the rail throughout its entire section is subjected to alternating tension, compression and torsion and the head to crushing and abrasion. There is not a piece of steel made for any structure whatever that has to withstand such severe treatment as that imposed on a rail.

The users contend that rails fail because of defective material or shortcomings on the part of the manufacturers in the process of making. The manufacturers claim that the users do not specify the grade of steel, nor weight of rail

best suited to their various traffic and climatic conditions; that maintenance of way is not always what it should be; that bad order rolling stock and irregular operations of motive power are responsible for a greater part of rail destruction.

There are nine or ten classifications of rail failures, but more than 95 per cent. can be placed under less than half that number. The remainder are of rare occurrence and little account.

Piping.—First are the head failures which are the result of piping, or caused by the metal actually shearing off at the sides, usually about on line with one side of the web. Piping is a defect adherent in the steel, and the whole responsibility for this rests with the manufacturing. Every practicable precaution is constantly exercised against such material going into rails, but in spite of all that can be done, some with this defect get into use.

To reconcile the fact that piped rails are found, with the claim made that sufficient material is discarded from top of ingot to insure sound steel, it will be necessary to explain that piping in ingots is not confined entirely to the top, but does at times occur all the way down through the center, although it may not be continuous. Such piping will not show at the ends nor give any surface indication of its existence when rails are finished. It ordinarily develops under traffic and then appears by the head flattening or spreading out. Only a very small percentage of piped rails give out suddenly, or without first showing this condition on the head surface and affording time for removal before harm is done. Some railroad engineers say that they do not regard rails showing slight piping as particularly dangerous, and often allow them to remain in use after their condition is known. It is the opinion of the writer, however, that rails which show piping in any degree are wholly unfit for any main line track, and never should be allowed to remain in service.

Split and Crushed Heads.—Split head failures occur mainly on high curvature track and on the inside or low rail of the curves. These are apparently due to irregular bearings of worn wheels and cross strains thrust into the rail head by tread of false flanges, on extreme outside corner. This leverage brings the maximum stress at top of rail heads, about on line with side of web, where such breaks are generally found.

Another type of failures resulting from rail and track conditions, similar to that just mentioned, is in the metal flowing or crushing off the corners of the head. The inside wheel of a train passing around a curve, not only rolls but slips over the rail, and when the track gauge is wide, it slides across the head, causing the metal to flow or shell off in long, ragged strips. This kind of giving out is sharply criticised and often causes considerably anxiety among railroad engineers, on account of the seeming weakness. Such rails have an extremely bad appearance and ordinarily show excessive wear, but they are not unsafe to run over and may be retained in service without any unusual risk, until completely worn out.

Breakage.—By far the greatest number of failed rails are due to breakage, that is to say, complete fracture of the entire section. These are not only most numerous, but most dangerous of any in the whole classification. There are three distinctive characters—breaks that may be described and in a measure accounted for as follows:

First: The square break in which the fracture is almost at right angle with the axes of the rail and is often quite as regular as a saw cut. The fractured surface may be fine, close, homogeneous texture, but the shape of the break indicates excessive hardening properties in the metal, bringing it close to the point of brittleness, hence, easily ruptured by shock and therefore poor quality steel for rails.

Second: The angular, or shearing break, which generally passes through the section at an angle of 45 deg. or less, with longitudinal axes. This shows that the rail stood a deflection and elongated before breaking, indicating ductility and a perfectly good grade of steel, but probably broken by severe shock or excessive overloading.

Third: The base break. There are more failed rails from breaks of this character than from any other cause. It is found in varying degrees on all railroads and in rails from all mills. The principal peculiarity of this break is that it starts at the center of the rail base, directly under the web, and develops longitudinally, extending from 6 in. to 18 in. and will then run out to the edge of the flange, resulting in a "half moon," or flange break, and in many cases also extending upward through the rail, causing a complete fracture of the entire section.

As a girder the rail seems to be theoretically and practically correct in shape. But it has always been shown that the roadbed and ties, which constitute the rail foundation, are unstable, and yielding and that the solidity of tie bearings are at times widely variable, making the bearing surface of the whole rail base quite irregular and uneven. These conditions are generally worse when the roadbed is frozen. In consequence, the base member of the rail section has to sustain excessive compressive strains at the higher or more solid points of its bearings.

The rail base in compression will, on account of its shape, buckle, drawing the edges of the flanges upward, thereby causing a cross strain with maximum tension at the center directly under the web, and this is the point where base break begins. Therefore, it appears that the base member of the girder tee-rail as now made is deficient when subjected to compressive strain and for that reason fails.

Improvements.—Just at the present time we seem to have reached one of the transition periods in the manufacture and use of steel rails, in which the rails as made do not quite balance with the railroad traffic as it exists. A correction must be found.

The manufacturer is held by certain limitations in character of raw materials that prevent meeting all that might be desirable in changes of composition of steel for the improvements needed. The railroads cannot recede in the matter of heavy loads and fast trains, and must by some means get rails that will hold up to changed conditions as they are.

It is believed that a remedy can be obtained by the co-operation of the manufacturers and railroads in bringing out a revised rail section. This will embody certain cardinal principles and be designed with a view to overcoming detail deficiencies found in the present sections, at the same time be a better shape to roll. It is suggested that, in comparison with the Am. Soc. C. E. sections, both head and base shall be reenforced, and that the distribution of metal be nearly balanced, making that in the base equal or slightly greater than in the head. It is also proposed that width of base shall be less than height of rail, which will admit of forming thicker flanges.

The advantages of a balanced section, with comparatively thick base are:

First, lower temperature of the whole section at the final pass, hence a colder finish of the rail head, giving denser and better wearing material.

Traveling Derrick for Trenching for 15-Foot Sewer, Borough of Queens.

Second, less cambering and better hot straightening, reducing as much as possible the objectionable cold straightening work.

Third, a reinforced head to provide against splits and other head failures.

Fourth, a reinforced base to overcome the weakness that seems so prominent in present pattern rails.

It is expected, also, that with this pattern rail the higher carbon steel from grades of ores now available may be made with safety, and by longer service prove a benefit to the railroads. The balanced sections can be made easily and economically, and will thereby contribute to the interests of the manufacturer.

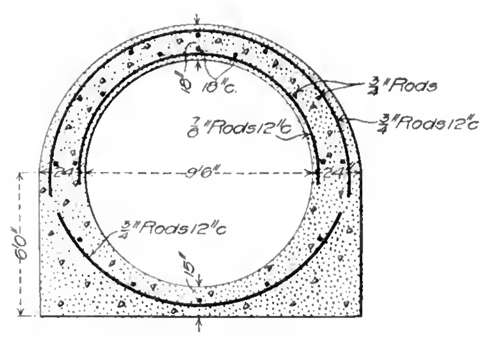
A STEEL STACK over 100 ft. high and weighing 22 tons was erected recently in a single piece at the works of Messrs. Brown, Bayley & Co., Sheffield, England. The stack is 10 ft. in diameter at the base and 7 ft. at the top and serves a 20-ton open-hearth furnace. It has no stays or braces but the brick base is founded 20 ft. below ground, and the iron base plate is anchored to the brickwork by eight 16-ft. bolts. The stack was raised in slings by a high derrick and the base was then guided into the flanged base plate to which it is securely bolted.

A Large Reinforced Concrete Sewer in the Borough of Queens, New York City.

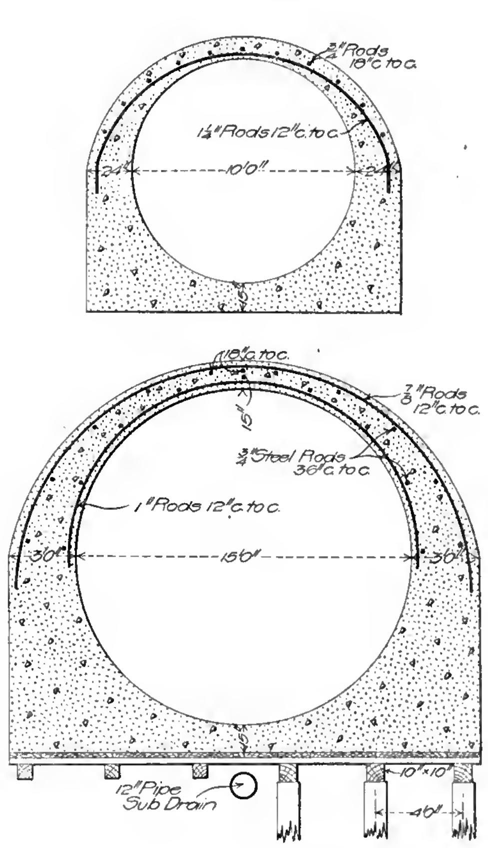
A circular reinforced concrete trunk sewer, varying from 2½ to 15 ft. in diameter, is now being built in Myrtle and St. Nicholas avenues, in the Borough of Queens, New York City, to serve a 2,150-acre area in the southwestern section of that borough. This work is part of a general sewerage system planned for the southwestern part of the Borough of Queens. This borough, while the largest of the five that make up Greater New York City, covering an area of 127 square miles, is, at the same time, the most sparsely populated, having less than 250,000 inhabitants, collected in scattering settlements. The water front totals 116 miles, but the length along which sewage may be discharged is limited to 27 miles by laws prohibiting the discharge of crude sewage into Flushing and Jamaica bays and Newtown creek. This complicates and makes difficult the problem of sewerage, and in the case of the system mentioned necessitates carrying the flow to the East River, through a 16-ft. continuation in the Borough of Brooklyn. The work in Brooklyn has not yet been put under construction.

The approximate quantities of work included in this contract in Queens are: 1,355 ft. of 15-ft. sewer; 690 ft. of 11¼-ft.; 1,335 ft. of 10-ft.; 2,070 ft. of 9½-ft.; 2,000 ft. of 5 and 5½ ft., and 2,190 ft. of smaller sizes. The total length under contract, including 255 ft. of 24-in. pipe sewer, is 9,845 ft., and the total fall is 46.73 ft. The grades are: 0.002315 in the 15-ft. section; 0.00296 in the 11¼-ft. section; 0.00442 and 0.00412 in the 10-ft. and 9½-ft. sections; and 0.0052 to 0.00425 in the smaller sections. The cover over the larger sections is fairly uniform, being in general about 15 ft. At one point, however, the cover over the 9½-ft. sewer is 22 ft. deep. The smaller sizes, from 5½ ft. down, have, in general, 8 to 10 ft. of cover. The excavation is mainly in sand or sandy soil, and practically no water has been encountered.

The sewer now under construction in the Borough of Queens has the same general sectional form in all sizes, the outer sides of the invert being tangent to the extrados of the arch at its springing line and carried down vertically to meet the plane of the foundation. The concrete below the springing line is a 1:2:4 mixture of Atlas Portland cement, sand and bank gravel, having a maximum size of 1½ in., and is without reinforcement. Above the springing line all sizes are reinforced laterally and longitudinally with "new style" Johnson corrugated bars. The concrete of the arch is the same as that below the springing line, except that the stones larger than ¾ in. are screened out. The sections of sewer smaller than 4½ ft. in diameter have ¾-in. lateral rods, 12 in. on centers, and three lines of ¾-in. longitudinal rods over the crown and haunches; the arch in all these sections is 6 in. thick at the crown and 6 to 9 in. thick at the springing line; and the lateral rods are equidistant at all points from the intrados of the arch. The sizes from 4½ to 5½ ft. in diameter, inclusive, have ¾-in. lateral rods, 12 in. on centers, and ¾-in. longitudinal rods, 18 in. on centers, but the lateral rods are placed on a three-centered curve, being near the intrados at the crown and near the extrados at the springing line. The longitudinal rods rest directly on the lateral rods. The arch ring in these sections varies from 6 to 8 in. thick at the crown and from 12 to 15 in. thick at the springing line. The 9½ and 10 ft. sections are much like those just described. The lateral reinforcement is three-centered, and the thickness at the crown and springing line is 12 and 24 in., respectively, for both sizes. The 10-ft. section is shown in the accompanying illustration. The 11¼ and 15 ft. sizes have two series of both lateral and longitudinal rods, one series being parallel to the intrados and the other parallel to the extrados of the arch ring, as shown in an accompanying illustration of the 15-ft. section, on which the important dimensions are indicated. The arch ring of the 11¼-ft. section is 12 and 27 in. thick at the crown and springing line respectively, and the reinforcement is like that of the 15-ft. section, except that the outside lateral rods are ¾ in. instead of ⅞ in.



Section under Tracks.



Sections of Large Sewer, Borough of Queens.

In designing the larger sizes it was assumed that the covering material, which is in many places clean sand, would, when saturated with water, transmit live loads very readily, and the sections are accordingly liberal. Moreover, the magnitude and permanency of the work warranted no doubtful economy of material, and the minimum thickness of protective covering of concrete over the reinforcing rod is accordingly in general about 2½ in. Pile foundations of the form indicated in the illustration are specified, to be used where required, but the excavation so far has been in good, dry, sandy soil, and no piles have been necessary.

The tracks of the Long Island R. R. cross the sewer over the 9½-ft. section, necessitating extra heavy construction for a distance of about 70 ft. Here the thickness of the arch ring at the crown and springing line is increased to 18 and 24 in., respectively, and the ring is reinforced with two series of lateral and longitudinal rods, one parallel to the extrados and the other parallel to the intrados, as shown in an accompanying illustration. A third series of lateral and longitudinal rods placed parallel to the surface of the invert reinforces the section below the springing line.

Along the line of the main sewer several junctions with tributary sewers are required. Of these, the one at Myrtle and Cyress avenues, where a 7-ft. sewer enters the 11¼-ft. section, is typical, and illustrations of it are given. The drawings of this intersection also show a reducer from 11¼ to 10 ft. just above the junction point.

Manholes are provided throughout the length of the sewer at intervals which do not in general exceed 250 ft. On the sections larger than 5 ft. the manholes will be placed at one side of the axis of the sewer, so that the vertical axis of the manholes will be about tangent to the barrel of the sewer. Center manholes on sewers as large as these make it difficult and dangerous for workmen to enter the sewers. The arrangement adopted will in a great measure remove this difficulty. The bottom of the manhole is usually at or a little below the springing line of the arch, and steps are provided leading down the side of the invert to the bottom. Up to a point about level with the crown of the arch ring the manhole is built of concrete reinforced with ¾-in. rods, which are bent into the arch ring wherever possible, as indicated in an accompanying illustration. Above the concrete the manhole is carried up to the cast-iron cover with brick work in the usual manner. A double-track street car line, which traverses the part of Myrtle avenue occupied bya section of the sewer 10 ft. and less in diameter, has influenced the position of the manholes somewhat, but they are placed either between the rails or outside the tracks, as the case requires.

The sections of the sewer 5½ ft. or less in diameter are built without the use of much mechanical equipment. Two-inch hemlock planks, 6 to 8 in. wide, are carefully driven to serve as sheeting and as boxing for the vertical walls below the springing line. The excavation is carried on with pick and shovel, the spoil being hoisted and delivered along one side of the trench in small buckets by a portable horse-power derrick mounted on a heavy four-wheel truck. The street car track, which is operated as a single track line where the work is in progress, is shifted over to the side of the trench not occupied by the spoil bank, and it has been possible to maintain the operation of cars constantly. Sand, cement and gravel are stored in convenient piles in vacant lots beyond the street car track and are delivered to the work in wheelbarrows. The concrete is hand mixed on a plank platform spanning the trench.

In building the smaller sections a slab of concrete is first laid on the bottom of the trench, its top surface being kept a little below the grade line of the finished invert. A narrow strip along the center of the top of this slab is then built up carefully to the grade line, and the cradle forms are rested on it, being braced from the sides with wooden struts against the sheeting, and internally with rods and struts supplied with turnbuckles and screws. The concrete is then poured up to the level of the springing line. Before it has set the ends of the lateral rods of the arch ring are thrust into it at the proper point, the weight of the rods being carried by a ridge pole previously fixed at the proper height. The placing of the concrete of the arch ring is carried on in the usual manner. Sheet-steel forms, made by the Blaw Collapsible Steel Centering Co., are used for all sizes of the sewer.

On the larger sizes of the sewer the excavation is also carried on by pick and shovel, but more elaborate equipment is required to hoist the spoil and deliver it as back-fill. In Myrtle avenue, near its intersection with Cypress avenue, the section of 10-ft. sewer is now being built; here the cover

is about 14 ft. The sides of the trench are retained, as in the smaller sizes of sewer, with narrow 2-in. hemlock sheeting, driven by hand in 16-ft. lengths and carefully supported by waling pieces and struts. Here again the sheeting serves as boxing for the vertical outside walls of the invert.

The spoil is shoveled into 1-yd. Haywood buckets, which are hoisted by two stiff-leg derricks, with 25-ft. booms, and masts short enough to clear the overhead trolley construction above the street. These derricks, with their hoisting engines and boilers, made by National Hoisting Engine Co., are mounted on a large platform traveler, which spans the trench, with three wheels on each side running on heavy railroad rails. These rails are laid on 6 x 8-in. timbers, laid across the trench about 3 ft. on centers and extending far enough beyond the sheeting to secure a good bearing.

The derrick mounted on the front end of the traveler handles the top surplus spoil not required for back-filling. This material is delivered to Troy dump wagons and hauled away, to be used in filling neighboring lowlands. The derrick on the rear end of the traveler handles the back-filling material, which is delivered to 1-yd. Koppel cars, operated by hand on track laid on the 6 x 8-in. timbers spanning the trench, which have been before referred to. These timbers are left in place behind, as the traveler proceeds, to carry the narrow-gauge track and are taken up as the back-filling progresses.

At Cypress avenue a street car line crosses Myrtle avenue, and when the traveler was on one side and the unfilled trench on the other side of this car line it was necessary to run the dump cars across it. This was accomplished by means of a turn-table of heavy bar-iron rails, arranged so that when a street car passed the turn-table could be turned, with its axis parallel to the car track, so that the turn-table rails would clear the car wheels. The car track was supported over the trench by lines of timber stringers.

The order of procedure in constructing the larger sizes of the sewer is much the same as has been described for the smaller sizes. The bottom slab is laid first and brought up to the grade line of the invert along its center, to carry the cradle forms, which are braced both from the sides of the trench and internally, as shown in the accompanying illustration. Before the placing of concrete is begun the cradle and arch forms are carefully trued up under the direction of an inspector. Wooden pegs are inserted in the key-holes at the free end of the steel forms, to hold the wooden bulkhead in place. The turn-buckles and screws are covered with cloth or paper to prevent their becoming fouled with concrete.

The concrete for the 10-ft. section is mixed in a 1-yd. Smith machine, mounted on a low truck, which is moved alongside the trench as the work progresses. The mixer delivers through a short chute into a small hopper, which rests on horizontal timbers, laid parallel to the axis of the sewer on the series of transverse sheeting struts second from the surface of the ground. From the bottom of this hopper a 10-in. sheet-iron pipe leads down to a point a few feet above the crown of the arch ring. Here open chutes are provided, which lead the concrete to one side or the other, as required. The concrete is mixed wet and exerts a heavy pressure on the forms, which have to be braced very securely. In the larger sizes of the sewer the curved lateral rods are not put in place until the arch ring is about to be constructed. To provide for their support, holes are formed in the top of the sides of the invert while the concrete is still green, into which the rods are securely grouted later.

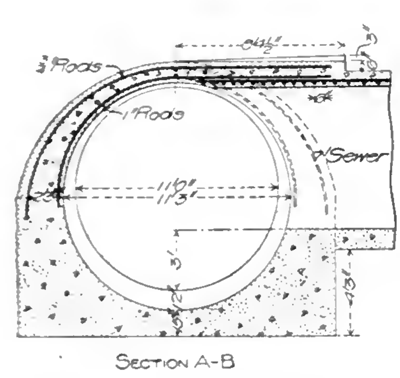
The lateral rods are bent at very little expense on the work by unskilled laborers. For this work a heavy plank platform is provided on which are nailed sticks 3 or 4 in. square and about 2 ft. long, placed radially so that their outer ends around which the bars are bent form a horseshoe-shaped curve. This curve, which is, of course, quite different from the curve of permanent set which the rods take, had to be determined by experiment. A separate series of blocks is necessary for each size of sewer but two or three curves can be formed on one platform by imposing one series of blocks upon another.

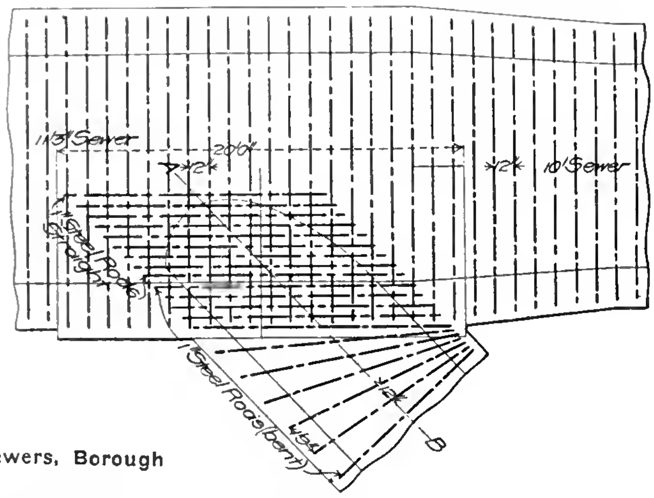
In St. Nicholas avenue, where the 15-ft. section is under construction, the same general methods of excavation and placing of concrete have been used as have already been described. Here, however, only one derrick is mounted on the traveler platform. It is of the stiff-leg type and is operated by a National hoisting outfit. The boom is 35 ft. long. A blacksmith's equipment is carried on the traveler platform where picks are sharpened and repair work is done with minimum delay.

A large part of the excavated material in St. Nicholas avenue is sand, which is available as concrete material. This is stored in convenient piles along the work and as the storage space was limited, the piles are high. In order to maintain the operation of the dump cars from the derrick to the storage piles by hand the track is raised on timber cribs placed about 20 ft. on centers between which are lines of timber stringers on which the Koppel track rests directly.

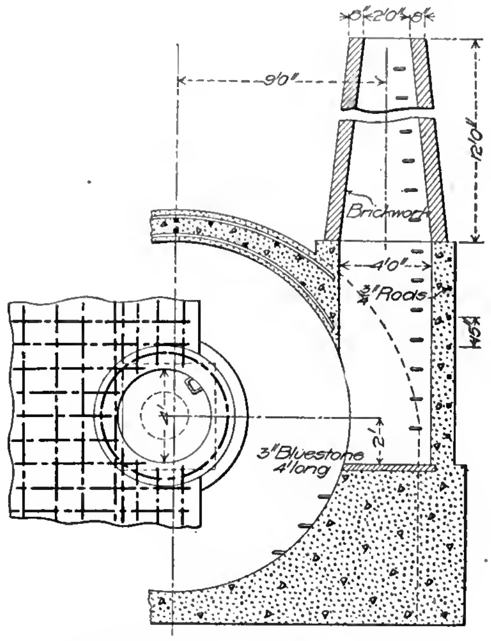
The double-track elevated steel structure of the Ridgewood division of the Brooklyn Rapid Transit R. R. crosses St. Nicholas avenue with too little clearance to allow the passage of the traveler and derrick. When the excavation reached the east line of the railroad structure, the derrick was dismantled, the traveler moved to the west side of the railroad track, and the derrick mounted again. Two short lines of narrow gauge track were then laid within the limits of the trench excavation under the steel structure parallel to the axis of the sewer. The dump bodies of two of the regular Koppel cars were then taken off and low wooden platforms substituted. One car was placed on each line of track with a Hayward 1-yd. bucket on its platform. As the buckets were filled by the shovellers, the cars were run forward to the west side of the elevated structure where the derrick could reach them. The tracks were lowered as the excavation progressed and when the portion of the trench under the elevated railroad was finished both cars and track were hoisted out by the derrick.

The four steel columns of the elevated structure in St. Nicholas avenue are placed two on each side of the pavement, just outside the curb lines. As the footings of these columns are close to the trench it was thought to be dangerous to depend on the trench sheeting to sustain the lateral pressure due to passing trains. Accordingly, part of the weight carried by the columns has been transferred to four timber towers, each made up of four 10 x 10-in. timbers, placed under the girders close to the property lines and wedged up to a solid bearing.





Junction of 7-Ft. and 11-Ft. 3-In. Sewers, Borough of Queens.



Special Manhole for Large Sewer.

When a section of forms is to be drawn forward into its new position the traveler platform is anchored in place and the hoisting engine is utilized. The forms are oiled carefully before each new section of concreting is begun and no difficulty has been experienced in drawing them. The invert and arch surfaces secured are very smooth and require no plastering or patching. The forms for the arch ring and invert of the 15-ft. sewer are handled in 30-ft. lengths. The hoisting equipment and traveler is moved forward with its own power by means of tackle attached to any convenient anchorage.

The work is being prosecuted under the direction of Mr. Joseph H. De Bragga, superintendent of sewers, and Mr. J. H. Johnson, chief engineer. The plans and specifications were prepared by Mr. Alberto F. Schreiner, assistant engineer, and Mr. Elmer W. Firth, assistant engineer, is in immediate charge of construction. The Sigretto & Manino Co., Brooklyn, N. Y., is doing the work, the total cost of which is $393,743.75. A surety bond of $155,000 was required and 400 working days are allowed for the completion of the work. The progress made so far indicates that the work will be completed within the specified time.

Longer Drill Rods than an ordinary air drill tripod will take were used recently by suspending the cylinder between the guides of a small pile driver frame.

New Mechanical Equipment of the Enlarged Tribune Building, New York.

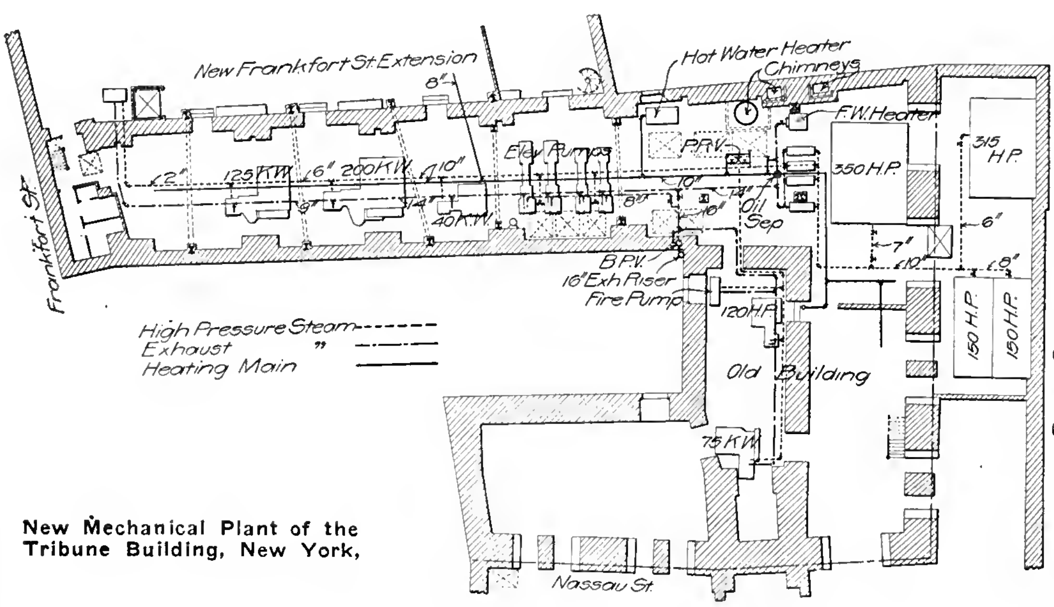
The ten-story building of the New York "Tribune," at Nassau and Spruce Sts., New York, has recently been raised and remodeled into a twenty-story office structure and increased in floor plan by a 60x116-ft. extension of similar height. The interesting and unusual engineering problems involved in this reconstruction were described in The Engineering Record of June 1. With the reconstruction of the building, extensive additions to the power and mechanical plants became necessary and as the equipments of the original building were entirely incapable of extension to the capacity desired, an entirely new layout was designed, providing the increased capacity required and ample accommodation for future growth. The power plant had consisted of an equipment of four small boiler units and of both Corliss and high speed automatic engines for the operation of the printing presses and dynamos, while the heating system was designed for operation with high pressure steam, a usage now practically extinct. The original elevators were of an early Crane design and incapable of extension. After a study of the requirements of the building as extended, it was decided to abandon the greater part of the original mechanical equipment and replace it by new equipment of modern design, which should be accessibly located and have sufficient reserve capacity for emergency requirements. While the new plant and its equipment involves many features of interest, its installation is of peculiar interest for the reason that the equipment is installed largely in the basement space occupied by the original apparatus, all of which it was necessary to keep in operation until the new apparatus had been placed in running order. Owing both to greatly congested space in the basement and to the necessity of entire rearrangement of the plant, the work was attended throughout by many temporary arrangements and connections, which hampered the work a large part of the time, but the new installation was finally completed without accident or interruption of any of the building services.

The basement space allotted to the power plant in the original structure consisted of a 16x40-ft. passage under the front portion of the building and the 24x170-ft. space under the rear portion, extending through between Spruce and Frankfort streets, with, in addition, the 18x63-ft. space under the Spruce street sidewalk, in which the boilers were located. In the remainder of the space under the front portion of the building were located the printing presses, pressroom and other portions of the Tribune's printing plant, with the exception of the stereotyping department, which shared with the power plant the basement space in the rear extension. With the extension of the Frankfort street frontage, however, a greatly increased basement space was there afforded for an enlarged printing plant, and also a division of that space was devoted to the requirements of the stereotyping plant, thus entirely freeing the central basement space for the power plant equipment. The rearrangement of the power plant consisted in the main of remodeling the boiler plant, the removal of the engines and the electrical generating equipment from the front portion of the Frankfort street end to the original basement in space formerly occupied by the stereotyping department, and the location of the new elevator equipment in the central portion of this section, next to the boiler plant. In the latter there was also added later a fourth unit of 350 h.p. capacity, just within the building wall from the original boilers. The plant has always been limited as to space available for fuel storage, and no increase in storage is as yet available from the new arrangement, although when the presses and the printing plant are moved from their present location in the front portion of the basement to the new basement space under the Frankfort street extension a large amount of space will become available under the front portion of the building for coal storage, additional mechanical equipment and rearrangement of the boiler plant if need be. Access is had to the basement for machinery parts and supplies by conveniently located sidewalk lifts on both the Spruce and Frankfort street fronts.

The steam generating equipment had originally consisted of two 60-h.p. horizontal return tubular and two 150-h.p. Babcock & Wilcox water tube boilers, which were located in the Spruce street sidewalk vault, but early in the course of reconstruction the return tubular boilers had been replaced by a single Babcock & Wilcox water tube boiler of 315 h.p. rating, to provide needed additional capacity. As the other water tube units were of comparatively recent installation they were retained for the new plant and merely supplemented by a new unit of the same type and make, which is of 350 h.p. capacity, giving thus a total steam generating capacity of approximately 1,000 boiler h.p. This capacity will enable the maximum power demands of the enlarged building to be carried with one unit always in reserve. The new unit was installed alongside of the 315-h.p. boiler, just within the building wall, so that the same firing floor serves all four of the boiler units and also a considerable space is afforded between these units for the storage of fuel. The only other change in the boiler plant was the erection of a steel smoke stack to supplement the two 24x36-in. flues in the rear wall, which served the four original boilers; the new stack is a 48-in. cylindrical steel stack, rising through the building in a 5x8-ft. shaft enclosure to a point some 260 ft. above the grates, and is connected by a breeching on the basement ceiling to the two larger boiler units, while the two 150-h.p. boilers are served by the wall flues through the original underground flue connections.

The boilers are of the standard Babcock & Wilcox inclined tube construction, designed for 125 lb. working pressure, the two larger units being arranged in single settings and the smaller units together in one setting, as shown in the basement plan of the building. The largest unit is of the longitudinal drum type, having three 36-in. drums and 189 4-in. tubes, 16 ft. in length, giving a total heating surface of 3,527 sq. ft., and has a furnace of 88 sq. ft. grate area. The other boilers are all of the cross-drum type, the larger unit having 144 4-in. tubes, 18 ft. in length, giving 3,100 sq. ft. of heating surface, while the two small units have each 84 4-in. tubes, 18 ft. long, with 1,500 sq. ft. of heating surface each. The two larger units are fitted with Thompson dumping grates for burning low grade anthracite coal and are hand fired, coal being dumped directly from wagons in the street into the storage space or on to the firing floor. Ashes are removed in the usual way, in cans upon the adjoining sidewalk lift. The boilers are fed by two $9\frac{1}{2}x5\frac{1}{2}x12$-in. feed pumps in duplicate, one a Knowles type A simplex pump, which was used in the old plant, and the other a new Davidson pump, either one of which is of capacity sufficient to operate the entire boiler plant. The pumps draw from a Webster open feed heater of 1,000 h.p. capacity, which has been installed at the rear of the boiler room for heating the feed by exhaust steam, and delivers to the boilers through a $2\frac{1}{2}$-in. main, with $2\frac{1}{2}$-in. and 2-in. branches to each unit. The greater part of the feed water supply is condensation returns from the heating system and other steam apparatus, with make-up from the city water supply, all of which is filtered through a building service filter equipment installed by the New York Continental Jewel Filtration Co. The boiler blow-off system consists of a 3-in. main with $2\frac{1}{2}$-in. blow-off connections to each boiler, which delivers the discharge into a blow-off tank under the firing floor for partial cooling, from which it is subsequently raised to the sewers in the adjoining street by a small steam pump.

Owing to the general rearrangement of apparatus, practically all of the piping of the plant had to be reconstructed and enlarged, and as, on account of the importance of the service, all new work had to be erected and placed in service before any of the original piping could be dismantled, all systems were laid out on as simple an arrangement as could be devised. The high pressure steam system consists of a single 10-in. main leading from the boiler room directly to the engine room, with an 8-in. branch into the old section of the plant in the front portion of the building. It has double-valved supply connections to each of the boilers, which are graded to drain condensation into the mains, while the latter has all steam delivery connections made from the upper side, so that condensation will accumulate in the main; this condensation is removed from the main by connections to the feed and vacuum pumps, which are connected from the lower side, and by steam traps at the ends of the main run and of the branch. In the 8-in. branch to the old division of the power plant connection is made with a low branch from one of the 150-h.p. boilers, which serves as a by-pass to the 75-h.p. generating unit, permitting lighting service to be maintained in the building if the main



New Mechanical Plant of the Tribune Building, New York,

generating plant be shut down for repairs. Drainage from this line is facilitated by both a connection to a steam pump and to a steam trap. The exhaust main practically parallels the high pressure main, consisting of a 14-in. line in the engine room, with an 8-in. branch from the engines in the front portion of the basement, and it has connection through a back pressure valve into a 16-in. atmospheric riser to a roof exhaust head and through an oil separator, to the low pressure heating main and the feed water heater. This line is also similarly drained by steam traps and the connection to the feed water heater. There has also been installed a supplementary exhaust main, consisting of an 8-in. line having duplicate connections to the exhaust outlets from the elevator pumps, which supplementary main has a direct valved connection to the atmospheric relief riser branch; the purpose of this is to permit of a sub-division of the exhaust main and allow the elevator pumps to exhaust direct to the atmosphere, independent of the disposal of the main exhaust, when little steam is required for heating purposes. The new low pressure heating main follows the general arrangement of the original heating main, except that it is enlarged to a 10-in. line in the engine room and with a 9-in. branch to the old portion of the basement; this is supplied with steam through a 14-in. connection direct from the exhaust main, with also a live steam supplementary connection from the high pressure system through an 8x12-in. pressure reducing valve.

With the reconstruction of the plant, the power scheme has been entirely remodeled, with a view of electrically driving all the machinery in the building. The machinery of the pressroom and other departments of the printing plant had formerly been operated through shafting and belt drives from a large Corliss engine, with the fly-wheel of the 75 k.w. American-Ball generating unit lined up for a belt drive connection in reserve, and there were, in addition, two direct-connected electrical generating units of 40 and 50 k.w. capacity each, for operating the electric lighting service in the original building. As the Corliss engine was located in the space now occupied by pumps and the elevator equipment, it was removed early in the course of the reconstruction work, and the press load carried by the simple automatic engine, and an electrical generating equipment of nearly 500 k.w. capacity has been installed with provisions for easy enlargement in view of the possibililty of eventually replacing the belt drives if the printing plant is remodeled. For the present, however, the original presses, located in the front portion of the old basement, are still in operation, but a large space has been provided in the basement of the new Frankfort street extension to amply accommodate the proposed new printing plant. Two of the original electrical generating units, namely, the 40 and 75 k.w. machines, have been maintained in the new plant, and in addition two larger units with compound driving engines installed, which are of 125 and 200 k. w. capacity respectively. The two large new units and the 40 k. w. unit are located in the newly arranged engine room at the Frankfort street end of the basement, as shown in the basement plan, while the 75 k .w. unit was left in its original location, where it had been so placed that it might also be utilized to operate the printing plant shafting from its fly-wheel, and thus serve as a reserve power unit, while still available for generating electric current supply. The 200 k.w. generator is driven by an 18 and 28x18-in. American-Ball compound engine, which, operating at 200 r. p. m. and with a boiler pressure of 120 lb., has a rating of 325 h.p., while the 125 k.w. unit is driven by a 14 and 22x16-in. engine of similar make, that operates at 230 r. p. m. and has a rating of 200 h.p. The 40 k.w. unit that was moved to the new engine room has a 12x12 simple Ames engine, operating at 300 r. p. m. and rated at 60 h.p., and the 75 k.w. unit a 15x12-in. simple American Ball engine that operates at 285 r.p.m. and has a rating of 100 h.p.; both of these engines were designed for the steam pressure originally carried at the plant, namely, 80 lb., and accordingly are now supplied through reducing valves which reduce the pressure from 120 to 80 lb. at the throttle. The power unit by which the presses are normally operated is a 11½ and 13½x12-in. American Ball compound engine, which operates at 250 r. p. m. and is rated at 120 h.p. The two larger engines are of the improved duplex compound type, with piston valves and balanced inertia governor, built by the American Engine Co., Bound Brook, N. J.

The 125 and 75 kw. electrical generators were supplied by the American Engine Co., in both cases direct-connected to American Ball engines, while the 200 and the 40 kw. units are General Electrical generators, the 40 kw. unit direct-connected to the Ames engine. These generators are all compound wound multipolar machines, wound to deliver 120 volts direct current, and are all designed with very liberal ratings, having capacities for 50 per cent. overload for 2 hr. continuously and for 100 per cent. momentarily. The distribution is on the two-wire system throughout the building, being controlled on a handsome five-panel switchboard of Vermont marble. The board is of double bus-bar construction and has the usual arrangement of switching and indicating apparatus, and, in addition, recording apparatus so connected that the current consumptions for both power and lighting purposes may be recorded separately. Two panels are devoted to the generator circuits, a feature of the equipment of which is the use of I. T. E. reversite circuit breakers, which are designed to open the circuits in cases of a very slight amount of reverse current in paralleling the generators, and of the remaining three panels two are used at present, the two lower rows of switches being on the lighting, while the upper row is for power and the third is held in reserve for future circuits to the proposed new printing plant and other new departments. The power load of the plant is already of considerable size, there being seven individual motor drives operated in the stereotype room, using motors from ½ to 5 h.-p. capacity; two small motors in the engraving room; in the composing room four motors operating job and proof-presses and 35 ¼ h.-p. Sprague motors individually connected to linotype machines, while there are one 15 h.-p., two 5 h.-p. and two 2½ h.-p. motors operating ventilating apparatus. The lighting system will consist of a connected load of 6,000 to 7,000 16-c.p. lamps in the offices, and, in addition, 76 Cooper-Hewitt mercury vapor lamps distributed throughout the different departments of the Tribune; four of these are 700 candle power lamps, located in the clock tower for illumination of the clock's dial.

The new elevator plant that has been installed consists of eight high-rise passenger and one freight elevator machines of the plunger type, which are operated on the back-pressure discharge system, and a high-duty pumping equipment with ample reserve capacity. The machines all have full travel to the twentieth floor of the building with the exception of one passenger machine, which has a rise to the eleventh floor only, and three of the passenger machines are operated for express service, while the remaining five passenger machines are for the local service, making stops at all floors. The passenger machines are all designed for capacities of 2,000 lb. each, the three express cars to travel at a speed of 600 ft. per minute, and the five locals at 400 ft. per minute, and the freight elevator for a capacity of 3,000 lb. at 200 ft. per minute, while in addition the freight machine is fitted with a jack pump attachment, by means of which its capacity can be raised to 6,000 lb. in special cases, when lifting heavy machinery, safes, etc. These equipments were supplied by the Standard Plunger Elevator Co., New York, and embrace apparatus of the standard construction of this company, with the exception that closed discharge tanks are used in connection with the back pressure discharge system, instead of the usual open tank discharge. The plunger cylinder valves and the control apparatus for the machines are, owing to the location of the corridors in the building, arranged in the central portion of the engine room, and for convenience of piping connections, the tanks and pumps have been here located also. There are four tanks used in the operation of this system, two for the pressure supply system and two for the discharge, in all of which air space is maintained in the usual manner by means of compressed air supplied from a Westinghouse locomotive type air compressor. The main pressure tank is located in the attic of the building, a 7½x24-ft. cylindrical steel tank, to which pressure is delivered from the pump through a 15-in. delivery main and stand pipe, while the auxiliary pressure tank, a 5x10-ft. vertical cylindrical steel tank, is located in the basement, at the foot of the stand pipe, and from this tank the delivery connections are made to the control valves of the elevator machines. The discharge tanks are horizontal cylindrical steel tanks, 6¾ ft. in diameter, one 16 ft. and the other 28 ft. in length, which are mounted on a structural steel platform 6½ ft. above the basement floor level, and into these the control valves discharge through independent grouped connections. The two tanks are interconnected by a 10-in. main, to which is attached a 7-in. line that is carried up alongside of the stand pipe to a point 68 ft. above the cellar floor level to an open discharge outlet, for the purpose of securing the desired back pressure effect. The pumps are located directly underneath the discharge tanks and consist of Davidson compound duplex pumps of the separable type, so that either unit may be worked to its full or half capacity, as required by the elevator service. The larger unit is a 16 and 30x14x24-in. pump, while the smaller unit has 12 and 22x10x24-in. cylinders. The jack pump which is located alongside of the freight elevator in the rear end of the building, and is used for that machine only, is a 10x5x12-in. Davidson simplex pump.

The heating system of the building has been entirely remodeled and converted into a low pressure system, operating with exhaust steam from the power plant and with a vacuum system of condensation return. The original system in the old building was of the high pressure type, using steam at about 10 to 12 lb. pressure, with small size mains and risers and gravity returns, so that the original basement piping was entirely unadapted for extensions, and a new basement distributing system was installed. This consists of a 10-in. header that extends longitudinally through the central portion of the basement and has a 9-in. extension into the front portion of the basement, to connect with certain portions of the original heating system which have been retained in the new plant, and an 8-in. extension into the new Frankfort street extension of the building, with numerous branch connections to nearby risers in the central portion. The header has a 14-in. supply connection from the exhaust main near its central point through a Webster oil separator, and has, in addition, a live steam make-up connection from the high pressure system consisting of a 6x10-in. Kieley reducing valve with by-pass. The supply connections to radiation throughout the building are made in the usual way through 43 wall risers which receive steam directly from the basement heating header

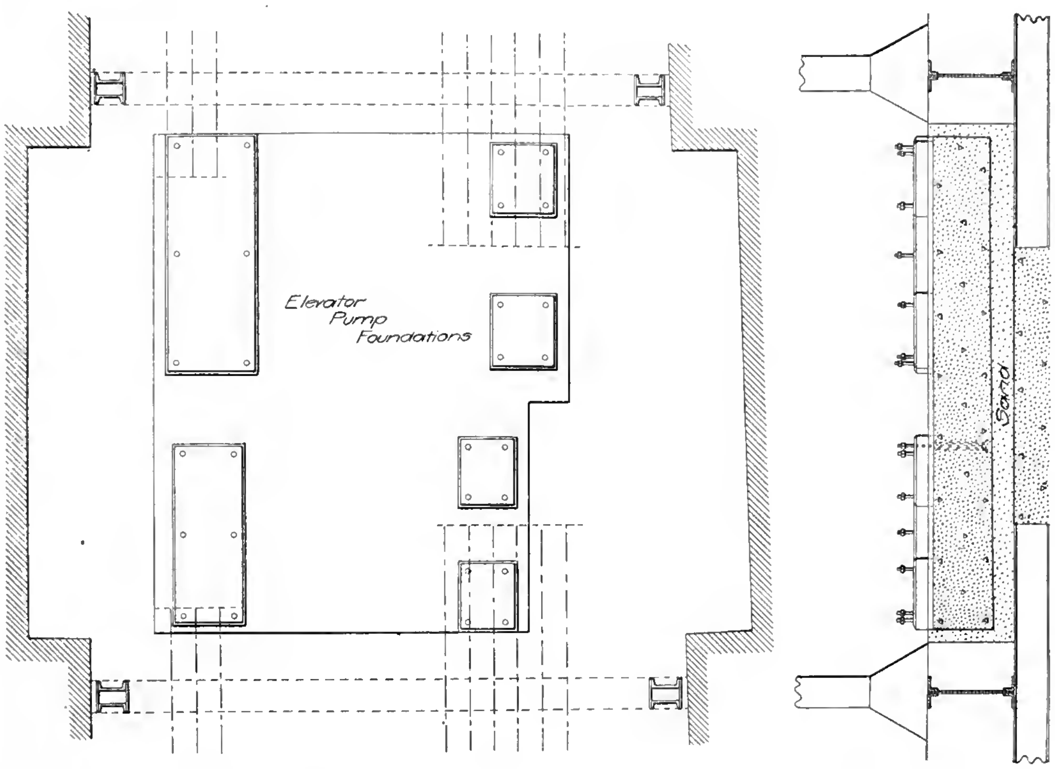
above referred to, and for the greater part are carried up to the top of the building, with anchorages to the building framework at the fourth and thirteenth floors, and expansion joints between at the eight or ninth floors. An exception to this arrangement occurs in the old Nassau St. front portion of the building, in which portion a minimum of building changes were made, and it was thought desirable to utilize the original small size risers that were used in the high pressure heating systetm; this was accomplished by running an overhead distributing main in a mezzanine space above the twelfth floor, in which are located the series of distributing and equalizing beams that carry the steel work of the new upper stories, and feeding from this main both into the new wall risers that are carried up to the new upper stories and also back down into the small old risers from the top. In this way the old risers, which were not disturbed and which are as small in some cases as ½ in. at the top, are successfully operated by feeding in at both top and bottom, in conjunction with the use of the vacuum system of returns. This distributing main above the twelfth floor is a 5-in. line, which is supplied by a direct 8-in. riser from the basement heating header, and from it 1 or 1½ in. connections are run to the tops of all of the old risers below, while the new risers above it are designed and connected in the usual manner. Condensation from the heating system is returned from the power plant by the Webster system of vacuum returns, return risers being run to parallel each of the steam supply risers throughout the building; these connect in the basement to a 3½-in. gathering main, which is in turn connected in the engine room through suction strainers to two vacuum pumps installed in duplicate. These pumps are Davidson 8x12x12-in. simplex pumps, which deliver the condensation first into an overhead separating tank, in which entrained air and vapor is allowed to escape, and from thence it is delivered into the feed water heater for return to the boilers. The total amount of radiation operated in the extended building is about 35,000 sq. ft., which is divided into about 1,000 heating units.

An interesting result of operation with the new plant has been obtained in a considerably reduced coal consumption. The fuel consumption of the old plant was, from records made for six months, from April 1 to October 1, approximately 1,815 short tons, in both 1903 and 1904, which amounts to a daily average consumption of 9.92 tons of pea anthracite during a period when 226 h.p. hours were produced on an average per 24 hours. On October 1 of this year a summary of the plant records for the same six months period indicates a total fuel consumption of 2,212 tons, or a daily average of but 2.16 tons, and this with the building increased to about three times its former size. The electric lighting and power load is now about 75 per cent. greater than before, while the total combined car travel of the present nine elevators is 2,030 ft., as compared with the combined rise of 360 ft. of the former three elevators in the original 10-story building, which indicates a power production on a much more economical basis—due, it is thought, to the use of compound engines and pumps and the operation with 125-lb. steam instead of 80-lb., as formerly.

In the installation of the power plant machinery in the central portion of the basement, difficulty was experienced in obtaining satisfactory foundations without interference with the grillages of the new building framework, and in order to prevent communication of disagreeable vibrations to the upper portions of the building, an interesting arrangement of sound-proof foundation construction was devised. As above stated, reinforcing framework was necessary in the rear portion of the building above the engine room, in order to carry the increased weight of the ten stories added, which consist of balanced columns carried up from new footings in the basement to the thirteenth floor without intermediate loading, at which point the weight of the new upper stories is distributed upon them by a system of equalizing girders. These columns, which were erected through the floors within the old building walls, are carried in pairs on distributing girders placed below the basement floor level, which rest on I-beam grillages that were set in excavations between the original building wall footings, in order not to disturb the original structure. The grillages consist of 15-in. I-beams 12 ft. in length, which are set longitudinally of the basement space, and as the distributing girders supported are but 20 to 24 ft. apart, it will be seen that very little space was afforded between grillages for foundation purposes. It was finally decided to locate the pump and engine foundations directly upon the grillages, taking such precautions as possible to prevent the communication of vibration from the reciprocating machinery to the upper portions of the building framework. For the latter purpose sand-bed insulation was used, there being 8-in. sand-beds provided underneath all foundations and 6-in. sand packed spaces between the edges of the foundation and any adjacent footings, beams or other building construction. This construction is shown in the accompanying detail of the elevator pump foundation, which was built in a single unit for both the larger and smaller separable compound pumps. In this case almost the entire space between adjacent distributing girders is occupied, the block of concrete overlapping the grillages on either side by nearly 4 ft. in either case.

In the construction of the foundations the spaces between the ends of the grillage beams were in all cases excavated to some distance and then concreted to an even surface, level with the tops of the grillage beams, and upon this the sand bed was placed, preparatory to the construction of the foundation blocks. The block was then constructed by erecting forms for the side and placing a water-proofing course over the sand-bed in order to prevent contact of the concrete with the sand and subsequent solidification of the latter. Upon completion, the forms were drawn at the sides and the spaces there packed with sand, the floor being finished directly across the side sand spaces. This construction was found successful, as no vibration is communicated to the upper floors, and this without sacrificing any of the stability of the foundations.

The design of the new mechanical and electrical equipment is due to Mr. Arthur S. Vincent, the mechanical engineer for the Tribune Association, under whose supervision the entire equipment was installed. The general contractors for the building reconstruction were D. C. Weeks & Sons, New York, while the heating and ventilating equipment was installed by Baker, Smith & Co., New York. The architects of the building were Messrs. D'Oench & Yost and L. Thouvard, New York.



Details of Sand Cushions Used for Machinery Foundations, Tribune Building, New York.

Trade Names for Malleable Cast Iron.

A trade misnomer relating to malleable cast-iron is mentioned by Prof. Bradley Stoughton in the "School of Mines Quarterly." On account of its fluidity such iron may be cast very cheaply in small sizes, and therefore the temptation to use it as a material for "cast-steel hammers," "hard-steel" bevel gears, "semi-steel castings," and even automobile "steel" drop-forgings, is a strong one. Engineers are warned to be on their guard against a deception of this kind, for legal redress has been sought many times in vain. A clever lawyer may easily confuse a judge or jury with the involved definitions and technical descriptions necessary to make the distinction clear. It is usual for the manufacturer when putting material of this kind upon the market to qualify the name "steel" with some other letter or name, such as "P. Q. steel"; but they all differ from true steel in that they were not "cast into an initially malleable mass." Some are made by melting a large proportion of steel with cast-iron, after which the cooled metal may or may not be annealed in iron oxide. Others are made by a long or thorough annealing of ordinary malleable castings in iron oxide, by means of which the metal is decarburized to some depth, and is then carburized again by a cementation process. This makes a very good material for some purposes, such as small bevel gears not requiring strength or much ducility, but it ought not to be called "steel."

A Large Coal-Storage Wharf at Superior, Wisconsin.

A coal-storage wharf, which has recently been placed in service at Superior, Wis., by the Berwind Fuel Co., is served by three electrically operated tramway bridges, for unloading coal from vessels and reloading it into railway cars, that are believed to be the largest and heaviest structures of this type thus far built on the Great Lakes. The site of the wharf is on St. Louis Bay, in the harbor of Duluth and Superior, adjacent to a number of other large coal-storage wharves, over which the immense coal traffic passing through Duluth and Superior is handled. This traffic reached a total of over 5,000,000 tons in 1906 and is increasing at a remarkable rate. Many of the large vessels which carry iron ore to the lower lake ports from the Messaba and Vermillion mining districts, northeast of Superior and Duluth, return with cargoes of coal. A small part of this coal is used locally, but a very large percentage of it is unloaded on wharves in Superior and transshipped by rail to the Northwestern part of the United States and Southwestern Canada.

The property on which the new wharf is located is 455 ft. wide and has a frontage of 2,700 ft. on a slip of that length, which has been dredged at nearly right angles to the dredged channel in the bay. The fuel company also owns two strips of land, one 75 ft. and the other 82.5 ft. wide, which extend from the wharf site to right-of-way of a belt-line railroad that connects with all the railroads entering Duluth and Superior. A portion of the wharf site, 1,500 ft. in length, at the shore end, has been developed as a coal-storage wharf during this year, making 682,500 sq. ft. of developed area, which should store 350,000 tons of coal. The remaining offshore undeveloped area covers 546,000 sq. ft., and when the wharf is extended over it the total storage capacity will be about 700,000 tons.

The water was from 4 to 8 ft. deep over all of the wharf site, except for a narrow strip at the shore end where the ground rose from 20 ft. above the level of the bay. The developed portion of the site that was inundated has been reclaimed by a fill confined by tight timber bulkheads; the high ground at the shore end has been cut down to the level of this fill; cuts have been made through the narrow strips of land extending from the shore end of the site to the belt-line railroad, and two tracks have been laid in each of these cuts to provide switching connections for the wharf. The three bridges for unloading coal from vessels in the slip and for rehandling it into cars on the railway tracks span the wharf and travel the full length of the developed area, reaching out also over vessels in the slip.

Wharf Construction.—The fill which was required to develop practically all of the wharf site was carried up 5.5 ft. above mean low water in the bay. It is confined on the slip side, where the minimum depth of water is 21 ft., by a timber crib, 1,500 ft. in length, which is of unusually heavy construction, as may be seen from the accompanying illustration showing the details of it. The crib is 18 ft. wide and 28 ft. high. The sides of the crib are each formed by a row of 12x12-in. timbers, in 12, 14 and 16 ft. or greater lengths, all thoroughly drift-bolted together. The row of timbers on the slip side also has 1x6-ft. battens over the joints between the timbers to prevent the fill from filtering through these joints. The cross bracing between the two sides of the crib consists of 10x12-in. timbers, placed transversely in vertical rows, the rows being spaced 8 ft. apart on centers, the timbers in the rows being 14 in. apart. Between each two of these vertical rows of cross braces are three pairs of 6x8-in. diagonal braces, the first pair 6 ft. from the top of the crib, the second 8 ft. below the first and the third 10 ft. below the second. The cross braces in each vertical row have 12x14x48-in. blocks between them on the slip side, and also 12x14x16-in. blocks at the middle. The crib is protected on the slip side by a row of round piles, 36 to 40 ft. long, which are placed 8 ft. apart on centers, alternating with the cross braces. These piles are blocked against the side of the crib and carry two 8x12-in. oak waling fenders. Above the waterline the crib is built of white pine and fir, and below that of hemlock.

After enough of the row of protection piles had been driven to permit work to be started on the crib the latter was built up in sections, 600 ft. long, directly over the site it was to occupy. These sections floated 6 to 8 ft. out of the water when finished. They were sunk and anchored in position by material placed in them by a dipper dredge. The bottom was previously prepared, where necessary, so each section settled into place evenly and to proper alignment.

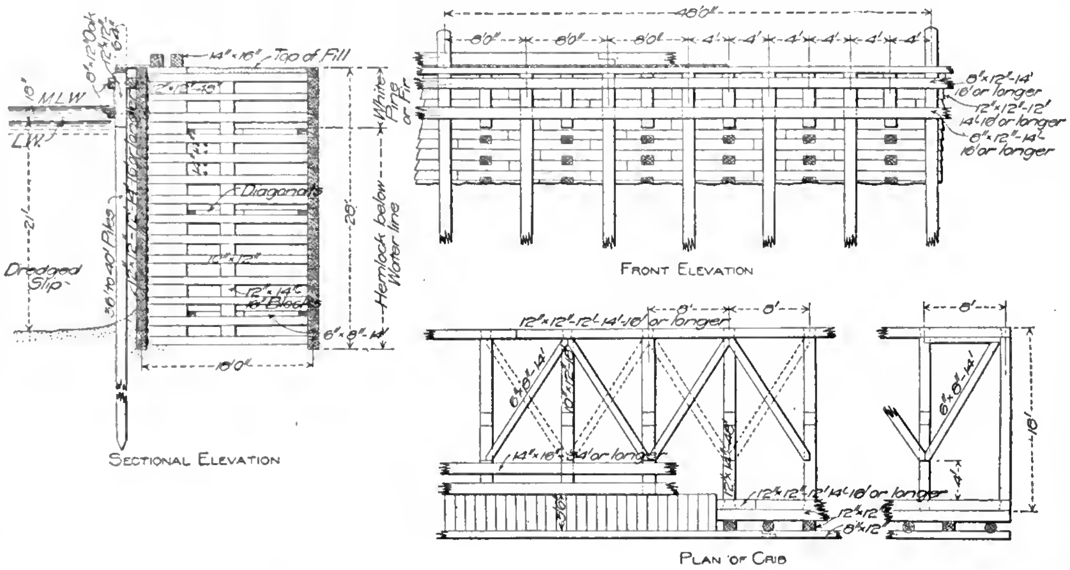
The water is 4 to 8 ft. deep on the side of the fill opposite from the slip. The fill is confined along that side by a sheet-pile bulkhead, 1,350 ft. long, which is continued along the off-shore end the full 455 ft. of the width of the wharf to a connection with the crib on the slip side. This bulkhead consists of a row of triple-lap Wakefield sheet-piling formed of 3x12-in. Norway pine in 16-ft. lengths. A row of round piles, 30 to 70 ft. long, is driven on the outside of the sheet piling as a brace and protection. These round piles are 3 ft. 10½ in. apart on centers for 250 ft. from the shore, and 2 ft. 3 in. apart on centers in the balance of the bulkhead. They are anchored to round piles, 20 to 30 ft. long, which are driven 16 ft. apart on centers in a row 50 ft. back in the fill from the row of protection piles.

The extremely heavy loads on the towers of the tramway bridges are carried by rows of heavy piling, thoroughly braced and capped. These piling foundations for the bridges are entirely independent of the crib and the sheet-piling which confine the wharf fill. They were driven ahead of the work on the fill and are cut off at the surface of the latter.

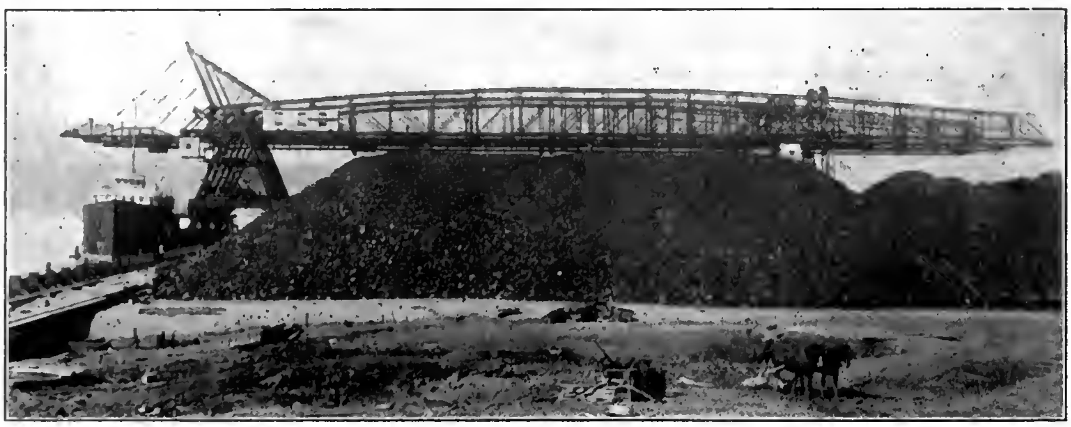
The crib and bulkhead work was done under contract by the Barnett & Record Co., of Minneapolis, Minn. The piling was driven with a hydraulic jet and a drop hammer.

The fill contains about 250,000 cu. yd. of material, 180,000 cu. yd. of which were pumped into the property by the hydraulic dredge "Enterprise." This dredge is owned and operated by the Duluth-Superior Dredging Co., of which Mr. Edward Clifford is president and was in charge of the operations. It is equipped with a 22-in. special centrifugal dredging pump, and has a 20-in. discharge line. The fill for the wharf was made by the dredge in a remarkably short time. When the Berwind Fuel Co. contemplated the construction of a wharf at the head of Lake Superior it was generally conceded by those conversant with such work in the locality that it was impossible to build a wharf of the projected size and fill it with sand in twelve months. At the time the contract for making the fill was awarded the dredge "Enterprise" was on the St. Lawrence River at Messena, N. Y., so had to be brought through the Welland Canal and up the Great Lakes. On account of the backward spring, which caused the Welland Canal to be two weeks late in opening, the dredge did not arrive until May 19, but was started in service on May 26 and practically completed the fill about August 15.

The remaining 70,000 cu. yd. of material in the fill, in addition to that supplied by the dredge, was obtained in cutting down the land at the shore end of the property and from the cuts



Details of Crib along the Slip Side of Coal Wharf.



View of Coal-Storage Space.

made through the narrow right-of-way strips for the railroad connections. Two steam shovels were installed to do most of the cutting, while some of the lighter work was done by grading machines. The material excavated by the shovels was hauled out on the fill in trains of dump cars running on narrow-gauge tracks. The grading machines were served by dump wagons in which the material was also carried out on the fill. This excavation was all made in a peculiarly difficult clay, which, when frozen, could scarcely be loosened in any quantity by blasting. The erection of the three traveling bridges and the other construction work also complicated the grading considerably, but the large amount of plant installed enabled it to be finished along with the other work.

Coal-Handling Equipment.—The coal-handling equipment consists of three traveling bridges, two screening towers and two locomotive cranes. Each traveling bridge is 506 ft. in length, from end to end, and is carried by two towers, one at the front, traveling along the slip, and the other toward the opposite end of the bridge, the clear span between the two towers being 295 ft. A section of each bridge, 64 ft. long, projects out over the slip from the front tower, and is hinged so it can be raised and lowered to permit the passage of boats with spars. The other end of the bridge is a fixed cantilever, extending 125 ft. beyond the tower leg toward that end. The front tower of the bridge has two legs, 35.5 ft. apart on centers. Each of these legs is carried by two narrow-gauge four-wheel trucks with double-flanged wheels running on rails laid on the heavy pile foundations. The other tower of the bridge is a shear leg, with two vertical posts each carried by a four-wheel truck. The following loads on these various trucks convey an impression of the size of the bridges: the total load per truck on the front leg of the front tower is 177,000 lb.; on the rear leg of this tower, 215,000 lb. per truck; and on the rear tower, or shear-leg, 336,000 lb. per truck.

Each bridge is equipped with a 3-ton clam-shell bucket carried by a trolley having an extreme travel, from end to end of the bridge, of 474 ft. These buckets are self-filling and will handle either bituminous or anthracite coal. Each bucket is arranged to handle coal in several ways. It will unload coal from the hold of a vessel in the slip and place it in storage piles between the two towers of the bridges; or in a hopper on the front tower of the bridge, from which cars on the switch track are loaded; or in the hopper of the screening tower under the cantilever end of the bridge beyond the shear leg. It will also handle coal from the storage piles into the reloading hopper, or into the hopper of the screening tower, and will convey screenings from the piles at the screening towers to either of these hoppers.

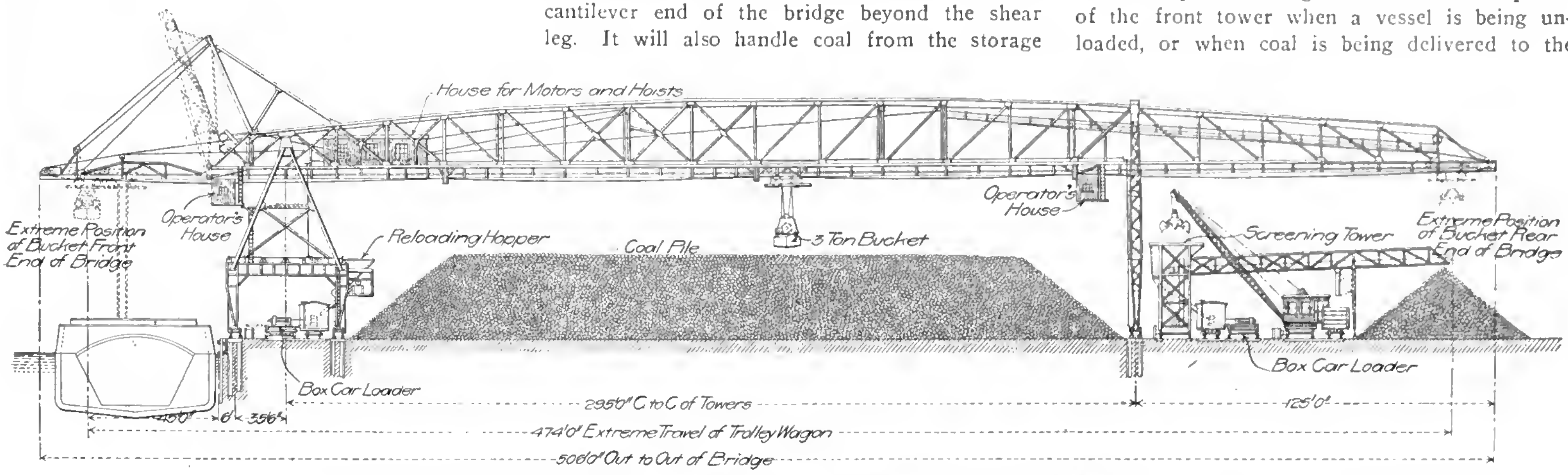
One of the salient features of the arrangement of the bridges and of the operation of the bucket carried by each of them is the provision of a hopper on the front tower through which run-of-mine coal may be loaded directly into railroad cars from the vessel. This hopper is so close to the slip that the bucket trolley is required to travel a very short distance, thus enabling a large unloading capacity to be maintained. The hopper is also built to handle large quantities of coal, and as a box-car loader is provided in connection with it, the cars can be filled from the hopper without delaying the operation of the bridge when the latter is working to full capacity.

The buckets have a guaranteed hoisting speed of 300 ft. per minute and a trolley travel of 1,000 ft. per minute. On an average of a round trip a minute and 3 tons per trip, the three bridges should handle 5,400 tons in 10 hr.

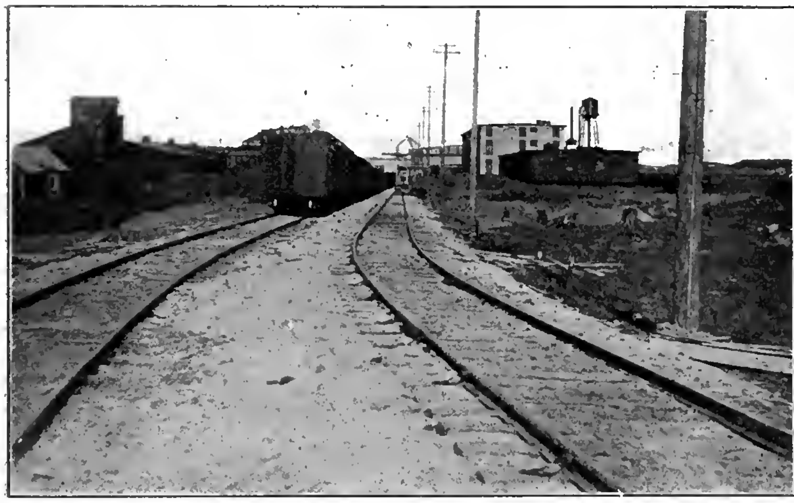
The buckets are each operated by an electric hoist, with its hoisting and holding drums controlled, respectively, by means of a hand brake and a friction clutch, the latter being shifted by a General Electric solenoid controller. The hoists are each driven by a 3-phase 25-cycle 440-volt 225-h.-p. General Electric alternating-current induction motor, which has double-reduction gearing to the hoisting and holding drums. The trolley carriage of the bucket is moved by a cable on a trolley drum driven by a 3-phase 25-cycle 440-volt 75-h.-p. General Electric alternating-current induction motor operated by a controller. The motor and hoists for each bridge are placed in a house on the bridge just in the rear of the front tower. The motor and friction clutch are arranged for remote control, the operator being in a cab on the slip side of the front tower when a vessel is being unloaded, or when coal is being delivered to the reloading hopper; and in a second cab at the shear leg when other operations are in progress.

The bridges are moved along the wharf at a speed of 50 ft. per minute by means of a 75-h.-p. General Electric alternating-current induction motor, connected to the axles of the track wheels on the front and rear towers by cast-steel gears. These motors are also arranged for remote control from either of the operator's cabs.

The two screening towers are self-propelled, and are entirely independent of all other coal-handling equipment. They are built of structural steel, each having an overhead conveyor carried by a four-leg tower at one end by shear leg near the other end. This tower and the shear leg are on wheels traveling on rails laid on the wharf. The tower carries a loading hopper and a screening pocket. The screens in this pocket are arranged with interchangeable bars, which permit practically any grade of coal to be prepared with each tower. The screenings are dropped into a hopper which deposits them on a traveling belt-conveyor, and are delivered by this conveyor to storage piles under the extreme end of the bridges, where they can be



Elevation of Coal Handling Equipment at Superior, Wis.



West Right of Way Showing Full Length of Leads.

East Right of Way Showing about Half of Leads.

reached by the 3-ton bucket carried by each of the latter. The screenings can also be dumped from the conveyor directly into cars on a track under the bridge of the screening tower. Each screening tower is designed to handle 4,000 tons of coal in 10 hr., and can be used in connection with the traveling bridges, or with either of the two locomotive cranes, which travel on a track under the bridges of the screening towers. These locomotive cranes are intended to be used exclusively for loading commercial coal when the traveling bridges are unloading a vessel, or are otherwise engaged. They are thus expected to preclude the chief objection previously made to a large traveling bridge, namely, when unloading any particular grade of coal from a vessel it was impossible to load out another grade without taking the bridge from the vessel.

Most of the coal is shipped to the Northwest from Superior and Duluth in box cars. Two portable box-car loading machines, each driven by a 100-h.-p. General Electric motor, are used in loading the cars. One of these machines travels on a track parallel with the track which serves the hopper of the screening towers; the other is on a track on the opposite side of the wharf next to the track for cars supplied from the reloading hoppers on the front towers of the bridges.

The electric power to operate the various coal-handling equipment is delivered to the dock as 25-cycle 3-phase alternating current at 13,200 volts, by the Great Northern Power Co. of Duluth. The current is received in a fireproof transformer house containing three General Electric 3-phase oil-cooled 500-kw. transformers for stepping the current from 13,200 volts down to 440 volts. Each transformer has four 2½ per cent. primary taps and two 4 per cent. secondary taps. A five-panel switch-board is also provided in the transformer house. One panel of this board, which is equipped with indicating and recording instruments, is for the high-tension incoming line. An automatically motor-operated oil switch for this line is placed in concrete cells. A multiplex lightning arrester is also provided for the high-tension line. The other four panels of the board are each for a feeder circuit, each panel being equipped with an ammeter, a circuit breaker and a main-line switch.

The following four buildings were also erected in connection with the dock: a machine shop, equipped with a traveling crane, planers, lathes, drill presses and forges, permitting all necessary repairs to the equipment to be made in this shop; a store house, equipped with a traveling crane of sufficient capacity to handle any piece of machinery or extra parts for the dock equipment; an office and service building, divided into two parts, one for the necessary accounting, and the other for toilet, running water and comforts for the laborers; and an oil storage house, isolated from the remainder of the buildings. All of these buildings and the transformer house are thoroughly fireproof, having brick side walls and book-tile roofs; the machine shop also has a steel frame.

The contract for the three traveling bridges, the two screening towers and the two locomotive cranes was awarded to the Dodge Coal Storage Co. of Philadelphia. Coal was unloaded from the steamer Joe S. Morrow by all three bridges on August 13, two days prior to the date originally contemplated. The wharf and all of the equipment were practically complete at that time, six months after the contract was awarded. The early completion of the work was largely due to the efforts of Mr. C. J. A. Morris, of St. Paul, Minn., who was appointed chief engineer of the project for the Berwind Fuel Co., and personally supervised the construction from its inception. The structural steel work was all fabricated and erected under a sub-contract by the Morava Construction Co., of Chicago, which company completed the work in contract time, although erection was not commenced until April 23.

This journal is indebted to Mr. F. G. Hartwell, president of the Berwind Fuel Co., for permission to visit the wharf and collect the data from which these notes have been prepared.

Macadam Roads in King County, Wash.

A short resume of the principles and methods of macadam road construction and the cost of a number of roads, formed the subject of a paper by Mr. A. L. Valentine, county engineer of King County, Wash., before the last convention of the Pacific Northwest Society of Engineers, Seattle. The paper was printed in the September, 1907, issue of the proceedings of the Society, from which these notes have been taken.

The broken stone used in King County is graded into three sizes, No. 1 passing a 3-in. ring, No. 2 a 1½-in. ring, and No. 3, which contains all the dust of fracture, including stone passing a ½-in. screen The bottom course of the road is made of No. 1 stone, and the course of No. 2 contains only a sufficient quantity of stone to fill the voids of the lower course. Experience in King County has shown that an allowance of one-third of the desired thickness of the completed roadbed is necessary in the loose stone, to allow for shrinkage in rolling, so that 9 in. of loose stone are used where a completed bed of 6 in. is desired. The work is started at the end farthest from the source of supply, so that in the earlier stages of construction there will be no traffic to form wheel ruts in the first and second courses, which may be easily injured even though they have been rolled.

The costs and quantities which follow are given by Mr. Valentine for macadam roads in King County.

One road 6,600 ft. long, with 16-ft. stone bed 6 in. deep, contained, including turn-outs, 12,006 sq. yd. Total number of cubic yards used was 3,048. In this instance one cubic yard covered 3.93 sq. yd. The proportion of stone was 66 per cent. of No. 1, 25 per cent. of No. 2, and 9 per cent dust. The cost per square yard was as follows: Stone, 0.44427 cents; rolling, 0.03823 cents; sprinkling, 0.01388; spreading, 0.04043; hauling, 0.08536; total cost, 0.62217 cents. Adding 25 per cent. for contractor's profit, gives 0.7777 cents per square yard, or a cost per mile of $7,300 for the stone bed only. This represents the cost after the roadbed had been shaped and was ready to be rolled. The stone was delivered at station 24, making the greatest haul 4,200 ft., station 0 being the beginning.

Another section of road, 4,800 ft. long, was constructed during the wet season and contained 1,869 cu. yd., used in the following proportions: Seventy-eight per cent. No. 1, 18 per cent. No. 2 and 4 per cent. dust. It will be noted there is considerable difference in the quantity one course bears to the other, as compared with the previous figures. This difference is caused by using just enough of course No. 2 and the binder to fill the voids. Taking the number of cubic yards actually used (1,869), and at the rate for carload lots, delivered, $1.75 f. o. b. cars, we have the following costs per square yard: Stone, 0.381 cents; rolling and sprinkling, 0.084 cents; hauling and spreading, 0.166 cents; total cost, 0.631 cents. This cost represents a maximum haul of 4,260 ft. in one direction and 3,700 ft. in the other, the stone being delivered on the road between these points. In this instance, one cubic yard of stone covered 4¼ sq. yd.

This also includes the following labor cost: Foreman, $4.00; rollerman, $3.50; spreadermen, $3.00 and $3.50, and teams at $7.00 per day of ten hours. No superintendence, interest on money invested or contractor's profit is added. Adding a contractor's profit of 25 per cent. we would have 0.788 cents, or a cost per mile of $7,400, for the stone bed only.

Another road exactly one mile long was constructed during dry weather. The road had been built two years and was but 10 ft. wide, with a 6-in. stone bed. It had been entirely covered with water during floods, and the roadbed exposed to the wash of the river current. This washed away the binder and softened the bed so that it was badly rutted. Owing to these conditions it was considered best to increase the width to 16 ft. This meant an increase in the crown and practically an entirely new road, both as regards quantity of material and labor. The entire bed was scarified by hand; that is, laborers were employed at $3.00 per day of ten hours to pick up the stone bed before the first course was spread. This cost would about offset the cost of rolling the sub-grade of a new road, so that the item of sub-grade rolling shows in the summary of cost, but is really included in spreading and scarifying, and the cost of rolling is reduced in that proportion.

The total number of cubic yards of stone used was 1,792, in the following proportions: 72 per cent. No. 1, 22 per cent. No. 2 and 6 per cent dust. The longest haul was 3,970 ft., the stone being delivered at stations 39 plus 70 and hauled each way; that is, to stations 0 and 52 plus 80. Cost of stone delivered f. o. b. cars at station 39 plus 70 was $1.75 per cubic yard; wages of foreman, $4.00; rollerman, $3.50; teams, $7.00, and laborers, $3.00 and $3.50 per day of ten hours; cost of water, 15 cents per tank of 600 gal.; coal for roller at $6.50 per ton. The cost per square yard was as follows: Rolling, 0.0333 cents; sprinkling, 0.0269 cents; hauling, sprinkling, spreading, 0.1695 cents; stone, 0.3340 cents; total cost, 0.5637 cents. Adding 10 per cent. to cover shrinkage and incidentals necessary on a new road on an ordinary foundation, or $5,820.59 for one mile, and 25 per cent. for contractor's profit, we would have 0.770 cents per square yard, or $7,275 per mile.

On this road there was used 1,792 cu. yd. of stone. Had it been an ordinary foundation, allowing one-third for shrinkage, we would have used 2,080 cu. yd. One tank of water covered 64 sq. yds., or 9.33 gal. covered one square yard. figuring each tank at 600 gal. One ton of coal was sufficient for rolling 383 sq. yd. Each cubic yard of stone covered 5.23 sq. yd.

From these figures it appears safe to estimate the stone bed at 80 cents per square yard, or $7,500 the mile, haul not exceeding 4,200 ft. and stone costing $1.75 per cubic yard.

THE NEW SHIPBUILDING PLANT of Yarrow & Co., Ltd., on the river Clyde, is now nearing completion, the buildings being finished, though much of the machinery is not installed. The plant is entirely new and when in full operation the old works on the Thames will be closed, the reason for the removal being the high cost of coal, material, property and labor at the latter point. The new works will be operated almost entirely by electric, hydraulic and pneumatic systems, the pumps and compressors being motor driven. Several unusual features are introduced, notably the installation on each machine in the shops of a gas jet in addition to the regular electric lights. The firm's experience, according to "The Engineer," London, is that workmen, on the whole, work under better conditions as to light and general convenience with gas than with incandescent or arc lamps. Another unusual feature is the use of bare copper wiring in the shops wherever it can be safely used.

Experimental Purification of Boston Sewage.

The Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology was founded in 1902 by an anonymous donor for the purpose of making experiments upon improved methods of sewage disposal, especially those adapted to large cities. A large part of the work of the staff has been devoted to the study of the more purely scientific problems, chemical, bacteriological, and hydraulic, which underlie the practice of sewage analysis and sewage purification. These has been carried on, however, along with these theoretical investigations, an experimental study of the immediate local problems of sewage disposal as seem likely some day to confront the city of Boston, and on November 15 a paper on this study and some deductions from it was presented to the Sanitary Section of the Boston Society of Civil Engineers by Messrs. C. E. A. Winslow and E. B. Phelps. An abstract of this paper follows:

The sewage of the metropolitan district of Boston is at present discharged untreated into the waters of the harbor at three different points. The main outfall sewer of the North district carries some 50,000,000 gal. daily and discharges continually off Deer Island. The sewage from the High Level district passed out to Peddock's Island, near the southeastern limit of the harbor; this amounts to about 20,000,000 gal. The main outfall of the south metropolitan district is at Moon Island, nearer the center of the harbor, and here the sewage is stored in masonry tanks and discharged only on the turn of the tide. The daily flow in this sewer is in the neighborhood of 100,000,000 gal. The Massachusetts State Board of Health investigated the condition of Boston harbor in 1905, and found no serious damage from this method of disposal. The town of Wellesley has, however, recently been refused admittance to the metropolitan system from fear of overtaxing the purifying power of the harbor; and it can scarcely be doubted that the progressive increase of population within the drainage district itself will ultimately bring the problem of sewage purification to the fore. The present agitation in regard to the pollution of New York harbor, under somewhat similar conditions, is an indication of what must some day be expected in Boston.

Under these circumstances it is important to form a general idea beforehand of what a proper purification of Boston sewage will involve; and the investigations at the Technology Station have reached a point at which this can approximately be determined. The detailed results of the work will shortly be published in full in the "Technology Quarterly." The general conclusions, as reported to the Sanitary Section of the Boston Society of Civil Engineers, are as follows:

Trickling Beds.—The main result of this investigation has been to show the feasibility of treating Boston sewage on trickling beds so as to secure organic stability. In the experiments conducted, the filters were operated at a rate of about 2,000,000 gal. per acre per day, which would call for 50 acres of stone beds for the treatment of the sewage now discharged at Moon Island. A comparison with the problem of constructing 133 acres of contact beds, or 1,000 acres of sand beds which would be necessary for other processes, indicates clearly that for this city the trickling bed offers the most practical method of treatment.

It has been found that with good distribution, a trickling bed 8 ft. deep will operate successfully at all seasons, under local weather conditions. It removes about half the soluble organic matter, yielding an effluent which is somewhat turbid, but stable and well oxygenated. The organic matter present has been so worked over and purified by the bacteria in the filter as to be non-putrescible. Judged by the methylene-blue reduction test, 90 per cent. of the samples of the effluent are of such stability as to undergo no putrefactive change when kept closed up from the air for four days. Under ordinary conditions of discharge into open water such an effluent would be entirely unobjectionable.

The proper distribution on trickling beds can be attained either by the use of fixed sprinkler heads of the Columbus type, so arranged as to discharge intermittently at frequent intervals, or by the use of the splashing gravity distributors designed at the experimental station for this purpose.

With good distribution the trickling beds show no appreciable tendency to clog. During the greater part of the year solid matter accumulates on the surface of the stones throughout the bed, but when this storage reaches a certain point, usually in the early spring, the solids break away and come off in the effluent in a stable condition. In a period covering two years, the total amount of solid matter coming off balanced that going on. The filtering material at the end of the experiments was in excellent condition and showed no storage of nitrogen.

The results point strongly to the advantage of operating trickling beds under conditions as uniform as possible. Resting periods proved distinctly detrimental to the work of the beds, and constant operation is recommended rather than any process which involves alternate working and resting periods.

Septic Tanks.—It appears from the experiments that Boston sewage may be treated in the septic tank with excellent results, and that a period of 7 hours is a sufficiently long one. Thus operated, an open tank will remove 40 per cent. of the total suspended solids and 60 per cent. of the fixed suspended solids; its effluent shows a decrease of about 25 per cent. in organic nitrogen in solution and a corresponding increase in free ammonia. The septic action on the stored solids is an active one, four-fifths of the organic solids deposited disappearing in solution or as gas. Fixed solids gradually accumulate so as to render it probable that tanks would require cleaning about once in two years.

On the whole, however, the experiments indicate that the septic tank need not be used at all in the treatment of Boston sewage. Since November, 1906, when the distribution system was put in order, crude sewage has been treated on one of the trickling beds with perfect success. On the whole, the effluent from this filter was less frequently putrescible than that from the bed which received septic effluent. Furthermore, the filter taking septic effluent showed a deposit on its floor, due to secondary reducing changes, which was absent from the crude sewage bed. In addition, the absence of the odors produced by spraying septic sewage is an advantage of considerable moment in favor of the process of treating fresh sewage. Combined with the saving of the cost of tanks, in the neighborhood of $250,000, these argments seem to indicate the treatment of crude sewage directly on trickling beds as most desirable. Modern devices for ensuring a thorough preliminary screening should, however, be installed.

Sedimentation of Trickling Effluents.—The suspended solids which appear in the trickling effluent, though inoffensive, are unsightly and in many locations might require removal. By a sedimentation of two hours it has been found possible to remove about half the suspended solids. This clarification was accompanied by an improvement in stability.

In the case of Boston, the currents of the harbor would be amply competent to care for the solid matter discharged if that matter were of an inoffensive and non-putrescible nature. Experience with the system at present in use has indicated this quite clearly. For a comparatively slight improvement in stability, it does not appear justifiable to go to the expense of installing secondary sedimentation tanks. The sludge accumulating in such tanks would amount to 2 or 3 cu. yd. per million gallons of effluent, a serious problem in itself. It is therefore considered by Messrs. Winslow and Phelps that the effluent from the trickling beds may best be discharged directly into the harbor as it comes from the beds. A stable effluent under such conditions could cause no nuisance and if a submerged discharge were provided its presence would scarcely be detected.

Disinfection of Trickling Effluent.—The problem of bacterial purification still remains to be considered, since the trickling bed produces organic stability without destroying pathogenic bacteria. In the case of Boston harbor, with its large contiguous population, its bathers, and its shellfish industry, this aspect is an important one. The experiments carried out during the last two years have made it clear that the effluents from trickling beds may be so purified bacterially by disinfection with chloride of lime as to be of much better quality than the present stream entering Boston harbor. This bacterial purification requires about five parts of available chloride per million gallons and the cost of treatment would be within moderate limits.

The process of disinfection with chloride can be applied to crude sewage, as well as to trickling effluent, although experiments carried out at the station indicate that about double the amount of chloride is needed on account of the reducing action of the organic matter in the sewage. Pending the construction of a trickling filter plant for the treatment of the organic matter in Boston sewage, it might well be purified bacterially by this process at the present Moon Island outfall.

General Plan for Treatment.—The sewage outfall of the South metropolitan district at Moon Island is the one which threatens most seriously to menace the purity of Boston harbor; and it is this sewage which will certainly first require some different method of treatment. Messrs. Winslow and Phelps have therefore considered in a general way the practical problem of dealing with this sewage in the light of the results of their experiments.

The most convenient location for a trickling filter area would be at the Calf Pasture in Dorchester, near the present pumping station. This is objectionable, however, on account of its proximity to the thickly settled portion of Dorchester. Furthermore, the necessity for excavating about 10 feet of mud and refilling in its place would greatly increase the cost of construction at this point. The same objections apply to certain waste areas on the Neponset marshes which suggested themselves as possibly available. The headland of Squantum would offer an ideal opportunity for building trickling beds, but the difficulties of obtaining land in another town militate against the use of this site.

The southern portion of Thompson's Island would furnish a location free from all the objections to which the other sites are open. On an embankment 1,500 ft. long the sewage could be carried from Squantum across to the island, the effluent flowing back along the same embankment to the existing outfall sewer. The pumping station at Dorchester and the tanks and outlet at Moon Island could thus be used without substantial changes. Preliminary estimates of the cost of building 50 acres of trickling beds, 8 feet deep and equipped with the gravity distribution system, including the embankment with its two sewers, an efficient grit chamber, a reasonable purchase price for the necessary land, grading, stone filling brought to the island by water, con-

crete construction, and sprinklers, are in the neighborhood of $1,800,000.

If this capital sum were borrowed at 5 per cent. on a 25-year loan, the annual expense for interest and sinking fund would be $126,800 a year, paying off the entire cost in the 25 year period. As a matter of fact, the authors of the paper see no reason to suppose that at the end of this time the plant would not be good for another 25 years without substantial reconstruction. The cost of operation, including extra pumping and supervision would amount to $70,000 a year, bringing the total cost to about $200,000 a year, or $5.50 per million gallons of sewage treated.

The effluent from the trickling beds, wherever situated, could be further bacterially purified by disinfection with chloride of lime, at a cost of approximately $1.50 per million gallons, or $55,000 annually.

Pending the construction of filters for the removal of putrescible organic matter from Boston sewage, if it should seem desirable to secure bacterial purification, this may be effected by direct treatment of the crude sewage with chloride of lime, which could probably be done for $3.00 per million gallons, or $110,000 annually.

Experiments are now in progress at the Experiment Station to test the practicability of higher rates of filtration and shallower beds than those used in the experiments on which these calculations are based, as well as on the treatment of sewage and effluents by electrolytically produced chloride. It it hoped that these experiments may lead to a material reduction in the estimated cost of the purification processes. It seems clear, however, that the combination of trickling filters and chemical disinfection will solve the Boston sewage problem satisfactorily; and in the light of present knowledge these two methods are the most efficient and economical available for the purpose.

Book Notes.

A little pamphlet which will prove particularly useful to mill architects and others who use tin roofs to a considerable extent has just been issued by the joint committee on tin plates of the National Association of Master Sheet Metal Workers of the United States. The pamphlet gives a brief history of tin roofing, discusses its advantages, and then gives an excellent set of standard specifications, well illustrated, prepared by the trustees of the association after long study for the purpose of indicating the best method of securing the highest grade of material and workmanship in such roofs. There are also practical hints regarding methods of carrying on construction, published for the benefit of contractors. Copies of this pamphlet may be obtained by addressing the president of the Association, Mr. E. L. Seabrook, 2,213 Chestnut St., Philadelphia, Pa.

A second edition of "Tables for Engineering Calculations," which has recently been brought out by Mr. Richard C. Powell, is a revision and amplification of a hand-book which he compiled with Mr. Wm. E. Hawley some years ago. The new edition is about twice the size of the first and contains additional tables which the experience of the author and the criticisms of other engineers have indicated to be useful. The section on hydraulics has been compiled in large part by Professor LeConte, of the University of California, while the tables of rolled steel sections have been furnished by the Cambria Steel Co. The book is likely to be particularly useful to engineers engaged in hydraulic power work. About half of the book is made up of natural and common logarithms of numbers and trigonometrical functions, functions of natural numbers, an excellent collection of conversion factors, and other mathematical tables and formulas. The remainder is made up of information relating to the strength of materials, the properties of steam, and electrical and hydraulic data. Special care has been taken to arrange this information in a handy shape, and to check it to avoid errors. The object of the author has apparently been to bring together in a compact form the tables and formulas likely to be of general use in the office of a designing engineer, and to leave for the reference library such rules and tables as are required but rarely. (Berkeley, Cal., R. C. Powell, $2.00.)

A good many readers of The Engineering Record are probably aware that the French methods of designing walls, dams and barrages have received much study by specialists. A well-written presentation of the current opinions in that country on this subject will be found in the volume on "Barrages en Maconneric et Murs de Reservoirs," by Mr. H. Bellet, an engineer whose visit to this country about eighteen months ago will be recalled by a number of readers. The author first takes up the general problem of calculating the cross-section of a masonry dam and in the second chapter there is a brief discussion of the advantages and drawbacks of dams of different materials. Seven chapters are then devoted to a historical review of masonry dam design, beginning with the early works in Spain and France and then taking up in detail the profiles planned by eminent French engineers and carried out in one or more structures. This portion of the book is equally explicit regarding theory and actual construction, and will be found of particular interest to those who desire to become acquainted with the views that have been developed in France. Next there is an elaborate theoretical analysis of dams both straight and curved in plan, in which the author refers to similar work done by other French engineers and thus rounds out his own analysis in a comprehensive manner. This theoretical study is followed by a description of a large number of structures, mostly European, but including some American examples and a few from Great Britain. The practical design of dams is next taken up and attention is given to those features of design and construction not previously discussed. The volume closes with the regulations of the French government controlling the construction of dams and demonstrations of a number of the more important formulas in the work. It is unnecessary to critically review the mathematical work of the author in this volume, as it follows very largely the accepted French practice. Design of masonry dams of considerable height in France is based rather more completely on methematical analysis than is the custom in the United States, and for this reason the volume under review will be found a particularly interesting one. (Grenoble, France, A. Gratier & J. Rey, 8.25 francs.)

Letters to the Editor.

Sheet Piling and Earth Pressure.

Sir: In your discussion on Nov. 16 of the paper by Mr. J. C. Meem on "The Bracing of Trenches and Tunnels, with Practical Formulas for Earth Pressures," it seems to me that you have misunderstood his views in two points. You state that in the case of dry, sandy material he would employ "the generally accepted theory of earth pressure, the law of whose variation with the depth below the surface is similar to that of liquid pressure." As a matter of fact, Mr. Meem's paper does not admit at any time that earth and aqueous pressures are allied, although it agrees with the common theory of hydrostatic pressures in saturated soils. The opinion of the author of the paper also seems to be that the drier the sand the more it tends to wedge itself between the sheeting and the natural slope line and throw a series of arches to hold itself up. This also applies to the "internal cohesion" of the particles. It will be noticed that the author does not make much use of this arch action, except as increasing the factor of safety, but depends on the tightness of the sheeting and bracing to hold the upper masses of material in place while working below. Of course, there must be a theoretical movement, which gives what the author terms "external coherence" by tending to produce the wedging action above mentioned.

It seems to me that the theory of Mr. Meem gives results more in harmony with observed conditions than the older theories based upon assumed conditions in the earth that very rarely, if ever, exist. It is directly at variance with the theories of high authorities, approved by long use, but why should it not be accepted if it accords best with those conditions observed in practical work? Foundations.

Garbage Reduction in Toledo.

Sir: Referring to Mr. Cook's interesting article in your issue of Oct. 12, on the "Garbage Reduction Process at Toledo," I beg to suggest that, instead of saying "the garbage at Toledo, Ohio, is treated by the reduction process, etc.," you should change this to the past tense. Mr. Cook comments upon the commercial aspect of garbage reduction by mentioning the fact that a receiver had to be appointed to take charge of the company's affairs; but concerning the sanitary aspect of the system it may be of further interest to your readers to know that, in spite of the elaborate precautions which were taken to prevent offense from the workings of the plant, it was enjoined by the courts as a nuisance and went out of commission last July, since which time the city has returned to the primeval method of dumping garbage on farm lands.

When the city entered into this reduction contract (some three years ago), it looked as if it were a very favorable arrangement, as the reduction company agreed to receive and dispose of the garbage free of charge. But, owing to the fact that the reduction system was to be employed, it was found impossible to find an advantageous location for the plant, which was finally built so far from the center of production that the average cost of hauling the garbage to it has been, I am told, about $1.30 per ton; in contrast with which other cities have found it possible to conduct centrally-located incinerating plants at a less cost per ton, including both the collection of the garbage and its final destruction by a process which also enables the city to dispose of combustible rubbish, waste paper, etc., which a reduction plant cannot receive.

In my opinion, it is to the principle of destroying municipal refuse by fire that we must look for a satisfactory solution of this knotty problem, at least in all except our very largest cities, which still show some possible promise of producing organic garbage in sufficient quantities to cover the heavy expense and depreciation incidental to a reduction plant, when all conditions are distinctly favorable.

Yours very truly,

Toledo, Nov. 19. George V. Rhines.

Graphic Solution of a Problem in Hydraulics.

Sir: In a recent test in the Engineering Department of the University of Montana it was necessary to determine beforehand the exact distance to one-hundredth of an inch that a wooden ball, as shown in the sketch, would sink when placed in a measuring tank, as the gauge attachments for measuring the outflow of water were connected to this float. The ball was carefully designed and trued up to a 4-in. radius. The material of which it was made was wood found to have a specific gravity of 0.62. The dis-

tance z to which the sphere will sink when placed in water will be such that the exact weight of the displaced water will just equal the weight of the wooden sphere. The solution of this, however, leads to a cubic equation and a method of attack was then sought for that did not involve higher mathematics. The method as shown in detail will be found useful not only in solving any cubic equation, but, in fact, an equation of any degree whatsoever.

Let r be the radius of the sphere, which is 4 in.; w will be the weight per cubic foot of water, W be the weight per cubic foot of wood, and s be the specific gravity of the wood, which is 0.62.

The volume of a segment of a sphere of depth z is $\pi\ (rz^2 - \frac{1}{3}z^3)$. The volume of a sphere is $\frac{4}{3}\pi r^3$.

Since the weight of the sphere is equal to the weight of the displaced water, $\pi\ (rz^2 - \frac{1}{3}z^3)\ w = \frac{4}{3}\pi r^3 W$.

Clearing fractions and cancelling $z^3 - 3\ rz^2 + 4\ r^3\ s = 0$.

Substituting our particular values for r and s we have the following cubic equation:

$$z^3 - 12\ z^2 + 158.72 = 0.$$

The easiest way and the way that is sufficiently accurate for handling equations of this sort and of higher degree is to divide the equation into two parts, thus:

$$z^3 = 12\ z^2 - 158.72 \ldots\ldots\ldots\ldots\ldots \text{I.}$$
$$-y_1 = z^3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{II.}$$
$$y_2 = 12\ z^2 - 158.72 \ldots\ldots\ldots\ldots \text{III.}$$

Now it is easily seen by looking at equation I that if we find a value of y_1 that makes equation II reduce to zero and an equal value of y_2 that makes equation III reduce to zero, this value when substituted in equation I will make it also reduce to zero. In other words this is one of the values of z we are looking for. In the diagram the two equations II and III have been plotted to the same scale with values of y as ordinates and z as abscissas. Now by looking carefully at the plot, we see that the two curves cross each other at three places. Hence each one of these values is a solution of equation I.

Scaling these off we find: $z_1 = -3.23$, $z_2 = +4.65$, and $z_3 = +10.58$.

As a check that these values are correct their sum should be equal to the second term in equa- I which is +12. As the sum of the above three values gives +12 we conclude that they are correct as far as they have been carried out, since there are no exact roots in the above equation.

The only possible value for our float is thus seen to be 4.65 in.

Robert Sibley.

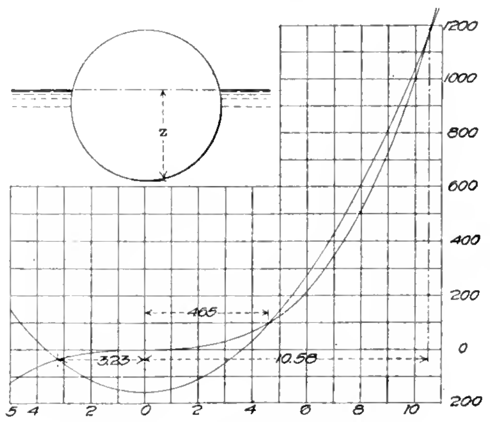
Missoula, Mont.

Treating Wood Paving Blocks.

Sir: In the paper on "Requirements for Treating Wood Paving Blocks" in your issue of Nov. 16 I find several valuable suggestions on a matter which, at this particular time, is attracting considerable attention in New York City, and I would like to add a trifle on this subject and also to correct a statement which appears in the paper to the effect that Brooklyn is using, or has used recently, the specification which is referred to in the table showing the comparative requirements of several cities as to class of timber used, treatment, etc.

Early in 1906 I found this Brooklyn specification for wood block, as quoted, in vogue. It was, I believe, Mr. Tillson's own specification, having been compiled for the borough in 1903. This old specification I promptly concluded to be defective, in that (1) No provision was made for seasoning timber for paving blocks; (2) "All heart" long leaf pine was required, which was not procurable except with great waste of material in cutting blocks; (3) In allowing no other class of timber to be used in competition with this high-priced timber; (4) In calling for treatment of unseasoned blocks with an antiseptic waterproofing mixture, of which 50 per cent. might be creosote of uncertain quality or specific gravity; (5) In using in this mixture 50 per cent. of resin, which is more costly than creosote and not of equal value as a preservative; (6) In allowing a variation of only one inch in the length of the blocks, thus adding to the cost and waste in cutting from merchantable timber and in allowing blocks as thin as 2½ in., which would tend to warp and check under traffic; (7) In making no provision for waterproofing the joints; (8) In bedding the blocks on an unstable mortar bed, composed of only one part of cement to four parts of sand; (9) In providing a concrete base only 4 in. in thickness.

In taking this matter up in Brooklyn I advocated the use of Southern black gum as a cheap alternative for long leaf yellow pine, and urged as a substitute for a light or volatile creosote oil a heavier creosote oil unmixed with resin, advocating also a waterproof joint between the blocks, which were to be laid on a thoroughly mixed and richer mortar bed, carried on at least



Solution of Hydraulic Problem.

5 in. of concrete as a minimum foundation, and I had the department chemist conduct tests of the heavy creosote oils so as to determine their value and permanency as a substitute for the lighter oils and resin called for in the old specification. Through my efforts in this direction, with the co-operation of Mr. Tillson, a specification was compiled in 1906, which has been in print for some time, containing the following requirements for wood paving blocks:

1. Well seasoned timber of long leaf pine, Southern black gum or tamarac.

2. An allowance of 10 per cent. for maximum volume of sap wood in blocks (which restriction should not, however, be applied to the black gum).

3. No blocks shorter than 6 in. or longer than 8 in., and no variation from the depth of the block or the width, so as to secure an even surface and close transverse joints throughout.

4. A straight creosote of 1.12 specific gravity at 68 deg. F., of which not less than 20 lb. to the cubic foot of timber is required.

5. A maximum absorption by a treated block of 3 per cent. when dried at 100 deg. F. in a ventilating oven for 24 hours. (This requirement, as Mr. Tillson says, is a valuable test.)

6. No burden on the contractor for cost of inspection at the works, the city to assume this expense directly.

7. A strong mortar bed of one part of cement to two and a half parts of screened sand, all carried on a 5-in. concrete base.

The comparison with the so-called Brooklyn specification seems unfair, as it had been obsolete for more than a year.

After many inspections of pavements of this class and visits to several block plants, it would seem that the defects in wood block pavements as produced to-day for the several boroughs of New York City are due in a great measure to the lack of selection and seasoning of the timber before treatment and to the steaming and softening of the fiber under a continuous high temperature, to which the raw block is treated under what the old Manhattan Borough specifications peculiarly designated as "dry heat, i. e.:

"In preparing the blocks to receive the creosote mixture they shall be placed in an air-tight cylinder, in which dry heat, or heat produced by superheated steam, is maintained and raised to a temperature of 215° Fahr., for one hour, for the purpose of expelling moisture; the heat is then to be increased until it has reached 285° Fahr., this heat being maintained for a period of three hours, or until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour, or until the same has been reduced to 250°.

Some instructive tests on railroad ties and samples therefrom, conducted under Mr. Pinchot of the U. S. Forestry Service, indicate that in wood block treatment as practised by several of our producers to-day, where high temperatures are maintained in the impregnating cylinder carrying the green blocks, the great amount of comparative free water carried in the blocks gives a soaking or steam treatment for this long period of five hours, which has a permanent and deleterious effect upon the fiber. It must in effect be practically a steam treatment.

At the Yale Forest School this deterioration in strength of the timber has been noted, and it is found that if "the steam process has not been excessive" subsequent seasoning by a drying process will restore the greater part of the strength of the timber lost by the high steam treatment.

In the tests also of the Forest Service at the Louisiana Purchase Exposition it was found, with the original strength of loblolly pine ties taken at 100, the strength after 10 lb. steam pressure for a period of four hours, was reduced to 89 lb., and with 100 lb. steam pressure for four hours it was reduced to 41 lb. The increase in strength of seasoned or kiln-dried timbers is too well known to need comment. Re-soaking with water lowers the seasoned timber to a very material extent, but on thorough soaking with creosote the strength is but slightly reduced.

I note these features and the need of getting some more definite information on this subject than is at the present time at hand, and believe that radical changes will shortly ensue in the process of manufacture of city paving blocks. What we require is a thoroughly seasoned, thoroughly sterilized and waterproofed block of high compressive strength, but not too smooth on the end of fiber, with low cost as a first and last requirement.

I am of the opinion that Southern black gum will fill fairly well the need for competition against high-priced long leaf pine and greatly reduce the cost, with good results in durability on the street. Yellow pine specifications must be adapted to this new timber as to the amount of heart or sap, and as the specific gravity is less a properly treated block may not sink in water. Anything more than 20 lb. of heavy oil would seem to be an extravagant treatment, except for very heavy traffic streets, and some less expensive and perhaps inactive filler might be found as a substitute for resin, to be mixed with heavy creosote oil.

In some averages taken by me at the works, comparatively green long leaf pine and black gum timber, said to have been cut three months and exposed to dry weather, showed weights per cubic foot respectively of 51 and 59 lb. These

weights would be reduced in the pine from 51 lb. to perhaps 43 or 44 lb. and in the gum from 50 lb to about 38 lb. if blocks were actually seasoned before injection of the creosote. Tests we now have under way will shortly throw more light on the comparative weights of (1) green, (2) steamed and vacuum drawn, and (3) treated blocks.

A wise move has been made by the Municipal Engineers in an attempt to establish uniform highway practice throughout the city, several engineers of the boroughs acting ex-officio on this committee, and it is hoped that a thoroughly practical standard specification will be given out during this winter for the coming season, which will be alike beneficial to the city and to the manufacturer, in settling several vexing questions as to the necessary seasoning for raw timbers before treatment—as to the amount of resin, if any, and the quantity and quality of creosote oils necessary for the several classes of timber suitable for paving blocks.

Respectfully, R. W. CREUZBAUR,
Consulting Engineer of Public Works.

BROOKLYN, NOV. 20.

HYDRAULIC DIAGRAM FOR CIRCULAR PIPES.

SIR: In the accompanying diagarm, the results of the Hazen-Williams formula for flow in pipes, $v = c\ r^{0.63}\ s^{0.54}\ 0.001^{-0.04}$ are represented graphically. It is the writer's opinion that a properly prepared diagram has decided advantages over tables or even slide rules specially made for the formula. The relations of the discharge, slope, diameter and velocity are presented in the diagram instantly and clearly: and the effect of a modification of one of the factors on the values of the other factors is readily obtained.

In the above formula, c is a constant, the value of which is dependent on the character of the material of the pipe or conduit, and is independent of the mean hydraulic radius and the slope. It is, therefore, different from c in Kutter's modification of Chezy's formula. The other symbols of the formula are the same as in Chezy's formula; v = velocity in feet per second, r = mean hydraulic radius, and s = sine of slope.

A few problems will be given to illustrate the uses of the diagram. These will be followed by a brief discussion of the method of plotting the equation. Along the horizontal line, the grade of the pipe is given in percentages or in feet drop per 100 ft. of distance, along the vertical line the discharge for pipes flowing full is given in cubic feet per second; one set of inclined lines gives the diameter of the pipe; the other set gives the velocity in feet per second.

The diagram is based on a value of c equal to 100, and values of c for different kinds of material are given in the accompanying table. Judgment is required in the selection of the proper value of c.

TABLE OF VALUES OF c IN HAZEN-WILLIAMS FORMULA.

Class of pipe	c
Very best cast iron pipe	140
Good new cast iron pipe	130
Tuberculated cast iron pipe	80 to 110
New riveted steel pipe	110
Lead, brass, tin and glass pipe	120 to 140
Smooth wooden pipe	120
Brick sewers	100
Vitrified pipe	110
Smooth, clean masonry	140
Slime-coated masonry	130
Ordinary good masonry	120

It is required, for example, to find the size of a brick sewer flowing full for a discharge of 250 cu. ft. per second and a grade of 0.55 per cent. In this case $c = 100$. The intersection of an interpolated line of 0.55 per cent. grade with a 250 discharge line gives a diameter of about 5 ft. 8 in., and a velocity of 9.8 ft. per second.

What is the size of a vitrified pipe for a discharge of 45 cu. ft. per second flowing full at an 0.8 per cent. grade? In this case $c = 110$. It is evident that a smaller size than the one obtained from the diagram for 45 cu. ft. per second will suffice. Divide 45 by 110/100 and 41 will be obtained. Using 41 instead of 45 for the discharge in the diagram and a grade of 0.8 per cent., a diameter of 2.7 ft. and a velocity of 7.5 ft. per second will be obtained. The nearest commercial size of vitrified pipe would, of course, be used. The velocity 7.5 is to be multiplied by 1.1, for the real discharge is 45 and not 41. The velocity will, therefore, be 8.25 ft. per second.

A 6-ft. circular masonry conduit of ordinary good work at a grade of 0.3 per cent. is to discharge into three cast-iron pipes, two of which are to be of the same size, determine the sizes of the cast-iron pipes. For the masonry conduit $c = 120$, and for the cast-iron pipe $c = 130$. The discharge through the masonry conduit flowing full is $210 \times 1.2 = 252$ cu. ft. per second. The discharge through one 42-in. cast-iron pipe at a 0.4 per cent. grade is $60 \times 1.3 = 78$ cu. ft. per second; and through a 48-in. at the same grade, the discharge is $83 \times 1.3 = 108$. Therefore, two 41-in. pipes and one 48-in. will give a discharge of 264 cu. ft. per second. This combination of cast-iron pipes will more than take care of the flow from the masonry conduit.

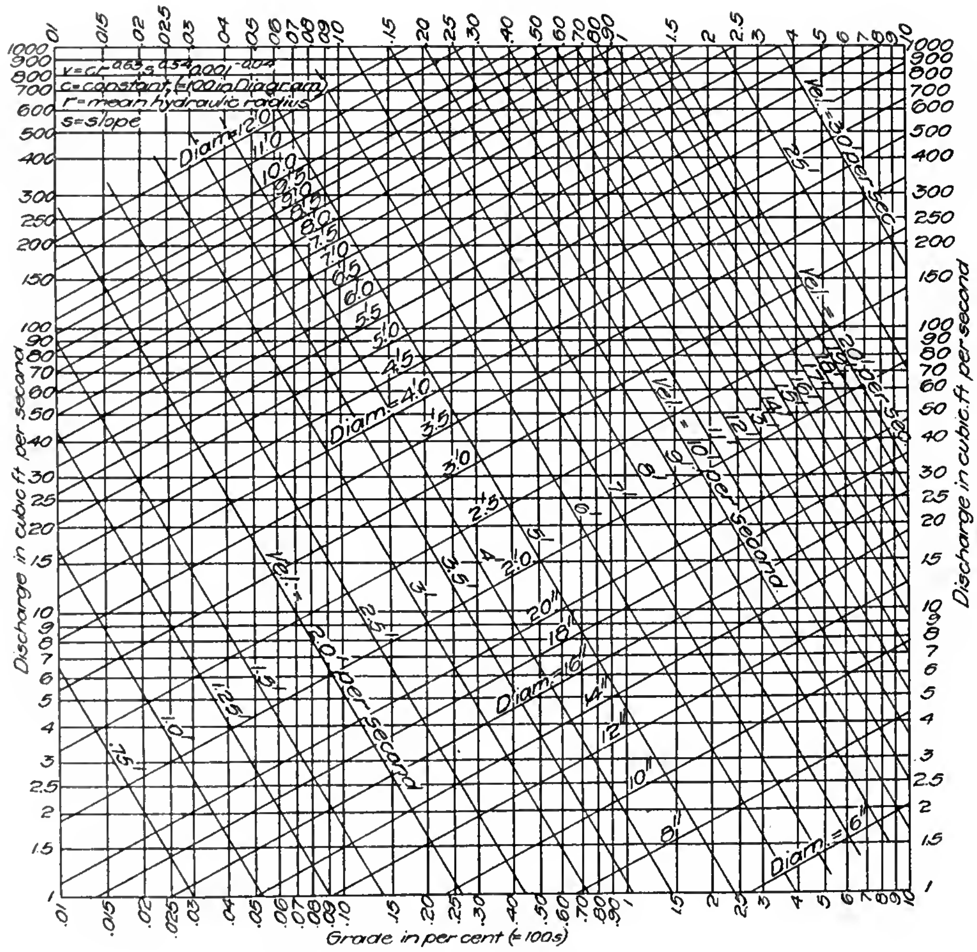
It will be noticed that the Hazen-Williams formula is exponential in form and lends itself readily to logarithmic computations. Advantage has been taken of this to employ logarithmic cross-sectioning for the diagram so that all lines will be straight and in parallel groups.

Multiplying the velocity v by the area A of the conduit in square feet, the discharge Q will be obtained in cubic feet per second. It is to be remembered, that the mean hydraulic radius r equals one-fourth of the diameter D of a circular pipe. $A = \frac{1}{4}\pi D^2$, $r = \frac{1}{4} D$, $Q = Av = \frac{1}{4}\pi \times 0.001^{-0.04}\ 0.25^{0.63}\ c\ D^{2.63}\ s^{0.54}$ in which D is given in feet.

The above equation reduced becomes, with $c = 100$, $Q = 43.23\ D^{2.63}\ s^{0.54}$. The logarithmic form of this equation $\log Q = 1.63580 \times 2.63 \log D + 0.54 \log s$.

This equation is linear in form. If, therefore, cross-section paper be ruled to a logarithmic scale in the same manner as the ordinary slide rule is divided, the relation between Q and s on this kind of ruling will be a straight line for any diameter. To obtain the straight line for $D = 3$ ft., substitute this value of D in the logarithmic equation, and compute two sets of values for Q and s. Plot these points on the logarithmic cross-section paper and connect them by a straight line. This line is the 3-ft. diameter line.

For instance, $\log 3 = 0.47712$ and $\log Q = 2.89063 + 0.54 \log s$.



Discharge of Round Cast-Iron Pipes.

For $s = .0001$; $\log s = -4$.
$\log Q = 0.73063$; $Q = 5.38$.
For $s = 0.10$; $\log s = -1$.
$\log Q = 2.35063$; $Q = 224$.

Plot the points ($s = .0001$, $Q = 5.38$) and (.10, 224) and connect them by a straight line to obtain the line for a diameter of 3 ft. The other lines can be obtained in the same manner. It will be noticed that all these lines should be parallel.

The velocity lines can be obtained in a similar manner from an equation giving the relation of Q, v, and s. Or the diameter lines can be used to obtain the velocity lines by help of the relation $Q = Av$. The velocity lines will also be parallel to each other.

Very truly,
SAMUEL D. BLEICH.

NEW YORK, NOV. 16.

[Similar diagrams giving the discharge in gallons were printed in The Engineering Record of June 20, 1903.]

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TABLE OF LEADING ARTICLES.

The Abuse of Cost Data.

A contractor of many years' experience on large work, whose father and grandfather before him had also been contractors, recently declared publicly that if a man could prognosticate accurately the cost of proposed construction undertakings, that man could command remuneration which would soon make him a prince even among the very wealthy. In the same connection it was also affirmed by more than one man of wide experience that it was absolutely impossible for any man to tell the cost of any large proposed engineering work until it was completed, and even then it was not always possible to determine the cost accurately in detail. Such statements doubtless will at once excite the interrogatory convolution of the brain of many a younger member of the profession, and of some also who can count some score of years since first they carried the rod. In these days there is a growing tendency in some quarters to place dependence upon cost analysis methods and records of cost data, to an unwarranted degree.

As a commentary upon methods of making estimates for proposed civil engineering works the testimony presented at hearings concerning the Ashokan dam contract now in progress in New York City has more than passing interest. As explained in some detail last week in The Engineering Record, this contract was awarded on the basis of unit prices and the engineers' estimated quantities to a bidder whose tender was about two and a third million dollars higher than the lowest bid. Although within the clearly prescribed power of the Board and by no means an unprecedented act in principle, the award elicited criticism from local newspapers, and in course of time the investigation now progressing was instituted by the Commissioners of Accounts. Investigations are an inevitable and necessary feature of public affairs, and their value in showing good as well as bad administration is important, provided the examination is a fair one. That the present investigation of the Board of Water Supply is proceeding along questionable lines seems to be the opinion of those who have attended the meetings and do not judge the testimony from the incomplete newspaper reports solely.

The engineers of the Board believe that the lowest bid was much below the reasonable probable cost of the work, and the investigation practically hinges on the value to be placed on their judgment. The Board held that the low tender of the lowest bidder and its inexperience in the class of work covered by the contract, consisting largely of rolled earth embankments for large dams, was deemed sufficient reason for the award made to a higher bidder, for records of many cases under similar circumstances showed that delay, additional expense and much other trouble had resulted from giving the contract to the lowest of all the responsible bidders. The construction of the dams within the time stipulated in the contract is highly important, because the additional water is urgently needed by the city. The president of the company which made the lowest bid, who was abroad at the time of the bidding, subsequently stated that he believed his tender was too low, but his engineer stood by his figures and testified that he estimated there would be something over two million dollars gross profits.

Quite naturally the technical features of the controversy hinge upon the ability of engineers and contractors to estimate with some degree of accuracy the cost of large works extending over a period of years; there may be political considerations back of the investigation that have not yet been made public. The three engineers hired by the Commissioners of Accounts to help them in the investigation are strong advocates of the cost-analysis method of estimating. On the contrary, the chief engineer of the Board testified that he believed published cost data, with their usual meagre statements of conditions, were exceedingly unreliable bases for important estimates. For work like that under discussion, he could make a safe estimate only by exercise of judgment trained by his long experience in this class of work, guided by a knowledge of the total unit costs of the most important items, gained from completed works with which he had been personally connected or with which he had intimate knowledge. He further testified that he had made many estimates of the cost of work in this way which had been closely confirmed by the actual total cost of the work when completed.

According to testimony during the investigation, the lowest bidder's estimate seems to have been made by one engineer and to have been merely reviewed by two other persons, one of whom checked it by aid of published cost data. In sharp contrast were the methods of the second bidder to whom the contract was given. Great care was exercised to have the work studied thoroughly, but quite independently, by several members of the associated concerns and their engineers, one of whom was specially retained for this purpose. On the fourth day prior to the date for receiving bids by the Water Board, a meeting of these parties was held and six independent bids submitted to the president of the company, just as if he were to award the contract. All of these bids were higher than the bid finally submitted to the Board. Then followed a discussion, with very brief interruptions for sleep and food, lasting until the morning of the day for depositing the bids. The reduction made in the final bid, as compared with the preliminary estimates, was determined upon principally because the company had over a million dollars' worth of suitable plant immediately available. The successful bidders testified that they had used only records of cost of completed works done by themselves or with which they had been connected, comparable to the work in hand, and that even these records had been applied with very careful exercise of judgment after learning as much as possible of the conditions surrounding the proposed work.

Altogther much testimony of a very positive tone was given by men of great experience as engineers and contractors as to the great hazard in using published cost data or similar information borrowed from other persons unless one had thorough personal knowledge of the works to which the information referred. Only the contractor, except in rare cases, can know the total cost of completed undertakings, and he frequently does not keep sufficiently complete records to permit detailed analysis of unit costs. Much less can a young engineer or inspector, by occasional observations or daily force account records, get at the real cost of the items of any large work on which he may be engaged, although he has the closest personal contact with it. There are a number of elements of cost, large in the aggregate, that cannot be detected by such observation. Contractors bid on much work which they do not get; it frequently costs thousands of dollars to prepare a safe bid on a large undertaking. At least a small nucleus of an organization has to be kept constantly, whether there is much business or little in the office, for such men are selected largely for compatibility and other personal qualities and cannot be easily replaced. Interest on deferred payments and on investment in plant, insurance of men and plant, losses due to delays or failures of supply dealers, and accidents must all be covered. And there are many other elusive factors in the total cost. To these must be added the so-called general office and administration expenses of the particular work. In view of these facts, refined analysis of the cost of labor and materials for masonry or earth work, for example, when labor and materials constitute but fifty to seventy per cent. of the total, is of questionable service, since the remaining and large element of the price to be used in the bid or estimate is not susceptible of close determination and is inevitably a matter of judgment, in large part.

The gathering of information about the cost of engineering works in detail is to be encouraged, but the notes must contain very complete

statements of conditions if they are to be used for estimating the cost of proposed construction. The likelihood is that, after all, they will be safely useful only to the men connected with the work on which they were made. In many lines of manufacturing and in a few kinds of engineering, the cost in detail of the various processes or acts entering into the finished product can be determined, by suitable records, with all necessary accuracy; but the number of dips a minute a steam shovel can make may have very little to do with the rate of progress or the cost of a large job of excavating, and the number of feet a minute a steam roller can travel may have still less to do with the cost of a large rolled earth dam. Such information is useful for the suggestions it gives concerning methods of increasing the efficiency of a working force, but it should no more enter into estimates of the cost of great undertakings like the Ashokan dam and dykes than the cost of lead pencils should be considered in the expense of preparing the plans for such works.

Improved Waterways.

The cry that is going up from most parts of the country for improved waterways would indicate that there are a number of people who must have water on the brain. If the history of means of transportation teaches anything it is that waterways are unexpectedly costly to construct and peculiarly uncertain as to returns. Those who talk so glibly about constructing canals and improving rivers at the public expense in order to supply competition to railways, overlook the fact that the railway has one tremendous advantage. It can overcome grades and force itself across country in a way that no canal possibly can. The grades that are possible for a canal are necessarily flat, it is often extremely difficult to provide locks where they are most needed, and in some cases the problem of supplying enough water for navigation has itself proved an insuperable obstacle to construction. Then, again, when the waterway has been completed it is unsuited for handling anything but slow freight. It is out of the question to make fast time on such narrow channels; even if boats are put upon them which have the power to make good speed, the wash they set up is so great that the banks are severely injured. On wide rivers this condition does not exist, but there is a limit to speed there which is set by the necessity of providing enough cargo space to make the boat pay a profit. This condition has practically done away with the old river packet which made fast time, and it is only in a few localities, where the travel is large in volume and can be done at night, that boats can hold their own for transporting passengers in competition with railways. The internal waterways problem is, therefore, essentially one of transporting freight, and must be approached from this point of view.

A great deal has been said about the competition which waterways will offer to railroads. This really seems more theoretical than actual. The trunk line railroads to-day are hard pressed to handle their business, at least those lines which would be, in a sense, paralleled by improved waterways. If much more business comes to them they will have to spend enormous sums for further improvements. It seems to be the general belief among railway men at the present time that what is most needed is the improvement of existing facilities, more side tracks on single-track lines, better terminals, the elimination of dangerous grade crossings, improved rolling stock, and things of this nature. Such improvements will enable the roads to take care of all the high-grade freight requiring fast movement that is likely to come for some time. The increase in this kind of freight seems likely to be steady. If waterways can be constructed which will handle the low-rate bulk freight which is actually a burden on some roads, so much the better for the lines in question. Leading railway officers unquestionably express their full belief, without reservation, when they endorse reasonable projects for internal navigation improvements, as they have done with practical unanimity during recent years.

Although these internal waterways can be considered only as partial competitors of railroads, and their merits on that score are problematical, they nevertheless have such important advantages as to merit the attention they are receiving from those who are approaching the subject from a sane point of view. The construction of an improved waterway is like any other transportation problem. It is necessary to look far into the future, to estimate the growth of the population in all the regions tributary to this waterway, to forsee the character of the products which will be produced there and the nature of the goods which must be imported into this region. It is necessary to study the types of vessels which seem likely to be suited for carrying freight on the waterway. Finally, it is necessary to go into the cost of the proposed work in careful detail, in order that the expense of providing the waterway may be fully understood before any work is done. When a project is approached in this thorough manner, it becomes one of such complication that most of the advocates of improvements of this nature either lose heart or are contented to deal in mere generalities. Most of the agitation which is being conducted at the present time has reached this stage. It is now a matter of either hard work or hot air. The Engineering Record is a sufficient believer in the value of improved waterways to hope that hard work will be done. We really know very little, speaking generally, in this country, concerning the important details of improved waterways, vessels best suited to navigate them, and such technical matters. Whatever work of this sort is done should be conducted, in most cases, by the Government, and this journal believes that Congress would do well to give the Chief of Engineers, U. S. A., an ample appropriation for a thorough investigation of the problem. This would require capable assistants, some of whom would have to make careful studies in Europe, and it would entail several years of investigation. The importance of the result, however, fully warrants the expenditure. Without some such thorough investigation, we are all groping in the dark at the present time.

The Evolution of Interurban Lines.

The growth of electric interurban lines in the last ten years has been of the most extraordinary character. Starting as mere extensions of urban lines, the electric roads felt their way out into the suburbs and then, growing bolder, began to take up the work of ordinary railways. There has been no sudden creation of an interurban species; it has developed by orderly evolution into what it is. A road which went into operation about a month ago, the Milwaukee Northern, is an excellent example both of the resulting product and of the variations which, unless suppressed by natural selection, may form a further stage of the evolutionary process.

To begin with, the road has reached out northward from Milwaukee about 30 miles and extensions are in prospect that will carry this distance to more than 100 miles. The country thereabouts is, as everyone knows, rich in small cities and large towns capable of giving large local and through traffic, just such a country, in fact, as twenty years ago would have tempted the capitalist to the construction of another steam railway line. To-day the motive power is changed, but in other respects the work has gone on by the usual methods of railroading. In other words the time has come when, given the economic need for a railway, it is built up to the proper standards of construction and the motive power is chosen on its merits.

The Milwaukee Northern owns its right of way, save in passing through cities, and has put in a good straightforward piece of railway construction, differing in no essential features from the standards of the best steam railway practice. It has a solid, well-ballasted roadbed, laid with standard 70-lb. rails in the main, and has kept rigorously to low curvature and low grades. The day has past when electric railway builders went in for sharp curves and 10 per cent. grades just to show that the motor cars could negotiate them. There is, too, a general absence of grade crossings and all the difficulties they entail. The electric construction along the line presents nothing out of the ordinary.

The most striking feature of the road is its power station at Port Washington. It is the first considerable electric plant for railway purposes worked with gas engines and producer gas —indeed the only large one which relies solely on this source of power. The only other gas engine railway stations are the Warren & Jamestown plant and the auxiliary stations of the Boston Elevated Railway, and these are not only much smaller than the Port Washington station but are not essential features of the Boston system. Indeed, from all accounts, it is rather likely that the latter are considered unimportant, for, while fairly successful, it has been no small task to get them into working condition, and there are no symptoms of any increase in capacity of this particular kind. The Port Washington station has its experience yet to acquire, and it is to be hoped that it will be altogether satisfactory. The plant consists of three 1,000-kw. Allis-Chalmers generating sets, designed for a large over-load capacity.

The engines are of the twin tandem horizontal double-acting type, with an ultimate capacity of more than 2,000 h.-p. each. One of them was described in the Current New Supplement of this journal on Aug. 24 of this year. The cylinders are 32x42 in., and operate at 107 r.p.m. The engine frames are arranged for side cranks instead of double throw cranks, a plan very unusual for large gas engines. These engines are supplied with gas from two Loomis-Pettibone units, each including a pair of producers with their accessories and rated at 2,000 h.p. per unit. The coal employed is Hocking Valley bituminous slack, having a thermal value of about 11,500 B.t.u. per pound. The resulting gas as drawn from the holders is of about 125 B.t.u. It is claimed that the producing system delivers in the gas 80 per cent. of the thermal value of the coal. If this figure is substantiated, it puts the producer on a considerably higher plane than the steam boiler as a thermal intermediary between fuel and engine.

No details of engine performance are yet available. Experience with big gas engines in this country has been quite varied, but upon the whole fairly encouraging. The opinions of engineers are much divided, some holding that gas engines are the coming motive power and others that they are uneconomical unless waste gases are available. Abroad a good degree of success seems to have been the rule, and the number of installations now going in on our own side of the sea shows that confidence is not wholly lack-

ing here. Yet there is a singular lack of definite data from American practice, which gives one a certain feeling of insecurity. Recent steam turbine performances have come so near to the best gas engine figures for fuel consumption per kilowatt-hour as to leave very little room for difference in fixed charges and maintenance as against the gas engine. It is to be hoped that figures from this big new plant will soon be available to show whether the gas contingent has been able to peg up the record a notch.

The Milwaukee Northern is doing by electric traction and from a gas-driven generating plant the regular work of the older steam railroad, and so far as all appearances indicate it is doing it better. Certainly it is doing it better from the standpoint of the patron, since the highest cash fare is but 2 cents per mile and mileage books bring the rate down to 1.3 cents per mile. An interesting feature of the traffic situation is that under the franchise provisions the Milwaukee Northern is obliged to sell eight tickets for 25 cents, good within the city limits. Cash fares are 5 cents, as usual. Now the company runs its city cars about a mile beyond the city limits and it has promptly toed the mark by making these tickets good for the whole city-car service, which extends to 4.3 miles. This comes pretty near to a record low fare and it certainly is enough to give a steam railway man the cold shivers. Of course the proposition is not so formidable as it looks. There are at present but four strictly city cars in service and the through cars can be depended upon to show ample earnings. It has often been the experience on interurban lines that the near suburban and urban work amounts to very little, and on a road like the present, with a long run and good population along it, the lowered fare within the city should cut a comparatively small figure in the balance sheet. As far as American data go eight tickets for a quarter is a figure just too low to be practicable even for strictly city work. Fortunately the Milwaukee Northern is unlikely to suffer much from this cause and has ample traffic in sight.

Working Stresses for Long Span Bridges.

It has never been an easy matter to determine properly the greatest permissible unit stresses in the members of bridges and other structures of moderate spans and ordinary dimensions, to say nothing about those structures of such unusual magnitude as to make that determination still more difficult. The stresses in an ordinary bridge structure for any prescribed moving load are easy to determine with a high degree of accuracy, if the load be considered static, and it is easy to go still further and fix a reasonable allowance for shock or the assumed effect of a rapidly moving load. After having determined these stresses, however, the real difficulty begins. While we may assume the greatest permissible stress per square inch in the material for both tension and compression members, the rational defence of such stresses against reasonable criticism requires far more consideration than at first sight seems necessary.

In the early days of bridge building the greatest working stress was ostensibly one fifth of the ultimate resistance, but that was a technical fiction which quickly disappeared in favor of a so-called safety factor of four; and even this latter value has attached to it considerable doubt. In order that a fractional value of the ultimate resistance of a member of a structure may acquire significance, that ultimate resistance must be known. There has been almost an endless number of tests of eye-bar tension members, but almost none at all of steel compression members or columns. As a matter of fact, the tests of eye-bars, even those up to 15 in. in width, and of other tension pieces, have disclosed fairly full and accurate knowledge of this class of structural members, showing that one-fourth of their ultimate resisting capacity is generally materially less than the allowed working stress. This difference, however, is not of great importance, a sufficient margin of safety existing in any event, but the case is radically different when compression members, as well as some important details are involved. So much investigating attention has been devoted to the testing of tension members that it has been quite forgotten that we know comparatively little about the ultimate carrying capacity of both upper chord sections and intermediate and end posts of the ordinary truss bridge. The failure of the great compression members of the Quebec bridge has directed public attention so intensely to this whole matter of the carrying power of built columns that experimental investigation as to this particular feature of design is likely soon to develop results of the highest value. In the meantime, nobody actually knows what safety factor exists in the built columns of any railroad bridge, even of moderate span. It is reasonably certain that the actual carrying power of these members, instead of being four times the greatest load coming upon them, is somewhat less, and possibly it does not exceed three times the actual load carried in some cases.

While these observations are directly pertinent to short-span bridges they bear with special force on the design of long-span structures. This arises from a number of causes. In the first place, the magnitude of the members required for a great bridge truss so far exceeds that of the ordinary bridge member that it is an open question whether inferences as to actual carrying capacity can be accurately drawn from tests of small sections for the larger. It is generally assumed that such inferences may safely be drawn, and that process seems reasonable. At the same time every thoughtful engineer who has this duty to perform frequently reflects most seriously whether, after all, he is proceeding along lines which can be effectively defended. And this statement is made entirely without reference to the fact that the elastic and other physical properties of the thick metal and heavy shapes and plates of the long-span pieces justify materially less working stresses than the thinner and lighter sections of short-span structures. This latter consideration is probably never permitted to affect the value of long-span working stresses, although probably no test of full-size structural pieces ever failed to indicate its importance. If a testing machine of great capacity ever becomes available for tests of compression members of comparatively great area of section, the importance of this feature of heavy section design will be fully recognized.

On the other hand, it is obvious that the long-span structure is far less likely to receive frequently its full loading than the short-span bridges. This condition in itself justifies the use of higher working stresses than would be permissible for a bridge whose length is so short as to cause its maximum loading possibly many times a day. While this is clear enough, it is not sufficiently obvious just how far the influence of this condition may be permitted to reach.. This, like many other highly important engineering questions, must rest wholly upon the judgment of the responsible engineer. The prevailing practice in the past, both in completed structures and in the design of some great projects not actually executed, appears to indicate that no main piece of any long-span structure should, under any conditions of loading whatever, be stressed more than one-third of its ultimate carrying capacity. When the many exigencies of manufacture, erection and use after completion are kept in view, such a limit certainly does not provide more than reasonable safety. When it is further reflected that engineers at the present day really possess little exact knowledge of the actual carrying capacity of one of the great classes of bridge members, the danger of adopting a working stress of but little less than half what may reasonably be anticipated to be the ultimate resistance can be appreciated, especially when one large element of the moving load is entirely neglected. Some fundamentals of long-span working stresses require most careful consideration and re-statement, and there is need of further experimental investigation as to the carrying capacity of large compression members.

The New York Subway report, which Mr. B. J. Arnold submitted to the Public Service Commission, is a particularly interesting document to the engineer. The subway trains are now jammed full of people during rush hours, and from time to time assertions are made that this crush is due to defective engineering work in designing the road or to negligence of the operating company to run enough trains of enough cars to handle the traffic. When the Public Service Commission assumed office and first investigated subway conditions, it decided that more cars were needed and directed the Interborough officials to buy them. When it was discovered that the company had already ordered these cars some months before the Commission was appointed, the latter body recognized that the problem was a pretty big one. It accordingly determined to supplement the advice of its own engineers with the counsel of Mr. Arnold, whose long study of intricate transportation problems in Chicago made him particularly fitted for such duties. In his preliminary report, printed on another page of this issue, he has nothing but praise for the subway and its operation, a decision to be expected but none the less gratifying as the judgment of a well-qualified critic never before connected with the enterprise in any way. The subway has almost reached the limits of its capacity, and the problem of carrying more people in it is one of policy and not of engineering. This journal believes that very rarely has an engineer so concisely and clearly demonstrated such a condition. If more people are to be carried, it will be necessary to reduce the number of seats, make more people stand in the cars, and manage the crowds on the station platforms more strictly. The Public Service Commission must accordingly make a serious decision itself, the responsibility for which cannot be delegated to its engineers. It is gratifying to see such a problem put directly into the hands of that body. But the main lesson of the report is that New York greatly needs more rapid transit lines, a fact reiterated many times by those familiar with transportation in the city. The tremendous cost of these roads is such that the city cannot well finance them for some years with its other great obligations, while no terms yet proposed by the city will attract private capital. The problem is a serious one to those who are obliged to struggle to and from their work in the present packed cars, and if the city cannot afford relief it would be wise to allow private capital to build at least one line even if the terms are not so favorable to the city as the municipal authorities desire. The necessities of the public should receive some consideration in discussions of such a complicated problem. At present the crowds on the trains are so great as to offend every sense of public decency.

Main Locomotive Shop, Missouri, Kansas & Texas Ry., Parsons, Kan.

SOME ENGINEERING FEATURES OF THE PARSONS SHOPS OF THE MISSOURI, KANSAS & TEXAS RY.

The Missouri, Kansas & Texas Ry. operates over 3,000 miles of track from St. Louis and Kansas City to an important Gulf terminal at Galveston. The company has over 20,000 cars and between 600 and 700 locomotives, the greater part of which is good equipment. Its maintenance is conducted at two small shops in Texas, at the Sedalia car shops and at the locomotive repair shops at Parsons, Kan., a city favorably located for division headquarters of the lines north of Texas. The old shops there became entirely inadequate for their work, and an entire reorganization of plant and methods was ordered. It was decided to locate the new shops on a 30-acre triangular tract close to the old site, so that when the latter was abandoned, the buildings could be utilized to a certain extent at least for car repairs.

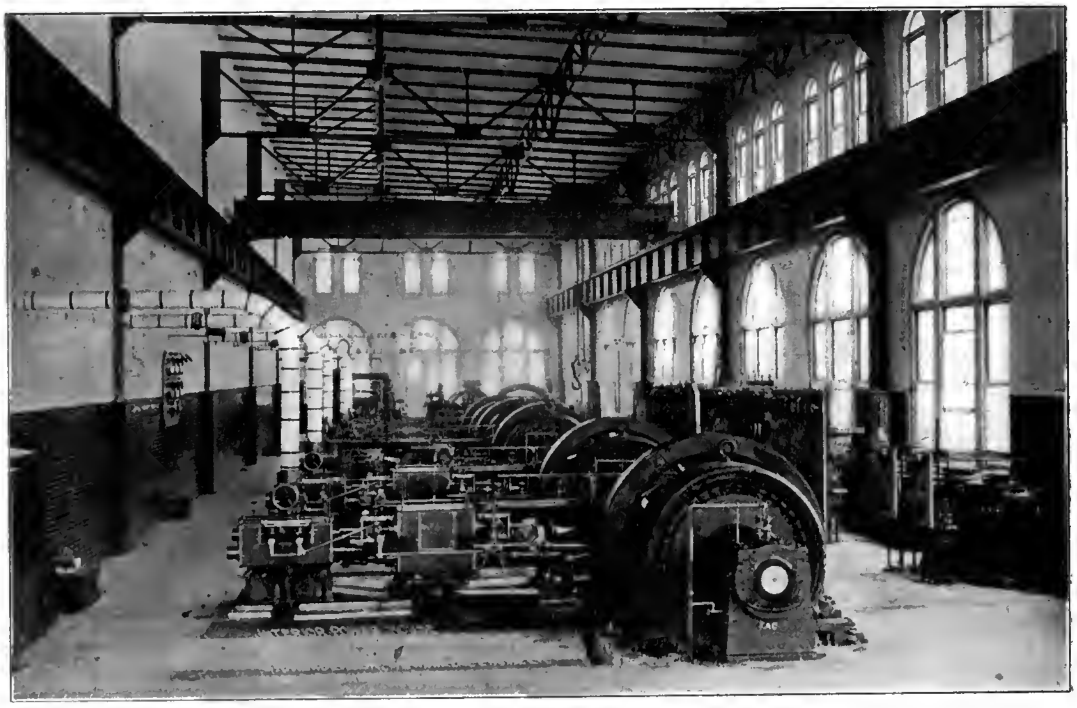
The shops provide for the maintenance of all locomotives of the lines north of Texas and also for a limited amount of manufacturing for other departments, together with ample provisions for considerable future growth. There are now operated on these lines between 350 and 400 locomotives, a considerable portion of which are large heavy-powered engines. The repair-work schedule on which the shops were designed provides for a general overhauling of approximately one complete engine per day, together with a considerable amount of manufacturing and auxiliary work. It was decided that this can be accomplished most efficiently in a single large shop building for the dismantling and erecting of both engines and tenders and also for all machine shop work, while a separate building is used for the blacksmith work. The longitudinal pit-track type of erecting shop was chosen as best adapted to the available yard lay-out and best suited to the character of the work to be handled. The improvement scheme does not include a reorganization for the present of the car repair shops of the northern lines, which are located at Sedalia, Mo., but the new organization and power scheme will permit the addition of large car shops without change.

The large main building is a steel structure 860 ft. long with a 78-ft. center bay and two side bays 153 ft. 9 in wide. The blacksmith shop is a 100x250-ft. steel structure, the power house is 84x215 ft., and the store house and office building, 60x150 ft. There are several small auxiliary buildings, a 500,000-gal. 50x150-ft. water storage reservoir, and a group of fuel oil tanks. The space actually occupied by the entire shop group is 450x1,300 ft. over all, which is exceptionally small for a plant of this capacity. The longitudinal track arrangement of the main shop simplifies the yard lay-out considerably, the total length of yard track devoted to shop purposes amounting to only a little over 3,000 ft.

Fire Protection.—The building layout has been studied with considerable care for fire-protection and provisions made for dealing with a fire very effectively before the city fire apparatus arrives. Direct pressure in the mains is furnished by pumps in the power house drawing from the city works, with the 500,000-gal. reservoir in reserve, and delivering through 8-in. mains encircling the shop group, with hose reels within the buildings and hydrants and hose houses distributed over the yard. Local fire signals have been arranged and provisions made for quickly raising the pressure in the mains. Fire roadways run throughout the yard surrounding the main building and lead to all large hydrants having steamer nozzles, to enable the city fire engines to be put in action rapidly. Special orders are given the yard crews to keep these roadways always clear of cars.

There are 18x10x12-in. Fairbanks-Morse duplex steam pumps in the engine room of the power house. The main source of water is an 8-in. metered service to a 10-in. city main leading to the reservoir, and there is also a suction connection to the reservoir. The suction main is 16 in. in diameter and has a by-pass to the 12-in. pump discharge to permit admitting city water into the shop mains in case it is desired to shut down the pumps. One pump is always kept in operation on the shop service, being fitted with a Fisher governor set to maintain the water pressure at 100 lb. The other pump is fully connected up and kept with its throttle valve open a mere crack. By this arrangement the pumps will continue in motion very slowly, but at such a rate as to insure their being kept hot and always ready for instant service. In case of fire the throttle on the second pump is opened and the governor disconnected from the first, allowing both pumps to furnish their maximum pressure.

The pumps discharge into the yard mains through a 12-in. pipe which connects about 50 ft. from the power house with a 10-in. main that feeds three longitudinal 8-in. service mains, one on either side of the main shop, and the other at the rear of the blacksmith shop, the power house and the store house. The central 8-in. line is extended several hundred feet beyond each end of the main building and all three lines are cross-connected at each end of the large shop. From the southerly end of the system a 6-in. connection is extended across the yard to connect with the water system of the round house and old shops, which are now to be used for car repair work only. There are sixteen hydrants installed along the line of the fire roadways to the yard, eight of which are plain two-way hydrants for hose while each of the remainder have two 2½-in. hose nozzles and one 4-in. steamer nozzle.

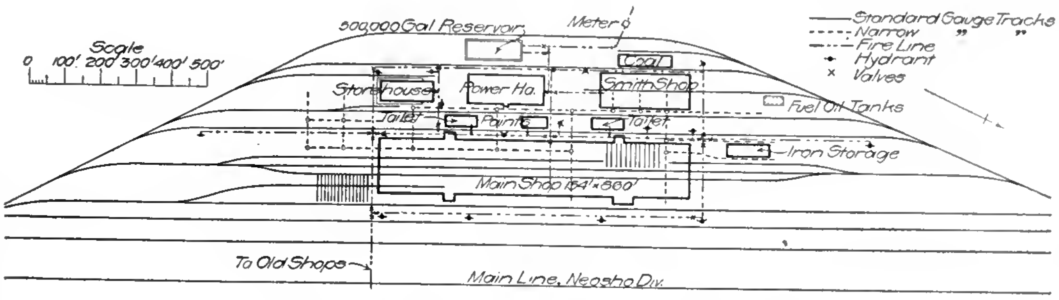


Engine Room of the Power Plant at the Parsons Shops.

Heating.—The buildings are heated with low-pressure exhaust steam from the power plant, supplemented by live steam at reduced pressure, when necessary, with hot-blast heating in the main locomotive shop and direct radiation in the store house, office building and auxiliary buildings. The heating requirements are, however, comparatively moderate at Parsons owing to its southerly location, for which reason no direct radiation was installed in the main shop or in the blacksmith shop, and, in fact, no heating of any kind was provided in the latter shop for service in the daytime owing to the warmth from the forges and furnaces; in this building a limited amount of heating is provided for use at night-time and on holidays, to prevent freezing in severe weather, by diverting the hot blast delivery from one of the heating stands of the main shop. The low-pressure steam supply is distributed by mains through the underground piping tunnels which connect the power house to various buildings, a 5-in. heating main extending from the exhaust header in the power plant to the store-house and office building and a 16-in. main to the main locomotive shop building.

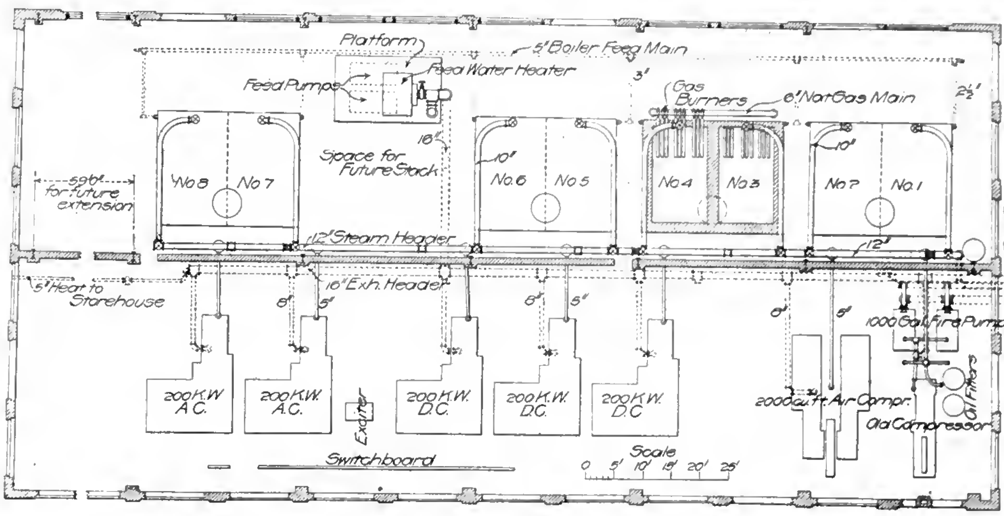
The main shop is served by four separate hot blast equipments. The blowers and heaters are of unusual size, and located in 20x26-ft. fan houses outside the walls of the building, there being two on each side at quarter points of the building. These houses open directly into the main shop, from which the fans draw their air; large windows are provided to supply fresh air when it is desired to run the fans for ventilation during hot weather. Sturtevant steel plate centrifugal fans are used with three-fourth down-

ward discharge housings and 9-ft. wheels 44 in. in width. Each is direct-driven by a 9x12-in. Sturtevant horizontal engine running at 180 r.p.m, at which speed the blower has a capacity of 57,000 cu. ft. per minute. Each engine receives steam through a 3-in. connection to the high pressure pipe from the power house and exhausts through a 3½-in. connection directly into the main which supplies low pressure steam to the heating stack. There is also an auxiliary 3½-in. connection for carrying the exhaust from the engines to the outside in case it is desired to operate the engine when heating is not required. The heating stacks are located in 10x12-ft. casings connecting with the fan intakes and each consists of four sections of Sturtevant heaters, containing 8,000 lin. ft. of 1-in. pipe.



Plan of the New Locomotive Shops at Parsons.

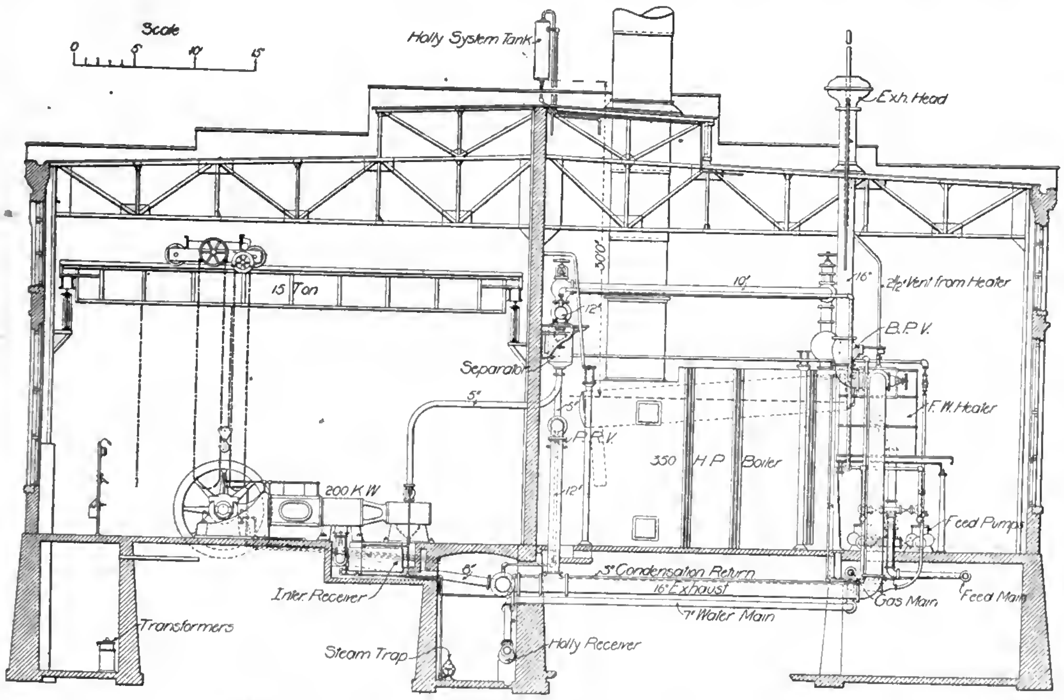
The hot blast is distributed through concrete trunk ducts from 36x40-in. to 20x20 in., running longitudinally under the floor within the rows of crane girder columns which extend approximately one-half the length of the shop building. Midway in its length each duct is connected with its blower by a concrete cross-duct under the side bay floor. These cross ducts are 4½ ft. square. The longitudinal ducts have 15x24-in. outlet connections alongside each crane column which supply the hot air duct risers. Galvanized ducts 20 in. square carry the air from the outlet branches to elbows which discharge horizontally about 10 ft. above the floor level. There are seventeen outlets supplied from each fan on the south side of the building and fourteen from each fan on the north side. The duct velocities are figured high for the cross and trunk ducts, averaging about 2,000 ft. per minute, but are reduced in the branch and outlet connections approximately 1,200 to 1,500 ft. per minute at the outlet elbows.



Plan of the Power Plant at Parsons.

Provision is made for diverting the discharge of the blower at the corner of the building opposite the blacksmith shop into the latter building for heating nights and on holidays when the forges and furnaces are not in operation. As at such times only partial heating is required in any of the buildings, it was figured that the hot blast delivery from this fan could well be diverted from the main shop to the blacksmith shop. For this purpose there is a full-size branch from the delivery duct from this blower to the blacksmith shop, where the underground duct connects with a 40-in. circular galvanized iron duct that rises within the building to a horizontal distributing duct 18 ft. above the floor level, which has five 20-in. horizontal outlets. No other heating arrangement is provided for this shop, as before stated. The hot air from the forges and furnaces is allowed to rise directly into the building without exhaust hoods. Smoke is removed by two 48-in. disc exhaust fans one in each end of the roof monitor, which are direct-driven by 3½ h.p. motors. Each fan is rated at 16,000 cu. ft. of air per minute.

A small amount of heating is also required in an oil-tank pit in the yard, in which fuel oil for the smith shop forges is stored. Owing to the underwriters' requirements, the tanks were located 200 ft. from the nearest building, and depressed below grade in a concrete pit, 14x34½ ft. in interior dimensions and about 8 ft. deep. There are two 6½x27-ft. cylindrical steel tanks, each of 4,000-gal. capacity, for the main storage and two 33-in. x 8½-ft. cylindrical steel pressure tanks, containing 350 gal. each, from which the oil is forced pneumatically to the shop. In order that the oil, which is a cheap grade of heavy fuel oil, may flow freely, the pit and the conduit carrying the piping have a 1¼-in. heating line from the high pressure heating main. Two coil radiators are used, one of 116 lin. ft. of 1¼-in. pipe between the large pair of tanks and the other of 52 lin. ft. between the small pressure tanks. As the pit has a wooden roof with tar and gravel covering about 10 in. above grade, the oil is easily kept at moderately high temperature and its fluidity is maintained in the conduit by the uncovered steam supply line. There is no return line, the condensation being discharged by a Geipel steam trap into a drain. For underground pipe lines, sectional tile conduit 8 in. in diameter was used, which carries a 2-in. oil line and 1¼-in. steam and air lines, the pipes being supported on expansion rollers spaced 11 ft. apart.



Cross Section of the Power House, Showing Pipe Systems.

Power Plant.—The shop group has been centered around the power plant which has sufficient capacity to provide power for the new locomotive shop and also for the car repair shop, with room for increase. The station takes care of the heating and lighting of the buildings, furnishes power for all the machinery driven electrically or pneumatically, and furnishes current for lighting the yard. The location of the power house was determined almost wholly by the center of power consumption, which lies near the center of the main locomotive shop building; the lighting of the yards and buildings in all portions of the property is done by high voltage circuits and thus does not affect the power house location. The site chosen is convenient for obtaining both fuel and water supplies and the piping and wiring to the buildings are carried in subways, so located as not to be affected by future extensions.

The plans of the station were drawn for an 84x215-ft. structure to accommodate a contemplated plant of a capacity represented by a total of 3,000 boiler horse-power, but only a portion of the equipment has yet been installed. There are now five electrical units of a total capacity of 1,000 kw., two air compressors together capable

of compressing 3,000 cu. ft. of free air per minute and four batteries of boilers having a combined rating of 2,000 h.p. The building is laid out with longitudinal boiler and engine rooms, capable of extension on either end, with a longitudinal wall through the center dividing it into boiler and engine rooms of equal width. Both the rooms have their floors 6 in. above the surrounding grade as are those of the other shop buildings, and in both there is a clear head-room under roof trusses of 26½ ft. A basement with 10-ft. head-room has been excavated under both boiler and engine rooms, surrounding the boiler and machinery foundations, in which piping connections and a considerable amount of auxiliary machinery are located. The building has a ferroinclave reinforced concrete roof covered with four plies of tarred felt laid in roofing pitch and covered with gravel. This roof is carried by steel roof trusses on 29½-ft. centers. These trusses on either side of the building have monitors on the ends adjoining the division wall, which is carried up to the monitor roof level. The monitor is 12½ ft. in width on either side and has 30-in. sash on the sides. The floor construction is of concrete with cement mortar finish throughout.

There are four batteries of water-tube boilers, with space left for two more, which are arranged along the inner side of the room facing a 15-ft. firing floor on the outer side, to permit ample lighting on the boiler fronts. Each battery of two boilers is 25 ft. wide. There are 4½-ft. spaces between them and a 3½-ft. space at the rear for steam and blow-off piping connections. The boiler room arrangement and equipment are considerably simplified by the use of natural gas for fuel, but arrangements have been made for handling and storing coal in case the gas becomes exhausted. The structural feature of the building are so arranged that elevated coal bunkers may be built over the firing floor, and space has been left in the roof and basement for installing a coal and ashes conveyor. The lower run of this conveyor would pass close to the outlet doors of the boiler ash pits which open into the basement and would raise the ashes to an elevated pocket, while coal would be raised from a basement receiving hopper to the bunkers. An opening has been left in the outer wall of this basement to permit constructing such a hopper under the coal siding alongside the boiler room, with crusher and auxiliary conveyor for delivering the fuel to the main conveyor. Short steel stacks are all that are needed while gas is used, but a tall brick stack to serve all boilers will be built if coal is used. A 58-in. steel stack is now used for each battery; these are supported on the rear of the boiler fittings and rise to a height of 60½ ft. above the boiler room floor.

Sectional water-tube boilers of the Heine make are employed, each rated at 250 h.p. Each has two 36-in. x 22½-ft. steam drums parallel to the tubes and a heating surface of 140 4-in. tubes, 18½ ft. in length which are expanded into wrought steel water legs which are riveted to the steam drums. Each drum is connected through 10-in. nozzles into a 30-in. steel cross drum 8 ft. long above the boiler front which carries two 6-in. safety valves and the main 10-in. steam nozzle. The boilers are hung free of the settings by link suspensions from two pairs of 15-in. I-beams which span the front and rear of the settings. The settings are 20-in. thick at the sides and 22-in. between boilers. They are carried on concrete foundations having ash-pits at the front which slope toward the special outlet doors through which ashes may be scraped out on the proposed conveyor. At present however, the ash pits and furnaces are closed with a fire-brick floor at the future grate level and in this flooring are nine openings about 5½ ft. in length in which the natural gas burners are inserted. These burners are 5-in. cast-iron pipes of a special form developed by the railroad company for this purpose, which have numerous small holes in the upper side opening into the furnace, with a 5-in. inlet on the lower side connecting through the ash-pit door to the gas valve. There are nine burners to each boiler, supplied through 1½-in. valves and connections from a 6-in. header covering the two boilers of each battery. This header is supplied by 6-in. connections from the gas distributing main on the basement ceiling directly under the boiler front. Provision has been made for adding Greene chain-grate stokers, if it be desired to use coal for fuel.

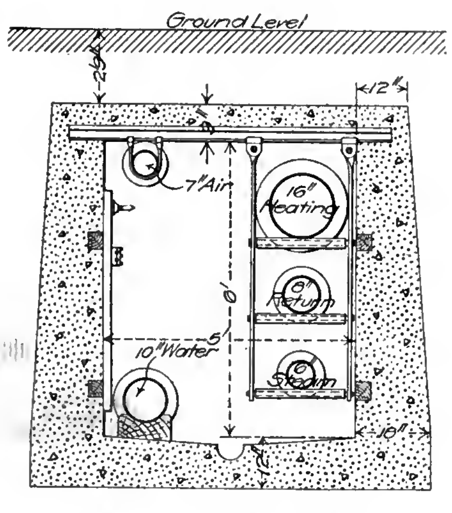
The boiler feed comes from the city works, supplemented by the condensation from the heating systems and the drips from the steam piping. All condensation and hot waste water, including the jacket water from the air compressors, is delivered to a Cochrane open feed-water heater, from which the boiler pumps draw, while make-up is supplied by an 8-in. connection from the 12-in. discharge line of the fire pumps. The boilers can be also fed directly from the mains. The heater is mounted on a steel platform 8 ft. above the firing floor at about the center of the room, and under the two feed pumps are below it. The heater is supplied with steam through an inductive connection from the 16-in. atmospheric relief riser from the engine room exhaust main, which discharges to the heater through an attached oil separator. The heater has a capacity of 2,000 h. p., and is fitted with chemical tanks for treating the water to remove a portion of the scale-forming impurities. The feed pumps are Fairbanks-Morse duplex pumps, each having 12x8x12-in. cylinders. They feed the boilers through a 5-in. main on the ceiling under the firing floor; this has 3-in. branches carried up between each battery and dividing into 2½-in. connections to each boiler. The boiler blow-off system consists of two 1¼-in. connections from the lower edge of the rear water leg of each boiler into a 4-in. blow-off main carried longitudinally through the boiler room in a trench at the rear of the setting. This main is carried out through the northerly wall of the building into one of the yard drains.

The steam piping systems are laid out with longitudinal headers for both high pressure and exhaust, the former in an elevated position on the boiler room side of the division wall and the latter in the basement on the opposite side. That for the high pressure system is a 12-in. header carried on cast-iron brackets 19½ ft. above the boiler room floor, with 10-in. branches to the boilers and eight 5-in. branches to the engine-room. The boiler connections are long-radius horizontal bends with a Davis automatic angle stop and check valve at the boiler nozzle and an angle stop valve at the header. The engine connections are made from the lower side of the header through Hoppes angle receiver-separators immediately below, from which the delivery lines lead down to the engines, compressors and pumps. The drainage of the header is effected directly by these separators, except at the ends, which are drained by two 1¼-in. connections. The condensation is removed from the separators and the header-end connections, and also from the throttle end of all steam connections, by a Holly loop system having a condensation receiving tank in the engine room basement and an elevated discharge chamber, together with the piping to return the condensation automatically to the boilers. The 16-in. exhaust header has eight 8-in. connections from the engines and pumps that pitch sharply downward toward it, and three delivery connections, one of full size which leads across to the feed-water heater and atmospheric relief riser in the boiler room and another connection of similar size at the north end of the power house through an oil separator into the piping tunnel for connection to the heating systems of the various shop buildings, with the exception of the store house, which is supplied by a similar 5-in. connection with oil separator at the southerly end of the power house. Condensation is drained from the receivers of the compound engines by Bundy steam traps which discharge to the sewer. A system of engine drains has also been provided so that the engine and pump cylinders and the receivers of the compound engines may be blown free in starting, the discharge being piped to the sewer. The oil separators in the connections to the low pressure heating mains are Bundy grease extractors from which condensation is drained to the sewer.

Boiler Room, Showing Gas-Fired Furnaces.

There are five tandem-compound four-valve engines direct-connected to 200-kw. generators of 2,000 cu. ft capacity per minute, another compressor of 1,000 cu. ft. capacity, and two large

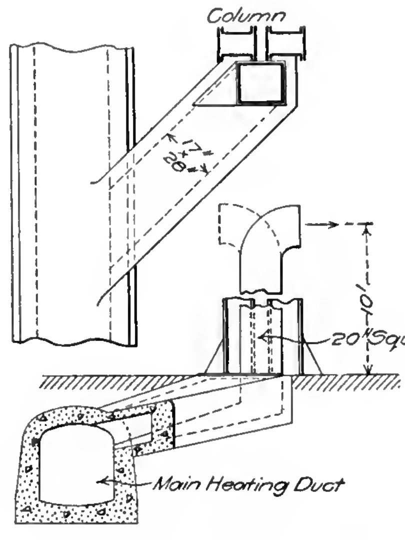
pumps. The engines are the Fitchburg heavy-duty side-crank tandem-compound type, with Tangye frames, and are designed to operate non-condensing with a considerable back pressure. They have governors of the centrifugal shaft type and double eccentrics for independent operation of the admission and exhaust valves. These units all have 14 and 22x21-in. cylinders and, operating at 200 r.p.m., have a rating of 320 h. p. each. The air compressors are the Ingersoll-Rand compound two-stage type designed to deliver compressed air at a pressure of 100 lb. The two units deliver air through a 7-in. line to vertical steel storage and cooling tanks outside the building; these are 54 in. in diameter by 12 ft. high and from them the air distribution system of the shop plant is supplied through a 7-in. connection. The engines and compressors are all lubricated by a continuous gravity oiling system, consisting of an elevated storage tank supplying oil to all bearings and a collecting and filtering system in the basement from which the oil is pumped back to the tank. The two pumps are the Fairbanks-Morse underwriter type of 1,000 gal. capacity each, and draw from the reservoir and city water service as before stated.



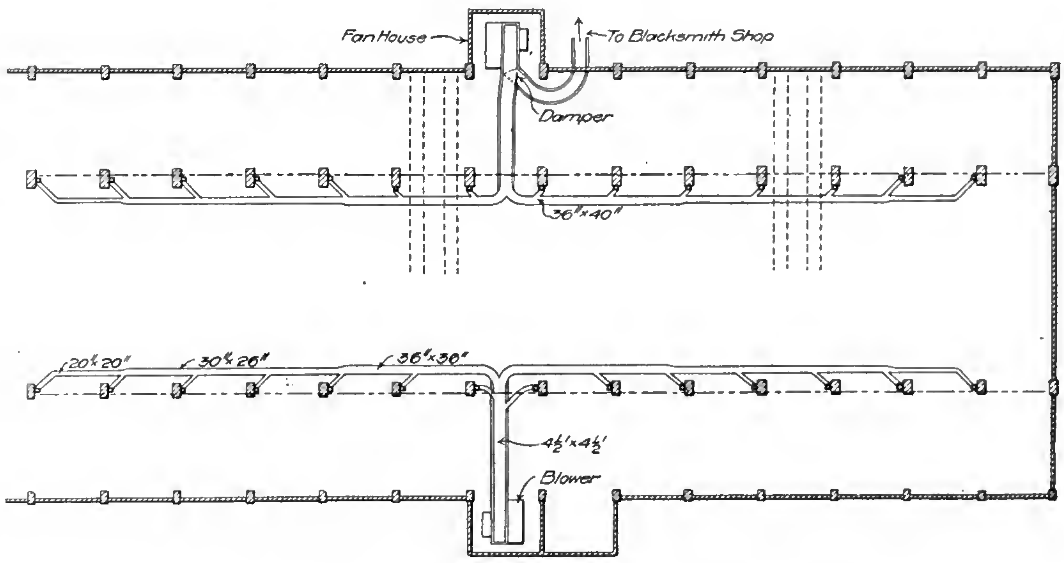
Section of Pipe Tunnel.

As before stated, the station supplies current for lighting both buildings and yards, the distribution system for which covers a considerable area, and for the power service in the buildings. For the former, an alternating current distribution was thought desirable on account of the distances of transmission which are over a mile in either direction. For the power service direct current was adopted to permit the use of variable speed motors for direct-connected machine tool drives. The generating equipment accordingly consists of three direct-current and two alternating-current units of 200 kw. capacity direct connected to the engines. The generators are all Westinghouse engine-type machines; those for the direct-current service are compound-wound multipolar machines delivering 230-volt current, and the alternating-current machines are of the revolving field type wound for two-phase current at 60 cycles and a potential of 2,300 volts. The alternators are arranged for excitation from either bus-bars of the 230-volt direct-current machines or from a 30-kw. motor-generator. No steam-driven excitor was necessary with this arrangement, as it is possible to start up the alternating current service by exciting the alternator field with current from any direct current generator, after which the motor generator set may be started for independent excitation to render the regulation independent of the voltage variations of the direct-current system.

The electrical distribution is controlled by a 18-panel switch-board, containing three generator panels, a total panel and three feeder panels at one end for the direct-current equipment, and two generator panels, an excitor panel, a total panel and four feeder panels at the opposite end for the alternating-current system. The switchboard equipment was supplied by the Westinghouse Electric & Mfg. Co., and contains oil switches for the control of the 2,300-volt alternating current and total recording watt meters for the measurement of the power consumed by either the direct or alternating system. There is also a small two-panel board for the control of the two-series alternating current arc lighting circuits, each operated by constant current transformers. The distribution system embraces nine circuits for direct-current, which are entirely local, and eight circuits for alternating current, four of which are for the new shop group and the others for transmission to other portions of the company's property. Of the direct-current system five feeders are carried to the locomotive shop for the crane motor and machine tool motor circuits, one each to the blacksmith shop and store house, and the remaining three to the old buildings for the operation of motors in the car shop. From the alternating current board, four feeder circuits supply local lighting in the main shop, blacksmith shop and store house, one the constant current transformers, and the remaining three the lighting at the old shops about 1,500 ft. distant. The freight department about 2,200 ft. distant, and the passenger depot about 4,000 ft. distant. The direct-current motor load, consisting of crane motors and machine tool motors in both old and new shops, averages about 400 kw., while the lighting load varies from 250 kw. to the uniform all-night load of about 150 kw.



Outlets of Heating Ducts.



Hot Blast Heating, Northerly Half of Main Building.

The new shops were laid out, and the buildings and their equipment, including the power plant, were designed by Mr. G. R. Henderson, who was consulting engineer to the Missouri, Kansas & Texas Railway. James Stewart & Co., New York, were general contractors for the shops. Mr. A. A. Allen is the vice-president and general manager of the system and Mr. W. O'Herin superintendent of machinery and equipment located at Parsons.

Sludge in Septic Tanks.

Septic tanks were first put in operation in the Lawrence Experiment Station of the Massachusetts Board of Health in 1898 and since that time tanks of this sort have been operated there. In the Board's last annual report there are some figures showing the disappearance of sludge which has been observed in the tanks; while such figures are applicable only to the local sewage they are of considerable interest because made with both concentrated sewage containing large amounts of suspended matter and with the regular station sewage. The two tanks receiving concentrated sewage were operated with storage periods of 18 hours to 15 days in one case and of 5 hours in another, and showed a disappearance of 82 and 75 per cent. of the sludge respectively. In the tanks receiving station sewage from 68 to 89 per cent. of the sludge disappeared. The detailed analytical and measurement results seem to show that more than 80 per cent. of the volatile organic matter deposited in the septic tanks in question is passed into solution or given off as gas. This is a deduction from analytical data, but it is of course difficult to obtain entirely representative samples. At times gas evolution causes sediment to rise and pass from the tanks, so that much matter passes off this way, which causes the figures showing sludge destruction to be greater than is actually the case. This fact has been pointed out in earlier reports of the Board. The analytical results show an apparent decomposition of much mineral matter, but this must be due mainly to the passage of this matter from the tanks without being detected. The time of storage within the limits of the experiments, ranging from 5 to 49 hours, except in the case of the 15-day experiments made with one tank in 1899, and the strength of the sewage seem to have little influence on the percentage of organic matter disappearing or on the number of pounds of dry sludge disappearing per million gallons of sewage. The average station sewage contains about 2,080 lb. of suspended matter per million gallons.

The Water Supply of Goldfield, Nevada.

The Goldfield, Nevada, mining district is in the center of one of the most desert regions in this country, where rainfall and moisture are almost entirely lacking and the aridity is pronounced and oppressive. In the face of the hardships and difficulties of living in a region of this kind, the remarkable richness of the mineral deposits of the district has attracted a large population, the town of Goldfield alone having about 22,000 inhabitants. The permanence of the resources of the district has been so well determined that an immense amount of money has already been expended in providing good transportation facilities, cheap electrical power and an adequate and suitable water supply to the isolated desert region in which the district is situated. The result of the provision of these facilities has been to change the camp of tents and temporary shacks into a city with pavements, electric lights, water works, sewers and other modern improvements. The construction of these improvements has been carried on at very unusual expense owing to the isolation of the district and the cost of transportation and labor.

When the richness of the mineral deposits in Goldfield and vicinity was discovered in 1903 the town was 100 miles from the nearest railroad, and for over a year after the wealth of the region was exploited no railroads were put under construction to reach the district. Since then, however, three standard-gauge lines have been built into Goldfield, providing good transportation facilities. The first of these was the Tonapah & Goldfield R. R., an extension of a branch of the Southern Pacific R. R., 100 miles in length, the branch connecting with the main line of the latter road at Reno, Nev. The second was a branch of the San Pedro, Los Angeles & Salt Lake R. R., 220 miles in length. A third railroad, the Tonopah & Tidewater, is just being completed from Tonopah through Goldfield to a connection with the main line of the Atchison, Topeka & Santa Fe R. R., with a total length of 326 miles. Practically all of this railroad construction was carried on in desert country, where water for all purposes frequently had to be hauled 30 to 50 miles, and, in instances through districts where no work could be done in the summer on account of the terrific heat. Some of the grading required also involved a large amount of work, so the cost of these lines has been excessive.

Electrical power for the Goldfield district, and for several other mining districts in the vicinity, is furnished from the extensive hydro-electric developments of the Nevada-California Power Co. on Bishop Creek in California, 113 miles from Goldfield. This creek is a tributary of the Owens River, from which the new water supply for Los Angeles, Cal., is to be obtained. It has its source in a mountain range which is covered with perennial snow, and its flow is remarkably uniform throughout the year. The power company has two hydro-electric stations, with a combined capacity of 7,500 h.-p., in operation, and is constructing two more stations, which will give an ultimate total capacity of 14,000 h.-p. Much additional power can also be developed as the company controls 3,200 ft. of fall on Bishop Creek, and large storage reservoirs can readily be built on the headwaters of the stream at a reasonable cost. The power generated is transmitted to Goldfield at 60,000 volts over a pole line 113 miles long, and branches from this line are extended to other points. Much of the transmission line was built through the rough mountain country and thence across the desert at a very great expenses. The whole power development project has been more than justified by the demands to be supplied, however, and will keep pace with these demands with difficulty.

Although ample railroad and power facilities were thus constructed at a great outlay, the provision of an adequate supply of satisfactory water remained to be accomplished. Such a supply has now been developed in the mountains, 30 miles from Goldfield, and the pipe line which delivers it to the city was recently placed in operation. Prior to the completion of this pipe line water was obtained from a mine and from various small wells and springs. All of this water was highly impregnated with alkali salts and practically none of it was suitable for domestic consumption. The salts contained in it were also of such nature that the water was highly unsatisfactory for use in boilers, or in the concentrating mills required to work a large portion of the ore which is mined in the district. Furthermore, the supply was entirely inadequate, so no fire protection could be provided and water commanded an apparently unreasonable price.

The chief part of the original supply was obtained from a mining company, which pumped water about 10 miles against a head of 800 ft. from a series of alkali springs, for use in a concentrating mill. These springs produce about 36,000 gal. per day, and the mining company sold the surplus over the requirements of its mill to a local water company at a flat rate of half a cent a gallon. The other springs and wells from which water was obtained were at varying distances from the town, but were all of small capacity. Two small and separate systems of distribution mains had been laid in the central part of the town, and water was retailed at three-quarters of a cent a gallon to consumers connected with these mains. Beyond the limits of the distribution mains water was delivered in barrels on wagons at prices of 1 to 3 cents a gallon, depending on the distance it had to be hauled. Under these conditions it cost $750 a month for enough water to run an 80-h.p. boiler; it also cost 25 cents to water a team of horses, and fire insurance could not be obtained owing to the lack of fire protection. In fact, a disastrous fire occurred, which could not be checked because no water was available. The inauguration of the new water supply has changed all of these conditions, as an ample amount of good spring water from the mountains is now available under a pressure that provides fully for fire protection.

The mountains in which the supply has been developed are 25 to 30 miles from Goldfield, along the western edge of the desert. The development has been made on, or in the vicinity of Mount Magruder, which is covered with snow until late in the summer. The surface of the upper part of this mountain is largely loose, disintegrated granite, with rocks of considerable size, which grade into gravel down on the mountain sides, and finally into the soil of the desert. Practically none of the melting snow ever runs off in streams and very little of it shows on the surface along the sides of the mountain, most of the water flowing away under ground and being dissipated through the dry soil of the desert below. In a few places along the side of the mountain, where the bed rock nearly outcrops at the beginning of the overlying gravel, several small springs appeared, and other conditions indicated the presence of an underground flow. At several of these points horizontal tunnels have been driven back into the side of the hill to intercept the sub-surface flow and to increase the output of the springs.

One of the principal sources of supply that has been developed in this manner is from Cartee Spring, across a canyon from Mount Magruder, at the base of a mountain of similar formation. This spring, which flowed upward of 80,000 gal. a day before it was developed, and had been used for 30 years in irrigating a small ranch, now delivers at least 100,000 gal. a day. The Gusher Spring, another one of considerable flow, is on the side of Mount Magruder, about 5 miles up the valley from the Cartee Spring. Three miles around the mountain from the Gusher Spring are the three State Line Springs, the water from which was used for years in placer mining. Another series of three springs has been developed on the side of Mount Magruder, between the Cartee and the Gusher springs, and

Two Views on Pipe Line during Construction across the Low Intervening Country.

three more exist adjacent to these. The springs which have been developed are perennial and have a normal daily flow of over 1,000,000 gal. Other large springs remain to be utilized, chief among these being the Hyde Spring, which will deliver 200,000 gal. of water in 24 hr., but is lower than the pipe line, so its flow will have to be pumped when required.

The tunnels which have been built into the side of the mountain to develop the underground flow involve no special features. They were usually driven so the bottom of the tunnel was at, or very close to bed rock, and were continued back into the side of the mountain until they intercepted the crevasses or channel through which the underground flow comes down the mountain. The total flow is thus conserved and

Hauling Pipe from the Railroad Station.

the original capacity of the sprıngs increased from 60 to 100 per cent. The tunnels were made about 6 ft. high, 3 ft. wide at the top and 4 ft. wide at the bottom, and have lengths varying from 20 to 160 ft. They were heavily timbered throughout to hold the loose material through which most of them had to be driven.

The various springs that have been thus developed are connected by a line of spirally-riveted steel pipe which is merely a continuation of the pipe line leading to Goldfield. This line starts at the State Line Springs and extends as a 6-in. pipe for three miles to the Gusher Spring, the fall in this distance being 32 ft. From the Gusher Spring to the Cartee Spring, in a distance of 5 miles, the fall is 1,200 ft., so a 5-in. pipe is fully sufficient to carry the flow. The series of three springs which have been developed on the side of Mount Magruder are connectetd to the 5-in. line by a 5-in. pipe.

Three miles toward Goldfield from the Cartee Spring is a summit, called Lida Summit, which is only 27 ft. below that spring, so in order to secure the desired capacity a 9-in. pipe was used for the main line in this distance. From the Lida Summit the country drops away rapidly, the line crossing a valley about 20 miles wide before reaching a second summit, called Malapi Summit, at the edge of Goldfield. The drop in this 20 miles is about 900 ft.; the Malapi Summit is 500 ft. lower than the Lida Summit and 400 ft. above the town. It was originally intended to operate the pipe line by gravity, but a pressure of over 390 lb. per square inch would thus have been brought on the section of the line between the two summits. The decision was made, therefore, to place a pumping station part way up on the rise to the Malapi Summit and operate the section of the line between the Lida Summit and this station by gravity, and thence pump the water against a head of about 150 lb., over the Malapi Summit. This arrangement permitted ordinary 7-in. spirally-riveted pipe to be used between the Lida Summit and the pumping station.

The flow line is all placed at least 18 in. below the surface, which is sufficient depth to protect it from frost in the region traversed. Air valves are provided at all summits and blow-off valves at low points, at intervals of about two miles. Owing to the nature of the country and the absence of rainfall, no waterway crossings had to be built, nor protection against washing provided at any point.

The pumping station contains a single 400,000-gal. Goulds triplex pump, belt-driven by a 50-h.-p. electric motor. A second unit of the same type will be installed when required. Electrical current is obtained from the Nevada-California

Mountains in Which the Supply was Developed; Desert in Foreground.

Power Co. The pump delivers into an 8-in. pipe line 6,000 ft. long, which leads over the Malapi Summit to storage tanks on the side of the latter. Several temporary tanks, with a combined capacity of 400,000 gal., are at present installed, but two new tanks, with a capacity of 200,000 gal. each, will be placed to provide for the variations in domestic consumption. One of the present tanks, with a capacity of 200,000 gal., will be retained for storage for fire purposes. These storage tanks will render available in the town a pressure of 50 to 60 lb. for domestic consumption and of 120 lb. for fire protection.

The distribution mains of the two original water supply companies operating in Goldfield were purchased by the company which made the development of the new supply. One of these systems was made up of spirally-riveted pipe and the other of standard well-casing and machine-banded wooden pipe. As parts of these systems were small pipe, and nothing smaller than 6-in. pipe will be used in the main part of the town for the new system, much of the original work is being replaced. In all new work lap-welded wrought-iron pipe, with Converse joints, is being used. All connections to the distribution mains are metered, water for domestic consumption being sold at ¼ cents a gallon and for commercial purposes at $2.50 to $4.00 per 1,000 gal.

The chief difficulty encountered in the construction was in building the pipe line across the 20 miles of desert between the two summits. All of the pipe for the entire line had to be hauled from the railroads at Goldfield. Water for all purposes frequently had to be hauled 15 miles. The trench for the line was opened up with eight and ten-horse teams on plows, but a hard, cemented conglomerate encountered just under the surface required a large amount of light blasting and greatly increased the cost.

An analysis made of the water from the new supply showed only 21.04 gr. per gallon of solids, with but 0.44 gr. of suspended matter and a trace of organic matter, while nitrates and nitrites were absent. The water, therefore, contains nothing to make it objectionable for domestic use. The percentage of scale-producing salts, the sulphates, which are the only corrosive salts present, and those salts which produce foaming, are all low, so with reasonable care the water can be used for boilers with no deleterious results. Carbonates predominate in the water, but are remarkably low, as compared with other waters in the country surrounding Goldfield. In fact, this analysis showed the water to compare favorably with most domestic supplies, which is a remarkable circumstance in this desert country in which the supply has been developed.

The scheme of securing water for Goldfield from the mountains was devised by Mr. Loren B. Curtis, of Denver, Colo., who, assisted by Mr. Charles G. Patrick, conducted the investigations of the source of the supply, prepared the plans for the work and supervised the construction. The water supply system and distribution mains are owned and operated by the Goldfield Consolidated Water Co., which is controlled by Denver and Goldfield interests.

TWO SCHOLARSHIPS in McGill University, Montreal, will be given by the Canadian Pacific Ry. to those employees or sons of employees who stand highest in entrance examinations next year. There are three students now holding such scholarships.

Methods of Increasing the Capacity of the New York Subway.

When the New York Subway railway was put in service, a good many people thought that the rapid transit problem in Manhattan was solved for at least a decade. Before the first operating year had passed, this belief had vanished. The difficulties of travel on the road during the rush hours proved even greater than on the elevated lines and came somewhat near the disgraceful scenes in evidence about six o'clock any week day afternoon at the Manhattan terminal of the Brooklyn Bridge. Naturally enough the overcrowding was attributed by the public to the lack of enough trains, but the correctness of this opinion seemed questionable after some study, and the fact that the subway was about taxed to its utmost gradually became apparent to those who observed the conditions critically. Pending the construction of more subways, it is necessary to utilize this one to the utmost, and so the Public Service Commission retained Mr. B. J. Arnold to study the conditions and suggest methods of improving the service now rendered by the Interborough Rapid Transit Commission. The full report on this subject is not yet written, but a preliminary report was made last week, from which the following extracts have been made:

It is but fair to say that, taking into consideration the circumstances under which the subway was built and is now being operated, it is one of the best constructed and best operated railways in existence. On the other hand, the service demanded of it is far in excess of that of any other road, and as a consequence conditions are now such that although the time card calls for a headway of 2 min. between trains south of 96th St. during rush hours, in actual operation the trains fall behind this schedule from 12 to 30 sec. under normal conditions during these hours. This results in only about 25 express trains per hour leaving Grand Central Station instead of 30 trains, as called for by the time card.

After studying the causes of delay, Mr. Arnold is convinced that several of them can be promptly removed and the 2-min. headway, as given by the time card, maintained under normal conditions during rush hours. Many of these delays are due entirely to the excessive time taken for loading and unloading trains at the platforms, and are caused largely by the policy of holding the trains at the stations until all the cars are jammed full of passengers, in an attempt to clear the station platforms. This policy should be changed to one of starting the trains within a fixed time after they have stopped in order that the maximum number of cars may be made to pass through the stations after allowing reasonable time for loading. This time of loading and unloading the express trains should be limited to 45 sec., instead of an average of 65 sec. taken at present at Grand Central Station. This can be accomplished provided the proper degree of efficiency is maintained by the platform men and train guards, by putting into effect the following method of operation:

First. In view of the fact that northbound evening express trains leaving Grand Central Station carry approximately 25 per cent. more passengers than are brought into this station from 14th St., a system of loading should be adopted, which will regulate the loading at Brooklyn Bridge and 14th St. in such a way that there will be capacity left in the cars for the increase of load at Grand Central Station, and thus avoid the present excessive crowding.

At present time the cars come into Grand Central Station fully loaded, and the delay at the station platforms is caused largely by passengers getting off slowly from crowded cars and the difficulty of loading so many additional passengers into cars already full. The delay caused by this congested condition of the cars at Grand Central Station soon backs the trains up in the subway as far as 14th St., and as the trains are held at 14th St., they are naturally loaded more fully, and thus the congestion is increased automatically, which can only be remedied by a combination of systematic loading and prompt movement of the trains.

In other words if part of the passengers who are ready to enter the trains at 14th St. are cut off, all trains can be moved on time, and therefore, more trains operated than at present. Thus additional speed and comfort can be obtained for all of the patrons of the subway by a small amount of inconvenience to a few patrons who are slightly delayed in taking the cars at 14th St., and on the principle of the greatest good to the greatest number, this policy should be adopted.

Second. On each express platform there should be stationed a train dispatcher provided with two stop watches, one for the local the other for the express service, with instructions to give the signal for closing the doors not later than 40 sec. after the train has come to a stop, thus allowing 5 sec. to close the doors and start the train within a 45 sec. period. Subsequently indicators visible to the passengers can be installed which will show them the time in seconds remaining before the closing of the doors.

Third. The guards upon the cars should be instructed to open the doors as soon as the train has stopped. There is now at times a noticeable delay in geting these doors opened. The train guard should also be instructed to listen attentively for the closing signal, and at once make every effort to close the doors with the assistance of the platform attendants, and when the doors are once closed they should be kept closed instead of being opened occasionally to let off a delinquent passenger.

Fourth. Train guards should be instructed to keep themselves more alert and to transmit promptly the starting signal. If it is found that the guards cannot be trained to attend to this matter of signaling promptly, it may be necessary to require an electrical system of signaling whereby the motorman will get the signal on the instant the last door is closed.

Fifth. The station attendants should be given positive instructions to act promptly when the signal is given for closing the doors. This can be done by positively regulating the stream of passengers entering the car so that the last passenger in will not obstruct the closing of the door.

In order to secure better service for the patrons of the subway the Interborough officials have pointed out that suitable police regulation on the station platforms should be provided in order to control such individuals as may interfere with the prompt closing of the doors. [The police department has now provided such special officers].

By making other improvements it will be possible to reduce the headway still further, for the present signal system is arranged so that by slightly changing it at the stations trains can be easily operated on a 90-sec. headway, if such a headway were not prohibited by excessive station stops. Mr. Arnold suggests that the Interborough officials be requested to prepare a train schedule on the basis of a 105-sec. headway during rush hours, which is a reduction from the present schedule of 15 sec. This saving in the headway can be secured at once by changing the block signaling system at the express stations. At the present time the station block is not cleared until the leaving train has nearly left the platform. With an eight-car train on the express tracks it requires from 22 to 25 sec. after a train starts to get the signal which allows the following train to proceed. It then requires a certain length of time for the following train to pull into the platform and come to a stop. For example, at Grand Central Station this time amounts to 50 sec. for a north-bound train. If the signal to the following train could be given at or about the time the leaving train starts rather than waiting until the train has cleared the platform, the 15-sec. saving could be effected at express station stops.

Mr. Arnold is studying the necessity of changing the design of the present cars so as to provide one or more openings in the sides, but he cannot reach a fair decision until the effect of the improvements suggested above, or their equivalent, has been shown.

There will always be the problems as to where to draw the line between seating capacity and standing room. At present during rush hours there are practically twice as many people standing as there are seated. If more seats were provided in the present cars, one seat would displace two standing passengers, and either the carrying capacity of the car would be reduced or the standing passengers would be more crowded than at present, which seems practically impossible. As it is impracticable to use wider cars, owing to the lack of clearance in the present subway, the only method of providing more seats is to provide more of the present type and size cars, but with more cross seats, which method would tend to greatly increase the time required for loading and unloading them. As soon, however, as the service of the subway becomes improved either by providing additional seating capacity or by more rapid service, instead of this service creating additional comforts to those who are now riding more people will be attracted by this superior service, and the applicants for seats will outnumber the available seats in practically the same ratio as at present. It is, therefore, evident that a decision must be made, relative to the general nature of the service to be supplied, before the proper type of car can be determined. The desirability of providing a certain number of passengers with a maximum number of seats, and thereby limiting the capacity of the subway to practically the number of seats that can be made to pass any given point within a given time must be compared with the desirability of providing transportation to the greatest number of passengers possible, even though a large majority are compelled to ride for a short time without being provided with seats.

It has been contended not only by those who have suggested certain methods for improving the subway service, but also by the advocates of better service in most of our large cities, that each passenger should be provided with a seat, or at any rate, that whatever improvement is attempted should tend to increase the seating capacity of all cars operated over the seating capacity of those now in use. There is no question as to the righteousness of this contention, but the futility of attempting to furnish such service to all patrons of the road may be judged any evening by the most casual observation of the crowded conditions of the present subway cars. If the policy is adopted of providing seats to the majority of those who ride during rush hours, it will result in a material decrease in the total number of passengers which it is now possible to transport in the subway, and would therefore result in turning away many passengers who now make use of its service.

If the principle of a slight reduction in the seating capacity of the present cars can be adopted, increased carrying capacity can be obtained by eliminating all or a part of the present cross seats. Their elimination makes it practicable to introduce center side doors into the present cars, should this change be found nec-

essary later. In case the traffic cannot be properly handled nor the desired 45-sec. limit for station stops be maintained with the present end door cars, the use of those center doors in connection with the absence of cross seats will make it practicable to load and unload so rapidly that this limit can be maintained.

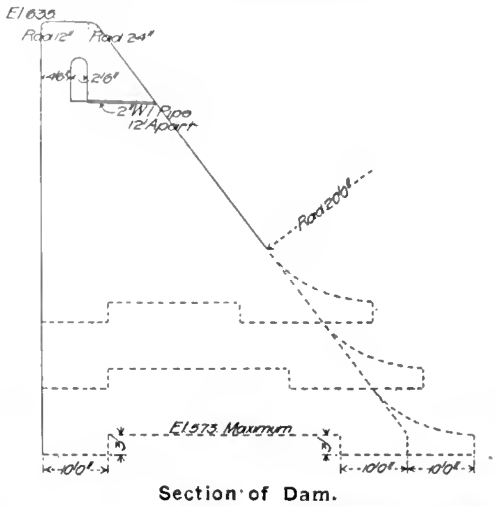
No one having the best interests of the public at heart will deny that if it were possible to provide each passenger with a seat throughout his entire journey that this should be done, but as it is practically impossible during rush hour periods in most transportation systems now existing in the principal cities of this country, the question of just how far this principle can be departed from and still serve the best interests of the public by providing as many seats in the cars as practicable requires most careful consideration.

The hardship imposed upon those who are compelled to stand in the subway cars during the rush hour period is not as great as it at first appears to be, for the reason that, owing to the transfer system between the express and local service, so well worked out in this railway, few passengers are compelled to stand for any great length of time. This is brought about through the fact that the passengers in each car are changed so often, due to transfers at express stations, that many of those who stand at first soon get seats, compelling the newcomers to stand, who for like reason and in turn soon find seats.

In further support of the policy favoring increased standing room in the cars it is but proper to point out that the reason for diminishing the number of seats is for the purpose of providing greater aisle space so that a system of circulation of passengers from the entrances toward the exits of the cars may be more easily maintained, resulting in greater comfort not only to those standing but also to those seated, and at the same time avoiding the conflict of streams of passengers with its resulting discomfort, now so evident at the express stations during the rush hours. As an additional result of maintaining a definite circulation of passengers, greater expedition will be possible in loading and unloading, station waits will be reduced, and the average speed of travel materially increased, so that the discomfort of standing is further lessened by being shortened.

The question then tersely stated is as follows:

Having 60,000 people to carry per hour, shall we, by following one policy, provide seats for 40,000 people with standing room for possible 10,000 more, and turn away 10,000 to other and slower means of transportation, or by adopting, at least until future subways can be built, the other policy whereby increased standing capacity is obtained, provide seats for 20,000 and carry the other 40,000 standing for short intervals of time, and thus furnish transportation for the entire 60,000. Inasmuch as an answer to this question involves a decision based upon public policy rather than upon engineering feasibility, Mr. Arnold feels that the Commission should first pass upon it and instruct him accordingly.



Section of Dam.

A CAR FERRY service across Lake Ontario has been placed in operation between the Genesee River, above Rochester, N. Y., and Coburg, Ont., a distance of 60 miles, by the Grand Trunk and the Buffalo, Rochester & Pittsburg railways. The boat, which is expected to make two round trips in 24 hours, is said to be the largest on Lake Ontario, being 316 ft. long, 57 ft. 4 in. beam and drawing 17 ft. It has a capacity of 26 cars and is expected to develop a considerable coal carrying trade. Though intended primarily for freight, passenger accommodations have been provided on the upper deck.

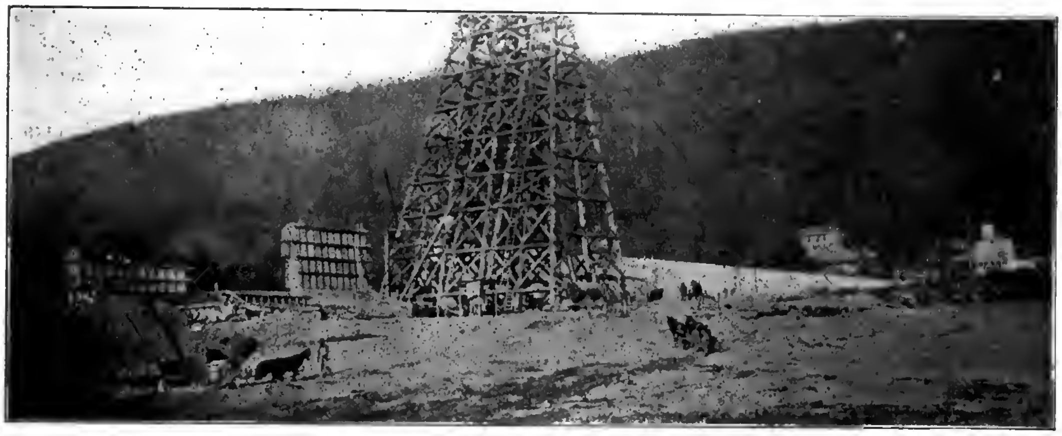
The Chattanooga & Tennessee River Power Company's Plant.

By Howard Egleston, C. E.

During the past ten years the growth of Chattanooga, Tenn., has been very remarkable, and there is every prospect that her future development will be even greater than her past. Blest with cheap coal from nearby fields, her cost of power has been very low; add to this her location, central to immense developments of iron, great forests of hard wood, and many other raw materials, her wonderfully good transportation facilities, and we have the reasons for her being one of the largest manufacturing cities in the South. But in addition to these advantages, nature has furnished another, hitherto not utilized—the Tennessee River as a source of power.

For nearly three-quarters of a century U. S. Army Engineers in charge of the improvement of our inland waterways have studied the improvement of navigation of this river where it breaks through the mountains near Chattanooga. Finally, in 1900, it was practically determined that a dam and lock should be built at Scott Point, 17 miles below Chattanooga, if an appropriation could be obtained from Congress, but some of Chattanooga's wide-awake citizens had been impressed by the success attending the development of water power in other Southern cities, and Messrs. C. E. James and J. C. Guild took the matter up with great energy. By demonstrating the enormous benefit, commercially, that would accrue to Chattanooga, if the power of the river could be converted into electrical energy and brought to that city, they secured the co-operation of Representative John A. Moon, of their district, in obtaining the necessary legislation, and finally in 1904 an act was passed authorizing the Secretary of War to grant permission to the City of Chattanooga to build and construct a lock and dam across the Tennessee River at Scott Point. The act also provided that if the city did not accept this privilege within four months from the date of passage of the act, then the Secretary of War should offer the franchise to Messrs. James and Guild for a period of eight months, and failing to contract with them, to contract with any private corporation, firm or business, for the construction of the lock and dam. The citizens of Chattanooga did not accept the offer, but Messrs. James and Guild organized the Chattanooga & Tennessee River Power Co., with Mr. A. N. Brady in charge of the financial end, Mr. John Bogart becoming consulting engineer for the company.

Scott Point has been selected as being the place



Cableway Tower on East Side of River.

View of Lock Basin, Looking Upstream.

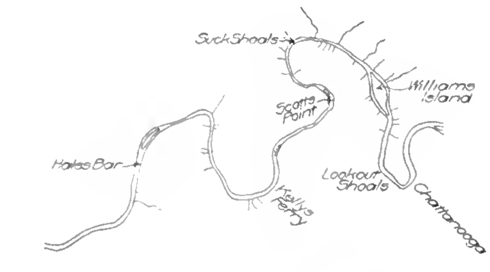
where the greatest improvement to the river could be made at the least cost, but when the plan was changed from simple river improvement to the development of power, it was decided that greater power could be secured, together with an equal or greater improvement to navigation, by constructing the lock and dam further down the river, at Hale's Bar, 33 miles below Chattanooga. Another act of Congress was therefore obtained in January, 1905, authorizing the location of the dam at such other place below Scott Point as the Secretary of War might approve.

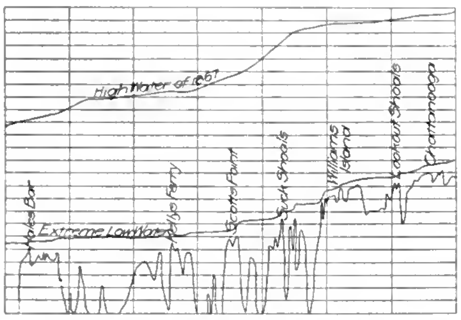
The designs for lock and dam were prepared under Major H. C. Newcomer, Corps of Engineers, U. S. A., by Mr. John M. G. Watt, principal assistant engineer. The power house and all appurtenances for developing the water power were designed by Mr. Bogart.

The lock and dam will be built of Cyclopean concrete, making all walls solid except for a passage through the dam and the necessary culverts for filling and emptying the lock. The total length of lock, dam and embankment between the rock bluff on the west side of the river and the hill where the embankment terminates is 2,300 ft., the dam being 1,200 ft. long, power house 300 ft. and embankment 700 ft. The top of the lock walls will be 52 ft. above present low water, or 58 ft. from foundation to top and 17 ft. above crest of dam. This will allow operating the lock in times of flood of 35 ft., though at that time the river would be 14 ft. above the crest of the dam.

The walls of the lock on the land side will be 30 ft. at bottom and 5 ft. at top, except for the buttresses supporting the gates, where the top will be increased to 25 ft. and the bottom to dam, the difference in height between the upper and lower pools will be over 40 ft. The gates to hold back this great mass of water must be of extraordinary strength; each leaf of the upper gate will be 34 ft. wide by 26 ft. high, weighing about 50 tons, while those of the lower gate will be each 34 ft. wide by 59 ft. high and weigh 130 tons.

Should the gates become damaged at any time the lock can be closed by using five steel trestles at each end. These will be fitted into journals placed in the concrete during the construction





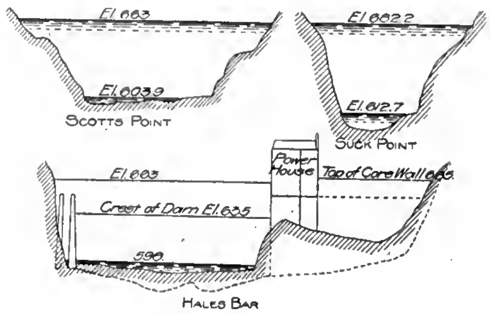
Course and Profile of River.

large quantity of water is flowing, but with a reduced head. Under ordinary conditions of the river the head at the dam will be 36.5 ft.; this may be increased to 39.5 ft. by the use of flashboards.

The generators to be used will be each 4,000 kw. At present it is the intention of the company to install at first only eleven of the fourteen ultimately to be used.

The transmission line is planned to consist of two three-phase lines, both mounted on the same line of poles and carried in as straight a line as possible from the transformer room at the dam to the receiving station in the city, a distance of about ten miles.

The contract for the lock, dam and power house was made with W. J. Oliver in 1905 on a quantity basis, the work to be completed in two years, or in the summer of this year. Apparently a great miscalculation was made, for at this writing, the middle of October, nothing has been done on the dam or power house, and the only evidences of progress are shown in the partly completed core wall for the shore embankment and the coffer dam for the lock, which has been



Sections of River.

Core Wall of Embankment between Bluff and Power Plant.

raised to only 10 ft. above low mark. I do not believe it possible to finish this work under two years, and it is quite possible that a destructive flood may considerably increase this time. To complete the work within two years the working force and plant employed will have to be greatly increased. The General Electric Co. will furnish the electric equipment.

It is the intention of the power company to furnish electric power at not more than $20 per horse-power per year, and they have already contracted for 50,000 h.-p., or practically the entire horse-power now used in the city. This rate will be about one-half of the present cost of power and is sure to cause many industries to locate in this favored city.

33 ft. The river side walls will be 32 ft. wide on bottom and 8 ft. wide on top, widened at the buttress supporting the gate at the upper end to 25 ft. on top and 35 ft. at bottom; and at the lower end to 25 ft. on top and 46 ft. on bottom. In each wall will be built culverts 11 ft. high by 6 ft. wide, running the entire length of lock chamber, and each having ten openings 3 ft. below low water, by means of which the lock chamber will be filled. It will be emptied by two culverts of similar size, having their openings into the lower bay. Stoney sluice gates, operated by electric power, will be used to open and close these culverts.

The gates of the lock will be of the mitering type, horizontally framed, of mild steel, opened and closed by electric motors operating through rack bars. Provision will be made for operating by hand power should electric current fail. In extreme low water, with flash boards on the of the lock. To these trestles will be attached steel beams, against which will rest vertical needles of steel or wood.

Through the whole length of the dam will run a passage 2½ ft. wide by 6½ ft. high, its floor being 12 ft. below crest of dam. From the bottom of this passage will run every 12 ft. a 2-in. wrought iron pipe, extending to the downstream face of the dam, to supply air under the water passing over the dam. The passage will furnish a mode of crossing the river from the power house to the lock and carry the wires for furnishing electric power and light.

The power house will have seven bays, each containing two units. Each unit will consist of a generator and three turbines. This use of three turbines is made necessary by the great variation in the volume of water in the river. In ordinary heights of water only two of the turbines will be used; the third wheel is to be used when a

THE KAISER WILHELM CANAL connecting the Baltic and the North Seas has become too small for the demands of the traffic, and its enlargement and improvement have been proposed. The present profile is 29½ ft. deep at mean water level, 72 ft. wide at the bottom and 220 ft. at the surface. It is proposed to deepen it to 36 ft. and increase the width at the bottom to 144½ ft. and at water level to 334 ft. It is proposed to increase the length of the locks to 1,083 ft. and the width to 147½ ft., with a depth of 45 ft. at mean water level, which is equivalent to 39 ft. at low water. At two points it will be necessary to change the alignment, because the curves are too sharp for large, modern vessels. The present radius is 3,935 ft. and the proposed radius 5,866 ft. Beyond these two instances no change is proposed in the line of the canal. The passing stations are to be increased in number and will be, with the former ones, about 6 miles apart. The cross section of these stations is to be 440 ft. at the bottom and 624 ft. at the water surface. Turning stations will be created at four points by enlarging four of the passing stations, so as to have a length of 3,919 ft. a bottom width of 538 ft. and a surface width of 722 ft.

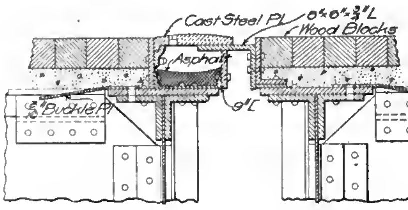
The Queens Approach to the Blackwell's Island Bridge, New York.

The approach to the east or Long Island end of the main spans of the bridge across the East River and Blackwell's Island has provision for two elevated railroad tracks, four other railroad tracks, a carriage way and two sidewalks. It consists chiefly of a steel viaduct with spans of from about 56 to 166 ft. It it 86 ft. wide over all and about 2,663 ft. long from the center of the anchorage pier to the entrance, including about 333 ft. of solid fill between masonry retaining walls at the entrance. The carriage-way and the four surface tracks, rise at a uniform grade of 2.4 per 100 from the surface of the ground at the entrance to a height of about 100 ft. above the ground or 112 ft. above mean low water at the anchor pier. It lies wholly in the borough of Queens and crosses eight streets and boulevards in the suburbs of Ravenswood, Long Island City. Like the main spans of the bridge and the Manhattan approach, described on Nov. 23, it has two decks, the upper one about 63 ft. wide over all, carrying in the center the two elevated railroad tracks and on each side a foot-walk about 14 ft. wide in the clear. The lower deck, about 21 ft. 9 in. below the base of rail of the elevated track has a clearance of about 15 ft. 9 in. under the transverse girders of the upper deck. It is 86 ft. wide over all, corresponding to that of the main spans and differing from the Manhattan approach, which is much wider and is in accordance with the totally different types of construction, being more suitable for the cantilever construction adopted here for the support of the outside tracks which in the Manhattan approach are carried directly by vertical columns under the extremities of the transverse girders.

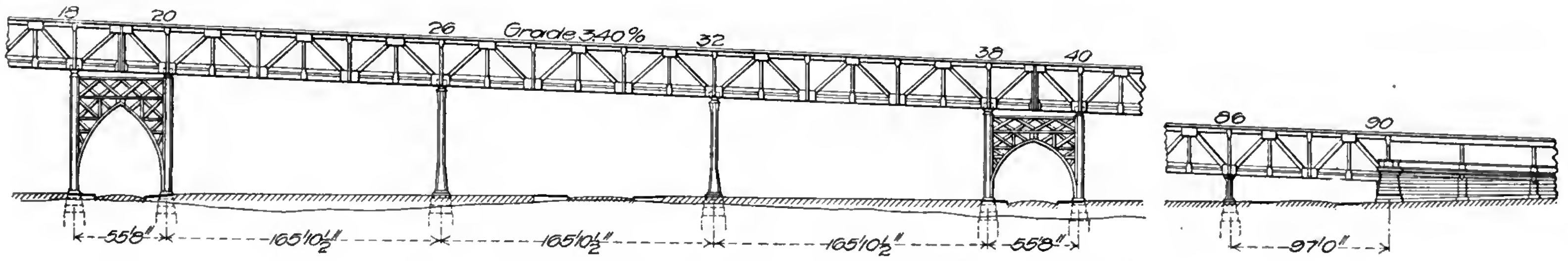
This steel superstructure consists essentially of groups of five spans each, supported on towers 55 ft. 8 in. long and on two transverse bents intermediate between each pair of towers. The lengths of the main spans are proportioned in accordance with their height above the ground, varying from 97 ft. at the lower end to 131 ft. 4 in., 145 ft. 6 in., and 165 ft. 10½ in. at the bridge ends. The minimum clearance of the completed superstructure above the surface of the ground is about 15 ft., and the towers and vertical columns are so located that they clear the intersecting streets, four of which pass through the towers.

Unlike the Manhattan approach this approach has no subway station or depressed tracks, all of the surface tracks leaving the bridge at grade at the Crescent St. entrance, where the only structure of an auxiliary character is the stairway leading to the end of the elevated railroad tracks which may later on be joined to a connecting line in Ravenswood. The embankment approach has a clear width of 86 ft. uniform with that of the lower deck of the steel viaduct and has retaining walls 333 ft. long and 20 ft. in maximum height above the surface of the ground. They are of concrete offset in the rear and battered in front where they are faced with granite down to a few inches below the surface of the ground. They are 3½ ft. wide under the coping and are 10 ft. wide at the base for a height of 20 ft. The filled embankment between them is covered with 6 in. of concrete on which the wood pavements, railroad tracks, and electric conduits are laid and in which there are four lines of electric ducts. The columns for the elevated railroads are carried down 5½ ft. below the surface of the roadway where they are seated on separate offset concrete piers of a maximum height of 16¼ ft. and footings on dense sand. A cast-iron guard encloses the column to a height of about 18 in. above the roadway, and below its top the column is entirely enclosed in a solid mass of concrete.

The elevated railroad structure is substantially the same throughout the length of the approach whether it is supported by the steel viaduct or on the filled embankment. The principal difference is in the feet of the columns, which in one case are seated as already described on masonry piers, and in the other case are the regular vertical posts at the panel posts of the main trusses which carry the lower deck. Accordingly, in the viaduct spans the transverse girders of the elevated structure, about 22 ft. apart, directly support the four lines of track stringers and the four lines of sidewalk stringers, all of which are plate girders, respectively 48 in. and 42 in. deep.



Expansion Joint in Roadway.



Part Elevation of Queens Viaduct of the Blackwell's Island Bridge.

The sidewalks are carried by 7-in. transverse I-beams supported on each side of the bridge by two lines of stringers and by the top cords of the truss. At the end of the steel viaduct there are eight 44-ft. elevated railroad spans supported by the vertical columns. Each of them has eight lines of 48-in. longitudinal plate-girders web-connected to the transverse girders 6 ft. deep that are supported by the vertical columns 60 ft. apart transversely, to which they are connected by vertical web angles and by deep solid-plate kneebrace brackets. There are also two lines of fascia girders 3½ ft. deep riveted directly to the columns and each carrying, together with two adjacent lines of longitudinal girders the transverse sidewalk floor beams on cast-iron filler blocks. The floor panels are X-braced with single 6-in. horizontal lateral angels web-connected to the transverse girders about 2 ft. above their bottom flanges. The sidewalks are made with reinforced concrete floor slabs and have hand rails with cast-iron bolts, cast pipe rails and riveted lattice work webs.

The transverse girders have 7-16-in. web-plates reinforced to 1 3-16-in. thick at the ends and each flange is made with a pair of 8x8x13-16-in. angles and three 18-in. cover plates of different thicknesses and lengths. The columns are vertical and the transverse girders are riveted to them at a slight angle to correspond with the angle of the grade.

The longitudinal girders have their fixed ends field riveted to the webs of the transverse girders and their expansion ends are supported in pockets made with pairs of vertical angles riveted to the webs of the transverse girders and connected at the bottom by a reinforced horizontal shelf angle. The bottom flange of the longitudinal girder slides freely on the shelf angle and the top flange is guided between the vertical pockets by short longitudinal angles riveted to the under side of its top flange and forming transverse bearings.

The four viaduct towers vary in height from about 20 to 80 ft., but all have the same transverse and longitudinal dimensions, namely 55 ft. 8 in. and 60 ft. on centers, and have the same details of bracing modified only by the varying dimensions. The faces are similar in transverse and longitudinal elevations, in each of which the tops of the vertical columns are connected by a horizontal lattice girder and by deep portal struts forming a continuous arch between the columns. The dimensions of the two bents of the same tower vary slightly, but the materials are alike. In successive towers both materials and dimensions vary perceptibly.

In the second tower from the entrance the tallest bent has a height of about 36 feet., and the lattice girders are 7 ft. 9 in. deep on centers, with a rectangular top chord composed of two 12-in. channels and a 34x9-16-in. cover plate. The bottom chord has an H-shape cross section made with two 12-in. channels connected with lattice on their flanges and by an intermediate horizontal diaphragm made with two continuous full-length angles latticed. The web members consist of X-braces each of which has an I-shaped cross section made with two pairs of 3x3½-in. angles back to back latticed. At intersections one member is continuous and the other is cut to clear and spliced with field riveted cover plates on both flanges. The curved portal brace has a rectangular cross section with two 17x⅜-in. web plates, one 25x⅜-in. cover plate, two 8x6x½-in. bottom flange angles turned inward, two 3½x3½x⅜-in. inside and two 4x4x⅝-in. outside top flange angles. The top flanges are connected by the cover plate and the bottom flanges are latticed. The web members connecting the curved portal brace with the columns and with the horizontal girders correspond to those in the latter member and are connected to rectangular extensions projecting from the face of the column.

The column has a cruciform cross-section, closed excepting for narrow lattice spaces in each face, and is also provided with an interior I-shaped diaphragm in a plane parallel to the bridge axis. It is made in the heaviest bent with four 8x6x¾-in. outside and eight 4x3½x⅜-in. inside flange angles, four 8x6x11-16-in. web angles, for the I-shaped diaphragm, two 38x13-16-in., four 7x⅜-in., and one 23x½-in. plates. The foot of the column is connected by ¾-in. bent plates to the 58x1-in.x58-in. base plates seated on a cast-steel pedestal. The bottom chords of the longitudinal and transverse latticed girders are braced at their centre points by I-shape horizontal struts perpendicular to them, each made with two pairs of 6x3½x⅜-in. angles latticed and intersecting in a common point at the center of the tower with two main diagonals of the same panel. At the intersection the longitudinal girder is continuous and

all of the others are cut to clear it and connected together and spliced with large field riveted top and bottom flange cover plates.

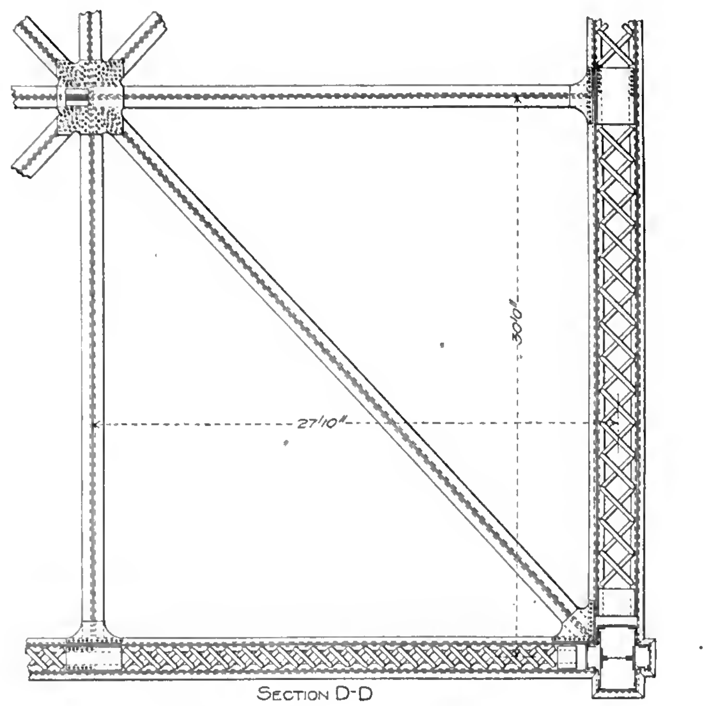
The single transverse bents intermediate between the towers correspond exactly to the bents forming the towers, except that the upper and lower ends of the columns are expanded longitudinally to form wider seats for the trusses and to secure extended bases. The construction is clearly indicated by the side elevation and cross sections of the 30-ft. 6-in. column in bent No. 64, which has a width of 5 ft. at the top and a width of 6 ft. at the bottom. It is made with eight 8x6x¾-in. and eight 4x3½x⅜-in. angles and four 38x⅜-in. and four 7x⅜-in. plates, the 7-in. plates have the small angles forming the wings. The shortest bents have a height of only about 12 ft. and 15 ft. and in them the horizontal girders are omitted, the columns being connected only by the curved portal struts and narrow top struts connected together with vertical and diagonal members so as to practically form spandrel braced arches. The cross sections of the column and portal bracing correspond essentially to those already described.

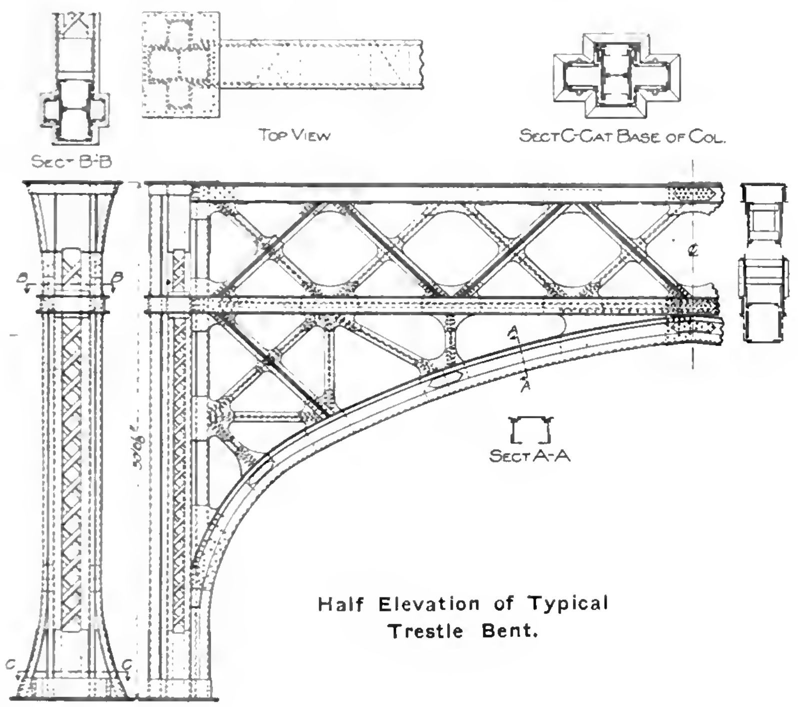
The cast-steel column bases have cruciform plans corresponding to the cross section of the columns and have a uniform height of 8 in. They are of cellular construction with a continuous base plate and vertical webs all 2½ in. thick. Both top and bottom surfaces are planed and the vertical webs are located in the planes of the column webs so as to afford them direct bearing without any horizontal top plates. Each pedestal has four 3-in. holes for vertical anchor bolts in the piers, and after its column is erected on it the pockets between the vertical webs are filled solid with concrete extending up into the base of the column.

The spans connecting the towers and intermediate bents are made with two lines of riveted trusses 25 ft. 6¼ in. deep and 60 feet apart on centers. The three spans in each panel between towers are duplicates except that the two end spans cantilever one panel beyond their supports on the tower to form half of the tower span. Except for the three spans at the shore ends which have two panels each, all spans have three panels, varying with the total length of 131 ft. 4 in., 145 ft. 6 in., and 165 ft. 10½ in. Except for these changes and the corresponding variations in material all spans are essentially duplicate and the details of construction and connections are alike throughout the approach. The spans between the first and second towers from the shore ends are 131 ft. 4 in. long on centers, with 21 ft. 10⅝ in. panel lengths.

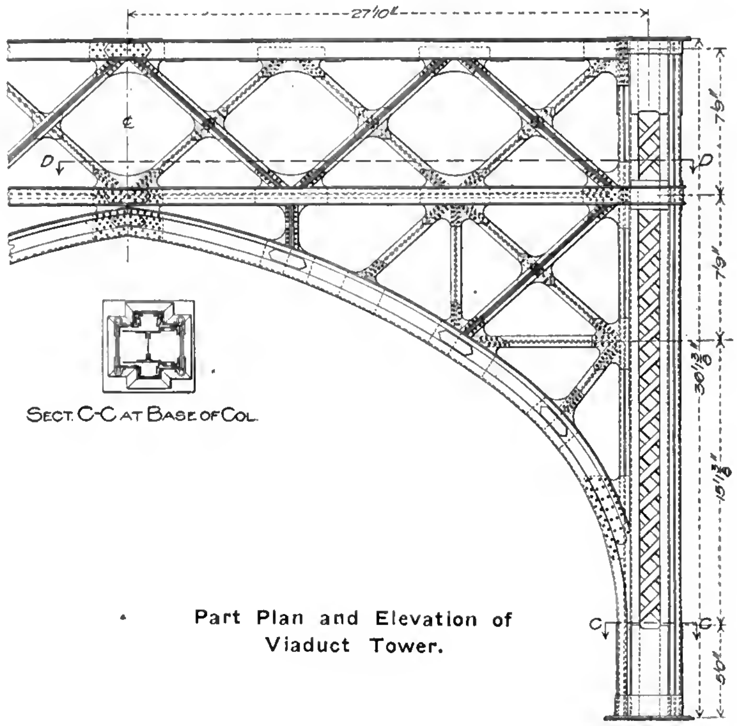
Both top and bottom chords have rectangular cross sections made with a pair of built channels with their flanges turned inward and latticed. The maximum bottom chord section consists of four 6x4x⅝-in. flange angles, two 30x9-16-in., two 28x½-in., and two 22x⅝-in. web plates, giving a net area of 96 7-10 sq. in. The minimum bottom chord is made with four 6x4x7-16-in. flange angles and two 30x⅝-in. web plates, giving a net sectional area of 45.7 sq. in. The top chord is of similar construction materials and dimensions, with a minimum net area of 33 3-10 sq. in.

Both top and bottom chords are apparently continuous through the three spans from center to center of towers, but sliding joints with cover plates bolted on through slotted holes are introduced in the top chords near the intermediate bents to separate the spans and prevent continuous girder action in the trusses. The construction of the diagonal members is similar to that of the chords, being made with rectangular cross sections composed of two built channels with their flanges turned in and latticed, with a maximum cross section composed of four 6x6x½-in. flange angles, two 30x½-in., two 28x9-16-in., and two 18x½-in. web plates. The panels are subdivided by vertical posts having a uniform I-shape cross section made with four 7x3½x½-in. flange angles and a 23½x⅜-in. web plate.





Half Elevation of Typical Trestle Bent.



Part Plan and Elevation of Viaduct Tower.

All members of the trusses are shipped separately, the chords being made in two-panel lengths and having ¾-in. connection plates shop riveted to the backs of their channels at panel points and projecting beyond their inner flanges to serve as connection plates receiving the field riveted connections to the vertical and diagonal members. At the panel points over the intermediate posts supporting the center span, these connection plates serve as field splice plates for lower chords. At all other points top and bottom chords are spliced with six or eight web and flange cover plates field riveted to both members.

The trusses are connected at panel and sub-panel points by the transverse girders in the upper and lower deck which are field-riveted to the vertical members with their flanges flush with those of the chords. At the girder connections the chord webs are connected by the vertical members of the truss which pass through them or by pairs of vertical transverse diaphragms which stiffen them and distribute the load through both of the built channels. In the lower chord these members also provide continuous connections between the main section of the floor beam uniting the trusses and the cantilever extensions on the outside of the trusses. Horizontal connection plates riveted through the lower flanges of top and bottom chords at panel points and to the floor beam flanges provide for the field riveted connnections of the single top and bottom lateral system diagonal angles. The trusses have no transverse vertical diagonals, but are sway-braced by the depths of the connections to the transverse girders and by the portal-like kneebrace brackets under the upper deck.

Over the vertical posts in the towers and transverse bents the trusses have bearings on 9-in. pins engaging half-hole bearings in cast-steel shoes and pedestals. The shoe differs from those ordinarily employed for the bearings of riveted trusses for

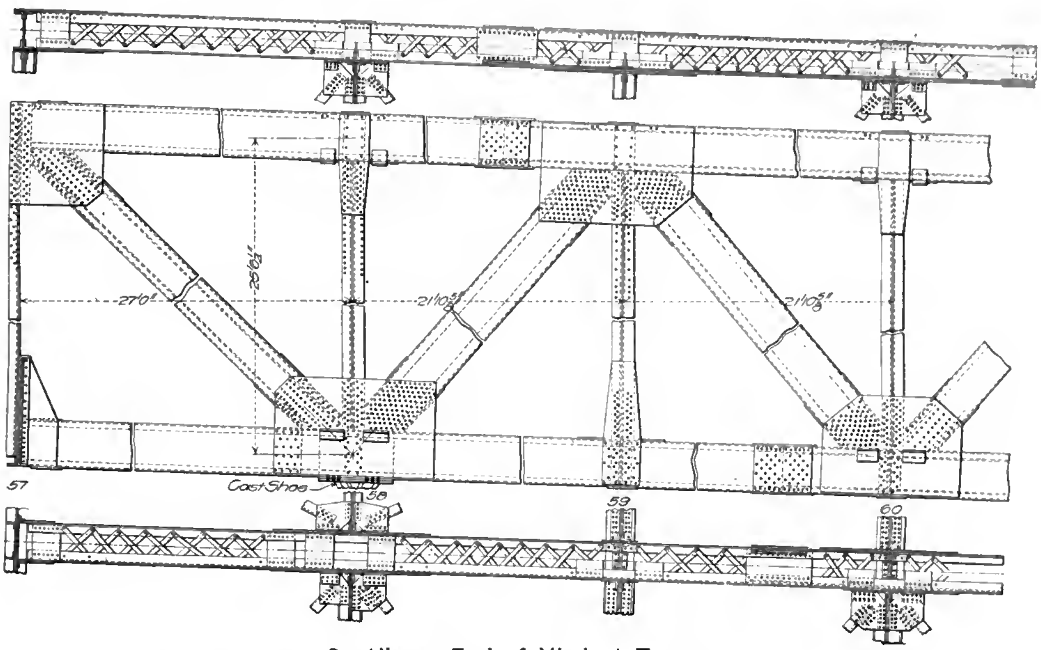
girders in that it has, besides the horizontal bearing on the bottom flange of the chord, a pair of vertical web plates connected by an integral transverse diaphragm and engaging and riveted to the webs of the lower chords. Both vertical and horizontal bearing surfaces are faced and the rivet holes are drilled after the shoe is assembled to the lower chord, thus insuring absolute precision in the rivet holes.

The continuous half-hole bearing for the pin is stiffened with longitudinal and transverse webs and has in the center a groove for a collar, which is also grooved into the pin and locks it in position. The pedestal has a similar half-hole pin bearing stiffened with one longitudinal and four inclined transverse webs integral with the wide base plate, 3¼ in. thick, secured to the tower or

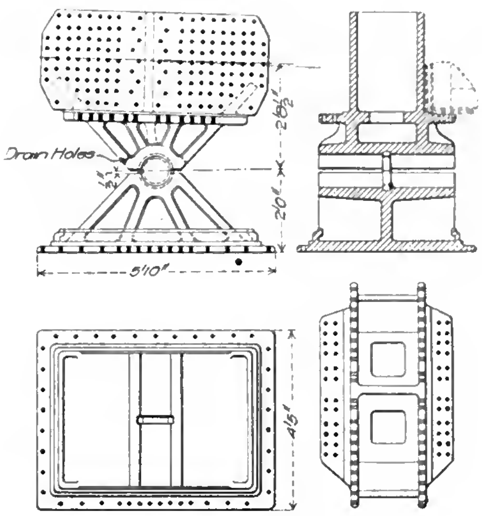
The four trolley stringers have pairs of 5x3½x⅜-in. flange angles and single full length 16½x⅜-in. top flange cover plates. The seven intermediate stringers carry the roadway at 3½x3½x½-in. flange angles without cover plates. All the stringers are web-connected to the web of the transverse girder and are seated for convenience in erection on horizontal bracket angle shelves and have the upper corners of their webs cut to clear the top flanges of the transverse girders.

A solid floor of ⅜-in. buckle plates is riveted to the top flanges of all stringers and transverse girders. The cantilever ends of the transverse girders are field riveted to the vertical posts of the trusses and are spliced to the main girders by pairs of angles on the top flange and by an 18x15/16-in. cover plate 7 ft. 9 in. long on the

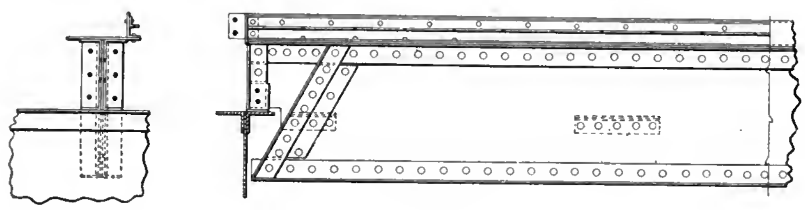
At these points there are double floorbeams 20½ in. apart on centers with special top flanges connected by a sliding apron plate. A full length trough made with 5x¾-in. plates riveted to the flanges of a horizontal 9-in. channel is riveted to the top flange of the fixed girder, and the space between the channel flanges is filled with asphalt hitched to one end and making a gutter to carry off drainage water from the pavement without danger of leakage to the road below. One edge of the trough has a continuous cast-steel bracket forming a sort of hinge connection for the checkered cast-iron apron plate 12 in. wide and 2 in. thick, with a convex checkered upper surface, which is made in sections about 5 ft. long. The outer edge of this plate is supported by and slides freely on the horizontal flange of a 6x8-in. angle riveted to the transverse movable girder and bearing on the upper edge of one of the trough plates. This arrangement provides for a movement of several inches, causes very little ir-



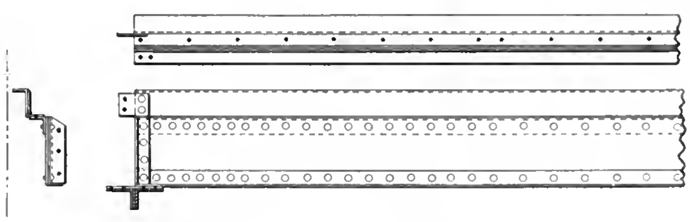
Cantilever End of Viaduct Truss.



End Bearing for Viaduct Span.



Drop End Stringer.



Cable Conduit Stringer.

vertical post with numerous field rivets around the outer edge. The space around the webs is filled solid with concrete retained by a projecting fillet around the edge of the base plate, which is recessed to lock the concrete in position. At the expansion ends the height of the pedestal is made 7¼ in. less than at the fixed end, and it is seated on a nest of eleven 4-in nickel steel rollers 40 in. long, supported on a cast-steel bed plate 3 in. thick. The rollers are fixed transversely by center guide ribs and their shouldered ends engage the vertical flanges of angles carefully fitted to rebates in the end of the base plate and pedestal, thus excluding dust and rubbish from the rollers.

The transverse girders in the lower deck are each made in three sections, one of them 58 ft. long between the trusses, with a 12-ft. cantilever extension outside the trusses at each end. The 58-ft. section has a 72½x7-16-in. web shop spliced in three lengths and a pair of full length 8x6x⅝-in. angles in each flange. The top flange has a single 24x¾-in. full length cover plate and the bottom flange has a full length 18x⅝-in. and a 34-ft. 18x½-in. cover plate. The girder is divided into 5-ft. panels by vertical web stiffener angles at the connections to eleven lines of stringers, all of which are plate girders with 27x28-in. webs.

bottom flange. Their outer ends are connected by a continuous line of facia stringers made with a 45x⅜-in. web plate and a single 6-in. 15-lb. channel riveted to the outside of each flange.

The stringers for the outside trolley track are of special construction with a 27x⅜-in. web and 5x3½x½-in. flange angle. The top flange is reinforced by a 60½x⅜-in. cover plate, to which is riveted a 6-in. bulb angle reinforced by a 2x2-in. stiffening angle to serve as a guard-rail. The lower corners of the webs are notched to clear the top flange of the cantilever and give a bearing on it for the stringer web and allow the bottom flange to be seated in the usual manner on a bracket angle riveted to the girder web. The end of the lower flange is stiffened by a pair of inclined web stiffener angles and pillar plates.

The electric conduit in the center of the trolley track is made with a pair of built channels 13 in. deep with their flanges turned in and the upper one supporting the Z-bars forming the slot. The curb girder just inside the trusses has a rectangular cross section, made with two 15-in. channels, with both flanges turned in the same direction and connected by an 18x⅜-in. cover plate on top and by lattice bars on the bottom.

Transverse expansion joints are provided in the lower floor on the center lines of the towers.

regularity in the surface of the pavement and can be easily inspected, cleaned or repaired.

The specifications for the sub-structure and super-tructure are very complete and correspond substantially with those already mentioned in the article descriptive of the Manhattan approach. The requirements for the structural steel and for the cement correspond to accepted standards and contain ample provisions for tests and inspections. All parts of the work are proportioned for expansion and contraction due to a change of temperature of 160° Fahr. and all rods and tapes used in laying out these works in the shops are carefully standardized with those used in the location work. Paint is mixed with 500 lb. of red lead to 19 gallons of pure linseed oil. The red lead must contain at least 80 per cent. true red lead and not more than 1/10 of 1 per cent. of metallic lead. It shall pass through No. 19 silk bolting cloth with a residue of only 1 per cent Very complete specifications and descriptions are given for the track construction, electric equipment, rail joints and bondings and the creoresinade wood block pavement.

The principal quantities in the second section include about 17,000 cu. yd. of excavation, 35,000 yd. of fill, 8,400 yd. of concrete, 2,500 yd. of dry rubble retaining walls and coping, 4,900 yd. of

granolithic concrete walks and foundations, 10,500 yd. of pavement, 3,900 lin. ft. of four-way electric conduits, 9,500,000 lb. of structural steel, 280,000 lb. of steel castings and 60,500 lb. of nickel steel castings, 172,000 lb. of steel rails and 173,000 lb. of cast-iron.

The bridge was designed and its construction supervised by the Department of Bridges of New York, Mr. J. W. Stevenson, commissioner; Mr. C. F. Ingersoll, Jr., chief engineer. The contract for about 1,420 ft. of the viaduct nearest the river was awarded to the Buckley Realty Construction Co. and the contract for the remainder was awarded to the Maryland Steel Co., who fabricate the structural steel work at their steel shop and who have sublet the contract for the erection and for the sub-structure work to the Snare & Triest Co., New York.

Ditch Construction on the Seward Peninsula.

The placer mining industry of the Seward Peninsula, Alaska, was developed at a very remarkable rate, the possibility of lucrative mining being established within about a year of the discovery of gold. The great drawback, however, was the absence of water, and though good sense and engineering judgment discouraged the construction of ditches, the rich field awaiting development promised a return on the heavy investment necessary to get water. Construction was first started in the Miocene Ditch, a project about 60 miles long, which carried the water from the head of Nome River across the divide to a point above the benches of the Snake River slope. The constructors had no precedent for such work in this climate, but by sheer grit surmounted all difficulties. The success of the enterprise ushered in an era of construction during which, in 1905, the ditch of the Taylor Creek Ditch Co., of New York, was built. The latter work was described by Mr. James A. Kelly, engineer for the company, before the Pacific Northwest Society of Engineers, in a paper reprinted in the September "Proceedings" of the society, from which these notes have been taken.

The data furnished to Mr. Kelly consisted of a profile of the proposed ground to be traversed, which plainly showed itself to be the work of the barometer and hand level, and a verbal description of the country. The date fixed for embarking upon the expedition was June 4.

Among the materials necessary were one-half mile of 40-in. No. 10 B. W. G. steel riveted pipe, 400,000 ft. of No. 1 clear fir lumber, surfaced four sides, and some few miles of burlap 12 ft. wide; plows, scrapers and graders; sixty-five horses, twenty-two wagons, material for a suspension bridge and tons upon tons of provisions for the laborers and feed for the horses; 50 tons of coal; tents to house three hundred men, office tents and stable tents, the latter accommodating twenty horses each.

The pipe was nested, one section 5 ft. long, full riveted, enclosing four other sections nested inside and bound with clamps of strap iron after the fashion of sheet steel. Hay was hydraulically compressed. Sustenance for the men selected from the class of provisions generally conceded to be the most filling and nourishing for their weight. The material and supplies were sent by tramp steamship to Teller, at the mouth of Grantley Harbor, the main part of the expedition sailing to Nome with the horses, wagons and some few implements for the construction. The trip to Nome and unloading of boats occupied about 15 days. Then followed a wait of about two weeks to allow the horses to recover from the effects of the sea voyage and get acclimated; also to allow spring freshets in the rivers time to subside.

During the first week in July the expedition started out overland for the Kugorock River, a distance of about 150 miles. It tallied-up ten wagon outfits, each comprising six horses and two wagons and about twenty men, including drivers. From ten to twelve miles per day was the average haul, and that with only about 3,000 lb. load for six big horses and two wagons. Extra feed and provisions for horses and men were brought up by boats from Teller through Grantley Harbor and Great Salt Lake to Mary's Igloo, a distance of 65 miles, and from here on up the Kutsitrin River in horse boats to Lane's Landing, fifteen miles. This place was about half way between Nome and the destination and was generally used as a supply station for the surrounding country. The horse boats were usually about 20 ft. long, built scow fashion, but with a great deal of dish, and flexible enough to be twisted without breaking. They were pulled up stream by one horse.

The Peninsula is practically barren of timber, except for a few small clumps of cottonwoods and dwarf firs in river bottoms, and is for the most part covered with tundra. There were no roads in the country, and had there been, contrary to what is usual, the beaten track would be the thing to shun, it being always one continuous mudhole. On the 18th of July the expedition started down the slope into the Taylor Creek valley, and at noon camped at a point about the center of the proposed ditch line.

Transportation of the main part of the material was effected as follows: One supply station was established on the beach at Teller, and another one, to be used as a base, established on a navigable slough or arm of Great Salt Lake and named Kugorock. Here the party built a large warehouse and stable 60x80 ft., with a strip off each side used for stables for horses and the center for perishable supplies. A light draught stern-wheel gasoline boat provided with several scows was placed on the run between these two supply stations, traversing Grantley Harbor and Great Salt Lake and the aforementioned slough, a distance of 60 miles. From here on material was transported by wagon outfits up the bed of Mary's River to the summit, down Coarse Gold Creek to the Kugorock, and up the Kugorock to Taylor Creek, a distance of 45 miles, and distributed as required. The wagons were the common type of farm wagon, with perhaps all vulnerable parts a little stronger than is usual. One ditch company used an ordinary wagon with extra tires of steel 10 to 12 in. wide, shackled on over the felloes of the wheels, these tires sometimes preventing the wheels from sinking in the mud, but making matters much worse when they did. Another outfit would have nothing but narrow felloes and tires, with spokes widening toward the hubs so that if the wheels did sink more readily they would the more easily be pulled out. Wherever possible wagon trains took to the beds of streams, which, though full of boulders, at least had the virtue of being solid.

The methods of making the surveys were simple, being first the setting of stakes 1½ ft. above the proposed sub-grade of the ditch, the fall of which was only about 4 ft. per mile, owing to the necessity for developing head in as short a distance as possible and the danger from erosion in glacial ground consequent to high velocities. Following the level party, a hand level party reset the lower stakes to obtain some respectable appearance of curvature and allow for slope, at the same time setting upper slope stakes to conform. Slope was usually 2 to 1. The stake material was all of selected fir, 5 ft. long, 1½ in. wide, ¾ in. thick, surfaced four sides, and shipped in bundles of fifty each. On the ground the bundle was sawed in two and the stakes sharpened.

The ditch was to be some twenty odd miles long and designed to carry about 90 cu. ft. per second. It was broken in the middle by a crossing of Taylor Creek, in the form of an inverted syphon carried on a suspension bridge. Spillways were to be placed every mile or so of its length to regulate the flow of the water in the ditch, which would vary considerably owing to the surface drainage. Alternating with these spillways every mile were waste gates, permitting the water to be shut off entirely from the portion of the ditch beyond and allowing the section of the ditch thus isolated to be thoroughly emptied for repairs.

The working season being a short three months, dirt was flying before the first 600 ft. of stakes were set. The stakes being set, tundra was immediately plowed up between the lower slope stakes and up to a point directly over the bottom of the ditch on the up-hill side. This sod or tundra was dragged off by laborers with hooks made from miners' driving picks with the ends bent over, and if the sod was of any value at all as bank it was placed as such, otherwise tundra and light material was dragged down the slope to clear the bank. The ground thus exposed was allowed to thaw. In the glacial ground it thawed and sunk readily to a point below the sub-grade, then burlap was placed in the bottom of the ditch to prevent erosion and thawing, and covered with silt up to grade, the sod left on the upper side gradually dropping as the ground sloughed out from under, forming a protection for the upper bank against further thawing. In cases where the ground thawed unevenly an ordinary device similar to an old-fashioned snow plow, V-shaped, steel shod and well loaded with sand bags, was held against the upper bank and dragged along with horses, pushing the mud against the lower bank and evening up the bottom of the ditch. For ordinary dirt excavation, long-handled shovels and a type of horse scrapers generally known as "slushers" were used, six teams with scrapers comprising an outfit, with one driver, two loaders and two dumpers working in a circle crosswise of the ditch and dumping on the bank. When the ditch was roughly excavated by this means, it was trimmed up and sloped by laborers with shovels and mattocks.

The rock encountered footed about 20,000 cu. yd., and was for the most part perpendicular cliffs of mica schist, interspersed with stringers of quartzite, very soft and almost capable of being moved with mattock and shovels, but not quite, and Mr. Kelley states that after an experience of ten years and the personal use of hundreds of tons of high explosives, this rock is the worst to move he ever encountered, some innocent little shots tearing whole slabs of the cliff away below grade, while other big ones seemed to find their way into crevices and not accomplish anything. In places where no rim was left for the lower side of the ditch, sod walls built with all the care usually given masonry were placed.

Short pieces of flume were used across gaps, with aprons well sodded in, and sometimes burlap or canvas was used to make the joint tight. The foundation pits for the flume trestles were cut in the ground, mud blocks of cedar set and sills set on top, and as far as possible covered up with sod to prevent further thawing of the ground. These were left to stand a while and assume any position or elevation they chose, and trestles and flumes built on top. On the whole line there was about a half mile of flume.

It was intended to construct the dam of concrete, but legal obstacles prevented securing a favorable site and the dam was built of sand bags, sod and boulders.

The inverted syphon was constructed from the 40-in. pipe afore-mentioned, having a maximum pressure at the lowest point of 50 lbs. per square inch, and the pipe was supplied at each hump in the grade with automatic air valves, six in all, and in the center of the suspension bridge with a blow-off. The suspension bridge carrying the syphon had a clear span of 100 ft., and consisted of two 1¾-in. plow steel cables, 4 ft. 4 in. apart, one on each side of the pipe, from which yokes were suspended every 5 ft. apart. The main cables had a dip of 12 ft. at the center of the span, and were carried back 37½ ft. beyond the towers to anchors buried in the frozen ground. The yokes which were suspended between the hangers and carried the pipe were of fir, 6x16 in. x 5 ft. 4 in. Foot boards of 3x12-in. stuff were laid on the yokes on both sides of the pipe and guys of ¾-in. rope were run to shore in four directions from the center, and anchored with dead men frozen in. The towers were built of timber 19 ft. 6 in. high.

The anchorage pits for the main cables were cut into the ice about 15 ft. by means of steam thawers. Dimensions at the bottom were 8x17 ft. Here a mattress was placed consisting of 12x12-in. plank 17 ft. long, and on top of this cedar planks, 3x12 in. x 8 ft., placed crosswise. The main cables were secured to these by means of a number of loops from the flexible small cable and water and mud poured in until the pit was filled up and the holes allowed to freeze again before the false work for the bridge was removed.

By the term "glacial ground" in this article is meant ground with a covering of moss or tundra a foot or two thick, with a stratum or deposit of mud and black peat from 2 in. to 1 ft. thick, and below this from 10 to 40 ft. of ice holding in suspension perhaps 10 to 20 per cent. of silt. Under normal conditions the peat or mud thaws in the summer time a foot or so, but in some places not at all. It was observed by the pioneers, however, that there was less liability to encounter ice on the south slopes, hence frequent crossings from one side of the valley to the other were resorted to.

STEEL CROSS-TIES of trough section placed 6 ft. on centers have been used on about 75 per cent. of the city lines of the Montreal Street Ry. Under each line of rails there is a concrete beam, while between the beams there is the usual concrete foundation for the pavement.

Fire Protection System of the American Dock Stores.

By Frank Sutton, Consulting Engineer, New York.

It has only been during the past few years that the question of some adequate means of fire protection has been adopted. While it is true that the sprinkler head has been used for some time, it has been confined almost entirely to manufacturing establishments, and even then to a limited extent, the owners of buildings having depended largely upon the fire departments of the towns in which they were located. Of late years the importance of some adequate and reliable means of extinguishing fires has been realized, and to-day a large number of manufacturing concerns are endeavoring to provide complete systems of fire protection.

The credit of bringing this branch of engineering up to its present state of perfection is without doubt due to the New England manufacturers, who long ago realized that it was to their advantage to provide some suitable form of protection, and their example has been steadily followed, until at the present time the sprinkler and fire protection business has grown to a very large extent, although, strange to say, this particular line is confined to a small number of concerns who make a specialty of this class of work. This is without doubt due to the fact that the underwriters have been very stringent in their requirements as to the design of the sprinkler head, which is the important factor in an up-to-date fire protection equipment. Then, again, the question of patents has entered largely into the design of heads, and at the present time it is a difficult matter to design a new head which will not infringe on some article already being manufactured. Even up to this time designing engineers have paid much too little attention to this question, the work having been left almost entirely to the sprinkler concerns to design the systems which are installed.

Another important feature in connection with this class of work is not only the advantages gained by protecting the property against loss by fire, but also the large reduction in the rate of insurance, varying from 30 to 50 per cent. reduction for a sprinkler equipment. The writer has known of cases where in a first-class equipment the insurance is carried for from 5 to 8 cents per hundred, which is extremely low. These low rates are confined mostly to the mutual companies, which are in the majority of cases more stringent in their requirements and will only assure what might be termed preferred risks, such as factories of certain construction and manufacturing certain lines of goods, and in some cases docks and warehouses, and will only accept risks that are protected with sprinkler equipments.

Sprinkler systems may be divided into two classes, wet pipe systems and dry pipe systems, the wet pipe system being used and being required for all purposes where the lines are not exposed to freezing. It is only in cases where the pipe is exposed to low temperatures that the dry pipe system is installed.

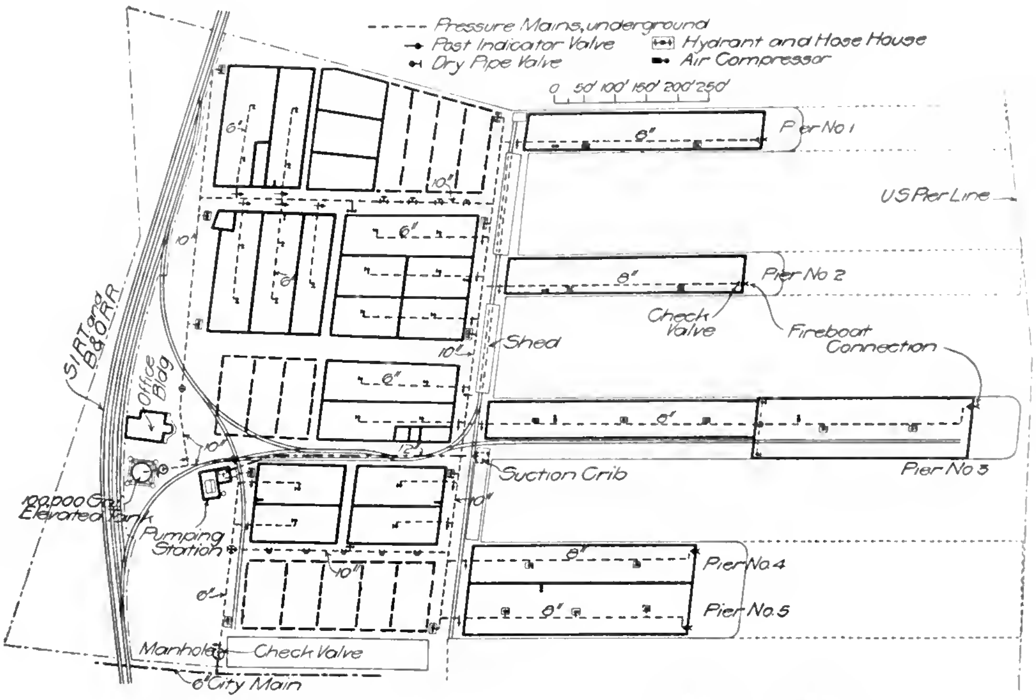
The principal differences between these two systems is that in the wet system the piping up to the sprinkler head is full of water. The dry system is supplied with air in that part of the piping which is exposed to freezing temperature. This is accomplished by keeping a pressure of air in the lines a little above that of the pressure in the water pipes and interposed by a specially constructed dry valve which operates when a head discharges, thereby relieving the air pressure and allowing water to flow through the lines. The illustration shows a dry valve which is used by one of the sprinkler concerns. These valves are all constructed on similar lines and are fully protected by patents.

To install a first-class fire protection system there should be at least two sources of supply and preferably three; that is, three distinct sources from which water may be drawn. One source is the sprinkler tank, located at some distance above the highest sprinkler head, and another source is the supply of water furnished by some public water works, either getting direct pressure into the system or operating through a fire pump. Other sources may be either a lake or a river, or artesian wells or springs, depending upon the location of the building. It is also sometimes customary to build a large reservoir, underground or outside, holding anywhere from 100,000 to 500,000 gallons, that may be drawn upon as required.

The insurance people, especially the mutual companies, insist on two sources, namely, a sprinkler tank and a fire pump if the street pressure is not great enough to carry the water to the highest sprinkler head. Where a steam fire pump is installed it is obligatory on the part of the assured, especially in mutual risks, that the boiler plant be kept under 50 lb. of steam at all times, so as to assure ample protection in case of fire. The electric fire pump is used to a considerable extent, but is not considered by the underwriters so good as a steam pump, on account of the danger of the pump motor being put out of commission either by water or by the breaking of electric wires.

The wet pipe system is by far the simpler of the two systems to install, as no complicated dry valves, air compressors or the like are required. The two systems, however, operate practically the same; that is, whether a dry pipe or a wet pipe system is installed the underwriters will require the same sources of supply and the equipment installed in the same manner, as far as the spacing of sprinkler heads is concerned, and the sizes of pipe used in connection with the installation of the system.

The following description of the fire protection system installed in the extensive docks and warehouses of the American Dock & Trust Co., at Tompkinsville, Staten Island, on lower New York Bay, gives an idea of a thoroughly up-to-date dry pipe system. In buildings of this class it would have been impracticable to install a wet pipe system, on account of the danger of freezing the lines, as neither the piers nor the warehouses have any heat whatsoever, and, in fact, the underwriters particularly stipulate that no heat shall



Warehouses and Docks of the American Dock Stores, Staten Island, N. Y.

be installed in any public warehouse. It became, therefore, necessary to install a dry pipe system throughout.

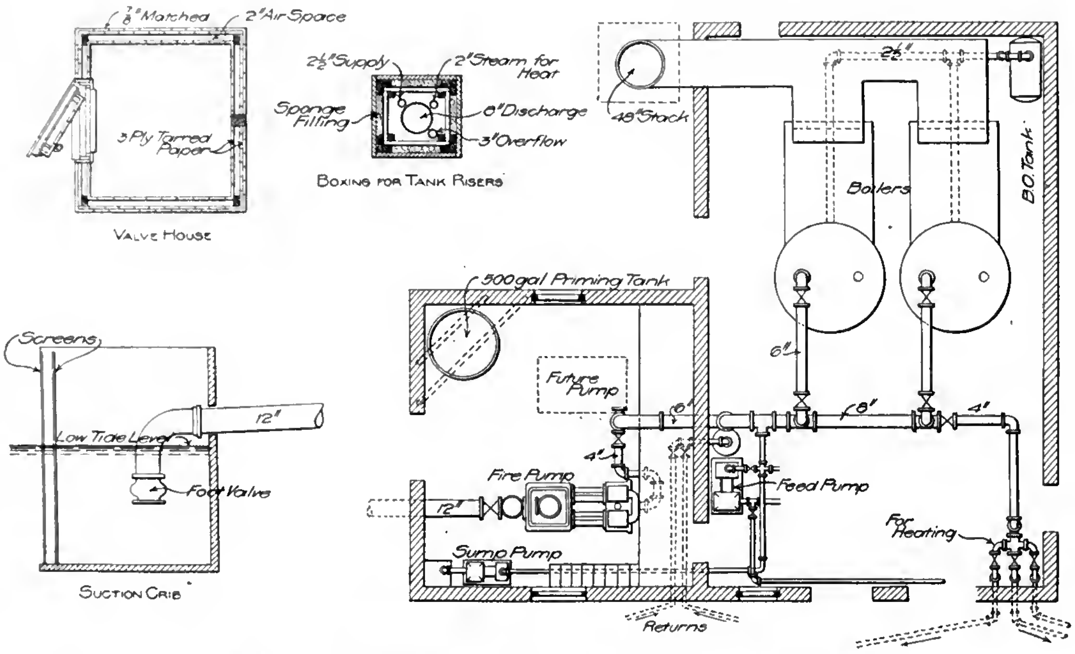
This particular system has three sources of supply, namely, a 100,000 gal. sprinkler tank erected on a 100-ft. tower, a supply from the Staten Island Water Co., running full 6 in. into the property, and a 12 in. suction line, running from the Lower Bay to the fire pump. It can be seen that from these three sources the property in question is assured without doubt of always obtaining at least one source of supply in case the other two are for any reason out of commission in time of fire.

A specially constructed brick and concrete pumping station has been located at the back part of the property on a line of the Baltimore & Ohio R. R., as shown on the plan. The boiler and pump rooms are divided by a brick partition, and a fire pump has been placed at a level about 6 ft. below the grade to assure a good suction from the Bay at low tide. The plant consists of two 150-h.-p. Fitzgibbon boilers, designed for a working steam pressure of 125 lb., which, however, is only used in cases of emergency, where the pump is required to work at its maximum duty. There has been installed one 1,000-gal. Worthington standard duplex fire underwriters' pump, having a 12-in. suction and an 8-in. discharge. The pump is also fitted with four independent 2½-in. nozzles, with gate valves for drawing four streams from the pump house in case of necessity. The boiler plant is fed by a duplex pump and also an injector to assure the boiler being supplied at all times. Ordinarily anthracite coal is used for running the fires, but a supply of cannel coal is always kept on hand, so that in case of emergency a high steam pressure can be developed within a very short space of time.

This line feeds the hydrant system and also the sprinkler system. The underground system is connected with a 10-in. drop riser, running from the sprinkler tank into it, and a 6-in. service pipe, running from the mains of the Staten Island Water Co. The discharge from the fire pump also empties into this line. Standard two-way underwriters' hydrants have been placed at intervals of about 200 ft., and at each hydrant is a complete hose house, equipped with standard underwriters' cotton hose, lanterns, wrenches, nozzles and other appurtenances required by the underwriters.

freezing. The sprinkler system itself is kept at an air pressure of about 45 lb. in this particular case and is supplied from a system of air lines, which start from the boiler house and are connected to a New York Air Brake Co.'s duplex, locomotive type air compressor, steam driven. The air compressor is automatically operated by a governor placed on the steam inlet to the compressor and set at 45 lb., which starts the pumps when the pressure falls below this amount.

In case a sprinkler head is set off it can be readily seen that the pressure in the line is immediately relieved, and the water forces its way



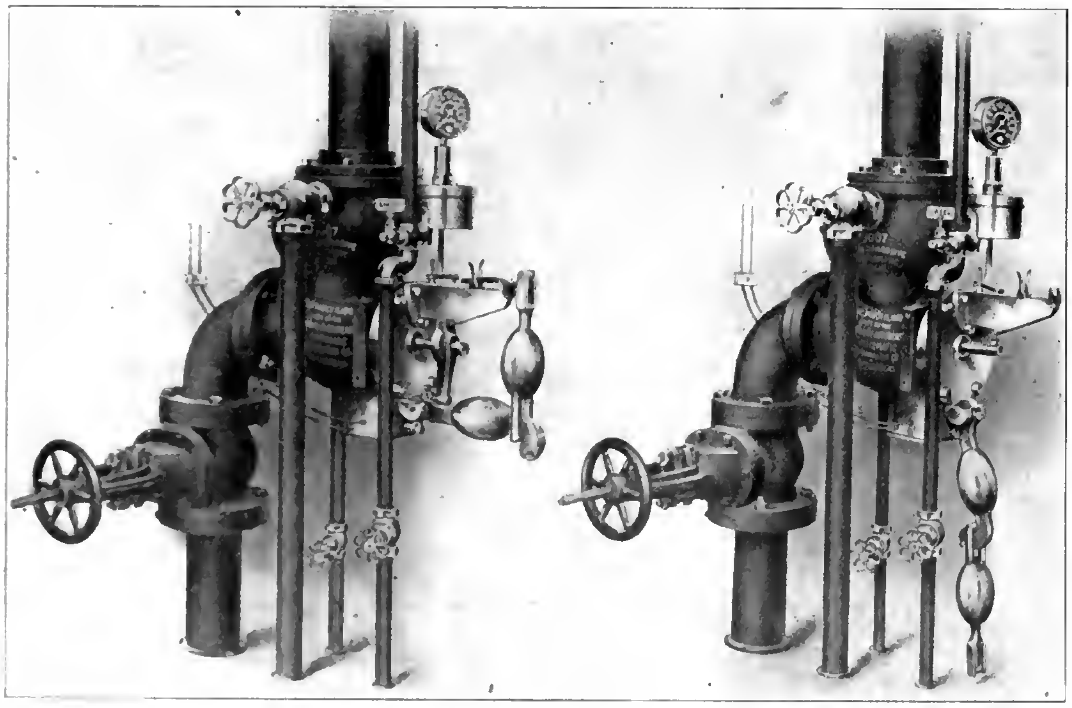
Details of Pumping Station for the Fire Protection System.

through the system and discharges at the head.

In addition to the dry sprinklers there has been installed a water curtain wall around the sides and fronts of all piers. This curtain wall consists of open sprinkler heads, set at a distance of about 8 ft. apart and divided into sections of about ten heads each, each section being operated by an independent valve, located in the valve house on the piers. This curtain wall is for use principally in case a steamer or lighter should take fire while tied up at the pier, so as to protect the pier against damage by fire.

In connection with this equipment a complete electric signaling system has been installed, with an annunciator placed in the pump room and connected with each valve house, so that in case a sprinkler head is set off the signal will be given in the pump room, locating the exact section of the discharged head. In addition to this system of electric signals, a water-motor gong is placed outside each building, which gives a further indication of the discharged head in that section.

The property is patrolled night and day by a force of skilled men, who take hourly readings of all instruments and conditions of valves and other apparatus in connection with the plant.



Closed and Open Positions of the Dry-Pipe Valve.

Around the suction line where it enters the water a large yellow pine crib has been erected, with two iron screens placed on one side. The crib was necessary, on account of the large amount of seaweed and other material which would get into the suction if the line was dropped directly into the water. A 12-in. foot-valve has been placed on the end of the suction to keep the suction line always full of water and to safeguard against having the pump start on a practically empty line.

A complete system of cast iron high-pressure service mains, ranging from 10 to 6 in. in diameter, has been laid through all streets and alleys.

The warehouses and piers are equipped with a complete system of dry sprinklers, there being at the present time about 7,000 heads installed. Each warehouse and pier is separately controlled from the underground system by a post indicator valve located outside the building. The main continues from the post valve under the floor of the building and connects inside the building in a valve house, with an automatic dry valve. This is the point where the air pressure on the sprinkler system starts, the valve acting as an interceptor between the water and the air. These houses are kept heated in the cold weather by lard oil lanterns to prevent the water from

The system as installed has been made as complete as possible, and no expense has been spared to bring it up to a thoroughly up-to-date condition. It was only after several disastrous fires at the American Dock Stores, which did considerable damage to the buildings, that it was decided to install some system of fire protection. The entire sprinkler and hydrant system, as well as the steam plant, was designed by the writer, and installed by the Manufacturers' Automatic Sprinkler Co., of New York.

Reforesting Mineral Lands in Michigan is being taken up by the Cleveland-Cliffs Iron Co., which proposes to plant 14,000 acres.

Secrecy in the Arts.

Extracts from a paper by James Douglas, LL.D., presented at the Toronto meeting of the American Institute of Mining Engineers.

The title which we have assumed claims for the sphere of our activities the whole American continent, regardless of such trifling details as boundary-lines. The fact that we meet to communicate each other's experience, to discuss our difficulties, and to seek each other's aid in solving the intricate problems that so often present themselves in the course of our professional life, is an acknowledgment of our individual helplessness; and therefore an argument for united effort. But no effort can be of any value if there is an underlying suspicion of reserve and lack of candor in our treatment of the technical questions which it is our province at these meetings to discuss.

Yet there are limits to the extent to which we may go as officials of public companies. We know that even as professional men it is not always easy to reconcile principles with practice, and on this subject of sincerity and transparent diffusion of our experience there is some slight difference of opinion and difficulty of application. The most of us are paid officials of corporations whose *raison d'être* is to make money, and whose executive officers sometimes, not without some reason, consider their trade secrets as part of their capital. Some companies confide these secrets to the honor of their technical workers under as strict rules as those imposed on their cashier in the distribution of their money. Unless, therefore, our employers permit, we as employees are under pledge of secrecy.

If the question were left to us alone, it would be easy of solution. Our reliance on one another, as workmen in such distinct branches of engineering as civil, mechanical, electrical, and mining, is so close that we must co-operate in every large enterprise we undertake. We cannot succeed singly, for few of us claim to be so encyclopædic in our knowledge or universal in our experience as to make it safe to rely on our own acquaintance with the practical details of every one of these important departments. Every industrial advance brings us closer together and makes it more impossible to act independently.

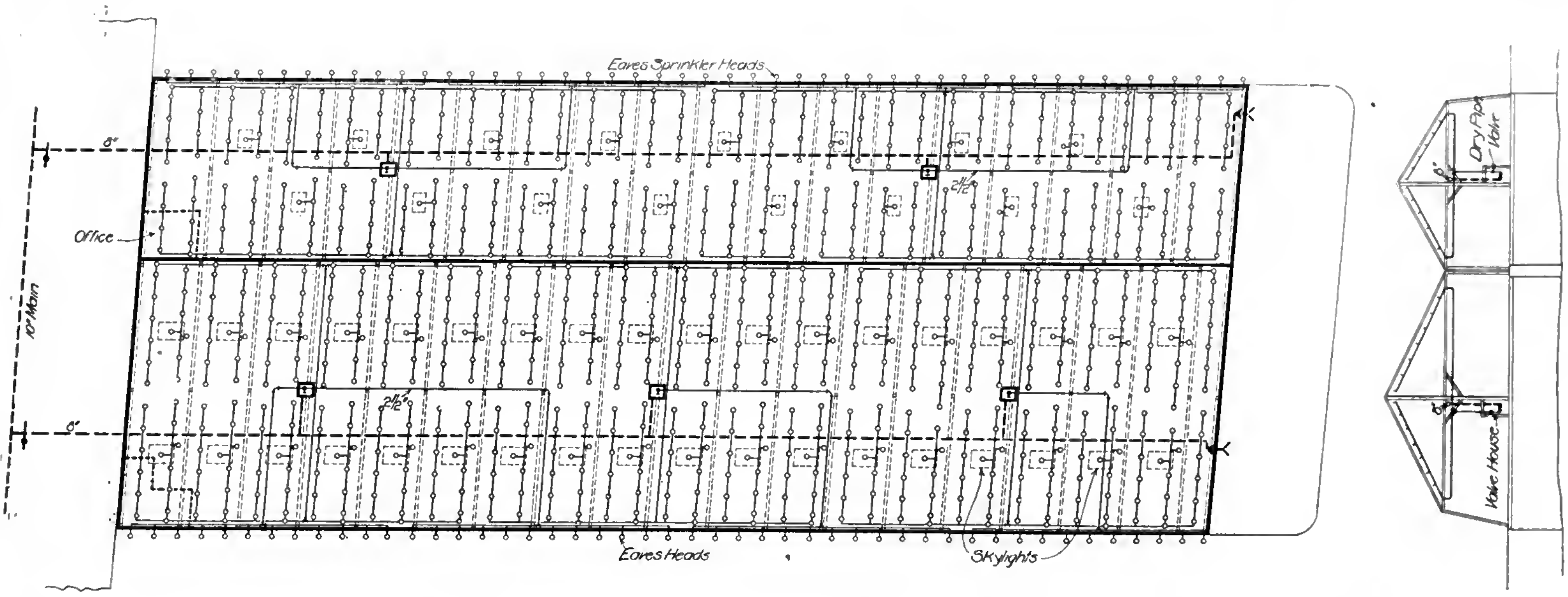
I think, moreover, that many of us are also convinced that open-mindedness to the suggestions of others is a useful quality to carry into our work, even after we and our scientific staff, in our joint wisdom, have co-operated in formulating and laying out our plans. Every draftsman in our offices, every master mechanic in our shops, every foreman in our mines, is an expert in his particular line, and may be supposed to be familiar with minutiæ which have escaped our observation, or, to put it frankly, may know more than we do ourselves on some of the innumerable details which make up the sum total of the questions on which we have ultimately to pass.

I recently went into our purchasing department and found every desk empty, and all the clerks assembled in the manager's room. He had found it conducive to the most efficient conduct of his office to assemble all his staff once a week for free discussion as to the most economical distribution of work. The result was that instead of late hours and overtime the necessary day's work was obtained very easily within office hours; for suggestions from the men actually engaged were found to be worth more than those from the men merely superintending.

How far and how completely should even corporations and industrial concerns permit and encourage the interchange of information? I am inclined to think that few limits should be set; for every limitation means the concealment of some fact or some principle which only if revealed can be developed to its full significance and utility. As a rule this can be best done by the action of many minds and many hands. Till developed it does not yield its full advantage to even the original discoverer, for he alone, unaided, in the solitude of his laboratory or behind the bars of his factory, without the practical assistance of his fellow-workers, rarely brings his original germinal idea into efficient, practical utility.

Were we free to appeal to purely altruistic motives, it would therefore be superfluous to argue in favor of complete knowledge- and experience-sharing, but profit-sharing is after all the impelling motive of industrial advance to-day, as it has been in all ages, and to reconcile the admitted evils of secrecy with the admitted advantages of publicity, the patent laws have been framed. They have always given the patentee the right to use either in his person or through his agent his invention or discovery for a limited number of years, provided he describes it so fully that it can be practiced by one skilled in the art. The publicity and knowledge conveyed by the specification stimulates the inventive faculties of others, and patented and unpatented improvements, along the line of the original invention, demonstrate both the value of publicity and the cupidity of men, even of the technico-scientific class.

It is foreign to my purpose to discuss the patent laws, except casually as they bear upon the subject of secrecy in the arts. One's thoughts pass with pleasure from the contemplation of money-making inventors and investigators to such prophets and apostles of science as Sir Michael Faraday. Sir Michael's profound and original investigations into electricity and magnetism gave the world the dynamo. Though he did not work out the mechanical details of a practical generator, he undoubtedly invented appliances which might have been used for making a strong basis-claim for a patent. But nothing could have been more repulsive to his spirit or foreign to his high aim in life than gauging his time and talents by a mere money standard. He lived contentedly on the small salary he received from the Royal Institution, preparing his lectures to children with as much care as he bestowed on those delivered before the Institution which made him famous; and turning his great learning and power of investigation to the nation's good in return for very scanty remuneration, for he deliberately decided to devote his life to scientific research for truth's sake, rather than to use his vast attainments in the service of Mammon. At the commencement of his career, Faraday added to his salary from the Royal Institution by what he called commercial work. At first, his average earnings from this source were £240 per year. By 1831 they reached £1,090. By 1838 they had shrunk to nothing; for in the meantime his great discovery of magneto-electricity was made, and his thoughts were so intently directed to his experimental work that no time could be spared for money-making.



Typical Lay-out of Mains, Valve Houses and Sprinkler Heads on Piers 4 and 5, American Dock Stores.

But to descend to a lower plane. If it is the fact that technical science has progressed of late with unwonted speed through the co-operation of many workers, and that this co-operation has been made possible by the publication and exchange of ideas and experiences in the technical and scientific journals, would not our progress be even more rapid and thorough if all barriers of secrecy were broken down, and every encouragement were given to our techincal workers to describe in print and by conference, their notions and their actual experiments? This is the attitude of some, I may almost say of most, of our large concerns, but unfortunately it is not that of all. It is impossible to compare, as to efficiency and profit, works the gates of which are fast shut, and in which obscurity and secrecy are imposed and practiced, with those to which free admission is granted and in which freedom of information is encouraged. But the following reflections force themselves upon us in this connection.

We know that very few technical papers issue from certain establishments; that on their officials silence is imposed; and that to these works inquisitive visitors are politely but peremptorily

refused admission. There are not many such, but they are and have been very successful. But suppose that in imitation of their practice and regulations all were tempted to adopt it, so that the same policy became universal; what a sudden paralysis of industry would follow! Our secretaries would find it difficult to fill even their shrunken volumes of transactions with papers worth printing; our students would have to content themselves with the antiquated learning which their professors could supply; for there would be no more summer classes for practical work in mines, smelters and electrical factories, and the professors themselves would have to learn from old books. Every manufacturer and smelter would be obliged to bribe his neighbor's workmen and tempt away his neighbor's superintendents for information. As a result, before long, the very works which now find it so profitable, or think they do, to tap their friends' stock of knowledge and experience, and give nothing in return, would be driven in upon their own resources, and would undoubtedly then find them not so complete as they imagine. Of course, I am supposing an impossibility, because the spirit of intellectual freedom in our professions is too strong and too widespread to submit to such a tyranny, and because, before such darkness of ignorance had settled down on our great industries, the most pronounced advocates of secrecy would feel and acknowledge the ultimate consequences of concealment, and would become reformers.

This is a temper of mind foreign to a new country like ours, whose special industries have not been established long enough to wear grooves of rigid practice and sink into ruts of self-satisfied indifference. About the best correction we can apply to the growth of dry-rot is the banishment of secrecy. A curious instance of its blighting influence is seen in some of the older, not the newer, industries of the old world. The iron- and steel-works of Europe have not kept pace with ours in size and production, but the iron-masters of Great Britain and Germany, in coke-making and in blast-furnace economies and in steel-making processes, have been our teachers. Nor have they been shy of communicating their improvements, or, through jealousy of our success, slow in adopting ours. No nobler monument of international comity in thought and experience exists than the seventy volumes of the "Proceedings of the Iron and Steel Institute." And with few exceptions the iron- and steel-works of England, Scotland, Germany and France are open to any accredited worker in the same domain.

Yet before England was conspicuous as a maker of iron, she was famous the world over for her copper and tin production. But, between self-conceit and the inbred habits of trade-secrecy, her copper-smelting industry has fallen from its high estate. And it is not accidental, but linked as closely as any effect with its cause, that this decline is in great part the result of habits of secrecy which grew with the growth of age. At Swansea, every gate of the smelting-works is guarded, and as a result it has been as difficult for thought to escape out as for suggestions to find their way in. Swansea should still enjoy the leadership which her skilled labor, splendid coal and commanding maritime situation put within her reach; but she has preferred to gloat over her secrets behind closed doors rather than go out into the world in search of new business as well as technical methods, while also inviting the world to enter and exchange ideas with her. What is the consequence? New Zealand copper comes here to be refined, notwithstanding the first practical application of electrolysis to metals was made by Elkinton in England, and the Vivians adopted the Manhès method before Farrell introduced it into this country.

There are, however, of course, exceptions in England to this too prevalent habit of secrecy. To the works of the Rio Tinto at Port Talbot or of the Cape Copper Co. at Briton Ferry in South Wales, where metallurgical novelties have been tried, introductions are not refused. But the alliance of decay and suspicion in the instance I have given can hardly be accidental; and we may be sure that what is baneful in its effects in Europe is not likely to be beneficial here; for while the Atlantic separates continents it does not delimit the operation of laws.

In political life, vitality is maintained only when every man takes his full share as a debater in the discussion of political questions, and as a voter in the determination of state affairs. So in scientific and technical matters, the banishment of deceit, mystery and jealousy, and the freest admission of daylight by means of the unreserved diffusion of information through the press and personal intercourse, will instill into the whole body of workers a feeling of healthy rivalry, which, while stimulating their mental activity, will correspondingly benefit the financial interests of their employers.

I have supposed an extreme case—that the example set by our few secretive establishments were followed by all. Let me imagine a more probable issue, such as, I believe, will result from the fellowship of knowledge and experience which Mr. Carnegie, in presenting to our national engineering societies their new home, urges them to cultivate—namely, that all our technical manufacturers will learn how they gain, and not lose, by encouraging their staff-officers to study their neighbors' methods, and by throwing open their own establishments, in turn to the freest criticism of their competitors in trade. What will result? Nothing but advantage, I believe, to all whose wisdom and means have enabled them to provide themselves with the raw material of manufacture on advantageous terms, and to locate their works or factories at localities favorable for economical operation. Loss only to those who, in any case, ought to go out of business, because they have failed to secure the conditions essential to success! And, above all, benefit to the public, which, after all, is the finality we should always keep in view.

How, now, can these two cardinal conditions —financial success and public approval—be best attained? Unquestionably, by mutual help and the most unreserved publicity. In any branch of industry, no intelligent worker claims that he and his staff have attained either the utmost economy in operation or the most thorough acquaintance with all the reactions which may enter into the processes which he practices. Each knows that hundreds of other intelligent and well-informed men are eagerly at work on the solution of the same problem. Some may be a little cleverer than others, and some may have made a little more progress in certain lines than their co-workers. But this discrepancy will not necessarily continue; for the clever fellow is picked up by rival works, the secret so carefully guarded leaks out, and the disturbed average of paid ability and of stock of knowledge is restored. But if the companies and their staff are unwilling unreservedly to pool their knowledge and experience, the advantage of making into one great stock such accumulated experience and knowledge of these hundreds of workers is forfeited. With certain reservations, and by special permission, many of our larger establishments, in all or in certain departments, are freely open to each other's technical officers; but instead of being admitted upon sufferance, they should be invited in, with full liberty to study processes and test machinery; for assuredly the host would benefit as much as the guests by the discussion which would follow such unreserved exchange of ideas and comparisons of appliances and methods.

I have referred to certain limitations to publicity. One, undoubtedly, is costs. Under our present economic system, no manufacturer or miner or metallurgist cares to give away his costs, and that for very obvious reasons. What they are may be inferred, but professional courtesy forbids direct inquiry into that delicate subject. This restriction, however, need not interfere with unstinted technical freedom of intercourse.

There is, moreover, an additional judicious limitation to publicity. Most of our largest concerns are incorporated and financed as joint-stock organizations, in which thousands of technically ignorant and helpless shareholders are interested. Unquestionably, indiscriminate admission to works and mines must be refused, for, unfortunately, there would be visitors who, if admitted, after the visit would tell remarkable stories, from actual observation, with the view to affect the value of stocks. But such restrictions do not affect the main proposition that mercantile concerns of every class, depending for success on technical knowledge and skill, would gain by the removal of restraint on the thought and action of their technical staff.

I am not blind to the fact that the same object is sought to be attained by the consolidation of many works under one organization, or by the encouragement of friendly financial co-operation among even competing companies; but this tendency to consolidation has not yet succeeded in obliterating competition, and will not as long as there are active, intelligent men among us, who prefer to rule rather than to be ruled, and to manage their own business rather than have it managed for them.

On the benefits or disadvantages of the present movement towards consolidation of works and the combination of capital in large industrial undertakings, there is, and will be, of course, considerable diversity of opinion. That competition is wasteful and is encumbered with other evils few will deny; that it has a keenly stimulating effect all will admit. Yet it remains to be determined whether a board of absentee managers and paid officials will be a compensating substitute for the ambitions, personal pride and tireless energy and skill of the individuals who have built up great works which they may have seen, perhaps reluctantly, absorbed into a combination. There are, apart from the political and sociological aspects of the present consolidation tendency, technical and economical conditions which force themselves upon the consideration of those of us under whose management works have grown from small to large dimensions. The difficulty of maintaining a high standard of quality as the demand is made for enormously increased production is urgently presenting itself both to the management and to the public. And it is doubtful whether, after expansion has reached the point where administration charges become light, there is actual economy in unlimited expansion; and whether the most skillful and closely managed corporate organization can replace the personal supervision of a single mind. But what immediately concerns us in the present discussion is the dangerous temptation to adopt secretive methods by very large corporations.

The larger the combination grows the more sensitive will the management be lest business and trade secrets which they possess, or think they possess, be revealed by subordinate officers. The imposition, therefore, of strict rules of silence on all except those in supreme command is likely to result. If the absorption of any one class of our national resources should pass under

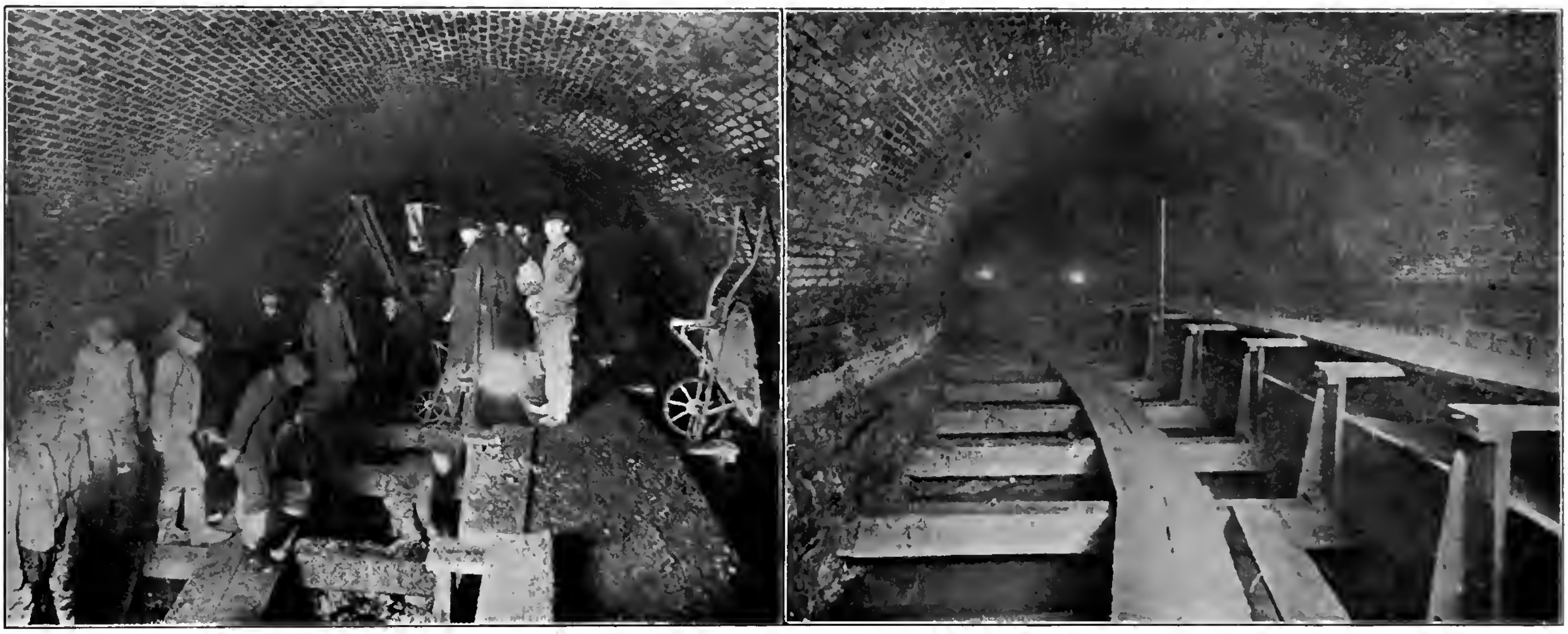
the control of any one organization, the technical knowledge necessary to the development of that particular resource would be of interest to that organization alone, and the risks of publicity, and therefore the evils of secrecy, would become a merely academic question. This dangerous point, under our present industrial system, will probably not be reached; for state socialism, to which concentration steadily approaches, would be the inevitable alternative and would be adopted before the other alternative had been attained. But it must be to the management of those enormous consolidations a grave consideration how they can give such latitude to the members of their staff as will produce that healthy self-reliance which comes from freedom of speech and freedom of opinion, without endangering the tremendous financial interests for which they are responsible. Whatever individual difference of opinion on this subject there may be among the managers of the great industrial establishments, there is not any difference of opinion in the country at large; and public opinion has to be consulted. Therefore, would it not be safer and better for the interests of the shareholders to adopt the policy of freedom which I have outlined, and thus placate the public? For the growing public anxiety, amounting to animosity and suspicion, against our big corporations would be allayed if it were apparent that the technical officials of the small concern had at least the right of knowing what the big concern was doing, and the big official did not arrogate to himself the possession of exclusive knowledge and exclusive skill. From the point of view of public policy, the question is one well worthy of consideration; for it is coming about that not only railroads, as public highways, but all large corporations utilizing the country's natural products and converting them into necessary objects of trade, will pass under closer legislative scrutiny and public criticism in the future than they have in the past—a necessary limitation, which will become more exacting the larger the corporations grow—if the tendency to growth continues.

While unquestionably dangers can be foreseen as arising out of these great industrial aggregations—not only of capital but of industrial energy—dangers technical, social and political—there are also great possibilities of good. One of the benefits may justly be claimed to reside in the large funds that are thus rendered available for technical research, from which the public derives benefit indirectly, even if the results are not published. But if we could banish secrecy; if every industrial establishment of any magnitude, which is in its own interest carrying on technical research, should encourage its technical staff to confer freely with the members of every other technical staff, would not the sciences and arts progress far more rapidly than if one huge organization controlled a given industry? All our principal metallurgical and chemical concerns have laboratories, and carry on investigations and make experiments, generally on a large working scale; and surely the advancement of technological science can be better attained in a number of such laboratories than if there were fewer or in only one. There is keener competition of wits when many brains are working independently. The friction of honest rivalry is a force not to be despised. The stimulus of ambition is sure to be stronger in smaller than in large consolidated workshops. The air in such laboratories is freer and purer than when men are working in the stifling atmosphere of secrecy. I believe that such a consolidation of mind and high impulses would carry us further and faster along the road of human progress than all the money that all the trusts could appropriate for the advancement of technical knowledge.

Buttressed Masonry Dams continue to be constructed from time to time, chiefly as extensions of old structures, and it is considered likely by a number of engineers that the type will find more application as a result of the present rapid increase in favor of the buttressed concrete retaining wall. For this reason mention may be made of a detailed analysis of such dams presented earlier in the year to the Institution of Civil Engineers of Ireland by Mr. M. T. Ormsby, and recently printed in Vol. 33 of its "Transactions." The final results of the study give the leading dimensions of such structures up to 40 ft. in height, in which there is no tension in the concrete, and the resultant force makes an angle of 35 deg. with the vertical. With the dimensions he gives, the maximum pressure at the toe of the buttress works out to 6.29 tons per square foot in the higher dams, corresponding with a maximum vertical pressure of rather less than 4½ tons per square foot. The saving of masonry, as compared with a solid trapezoidal dam, varies from about 40 per cent. with a 10-ft. dam and masonry of 1.8 specific gravity to about 28 per cent. with a 40-ft. dam having masonry of 2.2 specific gravity. Experiments on models of such dams are also described.

The Reconstruction of Large Sewers in St. Louis, Mo.

The sewerage system of St. Louis is built on the combined plan, the domestic sewage and storm-water run-off being carried to the Mississippi River by the same sewers. Some of the latter were constructed 30 to 40 years ago before the districts which they serve were built up to any extent, and, in cases, where the immediate districts gave no evidence of being developed fully at any future time. Several sections of the city which were almost open country when the main outlet sewers serving them were built, are now congested business or residence districts. As the old sewers were apparently not designed for such conditions, their capacities are consequently now insufficient in many cases. This inadequate capacity of some of the main sewers, and the structural failure of others, has necessitated a large amount of reconstruction on several of the main outlet sewers.



Runways for Handling Excavation and Materials, and Temporary Flume in Reconstructing a St. Louis Sewer.

The Rocky Branch outlet sewer is one of those having an inadequate capacity to carry the storm water reaching it. This sewer serves an area of about 3,500 acres in the closely built-up residence portion of this city where practically all of the streets are paved. The lateral sewers in the area are also largely on comparatively steep grades, the whole combination of conditions tending to bring the storm water to the main outlet very quickly. The latter has a total length of 8,700 ft., the first 2,500 ft. of which from the river is across the low swampy river bottom, the ground rising gradually from this low land to the district served by the outlet sewer.

The outlet sewer for over half a mile from the river has a semi-circular arch, with a clear span of 18 ft., which is carried by haunch walls with vertical faces. The arch consists of four to five rings of brick laid in cement mortar; the haunch walls have cut stone facing backed with rubble masonry.

In constructing the bottom of the sewer, at least, no uniform grade appears to have been followed, as numerous breaks in grade occur in it at uncalled for points. These breaks were introduced at some places, moreover, without similar changes in the grade of the arch. The bottom of the sewer was never lined, nor the natural surface properly leveled. A part of the sewer is on rock and the remainder on soils of different capacities for carrying loads. Where rock foundation occurs the bottom of the sewer

was in many places left as the rock was blasted out, with the result that depressions 2 to 7 ft. below grade frequently exist. In soft foundations the haunch walls of the arch were built on heavy logs laid transversely with the sewer. These logs are 18 to 24 in. wide, 8 to 14 in. thick and 18 to 19 ft. long. They are still in a good state of preservation, although the sewer was built in 1870 and the velocity of the sewage over them has been high at various points.

This sewer had become so badly overtaxed that some means of relief for it became an immediate necessity. It is built in a city street for 3,500 ft. back from the river and is of such size that in this distance no room exists in the street for a relief sewer. Furthermore, the soil and other conditions in adjoining parallel streets made the construction of a relief sewer in the latter impracticable. The grade of the bottom of the existing sewer is accordingly being straightened, and the bottom lowered to some extent and lined with an inverted brick arch, with the belief that the carrying capacity of the sewer will be increased in this manner sufficiently to provide for the removal of the flow reaching the sewer. This straightening of the bottom grades required the excavation of 2 to 7 ft. of materials, varying from quicksand to rock and included the logs, where they occurred. The arch ring was also underpinned down to the new bottom level and a new invert placed. Where the sewer was built on rock, this rock was blasted out at the sides, during the original construction, only enough to carry the arch ring, so the excavation made to straighten the bottom grade had to be carried wide enough to provide room for a new haunch walls for the arch.

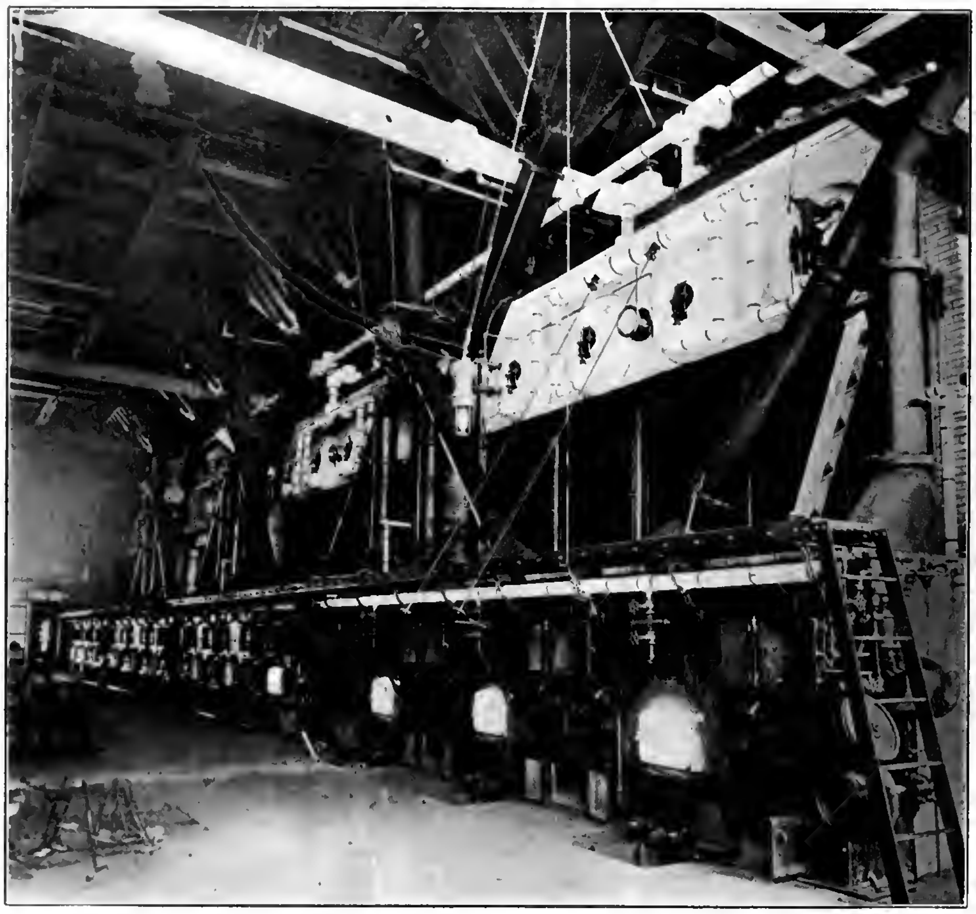
The work of lowering and straightening the bottom of the sewer was started at the river and carried back for 3,500 ft. to high ground at a point where the sewer leaves the street and passes under private property. From this point a new sewer will be built to relieve the existing one, as conditions are such as to permit the construction of this relief sewer.

During the reconstruction, the dry weather flow reaching the outlet sewer was carried at all times in a wooden flume which was supported. with its bottom on an average of about 6 ft. above the bottom of the sewer, by 12x12-in. transverse timbers having their ends set in the old masonry. This flume had sufficient capacity to carry some storm water in addition to the dry weather flow, but during heavy rains the water filled the lower part of the sewer and covered the work in progress. Much pumping was thus necessitated, and as ground water was encountered in several places while the reconstruction was in progress, the pumps were kept almost continually in service.

For some distance from the river the bottom was largely alluvial deposits, the haunch walls of the sewer as originally built being carried in most of this distance by the heavy transverse timbers. In the reconstruction work, where these timbers occurred the haunch walls were taken out in short sections and the timbers removed. While the excavation necessary to lower or to straighten the grade of the bottom was being made and the brick invert laid, and until masonry underpinning had been carried up to the haunches of the arch from the invert, the arch was carried on shoring on jackscrews. All of this shoring and reconstruction work was handled with much difficulty, some of it being particularly hazardous. Quicksand was encountered for a length of 500 ft. in making the excavation for the new bottom, but the latter was put in as planned in this section, without losing any of the sewer. The work was handled in short sections after the quicksand was encountered, from 4 to 6 ft. being opened at a time. As soon as the timbers were removed and the excavation made, the bottom was sealed with concrete in sacks. Considerable sheeting and much intricate shoring had to be done in all of this work to restrain the quicksand and to support the sewer arch until the concrete seal could be placed.

Rock was encountered in the bottom after the higher ground was reached, and its surface rose faster than the grade of the sewer, so that the lower part of the latter is in excavation in rock at the upper end of the reconstruction work. The sequence of operations after the rock was encountered was generally the same as that followed in the reconstruction in soft ground, except no concrete seal had to be placed in the bottom. The rock was blastetd out as required, small shots being used to avoid injury to the existing masonry and to prevent the disturbance of the shoring supporting the portions of the arch from openings to the point where work was in progress in the same manner. The concrete was mixed by hand in the sewer.

The reconstruction of the Mill Creek outlet sewer has also recently been completed in a manner similar to that followed in the work just described. This sewer provides a drainage outlet for 6,000 acres of congested city districts. It has a brick arch, with a clear span of 18 ft., carried by cut-stone haunch walls, the latter being originally built on heavy transverse timbers in the same way as in the Rocky Branch sewer. These old timbers used for the footing and invert began to give way, so a new invert had to be built. The capacity of the sewer being somewhat overtaxed, the new invert was placed 2 ft. below the original bottom formed by the timbers, and was laid at a more uniform grade than the one on which the former had been built.



Boiler Room of the Main Power Station at New Orleans.

which the haunch walls were temporarily removed. Where the rock came up on the sides to any extent only enough of it was blasted out to secure a bond for the concrete wall used to underpin the existing wall. The underpinning in all cases was done with concrete, the inside face of the new wall being built out a few inches farther than the inside face of the existing masonry to insure the stability of the latter.

The blast holes required in excavating the rock were made by Ingersoll Sergeant air drills, supplied with power from a central plant erected by the contractor. This plant contained an Ingersoll-Sergeant compressor belt-driven by a 150-h. p. electric motor, and an alternating current generator furnishing power for lights in the sewer.

Several steam pumps were installed to keep the water level lowered while work was in progress and to pump out the sewer after a heavy rain. These pumps were supplied with steam from the boiler of a derrick outfit which was used in lowering materials into and hoisting them out of the sewer. The excavated materials were hauled to openings in the arch of the sewer on a plank runway laid on the timbers carrying the flume, and the supplies were hauled from these

The haunch walls of this sewer are of first-class cut-stone masonry and the soil through which it is built is for the most part fairly good, so the reconstruction could be carried forward in longer sections than was possible on the Rocky Branch sewer, 32 ft. of the bottom generally being opened up at a time. The timbers being in a good state of preservation, they were chopped off close to the sides of the haunch walls and the part between the walls removed; the excavation for the new invert was then made and the invert built. The latter is of concrete, with a lining of vitrified paving brick, the ends of the old timbers being covered by the concrete.

The dry weather flow in this work was also carried by a flume supported by transverse timbers carried at the ends by the old masonry of the sewer. Since the amount of ground water encountered was much less and the soil conditions considerably better than in the Rocky Branch reconstruction, work was handled with less difficulty.

Mr. H. F. Fardwell is sewer commissioner and Mr. J. A. Hooke is assistant sewer commissioner of St. Louis. The reconstruction of the Rocky Branch sewer was carried on by the Cooney Construction Co. of St. Louis.

The Market Street Station of the New Orleans Railway & Light Company.

One of the advantages of the concentration of public-service undertakings in a city under the control of one organization is the practicability of concentrating the power plants to whatever degree is desirable. This is well shown by the improvements carried out in New Orleans under the direction of Sanderson & Porter, the New York consulting engineers, by the New Orleans Railway & Light Co. When this corporation took over various independent railway, gas and electric properties of that city a few years ago it was at once seen that some of the smaller and less economical power stations could be abandoned to advantage and two of the plants greatly enlarged. A single central station was not desirable, because its construction would have made it necessary to abandon two modern generating stations and because in some areas the distribution of the railway load made it more economical to generate direct current near the points of heavy consumption than to produce alternating current in one central station, with high-tension transmission and conversion to direct current in sub-stations located at the points of consumption. The less likelihood of complete shutdowns in cases of station troubles was another consideration.

The system as reconstructed comprises one direct-current commercial lighting station and one direct-current railway station in the congested districts, and one large alternating-current station to feed the balance of the territory and the outlying districts. This station also contains 6,000 kw. of direct-current generators for feeding the railway lines in its vicinity. The three stations have an aggregate capacity of 25,000 kw. Sub-stations have been built preparatory to abandoning the small generating plants, over 100 miles of underground conduits have been constructed and a complete new street lighting system, with 3,000 series alternating arc lamps, has been installed. As the load increases and the system is extended additional sub-stations are to be built, and the capacity of the main or alternating-current power station is to be increased up to 50,000 kw. It is not necessary that new generating stations be built until this capacity is reached.

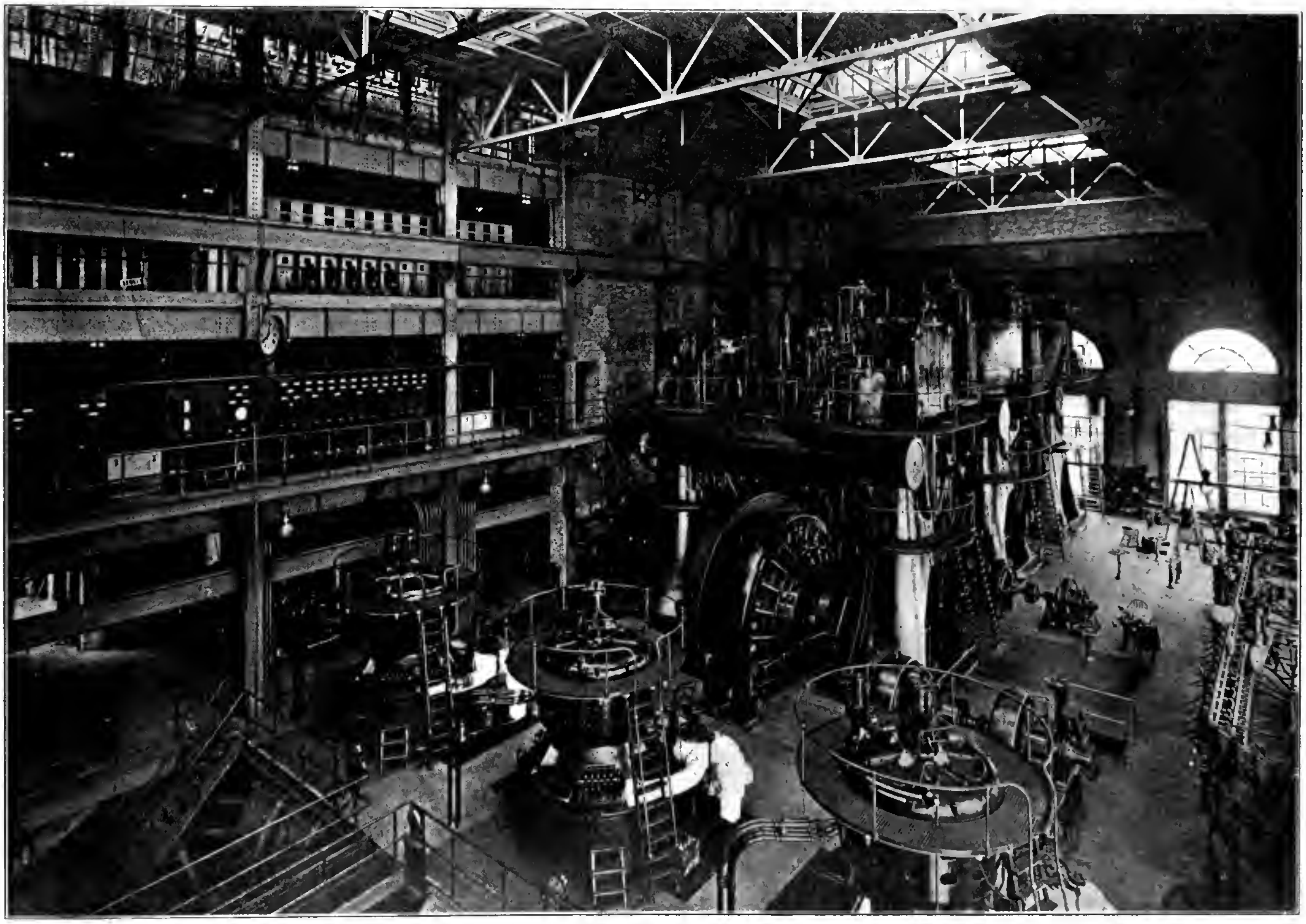
A 2,300-volt and 6,600-volt 60-cycle alternating current and 250-volt and 600-volt direct current are now generated. By means of static transformers between the two alternating-current voltages and motor-generator sets between the alternating and direct current systems the generators in any station may be used to supply current for the commercial or arc lighting or railway services.

The magnitude of the initial and ultimate investment involved for apparatus and the importance of handling the varied services in the most reliable and economical manner were governing factors in settling upon the frequency and voltage characteristics of the generating and distributing systems. The far-reaching importance of correctly establishing these essentials was early recognized, and the decision to adopt a frequency of 60 cycles for the alternating service was finally made as a result of careful deliberation and study of all possible methods. This frequency has been made standard for alternating power required for lighting and railway service. The decision against 25-cycle frequency was based upon the much greater cost of such installation, which would have involved heavy expense for frequency changing apparatus for the large amount of the service requiring 60 cycles and the unsuitability of 25 cycles for the operation of incandescent and arc lamps.

By using only one alternating-current generating frequency the load factor on the station and on the generating units was much improved, with resulting large savings in the cost of generated power, and the idle investment in reserve apparatus was minimized. The large sub-station energy loss which would have resulted from the use of such frequency changes as would have been necessary had 25-cycle generation been adopted was saved by the adoption of a uniform 60-cycle frequency.

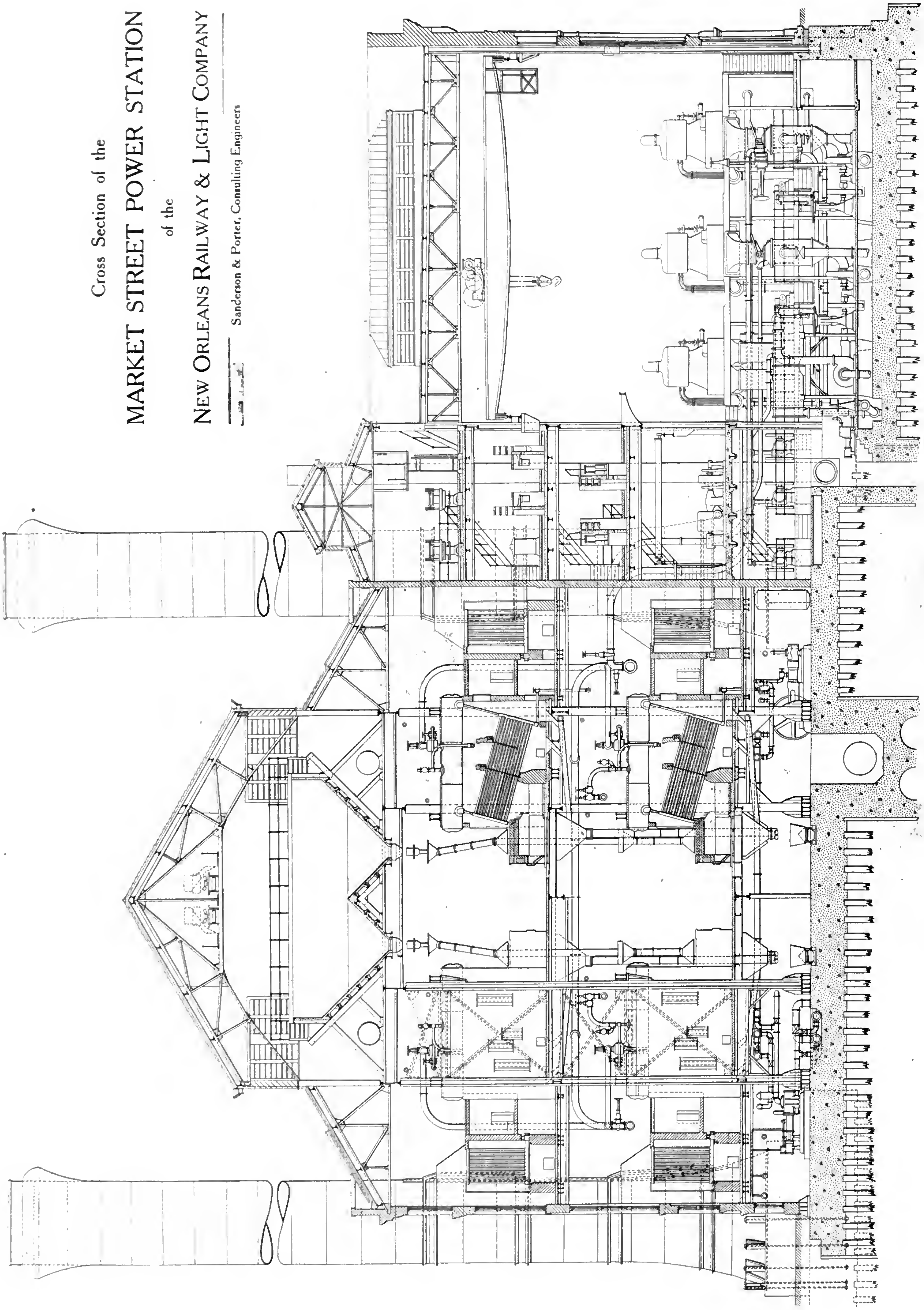
It is believed that the higher frequency standard more nearly satisfies all of the present and future requirements and that it will show a decidedly higher all-round efficiency, everything considered, than 25 cycles or a combination of 25-cycle and 60-cycle generation. Furthermore, increase in business is largely dependent upon adopting a system which will involve the least first cost of installation to the consumer. The lesser cost of 60-cycle motors constitutes an important factor, viewed from the standpoint of the operating company.

Sixty-six hundred volts was adopted as being a thoroughly standardized commercial voltage, for which motor generator sets of 50 kw. and upward could be readily wound, so eliminating sub-station transformers. The transmission distances, being relatively short, did not call for a higher voltage than 6,600, which would permit sending the maxi-



Engine Room of the Main Station of the New Orleans Railway & Light Company.

Cross Section of the
MARKET STREET POWER STATION
of the
NEW ORLEANS RAILWAY & LIGHT COMPANY
Sanderson & Porter, Consulting Engineers



mum desired amount of energy through any individual feeder with small energy loss. The frequent flooding of the underground conduits by heavy rains, which for short periods may overtax the capacity of the drainage system, rendered expedient the adoption of a moderate voltage, involving no particular difficulties for insulation under these conditions.

The recent work has involved the construction of practically an entirely new station at Market and South Peters Sts., on the Mississippi River, about two miles upstream from the business center of the city. The station now contains 17,800 kw., and provisions have been made for an ultimate capacity of 50,000 kw. In the "Street Railway Journal" of Sept. 18, 1904, a description of the then existing plant stated that it contained two 2,250-kw. Westinghouse and one 1,500-kw. General Electric railway generating units driven by Allis-Chalmers vertical compound engines, contained in a new building and supplied with steam from boilers in an adjacent old station. The building now forms a portion of the generating room of the new station.

The building is a brick, steel and concrete structure. The portion built measures 181 x 212 ft. and is 122 ft. high. When extended 92 ft., as planned, it will be 273 ft. long. It is supported on approximately 4,000 round piles driven on about 3-ft. centers. The piles are 50 ft. long, and some were set 30 ft. below the surface or were driven to a total penetration of 80 ft. In excavating for foundations and trenches for pipes the surrounding earth was assumed to be of liquid weighing 120 lb. per cubic foot. Excavations were protected by 6-in. grooved piling 30 to 50 ft. in length, with splines measuring 2 x 4 in., to insure alignment and tight joints. Where possible excavating was done by means of an orange-peel digger, and the earth was removed by a tramway. The piles were capped with a reinforced concrete bed approximately 6 ft. thick.

The average load over the entire foundation is something less than 2,000 lb. per square foot, but at points the load concentrated is very much above this figure. At such points twisted steel rods varying in number with the loads were used to reinforce the concrete.

Plans provide for the ultimate installation of four 72-in. pipes to serve as condenser intake and discharge pipes. All four pipes have been extended through the levee, three have been installed under the boiler room and one intake and one discharge pipe have been placed under the railway tracks between the boiler room and the levee. The pipes are made in 30-ft. lengths of ½-in. riveted steel by James McNeil & Bro. Co. and were covered with a protective coating from the American Asphaltum & Rubber Co.

Special provisions have been made for removing sand and silt from the pipes. Water jets supplied with water from a fire pump have been installed at 10-ft. intervals in the bottom of the pipes, and by a system of valves the intake and discharge pipes may be connected at the station end with a propeller type of circulating pump, so located in the connection that a flow of 8 to 10 ft. per second can be produced through the pipes. The pump is driven by a 700-h.-p. 550-volt motor. When the pipes are to be cleaned the jets are first operated to loosen the deposit, and this is then washed out by the flow from the pump. The pipes terminate at the river end in concrete wells, that for the intakes being provided with three sizes of screens.

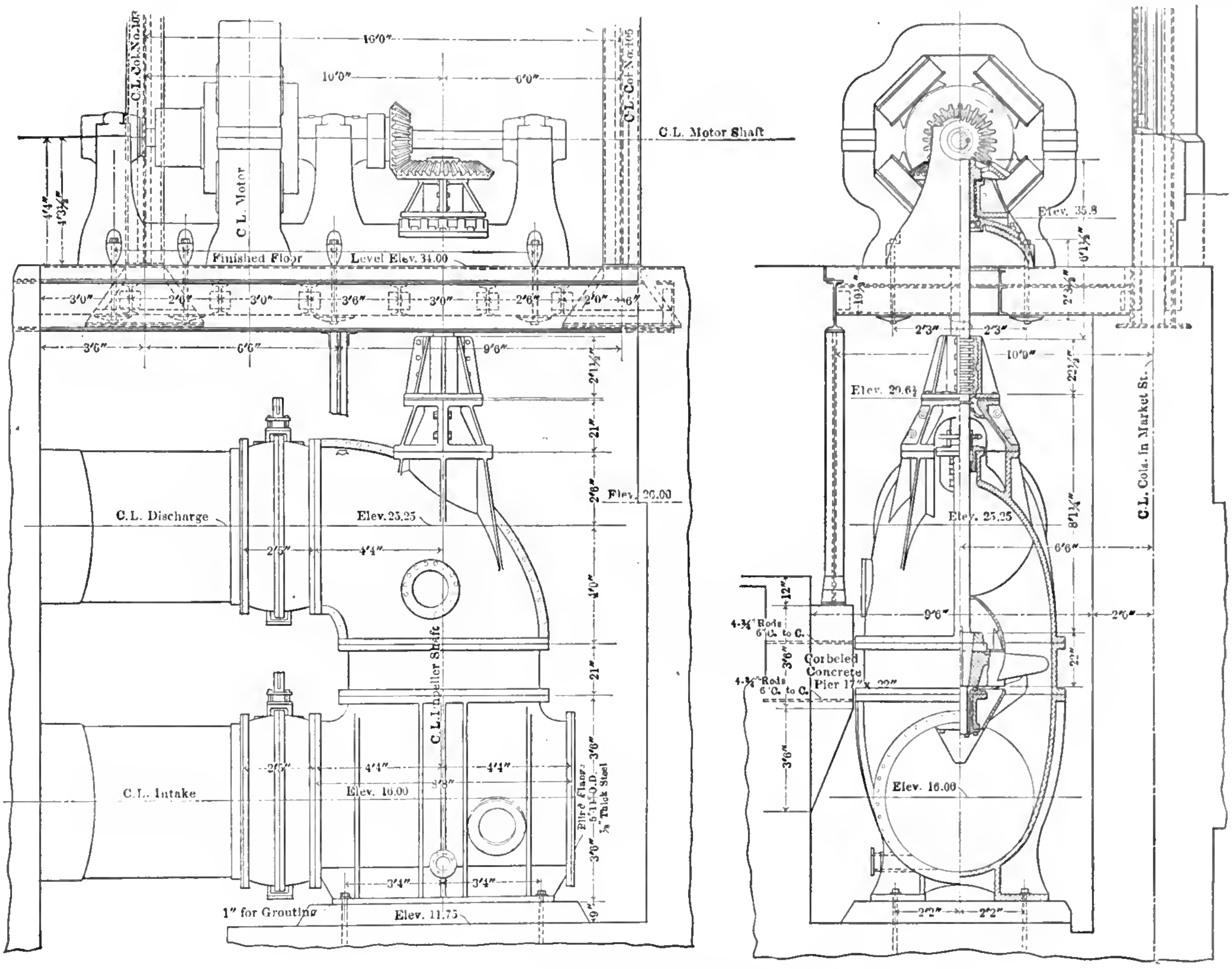
The building has a steel framework, with brick walls. The roof is of Ludowici and book tile, with a composition top. Bunkers and floors are of reinforced concrete. With regard to steel and roof construction, the building may be said to consist of three parts, the generator room, the double-deck boiler room and an intermediate section occupied by switchboard apparatus, shop and offices and toilet rooms. The adoption of this arrangement permitted the successful execution of the new construction without interference with the operation of units which had to be kept in service. Ample ventilation, important in Southern power plants, is provided by monitors and pivoted windows.

The two steel stacks erected are 15 ft. in diameter and extend 273 ft. above the street level. Both are brick lined to the roof line. Plans provide for the later erection of two additional similar stacks when building is extended.

The present building provides for sixteen 900-h.-p. boilers. Twelve such Babcock & Wilcox water tube units are now installed. They are located on two decks in double rows facing each other and parallel to the generator room wall. They are of forged steel header type, constructed for 200 lb. pressure and are fitted with Babcock & Wilcox bent tube superheaters for 150° superheat. Behind them are Sturtevant economizers, there being one economizer with 4,900 sq. ft. of heating surface to each two boilers. The scrapers of the econmizers are driven by induction motors.

The boiler plant is equipped with thirty-six 300-h.-p. Murphy smokeless furnaces and stokers, set three in a battery under each boiler. Coal is fed to the furnaces through down spouts extending from the overhead bunkers. Provision has been made to later install scales in each down spout. Ashes from the furnaces fall direct into a hopper underneath, while the fine ashes drawn over the bridge wall and the soot accumulation are carried into this hopper by a motor-driven screw conveyor.

Boiler feed water is obtained from two 750-ft. wells, one 6 and one 8 in. in diameter, having



Impeller Pump for Flushing Condenser Mains, New Orleans Power Station.

a combined capacity of over 1,800 gal. per minute. Water is raised with air furnished by two Ingersoll-Sergeant compressors in the boiler room basement. The water is discharged either into tanks in the basement of the boiler room or into a 60,000-gal. stand-pipe near the building. The boilers are fed by a 1,000-gal. De Laval steam turbine-driven centrifugal pump and three Epping Carpenter pumps, with 16 x 10 x 16-in. cylinders. Connections are arranged so that the water may be forced either through the economizers or direct into the boilers.

A switch extending along the east end of the station contains a 100-ton track scale, and all cars are weighed before and after being unloaded. The cars are run on a sheltered track under the ash bunker at the end of the boiler house and unloaded into a hopper beneath the track. After passing through a crusher provided with an adjustable positive feed the coal is carried by a bucket elevator to the top of the boiler house structure, where it is discharged on a belt conveyor and distributed to any predetermined part of the coal bunkers by an automatic unloader. A 35-h.-p. 550-volt direct-current motor drives the crusher and both belt and bucket conveyor.

The initial coal-handling plant has a capacity of 100 tons per hour, and the plans provide for a duplicate equipment of equal capacity. The initial coal bunkers hold 2,000 tons, and those of the ultimate building will store about 5,000 tons. Additional storage capacity is provided in a vacant lot near the station, coal being conveyed to and from this storage space in electric cars. Dock privileges have been obtained from the city and a portion of the plant for unloading river coal from boats has been erected. This has a rated capacity of 200 tons per hour.

Small side dump cars operating on tracks in the basement underneath the ash hoppers convey the contents of these hoppers to the east end of the building, where the ashes are dumpd into an automatic skip. This skip bucket of 60 cu. ft. capacity hoists the ashes to the top of the boiler room and dumps them into a bunker built over the coal switch. Ashes are discharged by gravity from bunker direct into steam or electric cars and conveyed to the suburbs to be used in track construction or filling.

All high pressure piping is of standard lap weld mild steel, with fittings and valve bodies of cast steel. The high-pressure steam valves are especially designed for use with superheated steam at 200 lb. pressure and have extra long necks at the stuffing boxes. Chapman valves were mainly used, the large ones motor-driven.

The boilers on the upper deck feed through lines passing down behind them into headers running the full length of the boiler room in the rear of those boilers on the lower deck. These headers also receive the steam of the lower deck boilers. Crossover pipes running just underneath the second floor connect the header most distant from the generator room with that one nearest to it, which may be regarded as the main steam header. Steam mains to both reciprocating engines and turbines pass through the boiler room wall and underneath the generator room floor to their respective units.

Connections from the headers behind the boilers drop through the floor to mains supplying the auxiliary apparatus. Extensions continue through the basement wall to serve the engines driving the condenser pumps and other auxiliaries.

In the new portion of the generator room there are installed three 1,500-kw. three-phase 60-cycle 2,300-volt Curtis turbines. A 3,000-kw. and a 500-kw. 6,600-volt turbine of the same make are also provided in the initial building, the former now being in operation and the latter under construction.

One common oiling system, with one accumulator, serves the step bearings of the three smaller turbines. A separate oiling system, with an accumulator, is provided for the two larger turbines. The oil pumps and other auxiliary apparatus, except exciters, are located in the basement.

Three motor-generator sets now operating on other service, each consisting of 500-kw. 2,300-volt synchronous motors and 600-volt direct-current generators are to be installed on the main floor alongside the exciters under the bus structures and will permit transferring 1,500-kw. capacity from either alternating-current or direct-current portion of the station.

Past difficulties in the operation of surface condensers using the silt and clay bearing water of the lower Mississippi River led to the general adoption of Dean and Allis jet condensers on the engines and Alberger jet condensers on three of the turbines. One 1,500-kw. turbine was provided with an experimental, specially designed Alberger surface condenser. The jet condensers of the 1,500-kw. turbines are connected to 12-in. centrifugal pumps and of the 3,000-kw. condenser to a 16-in. pump. All the circulating pumps are driven by single-cylinder Buckeye engines. The turbine condensers are each served by Alberger dry vacuum pumps, which may be run separately or on a common vacuum system.

The exciter equipment already installed consists of an 80-kw. induction motor-driven unit and a 75-kw. unit, driven by a two-stage horizontal Curtis turbine. The exciters are connected to a double bus system, and voltage regulation is effected by a Tirrill regulator built for four exciters. Plans provide for two additional 150-kw. exciter sets, which will be installed near those already in operation on the main floor underneath the switch structure.

The switchboard proper is located on an overhanging balcony at the same height as the second floor of that section of the building between the boiler and generator room. From his position on the balcony the operator has a general view of the entire operating floor. Behind the switchboard are the generator switch and bus structures. On the floor above are similar structures for feeder busses and switches, and there is also located on such floor 2,300-volt regulators for the commercial feeder circuits. On the fourth or top floor is an arc light sub-station. All main and high-tension switches are of the oil break type controlled from the main switchboard by pilot switches. Both generator and feeder busbars are in duplicate and all may be sectionalized.

The floors on which the switch-control apparatus is located are constructed with a view of facilitating repairs should it ever become necessary to get at the cable or conduits. The I-beams support a 6-in. solid concrete floor. On this is a 11-in. loose filling, in which the conduits are laid, this being covered with a 4-in. concrete floor.

The bus and cell structures are built in groups, with the main and auxiliary bus structures flanking a common passageway on the second floor, and the feeder bus structures similarly arranged on the third floor. The structures are of concrete, with the exception that the tops and bottoms of the generator and sectionalizing switch compartments are of Alberene stone. The structures are reinforced by iron rods running through the barriers from top to bottom. The generator leads are carried down under the generator room floor from the generator terminals to junction boxes and then up the building columns in brass conduit direct to the generator switches of the main generator and auxiliary busses. A group switch connects the 2,300-volt main generator bus to a main feeder bus on the floor above, and a similar switch connects the generator auxiliary bus with an emergency feeder bus. The 6,600-volt generator and auxiliary busses are permanently connected to extensions of these busses in structures on the floor above and from which the feeders are taken off. The 6,600-volt and the 2,300-volt bus systems are connected by two 1,500-kw. oil-insulated water-cooled three-phase transformers, located in the basement.

The generator control panels are located at the west end of the initial switchboard, the plans providing for the installation of 6,600-volt feeder panels west of them, so that they will be centrally located with respect to the ultimate switchboard. To the east of the generator panels are exciter and house service panels and space for three synchronous motors and three railway generator panels.

The space east of the switchboard and bus structures is devoted to offices, a machine shop, toilet and wash rooms, which contain needle baths and porcelain finish wash troughs, supplied with hot and cold water, and are furnished with expanded metal lockers. Separate toilet and wash rooms are provided for the colored firemen.

General lighting of the generator room is effected by arc lamps supported on wall brackets. The boiler room and switchboard structure are lighted with incandescent lamps.

Collecting Paper from a Street Rubbish Can in Denver,

A Storage House for Records, documents and valuable papers is being planned by the Pennsylvania Lines West of Pittsburg, according to a recent report. At the present time a great many valuable papers are stored in the offices of the various divisions in buildings which are often far from fireproof. In order to remove the danger of loss by fire, it is proposed to erect a large fireproof building in Pittsburg where the records from all parts of the system west of that point could be filed and cared for.

Street Cleaning in Denver, Col.

Street-cleaning operations in Denver have been developed along lines somewhat different from those followed in most cities in this country. The streets in the central portion of the city are paved with asphalt, over twenty-five miles of this pavement having been laid. The remainder of the total thirty-five miles of paved streets are paved with sandstone block, and, in addition, nearly twelve miles have been macadamized. A considerable mileage of the balance of the streets are surfaced with gravel, and are provided with curb and gutters. All of these improved streets are cleaned regularly, at intervals depending entirely on the density of the traffic tributary to them.

A large percentage of the street traffic in Denver, and particularly of the horse-drawn vehicles, is over the asphalt streets. Consequently, a major portion of the activities of the street-cleaning department of the city is devoted to these streets. Rotary sweeping machines, each mounted on a four-wheel truck drawn by a team of horses, are used to collect in furrows the principal part of the detrius on the asphalt. These machines are followed by automatic pick-up machines, also mounted on a four-wheel truck drawn by a pair of horses, which collect practically all of the material placed in the furrows by the sweepers. When the weather is propitious, the street over which the pick-up machines has just passed is thoroughly washed with sanitary flush-tank wagons, built especially for this purpose. These flushing wagons are followed closely, in turn, by men with brooms, who sweep into the storm water sewers such water, refuse and fine particles of material as remain. All of this work is done during the day, the heavily-traveled streets being cleaned first. After the sweepers have passed, block men with brooms and two-wheel push carts continue the removal of refuse the balance of the day.

The operation of the rotary sweeping machines during the day, without delivering a continuous cloud of dust to interfere with traffic on the streets, or with pedestrians, is rendered possible by several changes which have been made in the construction of these machines. The most important of these changes, so far as avoiding an obnoxious cloud of dust is concerned, has been the extension of the tight wooden deck over the machines so two heavy canvas hoods can be placed around the machine, instead of a single hood, as is usual. The two hoods are arranged so an air space of about 5 in. is provided between them. This enclosed air space quite effectually intercepts all of the dust that passes under, or through the inner hood, with the result that the sweepers thus equipped are regularly operated in the daytime, without complaint from the merchants and residents along the streets, or from pedestrians. This ability to do all of the sweeping in daylight has greatly increased the efficiency of the street cleaning forces, and reduced the cost of the work, as compared with the efficiency and cost when the work was done at night.

The refuse collected by the block men with brooms and push carts is placed in 3-yd. boxes, placed at convenient intervals in the alleys. The alleys in the business district are also cleaned daily and the refuse placed in these boxes, which are emptied into wagons each day.

A sanitary rubbish can of special design, which has been used for about two years in the business district, has proved particularly effectual in obtaining the assistance of pedestrians to keep paper, fruit skins and similar litter off the streets. Prior to the use of these special cans ordinary round garbage cans were placed at the street corners and other points, as the receptacles for this litter. The records of the street-cleaning department show that these original cans enabled much of the refuse and litter formerly cast into the streets to be collected. Soon after the installation of the new cans the amount of material thus collected was doubled and is now more than three times what it was with the old cans. This condition can probably be attributed, more than anything else, to the attractive appearance of the new cans, which are at the same time built to be specially adapted for service.

The body of each can is 36 in. high and 19 in. square, with a frame of light steel angles and sides of sheet iron, the bottom being open. A leg, consisting of a short piece of steel angle, is placed under each of the four corners; these legs are adjustable in height so the can may be set in an upright position on a slanting sidewalk. The cans are designed to be attached to an angle-iron post set in the sidewalk. Some of the cans which have been installed were built with a vertical depression in the middle of one side, in order that the can might be attached to the angle-iron post in a minimum space. Some few of the cans are also attached to trolley wire posts of the street railway.

The top of the can is an inverted hopper, with a wide-mouth opening, and is not hinged to the body. A groove along one side of it fits over a projection on the inside of the body in such a manner that when a hasp on the oppostte side of the top is attached to a fastening on the outside of the can by a padlock, the top cannot be removed. The wide opening in the top, together with the trim form and the fact that each can is painted a silver gray, with nothing but the words "Rubbish and Paper" on them, appear to be the chief features which attract attention to the object of the can.

A burlap sack, which just fits the interior of the can, suspended from a row of hooks around the sides of the top of the body. The top edge of this sack is provided with eyelets which fit over the hooks. The latter are placed directly under the removable top, so the the sack cannot be taken out as long as the top is in place. The bottom of the sack is perforated to permit the escape of moisture, and as the can is built without a bottom, a free circulation occurs through the contents, keeping them as nearly dry as possible.

The removal of the filled sacks, without causing any dust and without losing any of the contents, is readily accomplished by a simple arrangement. A rope is threaded through the eyelets in the sack so the top of the latter can be drawn together and tied before it is pulled out of the can. An empty sack is then placed in the can and the filled one loaded on a wagon which makes regular collections. In all, 276 of these cans have been installed, and when making a collection three times a week the large rack wagon, shown in the accompanying illustration, is completely filled at each collection under normal conditions. The average load at each of these collections is about 2,400 lb.

The macadam streets in the residence districts of the city are swept regularly and the gutters of the surfaced streets are cleaned by a combined sweeper and sprinkler. The paved alleys in these districts are cleaned three times each week.

The equipment of the street cleaning department is housed in sheds adjacent to the business district. A shop in which all of the equipment is kept in repair is maintained in connection with these sheds. The rotary sweeping machines were built, and the pick-up machines were rebuilt in the shop, according to plans of the department.

The department has 90 men in its employ, regularly maintaining four sweeping outfits, which each include a rotary sweeper and a pick-up machine, with five men and a foreman to each outfit; another man and team are also added to the outfits at work on asphalt streets when flushing is done. Forty-five block men, with brooms and push carts are kept at work, the territory covered by each man depending on the traffic. The expenses of the department for the year of 1906 were $81,482.55, of which over $6,000 was for the establishment of the new plant and $8,454 for new equipment.

The department is under the supervision of Mr. Samuel L. Phillips, commissioner of highways, of Denver, to whom this journel is indebted for the information from which the foregoing notes have been prepared.

Book Notes.

About seven years ago Mr. Thomas Aitken, surveyor to the County Council of Fife, wrote a book on "Road Making and Maintenance," which is one of the best practical manuals on work of this sort in Great Britain. Since it appeared there has been a considerable change in many branches of road work. The automobile has demonstrated its devastating powers on roadways, new types of wood pavement have been introduced, tarring has pushed its way to the forefront, and the author himself has taken a prominent part in the widespread movement to prevent dust. A new edition of the book has accordingly been prepared to agree with the changed conditions. It has the same practical character as the first edition and will be found of much interest to American engineers who wish to secure information concerning the many British novelties in methods and plans which are attracting attention there but seem to be strangely belated in appearing on this side of the Atlantic. (London, Charles Griffin & Co., Ltd., 21s.).

One of the most perfect books typographically that has appeared in this country is the translation by Brother Arnold, principal of La Salle Institute, Troy, of the "Letters of Petrus Peregrinus on the Magnet." The author, a friend of Roger Bacon, was a highly educated French military engineer, who wrote his famous letters in 1269, thus making the first important contribution to magnetic philosophy, the next being the "De Magnete" of Gilbert in 1600. There are a dozen or so ancient manuscript copies of this letter in European libraries, and a copy of the first printed edition, that of 1558, is in the Wheeler Collection of the library of the American Institute of Electrical Engineers. This translation has been made with a scholarly accuracy and literary grace that are charming, and a similar satisfactory introduction concerning the author and his letter has been written by Brother Potamian, of Manhattan College. The great importance of this letter and the exceptional character of its translation and introductory notice led the publishers to give the book a form that was similarly perfect. A large amount of study and experiment was put on the task, and it is believed that nothing has yet been done in this country which is any better, the result being a unique volume of interest equally to those who wish to know about the very beginnings of electrical knowledge, and to bibliophiles. (New York, McGraw Publishing Co., $1.50.)

The first volume of Dr. S. Dunkerley's "Hydraulics" is somewhat disappointing, because it is by no means as good a work on the subject as the author is able to write, and, moreover, it contains typographical and other inaccuracies that are annoying. The first chapter is a discussion of the flow of a perfect fluid through orifices, jets and notches, and the second discusses fluid friction, practical formulas for the flow of

water, steam gauging and allied subjects. The chapter has a short article on water meters in which American meters receive very snippy notice, which is rather surprising in view of the favor with which they are regarded in Europe. The third chapter is a description of hydraulic pressure machines; the elevators of the Eiffel tower are given among the examples of such machines, but the latest patterns of apparatus designed by the same builders, the Otis Co., are overlooked. This is a pity, for elevator machines of the hydraulic type have revolutionized the possibilities of office-building construction and their details are of unusual interest. In the chapter on reciprocating pumps, which comes next, the main interest will probably be found in the discussion of the theory of air chambers, although there is a long description of the Gutermuth spring valve for water chambers, a German novelty. The fifth chapter is on turbines, and the sixth is on centrifugal pumps; in each the theoretical principles are first outlined and then apparatus is described, special attention being drawn to compound turbines and pumps built under the direction of Prof. Osborne Reynolds some twenty years ago. The seventh and final chapter is a review of that scientist's researches in viscous flow and the theory of lubrication. It must not be inferred from what has been stated that the book is not a useful one, for it is one of the best resumés of British research in hydraulics that has yet appeared. Its defects, outside of the poor proof-reading, lie in the references to machinery that can hardly be considered typical of the state of engineering at present. (New York, Longmans, Green & Co., $3.00.)

Letters to the Editor.

Metric Curves.

Sir: Enclosed find a few rules for reducing English curve values to metric. These were deduced for the purpose of platting metric curves, and are not applicable to field work as the values given are not exact. They vary on the same principle that the radius of a 2° curve is not exactly one-half that of a 1° curve, nevertheless they are sufficiently accurate for most purposes of platting, and may interest some of your readers. A table giving the radii, arcs and tangent distances in English values is required for their use.

The basis of the metric curve is: A twenty-meter chord subtends one degree of central angle.

To find the radius: From an English table find the radius of a curve of one-half the degree of the required metric curve, and point off one place; this is the radius of the required metric curve. Required to find the radius of a 5° metric curve: $5° \div 2 = 2° 30'$. R. $2° 30' = 2292.01$. 229.20 is approximately the radius of a 5° metric curve.

To find the S. T. From an English table find the S. T. for the given central angle, but for a curve of one-half the given degree, and point off one place.

To find the arc or length of curve: From an English table find the arc for the given central angle, but for a curve of one-half the given degree, and point off one place.

The above values may be reduced for English to metric, by multiplying the English value by .2, or dividing by 5.

Yours respectfully,

Geo. E. Winton.

Merced, Cal., Nov. 17.

[This relation is pointed out as follows by Professor C. F. Allen in his "Field and Office Tables": "The radius, the chord, length, offset, or other linear dimensions on the metric curve will be 0.2 that of U. S. curves of double the degree or nearly 0.1 those of U. S. curves of the same degree." Professor Allen here takes the degree of curve in the metric system as the deflection angle for a chord of 20 meters, whereas in the above letter it is taken as the angle subtended at the center by a chord of 20 meters. The two formulas, therefore, give similar results.—Editor.]

Heating and Ventilation.

Sir: Your editorial of Oct. 26 and the letter of Mr. Walter B. Snow of Oct. 31 I consider very much to the point, and feel that you and he have done one phase of mechanical engineering a service by calling attention to a situation that requires improvement. It is a fact that most heating and ventilating work of the present day, though not by any means all, is done on rule of thumb methods but little removed from the ordinary work of the skilled mechanic, and such mistakes as develop are either left in or corrected after the installation has been completed. This has permitted men who are little more than steam fitters to pose as mechanical engineers engaged in heating and ventilating as a branch of mechanical engineering, much to the detriment of the work done and to the standing of the profession, the purchaser or owner paying for the mistakes. There are many prominent exceptions to this, as in every line, and those engaged in this work can no doubt name colleagues who have become scientific engineers without ever having seen a college, but such men rose only through natural ability and effort impossible for the average. This situation has arisen largely through the absence of scientific data, but largely also through the ignorance of the existence of such data as there is, on the part of those engaged in the work.

It is the function of the schools of mechanical engineering primarily to teach students what there is known on any particular appropriate subject so far as possible and to extend the knowledge of that subject by research work. Heating and ventilation as a profession is not at this time recognized in any school of good standing in this country and it is an open question whether the time has not come to so consider it. That it is a branch of work capable of scientific treatment and of importance to the general public health admits of no question. It is, however, only one branch of that most broad and scientific department of engineering commonly known as "mechanical engineering," and as such, and by reason of its importance, should receive some treatment in a course of mechanical engineering. It is an error to assume that any such course, however thorough it maybe in its fundamental training on heat, applied thermodynamics, mathematics, physics and chemistry and steam machinery as taught in the laboratory, drafting-room and class, which contains no treatment of the methods of applying this knowledge to the problems of heating and ventilation or the analysis of these problems into the fundamental elements, is a sufficient preparation for its practice. The analysis of practical heating and ventilating problems in as great a variety as possible into their elements, all of which elements are contained and covered in any good course of mechanical engineering, is just as much necessary as the proper teaching of these basic subjects. Any course of instruction laid out with the idea of teaching the practice of heating and ventilation in the shortest time and of teaching nothing else would be entirely too narrow to be dignified by the name of a profession or to be of much use to the engineer who must keep up to date and lead in the solution of new problems.

It would seem that the best preparation for the practice of heating and ventilation would be a course in mechanical engineering to which was added, or which included, an examination of heating and ventilation problems and their analysis into the elements that are included in every course in mechanical engineering. Thus would be laid down a scientific basis as broad and many-sided as anyone could desire. There would be lacking, however, in the man thus prepared the ability to approach in a practical way a heating and ventilation proposition; he would not have much knowledge of costs of materials, labor or fixed charges or how to use them; he would not have much knowledge of the necessity for the exercise of ingenuity in locating his pipes and conduits, his heating surface, his returns, fans, fittings and regulators to those spaces left by the architects for the purpose, nor would he be able to surpervise the installation of a system because he would not know good work from bad. Such practical knowledge as this, however, cannot be taught entirely in the schools. It must be learned in the doing, and with the sort of preparation laid down above should be quickly learned. After the completion of an ordinary four-year course in mechanical engineering, a simple way of acquiring much that is practical and special in heating and ventilation would be the pursuit of a fifth year combining the present methods of instruction with practice of some of the art schools. In the fifth year the student can listen to lectures by prominent specialists on various phases of the subject, for, say, half his time or full time on alternate weeks and spend the rest of his time in the business office estimating and analyzing costs, in the drafting-room making layouts, and in the field assisting in the supervision of installations; he would at the end of that time be very much farther along toward becoming a useful heating and ventilating engineer than if he had spent two years at the practical work alone or a similar time additional in the college.

Mechanical engineering has split up into many specialties besides heating and ventilation, such as the powering of ships, mechanical refrigeration and ice-making, the management of factories, the design, construction and operation of power plants, and special machinery for elevating and conveying, pumping, air compression, crushing and grinding, the manufacture of cement and plaster, brick, textile and paper, the construction and use of machine tools and hosts of others, all demanding recognition. In the present four-year course we find it difficult to teach properly even those things that may be considered most broadly fundamental and necessary to all branches of mechanical engineering. How then are the schools going to face the problem of teaching these specialties as they should be taught? The method that will probably be the most feasible is the fifth year, not devoted entirely to the school, but spent partly in the school and partly in the field after the four years' work, in which special application can be effectively made without narrowness.

Yours very truly,

Charles E. Lucke.

Columbia Univ., Nov. 29.

The Iron Ore Production in the United States during the fiscal year 1906 is stated by the U. S. Geological Survey to have been 47,750,000 gross tons, valued at $100,597,000. This is an increase of about 12¼ per cent. in tonnage and nearly 34 per cent. in value over the production for 1905. Minnesota furnished ore valued at nearly $52,000,000 in 1906 and Michigan produced an output valued at $31,000,000. Alabama ranked third with an output valued at a little over $5,000,000. The larger part of the ore was mined directly by companies using it in their own furnaces.

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TABLE OF LEADING ARTICLES.

Publicity.

John D. Archbold, vice-president of the Standard Oil Co., makes the following unexpected acknowledgment in the "Saturday Evening Post" of Dec. 7: "I say with the utmost frankness that I believe the policy of silence which the company maintained for so many years, amid the misrepresentations which assailed it, is a mistaken policy, which, if earlier abandoned, would have saved the company from the injurious effects of much of that misrepresentation." The publicity policy of the great corporation has been for so long one of absolute silence concerning everything except its products, that this announcement by Mr. Archbold is very significant of the present influence of journalism. Some great railway companies long ago recognized that secrecy concerning everything in which the public was concerned had a bad effect on their place in public opinion. Some of the most gifted men in the journalistic field have undertaken this kind of publicity work, one of them even joining the staff of the Standard Oil Co. some months ago. It is safe to say, however, that this step, so far as the Standard Oil Co. is concerned, was taken too late; the public has been led to believe altogether too much evil of this great corporation to look upon its tardy recognition of publicity as anything but a desire to fight back as well as it can against its avowed enemies, who have long shown themselves to be masters of the resources of paper and pen.

It was natural enough for the great commanders of commerce and manufacturing, who were engaged in building up enormous business enterprises, to feel that the public had no right to information concerning their undertakings so long as they kept within the law, and that information concerning the products was all that there was any reason for giving out. Unquestionably this feeling has gradually changed, and it is now seen to be good policy to allow for two characteristics of the average man. The first is his legitimate inquisitiveness concerning the manner in which a product that he uses is made, and the second is a determination to buy that product just as low as anybody else. When a man delves into the secrets of nature in an intelligent manner he is considered a scientist, although very likely his researches may be of no immediate value. On the other hand, when he endeavors with equal intelligence to ascertain how a product is manufactured, so that he may judge for himself what improvements can be made in it without increasing its cost above what he wishes, he is, or was, regarded as altogether too inquisitive. Now these two manifestations of curiosity are really the same, and it is the recognition of this fact that has led to the increasing appreciation of what legitimate publicity means. The fact that the Standard Oil Co. has at last abandoned in a measure its policy of stony silence for that of reasonable publicity is one of those indications of the great business shrewdness that is expected in the management of that corporation.

Another aspect of this matter was referred to in this journal last week in the extracts from the address by Dr. James Douglas at the Toronto meeting of the American Institute of Mining Engineers. Dr. Douglas discussed the extent to which secrecy in the arts was desirable. His arguments for and against such secrecy were well stated, and the address as a whole is one of those contributions to engineering literature that deserve study by every engineer. A little reflection will show, however, that the views of secrecy outlined in the address of Dr. Douglas do not differ from those of publicity outlined by Mr. Archbold. Both agree that secrecy does not pay in these days in most enterprises. The reason for this is obvious. There are some special processes which can occasionally be maintained as trade secrets, and occasionally some one is able to devise a machine which it is advisable to operate in a secret manner. As a rule, however, secrecy is a cloak for ignorance. There are too many thoroughly competent men ready to undertake almost every kind of work to make the average secret, either of process or of organization, of much use. There are three things that count in large affairs. One of them, the most important, is an organization of competent men thoroughly inspired by esprit de corps. The second thing is sound financial management, and the third thing is control of the resources from which raw materials are obtained. At the present date patents are largely things to fight over, secret processes are things to worry over, and an inefficient staff of men is a thing to weep over. Given a good staff, a good supply of raw materials and a financial management that is neither reckless nor timid, and the success of any business is pretty well assured. It is safe to say that one of the first things a corporation of this nature will take in hand is its arrangements for securing legitimate publicity. The art of doing this is still in its infancy. There seems to be a feeling that by spending a little money in the advertising pages of various publications it is possible to control the reading pages, although this is not the case with any reliable journal. The way to secure publicity is that outlined by Dr. Douglas, to give out information which is likely to interest the people who subscribe to the various papers or join the important engineering societies. Just as soon as a corporation understands that there are two kinds of publicity, one entirely appropriate to advertising pages and trade catalogues, and the other appropriate to reading pages, and that the two are as far apart as the North and South poles, it has attained knowledge that, rightly applied, will enable it to gain satisfactory publicity in a manner and to an extent possible in no other way.

Tests of Full-Size Reinforced Concrete Compression Members.

Compressive tests of concrete cubes from twelve inches downward are much like those of steel eye-bars, so many in number as to leave little to be desired. The same is true concerning the tensile tests of cement and mortar briquettes, and it is even more true concerning the tensile tests of steel. In spite of this abundance of experimental investigations of the two materials of the concrete-steel combination there is a dearth of empirical data relating to the reinforced concrete compression member, although the engineering laboratory of the University of Illinois and the testing bureau at the Watertown Arsenal have made experiments valuable in their way, but not yet conclusive concerning some important features of reinforced concrete column design. The tests of banded columns have disclosed information of much importance and have aided greatly in giving the banded concrete column sufficient standing to secure its adoption in many buildings, but a little reflection makes it apparent that some of the most valuable information which can be established by experimental investigation cannot be obtained from columns of that type.

The longitudinal steel in banded columns is of very small sectional area and usually in such shape as to offer no sensible resistance to direct compression in itself, even when such angles are employed as have occasionally been used in this particular class of column tests. The natural and inevitable consequence is, first, a certain heterogeneous action of the two materials, in consequence of which the steel bars or rods tend to buckle under even a small compressive loading and hence to split the concrete surrounding them. This tendency is, of course, opposed and controlled by the steel banding, provided it is heavy enough. Some experiments seem to show that the banding does not in general come into positive effective action until the concrete has been loaded beyond any intensity of working stress which has yet been prescribed for the concrete; in other words, the lateral expansion of the concrete under the maximum working loads of engineering structures is not enough to

develop any material amount of support from the banding steel. Or, to put it in another way, the ordinary round rod steel banding does not act quickly enough to meet the requirements of usual loading on the concrete, although it gives material support to the latter under loads imposed by the testing machine far beyond the maximum working stress in any structure. While, therefore, the tests of full-size banded columns produce results which fully illuminate the conditions attending the action of a wire-wound concrete core, they have not thrown much light upon the ultimate resistance of a combination column in which the steel is so distributed as to form a full load-carrying steel column, while at the same time it envelops and supports as an effective banding the concrete within it.

This latter type of column, used successfully in the building in which this journal is published, is a true concrete-steel column in the full sense of the expression. The combined action of the two materials is radically different from that of any series of concrete-steel columns yet tested. The load acts directly upon both steel and concrete from the initial loading to the full working stress. The steel performs its function promptly and without waiting for the development of lateral strains in the concrete. While the lacing bars may, and undoubtedly will, yield to some extent to the flexure induced by the lateral enlargement of the concrete, it must be remembered that when properly designed the flexure of the lacing bars will afford considerable lateral support to the concrete and, within the working stresses permitted in that material, it may be even quite as much as or more than that offered by wire banding. If it be further remembered that a large part of the mass of the concrete at the four corners of a column is embraced throughout its entire length by the steel angles, and thus held far more effectively in this respect than by any possible wire banding, it is clear that the enclosed concrete must be substantially supported. At the same time the crucial test, of course, lies in the actual loading to failure of full-size members.

There are other features of these combinations of different materials the influence of which can only be satisfactorily determined by experimental investigation. It is ordinarily assumed that in all types of columns the intensities of stress are directly proportional to the compressive strains produced, and as a general law that is certainly true, but the effect upon the stresses in the concrete due to the partial prevention of the lateral strains by enclosure has not yet been demonstrated. It is quite supposable that in the combination of a steel column enclosing concrete the effective support of the latter by the steel surrounding it may throw upon the concrete sensibly more stress than would be the case with unrestricted lateral movement. Under such conditions the steel would carry with increasing loads a less proportion of the total and the concrete more. A careful set of measurements of the shortening of a test column under loads gradually advancing to that producing failure would yield sufficient information to settle this and other similar questions regarding the interaction of the two elements. There can be little or no question about the wisdom and safety of the present allowed stresses by the Bureau of Buildings of New York in columns of this type, especially as there are numerous tests of 1:2:4 concrete, showing that even in ordinary cubes a working stress for the purpose indicated of 750 lbs. per square inch may carry with it at the age of six months a safety factor between 5 and 6. It is much to be desired that in the mass of material testing now being planned ample provision may be made for full experimental investigation of this type of column which has so much to commend it from every point of view.

Vocational Schools.

The discussion which has been carried on in the columns of this journal recently is one that stimulates thought on educational topics. No country has a more active interest in education than our own and nowhere have experiments in education been tried on a more lavish scale. Some of them have been highly successful, others have not. In the early days of the country the situation was a very simple one. There were at the bottom the common schools, covering a range roughly equivalent to the first ten years of the present graded schools. Beyond these were a limited number of schools preparatory to the existing colleges and doing something less than the present classical high school. If these were not accessible the student was likely to prepare for college in his pastor's study. Then came the college, with a rigid course devoid of ornamentation but crudely effective. For professional study there was the divinity school, law and medicine being commonly studied in the office of the practitioner. It is only within the present generation that technological training has became reasonably accessible to those who are not desirous of the old classical training, now very much out of vogue.

The present technological school is the outcome of a demand for practical studies which could be applied to the occupations of every day life. It was roundly abused in its beginning, more for social than for strictly educational reasons. It was looked upon as the resort of young men of small means and mediocre attainments who desired with a strictly commercial instinct to turn studies into dollars in the minimum possible time. At present that stigma has worn off, for the point of view has changed and the growth of industry has opened careers which demand for preparation something more than the old education had to give. And by reason of the same sort of demand, there have sprung up a host of what one may call rudimentary technical schools, and institutions even more strictly vocational, such as correspondence schools and trade schools, teaching for better or worse practical things which can be turned into the coin of the republic. Besides these there are the so-called business colleges, which exist simply on account of the incapacity of the public school to come down out of the moonshine long enough to teach common things thoroughly.

Now the vocational school, by whatever name you choose to call it, exists in honorable recognition of the fact that the grand army of the world's workers must have privates and non-commissioned officers as well as staff and line. One may try to conceal their function behind fine spun theories regarding the superlative cultural value of handicraft, but the fabric is transparent. The students of the vocational school, whether it be a manual training, a trade, or a business school, are there because they lack the time, taste or capacity for pursuing the so-called "higher" education. Many of them are the better for their choice, and all are going honorably forward to find their places in the ranks. Some will win their commissions in due season, others will stay privates and corporals. It is sheer snobbery to look down upon the vocational schools, but it is equally culpable stupidity to suppose that they exist for psychological rather than utilitarian reasons. There are doubtless some boys whose intellects can be stimulated only through their hands, but these cases are essentially unfortunates like those deficient in sight or hearing to whom the ordinary channels of communication are unhappily closed.

The "manual training" high school occupies a somewhat anomalous position at the head of the list. At present it turns out neither engineers nor finished craftsmen, but gives a good sound training so far as it goes. There is a pretty general feeling among engineers and manufacturers who have considered the subject that if the manual training school could go about two years further it would prove invaluable in the training of young men fit to be foremen and superintendents, the sergeants and lieutenants, so to speak, of industry, not out of line for promotion. A very few schools which actually give just about this training can show a remarkably successful list of graduates. It would be an admirable thing if the manual training schools could generally be expanded into this particular sphere of usefulness.

The trade schools have not been so successful as one could wish, mainly on account of unreasoning prejudice on the part of organized labor. The Y. M. C. A. industrial courses and the correspondence schools, by dodging around this obstacle, have, on the other hand, made substantial progress. The trade schools certainly have the possibility of very great usefulness, since the lack of trained workmen is being very severely felt in American industry. They ought to be actively encouraged and made an efficient part of the educational organization. If they were vigorously pushed the prejudice which now handicaps them would soon disappear and one would not be under the necessity of hunting up foreign-trained workmen in many branches of industry. At present all that is done in the way of training for trades is a mere drop in the bucket. Not every man can be made into a good workman, but every man ought to have the chance. With all the millions that are being spent for the cause of education in the United States it is a shame that more and better trade schools are not in operation. They are far more necessary to the national future than are the scores of petty colleges that provide sham B.A. and B.S. degrees in scores of self-satisfied communities. The country could well exchange a job lot of shabby "universities" for as many thoroughly good vocational schools. Education as at present organized is unhappily more extensive than intensive. This is not altogether the fault of the educators, but rather of the community that too frequently wants its culture like its parlor —plenty of veneer and varnish, and never mind about the joints. It is perhaps only a transitory foible of a rapidly growing coutnry,. but it is serious in that it leaves to the future the task of patching things up as best it can. It is time to drop makeshifts and to begin accumulating for the next generation a heritage of honest work in culture as in industry. It is a national boast to give every man a fair chance . Is it not time to make that boast good by giving every man an opportunity to learn how to win an honest livlihood?

Common Sense about Smoke Abatement.

The Chamber of Commerce of Syracuse, N. Y., is to be congratulated on having published the best report on smoke abatement that has yet appeared. It combines scientific accuracy with an appreciation of what is practicable, and is neither disfigured by questionable theory nor marred by the wordiness which disfigures so much that has been written on this important subject. Moreover, from cover to cover the report is characterized by a sanity of view that is gratifying. While it has been prepared for the use of Syracuse citizens, the work has been so thoroughly well done that its advice is applicable in most of our cities. If it is studied carefully and its conservative recommendations are followed, the manufacturers whose plants are now emitting dense smoke and the people who are subjected to inconvenience by such smoke will alike be bene-

fited. It is not surprising that the report is such a good one for the Chamber of Commerce appointed a committee to carry on the investigation which was fully able to execute its task in a proper manner. Four of the members were men everywhere recognized as authorities in industrial engineering affairs, while the others were equally competent to give advice on other features of the smoke problem. Plenty of time was taken by the committee to become acquainted with the conditions in various cities and to study the operation of devices for preventing smoke. Correspondence was conducted with cities having smoke-prevention ordinances and every attempt was made to find out what had been accomplished in this country and abroad. The report is consequently one of those documents which will become a standard authority, and it is to be hoped that the Syracuse Chamber of Commerce has printed an edition sufficiently large to enable engineers and municipal officers in other cities to obtain copies.

It is gratifying to notice that the committee has resolutely refused to lend itself to the position taken by some sanitarians that all smoke is injurious to public health. Very likely it is when present in large quantities, but there is a great difference between the atmosphere of the mill district of Pittsburg and the atmosphere of Syracuse. In Syracuse the problem of smoke abatement is essentially one of aesthetic and economical conditions rather than one of hygiene. This is generally the case elsewhere and the sooner the fact is recognized the sooner will we have good progress in smoke prevention. If an ordinance is passed by a city which makes absolute prevention of smoke necessary at all times, the way is open for endless graft. Such a condition is not practicable nor is it necessary. There are a number of appliances on the market which will prevent smoke entirely under most conditions, when properly applied and managed, and the worst condition they will permit is a gray haze at the time fresh coal is charged on the fires. When the smoke given off by all plants is reduced to this extent, about all that is really necessary has been accomplished.

A great trouble with attempts made in the past to abate smoke has been due to the endeavor to place the matter in the hands of the police, or to take some equally drastic action. This is unfortunate. The history of smoke abatement demonstrates beyond any question that success can only be attained when the manufacturers whose plants belch forth black clouds and the owners of small boiler plants which are offenders in the same way, are brought to an appreciation of the importance to themselves of stopping such practices. Men told peremptorily to stop the nuisance their premises are causing, under penalty of heavy fine, are not approached in a tactful manner. Up to date no attempt to introduce such a policy in an American city has been successful, and most such attempts have been flat failures. On the other hand, marked success has been the result of harmonious action on the part of manufacturers and others to remedy this trouble. This has been shown particularly in the case of Cleveland, where great improvements are being made and arrests and fines are rarely necessary. Of course there will be cases in all cities where the law must be invoked to stop the nuisance. This is to be expected, but it is highly desirable that the number of such cases be restricted entirely to those parties who by nature are reluctant to do anything which is desirable for the public welfare.

It is really surprising that so little has been accomplished in the way of a general education of the people concerning the causes of smoke. The essential facts are readily understood. They do not require a technical education nor a deep knowledge of the secrets of science. The report issued by the Chamber of Commerce of Syracuse states both the principles of combustion and the causes of smoke in six pages of ordinary octavo size. A study of these pages is a matter of half an hour or so, and once the information they give is learned thoroughly the reader is in a position to talk intelligently on the subject of smoke abatement. He is also in a position to avoid accepting the preposterous claims occasionally made for patented devices to bring about smokeless combustion. Probably one reason that so many people are reluctant to try to prevent smoke is the fear that they will fall into the hands of some salesman whose apparatus is made to sell and not to work. Such people will find in this report a fair statement of what can and cannot be accomplished by different types of apparatus. The committee states emphatically that there is no one apparatus which will accomplish everything to be desired in every place, and it gives a warning that the selection of the apparatus for smoke prevention is something which should be entrusted if practicable to an independent specialist. There are a great many people owning small plants who will be reluctant to engage a specialist for the small installation necessary for their works, and for such people this report will be a boon. It is an excellent example of the good work that can be done by such a body as the Syracuse Chamber of Commerce, when it sets about it in the right way and takes plenty of time to do the work thoroughly and impartially.

Notes and Comments.

The Credit Man in business organizations has become a particularly important man these days, and because of the talk going on about over-expansion of business there is danger that, by over-conservative judgment, he may cause his associates to lose some good things. A pretty careful study of reports received by this journal during November, coming from all parts of the country, indicates that there is a very large amount of work fairly certain to be undertaken during the coming year. There is likely, however, to be some change in its character as compared with that undertaken at the beginning of this year. The anti-railway laws in the South have shut down railway improvements there, but more municipal work seems likely to be undertaken. A good many manufacturing companies which have recently reported improvements to be undertaken by them have apparently determined to confine this work more to equipment and reconstruction than to new buildings. The work that will be done will be carried out for responsible people of ample resources, who will take advantage of every flurry that lowers prices to secure whatever they need at favorable rates. The flighty promotor will not have much support and he will not be in evidence. Under such conditions, the credit man who is too conservative hurts his associates and his community. There is a large amount of engineering work greatly needed, there is plenty of money for it, and the only obstacle is the tendency to be too suspicious. It has been stated before in this journal, and this statement has found general approval, that it is highly desirable for the sound business men of every community to get together in an association for mutual help. It has been pointed out that such an association can be of great aid financially in a community where the banks are not rendering the service they should. An equally valuable help can be afforded by maintaining a central credit bureau. This has been done for years by merchants in New England cities; in the largest cities bitter commercial rivals exchange information concerning the financial standing of applicants for credit. A good deal depends now on giving all credit that is reasonable for engineering and industrial enterprises, and for this reason a closer association and supervision of the work of the credit man seems desirable.

The London Water Supply is the subject of an unusually interesting report made public last month by the Water Board of the metropolis. Some years ago, when the existing works were under private ownership and the London County Council thought it would be a good thing to build a great system drawing a supply from Wales, there was a lack of harmony concerning the course most desirable to pursue. Since then the works have passed under the control of a single commission, which has been studying carefully the needs of the future and the means of meeting them. The report states the results of this study. Primarily it is based on the utilization of the Thames by storage and filtration until the cost of works for the purpose becomes greater than the cost of works to bring water from Wales. This decision is a gratifying recognition of the resources of sanitary engineering. It was not so long ago that the idea of utilizing river water, even when filtered, would have been regarded with grave doubt, but we now know that storage and filtration will furnish a good supply from the Thames unless it should be polluted far more than is now the case. Such an increase in pollution is extremely unlikely. The amount of water used daily in the district is now about 225,000,000 imp. gal., of which nearly 129,000,000 gal. are from the Thames and the remainder are from other sources which cannot yield more than 120,000,000 imp. gal. when fully developed. The average daily flow of the Thames over Teddington Weir in the driest year is 900,000,000 imp. gal., so that a large amount of water can be diverted from it. A study of the probable growth of the population to be served and its consumption of water indicates that in 1916 the storage should be 37 gal. for each gallon of average daily supply, in 1926 it should be 72 gal., in 1941 it should be 91 gal., and about 1960 it should be 120 gal. With such an amount of storage 450,000,000 imp. gal. can be utilized from the river at a lower total expense than water will cost from other sources. The Thames is capable of furnishing a larger quantity than that, but the expense of the additional storage renders any further development of the works undesirable. The population served at that date is estimated at the enormous total of 16,286,000 people, who must be furnished 35 imp. gal. per capita daily, 1.5 gal. more than the present consumption. The astounding thing about the project to the American engineer is the belief of the Water Board that all these great works can be built out of its revenues. Evidently the American plan of paying for such things with the proceeds of bonds and thus charging their expense to the taxpayers instead of the consumers is not regarded with favor. Another feature of the report is the admirable foresight shown in the recommendation to acquire a tract in Wales large enough to meet the requirements for the additional water in the last four decades of this century. The principality does not look with favor on the appropriation of its water, and it will be far less expensive and troublesome to acquire the needed territory now than fifty years hence. The investment will not be entirely without returns, moreover, for by forestry and the lease of the land for grazing and agriculture interest charges on the investment can probably be considerably reduced. It must be gratifying to the people of the British metropolis to have such a satisfactory forecast of future possibilities as the Water Board and its engineer, Mr. Bryan, present in this comprehensive and convincing report.

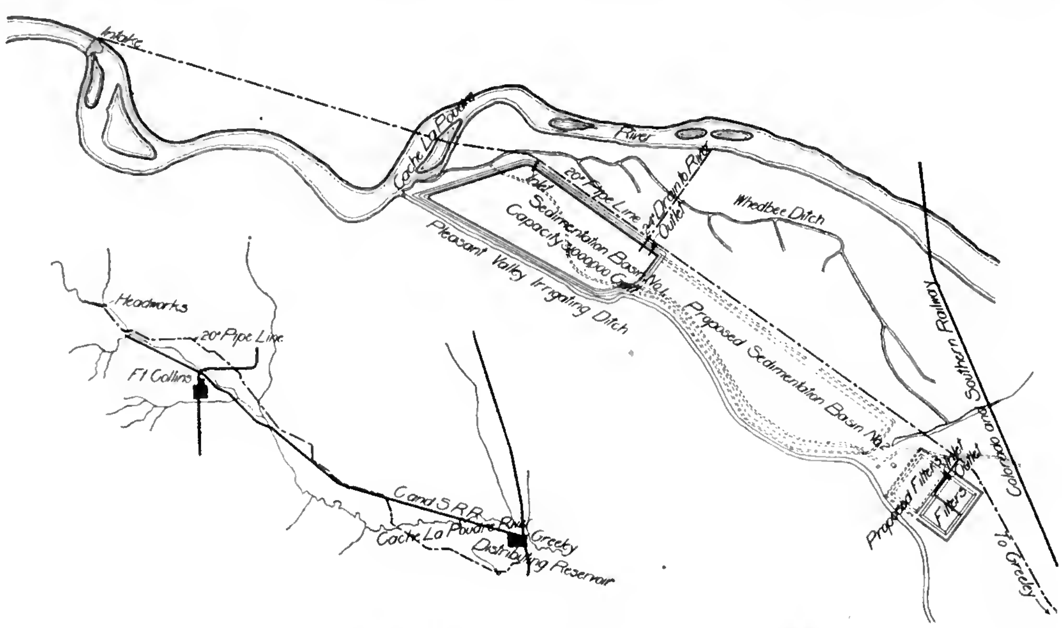
A GRAVITY WATER SUPPLY SYSTEM AT GREELEY, COLO.

A municipal gravity water-supply system, which embraces various special features of arrangement and design has recently been placed in service at Greeley, Colorado. Greeley is a city of about 7,500 inhabitants, 52 miles north of Denver on the eastern slope of the Rocky Mountains, and is surrounded by an extremely productive agricultural region, although the mean average rainfall in this locality is only a little more than 14 in. a year. The great productivity of the surrounding country is due to the fact that, almost without exception, the land is under irrigation. Water for irrigation is diverted from streams which have their source in springs, or in the almost perennial snow fields in the mountains, the foothills of the latter being about 30 miles west of Greeley. The largest of these streams is the Cache La Poudre River, the principal tributary of the South Platte River, the normal and minimum flows of the former being, in fact, greater than those of the main stream. The waters of the Cache La Poudre River, and of its tributaries, with the exception of a part of the extreme flood flows, are entirely appropriated for irrigation ditches which have their headworks above Greeley. Consequently, the only flow in the river at the latter during dry seasons is the seepage water which finds its way back into the stream from the irrigated lands.

Until the new gravity system was placed in operation, the water supply for general consumption in Greeley was derived from an infiltration well built in the gravel bed of the river a short distance above the business section. The distribution mains were operated under direct pressure from pumps in a station on the river bank adjacent to the galleries, a 14,000-gal. tank on the hill above the city maintaining the pressure during maximum consumption. The supply thus obtained and delivered was not only exceptionally poor in quality, but was also quite limited in quantity during certain seasons. The water which seeps back into the river from the irrigated lands is very highly impregnated with alkali salts of various kinds, a hardness of 1,800 parts per 1,000,000 being common to it. These salts impart a decidedly objectionable taste to the water and actually render it harmful. At the same time, the greatest defect of the water for domestic purposes is the extreme hardness. The water in the river at Greeley is also very deleterious to boilers, and was entirely unsuited for other commercial uses. The infiltration well was practically ineffectual in reducing the extreme hardness, although the turbidity which occurs in the river water under certain conditions was removed by it.

Notwithstanding this extremely unsatisfactory water supply, the local geographic and hydraulic conditions rendered the provision of an adequate quantity of good water an undertaking of exceptional magnitude for the comparatively small community to be served. Ground water from deep drilled, or bored wells in the vicinity is generally good, but the quantity to be obtained in this manner is limited. No possibility, therefore, of obtaining an adequate supply from wells existed. As the Cache La Poudre River and its tributaries are the only permanent streams within a reasonable distance of Greeley, it was evident that the only available supply of surface water to be obtained was from this river. The land is irrigated on both sides of the river above Greeley to the foothills of the mountains, so in order to secure a supply free from seepage from these irrigated lands the water had to be taken from the river in the foothills, at least 36 miles from Greeley.

While the location of the only satisfactory source of supply was thus determined within relatively narrow limits, other conditions of an exceedingly serious nature had to be met. Since the difference in the value of water rights in the eastern and western sections of this country, or more properly between the humid and arid regions, is so great, and because of the almost sacred character attached to such rights in a section in which irrigation is well advanced, the conditions which were presented will be treated in considerable detail. The appropriations of the entire flow of the river, up to and including part of the storm-water run-off, have become, under decrees of the courts in the order of their application to actual use, vested rights of great commercial value, due to the intense agricultural development of the river valley. These rights are, consequently, guarded with the utmost jealousy by the individual farmers who own them, and any infraction of them, or interference with their rank and precedure in priority is subject to opposition and protest of formidable character. From these conditions, the acquirement of a diversion from the intake of the ditch to a point some 3,000 ft. upstream in order to locate advantageously an intake for a pipe line leading to Greeley. Furthermore, the quantity of water decreed for irrigation purposes had to be transferred to a right for domestic and sanitary uses. The legal processes of both such transfers frequently meet with strenuous opposition from other water-right owners. The mere diversion of a quantity of water from one to another point of the river may adversely affect the established rights in the intervening section. Besides, the use of water for domestic purposes is essentially more imperative in its demands than for irrigation purposes. It also covers the full year, while water decreed for irrigation purposes may be limited in right to the irrigation season, extending from April 15 to November 15. These transfers were nevertheless made by the court, so the appropriation granted to the ditch placed fourth in the order of priority, and permits the diversion of the water at the desired point. Less than 50 cu. ft. per second have been decreed to other ditches ahead of this one and as the flow of the



Map of Pipe Line and Arrangement of Headworks.

legal right to an adequate water supply at all seasons of the year and at all stages of the river, formed for Greeley, as it must do for all other towns and cities in an arid region where a great irrigation development exists, a most serious problem. In this instance, however, the requisite rights were obtained at a nominal cost and without conflicting with other appropriators.

In the purchase of a site on the river at the edge of the foothills, a portion of the land acquired conveyed with it the title to an irrigation ditch built from the Cache La Poudre River in 1862, which makes it one of the earliest ditches constructed in the valley. This ditch had been used continuously for irrigation purposes from the time it was built practically to the time it was purchased by the city, and it had a carrying capacity of about 7.5 cu. ft. per second. The ditch did not, however, possess a legal existence, so far as the records of appropriations decreed by the courts showed, although it had a right to a supply of water from the stream, because the formality of presenting a claim, or statement of its standing and of having the appropriation of its right decreed by the courts had been neglected. The state laws of Colorado contemplate the correction of such omissions, however, on due notice to all parties concerned in the water appropriations. Accordingly, when the claim was properly presented the decree for the ditch was entered as August, 1862, with an appropriation of 7½ cu. ft. per second. It was then necessary to transfer the point of river is rarely, if ever, less than that quantity, a supply is assured at all times. The quality of the supply is also excellent. The normal total hardness of the water is only 40 parts per million, as compared with the 1,800 parts per million in the original supply of the city; the normal bacterial content is remarkably low, and during almost the entire year turbidity and color are absent. The value of a supply of this character to a community in the semi-arid region in which it has been obtained is scarcely appreciated in sections of the country where water is plentiful and quality of the supply is the chief consideration.

A 20-in. wood-stave pipe line, 36 miles long, has been built to deliver the water to Greeley from an intake in the river near the head-works of the old irrigation ditch. In connection with this pipe line, a 31,000,000-gal. storage and sedimentation basin and two 1.25-acre slow-sand filtration basins have been built a short distance downstream from the intake. A 5,000,000-gal. receiving and distributing reservoir has also been built on a hill, two miles from the city. Sites have also been reserved for a second sedimentation basin of over twice the capacity as the existing one for doubling the filtering area and for a second receiving and distributing reservoir. Provisions for connections for these proposed additions have been made along with the present work, to facilitate future construction.

The ultimate capacity of the pipe line of the new system is 5,000,000 gal. per day, while the

The 31,000,000-Gallon Sedimentation Basin.

normal average daily consumption in Greeley is now about 1,250,000 gal. In the design it was planned to provide for a population of 15,000, with a per capita consumption of 300 gal. This allowance is not unusual in cities and towns in the arid or semi-arid regions where lawns, trees and all vegetation is wholly dependent on irrigation. The construction of the new system along these lines and the acquisition of the water right described, make ample provision for the growth of the city.

The intake of the pipe line is only half a mile downstream from the mouth of the canon of the river in the foothills. About six miles above this intake the river divides into two branches, the North, and the Main Forks. The water from both forks is normally clear and cold, since the source of both is springs and snowfields in the mountains. Under certain rainfall and flood conditions, however, the turbidity of both streams is pronounced for short periods. The turbidity which occurs is due to the washing of the light soils in the watersheds and is remarkably difficult to remove by sedimentation. The conditions which cause it frequently occur on different occasions in the watersheds of the two forks, so the water from one fork may be clear when that in the other is fouled.

The normal bacterial content of the water of the river above the intake is unusually low, due largely to the fact that little or no land on the watershed is cultivated and the resident population is extremely scant. On the other rand, much grazing land exists in the catchment area of the river and large numbers of camping parties frequent the mountains in this locality during the summer. Consequently, in designing the works the waters of both forks of the river were considered to be liable to immediate dangerous contamination, under certain conditions, and to more frequent contamination in the future.

Under these circumstances, the storage and sedimentation basin and the slow-sand filters were provided, in order that a uniformly clear, pure water might be delivered to the city. The only other alternative to these works would have been to extend the pipe line six miles up the canon to the junction of the two forks of the river, so water could be taken from the Main Fork only, which prior to the construction of the new works was considered to be free from turbidity, although subsequent observations have disproved this. Such an extension would have cost quite as much as the works that have been built, owing to the difficult and expensive character of the construction work required to make it. Moreover, the supply would have still been subject to periods of turbid water and to the possibility of dangerous contamination. The storage and sedimentation basin that has been built has sufficient capacity to supply the system, during the short periods when the turbidity of the river is the worst, without requiring any water to be drawn from the river during these periods. It also has enough capacity to permit a considerable percentage of the bacteria as well as the rarely occurring turbidity, to be removed by sedimentation. The slow-sand filters have already demonstrated that they will reduce the bacterial content well within what is considered a safe limit for a domestic supply.

Headworks. A loose-rock diverting dam, 6 ft. high and 10 ft. wide on top, has been built across the river at the intake where the width of the stream channel is about 125 ft. The bed of the channel in this vicinity is gravel and small boulders. The latter and a quantity of broken rock, in pieces containing from 2 to 6 cu. ft. each, were used in making the dam, the downstream face being built on a slope of about 5 to 1 and the upstream face 1 to 1. The dam was made only tight enough to raise the stream level above it, in order that water might be diverted into the intake. The loose-rock construction has already been subjected to as nearly severe flood conditions as may be expected to occur, without material damage, and it is considered to be as well adapted for the service required as a more expensive masonry structure.

The intake to the 20-in. wood-stave pipe line is simply a concrete chamber at one end of the diverting dam, with an opening, protected with a rack screen, connecting it with the river. A manhole is provided in the top of the chamber so that the latter may be entered. A vent is placed in the pipe line just below the intake to permit the escape of air that enters the line at the latter.

The pipe line is on the right bank of the river for about half a mile from the intake, and then crosses the river at a wide place in the channel of the latter, close to the upper end of the sedimentation basin. This first part of the pipe line involves no special features of construction, except the river crossing was made with cast-iron pipe.

Sedimentation Basin. The sedimentation basin and the filters are along the foot of a high hill, between the river and an irrigation ditch, which has its intake at the upper end of the sedimentation basin and skirts the base of the hill. The sedimentation basin was built to fit the ground, so is irregular in plan, its extreme width being 500 ft. and extreme length 1,400 ft. It is partly in excavation and partly in embankment. The embankments are 20 ft. wide on top, have a 1½ to 1 slope on the outer faces and a 2 to 1 slope on the inner faces. They were built with material from the excavation, which was hauled into place by teams and scrapers. The inner slopes are protected with hand-laid rip-rap, consisting of small glacial-drift boulders. The basin is not otherwise lined, but is practically water-tight. The outer slope of the upstream embankment is liable to wash during flood flows, so it is well protected with a layer of rip-rap of fair-sized boulders, the top of the embankment being placed 5 ft. above the highest known flood level, which occurred in 1904.

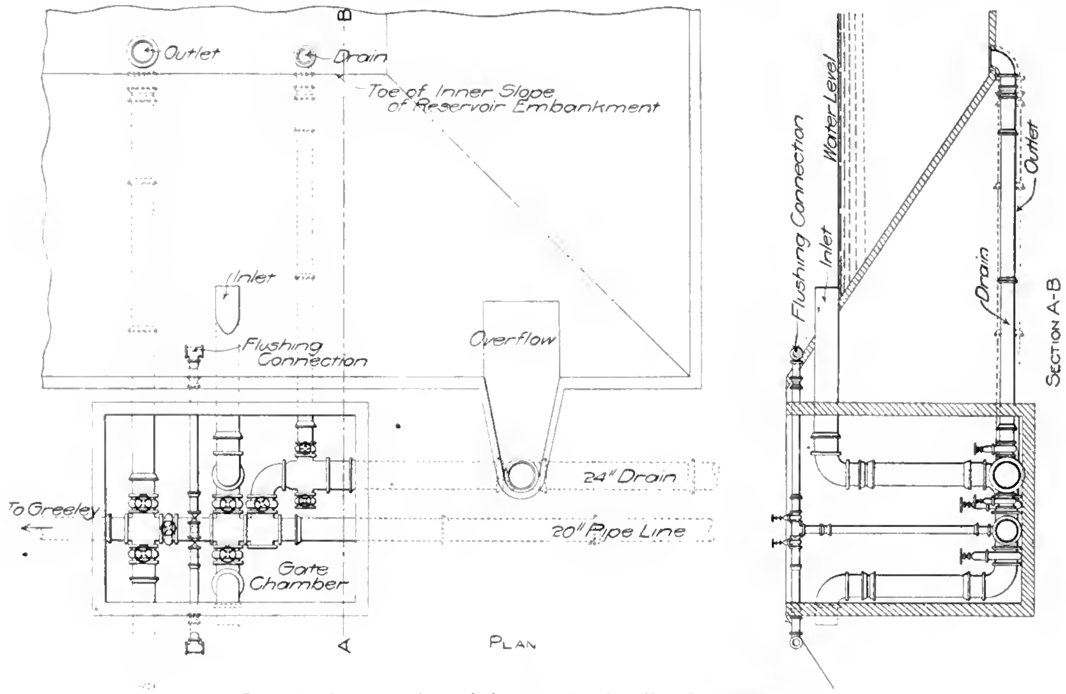
Receiving and Distributing Reservoir with Concrete Columns Ready for Wooden Roof.

The 20-in. wood-stave pipe line extends along the river side of the basin, close to the toe of the outer slope of the embankment on that side. An inlet connection to the basin from the pipe line is made at the outer, upstream corner. This connection is a 20-in. cast-iron pipe, laid under the embankment to a point 40 ft. inside the inner slope, and is provided with a gate valve so the flow in it may be controlled. The outlet from the basin is through a riser in an 8-ft. circular concrete chamber, in the downstream end of the basin, close to the inner toe of the slope of the embankment on the river side, the bottom of the basin sloping to this corner. Water can be drawn into the riser in the outlet chamber through four 20-in. connections, all at different levels, one of these is at the bottom and permits the basin to be drawn down entirely; the second is 8.5 ft. above the bottom; the third 6 ft. above the second, and the fourth is an overflow, which prevents the depth of the water in the basin becoming more than 16 ft. at the outlet. Each of the three lower connections is provided with a gate valve in the chamber. The connection between riser in the chamber and the 20-in. wood-stave line has a valve in it near the junction with that line; a valve is also placed in the latter near this connection. The arrangement of valves permits the basin to be by-passed, if desired, or the flow in the pipe line above the basin may be cut off and the supply drawn from the basin. The reservoir can also be drained by a 24-inch sewer leading to the river.

The site for the second sedimentation basin is immediately down stream from the first, the two basins being arranged, in fact, to have a common embankment at their adjacent ends. The two filters that have been built are 800 ft. downstream from the lower end of the proposed sedimentation basin, space being left on their upstream side for the two proposed additional filters and for the house and grounds of the attendant who is in charge of the filters and headworks.

Filters. The two filters which have been built are in a single open basin, 210 x 330 ft, in plan at the top, which is formed partly in excavation and partly by embankments. The embankments are 20 ft. wide on top and have both faces on a slope of 1½ to 1. The inner slopes of the embankments and the bottom of the filters are lined with 6 in. of concrete. A reinforced concrete division wall on the transverse center line of the basin separates the latter into the two independent filters, each with a filtering area of 1.25 acres. No covering was provided for the filters, as many years' experience in the operation of the open slow-sand filters of the Denver Union Water Co., at Denver, Colo., under climatic conditions very similar to those existing at the filters of this system is considered to show that the reduction in cost of operation produced by the covers, under the existing conditions, would not have justified the increased cost of such construction.

The operation of the filters is controlled from a 20 x 20 ft. concrete gate chamber built in the embankment, at the upstream end of the division wall. This chamber is surmounted by a substantial brick house of quite satisfactory appearance. The chamber contains all the necessary inlet, outlet and drainage connections for the two existing filters, and for the two proposed additional filters as well. The 20 in. wood-stave pipe line extends along the river side of the filters and has two 20-in. lines leading from it to the gate chamber, one for an inlet and one for an outlet. Both of these lines are cast-iron pipe laid under the embankment, which will be common to the two existing and the two proposed filters, when the latter are built. The inlet has two tees inserted in it in the gate chamber, with four 20-in. inlet connections, one for each filter, provided in these tees. As in all of the connections for the two proposed additional filters, the inlets provided for the latter are fitted with blank flanges. Each inlet connection is fitted with a gate valve and ends in an open chamber in the adjacent corner of the filter, the sides of this chamber being carried above the sand level in the filter. Four connections to the 20-in. outlet are provided, one for the underdrainage system of each filter; these connections are arranged in the gate chamber the same as the inlet connections.



Connections at Receiving and Distributing Reservoir.

A 12-in. drain leads from the gate chamber to the river. A 6-in. connection to this drain for each filter permits the water over the sand in the filters to be drawn off. An overflow connection to the 12-in. drain from each filter prevents the water in the filter exceeding a depth of 6 ft. above the bottom.

The underdrainage system of each filter consists of a 24-in. main drain, on the longitudinal center line of the filter, with 6 in. lateral drains. These drains are all vitrified sewer pipe, laid with open joints. The lateral drains are 14 ft. apart and extend to within 3 ft. of the sides of the filter. The end of the main drain distant from the outlet end is 0.7 ft. higher than the latter end, and each lateral has a fall of 0.4 ft., insuring drainage.

A minimum depth of 3 ft. of filtering materials is placed over the underdrains, 1 ft. of gravel at the bottom surrounding the underdrains, with 2 ft. of sand over it. Washed gravel from the river was found to be entirely satisfactory for the purpose. The gravel in the lower 7 in. of the 1-ft. layer was required to remain on a screen with 1-in. meshes, but to contain very few stones over 2 in. diameter. Over this coarse gravel is a 2½-in. layer of gravel, which will pass a screen with 1-in. meshes, but be retained on one with ⅜-in. meshes. The gravel in the remaining 2½ in. would all pass a screen with ⅜-in. meshes, but is coarser than ordinary sand, and free from fine material. Sand of excellent character was also obtained from the river. Two mechanical analyses of this sand are shown in the accompanying table, from which the high coefficient of uniformity is evident. Chemical analysis made of the same samples showed the percentage of carbonates contained in the water to be low, as might be expected, since the river water is practically free from salts at this point.

Table 1.—Analyses of Sand in Filters.

Mechanical Analyses— Mean Diameter.	Sample 1. Per Cent.	Sample 2. Per Cent.
Less than 0.13 m.m.	0.125	0.034
Between 0.13 and 0.27 m.m.	0.590	0.235
Between 0.27 and 1.00 m.m.	89.585	82.731
Between 1.00 and 5.00 m.m.	9.700	17.000
Over 5.00 m.m.	0.000	0.000
Total	100.000	100.000
Chemical Analysis to determine Carbonates—	Per cent.	Per Cent.
Lime (as carbonates)	0.42	0.36
Magnesia (as carbonates)	0.064	0.112
Total carbonates	0.484	0.472

The 6,800 cu. yd. of gravel and sand in the two filters were hauled about a mile from the river in wagons. The gravel was screened by hand, and the sand and gravel were washed in a flume, the same as gold was formerly washed in placer mining. A permanent incline, built in one corner of each filter, permitted the washed gravel and sand to be hauled into the filters in wagons, but it was found more advantageous and and equally satisfactory to dump the materials over the sides of the embankment and to distribute them by wheel barrows. The inclines are intended for use in removing the dirty sand scraped from the filters and in replacing clean sand, as it was impracticable to install mechanical sand handling apparatus.

The head-works of the supply system, including the filters, are operated by an attendant who has had long experience in the work of this character, and lives in a house provided, adjacent to the filters, by the city. The experienced attendant, at a salary somewhat in advance of the amount for which an inexperienced man could be secured is an unusual proceedure in the management of municipal works of the character and size of these, but the slight additional cost has already proved a profitable investment, as more uniform results from the filters and lower maintenance charges are thus assured.

The filters were placed in operation on Sept. 4, last, but the results of only a single series of tests to determine their bacteriological efficiency is available. Three samples of water taken from the inlet to the filters on Nov. 3 showed, after four days plating, 310, 320 and 335 colonies per cubic centimeter, respectively, while two samples taken from the effluent the same day developed only 38 and 47 colonies, after four days' plating. From this test the efficiency of the

filters was 86.79 per cent. In considering this efficiency it must be borne in mind that the bacterial content of the raw water is unusually low and that the water was practically free of sediment at the time. From Sept. 8 to Oct. 30, inclusive, a bacteriological analysis of the water delivered from the tap in the city was made each alternate day. An abstract of the results of these analyses is shown in the accompanying Table 2, from which the uniformly small number of bacteria is evident. The rather large number of bacteria from Sept. 8 to 16 inclusive, is considered to be due to the sediment and impurities in the pipe line and other parts of the new system.

Hauling Wood-Stave Pipe.

Typical Section of Pipe Trench.

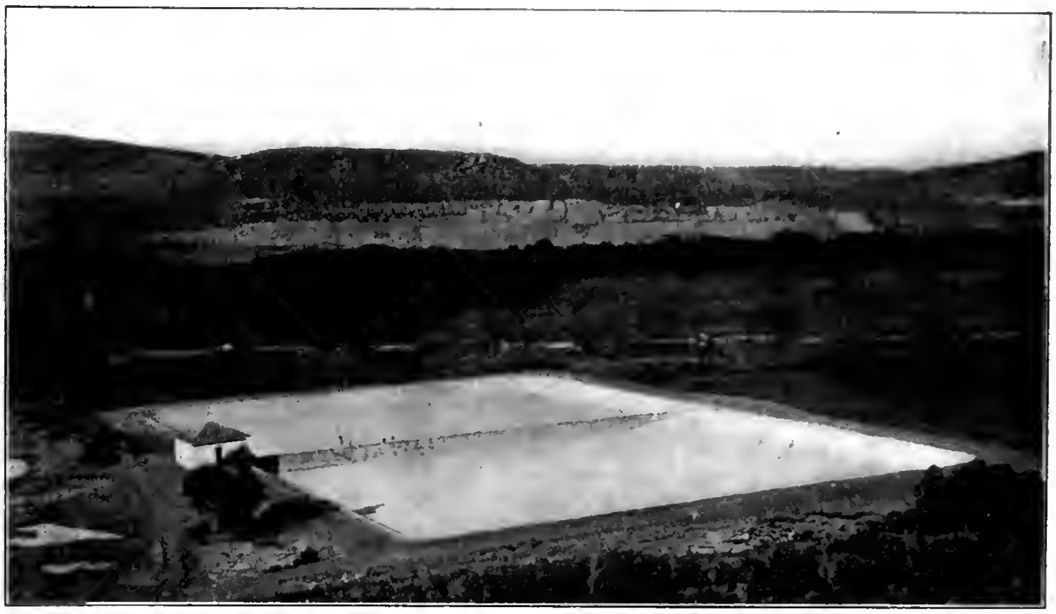
Table 2.—Colonies Per Cubic Centimeter in Tap Water in Greeley.

Date.	48 hrs.	96 hrs.	Date.	48 hrs.	96 hrs.
Sept. 8	750	...	Oct. 7	68	184
Sept. 10	625	...	Oct. 9	77	191
Sept. 12	568	...	Oct. 11	64	185
Sept. 14	500	...	Oct. 13	81	217
Sept. 16	200	...	Oct. 15	68	206
Sept. 18	76	...	Oct. 17	52	173
Sept. 20	118	387	Oct. 20	29	125
Sept. 22	80	449	Oct. 21	43	109
Sept. 24	73	381	Oct. 23	57	203
Sept. 26	61	388	Oct. 25	49	181
Sept. 28	58	...	Oct. 27	46	194
Oct. 3	65	186	Oct. 30	41	189
Oct. 5	52	165			

Pipe Line. The country drops away gradually towards Greeley from the filters, the latter being 340 ft. above the receiving and distribution reservoir, but the topography is rough and broken in many places. Considering this rough nature of the country, the pipe line has an exceptionally straight alignment and very satisfactory grades. In general, the line follows down the valley of the Cache La Poudre River. To within 8 miles of Greeley, it is up along the base of hills which skirt the right side of the valley, and then crosses the river and continues on the left side of the valley to Greeley. From the head-works to this crossing of the river, 8 miles from Greeley, the pipe line takes a nearly direct course and is laid on a remarkably smooth, even grade, with few special features, except the crossings of several streams and irrigation ditches, at which crossings cast-iron pipe was used. In crossing from the right to the left-hand side of the river valley, advantage was taken of a low divide on the left side of the valley which permitted the higher ground on that side to be reached. From this crossing to the receiving reservoir the country is particularly broken and hilly, but even under these adverse conditions a comparatively straight line, with few abrupt grades, was secured.

Automatic air valves are placed at summits in the line as required, and blow-off valves and connections at convenient low points. At a point about three miles from the receiving reservoir where the pipe rises to within 12 ft. of the hydraulic grade line a section of 20-in. pipe was placed on the line as a surge chamber.

Machine-banded wood-stave pipe was used for the entire line, except at stream crossings and the connections to the reservoirs and basins, for which crossings and connections cast-iron pipe was used. The staves were cut from Douglas fir, free from all defects that would impair their strength or water tightness, and were at least 1⅛ in. thick when put into the pipe. The edge of the staves were planed to true radial lines and then cut so as to form a double tongue and grooved joint between each two staves. The pipe is banded with double-galvanized wire, having a tensile strength of not less than 60,000 lb. and not more than 70,000 lb. The wire was spaced on the pipe according to the following formula: Spacing in inches $= 43000d^2 \div DH$, in which $d =$ diameter of the wire, $D =$ diameter of pipe and $H =$ head on the line in feet. The maximum spacing under any conditions was 3 in., and No. 4 Washburn & Moen's gauge wire was the smallest used.



The Two Slow-Sand Filters.

The pipe was made in 6 to 16 ft. lengths, over 50 per cent. of the lengths being at least 10 ft. long. The lengths were sawed square at the ends and turned smooth on the outside for a width of 4 in. from each end, to provide for the couplings used. These couplings are of wood-stave pipe, each 8 in. long, and are made just large enough to fit snugly over the turned ends of the pipe lengths. They are banded, with a factor of safety twice that of the pipe, with individual round wires not less than ½ in. in diameter, and of the same tensile strength as the banding of the pipe.

The lumber for the pipe was shipped to Greeley from the State of Washington in 2x4-in. and 2x6-in. sticks of varying lengths, the pipe being made in a factory built in connection with the work. This factory was erected close to the railroad in Greeley, in order to facilitate delivery of the pipe to the line. The factory building was a temporary frame structure, 40x125 ft. in plan. The equipment in it was all motor driven, thus greatly reducing the danger from fire. The staves were cut to shape from the square timbers by two planers, which also formed the tongues and grooves on the edges. The finished staves were placed in an accumulating machine, in which they were formed into the pipe lengths, and the ends of the lengths cut square and turned on the outside. The continuous bands were then wound on the lengths by another machine. The complete pipe lengths were finally delivered to a tank outside the building, in which they were dipped to receive an asphalt and tar coating, applied to protect the bands.

The location of the pipe line greatly simplified the delivery of the pipe from the factory to the trench, since the maximum haul from a railroad station at any point on the line was not over 2 miles. The pipes were hauled from the various railroad sidings to the work on ordinary four-wheel wagons, a single team being able to draw seven to nine 16-ft. sections at a load. Care was taken after the pipe left the factory to prevent injury to the coating, and after the pipe was in place all bands on which the coating had been injured were painted with asphalt and tar.

The pipe trench was made uniformly 30 in. wide and 4 ft. deep. With the exception of about 2,000 linear feet of rock work, the excavation was made with a Buckeye traction ditching machine. This machine worked to great advantage and greatly increased the speed and reduced the cost of the trenching. For nearly 7 miles from the intake of the pipe line, the trench was almost continuously in a stratum of gravel, containing numerous small boulders, with much of the gravel of a cementing nature. The balance of the trench, however, was mostly in hard clay, with the exception of about a mile of gravel and boulders near the receiving reservoir. The ditching machine dug from 600 to 1,000 ft. of trench in a 10-hr. day in the gravel and boulders, an average day's run in such materials being about 800 ft. In the clay and other soils the machine frequently finished 2,500 ft. of trench in a day, 1,600 ft. being normally dug under such conditions. Since the machine requires only four men to operate it, the cost of the trenching was very low. In fact, the contract price was only 9 cents per linear foot, but at least a fair profit was made at that very low price.

Receiving and Distributing Reservoir.—The 5,000,000-gal. receiving and distributing reservoir on the hill above the city is 224 ft. square in plan at the bottom, and is built in excavation and em-

bankments. The tops of the embankments are 16 ft. above the bottom of the reservoir and are 20 ft. wide on top, with 1½ to 1 slopes on both sides. The inner slopes of the embankments and the bottom of the reservoir are lined with 6 in. of concrete.

In order to exclude sunlight from the filtered water, and thus prevent growths of obnoxious algae in the reservoir, the latter was covered with a flat wooden roof carried by concrete columns. These columns are in regular transverse and longitudinal rows, spaced 14 ft. apart on centers in one direction and 18 ft. in the other. They are 18 in. square at the base, 12½ ft. high and 6 in. square at the top. Each column stands on a square pier, independent of the concrete lining of the bottom, and is reinforced with two vertical ½-in. Johnson corrugated bars. Although these columns have a comparatively small cross section, they were quite readily built by making the forms in two parts, an upper and a lower, and casting the lower 6 ft. of the columns before the top sections of the forms were placed.

The wooden roof has 6x6-in. timber girders, spaced 14 ft. apart on centers on the transverse rows of columns, with 2x8-in. joists, 4 ft. apart, in the opposite direction. The joists are braced together by a row of 2x4-in. bridging between each two girders. The flooring consists of 1x10-in. by 16-ft. roofing boards. The roof contains, alternately, one and two 30-in. by 16-ft. trapdoors in the 14x18-ft. bays.

This roof cost $6,000 complete, including the concrete columns. It is considered to be entirely satisfactory for the purpose, as the snowfall in the vicinity is relatively light, so no heavy live loads will be brought on it. As the maximum level in the reservoir is 1 ft. below the lowest part of the roof, and as no covering is to be placed over the roof, the lumber may also be expected to last a long time in the dry climate.

The additional receiving and distributing reservoir, which it is proposed to build when required, will be at one end of the present one, the two having a common end embankment. An 18x18-ft. concrete gate chamber, surmounted by a brick house, has been built in the incoming end of this embankment and is arranged with inlet and outlet connections for both reservoirs, so the future work will be greatly simplified. The 20-in. pipe line from the head works is laid longitudinally under this embankment, passing through the bottom of the gate chamber. Two tee connections are placed in the pipe line in the chamber, providing for an inlet and an outlet for each reservoir. Each of these inlets and outlets is fitted with a gate valve and the pipe line has a gate valve between the two tee connections, so water may be passed through either reservoir, or both reservoirs by-passed. The inlet to the reservoir delivers into a 2x3-ft. flume, 12 ft. long, which is suspended from the reservoir roof, close to the gate chamber. The outlet is connected to a sump in the bottom of the reservoir just outside the inner toe of the slope of the embankment. An overflow is provided so the maximum depth of water in the reservoir will be 12 ft. At this depth the water surface is 176 ft. above the central part of Greeley and produces 60 to 70 lb. pressure at the fire hydrants in the city.

The pipe line is connected in the gate chamber with a 20-in. waste pipe leading to an adjacent irrigating ditch, so it can be drained. An 8-in. connection to this waste pipe is also provided for each reservoir in the gate chamber. This connection ends in a sump in the bottom of the reservoir, so the reservoir may be drained. A standpipe, consisting of two sections of 20-in. cast-iron pipe, was placed on the pipe line near the gate chamber, in order to provide sufficient head to flush the reservoir when the latter is empty.

A 6-in. connection to the pipe line is made in the gate chamber and is carried into the reservoir, where it connects with three lines of 2-in. pipe extending across the reservoir with hose connections at suitable intervals.

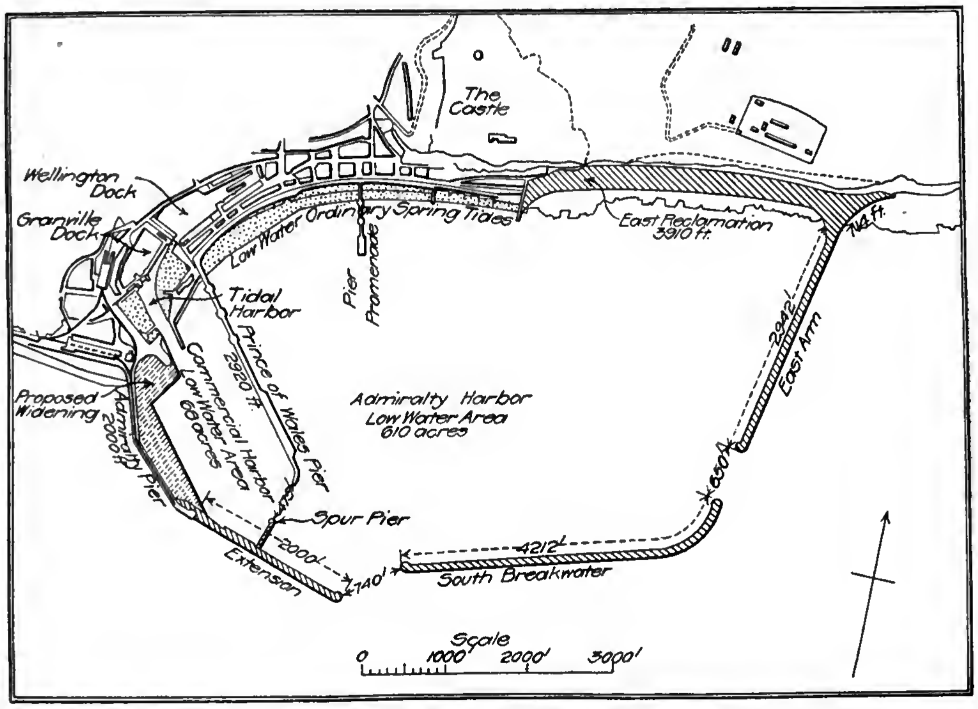
The new water supply system for Greeley, which has been described herewith, was designed by Mr. George G. Anderson, consulting civil and hydraulic engineer, of Colorado, and was built under his supervision by The Jacobson Bade Co., of Portland, Ore. The City Council of Greeley, to whom credit is largely due for the adoption of the various modern features of the system as suggested by the engineer, are as follows: Mr. F. J. Green, mayor, and Messrs. F. M. Barber, A. W. Jacobs, J. B. Phillips, C. H. Ward, D. H. Strohl and W. C. Wilson, of which Messrs. Wilson, Phillips and Ward were the water-works committee. The Pacific Coast Pipe Co., of Ballard, Wash., furnished the lumber and built the wood-stave pipe. The total cost of the entire system, including all construction, water-rights, rights-of-way, legal expenses and so forth, was between $360,000 and $365,000.

The Stadium in which the Olympic games will be held next year at the Franco-British Exhibition, London, is now under construction. It is oblong in plan, with straight sides and semi-circular ends, and measures 594x1,000 ft. over all. The arena besides the large turf-covered space for games, will contain a bicycle track 35 ft. wide, a running track 25 ft. wide, and a swimming tank 50x335 ft. The total capacity is about 75,000 persons. Seats are arranged in 32 tiers along the straight sides, while standing room arranged in 65 tiers is provided in the semi-circular ends. The inclined stringers supporting the tiers are of 15-in., 42-lb. I-beams, 20 ft. apart, and are carried by latticed-channel columns, braced longitudinally and transversely. The risers consist of channels fixed to the stringers by means of forged stools. The tiers are of reinforced concrete, averaging 2 in. thick, the steel consisting of indented bars 1-3 in. square, spaced 12 in. apart. Seats of wooden lath are to be fixed to the concrete. On the flat sides the seats are covered by a roof with a span of 61 ft. 8 in., having an overhang of 17 ft. 10 1-2 in. The roofing is of corrugated sheets. The space under the seats will be used for offices, restaurants, and like purposes. There is an open space 10 ft. wide in front of the seats from which numerous entrances are provided.

The Harbor Works at Dover, England.

By C. O. Burge, M. Inst. C. E.

A few months ago reference was made to these works in an article, more especially in connection with the proposed Channel Ferry, which, as was pointed out, is of special interest, as virtually making Dover a Continental as well as a British port. Atlantic passengers landing there will, when the ferry is established, be able to proceed without further change equally to any part of the Continent as well as Great Britain, and, vice versa, the same considerations applying to freight. In reference to the ferry, a deputation headed by Lord Weardale, the chairman of the ferry company, had an interview on Oct. 24 last with the president of the British Board of Trade, a Cabinet minister, who expressed the warm approval of the government



Harbor Works of Dover.

to the scheme, in preference to the rival one of the tunnel, now set aside. The deputation, besides the chairman, consisted of Sir C. Rivers Wilson, chairman of the Grand Trunk Ry., Canada; Admiral Sir Cyprian Bridge, Colonel Ivor Phillips and the Hon. George Peel. The French authorities were subsequently approached and also gave their approval of the scheme, which we may, therefore, hope to see put in hand at an early date. But apart from this, Dover as a present port of call for an increasing number of Atlantic liners claims our attention, while the British Admiralty have almost completed very large works, in order to make the port a naval base, and their operations are of considerable interest as affording one of the latest examples of harbor construction. Originally there was a commercial harbor only at the extreme west side of the port, consisting of a structure called the Admiralty pier, 2,000 ft. long, sheltering on the west the entrance to the tidal harbor, and the Wellington and Granville docks (see map), there being no shelter from south or east. This accommodated the cross channel traffic for years. So long ago, however, as the time of Sir Walter Raleigh the advantages of Dover as a naval port were recognized by that far-seeing statesman, though it was not till about two and a half centuries after his time, viz., in 1840, that steps were taken by the appointment of a commission to give effect to his ideas. The plans, subsequently improved, have now resulted in the following works:

The Prince of Wales Pier, 2,920 ft. long, dividing the commercial from the future Admi-

ralty harbor. This is roughly parallel to the original Admiralty pier and eastward of it and of the entrance to the tidal harbor; secondly, the extension of the latter pier, approximately easterly, to double its original length, making it 4,000 ft. long, and a northeasterly spur from it nearly midway on the extension, towards the head of the Prince of Wales pier, enclosing as the commercial harbor, 68 acres. The mouth of this is 475 ft. wide, facing nearly east, and is protected by the remainder of the Admiralty pier extension. The naval harbor, which has an area of 610 acres, lies to the eastward and is bounded on the west by the Prince of Wales pier and the extension, beyond the spur, of the addition to the original Admiralty pier; and on the east by a pier springing from the shore about 1½ miles east of the Prince of Wales pier and running south for 2,942 ft. The harbor is protected from the south by a breakwater extending from near the end of the pier just mentioned to within 740 ft. of the head, on the west, of the Admiralty pier extension. The gap between the east pier and the breakwater, 650 ft. wide, forms the eastern entrance. The breakwater is 4,212 ft. long and is so aligned as to finish westerly somewhat nearer to the shore than the pier head of the extension, so that the western 740-ft. entrance is partly sheltered from the west.

The government works also include a reclamation, 250 ft. wide, extending for 3,910 ft. from the foot of the cliffs on which the ancient Dover Castle stands, dominating, in the center, the whole harbor, to the root of the east pier. The depth of water at low water is only from 14 ft. to 19 ft. within 1,000 ft. from the coast line, increasing to from 30 to 40 ft. within a further belt of 1,000 ft., so it will be seen what increased accommodation will be afforded by the works outlined above. The "Dreadnought" and battleships of even greater size can be berthed alongside at almost any part of these piers. It is proposed also to connect the east pier, by rail through a tunnel under the cliff, with the railway, some distance inland, which connects Dover with Chatham and Woolwich, the great military and naval arsenals, so that the ships of war can thus be the more readily supplied with material. In conjunction with Sheerness, in the Thames estuary, Dover harbor will form an effective base for British naval operations in the North Sea.

As to the commercial harbor, the Admiralty have hitherto allowed the use, with some necessary interruptions, owing to construction operations, of the northeast side of the Prince of Wales pier for transatlantic service, but it is understood that, in order to make the division between the naval and commercial portion distinct, the transatlantic steamers will berth in the future within the latter division. Quite recently, we understand, an arrangement has been made between the railway company and the harbor board for the erection of a new station and wharf extension at the eastern side of the original Admiralty pier for the better accommodation of the ordinary cross-channel traffic, and though the site for the special landing device for the channel ferry is not yet definitely fixed, it must necessarily be close by.

A bill is to be promoted in the forthcoming session of the British Parliament to obtain powers to build two graving docks at Dover. The larger of the two will be about 950 ft. in length and 110 ft. wide, with a depth of 33 ft. It will be therefore capable of taking the largest ship in the British navy.

For ocean traffic to or from London and the ports of Northern Europe, Dover possesses, as a port of call, one great advantage in these days of record voyages. Such traffic must, in any case, pass close to the heads of the new harbor, so that there is no detour, while a call at Southampton entails a considerable one up Spithead and Southampton water at slow speed, while Plymouth Sound also requires a deviation from the direct route. A smaller advantage might be mentioned, that is, that Dover is only about one hour and a half by rail from London, and the terminus there is the most central in that city.

The harbor works, which have been mostly carried out by Messrs. S. Pearson & Son, are chiefly constructed of concrete blocks and granite. The Prince of Wales pier, however, for 1,200 ft. from the shore line, is of iron screw piles, the remainder of its full length of 2,920 ft. being of concrete. We are indebted to "Engineering" for the information on which the following outline of the concrete work is based: The bottom is of chalk and chalk marl, and marl and flint, very tenacious for anchorage purposes, and was considered, after levelling by divers, as a good foundation for the concrete blocks, which are 6 to 1, and range up to 40 tons in weight, the maximum size being 14 ft. by 11 ft. 6 in. by 6 ft. 6 in. high. The bond is formed by the variation in the size of the blocks. Above low water level the work is grouted with 2 to 1 cement mortar and is faced with granite, the face blocks being joggled with 4 to 1 concrete pins fitting into circular cavities in adjoining ones. The faces above low water have a slight batter, below they are stepped, the east pier being 40 ft. above and a maximum of 47 ft. below that level, the widths at top and bottom being 47.6 ft. and 54 ft. Along the seaward sides, there are aprons of 40-ton concrete blocks formed with a curve to dissipate the waves. The retaining wall for the reclamation is also of concrete blocks, and granite facing and coping, with filling in of chalk. The progress in the science of engineering construction is shown by the fact that 80 to 90 ft. per annum was the rate of progress in the original Admiralty pier finished in 1871, while the rate in the new harbor has ranged from 450 ft. to 1,500 ft. per annum.

Messrs. Coode, Son & Matthews, the head of which firm, Sir William Matthews, is at present President of the Institution of Civil Engineers, are the engineers, Mr. A. G. Vaughan-Lee, M. Inst. C. E., being in local charge. Major Sir H. Pilkington, R. E., K. C. B., represented the admiralty from 1895 to 1906.

Belt Conveyors are used extensively in the mine headworks of the New Kleinfontein Co., Transvaal. Of the seventeen belts used, the waste system contains five working in succession, the last two on top of a dump 130 ft. high. They handle an average of 1,358 tons of waste rock, sand and ashes per day and are 30 in. wide. The longest is 454 ft. between pulley centers. The second belt runs horizontally in a deep cut for 110 ft., then rises to the surface and continues at an inclination of 19½ deg. to the top of a light steel tower 60½ ft. high. Between this tower and a similar but higher one, 195 ft. distant, the third belt is carried by two inverted bow-string trusses. When the spoil had reached the top of the higher tower a fourth belt was installed and carried on a boom swung from a 60-ft. steel mast. The boom was originally 20 ft. long, but was extended in sections as the dump required, until it reached 140 ft. A fifth belt was then installed. It is carried on a 164-ft. double cantilever of two trusses, supported at the center on a turn-table carriage, which runs on a track 20 ft. from the edge of the dump. By this combination of a swinging boom and a traveling cantilever the discharge end moves in the arc of a circle through an angle of 170 deg., with the mast as the center. The belts are electrically driven, the speeds varying from 275 to 340 ft. per minute.

A Discussion of Smoke Prevention.

The Chamber of Commerce of Syracuse, N. Y., appointed a commitee some time ago to conduct an impartial investigation of the ways and means of abating smoke. This committee consisted of Dr. John A. Mathews, chairman, and Messrs. John H. Barr, W. H. Blauvelt, Carleton A. Chase, William Kent, J. D. Pennock and John E. Sweet. This committee has recently made a valuable report on the subject. It has reached the conclusion that in a place like Syracuse the abatement of smoke is desirable on aesthetic and economical grounds rather than one of public health. A study of what has been done elsewhere has also led the committee to the opinion that the passage of an ordinance, no matter how drastic, will not remedy the smoke evil. The enforcement of the ordinance must be rendered unnecessary by the hearty co-operation of steam users. When it can be demonstrated that economics may be effected by improved methods of firing, the enforcement of the ordinance becomes a voluntary act of enlightened self-interest on the part of the manufacturers.

Hand Firing.—The first remedy suggested by the committee for smoky chimneys is proper hand-firing, which seems to be given more attention in Great Britain and Europe than here. The committee points out that an inteligent fireman is worthy of good pay, for many ignorant and careless men doubtless waste more than their wages daily. This is especially true in small plants, and small plants preponderate in every city, and in these plants the possibility of great economics through the installation of mechanical stokers is small. Yet firemen can hardly be expected to know intuitively the chemistry of combustion, and certain it is that they have never been instructed in the fundamental principles of their occupation. Muscle and endurance have been considered the chief elements in the make-up of a fireman, and the arduous duties, too often performed in the dark, hot and ill-ventilated basements, have not attracted many men of intelligence.

The committee suggests that we might follow the example of the Prussian Government, which makes an annual appropriation for the purpose of giving instruction to firemen. Both academic instruction and practical demonstration is included in the course. In connection with Prussian government buildings and works, where stationary boilers are in use, it is required that: "As far as is in any way feasible, care should be taken that only such persons as have satisfactorily managed furnaces for a considerable time, shall be employed as independent firemen. If these persons have not gone through a satisfactory course at a fireman's school, opportunity should be given them as far as possible to attend one." Only when all methods of careful management and supervision of firemen and selection of fuel have failed to abate smoke, do the authorities recommend trying special appliances of a mechanical sort.

In St. Louis the Smoke Abatement Department causes to be posted in every boiler-room a list of "Directions for Firing." These are intended, primarily, for the users of low pressure steam heating plants. In such plants, especially, and in all other hand-firing boilers, efficiency is improved and smoke may be greatly lessened by close adherence to the following rules:

1—Fire frequently in small quantities and at regular intervals.

2—Break up lumps to fist size.

3—Carry a level surface over entire grate.

4—Avoid thin and bare spots on grate.

5—Keep the fires clean.

6—Fire one door at a time, and wait until that

fire is in good shape before charging the other door.

7—Leave furnace door slightly ajar for one minute after each firing.

These rules are good, if firemen will follow them, but the committee holds that a more certain solution of the problem in apartment houses and small buildings, where the demand for steam is too light to require the hot fire which is essential to perfect combustion and smokelessness, is the use of anthracite or smokeless coal or coke, or better still, to make use of central heating plants of sufficient capacity to ensure proper attention to economical methods of combustion and coal handling.

Prof. Goss, referring to the method of treating the small plant smoke nuisance, writes as follows: "The wisest and most effective course to follow with reference to such fires is to provide a satisfactory substitute and then abolish them. So far as such plants are now employed in the production of power, they can be rendered unnecessary through the cheaper and more effective distribution of electrical power. So far as steam from such boilers may at present be used for heating, they can be rendered of no effect through the supply of heat from a central station."

It seems to the committee that a combination of good hand firing and mechanical stoking will give real success, i. e., train men to operate scientifically the score or more of excellent mechanical devices now on the market. The committee believes the methods adopted by the Hamburg Smoke Abatement Society are so sound in principle, as to warrant publishing a description of their aims and work, by Mr. J. B. C. Kershaw, of London.

"The Hamburg Verein für Feuerungs-Betrieb und Rauchbekämpfung is, however, an entirely voluntary organization of steam-users, and its members are only bound by the common desire to obtain greater efficiency and less smoke from their steam-raising plants. The society has now (in 1906) been in existence three and a quarter years, and the following account of its organization, aims and work, is drawn from an explanatory pamphlet and from the two annual reports which have been issued since its inauguration in October, 1902.

"The work of the society is controlled by a committee of six to nine members, elected annually. The technical and scientific work is undertaken by the staff of experts retained by the society for this special work. At the date of the last report this staff consisted of a chief engineer, two assistant engineers, two instructors for firemen, and one clerk, while for special steam-raising and other trials, three additional assistants had also been employed. The chief engineer attends the committee meetings and takes part in the discussions relating to the work of the society. The funds of the society are drawn from three sources: From the annual subscription of its members; from payment for special work and reports for its members; from payments for outside work.

"The society is thus entirely self-supporting, and its success is dependent upon the value of the return it makes to its members for their contributions and fees. It is, therefore, gratifying to note that the membership shows steady growth. Starting with a few members in October, 1902, the register contained 60 firms and 249 boilers at the end of September, 1905, and fifteen months later these had increased to 115 firms and 351 boilers. The report for the year 1905 is not yet published, but I am informed by the chief engineer that the membership is now 150, with 420 boilers under their control.

"The objects of the society, as set forth in the rules, are the attainment of the highest possible efficiency from the heating and boiler plants of its members, with the least possible emission of smoke. To this end regular examination of these plants and of the methods of working them is undertaken by the expert staff of the society, and suggestions are made for improvements when such are required. The education and control of the firemen in the proper performance of their duties are also undertaken by the fireman-instructors on the staff of the society. Comparative tests of fuel, and tests of smoke-prevention and other appliances of a similar character, are also carried out by the expert staff, and the results are circulated amongst members of the society.

"Members of the society can demand that their boiler or heating-plant shall be regularly inspected, and that its working shall be tested and reported on at least three times a year. They have also the right to consult the chief engineer of the society regarding improvements and alterations in the design and working of their plant.

"They on their side are bound to allow the chief engineers and other members of his staff free access to their heating and boiler-plants at all times, and are bound to make the necessary provisions for conducting the tests. They are also required to carry out the suggestions made for improving the efficiency of the plant, especially as regards the abatement of smoke, and to submit to the chief engineer all plans for extension of the plant, or for change in the methods of work.

"Each boiler or heating-plant, when brought under the control of the expert staff of the society, is tested at the earliest possible date, and a written report upon the results of the examination is submitted to the owner. Should the firing have proved inefficient, one of the firemen instructors is sent to the works to give practical instruction to the firemen employed there, and tests of the plant are made at intervals until this fault is remedied. Defects in design are similarly dealt with.

"The annual subscription to the society for members without any boiler or heating-plant is 20 marks ($5.00). Members having boilers or furnaces which they desire to place under the control of the experts of the society, pay a further 20 marks annually for each boiler or furnace.

"The extra charges for tests and reports are based upon the time spent upon them and the number of experts employed. Engineers are charged for at the rate of 20 marks per day, and firemen-instructors at 5 marks per day. Special reports upon patented appliances are charged for at the customary rates; members receive a special discount of 30 per cent. on these, as compared with outsiders."

Steam Jets.—There are many forms of application of the steam jet to boilers. Sometimes the steam is applied below and sometimes above the grate. Below the grate the effect is perhaps slightly to increase the draft, but mainly to soften the clinkers. Above the grate the steam jet is essentially for the purpose of inducing a draft of air over the fire and to mix the air with the gases from the coal. The steam itself is not a source of any heat.

Many devices for smoke prevention which are based on the use of the steam jet are of little value, the committee says, and seem to be made only to sell. Others are carefully worked out in their details and are really of use, especially when properly applied to meet the special conditions, and when combined with a device for automatically adjusting the supply of air to the volume of gases produced. Based on the fact that the volume of gases is great immediately after fresh coal is charged and slowly falls off until the next firing, these devices open a damper above the fire immediately after the closing of the fire-door, and by a dash-pot arrangement this damper is slowly closed, thereby regulating the supply of air between the maximum and minimum amount needed.

A number of such devices are in successful use, and when properly applied and operated will prevent smoke. The cost of their installation is low compared with stokers, but they effect economy in coal consumption only to the extent to which they more perfectly burn the gases by the admission of neither too little nor too much air to meet the varying requirements of the fire.

Down-draft Furnace.—The principle ultilized in the operation of this furnace, according to the committee, is not unlike that of the under-feed stokers, inasmuch as the volatile hydrocarbons pass through the green fuel before reaching the combustion zone. The result is that the volatile gases are intimately mixed with the supply of air as they are distilled off and the conditions are favorable for complete combustion when these gases attain the ignition temperature.

The down-draft furnace, according to the committee, is effective in reduction of smoke when properly handled, and it is not difficult to secure very satisfactory results so far as smoke prevention is concerned. It has the advantage over mechanical stokers in small plants, since the relative economy of the down-draft furnace is substantially as high with a single boiler as with a large plant. The very complete combustion is favorable to good economy of fuel and the possibility of high temperature of the products of combustion may result in a very considerable increase in the effective capacity of the boiler. The down-draft furnace is usually hand-fired, though large plants are frequently fed by a so-called automatic gravity system.

This furnace is considered well adapted to single boilers or to plants too small to warrant the installation of automatic stokers. It may be expected to effectively reduce the smoke emitted from the stack under reasonably favorable conditions, and to do it economically. The down-draft furnace requires a good draft for the best results and is not so well adapted as certain forms of automatic stokers to plants which must be forced at times greatly in excess of normal capacity.

Mechanical Stokers.—The large number of mechanical stokers which have been developed may perhaps be conveniently divided into four types. First, the forwardly inclined grate, of which the Roney stoker is an example. Second, the V-shaped grate, of which the Murphy stoker is a representative. Third, the under-feed stoker. Fourth, the chain grate. There are a number of successful applications of the principles represented by all of these types, and there are records of very successful performances of installations of many variations of each type. While each has special features of excellence, yet some installations and conditions are better suited to one type and some to another, according to the committee, and it is of the greatest importance that in the selection of a stoker the owner should make sure that he has the type best suited to his conditions, and that the details of the particular apparatus are developed on sound mechanical lines and based on mature experience.

While it can hardly be called a mechanical stoker, the application of pulverized fuel, which has been made familiar by its extended use in cement burning, for example, has had some success in firing boilers. It can hardly be said, however, that this method has passed the experimental stage. It is claimed that combustion can always be maintained with entire absence of smoke and with great economy, in that only about the theoretical amount of air is required, and the coal is very thoroughly burned, the remaining ash being a fine, clean powder. The very high temperatures are attended with some practical difficulties, which perhaps may be overcome with more experience.

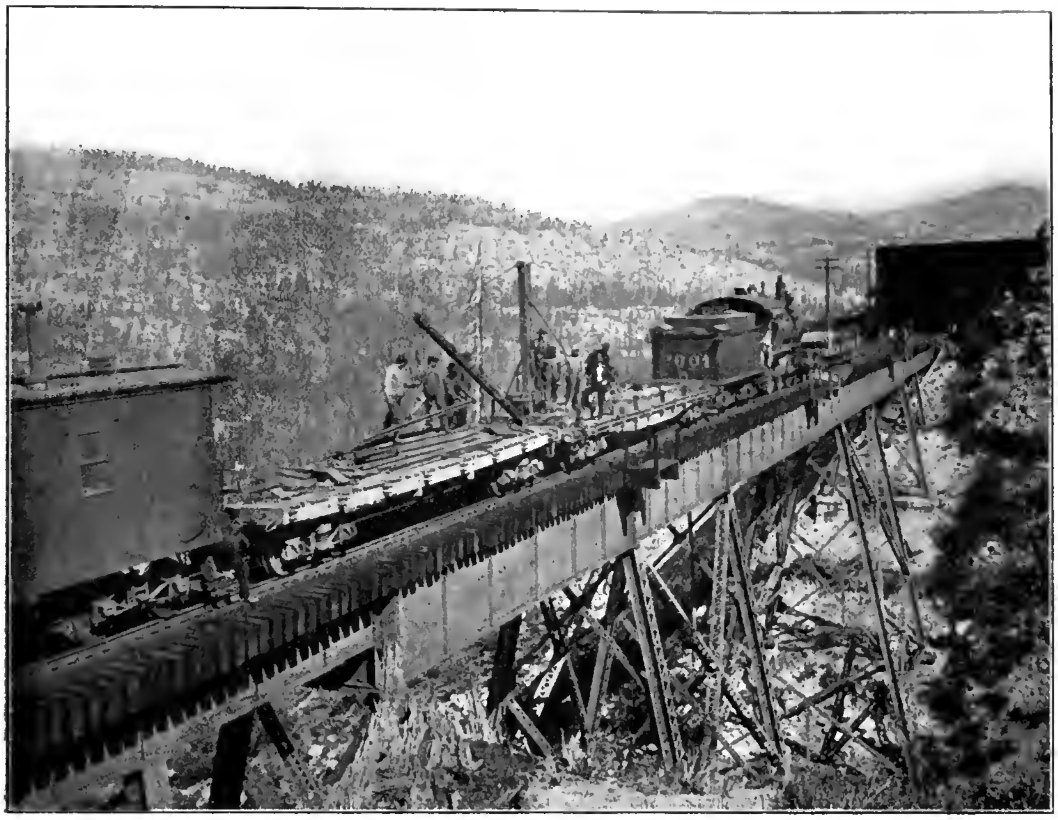
From the point of view of smoke prevention the automatic stoker is merely a means for feeding the coal uniformly into the fire, and therefore uniform production of hydrocarbon gases. Uniform conditions make it much easier to maintain perfect combustion of the hydrocarbons, and hence to prevent smoke, but very many installations of automatic stokers smoke very badly, often quite as badly as furnaces with poor hand-firing

In order to prevent smoke, it is quite as necessary to maintain the proper conditions for good combustion with stokers as without them. To insure these conditions, it is customary to build a fire-brick arch over the stoker, either in the shape of a Dutch oven in front of the boiler setting, which is usually the better plan where room permits, or the arch is thrown across the fire-box between the fire and the boiler. It is usually quite difficult to maintain an arch in this position, owing to the high temperature to which the brick work is subjected on both sides, and many devices have been put forward to maintain these arches. One type, which appears so far to be quite successful, consists of special shaped bricks, which are perforated, so that air from the outside is permitted to travel the whole length of the arch within the chambers or flues formed by these perforations, and is delivered, considerably heated, at the rear end of the arch, where it supplies the air for the final combustion of the gases. The heat absorbed by this air keeps the bricks sufficiently cool to prevent their destruction. The Dutch oven construction has the advantage that this arch is free to radiate its heat through the top, and it is, therefore, relatively easy to maintain.

Smokestack Cinders from locomotives are being used for making producer gas at two places in Germany by the railway administration. The plant at Koenigsberg has three generators and three double-acting gas engines, each of 180 h. p. capacity. The engines are direct connected to electric generators. The other plant has two gas generators and two single-acting gas engines, each of 90 h. p. Both plants are said to be giving satisfaction, the consumption of cinders being reported from 1.3 to 2.4 lbs. per horse power, varying with the load.

Southern Pacific Improvements.

Pending the final reports of the engineers who are at work upon plans for the electrification of its lines across the Sierras, the Southern Pacific Co. is carrying out improvements which will immediately have the effect of greatly bettering traffic conditions between Sacramento and Truckee. By these improvements the company has theoretically increased by 50 per cent. the efficiency of its freight service across the mountains by additional sidings, while the great freight terminal at Roseville, on which work is now well under way, will further facilitate the handling of transcontinental traffic.



Construction Train on the Cascades Bridge in California.

The Turntable at Roseville, Cal.

The immediate effect of these track extensions is shown in the fact that beginning last month the possible capacity of trains across the mountains has been increased from 30 to 45 cars, and the likelihood of another congestion of transcontinental freight, such as this year witnessed, would seem to be avoided.

The Southern Pacific line to Ogden is a single track, and traffic is carried on in both directions at once by the use of sidings or passing tracks. Between Roseville and Truckee there are 24 of these passing tracks, and the average length of each has been 1,950 feet. Half of the 24 are in the 46 miles of snow-sheds, which inclose the road between Blue Canyon and Truckee. The large consolidation locomotives have pulled freight trains whose greatest possible capacity, limited by the length of the sidings, was about 30 box and flat cars. To each of these sidings is being added some 700 ft. of new track, and with the 24 sidings, each 2,600 ft. long, it will be possible to dispatch freight trains hauled by three engines, of 45 cars each. With 45 cars moving in the same time that has been required to move two-thirds that number, it is patent how the saving in train movements will facilitate the handling of traffic.

What a great undertaking was the lengthening of these sidings is apparent when it is remembered that all of them are on a mountain division, where for the most part the roadbed is a shelf blasted out of the solid rock, and that half of the sidings lie in the snow sheds where every foot of extension means the reconstruction and widening of a corresponding length of shed.

The work, which is under the general supervision of District Engineer R. M. Drake, is being carried out by Assistant Resident Engineer E. C. Morrison. It began about the middle of July. The graders and track layers comprised 400 Greeks, 160 Hindus, and 50 Italians in addition to 50 or 60 native workmen. Three and a half miles of steel track was laid, and it was necessary to build 6,000 ft. of double snowshed at a cost of $16 a foot. Seven gangs of 20 carpenters each were employed on this new work and in making repairs in the sheds. Seven million feet of lumber, which came from mills along the line, was used.

Between Smart and Tunnel 13 the excavation

was in loose rock, which was removed without great difficulty, except at Crystal Lake, where the work was in granite, which yielded only to Burleigh drills and a great deal of Giant powder. At Summit, which is, as its name denotes, at the top of the mountains, an entirely new track 3,100 ft. in length has been put in to handle the traffic which always congests at such a point. Here, too, the 65-ft. steel turntable was taken out and replaced by an 80-ft. table, to accommodate the largest engines.

In addition to the sidings, a double track is being laid between Truckee and Winsted, a distance of 2.7 miles. A year ago work was begun on a double track between Elvas and Loomis, 21 miles apart. This is complete, except for the 6 miles between Roseville and Loomis.

The heaviest grade in the Sierras is 2.2 per cent. at a point between Summit and Truckee on the eastern slope. Between Blue Canyon and a point 6 miles west of Truckee there are 13 tunnels. Tunnel No. 6, at Summit, is 1,800 ft. in length.

There are five regular eastbound passenger trains each day and the same number of westbound passengers and often these run in two or three sections. Besides many extra passenger trains there are ten freight trains each way daily. On a road as busy as this the importance of the lengthening of the frequent sidings, or passing tracks, which all but equal a double track line, can hardly be over-estimated.

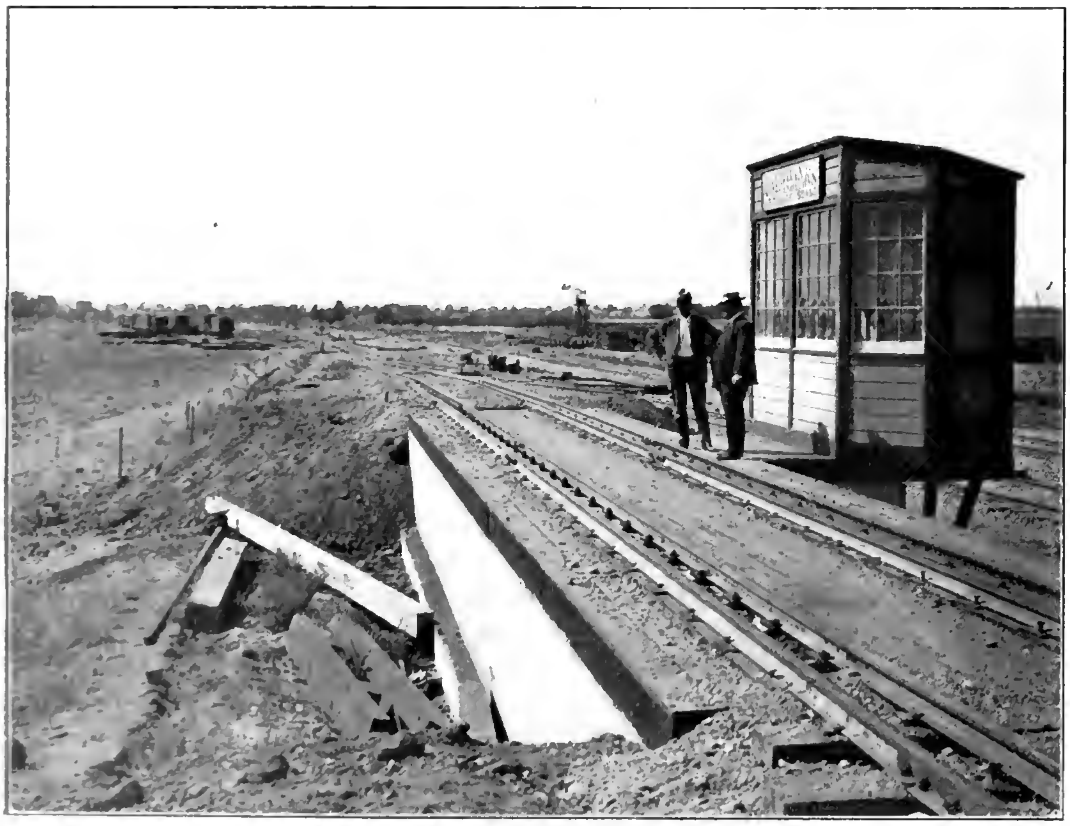
The great terminal being constructed at Roseville will affect the traffic of practically all the Pacific Coast. It will have a bearing upon the transcontinental traffic that goes across the Sierras to Ogden and the traffic that parallels the Pacific Ocean from Los Angeles to Portland. Roseville is the natural distributing point for freight in transit, for two reasons. The grades between that place and Sacramento are slight and the track straight, while from Roseville eastward the grades are heavy with many curves; consequently long trains can be brought to Roseville economically and broken up into smaller trains. In the second place, Roseville is the junction between the Ogden and the Shasta routes, and freight trains containing cars destined in both directions can be brought there to be broken up.

In the Roseville yard, which is 4 miles in length, the last of 50 miles of trackage is being laid. The receiving, departure and classification tracks, where the greatest volume of work will be done, comprise 27 miles. There are 3 miles of repair tracks and the remainder are storage and warehouse tracks and industry spurs.

The first of two roundhouses, which are to be identical, is completed. This roundhouse contains 32 stalls, divided into four compartments separated by brick firewalls and automatic fire doors.

The machine shop, where repairs will be made, is ready for its equipment. Engineers' quarters adjoin the roundhouses. Buildings yet to be completed are the car repair shop, two sandhouses, freight house, icing plant to accommodate 20 cars at a time, a commodious two-story clubhouse, two office buildings, an emergency hospital where a staff of nurses will be maintained, and a lumber shed. Large rest corrals for cattle in transit will be provided. The machine shops and the two large turntables will be operated by electricity.

Water Tank on Southern Pacific Line at Roseville, Cal.



The Hump in the Yards at Roseville, Cal.

There are two main receiving and departure yards, an eastbound and a westbound, each 3,000 ft. in length. Into these trains will run as they arrive. The road engine will then uncouple and go to the roundhouse and a switch engine will push the train up the gravity hump. On the hump each car as it rolls along is weighed automatically and the weight recorded. One by one the cars are uncoupled and run down by gravity into the classification yards, the switchmen being provided with switching lists. When a classification track is filled with cars bound for a certain destination a switch engine pushes the train around the hump, instead of over it, to a departure track, a road engine is brought out and the train dispatched. When these yards are in operation a great deal of eastbound freight will be brought by way of Stockton and will not go into Sacramento at all.

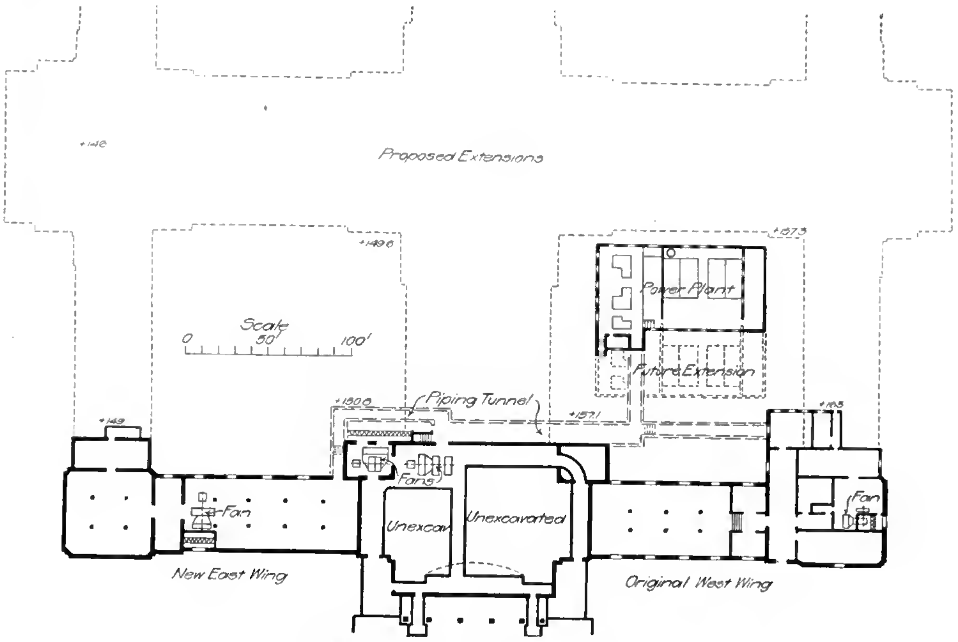
At the west end of the yards a subway will be built under the tracks so that vehicles and pedestrians may cross without danger from the many trains. A 350,000-gal. steel water tank, fed from a reservoir in the foothills above Rocklin, will supply the yards with water through 3 miles of 8-in. pipe. Oil will be supplied from a 55,000-bbl. tank and a 65,000-gal. auxiliary tank and will be conducted through steam-heated pipes. In addition to the water column near the handsome new depot, there will be six water columns and as many oil columns conveniently located about the yards. Locomotives will be able to take oil and water at the same time.

The work at Roseville, which is under the direction of Assistant Engineer Norman Collyer, was begun in June, 1906, and will be completed next summer.

Mechanical Plant of the Brooklyn Institute Building.—I.

The Brooklyn Institute of Arts and Sciences has recently completed large extensions of its buildings at Eastern Parkway and Washington Avenue, near Prospect Park, Brooklyn, in the course of enlarging its museums and broadening its educational scheme. The entire northerly facade, over 500 ft. in length, has been completed of a structure that was laid out a number of years ago on a magnificent plan, to be erected in sections as the development of the work requires, and to embrace eventually a building over 570 ft. square with four open interior courts. A third section of the structure has recently been completed, the addition of which to the two earlier sections of the building has necessitated an entire revision of the power and mechanical equipments in order to accommodate the extended and enlarged services of the building and has resulted in the installation of a new power plant in a separate building which will amply accommodate the division now completed and is capable of expansion to provide for a considerable portion of the extensions of the main building projected. The mechanical services have from the beginning been operated by an isolated plant of the institute and includes heating, mechanical ventilation and electric supply for lighting and power purposes, and at present require a power plant of 700 boiler horse power capacity. An interesting feature of the present power lay-out is that while the new power plant was laid out on a carefully studied plan with permanent construction and provision for considerable future extension, it is of a temporary nature as it cannot be extended sufficiently on the present plan to provide adequately for all the extensions to the main building that are contemplated. As it will, however, be a number of years before the main structure shall have been extended to a point beyond the capacity of the present power plant, it has been arranged to proceed with the power scheme as at present laid out, which will provide for the extensions to the main building until fully one-half completed, whereupon the power requirements of the ultimate extension shall become defined and a suitable location for the necessary enlargement of plant be provided.

The institute building as now completed with the new detached power house is shown in ground plan, together with an outline of the extensions proposed, in an accompanying drawing. The building is, as above stated, laid out on the plan of a large hollow square about 575 ft. square, with interconnecting interior wings that will form four open interior courts, about 150 ft. square. In one of these courts the power plant was located, that at the rear of the present westerly wing being selected as most convenient for piping and power connections to the older sections of the building. In this court, space is available for extension of the plant to double its present capacity without interfering with the main building or any of the extensions contemplated. The portion of the structure at present completed was erected in three sections, of which the wing to the west of the central portion, 48 ft. wide x 175 ft. long, was the first to be constructed, about 9 years ago, the central or entrance division, 114 x 124 ft. in size next, being completed in 1902, while the easterly wing, similar in size to the original west wing, is the portion just recently completed. The two side wings are three stories and basement in height with the exception of the new easterly wing which, owing to a depression of the grade at that point, has a sub-basement and cellar in addition, while the central portion has a large auditorium with gallery in the basement above which are two floors devoted to corridor purposes, and on the third floor level a magnificent sculpture hall connecting with the art galleries and rising to a dome surmounting this portion of the building. The west wing of the building is, with the exception of the third floor, devoted to museum purposes, with lecture rooms in the basement, while the new easterly wing provides laboratories, work and study rooms and upon the third floor an extension of the art gallery of the west wing. The building is of massive wall bearing construction with an exterior of stone and is of as nearly fire-proof construction as possible.



Plan of the Present Building of the Brooklyn Institute.

The main building has large quantities of side window and skylight glass exposure and is situated on an eminence in one of the highest sections of Brooklyn, so that its exposure is particularly severe, rendering the provisions for heating of special importance. The heating is accomplished throughout the entire building by direct radiation, the ventilation provided being independent of heating in all cases. The system is operated throughout at low pressure, using exhaust steam from the power plant and from the steam-using machinery in the various sections of the building and all radiation, both direct and the tempering coils of the ventilating systems, are fitted with pump condensation returns and vapor lines operated on the Paul system. All radiation is also fitted for automatic temperature control, utilizing the Johnson system with thermostats in the rooms heated governing motor valves on the radiation supply connections. The heating surfaces were proportioned with considerable care in all parts of the building, owing to the large interiors to be heated and the excessive exposure, and the radiator locations chosen are also the result of careful study. The total amount of direct radiation installed in the building is approximately 17,500 sq ft., which is exclusive of over 7,650 sq. ft. in the tempering coils of the ventilating system; of the direct radiation 5,200 sq ft. is in the original west wing, about 5,300 in the central wing and 7,000 sq. ft. in the new east wing which, although of the same size in plan as the original west wing, has a considerably greater exposure due to the addition of a sub-basement floor above ground level, permitted by the depression in the grade at that portion of the grounds.

A feature of the heating installation is the concealment of practically all radiators in exhibition rooms and in all public portions of the building; in all the basement and sub-basement work rooms and laboratories and in auxiliary rooms the radiators installed are exposed. Also all piping is concealed, the rising lines from the basement or cellar being run in chases in the wall construction with connections to the radiators behind partitions or under the floor construction. The radiators are all installed in the usual locations under window-sills to counteract window glass exposure and for the concealed units, recesses or pockets have in all cases been provided under the sills for grilled enclosures to contain them. In the auditorium, the few radiators which are installed under the four rear windows, are located in special pockets having intake openings near the floor line and delivery registers in the sills. The radiator units are installed in varying heights in accordance to the height of window sill and where low sills are encountered they are in some instances installed of the 3-column type, necessitating a recess 15 in. deep. The recesses are all lined with galvanized iron and asbestos board and are faced with removable brass band screens. A convenient feature of the enclosing screens is the provision of small door openings, about 12 in. square, at the lower side on either end for access to the motor valves on the radiators of the temperature regulation system, which obviates the necessity of removing the screens in their entirety whenever access to the valves is necessary.

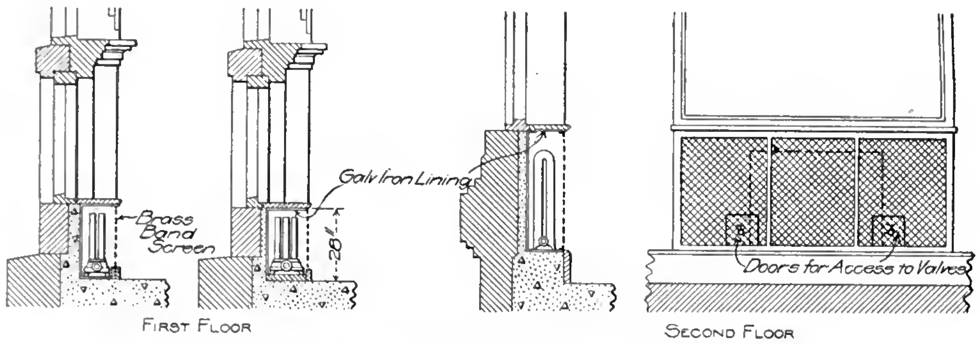
Large amounts of surface are provided in skylight coils to counteract the exposure of the large skylight areas, practically the entire third floor of the east and west wings being devoid of side window lighting, on account of a peculiar cornice construction of the exterior of the building, and thus fitted with skylighting for use as picture galleries and sculpture exhibition halls. These coils are of 1¼-in. iron pipe, surrounding the skylight and varying in surface for the different sizes of the skylights up to 720 sq. ft. of heating surface. In the roof of the central portion there are a number of small skylights surrounding the central dome, which are fitted with coils from 50 to 60 sq. ft. each. The coils are in all cases installed under the upper outside lights, being screened from the galleries by the lower ground glass lights, and under them are suspended drip pans of heavy galvanized iron construction with connections to sewer to dispose of any leakage of condensation that might occur.

Steam is supplied to the direct radiation in the building by a total of 46 riser lines, of which there are 14 in both the west wing and the central portion and 18 in the new east wing. These risers vary in size from 2-in. to 3-in. pipe, the 2-in. size predominating and of these eight are extended to the roof to supply skylight coils in both the easterly and westerly wings and 11 to the dome of the central portion for the same

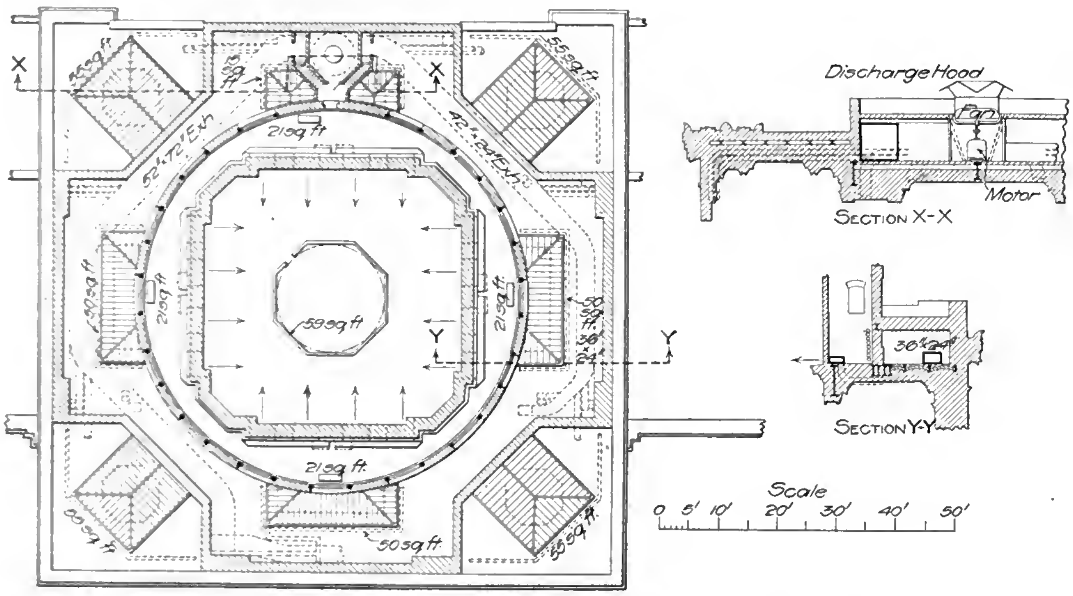
purpose. The risers connect in the basement or sub-basement into distributing mains, which, owing to the construction of the three different sections of the building at different times, are arranged in three different divisions. Those supplying the central portion and east wing originate in a low-pressure exhaust steam main from the power plant of the building, while that of the older west wing is an independent system supplied with exhaust steam from an engine driving the ventilating blower and from the steam pumps with make-up from the high pressure steam system when the exhaust is insufficient for proper heating. This latter main in the basement of the old west wing is an 8-in. line into which connects a 5-in. exhaust main from the original steam-using equipment in this portion and a 6-in. live steam make-up connection through a reducing valve, and which is carried around on the basement ceiling making connections with the riser lines and the tempering coil of the fresh air supply fan for that division of the building. The central portion of the building is supplied by a 10-in. and the east wing by an 8-in. low-pressure heating main, which in either case encircles its basement, reducing in size as connections are made to the risers. In addition to the riser lines, steam is supplied to the tempering coils of a ventilating blower in the east wing and to those of two blowers in the central portion. The 8-in. and 10-in. basement mains connect with a 12-in. low-pressure heating main that originates in the exhaust steam system of the power plant some distance away, the supply main being run from the power plant to the basement of the building through a piping and wiring tunnel underground at the rear. This heating main has in the power plant a live steam supplementary connection consisting of a 6x12-in. Kieley pressure reducing valve for adding live steam to the system when the exhaust supply is insufficient. The system in the west wing having no low-pressure connection from the main power plant, is supplied with high pressure for this equipment through a 7-in. main which is extended to the basement of this portion through another division of the piping tunnel connecting the power plant with the main building.

Condensation is returned from all radiation by direct pump returns, return pumps being installed in each of the three sections of the building heated, which deliver direct to a return tank in the power plant, air and vapor being removed from the radiation separately through connections to a Paul system. Return risers parallel all of the steam supply risers to the upper floors which are of unusually large sizes ranging from 1½ to 2½-in. pipe, and connect into condensation gathering mains in the basement or sub-basement that lead in each section of the building to a pair of return pumps. These pumps are 6x4x6-in. Deane duplex steam pumps operated under control of Kieley pump governors, receiving steam from high pressure lines carried over from the main power plant and exhausting through grease extractors into the local divisions of the low-pressure heating main. There are two of these pumps in both east and west wings so that the fan system tempering coils and the direct radiation may be operated separately if desired, while in the central portion of the building there are three such pumps, there being two fan systems with tempering coils here in addition to the direct radiation, and the connections to each group are so interconnected and by-passed, that either unit is interchangeable upon any of the services. The pumps of the central portion deliver through a 3½-in. connection and those of the east wing through a 2½-in. line into a common 4-in. condensation main that leads through the tunnel to a return tank in the power house, while the returns for the west wing are delivered through an independent 3-in. line which leads also to the return tank. The Paul system of returns consists of air lines paralleling the steam supply and return risers, which connect with air valves on all direct and indirect radiation and lead to exhausters which are in this plant located in the piping tunnel near the power plant. These air return mains are 1½-in. lines from the central portion and east wing and 1¼-in. from the west wing, and extend through the piping tunnels to a point opposite the power house where connection is made to an equipment of two Paul exhausters in duplicate, either one of which is of capacity sufficient to operate the entire building.

Power Plant:—The new temporary power house was, as above stated, located in what will be one of the open interior courts of the building, as extended, so that further building construction may be carried on in the process of extension entirely without interference to the power services. The court at the rear of the westerly wing of the structure was selected as the more convenient location for connection to present piping systems of the older sections of the building, in which projected court space, an available free area of about 150 ft. square was afforded. The plant was laid out for capacity of 700 boiler h.p., with building and equipment arranged for approximately doubling this initial capacity by extension to the front toward the present west wing, by means of which a duplicate equipment of that now in place may easily be installed, which will provide plant capacity sufficient for fully one-half of the extension of the museum building as projected. When it shall become desirable to increase the building beyond this extent in future years, it is the plan to provide a new power plant of the increased size necessary, in some other portion of the building or make such other provisions for the mechanical services of the building as may then become desirable, the present plant in the interior court space to be subsequently removed.



Typical Radiator Enclosures underneath Window Sills.



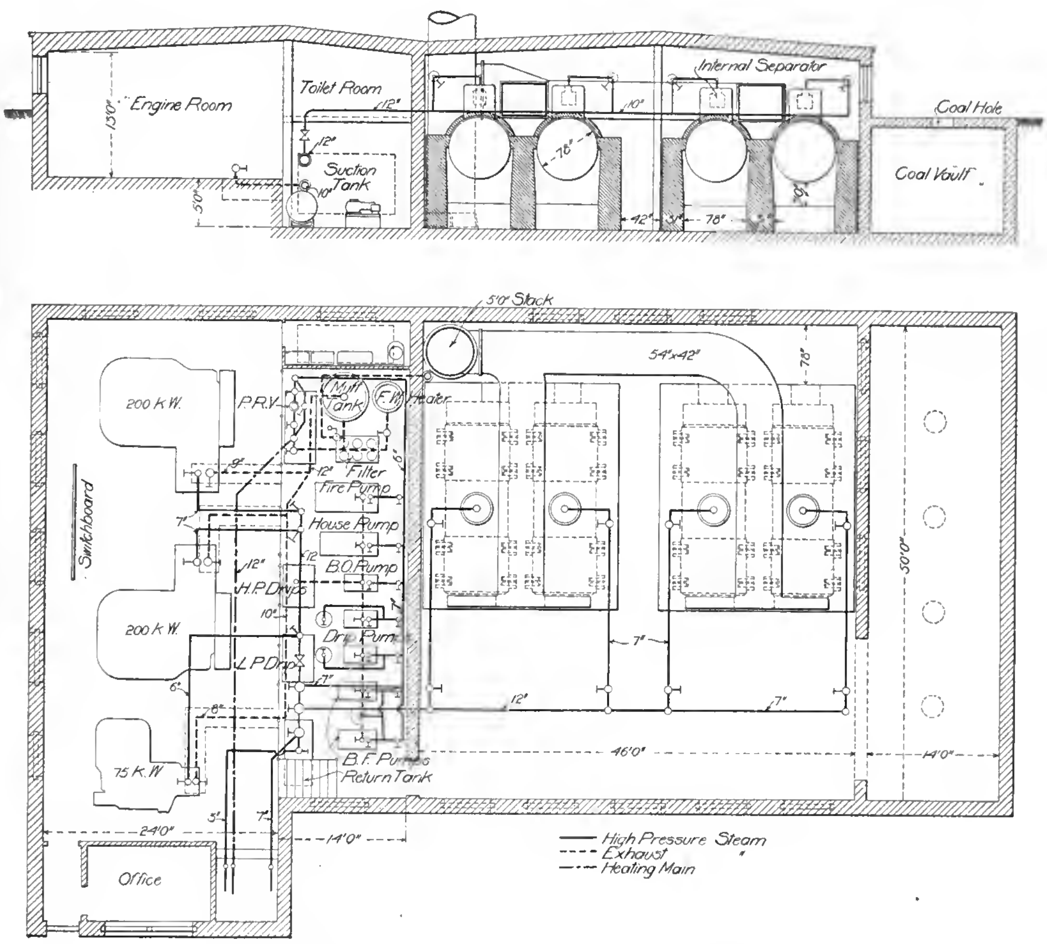
Arrangement of Radiation underneath Special Skylight at Base of Dome.

As the plant is destined to remain in service a number of years, before being supplanted by one of greater magnitude, the power house was designed of comparatively substantial construction of brick with concrete floors and roof, and is of ample size for convenient arrangement of apparatus. The exterior of the building is severely plain and for minimizing the interference with the lighting of the west wing of the museum from the rear, it is depressed, with its floor level from 6 to 12 ft. below grade, the roof of this structure rising, in fact, but about 10 ft. above grade. The structure as at present built is 88 ft. in length by 53 ft. wide, with a 14 x 24-ft. extension at one end over the piping tunnel that connects with the museum building. The extension proposed for doubling the capacity of the plant will increase the width to about 90 ft., so that the structure will be practically square, as indicated in the museum ground plan. The power house is divided into a 38-ft. engine and pump room and a 46-ft. boiler room, the engine room having a 13-ft. clear headroom, with floor depressed 6 ft. below grade, while the boiler room floor is depressed 5 ft. below this level, giving a clear headroom of 18 ft. A section of the engine room, 14 ft. in width, adjacent to the division wall, is depressed to the boiler room floor level to accommodate the extensive equipment of pumping units, filters, feed water heaters, etc. In the wing extension off the engine room there is an 8 x 13-ft. office for the chief engineer, with floor on level of the exterior grade, and in the opposite end of the engine room, over the pump floor, a 5 x 13-ft. toilet room. Ample lighting is afforded throughout by windows above grade near the roof line on all sides.

The question of fuel handling was simplified by the depression of the boiler room floor below grade, as an underground bunker communicating with the boiler room was thus made possible, onto the top of which coal wagons may be driven directly for dumping through coal holes in the

roof. Such a bunker, 14 x 50 ft. inside measurement, was constructed at the westerly end of the boiler room, with a reinforced concrete roof on level with grade at that point and containing four coal holes, through which fuel may be dumped. The bunker has a clear inside height of 11 ft., and about 30 ft. of it is used for coal, so that when filled to the roof it has a capacity for about 150 tons of coal. The coal is wheeled to the firing floor in barrows. Ashes are removed to the surface in barrows on a hydraulic elevator at the rear of the boiler room for hauling away in ash carts.

The boiler equipment consists of four 6½ x 18-ft. horizontal return tubular boilers, built by the Coatesville Boiler Works, which are conveniently arranged in two settings, with a 4½-ft. space between them, a 6½-ft. space at the rear and facing a 20-ft. firing floor. Each unit has 120 lap-welded tubes 3½ in. in diameter, giving a total heating surface of approximately 2,300 sq. ft., and has a 36-in. dome over the center sheet, in which is fitted a Potter mesh separator and superheater. Each boiler is set in a substantial brick setting, with flush cast-iron fronts, each shell being supported by eight lugs with roller bearings and each has grates 6½ ft. square, with fire brick bridge walls rising to within 14 in. of the bottom of the shell. The smoke connections consist of a 42 x 54-in. breeching over the middle of each double setting, connecting at the front with the smoke boxes of either boiler and at the rear into a cross breeching leading to the stack in the rear corner of the room. This stack is a 60-in. unlined stack of ⅜-in. wought iron plate and rises to a height of 125 ft. above the grade. Each flue connection has a hand-operated tight-closing damper, while in the main breeching connection to the stack there is a main damper operated by a Spencer automatic damper regulator for control of the draft by the steam pressure.



Present Power Plant of the Brooklyn Institute.

The boiler feed system consists of an equipment of two 7½ x 5 x 6-in. Deane duplex pumps, which draw from the condensation return tank or from the city water mains and deliver through a 3-in. boiler feed main over the boilers. The latter has a 2-in. branch to each boiler, which connects into a Fox water arch for preheating and has a check and two stop valves. The delivery from the pumps is connected to pass the feed first to a Ward feed water filter and then to a Berryman feed heater, which is inductively connected to the exhaust steam main of the plant. The delivery from two Nathan monitor injectors, which have been installed to supplement the feed pumps, is also conected to pass through the filter and heater, either of which may, however, be by-passed if desired. The Ward filter is of the usual cast-iron chamber type, having six cylinders, 12 in. in diameter by 7 ft. in height, which are fitted with cast-zinc bars and animal charcoal. The Berryman heater is a 39-in. by 13-ft. heater, containing 215 sq. ft. of surface made up of 2 in. seamless brass tubing. Each of the boiler shells has a 3-in. protected blow-off connection from the lower rear end, which leads out to the rear of the setting to a 3-in. blow-off main connecting with a 3 x 8-ft. cylindrical blow-off tank at the rear of the pump space in the engine room. This tank has a cooling coil, consisting of 60 lin. ft. of 3-in. brass pipes, for partially cooling the hot blow-off discharge, after which it is raised to the sewer by a 6 x 4 x 6-in. Deane blow-off pump. Vapor from this tank is removed by a 2½-in. connection to a 4-in. vapor riser that is carried up alongside of the smoke stack to a copper exhaust head.

The high-pressure steam piping of the plant is laid out with a simple boiler room header, delivering into a distributing header in the engine room, which is of extra heavy piping throughout and without duplication. The boiler branches are double valved 7-in. connections, which deliver into a 12-in. header arranged longitudinally over the center of the firing floor and below the level of the boiler branches to facilitate drainage. This line extends through the division wall to the 8-in. distributing header in the engine room, from which a 5-in. and two 7-in. branches are taken off to supply electrical generating units, a 7-in. line to supply a pump and auxiliary machinery header, and a 3-in. and a 7-in. branch to the museum building to supply steam using apparatus there located. The auxiliary header supplies the equipment of seven steam pumps and, in addition, has a 6-in. connection to the reducing valve, through which live steam is supplied to the low-pressure exhaust heating system for use when the exhaust supply is insufficient for adequate heating. The high-pressure lines in both the power plant and in the tunnel ways to the museum building are well drained through Nason traps, each drip point, as well as also the steam separators at the steam using units, being dripped separately through a trap with by-pass. These traps all deliver into a return line that connects with a 3 x 5-ft. drip tank, from which the condensation is returned to the boilers by a 6 x 4 x 6-in. Worthington duplex pump under control of a Kieley pump governor. The piping used is standard full-weight wrought-iron pipe, with extra heavy flange fittings and corrugated copper gaskets and fitted with extra heavy pattern gate valves having bronze discs and seats. All piping, both high and low pressure, is insulated with magnesia pipe covering, canvas jacketed, while the domes of the boilers, the feed water heater, filter and all tanks, separators, etc., are covered with magnesia blocks 1½ in. thick, protected with canvas jacketing. The smoke connections and also the stack up to the roof are covered with similar 1½-in. magnesia block, on wire netting over a 2-in. air space, finished with hard plaster and painted with black japan varnish.

The exhaust steam system which serves as the basis of the low-pressure heating supply, consists of a 12-in. header in the pump pit directly underneath the high pressure header which has a 6-in and two 9-in. connections from the generator engine and a 5-in. connection from an auxiliary line from the pumps. This header leads directly to a muffler tank at the southerly end of the pump pit and to an inductive connection to the feed water heater, with near the latter, a connection to a 10-in. back-pressure valve that delivers through a 10-in. riser to an exhaust head near the top of a smoke stack for atmospheric relief in case of excessive pressure on the exhaust system. The muffler tank is a Potter muffler and oil separator, 4 ft. in diameter by 6 ft. high, containing 24 galvanized wire discs and from this a 12-in. connection is extended to the Museum building for the low pressure heating supply. Near the muffler tank the live steam supplementary steam supply connection, above referred to, is made, there being in addition a by-pass around the reducing valve permitting of manual control if desired. Drainage from the exhaust system is effected by a low-pressure drip system, having connection to the cylinders of all engines and pumps, to the exhaust heads, the muffler tank and the feed heater, and delivering into a 3x5-ft. cylindrical drip tank. The low-pressure drip is like that from the high-pressure system, removed by a 6x4x6-in. Deane duplex pump under control of a Kieley pump governor, but being contaminated with lubricating oil, is wasted to the sewer. The drip connections from the engine and pump cylinders to this line are made separately through steam traps.

The electrical current supply for power and lighting purposes is generated by three direct connected units, two of 200-kw. capacity and one of 75-kw., which are conveniently and accessibly arranged with the smaller unit near the center of the projected building as shown in the ground plan. The engines are all simple high-speed machines built by the Harrisburg Foundry & Machine Works of Harrisburg, Pa., the larger

unit having 22x20-in. cylinders and a rating when operating at 200 r.p.m., with an initial steam pressure of 80 lb., of 320 h. p., while the smaller unit has a 15x14-in. cylinder and a rating, at 275 r. p. m., of 120 h.p. The engines have 7 and 5-in. steam supply connections respectively, each with a DeRycke steam separator, and each engine is fitted with a Manzel oil pump for cylinder lubrication. The engines are direct connected to Keystone multipolar direct-current compound-wound generators built by the Burke Electric Co., of Erie, Pa. These generators are wound for 125 volts and are designed to deliver full load for 24 hr. per day without undue heating.

The generator circuits are controlled upon a 3-panel switchboard of Tennessee marble in the engine room which contains the necessary indicating instruments, circuit breakers, rheostats and switches for the regulation and control of the generators, but the distribution at this plant is arranged in a novel manner, current being delivered from the generator panels, direct to independent distribution switchboards in each of the three sections of the museum building, from which the local feeder circuits are independently controlled. This arrangement effected a considerable simplification of the switchboard equipment for the plant and places the control of the distribution at points where it is most effective locally.

In the west wing of the museum building, the first section to be built, connection is made to a distribution switchboard which served the early lighting plant installed originally in the basement of that section; here the lighting circuits of this wing and an electric elevator are controlled upon the distribution originally laid out. In the central wing, there are two switchboards, one for general lighting distribution and the other lighting control for a large auditorium in the basement, the latter having a complete equipment for theatrical effects, including four dimmers. In the new easterly wing there has also been installed a similar switchboard for local lighting distribution. Each of the wings has a separate feeder connection from the power plant switchboard for direct supply and there are inter-connecting circuits between the local distribution boards in reserve for emergency purposes.

The power plant equipment and heating system of the institution were designed by Mr. Alfred R. Wolff, New York. The contractor for the power plant equipment was the E. Rutzler Co., New York. The electrical equipment and distribution system was laid out by Mr. Freemont Wilson, New York. Messrs. McKim, Mead and White, New York, are the architects for the buildings of the Institute.

(To be continued.)

Electric Heating is being tried in France for drying paper, in place of steam. Where the machine permits it is considered preferable to place the resistance, in which the heat is developed electrically, against the inside metal walls of the cylinders. A special advantage claimed for this system of heating is said to be the ease with which the temperature of the cylinder can be regulated while in operation. In the case of a machine producing 132 lbs. of paper per hour, which paper reaches the dryers with 50 per cent. of water to be evaporated, the electric heating must be capable of evaporating 66 lbs. of water per hour. In such a case, in order to avoid injuring the paper, progressive drying is recommended with three cylinders having a temperature of 158°, 212° and 250° Fahr., respectively. While such drying calls for a considerable amount of current, it is believed in the French plants where the experiments are being conducted that the cost is not excessive where current is furnished by hydro-electric plants belonging to the mills.

Coal Mining and Coke Making in the Trinidad, Colorado, District.

The chief known coal deposits of the Rocky Mountain region exist in a belt along the eastern base of the main range, extending southward from the Canadian boundary fully 1,000 miles, through Montana, Wyoming, Colorado and New Mexico. Although the coal-bearing formations are not continuous throughout this belt, which is of varying width in different sections, they have been found in about 60 per cent. of the distance. Another less extensive area of coal measures occurs along the western base of the Rocky Mountains in Wyoming, Utah, Colorado and New Mexico. Between the deposits on the eastern and those on the western slope are numerous isolated areas of coal measures, but in most of these the strata have been so much disturbed that coal-mining operations are carried on with difficulty. Coal from the various deposits has been mined extensively in southern and western Wyoming, in various parts of Colorado, in sections of Utah and in northern New Mexico for many years, but by far the greatest output has been maintained in Colorado. The principal fields of operation in that state are in the eastern and central part, near Denver, in the Walsenburg district, 175 miles to the south of Denver, in the Trinidad district at the extreme southern part of the state, and a few isolated sections along the western slope of the mountains. The coal fields of the Trinidad district were among the first in the state to be opened, and have been developed recently until the mining operations in that district are already the most extensive west of the Mississippi River, while new developments are being made continuously.

The portion of the Trinidad district that has been developed is approximately 20 miles wide, from the north to the south, and 45 miles wide, from the east to the west. The coal measures of this district are known to continue to the east from the present developments, but to the north they end in the measures of the Walsenburg district. The western boundary is quite well defined, however, by a practically continuous vertical strata of granite that extends almost exactly from north to south for several hundred miles close to the eastern base of the mountains. A range of mountains along the southern edge of the district interrupts the coal measures there, but extensive mining operations in coal of the same general characteristics are carried on in northern New Mexico, in the vicinity of Raton.

The workable coal measures in the Trinidad district are above an almost uniformly continuous stratum of bed rock, generally termed Trinidad sandstone, which lies at varying depths, depending on the topography of the country. Three principal series of coal veins, with an occasional occurrence of a fourth series, exist above this sandstone. First, is the Berwind series directly over the sandstone; then, about 60 ft. above that is the Hastings series and 30 ft. above the Hastings is a third rather indefinite series that is workable in a few localities. The fourth series, termed the Del Agua, is approximately 200 ft. above the third indefinite series, but thus far only a few mines are operated in it. The coal veins in all of these series frequently vary greatly in thickness and quality in short distances, so that mining operations are carried on with no small uncertainty. The veins that are worked range from 4 to 7 ft. in thickness, the average normal thickness being about 6 ft.

The average analysis of the coal produced in the district is about as follows: 60 per cent. of fixed carbon, 30 per cent. of volatile carbon and 10 per cent. of ash. First grade coke for blast furnaces and smelters can be produced readily from this coal, and as very little coking coal has been developed west of the Mississippi River, or, in fact, west of Pennsylvania and West Virginia, a great demand for coke for various purposes exists in the mining regions readily reached by rail from this district. The character of the coal and the demand for coke has consequently resulted in the installation in the Trinidad district of a large number of coke-oven plants of large magnitude. As only the slack and the smaller sizes of the run-of-mine coal are generally used in this district in making coke, the coal output is correspondingly large, the coal being of excellent quality for steam and commercial purposes.

The principal operator in the Trinidad district is the Colorado Fuel & Iron Co., which owns a large number of properties in Colorado, Wyoming, Utah and New Mexico. The largest single property of this company is the extensive steel works at Pueblo. These works embrace 6 blast furnaces and have a normal output of about 42,000 tons of steel rails each month, besides various other products. An outline of the plant, equipment and methods of Colorado Fuel & Iron Co. in the Trinidad district will serve, therefore, to show the character and extent of the workings in the latter.

Most of the recent developments of this company in the Trinidad district are along the southern division of the Colorado & Wyoming R. R. This division extends up the canyon of the Las Animas River from a connection with the main line of the Atchison, Topeka & Santa Fe R. R. at Jansen, 2 miles from Trinidad, to Tercio, a distance of 31 miles, and was built to develop the coal lands of the region through which it passes. The construction and maintenance of this railroad are at least equal to those of any of the trunk-line roads in the same region. The difference in elevation between Jansen and Tercio is about 1,831 ft., but the maximum grade in the first twelve miles of the railroad is 1 per cent. and in the remainder of the distance the maximum is 2 per cent. These comparatively moderate grades in the rough country traversed were obtained by following quite closely the course of the river. Since the balance of traffic is very largely down-hill toward Jansen, the existing grades introduce few operating difficulties.

In the construction of the railroad the embankments were made 16 ft. wide on top and the roadway in excavation 18 ft. wide in rock and 20 ft. in earth. The track has 75 lb. and 80 lb. rails laid on native and Texas pine ties. Tie plates are used on all curves, so the soft wood ties are quite satisfactory. Nine miles of the track from Jansen to a station called Segundo are ballasted with crushed stone; the yards and much of the balance of the line are ballasted with waste from the washeries at the coking plants and with coke braize. The curves above 4 degrees are spiraled, and maximum grades are compensated for curves.

The principal stream crossings are made on four single-span and two double-span steel bridges, carried by concrete abutments. The spans are each 105 ft. long, of the lattice truss type, and are designed according to Cooper's E 50 loading. The remaining stream crossings are small and are made on pile trestles or masonry culverts.

The principal yard on the line is at Segundo, where an eight-stall round house and a repair shop is maintained. This division of the Colorado & Wyoming R. R., together with other divisions, has three hundred 100,000-lb. capacity Ingolsby bottom-dump coal cars, which are used exclusively in the operations of the Colorado Fuel & Iron Co. Coal from the mines is hauled in these cars, while coke from the oven plants is hauled in regulation coke cars from various foreign lines.

The company operates five mines and two extensive coking plants on this division of the Colorado & Wyoming R. R. The first and larg-

est of these mines is at Primero, on a three-mile branch that leaves the main railroad just above Segundo. This mine has produced from 2,500 to 3,000 tons of coal a day and was at one time one of the heaviest producers west of Pennsylvania. In a straight line Primero is only a mile from Segundo, but it is 300 ft. above the latter, so the branch of the railroad had to swing around the hills to avoid exceeding the maximum grade of 2 per cent. Like practically all of the mines in the Trinidad district, the one at Primero is worked from a number of drift entries and slopes; in fact, none of the mines in the district are worked from shafts. Six working entries, with the necessary ventilating openings, are used in taking out coal. Two of these openings are on one side and the remainder on the opposite side of the canyon up which the railroad is built. The mining operations are carried on by the room and pillar system from side entries. The physical character of the coal is such that it can be removed readily with picks and shovels with comparatively little blasting. For this reason no under-cutting or other mining machines are employed. The same condition likewise exists throughout the district, all mining being done by hand.

The main entry of Primero is over 6,500 ft. long and has a maximum grade of 4 per cent. The mine cars are collected to it from the side entries by electric locomotives and are hauled from the inner end to the mouth of this entry in strings of 10 to 12 by a wire-rope haulage cable, operated by an Ottumwa steam hoisting engine, with two 72-in. drums. The cars in the other three hauling entries, adjacent to the main entry, are collected and delivered to a point on the side of the canyon near the mouth of the main entry by electric locomotives. The two entries on the opposite side of the canyon are also served by electric locomotives.

A 3,000-ton double tipple, built across the canyon and over the railroad tracks, is arranged so cars from either side of the canyon may be delivered to either of the two tipples, which are of the Mitchell automatic-dumping type. The cars are hauled from the mouth of the entries to the tipple by three 25-ton locomotives. The coal is passed over grizzlies as it falls through the tipples into the railroad cars below, in order to remove the slack and fine coal. The coal retained by the grizzlies is shipped for general consumption, while the remainder is taken to Segundo in standard-gauge cars to be used in making coke.

Power for operating the main haulage cable and the electric locomotives is supplied from a central station. This station contains six 100-h. p. return tubular boilers, which furnish steam to operate the haulage engine for the main entry and also to two 18 x 17-in. Ridgway engines, each belted to a 120-h.-p. Jeffrey generator. The water supply for the camp, in connection with the mine, is raised from the Las Animas River to a reservoir on a hill above the mine and camp by pumps at Segundo.

At Segundo two coal washers, each with a capacity of 1,200 to 1,500 tons a day, and 800 beehive coke ovens are in operation. The slack and fine coal from three separate mining operations, besides Primero, are delivered to these two washeries. One of these mines is an extensive new development on the main line of the Santa Fe R. R. at Morley, about 10 miles south of Trinidad, and the other two are on the Colorado & Wyoming R. R. adjacent to Segundo; one of these two is also a new mine at Frederick, a mile below Segundo, and the other is a smaller mine at Quinto, above Segundo. The slack and fine coal are delivered to Segundo from all four of these mines in the 100,000-lb. Ingolsby dump cars. The two washery buildings are located so their transverse center lines are coincident, but they are spaced apart to provide room for two standard-gauge tracks between them. Two 400-ton storage hoppers are placed under these tracks, adjacent to one end of the washeries, to receive the slack and coal from the various mines. A large coal crusher is also installed at one side of the tracks near the end of the hoppers, in order that run-of-mine coal may be reduced before being introduced to the washeries.

Washery, Coke Ovens and Railroad Yards at Segundo.

A flight conveyor in each of the track hoppers delivers to a bucket elevator extending to a bin in the top of one of the washeries. The arrangement of the both latter and, in fact, of all the washeries operated by the Colorado Fuel & Iron Co. in Trinidad district is the same. The elevator delivers to a bin, from which the coal passes through a toothed roll crusher, thence through shaking or rotary screens, in which it is sized. The different sizes pass through washing jigs that deliver the washed coal to a rotary screen, in which it is partially dried. This screen delivers in turn to a disintegrator, the output of the latter being raised to overhead storage bins with a capacity of 630 tons. The waste from the washing jigs is passed to settling basins and is finally drawn off into cars, in which it is hauled to the spoil bank.

The 800 ovens are in a group on the opposite side of the washery buildings from the track hoppers, with 100 ovens in a row and two rows to a battery. These ovens, and all of those in the district are of the bee-hive type, with an internal diameter of 13 ft. The washed coal is delivered from the storage bins at the washeries in 6-ton 4-wheel larry cars. These cars operate from the storage bins to the ovens on trestles and thence along the top of each pair of rows of the ovens on a track carried by I-beams, supported by masonry piers in the spaces between the ovens. The grade of the tracks on the trestles is such that the loaded cars go down to the ovens by gravity; the empty cars are pulled back up to storage bins by wire haulage cables, operated by steam-driven hoisting engines at the washeries. The larry cars, however, are being equipped to operate electrically, and trolley wires are being installed to deliver power to them.

As originally built all of the ovens in the various coking plants of the Colorado Fuel & Iron Co. were operated by hand. The pairs of rows of ovens were built with a wharf along each side of the row and with two standard-gauge railroad tracks between each two pairs of rows. Arrangements are now being made at Segundo and at several other coke-oven plants of the company to install electrically operated Covington machines for pulling coke from the ovens and loading it into cars. To this end the wharves are being lowered and a standard-gauge track laid on each of them at the new grade. The pulling-machine which serves one row of ovens will operate on the track close to that row and load coke into cars on the track across the space between the pairs of rows. The two tracks in each space will be connected by cross-overs at intervals, in order that the machines on the adjacent tracks may operate without interference. The only changes in the ovens thus required by the installation of the pulling machines is the widening of the oven doors from the old standard of 34 in. to 48 in. This change increases the capacity of the machines from 20 to 40 ovens in 24 hr. with 72-hr. coke, the corresponding capacities being even greater with the 48-hr. coke, which is produced in most of the coke-oven plants of this company.

A central station supplies power to operate the engines of the washeries and for the various other equipment at Segundo. The boiler room of this station contains ten 100-h.-p. return tubular boilers, which are equipped with fans for producing induced draft, so they may be fired with coke braize mixed with fine coal. The fuel is delivered to the boiler house in cars and is raised to overhead storage bins by bucket elevators. From these bins it flows to the firing floor by gravity and is fed by hand. The ashes are carried by a conveyor from the boilers to a storage bin over the track along the building. A 150-kw. 250-volt Thompson-Ryan generator, direct connected to a 240-h.-p. McEwen engine, has been installed to supply power to operate the larry cars and coke-pulling machines. Until all the power produced by this unit is required at Segundo for these purposes it will be transmitted to the mine at Frederick to operate the electric locomotives which are to be installed there to collect the mine cars and deliver them to the tipple at the railroad. As soon as more power is required at Segundo another generator similar to the one now in service will be installed.

The water supply for both Segundo and Primero is obtained from the Las Animas River. A pumping station on the bank of the river at the former contains two 500-gal. Jeansville compound duplex pumps, supplied with steam by two 100-h.-p. boilers. One of these pumps delivers against a head of 175 lb. to an 8-in. main extending to a 50 x 70 x 12-ft. reservoir at Primero, and the other delivers through an 8-in. main to a reservoir of the same size on the hill above Segundo. The discharges of the two pumps are cross-connected, so either pump may deliver to either reservoir. The water is piped from the reservoirs to all parts of the adjacent camps, so an ample supply for general use, do-

mestic consumption and fire protection is available.

The next operation of importance on the Colorado & Wyoming R. R. is at the present terminus of the latter at Tercio, where a large output of coal is maintained, two washeries are erected and 600 coke ovens have been installed. The coal veins at this point are inclined 40 to 60 degrees from the horizontal, so the coal is mined from them in a manner different than that followed in the balance of the operations of the company, where the coal is in nearly horizontal veins. Three entries adjacent to the washeries are at present in service, and a fourth is being opened across the canyon in which the washeries and coke ovens are situated. The adjacent entries are 350 ft. apart, and advantage is taken of the inclination of the coal veins by driving branches from the main entries on the upper side only. The coal can thus be delivered by gravity from the working face directly into cars on a track in the main entry, and in some instances it is delivered from an upper to a lower entry in this manner to reduce haulage. Where necessary, gates are built over the lower ends of the side entries to retain the coal until it can be delivered to the cars.

A tipple has been extended across the canyon, in order that coal may be delivered to cars on the railroad tracks, or to the washeries from the entries on both sides. The coal from the entries on the side adjacent to the washeries is passed through a tipple at the washeries; the coal retained by the grizzlies in this tipple goes into railroad cars, and the balance is delivered directly into storage bins in the washeries. The arrangement and equipment of the washeries is the same as those of Segundo. The 600 coke ovens are in four rows adjacent to the washeries. Washed slack and coal is delivered to them in larry cars operated by gravity in a manner similar to that followed at Segundo. Arrangements are being made, however, to operate these cars electrically and also to install four Covington coke-pulling machines in connection with the ovens.

New power equipment, consisting of a 150-kw. 440-volt alternating-current General Electric generator and a 150-kw. 220-volt direct-current General Electric generator, each of which is direct-connected to a 250-h.-p. high-speed Chuse engine. The 220-volt unit will supply power to operate the larry cars and coke-pulling machines at Tercio. The mine cars, which are now hauled entirely by mules, will be collected and delivered to the mouth of the entries by electric locomotives and then operated on inclines, leading down to the tipple and washeries by wire-rope haulage on electrically-driven hoists. The output of the 440-volt unit will be transmitted to a new mine at Cornell, two miles beyond the present end of the railroad, where it will be utilized by electric hoists and electric locomotives. Steam for the various units in the power station and washeries is furnished by six 100-h.-p. return tubular boilers.

The water supply for Tercio is obtained from a 900,000-gal. storage reservoir, which is supplied from a mountain stream by gravity. Another reservoir site in an adjacent valley will render available a storage capacity of 70,000,000 gal. of water by constructing a dam about 1,000 ft. long and with a maximum height of 67 ft. The construction of this dam will insure an ample supply of water for the present and subsequent developments of the company along the Colorado & Wyoming R. R. Since the average rainfall in the Trinidad district is about 13 in., and as practically all of the normal flow of the streams in this region have been appropriated for irrigation or other purposes, a good water supply is very valuable and is difficult to secure.

The other operations of the Colorado Fuel & Iron Co. in the Trinidad district are all adjacent to Trinidad. One of the oldest mines is at Starkville, on the main line of the Atchison, Topeka & Santa Fe R. R., five miles south of Trinidad. This mine was opened in 1865 and was operated for years by the railroad company. The slack and fine coal are now passed through a standard washery and utilized in 200 coke ovens adjacent to the mines, while the balance of the output of the latter is delivered to the railroad company. The workings of this mine and of one at Engleville, which adjoins it, underlie an area of about 10 square miles and are believed to be the most extensive west of Pennsylvania. One air course, 7½ miles in length, is in service, and the main hauling entry is 4½ miles long. The mine cars are collected by electric locomotives and delivered to the mouth of the entries by them or by rope haulage. A new entry, 10,200 ft. long and with a maximum grade of 4 per cent., which has recently been opened, will be operated by a continuous ⅞-in. rope haul driven by an Ottumwa hoisting engine, with 84-in. drums.

The electric locomotives are supplied with power by two 120-kw. Jeffry generators, each direct connected to a 200-h.-p. Ridgway engine. Coke-pulling machines are to be installed at the ovens of this plant and will also be supplied with power by these units. Steam for the engines of the electrical units, the haulage engine and the engine in the washery is supplied by five 100-h.-p. and three 125-h.-p. return tubular boilers.

A new mine that is being developed at Morley, about 6 miles south of Starkville, is indicative of the class of equipment that is being installed in the new developments in the Trinidad district. This development at present consists of an entry on one side and two entries on the opposite side of a narrow canyon, in which the main-line tracks of the Atchison, Topeka & Santa Fe R. R. are laid. A tipple has been erected across the canyon and the railroad tracks, in order that coal may be delivered easily from entries on either side. As one of the entries is on a slope, the mine cars will be hauled in this entry by a steam-driven rope haulage system. In the other entries and on the inside 10-ton Westinghouse electric locomotives will be used for hauling cars.

Two 150-kw. 250-volt direct-current General Electric generators, each direct connected to a 200-h.-p. Chuse engine, are to be installed to furnish power for the locomotives. Four 100-h.-p. return tubular boilers have been installed to furnish steam, and additional boilers will be provided as needed.

The houses for the miners employed in this development are all built of concrete blocks and have stone foundations. Water for domestic consumption and for the power station is obtained by a gravity supply line, 2½ miles long, which terminates in a storage reservoir.

The oldest coke oven plant in the Trinidad district is at El Moro, just north of Trinidad, where 240 ovens have been erected, and 200 more ovens are under construction. The new ovens are to be equipped with electrically operated coke-pulling machines. The slack and fine coal utilized in these ovens is obtained from the mine at Engleville, which is five miles distant. This mine was also one of the first to be worked in the district and is very extensive, having one main haulage entry 9,000 ft. in length and a second haulage entry 6,000 ft. long. Rope haulage systems are operated in both of these entries, one system in connection with an Ottumwa hoisting engine and the other with a Jackson hoisting engine.

Washery and Tipple at Sopris.

The entire output of a mine at Sopris, four miles southwest of Trinidad, is used in making coke for the steel works at Pueblo, as the coal obtained from this mine is specially adapted for such purposes. The Sopris development, which has been worked for many years, has 276 beehive coke ovens operated in connection with it. The mine cars are drawn to the mouth of the main entry by a rope-haulage system, operated by a Bullock hoisting engine; and thence three-quarters of a mile to a tipple at the washery operated in connection with the coke ovens by a second haulage system operated by an Ottumwa engine. The waste from the washeries is conveyed across a canyon to a spoil bank by an aerial tramway having a 1,600-ft. span.

The principal remaining operation of the Colorado Fuel & Iron Co. in the Trinidad district is at Berwind and Tabasco, 17 miles northwest of Trinidad. Coal is mined extensively at Berwind, and the slack and fine coal delivered to a coke oven plant at Tabasco, which is 1½ miles from the mines. The latter is operated with electric locomotives for collecting cars and with a rope haulage system in the entry. A power station containing six 100-h.-p. boilers and three 120-kw. Jeffrey generators, each belted to a McEwen engine, is installed at this mine.

A washery with a capacity of 1,000 tons in 10 hr. is operated in connection with the coke oven

plant at Tabasco. This plant contains 320 ovens, which have been equipped with electrically operated coke-pulling machines. The larry cars delivering coal from the washery to the ovens are operated by rope haulage system.

The difficulty of obtaining water in this region is illustrated in the case of the supply for Berwind and Tabasco. Water has to be obtained from an abandoned mine 12 miles distant. It is pumped that distance through a 10-in. pipe line and against a head of 250 lb. into a storage reservoir at each of the towns.

Camps or towns of unusually good character have been built and are well maintained by the company in connection with each of the developments which have been mentioned. This has been done, notwithstanding the fact that building materials are very expensive in the practically barren country in which the district is located, because experience has shown that laborers of the class available for work in the mines will not provide even reasonably decent quarters if left to themselves. In the older camps the houses are generally frame on stone foundations, but they are built along regular streets and are kept in good condition. The concrete block houses in Morley are an example of more recent construction. Water is piped to all parts of each town, and connections are provided for domestic service, with hydrants for fire protection. Good schools are maintained in each community and the general welfare of the inhabitants is otherwise well cared for. A large general store is operated in each town by a subsidiary organization of the Colorado Fuel & Iron Co., the prices charged in the stores being uniformly reasonable for the isolated district in which the latter are situated.

Mr. E. H. Weitzel, as chief engineer of the fuel department of the Colorado Fuel & Iron Co., has direction of the construction and maintenance of the coal mines and coke plants of the company. The construction and maintenance of the Colorado & Wyoming R. R. and of the various water supply systems of the company are under the supervision of Mr. R. M. Hosea, chief engineer.

A GYROSCOPE FOR STEADYING SHIPS was given a public test last month off the river Tyne on the "Seebar," formerly a first-class German torpedo boat, measuring 116 ft. in length, 11.7 ft. beam, with a displacement of 56.2 tons. The apparatus consists of a heavy fly-wheel rotating about an axis, and carried by a frame which can oscillate about a horizontal axis, the oscillating motion of the frame being checked by brakes. The wheel is one meter in diameter, weighs 1,106 lb. and makes 1,600 r.p.m. and is steam driven. The periphery is provided with blades and works like a turbine, the wheel being enclosed in a casing. In the tests with the gyroscope out of action the roll was about 14 deg., according to "The Engineer," London, while the boat was kept steady with the machine acting.

The Woodbury Viaduct.

The double-track viaduct of the Erie & Jersey R. R. at Woodbury, N. Y., crosses Bonney Brook at a height of about 72 ft. and is 590 ft. long between face walls of approaches. It is made with plate girder spans, from 40 to 82½ ft. long, supported on two 40-ft. single towers, one 80-ft. double tower and two single bents. The axle is partly on a tangent and partly on a 2-deg. curve, and the location and design were made difficult by the crossing of the contours at an acute angle and by the necessity for clearance of the proposed highway and of the existing track and a future track of the Newburgh Short Line, which intersects the axis of the viaduct at such an acute angle that neither track could be located entirely under one span, and provision was necessary for each track to pass between the vertical columns of a transverse bent, thus necessitating unusual clearance and special transverse and sway-bracing in the viaduct.

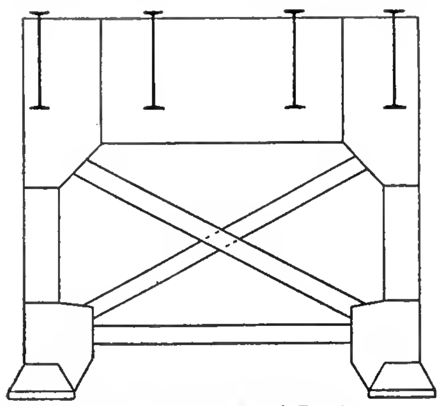
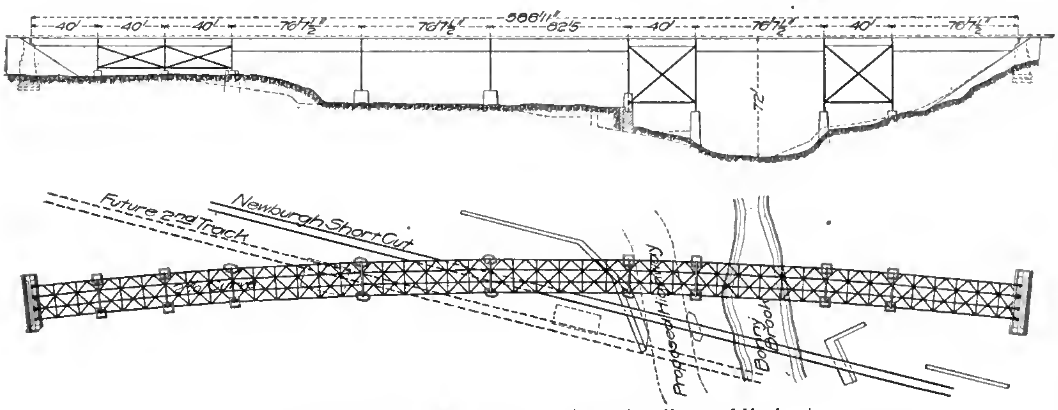


Diagram of Braced Bent.

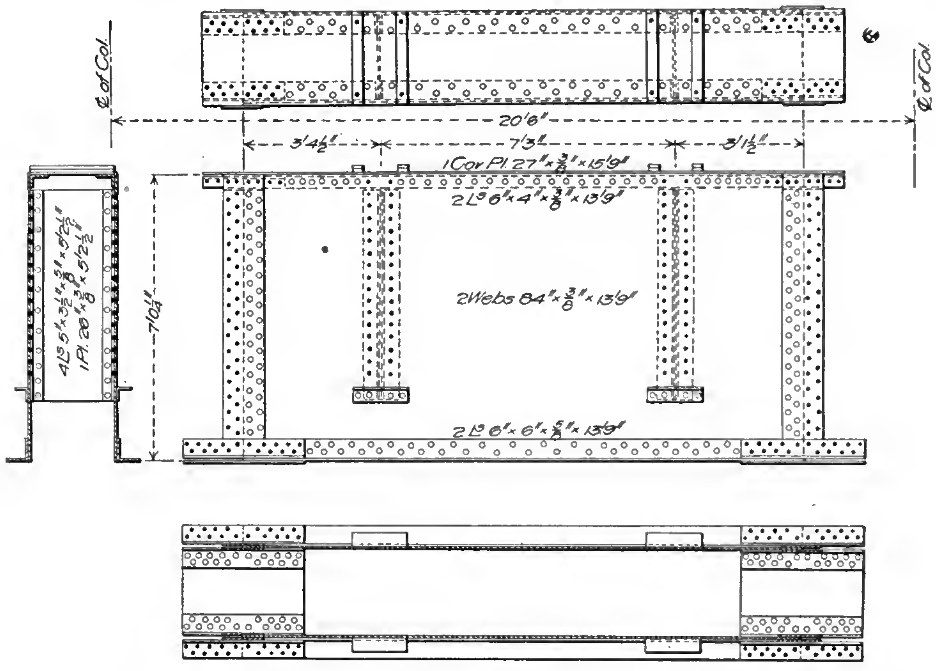


Part Plan and Elevation of the Woodbury Viaduct.

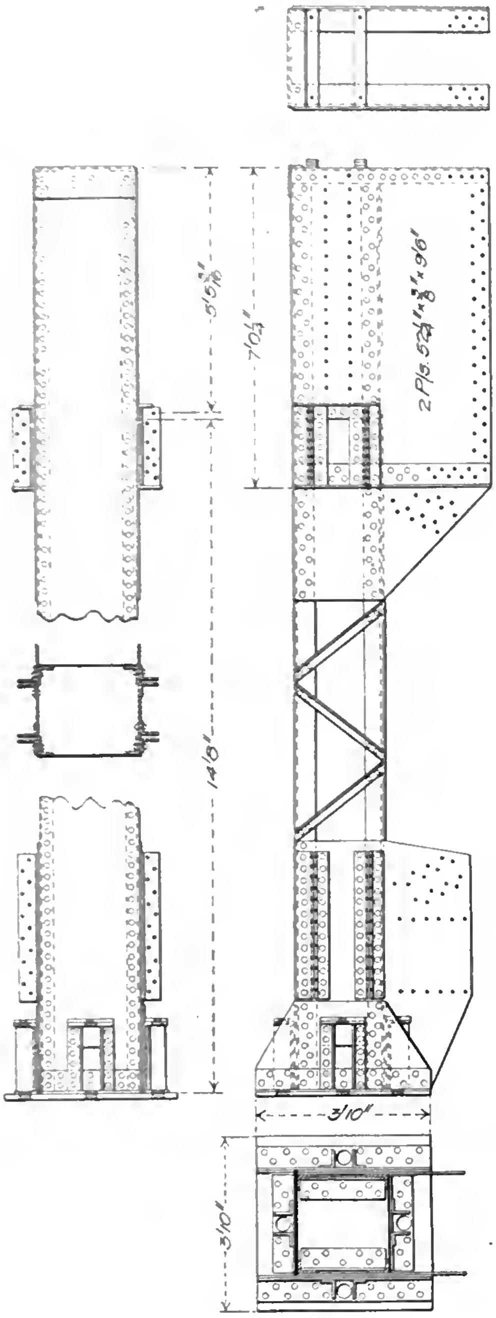
The sub-structure consists of concrete abutments carried down to a considerable depth through embankment to the solid earth, and of separate piers under the column bents. The latter are rectangular in cross section, except where, in order to provide clearance for the railroad tracks and highway, they are made oblique to the axis of the viaduct and are six-sided. There are four lines of longitudinal girders, 6 ft. 6 in., 7 ft. 3 in. and 6 ft. 6 in. apart, which received the ties on their top flanges, and are braced together in the usual way with transverse vertical frames and lateral angles connecting all four lines. The 40-ft. girders are 5½ ft. deep and are fixed at both ends; all remaining girders have a uniform depth of 9 ft. and are fixed at both ends, except for sliding bearings at two expansion joints on opposite sides of the brook.

The most interesting features of construction are in the design of single bents 5 and 6, though which there is clearance for the Short Line trains. The concrete pedestals for each column are built up to a height of about 10 ft. above the base of rail, so as to afford mass and protection against impact, and are seated on wide offset footings, which give them stability. The columns, nearly 31 ft. long over all, are, like all other columns in the viaduct, 20 ft. 6 in. apart, transversely on centers, and extend to the tops of the transverse girders, which in this case are 10 ft. deep. Below the transverse girder and connected to its bottom flange there is a portal bracing nearly 6 ft. deep, substantially equivalent to a transverse lattice girder with curved knee braces at each end.

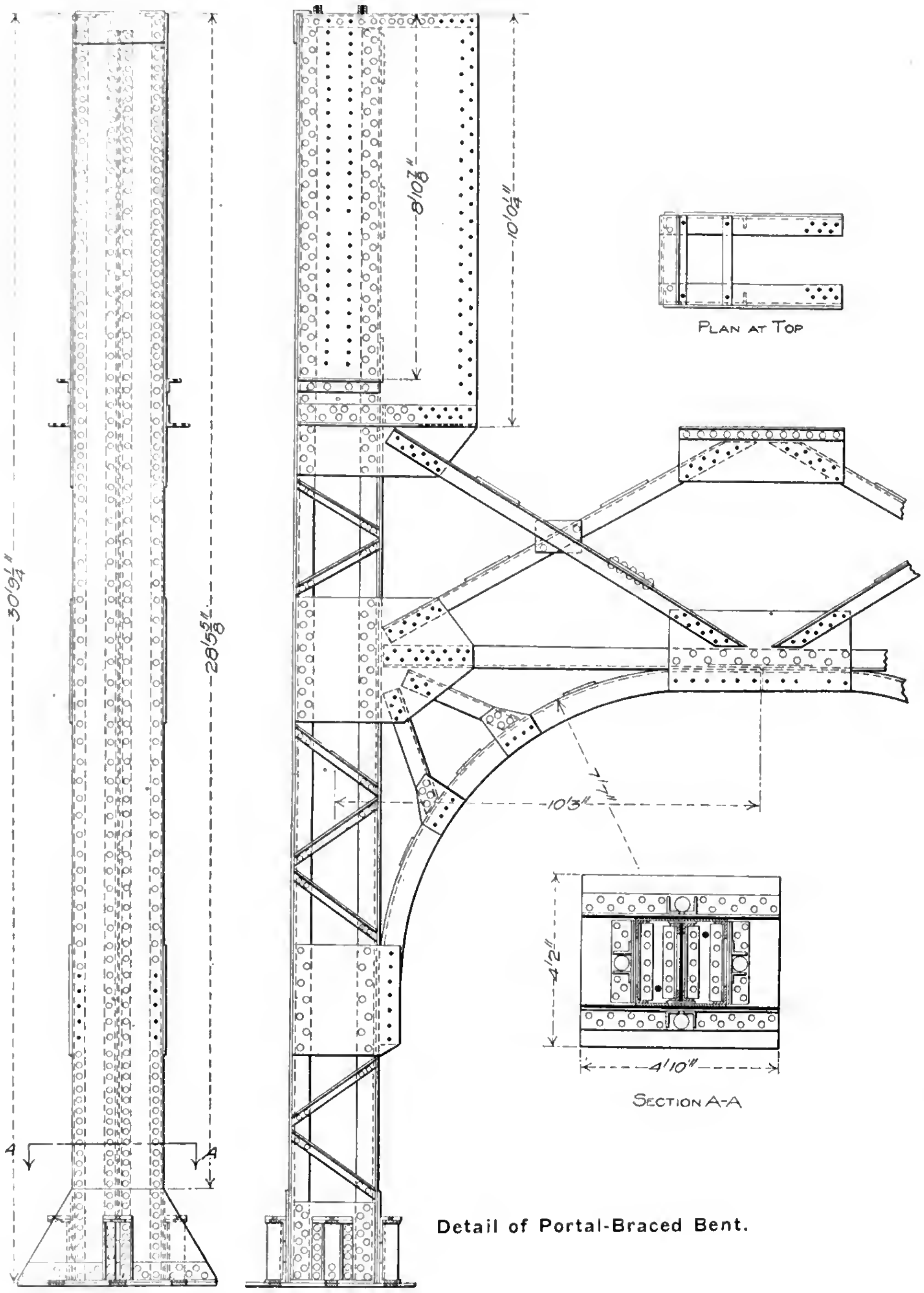
Each column has an I-shaped cross-section, made with two built channels having their webs perpendicular to the axis of the viaduct, and their flanges turned in and latticed, and an I-shaped interior rib, with its web parallel to the axis of the viaduct and its flanges riveted to the webs of the outside channel. Each column is made with four 6 x 6 x ⅝ and four 6 x 4 x ⅝ in. flange angles and two 27 x ⅝-in. and two 24 x ½-in. web plates. The 50 x 1¼ x 58-in. base plate is stiffened by two extended flange plates riveted to the column side plates, riveted across the bottoms of the column flanges, and has four holes for long 3½-in. anchor bolts, with nuts at their upper end bearing on reinforced shelf angles riveted to the column flanges. On one column the holes through the base plate are 4 in. in diameter, and on the other they are slotted 4 x 6 in. to allow for temperature expansion.



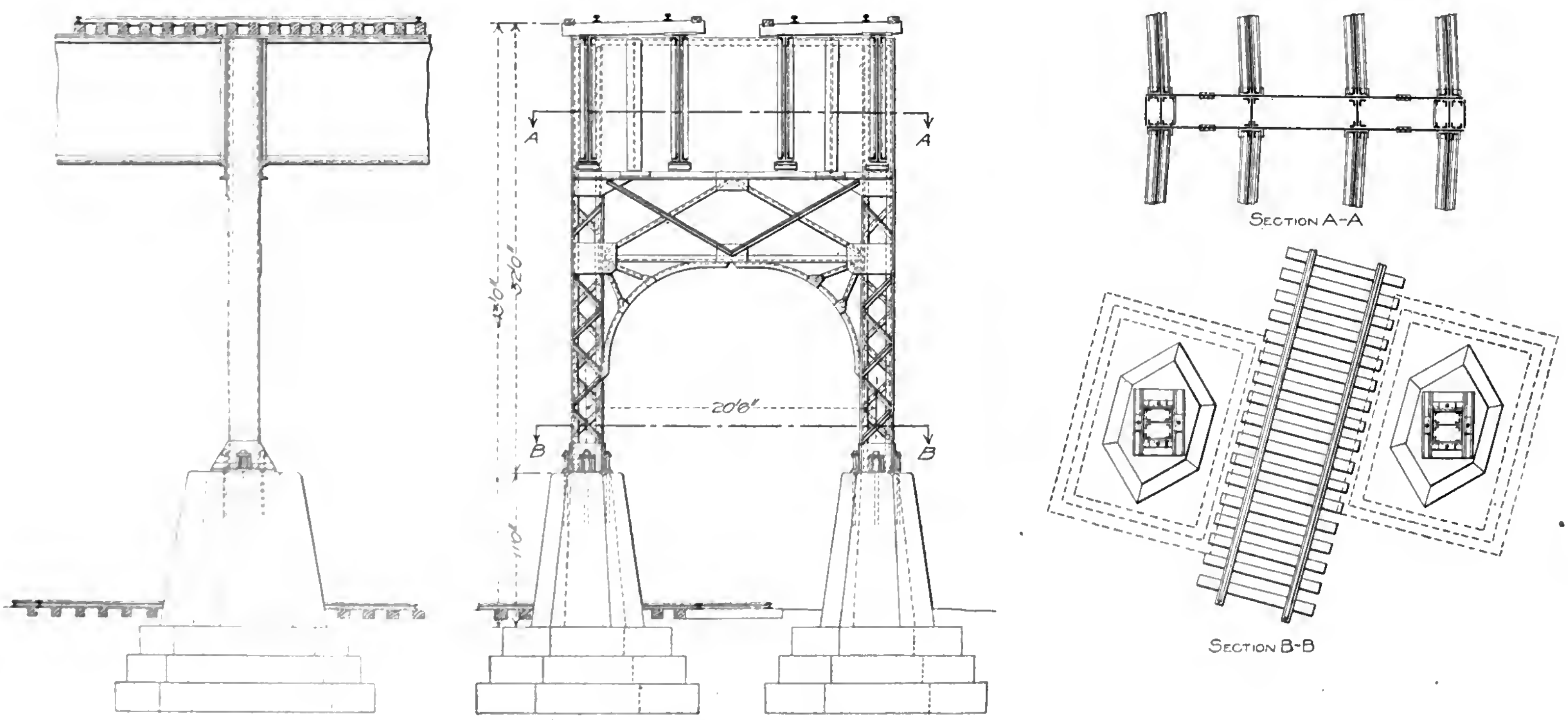
Transverse Girder, Woodbury Viaduct.



Column for Transverse Bent.



Detail of Portal-Braced Bent.



Portal Bent and Girders of the Woodbury Viaduct.

At the upper end of the column pairs of 52½ x 7-16-in., plates 11 ft. 3 in. long are riveted across the flanges projecting on the inner side to form the end sections of the double-web transverse girders connecting the columns. The plates are field-riveted to the ends of the longitudinal girders and to the web cover splice plates of the transverse girders. The portal bracing below the transverse girders is made with pairs of 5 x 3½-in. straight angles and pairs of 6 x 6 x ⅝-in. curved angles, all shipped loose and field-riveted to gusset connection plates.

The tower bents are each made with two vertical posts having their tops web-connected to the full depth of the double web transverse plate girders similar to those in the single bents, but different from them in that they have horizontal bottom struts and X-bracing in both longitudinal and transverse panels. The columns have open rectangular cross-sections made with pairs of built channels, with their flanges turned in and latticed, and have wide projecting flange plates to form jaws, receiving the transverse bracing with pairs of vertical connection angles shop-riveted to them to receive the gusset connection plates of the longitudinal bracing. They have 46 x 1¼ x 46-in. base plates, with anchor belt connections similar to those of the single bent columns. Each column is made with two 26 x 7-16-in. web plate and four 5 x 3½ x 7-16-in. flange angles latticed together with 2½-in. zigzag angles having two rivets in each end.

The center sections of the transverse girders are webspliced to the projecting flange cover plates in the tops of the columns and are made with a pair of 84 x ⅜-in. web plates 13 ft. 9 in. long and 2 ft. 2 in. apart, with their ends faced to make butt joints with the end sections between the cover plates, which are shop-riveted to them and field-riveted to the column plates. The webs are connected by vertical longitudinal diaphragms in the lines of the longitudinal girders, and the latter have 34 field rivets in each connection, besides being seated, for convenience in erection, on horizontal bracket angles. At the ends of the 76 and 82 ft. spans the transverse girders are similar to those above described, except that they are 10 ft. deep. All of the horizontal and diagonal tower struts have I-shape cross-sections made with pairs of angles back to back latticed; all of them are 2 ft. deep over all to correspond with the width of the post, and one diagonal in each panel is made continuous, while the other is cut to clear it and spliced across it with flange cover plates riveted to both members.

The Erie Railroad's Construction Department is under Mr. J. M. Graham, vice-president, and Mr. Francis Lee Stuart, chief engineer, under whose direction the viaduct, including the foundations, was designed by Mr. Mason R. Strong, engineer of bridges and buildings. The erection will be done by the Bridge and Building Department, under the charge of Mr. W. H. Wilkinson, inspector of bridges. The steel work was fabricated by the American Bridge Co.

THE SURPRISE SIGNAL TESTS made during October on the Pennsylvania R. R. were the most satisfactory ever made. There were 2,245 of these tests and of them 98.8 per cent. were absolutely successful and the remaining 1.2 per cent. were marked deficient merely because the signals were passed only a few feet. Taken as a whole, the October record was 1.2 per cent. better than that of September, the best previous month. Fifteen entire divisions received a perfect rating, while only ten divisions were so rated during September. Five divisions were above 97 per cent. and only one fell below 90 per cent. The skill attained by the trainmen in observing signals is shown by the fact that there was but one failure in the 952 tests on the very busy lines of the Schuylkill division.

The State's Responsibility in Road Improvement.

A paper by Director A. Marston, Iowa Highway Commission, in the "Iowa Engineer," published by the Engineering Department of the Iowa State College.

There is going on at the present time an extended discussion regarding the relative functions of central and local authorities in the government of our country. This is the result of an unconscious movement in the United States toward the centralization of government functions, a movement which has resulted from the necessities of our complex modern conditions. It is found that disjointed, local efforts are no longer sufficient to meet the conditions of the present time. Laws which were entirely satisfactory when our factories consisted of a few hands working with the owner, in close personal relations with him, are no longer sufficient to meet the conditions imposed by the great trusts of to-day.

What is true of governmental functions in general is also true of the administration of our roads. In the old days the requirements were met sufficiently well by entrusting the entire control and improvement of the roads to local authorities. But at the present time it is believed that the state should assume part of the responsibility, and that an enormous waste and inefficiency result from leaving road administration entirely to disjointed local managements.

The fact is, our country roads have come to occupy a place in the life of our population enormously important as compared with the old conditions. Formerly each farmer was, to a large extent, his own manufacturer and consumer and he used little not produced or made on the farm. At the present time he takes full advantage of the world's factories, commerce, literature, and art, and finds it is economical to leave the manufacture of most of the articles which he uses to the world's factories. The result is that the road which connects him with the nearest satisfactory market has become a vital link in his everyday life.

It has been very commonly supposed that success in agriculture is the result simply of the use of the best methods of cultivation and management on the farm itself, whereas, in reality the successful agriculturist of to-day must take an active part in the transaction of business entirely outside of his immediate farming operations. He needs to know the prices prevailing in the world's markets each day, and to be able to buy and sell at any time of the year, independent of weather conditions.

His intellectual and social life, also, are exceedingly important as compared with former conditions. He must be able to receive his mail every day of the year, delivered at his home. He must be able to procure the best journals and books at will, and in every way must keep in close touch with the intelligence of the world.

In fact, we may say that the radius of the country world at the present day has been enormously enlarged, as compared with former times. Looking back to my boyhood days, I can see the picture of the portion of the world's surface closely known to me, as I presume each man can who was reared in the country. Extending out a few miles in each direction from the home place was a region intimately known to us, and it was mainly with the people living in this region that we had social and business relations of mutual advantage. We thought we were doing well to receive our mail once each week, and if any message was to be given to a neighbor it had to be transmitted by word of mouth. How different are the conditions at the present time! My father, who *then* seemed to me to be a man of advanced age, now receives his Chicago paper every day, and if he wishes to communicate with his neighbors he has but to take down the telephone receiver.

Nor should we confine our point of view to the country alone. The modern tendency is toward grouping our population in cities and towns. In Iowa the prosperity of the cities depends mainly upon the magnitude of the territory tributary to them, and upon the regularity and surety with which the inhabitants of the tributary territory can maintain their business relations with the city. Any city which can secure the permanent improvement of the principal roads radiating out from it in all directions, will thereby do much to extend its tributary territory and to insure its business prosperity.

In the investigations of the Iowa Highway Commission of the statistics of the use of Iowa roads, that which has come out most promiently has been the exceeding importance of what might be called the light travel over these roads; that is, their use for other purposs than for the hauling of heavy loads. It is impossible to estimate the money value to the people of Iowa of having good, hard roads at all seasons of the year and under all conditions of weather, for the transaction of the business of the state, and for securing social and intellectual advantages which would otherwise be unattainable.

It is, however, a sad fact that country road improvement has not kept pace at all with the other advances of civilization in America. The present conditions are rapidly becoming intolerable. They constitute what might be termed, and will soon be regarded as, a disgrace to the state.

Yet, we are expending, at the present time, enormous sums upon our roads. The figures for the last three years are as follows:

Year.	County Road Tax.	Township Road Tax.	County Bridge Tax.	Total.
1903	$547,309.92	$2,283,129.65	$1,628,720.88	$4,459,160.45
1904	550,409.42	1,749,395.23	1,947,423.53	4,259,228.18
1905	518,535.71	1,923,431.81	1,773,304.08	4,215,271.60

Taking into account the money value of the poll taxes, and the sums from other sources than those above enumerated that are expended upon the roads of Iowa, it is probable that the total annual expenditures for road purposes are between $4,500,000 and $5,000,000.

To form some idea of the magnitude of this great sum we may compare it with the total expenditures for state purposes in Iowa during the fiscal year ending June 30, 1906, which were $4,165,639.81. It appears, therefore, that the money expended on Iowa roads in one year is considerably in excess of the total sum required to run the state government, and to support the state asylums, penitentiaries and other charitable and penal institutions, together with the State Normal School, the State University, and the State College.

To administer this smaller fund we elect a state legislature with all its attendant expenses, but as yet Iowa has not taken, as a state, an active part in administering the expenditures of the road funds. Apparently, however, the inevitable force of progress is compelling the state to participate more actively in securing efficient results from its large expenditures on roads.

It is a matter of common knowledge that we do not, under the present system, secure the results to which we are entitled, for the amount of money expended, although our road officers are almost universally absolutely honest, and have the best of intentions. The fault is in the system, in the lack of the *training* of the men, and not in the men themselves. It will be of interest to inquire what results we could reasonably expect from the money now being spent upon our state roads with proper system, and with thoroughly trained men.

In the first place, we may say that Iowa has approximately 100,000 miles of country roads and that at a maximum expense of five dollars per mile, or a total of $500,000 annually, these roads

could be maintained in good condition during almost all the year by the proper systematic use of the road drag. If, therefore, our road work were systematized under well trained, responsible men, $500,000 could be expended each year with results which would be many times more valuable than at present attained with the expenditures of our entire road funds.

In the second place, nearly all the moneys expended for bridges should be put into permanent structures, such as concrete culverts, and steel bridges with masonry abutments. If this policy were followed for a considerable period of years the annual amount required for bridges would greatly diminish. In this way $1,500,000 to $2,000,000 could be profitably spent annually for a number of years to come.

In the third place, $1,000,000 per year could be concentrated upon the improvement of the main traveled roads of the state, including the surfacing of such roads with gravel, broken stone, or other material suitable for making permanent improvement. At prices which have actually realized in the state, this would be sufficent to build 1,000 to 1,500 miles of gravel road per year, two hundred to four hundred miles of stone road.

In the fourth place, there would be left $1,000,000 to $1,500,000 for general administration and for grading. The grading done wit hthis fund should be devoted to building good, substantial grades and side ditches, in accordance with road engineer's plans, instead of patching a little here and a little there. Several million cubic yards of earth per year could be moved with this fund.

It is not too much to say that if the administration of the road funds of Iowa were under the management of one of our great railway systems, all the above results would be secured, and that within a comparatively limited number of years we would have a system of roads that would be the admiration of the world, without taxing ourselves any more than we now do. It is impossible, of course, to actually secure such perfect business administration, while still leaving the control of our road funds as closely to the people who pay the taxes as is right and desirable under our system of government. But we should approach much nearer to this ideal than at present. Under the present conditions we see little improvement from year to year, and the money seems to go to just about keep up the roads in their present condition.

To systematize and concentrate our road work must be our endeavor if we would improve present conditions.

Until recently, our state has taken no part in road administration further than to pass uniform road laws. This is a function of state government which has, of course, been recognized in every state in the union. But while the laws are uniform in each particular state, in their administration we find wide difference in practice in different parts of Iowa. There is, perhaps, a more pressing need for an exact and uniform enforcement of our present road laws than for the enactment of new laws. For example, the laws require a proper accounting of road funds, yet we find that the actual system of accounting is often hardly worthy of the name.

Of recent years there has been a general movement in the United States towards more active participation by the state in road administration, and this has shown itself in the creation of state highway commissions. California, Connecticut, Idaho, Illinois, Iowa, Minnesota, Massachusetts, Michigan, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Vermont and Washington have created such commissions. Taking the cases of some of our neighboring states, it may be stated that Illinois appropriates $50,000 per year for its highway commission; that Missouri has just provided for a state highway engineer, with an appropriation of $12,000 per year for expenses and has further provided for a county road engineer in each county of the state. Iowa has provided that the Iowa State College shall constitute a highway commission. and has appropriated $5,000 per year, which amount is the lowest provided by any state for its highway commission.

The duties of these highway commissions vary from mainly investigation and advisory work, to active building and maintenance of state roads. The work of our own commission may be said to have just begun. So far, we have been making a thorough preliminary study of road conditions in Iowa, have prepared and distributed road bulletins, have prepared and have been furnishing to road officers standard plans for culverts, bridges, and road construction, have inaugurated an annual road school for the training of road officers, have furnished expert advice to road officers calling for it, both by correspondence and personal visit, and have been endeavoring to assist further in the road work in all ways possible.

Another very important method by which the states of our country have been taking active part in road work in recent years is state aid. Connecticut has available about $225,000 per year for the construction of state roads, the state paying ninety-five per cent. of the cost. Massachusetts appropriated in 1905 about $550,000, paying seventy-five per cent of the total cost. In New Hampshire the amount is $125,000 per year, the state paying from twenty-five to seventy-five per cent. of the cost. New Jersey, which shares with Massachusetts the honor of pioneering the way in state road construction, expends annually $400,000, paying one-third of the cost. New York has recently appropriated $50,000,000 for state roads, to be expended in ten years, and pays fifty per cent of the cost. Pennsylvania appropriated $6,356,232, to be expended in five years ending 1909, and pays seventy-five per cent of the cost. Washington pays fifty per cent of the cost of all roads built by the state highway commissioner. Michigan pays "state rewards" for gravel and macadam roads, ranging from two hundred fifty to one thousand dollars per mile, according to the kind of road built, when same have been constructed according to the plans and specifications of the state highway commissioner and have received his approval.

While there might be much doubt in the minds of many people whether as yet Iowa has reached the time for extending state aid for hard roads, yet all who have studied those built under this system in our eastern states must admit that they are the finest roads in the world. And the plan is so popular with the tax-payers who foot the bills that in every state having such a system there are continual demands for the construction of many more such roads than can possibly be built. At the same time those making the requests understand that they have personally to pay a large part of the cost in addition to the amount paid by the state. The macadamized roads built by New Jersey, Massachusetts and New York under the system of state aid road construction are ideal, and are unsurpassed in the world, whereas, a few years ago these same states had roads equal to the worst.

In conclusion we may inquire what can be done in Iowa by the state to secure better roads. I will enumerate certain things which we believe our state could well undertake.

In the first place the state should systematize our road work.

(1) Its highway commission will supply to all road officers desiring them standard plans for culverts, bridges and road construction. We believe the state should require that all plans and specifications for large bridges be submitted to and approved by the commission, and that the construction of culverts and roads should, in general, be carried out in accordance with standard plans.

(2) The highway commission should supply road experts to respond to the call of road officers for advice and assistance.

(3) The state should by law provide for a road engineer in each county of the state, who should be a trained and well qualified road expert, who should make surveys and prepare plans for all important road work, and under whom in general the road work of the county should be placed. These county road engineers should be required to make regular reports to the highway commission, and to keep in close touch with it.

(4) The local road officers of each township should be required to make regular reports to the county engineer, and in general to work in consultation with him.

(5) Means should be provided for educating and training road officers. The present Road School should have its facilities for such work greatly extended and, if necessary, should hold a number of sessions each year in different parts of the state, so as to make it more convenient for road officers to attend.

In the second place our present road funds should be expended in such a way as to secure better results for the money.

(6) Systematic dragging of all earth roads, except unused byways, should be required, and should be carried out under road officers who can be held responsible for results.

(7) The expenditures for culverts should be devoted mainly to the building of permanent concrete structures.

(8) All large steel bridges should be built in accordance with definite plans and specifications prepared by competent engineers and let to the lowest responsible bidder, after being properly advertised.

(9) The county road fund should be increased one mill, and in general the road work should be to a considerable extent concentrated on main traveled highways.

(10) Wherever practicable, a beginning should be made at surfacing the principal roads with the best gravel or stone or other hard material locally available.

In the third place, the state should by direct appropriation provide for the building by the State Highway Commission of sections of experimental road in different parts of the state. In no other way can the best materials available in Iowa be discovered and the cost of good roads construction be ascertained.

The road question in Iowa is one of the most important to be solved by our people. The traffic on these roads is so large that if teams could be collected in one string to do the annual traveling in one day, at thirty miles per day, this string of teams would reach more than one and one-half times around the entire earth. In every way is the attainment of good roads most vital to our people. We must believe that the problem will be successfully solved in our state, and that Iowa roads, as well as Iowa agriculture, will in the future be found in the first rank.

A HYDRAULIC DREDGE designed for the removal of 4,500 tons of sand per hour from a depth of 70 ft. below water level has been built by Ferguson Brothers, Port Glasgow, Scotland, for dredging the Thames estuary. The spoil will be carried in hoppers aboard the dredger itself until ready for discharging. The vessel is twin-screw, 330 ft. long, 55 ft. 6 in. wide and draws 23 ft. There are two suction pipes, connected to Gwynne centrifugal pumps. The work to be done consists in constructing a channel 1,000 ft. wide and 30 ft. deep at low water through Leigh Middle Shoal, the total being about 6,000,000 cu. yd.

A Few Tests and Experiments with Reinforced Concrete.

By R. T. Surtees, C. E., Newton-le-Willows, Lancashire, England.

During the last few years, reinforced concrete for building and engineering works has made such headway that the limits of its application appear almost boundless. Construction of great intricacy and daring has been successfully carried out with it, whilst the failures have been few, those that have taken place being traceable to the inexperience or carelessness that may be found in all departments of works and labor. It is no doubt a material, or system of building that requires a considerable amount of care to ensure success, and whilst the principal amount of labor in connection with it may be got from the unskilled, the leading hands should be experienced and able to see the object of the designer and ensure it being carried out. Care should be taken in the selection of proper materials, according to the work required of them, and it is surprising what useful tests can be made at a cost warrantable for jobs of comparatively small dimensions. The writer was once nearly led into disaster by what appeared a hard gravel, apparently admirably suited for concrete, but on leaving a handful near a warm steam pipe, was surprised to find after a few hours, a number of cracks in each piece, so very small as to look like fine hairs. On breaking them up they were found to be nodules of clay encased with a thin coating of hard material, and it required only a comparatively small rise in temperature to cause them to burst, making them most dangerous to use for concrete. Failures have been reported from concrete made with aggregates containing a small percentage of sulphur, such as is found in certain blast furnace slags, etc., but it is doubtful as to what was the precise cause, and perhaps if careful and intelligent investigation had been carried out, it would have been found to be due to the imperfect proportioning and mixing of the materials and not to the constituents.

It has been found that iron cramps after being surrounded with concrete for hundreds of years, have been proved to be in perfect condition, whilst it has been equally proved that steel embedded in concrete floors for only a few years has been affected to such an extent that the wonder was that a collapse had not taken place.

What is the cause of this great difference? Is it the chemical composition of the steel or the aggregate, or is it due to the mixing and placing of the concrete? The following experiments have been carried out with a view of ascertaining a correct answer to these questions, so far as the aggregate or the concrete is concerned, and to many, I am afraid, the results will be in one or two instances, not quite what might be expected.

With aggregates of various materials, concrete blocks were made up in which were inserted pieces of steel, with their ends projecting out of the mass for a few inches. These blocks were immersed in water at frequent intervals, for a period extending over twelve months, when the projecting ends of the steel were found to be highly corroded. They were then submitted to the action of steam from a boiling solution of acid, until the exposed steel was, in most instances practically destroyed. The blocks were then cut open so that the embedded portions of the steel could be inspected. Fig. 1 is from a photograph of some of these blocks, the concrete in which was made with an aggregate composed of blast furnace slag from the works of the Wigan Coal & Iron Co., Lancashire. Figs. 2 and 3 show other blocks made with boiler furnace clinker, crushed bricks, and a mixture of brick and clinker, included in Table 1, which also gives the results of the experiments:

TABLE 1.—EFFECT OF WATER AND ACID VAPOR ON STEEL IN CONCRETE.

No.	Aggregate.	Sulphur. Per Ct.	Concrete Over Steel. In.	Remarks.
1	Slag	2.07	1¾	Steet unaffected
2	"	2.07	½	" "
3	"	....	⅜	" "
4	"	....	1¾	" "
5	"	....	1¾	" "
6	"	....	½	" "
7	"	2.07	¾	" "
8	"	2.07	1½	" "
9	Clinker	....	2	" "
10	Brickbats	....	2	Corroded from honeycomb in concrete
21	Clinker	....	1¾	" " "
23	Brickbats	....	2	" " "
25	Br'k. and clin.	....	2	" " "
27	Brickbats	....	1¾	" " "

In Nos. 2, 3, 6 and 7, the bars were nearer the outside of the blocks than is usual in reinforced work, and yet nothing penetrated the concrete far enough to cause rust to form on the steel.

The amount of sulphur in Nos. 1, 2, 7 and 8 was sufficient to color the concrete to a dark green, and there appeared to be no deleterious action set up on the steel.

There was a large amount of iron in the clinker which did not show any effect on the embedded steel when the concrete was properly consolidated and without voids.

In all cases where the steel showed corrosion, the concrete had not been properly graded, or made free from honeycombs or voids, which in most cases were easily traceable right from the steel to the outside of the blocks when examined.

The whole of the concrete used was made with aggregates containing the run of the crusher, none of the fine dust being kept out.

These experiments indicate that to preserve the steel effectually the aggregate for the concrete should be carefully graded to ensure the filling of the voids, that the concrete should be carefully mixed, placed, and consolidated, and even if this mixture does contain certain chemical impurities, there is small likelihood of rust being formed. Great care should be exercised to prevent the possibility of air spaces, honeycombs, or cracks on the outer surface extending into the mass far enough to allow an air passage to reach the steel, for if unnoticed or allowed to remain, rust will form, which may burst off part of the concrete, and so weaken the structure that disaster will eventually result. A case which recently came under the writer's notice was caused by the timbers being removed by the workmen before the concrete had been properly set, when its own weight had caused it to fall away from the steel just enough to cause a crack extending a considerable distance along the rods. No attempt had been made to remedy this, and after the contractor had handed over the work, the evil results began to appear. In a case of this kind, the rusting of the steel may perhaps not be the least danger incurred, for the concrete might be materially damaged, whilst its adhesion to the steel would be far from what it ought to have been.

Tests of the Permeability of Concrete and the Protection of Steel.

Cinders, pan breeze and such like are undoubtedly attended with a certain amount of danger in their use as aggregates in concrete having direct contact with steel. When soft they will not stand ramming without crushing, and the crushed parts may not be coated with cement, consequently dampness may make through to the detriment of the steel. Cinder concretes have no doubt been the cause of failures, and in the hands of careless contractors are most dangerous to allow. A concrete made with them may, however, with advantage be used under certain floors, or in partitions where it is required to take nails for fixing boards or other timbers. It is also a poor conductor of sound and useful as deafening.

Under no conditions is a rich concrete, having an aggregate of hard, sound material, proportioned and placed so as to secure the greatest density, more necessary than for an impermeable concrete. A concrete of this kind is often required for cellars, reservoirs, tanks, pipes and such like. Fig. 4 shows a method of carrying out experiments with a view to securing the best results, the apparatus being of simple construc-

tion, will allow the test to be carried out on most jobs at little expense. In each of the four large pipes shown are blocks of concrete, 5 in. in thickness, moulded inside. The larger pipes are connected to the town's water supply by means of the small pipe along the top, which allowed a pressure of 40 lb. per square inch, means being provided to allow the enclosed air to escape. The arrangement shown is also connected to a small boiler feed pump by which the pressure could be increased to 260 lb. per square inch, the town's pressure being shut off by a small valve when this was being applied. Table 2 gives the composition of the concrete in each pipe.

The aggregates included the fine stuff contained in the whole run of the crusher. The pipes were allowed to stand under damp cloths for two days, and afterwards were immersed in water for eighteen days, the test being applied on the twenty-first day after the concrete was placed. The results of the tests are given in Table 2.

TABLE 2.—PERMEABILITY TESTS OF CONCRETE.

Number	1	2	3	4
Gravel, uncrushed, parts	2½	3	4	3
Gravel, crushed, parts	2½	3	2	3
Sand, parts	3	2	2	2
Cement, parts	2	2	2	2
Screen for gravel, in	½	½	¾	¾

Date After Applying Pres.	Press. in lbs. per sq. in.	Leakage in Centileters per hour.			
1	35-50	36.60	5.37	0	0
2	35-50	20.00	1.91	0	0
3	35-50	12.00	0.986	0	0
4	60-70	30.00	3.25	0	0
5	35-50	14.66	0.62	0	0
6	35-50	7.50	0.332	0	0
7	35-50	6.00	0.32	0	0
8	35-50	7.57	0.427	0	0
9	35-50	6.00	0.083	0	0
10	35-50	5.83	0.041	0	0
11	35-50	5.25	0	0	0
12	35-50	6.00	0	0	0
13	35-50	6.33	0	0	0
14	35-50	5.83	0	0	0

NOTE: The tests were continued at about the last rate until the thirtieth day, when the experiment was considered finished.

Having proved a satisfactory mixture, from the materials to hand, an attempt was next made to find out the best conditions under which the concrete would set, for should contraction take place, cracks might occur, through which water could pass. With this object in view, four more pipes were used, in each of which was placed a thickness of 5 in. of concrete, prepared in a similar manner to those giving the best results in the preceding experiment. No. 1 was placed in a position to set where a hot sun could get at it during most part of the day, No. 2 was placed in a shaded place, and Nos. 3 and 4 were allowed two days under a damp cloth, twenty-eight days immersed in water, and all were put under pressure on the thirtieth day. The concrete in No. 1 had contracted in setting as water passed between the pipe and the block of concrete inside. No. 2 showed a very slight dampness which soon took up, while Nos. 3 and 4 were perfectly watertight. The set of pipes shown in Fig. 4 were made up of Nos. 3 and 4 of the former experiment, renumbered respectively 1 and 2, with Nos. 3 and 4 of the latter. The pressure was again applied, being gradually increased up to 260 lb. per square inch, and after two days with it varying between 50 lb per square inch and this. During this time no signs of dampness appeared on the underside. One of the blocks was cut out to see how far the water had penetrated into the mass of concrete, where it was seen to be traceable for a distance of only 1⅛ in. Whilst it may not be a difficult matter to make blocks of this size to stand such high pressures, it could hardly be expected that a long, thin wall of the same materials would give the same results, there being so many other factors to contend against.

Following this investigation a step further, a reinforced concrete pipe was made, as seen in Fig. 5. This was first made with an open end, and after the concrete had set, a short length of cast iron pipe,—for a special purpose other than connecting the hydraulic pressures—was moulded on to the end, the longitudinal steel reinforcing rods passing through the pipe and well into the concrete securing the cap. After connecting up the pipes, pressure at the rate of 30 lb. per square inch was applied, being gradually increased until it reached 120 lb., with no signs of dampness appearing on the outside of the pipe. This pressure was maintained for three hours, and on attempting to raise it higher, the joint between the first-made concrete and that fixing the cap gave way; as the object of the experiment had been attained, no further attempt was made to reconnect it.

Reinforced concrete pipes without the assistance of internal metal tubes to stand a pressure of this severity require great care in their construction, and a little remissness in mixing, placing or consolidating the concrete may lead to failure.

To secure the best results under direct compressional loads, as in columns and such like structures, it is imperative that the main or vertical reinforcing bars should be so fixed as to secure the requisite size of core, to be hooped or bound with a wire, wrapped spirally around the steel skeleton, to the bars of which it may be tied

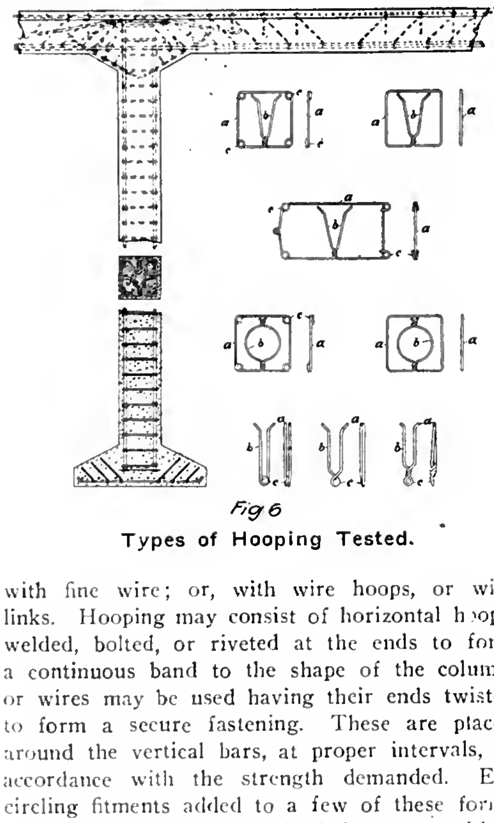


Fig 6

Types of Hooping Tested.

with fine wire; or, with wire hoops, or with links. Hooping may consist of horizontal hoops, welded, bolted, or riveted at the ends to form a continuous band to the shape of the column, or wires may be used having their ends twisted to form a secure fastening. These are placed around the vertical bars, at proper intervals, in accordance with the strength demanded. Encircling fitments added to a few of these forms of hoops, to hold the bars in their exact position, are well worth the little extra expense, as they serve both to connect the bars together and hold them apart from each other, so that the core cannot be otherwise than the size and shape designed.

The spirally wrapped skeleton has often been throught one of the strongest systems, but is difficult to apply, and as the whole skeleton has to be built up in position before any of the concrete is placed, it makes this difficult to do. What may be gained in a stronger skeleton may be lost in weaker concrete; and should the continuous wire wrapping get damaged at any one place in its length, it materially weakens the whole structure, whilst one break in it practically destroys the whole length of hooping. With any form of skeleton, however well it may be made, care is required in ramming the concrete, and care should be taken to ensure as little obstruction as possible to this part of the work. Even if the steel is made up into units, they may be thrust out of place by careless workmen who do not realize the importance of what they are doing. It has been contended that the advantage said to attend a spirally wrapped hooping lay in the fact that the spaces between the spirals were not in the same horizontal plane right round the column, as in the case with plain link hooping. This is doubtful, nor does the following experiments bear this out.

The arms of the hoop were arranged, see Fig. 6, in the mass of concrete in different directions to those of the next adjoining hoop, thus further reinforcing the core against that bulging action which is always set up when the load is applied. It is also probable that the horizontal hooping, as heretofore tested against wire wrapping, may have had the ends of the links simply laid side by side in the concrete, as was formerly the common practice, instead of having them securely twisted to form a tie, which ensures a structure being fully 23 per cent. stronger. It may be a comparatively simple matter to keep the steel members in their correct position in making a small test piece, but in actual work the difficulty is great, as every worker in reinforced concrete knows. Instances have been found where the steel members have been found to be far different to where the designer intended they should have been placed, and even in test pieces where every care has been taken to ensure correct work, members have been discovered out of place. Systems giving simplicity in design and execution, with secure fixing of the steel as the work proceeds have much to commend them.

It cannot be expected to make a structure of greater strength than its component parts, therefore, we may look to get the best results under compressional loading, with a concrete having an aggregate of the hardest materials.

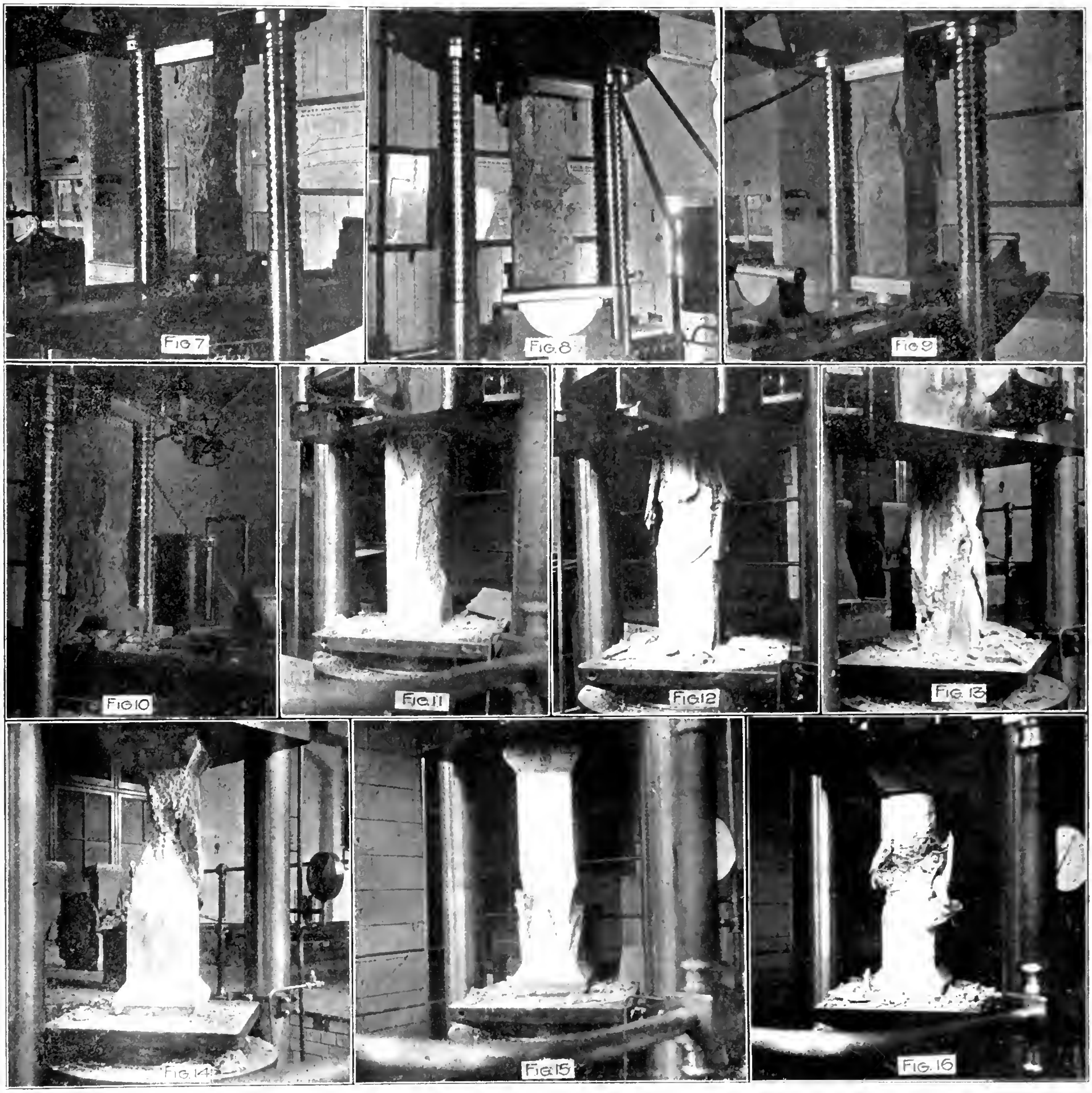
Fig. 7, 8, 9 and 10 show a set of columns made as nearly as possible under identical conditions as regards aggregates, sand, mixing, placing and consolidating the concrete, special efforts being made to ensure that the whole should be as uniform as possible. Fig. 7 and 8 had the longitudinal bars spirally wrapped and Fig. 9 and 10 had horizontal hoopings, as illustrated in Fig. 6, the steel in each instance being of the same weight throughout. Fig. 7 is of particular interest, inasmuch as it indicates a peculiar twisting action, which is perhaps attributable to this form of hooping when under load. As it happened, the pin which holds the table of the testing machine in position, had been accidentally left out, thus leaving it free to move on its pivot, and after the application of the pressure, the column began to twist to failure, the table moving around in unison therewith, destruction being achieved with a load of 49 tons. Fig. 8 was tested with the table fixed and failed under a load of 55 tons. Fig. 9 failed under 85½ tons and Fig. 10 under 91½ tons. The specimens were all 2 ft. 6 in. long by 8 in. square.

Figures 11, 12 and 13 and Figs. 14, 15 and 16 illustrate respectively two sets of columns, the experiments being carried out as before, the concrete being prepared and the work executed with a view to securing uniformity throughout. The longitudinal bars were 13/16 in. in diameter in all cases, there being a slight difference in the spacing of the hoops, which were of the link and strut pattern.

No.	Crushed at.	Length.	Size.
11	134½ tons	3 ft.	10 x 10 in.
12	176 "	3 "	"
13	209 "	3 "	"
14	219 "	4 "	"
15	197 "	4 "	"
16	215 "	4 "	"

It will be seen that Fig. 14, which is made with concrete having no reinforcing steel in it, comes out stronger than any of the others. In

this case the failure took place suddenly and with a loud report, as of an explosion, whilst pieces of the concrete flew about the room with dangerous velocity. It is undoubtedly one of those freaks which sometimes develop even after the greatest care has been devoted to the work of construction. In this case the whole of the details connected with their construction were



Method of Failure of Reinforced Concrete Columns.

personally supervised by competent engineers representing three different authorities.

If it were possible, in actual work, to consistently obtain a concrete of this superior quality and strength, reinforcing would not be so much necessary. After breaking, the sample of concrete showed to be very dense, with practically no pinholes in it, and hundreds of attempts might be made to make another to give such good results, without success. It shows the advantage of having the soft concrete of the right consistency and that there be no obstruction to its efficient consolidation, such as jarring after it has begun to set.

The mixture used in the manufacture of the last two sets of columns, was just something less than a wet one, and with those having the steel skeleton in the moulds, the concrete could not be so thoroughly rammed as where there was no such obstruction. A bigger rammer could also be used. It is undoubtedly due to these causes that such a high result was obtained in this particular specimen. Fig. 16 shows excellent design and construction.

In the columns comprising the last six experiments, the concrete was mixed in a machine of the revolving drum type, which, after repeated tests, the writer is convinced, made a concrete which was 16 per cent. stronger than could be turned out by hand mixing.

Concrete in Bags.

Bags of concrete are often used in constructing foundations under water, but caution should be exercised, Mr. W. D. Cay states in "Engineering," to see that the protecting ends of such bags are not subjected to the pounding of a heavy sea or its equivalent. In his opinion there must be ample mixing facilities, the materials must be collected close to the hoppers of the mixers, and large cars or skips used to transfer the concrete to a box in a hopper barge, in which the bag has previously been placed. The barge should be taken rapidly to the site of deposit, the bag being sewn up during transit and when brought into position the pulling of a trigger releases the doors of the box and the bag falls slowly down through the water to its place.

The Harlem Creek Sewer, St. Louis, Mo.

The Harlem Creek sewer, in St. Louis, Mo., is being constructed to carry to the Mississippi River the combined domestic sewage flow and storm-water run-off from a residential section of 6,000 acres in the northern part of the city. The area which will be served by the sewer lies about a mile back from the river, and between it and the latter is a stretch of low, flat river bottom land that is only slightly above extreme high water in the river. Back of this bottom land the country is considerably rough and broken, but is fairly well built up as a residence district. The storm-water run-off accordingly reaches the drainage outlets quickly, thus requiring large sewers to carry it away.

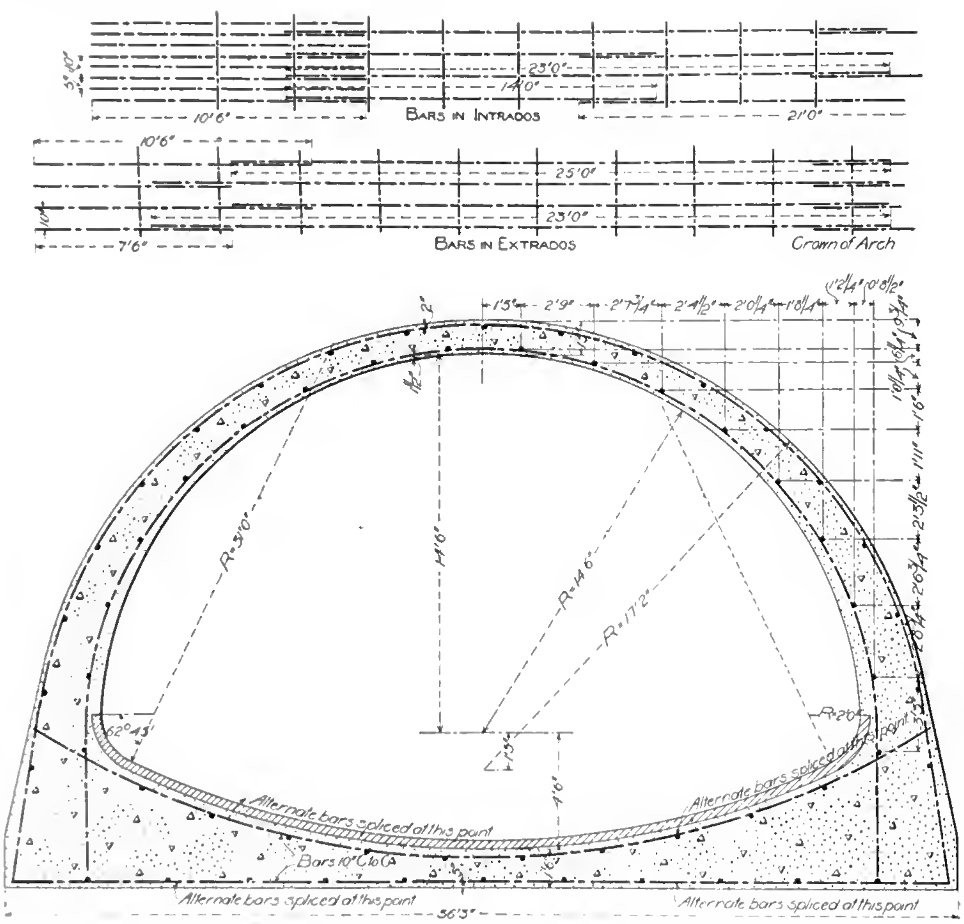
The Harlem Creek sewer has a total length of approximately a mile, extending from an outlet in the low area, about 1,500 ft. from the foot of the higher ground, back up into the hills for nearly 3,700 ft. The sewer has a semi-circular arch, with a flat, inverted semi-circular arch invert, and is built of reinforced concrete. In the first 1,000 ft. from the outlet the intrados of the arch has a radius of 14.5 ft. and the invert a radius of 29 ft. In this length the cross section of the sewer has an area of 411 sq. ft., giving a hydraulic radius of 6.41 ft., and the sewer is laid on a grade of 3 in. to 100 ft., which produces a velocity of 18.9 ft. per second and a carrying capacity of 7,480 cu. ft. per second. The arch of the sewer in the next 1,400 ft. has a radius of 13.5 ft., and the invert of 27 ft., the cross-section being 379 sq. ft., the hydraulic radius 6.2 ft., the velocity 18.2 ft. per second and the carrying capacity 6,714 cu. ft per second. The remainder of the sewer has an arch with a radius of 12.5 ft. and an invert radius of 25 ft., the cross-section being 327 sq ft., the hydraulic radius 5.76 ft., the velocity 17.8 ft. per second and the carrying capacity 5,570 cu. ft. per second.

Since the sewer is over a mile in length and has such a large section, the saving of the smallest quantities per linear foot results in a very considerable economy in the structure as a whole. A semi-circular section was selected because of the simplicity of form work required for it, of the determination of waterway areas, and of the belief that all uncertainties of loading considered, it would come as near being the economical form as any that might be designed.

The low area which is crossed by the sewer will doubtless eventually be occupied by railroad yards, as it is crossed by several trunk lines, which already have considerable yard facilities in this area. A switch track also extends from these yards up the valley that is occupied by the sewer. The latter was accordingly designed to carry the loads that will be brought on it by these tracks. The selection of a conduit section on the basis of loading alone necessarily involves some definite assumptions as to loads. They must be considered either vertical, or partly vertical and partly horizontal, and if so, the ratio of the horizontal to the vertical must be assumed. The variation in the height of fill, the nature of the filling material, the manner of placing, the amount of moisture and so forth all affect these assumptions to such an extent as to make a selection on such a basis rather impracticable. The largest section, with a 29-ft. clear span, was assumed to have a 15-ft. fill over the top of the arch, and also to carry the heaviest railroad loading combined with a 7-ft. fill. In order to provide for the most unfavorable condition of back filling, the loads were assumed to have such position as to produce maximum bending moments without regard to continuity. It was found that this method in the case of the 15-ft. fill also provided amply for the railroad loads.

The stresses in the various sections were determined from the analysis of circular ribs with fixed ends in Prof. Chas. E. Green's treatise on arches. The determination of constants for the horizontal forces had to be made from the general equations and involved considerable labor, but the work proved very much worth while, as the horizontal forces were found to reduce the bending moments from the vertical loads. To illustrate this point: The bending moment at the crown of the 29-ft. arch, due to vertical load, was found to be about 208,000 in pounds, but of the opposite sign, leaving a resultant positive bending moment, which results in a tension in the intrados of the arch of about 108,000 in pounds, or a reduction of nearly 50 per cent.

The advantage of reinforced concrete over plain is considered to be very clearly shown by



Reinforcement in Maximum Section of Harlem Creek Sewer.

the stress conditions existing at the crown. The resultant bending moment being 108,000 inch pounds, while the total thrust was but 18,000 lb., gives an eccentricity of 6 in. To keep the thrust inside the middle third, or to cause no tension, would therefore require a thickness of about 36 in. But assuming a section of reinforced concrete 15 in. thick, the combined stress due to thrust and bending moment would be:

$$f = 108{,}000 \div (12 \times 15) \pm 6 \times 108{,}000 \div (12 \times 25) = 100 \pm 240.$$

The stream carrying capacity required for the sewer was obtained by McMath's formula for determining run-off, which is $Q = pr\sqrt[5]{(A^4 s)}$; Q being the quantity in cubic feet per second; p, the percentage of the total rainfall in inches; A, the area in acres and s, the slope of the surface. It was assumed that 75 per cent. of the rainfall would reach the sewers and that the maximum rate of rainfall would be 2.75 in. per hour. In estimating the carrying capacity of the sewer, n in Kutter's formula was assumed to be 0.013 for the brick lining, which is provided for the invert of the sewer.

The concrete in the invert and up to the springing line of the sewer was made in the proportion of 1 part Red Ring Portland cement, 3 parts river sand and 6 parts crushed limestone, the pieces of which vary from ¼ in. to 1 in. in size. In ordinary soil about 4 cu. yd. of this class of concrete was required per linear foot of sewer. The arch concrete was made in the proportions 1:2:5, 2 cu. yd. per linear foot of sewer being required. The proportions of the two mixtures are varied to suit the percentage of voids in the sand and broken stone.

The details of the reinforcement of the sewer section are clearly shown in an accompanying illustration and need little explanation, Johnson corrugated bars being used for reinforcing. All transverse reinforcement is made with 1-in. bars, and all longitudinal reinforcement with ½-in. bars.

The construction of the sewer presented no special difficulties, the sewer extending down the valley of a small crooked stream, which carries a large volume of water during floods, but is very low during dry seasons. The channel of the stream is cut across several times to avoid curves in the sewer. The construction has been handled in alternate sections between these crossings, in order that the flow of the stream might be handled easily. The extrados of the sewer is from 4 ft. to 20 ft. below the natural surface until the edge of the low area is reached and across that area filling has to be provided in places to cover the sewer. As the trench has to be opened 2.5 ft. wider on each side than the base of the sewer, or to a total width of 41 ft. in the large section, it involves a large amount of excavation. Across the portion of the low area in which construction was carried on the soil is river silt to a depth of a few feet, under which is a stratum of limestone; in the higher ground the soil covering over the limestone is considerably thicker. The preliminary estimates indicated that 13,000 cu. yd. of rock and 50,000 cu. yd. of earth would have to be moved in building the sewer. It was also expected that considerable quicksand would be encountered, but at the time these notes were prepared no difficulty had been

experienced from this source. The earth excavation has been made by hand, the excavated material being handled out of the trench in buckets by stiff-leg derricks. The limestone rock, which is of an excellent quality and is crushed for use in making concrete, is loosened by blasting and stored along the sides of the trench. The contractor has installed a No. 3 Gates gyratory crusher in which the rock is reduced. The output of this crusher is raised to an elevated storage bin by a bucket elevator which delivers to a screen that separates the stone into the following three sizes: screenings, ¼-in. to ½-in. pieces and ½-in. to 1-in. pieces. The screenings are not used in the concrete, sand being employed for the fine aggregate.

Mr. H. F. Fardwell is sewer commissioner, and Mr. J. A. Hooke is assistant sewer commissioner of St. Louis, in charge of the construction of this sewer.

Letters to the Editor.

COST OF ENGINEERING WORKS.

SIR: I read with deep interest your editorial on "The Cost of Engineering Works," and thoroughly agree with you that it is unjust and unfair to attempt "to discredit the evidence of an eminent engineer of twenty to forty years' active professioal work," and such an attempt to so discredit such an engineer should be frowned down upon by the entire engineering profession.

When, however, an eminent engineer, goes upon the witness stand as an expert, he cannot object to inquiries as to the exact nature of his "active professional work," and upon which he bases his expert opinion. In a recent case which came under my observation, one such expert, of high standing and reputation, had actually no construction experience for over twenty years in which he was responsible for the results obtained, and his memory of his experience prior to that time proved to be extremely hazy. It will perhaps not be denied by anyone that in the engineering profession construction methods have somewhat progressed during the last twenty years.

Very truly,

ALEXANDER POTTER.

New York, Dec. 2.

CONCRETE COKE OVENS.

SIR: In reference to a letter in your issue of Nov. 16th upon the subject of "Concrete Coke Ovens," during the winter of 1906-7, the writer designed and supervised the construction of 350 beehive coke ovens, which are probably of the type referred to by your correspondent. In these ovens the ring wall foundations, larry-track columns, and battery retaining walls are of concrete, the ovens and oven floors being of fire brick. The battery retaining walls are 12 in. thick and reinforced with plain round rods. The observed temperatures on the outside and inside of this wall were 120° and 250° Fahr., respectively. It is not probable that the inner face of the wall is ever subjected to a higher temperature than 400° Laboratory tests would indicate that concrete is improved rather than injured by a steady heat of this temperature.

The ovens are the property of the Carbon Coal & Coke Co., of Trinidad, Colo., a subsidary concern of the American Smelting & Refining Co., and were first fired up in August, 1907. No bad effects have been observed to date and the writer sees no reason why ovens of this type should not come into general use wherever a considerable number of ovens are to be built at one time.

Very truly yours,

LINDSAY DUNCAN.

McGill. Nev., Nov. 26.

STEAM TURBINE ECONOMY.

SIR: Permit me to verify the statements made in your issue of Oct. 12, in connection with an economy test on a large turbine of the Parsons type at the station of the New York Edison Co. The accuracy of the results has been called into question, and I therefore desire, first, to uphold the accuracy of your published reports, and, second, to correct a popular misconception regarding comparison of turbine economies under different operating conditions.

The point at issue is whether the water rate of 14.9 lb. per kilowatt-hour, developed by the New York Edison turbine, represents higher economy than 12.5 lb. per kilowatt-hour, which is said to have been developed by a large Curtis turbine at the station of the Chicago Edison Co. Presumably the latter figures have been incorrectly quoted from a test recently reported on a 9,000-kw. turbine at the station of the Chicago Edison Co., which showed a maximum economy of 12.9 lb. per kilowatt-hour at 10,000 kw. load.

Now, as far as I am able to ascertain, the basic facts are these: Taking both machines at their point of maximum economy, the Westinghouse-Parsons turbine developed a water rate of approximately 15.1 lb. per kilowatt-hour output at the switchboard for two consecutive hours with an average steam pressure of 175 lb. gauge, 97° superheat and 27.3 in. vacuum. Correcting to contract conditions, 175 lb. pressure, 100° superheat and 28 in. vacuum, this is equivalent to 14.73 lb. per kilowatt-hour. The Curtis turbine, on the other hand, developed 12.9 lb. per kilowatt-hour, with 176 lb. pressure, 147° superheat and 29.5 in. vacuum. Correcting to the above contract conditions by percentages advocated by the builders of these machines, it develops that the equivalent water rate at the same load, is 15.08 lb. per kilowatt-hour. These results might be reduced still further, to a basis of dry-saturated steam, and still be within the limits of your published statement regarding the economic record established by the New York Edison tests, I believe the above figures will be sufficient for the point in view.

The inference drawn from the above, is that economy tests are not comparable from either a technical or a commercial standpoint, unless respective operating conditions are known, so that it is manifestly improper to question the accuracy of your published report upon such a superficial basis. And, in making comparisons, such as these (which heretofore have seemed neither necessary nor opportune), I do so purely in the interest of a clear understanding of the situation, not for the purpose of drawing illusive conclusions even though the latter may be quite tenable on careful analysis. In examining the performance of prime movers, we must not simply accept the rate of consumption of heat energy in the form of steam, gas or oil, but make comparisons on a true, scientific basis, else the results will quickly lead to erroneous conclusions. The sooner these principles are clearly understood and appreciated at their true value, the sooner will the apparently great disparity between turbine tests, such as those above outlined, be dispelled.

And herein, by the way, lies the greatest fallacy in the ceaseless struggle for high economies. Every engineer is, of course, interested from a personal standpoint, in the attainment of the highest cyclical efficiency for all forms of prime movers; but high efficiency, *per se*, means little from a commercial standpoint unless the cost of attaining it is reckoned. This is particularly true of the extreme operating conditions assiduously cultivated in turbine operation. Unquestionably, the results are spectacular, but when we take into consideration the extra cost, maintenance, the complexity of the additional auxiliary equipment, and the losses incident thereto, our enthusiasm wanes, and we intuitively seek a lower plane where efficiency and cost form a more reasonable balance.

J. R. BIBBINS.

CONCRETE PILES.

SIR: In a recent paper read by Mr. Charles R. Gow before the Boston Society of Civil Engineers, relating to experience in molding and sinking concrete piles, Mr. Gow referred to concrete piles constructed or built in place and those cast and driven. Piles constructed as mentioned were limited as to their length and their carrying capacity by reason of natural formation of soil penetrated, the composition of the material under and around the pile, which ultimately carried the load, and an approximate load of thirty tons was considered safe. Quoting Mr. Gow, "The extreme length of many of the piles introduced a serious question as to how best to handle them and avoid breakage. Piles up to 30 ft. in length could be picked up by the end without producing any undue strain; but over 30 ft. long, they almost invariably crack."

There has been considerable interest manifested of late in concrete pile construction. Further observations are hereby submitted relating to reinforced concrete piles produced by the rolling process, which is a decided departure from that introduced by Mr. Gow in his report. A specially designed machine for manufacturing and rolling round piles has been produced. Reinforced piles of various lengths and diameters have been made and used, giving considerable satisfaction.

Piles manufactured as stated can be driven by an ordinary pile-driving plant or a water jet. Experience has shown that they can be driven through all kinds of soil and endure the roughest kind of treatment without injury. Such piles were driven for the Erie Railroad at Susquehanna, Pa., under the foundation of the power house. They were constructed in various lengths up to 34 ft., and from 14 to 16 in. in diameter. The material penetrated was clay filling, furnace slag, and river silt to rock. On the Brighton Beach & Coney Island branch of the Brooklyn Rapid Transit Ry. four station foundations were constructed, using longer lengths, driven to compact gravel.

It has been observed that a concrete pile, in order to compete with a wooden pile, should be able to carry a much larger load than 30 tons by reason of its cost, and friction should not be relied upon to sustain the pile, as friction as a condition limits its application. When longer lengths are used and the piles driven to a firm foundation, 100 tons can be safely carried. Consequently fewer concrete piles can be used, replacing a larger number of wooden ones. The frictional resistance is no more than the pressure brought to bear by the displaced material through which the pile penetrates. Piles constructed in place where the displaced material is removed, have practically no frictional resistance, as shown by sinking tubes in deep well construction. They are easily driven after the material has been removed, with no great resistance. Piles built in place are very imperfectly reinforced, often not reinforced at all, which limits their carrying capacity.

Referring to the piles driven, manufactured as before stated, they were made by a machine set up at a convenient place. The reinforcing members consisted of a central tube, 2 in. in diameter, to which was fastened a steel wire fabric, 6 ft. wide and the same length as the pile, made of No. 16 steel wire, spaced every half in., securely fastened to the tube; eight square steel bars were fastened to the mesh and placed parallel to the vertical axis of the pile, equally distant apart. The diameter of these bars varies with the length of the pile. The ratio of the

diameters has been determined by previous experiment. A pile 62 ft. long requires the bar to be 1 in. in diameter. They are arranged in such a way that when wound in the convolution of the mesh they occupy positions near the circumference of the pile equally distant apart. The function of these bars is two-fold. They reinforce the pile against breakage by reason of its own weight and add to the carrying capacity as well. The fabric with bars in place is placed in the machine, over which a layer of concrete is deposited.

The concrete consists of a mixture of one part of cement, two of sand, and three of coarse gravel, evenly distributed over the wire fabric. The whole is then made into a roll by the machine and bound about every 6 in. with a No. 10 malleable steel wire and fastened, which forms a hooping the entire length of the pile. The pile is removed from the machine on a long car, transported to a convenient place, plastered on the outside and pointed, and in seventeen days it is ready for use. Being round, it can be handled with great ease, rolled down inclines, dragged by a hawser attached to one end, or suspended in the middle, dropped from a platform or flat car and rolled down an embankment, all of which has been done to test the capabilities of handling piles constructed in this way.

In construction, compression is used by heavy rollers that squeeze out all voids. The concrete becomes a dense, homogeneous mass. The finished roll, before the concrete sets, is so firm that it can be rolled around without inury. It takes twenty minutes to make a pile 35 ft. long.

This reinforcement of a pile with interlaced wire mesh, wound in convolution about a central steel tube, under compression rollers and bound about the exterior at regular intervals, produces a hooped column action throught out at a recent test made as to the load capacity of columns); and also a close connection of concrete and steel, whereby a simultaneous working of the two materials is obtained, when a load is applied.

The piles made for the foundation mentioned in Brooklyn, were rolled off skids, up an incline, to flat cars, transported to embankments 30 ft high, dropped off the cars, rolled down the embankment. When used a hawser was attached to one end, and in one case they were dragged 200 ft. over two tracks, by a winch driven by a pile driver. No cracks or defects could be discovered. They were driven by an ordinary pile driving hammer, weighing 2,500 lb. A cylindrical cap was used, containing a diaphragm. Below the diaphragm on top of the pile was a coil of old rope; above the diaphragm was 6 in. of sawdust and a wooden follower block, that received the blows of the hammer. The piles were of various lengths, from 30 to 35 ft., driven through the embankment to hard, compact gravel.

The piles driven at Greenfield Ave. station required 450 blows to drive them to hard, compact gravel, where they refused to move any further. The hammer was dropped 15 ft. and weighed 2,300 lb. A mixture of concrete of 1, 2 and 3, using gravel, seems to be far superior for pile construction than any other mixture, and is recommended particularly where water is to be encountered.

ALEXANDER CRAWFORD CHENOWETH.

Brooklyn, Dec. 7.

REINFORCED CONCRETE BEAMS.

SIR: Perhaps in this era of reinforced concrete construction, you may deem it advisable to submit the enclosed diagrams to your readers. They were devised by the writer some time ago, while designing structures for the U. S. Reclamation Service in the West, and have saved him many hours of unnecessary work. By using a slide rule in obtaining the bending moments, and then the diagrams, the depth of a beam and the necessary reinforcement can be determined in a few minutes.

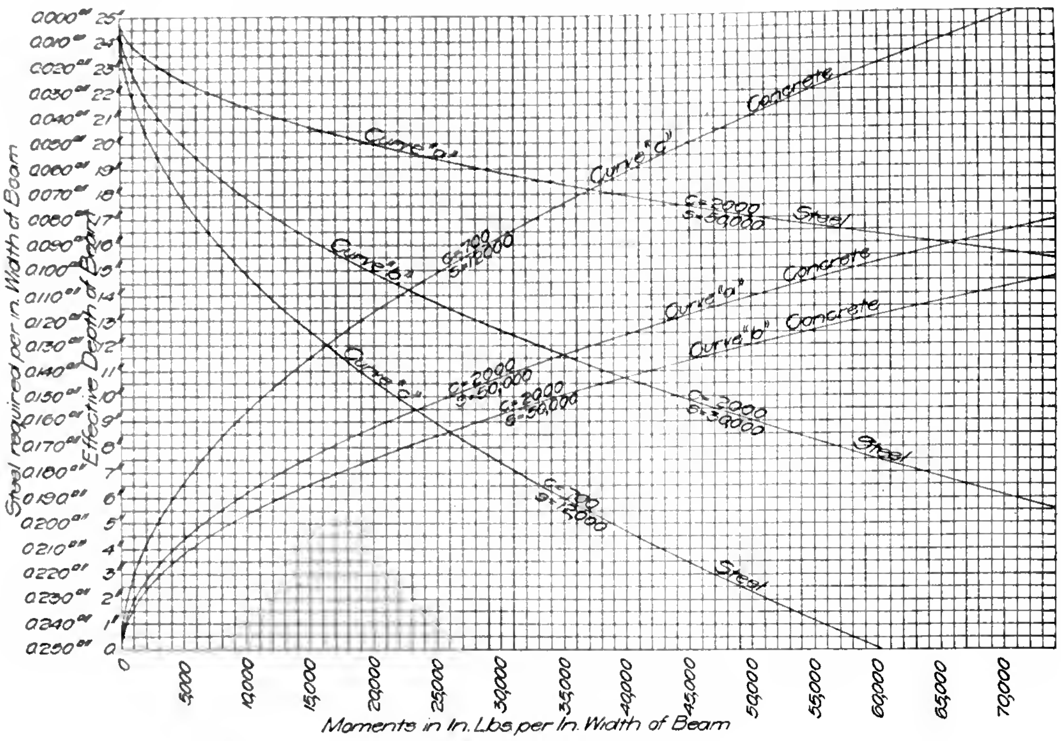


Diagram "A" for the Design of Reinforced Concrete Beams.

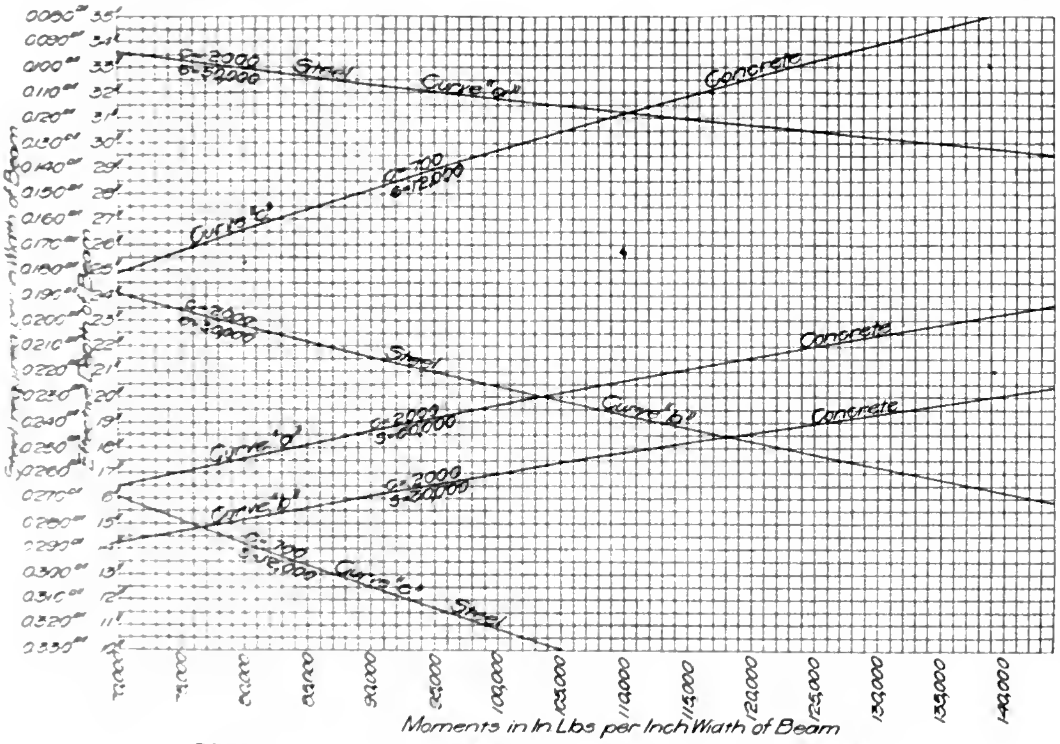


Diagram "B" for the Design of Reinforced Concrete Beams.

The bending moment in inch-pounds per inch width of beam is first obtained and multiplied by the factor of safety desired. Apply this to the bottom of the diagram, run up the vertical lines until the curve for concrete is intersected, and then run horizontally to the side of the diagram where the depth of the beam will be obtained. From 2½ to 3 in. more must be allowed for the covering of the bars. The same process followed to an intersection with the steel curve and then to the side of the diagram will give the steel required per inch width of beam.

Curves *a* are for a compressive strength in the concrete of 2,000 lb. per square inch and an elastic limit in the steel of 50,000 lb. Curves *b* are for a compressive strength in the concrete of 2,000 lb. and an elastic limit in the steel of 30,000 lb. With curve *c*, the factor of safety is already applied, or, rather, safe unit stresses of 700 lb. for concrete and 12,000 lb. for steel are used. The bending moment as found is applied directly to the bottom of the diagram. These diagrams are based on Taylor and Thompson's straight-line formula, the theory of which can be found in their book on "Concrete, Plain and Reinforced."

Very truly,

HENRY A. YOUNG.

Camaguey, Nov. 18.

PRIZES FOR TRACK SUPERVISORS to the value of $5,400 were distributed by the Pennsylvania R. R. in October for the tracks maintained in the safest and most perfect condition. The largest prize, $1,200, was for the line best maintained during the year, and the next largest, $1,000, for the division showing the greatest improvement. The remainder of the sum was divided into four $800 prizes for divisions showing especially good maintenance and improvement.

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TABLE OF LEADING ARTICLES.

Cost Estimates in Hydro-Electric Transmission.

It is doubtful if any subject related to the production and sale of power for commercial purposes deserves more careful consideration at the hands of engineers than cost estimates in hydro-electric transmission. The reasons are not far to seek. Power distribution from steam plants is on the whole more restricted than transmission from hydraulic stations; the real question is narrowed down as a rule to securing the best location with respect to the market that is consistent with a given cost of land per square foot. The market itself lies within a smaller area, with rare exceptions; and the first cost, operating expenses and success of the selected equipment in service introduce few uncertainties unless standard types of apparatus are forsaken. There are, of course, notable exceptions to the prevalence of relatively narrow markets for coal-generated power in specific stations, such as the field of service of the Boston Edison Company's main station, or the distribution area of the Union Traction Company's central plant in Indiana. But in general there is little doubt that the commercial steam plant production is associated with more readily verifiable cost data than are available for hydro-electric estimates.

In the transmission of power from hydro-electric plants the competition of coal at distant markets, scattered over many counties, perhaps; the reliability of many miles of line operated at very high voltages; the fluctuations in the water supply at the generating station, the cost of flowage rights and of land for the transmission right-of-way, all complicate the estimated expenses and profits of the enterprise. Uncertain as these factors sometimes are they must be handled with the most unsparing frankness in preparing a sound estimate, and on top of all comes the vital question of development cost. To assume that a water-power project is a synonym for financial success simply because coal is eliminated from the generating process and fewer men are required at the plant per kilowatt of capacity, is the height of rashness. Recent observation of the commercial conditions in a number of hydro-electric plants confirms the conviction that the cost of development is second in importance to no other factor in the success of a modern transmission, on the monetary side.

Haphazard assumptions that the flow of a river as observed in one or two years can be counted upon indefinitely are likely to lead to serious expenditures for auxiliary steam equipment, especially in locations unfavorable to the storage of water in reservoirs. In proportion as records of flowage are in existence—and by records are not meant the stimulated recollections of the long bearded cross-roads grocery parliament—covering many years of extreme and average conditions, so will be the accuracy of the capacity estimate. So intimately is the development cost bound up with the available flow at different seasons in relation to head and storage, that long and painstaking checking and studying of the stream's discharge is amply justified, even though it increase the engineering cost by many hundred dollars.

Failure to utilize to the utmost every favorable natural condition in the hydraulic development exacts its tax in increased fixed charges. The estimate which overlooks the possibility of storage capacity for even 24 hours' operation falls short of the work. It costs money to keep a man on duty constantly and the boilers banked at an auxiliary steam plant, and where this is the practice, it is decidedly worth while to sit down and figure every possible scheme to secure one or two days' storage, at the least. It is not enough to make an estimate of the hydraulic development based on one or two hasty trips into the watershed to be utilized, and refreshed by hearsay data as to the flowage and drainage characteristics of the locality. Provision for the growth of the plant also receives scanty consideration in some reports. The cost of labor, of materials, expense of food supplies and of transportation may be lumped in a round figure of plant cost per kilowatt of capacity, but unless the local factors in these questions are known, uncertainty is given the chance to increase the fixed charges, which are as a rule the most important sum in the total cost of water power per unit of output.

Once the hydraulic development cost and probable average and minimum power available are carefully estimated, the way clears to a discussion of the rate problem. To a large extent rate consideration must be tentative in hydro-electric estimates, for under the stress of commercial operation and developing competition the rates may be obliged to change their shape if not their substance. Failure to estimate the minimum rate which, on the average, will pay the requisite operating expenses and investment charges, including depreciation of hydraulic as well as electric structures, invites disaster. There is little doubt that the charges of not a few hydro-electric power companies are too low, in consideration of the total cost of power production. Thus, to generate current in a hydraulic plant requiring the services of a steam auxiliary constantly as a reserve and often as a supplement, to transmit it 25 miles and sell it at from 3 to 1.5 cents per horse-power-hour even to consumers of moderate motor capacity, is a doubtful policy on the score of reasonable profit, even with coal at $6.00 per ton. In the particular system in mind which does this, it would be a difficult matter to raise the rates, for the present consumers never accurately figured the cost of their steam power before it was superseded by electricity, and were accustomed to paying power costs not in a single monthly bill, but in scattered items. If the original owners of the plant had made or purchased the necessary accurate cost estimates before embarking on the enterprise, the conditions to-day would be more favorable to securing the profit which could rightfully be expected in addition to the present divided rate.

The Policy of Secrecy.

An address by Dr. James Douglas, published on Dec. 7 in these columns, sets forth with admirable breadth of view the desirability of free interchange of ideas throughout the techincal world. Time was when, in all technical processes, profound secrecy was the order of the day. Patents were in ill odor, and the measure of protection secured by them was judged inadequate, so that when a valuable process was discovered it was worked behind closed doors so long as practicable and employees were muzzled as effectively as possible. The obvious difficulty of keeping many trade secrets against acute detective work and bribery has done more than anything else to check the practice, and while trade secrets still persist they are generally now of relatively minor moment, the really important advances being made the subject of patents.

Were the patent law more perfect and comprehensive, secrets would practically disappear and technical workers all the world over would live in a freer atmosphere. But the fact is that under the present rules of patent practice there are some things which are very difficult to protect adequately and others which can hardly be protected at all. One of the curious results of this is the not very infrequent use of a singular combination of patents and secrecy, a very generalized process being patented, *in terrorem* as it were, while the real process hidden behind it is practically a trade secret. In theory a patent must fully disclose to one skilled in the art the subject matter involved, so that the process could be actually worked or the apparatus successfully built on the basis of the published patent. As a matter of fact, and in the face of existing decisions, the nature of a technical disclosure is somewhat hazy and many patents are granted in which the disclosure is so incomplete that the real invention as practiced in very difficult to dig out of its environment. For example, if one looks up the patents on smokeless powder some very extraordinary misinformation can be se-

cured. Some of them are clear enough, but in others the list of alleged components and proportions is so vague that no one except the putative inventor could go ahead and make the supposed compound without a research quite equivalent to an independent invention. Some dye-stuff patents are almost equally bad, and it is reported that in the well-known case of the chemical final exhaustion of incandescent lamps one of the important defenses is incompleteness of disclosure. It is commonly said, too, that the data in some patents on photographic lenses are such as to require entirely independent redesign in order to produce anything of value.

In other cases, while the process of a patent may be technically fully disclosed, details necessary to commercial success are suppressed. All told, the number of commercial processes thus worked by practical secrecy although nominally patented, is very considerable. There are, besides, a good many instances of secret processes which, so far as anybody knows, are quite unpatented. Some few remain in the steel industry, in various metallurgical works, in the manufacture of special kinds of glass, and elsewhere. There is little doubt that in some cases secret details are important and valuable, and that the present patent system would not adequately protect them. Patents upon process are singularly hard to get in satisfactory shape, owing to various quantitative relations. In metallurgy, for instance, a particular reaction may give first-class yield only with particular proportions of ingredients or under peculiar temperature conditions. Infringement would be almost impossible to prove, even if the detail necessary to practical success could be patented, which is often difficult or impossible. The courts now distinctly recognize property in trade secrets and are disposed to protect it from theft or from improper use, as explained in previous issues of this journal.

Granting, then, that there may be wisdom in the preservation of trade secrets, one must admit that few technical manipulations really rise to that dignity. In most cases, the few little "wrinkles" held in a factory could be with great advantage swapped for others held somewhere else. It is one of the excellent functions of technical organizations to serve as a sort of clearing house for just these things. On the whole, and in the long run, a dog-in-the-manger policy does not pay either individuals or corporations. The engineer who freely and cheerfully gives helpful casual information on technical subjects to his colleagues makes more friends and gets more business than the solemn-faced chap who looks wise and hints grimly at important secrets when asked to lend a hand.

Of course an engineer, while developing a new apparatus or method, must in self-protection keep much to himself, lest some one with larger resources take the cue and push ahead of him. And yet stolen inventions are rare outside of novels—at least in the sense of inventions purloined prior to completion and developed for the benefit of the thief. There was a case of this sort a couple of years ago in which the inventor's mechanician queered an experiment and afterwards worked it out with some wicked partners and then sued the original inventor on the resulting patent. But the court arose and smote the offenders, and one can say generally that such larceny has very seldom been successful. In fact more inventors have suffered from failing to make disclosures of their work to their friends than have ever found disclosures misused. It is well, therefore, to take the optimistic view of human nature and to realize that one rarely meets a confrere who has nothing to give or is unwilling to impart what he has. One reason for the rapid progress of the arts and sciences in the last century was the growth of technical organizations and literature and the spread of a certain feeling of brotherhood among technical men.

At the present time there is more free and kindly interchange of information than ever before, and one has a right to expect still greater results in science and the arts. The technical papers read before various societies and the following discussions are rich in facts that a generation ago would have been jealously guarded, by which policy progress, which after all makes for general success, would have been checked. One kind of information, to venture a suggestion of improvement, ought, however, to be more freely given than is usual—and that is the results of failures. It takes a rather big man to own up to the futile things which he has attempted and yet such confession should be received with honor, for it is sometimes more valuable than the record of a success. Not only technologists but devotees of pure science are sometimes guilty of keeping very quiet about their failures. The result is a large amount of valuable human energy wasted in useless repetition of wearisome work. The best policy to-day is the broad-minded interchange of information, unless there are genuine and necessary trade secrets to be guarded, and these will steadily grow fewer.

Tests of Riveted Joints.

With the present requirements of large members for nearly every line of steel construction, it becomes of the utmost importance to reinvestigate the fundamental principles governing such construction before they are applied to members of much greater dimensions. The results obtained in the past by loading comparatively small members to failure, although in some cases few in number, have formed in reality the entire empirical basis of structural design. They have been of the highest value and, in general, it may be considered both rational and safe to reason from the tests of small members to the design of the largest now required, but that is not by any means the whole subject, even if the apprehensions created by the Quebec bridge failure be disregarded. The Engineering Record has already commented editorially upon the need of tests of the largest steel compression members which can be broken in any testing machine now existing, and all observations of that character applicable to compression members bear no less forcibly on riveted joints.

On the whole, a good many riveted joints which may be considered full-size have been tested to destruction, the most of such investigation having been done at the Watertown arsenal. This work, however, was performed a dozen or fifteen years ago before riveted joints had assumed anything like the magnitude in structural work which they now attain. A reference to the records of these and other similar tests will show at a glance the pressing need of an extension of that class of experimental work to joints of more nearly the proportions constantly employed in structural design of the present day. The plates then used were, in the main, much thinner than those now required, and the prevailing diameter of rivets now employed is seldom found in the older tests. Any one who has had occasion to test plates and shapes of light section will be impressed by the need of tests of joints built of much heavier plates than those of the old investigations and with the further need of using not only larger rivets to correspond with those now generally used in heavy work, but also greater numbers in the joints to be investigated. With joints of one or two rows of rivets, whether that joint be butt, lap or any other type, the distribution of the shearing stresses on the rivets or the tensile stresses in the net sections of the plates must be at least approximately uniform, eliminating any strong probability that the maximum intensity of either kind will be substantially different from the mean. That condition no longer holds, however, with three or four or more rows of rivets, which may easily be required in a structural tension joint, to say nothing of the excessive grouping of rivets found in compression joints, and allowing for the fact that the latter are usually supposedly of such a character as to permit the machined ends of plates and shapes to abut. Finally, the thicker plates produce a proportionately greater bending of the rivets. This latter is a most important consideration, for its influence in reducing the ultimate resistance of the joint is too complicated to permit its value to be computed with any sensible degree of accuracy.

The thinner plates not only leave the rolls at a sensibly lower temperature than thick plates, but they also generally have more work put upon them between the ingot and the final pass between the rolls, both of these effects tending to increase greatly the elastic limit and to some extent the ultimate resistance. A similar general observation, although of less force, may be applied to the smaller rivet in comparison with the larger. These and other material considerations go to show conclusively that while the values determined by the older tests of joints may not be, and probably are not, dangerously in error when applied to the heaviest connections now in use, there is sufficient reason to believe that either new values should be determined or the older confirmed by sufficient range of experimental work to include the full-size types now generally employed.

Public interest, at least that portion of it with industrial or technical affiliations, has been much stimulated during the past year or two by agitations designed to secure federal appropriations or funds from other quarters to be expended in full-size tests of structural members. No work of this character can be considered satisfactorily comprehensive without including the breaking of full-size riveted joints with such complete records of attendant phenomena as to solve all questions relating to the intensities and distribution of the tensile, shearing and bearing stresses developed in the various elements of the joints.

It is of special importance, among other things, to determine the effect of such unbalanced riveted connections as that of a group of rivets through the long leg of an unequal legged angle both with and without connecting lugs, and what may be taken as the real net section in such cases and others where the group of joint rivets is symmetrical about the centre line of the member, but with the outer rows of rivets diminishing in number nearly or quite to a point. In the case of the tension flange angles of a plate girder, when the rivets are staggered so as to make the net section the greatest practicable, no designer can be certain as to the value of that net section. Practice is by no means uniform in regard to these various questions of design of riveted connections, although they are of great importance as constituting the main features of the particular constructions in question. It is not possible to solve these questions of unsymmetrical arrangements of rivets or of real net sections except by full-size tests with the dimensions corresponding closely to those of actual work.

As already indicated, the apparent shear of rivets in joints, as determined by test would naturally be expected to be sensibly different from the ultimate shearing stress as determined for pure shear. The rivet has been upset to fill its hole in the process of heading, but, what is of more consequence, it is usually subjected to much bending unless the plate is thin. There are at

the present time not enough data to determine what may properly be taken as the working shear, with accuracy, in this branch of structural design. It is known well enough that when the rivet is subjected to heavy bending, its resistance to apparent shear is materially less than when such bending is absent, but a suitable allowance for thick plates has not yet been determined. Nor again can any engineer be confident of the value of rivets which bind three or four or more cover plates to the flange angles of a plate girder, supposing that the rivets fully fill their holes. Although riveted joints are constantly designed as if every element of any given case were completely known, few parts of a steel structure are in greater need of thorough experimental investigation.

Notes and Comments.

PASSENGER RATES between Pittsburg and Cincinnati on the boats of the Pittsburg & Cincinnati Packet Co. have been reduced to one cent a mile as a result of the two-cent fare on railroads required by recent legislation in Pennsylvania, Ohio and West Virginia. The loss of passenger business by the boats since the railroads reduced their fare was stated to be the cause of this cut in the rates. This does not look as if steamboats had such a tremendous influence as competitors of railways for passenger business as some inland navigation enthusiasts would have us believe.

THE CONNECTICUT RIVER BRIDGE at Hartford has been put in service, although it will not be formally dedicated until next spring. The design and construction of this imposing structure have been fully described in a number of articles in this journal, and it is therefore necessary to mention here only that it ranks among the finest masonry bridges of the world, which is only natural in view of the fact that Messrs. Alfred Boller and E. M. Wheelwright co-operated as consulting engineer and architect respectively in its design and Mr. Edwin D. Graves put so much of his ability and energy into his work as chief engineer that his health gave way under the strain about a year ago. The bridge has nine spans of lengths varying from 68 to 119 ft., its total length being 1,192½ ft. It is constructed of granite, and the simple grace of the spans and the strength of the piers make it a masonry structure well deserving a visit from those interested in bridge building.

THE ENGINEERS' CLUB of Philadelphia has recently shown good proof of its strong position by the purchase of a handsome house on Spruce St., which will be fitted up for a clubhouse. It is a four-story building, occupying a 25x170-ft. lot. Alterations will be made in it so that the second floor can be used as an assembly room for general meetings, and the first floor will have dining, smoking and meeting rooms. There will be a billiard room and other conveniences of a social nature in the building, and it is expected that with the greatly improved facilities the social side of the club will take an added importance. Attention is particularly called to this new home of the engineers of Philadelphia because it is an excellent example of what this journal considers the best thing for the engineering profession in any city. Engineering has so many branches, and those following them so rarely come together in a business way, that a club of this sort, combining both social and professional features, is highly desirable in any city large enough to have many engineers. What is wanted at the present time more than anything else in engineering circles is some centripetal tendency which will draw together all those who are engaged in designing or constructing works and machinery in any district. Until engineers get together socially and learn to know and respect each other personally there will be lacking that bond of good fellowship which has enabled physicians and lawyers to act unitedly whenever their interests required it. The Engineers' Club of Philadelphia is doing just this kind of good work, and its success should lead local engineering organizations elsewhere to strengthen their position in the same manner.

THE LIGHT MOTOR exhibited at the Paris Automobile Salon by M. Robert Esnault-Pelterie is interesting as bringing a little closer the practicability of aerial navigation. Few people realize that the distance between impossibility and possibility is almost reached, and that the engineer is the one who has the task of reaching and passing it. The successful construction of powerful motors of light weight, which has made the automobile a standard product, is an indication of what may be expected when more time and study have been spent on motors for aviation. The motor referred to weighs 2.86 lb. per horsepower, but its accessories and the propellor bring the total weight up to about 5.5 lb., and it is considered by some engineers who have looked into the subject that the greatest promise of successful reduction in weight is offered by a redesign of accessories and possibly by the use of some other source of power than gasoline. It is difficult to see how much more weight can be eliminated from the Esmault-Pelterie motor.

SOCIETY AFFAIRS are managed in some respects differently in Great Britain from the way they are here, as is evident from an announcement in the "Architect," of Dec. 6. It is given here in all its simplicity: "The Council of the Royal Institute of British Architects are prepared to receive applications for the appointment of secretary. Applicants, who need not necessarily be architects, should possess some literary capacity, a thorough knowledge of French and a working acquaintance with other languages. Age not less than about thirty or more than about forty-five years. The secretary will be required to devote his whole time to his official duties. Salary £500 per annum. Any canvassing will disqualify. Particulars may be obtained by writing to the Honorary Secretary, 9 Conduit St., W., not later than the 21st inst., and applications must be received by Dec. 31." It is worth while considering whether such a method of filling a vacant secretaryship of a great national professional organization may not have advantages when American societies have to appoint such officers, provided the constitutional requirements permit the procedure.

CENTRAL PARK, New York, is one of the city's most precious possessions. Visited during most of the days of the week it seems given over to wealthy drivers, riders and motorists, but on Saturday afternoon and Sunday it amply repays all the money spent on it. Children who otherwise would never know of birds and flowers, tired and worn men and women whose conditions of life have little enough sunshine and happiness to offset stern struggles, young people who see nothing attractive in Coney Island dance halls and the back rooms of saloons, fill the Park on such days. In the summer, particularly, this great open space for the people is a self-evident blessing to the city. It is therefore surprising that the municipal fathers pay no attention to the fact that the Park is wearing out. Five years ago, Mr. Samuel Parsons, who is the technical director of the Park Board's work, gave notice that the vegetation was dying out, but he was merely ridiculed then. Now anybody who knows about such things can see this for himself. Many of the trees and shrubs are past maturity and should be replaced. The thin layer of soil on the rocky bed of much of the Park needs mould and fertilizer, and a great amount of sodding must be done. The drives should be reconstructed and, as a matter of public health as well as public pleasure, the drainage of the land must be remodeled. These and other things will require about two and a half million dollars. It is a large sum, but it can be furnished in installments during a period of five years. It must be furnished before long or this chief pride of the city will deteriorate rapidly, and a place that has meant health as well as happiness to thousands of people of little means will lose much of its charm.

THE SETTING OF CEMENT has been discussed a great many times but it is safe to say that very rarely has a paper on the subject contained so much material for careful consideration as that by Messrs. Henry S. Spackman and Robert W. Lesley, printed in this issue. Mr. Lesley is not only a pioneer manufacturer of Portland cement in this country but he is also a student of the technology of the industry with which he is prominently identified. He is a firm believer in the obligation a successful manufacturer owes to the welfare of his industry, a belief that led him to endow the Lesley cement laboratory of the University of Pennsylvania. It has further led him to plan investigations into various aspects of cement and concrete that are still matters of dispute, and, with the co-operation of the Spackman Engineering Co., to carry on some most interesting research work, begun several years ago. The first fruits of this work was a paper on ancient Roman mortars read before the Association of American Portland Cement Manufacturers some time ago, and the second result is the paper printed on page 691. More studies are being made, and the results of all this work will form one of the most important contributions to our knowledge of structural materials ever made by an American manufacturer.

THE GRADE CROSSING PROBLEM was discussed very plainly by President Ralph Peters of the Long Island R. R. recently. He pointed out that notwithstanding the efforts of railroad companies to reduce the number of such crossings and the laws in many States providing for a joint expenditure of railroad and public funds for their elimination, there is a constant and persistent demand in every community for constructing more of them. The development of land schemes, of additions to towns and cities, the natural growth of communities in sections adjacent to railroads, have created new lines of travel and resulted in opening new streets and establishing new grade crossings. These crossings, when rightfully opposed by railroad companies, have been the cause of prejudice against corporations endeavoring to protect public interests as well as their own. The railroad is not so much responsible for the grade crossings as the public, for railroad managers are more than anxious to prevent more of them and to eliminate those in existence. They are ready to join in doing away with them, but feel that the work must be done with the co-operation of the communities and, in many cases, at joint expense. Mr. Peters urges that until all grade crossings have been eliminated, the public should not forget its joint responsibility for their existence and should use such crossings with great care. This opinion of the head of the Long Island R. R. is substantially that expressed in the laws of Massachusetts, the State where the respective rights of the public and of public-service corporations have received the most thorough study and the most equitable legislative treatment.

Appearance of Bridge on June 15th of this Year.

THE ERECTION OF THE ANCHOR ARMS OF THE BLACKWELL'S ISLAND BRIDGE.

The 630-ft. island span and the adjacent 591-ft. and 492-ft. cantilever arms of the 1,182-ft. west channel span and the 984-ft. east channel span have now been virtually completed, making a continuous structure 1,713 ft. long. This portion of the bridge has a total weight of about 48,700,000 lb. and is 135 ft. high above low water and about 320 ft. high to the tops of the main bents. Riveting, the construction of the upper floor, and other minor operations are now in progress on the cantilever arms, but the main travelers and steel falsework have been removed and are now in service for the erection of the anchor arms, 469½ ft. and 459 ft. long, on the Manhattan and Queens shores respectively.

Underneath each anchor arm a large storage yard has been enclosed by a high fence and in it a full length 85-ft. gauge track has been laid on which there is one of the two 65-ton gantries originally provided for the Blackwell's Island storage yard. Timber docks have been built near the piers at the water's edge, on both sides of the river, and equipped with 65-ton steel derricks with which the riveted members are unloaded from car floats and transferred on service tracks to the gantries, which pile and store them and finally deliver them to other service cars carrying them under the anchor arms within reach of the erection travelers, as they are needed. Shipments were commenced in January last, and since then about 11,000 tons of steel have been received at the Manhattan end and about 7,000 tons of it have been erected there. At the Queens end, about 8,000 tons of steel have been received since March, and about 4,700 tons were erected up to Oct 1. The construction of steel falsework for the Manhattan anchor arm was commenced in March, and erection was commenced in June and has since been carried on with a force of 75 to 150 men. For the Queens anchor arm the erection of falsework was commenced in April and of steel in July, and about 1,700 tons of steel were erected up to Oct. 1, with a corresponding number of men. The total weight of steel erected on Oct. 1 was about 68,000,000 lb.

The erection of the Manhattan anchor arm was commenced by a stiff leg wooden derrick with a 50-ft. 10-ton boom seated on top of pier 1, which built up the first two steel falsework towers and assembled on top of them the falsework traveler. This has a 33x57-ft. platform built up of stringers and floor-beams borrowed from the permanent structure, and carries one of the standard steel derricks with a 75-ft. boom of 65 tons capacity.

After several panels of the steel falsework had been erected and the falsework traveler advanced some distance beyond pier 1, the wooden derrick there commenced the erection of the No. 1 derrick used to assemble the permanent trusses. This traveler is of very simple construction, with a steel girder platform carrying two stiff-leg steel derricks with their masts braced together horizontally and diagonally, and having 65-ton booms, 85 ft. long. The traveler is operated by two special Lidgerwood engines and weighs about 300 tons with its rigging.

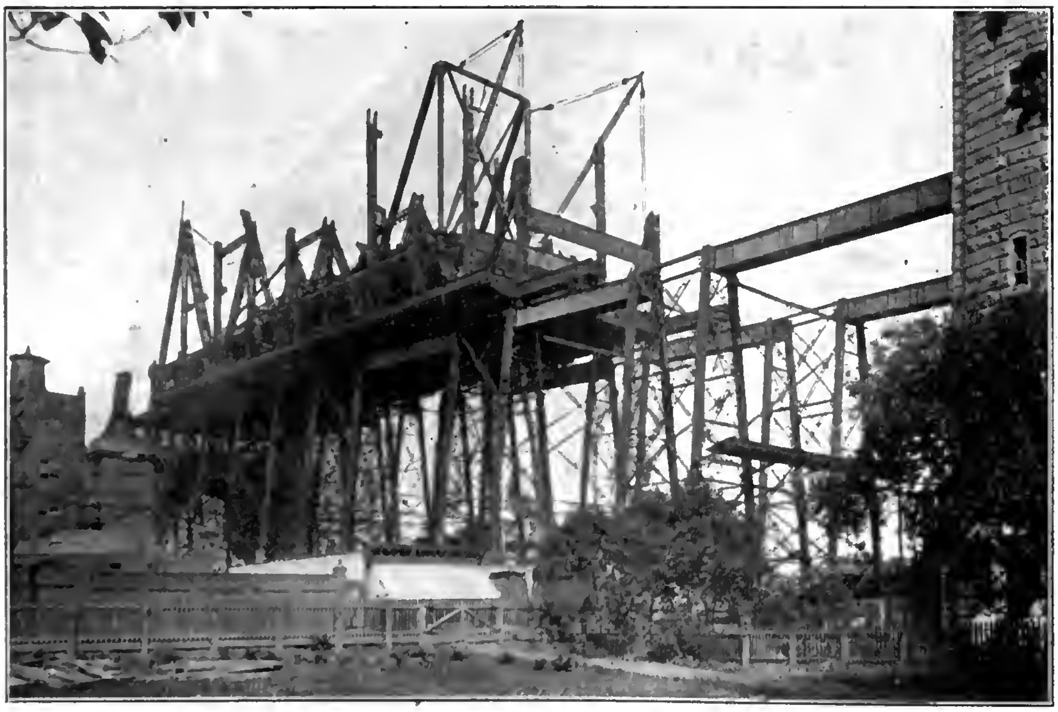
On the Queens anchor arm, traveler No. 1 has already progressed from pier No. 1 almost to the anchor pier, and has nearly completed the erection of the span up to the middle of the truss. On the Manhattan anchor arm, traveler No. 1 has now reached the anchor pier and completed the erection of the lower half of the truss, and the erection of the upper half has been commenced by traveler No. 2. This traveler has a Z-shaped side elevation and consists of a 36x40-ft. steel tower 124 ft. high, with an extended base and 63-ft. top overhang on the forward side to provide for the erection of panels of the truss in advance of the traveler for the cantilever arm. Although this function of the traveler is not necessary for the anchor arm erection, the large number of tackles are still suspended from it and it is equally serviceable in building the upper part of these trusses. This traveler, like No. 1, is operated by two special steam hoisting engines and, with its rigging and other equipment, weighs about 550 tons and requires a force of 60 men for its operation. No. 2 traveler is not yet entirely completed for the Queens anchor arm, but has been finished and in service for some time on the Manhattan arm, where its operations were at first supplemented by traveler No. 1, which for a time worked simultaneously with it erecting the upper parts of the trusses in the panels next the anchor pier as the traveler returned from that point toward the river.

The removal of the No. 2 travelers from the cantilever arms over the main channels was a work of some difficulty and was accomplished by means of the stiff-leg derricks seated on top of the travelers for use in erection operations and by a derrick and special falsework tower alongside. The first mentioned derrick was used for the removal of the overhang and part of the upper portion of the traveler. The remainder of the traveler was handled by a 10-ton 50-ft. derrick on top of a 29½x57-ft tower, 24 ft. high, seated adjacent to the traveler on the top lateral struts of the bridge. The tower was made with two transverse X-braced panels and a center post to carry the foot of the mast, which was supported on a small auxiliary tower, with bearing on the upper deck of the bridge.

Derrick No. 2 was re-erected on the Manhattan anchor arm, with a 13x18-ft. wooden tower, 70 ft. high, set at panel point 15. This tower was simply used as a support for the mast of the wooden stiff-leg derrick, with a 70-ft. boom of 10 tons capacity. The feet of the stiff-legs were anchored to the permanent trusses at panel point 16.

The booms for the large steel derricks were originally 75 ft. long, with a capacity of 65 tons. Since the completion of the island span and river cantilever arms they have been extended to a length of 85 ft. and reinforced to handle 75 tons. The rectangular cross section is now made up of two built channels, each with a 29x½-in. web plate and two 6x4-in. flange angles, latticed and connected by diaphragms 7½ ft. apart on centers. The links for connection with the topping lift tackle are six 6x¾-in. eye-bars 6 ft. 4 in. long, two of the center ones being bent to secure the proper spacing on the 3 and 5 in. pins. The bars are fixed in their relative positions with tie bolts and gas pipe separators. Similar links are provided for the hoisting tackle.

The plans and operations for the erection of the anchor arms correspond almost exactly with those for the island span and the cantilever arms,



Erection of Lower Part of Queens Anchor Arm with No. 1 Traveler.

described in previous issues of this journal. All of the principal web members of the trusses are erected in halves, spliced near the center of the height of the truss, the heaviest member being the 80-ton semi-diagonal nearest the main pier. As fast as the truss members are put in position temporary connections are made by inserting wooden pins 1 or 2 in. smaller in diameter than the holes, and later following them with the permanent pins preceded by ordinary sectional pilot nuts. The eye-bar members are assembled in complete panel groups in the storage yard, where they are accurately spaced and strongly clamped with steel and wooden yokes, after which they are handled like compression members as single units, the largest containing twenty separate bars and weighing about 65 tons. All truss pins are driven with an ordinary steel ram weighing about 2 tons. This has proved thoroughly efficient, so that it has not been necessary to use the hydro-pneumatic ram provided for this purpose. The 185-ft. vertical bents on piers 2 and 3, which weigh about 1,200,000 lb. each and were erected 8 in. out of plumb at the top, so as to provide for the reverse camber in the island spans, have gradually approached their final positions and are now exactly vertical and correspond to their calculated dimensions and locations.

Erection of Upper Part of Queens Anchor Arm with No. 2 Traveler,

There are in all about 752,000 field-driven rivets in the bridge, of which 125,300 are 1 in. in diameter, 426,850 are 7/8 in. and 199,860 are 3/4 in. Of these about 37,500 in the island span and adjacent cantilever arms are all driven. Field riveting on the Manhattan anchor arm is in progress in most of the vertical bents and includes pracically all of the rivets which can be driven without interfering with the possible adjustment of the members to take their share of the final stresses. All chord splices in the anchor arms are left entirely undriven, and no rivets are driven in the stringers at the main panel points. One end of each truss diagonal is left unriveted, and one end of each lateral diagonal or sway-brace member is also left unriveted.

On the island cantilevers a very large number of rivets in the bottom lateral system, floorbeams, stringers and lower chord splices were driven from a movable platform suspended underneath the lower deck of the bridge, which greatly facilitated the work and diminished the danger. The platform is 98 ft. long, transverse to the bridge axis and 26 ft. wide, and has a solid wooden floor protected by a hand rail and supported on a pair of wooden lattice girders 9 ft. deep and 98 ft. long. Long steel connection plates secured to the top chords of the girders are provided with a number of bolt holes to receive the lower ends of the suspenders. The latter are stiff vertical members made of angles and having hooked upper ends engaging the bulb angles which serve as guards on the outer flanges of two of the track stringers.

The platform was originally designed to have roller bearings on these angles, but after construction it was found easy to move it forward without the rollers, simply sliding on the angles by means of two small tackles anchored in advance and operated by hand. The roller bearings were therefore dispensed with, and the platform is rapidly moved back and forth by the men on it. Double sets of suspenders are provided, and when one set interferes with the floorbeams the other set is connected to the platform on the opposite side of the floorbeams, and afterwards the rear set is removed and the platform advanced. This arrangement saves time and expense otherwise necessary for placing numerous small riveting scaffolds and affords much greater convenience and safety for the riveters and painters.

On the lower deck of each of the anchor arm spans there is a small building, which contains an Ingersoll-Rand compressor of a capacity of 200 cu. ft. of free air per minute, driven by a Westinghouse 50-h.-p. electric motor. A special feature of the arrangement is the application to the motor of a pneumatic controller connected with the air in the receiver and adjusted to shut off the current in the motor when the pressure reaches 105 lb. per square inch and to turn it on when the pressure falls to 95 lb. The governor is of the standard type made by the Cutler-Hammer Manufacturing Co. The cooling water from the compressor is circulated through a Koven atmospheric cooler, where it falls in a thin sheet successively over a large number of horizontal steel discs arranged in a verical line, so as to cause a number of cascades. About thirty-two gangs of riveters are kept constantly at work, and the fitting-up for them is accomplished by four Philadelphia pneumatic reamers, which are also able to drill all the new holes required and frequently drill out bolts, rivets or drift pins that have to be removed. Compressed air at about 100 lb. is distributed parallel to the axis of the bridge through a screwed steel pipe 3 in. in diameter at the receiver, which gradually reduces and is provided with numerous valved outlets at convenient intervals.

There are about thirty pneumatic hammers used for general riveting, but for the rivets in the web splices of the bottom chords special pneumatic machines have been provided. These are designed to work in the 15-in. space between the webs, which could hardly be reached by ordinary methods. One machine has an X-shape framework, with two curved arms about 10 ft. long, intersecting on a common pivot like a pair of shear blades. The extremity of one long arm carries a pneumatic hammer, opposed to which is a holding-on die attached to the extremity of the other long arm. A pneumatic cylinder is placed at the opposite end of the machine, between the extremities of the short arms, to both of which it is connected. The long arms are set on opposite sides of the webs in which rivets are to be driven. The die is placed in engagement with the rivet head, and the pneumatic cylinder operated to separate the short arms and correspondingly converge the long arms, bringing the pneumatic hammer down close on the point of the rivet which is being held by the cap. The hammer is put in operation in the ordinary way and drives the rivets. Four of these machines are in service and are doing excellent work, having a capacity from 200 to 400 1-in. rivets daily.

Two other special riveting machines are so small and compact that they can be placed entirely within the chord in the 15-in. space between its webs. The cast-iron housing contains three horizontal pneumatic cylinders, transverse to the bridge axis. The center one, 4 in. in diameter, operates an ordinary pneumatic riveting hammer at one end of the machine, while the other two, 2 in. in diameter, operate cylinders at the opposite end on both sides of the machine, which, when pressure is admitted, are forced against one web of the chord and push the machine and pneumatic hammer against the opposite web, where the hammer engages the rivet to be driven. The latter is maintained in position by an ordinary pneumatic holder-on outside of the chords. This machine drives about the same number of rivets as the one previously mentioned, and both of them require four men to operate them. The rivets driven by them are 1 in. in diameter and about 6 in. grip. The painters follow the riveters and use the same suspended platforms.

The bridge was designed and its construction was executed under the direction of the Department of Bridges, of which Mr. J. W. Stevenson is now commissioner; Mr. C. M. Ingersoll, Jr., chief engineer; Messrs. O. F. Nichols and Albert Lord Bowman, consulting engineers; Mr. J. D. Wilkins, assistant engineer in charge of design, and Mr. J. B. Knighton, resident engineer. The Pennsylvania Steel Co. is the contractor for the fabrication and erection of the steel work.

AN ELECTRIC RAILWAY of considerable technical interest is operated by the Indianapolis & Louisville Traction Co. between Seymour and Sellersburg, Ind., a distance of 41 miles. The power-house is located at about the center of the route and direct current is transmitted from it at 1,200 volts, measured at the station between the single OOOO grooved trolley wire and the rails. There is an entire absence of high-tension feeder wiring and sub-stations. The station has two 26x48-in. Allis-Chalmers engines operating non-condensing at 120 r. p. m. These drive in pairs four 300-kw., 600-volt General Electric generators with their armatures mounted commutator to commutator on the engine shaft.

Retaining Walls on the Delaware, Lackawanna & Western R. R. at Buffalo.

The Delaware, Lackawanna & Western R. R. has just completed the reinforced concrete retaining walls for its track elevation work in the southeastern part of Buffalo, N. Y. Two general types of walls have been used, one for the sections below 12 ft. in height, and the other for sections from 12 to 24 ft., the last height being that of the maximum section. A buttressed wall is used for the higher sections, but because the saving effected by this type would not offset the extra cost of forming for the buttresses a plain L-section without buttresses was adopted for walls under 12 ft. in height. The forms for the latter are no more expensive than would be required for a plain concrete wall, while the saving of the L-section in concrete is evidently quite a material one. A wall with a toe projecting beyond the front face and under the sidewalk was first contemplated but objections by the authorities of the city of Buffalo prevented the adoption of such a design.

The tracks were placed near retaining walls only where the buttressed section was used, the distance from the center of the track to the back of the wall in no case being less than 7 ft. 6 in. No tracks whatever were close to the section without buttresses, the retained fill having a long slope up to the roadbed level. The earth pressure against the walls, which are 2 ft. thick, was figured according to the formulas in Church's Mechanics, the weight of earth being taken at 100 lb. per cubic foot. The weight of concrete was taken as 150 lb. The pressures due to the moving loads on the tracks were figured for Cooper's E 50 loading. The width of the base for the buttressed type was taken as half the height of the wall above the top of the base plus 2 ft., and for the L-section as half the distance from the top of the base to a point where a vertical line through the inner edge of the base intersects the slope line, the slope being 1½:1. The base is 2 ft. 6 in. thick. The stresses in the steel were kept under 16,000 lb. per square inch and in the concrete under 500 lb.

The reinforcement of the buttressed section consists of both horizontal and vertical bars near the face of the wall, horizontal bars in the base and inclined bars in the buttresses, square mild steel being used in all cases. Those laid horizontally in the face of the wall are ⅝-in. material spaced on different centers, farther apart at the top and closer at the bottom, to take care of the increasing pressures toward the bottom of the wall. The vertical bars in the front face are of ½-in. material spaced throughout on 2-ft. centers. In the back face five ½-in. bars have been placed on 18-in. centers. Tie rods run from the wall into each buttress, two of them being looped over every third of the horizontal face bars. They are 6 ft. long and ½ in. square. The heaviest bars used on the work, 1¼ in. square, are used for the diagonals in the buttresses. There are eight of these, but only four run the entire distance from the top of the wall to the outer end of the base, the others starting at intermediate points. At the bottom of the buttresses, four of the diagonal bars are bent back toward the wall and are embedded near the under side of the base. Running longitudinally in the top of the latter are 1-in. square bars, in the outer half of the footings. The rods in the face do not come closer than 2½ in. to the surface of the concrete, and those in the buttresses and in the base not closer than 3½ in.

In order to preserve the proper spacing for the horizontal bars in the face a 2 x 2 x 3-16-in. angle is placed in the face at each buttress, holes being punched in one leg to hold the bars in their proper positions. They are left in place and form part of the permanent reinforcement of the wall. The horizontal bars are on 18-in. centers for the first 6 ft. down from the top, on 12-in. centers for the next 6 ft., on 9-in. centers for the next 5 ft. 3 in., and on 6-in. centers for the remainder of the distance to the bottom of the wall.

The reinforcement for the sections below 24 ft. and above 12 ft. in height is substantially the same for all sections, except that the base would be moved upward cutting off the lower part of the reinforcement shown in the diagram, so that from the top down for any given distance the steel will be the same in walls of all heights.

The buttresses are 2 ft. wide and 12 ft. 6 in. on centers. In the original design it was intended to place an expansion joint every 25 ft., or on the center line of every second buttress. When construction was started, however, it was found that the wall could be more economically placed in 50-ft. than in 25-ft. sections and it was therefore decided to place the expansion joints every 50 ft., so that the day's work could be made to terminate at an expansion joint.

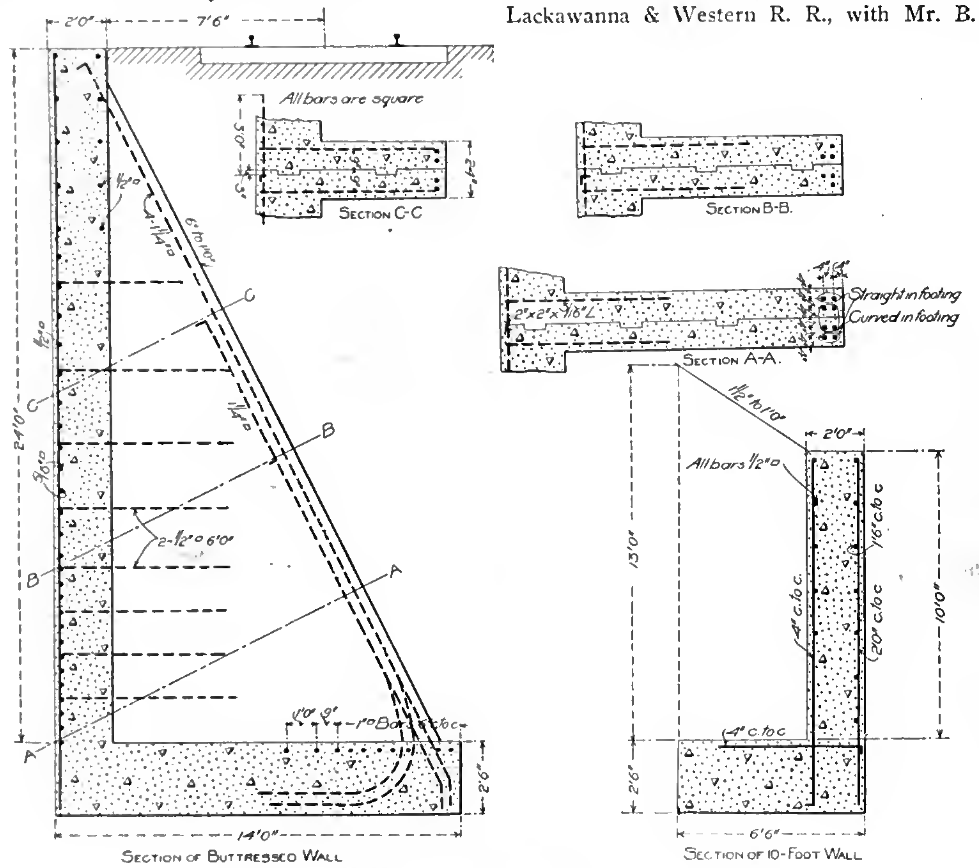
All of the horizontal bars are 28 ft. long, while the others, necessarily, are cut to shorter lengths in accordance with their positions. The concrete was a 1:3:6 mixture made with gravel.

For the lower walls without buttresses the reinforcement is similar to that of the 10-ft. wall in the diagram. For this particular height it consists of ½-in. square bars in the base and in both faces of the wall. The vertical bars in the front face are on 2-ft. centers, and the horizontal bars on 18-in. centers, while in the back face the vertical bars are on 4-in. centers and the horizontal ones on 18-in. centers. The bars in the base are placed horizontally on 4-in. centers and run from the front of the wall back into the footing.

An accompanying photograph shows clearly the placing of part of the reinforcement before the concrete was cast. As will be noted, great care was exercised in holding the steel in its proper place. A board notched on both sides with the proper spacing for the diagonal bars was used to prevent the displacement of the steel. Similar notched boards were placed in the base to hold the bars in proper position, and at the upper ends of the diagonal bars in the buttresses. For the latter purpose the notched piece was nailed to a bracket attached to the front form for the wall. The vertical and horizontal bars, in addition to these precautions, were wired at intersections so as to insure against displacement. The concrete was placed very wet and on this account long ½-in. rods threaded at both ends were used to tie the forms together.

The walls are now completed and although on account of the soft nature of the ground along the right of way, all of them rest upon piles, no cracks have occurred. Of the maximum section, 24 ft. high, there is a total length of 1,700 ft., and of this length 1,000 ft. are in one continuous wall.

The wall was designed under the direction of Mr. L. Bush, chief engineer of the Delaware, Lackawanna & Western R. R., with Mr. B. H. Davis in immediate charge of the work. The field construction was in charge of Mr. R. M. White, resident engineer.



Reinforcement in Buttressed and L-Sections.

COMPETITIVE DESIGNS for the proposed municipal office building for Greater New York have been invited by the city from thirteen architectural firms. The building, which is to cost about $8,000,000, is to stand near the Manhattan end of the Brooklyn Bridge and its lower floors will be used as the Bridge terminal for surface, subway loop and elevated trains. The floor space for offices, exclusive of halls, shafts and courts, is 600,000 sq. ft., necessitating a building 20 stories high, which will accommodate all but two of the municipal departments. The firms invited to compete are J. Stewart Barney, Carrère & Hastings, Clinton & Russell, J. H. Freedlander, Cass Gilbert, Heins & La Farge, Helmle & Huberty, Hoppin & Koen, Howells & Stokes, H. R. Marshall, McKim, Mead & White, Trowbridge & Livingston and Warren & Wetmore. It is understood that Mr. Cass Gilbert will not compete. Each firm will receive $1,000, and the winner will receive $5,000 for his design if the city does not accept it. The judges agreed upon are Frank Miles Day, president, American Institute of Architects; William A. Boring, vice-president, American Institute of Architects, and Francis C. Kimball, designer of many large New York office buildings. The designs are to be submitted April 15, and the decision announced on May 14, 1908.

Pipe Lines for Hydraulic Power Plants.

The technical staff of the Telluride Power Co. have organized the Telluride Institute, and at its meetings papers of an engineering character are presented for discussion. One of these, by Mr. Arthur Jobson, was on pipe lines for hydraulic power plants, and an abstract of it follows:

The determination of the most economical diameter for the penstocks of high-head hydraulic power plants is often a troublesome problem to the engineer. The principal factors on which the solution of this question depends are quantity of flow, static head, probable total cost of development per horse-power, and cost per pound of the pipe or penstock erected. Its proper solution is particularly important should the proposed plant be one of high head, in which case the cost of the penstock will be a large percentage of the total cost of the installation.

Methods of Holding Reinforcement in Place.

Long Stretch of 24-Foot Retaining Wall on Lackawanna Track Elevation, Buffalo.

The power lost in a pipe line per unit of length for a fixed quantity of flow varies inversely as the fifth power of its diameter. On the other hand, its cost per unit of length for a fixed static head will vary as the square of the diameter. Hence it follows that should a pipe of very large diameter be selected for the purpose of increasing the efficiency of the pipe line, the value of the extra amount of power obtained due to this higher efficiency may not merit the increased investment required. It also follows that should a very small size be selected for the purpose of reducing the annual charges on the investment, the resulting loss due to the lower efficiency of the pipe line may more than offset this reduction in annual cost. As a result it is important in fixing the diameter of penstocks to consider both the cost of the pipe installed and the loss of power in the pipe during the operation of the plant. These losses should be balanced, one against the other, in such a manner that the resultant due to each factor acting in coincidence, shall be as small as possible, consistent with the total first cost of the plant and its operating expenses.

In deriving an expression for the most economical diameter of penstocks, two methods of procedure may be adopted: (1) The yearly interest and depreciation on the first cost of the pipe may be obtained in terms of its diameter, and also the value of the power lost in the pipe line per year in terms of the diameter. Evidently the sum of these two expressions will be the total loss per year due to each factor acting in coincidence, and if this sum is derived with respect to the diameter, a diameter will be obtained such that the sum of these losses will be a minimum. (2) The sum of two ratios may be obtained in terms of the diameter; one ratio being that of the total cost per unit of length of the pipe installed to the total cost of the proposed installation, and the other, the ratio of the power lost in the pipe to the total rated capacity of the plant. If this sum be derived with respect to the diameter of the pipe, a diameter will be obtained such that the sum of these ratios will be a minimum.

Either one of these two methods will result, theoretically, in the most economical size of pipe. In developing this expression the second method will be adopted, the values of the letters and symbols used being represented as follows: Q = quantity of flow in cubic feet per second; V = velocity of water in feet per second; D = diameter of pipe in feet; t = thickness of pipe in feet: S = safe tensile stress of metal in pounds per square foot; P = internal pipe pressure in pounds per square foot; A = internal cross-sectional area of pipe in square feet; h = static head in feet; h' = loss of head in feet due to pipe friction; f = coefficient of pipe friction; c = cost in dollars per pound of installed pipe; k = weight of metal used in pounds per square foot; N = total cost of proposed installation in dollars; C = cost of pipe installed per unit length; H = total cost of installation per horse-power.

The following well-known formula represents the loss of head per unit of length in a circular pipe flowing full of water:

$$h' = 2 f V^2 \div Dg \ldots\ldots (1)$$

Since $V = Q \div A = 4Q \div \pi D^2$, by substituting this value for V in (1), $h' = 32 f Q^2 \div \pi^2 g D^5$. Assuming the combined efficiency of a water wheel and generator to be 75 per cent. for large units, the following is the expression for the horse-power developed from a water-power installation: Horse-power = 0.0851 $Q h''$, where h'' is the effective head. Hence the loss of power per unit length of pipe due to friction will be given by:

$$\text{Horse-power lost} = 0.0851\ Q\ h' \ldots\ldots (3).$$

Substituting the value already derived for h' in (3):

$$\text{Horse-power lost} = 2.723\ f\ Q^3 \div \pi^2\ g\ D^5 \ldots (4).$$

Let $H.\ P.$ equal total horse-power of plant, and r' equal ratio of horse-power lost to $H.\ P.$ Then,

$$r' = 2.723\ f\ Q^3 \div \pi^2\ g\ D^5\ H.\ P. \ldots\ldots (5)$$

The volume of the pipe per unit of length will be given by $t\ \pi\ D$, and its weight per unit of length by $k\ t\ \pi\ D$. Hence,

$$C = c\ k\ \pi\ D\ t \ldots\ldots (6).$$

But, $t = P\ D \div 2\ S$, and, $P = 62.4\ h$. Therefore, $t = 31.2\ h\ D \div S$. Substituting this value for t in (6), gives,

$$C = 31.2\ c\ k\ \pi\ D^2\ h \div S \ldots\ldots (7).$$

Let r'' = ratio of C to N.

$$r'' = 31.2\ c\ k\ \pi\ D^2\ h \div S\ N \ldots\ldots (8).$$

Hence,

$$r'' + r' = 31.2\ c\ k\ \pi\ D^2\ h \div S\ N + 2.723\ f\ Q^3 \div \pi^2\ g\ D^3\ H.\ P. \ldots\ldots (9)$$

This last expression is the one sought for, namely, the sum of the ratios of the cost of the pipe per unit length to the total cost of the installation, and the power lost per unit length of the pipe to the available power, in terms of the diameter, D. If this expression is derived with respect to D and equated to zero, the resulting value of D will be that for which the sum of these ratios will be a minimum. Let $R = r'' + r'$.

$$\frac{dR}{dD} = \frac{62.4\ c\ k\ \pi\ D\ h}{S\ N} - \frac{13.615\ f\ Q^3}{\pi^2\ g\ D^6\ H.\ P.}$$

Equating this expression to zero and solving for the power of D, we get:

$$D^7 = 0.218\ f\ S\ N\ Q^3 \div c\ k\ \pi^3\ h\ g\ H.\ P. \ldots (10).$$

Let H equal total cost of installation per horse-power.

$D^7 = 0.218\ f\ S\ H\ Q^3 \div c\ k\ \pi\ h\ g$.....(11).

The safe tensile stress of ordinary steel may be taken at 8,000 to 10,000 lb. per square inch and its weight 490 lb. per cubic foot. Assuming 8,000 lb. per square inch as the value of the safe tensile stress, and its weight per cubic foot as given above; also reducing π and g to their proper numerical values,

$D = \sqrt[7]{(0.5145\ f\ H\ Q^3 \div c\ h)}$.......(12).

Allowing S to remain in the formula, we get:

$D = \sqrt[7]{(0.0000004466\ f\ S\ H\ Q^3 \div c\ h)}$..(13).

Several objections will no doubt arise as to the value of the above derived formula in actual practice. Foreseeing a few of these possible objections and questions, they will now be discussed before attempting to make an application of the formula.

The first question which may arise is: Does the value of D as given in this equation represent a fixed value for the total length of the pipe to be installed, or is it a variable quantity depending upon the static head impressed upon each unit of the pipe? It will be remembered that h is the total, or static head under which the proposed plant is to operate. It will also be seen that the cost of the pipe installed was computed on the basis of unit length, and furthermore, that in making this computation the diameter and thickness of this unit length was assumed constant. But in the final cost formula, $C = 31.2\ c\ k\ \pi\ D^2\ h \div s$, t is eliminated, its value being replaced in terms of h. Hence it follows that the cost of the pipe per unit of length is a direct function of the static head impressed upon that particular unit length, and from this it follows that the value of D as given by equation (13) is the most economical size of pipe for that unit length and the static head impressed upon it. Evidently then D is not fixed for any particular installation, but varies as the static head upon the different parts of the pipe varies. In computing the most economical size of pipe at the power station, h represents the actual or static head of the installation, but in computing the most economical size of pipe for the same installation under half the static head of the station, then the value of h to be substituted in the final formula will be represented by one-half the actual head. Hence the interpretation of h will have to be changed. Instead of defining it as the actual head of the installation in feet, it will now be defined as the static head impressed upon a unit length of pipe for which the most economical size is being computed.

No serious questions can arise regarding the values of S and Q in the final formula. The tensile strength of the metal to be used in the pipe may be determined very closely, and when once determined, the value of S then depends upon the allowable factor of safety. The quantity of flow is usually one of the first factors to be definitely fixed in a proposed hydraulic power development, as this and the effective head are the two factors which determine the rated horse-power capacity of the plant. However, some allowance should be made for load factor in fixing the value of Q, as it is the average quantity of flow which should be used to determine the proper size of pipe rather than the maximum.

The most serious questions which may arise in making a practical application of this formula are those which will be suggested in making substitutions for f and H; the coefficient of pipe friction, and the cost per horse-power of the proposed installation in dollars. Each of these quantities are functions of D. Rankine gives $f = 0.005\ (1 + 1/12\ D)$. This, however, is not strictly true. Experiments show that the value of f depends not only upon the diameter of the pipe, but also upon the velocity of flow. J. T. Fanning gives in "Hydraulic and Water Supply Engineering," p. 233, several tables showing the value of f for various pipe diameters and velocities of flow. These values were determined by experiments with smooth iron pipes, and are probably correct, within a reasonable degree of accuracy. In these tables it is shown that for a pipe 18 in. in diameter, f varies from 0.00559 to 0.00451 at velocities of flow ranging from 1 to 20 ft. per second; a decrease of approximately 20 per cent. If the velocity of flow is fixed at 20 ft. per second, then f varies from 0.00481 to 0.00381 for pipes varying in diameter from 12 in. to 36 in., a reduction again of approximately 20 per cent. In any case the value of f should easily be fixed within 10 per cent. of its true value, since for a fixed quantity of flow a variation in velocity of flow of from 1 to 20 ft. per second would result in a decrease of diameter in the ratio of 4.5 to 1. Assuming that it is possible to select the value of f within 10 per cent. of its true value for the most economical size of pipe, then the resulting error in computing the diameter of the pipe from equation (13) will be the seventh root of 10 per cent., or approximately 1.4 per cent. From this diameter of pipe which is in error 1.4 per cent., the velocity of flow may be easily determined, which will be in error approximately 2 per cent. But for these slight errors in both D and the velocity of flow, the resultant error in the selection of f from the tables will be almost inappreciable, and in substituting this new value for f in equation (13) for recomputing D, evidently this error will be inappreciable in the diameter since the seventh root of the error will be taken. Hence one computation of D, with an assumed value of f, is all that is necessary to determine the true value of f within reasonable limits.

As has already been mentioned, the cost of a hydraulic power plant is a function of the high-pressure pipe used in the installation. Also, in the substitution for the value of H in equation (13), the objection may be made that the value of H cannot be definitely determined before the proposed plant is completed. However, after all preliminary investigations have been made in regard to such a plant, experience has shown that the cost of the plant completed and ready for operation can be predetermined very closely. At least the permissible investment should be known within reasonable limits after all the factors affecting the sale and generation of power have been investigated. If it is impossible to estimate even approximately the actual cost of the plant, then the value of the permissible investment should be used for H.

Let it now be assumed that all the factors entering into the cost of a proposed plant are known with the exception of the cost of the high-pressure pipe. This may be roughly estimated at first, to be determined more definitely after a computation of the diameter has been made, using the above rough estimate. For instance, let it be assumed that the estimated cost of a plant is \$90 per horse-power, \$15 of which is the estimated cost of the pipe line. However, upon computing D on this basis, and then computing the cost of the pipe for this value of D, it is found that the cost of the pipe will be \$7.50 per horse-power, instead of \$15 as first estimated. Hence in using \$90 per horse-power instead of \$82.50, which is very near the true value, an error of about 1.3 per cent. was made in the computation of D. Since the cost of the pipe varies as the square of the diameter, an error of approximately 1.7 per cent. was made in computing its cost on basis of \$90 per horse-power, instead of \$82.50. But a variation of 1.7 per cent. in the computed cost of the pipe (D being determined on a basis of \$15 per horse-power), when taken in connection with the total cost of the installation per horse-power, is scarcely appreciable, and is inappreciable when substituted in equation (13) for computing D. Hence, as in determining the proper value for f, two computations are all that are necessary. First, estimate as near as possible the cost of the pipe. Use this value in connection with the other factors entering into the total cost of the proposed installation for H. Determine the value of D on this basis; knowing D determine the cost of the pipe. If this computed cost is reasonably close to the estimated cost, no change need be made in the value of H. If it is not, then change H to correspond to this new value of the pipe cost and recompute the value of D.

For the purpose of making an application of this formula the following hypothetical case will now be assumed: Let $h = 1800$; $Q = 30$; $f = 0.005$ (for first computation); $H = 100$; $c = 0.11$. Two different forms of pipe will be assumed, lap-welded for the high pressure, and riveted pipe for the lower pressures. Let safe tensile stress for lap-welded pipe equal 8,000 lb. per square inch, $= s'$, and, safe tensile stress for riveted pipe equal 10,000 lb. per square inch, $= s''$. The efficiency of the riveted joints will be taken at 70 per cent.

With the above assumed static head and quantity of flow the capacity of the plant will be approximately 4,500 h.-p., and its total cost \$450,000 at \$100 per horse-power. The total length of the pipe line will be assumed to be 5,000 ft., and its cost, erected, \$45,000; one-tenth of the cost of the plant. In making this computation the method of procedure will be as follows: The length of pipe subtended between the static heads of 1,800 and 1,500 ft. will be given a constant diameter and definite length; between the static heads of 1,500 and 1,250 ft., also a constant diameter and definite length, and so forth; decreasing the difference of elevation between the terminals of pipe lengths having fixed diameters as the elevation increases. In computing D by equation (13), the mean static head upon sections of fixed diameters will be taken, and also in computing the cost of these different sections the mean static head will be used. This will result in no error in cost computation, since the thickness of the pipe is a direct function of h where D is constant.

TABLE I. VALUES OF DIFFERENT FUNCTIONS FOR VARIOUS HEADS.

h	l	D'	V	C	f	D'
1,800 to 1,500	450	1.68	13.5	\$9,500	.00453	1.66
1,500 to 1,250	500	1.73	12.7	\$9,300	.00450	1.698
1,250 to 1,000	300	1.78	12.0	\$4,850	.00449	1.75
1,000 to 800	400	1.84	11.2	\$5,550	.00447	1.807
800 to 600	400	1.90	10.6	\$4,600	.00445	1.872
600 to 400	600	2.00	9.5	\$5,500	.00440	1.96
400 to 250	500	2.08	8.8	\$3,730	.00437	2.042
250 to 150	700	2.23	7.7	\$3,700	.00431	2.174
150 to 50	950	2.47	6.3	\$3,070	.00424	2.41
50 to 0	200	3.00	4.3	\$ 240	.00406	2.917

The diameter of the pipe will first be computed on a basis of f equals 0.005, and pipe cost equals \$45,000. This will be designated D'. Having D', the true value of f may be obtained closely from the tables, and also very near the true pipe cost may be computed. Using these values of f and of pipe cost, D will be recomputed.

Substituting in equation (13) the values assumed for this hypothetical case: $D' = \sqrt[7]{(63{,}100 \div h)}$, for the lap-welded pipe, and $D' = \sqrt[7]{(55{,}400 \div h)}$ for the riveted pipe. Also from equation (7) $C = 0.00455\ D^2\ h\ l$, for the lap-welded pipe and $C = 0.0053\ D^2\ h\ l$, for the riveted pipe.

In the accompanying Table I the computations are tabulated in the order in which they were made. The first six sets of values are for lap-welded pipe and the remainder are for riveted pipe. The total cost of the pipe as given in the first computation is \$50,040. This value is so near the estimated cost of the pipe that no change need be made in H for the second computation of the diameter. Hence in recomputing D the original expression was changed only by the values of f as given in the above table, instead of the constant value 0.005, as first assumed.

The Stone Crushing Plant at the Menard, Ill., Penitentiary.

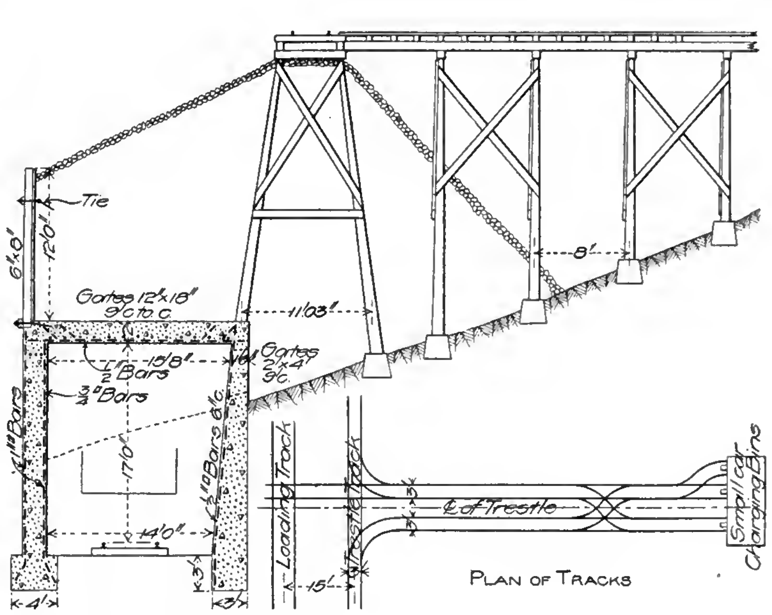
The Illinois State Highway Commission has, as one of its functions, the regulation of the distribution of crushed stone produced by convict labor at the State penitentiaries. Under regulations formulated by the Commission, this stone is supplied free to township or county highway officials for use on the public highways, the local officials paying the freight charges. It is also used by the Highway Commission in the construction of experimental roads.

When the act creating the Highway Commission was passed, in May, 1905, there was, at the Southern Illinois Penitentiary, at Menard, on the Mississippi River, about 70 miles below St. Louis, a stone crushing plant consisting of a No. 6 old-style Allis-Chalmers crusher, run with a 90-h.p. Westinghouse engine and an O'Brien boiler. This plant, which is operated entirely by convicts, is within the prison stockade and has a capacity of about 350 cu. yd. per 8-hr. day. As soon as the provisions of the State Highway Commission act became widely known, "free macadam" was in such demand that this plant became entirely inadequate. Accordingly, in the crusher like that already installed and, as will be seen later, the storage capacity can be greatly increased with very little difficulty.

A new quarry at Menard has been opened up in the rocky bluff, which is characteristic of the east bank of the Mississippi River from St. Louis to Cairo. Just north of the prison yard this bluff rises on an angle of nearly 45 deg., from the river bank to a general height of about 250 ft. above the water. The rock formation, which is a fairly good limestone, is overlaid on top of the bluff with considerable clay soil, a great quantity of which has been gradually washed down over the bluff, reducing the steepness of the incline and necessitating some difficult excavation before solid foundations can be secured. At the foot of the bluff, near the water's edge and parallel to it, a bench about 50 ft. wide is maintained, on which are the tracks of the Missouri Pacific Ry. and the Illinois Southern Ry., the latter being on the river side. Just inside the railroad tracks and about 15 ft. above them, is a county highway, the east fence of which is the west boundary of the State property available for the crusher site and quarry.

The crusher, which is an Allis-Chalmers, rotary No. 7½ machine, is located on the side storage pile and under which the railroad cars are run to be loaded. Small dump cars, operated by hand on the trestle tracks, deliver the stone from the three small receiving bins to the storage pile under the high single-track trestle.

The wall on the east or quarry side of the loading track supports one side of the floor of the storage bins; it also acts as a braced retaining wall, supporting the material on the hillside. It is 22 ft. high, 3 ft. wide at the base, and 16 in. wide at the top and is reinforced near its free face with ½-in. vertical twisted bars spaced 6 in. center to center. On the river side of the loading track the weight of the stored material is carried by series of 15x24-in. reinforced concrete columns. These columns are spaced 6 ft. on centers and each rests on a concrete pedestal 4 ft. square and 3 ft. deep. Each column is reinforced with four 1-in. twisted bars, one in each corner, and these are hooped at 18-in. intervals with No. 8 steel wire. The columns carry a reinforced concrete girder 24 in. wide and 37 in. deep, including the 20-in. floor slab of the storage bins. The girder is reinforced with four ¾-in. bars placed in a plane just above the crowns of the soffits of the arches. No arching effect was considered in the preparation of the



Stone Crushing Plant at the Southern Illinois Penitentiary, Menard, Ill.

spring of 1906, the Commission, in accordance with its powers as defined in the convict labor act, called on the Board of Prison Industries to install additional crushing plants at the Menard and Joliet penitentiaries. The Joliet plant, which has no unusual features, was put in operation in a few months. At Menard, a side-hill installation was required and it was decided to construct storage and car-loading pockets in connection with the crushing plant. This plant has been completed and put in operation only recently. The combined capacity of the plants at the two prisons amounts to about 1,350 cu. yd. per day.

Among the considerations that influenced the design of the Menard plant was the fact that it is desirable to employ convicts as steadily as possible. The preparation of crushed stone for road construction, at a plant without storage facilities, can be carried on economically only during the summer and fall when the crushed stone can be loaded directly from the crusher bins into cars and shipped to the work. Even during the working season it seemed likely that the men would often be idle because of lack of cars or delays on the construction work. With storage facilities, however, the crusher can be run more steadily and better advantage can be taken of empty cars when they are available. It is thought that the present storage pockets at Menard will be practically equivalent to another hill with its head at the elevation of the quarry floor, which was placed at El. 167 on the advice of Dr. H. Foster Bain, State Geologist, whose examinations indicated that the stone below this elevation is of a poor quality. The crusher has a capacity of 500 cu. yd. per 8-hr. day and is driven by a 100-h.p. Chandler & Taylor engine supplied with steam by a 150-h.p. Allis-Chalmers boiler. The engine and boiler rooms are placed on the north side of the crusher building, the engine-room floor being at El. 149.3 and the boiler-room floor at El. 134.8.

The skip cars loaded with uncrushed rock are run downgrade to the crusher and their contents delivered by gravity. The crushed stone passes by gravity from the crusher to the screen and from the latter falls into three small bins, built over two 3-ft. tracks which extend on a slight down-grade on a timber trestle nearly perpendicular to the general north and south direction of the quarry face. About 50 ft. from the crusher house the two tracks on the outgoing trestle diverge and turn off on a single-track trestle whose general direction is parallel to the quarry face. The rails of the single-track or storage trestle are about 27 ft. above the surface of the hill directly beneath them. The trestle legs on the up-hill side rest on concrete pedestals, while those on the down-hill side rest on a reinforced concrete structure, which partially supports the designs, the arches being introduced solely for their appearance. The 20-in. floor slab is reinforced transversely with 1-in. bars, 4-in. center to center, and longitudinally with ½-in. bars, 8-in. center to center.

The outside walls of the storage bins are made of 2-in. planks nailed to 6x8-in. posts, the feet of which are placed in niches along the edge of the floor slab, where they are secured by rag bolts and a continuous waling piece. A second waling strip is secured to the posts near the top of the bins, and provision has been made for securely anchoring the posts against the outward pressure of the retained material by ties running to deadmen buried in the hillside. The crushed stone is dumped from both sides of the longitudinal trestle track, and the pile rests partly on the concrete floor and partly on the hillside. The different sizes are kept in separate piles by light plank partitions. Most of the stone is admitted to the railroad cars through 12x18-in. gates in the floor of the bins over the center line of the loading track, spaced 9 ft. on centers. When the supply of stone is so low that it does not run freely through these gates it can still be delivered to the cars by gravity and without shoveling, through 2x4 ft. gates in the side wall, spaced 9 ft. on centers.

The switch track to the storage pocket leaves the Missouri Pacific Ry. about 1,300 ft. south of

the crusher. It crosses the tracks of the Illinois Southern Ry. and, continuing northward on a rising grade, crosses the county highway at grade and runs along the bluff in a bench cut through the storage plant and several hundred feet beyond. Empty cars are stored on the track north of the crusher and are run under and away from the storage packets by gravity. At present only 125 lin. ft. of concrete structure has been built, 62½ ft. north and 62½ ft. south of the center line of the double-track trestle from the crusher. The length of the storage pockets can be increased readily whenever this seems desirable. It is estimated that the storage pile will contain about 3,500 cu. yd. per 100 lin. ft.

The excavations for the crusher plant foundations and for the loading track amounted to about 1,300 and 8,000 cu. yd., respectively. Though the excavated material was mainly earth, the work was very difficult owing to the great number of buried boulders which from time to time had broken off from the outcrop at the top of the bluff, and rolled down the side hill. Many of these necessitated blasting. All the work was done with convicts, three of whom in general are equal to two ordinary men, and with mules and wheel scrapers. Some of the earth was wasted and the rest was used in forming an embankment for the switch track near its junction with the main line.

The material excavated at the crusher site was delivered to wagons in the switch-track cut through an open chute 2 ft. wide and 2 ft. deep. As the chute could not be placed at a grade steep enough to cause the earth to slide freely, the latter was scraped down with a specially designed scraper made to fit the chute. This was drawn by a mule which walked on a path at right angles to the chute, lines and pulleys being arranged so that the scraper was pulled down as the mule walked one way and up as he walked in the opposite direction. The earth was delivered to the chute in wheelbarrows, and boulders too large to be handled in this manner were rolled down the hill. The crusher machinery was brought to the site from the main line of the railroad in wagons over a road built along the side of the bluff. Coal and other supplies are now hauled to the plant over the same road.

The reinforced concrete structure was built entirely by convict labor and the construction presented no unusual features. The concrete was hand-mixed.

The plans and specifications for the entire installation were prepared by Mr. A. N. Johnson, State Engineer. The plant was built under the direction of the Board of Prison Industries, whose general representative on the work was Gen. J. B. Smith, warden of the Southern Illinois Penitentiary. The storage pockets and the foundations and houses for the crusher, boiler and engine were built by convict labor. Mr. W. S. Gearhart was resident engineer for the Board of Prison Industries during the early part of the work, and Mr. W. T. Beckelhimer during the later part.

A 55-Ton Traveling Tower Crane of unusual working radius has been placed in service on the docks at the harbor of Santa Cruz, on the island of Teneriffe. The tower section, about 20 ft. in height, is carried on six legs, each traveling on a four-wheel truck. The crane member pivoted to the tower is a double-truss structure, 138 ft. long, overhanging 105 ft. from the pivot to the hoisting end and 33 ft. in length from the pivot to the counterbalance. It is designed for a capacity of 55 tons at a radius of 58 ft. from the pivot. The crane is operated electrically, a 54-h.-p. motor being used, both for hoisting and for moving the tower, a 15-h.-p. motor for revolving the crane and a 30-h.-p. for the trolley.

Experiments on Wind Pressure.

About five years ago Dr. T. E. Stanton began a series of investigations to determine the distribution and intensity of the pressure of the wind on structures. This research work was proposed by the Committee of the National Physical Laboratory of Great Britain as the first investigation to be undertaken in the Engineering Department of the Laboratory. The first part of this research was communicated to the Institution of Civil Engineers in December, 1903, and related to the resultant pressure and distribution of pressure on flat plates normal to and inclined to the direction of a uniform current of air.

As those experiments were made in a channel 24 in. in diameter, the dimensions of the plates were necessarily small, but between the range in dimensions obtained, which for circular plates was from ¼ in. to 2½ in. in diameter, the results indicated that the resistance of geometrically similar plates was proportional to the area of the plates. In the case of dissimilar plates, however, such as square plates and long rectangles, the resistances per unit area differed considerably.

The value of the resistance so found in these experiments on small plates was somewhat smaller than that determined by Dines, Frowde and Langley for plates of the order of 1 square foot in area. For comparison, the values of the constant, K, in the pressure velocity relation, $P = KV^2$ are given in the following table:

Experimenter	Method	Value of K
Dines	Whirling Table	0.0029
Frowde	Moving Carriage	0.0037
Langley	Whirling Table	0.0033
Author	Plate in uniform current	0.0027

On the completion of this part of the work, it was decided to make observations on flat surfaces of areas ranging up to 100 sq. ft. when exposed to the wind, since general experience tended to show that in actual winds whose velocity was not uniform over time or space, the mean pressure per square foot on a large surface was considerably less than that on a small one. As a knowledge of this variation in resistance with the dimensions of the structure, if it exists, is all-important in design, the investigation of this problem was made the chief feature of the new experiments. This work was described by Dr. Stanton in a paper read before the Institution of Civil Engineers on Dec. 3, of which an abstract follows.

For the purpose of the work a steel windmill tower was erected in the grounds of the National Physical Laboratory at Teddington. The experimental boards and models of structures were attached to a light framework carried by the cap of the tower, the height of the center of the boards from the ground being 50 ft.

After some preliminary experiments, the method of observation finally adopted was the determination of the constant in the pressure-velocity relation for pressure-boards of varying dimensions and for the models of structures. It was found, as anticipated from a knowledge of the variable character of the velocity of the wind, that single observations were quite worthless for the purpose in view, but that, if for any pressure-board or model about 200 observations of the velocity of the wind and the corresponding pressure on the board were taken, it was possible to obtain a fairly accurate value of the constant. In these observations the velocity of the wind was estimated from a pair of pressure-tubes, similar to those used by Mr. Dines in his anemometer, placed about 15 ft. above the center of the board. These tubes were connected by lead pipes to a sensitive water-gauge, of the type used in the author's previous experiments, placed at the foot of the tower. The resultant pressure of the wind on the board was estimated from a measurement of the pressure produced in a closed cylinder of air by the deformation of a thin steel diaphragm forming its cover which was in contact with the center of the pressure-board. This pressure was also transmitted through lead pipes to the foot of the tower, and there measured by a similar tilting gauge to the one used for the velocity estimations. The simultaneous observations of pressure and velocity were only possible in the short periods of time in which the velocity of the wind was fairly constant. Such periods, lasting from 2 to 5 seconds, were found to occur about once a minute in a fairly steady breeze.

The results of these observations on three pressure-boards, one 5 x 5 ft., one 5 x 10 ft., and one 10 x 10 ft., gave practically identical values of the constant in the pressure-velocity relation. In units of pounds per square foot and miles per hour, the mean value of this constant for the three boards was 0.0032. As this value agreed so well with the average of those obtained by previous experimenters when using plates of the order of 1 sq ft. in area, it was not considered necessary to make experiments on plates smaller than the one 5 x 5 ft. in the present case.

Further observations on the intensity of the pressure at the front and back of the boards appeared to show that the cause of the higher value of the constant compared with that obtained in the case of the small plates in the 24-in. experimental channel, was the relatively greater intensity of the negative pressure at the back of the boards compared to that at the back of the small plates.

Experiments were also made on a model of a braced-girder 29 ft. long by 3 ft. 7 in. deep, and on a roof model whose sides were 8 x 7 ft. The ratio of the resistance per unit of area of the model girder to that of a square board in the wind was found to be precisely the same as the ratio of the resistance per unit of area of a small model of the girder made to a linear scale of 1 in 42 to a square plate in the experimental channel and uniform current used in the previous experiments.

The resultant pressures on the roof were obtained, for both windward and leeward sides, at angles of 30, 45 and 60 deg. inclination to the horizontal, and indicated the considerable suction effects on the leeward side of a roof when the pressure inside the building is augmented from the windward side by open doors or windows.

These results lead to the conclusion that the resistance of a complicated structure in the wind can be accurately predicted from a determination of the resistance of a small model of the structure in an experimental channel.

The Motor Boat for naval service appears, from discussions at the recent meeting of the Society of Naval Architects and Marine Engineers, to have some advantages over the steam launch. The question of reliability of the gasoline engine as a prime mover, which has heretofore deterred its more general adoption for naval service, has been practically settled by elaboration of design and refinements in construction, so that the general opinion is that when a well-built engine is placed in the hands of a man trained for the work, it is sufficiently reliable for naval use. It was pointed out in the discussion that the launch engine is not subjected to the jar and vibration that attend the operation of the automobile motor, and that the latter engines have now been made so flexible and reliable that 100-mile sealed-bonnet tests are possible. The saving of space required for the machinery over that of the steam launch is 20 to 25 per cent., according to the design of the engine.

The Gatun Dam.

The annual report of the Isthmian Canal Commission for the past year, and the issue of the "Canal Record" for Dec. 4, together give some instructive information concerning the Gatun dam, which is the crucial feature of the Panama Canal design. In one of the appendices to the Commission's report, Mr. Ernest Howe, geologist, furnishes a detailed account of the geology of the site of this great structure. According to his statements, the sides of the broad lower valley of the Chagres at Gatun converge and the stream passes through a gap in the mountains which is a little over one mile wide. The geological conditions at the site of the dam are the result of many changes. At some time after the Gatun beds had been deposited, the central and southern portions of the present isthmus were subjected to volcanic disturbances and the whole region underwent considerable deformation. The geology of the central portion of the isthmus indicates that a vast amount of erosion took place following the elevation of the land, and that the sedimentary and later volcanic rock now exposed represent but a very small part of the bed that originally covered the region. There were three great uplifts which threw these beds out of position and the third resulted in the streams intrenching themselves in deep canyons in the material left by the second uplift. When the Chagres River had succeeded in cutting somesomething more than 200 ft. below the second level, the land began to sink and the gorges were gradually filled with gravel, sand, silt and clay. It is believed that this sinking continued until a large part of the Colon level now represented by swamps, was submerged and covered by sea water. Finally there was a slight elevation of the whole region, which raised these deposits a few feet above tide level.

During the periods of maximum uplifts, when streams were flowing in canyons like those of the Chagres, the rivers were heavily charged with detritus. All of the finer part of this material was swept down to the sea, the coarsest was deposited along the upper portions of the stream, but gravels and small boulders filled the stream beds to the mouths of the rivers. Where subsidence took place before the period of canyon cutting has ceased, as in the case of the Chagres, the velocity of the streams was checked and they were capable of carrying only fine material, which was deposited far back from the mouths. As a result, in the bottom of such a gorge as that of the Chagres at Gatun, there is a comparatively thin deposit of coarse gravel, sand and a few boulders, while the greater part of the alluvium is of the finest clay and silt, with a certain amount of fine gravel and sand mixed with it.

The boring records indicate considerable sand and gravel at points comparatively near the present surface; Mr. Howe considers that it is unlikely, however, that any sand or gravel, unmixed with clay, occurs in the deposits except at or very near the bottom. The reason that the boring records specify "Sand and Gravel" is that when the samples are taken from time to time during the process of sinking the hole, only the coarsest material is collected, the finer clay being held in suspension and carried off with the water flowing from the hole. In certain of the holes temporary flows of water were encountered, but after a few hours these invariably ceased. They are believed to occur when, in the course of making a boring, the casing is introduced into a lenticular deposit of sand or water-bearing gravel under pressure from the overlying bed. The sands, being surrounded by much less pervious material, are in the nature of reservoirs in which water is stored under pressure, and when this pressure is released at the point where the casing enters the sand, water may rise to the surface if under sufficient pressure and flow from the top of the casing until the pressures are readjusted. Professor Howe believes that far from indicating porous materials underlying the site for the dam, the occurrence of such flows of water only proves the extremely impervious character of the materials lying between the surface and the water-bearing beds. As a foundation for an earth dam, he considers that the geological facts show that the alluvium filling the valley of the Chagres at Gatun will be entirely satisfactory.

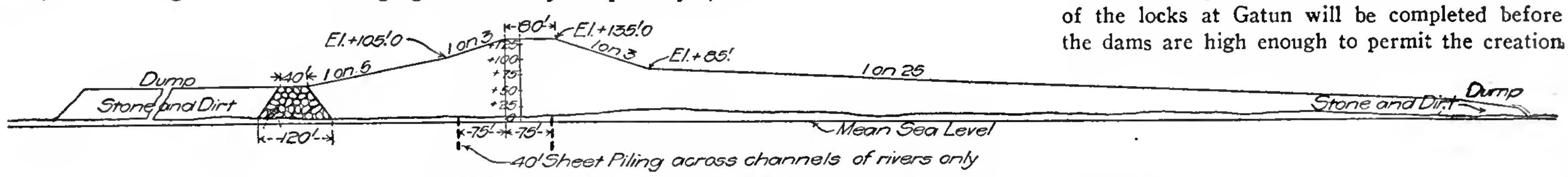
The great locks will be at the northeast end of this dam. They will be almost entirely in fine-grained argillaceous sandstone, except at the lowest point to be reached at the extreme southern end, where conglomerate occurs beneath the sandstone. The sand of which these rocks are composed was derived from the older igneous rocks of the region. The debris resulting from the breaking down of these rocks was transported by the streams to the sea and deposited, layer upon layer, until some 200 ft. had accumulated. Considerable clay was mixed with the sand, and this, together with the lime derived from the sea water, acted as a cement and bound the grains of sand together, forming a massive rock.

The rocks from which the sands were derived were almost, if not entirely, destitute of quartz, and the sandstones lacking this mineral are more subject to decomposition than rocks consisting principally of quartz sand. As a whole the rocks are stated to make excellent cores with the diamond drill. When taken out and exposed on the surface they remain firm and hard; in rare instances they have been found to crumble and break down into a sandy clay. The rocks are well compacted and capable of supporting heavy loads when confined, but being poorly cemented are unable to withstand erosion, and should be fully protected where such action is anticipated. On account of the very considerable amount of clay present in all of the rocks, it is believed by Mr. Howe that they will prove to be almost entirely impervious to water, except in the case of the conglomerate. Wherever the latter is encountered, it may be expected to be water-bearing at all times. This rock stands in vertical walls without timbering in a test pit sunk into it, and so long as it is confined it will support heavy loads.

The section of the Gatun dam has recently been slightly changed, and the accompanying diagram shows the revised form. The method of building the dam and filling the lake is explained in the "Canal Record" substantially as follows:

The total length of the dam is about 7,700 ft. from the locks on the northeast to the hills on the southwest. At about its middle point there is rising ground, now known as Spillway Hill, where the regulating works are to be built. It is proposed first to dig a channel about 300 ft. wide through Spillway Hill, the bottom of it to be at sea level or thereabouts. The Chagres River will be passed through this channel during the construction of the dam across the valleys on either side of the hill. As soon as the portions of the dam abutting on Spillway Hill are high enough to hold from 50 to 55 ft. of water in the lake it is proposed to build across the channel through Spillway Hill a concrete dam high enough to hold the lake at this level. This will be done to facilitate the work of dredging in the Chagres Division. During the dry season following the completion of this dredging the dam across the channel through Spillway Hill will be brought to its full height, and a permanent spillway constructed, which will include the necessary regulating works, by means of which the surplus water of the lake will be passed down to the level of the sea.

Preparations will be made for closing the channel through Spillway Hill before the Chagres is turned into it, and all closures will be accomplished during the dry season, thus enabling the Chagres to form a lake to the height of the dam across the spillway channel during the following wet season. It is considered probable that Gatun Lake will not be allowed to fill to the height of 50 or 55 ft. until the upper end of the lock at Gatun has been completed and the upper gates have been erected. If this plan of procedure is carried out and the progress of the work comes up to anticipation, the upper portion of the locks at Gatun will be completed before the dams are high enough to permit the creation of the lake at 50 to 55 ft. elevation. This lake will make water transportation available for handling large quantities of timber that will be submerged by the lake, and contracts may be let for cutting this timber, or it may be sold standing to the highest bidder. The exact capacity of Gatun Lake has not yet been known. The total amount of excavation at the Gatun lock, dam and spillway up to Dec. 1 has been 1,136,000 cu. yd.



The Revised Cross-Section of the Gatun Dam of the Panama Canal.

A BRICK CHIMNEY under construction for the 59th St. station of the New York Steam Co. lost a small section of its top in a hurricane on Dec. 14. The chimney is being built of perforated radial brick by the M. W. Kellogg Co. and will be 264 ft. high and 17 ft. in diameter at the top. The condition of the chimney at the time of the accident is stated by Mr. M. W. Kellogg, president of the M. W. Kellogg Company, to have been as follows: "On Friday, the day before the storm, the brickwork of the chimney had been completed to within about 12 in. of the cap at the top, the chimney wall having been carried up about 2½ ft. on that day. Practically no work was done on Saturday morning, owing to the snow, which later turned to rain. Upon increase of the wind in the afternoon to a gale of 70 miles velocity, the brickwork freshly laid at the top on the afternoon before was dislodged and fell. A careful investigation indicates that none of the brickwork but that laid on Friday and which was still green was affected. The height of wall dislodged was from 2 to 2½ ft., but, owing to the circumference of the chimney at the top of about 55 ft., the quantity of material that fell was large, probably 20 tons." When the top of the stack fell it crashed through the roof of an adjoining building, killing one person.

Accuracy of Slide Rule Computations.

By John Berg.

When preliminary estimates on engineering works are of such a nature that the slide rule can be used in their computation, then this little instrument ought to be employed. It not only saves considerable time, but it saves much mental effort; and the final results are more apt to be free from large errors than when all the work is done the long, tedious way. To sit day after day for seven or eight hours, with only a short intermission at noon, multiplying and dividing, and not doing much else, is very tiresome work. I have also found that I am more liable to errors during the latter part of the afternoon after such a day's work.

I have known the average end-area formula to be used in finding the volume of a prismoid; the unit weight per cubic foot assumed to the nearest tenth of a pound; the stress in full members computed to the nearest pound and better. More consistent would it have been to have used the prismoidal formula in finding the volume; assume unit weight per cubic foot to the nearest pound; compute stresses to the nearest hundred pounds, and do all the work of multiplication and division on a slide rule—i. e., by graphic logarithms. There is much less chance for a large error in the latter result, and it should be obtained with less fatigue and greater speed.

Practical opportunity has recently been afforded me to test the accuracy of slide rule computation, especially in the reduction of cubic feet to cubic yards, and, though having already had a good deal of respect for the efficiency of the slide rule for accuracy on computations, I was more than satisfied with the results obtained in the investigation. Omitting one large error, apparently due to a slipping of the slide and reading before re-setting, and instantly discovered on a rapid and rougher check of the work, the following results in division were obtained:

Of 28 three-figure quotients, ranging in magnitude from 391 to 999, inclusive, 23 were correct to the nearest unit; the remaining 5 were each 1 unit too small. However, the maximum "unit" error in the case of the 5 quotients was really only ⅔ and not 1; or, reduced to a percentage basis, the maximum error was 0.11 of 1 per cent. The sum of the 28 numbers representing cubic feet was 510,349; the sum of the 28 quotients as obtained by the slide rule was 18,900 cu. yd., a sum that is too small by 1.8 cu. yds.; i. e., the sum as obtained from slide rule results is in error by less than 0.01 of 1 per cent.

A similar study was made of 116 quotients ranging in magnitude from 1,007 to 8,590, inclusive, the numbers being pretty well distributed under the respective groups given in the accompanying table.

With the exception of group 9, maximum and total errors had to be added to the corresponding slide rule result to give the correct amount.

Of the 144 quotients only 2 were in error by as much as 0.1 of 1 per cent., and these were 0.110 per cent. and 0.101 per cent. respectively. From the table it will be seen that in no case is the average error in the sum of even a comparatively few numbers one-half of this maximum. The average error for the 144 quotients was 0.024 of 1 per cent., or, expressed as a ratio, 1 in 4,200, a result quite comparable with that obtained with a steel tape over moderately rough ground. By a comparison with the results of the thorough investigation of the relative accuracy of planimeters by Prof. Lorber, of Loeben, Austria, quoted in J. B. Johnson's "Surveying," it will be seen that the slide rule is far more accurate than the polar planimeter, and that it compares very favorably with the suspended and rolling planimeters, even though the latter of these is considered an "instrument of precision."

Assuming the possibility of absolutely accurate horizontal measurements, it will not be very difficult to find a field engineer who will admit the possibility and even the probability of errors of 0.1 of a foot in the differences of level elevations in a cut or fill. If the cut is of an average depth of 10 ft. the above error is 1 per cent. of the quantity. Cut the probable error down to 0.01 of a foot and the chances are 70 to 1 that the slide rule is more accurate still. Allowing, further, for errors in plotting up the field notes; errors in the transfer to a tracing; errors due to shrinkage of tracing cloth and blue-print paper; "personal equation" errors in following contour lines with the tracing arm of the planimeter; errors inherent in the planimeter measurement itself, allowing for all these and other probable errors, not more than due credit will be given if we say that the slide rule is at least as accurate for the conversion of field data into office estimates as are the methods used in obtaining these data by the average assistant in the field and in the drafting-room.

TABLE OF ERRORS IN 116 QUOTIENTS.

Group.	Number and Range of Quotients. Correct.	Small.	Large.	Total.	From.	To.	Numerical Error. Max.	Total.	Per Cent. Error. Max.	Average.
1	23	5	0	28	391	999	0.7	1.8	0.110	0.010
2	25	14	5	44	1007	1980	1.4	12.5	0.095	0.020
3	11	8	5	24	2000	2944	1.9	3.7	0.068	0.007
4	4	5	2	11	3027	3934	3.9	9.1	0.101	0.024
5	0	9	1	10	4033	4991	4.4	20.0	0.088	0.044
6	2	6	0	8	5105	5945	2.5	9.5	0.042	0.021
7	2	6	0	8	6070	6991	4.8	14.6	0.075	0.028
8	0	6	1	7	7131	7989	6.7	25.5	0.091	0.047
9	0	2	2	4	8137	8590	3.3	0.6	0.040	0.002
Total..	67	61	16	144	391	8590	6.7	96.1	0.110	0.024

Should it be desirable to approximate to greater accuracy than is possible with a direct reading of the rule, then the first figure may be obtained mentally when a series of numbers is to be divided by the same small number as, in this case, 27. In such a series of 21 quotients, also taken from practical work, only one was in four figures, all the others having five figures and ranging in magnitude from 11,324 to 69,493. Of the 21 quotients 5 were correct to the nearest unit; 1 was too large by 1 unit; 1 was too large by 2 units; 7 were too small by 1 unit; 3 were too small by 3 units; and 4 were too small by 4, 5, 6 and 7 units each. Reduced to a percentage basis the maximum error in this series was 0.022 of 1 per cent., and the average error for the 21 quotients was less than 0.004 of 1 per cent., 1 in 25,000! If these errors are larger than first expected it can be explained by the fact that the maximum was obtained from a quotient beginning with 2, which was followed by a 7. The four largest errors of 4, 5, 6 and 7 were all found in quotients whose first digits were smaller than the following digit. But for this fact we might have expected even a better ratio for the average error than 1 in 25,000. Though the observations are not numerous enough to warrant enunciation of a proposition to the effect that the percentage of error is independent of the size of the first digit, yet this seems to obtain, as might be expected, though it appears somewhat erratic.

As in the case of straight division on the rule, its use in getting the remaining figures, after the first has been obtained mentally, has yet the advantage of speed and accuracy with less liability to large error. The probable percentage of error in this method depends mainly on the relative numerical values of the first two figures: e. g., if the first figure is 1, obtained mentally, and the second 9, obtained on the scale, then the maximum error on direct reading of, say, 0.1 per cent. may be reduced to 0.05 per cent. If, on the other hand, the first figure is 9, and the second figure is 1, the above maximum of 0.1 per cent. on direct reading will approach 0.001 per cent., a total range in the ratio of probable maximum error from 1 in 2,000 to 1 in 100,000, accepting an ordinary maximum error of 0.1 per cent. for direct reading on the scale.

Since accuracy in reading depends primarily on the accuracy of the graduations and secondarily on close interpolation, we should expect as small errors in multiplication as in division. This is well illustrated by the following example: Of 27 two-factor, four-figure products, ranging in magnitude from 3,321 to 8,046, inclusive, none ending in 0, 7 were correct to the nearest unit; 2 were too large by 1 unit; 12 were too small by 1 unit; 2 were too small by 2 units; 1 was too small by 3 units; and 3 were too small by 4 units. Reduced to a percentage basis, the maximum error was 0.079 per cent., and the average error was 0.019 per cent., both of which results compare favorably with the maximum and average errors for quotients.

For most engineering computations with the pocket-and-office rule it is a useless waste of time to attempt reading all results to four significant figures; but if the greatest possible accuracy is desired, result to four figures, beginning with the figure 1, may be read to the nearest unit; and those beginning with 2 and 3 may be read to the nearest 5 units; but in the remaining numbers the fourth figure may as well be 0. Even with these limitations average errors ought to be well within the ratio of 1 in 2,000, while the chances appear very favorable for much better results, unless several settings have been made as in a continued multiplication or division.

Engineering students can never begin too early getting acquainted with a slide rule. Its study can with much profit be begun in the freshman year, or as soon as the study of logarithms is well under way. The two studies are more than supplementary; they are identical. A proper understanding of the one is a thorough knowledge of the other. A slide rule is a whole set of logarithm tables in itself, in which, as in the tables, the characteristic is absent; a fractional part of the scale unit of which is an equal fractional part, the mantissa, of the unit exponent whose base is 10; and on which the engraved figures and intermediate graduations are the numbers corresponding to the fractional exponent, or mantissa, above mentioned.

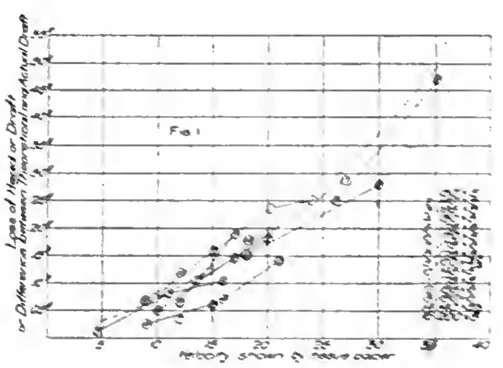
For evident reasons it is not always best to require students to purchase slide rules early in their college course, yet students have been known to be sorry afterwards that they had not been compelled to get the rule much earlier. Unless one has had a rule in use a little so he can himself test it for accuracy, he ought to intrust its purchase to someone better acquainted with its use. For lack of something else which may be better, I have been substituting this test for accuracy in the graduations on the scale most used: Find the reciprocals of several numbers along the whole length of the scale, say all the prime numbers from 11 to 97, inclusive, and as many more similar three-figure numbers, reading their reciprocals to four significant figures. Compare with a table of reciprocals found in most any handbook. With the usual pocket rule the reciprocals will not all be correct to the nearest unit; but the maximum error, with careful reading, ought not to be over 0.1 per cent., and the average at least not more than one-half, and preferably not much over one-fourth, of this maximum, the average being obtained by adding all errors numerically and not algebraically. If these limits are considerably exceeded another rule should be tried, for there is a great difference in the accuracy of slide rules on the market.

The Design of Power Plant Chimneys.

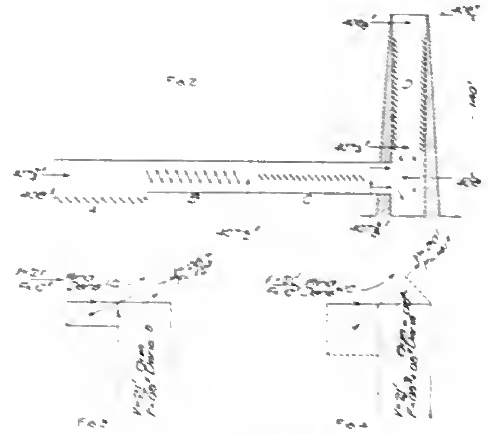
By Frank Kingsley.

The design of a power plant chimney is a problem which is usually solved by rule-of-thumb methods. The common practice is to look over the vague generalities expressed in engineering hand-books and then lay out a structure vastly in excess of the requirements. We say that a chimney 150 ft. in height and 6 ft. in diameter will serve 1,000 h.-p. of boilers, or carry off gas from the combustion of 5,000 lb. of coal per hour, but what is the result if the diameter is made only 5 ft.? What if the height is made 100 ft.? What if 500 h.-p. is added to the plant? What if forced draft is introduced? Answers to these questions cannot be obtained from any of the formulas in common use.

Considering Kent's formula, $H = (0.3 \text{ h.-p.} \div E)^2$, which is the best known of any of the empirical formulæ, it is manifest that if it gave a satisfactory stack for a battery of Babcock & Wilcox boilers (where the gases make three passes through 10 or 12 rows of staggered tubes) it would give, for a battery of Manning upright boilers, a structure vastly in excess of the requirements. This is because the resistance to the passage of gases through the former type of boiler is much greater than through the latter, and more draft is needed to pass the gases through it. It is also evident that with a stack designed from this formula the proper grate area and rate of combustion will have to be determined by experiment after the plant is in operation. In fact, Mr. Kent, in his hand-book, admits that this is necessary.



Draft Measurements.



Draft Diagrams.

The Stirling Company, in its book on steam boilers, offered a method of stack design by which the resistance of the boiler, of the bed of coal and of the flue are approximated from past experience, added together, and from this total the necessary height of stack is obtained on the assumption that the effective draft is 80 per cent. of the theoretical draft. The area is found from the formula, $A = 4.92 \text{ h.-p}^{2/5}$.

Both of the foregoing methods of stack design are incomplete, because they do not consider the fact that a stack has two duties to perform; first, to produce draft at its base; second, to carry off gas.

Now, if any stack is considered from the standpoint of the quantity of gas carried off, the problem becomes solely one of velocities, because the relative density of stack gas does not vary, at any certain temperature, over 1 per cent, and the variations from the absolute temperature of 1,000° F. found in fairly good practice are negligible. Hence, the weight of gas passed up any stack depends simply upon the speed at which it travels, and it would appear that, if high velocities could be obtained, stacks of extremely small diameter could be used.

However, the resistances within the stack become greater as the velocity of gas increases, and, while diameter may be decreased by high velocity, the effective draft at the stack base will be decreased so that height will have to be added to make up for it, or else grate area increased to make up for the decreased draft.

A question might be asked here as to how the high velocities may be obtained, and it will be necessary to bear in mind that the velocity of gas in any stack depends simply upon the amount of gas delivered to the stack. As more coal is burned, and more gas is produced, the velocity rises; as less coal is burned, the velocity falls. The stack height is absolutely immaterial, except in that it establishes as a limit the point where the entire theoretical draft is devoted to producing velocity, and this condition is, of course, never reached. A stack 200 ft. high with dampers closed tight will give no velocity to the gas in it, notwithstanding the height; while the gas in a 50-ft. stack over an upright boiler with under grate forced draft may nearly reach the maximum velocity of 29 ft. per second.

In order to throw some light on this subject, the writer made a series of observations, at the instance of the Parson Manufacturing Co., upon a number of average-size power plant chimneys. These consisted of stack draft and temperature readings on each stack; and, after each reading, obtaining the velocity of the gas in the stack by timing a handful of tissue paper, introduced into the stack, from the base to the top.

The temperatures of stack gas and external air were obtained with 800° thermometers, and the draft was obtained with a spiral draft gauge reading to 0.01 in. The paper was introduced into the stack by springing the breeching slightly away from the brickwork where it entered the stack. Its velocity was timed with a stop-watch. The paper was found to fall in stationary air at the rate of, roughly, 2 ft. per second for the average stack; and, consequently, it was assumed, on account of the less dense medium, to show a velocity of 3 ft. per second less than the real velocity of the stream of gas.

Barometer and weather conditions were noted daily, but as the average barometric variation only affected the draft 0.01 in., it was neglected eventually. As all the plants visited had either a damper regulator or ash pit blower regulator, a number of readings were taken with this on and with it off. Each set of readings was averaged; and the variation from the mean noted. This was for the purpose of obtaining an idea of the efficacy of the apparatus, and to detect the presence of unconsidered factors. At the lower velocities of stack gas, or where the stack was under-loaded, the variations were large; but at high velocities they were inconsiderable. Unfortunately the importance of the pressure created by a wind blowing into an open fire-room door was not considered when the readings were taken, and this introduced an error in several instances.

The aspirating effect of wind in blowing across the top of the stack was found to be negligible; in fact, when it is considered that the ordinary "brisk wind" has no greater velocity than the gas in the average stack—namely, 20 ft. per second—it becomes evident that this very common assumption is not based on sound reasoning. It is also evident that no appreciable change of temperature can take place in a properly loaded stack, because the gas travels to the top in 5 to 10 seconds.

It was found that the pyrometer was very slow in action, in comparison with the draft gauge; and, as the conditions were subject to continual slight changes, a certain amount of error was introduced from this source also.

With the above readings, and a knowledge of the stack height, it became possible to calculate the draft which the stack should give at its base; and by subtracting from this the actual reading shown by the draft-gauge, the loss of head for certain velocities in the stack were obtained. The results obtained are given in Fig. 1, being platted with vertical measurements, indicating loss of head, or draft, in inches of water, and horizontal measurements indicating velocities (not corrected for the action of gravity on the tissue paper).

It will be observed that the platted results take the form of a roughly defined curve, regardless of the size of the stack, showing that resistance is not due to friction alone, which is determined by the well-established formula:

$$\text{Loss of head} = CV^2H/D.$$

In view of this fact it might be well to analyze the forces and resistances acting on stack gases, with the help of Fig. 2. Assume a stack about 140 ft. in height, with an atmospheric pressure at its base of 408 in. of water, or 14.75 lb. per square inch. Call A the grate, B the tubes and C the breeching. Let D represent the rough sides, giving a skin friction. Now, with air at about 50° F. and stack gases at 560° F., we may expect that the air between the top and the bottom of the stack will exert a pressure of 2 in. of water, and the gas in the stack (being of half the density) will exert 1 in. pressure. Then at the top of the stack there will be 406 in. pressure, and at the base inside 1 in. more, or 407 in., if the gas is stationary. However, assume the gas is moving, and assume that, just before exit, the gas has ⅜ in. of pressure above the atmospheric pressure (this will be considered later). Then, if the skin friction, D, is ⅜ in., the pressure just above the breeching connection will be 406¾ in. + 1 in. = 407¾ in. Now, to turn the gases from their horizontal direction as they leave the breeching requires a certain force. Calling this ⅛ in. the pressure at the point where the observations of draft were made would be 407⅞ in., and a draft gauge would show ⅝ in. of draft at this point, whereas if the gas were stationary the pressure would be 407 in. and the gauge would read 1 in. From this it will be seen that each loss of draft or head shown on Fig. 1 was composed of three separate resistances: (1) exit velocity, (2) skin friction, (3) change of direction.

To consider each of these separately: When air at a small pressure flows through a frictionless tube into the atmosphere it obtains velocity as it enters the tube and loses pressure. In other words, its potential energy of pressure changes to the kinetic energy of motion. At the exit the kinetic energy or "velocity head" is dissipated in eddies and friction as each particle gives up its velocity to other particles, and if a draft gauge were placed at the exit no reading would be shown. In the case of a chimney, however, the condition is one where a stream of gas of, roughly, half the density of air, is made to issue from the top of the stack, and in so doing it displaces its own volume of the

heavier medium. Assume a frictionless, weightless piston, introduced momentarily just below the top of the stack; on its under side it will have the force due to velocity of the gas, and equal to $h = v^2/64.4$, and on its upper side it has air, to move which at the same velocity requires a force $H = v^2/64.4$; but since the density of air is twice that of gas, the force or column, H (although the same height), weighs twice as much as h; consequently, twice the force, which the velocity of gas exerts alone, is needed to move the piston at the velocity of the stack gas.

Another method of explaining this would be to consider a stack 1 ft. square, as shown on Fig. 3. Assume the velocity of the gas in the stack, as shown, to be 21 ft. per second, which gives it velocity head of 0.05 in. Then assume a wind blowing across the top of the stack at the same velocity, which would give it (due to greater density) a velocity head of 0.10 in. By completing the parallelogram of forces, it is seen that the two forces will combine and proceed at an angle of 26° 30′ from the horizontal; and, as the mean density, upon which the resultant force of 0.112 in. acts, is .75, the velocity in that direction will be 26.7 ft. per second. But since the sine of 26° 30′ is 0.446, it will be necessary to have the same amount of gas that passes through an opening 1 ft. square at 21 ft. per second velocity pass across an area of 0.446 sq. ft. at a velocity of 26.7 ft. per second. This is manifestly impossible, and the pressure in the stack must be increased or the stack velocity decreased.

If the same conditions occur with 0.05 in. excess pressure in the stack, Fig. 4, the two forces combine to produce 0.141 in., which acts at 45 deg. from the horizontal and gives a velocity to the combined gases of 30 ft. per second, as they have a mean density of 0.75. Now, the sine of 45 deg. is 0.70; so that we have to pass gas at 30 ft. per second across an area of 0.70 sq. ft., which makes a discharge of 21 cu. ft. This is the exact amount of gas that the stack is carrying.

Hence a pressure must be exerted at the top of the stack equal to the difference between that which will move the gas and that which will move the air at the same velocity, or, roughly, $R_1 = \frac{1}{2} CV^2 \div 64$, C being the factor for changing feet of air at 60° to inches of water; or, corrected for gas at 500°, this amounts to $R = 0.00011V^2$. The second of the resistances, or the skin friction of the stack, is unquestionably expressed by the formula $R_2 = CV^2H \div D$, C being a constant depending on the nature of the substances in contact and the density of the gas. Sturtevant's factor, which is very commonly used for the friction of the air in iron pipe, would give, allowing for the decreased density, $C = 0.0000285$; and since it is generally conceded that this is 75 per cent. of the factor for brick ducts, the resistance to skin friction would become $R_2 = 0.0000038V^2H \div D$.

Now, the value of $H \div D$ varies from 15 to 35 for average stacks, with a mean of about 25; and by substituting:

Maximum	$R_2 = 0.000133V^2$
Mean	$R_2 = .000095V^2$
Minimum	$R_2 = .000057V^2$

The third resistance, or that caused by the bend at the base of the stack, is one to which it is difficult to ascribe an exact value. It would seem from Fig. 2 that the velocity head should be neutralized by eddies due to impingement of the gas upon the perpendicular stack walls. The resistance of the bend would then be the head necessary to again impart velocity to the gas, or $R_3 = 0.000115v^2$.

In several cases this resistance has been found to agree with the formula $R_3 = 0.00015v^2$; and this, at 18 ft. velocity, amounts to 0.05 in., or the amount allowed by Stirling for any bend, the velocities given by their formula being about 18 ft. per second. If for want of a better established formula this be taken, the total resistances are as follows:

Maximum	$R = .000393V^2$
Mean	$R = .000355V^2$
Minimum	$R = .000317V^2$

Now, even with the high velocity of 30 ft. per second, the variation from the mean is only 0.034 in., and this, when compared to the draft of the stack, or, say, 1 in., is negligible. Therefore, $0.000355v^2$, or, say, $0.00036v^2$ can be taken as a close approximation of the loss of head in any stack, where V equals velocity of stack gas in feet per second.

Stirling uses $\Delta D \; fW^2VH \div A^2$ as a formula showing the loss of head or draft in stacks "due to inertia and friction." While this formula is incorrect in form, the constant used has been undoubtedly determined by the average of a large number of experiments, and for average conditions it may be used as a check. By substituting for A its equivalent, $\frac{1}{4}\pi D^2$, and for C its equivalent, πD, and by using the mean value for f, or 0.0017, the formula becomes:

$$\Delta D = 0.0018H \; (W/A)^2(4\pi D/\pi D^2).$$

But the weight of any sample of flue gas, or W, at average temperature varies but little from (volume $\div$ 23), and volume divided by area equals velocity. Substituting and cancelling:

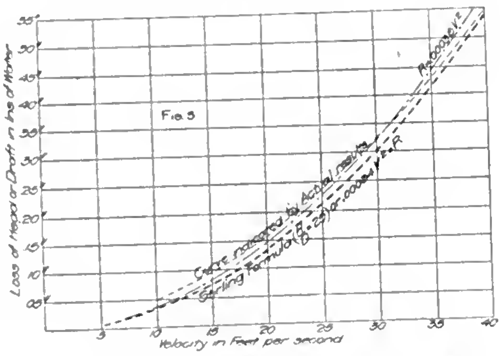
$$\Delta D = 0.0000136v^2H \div D;$$

Then calling $H \div D = 25$, as before:

$$AD = 0.00034v^2.$$

This checks closely with the previous formula:

$$R = 0.00036v^2.$$



Velocity and Loss of Head Curves.

The curves in Fig. 5 are platted from these two formulæ, and from the average of the results indicated by Fig. 1 and corrected for action of gravity on the tissue paper used to determine velocities.

Now having established the approximate relation between velocity and loss of draft by experiment and by theory, and having checked the result from past practice, it is possible to make use of the curve, as follows:

The curves in Fig. 6 are based on the principle that if a 100-ft. stack will give a draft of 0.61 in., with no velocity when the outer air is at the temperature of 70° Fahrenheit, and the stack gas is at the temperature of 500° F., the draft at a velocity of 10 ft. per second will be 0.036 in. less [$R = .00036 \times (10)^2$], as shown by Fig. 5.; at 20 ft. velocity it will be 0.144 in. less.; at 30 ft. velocity it will be 0.324 in. less, and so on. These results, shown in the form of a curve for a 100-ft. stack, give the drafts which may be expected at various velocities. Curves for stacks of other heights are laid off in the same manner.

Since these curves are based on a stack temperature of 500° F., and since this temperature may sometimes be as high as 600° F., it is necessary to consider the effect of this variation. With 600° F. temperature an 88-ft. stack produces about the same draft as a 100-ft. stack with 500° F. temperature. Therefore, if a temperature of 600° F. is expected (from overrating boilers or other causes), and a draft of 1 in. is required, the stack which gives 88 per cent. of this, or 0.88 in., is the one to be taken from the curves of Fig. 6.

To consider now the ability of a stack to carry off gas: The volume of stack gas produced in any power plant is primarily dependent upon the weight of coal burned. It is also dependent upon the temperature of the gas and upon the amount of excess air used in the combustion of the coal. The extreme variation of temperature, with fair practice, is to 600° F., which makes an increase in volume of 10 per cent. The factor of excess air is, however, a large one. One pound of coal when completely burned requires, under very good conditions, 200 cu. ft. of air; under good conditions, 250 cu. ft. of air; under poor conditions, 300 cu. ft. of air.

Thin fires, irregular stoking and excessive drafts are conditions which should not occur in a modern boiler room, and so need not be considered.

Now, 250 cu. ft. of air, after burning 1 lb. of coal and being reduced in temperature to 500° F., makes a volume of about 450 cu. ft. of flue gas; and if the stack velocity is 1 ft. per second, or 3,600 ft. per hour, the area of stack necessary to carry off gas from the combustion of 1 lb. of coal per hour is, under the above conditions, $450 \div 3{,}600 = 0.125$ sq. ft. Therefore, by dividing the area of any stack by 0.125 the number of pounds of coal that the stack will handle at a velocity of 1 ft. per second is obtained; or, multiplying the required weight of coal in pounds per hour by 0.125, gives the necessary stack area for a velocity of 1 ft. per second.

The actual area of a stack, however, is not all effective. There is a layer of gas at the sides which is stationary or nearly so. The thickness of this probably varies with the velocity, but Kent assumes it as 2 in. thick for all stacks, and following this principle as one of long established use, a 4-ft. stack would have an effective area of 10.44 sq. ft., and at 1 ft. per second velocity would carry off gas from 84 lb. of coal per hour. At 5 ft. per second velocity it would handle 418 lb., and at 10 ft. per second, 836 lb.

By applying this method to various sizes of stacks, the table under Fig. 6 was prepared, and with the combined curve and table it is possible to give the necessary height and diameter of a stack which will maintain a given draft at the base while carrying off the gas produced by the combustion of a given weight of coal per hour.

The object of maintaining draft at the base of a stack is to overcome the resistances of flue and boiler and to produce sufficient vacuum over the fire to give the necessary rate of combustion. The relation of vacuum over fire, or furnace draft, to the number of pounds of coal burned per square foot of grate per hour is a subject which is hardly within the scope of this article. It is affected largely by the care with which the firing is done and, with the coking coals of the Eastern States, depends on how often and how well the lumps of coke are broken up. It is also affected by the class of fuel, but as anthracite is no longer a commercial steam fuel, soft coal need only be considered. Owing to the wide use of stokers, soft coal slack will soon be about as high priced as run of mine coal. In fact, at the prevailing prices, run of mine coal is by far the better fuel commercially in almost all parts of the country; hence slack coal need not be considered under ordinary conditions, and with

average firemen the following rates may be expected for run of mine coal:

Eastern Coal. Draft.	Coal per sq. ft. of grate.	Western Coal. Draft.	Coal per sq. ft. of grate.
0.20 in.	14 lb.	0.20 in.	18 lb.
0.30 "	19 "	0.30 "	24 "
0.40 "	24 "	0.40 "	30 "
0.50 "	28 "	0.50 "	35 "

These figures may be greatly exceeded under favorable conditions.

Stirling gives a curve showing a rate of 50 lb. coal per square foot of grate, with a draft of 0.40 in., and Whitham records a test where 0.30 in. gave a rate of 32 lb. of coal per square foot, but such results could not be expected in every day practice. In fact, dirty or uneven fires, holes or large lumps of coke may easily reduce the figures in the table 50 per cent. In one plant examined by the writer a draft of 0.70 in. only produced a rate of 20 lb, with good Pennsylvania coal mixed with 40 per cent. of yard screenings, because the firemen spoiled the fires by excessive slashing and did not keep the surface well broken up and even.

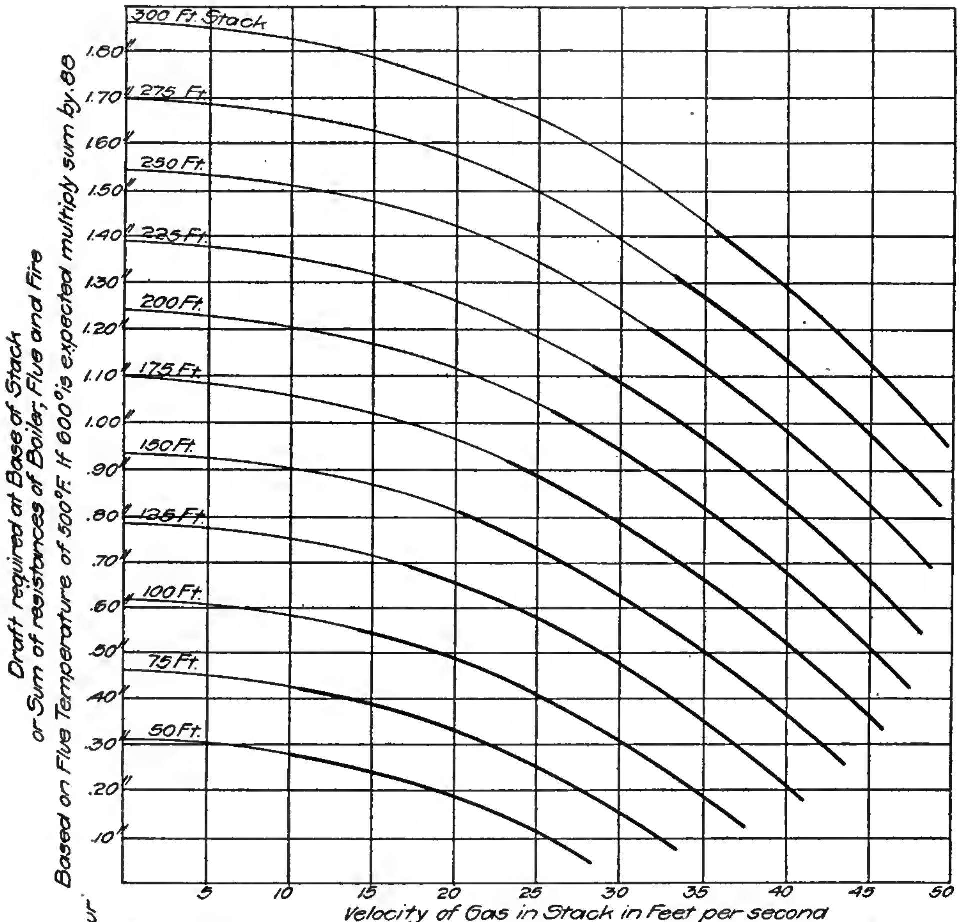
The resistances of the various types of boilers have been found to be, roughly, as follows, when delivering rated capacity under ordinary conditions of operation:

RESISTANCES OF BOILERS.

Babcock & Wilcox, double deck	0.40 in.
Babcock & Wilcox, standard	0.30 "
Stirling	0.20 "
Heine	0.20 "
Return tubular	0.10 "
Upright	0.00 "

(For 25 per cent. over-rate multiplied by 1.5.)

The resistance of each 100 ft. of straight flue may be considered as 0.05 in., and the resistance of each bend as 0.05 in. These values are, of course, dependent upon the size of the flue and the velocity of the gas in it, which should be about 20 ft. per second under ordinary conditions. This velocity gives very large flue areas, compared with past practice, but it is nearly always cheaper to build large flues than high stacks.



Lbs of coal to be burned per hour

Stack Dia.	Eff. Area	10	15	20	25	30	35	40	45
4	10.4	835	1250	1670	2090	2510	2930	3350	3760
4½	13.5	1080	1620	2060	2700	3240	3780	4320	4850
5	17.	1360	2040	2720	3400	4080	4750	5440	6100
5½	20.8	1660	2500	3330	4160	5000	5820	6660	7500
6	25.1	2010	3010	4010	5020	6020	7030	8040	9000
6½	29.7	2380	3560	4750	5950	7140	8310	9500	10700
7	34.8	2780	4180	5570	6960	8350	9750	11140	12500
7½	40.2	3220	4820	6440	8040	9660	11250	12870	14500
8	46.	3680	5540	7360	9220	11030	12880	14720	16500
8½	52.2	4180	6260	8360	10450	12530	14620	16710	18800
9	58.8	4700	7050	9400	11750	14100	16500	18800	21200
10	73.2	5860	8780	11700	14650	17600	20500	23400	26300
11	89.2	7140	10700	14300	17850	21400	25000	28600	32100
12	106.7	8530	12800	17050	21300	25600	29800	34100	38400

Based on 500° Stack Temperature — If 600° is expected multiply lbs. of coal to be burned by 1.10

Based on 250 cu.ft. Air per 1 lb. coal — If 300 cu.ft. is expected multiply lbs. of coal to be burned by 1.20

Chart Giving Dimensions of Chimneys for Different Services.

To take a concrete example: Assume a battery of Babcock & Wilcox boilers, which are to run at rating. They are connected to a horizontal flue 100 ft. long, which makes one bend before entering the stack. The uptake from each boiler enters the main flue at right angles. The boilers are to furnish 3,000 h.-p. by burning a fair grade of Eastern coking coal, giving 1 h.-p. for each 4 lb. of coal burned, and hence 12,000 lb. of coal are to be burned per hour. Assume the total grate area of all boilers to be 500 sq. ft., then 24 lb. of coal must be burned on each square foot per hour, and from the table of rates of combustion it is seen that 0.40 in. of draft must be given over the fire.

Now, there will be needed 0.4 in. draft for the furnace, 0.3 in. to overcome boiler resistance, 0.05 in. to overcome the bend at each uptake, 0.05 in. for the 100 ft. of main flue, and 0.05 in. for the bend in the main flue. This gives a total of 0.85 in. needed at the stack base.

Referring to the vertical division marked "draft" on Fig. 6 and selecting the point corresponding to 0.85 in., it is seen that a horizontal line, drawn from this point, crosses the curve marked "150-ft. stack" directly above the velocity of 15 ft., meaning that a 150-ft. stack will give 0.85 in. draft when the velocity is 15 ft. per second. Extending the horizontal line to the curve of the 175-ft stack, it is seen that the velocity nearest to being below the intersection is 25 ft., meaning a 175-ft. stack will maintain 0.85 in. of draft and a velocity of 25 ft. per second. In the same way a 200-ft. stack is shown to give 0.85 in. of draft and 35 ft. velocity.

Now referring to the table of Fig. 6, it is seen that if 12,000 lb. of coal are to be burned with a stack velocity at 15 ft., or that given by a 150-ft. stack maintaining 0.85 in. of draft, the stack must be nearly 12 ft. in diameter (which diameter will handle 12,800 lb. of coal at this velocity). But if the stack is 175 ft. high and the velocity is 25 ft., the diameter need only be 9 ft., or if the stack is 200 ft. high it need be only 8 ft. in diameter.

The horizontal line showing 0.85 in. of draft crosses the curve of the 150-ft. stack outside of the heavily marked part of the curve, and this indicates a velocity too low to be economical. Except under extraordinary conditions, the 175-ft. by 9-ft. stack will be cheaper than and preferable to the 150 x 12-ft. It will undoubtedly contain less brick and will be less liable to the effect of outside conditions.

Suppose that it is desired to get the same horse-power by reducing the number of boilers or by over-rating the boilers 25 per cent., and say that the grate area is proportionately larger and the fireman careless. Then it may be expected that the flue temperature will go up to 600° F. and that uneven fires will bring up the volume of air per pound of coal to 300 cu. ft. Then if the total grate area again is 500 sq. ft. the sum of resistances will be $0.30'' \times 1\frac{1}{2} + 0.05 + 0.05 + 0.05 = 1.00$ in.; but as the temperature is 600° F., it is necessary to figure on only 88 per cent. of this, or 0.88 in.

The coal actually to be burned will be 12,000 lb. per hour, but since temperature is 600° F., its equivalent, or $12{,}000 \times 1.10 = 13{,}200$ lb., must be allowed for. Also, since excess air is to be increased, the equivalent of coal properly burned is $13{,}200 \times 1.20 = 15{,}800$ lb.

The table shows that a 10-ft. stack handles at 25 ft. velocity 14,650 lb. of coal, and at 30 ft. velocity 17,500 lb. of coal; and as the horizontal line of 0.88 in. of draft crosses the 175-ft stack curve at about 27 ft. velocity, it may be expected that a 175 x 10-ft. stack will handle 16,100 lb. of coal, which is just above the required amount of 15,800 lb., so that the necessary stack is 175 x 10 ft.

To consider another problem which often arises, namely, that of determining the height of stack to be added in case of an increase of horse-power in an old boiler plant: Assume that the foregoing plant has a stack 175 x 9 ft. and that it becomes necessary to add 1,000 boiler horse-power to the plant, the new boilers to be similar to the old ones in every way, and led into the stack by a separate connection or by a properly enlarged breeching. Then the amount of draft at the stack base will not have to be increased, but the velocity of the stack gas must be increased to take care of the extra 4,000 lb. of coal burned per hour.

Referring to the table of pounds of coal burned, Fig. 6, it is seen that if 16,000 lb. are to be burned and the stack is 9 ft. in diameter, the velocity will have to be nearly 35 ft. per second, because this velocity in a 9-ft. stack carries off gas from 10,500 lb. of coal per hour. A vertical line drawn from the point showing 35 ft. velocity intersects the horizontal line of 0.85 in. draft just above the curve for the 200-ft. stack, or where the curve for a 205-ft. stack would be; or, in other words, it is necessary to "top out" the old stack 30 ft. This will undoubtedly be cheaper than building a new stack and foundation for the new boilers.

The proper areas for breechings which will give a velocity of 20 ft. per second may be obtained from the column showing effective areas corresponding to the various weights of coal burned per hour in the column under 20-ft. velocity.

Now by comparing the figures given in the first of the foregoing examples and Kent's table of chimney capacity, it is seen that in Kent's table a stack 175 x 8½ ft. will serve 2,300 h.-p. or burn about 12,000 lb. of coal. This is a smaller stack than is indicated in the example, but if the draft over the fire is set at 0.30 in. instead of 0.40 in., and the draft at the stack base reduced to 0.75 in., the table in Fig. 6 shows that about 12000 lb. can be handled by a 175 x 8-ft. stack. If in the same example tubular boilers are used instead of Babcock & Wilcox, and the necessary draft reduced to 0.55 in., the stack may be reduced to 133 ft. in height, if the diameter is kept at 9 ft.; or if the dimensions are kept at 175 x 8½ ft it will burn 16,500 lb. of coal.

Referring again to the formula $H = (0.3\ \text{h.-p}/E)^2$, with regard to the velocity it gives and the drafts exerted at stack bases, it is evident that, since the height is made a function of horse-power divided by area, the velocity for any height is constant. These velocities, drafts and percentages of total drafts are shown below in a table:

Height.	Velocity.	Effective draft at base.	Per cent. of total draft exerted.
300 ft.	37 ft	1.38 in.	75 per cent.
250 "	33 "	1.17 "	75 "
200 "	30 "	.93 "	76 "
150 "	25 "	.72 "	78 "
100 "	20 "	.48 "	79 "

From this it is easily seen why stacks designed from this formula give good results if the correct height is chosen. It also accounts for the common saying that for the taller stacks Kent's formula gives excessive diameters, because it is seldom that the draft at the base of a stack has to be over 1.00 in., and consequently there would be 0.17 to 0.38 in. wasted which could have been applied to increasing the velocity and decreasing the diameter.

To return to the questions in the opening paragraph: Reducing a 150 x 6-ft. stack, burning 5,000 lb. of coal, to a diameter of 5 ft. will decrease the draft 0.30 in. Reducing the height to 100 ft. will also decrease the draft 0.30 in. If we add 500 h.-p. to the plant, without increasing the grate area under each boiler, the stack must be increased to 200 ft. in height. Introducing forced draft will allow the furnace draft to be applied to increasing velocity; if this be 0.40 in. it will enable the stack to carry 1,600 h.-p., or burn 8,000 lb. coal per hour.

This article refers in a number of places to the well-known chimney formula originated by Prof. William Kent, dean of the College of Applied Science at Syracuse University. Proofs of the article were accordingly submitted to him and he has furnished the following comments:

"There is one statement by the author that I do not think quite fair to my formula. He says, 'It is manifest that if it gave a satisfactory stack for a battery of Babcock & Wilcox boilers, it would give for a battery of Manning upright boilers a structure vastly in excess of the requirements.' I tried to make it clear in my book that the formula was to be used after the height had been assumed, see pages 734-6.

"I have looked into Mr. Kingsley's paper to see how he would solve a practical problem of burning 12,000 lb. of coal per hour under B. & W. boilers. He says that for a 175-ft. stack, the diameter need only be 9 ft. My table shows that for a 175-ft. stack, 102 in. diameter will give 11,500 lb. of coal per hour, and if, as is generally believed, my table errs on the safe side, then 102 in. diameter may be considered enough for 12,000 lb. of coal, instead of 108 in. that Mr. Kingsley's formula would give. Mr. Kingsley, however, states that if the chimney is 200 ft. high, it need only be 8 ft. in diameter. My figure for a chimney of that size is 2,167 × 5, or only 10,835 lb. of coal, so there is a considerable lack of harmony between Mr. Kingsley's method and my own. For a 175-ft. stack he would give a larger diameter than I would and for a 250-ft. stack he would give a smaller diameter. In the absence of experimental proof I should prefer to use my method.

"Mr. Kingsley's method of proportioning a stack seems to be a rather roundabout one, involving a knowledge of what drafts are required to burn different kinds of coal at different rates of combustion, what velocities are needed in chimneys to carry off the gases, and what resistances to draft there are in different kinds of boilers and in flues and bends. Many of these data are imperfectly known, and one of them, the resistance on the bed of coal on the grate may vary from minute to minute through a wide range. It would seem to be just as well to have a purely empirical method of selecting the height of the chimney; that is, to find out from boiler manufacturers or others what height of chimney they have found suitable for different rates of combustion with different kinds of coal, and then, using that height, take the diameter from my table. In the more than twenty years that my table has been before the public, I have never heard objection to it on the ground that it gave too small an area of chimney. It has often been objected to for giving a chimney larger than was necessary, but that is a good fault, and I have never had sufficient evidence of the fault being large enough to warrant the figures or the formula being changed."

The Mississippi River Bridge, at St. Louis, of the Illinois Traction System, commonly known as the McKinley syndicate, was started on Dec. 8 by launching the foundation caisson for one of the channel piers on the Illinois side of the river. The bridge will span the river from the town of Venice, just north of East St. Louis, on the Illinois side, to the northern part of St. Louis, on the Missouri side, the location being about 8 miles south of the Merchants Bridge. The structure will consist of three channel spans, the middle one 523 ft. long, and the other two 521 ft. long, with three short approach truss spans on the Missouri side and two on the Illinois side. The piers will be of concrete with stone facing and granite coping. Those for the main spans will be carried down 60 to 65 ft. to bed rock, while the approach piers will rest on piles. The bridge has been designed for two 120-ton electric locomotives, and will be heavier than either of the other St. Louis bridges. In general outlines it is similar to the Merchants Bridge, but differs in details. The wagon ways will probably be located in the center at first, but as traffic increases will be placed outside the trusses on cantilever supports. Mr. Ralph Modjeski, Chicago, as consulting engineer for the St. Louis Electric Bridge Co., designed the structure.

Mechanical Plant of the Brooklyn Institute Building.—II.

Ventilation.—The building of the Brooklyn Institute of Arts and Sciences is devoted to a variety of museum and educational purposes, including extensive museums of natural history, archaeology, anthropology and ethnology, a large gallery and sculpture hall, an auditorium seating 1,500 persons and laboratories, studies and work-rooms, all of which are largely public in character, so that it is desirable to provide for thorough ventilation. Mechanical ventilation had been provided for in the original west wing of the building, including both fresh air supply and exhaust ventilation in capacity sufficient to clear the air in all departments when crowded with visitors, and this provision has also been made a feature of the second and third sections of the building, recently completed. Ventilation has been provided for in practically all rooms above the cellar, in capacities sufficient for maximum normal occupancy while in the auditorium special provisions were made for ventilation along the lines of the best practice in theatre and lecture hall ventilation.

The ventilation systems were, owing chiefly to the construction of the building in sections at different times, laid out independently for each section. Each division requires, on account of the size of the building, an equipment of large capacity and extensive duct systems for air distribution and gathering systems, the central section having an additional system independent of that for general ventilation which is intended to serve the auditorium only. There is to be noticed a lack of uniformity in capacities between the ventilating equipment in the different sections which is due largely to the varying purposes for which the different portions of the building are used. The systems vary in capacities from 30,000 to over 50,000 cu. ft. per minute of fresh air supply and from 26,000 to 50,000 cu. ft. of exhaust, the capacity of supply generally exceeding that of exhaust ventilation to create a plenum within the building. The fresh air supplies are all cleansed by cheese-cloth filters of the usual construction and the systems are fitted with tempering coils and moistening pans for the control of the temperature and the humidity of the air delivery.

The ventilation is planned throughout the entire building for downward circulation of air, the fresh air supply being admitted through registers in the upper side walls near the ceiling line, except in special cases where the outlets are located in the ceiling, while the exhaust register openings are almost all located at or near the floor level; in toilets and where heat removal was deemed of importance, there are top exhaust openings. Thorough distribution of the supply is provided by well-studied arrangements of registers in all rooms, which, in their relation to the exhaust registers, direct currents of air into all corners. In all of the larger rooms there are two or more sets of supply and exhaust registers, there being in some of the larger museum and laboratory rooms, of a maximum size of 38 x 108 ft. in plan, as many as six and eight registers each for supply and exhaust. In the smaller rooms such as used for offices and auxiliary work rooms which range in size from 12 x 20 ft. to 15 x 40 ft., there are uniformly two each for supply and exhaust, but the locations chosen are so separated as to render the circulation general and positive. Exceptions to this are to be noted only in the auditorium, where a special system has been installed and in the toilet rooms, which, of course, have exhaust ventilation connections only, with fresh air supply connections omitted other than in the form of louvres in the panels of the doors connecting with the

outside or the corridors through which air may enter to replace that exhausted. The general arrangement of register openings was affected somewhat by the desire to confine the duct risers connecting with them to certain rows of inside partition walls in which they may be concealed with the least amount of interference with the interior arrangement and the daylight lighting from side windows. As may be noticed from the general first floor plan of the building, in the original west wing, all of the duct risers are arranged in the cross-wise partition walls with none in the side walls, but in the new easterly wing ducts have been placed in the side walls to a limited extent where found desirable for better distribution connections. In the central section of the building the duct risers are very generally distributed, being carried up for the greater part in furred enclosures which were provided for the interior decorative construction.

As there were no definite ventilation requirements imposed in the various parts of the building, as the conditions of occupancy are in all portions except the auditorium irregular and indefinite, the design of the ventilating equipments was merely based on the desirable ventilation rates of from three to four changes of air per hour in all rooms which it is thought will be ample for all ordinary conditions. In the auditorium in the basement of the central portion, however, the conditions were more definite, ventilation being required at the rate of 30 cu. ft. per person for the average audience expected in attendance. The sizes and arrangements of the fan equipment were decided by the construction of the different sections of the building at detached intervals, a single unit each for both fresh air supply and exhaust being installed in each section of sufficient capacity to handle that general division of the building, while basement or cellar locations for the fresh air supply blowers, with convenient filtered air intakes, were chosen with exhaust fans in the attic. In the original west wing, the fresh air blower was located in the west end of the basement, the greater part of which floor is utilized for museum purposes, and the distribution duct line concealed in furred ceiling construction, but in the central portion and the new east wing, the sharp descent in the grade at that portion of the site facilitated the provision of sub-floors which are used solely for the mechanical equipment and thus without waste of valuable space above ground level. In the two latter cases the distribution duct lines are carried on the cellar ceiling exposed, the trunk duct and branches being covered with asbestos block and canvas. For the fresh air supply, fans of the centrifugal type were selected in all cases, while for exhaust, disc fans were installed in attic locations where convenient to the gathering duct systems and roof discharge outlets, excepting in the case of the auditorium system, where owing to concentrated space ventilated it was thought desirable to locate this fan in the basement alongside of that for fresh air supply. The fans are all motor driven with the exception of that for fresh air supply in the old west wing, in which case the direct connected steam engine drive which was originally installed, has been retained. In the case of the auditorium systems where both fresh air supply and exhaust fans are both located in the basement, they have been arranged side by side with a tandem drive from a single large motor.

The principal details of the fan equipments, their drives and tempering coils are presented in an accompanying table. The fans of the centrifugal type are all three-quarter housed steel plate blowers supplied with the tempering coils by the B. F. Sturtevant Co., and are for the greater part installed with top horizontal discharge casings. They have single direct connected drives with the exception of the systems supplying fresh air to the central portion of the building where, on account of the large volume of supply required, and also of lack of space for a very large unit, two smaller units were installed which are coupled in tandem to a single motor drive and have connections in multiple for both intake and delivery. The motors installed are all C. & C. direct-current, slow-speed motors which are operated on separate power circuits from the local power plant supply, their control being in the local distributing switchboards in each section of the building; they are fitted with Cutler-Hammer starting boxes fitted with both overload and underload release to permit of their being operated with a minimum of attention. The fresh air blower in the west wing is driven by a 10x12-in. Sturtevant horizontal automatic steam engine which, as stated in the preceding article, receives steam from the high pressure system from the power plant and exhausts locally into the low pressure heating main which centers in that wing.

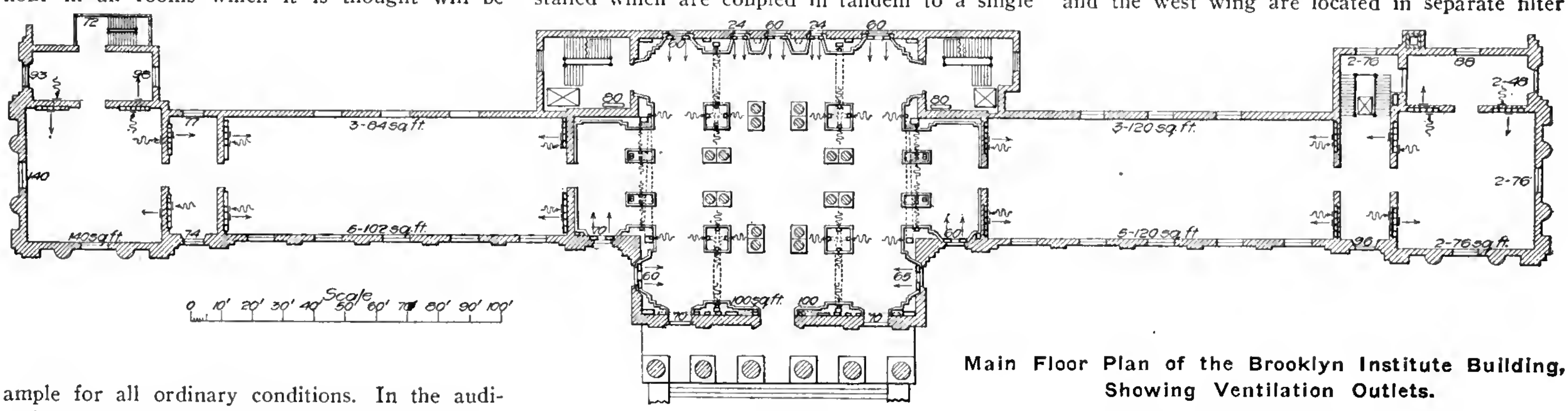
The fresh air fans have short direct intake connections made in the most convenient manner to the outside air, at low levels, the intake air being cleansed by cheesecloth filters. The west wing fan intake is through a grilled window opening in the west end of the basement, that for the east wing fan through a window and area way at the front, while that for the two fans in the central portion is through a masonry enclosure outside of the building wall which is connected with a 3x24-ft. galvanized iron enclosure that is carried up to a hooded opening about 12 ft. above grade level at the rear of the building.

Details of Fan Equipment for Ventilation of Brooklyn Institute Building.

Section Served	Size of Fan Wheel. Diam., ft.	Size of Fan Wheel. Width, ft.	Size of Motor, h.p.	Speed, r.p.m.	Capacity, cu. ft per min. Supply.	Capacity, cu. ft per min. Exhaust.	Tempering Coils. No. of Sections.	Tempering Coils. H't'g Surface, sq. ft.
West wing	8	4	(10x12-in. engine)	140	31,600	......	8	1,845
West wing	5	disc	10	140	......	30,700	..	.....
Central portion........	2·7	3	18	165	54,100	......	10	2,000
Central portion........	7	disc	10	225	......	49,700	..	.....
Auditorium	8	4 }	18	140	31,500	......	7	1,800
Auditorium	7	4 }		140	......	26,000	..	.....
East wing	9	4½	14	130	43,000	......	7	2,000
East wing	6	disc	15	275	......	38,000	..	.....

Each of the intakes is fitted with a filter of the usual zigzag frame construction with cheese-cloth as the filtering medium, the areas of which cloth are proportioned in relation to the maximum fan capacities as to secure low rates of filtering velocities, which range from 50 to 70 ft. per minute in the various filters. The higher filter velocity of approximately 70 ft. per minute, is to be found in the filter for the central portion which supplies the two fans, one for general ventilation and the other that for the auditorium; as the auditorium is to be used only occasionally and presumably at such times as the remainder of the building will be closed, an area of filtering medium was chosen which, while causing a rather high rate of flow if for both systems should happen to be operated to maximum capacity simultaneously, will in all probability be rarely if ever operated under this condition of maximum capacity. The filters are of the usual construction consisting of light wooden frames carrying wire netting over which the cloth is tightly stretched, which are mounted in light galvanized iron framework with fittings for clamping them in place air-tight; duplicate filter screens are provided to enable replacements of those in service for cleaning. The filters for the central portion and the west wing are located in separate filter chambers of ample size which open directly to the outside and from which the fans draw through short duct connections; in the west wing system the fan is itself located directly within the filter chamber enclosure, thus avoiding the intake duct connections. In the two former cases, however, the tempering coils are conveniently located in the intake duct connections between the filter chamber and the fan intake, permitting direct connections from the fan delivery openings to the delivery duct lines, while in the west wing system it was necessary to provide space in the fan delivery ducts for the coils. The tempering coils are of the Sturtevant mitre pattern of 1-in. pipes, which are installed in two row sections throughout in numbers of sections and in capacities of surface indicated in the accompanying table. The steam supply and vapor and condensation return connections to these coils were referred to in the description of the heating system of the building in the preceding article. These coils are like the direct radiation fitted for automatic temperature regulation, each system having two control thermostats, one in the outside air operating the supply and return valves of the two outside pipe sections only when the exterior temperature drops below freezing and the other inserted within the delivery ducts for the close adjustment of the air delivery to the temperature required.

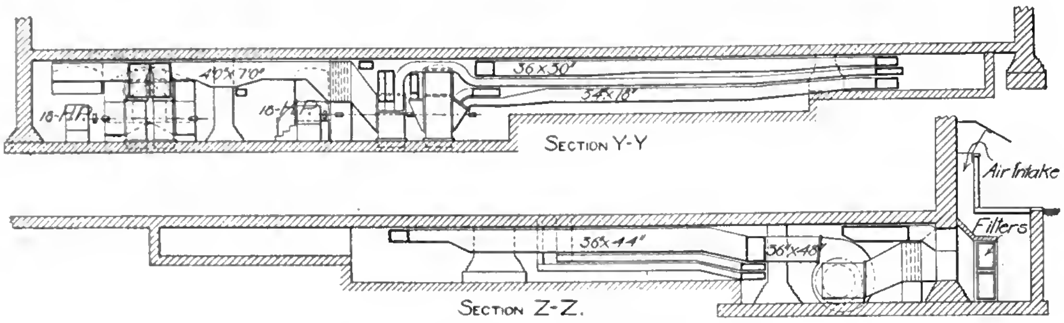
The duct systems have been liberally proportioned for low velocities of flow, rates of from 1,800 to 2,000 ft. per minute being prevalent in trunk duct lines which are decreased to lower values in the branches and finally to velocities of outflow not to exceed 350 ft. per minute through the outlet registers. The duct systems in the side wings are comparatively simple, consisting of a single longitudinal trunk duct through the



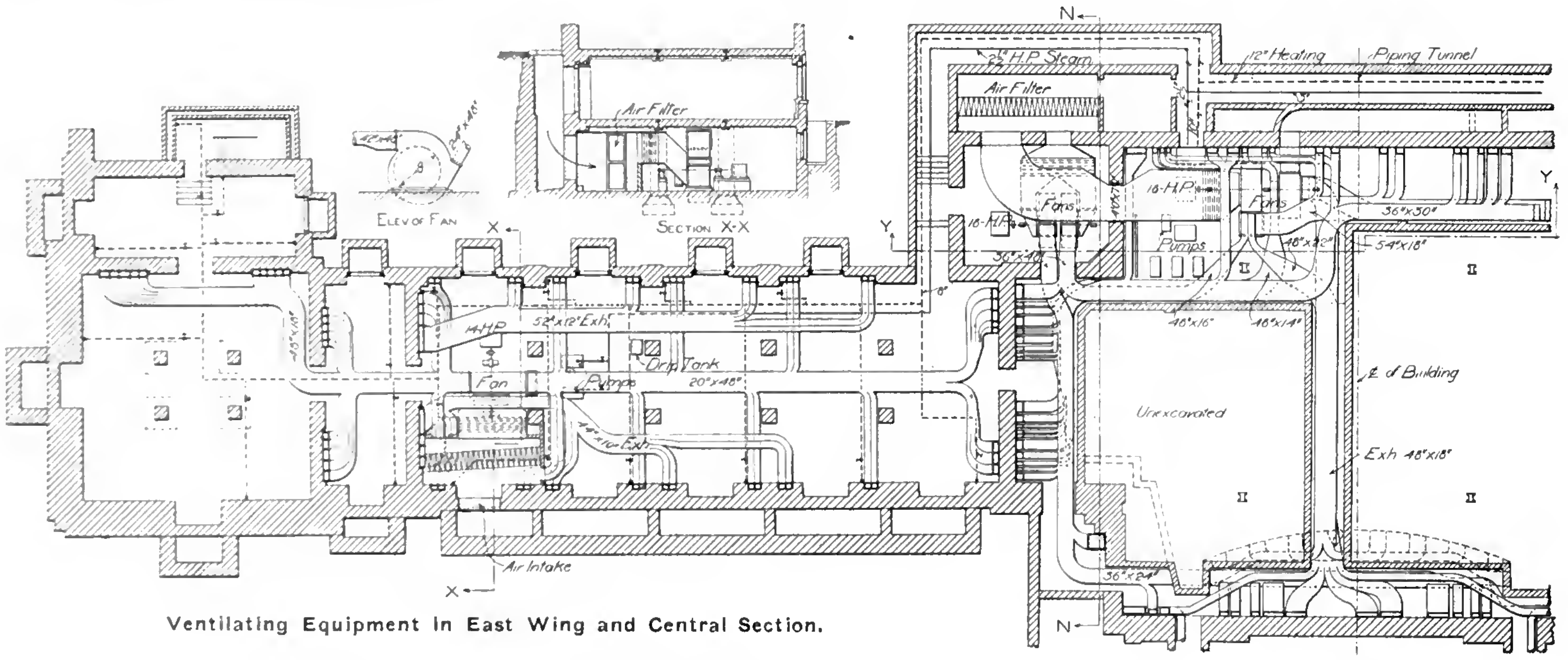
Main Floor Plan of the Brooklyn Institute Building, Showing Ventilation Outlets.

center of the cellar or basement with branches to the banks of partition risers to the upper floors; these risers of which there are one to practically every floor in each group, are made uniformly 12 in. in depth and vary in width, provisions being made for them in the furred wall construction in the various cross-wise partitions of the side wings. In the central portion of the building the arrangement differs somewhat, trunk duct lines extending from each of the two fans for general ventilation around the four side walls of the basement with branches to the duct risers that are carried up in the furred side wall faces. The general arrangement of the supply duct work, as well as also that for exhaust ventilation, are well shown in the accompanying drawings. The exhaust ducts and connections follow in fact the general arrangement of those for fresh air supply, duct risers being carried up also in the cross-wise partitions of the wings and in the furred side wall construction of the central portion to gathering duct lines in the attic which connect with the disc exhaust fans. The supply and exhaust duct risers are in fact alternated, the exhaust connections to the upper floors occupying spaces directly above those for supply to the lower floors with consequent economy of space. It was necessary to arrange the gathering duct lines in the side wing attics in two divided lines on either side owing to the provision of the extensive skylights in the middle portion of the roofs for the art gallery lighting. These lines and only on starting. These fans all draw from spacious exhaust chambers into which the branch gathering ducts connect and deliver direct to the outside through exhaust hoods in the roof with openings of the full size of the fan in each case. These roof discharge hoods are of heavy copper construction, well braced and are specially designed to protect the fan and motor from the weather, while not restricting the outflow.

Auditorium System.—The ventilation of the auditorium has, as above stated, been provided for in accordance with approved public hall practice, air being circulated on the downward system and capacity provided for approximately 30 cu. ft. per minute per person for an average audience of a little over two-thirds of the seating capacity. The seating capacity of the hall is about 1,500, of which there are about 1,000 seats on the main exhaust are, as above stated, located in the sub-basement space under the rear of the main floor where convenient for short connections to the outside air. The fans are both Sturtevant centrifugal blowers, of sizes and capacities indicated in the accompanying table, and as they are intended only for simultaneous operation when the hall is occupied, they were located side by side and fitted with tandem drive from a single large motor. They both have three-quarter housed casings, the exhaust blower with top horizontal discharge outlets, while the fresh air fan, being connected to the same drive, is necessarily of the 45-deg. upward discharge type. The arrangements of duct work connections are shown in the accompanying drawings. The fresh air supply fan has intake in common with that for general ventilation of the central portion, connection from



Sections Showing Fans and Ducts in Central Section.



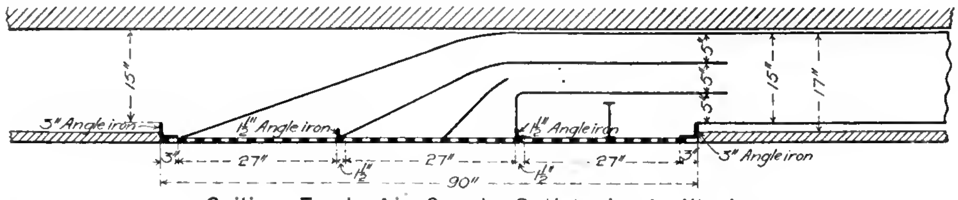
Ventilating Equipment in East Wing and Central Section.

the branch lines from the end sections of the wings lead in both cases to exhaust chambers near the central portion of the wing from which disc exhaust fans discharge through roof outlets. In the case of the central portion of the building the exhaust fan is located in the attic space in the rear of the base of the dome and draws through two gathering ducts that extend on all four sides of this section. The exhaust duct lines are similarly designed for low velocities of flow, averaging but little over 1,000 ft. per minute, and the ducts are without insulation covering throughout.

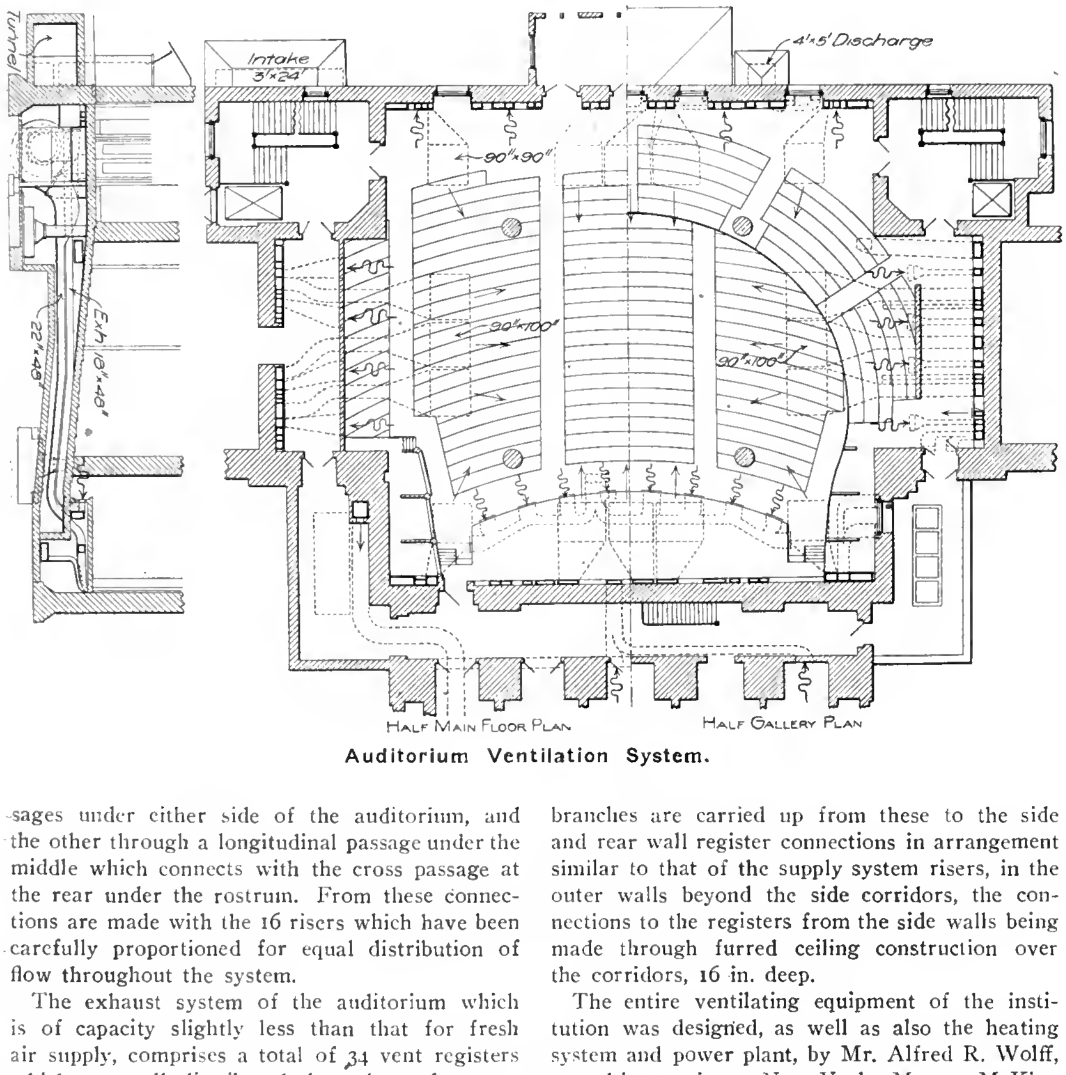
The exhaust fans are Howard & Morse disc exhaust fans of the sizes and capacities indicated in the table and are of the vertical type in the central portion and east wing systems while that for the original west wing was installed horizontally. They are all direct connected to C. & C. direct current electric motors, special vertical shaft motors being used for the two former units. These motors all have separate feeder circuits from the distributing switchboard in the basement to permit of being shut down directly from the latter board and requiring attention floor arranged in five rows and about 500 seats in six groups in a balcony that surrounds the hall on three sides, with in all, 12 boxes, six on either level. The main floor slopes downward to the front towards the rostrum, to a point 4 ft. below the level of the rostrum, the latter and the rear floor and corridors being on the level of the basement floor of the building. The rostrum is 16 ft. in width by 58 ft. long, and the hall itself 104 ft. in maximum length, parallel to the rostrum, and 86 ft. in width, with a ceiling height of 26 ft., giving thus a total cubical content of approximately 235,000 cu. ft. With this arrangement of the gallery and the seating, it was thought preferable to admit the fresh air supply through distributed points in the ceiling, around the outer edges, and to withdraw the foul air in the main hall through openings under the rostrum, and in part through ceiling registers at the extreme rear edges and sides of the room both under and over the gallery. In this way it was felt that by designing for low velocities of register flow the most effective distribution could be secured without noticeable draft.

The fan equipments both fresh air supply and the filter chamber to the fan being made through an intake duct of some length located on the ceiling of the sub-basement above the other supply fan. The exhaust fan has its discharge at the rear of the building through a short stack of height similar to that for the central portion fresh air intake, but for purposes of separation of the intake and discharge, the latter stack, which is 4 x 5 ft. in section, is located some 75 ft. to the west of the intake stack, connection being made to the fan discharge through a 4x4-ft. underground masonry duct immediately outside of the building wall. Fresh air is delivered to the auditorium through 16 ceiling outlet registers which are well distributed over the ceiling area. Twelve of them are registers with 90x100-in. faces which are arranged in groups of three over the center of each of the four sides of the room, while the remaining four registers have 90x90-in. faces and are distributed in the corners of the ceiling. Each of the outlet registers is, as may be noted from the accompanying detail, divided into three sections with distributing baffles in the connection to the ducts in order to spread the outflow evenly over the register face and prevent

any tendency toward draft. The delivery velocities for which this system was designed are exceptionally low, the flow velocities averaging from 1,500 to 1,700 ft. per minute in the trunk duct lines from the blower which are successively decreased in the risers and branches to about 800 ft. per minute at the connections to the registers in which the discharge velocities are reduced to only about 50 ft. per minute, thus precluding the possibility of a draft being felt in any part of the room. These ceiling registers are supplied through three main duct lines from the fan in the basement, one of which extends through pas-



Ceiling Fresh Air Supply Outlets in Auditorium.



Auditorium Ventilation System.

sages under either side of the auditorium, and the other through a longitudinal passage under the middle which connects with the cross passage at the rear under the rostrum. From these connections are made with the 16 risers which have been carefully proportioned for equal distribution of flow throughout the system.

The exhaust system of the auditorium which is of capacity slightly less than that for fresh air supply, comprises a total of 34 vent registers which are well distributed throughout the room in relation to the fresh air supply openings for the purpose of creating a thorough and positive circulation. Of these vent registers, there are 10, each with 14x36-in. faces and comprising together about one-third of the total exhaust ventilation capacity of the system, which are located in the front portion of the rostrum. Of the remainder 12 are located in the side and rear walls of the room under the balcony, and the other 12 similarly in the side walls above, all of these registers being located at the ceiling line with the exception of the four at the rear under the balcony; at this portion of the main floor there are doorways leading out into the area way at the rear for purposes of fire exits, and here the register openings were located near the floor line. This arrangement divides the remaining two-thirds of the vent register capacity between the spaces at the rear both above and below the balcony, obtaining thereby the most complete distribution of register openings. Similar low velocities of flow are also provided for in this system, the duct lines being proportioned for maximum velocities of less than 1,500 ft. per minute, while the connections to the registers are proportioned for velocities of inflow of less than 250 ft. per minute. The arrangement of the exhaust duct work is also similar to that for fresh air supply, there being three main trunk lines leading to the fan intake, one through each of the side passages, and the other through the central passage to the rostrum intake openings at the rear. Riser branches are carried up from these to the side and rear wall register connections in arrangement similar to that of the supply system risers, in the outer walls beyond the side corridors, the connections to the registers from the side walls being made through furred ceiling construction over the corridors, 16 in. deep.

The entire ventilating equipment of the institution was designed, as well as also the heating system and power plant, by Mr. Alfred R. Wolff, consulting engineer, New York. Messrs. McKim, Mead & White, New York, are architects for the institute buildings.

THE LIMIT OF SUPERHEATING desirable for Corliss engines was stated in a discussion of papers on superheated steam at the recent New York meeting of the American Society of Mechanical Engineers, to be to a temperature of 500° Fahr. With steam used at higher temperatures, the valves give trouble by warping and binding, due to their unsymmetrical form, and also in certain cases cylinders have been known to change shape sufficiently to give trouble. In engines fitted with slide and gridiron valves, however, no difficulty is experienced except with lubrication and that has in certain cases been overcome by special direct oil connections to the valve seats.

Some Main Line Revisions on the Baltimore & Ohio R. R.

The Baltimore & Ohio R. R. has completed a revision of its main line between Hollafield and Davis, Md. This is a continuation of work that has been going on for the past seven years in straightening the alignment and making a low-grade freight line from Relay to Washington Junction, the former place being its junction point with the Washington branch, and the latter its junction point with the Metropolitan branch; these two branches forming its line via Washington, by which route its through passenger trains are run. That part of the main line between Relay and Mt. Airy follows the Patapsco River, the valley being narrow and crooked, with hills rising from the water's edge and spurs from the hills projecting across the bends at intervals which have made it necessary in the reconstruction to build a number of tunnels and bridges, as the original location followed closely the windings of the stream resulting in heavy grades and curves.

T. A. Shoemaker & Co., contractors, of Philadelphia, began work on the revision of the line between Hollafield and Davis, in September, 1905, and completed it in October, 1907, during which time they excavated 400,000 cu. yd. of material, 70 per cent. of which was solid granite, the balance being sand, loam, and clay; 10,000 cu. yd. of bridge masonry of Pennsylvania sand stone; 5,000 cu. yd. of concrete in foundation; two tunnels having a combined length of 1,523 ft.; three undergrade crossings; reconstructed a highway 5,000 ft. in length, and changed the channel of the river in two places.

The grading averaged 100,000 cu. yd. per mile, 187,000 cu. yd. being in the Alberton cut, which was 2,000 ft. in length and 75 ft. high, and practically all the earth on the entire work was in this cut, between the original surface and a point about 25 ft. above subgrade. All the material was removed with a 70-ton Bucyrus shovel working in lifts from the surface to subgrade, bringing it down full-width, and wasting the top material on tracks on the same grade with the shovel, running around the contours of the hill.

The material in the east end on the south side was found to be a conglomerate, there being pockets of mica sand, red clay, and ledges of limestone alternating, which caused the south slope to break and pockets of this material to slide out at the seams. These slips were removed with the shovel. The balance of the excavation was all granite, which was removed with steam drills, and shovel. Dorsey tunnel, one mile west of Alberton and on the opposite side of the river from the old line, with a length of 1,025 ft. face to face of portals, was bored through solid granite, and only 96 ft. at the west end had to be timbered, on account of seams in the roof. A top heading, 7x10 ft., was first driven from both ends, the balance of the material being taken out in two benches. The amount of excavation in this tunnel was 36,500 cu. yd.

The material in Davis tunnel, one-half mile east of Davis and on the same side of the river as the old line, proved to be a mixture of mica sand, soft granite which disintegrated when exposed to the air, and a hard rock which followed the subgrade closely, at times reaching as high as the wall plate grade 14 ft. above subgrade. The length of this tunnel is 498 ft., face to face of portals, and it had to be timbered for its entire length. Seven segments of 12x12-in. timbers were used for the centers, and plumb posts 3 ft. center to center, also 12x12-in. for two-thirds of its length. Where hard rock was encountered at wall-plate grade the segments rested on wall plates on the rock bench.

The method used in driving this tunnel was

varied from that at the Dorsey tunnel, to the extent that the first heading was excavated from the roof to the wall-plate grade and was taken out full width, the bottom bench being taken out later, the excavation amounting to 17,000 cu. yd. On Oct. 22, 1906, while this tunnel was being lined, 98 ft. of lining having been completed in the east end, a fall occurred 140 ft. from the east end, 30 ft. in diameter almost on the center line, and extending to the original surface of ground 92 ft. above subgrade. This fall was almost plumb and had the appearance of being a shaft, the north side overhanging slightly, having a well-defined rock seam, and from that point south the material was soft granite and mica sand. The contractors began to line the tunnel from the west end and finally got to within 104 ft. of the lining from the east end. They tried several times to get under the fall by using crown bars, and on four different occasions were within a few feet of getting through when the southwest corner would give away and crush their timber centers. They finally gave this method up, and in June, 1907, when the size of the fall had increased to 53 ft. at the roof of the tunnel and 140 ft. at the surface of the ground, they began the use of a Model A Marion shovel and had the fall removed, which consisted of 36,000 cu. yd. and formed a natural slope to original grade. The tunnel was completed Sept. 25, 1907.

Both tunnels are standard section for double track, and lined with shale and vitrified brick and have sandstone portals. Both were driven by compressed air, the compressor plant being located midway between them, and the air conveyed to them by a [illegible] pipe. The excavation was unclassified.

The old roadbed [illegible] abandoned except for one-half mile [illegible] of [illegible]ollafield, which was raised 5 ft. above the old grade. East of Alberton the new line [illegible] north of the old line through a rock cut [illegible] from Alberton to just east of Davis tunnel [illegible] line runs on the opposite side of the river [illegible] the old line, crossing it at this point [illegible] the old grade and again crossing to the north side of the old line at the west end of Davis tunnel 8.2 ft. above the old grade, where it continues on this side until Davis is reached, where it connects with the old line.

The revision eliminates 542° 02′ of central angle, and reduces the maximum curve from 12° to 7°, all curves being spiraled. The double-track roadbed is 30 ft. in cuts, and 33 ft. on fills, with 85-lb. rails and stone ballast. The west-bound grade has been reduced from 0.9 to 0.5 per cent. and the east-bound from 0.8 to 0.5, all grades being compensated.

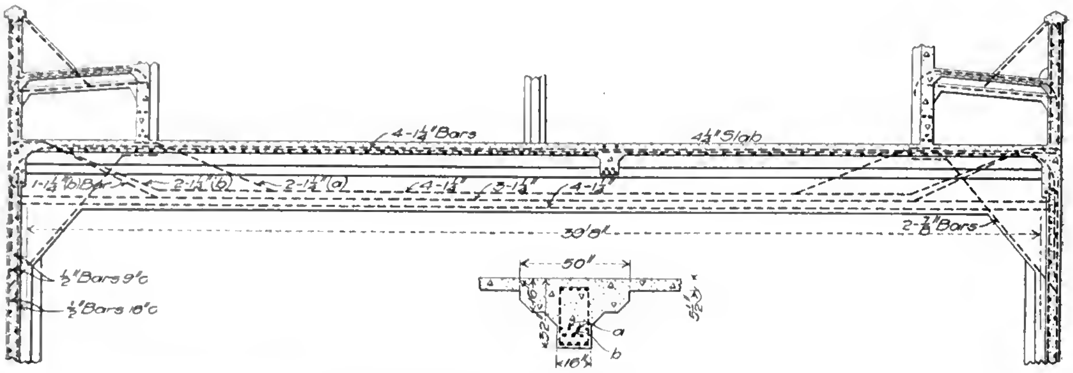
The cost of the improvement has been $750,000 and the work has been done under the direction of Mr. D. D. Carothers, chief engineer; Mr. A. M. Kinsman, engineer of construction, and Mr. J. T. Wilson, assistant engineer.

THE BAY SHORE CUT-OFF of the Southern Pacific Railroad in San Francisco was put into service last week. The new line eliminates the disadvantages of the old coast line route in entering the city, and cuts out about five miles of distance, several hundred degrees of curvature and some heavy grades. The ranges of hills to the south of the city are pierced by the new line, necessitating about two miles of tunnels, two miles of trestle and a cut 95 ft. deep, all within 10 miles.

A Reinforced Concrete Hotel Building in Oakland, Cal.

By Edw. L. Soulé, Assistant Engineer with John B. Leonard, San Francisco.

An interesting example of the use of reinforced concrete is furnished by the Hotel St. Mark, now nearing completion at the corner of Twelfth and Franklin Sts., Oakland, Cal. A view of the finished structural framework, as recently completed, is shown in an accompanying picture. The building consists of two rectangular structures, with a connecting portion, the whole having a shape resembling somewhat that of the letter H. The building rises to a height of 108 ft. above the street level and includes nine floors, a mezzanine floor and a basement. On the outside the concrete skeleton is covered with cement plaster and provided with moulded ornamental trimmings and galvanized iron cornice. The interior finish and partitions conceal the beam and girder construction. The present description will treat of the reinforced concrete work. The main entrance on Twelfth St. leads through the arched lobby to the hotel office in the central portion. The entire Franklin St. portion will be elaborately fitted for a cafe and banquet hall, while the hotel lobby, parlor, organ loft, kitchen and bar occupy the remaining space of the first floor. The upper floors will furnish about 250 rooms equipped for hotel accommodations. The ninth, or sample room floor, will afford commodious display rooms for commercial men.



Design of Ninth or Sample-Room Girders.

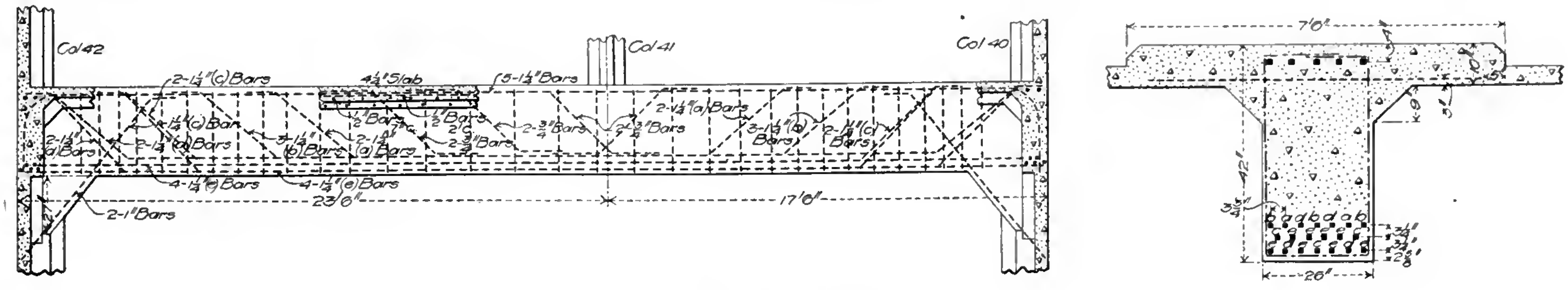

The Hotel St. Mark in Oakland.

The plan of the foundation, shown in one of the diagrams, consists of simple, spread and continuous footings, which bring a load of about three and one-half tons per square foot upon a firm clay soil. The lot line footings are carried partly on continuous and partly on cantilever footings. The eccentric moment of the continuous wall footing is overcome by reinforcing the basement wall vertically and by placing tension on the main slab bars of the first floor. Cast-iron plates were used in the majority of the footings to distribute the load carried by the column bars. Lapping bars were also provided, thereby securely anchoring the columns to the foundation and affording sufficient rigidity to move with it.

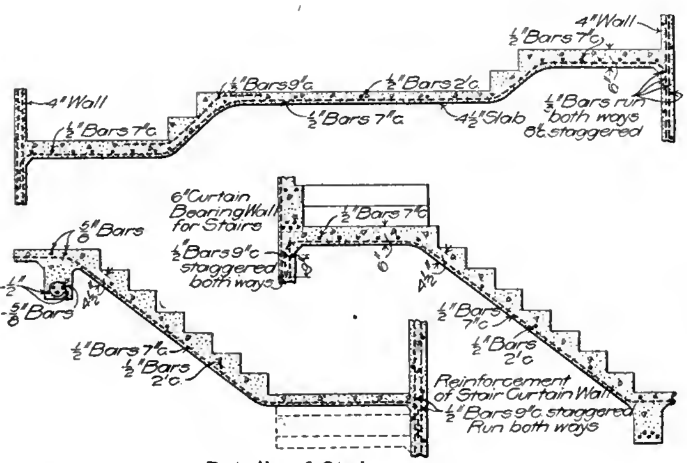
In the basement the columns have an octagonal cross-section. The vertical reinforcement varies according to the load, and is wrapped spirally with soft iron wire. In the majority of cases light reinforcing bars were used, and in some places a double core of eight bars each was provided. The outer bars form the basis for wrapping. The inner core, composed of large-sized bars, was strapped with ¼-in. soft wire at 12-in. intervals. The interior columns above the first floor are square, except two columns between the first and second floors, which were made round for architectural reasons. The corners of all square columns and beams were chamfered by nailing small triangular strips in the molds.

Half plans of the typical and second floors are

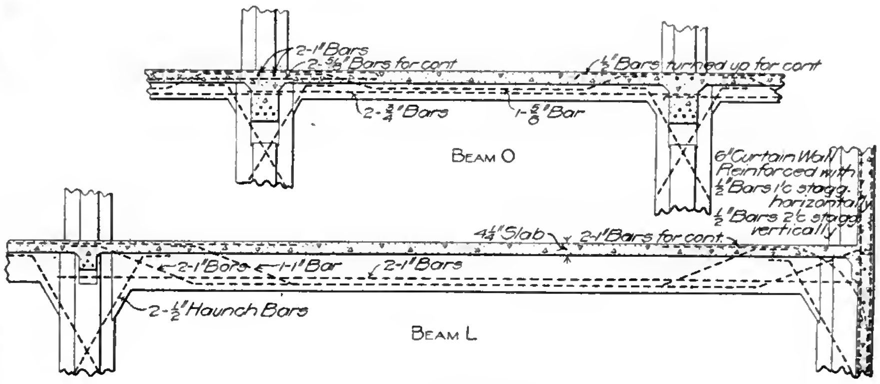
shown in one of the diagrams. In order to afford facility for rapid construction, the design adopted was that of a flat slab type with supporting beams between columns. The transverse beams L between the columns in the interior row are 10 in. wide and have a total depth of 18 in.



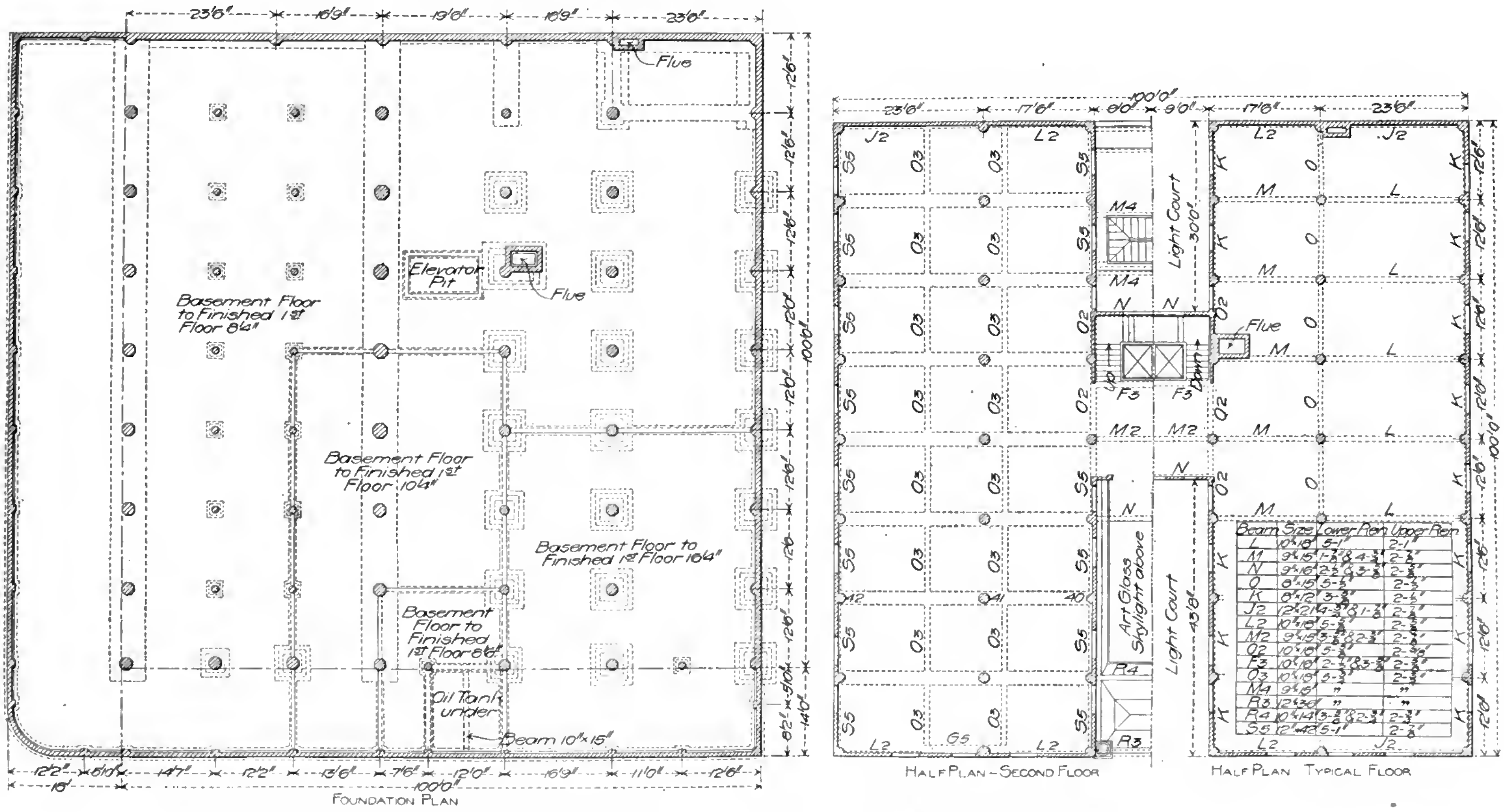
Design of Girders over the Banquet Hall.



Details of Stairs.



Details of Typical Beams.



Foundation and Floor Plans of the Hotel St. Mark, Oakland, Cal.

They are each reinforced with five 1-in. corrugated bars. The M beams are 9 in. wide and 15 in. deep, reinforced with one ⅞-in. and four ¾-in. corrugated bars. The O longitudinal beams are the same size as the M beams, with five ½-in. reinforcing bars each. In the details of a typical five-bar beam it will be seen that one bar turns up at the quarter point of the clear span, two bars at the eighth point and two bars continue over the supports. Due consideration has been given to the action of continuity by affording about four-tenths of the main reinforcement in the upper side of the beam at points of support. These continuity bars extend from the quarter point of the clear span to the corresponding quarter point of the adjacent span.

In order to maintain the clear space in the banquet hall, it was found necessary to terminate the intermediate columns on girders extending from wall to wall, affording a clear span of 37 ft. 8 in. This was accomplished by means of the tee girders shown in one of the detail diagrams. The architect's plans limited their size to 26 in. width and 32 in. depth to the underside of the slab, on account of the panel depth and finish of the cafe ceiling. Accordingly, the section consisted of five 1¼-in. bars placed in the compression area and twenty 1¼-in. bars to resist the tensional stress. The bars were obtained in special lengths and required no splicing.

Because of the limitation of size of the second-story girders and to reduce the load on the columns, there were also constructed suitable girders of the same span at the eighth floor and at the ninth, or sample room floor. The eighth floor girders are 16 in. wide by 25 in. total depth, and are each reinforced with seven 1¼-in. bars in the lower flange and two 1¼-in. bars in the compression flange. The ninth, or sample room, girders carry the roof loads concentrated on the columns and their own floor loads. One of the diagrams shows the details of sizes and reinforcement.

The first floor was designed for a live load of 120 lb. and the typical floor for a live load of

60 lb. per square foot. Intermediate beams were used on the first floor, thereby reducing the slab to $3\frac{1}{2}$ in. in thickness. The typical floors consist of a $4\frac{1}{4}$-in. slab. Over the rough slab is laid a $\frac{3}{4}$-in. finishing coat of cement grout, making a floor with a total depth of 5 in.

A large number of small openings for vents, electric wiring and pipes were required in the floors at various places. These areas were, however, reinforced with additional bars and enclosed by the partition framing.

All walls were built monolithic with the rest of the building and were usually 6 in. thick above the first floor. The reinforcement consisted of one-quarter of one per cent. of the sectional area, one-third of which was placed vertically and the remainder horizontally, all bars being staggered between the outer and inner surface of the concrete. The basement walls serve as retaining walls and are reinforced vertically on the lot line sides. The sidewalk retaining wall varies from 9 in. at the top to 12 in. at the bottom, and is reinforced horizontally between pilasters, which serve as vertical beams.

An interesting portion of the construction is presented in the various stairways, which illustrate the adaptability of concrete to special details. Attention is directed to the diagram giving plan and detail of typical stairways. The flat soffit allowed of uniform form work and proved an easy type for erection. Near the entrance there is a spiral stairway winding to the basement; also, in the central portion a circular stairway rises to the orchestra balcony.

For the columns, [illegible] the concrete used consisted of one part of cement and six parts of a sand and gravel mixture; for the foundation the proportions were one part cement and seven and one-half parts of aggregates. Golden Gate cement, manufactured at Cement, Cal., about forty miles from the building, was used almost exclusively.

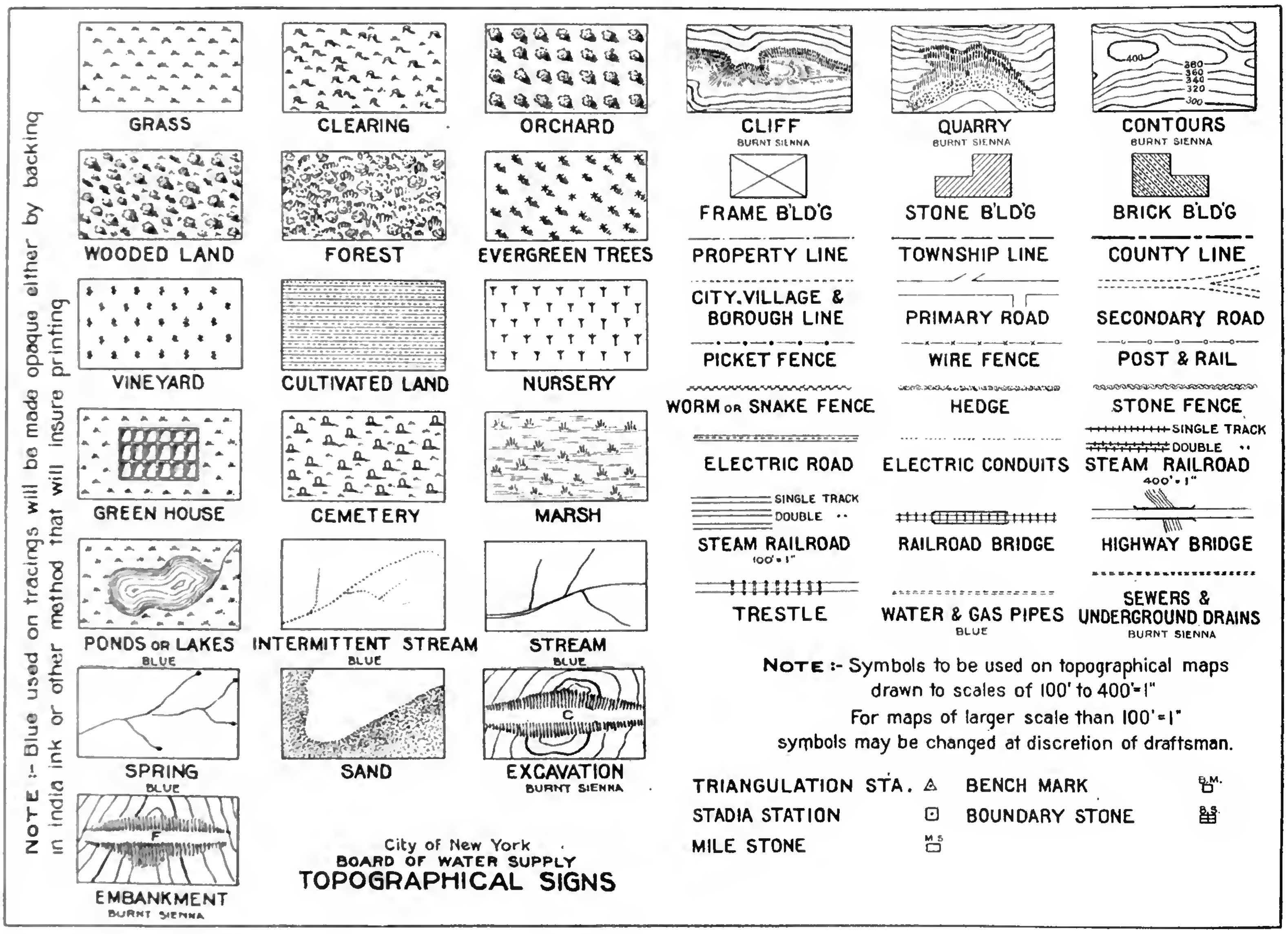
The natural mixture of sand and gravel were of such proportions as to be suitable for direct use. Two adjoining storage bins, one for the cement and one for the sand and gravel, were installed in the basement, near a Smith mixer that discharged the concrete into a hoist. This hoist was situated in the front light well, near the connecting portion of the two rectangular wings, and elevated the concrete to a dumping bin at the required height, from which carts were filled, wheeled over the forms and dumped as required. The concrete was mixed very wet.

Heavy rains considerably impeded the progress of excavation during the month of January, 1907. However, by March 1, the concreting of the foundation was commenced, and after the second story was passed an average progress of a floor per week was made, the fourth story being poured in five and one-half days. Ninety-nine yards were deposited in one day during the fabrication of the second story girders, and 65 yd. were recorded in four hours during the pouring of the eighth floor girders. By July 3 the building was completed structurally except the ceiling beams of the entrance lobby, which were omitted because of the hoist. The concrete was practically completed in 98 working days. On the work there were employed an average of 90 workmen, exclusive of plumbers and electricians, for about 130 days. About 2,520 yd. of concrete and 200 tons of reinforcing bars were used in the structural framework. All reinforcements were made with Johnson corrugated bars, proportioned for a unit stress of 16,000 lb. per square inch. In general, concrete is figured to carry a compressive stress of 600 lb. per square inch.

The architect of the building is Mr. Benjamin G. McDougall, who placed all the structural details of the building in the hands of Mr. John B. Leonard, consulting engineer, of San Francisco. The Lindgren-Hicks Co. is the contractor.

Standard Topographical Signs.

The Board of Water Supply of New York has to make a great many topographical maps for copying by blue-printing. This drafting is done in a number of offices widely separated, and to insure uniformity in the work the symbols shown in the accompanying chart have been adopted for all maps on scales of 100 to 400 ft. to 1 in. For



maps on a larger scale than 100 ft. to the inch, the symbols may be changed at the discretion of the draftsman. It will be noticed that these symbols are somewhat less detailed in some respects than those in most text books on topographical drawing. But two colors are used in addition to black, burnt sienna and blue; burnt sienna gives fairly good lines on blue prints, but blue gives poor lines, and for this reason blue used on tracings must be made opaque by backing with India ink or some other method that will insure printing. In reproducing the symbols by photo engraving, it has been necessary to reduce them from the original chart about three-tenths. So many inquiries for these symbols have been received by the Board that they are published here, by the consent of the Board, in order to be generally available for engineers interested in such work.

The Ratio of Heating Surface to Grate Surface as a Factor in Power Plant Design.

A paper read before the American Institute of Electrical Engineers on Dec. 19 by Walter S. Finlay, Jr.

Power plant design, in its modern development, is controlled solely by the specific application of general laws modified and moulded to suit special requirements. To attempt the construction of a comprehensive ruling from the results of a particular line of investigation in some particular plant, and then to advise the general use of such ruling as conducive to economical operation, would cause confusion, possibly resulting in a wholesale rejection of the good with the bad. The value of specific results and their publication lies in the opening up of a line of technical thought, or in adding information to some subject, from which specific deductions or particular application may be made.

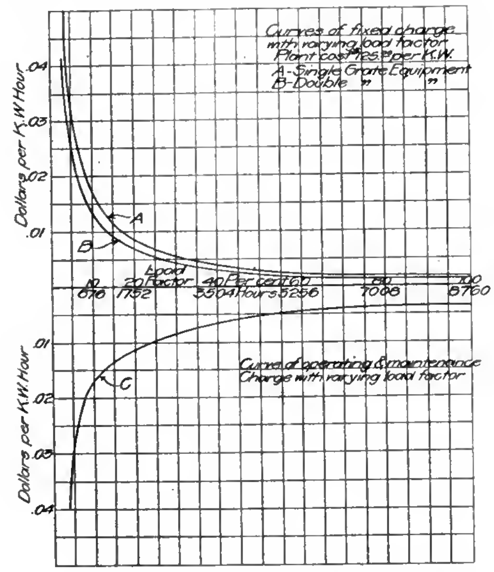


Fig. 1. Fixed Charges; $125 Base.

The results obtained in the investigation which was primarily the foundation of this paper should be looked upon merely as specific, but whose bearing upon the general subject by means of a general development may be of value, particularly in certain new phases of plant design.

As a fundamental and almost initial point of attack in the comprehensive subject of steam power-plant design, the ratio of heating surface to grate surface has been a value fixed from the beginning of results of commercial usage, and the expression of the same in empyrical formulas or figures suited to the requirements of this or that designer, builder or manufacturer.

A summation of practice from early engineering times to values developed by the most modern idea, gives a great range to this ratio; namely, from the extreme value, as advised by Dalton in 1839, of ten to one, to modern values up to seventy to one used, not only in locomotive but even in power-plant practice. Of course, the primary object in view has been the adaptation of values to produce the maximum useful effect; but the question now arises as to whether or not "maximum useful effect" is not being interpreted as maximum economical efficiency, with reference to fuel only, as a primary consideration, and with an undue subordination of total plant costs. By total plant costs are meant, of course, the combined fixed charges resulting from interest on plant investment, depreciation, taxes, etc., and operation and maintenance charges.

Properly to investigate the subject in its particular applications would require an extremely tedious and complicated study of innumerable individual requirements; but for a general survey assumptions based upon commonly accepted values would suffice to direct the attention to the point involved.

Assuming a plant first cost of $125 per kilowatt, equipment, including turbo-generators, boilers equipped with stokers, with, say, sixty to one ratio, the following relative costs may be assumed:

	Per kw.	Per cent.
Total cost	$125.00	100.0
Building	43.75	35.0
Boilers	6.875	5.5
Grates	1.75	1.4
Piping	5.625	4.5
Coal-handling app. per kilowatt	2.30	1.84
Balance of equipment	64.70	....

The value of the building as assumed might be considered low, particularly in the case of a turbine plant; boiler cost is possibly average; grates, high—a stoker valuation; piping value is about average.

Assuming as a fair value for determining fixed charges: Interest on investment, 5 per cent.; depreciation, 6 per cent.; taxes and insurance, 1 per cent; then the total fixed-charge rate would equal 12 per cent.

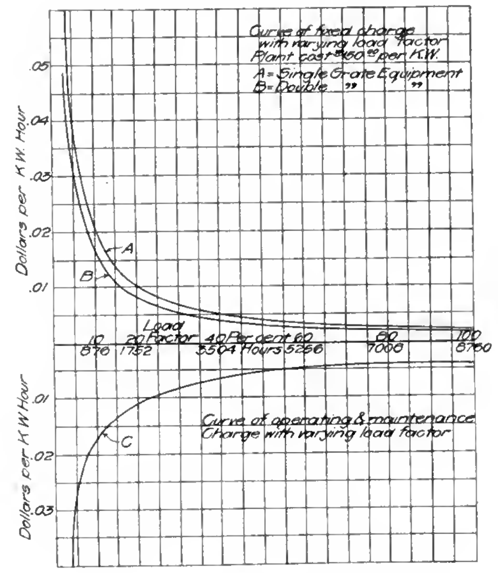


Fig. 2. Fixed Charges; $150 Base.

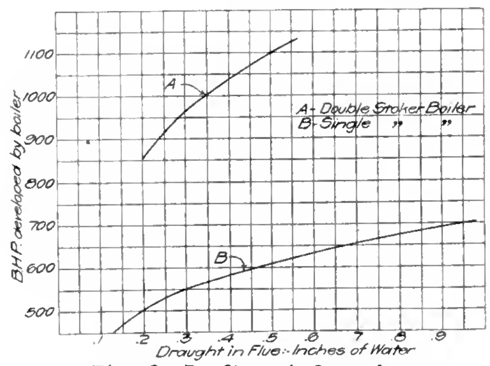


Fig. 3. Draft and Capacity.

Upon bases of load-factor and charges, a curve has been drawn showing the relative value of the fixed charges over a range of factor variation from approximately 3 to 100 per cent. in the case of the plant as assumed. (Curve A, Fig. 1.)

To determine total charges, the variation of maintenance and operation charges, relative to load-factor, must also be considered. It is rather difficult to assume this curve, as conditions in this respect vary rather widely. However, Curve C, Fig. 1, has been drawn through points located by comparative results obtained in actual cases of operation. The shape of the curve will practically be constant for any figure which may be assumed, and its relation to the general results will be such that the value of the principle involved will be unaffected. The sum of the ordinates between the two curves gives total charges per kilowatt-hour.

In a reconsideration of the plant design as affecting first cost, the natural method of procedure is to consider separately each item involved.

1. *Building.* In turbo-generator plant design it is a generally accepted rule that total plant dimensions are controlled by boiler-room dimensions; that, for instance, a diminution in the actual size of the boiler room may be accompanied by a proportional diminution in the size of the turbine-room, the output remaining the same. The methods of accomplishing such results are perhaps various; change in size of units, difference in type, closer grouping of units, etc.

2. *Boilers.* The consideration of this feature is naturally interlinked with the subject of "Grates," and the two can better be discussed together.

Rules of boiler-practice have been derived chiefly, if not entirely, by experiment and investigation; and those rules validated only by general acceptance can be quoted as bases for argument. Such a law is the following one:

All other conditions remaining constant, capacity developed is, with slight modifications, in direct ratio to the area of the active grate surface. An increase in capacity—heating surface remaining constant—caused by an increase in grate area, is accompanied by a loss in economical evaporation, due to the increased temperature of the escaping gases.

This loss in economy is the fundamental factor which must necessarily be the object of a careful study, involving the complete investigation of the heat interchanges taking place in a boiler. The research work of such men as Newton, Péclet, Joule and Rankine, together with recent investigation, has not, as yet, produced sufficiently definite and authoritative results, which may be used as bases of rational calculation in this regard. Under normal conditions of present boiler practice, estimates of loss vary from practically zero to as much as 15 per cent. fuel economy for an increase of 100 per cent. in boiler capacity.

Lately, however, the opinion has been advanced that considerable increase in capacity can, without great sacrifice in economy, be obtained by proportional increase in grate area. This idea is based upon the possibilty that combustion and heat distribution and transfer could be much improved under the new conditions, when in increasing the grate area careful attention is given to details of design most conducive to these features. Other conditions being favorable, and with a belief in the correctness of this theory, a change was made in the design of eighteen of the boiler furnaces in the 59th St. plant of the Interborough Rapid Transit Co. (See Fig. 7.) Such a design gave the possibility of operating within the range of the original single-stoker boiler together with the higher range of the double stoker.

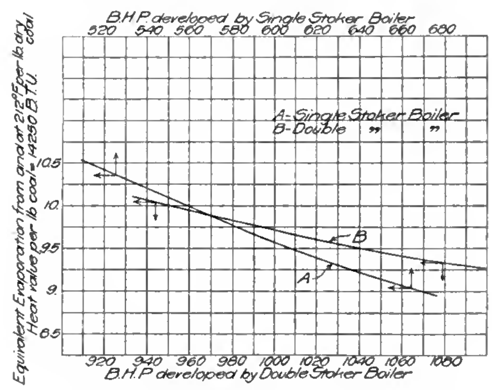


Fig. 4. Capacity and Evaporation.

The second stoker installed, that is, the one beneath the mud-drum, as shown in Fig. 7, has an area of 80 per cent. of that of the original stoker. Certain features in the construction of the plant prevented installation of a larger size. A detailed description of points in the design is unnecessary, save to call attention to the fact that the lower stoker is constructed practically within a so-called "Dutch oven," and whatever is conducive to good combustion is provided for therein.

The curve shown on Fig. 8 is given as corroborating this fact. Operation of these stokers has shown that such is practically done with but little more complication than existed in the single type.

Tests to determine the comparative economical operation of the double and single stokers show results given graphically in Figs. 3, 4, 5 and 6. The curves in Figs. 3 and 4 are self-explanatory. Fig 5 shows a curve plotted upon the values, as determined by curves in Fig. 4, this curve being indicative of the fact that operation with the double type was as economical in fuel values, as the single type increased in boiler capacity approximately 71 per cent. In the curves in Fig. 6 is shown the fact that the economical loss for an increase in rating of 80 per cent., as proportioned to the increase in grate area, varied between 2 and 3 per cent.

To summarize the results of these tests: It has been made evident that in this particular case double-stoker operation covers the entire range of single-stoker operation and adds an increase

lowered, although not in direct ratio to such change.

5. *Effect of change of ratio.* Suppose that in a reconsideration of the plant design it is decided to cut in half the ratio of heating surface to grate surface by the use of double grates or stokers under boilers of the same rating. Plant

Water	0.90	0.90
Engine-room mechanical labor..	1.70	1.70
Lubrication	0.44	0.44
Waste, etc.	0.38	0.38
Electrical labor	3.16	3.16
Total	100.00%	99.75%

The saving in boiler room maintenance and operation may be accounted for in the following itemized statement of boiler-room charges:

Maintenance.	Single Grate.	Double Grate.
Boilers	29.5%	14.75%
Economizers	2.78	2.78
Furnaces	17.29	17.29
Stokers and stoker engines	40.68	40.68
Boiler feed-pumps	5.42	5.42
Boiler feed-piping	2.20	1.10
Boiler blow-off piping	0.44	0.44
Water supply piping	1.52	1.52
Total	100.00%	83.98%
Operation.		
Water-tenders	20.82%	10.41%
Stoker operators	38.09	38.09
Assistant stoker operators	15.49	15.49
Stoker oilers	2.54	2.54
Economizer oilers and cleaners	5.84	2.92
Boiler feed-pump men	5.08	5.08
Boiler cleaners	10.41	5.21
Miscellaneous labor	1.73	1.73
Total	100.00%	81.47%

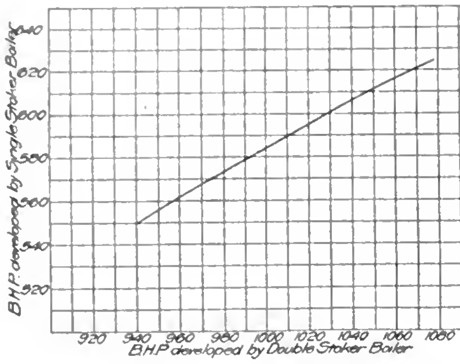


Fig. 5. Stoker Relations.

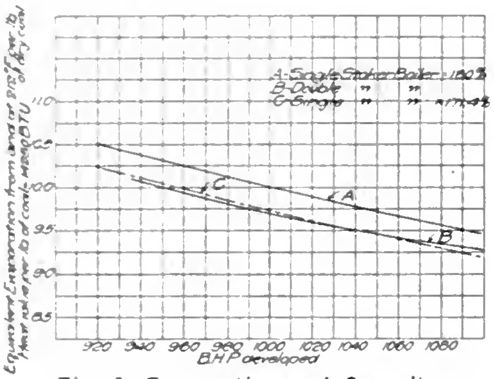


Fig. 6. Evaporation and Capacity.

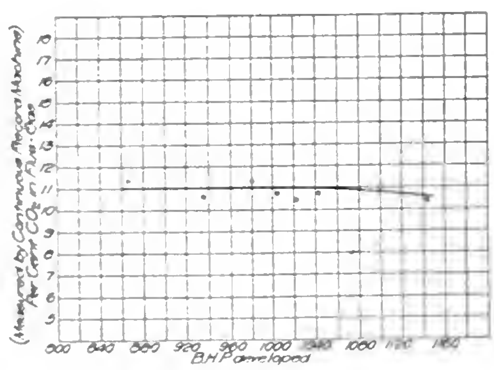


Fig. 8. Curve of Carbon Dioxide.

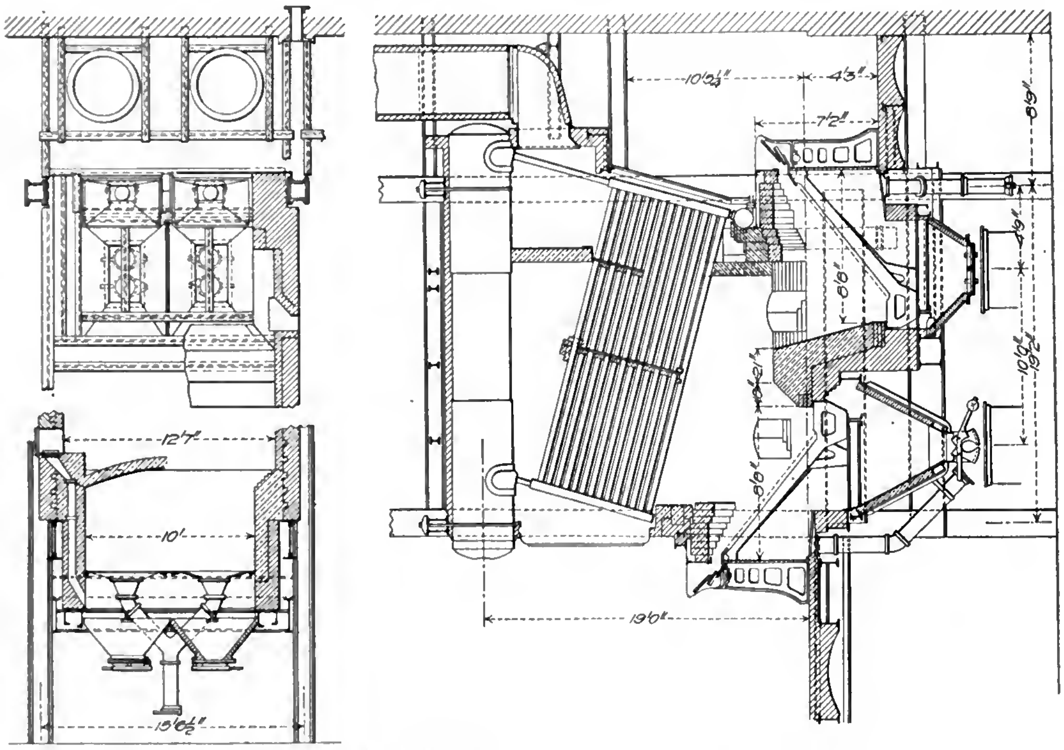


Fig. 7. Double Stoker Installation, Interborough Rapid Transit Co.

of capacity proportionate to its larger grate surface, with but slight loss in economy, and that the increase of 71 per cent. in capacity was accomplished with no loss in economy.

With these results as a basis, let it be assumed that boiler caapcity is increased in ratio to increase in grate surface with but little loss of economy. This view might be further strengthened when consideration is taken of the possibilities of economizer practice, the increase in saving, by proper design, being high in ratio to extra cost involved.

To return to the consideration of the items under the power plant whose first cost has been assumed to be $125 per kilowatt, the next point is:

3. *Piping.* In the case involved the cost of steam piping between boilers and manifolds, plus boiler feed piping, plus boiler blow-down piping, has alone been considered. With any change in number of boilers, capacity remaining the same, the cost of piping will vary in the same ratio times a factor due to change in size of pipe.

4. *Coal-handling apparatus.* Fixed plant capacity would seem to demand fixed cost of coal-handling apparatus, but the proportionate value of the conveying apparatus is so large that when any change is made affecting the length of carry the total system cost will be raised or

output is to remain the same. A tabulation of the costs as revised would be as follows:

	Per kw.
Building (reduced 40%)	$26.25
Boilers (reduced 50%)	3.438
Stokers (remain same)	1.75
Piping (reduced 40%)	3.735
Coal-handling app. (reduced 15%)	1.955
Balance (remains same)	64.70
	$101.468

A curve (B, Fig. 1) is plotted upon this new basis.

Summation: Plant first cost and fixed charges, each reduced 19.6 per cent.

The next consideration is that of the effect of such changes upon plant maintenance and operation charges. Properly to discuss this, the following tabulation, based upon the figures given by Mr. H. G. Stott in his paper on "Power Plant Economics," will furnish a means of comparison:

Maintenance.	Single Grate.	Double Grate.
Engine room mechanical	0.64%	0.65%
Boiler room	5.40—(16%) =	4.54
Coal- and ash-handling app.	0.68	0.68
Electrical apparatus	1.41	1.41
Operation.		
Coal- and ash-handling labor..	2.65	2.65
Removal of ashes	1.18	1.18
Dock rental	0.93	0.93
Boiler-room labor	8.38—(18.5%) =	6.83
Boiler-room oil, waste, etc.	0.21	0.21
Coal	71.94+(3%) =	74.10

Thus, with changes as noted, the decrease in maintenance and operation would be 0.25 per cent, the curve for same practically coinciding with Curve C, Fig. 1.

A second set of curves, based upon a plant cost of $150 per kilowatt, as shown in Fig. 2:

	Per kw.	Per cent.
Plant cost per kilowatt	$150.00	100
Building	60.00	40
Boilers	8.25	5.5
Stokers	2.25	1.5
Piping	6.75	4.5
Coal-handling apparatus	2.63	1.75
Balance	70.12	

Same plant double stoker.	
Building (reduced (40%)	$36.00
Boilers (reduced 50%)	4.13
Stokers (remain same)	2.25
Piping (reduced 40%)	4.05
Coal-handling apparatus (reduced 15%)	2.24
Balance	70.12
Total	$118.79

Showing a reduction in first cost and fixed charges of 20.8 per cent.

Summary. In the case of the $125 plant the following savings might be effected by use of double grate:

First cost, 19.6 per cent. saving.

Total plant charges varying from a saving of 5.64 per cent. at 100 per cent. load-factor to 7.54 per cent. at 50 per cent. factor to 9.65 per

cent at 4.16 per cent. factor (365 hours per year).

In the case of the $150 plant:

First cost, 20.8 per cent. saving.

Total plant charges vary from about 7.06 per cent. saving at 100 per cent. load-factor, to 9.26 per cent. at 50 per cent. factor to 11.5- at 4.16 per cent. factor.

Thus summarized, the remarkable effect that the grate area and heating surface ratio, when furance design is carefully considered, may have upon plant first cost and total annual costs should certainly place this particular feature well up in the list of subjects for careful investigation and make it a point of primary and fundamental consideration in advanced design.

Hydraulic Properties of Reground Cement Mortars.

A paper presented at the annual convention of the Association of American Portland Cement Manufacturers by Messrs. Henry S. Spackmand and Robert W. Lesley.

Observing in the course of our microscopic examination of cement mortars that a large proportion of the cement was unacted upon by water even after submergence for long periods, we decided to determine by actual test the extent of the hydraulic properties remaining in the cement after it had been gauged with water and allowed to harden. Having in the course of our regular routine cement testing, occasion to sample and test a large amount of one brand of cement, we determined to try the experiment on the broken neat briquettes from the seven and twenty-eight day tests of this cement.

The original cement, a well-known standard American brand, was sampled in carload lots, the sample being collected between July 17 and Sept. 16, 1905, and represented several thousand barrels. Each car was tested separately and all passed the requirements of the American Society for Testing Materials. In order to arrive at a standard of comparison, the results of the individual tests of the cars was averaged, giving the following as the mean of the different tests.

Fineness; 91.5 per cent. passed a No. 100 sieve and 76.2 per cent. passed a No. 200 sieve.

Setting time, as determined by Gilmore's needle; initial set, 170 minutes; final set, 334 minutes. Percentage of water, 21.

Soundness or constancy of volume; cold water pats, good; air pats, good; steam pats, good.

Specific gravity, 3.14.

Average tensile strength of standard briquettes; neat, 710 lb. at 7 days and 778 lb. at 28 days; 1:3 mortar, 261 lb. at 7 days and 360 lb. at 28 days.

As a further check an average sample was prepared from the various samples collected taking the same amount of cement from each sample and mixing thoroughly. The sample so prepared was tested in accordance with the standard specifications and gave the following result: Silica, 21.25; alumina and iron oxide, 11.09; lime, 62.96; magnesia, 2.35; sulphuric anhydride, 1.23; loss on ignition, 74; total, 99.12.

TENSILE TEST, STANDARD BRIQUETTES (AVERAGE OF 5 BRIQUETTES.)

Neat.		1-Cement, 3-Sand.	
7 days	610 lbs.	7 days	182 lbs.
28 days	752 "	28 days	338 "
3 months	754 "	3 months	487 "
6 months	646 "	6 months	415 "
9 months	593 "	9 months	350 "
1 year	706 "	1 year	322 "
2 years	670 "	2 years	325 "

The lower tensile tests obtained at the seven-day period can be accounted for by the cement having been exposed to air and aged considerably before the average sample was made up. For this reason, no test for setting time or specific gravity was made on the average sample.

In addition to the standard sieving tests the percentage of flour in the sample was determined by elutriation.

Percentage of cement passing 100-mesh sieve, 91.40.

Percentage of cement passing 200-mesh sieve, 76.30.

Percentage of cement remaining in suspension in dry kerosene after 30 seconds settling, 45.18.

Percentage of cement remaining in suspension in dry kerosene after 2 minutes settling, 29.85.

The broken neat seven and twenty-eight day briquettes made from the individual samples were saved, being stored in air in the cellar. After a sufficient quantity had accumulated they were dried at a temperature of 212° F. until of constant weight, then crushed and reground in a laboratory tube mill. The resultant product when tested as cement in accordance with the standard specifications gave the following results:

Fineness; 94.4 per cent. passed a No. 100 sieve; 74.4 per cent. passed a No. 200 sieve.

Setting time as determined by a Gilmore's needle; initial set, 60 minutes; final set, 310 minutes. Percentage of water, 25. Temperature of water, 62° F. Temperature of air 66° F.

Specific gravity, 2.57.

Soundness or constancy of volume; cold water pat, good; air pat, good; steam pat, good.

TENSILE TEST, STANDARD BRIQUETTES (AVERAGE OF 5 BRIQUETTES.)

Neat.		1-Cement, 3-Sand.	
7 days	123 lbs.	7 days	26 lbs.
28 days	253 "	28 days	63 "
2 months	340 "	2 months	145 "
3 months	383 "	3 months	179 "
4 months	402 "	4 months	227 "
1 year	401 "	1 year	198 "

The neat briquettes from the above test were in turn kept, being stored in air of cellar. On completion of the test, these were dried, reground and tested in the same manner as before, but the resultant cement was in addition analyzed. The results of the analysis after being twice gauged with water, were: Silica, 17.60; alumina, 5.67; iron oxide, 2.29; lime, 49.64; magnesia, 1.66; sulphuric anhydride, 1.13; water, 17.90; carbon dioxide, 3.84 = 8.27 $CaCO_3$.

The physical tests after three gaugings with water were as follows:

Fineness, 93.8 per cent. passed a No. 100 sieve and 73.6 per cent. passed a No. 200 sieve.

Setting time determined with a Gilmore's needle; initial set, 240 minutes; final set, 24 hours. Percentage of water, 26. Temperature of air, 73° F. Temperature of water, 70° F.

Soundness or constancy of volume; cold water pats, good; air pats, good; boiling pats, good.

Specific gravity, 2.35.

TENSILE TESTS, STANDARD BRIQUETTES (AVERAGE OF 3 BRIQUETTES.)

Neat.		1-Cement, 3-Sand.	
7 days	71 lbs.	7 days	17 lbs.
28 days	163 "	28 days	73 "
2 months	182 "	2 months	82 "
3 months	220 "	3 months	118 "
4 months	235 "	4 months	132 "
5 months	250 "	5 months	148 "

To confirm these results a similar test was made on another brand under conditions in all respects identical, with the following results:

Fineness: 96.3 per cent. passed No. 100 sieve, and 80 per cent. passed No. 200 sieve.

Setting time by Gilmore's needle: Initial set, 133 minutes; final set, 377 minutes. Percentage of water, 25. Temperature of water, 62° F. Temperature of air, 66° F.

Soundness or constancy of volume; coal water pat, good; air pat, good; steam pat, good.

TENSILE STRENGTH WITH STANDARD BRIQUETTES.

Neat.		1-Cement, 3-Sand.	
7 days	735 lbs.	7 days	265 lbs.
28 days	837 "	8 days	407 "

The test results obtained after regrinding the neat briquettes from the above cement were as follows:

The analysis of cement after the first gauging was: Silica, 19.88; alumina, 4.53; iron oxide, 2.03; lime, 55.30; magnesia, 2.64; sulphuric anhydride, .89; carbon dioxide, .68; water, 13.68.

Fineness: 97.1 per cent. passed a No. 100 sieve and 78.5 per cent. passed a No. 200 sieve.

Setting time by Gilmore's needle: Initial set, 209 minutes; final set, 434 minutes.

Soundness: Cold water pat, good; air pat, good; boiling pat, good.

Specific gravity, 2.56.

TENSILE TESTS, STANDARD BRIQUETTES (AVERAGE OF 5 BRIQUETTES.)

Neat.		1-Cement, 3-Sand.	
7 days	192 lbs.	7 days	57 lbs.
28 days	343 "	28 days	181 "
2 months	365 "	2 months	238 "
3 months	405 "	3 months	278 "
4 months	419 "	4 months	281 "
5 months	382 "	5 months	293 "
6 months	440 "	6 months	322 "
7 months	...	7 months	...

These experiments clearly show that even after cement has been twice gauged with water and allowed to harden under water, that all the cementing and hydraulic qualities are not destroyed, and that gauging with water and submergence in water does not retard the setting time of the reground cement as much as would be expected. Indeed, in the first test the setting time of the cement on being reground was quicker than in the original sample. A third conclusion is that it is only the very fine flour in the cement that is in condition to react when gauged with water and give strength to the mortars.

This last conclusion is further confirmed by other investigations undertaken at the same time to determine how fine the clinker had to be ground in order to be available for cementing action. Portland cement which had passed the 200-mesh sieve was further separated by elutriation into the following parts: (A) Material that settled out in 30 seconds. (B) Material that remained in suspension for 30 seconds, but settled out in one minute; (C) Material that remained in suspension for more than one minute. The cement thus divided into three portions according to size was treated with water in tightly stoppered tubes. "A" was only slightly acted upon by water, even after two years contact with it. "B" was only acted upon by water after three or four months, and only a portion became fully hydrated. "C" was acted upon almost immediately, swelling up and forming a very voluminous jelly.

Microscopic examinations of thin sections of neat Portland cement also show a large percentage of the cement unacted upon by water beyond a superficial or skin action. This being the case, then, in the regrinding of the neat briquettes after they had become hydrated, some of the coarser particles of the unacted-upon cement were reduced, by regrinding, to such a fineness as to become active. These three methods of investigation (first, microscopic study of set cement; second, the treatment of the various sizes of grains separated by elutriation; third, the regrinding of the neat cement after gauging with water and being allowed to harden under water), all lead to the same conclusion, that is, that only a comparatively small percentage of the original cement is ever acted upon by the water used in making the mortar, and that the portion of the cement which is acted upon is only the very fine impalpable flour which is not measured by present tests using sieves.

When cements were all ground in practically the same manner and on the same type of machinery, the use of sieves gave a fair indication of the flour present in the cement, it being a reasonable assumption that the finer the cement, the more flour present; but such is no longer the case with diversified methods of grinding and we have found more flour in cement ground on the burr stone showing a very poor degree of fineness as measured by the sieves than in some cements showing a very great fineness as measured by the 100-mesh and 200-mesh sieve. The fact that the sieving tests do not determine accurately the percentage of flour has been recognized in Europe, and various devices are being experi-

mented with to determine the percentage of flour. These investigations also show conclusively that all commercial cements contain a large amount of inert material and that the cement manufacturer is quarrying, grinding, burning, grinding again and paying freight upon from 50 to 60 per cent. of inert material which could as well be replaced by sand. Under present mechanical conditions it is commercially impossible to grind much finer than we are now doing, but one of the economies of the future in cement manufacture will be brought about by the perfection of grinding machinery that will avoid the waste above mentioned.

A study of the chemical analysis of the reground cement is also interesting. Taking up the first sample and disregarding the presence of calcium aluminate and arbitrarily assuming that the silica was present in the original cement as tricalcium silicate, and that, on hydrating, it is decomposed to the hydrated mono-calcium silicate (CaO, SiO_2, $3H_2O$) and calcium hydrate, and neglecting the calcium sulphate but deducting the amount of lime present as carbonate, the combined water will account for about 70 per cent. of the cement having been acted upon by water, after being twice gauged and once reground, leaving 30 per cent. still present and capable of developing hydraulic qualities on being ground sufficiently fine, as is proven by the tests obtained on the second regrinding.

These figures are, of course, only approximate, since they do not take into consideration the lime present as aluminate and it is not positive that the hydration takes place as indicated above, but they are borne out in a general way by the results of the physical tests, for on regauging the cement developed considerable hydraulic qualities.

The analysis of the second sample of cement shows, on the same arbitrary assumption, after the first gauging with water, the hydration of about 45 per cent. of the cement, leaving 55 per cent. unacted upon.

In a recent article in "The Engineer" of London, by Mr. W. Lawrence Gadd, entitled "Notes on the Le Chatelier Tests," he states in reference to Portland cement made by rotary kiln clinker that this "does not improve on aeration, but on the contrary almost invariably becomes more expansive, the increase being from 3 to 12 mm. after aeration for seven days; and many samples which, tested fresh, gave an expansion of only 2 to 5 mm., if again tested after seven days' aeration, would be condemned by the conditions of the British Standard Specifications as unsound. On the other hand, if the cement be kept for some time in a stoppered bottle or other closed receptacle, the expansion becomes less marked, and if kept long enough without exposure to air will become nil."

He explains this behavior of rotary kiln cement in Le Chatelier's tests as follows: "It is well known that rotary clinker is harder and therefore more difficult to grind than a chamber kiln clinker, and the ground product from the rotary kiln may be roughly divided into (a) flour; (b) comparatively large pieces of clinker grit, such as is retained on the 100 or 180-mesh sieve; (c) fine particles which are small enough to pass the 180-mesh sieve but are nevertheless particles of hard clinker grit. Tests show that although the chemical composition of this fine grit is practically identical with that of the flour, the former gives high expansion figures, whilst the latter gives rise to only slight divergence of the needles.

"The expansion appears to be as the proportion of fine grit, indirectly shown by the percentage of flour in the cement. Thus, to take an actual example: The respective products of two grinding mills were separately taken, carefully sampled, and tested by the Le Chatelier method. One of these mills (No. 1) was known to produce more flour and relatively less fine grit than did the other (No. 2). Both mills were concurrently fed with clinker from the same hopper, so that there should be no question of difference in composition or degree of calcination. The expansion results were: Cement from Mill No. 1, 3 mm.; cement from Mill No. 2, 17 mm.

"The fineness of the grinding in these two samples was practically the same, the residue on the 180-mesh sieve being in the one case 10 per cent. and in the other 10.5 per cent.

"The addition or removal of comparatively large pieces of clinker grit appear to have but little effect on the Le Chatelier test, and the addition of fine grit in the form of ground flints or sand has no appreciable action.

"It follows that the expansion, in the cases quoted, is due to changes in the fine particles of clinker grit under the influence of boiling water; and the view I wish to put forward is as follows: (1) At the time of gauging the cement the particles of fine flour, so called, are hydrated more or less completely. (2) Particles of clinker grit of comparatively large size are not hydrated, except, perhaps, on the surface, and act throughout as inert material. (3) Particles of fine grit clinker which are small enough to pass the 180-mesh sieve are only slightly hydrated at the time of gauging. The cement then sets hard, but under the influence of heat, when the block is boiled, the hydration of these small particles continues, with consequent expansion.

"The increase in expansion, after the cement has been subjected to aeration, may perhaps be explained by the assumption that the fine particles of clinker grit, on exposure to moist air, commence to disintegrate to some extent, and are thus rendered more easily hydrated when submitted to boiling heat. That something of this nature does happen is rather borne out by the fact that rotary clinker which has been weathered by exposure to air for some time is more easily ground, than if taken direct from the kiln, and such weathered clinker invariably gives lower expansion figures, provided of course, that it was properly burned, and contains no underburned portions."

While the behavior of the cement by the Le Chatelier tests for soundness is of little interest to us, however, as this test is not used in this country, of interest to us is the explanation offered by Gadd for the behavior of the cement, since this explanation is in line with the conclusions drawn in this article, that is, that the fine flour of cement is the only portion which is acted upon by water, hence comprises the portion of cement which gives to the mass its hydrated qualities.

Book Notes.

The exceptional value of the work done by the American Society for Testing Materials is clearly shown in the "Proceedings of the Tenth Annual Meeting," which has just appeared. It is a volume of 759 pages filled with information of the most important character for all engineers who have to do with the design of structures or machinery. This journal has held the opinion for a number of years that no engineer who has much designing to do can afford to be without a set of these volumes. They not only contain the latest ideas of thoroughly representative committees concerning the all-important subject of specifications, but they also cover all advances in testing materials and progress in research work to ascertain the strength of materials and standard products constructed from them, such as rails, castings, car wheels, reinforced concrete columns and beams, and the like. The object of the Society is, briefly stated, to furnish information concerning materials and the best methods of using them. The field is manifestly a wide one, and as the Society covers it thoroughly, its publications are invaluable to those who desire to keep abreast of the times. The proceedings which are recorded in the volume just issued were reported in the Current News Supplement of this journal of June 29, and it is therefore unnecessary to review the contents of the volume at length in this place. (Philadelphia, Prof. Edgar Marburg, University of Pennsylvania, $5.00.)

The twenty-first annual number of the "Mechanical World Pocket Diary" is an astonishing example of book making. It has nearly 400 pages, is bound in cloth, and yet it retails in Great Britain for only 12 cents. The diary gives ample space under each date to jot down all the notes that the average engineer keeps in such a book, while the mechanical information is comprehensive and accurate. This technical section has now assumed a comparatively permanent form, and the changes made from year to year are mainly to bring the contents up-to-date in those departments where new standards have been adopted or the progress of the art makes revision necessary. While the contents are by no means so complete as the information given in more elaborate engineering handbooks, there are few things which arise in the general run of mechanical drafting room work that cannot be answered at least in part, by reference to this little volume. (Manchester, England, Emmott & Co., 65 King St., 6 pence.)

A little book, professedly written for the engineer and engine man, but useful for a much wider circle of readers, is the "Engine-room Chemistry" of Prof. Augustus H. Gill, of the Massachusetts Institute of Technology. It aims to give such information concerning oils, fuels and the phenomena of combustion and steam-raising, all expressed in fairly non-technical language, as will enable the average reader to understand what is necessary from the point of view of chemistry to obtain the maximum efficiency in the power plant. The book opens with an explanation of those elements of chemistry which must be understood in order to study problems of this nature and describes the apparatus and chemicals used in making the tests under consideration. The author then takes up in detail fuels and their analysis, and gives in the next chapter an explanation of methods of regulating combustion and conducting gas analyses. Boiler scale, fitting and corrosion form the subject of the following chapter, in which the rather complicated subject of hard waters is outlined in a satisfactory manner. It is rather unfortunate, however, that this chapter was written before the presentation of the important paper by Dr. Cushman explaining the method of preventing pitting which is being followed with much success in some boiler plants in Washington. The remainder of the book is devoted to mineral, animal and vegetable oil and will be found particularly useful to those who have learned by experience the importance of more attention to this class of engine room supplies than is usually paid it. (New York, Hill Publishing Co., $1.00.)

Although there are many books on mechanical drawings available for self-instruction and classroom work, a new one entitled "Structural Drawing," by Mr. C. Franklin Edminster, of the Pratt Institute in Brooklyn, takes up a branch of the subject which has hitherto not been touched except very briefly. It gives a course of lessons in the drafting work in structural shops and the offices of architects and mill engineers, so far as steelwork is concerned. The book opens with the usual instructions concerning drafting materials, which are followed by a collection of geo-

metrical problems. Simple projection such as is used in preparing working drawings is then explained, after which structural drafting is taken up in detail. The first work is the drawing of cross sections of rolled shapes to scale and their lettering according to standard dimensions; the drawing to scale of nuts and bolts, tie rods, eye-bars and clevices, turn-buckles and anchors is then taken up and the more elementary connections are introduced. Afterward the student is taken along step by step as his skill increases until the most difficult forms of structural drafting connected with staircase details have been taken up. The many plates in the book are executed in the standard manner required in bridge shops, and the book as a whole is an excellent outline of the somewhat special class of drafting necessary for steel. (New York, David Williams Co., $2.50.)

The long-awaited "Municipal and Private Operations of Public Utility," the report to the National Civic Federation by its Commission on Public Ownership and Operation, has at last appeared in three bulky volumes, forming the latest and most complete word on this important subject. The first volume contains the final conclusions of the Committee and general summaries of the evidence upon the various phases of the question. These conclusions were reviewed at considerable length in The Engineering Record several months ago. The second volume is devoted to the reports of the experts upon conditions found in the United States, and the third volume is devoted to the situation in Great Britain. These volumes are made up of two entirely distinct parts. The first is a collection of information regarding public service undertaking, compiled by specialists in such work and approved as correct by the members of the committee who believed in municipal ownership and by those who believed in private ownership. The second portion of the volumes is a collection of monographs based on the data and written from the viewpoint of each interest. The reader desirous of making a thorough study of the relative advantages of municipal and private ownership will find the volumes of particular value on this account, for the advocates of each method of operation are here compelled to base their arguments on exactly the same basic facts. This is probably the first time that such a complete discussion of the subject has been presented under conditions so favorable for clearing away the unessential assumptions and disputed facts that make the usual article on the subject hardly worth reading. Inasmuch as the report has already been reviewed in this journal and an estimate of its value stated editorially it is hardly necessary to say more in this place than that the volumes should be in every library claiming to possess the more important works on the control of public service utilities. (New York, 281 Fourth Ave., National Civic Federation, $10.)

Letters to the Editor.

STRESSES ON RIVETS.

SIR: I notice that, while your standard specifications provide carefully for the effects of repeated stress in the members of a framework or structure, the effect on the rivets and pins is practically ignored, and constant values are assigned for safe shearing and bearing stresses on these. As a chief draftsman and designer of steel structures, I use the following formulas, which ensure that the connections are as strong as the pieces connected:

$$(1)\quad P = 9{,}000\left(1 + \frac{\text{minimum}}{2\ \text{maximum}}\right)$$

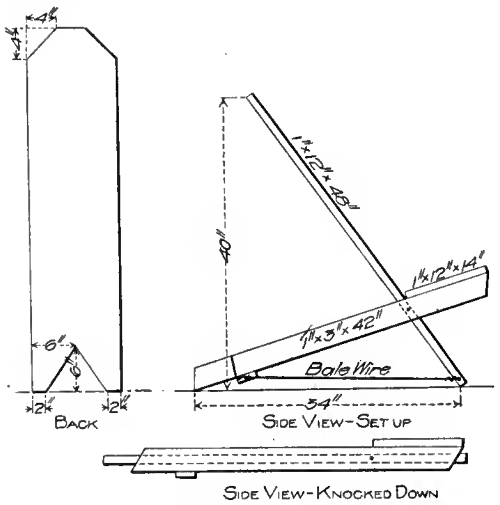
$$(2)\quad P = 9{,}000\left(1 - \frac{\text{minimum}}{2\ \text{maximum}}\right)$$

The first formula gives the unit stresses on mild steel rivets in single shear for repetition stresses, and the second gives the unit stresses for reversing loads. The safe bearing stresses and double shear stresses are double the amount given by these formulas. These formulas are original, so far as I know, and perhaps if you found space for them in The Engineering Record they would receive criticism and light would be thrown on the subject. Yours faithfully,

Bradford, Eng., Oct. 8. JAMES A ORREL.

CAMP COMFORTS.

SIR: When I arrived at the engineers' camp at Del Rio it was about as uninviting a place as I ever saw. The dirt floors of the tents consisted of an inch of dust—so fine that one could



A Camp Chair.

not stir without filling the tent with the powder. It seemed to me that the first night I spent there I breathed in my full "peck of dirt." This was intolerable and the next morning I had the men with our team get gravel from the river nearby and spread a layer of it 3 in. thick in each tent. We have had no dust since then. For seats we had boxes, and two roughly-made stools. Now, when I am working I work hard and when the time for rest comes I want to rest as thoroughly, which I cannot do on a tomato box nor very much better on a condensed milk box, so I determined to improve our sitting arrangements. The commissary had just received a quantity of 12-in. white pine boards for general camp use, and I ordered a half dozen of them sent to our camp. From these we made three easy chairs similar to those here shown. I had often seen these chairs in use, but always made rigid, and hence very unhandy to transport when moving camp. I therefore determined that the present lot should not have that defect. We first cut three pieces 4 ft. long for the backs, next six pieces 4 ft. 6 in. long by 3 in. wide, then three pieces 14 in. long and three 1 ft. 3 in. Placing the 4-ft. board on the ground, one of the 3x42-in. pieces was placed on edge on each side, and the pieces 14 in. long nailed crosswise to the 3-in. pieces. Turning the back board and sides over without disturbing their relative positions, one of the pieces 1 ft. long and 3 in. wide was nailed on 6 in. from the end opposite to where the seat was nailed. Next the back and side boards were set up as shown in sketch and a ten-penny wire nail driven in the center of the side piece just at the back of the seat and into the back piece 1 ft. from where it rests on the floor. The chair back can be fixed at any angle, but I found the angle shown to be the most satisfactory to all who tried it. The right slope of back board can be found by raising the top until it is 3 ft. 4 in. from the floor. To keep the chair in this position I used two bale wires, driving an eight-penny nail through the loop and into the bottom of the back piece and winding the other end around the 3-in. piece as shown. By unfastening the wire, the chair can be knocked down and occupies a space only 48 x 14 x 5 in.

For this work we had only a saw and hammer. We used fourteen nails and less than 8 sq. ft. of boards for each chair. I give this account of the work and sketch of the chair, not because I think I have made something new—I first saw this kind of chair thirty years ago—but because I have never seen a drawing of it, and I want to suggest to others to try it, and see if it is not one of the most comfortable a tired man ever threw himself into. HOWARD EGLESTON.

Del Rio, Mexico.

EXAMINATIONS FOR PHILIPPINE CIVIL ENGINEERS.

SIR: In an examination for civil engineer, in the Departmental and Phillipine Services, given by the United States Civil Service Commission at various points throughout the country on Oct. 16th and 17th, the subjects, with their weights, were as follows: (1) Pure and Applied Mathematics, "involving a fair knowledge of pure mathematics to and including calculus"; weight, 20. (2) Use and construction of instruments and surveying; transit, stadia, level, plane table, rod, chain, tape, current meter, etc.; weight, 30. (3) Design and construction, requiring knowledge of highways, railroads, dams, retaining walls, trusses, foundations, etc.; weight, 25. (4) Training and experience, rated from application form, answers to which are made under oath; weight, 25.

The time allowed for the examination was six hours on the first day and three hours on the second day, the first two subjects being given on the first day.

The questions asked, as nearly as I could recollect them the day after the examination, were as follows:

Mathematics; three questions to be answered.

(1) In a hollow cast-iron column 16 in. in diameter the thickness of metal is 1½ in., allowable stress is 9,000 lb. per square inch, column 24 ft. 5 in. high. $W = w + (wln^2/r^2)$, in which l = length of column in inches, $n = .002$, r = radius of gyration, W = load on column, and I for cylindrical form $= 11d^4/224$. Find w, in tons, to one decimal.

(2). The points, A, B and C, are in a straight line, $AB = 376.5$ ft., P is a point outside of the line. The angle $APB = 61° 20'$; and the angle $PAB = 42° 6'$. If D bisects ABC find angle ADP, to the nearest minute.

$$\frac{a-b}{a+b} = \tan \tfrac{1}{2}(A-B)\cot\frac{C}{2}$$

(3). In a triangular frame ABC, $AB = 15$ ft.; $BC = 12$ ft., and $AC = 20$ ft. There is a force of 6, normal to AB at A, one of 8 normal to BC at C, and a vertical one of 6 at B. The frame is fixed only at A. Find, by any method, the stresses in the parts of the frame.

(4). The bottom of a channel is 8 ft. wide, the water level is 16 ft. wide, the sides slope at 30° from the vertical, the flow is 288 cu. ft. per second and the grade 1 in 2,000. Find the mean depth, mean velocity and coefficient of friction.

Use and Construction of Instruments and Surveying; four questions to be answered.

(1). Name all of the ways errors can occur in the use of the transit, and state how to eliminate or reduce them.

(2) Give same for the wye level.

(3). State, in detail, how you would adjust the standards of a transit. What previous adjustment should be made and why?

(4). State, in detail, how you would proceed to make a topographic survey and map complete (a) of a very irregular plot of ground of not over 350 acres and showing 2-ft. contours to a large scale. (b) Give the same for a large similar plot on a small scale and showing 20-ft. contours.

(5) Give an account of the Government's method of surveying the public lands.

(6). Tell, in detail, how you would make a hydrographic survey of a river averaging 300 ft. wide and 15 ft. deep.

Design and Construction; three questions to be answered.

(1). Give a list of all the defects found in lumber and state the cause of each.

(2) Write as complete a specification as you can (*a*) for a brick pavement, (*b*) for an asphalt pavement.

(3). Given a town of 5,000 inhabitants. Describe in detail all the data you would collect before starting the design of a sewerage system.

(4). Given a reservoir of certain capacity. How would you determine the dimensions of dams, fills, walls, embankments, etc.? Show diagrams of same. How would you locate spillways and determine size of same?

(5). Give a list of the advantages and disadvantages of the different kinds of highways in use. Give sketches showing best methods of construction.

Competitor.

Cost Analysis Data.

Sir: In compliance with your request of Dec. 5, I send you a brief outline of my opinion regarding the practicability of using cost-analysis data with safety in estimating the probable cost of constructing engineering works.

It cannot be disputed that a complete system of cost keeping, in sufficient detail, is of great value to public works departments. If the work is performed by day labor such a system will serve as a useful guide to the engineer in charge, both in making his estimates of the probable cost of work and in checking from time to time the actual cost of construction with the cost of similar work previously done. Such a system is of nearly as much value to departments conducting work by contract. The greatest value of cost keeping in all cases, of course, results from the costs having been kept upon work under the direct personal supervision of the engineer who is using the cost system as a guide for estimates and for checking costs during construction. These observations imply that the use of such cost statistics is confined in each case to one locality, in which similar classes of work must be reasonably comparable. In making an estimate of the probable cost of work under these conditions the judgment of the engineer is of the utmost importance, and even with a satisfactory cost system his judgment must far exceed in comparative value the weight given to his statistics of cost upon past work.

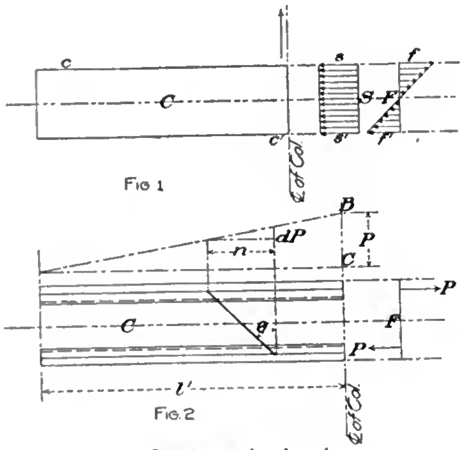
In the application of costs obtained by other engineers, or in other localities, the utmost care should be exercised, as it is impossible in almost all cases to have an accurate knowledge of the particular conditions surrounding the work done at the costs given. Such costs may serve as a very valuable general guide, but ought not to serve as the main basis of estimates, which should in every case be the result of personal judgment growing out of personal experience. If the engineer making the estimate has obtained the cost of other similar work under his own direction these costs would be of much greater value to him in assisting him to form his judgment than would be the costs obtained by other parties under conditions which must be largely unknown to him.

In fine, it is my opinion that cost statistics, as generally accessible from published records, are of very doubtful value for anything more than a general guide and may be exceedingly dangerous to follow. Very truly yours,

Harrison P. Eddy.

Boston, Mass., 14 Beacon St.

[This letter is an answer to a request made to Mr. Eddy to send for publication in The Engineering Record a statement of his conclusions regarding the value of cost analysis data. As superintendent of the sewer department of Worcester, Mass., from 1892 to 1907, he constructed by day labor all kinds of sewerage works, involving ordinary work in rock and earth, heavy trenching, difficult pile driving, tunneling in many kinds of material, and concrete structures. All payments for materials and labor were made by him directly, and for a number of years he kept very complete cost analysis records of these expenditures and the conditions of the construction. Probably very few engineers have had such an opportunity to



Stresses in Lacing.

study actual cost data on sewerage work, and for this reason Mr. Eddy's opinion deserves especial consideration.—Editor.]

Stresses in Lacing on Columns.

Sir: One of the fundamental features of short column design is the assumption that the compressive stress is distributed uniformly over the area of any cross-section. Suppose C in Fig. 1 to be such a column. Then S may represent the stress diagram. Now suppose the column becomes longer so that there is bending, or a tendency to bend in the direction shown by the arrow. There will then be set up in the column a flexure couple that we assume will take the form shown as F. It will be evident at once that the maximum stress under the second condition will be greater in compression and smaller in tension. The maximum stress on the tension side will be $(f-s)$. The maximum stress on the compression side will be $(f'+s')$. We might concentrate the entire stress shown by diagrams S and F about points respectively the centers of gravity of the parts of the diagram above and below the neutral axis. The stress shown by diagram S is balanced about the neutral axis, and therefore would not have a tendency to distort the column laterally. Lateral distortion of the column would depend on the flexure couple only. It is then this couple that has to do with the design of lacing in built-up columns.

Fig. 2 is a column composed of two channels laced back to back. The flexure diagram F is shown with forces concentrated at the centers of gravity of the channels. For practical purposes we may assume that $P=Af$ where A is the area of cross-section of one channel and f is to be taken as the maximum stress in the channel due to flexure at the point where the greatest bending, or the tendency to bend, occurs. In most cases, as that shown in Fig. 2, this point will be at the center of the column. In any practical case f should be taken as the difference between the allowable stress for the material in a short column and the calculated unit stress for the column in question. For instance, when the straight-line formula is used we have $s=s'-cl/r$, where s is the stress for a short column, c a constant, r the least radius of gyration, l the equivalent length, and s the stress for a long column. Then, in our discussion, the value of f is cl/r.

When Euler's formula is used

$$s-\frac{EI\pi^2}{A'l^2}=f$$

Where A' is the area of column cross section, and I is the moment of inertia about an axis perpendicular to the plane of bending.

Returning to Fig. 2, l' is the distance from section of maximum to section of no flexure. When l is equal to the length of the column in question l' may be equal to ½, ¼, etc., according to end connections. Upon the line AC at the point C we erect a perpendicular BC which shall equal to scale $P=Af$. Now at the points A and C we know the flexural stress. If we were to calculate it at all other points between A and C and plot to scale along AC as a base there would result a curve similar to a harmonic curve. A circular arc would not be greatly different, and for all practical purposes a straight line drawn from B to A will be sufficiently near. Then when n is the interval for lace spacing there results dP the change in flexural stress.

Then (1): $dP \csc\theta = G$,

Where G = stress in lace bar. From similar triangles $dP = nAf/l'$. Substituting in (1) this value of dP there results

(2) $G = nAf/l' \csc\theta$. Where there is a double system of lacing it is consistently accurate to take one-half the computed value of G as the stress in each bar of the panel.

The same reasoning makes it easy to derive formulas for the stress in lace bars where there are any number of leaves in the column. For example, we may assume a column where there are four leaves. The maximum stress will occur between the inner two leaves.

Let d_1 = distance from the neutral axis to the center of gravity of first leaf, and d_2 = distance from the neutral axis to the center of gravity of the second leaf. Let A_1 and A_2 be the area of the inner and outer leaves respectively. Then

(3) $P = (d_1/d_2)\, fA_1 + fA_2$.

$$G=\frac{fn}{l'}\left(A_1\frac{d_1}{d_2}+A_2\right)\csc\theta.$$

For the purpose of illustration assume a column made up of two 12-in., 20.5-lb. channels laced 13.75 in. out to out with square ends and an over all length of 24 ft. The area of a cross-section of this column is 12.06 sq. in. Assuming a factor of safety of 4, Gordon's formula gives a maximum safe unit stress of about 11,500 lb. Calling the safe stress for a short column of this steel 16,000 lb., there results f = 4,500 lb. Let $\theta = 45°$.

$$G=\frac{10\times 6\times 4{,}500\sqrt{2}}{6\times 12}=5{,}300\text{ lb.}$$

This would give for a 2x¼-in. lace bar a stress of 10,600 lb. which it is safe to allow under these conditions.

G. L. Bilderbeck.

East Berlin, Dec. 3.

Privately Owned Railroads in Belgium will shortly have their total length reduced to 200 miles, as the Belgian Parliament has authorized the purchase of a privately owned line 112 miles long. The 200 miles referred to are operated by six different companies.

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TABLE OF LEADING ARTICLES.

Fair Play for the Great Lakes Commerce.

A great deal is being said at this time about the improvement of rivers and harbors and the development of the water resources of the nation. It goes without saying that this journal is heartily in accord with everything of this nature that stands on a rational basis. It is necessary to bear in mind all the time, however, that the greatest inland waterway we have is the chain of Great Lakes. The water area of these lakes and the connecting and outflowing rivers is about 95,000 square miles, of which approximately two-thirds lies in the United States. The shore line is about 8,300 miles, and of this the American portion is 4,700 miles. These figures are worth comparing with the total shore line of the Atlantic, Pacific and Mexican seaboards of the United States, excluding Alaska and insular possessions, which is but 5,700 miles. The commerce of the Great Lakes is of great importance. It is nothing problematical, like the commerce which may be conducted on the improved rivers of the future, about which so much is now said, but is something that is existing and sure to increase further as facilities for its development are afforded. Therefore the people of the cities along the Great Lakes should instruct their representatives in Congress in no uncertain terms to make sure that in all the legislation for inland waterways the actual paramount character of the Great Lakes commerce and the imperative need of further improvements for Great Lakes navigation are not overlooked. Fortunately it is unnecessary to go beyond official documents to find full proof of the fact that the Great Lakes urgently demand the attention of Congress. The last annual report of General Mackenzie, Chief of Engineers, U. S. A., has a special section on this subject to which attention is drawn.

It will be a great surprise to many people to know that a thoroughly complete survey of the Great Lakes, such as is necessary for a comprehensive study of the needs of navigation before the actual shipping exists to make those needs felt, has never been made. In 1841 the first regular appropriation for the Lake Survey was made and since then annual appropriations have been made, except in 1847. The work has always been so well managed that the Survey has kept well in advance of the requirements of navigation in spite of the small sums available for its purposes and the great extent of the area to be covered. The time has now arrived, however, when the commerce of the Great Lakes requires more information than can possibly be given with the data obtained up to the present time, and it is necessary to adopt a general policy for the completion of the operations of the Survey. These operations must be conducted in part upon Canadian territory, for the fact that 95 per cent. of the commerce of the Great Lakes is American requires the extension of the work into those parts of the main traveled vessel tracks passing through Canadian waters. The area to be covered is about 70,000 square miles, and its shore line not less than 6,000 miles.

The time has certainly come when navigation on this great extent of inland waters should be made as safe as that along our seacoast, so far as reliable charts will accomplish this end. The essential difference between navigation on the Great Lakes and the deep seas is rarely appreciated except by those who have been aboard a lake steamer in a heavy storm. In the free ocean, when such a storm arises, it is only necessary to ease off from the course more or less, according to the severity of the gale, and everything is safe and comfortable. On the Great Lakes no such deviation from the true course is possible. The channels which must be followed by vessels of deep draught are comparatively restricted; a departure from them during a gale is absolutely certain to cause a wreck in some sections, and in other sections just what will happen is entirely unknown owing to the absence of careful hydrographic surveys. So the ship captain on the Great Lakes has to stick to his course, allowing his vessel to be battered by the wind in a manner that no deep-sea sailor would tolerate. Even this is not always practicable, for the storms are of great severity at times and drive vessels off their course in spite of everything that can be done. During the season of 1905 there were 230 casualties to vessels engaged on the Great Lakes, 173 lives were lost and property to the value of $3,953,000 was destroyed. One gale alone, that of Nov. 28, caused the loss of 30 lives, 35 vessels and property worth $1,881,000. During such storms the entire area of each lake must be known and made available by charts, for the lee of every island and the shelter of every bay and passage becomes a possible refuge when correctly charted. An inlet or a channel that is absolutely unimportant during pleasant weather may become a haven in times of distress and peril. It is manifest, therefore, that no time should be lost in surveying the 70,000 square miles of the water area of the Great Lakes.

As there may be confusion as to just what the Lake Survey does, a word concerning its work is in place here. The various Engineer Districts of the Great Lakes are charged with the duty of improving the terminal harbors and the connecting rivers. This work, however, covers but a small part of that which must be done to make navigation secure, and the Lake Survey, which is in charge of the remainder of this work, is engaged in the examination and exploration of the vastly larger and more dangerous areas of the lake. It prepares charts of the main routes, searches for undiscovered or obscure dangers, and studies the lake hydraulics in order to furnish data for the solution of the problem of maintaining more uniform surface levels, bettering draughts and protecting the lakes from the dangers that will follow any water diversion. It is manifest that the importance of the Lake Survey's work increases with the volume of traffic and the size of the individual carriers. The increase in the size of these carriers has been astonishing. When the Weitzel lock at Sault Ste. Marie was completed in 1881, 15-ft. draught of vessels was considered all that was probable for many years. In 1896 the Poe lock was opened with a depth of about 20 ft., which was considered ample for all time, but the project recently adopted for the new lock at the same place provides for a depth of 24½ ft. In 1906 the domestic lake traffic in freight alone amounted to 75,610,000 net tons. It was valued at about $780,000,000 and was carried by an American fleet worth approximately $125,000,000. This fleet saved the merchants of the country something like $100,000,000 excess freights charges which would have been paid out had the goods been carried by rail. As a matter of fact, railroad facilities do not exist for handling all this traffic. These figures take no account, moreover, of the enormous passenger traffic. Such statements show the extent of the already existing interests to be benefited by a suitable appropriation for placing the Lake Survey on a permanent basis.

It has been mentioned that the investigation of the hydraulics of the Great Lakes is a part of the duties of this Survey. The importance of this field of the work will be understood when it is considered that if, by regulating works, it is possible to enable the large vessels to have one additional foot of draught, this gain is equivalent to an increase of 10 per cent., in freight-carrying capacity with practically no added operating cost. And when it is considered that a single 600-ft. freighter, with its cargo, which may be saved from wreck by prompt charting of obscure or recently created dangers, is worth more than the total cost of maintaining the Lake Survey for over three years, there is manifestly every reason for granting the sum which General Mackenzie requests for this great undertaking. He asks for only $115,000 for the next year, an amount so insignificant in comparison with the benefit to follow its appropriation, that the congressional representatives of the Great Lake district should see that the money is voted.

Lord Kelvin.

In the death of William Thomson, Baron Kelvin, mentioned last week, the world loses not only its greatest physicist but one who in wideness of useful achievement and complete grasp of both theory and practice must rank among the few really colossal figures in the history of science. To him providentially had been given a span of life commensurate with his splendid activity. In the present generation he has been revered as the Nestor of physical science, pure and applied; in the last generation he was the commanding form that in useful research towered above his contemporaries.

It is sixty-six years since William Thomson, a lad of seventeen in the University of Glasgow, published his first contribution to the world's knowledge—a time so long that his early work has passed out of popular knowledge, effaced by the importance of his later investigations. His earliest paper was a rigid proof of some of the principles set forth in Fourier's theory of heat, and he pursued that line of investigation so industriously that he must be given place with Joule and Clausius as one of the founders of the present mechanical theory of heat. To him we owe the concept of absolute temperature and the foundation of the absolute thermometric scale, the experimental proof of the lowering of the freezing point of water by pressure, and the far-reaching doctrine of the dissipation of energy.

His thermal studies did not, however, confine his ceaseless activity, and at the age when the student of to-day is generally killing time as a swaggering sophomore, William Thomson had discovered the theory of electrical images and was writing papers about it in the chief French mathematical journal. A little later he followed it up with a study of the determination of electromotive force in absolute measure, and a brilliant mathematical investigation of the properties of transient electric currents, a study later destined to bear fruit in the engineering problems connected with the Atlantic cable. A few years more and he was plunged in cable work, bringing to bear upon it his extraordinary power of mathematical analysis, mechanical ingenuity and inventive genius. Technically the submarine cable was in very large measure his personal work. In the course of this labor he set up for the first time a conductivity specification for copper wire. The commercial wire available sixty years ago varied over a range all the way from the commercial wire of to-day to that having scarcely more than half the proper conductivity.

In this period, during which the Atlantic cable was evolved, he began the long series of inventions of electrical instruments which are familiar in laboratories the world over, and which need no commendation here. With it all, he found time for brilliant excursions into other fields, magnetism, resulting in his invention of the standard compensated compass tha guides the world's fleets over the seven seas, physical astronomy, with his studies of the source and cosmic history of solar energy and world-building and elasticity, with its fruition in theoretical optics.

From the very beginning of modern applied electricity, Sir William Thomson, knighted more than forty years ago for his achievements, bent his energies to its development in both theory and practice. His enunciation of the law of economy in conductors, his investigation of the skin effect in conductors, following the curious experience of Lord Armstrong, and a dozen other researches are familiar history.

There is no need to bespeak William Thomson's title to fame, but to those who have endeavored to gauge the breadth and depth of his career, or who have come into even casual contact with his inspiring personality, this thing stands out above all others, that he did with his might whatever he understood, whether the dynamics of a molecule or the design of a commercial instrument, and never left either problem until the world was the richer. He neither turned aside from pure science to pursue the practical, nor despised the practical when it confronted him. He never posed as a wizard or hesitated to give his confréres at least all the credit that was their due. No man in the century past has so fully combined the acumen of the trained investigator with the calm and sane judgments and practical common sense of the engineer.

As a lecturer, he was clear, suggestive, inspiring, working with simple apparatus and making every experiment count. A profound mathematician, he never forgot the physical concepts that lay behind his equations and never let his hearers forget them. And he never lost sight of the unity of physical phenomena. His famous Baltimore lectures on the dynamical theory of light are in no wise an attack upon the electromagnetic theory, but a vivid demonstration that the same ultimate reality lies behind them both. In dealing with the electronic theory of to-day he was equally ready to apply its analysis to familiar phenomena or to rebuke those who were tempted by it to essay speculative flights beyond the realm of cautious experimentation. He had outlived too many theories of matter to bespeak eternal life for the latest one.

And now his splendid career has ended. Revered of all men for his learning and loved of all who knew him for himself, he sleeps in the great Abbey amid the dust of forgotten kings, beside Newton and Darwin, his only peers in England's intellectual history. With them, he belongs not to England alone, but to the world's scant list of those who have borne the torch for generations yet to come.

The New Jersey Sewerage Commission.

It is gratifying to learn from the report of the New Jersey State Sewerage Commission, recently submitted to the Legislature, that there has been a steady progress in public appreciation of the importance of good sewerage and sewage disposal work. The conditions of water supply in Northern New Jersey and the manner of distribution of the very large population will probably make the general problem of sanitation in that section of the State approach in importance the sewage disposal and water supply problems that confront the average British city to-day. A considerable proportion of the male population in this section is engaged in business in the larger cities, and consequently the public affairs of the smaller towns where these men live, and even of some of the larger ones, have not received the careful attention that they required. Sewerage work is always liable to be unappreciated, for it is out of sight; a resident of one of these small towns who will vigorously oppose any failure to furnish and maintain fairly good roads will pay little or no attention to failure to provide proper sewerage. Moreover, when plans for good sewerage works are proposed and the amount of money they will cost is stated, a strong opposition often has arisen, nominally on the ground that the works are an unnecessary luxury, but actually because the importance of public sanitation is not thoroughly appreciated.

For years the New Jersey Sewerage Commission has therefore been obliged to carry on missionary work. It has been compelled to deny "that streams of water are God-given natural sewers, designed by Omnipotence to bear away human wastes, and that man is wiser than his Maker in providing that filth shall filter through soil." It has had to combat the idea that dangerous gases are emitted from disposal works, and that the winds will bring from such plants to all people within a radius of a mile a devastating swarm of bacteria which will cause desolation and death. The Commission has learned how to handle the difficult cases of objection based on ignorance and, since that ignorance is disappearing, the outlook for improved sanitation in the State is very bright. One unfortunate feature of its recent experience has been the necessity of a controversy with the State Board of Health, apparently due to a jealousy on the part of the latter board that was not only unwarranted but also lowered its standing in the eyes of those citizens who were acquainted with the facts. Both Boards have more than enough work to do, and it is unfortunate that the Board of Health endeavored to reach beyond its proper legal powers and interfere with the work of another commission which has been striving for many years, often against great difficulties, to improve the condition of public sanitation in certain directions. In view of the Commission's success and the manifest desirability of preventing any further conflict of authority, it would be a wise step to define its power clearly by new legislation. Such legislation is demanded, moreover, on account of an unfortunate decision of the Court of Errors and Appeals that creamery wastes do not come within the existing laws giving the Commission jurisdiction in questions relating to "sewage and other polluting matter." As a matter of fact, industrial wastes of all sorts are just as much sewage as the discharges from dwellings, and they are sometimes extremely difficult to deal with. For this reason a new law should be enacted at once giving the Commission authority over the disposal of every class of sewage.

One interesting feature of the Commission's work of late has been connected with the prevention of river pollution. At present most of the large cities are discharging their sewage directly into streams or bodies of water in a manner which is either already causing a nuisance or will undoubtedly do so within a comparatively few years. The city of Elizabeth has voluntarily undertaken to relieve the Elizabeth River of the sewage pollution which has formerly been taking place, and work done in other communities is praiseworthy. While the Commission has been forced to take legal action in order to accelerate better methods of disposal in some cases, the opposition which was at first encountered has generally disappeared entirely, and in the remaining cases is of little significance. The authorities of Pennsylvania and New York are co-operating with the Commission to reduce the pollution of interstate streams, and a good beginning has been made to stop the pollution of bathing beaches and waters where shell fish are taken. So far as stream pollution is concerned, the Commission takes the position that a safe water supply cannot be obtained from a stream draining a populated district, but that such a supply, if used at all, should be carefully filtered. Its duty is done when it reduces the pollution of a stream to an amount which is not an inequitable infringement on the rights of any party having a legal interest in the water. The position is that held by most authorities on sewage disposal and water supply and is the only one that is fair to all concerned.

It is interesting to learn that the Commission has already experienced the difficulties attending the disposal of sewage where an effluent of a high degree of purity is required, and has been forced to carry on investigations to determine the practicability of disinfecting the effluents of disposal works. Work done in 1906 by the Commission and the Hydrographic Division of the

United States Geological Survey jointly at Red Bank showed that, while chlorine would kill bacteria, yet a much larger quantity of chlorine was needed to treat septic sewage than was the case in treating raw sewage. During the present year the Geological Survey was unable to participate in the investigation, on account of inadequate funds, and the work was carried on by the Commission, with the assistance of Prof. Earle B. Phelps, of the Massachusetts Institute of Technology, whose individual interest led him to supervise the experiments. The results have been highly satisfactory and indicate that a practicable and economical method of destroying bacteria in a septic effluent like that of the Red Bank works is available. The chlorine for the purpose was obtained from a solution of chloride of lime and applied in the proper proportions to the flow of the sewage by a float regulator. It was found that a practically sterile effluent was obtained by a two-hour detention of the septic sewage in transit through a tank, after the chlorine solution was applied. Various other facts of value were determined, and the experiments, as a whole, show that it is practicable to sterilize sewage for discharge into waters where bathing is carried on or shell fish are taken at a far lower cost than has hitherto been practicable with septic tanks and filters.

Reinforced Concrete Construction and a Proposed Building Code.

The building code of the City of New York has recently been undergoing a process of revision. In fact there are few codes, building or other, which have been so frequently and so thoroughly revised as the New York building regulations. It is pretty well known that all parts of these revisions are not exclusively the outcome of disinterested efforts to secure types of construction calculated to be consistent with the best interests of the city in this particular field. Various parties have probably combined to influence revision committees in the interests of certain materials or systems to the obstruction of others. When the present revision was begun it was hoped by many that it would result in material improvements over any heretofore completed. This may still be so in general, but there are features of this last revision, lately submitted to the Board of Aldermen, which appear to indicate that some of the older methods of securing a new building code still prevail.

Reinforced concrete construction has been carried on in this city under the existing building code in a fairly satisfactory manner, although it is not what may be considered one of the formally recognized standard materials. Regulations have been adopted by the Bureau of Buildings of the Borough of Manhattan which, while not entirely satisfactory to those directly interested, have been at least sufficiently effective to secure some of the best reinforced concrete buildings yet constructed in this or any other country. It is not clear, therefore, nor can any satisfactory reason be given why the proposed new building code should be so written as to exclude hereafter what has already been so satisfactorily accomplished.

Among other provisions is one limiting the height of reinforced concrete buildings to 85 ft., while another requires the floors and roofs of a large class of buildings devoted to industrial purposes to be formed with steel beams placed not more than 5 ft. from centre to centre. The limitation of the height of this class of buildings to 85 ft. practically irrespective of the form of column employed, is without any valid reason whatever, and is calculated to prevent entirely the development of the best types of reinforced concrete columns yet devised. Doubtless there are classes of concrete-steel columns which are not well adapted to tall building construction, the use of some of which might properly be restricted to less than 85 ft., but to exclude such a type of column as that used in the Thirty-ninth Street Building, from which this journal is issued, is bad engineering.

Similarly the arbitrary maximum distance of 5 ft. between centres of floor beams is without any structural or other sensible or creditable reason. It would not be much of an exaggeration if any, to state that acres of floors have already been constructed for the satisfactory carrying of the heaviest warehouse and running machinery loads, in all of which this provision is disregarded. Innumerable flat and curved arches of greater span than 5 ft. are standing up under the heaviest loads, both static and dynamic.

It is probably true that the present regulations are, as a whole, meager and that they need amplification in a number of directions together with a revision of some of the working stresses. Criticism has been made in some quarters that a working stress of 750 lb. per square inch is too high for any type of reinforced concrete column, but as there are a large number of tests of 12-in. concrete cubes in existence, showing that the ultimate compressive resistance of such material at the age of three to six months may run from 3,000 to 4,500 lb. per square inch, it is clear that the working stress in question for such columns as those used in the Thirty-ninth Street Building, or any other column of equivalent carrying capacity, is amply justified. The prevailing maximum stresses of compression in the reinforced concrete arches of both this country and Europe are 500 to 600 lb. per square inch for the concrete and those values in such structures indicate a much more severe duty than 750 lb. per square inch in concrete so effectively supported as in the latest and best forms of combined concrete and steel columns.

Many years experience with modern concrete structures, as well as old Roman concrete remains, conclusively prove the durability of this material. Furthermore great conflagrations during the past half dozen years have demonstrated the eminently satisfactory fire resisting qualities of both plain and reinforced concrete. In every case of collapse of a concrete building during construction it has not been difficult to find a reason based either in ignorance or recklessness, wholly inconsistent with good engineering, just as is the case with the many collapses of iron and brick buildings. There is every reason why reinforced concrete contruction should receive rational treatment like every other type in the new building code.

Notes and Comments.

TRACK ARRANGEMENTS at small stations have apparently received very little attention in this country. The business of such stations is so small that a shed and a platform located anywhere have been considered ample for all purposes. Sidings have been put in without much regard to the real advantages of different places for them or consideration for the agent. As a result we hear from time to time of fatal accidents due to one defect or another at such stations. Attention must have been paid to the subject on some of the lines of this country, but the results of these studies have apparently never been made public. The recent killing by a passing train at one of these country stations of an intelligent man well acquainted with the dangers of the place led The Engineering Record to spend some time in endeavoring to find what had been published regarding track details at minor stopping places. The only comprehensive article it has been able to find up to the present time is the interesting paper elsewhere in this issue.

THE HOUSE FLY comes in for another heavy indictment in a complaint filed with Governor Hughes a few days ago by the Merchants' Association of New York City. The Association had an elaborate investigation made last summer of all cases of typhoid fever and intestinal diseases in the city. This work was done under the direction of Dr. Daniel D. Jackson, and is stated in an elaborate report written by him to show that such diseases are due primarily to the sewage in the waters about New York. Flies are stated to carry the germs of disease from this sewage to the food stuff in the markets, most of which are near the water front, or to the homes of the people. On the strength of this investigation the Governor is asked to call the attention of the city to its alleged violation of the public health laws of the State, which, according to the Association, renders the city liable to a daily fine of $31,200. There can be no question that flies are a source of danger as carriers of the germs of intestinal diseases. This has been established by elaborate investigations so that it is beyond question. The charts and statistics gathered by Dr. Jackson indicate that there is a possibility that flies may carry germs from the sewage contaminated waters about the city, in the manner he indicates. The decision as to the completeness of the proof is one for biologists and physicians to make, but as there are a good many things to be considered before it can be definitely shown where and how the flies of this great city first become the vehicles of the disease germs, it is hardly to be expected that the Governor will order the City of New York to cease disposing of its sewage in the manner now followed on the strength of one investigation.

THE 80-CENT GAS RATE law passed by the New York Legislature on April 3, 1906, has been declared unconstitutional by the United States Circuit Court, on the ground that it is confiscatory of the property rights of the Consolidated Gas Co. While this decision is apparently favorable to that company, an examination of its text indicates that really the victory is a pretty barren one. This case was first heard by a referee, who decided it in favor of the company, but Judge Hough of the Circuit Court has scaled down the referee's valuation of the company's property required for manufacturing gas to such a figure that, even with $12,000,000 allowed as the value of the franchises, it would not require much more than 80 cents per thousand cubic feet to earn 6 per cent. on the sum allowed. The case will undoubtedly be appealed to the United States Supreme Court where two important things will probably have to be settled, first, whether a public service corporation is warranted in claiming 6 per cent. as the proper rate of net income, and, second, whether franchises are to be considered assets upon which income must be earned. The latter point is particularly interesting. In some places, particularly in New England, franchises are bought at rates fixed by public agreement with the city; in other parts of the country, it is understood, franchises are bought at a private sale by those responsible for their delivery to the interested parties, and the amounts paid for them are hardly matters of public record except by investigations such as were recently made in San Francisco. If a company openly pays a sum to a city for the privilege of carrying on business, it is, of course, warranted to claim the right to earn a certain amount on that investment, but if it pays the same sum to private individuals to secure a franchise which is not exclusive and for which the city itself receives no payment, on what decent grounds can any return on that investment be claimed?

THE COAL-HANDLING APPARATUS OF A LARGE COKE OVEN PLANT.

An installation of coal handling apparatus of unusual magnitude and arrangement is operated in connection with the extensive new coke-oven plant of the By-Products Coke Corporation at Selvay, Ill., which is about $2\frac{1}{2}$ miles southwest of South Chicago and adjacent to the Calumet River. The plant covers an area approximately 1,200 x 2,500 ft. in plan, and at present contains 160 coke ovens, with various buildings for the by-product processes and other purposes. The main line of the New York, Chicago & St. Louis R. R. parallels one side of the plant; the tracks of the Chicago & Western Indiana R. R., over which the Wabash, the Erie and the Chicago, Indianapolis & Louisville roads obtain entrance to the city, cut across one corner of the plant on the opposite side; the tracks of a terminal belt-line railroad are parallel to the side opposite to the New York, Chicago & St. Louis R. R., and a freight line of the Pennsylvania R. R. is adjacent. With these numerous railroad connections exceptionally good facilities are available for receiving coal and shipping coke by rail. But notwithstanding these rail facilities, the principal part of the coal supply for the plant is now delivered by water, as the Calumet River is less than one-half mile distant and a slip has been built which brings deep water within a few hundred feet of the present work.

The coal handling apparatus consists essentially of two hoisting towers, which travel along the slip and unload coal from vessels in the latter; a main conveying belt, extending from the slip into the coke oven plant, with a total length of over 3,300 ft.; a large traveling bridge for delivering coal from the main conveyor to or from a large stock pile, and several auxiliary conveyor belts to handle the coal through various breaker, mixing and storage houses. The two hoisting towers at the slip are driven by steam engines, but all of the conveyor belts and other coal-handling equipment are driven by electric motors supplied with power generated in the plant.

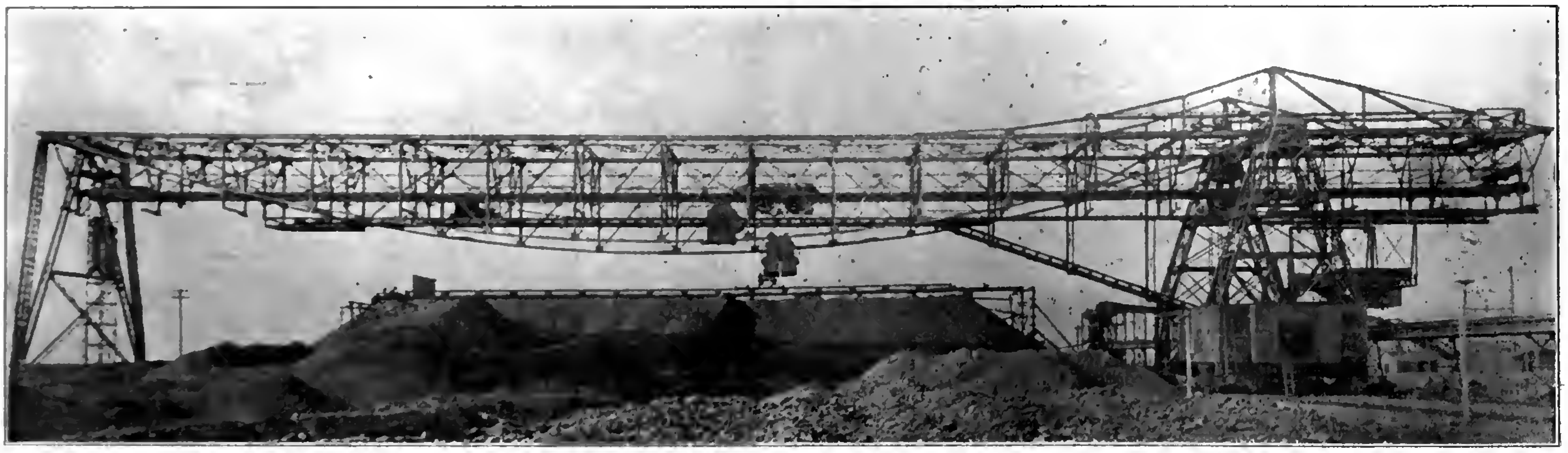
The slip along which the two hoisting towers are operated was built as a part of the coke-oven plant by the By-Products Coke Corporation. It is 1,200 ft. long, 175 ft. wide and affords a minimum depth of 21 ft. of water. The slip was made by dredging through ground which rose a few feet above the water level in the river, the excavated material being utilized in raising the grade of the land in the vicinity. The excavation was made through sand and sandy soil, which necessitated the use of close sheeting on both sides and the inshore end of the slip.

The two hoisting towers both travel on two pairs of rails, laid on heavy pile foundations along one side of the slip. Each of these towers is carried by two double column tower legs, one close to the edge of the slip and the other back far enough to permit the belt conveyor and two standard-gauge tracks to be placed between the tower legs. Each column of the latter is mounted on a four-wheel truck running on the rails on the dock. In each tower is an overhead receiving hopper, the bottom of which is high enough to provide a clearance of 16 ft. over the conveyor and the tracks. This hopper is 12 x 26 ft. in plan and has three 15-ton compartments, each with a separate gate and chute through which coal may be discharged. Over the hoppers and normal to the slip the tower has a bridge for a bucket trolley carriage. This bridge has a total length of 151 ft., a hinged cantilever section extending out over the slip at one end and a fixed cantilever over a storage pile at the other end. The hinged cantilever permits the trolley carriage to travel out 54 ft. 3 in. from the center line of the front tower leg and can be raised to allow the passage of boats with spars.

A 2-ton clam-shell bucket is swung from cables on two winding drums on the trolley carriage and is hoisted and lowered at a speed of 450 ft. per minute by a duplex Lidgerwood hoisting engine mounted over the trolley bridge on the front tower leg, the total lift being 54 ft. This engine is semi-automatically controlled so the bucket cannot be over-hoisted and comes to rest at the full working height. The trolley is operated by a separate engine, a device being provided which prevents over-travel on the bridge; this device is adjustable so the trolley can be stopped automatically at any predetermined position. The trolley carriage is of the Robins balanced type, which permits the trolley to be moved in and out without varying the height of the bucket; the trolley may also be moved along the bridge as the bucket is being raised or lowered. A counterweight is provided to give good efficiency for the combined operation of closing, hoisting and lowering the bucket.

Idlers for the Main Belt.

Conveyor Flights at the Plant.



Coal Storage and Reclaiming Bridge at the Plant.

Each tower has an average capacity for unloading 200 tons of coal per hour. The machinery of the tower is arranged so when it is working to this full capacity it can be operated by one man. Three levers are provided for controlling the movements of the trolley and bucket, two of which levers manipulate pilot valves governing the motion of the engines. Auxiliary direct-connected hand levers are also provided to be used in emergencies.

A separate engine geared to the truck wheels of the tower traverses the latter at a speed of 40 ft. per minute. The towers are both arranged to travel the full length of the dock and to unload coal from a vessel into the receiving hopper or into a storage pile along the land side of the dock, and to reclaim it from the latter at any point in the travel.

The continuous mouth of the three compart-

ments forming the receiving hopper has vertical sides of sufficient height to prevent any coal being spilled and also to act as a guard to limit the side swing of the bucket. As now arranged the central hopper delivers to the conveying belt and each of the side hoppers to cars on a track beneath them. The present consumption of the coke ovens is between 1,600 and 2,000 tons of coal a day, so the capacity of the unloading towers is sufficient to permit a part of the coal delivered by vessels to be transhipped by rail if desired. The conveying belt leading to the coke ovens can carry the full output of the unloading towers, however, and is supplied from the central hopper by an adjustable feeding device, which can deliver 400 tons an hour to it when operating at a reasonable speed.

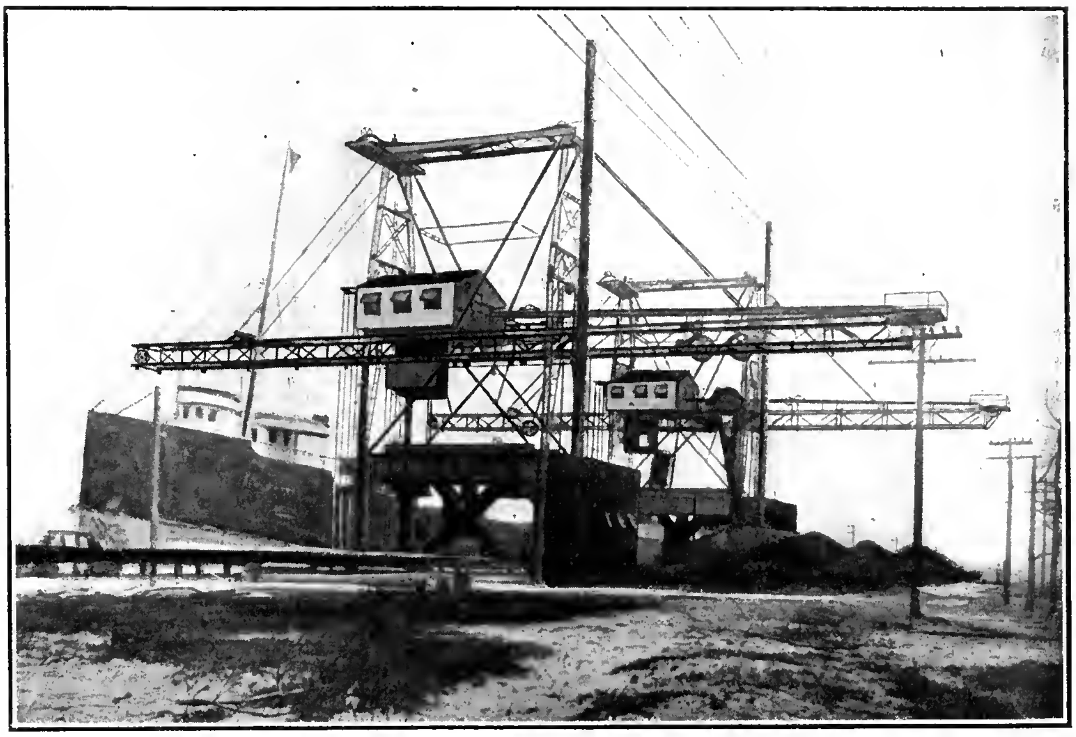
The frame for the idler pulleys of the main conveying belt extending from the slip to the coke ovens is on small concrete piers erected on the ground for a distance of about 1,000 ft. The conveyor then drops down into a subway, nearly 850 ft. long, in order to pass under the tracks of the various railroads on that side of the plant. At the end of this subway it rises on a 15 per cent. grade to a steel trestle, 1,000 ft. long and 35 ft. high, which provides an elevated crossing over the yard of the plant. From the end of this 35-ft. elevated trestle, a trestle, 15 ft high, extends for 1,340 ft. along the space provided for the coal-storage piles. Provisions are also made for extending this 15-ft. trestle in the opposite direction from the end of the higher trestle that is taken by the existing part of the 15-ft. trestle, so that a space for storing 300,000 tons of coal will be available along this low trestle and within the range of the large traveling bridge.

The main conveyor is made up of several belts of various lengths. A short belt has been installed temporarily at the slip end of the main conveyor, but will be replaced later by one 770 ft. long between centers of the end pulleys. This belt delivers to one of the same length, which extends down into the subway and to an angle of 40 deg. in the latter, where it delivers to a belt, 980 ft. long between end pulleys, that continues through the balance of the subway and thence up to the end of the high trestle. The conveyor on the existing part of the 15-ft. trestle along the storage piles is made up of two belts, each about 670 ft. long

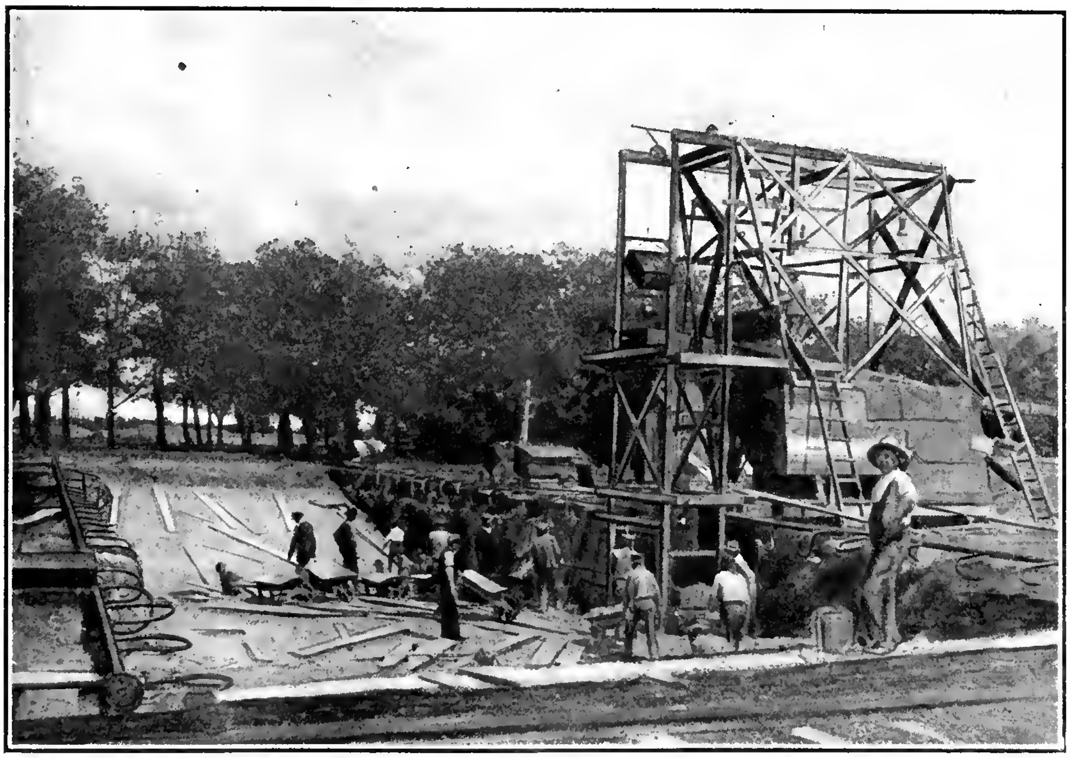
An alternating current motor is provided to drive each of the belts of the main conveyor. These motors are each placed in a closed house built to exclude dust. The belts from the dock to the end of the high trestle are all 36 in. wide and travel at a speed of 375 ft. per minute. A 30-h.-p. motor drives the first 770-ft. belt that has been installed, and a 50-h.-p. motor the 980-ft. belt. With these speeds and motors this leg of the conveyor has a capacity for handling about 400 tons of coal an hour. The switches controlling the operation of the motors driving the various belts which make up the main conveyor are arranged so when any belt is stopped all of the belts between it and the slip are also stopped.

The 980-ft. belt discharges at the end of the elevated trestle into a hopper carried by a steel tower. This hopper is arranged so coal may be supplied from it to a belt leading in either direction on the low trestle along the coal storage piles. The tower also carries a coal crusher, which may be fed from the hopper and delivers to the belts extending along the storage piles. This crusher is used as a spare when the main crusher is being repaired.

The belts on the 15-ft. trestle are 36 in. wide and travel at 375 ft. per minute. The breaker, mixing and storage buildings are placed midway on the leg of the main conveyor, the part of the 15-ft. trestle which has been installed, a 670-ft. belt extending from the end of the 35-ft. trestle to them, and one of the same length from them to the end of the storage space. Coal delivered from vessels in the slip, or from cars on the railroad tracks by the main conveyor is either placed in the storage piles by the traveling bridge, and then reclaimed by the latter to the main conveyor, as required, or is delivered immediately to the breakers prior to being passed through the mixers.



Unloading Towers at the Dock.



Sluicing Material at East End of Subway to Dump.

The traveling bridge is carried by a four-leg tower at the front end along the low trestle and by a shear leg at the other end. Each leg of the tower is carried by a four-wheel truck, and the shear leg is carried by two four-wheel trucks. The bridge has a total length of 340 ft., made up of a span of 280 ft. between the tower and shear leg and a 60-ft. cantilever extending out over the conveyor on the trestle. The span between the tower and the shear leg is an inverted parabolic bow-string truss, which has a clear width of 28 ft. between chords. The lowest point of the bottom chords of the truss are 35 ft. above the ground, and coal can be piled to a height of 30 ft.

Both of the belts which make up the section of the main conveyor on the low trestle each have a traveling tripper that permits coal to be discharged from either belt at any part of the latter onto a belt carried by the traveling bridge. This belt is 36 in. wide and a trifle over 262 ft. long between end pulleys; it extends from the receiving hopper up to floor beams carried by the lower chords of the bridge span and then horizontally to a point near the shear leg. This belt has a capacity for handling 750 tons an hour and is arranged with a tripper so coal can be discharged from it into the storage piles at any point in its horizontal run.

The bridge also carries a trolley carriage, which travels the full length of the structure from the shear leg to the end of the cantilever over the main conveyor on the 15-ft. trestle. A

5-ton clam-shell bucket mounted on this trolley carriage delivers coal from the storage piles to a hopper under the cantilever of the bridge. The main conveyor belts are supplied from this hopper by an automatic shaking feeder device. The trolley is moved back and forth along the bridge at a speed of 350 ft. per minute by a hoist driven by a 75-h.-p. motor; the bucket is hoisted and lowered by a second hoist driven by a 150-h.-p. motor, the hoisting speed being 275 ft. per minute. At these speeds the bucket has a capacity for rehandling 200 tons of coal an hour from the storage piles to the main conveyor. Both of the motor-driven hoists are in a house on the tower of the bridge; but they are arranged for remote control from an operator's cab on the trolley carriage, one man handling all of the operations of the bridge from this cab. The trolley is of Robins special balanced type, with the operating cables rove so it will remain in any desired position while the bucket is hoisted and lowered. The cables are also roved so there is no tendency for the trolley to run away in either direction at any time.

The traveling tripper on the belt leading from the end of the high trestle to the breaker, mixer and storage building is arranged to discharge coal in three ways; first, into the hopper of the traveling bridge; second, forward on the same belt, or to the belt extending along the storage piles from the buildings; and, third, into either of two belt conveyors leading to a tower in which seven belts leading to and from the various buildings converge. The conveyor belt extending along the storage piles from the buildings is arranged so it will run in either direction, in order that it can be reversed to deliver coal to the tower when supplied from the storage piles by the traveling bridge.

The tower is about 20 x 30 ft. in plan and 58 ft. in height to the eaves line. The two conveyors leading into it from the main conveyor on the 15-ft. trestle are placed one above the other in the same covered incline. The lower one of these conveyors is a 36-in. belt, about 79 ft. 4 in. long between end pulleys, and is driven at a speed of 375 ft. per minute by a 25-h.-p. motor. It delivers to a 36-in. belt, 196 ft. 5½ in. long, which is carried up to a storage bin in the top of the breaker building by a covered incline. This belt is driven at a speed of 375 ft. per minute by a 35-h.-p. motor, and is arranged to discharge into either of two compartments in which the storage bin is divided. These two compartments, with a combined capacity of 300 tons, are provided because two kinds of coal are mixed for use in making the coke produced by the plant.

The breaker building is 40 x 40 ft. in plan and has an extreme height of 65 ft. Each of the two compartments of the storage hopper at the top of the building supplies a 12-ft. diameter Bradford breaker, each of the latter being driven by a 50-h.-p. motor. Part of the product of the breakers is passed through a 30 x 60-in. Heyl & Patterson crusher driven by a 50-h.-p. motor, and thence through a Jeffery pulverizer, also driven by a 50-h.-p. motor. The pulverizer discharges on a short horizontal 48-in. conveyor belt, which delivers the fine coal to an inclined 36-in. conveyor belt leading from the bottom of the breaker house to storage bins in the top of a mixer house on the opposite side of the tower. The balance of the output of the breakers is delivered directly to this inclined belt. The latter is 264 ft. 10 in. long between end pulleys and is driven a speed of 375 ft. per minute by a 35-h.-p. motor.

The mixer building is 30 x 35 ft. in plan and 65 ft. high, 750 tons of storage capacity being provided in two hoppers in the top of it. One kind of crushed coal is supplied to each of these hoppers, and the two are mixed in proper proportions to make first-grade foundry coke by a mixer in the lower part of the building. The mixture is carried back to the tower by a 36-in. belt, 123 ft. 10 in. long, that is driven at a speed of 375 ft. per minute by a 25-h.-p. motor. This belt delivers to the upper one of the two conveyors, which enter the tower from the main conveyor on the trestle along the storage piles. This upper conveyor extends through the tower to a storage bin beyond the latter and carries the coal from the mixer to this bin. It is a 28-in. belt, 175 ft. long between end pulleys, and is driven by a 25-h.-p. motor. Ordinarily the belt below it carries coal from the conveyor on the trestle to the tower, but arrangements are made so the upper belt can perform this service and also deliver coal directly to the storage bin from the conveyor on the trestle in an emergency.

The storage bin is at the middle of a row in which the 160 coke ovens that are in operation have been placed. It is 40 x 80 ft in plan and has an extreme height of 80 ft. and a capacity of 1,000 tons, being elevated sufficiently to permit tracks to be run under it level with the tops of the ovens. The conveyor which carries coal to the bin delivers to a cross conveyor in a cupola at the top of the building; this cross conveyor is arranged to distribute coal to both ends of the bin. The bottom of the latter is built with several hopper-shaped outlets, through which coal is drawn into large electrically-operated larries that run on tracks laid on top of the ovens and supply the latter through holes in the top.

The main parts of the coal handling system are arranged so they may readily be altered and supplemented to provide sufficient capacity to supply a plant having 640 coke ovens. The subway and both trestles for the main conveyor belt are built to carry a second belt of the same size and capacity, and the traveling bridge can place in the storage piles practically all the coal that could be delivered by two conveyors of the same capacity as the existing main conveyor. The driving machinery of the present breaker, mixer and storage plant is large enough to supply 320 ovens, or 550 tons an hour. A duplicate arrangement of breaker, mixer and storage buildings and a row of ovens could also be placed on the opposide side of the low trestle from the present buildings and ovens.

The provision of the large amount of coal storage capacity that is available is one of the most salient features of the plant. The ovens require from 1,600 to 2,000 tons of coal a day under normal operating conditions, but from 100,000 to 200,000 tons are carried in the stock piles. With this arrangement the coke company is able to assure the consumer of almost immediate deliveries, so the consumer is required to provide for only enough coke storage to insure against delay in shipments between the ovens and the plant. Since it costs about 50 cents a ton to handle foundry coke into and out of storage, the actual saving is evident.

The coal handling system which has been described herewith was installed by the Robins Conveying Belt Co., of New York, the various apparatus being largely of special types controlled by that company. The guide and return idler pulleys and the troughing are built so the conveyor belts are subjected to very little wear. The idlers are heavy cast-iron pulleys on hollow cold-drawn steel tube shafts. The latter are provided with large grease cups at the ends and are lubricated internally, thus insuring freedom from dust and grit. The pillow blocks are of the ball and socket type, with heavily babbitted bearings four times the diameter of the shaft. The take-ups for the belts are also of the ball and socket type and have encased screws.

The construction of the long subway under the various railroad tracks involved considerable difficult work, owing to the necessity for handling the heavy traffic over the railroads without delay. The work was finished, however, practically without interfering with traffic. The soil conditions at the site also offered rather serious difficulties, which were overcome by a method of operations that was adopted. The soil is largely lake sand, in which the ground-water level was close to the surface. A row of well-point strainers was driven about 2 ft. outside the limits of the work, on each side and down below the subgrade of the latter. The strainers in each of these rows were then connected to a suction header attached to a pump, which drew the ground-water level down below the bottom of the excavation. The latter and the construction of the concrete bottom and sides of the subway were thus handled in sections about 100 ft. in length without any interference from water.

The material was also handled out of the excavation very economically by a system of hydraulic sluicing that was installed. A portable tower for a counterbalanced double hod hoist was erected on the side of the excavation in a position to permit the hoists to be lowered to the bottom of the latter. The material was loaded into wheel-barrows as it was excavated, and the wheel-barrows hoisted to the surface, where the material was dumped into a sluicing trough. Water was supplied to the trough through three 1-in. pipes by the pump attached to the well-point strainers. The pipes were arranged so the material was quickly placed in suspension in the trough and could be carried away by the water and used for filling. The well-points and portable hoisting tower were moved along as the work progressed, thus requiring very little wheeling in the excavation.

This plant of the By-Products Coke Corporation was installed under the supervision of Mr. W. T. Snively, engineer in charge.

Fittings for Superheated Steam.

Remarkable expansion and permanent set of cast-iron parts and fittings in superheated steam lines were reported in the discussions of papers on superheated steam before the recent New York meeting of the American Society of Mechanical Engineers. Valve bodies and fittings under the influence of the superheat are found to increase in dimensions at a much more rapid rate than at the lower temperatures of saturated steam, and after being subject to these temperatures for a considerable length of time, take on a permanent set in the increased dimensions. Fittings in 6 to 10-in. superheated lines are found to "grow" as much as ½ in. in length or more, and in many instances they warp into irregular shapes. In one instance, a cast-iron body globe valve, with inserted bronze seat, used for superheated steam, showed signs of leaking, and upon examination it was found that the body had expanded away from the inserted seat. A new seat was made and fitted to screw very tightly into the body, but after a short period of further service it again expanded sufficiently to cause leakage around the seat. Then a second new seat was made to the increased size necessary to screw very tightly into the body, and no further trouble was experienced, it being thought that permanent set had taken place. In other cases irregular expansion has been experienced, one fitting, 36 in. long, having expanded nearly an inch in length and ¼ in. more on one side than the other. It was the general experience that if the castings are symmetrical the tendency is toward regular expansion, but if they have lugs, arms or are irregular, warping will accompany the expansion. This extreme expansion occurs only with the higher degrees of superheat, little trouble being found at temperatures of 500° Fahr. and under, and is first noticed after periods of time, varying from a few weeks to a year or more.

The Engineering Features of the Proposed Henry Hudson Memorial Bridge.

A report to C. M. Ingersoll, chief engineer, Department of Bridges, New York City, by Leon S. Moisseiff, engineer in charge, Henry Hudson Memorial Bridge.

The proposed Henry Hudson Memorial Bridge is a concrete bridge of a total length of about 2,840 ft. It consists mainly of seven circular arches of about 108 ft. clear span each, with corresponding piers, and one main arch of 703 ft. clear span between skewbacks, flanked by two monumental piers of about 108 ft. width and 180 ft. height. The approaches are designed to be of concrete masonry reinforced by embedded steel wherever required, the piers being faced with natural stone.

The bridge is designed with an upper and lower deck providing for surface and subway traffic. The upper deck has a clear width of 80 ft. between balustrades, occupied by a 50-ft. roadway and two sidewalks of 15 ft. each. The lower deck is 70 ft. wide from outside to outside of walls and about 65 ft. on the inside. It is occupied by four railroad tracks and has sufficient space for pipe galleries and the like. The subway tracks on the main span are supported by steel beams and posts resting in turn on the secondary or relieving arches and on the vertical piers designed to be of reinforced concrete.

The provision for the subway tracks will, undoubtedly, prove of great ultimate value to the city, as it provides both local and express tracks at small additional cost. But the utilization of these tracks immediately on the completion of the bridge may not be expected. The location of the bridge, near the most northwestern point of Manhattan Island, is not likely to require and warrant rapid transit transportation before the next ten years. Several years will thus elapse after the completion of the bridge before the subway tracks will be required. Considering this situation, it will be in the interest of good economy not to install the tracks nor to put the steel supports in position before the time requiring their use. It is therefore intended to provide, for the present, the footings for the posts and the means for ready connection with the structure, and to leave the fabrication and construction of the track beams and posts for future time. This is stated here because it has, as will be seen later, some bearing on the strength of the structure when first put in operation.

The design of the approaches, as laid out, conforms with standard engineering practice, and their construction offers no special difficulties and requires only the attention and execution which should be bestowed on engineering works of this character. They need not be considered here further.

It is in the planning and building of the main span arch that the engineering problems to be solved and the difficulties to be overcome are centered. The clear span of the great arch is about 703 ft. between skewbacks and it has a greatest vertical clearance above the mean high water datum of 183 ft. Expressing it in a more technical way, the span center to center of skewbacks is 725 ft. and the rise, center to center, is 177 ft., or about one-fourth of the span. The longest span of any built masonry arch is that of the bridge over the Syra Valley at Plauen, Germany. It has a span of 295 ft. and a rise of 56 ft. or less than one-fifth of the span. It is built of hard slate. The longest span arch in this country is the Walnut Lane bridge in Philadelphia. It has a span of 233 ft. and is built of concrete without metal reinforcements. About five years ago at a prize competition for plans for a bridge over the Neckar River at Mannheim, Germany, the prize was awarded to an arch bridge with a main span of 365 ft. and a rise of one-twelfth of the span. The material proposed was brick. Because of conditions independent of the engineering problem, the bridge was not built of masonry.

It may be well to state here that the upper Niagara steel arch has a span of 840 ft. center to center of hinges and that the plans for the connecting railroad bridge at Hell Gate call for a steel arch of 1,000 ft. span.

Thus the span of the Henry Hudson Memorial Bridge, while not the longest arch, by far exceeds that of any built or proposed masonry arch. To arrive, however, at a correct basis for comparison, it should be considered that while the span of an arch apparently determines its position in the heirarchy of engineering achievements it is the ratio of the rise to the span that is determining. But the dimension really most characteristic of the boldness of an arch is the radius of curvature at the crown. It has also the advantage of furnishing a means for ready comparison. Thus the Plauen arch has a radius at the crown of 344 ft. and the above mentioned prize design for a Neckar bridge a radius of 558 ft. The radius at the crown of the Hudson Memorial arch is 489 ft., or less than that of the proposed Neckar bridge. It means that the Neckar arch with a span of only 365 ft. will strain the material of the arch rib more than that of the Hudson Memorial Bridge with twice that span. This general conclusion is verified by the comparison of the stresses as determined by careful computations.

The above discussion tends to show that while the Henry Hudson Memorial arch by far exceeds in magnitude any masonry arch in existence, its general proportions have been so chosen as to bring the resulting conditions within the limits of modern engineering practice.

There remains, then, to consider the main factors and physical conditions entering into the construction of a structure of like magnitude. These will be discussed in the following under several headings.

Foundations.—No other engineering structure is as much dependent on the stability and immovability of its foundations as the fixed arch. Even a relatively very small displacement may cause considerable strains in the arch ribs. For a reinforced concrete arch of the dimensions of the main arch of the Henry Hudson Memorial Bridge an immovable, incompressible and imperishable foundation is a prerequisite.

The geological conditions of the site selected for the bridge are quite well known, Manhattan Island and its adjacent territory having been made a subject of study by many geologists. The deep diamond drill borings made by the Department of Bridges, some of which went down to more than 138 ft. below the water level, affirm the information supplied by the former.

The south or Manhattan side of the bridge site is covered with "thin till with numerous rock exposures." The underlying rock is a hard rock known as Hudson schist. It is a sedimentary rock of the Silurian period and is essentially a mica schist consisting of biotite and quartz. It covers the greater part of Manhattan Island.

The surface condition on the north or Bronx side is described as a "till with occasional small rock exposures." The underlying rock here is known as Fordham gneiss. It is an ancient crystalline rock of the Pre-Cambrian period and consists of a gray banded gneiss of orthoclase, quartz, and biotite. It begins at Spuyten Duyvil and extends far up the Hudson River.

On both sides the rock slopes rapidly upward to a greatest elevation of 200 ft. above mean high water. The foundations for the main arch are practically all on dry land with the hard rock on the average 10 ft. below mean high water. It is intended to fix the bottom of the foundation at a level of 20 ft. below datum. The abutments, which will be of concrete, will thus rest on the hard rock and also abut against a wall of the same material. The pressure on the foundation is far below its bearing resistance, and to displace the abutments the rocky mountains behind them would have to be moved. The foundations are thus admirably adapted for their purpose and will furnish an absolutely immovable abutment in accordance with the requirements of rigid theory.

Methods of Computation.—In considering the methods of computation used it should be stated here that the construction of the upper and lower decks and of the secondary arches and vertical piers offers no theoretical or practical difficulties which should deserve special consideration. The following discussion refers, therefore, mainly to the great arched rib.

In deciding on the methods of computation to be used and on the degree of accuracy to be obtained, the consideration of the magnitude of the structure has exerted a determining influence. The most accurate available theory is applied; the assumptions it is based on have been scrutinized; simplifications generally made have been evaluated numerically as to their degree of accuracy. The computations are checked by as widely independent methods as physical facts will permit. The most modern procedures of engineering science are resorted to in determining the stresses at every section of the arch. Instead of the common practice of finding the stresses for certain assumed positions only of the moving load, the position of the moving load causing the greatest stress in any section of the rib is determined, and even the loading causing the greatest strain in upper and lower faces has been found. This more accurate method, of course, shows stresses in excess of those determined by the common procedure.

It is realized that the importance of the structure requires that all possible causes of stress in the arch be foreseen and provided for. Not only is, therefore, the effect of a change of temperature within reasonable limits computed but even that of the possible shrinkage of the concrete after the rib has been swung free of its falsework. The stresses caused in the arch by its greatest distortion from the original curve are also included in the resulting total. This again is not done in common practice.

Provision for the future is made by the assumption of high moving loads for both the upper and lower decks. The total moving load the arch is computed for is 15,000 lb. per linear foot of bridge. Compared with the moving load assumed for the Manhattan or Blackwell's Island Bridges, which are designed for the heavist loads as yet provided in long-span bridges, the equivalent moving load for the Henry Hudson Memorial Bridge would be 14,000 lb. per linear foot for congested load and 7,000 lb. for working load.

Thus, it may be stated, all possible effects on the arch are considered and will be provided for as far as the state of engineering science and the physical character of the material used will permit.

Material Used and Stresses Allowed for It.—As stated above, the materials of the main arch are to be concrete and steel. The arch is to be formed of a solid rib of concrete 70 ft. wide, 15 ft. thick at the crown and gradually increasing to a thickness of 28 ft. at the skewbacks. Embedded in the concrete are 48 rectangular units of four 8x8-in. angles, each laced on all sides. They are arranged in twelve vertical rows or frames which are thoroughly connected, both vertically and horizontally, to each other by bracing, forming a hugh steel cage of great rigidity. The steel members of the vertical piers are riveted to the steel frames, securing positive connection for the part of the structure above the rib. The steel units bear with suitable footings

directly on the rock and are anchored to it. The distribution of the steel in the concrete is uniform throughout its mass, completely supporting all its parts.

The embedded steel performs two functions: it first carries a certain portion of the load determined by the relative elasticity of the concrete and the steel, and secondly, it enables the concrete to act as a hemogeneous mass. The method of reinforcing by box-like units also bands the concrete, furnishing to it a lateral restraint, the great value of which in resisting compressive strains has come to be universally appreciated in recent years. It may well be stated here that the material of the rib will be called on to resist compressive stresses only and that under no conditions can any tensile stresses be induced.

Little need be said as to the quality of the steel required. A good structural steel satisfying the standard specifications of the Department of Bridges will be all that is required.

The concrete, on the contrary, deserves special consideration. The strength of concrete varies with the proportions and qualities of the constituent materials. It is intended to specify for the main structure a concrete at least as rich as one part of Portland cement to six of sand and broken stone properly balanced, which should develop an average compessive resistance of 3,000 lb. per square inch on a 12-in. cube 30 days old with a least resistance of 2,700 lb. per square inch. Since a least increase in strength of 10 per cent. can be counted on in two months, this would insure an average compressive resistance of 3,300 lb. per square inch with a mininum of 3,000 lb. at the end of three months. The method of specifying a concrete of a certain compressive resistance in addition to the usual specifications for the cement, sand and stone, has been approved and recommended by several foreign engineering societies and committees, and is in use in the best European and American practice. It should be applied in the case of the Henry Hudson Memorial Bridge.

The increase in strength with age of mortar and concrete is a well known fact. It may be illustrated here by a few records.

Experiments conducted on the effect of age upon the increase in tensile strength of mortar, by Dyckerhoff, for the German Association of Portland Cement Manufacturers, gave the results in the accompanying table.

INCREASE IN PERCENTAGES OF INITIAL TENSILE RESISTANCES.

Time	1:1 Mortar	1:2 Mortar	1:3 Mortar
4 weeks	Initial	Initial	Initial
13 weeks	51	44	48
26 weeks	53	47	51
1 year	66	60	56
2 years	131	108	118
3 years	125	119	98
4 years	131	124	141
5 years	152	142	148

The increase in the strength of concrete with age is not as rapid in the early months as it is in mortar, but is more gradually distributed through the first year.

Numerous tests on 12-in. concrete cubes were made at the United States Arsenal at Watertown, Mass., with cements of the better brands, in the proportions of one part of cement to two parts of sand and four parts of broken stone, developed a compressive resistance of 3,000 to 3,600 lb. per square inch at the age of three months.

An experimental arch was built in 1896 at Stuttgart, Germany, of a span of 65.6 ft. and observed under various loads and temperatures during five years. It was made of a concrete of one part of Portland cement and 7½ parts of broken limestone, using the product of the crusher to take the place of the sand. Test specimens of this concrete two years old developed a compressive resistance of 7,260 lb. per square inch. Blocks cut out of the arch after failure and probably somewhat impaired in strength by the shock of the collapse developed at the age of five years 6,615 lb. per square inch or 10 per cent. less than the test specimens.

The concrete of the Munderking arch was of the proportions of one part of cement to 2½ parts of sand and five of broken stone. At the age of 28 days it developed a compressive resistance of 3,615 lb. per square inch which at the age of 152 days increased to 4,720 lb. At the age of two years and eight months it had attained a resistance of 7,130 lb. per square inch on the specimen and 10 per cent. less on the concrete in the structure. The concrete of the viaduct over the Chemnitz Valley was of the proportions of 1:4:4-½. It developed at the age of 28 days a compressive resistance of 3,070 lb., and at the age of 90 days of 3,770 lb. per square inch. The concrete of the Exhibition Bridge at Duesseldorf was of the proportions of 1:4:4. It developed at the age of 28 days a compressive resistance of 3,610 lb. and at the age of 90 days of 3,940 lb. per square inch.

All of the above data are for concrete not reinforced by steel. The additional assistance furnished by the embedded steel in enhancing the homogeneity and creating a lateral restraint will be so much additional margin of strength. To determine the relative increase in strength due to the latter and also to demonstrate the degree of the co-operation of the two materials a short series of tests is about to be made by the Department.

Unit Stresses in Arch-Rib.—The compressive stress on the steel embedded in the concrete will not be allowed to exceed 20,000 lb. per square inch, allowing for all possible causes of stress. This is perfectly safe for a material of an elastic limit of 30,000 lb. per square inch, thoroughly braced and fully embedded.

The greatest stress to be allowed on the concrete in compression due to a combination of all of the causes enumerated in the above discussion on methods of computation has been fixed at 750 lb. per square inch. This is one-fourth of the least strength of the concrete at the age of three months. Compared to the common methods of computation the equivalent stress would be not more than 600 lb.

The French Government Commission on Reinforced Concrete, which completed its labors about a year ago, has recommended that "the limit of compressive stress for reinforced concrete to be allowed in computation shall not exceed two-sevenths of the crushing strength of plain concrete of the same proportions and at the age of 90 days." This would allow for a concrete of 3,000 lb. compressive resistance a stress of 860 lb. per square inch.

A noted German engineer, Mr. Leibbrand, who has built many concrete bridges, says: "The more reliable determination of stresses properly allows the use of higher working stresses. For the very best concrete up to 1,030 lb. per square inch in compression may be allowed."

The rib will be erected on falsework and the centers will not be struck until four months after the completion of the ring. Thus the least age of the concrete when first strained will be four months. The greatest stress caused at any point of the arch-rib when sprung freely off the falsework and only supporting its own weight will be 315 lb. per square inch. Including temperature changes the stress may reach 350 lb. per square inch.

The building of the vertical piers and secondary arches will then begin on top of the arch-rib. When the whole bridge including paving and balustrades, will be completed, but without the subway tracks and their supports, the greatest stress in the concrete of the rib will be 535 lb. per square inch, due to the fixed load. This cannot be done before a year's time from the date of the completion of the rib.

The total moving load on the upper deck will, in its position causing the greatest stress, bring the total compression up to 570 lb. per square inch. The effects of a change of temperature, shrinking of the concrete and distortion of the curve will increase this stress to 670 lb. per square inch. At least a year and a half will be required with the utmost speed of construction from the date of completing the rib to the opening of the bridge for traffic. Before that age of one and one half years the concrete in the rib will have an ultimate compressive resistance of at least 4,500 lb. per square inch, or 6.7 times the allowed unit stress.

Finally, when the subway tracks will be installed and trains be operated on the bridge the worst combination of all causes will induce a stress not exceeding 750 lb. per square inch at any point of the rib. The concrete at that time should have reached a compressive resistance of at least 6,000 lb. per square inch or three times the allowed unit stress.

It should be noted here that the greatet unit stress in the rib is not one due to direct compression only but represents a sum due both to direct and bending stresses. The resistance of concrete to such combined stress is 10 to 20 per cent. higher than to direct stress only.

The above discussion leads to the conclusion that, in view of the consideration given to all possible effects on the structure and the time required before the application of the full load, the adopted greatest compressive strain of 750 lb. per square inch on the concrete in the rib is well within the limits of safe construction.

Erection and Inspection.—The methods of erection to be followed in building the arch-rib, although generally planned, have not yet been worked out in detail. However, it may be stated that the arch will be erected on falsework resting in the river bed and thoroughly braced. Adjustments will be provided for all possible requirements during construction.

The proper design of the falsework is of great importance and it will be designed and detailed by the Department and will form a part of the contract for building the arch instead of being left to the contractor under the general approval only of the Department. It will be far better not to leave to the contractor to economize on the falsework or its careful design, but that the City pay for it the same as for any permanent part of the structure. Any improvements suggested by the experience of the contractor can always be incorporated afterwards.

After the completion of the arch-rib, it will be kept on the falsework for at least four months before striking the centers. During all this time the whole of the rib will be kept wet by a sprinkling system and be protected from the sun.

The inspection, including the testing of the materials, should be most thorough. A cement and concrete testing laboratory should be established on the building grounds in charge of a competent testing engineer. A testing machine of at least 500 tons capacity will be required for the work.

In addition to the usual experienced inspectors of masonary a corps of young graduate engineers should be employed to watch the work, all well organized under an engineer who should thoroughly understand all sides of the problem and the importance of every part thereof. A sufficient number of inspectors should be employed to insure the constant inspection of the whole job.

Concluding it may be stated that with careful design, careful selection of materials, thorough inspection and conscientious execution there is no reason why the construction of the Henry Hudson Memorial Bridge should not be brought to successful completion.

ELECTRIC TRAIN STAFF SIGNALS are to be used on two sections of the St. Louis & San Francisco R. R. near Birmingham, Ala.

A Study of Refuse Disposal.

On December 18, Mr. J. T. Fetherston, Superintendent of Street Cleaning of the Borough of Richmond, New York City, read a paper before the American Society of Civil Engineers on "Municipal Refuse Disposal; an Investigation," which gives the results of a very elaborate study of this subject, both its general principles and its special features in the borough. The full paper is printed in the "Proceedings" of the Society, vol. xxxiii., page 940, and a few of the statements in it were reported in this journal on December 8, 1906. The author made an elaborate study of the quantity, composition, seasonal variations and calorific value of the local household refuse, conducted tests by burning mixed wastes, and investigated many destructor plants. The information gathered by these means is given in detail in the paper.

The elaborate tables in the paper show that in the boroughs the volumes of the total collection during any month varies from 8 per cent. above to 12 per cent. below the average of 3.7 cu. yd. (or 1.6 tons) per thousand inhabitants per day, although the weight varies from 23 per cent. above the average in winter to 30 per cent. below it in the summer and fall. This weight variation is due to the different proportions of ashes, rubbish and garbage in the the different seasons.

Many tests of the compositions of the refuse and of the calorific value of the refuse and of its different parts are tabulated in the paper and from these data the accompanying table of the average fuel value of the refuse was computed. The figures for September are given separately, as the refuse during this month is more difficult to burn than that at any other portion of the year.

HEAT VALUE OF ONE POUND OF REFUSE.

Period.	Calorific Power of Combustible, B. t. u.	Moisture, Per Cent.	Ash, Per Cent.	Combustible, Per Cent.
Spring ...	4,747	14.03	50.06	35.91
Summer...	3,477	28.86	39.74	31.40
Autumn...	3,833	27.74	39.74	32.52
Winter....	4,358	13.11	52.72	34.17
Year	4,274	19.74	46.03	34.23
September.	3,265	35.83	33.69	30.48

Many tests of burning the refuse were made at a crematory on a grate of 12 sq. ft. area, and in spite of adverse conditions all tests but one were successful in destroying mixed household refuse, although unburned particles were at times found in the residue. The general results of these rough practical tests are summed up as follows:

1. Household refuse, as collected in this district, when burned in a properly designed furnace, will be self-combustible, under ordinary conditions, showing higher calorific power in winter than in summer. Screened refuse will give better results in burning than unscreened.

2. About 80 lb. of refuse per sq. ft. of grate could be burned before it became necessary to remove the clinker.

3. The process may be made continuous by retaining the heated coals from the top portion of the fire and removing the mass clinker. Coal may be required to heat the furnace walls if the operation of the plant is not made continuous.

4. The rate of burning will be higher in summer than in winter.

5. The percentage of clinker will also vary with the seasons, being high in winter and low in summer. The total residue was nôt determined, as a large portion of the fine ash was carried over by the air blast and could not be recovered.

6. The heat lost by the removal of hot clinker varied from 300 to 500 B. t. u. per lb. of clinker.

7. Street sweepings from this locality could not be burned with household refuse, except when mixed in small proportions.

From the data collected by his investigations and the information furnished by a thorough test of the destructor at Nelson, England, by Mr. C. E. Stromeyer, the author worked out a heat balance for the local refuse of which the leading deductions are given in the accompanying tables of the equivalent evaporation, from and at 212 degrees in pounds of water, and the estimated temperature of the combustion chamber, in degrees Fahrenheit, using the local refuse in a good destructor.

PROBABLE RESULTS WITH LOCAL REFUSE.

	Spring.	Summer.	Autumn.	Winter.	Year.	Sept.
Equiv. evap., lb.	2.46	1.29	1.68	1.98	2.03	1.02
Temp. deg......	2,370	1,710	1,950	2,140	2,150	1,550

Summarizing the results of examinations, tests, and experiments with mixed household refuse from the district considered, the following conclusions are derived:

1. Average local refuse differs mainly from what is known concerning average English refuse in the higher percentage of incombustible matter and the lower percentage of water. The average results to be expected in power production are surprisingly high, and the seasonal variations are greater with local refuse than with British refuse.

2. Under expert management, with a properly designed furnace, the process can be carried out in settled communities without nuisance.

3. The average local residue will be greater than the average English residue mainly because of the high percentage of fine ash which will to some extent be carried away from the fire-grate by the forced draft.

4. As compared with the local cost of burning garbage and caring for "ash and rubbish" dumps, the cost of the destruction of mixed refuse will probably be higher, though a proper utilization of the steam generated and the clinker resulting may offset this increase in cost, while a rearrangement of the refuse collection system may tend further to make the cost of the methods comparable.

5. For the particular condition herein considered, mixed-refuse destruction appears to offer the best solution of the problem.

Thirty-nine refuse destructors in Great Britain and one in Canada were visited by Mr. Fetherston, and his paper gives some elaborate summaries of the important facts concerning them. In comparing American household refuse with British refuse, localities having the same general characteristics and for the same period of the year should be chosen. On this basis, as a general conclusion, the author is of the opinion that British refuse contains more ashes, less garbage, less rubbish and more moisture than household refuse in the vicinity of New York. It would appear that no such seasonal variations occur as may be found in comparing American summer with American winter refuse, while, during the fruit season, British refuse contains no wastes comparable to melon rinds, and corn cobs.

That British refuse has a fuel value is proved beyond a doubt by the two hundred or more destructors in which refuse is burned throughout the year without additional fuel. There would seem to be no large seasonal variation in the calorific power of the material. The average evaporation for eighteen tests amounts to 1.62 lb. of water per pound of refuse.

The location of a plant for the final disposition of refuse has a most important bearing on the cost of the collection (including removal) of the material. Economy in collection requires that the plant shall be centrally located with regard to the district served, and that loaded collection wagons or carts shall proceed with the road gradient.

Of the forty destructors, four were critically located, so that the least nuisance would probably result in the abandonment of the plants; seventeen were centrally located in advantageous positions with regard to the district served, but the surrounding houses were not in close proximity to the destructors; nineteen were placed on the outskirts of towns and not likely to cause complaint, even if the plants were not well operated.

Complaints of nuisance due to the location of British refuse destructors in settled localities are said to be rare, and, as far as could be determined very few of the plants visited deserved condemnation in this respect.

All these destructors visited contain large brickwork chambers having fixed grates with boilers placed outside the refuse-burning portion. In the destruction of refuse by fire, well-determined principles of combustion apply. In practice, the destruction of refuse may be attained successfully by burning it by forced draft in a so-called Dutch oven or chamber where the brickwork is maintained at a high heat, and the escaping gases are subjected to a high temperature with an excess of air for a sufficient length of time to oxidize the combustible constituents of the material.

The forms of British destructors vary, and for convenience may be divided into two general groups.

Group 1.—The first may be termed the mutual assistance type, where one unit contains several grates with divided ash-pits, the products of combustion intermingling in the upper portion of the furnace, thus combining several furnaces or cells in one. Representatives of this type are the Meldrum and Heenan.

Group 2.—The second comprises furnaces in which each burning grate or cell forms a separate unit. The products of combustion either commingle in a general flue or combustion chamber, or pass directly from cell to boiler. Representatives of the cell type in which the products of combustion intermingle in a common chamber before passing to the boiler are the Horsfall, Sterling, and Beaman and Deas (Meldrum). Representatives of the type in which the products of combustion pass directly from the cell into contact with the boiler are the original Fryer, Fryer's Improved (Manlove-Alliott and Company), Warner, and Baker.

The Meldrum, Heenan, and Horsfall types pre-heat the air used for combustion to a temperature from 200 to 400° fahr. before it comes in contact with the burning fuel on the grate. Other makes of furnaces mentioned in Group 2 use air at ordinary atmospheric temperature. The utilization of heated air undoubtedly tends to more perfect combustion and higher temperatures both in cell and combustion chamber. Other differences in design, in the furnaces in Groups 1 and 2, may be noted, as for instance, the drying hearth which some furnace makers consider essential in the destruction of refuse, the use of steam-jet blowers or fans for forced draft, the different provisions for arresting dust, the kind of boilers used, the various methods of feeding, clinkering, stoking, etc. All the above-named destructors, except the original Fryer, use forced draft, which is considered necessary for the attainment of a high temperature.

The aim in the design of refuse destructors should be to maintain a steady temperature. If it be considered that 1,250° fahr. is the minimum at which septic poisons in the products of combustion are destroyed, the higher limit of temperature is fixed by the materials used in the construction of the furnace. Temperatures greater than 2,000° fahr. are apt to result in high cost of repairs. Thus temperatures between 1,250 and 2,000° fahr. are desirable, both from sanitary and economical points of view. As the burning of refuse in a destructor is an intermit-

tent process, requiring alternate charging and clinkering, the fluctuations in temperature should be minimized as much as possible. When destructors are of such design that the gases pass directly from cell to boiler without an intermediate combustion chamber, there is danger of unoxidized gases being cooled, by contact with the boiler, below the temperature required to prevent nuisance.

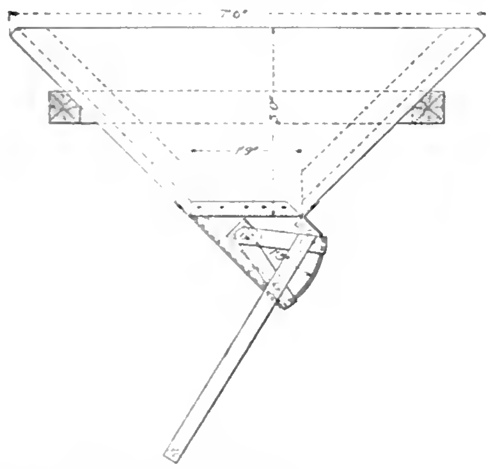
In general, modern British types of destructor vary in important details, and, of the different plants examined by the author, those in which a combustion chamber or flue was placed between the cell (or unit) and the boiler, and where heated air was used for combustion, appeared to be doing the most satisfactory work. Of the forty plants inspected, all but two produced steam for power purposes.

Cost of Operation.—The cost of operation was obtained from the engineer or superintendent in charge of the destructor or from the furnace makers. It appears that for twenty-four installations the average cost of labor per long ton (2,240 lb.) of refuse destroyed would amount to 24.3 cents, or 21.5 cents per short ton (2,000 lb.). As the American rate of laborers' wages is about double the British rate, this would make 43 cents per short ton of refuse destroyed on an American basis.

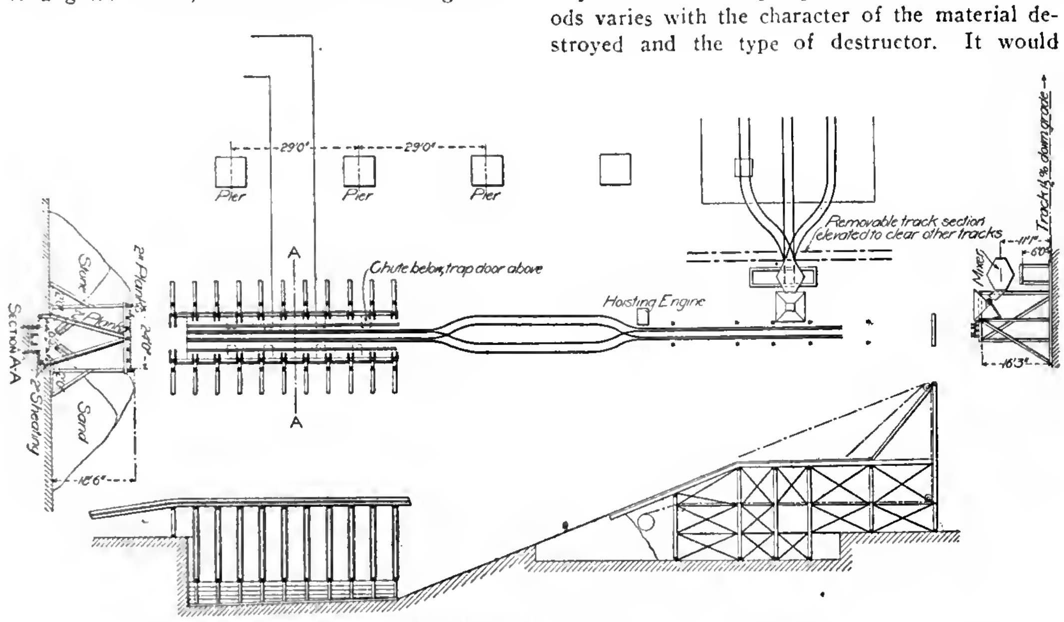
For supervision, only four installations had figures available, the average being 4.83 cents per long ton. Two plants reported the cost for repairs at 3.22 cents per long ton.

Only one complete report was obtained in which all charges for the destruction of refuse, including labor, supervision, interest on capital, sinking fund, repairs and supplies, were included. The total cost of operation, including all the above charges at Stoke-upon-Trent, amounted to $1.17 per long ton or $1.04 per short ton. By changing the labor rate so that it would compare with American conditions, and by assuming the same charges for interest, sinking fund and repairs, it would appear that the total cost of refuse destruction for a plant similar to that at Stoke-upon-Trent would amount to $1.50 per short ton in New York.

Definite information regarding the quantity of refuse handled per man per hour (assuming the quality of labor to be comparable) affords a better general means for arriving at the labor cost of operating a destructor. From the figures for twenty-seven plants, on an average, each man employed would handle 0.78 long tons per hour, varying from 0.5 to 2 tons per hour with the type of plant and method of operation. At an easy rate of working, there should be no difficulty in destroying 0.75 short tons per man per hour; hence, with wages at 25 cents per hour (or $2 per day), the cost of labor would amount to 33⅓ cents per ton, while at 31¼ cents per hour (or $2.50 per day), the cost would be about 42 cents per ton.



Charging Hopper, Manhattan Approach.



Concrete Plant of the Manhattan Approach, Blackwell's Island Bridge.

It appears that the top-feeding method (except where water-sealed doors are used) allows smoke to escape. Even with water-sealed doors, smoke escapes when charging. Of the hand-firing methods, the front-fed type appears to be advantageous, with regard to concentration of labor and freedom from escaping smoke, but the storage bin cuts off light and air from the firemen, while some refuse may be mixed with clinker if the men are careless. With back hand-feeding by shovel, ample light and air can be given on the clinkering side of the furnace where it is most needed. As compared with front-feeding, back hand-feeding does not permit of the same concentration of labor, but allows greater comfort to the men employed, which more than compensates for this slight disadvantage.

In general, shovel-feeding obviates escaping smoke from top-feeding doors, allows a better selection of refuse, and does away with stoking to a great extent, as refuse can be charged directly on the grate, thus saving one operation in destroying the material. When the refuse has not reached an advanced stage of decomposition, and does not contain an excess of water, or such objectionable material as nightsoil, hand-firing is undoubtedly to be preferred, especially for power plants.

By stoking is meant the dragging, pushing or spreading of refuse after it has been charged into the furnace. All top-fed destructors and all destructors provided with drying hearths require considerable stoking. Hand-fed types, without drying hearths, where refuse is thrown directly on the grate, do not need much stoking.

At first sight, it would seem that refuse charged direct from cart to cell without intermediate handling should prove most sanitary and economical, yet the disadvantages of this method are many. For any particular case, a study of local conditions will determine the best system to be used.

Clinkering is perhaps the most trying work in connection with the operation of a destructor. A mass of hot slag must be broken up by long bars, tipped into a wheel-barrow or other conveyance, and removed while in a highly heated condition. The work is performed by hand labor opposite the open doors of a highly heated furnace. There are various methods of conveying clinker, as by wheel-barrows, by cars on rails, or by skips running on an over-head rail. When cars or mono-railways are used, the storage room is limited, and the place where the material is deposited must be cleared at intervals; for this reason, the system has been abandoned in favor of wheel-barrows at many plants. Various mechanical devices, such as tipping grates, etc., have been tried in order to lessen the work of clinkering, but, up to the present time, all have failed.

As a general rule, the clinker in sight at the various installations was found to be hard and well-burned, except where plants were carelessly operated, or where fires were rushed at some electric lighting stations. In order that clinker shall be dense and that practically all the carbon shall be oxidized, it is necessary that the clinker be exposed to a high temperature for a sufficient time to consume thoroughly all the combustible material.

In burning mixed refuse, some fine incombustible material finds its way into the destructor flue or dust traps, and must be removed periodically. This may have an important bearing upon the actual capacity of a destructor, as it may be necessary to shut down the plant for several days while the cleaning process is under way. The time elapsing between cleaning periods varies with the character of the material destroyed and the type of destructor. It would appear to be necessary to clean out all flues thoroughly once every 4 to 6 weeks in Great Britain, except where a special dust-catcher is used.

Figures for eighteen destructor tests, giving the quantity of water evaporated per pound of refuse ("from and at 212° Fahr.") for periods varying from 6½ hours to one year were secured. The highest rate of evaporation was 2.66 lb. of water per pound of refuse, in a 15-hour run at a destructor in a colliery district. The lowest gave 0.88 lb. of water per pound of material, in a test of 11½ days, with refuse containing a large proportion of night-soil. The average evaporation in eighteen modern destructor tests amounted to 1.62 lb. of water per pound of refuse. In all the foregoing figures the water evaporated is a gross amount, and in order to obtain the net useful steam produced for power purposes it is necessary to deduct for forced draft apparatus. It appears, from the figures quoted, that, in a district where coal is abundant and cheap, it is possible to evaporate about 2.5 lb. of water per pound of refuse, while in other districts, distant from coal fields, destructors are capable of producing an evaporation of about 1.5 lb. per pound of refuse.

The Scrap Heap of the New York Edison Co. is a decidedly interesting affair. Moreover, it is a pretty valuable asset, for in 1906 the amount of scrap sold was approximately $200,000. The material included 632,000 lbs. of scrap copper, 350,000 lbs. of pig lead, 71,000 lbs. of mixed metals and approximately 500 tons of iron. This does not include the materials which were redeemed for further use.

Erection of the Manhattan Approach of the Blackwell's Island Bridge.

The double-deck approach to the Manhattan end of the Blackwell's Island bridge is a massive structure, about 1,070 ft. long, 120 ft. wide and 90 ft. in extreme height above the surface of the ground. Although really of plate girder construction, it is largely incased in masonry or terra cotta, designed to give it the effect of stone arches, as described in The Engineering Record of November 23. Except for a five-rib plate girder arch of 90 ft. clear span over First avenue the superstructure consists of 29-ft. plate girder spans seated on five longitudinal lines of vertical columns 30 ft. apart transversely.

The arch foundations were built in open pits, excavated through clay gravel, boulders and hard pan to solid rock at a distance varying from 20 to 35 ft. below the street surface. These foundations were sheeted with 2 and 3 in. square edge planks which were followed down by hand as the excavation proceeded. In places it was necessary to excavate as much at 5 ft. of decomposed rock before reaching a satisfactory foundation.

The column foundations, of which there are about 250, do not all extend to rock. The contractor was given the option of spreading the footing or continuing to rock. Part of these were sheeted same as the arch foundations and the shallower ones were constructed without sheeting.

The sub-structure including the retaining walls for the solid fill approach requires about 16,000 cu. yd. of concrete, besides about 10,000 yd. for subway roof, walls and other purposes, all of which is made in proportions of 1:3:6 and 1:2:4 using Giant Portland cement. An economical and efficient storage and mixing plant of large capacity has been installed by the contractor and is designed to make advantageous use of an old cellar on the site and to handle the concrete and materials as much as practicable by gravity. On the south side of the approach right-of-way, parallel to and clear of the rows of columns in the viaduct, a timber platform, 24 ft. wide and 47 ft. long, has been built over the cellar foundations on falsework bents 18½ ft. high above the cellar floor.

Under this platform there is an A-shape transverse frame with the vertex in the center of the roadway platforms just below the cross-girders and with the inclined posts entirely covered on the outer faces with 2-in. longitudinal planks, thus forming the walls of storage bins on opposite sides of the center of the platform. Four chutes inclined about 45 deg. to the vertical are set in both of the inclined sides of the bins with their lower ends clearing the tops of dump cars that travel between the bins on a narrow gauge track in a trench depressed 4½ ft. below the bottom of the bin. At the west end of the platform there is a plank incline to the surface of the ground on which wagons are driven up to the platform and dump sand and broken stone on opposite sides of it into the two large bins where they form piles of a total capacity of about 1,000 cu. yd. of stone and 500 yd. of sand resting on the cellar floor with their sides sloped at a natural angle of about 45 deg. on the exterior and retained by the inclined sides of the bin on the interior, thus storing about 200 cu. yd. on each side which can be discharged by gravity through the chutes leaving a residue of about 1,100 yd. which must be rehandled before it can pass through the chute. It is intended, however, to avoid the rehandling by reserving this excess portion for an emergency supply and to keep the bins filled to the level of the platform by constant supply wagons. By this means the lower part of the sand and gravel will be usually undisturbed and a gravity supply can always be drawn from the upper part unless the delivery of materials is unexpectedly interrupted.

On several occasions it has been found necessary to draw from the storage, but this has been done very economically by using a small slip scraper in the bin. It is operated by the niggerhead of the hoisting engine. Three men, one on the scraper, one signaling and one on the niggerhead handle as much as a dozen men with shovels.

Two 3-ft. gauge gauntleted trucks, are run between the sand and stone bins on a 1½ per cent. grade and at the east ends diverge to parallel locations 7½ ft. apart on centers and are carried up an incline of about 30 deg., to the horizontal mixing platform, built on falsework at a height of about 18 ft. above the original surface of the ground or 30 ft. above the bottom of the trench, where they are again gauntleted and run adjacent to a depressed charging hopper into which the cars containing the right proportions of sand and stone are dumped.

The steel side-dump cars of 45 cu. ft. capacity, water measure, were made by the Ernst Wiener Co., and are hauled up the incline by a wire cable operated through a sheave attached to the top of a braced mast rising 15 ft. above the mixing platform and wound on a single drum of a Lidgerwood hoisting engine located under the concrete platform at the east end and supplied with steam from a 40 h.-p. Nagle boiler.

Distributing Tracks above Concrete Moulds, Manhattan Approach of Blackwell's Island Bridge.

The concrete charging hoppers are about 7½ ft. square and 3 ft. deep, built of horizontal courses of planks nailed to 4x4-in. inside corner pieces and provided at the bottom with a segmental steel gate, 2 ft. long, operated by a horizontal hand lever. The contents of the hopper are discharged through an inclined steel chute 1½ ft. long to a No. 5 Smith mixer seated on a platform 6 ft. above the surface of the ground. The mixer delivers into two side-dump cars like those supplying stone and sand to the mixing platform. These cars run on surface tracks which will eventually be laid to all of the foundation piers. The first arrangement consisted as shown in the diagram of parallel transverse lines carried over the pits or one row of piers and over the trench for the abutments of the arch-span. The deepest pit will be about 35 ft. deep and as the concrete is dumped directly in them by reversing the car they are rapidly filled, over 275 cu. yd. of concrete from a single mixing machine being deposited in one 9-hr. day soon after the plant was put in operation.

The average nine-hour output up to November 1 was over 200 one cu. yd. batches. The maximum was 277. In one-half day an average of 33 batches an hour was maintained. These averages were also maintained while depositing concrete on the river side of First avenue, which meant mixing the concrete on one side of the street and transferring across to the other on an elevated structure. The car for the transfer was operated by a single-drum engine and was so arranged as to make the round trip in 1¾ minutes. When across the street it dumped into other cars for distribution.

Concrete for the piers at the west end of the viaduct will be delivered in buckets carried on flat cars, and will be handled by the traveler designed for the subsequent erection of the steel work The traveler has a 35x35-ft. horizontal timber platform running on three single lines of rails 18 ft. apart, the center one being near the axis of the viaduct. Each front corner of the platform carries a 30-ft. mast and a 50-ft. boom of 5 tons capacity, operated by a Lidgerwood hoisting engine and a Rawson swinging engine, supplied by an independent steam boiler. The dimensions of the traveler and the location of its track are such that it can serve 10 foundation piers or erect 5 viaduct columns from one position.

As it was specified that 3½ cu. ft. of sand or crushed stone should be equivalent to one barrel of cement, great care was taken to provide for the accurate measurement of the sand and stone used in the concrete. A wooden box, 18 in. square and 24 in. deep, was provided, filled with sand and shaken down from 23 1-16 to 18 11-16-in. Three measures of sand were thus prepared and filled in the hopper and carefully leveled and gauge marks made to indicate the height required on the sides of the hopper. The box was then filled with stone and shaken down from 20 15-16 in. to 18 11-16 in. and 6 boxes of stone were filled in the hopper and the gauge marks adjusted as before after which four bags of cement are added for each batch of 1:3:6 concrete.

Operations were commenced June 22, 1907, and a total force of about 200 men is now employed. Giant cement is used for the concrete, and over 7,000 cu. yd. have been laid to date. It is expected that the erection of the steel superstructure will be commenced about January 1, 1908. The excavation is nearly completed and amounts to a total of about 35,000 cu. yd.

The bridge was designed and its construction supervised by the Department of Bridges of New York, Mr. J. W. Stevenson, commissioner; Mr. C. F. Ingersoll, chief engineer; Mr. O. F. Nichols and Mr. Albert Lord Bowman, consulting engineers. The contract for the construction of the Manhattan approach was awarded to the Snare & Triest Co., Mr. J. C. Hain in charge of construction. The structural steel will be furnished by the Pennsylvania Steel Co.

The Southwest Pass Jetties at the mouth of the Mississippi River were completed this week, and after some dredging between them is finished work on this important waterway will be ended, after four years of construction and the expenditure of about $[illegible]. The jetties are about 3½ and 4 miles long and over half a mile apart. They are expected to produce a channel with a minimum depth of 35 ft. and a width of at least 1,000 ft. and have already caused a great improvement over most of the route of the channel. Each jetty is a pile of mattresses of scantling and brush, like those for bank protection, along the Mississippi. The top mattress is 35 ft. wide and the pile is 6 to 15 ft. deep. A massive concrete [illegible] on each jetty rises a little above the water.

Internal Combustion Motors in Municipal Plants.

The increased favor shown internal combustion engines for driving small pumping and lighting machinery has been rather marked during the past year. The late Freeman C. Coffin was one of the first engineers to use such motors in small water-works in New England, and for a time he was probably the leading believer in them for such service, although in the Western States they were long ago introduced on many farms for pumping water for irrigation, which was the natural result of their earlier use for other purposes on some of the large farms in that section of the country. At the present time there is considerable diversity in the plants, as the following notes on some recent installations will show.

Among the small water-works plants recently constructed in Massachusetts, there are three built from the plans of Mr. Edmund M. Blake, of Boston, that are unusual. The first of these is that of the Westford Water Co., which draws its supply from a number of driven wells and distributes it through about 8 miles of mains. There are two distribution districts, for high and low service respectively, with two standpipes, presenting an unusual load condition for the pumping station. This has a 50-h.p. Pintsch suction gas producer, a 50-h.p. Olds horizontal gas engine and a heavy-duty Platt triplex pump. This is one of the few pumping stations in New England to run on producer gas.

The plants at Wareham and Wrentham designed by the same engineer also pump water from driven wells into standpipes, but the engines in this case are Mietz & Weiss fuel oil motors direct-connected to Platt triplex pumps. At Wareham there are two 25-h.p. engines while at Wrentham there is but one. The Wareham plant has a single shaft with the two pumps in the middle and an engine at each end. The pumps are 8½ ft. apart on centers and the engine is 6 ft., 11 in. from the nearer pump, center to center. There is a clutch between each engine and the pump shaft so that either engine may drive either pump. The maximum head against which the pumps operate is 350 ft.

These engines run on fuel oil which is sold at about 4½ cents per gallon. The type of engine was described in The Engineering Record when it was first brought out, but since that time a number of improvements have been made, particularly in the steam details for the purpose of allowing low grades of crude oil to be employed without causing excessive deposits in the cylinder. The steam generated in the water jacket goes to a steam dome and thence to a port in the cylinder, where it enters with the air and mixes with the oil vapor in the cylinder to form the charge. This makes it possible to run with a somewhat higher compression pressure on account of the lower temperature with the steam mixture. With ordinary fuel oil of 20,000 B. t. u. per pound, the oil consumption with these engines is stated to vary from 0.86 to 1.25 pints per horse-power-hour, the maker's guarantee being 1 lb. per horse-power-hour. About 2 pints of water per horse-power-hour are used. The temperature in the jacket is stated to vary not over 5° from full load to no load. The governor is now of the high-speed steam-engine type, changing the throw of the eccentric which operates the oil pump by the centrifugal force of a weight acting against the spring.

A new plant recently installed for electric lighting at Ottawa, Kan., is specially interesting because it takes the place of a former steam-driven plant. The latter was installed in 1903, but when the Kansas Natural Gas Co. ran a pipe line into the city an opportunity to drive a good bargain for municipal power was seized. The franchise granted the gas company provided that the city can have gas for steam purposes at 10 cents per 1,000 cu. ft. and for engines at 12 cents. The company claimed that the great economy of gas engines as compared with the amount of gas used in raising steam under boilers would curtail its revenues were the former used and it held out for the higher price for gas used in internal combustion motors. The gas averages about 900 B. t. u. per cubic foot. The authorities burned the gas under the boilers of their old plant for nearly a year, but finally became convinced that a gas engine was the thing to use and accordingly bought one of 125 h.p. from the Weber Gas Engine Co., Kansas City. This is a vertical three-cylinder machine driving a 75-kw. alternator by belt. It was tested on Oct. 2, 1907, for 12 hours, current being supplied to the regular service and the surplus at the heavier loads being absorbed by a water rheostat. The engine was started at quarter load which was increased to 10 per cent. over the rating of the engine. The maximum load was 103 kw. During the 12 hours the total output was 1,020 kw.-hr. and 20,500 cu. ft. of gas was consumed, the cost of fuel per kilo-watt-hour being 2.4 mills, about one-fifth of the fuel expense when the gas was burned under the boilers of the old steam plant.

The operation of the sewage pumping plant at Newton, Mass., described in this Journal on June 11, 1904, furnishes information concerning what may be expected of small gasoline engines running intermittently. This outfit consists of two 6-h.p. Fairbanks-Morse motors driving a horizontal shaft from which a pair of submerged centrifugal pumps with vertical shafts are driven by bevel gears. The engine is run on 72° gasoline which has cost about 16 cents per gallon on the average, and it is estimated that the cost of pumping per million gallons raised 1 ft. is about $1.35, of which 58 cents is the cost of the fuel. According to Mr. Irving T. Farnham the plant as a whole has performed the service for which it was designed very satisfactorily, and the troubles, such as they were, have been due to other causes than difficulties with the engines except in connection with the electric igniters. The trouble in this case seemed to be with the apparatus for shutting down the motors when the pumping was to cease, and was remedied by a redesign of the apparatus.

About ten years ago the late Freeman C. Coffin designed two sewage pumping plants for Charlottetown, P. E. I., which have been in continuous service ever since it was installed. According to some statements recently made by Mr. Lewis D. Thorpe at a meeting of the Boston Society of Civil Engineers, each plant consists of a 7-h.p. Otto gas engine belted to two centrifugal pumps in a collecting reservoir. The engines are started up by hand when enough sewage is collected in the reservoirs to make pumping necessary, but they are stopped automatically when there is no more work to be done, and the same simple apparatus shuts off the supply of cooling water and drains the jacket. The gas required to pump a million gallons 1 ft. high costs from 20 to 27 cents, while the amount of attendance required is nominal.

Panama Canal Excavation during November exceeded all previous records, amounting to 790,632 cu. yd. on the Culebra division, 44,044 cu. yd. on the Chagres division, 121,635 cu. yd. at the Gatun locks, 40,987 cu. yd. at the Gatun dam and spillway, 8,190 cu. yd. on the La Boca division, 40,003 cu. yd. on the Colon division and 792,995 cu. yd. by dredging, a total of 1,838,486 cu. yd. The reports indicate a continued improvement in sanitary conditions, and no yellow fever has occurred for eighteen months. The annual death rate among employees is now 20.66 per thousand. It has been announced that medals will be given to all citizens of the United States serving two years satisfactorily on canal construction.

The Fish Freezing and Storage Plant of the Consolidated Weir Co., Provincetown.

By Howard S. Knowlton.

The Consolidated Weir Co., of Provincetown, Mass., operates a large fireproof fish-freezing warehouse on the shore of Cape Cod Bay about half a mile east of the business center of the town. The warehouse and a new power plant in connection with it have recently been completed, under the design and supervision of Mr. F. W. Dean, of Boston, mill engineer and architect. The equipment illustrates the dependence of the modern local fishing industry upon mechanical methods, beginning with the motor boats used in collecting catches from the weirs in the harbor and concluding with artificial refrigeration for the preservation of the fish in the warehouse.

The plant consists of a main building, 70 ft. square and five stories high, with elevator and conveyor, and an adjoining power house, 60 x 40 ft., containing boilers, engines and refrigerating equipment. Three floors are used for fish freezing and storing, one for fish receiving and distributing, and one for cooperage. The whole arrangement was planned to reduce insurance, depreciation, repairs and attendance as much as possible. The power house is designed not only to contain new machinery, but also some old refrigerating and power equipment used in connection with an old plant. The new power house and warehouse are both of reinforced concrete. The pilasters, girders, beams, columns and floors are of reinforced concrete, with panels of hollow concrete blocks laid in cement plaster. The window sash is galvanized iron glazed with wire glass. The inside surfaces of the walls on the first three stories are insulated with 4 in. of nonpareil sheet cork cemented on, with hard cement finish on the inside.

On the top of the first, second and third floors there is 4 in. of cork insulation, with a 3-in. top cement finish. All floors have a granolithic wearing finish, and the fourth or assorting floor is waterproofed. The fifth floor is used for cooperage, the fourth for receiving and distributing, the third for sharp freezing, and the first and second for storage. The doors leading into the freezing rooms are the Stevenson special freezer door, covered with galvanized iron. Stevenson cooler doors are used between air locks, the stair tower and elevator well. All other insulated doors are metal covered, and in angle iron frames. Scuttles are provided in the second and third floors for passing goods through to the floor below, these having insulated covers set in angle iron frames.

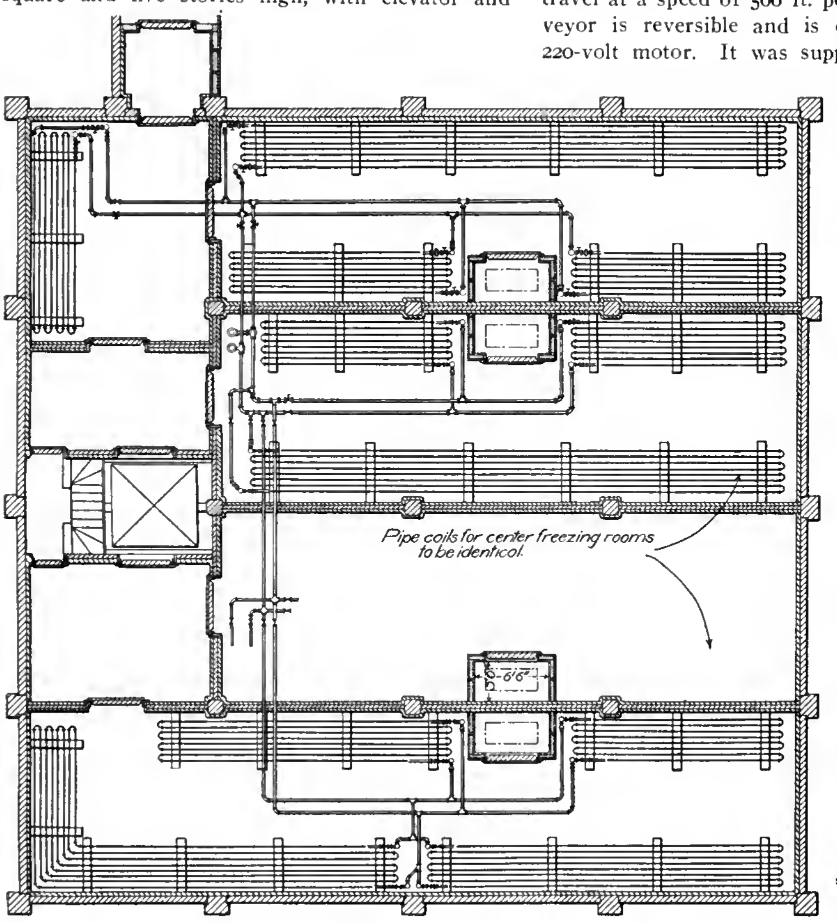
The power house is of the same general construction as the warehouse, with panels of concrete blocks. The roof is designed to carry part of the refrigerating apparatus and is waterproofed with granolithic finish.

Fish are received at the wharf about 500 ft. south of the freezer and are here cleaned or delivered directly into conveyor buckets. These are 2 ft. by 2 ft. by 30 in. in dimensions and travel at a speed of 500 ft. per minute. The conveyor is reversible and is driven by a 10-h.-p. 220-volt motor. It was supplied by the Coburn Trolley Track Company and is carried on spruce poles spaced 16 ft. apart. It rises from the wharf to the fourth floor of the freezing building by an incline 130 ft. long. Inside the building at the fourth floor level are two loop tracks, around which the buckets are operated by hand, as conditions require. The conveyor is of the traction rope type, and the buckets travel in a straight line. At the wharf a switch is provided to enable buckets to be stored at one side.

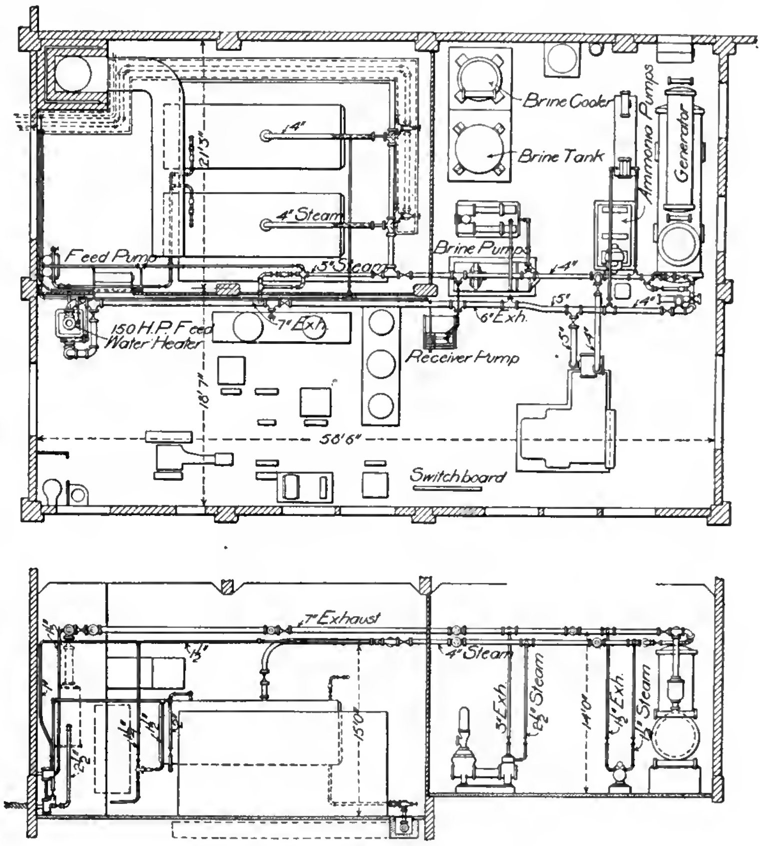
The boiler room is about 21 x 33 ft. and contains two 66-in. Bigelow horizontal return tubular units rated at 110 h.-p. each and operated at about 100 lb. steam pressure. Each boiler discharges into a common flue 2 ft. 9 in. by 2 ft. 7 in. in section, which leads into the uptake of an iron stack 3 ft. in diameter and 85 ft. high, that rises from one corner of the room to a point above the top of the building. A 6 x 4 x 7-in. Warren vertical feed pump is installed in the boiler room, and this delivers to the boilers through a 2-in. line. A 150-h.p. Cochrane feed water heater is installed in the engine room, and this is served with the exhaust steam of all the auxiliary pumps in the plant through a 7-in. line running the entire length of the engine room in decreasing sizes. Hand firing is, of course, employed.

The refrigerating and steam plants occupy the entire engine room, which is walled off from the boiler room. The engine room is large enough to contain an old refrigerating equipment of 20 tons capacity. This and the new refrigerating apparatus was supplied by the Carbondale Machine Co., of Carbondale, Pa. The new and the old plants are tied together, so that when desired each can help the other.

The new refrigeration apparatus consists of a 40-ton absorption-type equipment, with brine circulation. The condenser, atmospheric absorber and rectifier are placed on the roof of the engine room. Steam is taken from the central parts of the boiler shells by a quarter-turn 4-in. connection delivering into a 4 to 5 in. header. Before leaving the boiler room the header delivers into a 3-in. branch line carried to supply the old refrigerating equipment and the feed pump. A bypass with reducing valve is provided in the connection with the old machinery. The 4-in.



Piping in Freezing Room.



Steam and Exhaust Piping.

steam header is carried in a straight line about half way through the engine room, branches being taken off for the pumps and electric generator set. The ammonia system generator is supplied by a 3-in. connection. This generator is of the horizontal type and is operated at not over 10 lb. pressure through a reducing valve, ordinary operation being at 5 lb. or under. It is 39 in. in diameter and 14 ft. long, containing two steam coils. This low-pressure operation is a distinct departure from earlier practice and in the direction of better economy. The refrigerating apparatus is capable, with an initial temperature of condensing water not over 60° F., and with steam at not over 10 lb., of cooling 112.8 gal. of calcium chloride brine for 24 hours from 0 to 10° F.; the specific gravity of the brine being 1.240. The brine cooler is of the Hendrick type, 9 ft. high and 3 ft. in diameter. Two brine circulation pumps are installed, one being a Warren 12 x 8½ x 12-in. steam-driven duplex unit and the second a Lawrence two-stage centrifugal pump driven by a 10-h.p. motor. Each pump is rated at 300 gal. per minute. The steam supply of the Warren brine pump is drawn from the engine room main

through a 2½-in. line. The engine room also houses a brine-storage tank 4 ft. in diameter and 11 ft. high, fitted with perforated plates at the top for the charging process with calcium chloride. Either brine pump is capable of handling the entire circulation necessary in the refrigerating coils.

The ammonia circulation is handled by one or both of the pumps in the engine room. One is a 12 x 5 x 12-in. single Warren pump, steam operated through a 1¼-in. supply line, and the other a 3½ x 8-in. triplex pump driven by a 7.5-h.-p motor. The ammonia circulation starts at the generator in the engine room, passes through the analyzer to the rectifier and condenser on the roof, returns to an anhydrous receiver in the engine room, passes through the expansion valve to the brine cooler and then goes to the absorber, ammonia pump, exchanger and analyzer, back to the generator. All the ammonia piping is extra heavy lap-welded wrought iron.

Circulating and feed water for the plant is drawn from eight 8-in. wells 20 ft. deep, located beneath a pump house about 450 ft. from the power house. Each of these wells delivers into a 4-in. line, which joins the other 4-in. lines in a 5-in. lead that discharges into a sand chamber located centrally in the pump house. The 5-in. suction line of an 8x10-in. triplex pump is connected to this chamber, which is 30 in. in diameter and 6 ft. long. The pump is driven by a 20-h.-p. motor. A 3-h.-p. motor and air pump are also provided in the house to assist in the maintenance of a vacuum in the suction chamber. A 6-in. cast iron main connects the pump well with the power house, and a branch connection to the town water supply is provided. Strainers 8 ft long are used in the wells.

The current used in the establishment is furnished by a 62.5-kw. 220-volt Westinghouse direct-current generator direct connected to a 12 x 12-in. Skinner engine operating at 300 r. p. m. having a 4-in. steam supply, and a 5-in. exhaust. An old 110-volt generating unit is still available for service in connection with the old equipment, but all the new motor-operated machinery is driven by the 62.5-kw. unit.

All the principal steam-consuming units are connected to an exhaust main which traverses the power house longitudinally, increasing in diameter from 4 to 7 in. as it approaches the feed water heater. The exhaust main is also provided with an atmospheric outlet, a relief valve protecting the system from excessive pressures. The old refrigerating apparatus is also equipped to discharge through the feed-water heater.

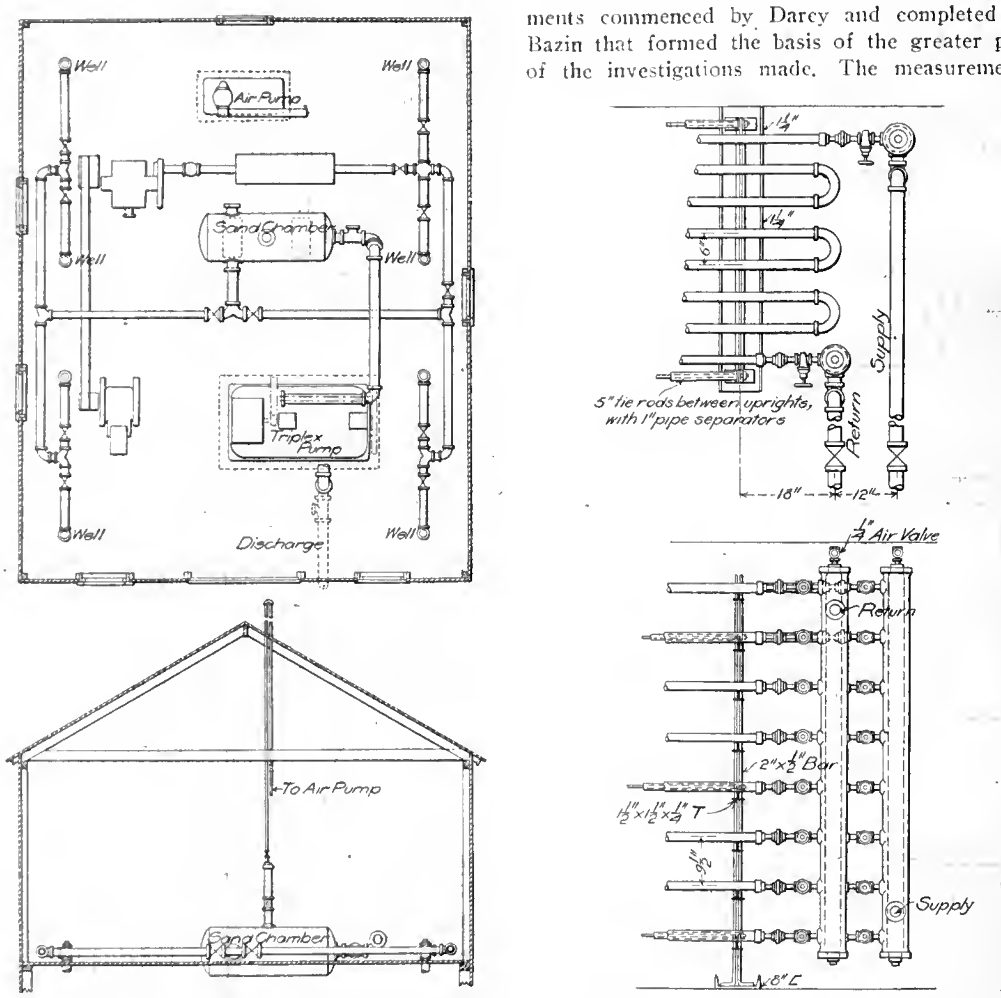
The accompanying drawing shows the arrangement of brine coils in the fish freezing rooms on the third floor of the warehouse. This floor is divided into five compartments for separate refrigeration, but only four are in use at present. All coils are of 1¼-in. pipe supported on galvanized channel iron racks. A vertical space of 9½ in. between centers is allowed for the placing of fish pans. In general, the supply and return mains for each chamber are 2½ in. in diameter, the coils being located on the opposite sides of the room, with separate valves for each section. The coils are connected in multiple, so that the operation or stoppage of any set will not affect the flow of brine through the others. All piping and supports in freezing rooms are galvanized. Air locks are installed to prevent the direct opening of any cold chamber to the external atmosphere. A 4,000-lb. Salem electric elevator driven by a 10-h.-p. motor and fitted with the Richmond safety gate serves all the floors of the warehouse.

THE SHRINKAGE OF WOOD from loss of moisture has been found by the U. S. Forest Service to range from 7 to 26 per cent. of the dry volume in different species.

Flow of Water in Open Conduits.

By A. P. Merrill, Salt Lake City, Utah.

In their evolution, the principles of what we term "hydraulics," like other branches of applied science, have been variously modified and changed in order that they may be made to conform with observed facts. Galileo was probably the first to turn his attention to this subject, and some of the theories he advocated are amusing in the light of modern knowledge. It was about the middle of the eighteenth century when Brahms and Chezy proposed the well-known formula, $V = C\sqrt{RS}$, and it has been very extensively used since that time. The coefficient, C, was at first supposed to be a constant, but as time advanced and experiments began to be made, it became evident that the expression must be modified.



Water Supply Station and Typical Coil Details, Fish Freezing Plant.

It is a little curious that many of the investigators have accepted, without question, the relation between the velocity, the hydraulic radius and the slope as proposed by Chezy, and have turned their attention to the coefficient, C, aiming to find some law by which it might be varied. The most noted of these are Ganguillet and Kutter, and it is the law proposed by them for the variation of this coefficient that is most extensively used to-day. This expression, while somewhat cumbersome, has been made quite easy of application by the various diagrams now in use. But is the general law with which Kutter's coefficient is used, correct? While the expression proposed by him is recognized by all as being very ingenious, and while the mathematical skill required in its development is no doubt beyond that possessed by many, yet if the Chezy formula does not involve the true law, then Kutter's proposed equation for the coefficient is merely a mechanical device designed to enable us to approximate the truth when applying a law which does not express it.

It was while the writer was working for his Master's degree at the University of Michigan that Prof. Gardiner S. Williams proposed the subject "Flow of Water in Open Conduits" as a suitable one for a thesis investigation, and the suggestion was gladly accepted. In studying this subject, the writer aimed to cast aside all preconceived notions as to what the various relations should be, and when the results obtained suggested a new working hypothesis, he did not hesitate to try it. This meant that much work was done on assumptions that were erroneous, and were necessarily discarded. The discussion presented here is merely a brief outline of some of the matter presented to the University of Michigan in the thesis referred to.

It was the results of those admirable experiments commenced by Darcy and completed by Bazin that formed the basis of the greater part of the investigations made. The measurements recorded in forty-one of their tables or "series" were used. They were taken from "Hydraulics," by Hamilton Smith, Jr. The general conditions under which these results were obtained, and the methods of experimentation, are too well known to need special comment here. Measurements were also used which were made on the Sudbury Conduit by Fteley and Stearns, on the Linth Canal at Grynau by Legler, on the Seine at Paris by M. Poiree, on the flume of the Puget Sound Power Co., in Pierce Co., Wash., by Jos. H. Cunningham, and on the flume of the Ulysses Heat, Light & Power Co. at Taughannock Falls, N. Y., by Messrs. Bell, Goodrich, Haefner and Thompson. Besides these, there were results used that were taken from the Roorkee Experiments by Capt. Allan Cunningham, and also some made by Rittinger.

Most of these last-named measurements were taken from Hering and Trautwine's translation of "Flow of Water in Rivers and Other Channels," by Ganguillet and Kutter. The measurements on the flume in Pierce Co., Wash., are found in the Trans. Am. Soc. of C. E., Vol. 55, p. 252. The ones made on the flume at Taughannock Falls were taken from some field books now on file at Cornell University. This work was the subject of a thesis presented to that

school, and it was at the request of Prof. Williams that the field notes were loaned to the writer.

Before outlining the steps taken in this investigation, reference is made to an article in the Journal of the American Society of Naval Engineers, Vol. 5, by William F. Durand, entitled, "Analysis of Certain Curves Arising in Engineering Investigations." This deals particularly with the meaning and use of logarithmic curves, and, as there is considerable literature on the subject, it is assumed that it is too well known to justify a special discussion here.

If we apply the priciples of work and energy to a given case of uniform flow in an open channel, we are readily led to expect that the laws governing it would involve some sort of relation between the mean velocity, the hydraulic radius, and the slope. If one assumption were made, viz., that the frictional resistance opposing the flow varies as the square of the mean velocity, it is well known how the principles referred to verify the Chezy formula. But in making this assumption we are applying to a viscous fluid a principle which is verified only by rigid bodies. Probably in each special case there may be found in some particular point in the cross-section of the stream, some velocity that would verify the assumption, but without experimental proof we are at a loss to tell where it is, if it exists at all.

In any given canal the bottom slope is fixed, and, theoretically, for the case of uniform flow it would be parallel to the surface slope. This was recorded as being the case in the greater part of the data studied. This meant, therefore, that each table of results contained but two observed variables, the mean velocity, and the hydraulic radius. To form a working hypothesis, it was assumed that V varied as R^x or $V = ZR^x$, Z being regarded as a constant for the present. If we place this in the form Log. V = Log. Z + x Log. R, we at once recognize the form of the straight line equation with x as the slope. It was on this basis that the first part of the investigation was made. In plotting, the writer preferred using the logarithms of the variables, rather than plotting the quantities directly on logarithmic paper.

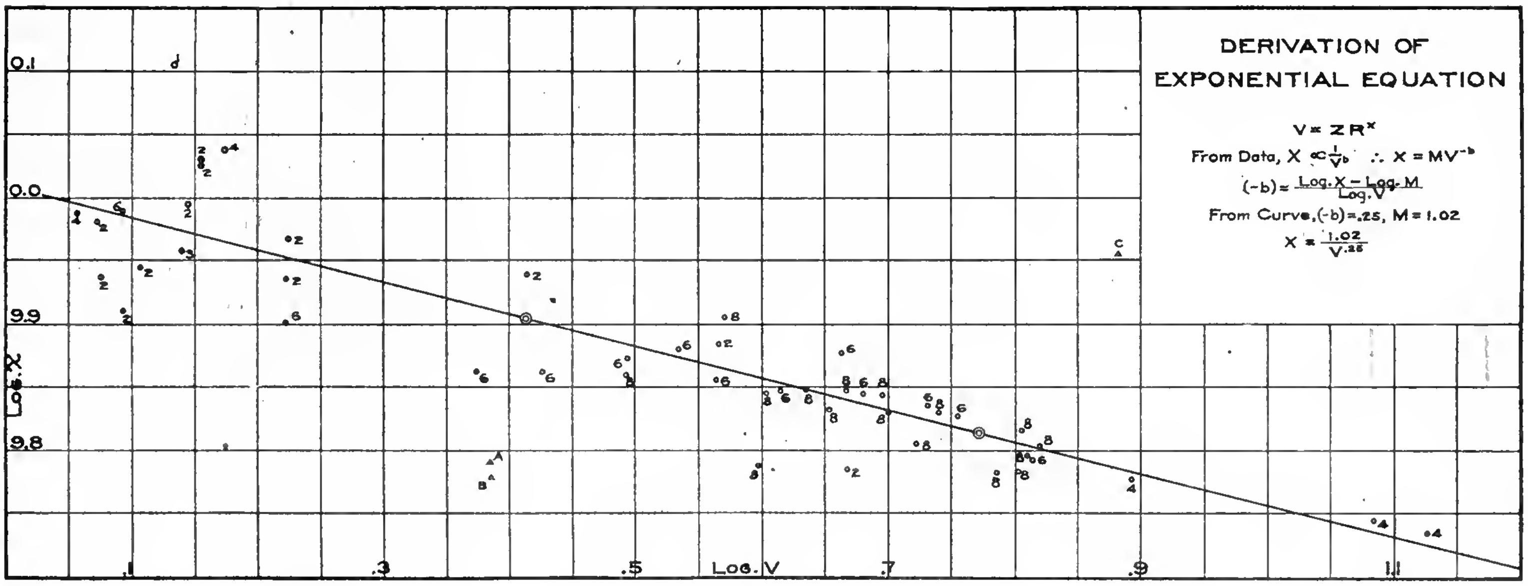
If the assumption made is correct, the locus of the points plotted as indicated above would be a straight line, and, without exception, the data in all of the 52 tables verified it. It might appear that the principal reason for making the plottings was to determine numerical values, either for the slope or some constant in the equations considered. However, the chief reason for making them was to disprove or verify the working hypothesis, to determine the value of the data as a whole or the relative value of the individual measurements in the table, and, roughly, to furnish a check on the numerical work. The plottings were used as a basis in assigning weights to the individual measurements, and the locus was determined by two points of the same weight calculated from the data itself. It was the numerical values which determined the location of these two points that were used in calculating the slope, or the constant in the equation.

Of course each table plotted furnished a numerical value for x. The results were somewhat surprising. Instead of being about constant, as was originally anticipated, they varied through such a wide margin that the writer began to suspect that the variation might be in accordance with some law. Various hypotheses were tried, but, being inadequate, were discarded. The suggestion as to what the law might be was furnished when a comparison was made between the results given by the measurements made in the flume at Taughannock Falls, N. Y., and those in the flume in Pierce Co., Wash. In the former case, the average velocity for the series was close to one foot per second, while the exponent, x, was comparatively high, and in the latter, with an average velocity of about 12 ft. per second, the exponent was the lowest obtained. This consideration was the foundation of the assumption involved in the development given on the diagram submitted. The values of the velocities, the logarithms of which are plotted on this diagram, are the averages of the values given in the table from which the corresponding value of x was obtained. The figure given at each circle indicates its weight, the number of readings from which the numerical values of x and V were derived, and the value of the readings as a whole as indicated by the plottings, having been used as a basis for assigning it. The double circles are the ones which gave the direction of the line, the numerical values having been computed as indicated above.

Attention is called to points a, b and c, on the diagram. If the law laid down for the variation of the exponent is sufficient, then it is necessary to find some explanation for the apparent contradiction indicated by these points. However, the canal in which the measurements were made which determined the location of point c had a fall of 24.6 ft. per thousand. This, of course, means that the conditions required for what we term uniform flow did not obtain in this case, and as the hypothesis did not provide for the elimination of the increased velocity head, the location of this point is nothing beyond what would be expected.

Points a and b were located by the results obtained from measurements on the Sudbury Conduit, and which were made by Fteley and Stearns. By plotting the readings given, it was seen that the measurements were quite uniform, and unless there was some constant error which affected all of the readings alike, it appeared that no better results could be desired. As yet the writer has not had an opportunity of studying in detail the methods or general conditions of experimentation in this case, so he withholds any attempt at this time to explain this discrepancy. Points a, b and c were not used in determining the direction of the line.

While the uniformity of the results indicated by the circles on this diagram is not all that might be desired, yet there is no doubt as to the general tendency. The points at the extreme left vary through a rather wide margin, but this is not surprising when we remember that the experimenters themselves did not regard these particular measurements as being much more than an approximation. Most of these observations were made on the Grobois canal. After considering that the results on the diagram submitted were obtained from observations made under widely varying conditions and by different people, the writer is fairly well satisfied with the evidence supporting the assumption regarding the exponential variation.



An inspection of the original equation, Log. V = Log. Z + x Log. R, shows how, for each value of the slope, a corresponding value for Log. Z could be obtained, for when Log. R = O, Log. V = Log. Z. These values were determined originally but, at that time, the author did not anticipate a variable exponent. The whole process being tentative anyway, it was thought well, after the equation for x had been determined, to compute, for each reading in the tables, a value for Z from the equation $V = ZR^x$. In these calculations the values of x were read directly from a curve given by its equation. This made the process quite simple as, in this case, the measured velocity was known.

After the computations just indicated were completed, an examination of the results showed that Z decreased quite uniformly as the velocity increased in the case of the smaller channels, while it increased with the increase of velocity in the case of rivers and very large canals. This again was somewhat surprising, as it was expected that the variation in the exponent, x, would counteract this tendency, and that the final formula would be obtained by merely substituting for Z the symbols, $CS^{1/2}$. But the full story was not to be so easily obtained, so as a further working basis it was assumed that $Z = K' V^{-n}$ in the case of ordinary channels, while for rivers and large canals, n would be positive. In order to verify this assumption, if true, and to determine numerical values of n and K', the values of Log. Z and Log. V were plotted and the locus

drawn. Of course space would not permit showing the resulting diagrams here, but, while the points were not quite as uniform as those obtained when Log. V and Log. R were plotted, yet evidence supporting the hypothesis was, as a whole, quite satisfactory.

If n varies, numerically, from positive to negative values, we would naturally ask, What is the size of conduit which would make $n = 0$? While the results of the measurements in the flume at Pierce Co., Wash., gave such a value, the width of which was approximately 8 ft., the writer does not regard the evidence sufficient upon which to base any general conclusions.

When the numerical values for n and Log. K' were collected, it was found that, with one exception, n did not vary through a very wide margin for the rectangular and miscellaneous conduits, such as used by Darcy and Bazin, and that Log. K' was nearly constant for different conduits with similar linings, but of course different values resulted for different materials. For semi-circular conduits, the values of n were fairly uniform, but were lower numerically than for the rectangular and miscellaneous forms. The numerical values given in the summary below resulted by taking the weighted averages of all of the values of n for the class of conduits in question. The development below indicates how the final values are obtained.

The remainder of the development is a question of mathematics only, and is as follows:

Let $V = ZR^x$

and $Z = K' V^{-n}$

so that, $V = K' V^{-n} R^x$

or, $V^{(1+n)=m} = K' R^x$

Let $K' = KS^{1/2}$

and reducing,

$$V = \left[KS^{1/2}R^x \right]^{1/m=b} = K^b\ S^{b/2=a}\ R^{bx=y}$$

Let $K^b = C$

so finally, $V = CS^a R^y$ .... (1)

The process is the same for rivers and large canals, except that n is positive instead of negative as above. The form of the final equation is the same in both cases.

The following is a summary of the numerical results:

Ordinary Conduits.—$a = 0.43$; $y = 0.869\ V^{-.25}$

	C
For unplaned plank	= 78
For lath in flume .12' c. to c.	= 64
For lath in flume 25' c. to c.	= 44
For pure cement	= 94
For small gravel	= 56
For large gravel	= 45
For brick (not very smooth)	= 75
For smooth masonry	= 77
For ordinary channels in earth	= 22—32

Semicircular Conduits.—$a = 0.46$; $y = 0.929\ V^{-.45}$

	C
For partly planed plank	= 97
For pure cement	= 114
For cement with one-third sand	= 104
For small gravel	= 74

Rivers and Large Canals.—$a = 0.76$; $y = 1.552\ V^{-.35}$; $C = 174$ to 248.

It is seen that C in the above summary varies through a wide range for rivers and large canals. The investigation on these large streams was not sufficiently extensive to warrant giving a more definite coefficient. The only measurements used for such streams were those made on the Linth Canal at Grynau, Solani embankment (Roorkee Experiments), Seine at Paris, and the Saone at Raconnay. These were the only measurements in the writer's possession that gave relations between V, R and S that were at all consistent. Other measurements were tried, but the resulting points were so much at random that nothing could be gained from them.

After the final exponential equations were determined, and the values for the coefficient obtained, the writer computed, by the formula submitted, the values for the velocities, using each of the readings given in 43 of the tables used. With one exception, the average computed velocity for each table differed from the average measured velocity by less than 6 per cent., while in the majority of cases, the difference was under 2 per cent. The results of the computations are recorded on the plates in the thesis to which reference has been made.

In applying the formula, the equation of the exponent for each class of conduits was plotted so that the value of y could be obtained readily for any given velocity. This made the application of the formula very simple as measured velocities were given. However, in some cases arising in practice, it would be necessary to first assume a value for V in order to obtain y, and this may require a second solution.

It may be noticed by many that equation (1) contradicts, in theory, the hypothesis originally used as a working basis, and which the data apparently verified, as the locus of the points obtained by plotting Log. V and Log. R was a straight line. But now the equation in its final form involves substituting for x the variable y. Theoretically, a curve with a variable slope could not be a straight line, so the question naturally arises, Would the locus of the latter equation differ sufficiently from a straight line, within the limits of the experiments used, to be discovered by the plottings? In order to answer this question the writer computed the values of y Log. R from the data in nine of the tables, and these were plotted with the corresponding ones for Log. V. The resulting locus differed so little from the straight line (none at all in a number of cases) that it was hardly noticeable. While within the limits of the experiments the contradiction is not serious, yet it emphasizes the folly of attempting to apply empirical formulas to conditions beyond those limits.

The bearing equation (1) has on the "sub-critical" velocity theory is no doubt evident to most readers. Some writers have said that the equation $V = C \sqrt{RS}$ expresses the law of flow until we approach quite low or "critical" velocities when the law changes. In the expression as usually proposed for the flow below the "critical" velocity, the exponent of R is said to be near unity. If the author's equations for y were plotted, it is seen that the exponent increases gradually as the velocity decreases, the increase being most rapid for low velocities. If the exponential equation here proposed can be accepted, it appears that we need no special theory for low or "sub-critical" velocities, so far as open conduits are concerned, and we have added evidence that nature's laws are constant and unchangeable.

Concrete Building Construction under Cover is being carried on at the present time on a new transformer house at Longue Pointe, Montreal. The building, which is entirely of reinforced concrete, measures 46 x 46 ft. in plan and is 32 ft. high. A tent with rounded ends 50 x 80 ft. over all and 25 ft. high at the eaves was erected over the site of the building and heated with salamanders and steam coils. The outside temperature up to the middle of December had reached as low as +3° Fahr. at night, and during some days did not go above 10°. Work was carried on continuously inside the tent. W. S. Barstow & Co., New York, are the engineers, and the Canadian White Co., Montreal, are the contractors.

Reinforced Concrete Chimneys.

Abstract of Report of Investigation made for the Association of American Portland Cement Manufacturers. By Sanford E. Thompson, M. Am. Soc. C. E., Consulting Engineer, Newton Highlands, Mass.

The first reinforced concrete chimney was built in 1898 by the Ransome & Smith Co. for the Pacific Coast Borax Co., Bayonne, N. J. Since that time about 400 stacks have been completed, and these are distributed through nearly every State of the Union and Canada. These stacks range in height above ground from 50 to 352½ ft. with inside diameters ranging from 4 to 18 ft., the majority of them being 150 to 200 ft. high and 5 to 6 ft. in inside diameter. Although the large majority of these chimneys have given satisfaction to their owners up to the present time, the failure of a few and serious cracks in several others have caused a number of inquiries to be made as to the reliability of reinforced concrete for chimney construction.

As a consequence of such questions, your Association has delegated the writer to investigate the causes of the faulty structures, and the condition of the chimneys now in service, with a view to reporting whether reinforced concrete may be safely recommended for chimney construction. With this in view the writer has visited and carefully examined a number of concrete chimneys; has investigated the causes for the defects in these structures; and has consulted with representatives of some of companies which make a specialty of this type of construction. Through inquiries made by your Association and by personal correspondence direct reports have been received upon nearly 150 chimneys. The results of this special investigation taken also in connection with two or three professional cases, in one of which opportunity was afforded for examination of the material in a chimney which was taken down, provide data for this report.

General Conclusions.—It is possible to present quite definite conclusions and recommendations with reference to this class of construction. The general conclusions which follow are considered in detail in the complete report, and reasons are given for their adoption.

(1) Reinforced concrete is a suitable material for chimney construction.

(2) Reinforced chimneys must be designed and built upon the same principles and by the same methods which have proved essential in other types of reinforced concrete construction.

(3) The defects and failures which have occurred in chimneys thus far built have been due to poor workmanship or faulty design or the use of the wrong concrete mixtures, or to all three.

(4) The methods of construction at present being followed are defective in many cases and liable to lead to subsequent failures, and they should be radically modified.

Investigation of Chimneys.—As already intimated, several reinforced concrete chimneys have fallen while being constructed, or at some later period, and the cracks developed in a number of others have raised serious questions as to their safety. On the other hand, in general chimneys built of reinforced concrete have given perfect satisfaction, this being attested by the fact that in many cases the owners have repeated their orders for such stacks, one corporation, for example, having built fourteen of them at its plants in various parts of the country.

The question, then, which confronts us is whether the faulty structures reported are due to qualities inherent in reinforced concrete; or whether they are due to defects in design and methods of construction which may be amended in the future; or whether they may be considered simply as accidental failures to which all engineering structures are occasionally liable. In other words, shall we condemn the building of chimneys of reinforced concrete, or may we dis-

regard the comparatively few actual failures as accidental, or shall we approve of building concrete chimneys, at the same time insisting that, to be sure of permanence, the methods of design and construction must be, in some cases, radically changed?

My investigations and examinations of chimneys have led me very decidedly to the third alternative. In other words, the writer is convinced that reinforced concrete chimneys can be built which are entirely safe and, practically indestructible, while recognizing that many have been erected with an utter disregard of the fundamental principles which have proved essential in all other classes of reinforced concrete construction.

In the first place, as we consider the problem, two principles must be recognized which may be termed axioms in engineering science. Failures do not necessarily throw doubt upon any class of construction unless the causes for failure are incapable of remedy. On the other hand, the fact that a structure or many structures have not failed is no proof that they are properly designed and built, since they may not have met with the most serious conditions or may be already stressed to a point so near breaking as to be liable to future deterioration from heat and frost and continued vibration.

To review the subject, therefore, the examination must be especially directed to the causes of the occasional failures and defects reported, with the object of determining, if possible, whether the conditions which have produced the troubles may be present in other chimneys and how they may be corrected in the future to prevent recurrence.

Eight cases have been reported in which chimneys have either blown over or have been taken down because they were defective, and ten or twelve others have been heard from in which cracks have developed which cause serious apprehension. In nearly every case of failure the chimney has been rebuilt by the construction company.

One of the failures most widely known is that which occurred at Peoria, Ill., in 1906. The chimney had been completed about three weeks when it gave way at the offset or projection, the upper part crumbling as it came down and the concrete breaking into small chunks. The T-shaped steel stripped clean from the concrete. The cause is stated to be a poor batch of concrete at the offset, although the manner of failure would indicate that the concrete in the upper portion also was not of the best quality.

Another case is cited in which the chimney stood for nearly two years, and then blew over in a wind storm of about 45 miles per hour. Here, as in the other case, the concrete stripped from the steel, and the fall was attributed to poor adhesion between the concrete and steel.

A stack built in very cold weather in Canada blew over when the concrete, which evidently froze without setting, thawed out.

A case occurred in 1905 where the upper 30 ft. broke and slid off while it was being topped off, the accident being charged to the fact that the mortar had not properly set.

This year a chimney in the West, after about two years' service, developed such cracks that it was considered dangerous, and was taken down and replaced.

Another stack was torn down, before the boilers were fired, because of defects in the workmanship.

The most recent failure occurred this last summer in Wisconsin where a chimney blew over, only two weeks after its completion, during a severe tornado which damaged many other structures. The blame is laid upon the unusual severity of the storm and the freshness of the concrete.

Considering the chimneys which are now in commission, we find that in general they are subject to more or less checking or cracking. This need not necessarily condemn the structure, since the reinforcement may be sufficient to hold together safely the blocks formed by the cracks, and yet it would seem that with the opportunity we have of introducing steel wherever needed all cracking ought to be averted, especially as there is always danger that the cracks may increase from wind vibration, heat and frost.

Our reports indicate in most cases that the cracks are not considered dangerous by the owners of the stacks. In several instances, however, long vertical cracks have appeared, and in others horizontal cracks have been found in the lower portion which have given serious concern. One chimney, straight when built, has since leaned about 3 to 4 in. from the vertical, beginning at a point about two-thirds up from the base. Another informant reports soft spots in his chimney.

About 400 reinforced concrete chimneys have been built in this country, and direct reports have been received by your Association and by the writer from nearly half of them. The failures cited amount to about 2 per cent. of the total number with at least 2 to 3 per cent. more of doubtful safety; it is probable that most of the seriously defective cases have been brought to light, since special care has been expended in running down doubtful ones. Of the others, even where personal examination has revealed somewhat serious cracks, the general verdict of the users is "satisfactory" and "good."

Reinforced concrete chimneys offer special structural difficulty because of the height to which they are carried, and the accompanying difficulty of obtaining the very best of workmanship. For this reason we might expect a somewhat higher percentage of error than in ordinary reinforced concrete construction. Even taking this into consideration, however, 4 per cent. appears to be a somewhat alarming proportion of defective construction. But the vital question is whether even these few cases may be passed over as isolated cases of defective construction, or whether they afford an arraignment of other chimneys now standing; and whether they predicate a similar percentage of defective construction in the future.

An examination by the writer of a chimney which was being taken down, if the structure is representative of others, throws considerable doubt upon their durability. On the other hand, it affords means for pointing out definitely the errors which must be guarded against in the future. This chimney showed soft spots in three of the sections, where the concrete could be readily loosened clear into the steel. The concrete was porous throughout, and scarcely bonded between the 6-in. layers. Samples cut from good portions of the concrete, which was a mortar of one part of cement to three parts of sand, gave an ultimate strength of about 1,200 lb. per square inch, or about one-half the strength of a good 1:3 mortar laid with a sufficient quantity of water. A month after this inspection the chimney was taken down, the 6-in. layers being readily loosened from each other and cut into pieces by a pneumatic chisel, and the concrete was found to vary materially in hardness. Of special importance was the fact that the mortar in the angles of the T-bars was weak and porous, showing scarcely any adhesion to the steel. Further investigation showed that the concrete, or mortar, used in the construction was of such extremely dry consistency that even where well rammed, the moisture did not cover all parts of the surface of a layer nor did it produce a proper bond with the steel.

From such evidence, it is impossible to avoid the conclusion that other chimneys built by similar methods, with so dry a mixture as to give a weak, porous concrete and to provide insufficient adhesion to the steel, are likely to cause trouble in the future.

This appears to be a severe arraignment of concrete chimney construction. And yet, to be fair, it must not be overlooked for a moment that every one of the points brought out, the low strength of the concrete, the dry mix, the porosity, the lack of adhesion to steel, the lack of bend, and the soft spots, indicate construction which would not be tolerated in any other case of reinforced concrete work. It has been proved beyond a doubt, and reiterated in print and verbally, that reinforced concrete must be mixed wet in order to have it adhere to the steel and protect the latter from corrosion; that a factor of safety of four is certainly a minimum in compression; and that a concrete structure must be essentially monolithic. It should be clearly understood, also, that in the chimney just referred to all of the essential elements were disregarded.

The defects noted are not inherent in chimney construction. In other words, from a practical standpoint, it is necessary to follow in chimney construction the methods which have proved necessary for success in other structures made from reinforced concrete. As a proof of this we may simply point to the indisputable fact that concrete chimneys have been built satisfactorily with a proper factor of safety and with a wet mix which insures a positive bond to the steel, and with a dense concrete which protects the steel from corrosion and permits bonding the various parts of the structure.

Since reinforced concrete is everywhere being constructed on these principles, and is proving durable and satisfactory, and is being used under all conceivable conditions, we have ample cause for security in reinforced concrete chimneys provided they are properly designed and constructed.

Effect of Heat.—In the above discussion the effect upon the chimney of the interior heat from the boilers is not directly referred to. Just what part this has played in the faults which we have noted is uncertain. Undoubtedly the interior heat adds to the stress in the concrete, and thereby increases the tendency to crack, especially at points near the top of the inner lining. This simply indicates, however, that the quantity and arrangement of the steel reinforcement should be adapted to resist this extra stress.

When reinforced concrete was first introduced it was questioned whether, with changes in temperature, the concrete and the steel would not expand and contract unequally, so as to make them separate from each other. If this were the case, it would be especially detrimental to a structure like a chimney where the range in temperature is greater than usual. It has been proved conclusively, however, that concrete and steel have substantially the same coefficient of expansion. For this reason there can be no separation due to change in temperature.

The interior heat affects the shell in another way, because concrete is a poor conductor. The interior surface for a depth of an inch or two becomes very much hotter than the exterior surface, and so tends to expand and crack the colder outside surface. This effect is most marked upon a thick wall, the action being similar to that of a thick glass bottle which breaks more readily when hot water is poured into it than does one of thin glass. The stress or pull on the outside surface must be met by increasing the amount of circular steel and placing it near this outside surface.

The effect of heat upon the concrete material itself is also a point which must be considered in chimney design. In the earliest chimneys built, the concrete lining extended the full height while in later ones it has ben generally carried up to only about one-third the height. Usually the lining has been reinforced concrete, although in some cases firebrick has been used. A few chimneys have been built with no lining at all.

While much remains to be learned with reference to the effect of heat upon concrete, it is known to be a most excellent fire-resisting material, although it has been found that a temperature as high as 1500° Fahr., continued for only two or three hours, will draw out the water of crystallization so as to take out the strength for a depth of ½ to 1 in. Lower temperatures affect the material less, and tests at the Watertown Arsenal indicate that a good cement mortar will not be appreciably injured at 600 to 700° Fahr. Tests of actual chimney temperature are extremely meager, but from records available we may say that the temperature in an ordinary chimney seldom exceeds 700° Fahr. at the base, while 400 to 500° is more usual. It is a fact not universally known among engineers that the temperature in in a chimney remains quite high even in its upper portion. For example, in the test of one chimney the temperature at three-quarters of the height above the base ranged only 10 to 20 per cent. lower than at the flue. This makes it evident that if the lining extends only one-third of the way from the bottom, the design of the concrete shell above it should be adapted to resist considerable heat, while greater safety may be insured by extending the lining far above the lower third.

Your Association has received no reports of injured linings. Many have never examined the interiors of their chimneys, but several have reported that the lining was in good condition. One correspondent states that after three months' use the interior surface of the chimney is "smooth, without cracks," and that "the soot does not adhere to the surface but falls to the bottom or is carried out by the draft." Since the fire-resisting quality of concrete increases very greatly with age, it is fair to assume that if the interior surface is sound at the end of the first two or three months it will not disintegrate after that time. In this connection, Mr. E. L. Ransome reports a recent examination of the inner shell of a chimney built nearly ten years ago of a true concrete of cement, sand and broken stone, in which he found the concrete in the hottest part of the chimney opposite the flue perfectly sound and exceptionally hard.

Concrete, then, may be considered as satisfactory for a lining or an inner shell in ordinary cases, although when exceptionally high temperatures are expected, say above 750° Fahr., it is on the side of safety to employ firebrick.

Summary.—In closing, a recapitulation of the most essential requirements for reinforced concrete chimney design and construction may be made:

(1) Design the foundations according to the best engineering practice.

(2) Compute the dimensions and reinforcement in the chimney with conservative units of stress, providing a factor of safety in the concrete of not less than 4 or 5.

(3) Provide enough vertical steel to take all of the pull without exceeding 14,000 lbs., or at most, 16,000 lbs., per square inch.

(4) Provide enough horizontal, or circular, steel to take the vertical shear (unless it does not exceed 50 lbs. per square inch in the concrete) and to resist the tendency to expansion due to the interior heat.

(5) Distribute the horizontal steel by numerous small rods in preference to larger rods spaced farther apart.

(6) Specially reinforce sections where the thickness of the wall of the chimney is changed or which are liable to marked changes of temperature.

(7) Select first-class materials and thoroughly test them before and during the progress of the work.

(8) Mix the concrete thoroughly and provide enough water to produce a quaking concrete.

(9) Bond the layers of concrete together.

(10) Accurately place the steel.

(11) Place the concrete around the steel carefully, ramming it so thoroughly that it will slush against the steel and adhere at every point.

(12) Keep the forms rigid.

The fulfilment of these requirements will increase the cost of the structure, but if the recommendations are followed, there should be no difficulty in erecting concrete chimneys which will give thorough satisfaction and last forever.

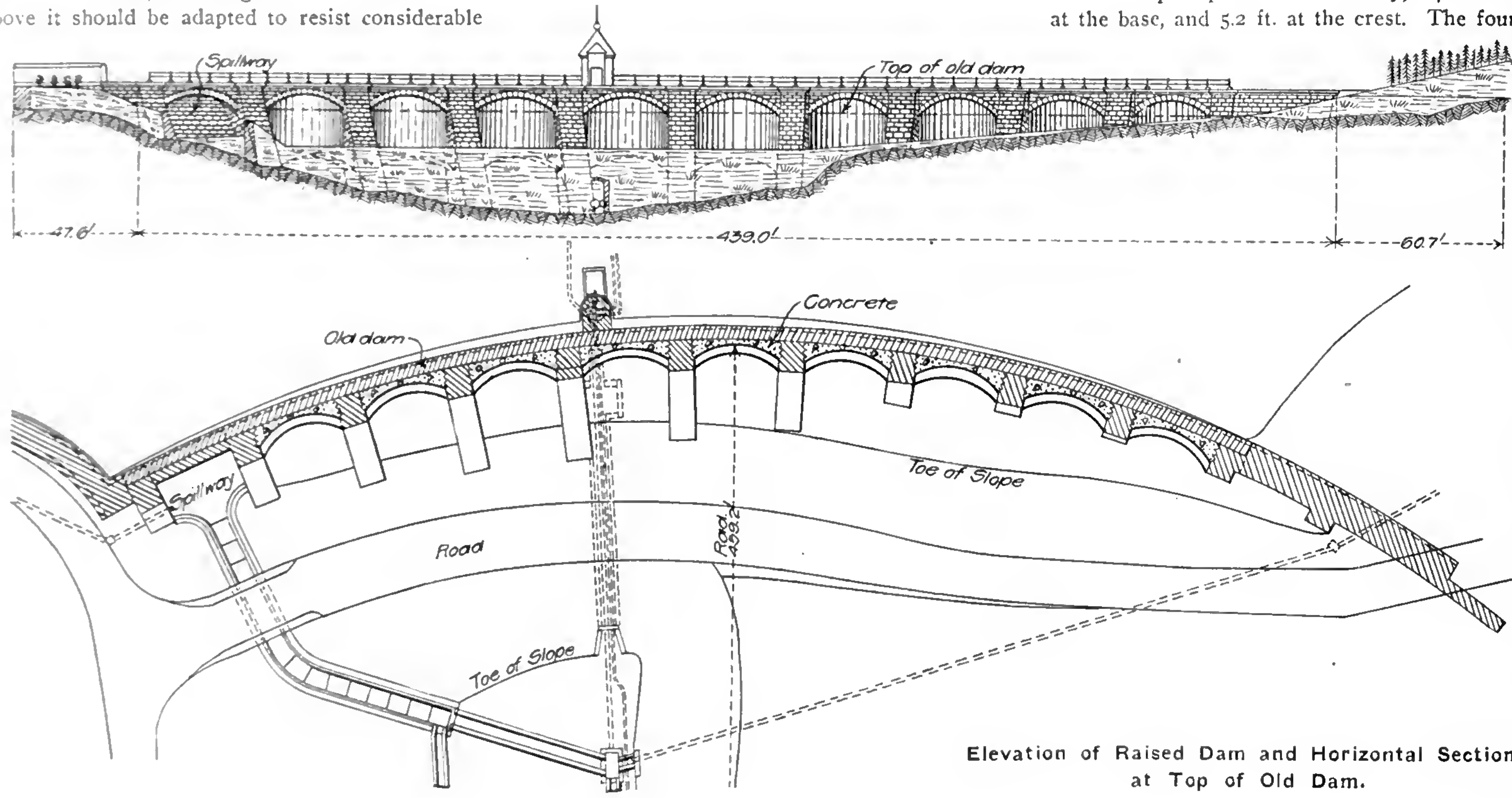
EXAMINATIONS OF MINE FOREMEN upon the State laws and its own rules relating to mining will be held every six months under a plan being worked out by the Delaware, Lackawanna & Western Co. The collieries will be divided into four districts of about five collieries each, and the averages obtained by all the foremen of each district will be taken together and a trophy awarded to the district standing highest. The trophy will become the permanent property of the district winning it three times in succession.

Raising a Dam at Lennep, Germany.

The city of Lennep, Germany, originally derived its water supply from gravel beds in the Valley of the Panzerbach, about two miles from the city. It became apparent in the early nineties that the supply was inadequate in times of long-continued dry weather and in 1893 a small dam was thrown across the valley at a narrow point in order to create a storage reservoir sufficiently large to tide over the dry seasons. From observations which had been made through a great many years, of rainfall and run-off near Lennep and at points in that part of Germany, where conditions were similar, it was determined that a yearly run-off of 1,259,700 cu. m. or about 333,000,000 gal. could be safely relied upon, the coefficient of run-off be taken as 68 per cent. of the rainfall. The yearly consumption in Lennep in 1892 was 52,800,000 gal. It was decided to create a reservoir with a capacity of 31,700,000 gal.

The dam was about 417 ft. long, 37.7 ft. high at the deepest point of the valley, 24.6 ft. wide at the base, and 5.2 ft. at the crest. The foundation consisted of hard blue slate with a covering of soil from 7 to 10 ft. deep. The structure was curved upstream, being in plan the segment of a circle with a radius of 459.2 ft., both ends abutting against the solid rock walls on both sides of the valley. A spillway 32.8 ft. long, with its crest 1.6 ft. below the top of the dam, was built in the structure on the right hand side of the valley. At the highest section of the dam a tunnel 4.2 ft. wide and 5.9 ft. high was built in the masonry; and through it were laid the service conduit and the waste pipe for emptying the reservoir, the opening being walled up when the installation of the pipes was completed. In order to make the dam thoroughly waterproof, two thicknesses of dense cement mortar were applied on the water side of the structure, one of the thicknesses being protected by a 23.6-in. wall, and the other, applied on the outside, by a waterproofing compound. The soil was stripped over the entire area of the reservoir.

In 1901, an exceptionally dry year, the capacity of the reservoir proved inadequate and the water level dropped so low that cool, clear water could not be obtained. An investigation was therefore undertaken to determine whether the existing dam could be raised so as to increase the capacity of the reservoir to 71,800,000 gal. The



Elevation of Raised Dam and Horizontal Section at Top of Old Dam.

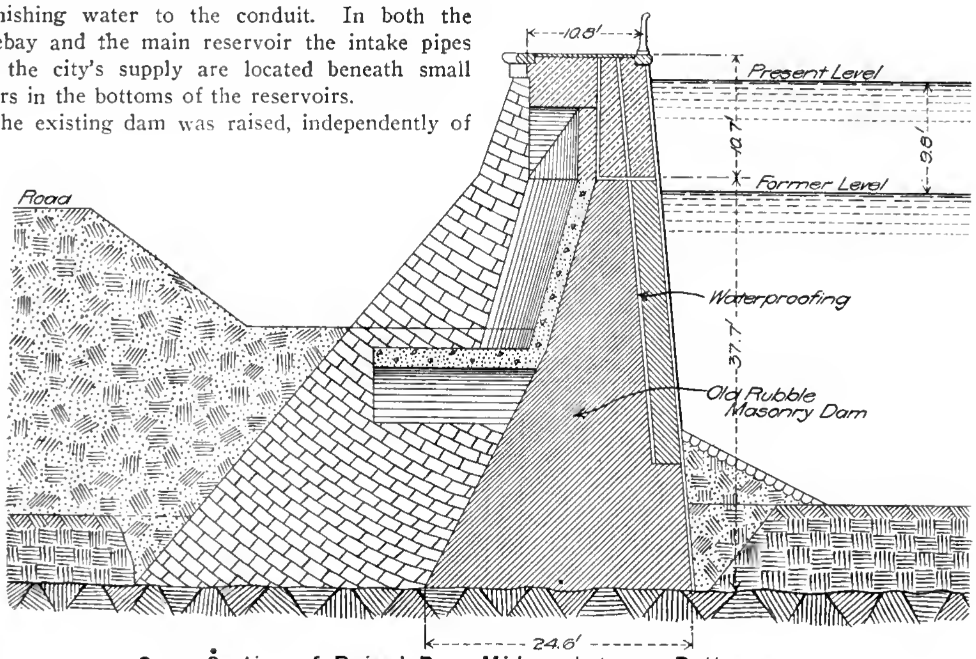
designer of the original wall, Herr Albert Schmidt, was commissioned to draw up plans for the work; and from his account of it in the "Zeitschrift fuer Bauwesen," these notes have been taken. Before the work was started the plans were submitted to the Ministry of Public Works for approval.

Simultaneously with the raising of the crest of the dam, plans were carried out for improving the quality of the water. Some distance upstream headworks were installed for distributing the water over a grass grown field, so that the vegetation would hold back all floating matter. From this field it flows to a meadow underlaid with drain tile, is filtered and flows to a forebay with a capity of 8,450,000 gal., separated from the main reservoir by a small curved dam, in the crest of which a weir has been placed so as to discharge into the larger body of water. The forebay was built separately from the main reservoir in order that the latter might be emptied, inspected and repaired in the fall of the year when the stream-flow is more than sufficient to supply the demand, the forebay during such time furnishing water to the conduit. In both the forebay and the main reservoir the intake pipes for the city's supply are located beneath small filters in the bottoms of the reservoirs.

The existing dam was raised, independently of the new construction, a height of 10.7 ft., the water level in the reservoir being raised thereby about 9.8 ft. The added masonry was carried to solid bearings in the rock on both sides of the valley. In front of the old wall on the downstream side, twelve buttresses 41 ft. on centers and 9.8 ft. thick were constructed, extending out beyond the original structure about 26 ft. at the base, in the deepest point in the valley, 10.7 ft. at the crest of old dam and 7.4 ft. at the top of the new crest. Between the buttresses at a level of half the height of the maximum depth of the wall, horizontal arches of concrete were sprung. They extend back of the old wall, a minimum distance of 11.8 ft., have a rise of 4.9 ft. and a thickness of 2 ft. at the crown. Below these arches the old dam is left exposed, the reinforcing, except for the buttresses, being kept above the springing lines of these arches. The latter are continued until their plane intersects the rock sides of the valley, where solid masses of concrete carry any thrust from them to the solid rock, thus giving, according to Herr Schmidt, an exceptionally strong and stiff construction by reason of the continuous arch action.

At the top of the buttresses a second series of horizontal arches is sprung. These arches, of hammer-dressed gray trap, have a span of 31.2 ft., and a rise of about 6.6 ft., are 6.6 ft. wide, and 3.28 ft. thick at the crown. As is the case with the lower series of arches the upper ones are carried continuously until the plane intersects both sides of the valley, where they are brought to a firm bearing on the solid rock. Despite the fact that ample provision has been made to take advantage of the arch form of the dam by using these horizontal arches, this action was not considered in the design, the gravity section of the masonry alone being sufficient for stability.

In order to carry over to the buttresses the increased water pressure which the old dam cannot carry, vertical arches have been sprung between the buttresses against the back face of the old dam, and between the level of the two series of horizontal arches just described The vertical arches are of concrete, 1.64 ft. thick midway between the buttresses, the arch surface intersecting the buttresses 6.56 ft. back from the downstream face of the old dam. The entire new construction, therefore, consists of a series of buttresses and arches built in front of the old wall and its newly-added top, and bearing against the solid rock on both sides of the valley. All parts of the work are founded on solid rock,



Cross Section of Raised Dam Midway between Buttresses.

which was carefully cleaned of all loose pieces and scrubbed with water under high pressure. The holes and crevices were then filled with cement mortar before construction was begun. The rock foundation was cut in saw-toothed shape so as to secure a better bond between it and the superstructure.

The same mortar mixture was used for the concrete and for laying the stone work, the proportions, Herr Schmidt states, being found by experience to give the best and densest, and at the same time the cheapest mortar. The mixture consisted of 1 part Portland cement, 1 part slacked lime paste, 1½ parts fine crushed trass and 4¾ parts of washed sharp sand. For the concrete 45 per cent. of this mortar was used with the broken stone. The face stones are of hammer-dressed gray trap and the body of slate.

On the right hand side of the valley a waste weir of the same width as the original one has been built. The water flows down over a stepped channel 6½ ft. wide and joins the original stream bed some distance below the dam. Assuming a coefficient of discharge of 0.5, the capacity of the weir is about nine times that of the run-off of the maximum flood of November 24, 1890, which for a precipitation of 1 cu. m. per second per square kilometer gave a run-off at this point of 1½ cu. m. or about 53 cu. ft. per second. A gate-house for operating the valves, both of the conduits and the drain pipes is built at the center of the dam. The drains are proportioned so as to discharge more water than can be supplied by the highest recorded flood.

In order to measure the movement of the dam under different heads and temperature variations, permanent points have been established on both sides of the valley and two points on the dam on a straight line between those on shore. The points on the dam can be shifted by means of micrometer screws in order to measure the movement. This amounted to 3 mm. when the reservoir was first filled after the dam was raised, and a further movement of 4 mm., due to temperature variations, has been noted.

In designing the dam the weight of the masonry was taken as 143½ lb. per cubic foot and of the concrete 118.6 lb. per cubic foot. The pressure line when the reservoir is at its highest level falls within the middle third of the body of the wall and consequently there is no tension in the masonry, the same being true of the buttresses. It is therefore apparent that the stability of the dam is assured independent of possible arch action. The maximum pressure in the old dam is 3.07 kg. per square centimeter or about 3.14 tons per square foot, and in the buttresses 3.86 kg. per square centimeter or about 4 tons per square foot, the minimum pressures being about 0.15 and 2.1 tons per square foot respectively.

The construction used for raising this dam, according to Herr Schmidt, can just as well be used for the construction of a new dam, in which case instead of building a continuous wall in front of the buttresses vertical arches would be sprung between the latter. Such a construction, the paper states, would effect a saving in first cost of 16 per cent.

A SMALL POWER PLANT at Pittsfield, Mass., has recently been built which is interesting on account of its use of oil engines. It belongs to the Pittsfield Electric Co., which has a steam-driven station in the heart of the city. The new station is a 60x73½-ft. building constructed of concrete blocks made at the site with Pettyjohn machines. These blocks were cheaper than brick. A railroad siding extends along one wall and fuel oil is delivered in cars on it, being stored in three 6,000-gal. tanks outside the building. From these tanks the oil is delivered by gravity into the basement, from which an attendant pumps the oil once an hour with a hand-operated registering pump into a couple of tanks in the engine room. The station contains at present a 350-kw. Stanley alternator mounted on a shaft between two 16x24-in three-cylinder Diesel engines. The latter operate on a four-stroke cycle, but differ from other internal combustion engines in compressing a full charge of air to a point above the igniting point of the fuel, and then injecting this fuel for a certain period, variable according to the load, into the hot air, where it burns under controlled limits of temperature and pressure. The operation is, therefore, one of combustion rather than explosion. Each engine is rated at 225 h.p. The station has two air compressors, each capable of supplying air to two engines under pressures of about 1,000 per square inch, and special steel piping is installed for the air. With each engine there are six air bottles, of which two are connected normally with the air pipes to absorb fluctuations in the air pressure and the other four are kept charged so as to furnish a means of starting the plant from rest. Cooling water is drawn through a conduit from a neighboring lake to a well, whence it is pumped by a motor-driven triplex pump to the jackets of the air compressors and the engine cylinders. Four 10-in. discharge pipes carry the engine exhaust from the station, but only two of these are needed for the present service. They are kept filled with 8 ins. of water and discharge into the neighboring lake.

Sewage Disposal Works at Lake Placid, N. Y.

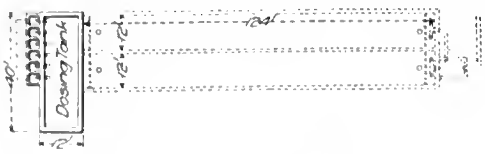
Lake Placid, N. Y., is one of the largest and most popular summer resorts in the Adirondack Mountains. It is about 2,000 ft. above sea level and its population, together with that of the hotels and cottages immediately about the village, varies between extreme limits of about 2,000 in winter and 7,000 in summer. In general, however, the average summer population is approximately double the winter population, and neither of the extreme limits continues for more than a short season.

To collect and treat the sewage of Lake Placid and the Whiteface Inn district, two systems of sewers and a sewage disposal plant have recently been constructed. The sewerage system in the village of Lake Placid comprises about five miles of sewers varying from 6 to 15 in., and the system in the Whiteface Inn sewer district comprises about four miles, varying in size from 8 to 12 in. The combined flow from these two systems is treated in a disposal plant consisting of a double-chamber septic tank and six intermittent sand filters. The present disposal plant is designed so that its capacity can be increased by the addition of another septic tank chamber and more filters and siphons without interrupting the operation of the present plant or changing the size of the present grit and dosing chambers.

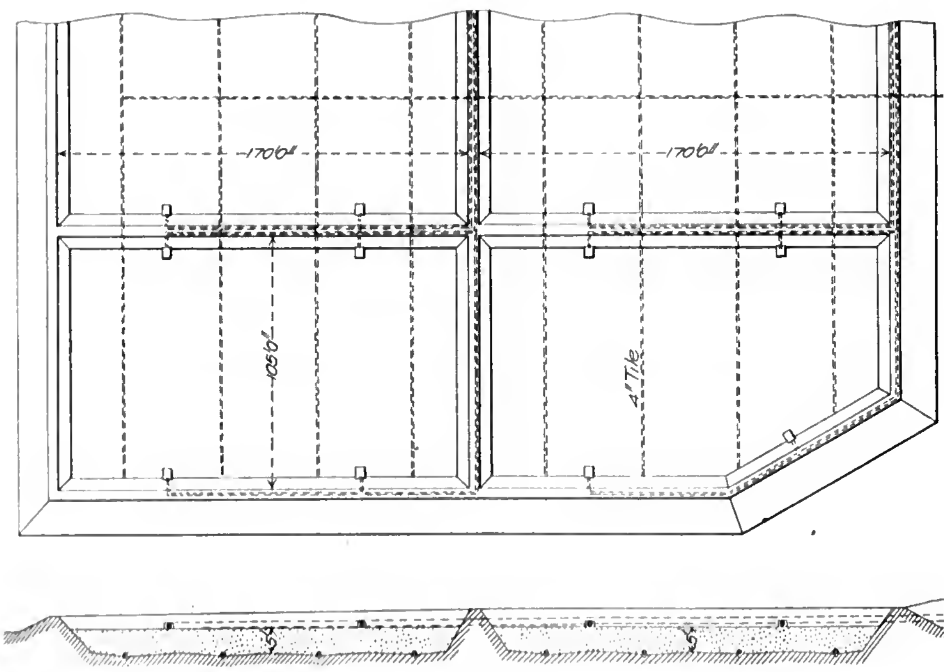
The disposal plant is designed to be operated at half its maximum capacity during the winter and the two compartments of the septic tank are accordingly equal in size. Each compartment is 12 ft. wide, 124 ft. long and 5 ft. deep. The tank is built of concrete and is covered with earth, two manholes over each compartment being provided for ventilation. The flow from the main trunk sewer first enters a 9x6-ft. grit chamber 5 ft. deep, at one end of the septic tank. Between the grit chamber and each compartment of the septic tank is a controlling valve by which either compartment may be cut out. Just inside each chamber on the inlet pipe is a tee and on each end of each tee is a 90 deg. elbow and a short piece of pipe. The arms of the tees are of the right length to bring the discharge pipes to the outside quarter points in the width of each compartment. In front of each discharge pipe is a baffle board, placed so as to distribute the flow as evenly as possible throughout the cross section of the tank.

Two feet from the wall at the outlet end of each compartment is a baffle, which extends down into the sewage half its depth, and in the end wall of each compartment are three weirs, the crests of which can be adjusted to any width up to a maximum of 24 in. The sewage passing under the suspended baffle and over these weirs, flows into a 12x[illegible]-ft. dosing tank 5 ft. deep in which are six 10-in. Miller automatic siphons supplied by the Pacific Flush Tank Co., Chicago. These are set to discharge in rotation and are arranged so that any number can be cut out, at the same time leaving those still in use operating in uniform rotation. Contiguous to the dosing tank are six [illegible] chambers into each of which one of the [illegible] siphons discharges. From [illegible] the effluent of the septic tank [illegible] beds, any one of which [illegible] cutting out the [illegible] particular bed. The dose delivered to each bed at each discharge is 17,000 gal., but this may be varied by setting the siphons to discharge at different depths. There [illegible] a bypass from the dosing tank by which the septic tanks may be operated without the filters. There is also a bypass through which raw sewage may be delivered directly to the filters without entering the septic tanks. There is no bypass, however, by which raw sewage may be discharged into the stream which receives the effluent of the plant. The floor of each septic tank chamber slopes toward a depressed clean-out pipe and one chamber can be cleaned of sludge while the other is in operation.

Each of the six intermittent fiters has an area of 0.4 of an acre and a depth of sand of 5 ft. It was originally planned to use a sand with an effective size of about 0.25 mm. excavated from a side hill nearby. Eventually, however, it was found impossible to secure enough sand of this size without any excessively long haul, and accordingly a finer but carefully selected sand was used. The sewage discharged by each siphon flows through a separate pipe to the nearest corner of one of the filter beds. Here the flow is taken by two pipes laid in the embankments of the beds and is delivered equally at four points on the perimeter of each bed from which points it is further distributed by wooden carriers. Each bed is underdrained by four lines of 4-in. tile aranged as shown on the accompanying plan.



Plan of Septic Tank.



Part Plan and Section of Sewage Filter Beds at Lake Placid.

Each drain is covered with about 6 in. of gravel or crushed stone and about 2 in. of coarse sand. The collecting drains lead to a central intercepting drain which discharges into Chubb River.

Chubb River has a drainage area above the disposal works of about 30 square miles. About three miles below Lake Placid it flows into the west branch of the Ausable River, the water of which, about eight miles further downstream, is used for drinking purposes by the village of Wilmington. At this point the river has a drainage area of about 150 square miles. Before the sewage disposal plant was installed traces of pollution due to the discharge from the Lake Placid sewers were found in the water at Wilmington, although at that time less than half as much sewage was being discharged into Chubb River at Lake Placid as is now being treated at the disposal plant. Since the plant has been in operation there has been no complaint concerning the condition of the water at Wilmington.

The sewerage works of Lake Placid were designed by Mr. Charles E. Collins, consulting engineer, Philadelphia, Pa. The disposal plant was built by Messrs. McCaghey & Linehan, of Little Falls, N. Y., the total cost of the plant being $26,000.

The Finish of Concrete Surfaces.

There are a good many methods of finishing concrete surfaces now in use, and it is probably true that most engineers have their favorite methods and are inclined to disregard the merits of all others. It is at times rather important, however, to be able to impart a variety of surface textures to concrete in the same structure, and on this account attention is called to the following comprehensive paper on the subject, read before the Boston Society of Civil Engineers on Dec. 11, by Mr. M. C. Tuttle, secretary of the Aberthaw Construction Co., of Boston, one of the pioneer companies making a specialty of concrete work.

Granolithic Finish.—The most common type of finish is the troweled or granolithic surface. The objections to it are its flat dull color, the prominence of any crazing or cracking which may occur, its slipperiness under foot and the prominence given any inequality, in its surface when the light strikes it diagonally. A slight hollow or ridge will show as a shadow and is accentuated greatly. From the construction standpoint there is little objection to this surface, provided the finish is put on before the body of the concrete has set and the surface is properly troweled.

The hard-troweled surface probably protects the under body of concrete from outside moisture as perfectly as any dressing that can be given. In proof that the granolithic surface is waterproof, Mr. Tuttle's firm, as a side line to its general construction, builds a great deal of sidewalk vault light work. The sidewalk is constructed of glass discs 1⅝ in. in depth with steel rods between them, all embedded in cement mortar which is troweled hard. These sidewalks properly built are absolutely watertight and give no trouble from moisture working through, even in the form of dampness.

One objection to granolithic finish for protection for concrete masonry is its great brittleness. Any crack which develops in the masonry below will certainly come through to the surface and allow water to get into the body of the concrete. The only method of finish which would permit cracking of the surface would be some elastic substance like asphalt and paper.

Rough Picked Work.—For wall work it is common to pick the surface with a pointed or toothed tool. This chips off the mortar which may have flushed to the surface and cuts away little parti-

cles of the mortar from the aggregate below. The roughening of the surface breaks up the light, gives a lighter, snappier color to the mortar itself, and besides this exposes the color of the aggregate below. Oftentimes where gravel is used the stones show rusting and have various shades of browns and reds. This additional color on the concrete adds a great deal to its appearance and when the dressing is carefully done it gives, in Mr. Tuttle's opinion, as pleasing a surface as can be obtained economically. The dressing removes most of the traces of the form and does away with inequalities which may occur in the work.

The objection to this kind of dressing comes in the removal of the surface mortar, which is the most waterproof part of the concrete. If there is any tendency towards porosity in the mass of concrete, it will absorb more moisture after the dressing than before it and will accentuate the injury from frost. From Mr. Tuttle's observation on well-handled and properly proportioned concrete, he is convinced there is, however, little danger from this, as the material is of itself very dense and waterproof. His firm built the fence around Soldiers Field in Cambridge in 1896. This is in low land along the river, where it is fairly damp. It is exposed fully to the weather and is in thin sections. He has watched this carefully and is unable to discover any surface deterioration from the weathering.

This rough picking shows the masonry honestly as concrete, without any imitation of other material. It gives a pleasing surface and one that can well be used on building work. A fairly good Boston example of this dressing is the little subway station on State St., near Atlantic Ave., built by Mr. Tuttle's firm under the direction of the Transit Commission. A comparison of the appearance of this dressing and of stone surface is readily afforded by the other subway stations. A laborer with a hand pick will dress between 40 to 50 ft. of concrete surface two to three weeks old in one day. With a pneumatic tool laborers will get over 50 to 60 ft. There is but the slightest difference between the work of the hand tool and the machine tool. The depth of the cutting and the fineness of it can, of course, be varied to suit the conditions. This is the surface that the architects use generally for their landscape and other ornamental work. Messrs. Fox & Gale use it in the garden work for Mr. Larz Anderson, of Brookline, and Messrs. Little & Browne used it on the Sicilian garden which the Aberthaw Construction Co. built for one of their clients at Beverly Cove. From the point of economy as well as good looks, this dressing for wall surfaces deserves attention.

Rub Mortar Surface.—Mr. Tuttle's firm built the past year two small factories for the Goodell Pratt Co., at Greenfield, under J. R. Worcester & Co.'s specifications. The method of finishing the walls struck him as thoroughly good for this class of building and the appearance was satisfactory. They specified as follows:

"After the forms are removed, the concrete shall be thoroughly wet with a brush and then rubbed with a coarse carborundum stone No. 16, bringing the surface to a lather. After this stone has been used sufficiently to take off the rough projections, the lather shall be washed off with a brush and the concrete again wet, and then dusted with a mixture of dry sand and cement, the proportion being one part of cement to two parts of sand. This shall be rubbed into the surface with the coarse No. 16 stone. Care shall be taken not to allow any of the mortar to remain on the surface. To give the final finish, a No. 30 carborundum stone shall be used and the whole surface well rubbed."

This finish gives a lighter surface than troweling, fills any pores that may be in the cement coating, and leaves the masonry more waterproof than it was originally. It seems to Mr. Tuttle an excellent method of finish for factory buildings, bridge abutments and concrete engineering works. This can be done fully as economically as picking.

Air Blast.—When the Aberthaw Construction Co. built the Stadium at Harvard, they tried, under Professor Johnson's direction, the dressing of the surface with air blast. The men employed had no experience in this work, but the experiment proved that the surface could be dressed this way and bring out the color of the stone underneath. Mr. Tuttle has no data as to the cost of this, but believes it to be a little more expensive than picking.

Hammered Surface.—With a stone hammer concrete made with a fine aggregate can be dressed to a good surface. The Transit Commission have used this in some of their exists and are using it now on parts of the Washington St. tunnel. With an eight-blade hammer it is necessary to have fine aggregate near the surface, as the hammer will not dress down through the end of a large stone which appears on the surface. A laborer with an eight-cut hammer working on the exit near the Old South Church stated that he could go over about 25 sq. ft. of surface per day. For fine detail work and for finished concrete block, and necessarily for imitations of natural stones, this form of dressing is used and is quite successful and satisfactory. It is more expensive than picking.

Acid Treatment.—It has been found that by applying dilute sulphuric acid to concrete surfaces and rubbing this with a steel brush, the cement can be dissolved away from the particles of aggregate and the color brought out very prettily. A United States patent was taken out to cover this process. Mr. Tuttle could not state how far this patent covers the matter.

Plastered Surface.—It has seemed to Mr. Tuttle that in the future concrete construction will be built more to standards as to size of columns, depth and thickness of beams, and that this will necessitate the use of plastering and modeling in order to bring a building to its desired form. It would seem that the present methods of building forms so accurately that the concrete shall assume its final shape in them is too expensive, and that eventually this work may be done more roughly and the surface brought up with an application of plaster or some other means of finishing. The cost of handling the concrete forms to exact masonry lines is very great. It is not exceptional to have the centering of the two sides of a plain wall cost 15 cents a square foot of wall surface or 7½ cents for each side. This cost can be much reduced if the work is not done so accurately.

A cheap method of finishing wall surfaces is to mix small pebbles with mortar and throw these at the wall. If the surface is kept free from freezing or from too quick drying out, they will adhere and make a rough, pleasing surface. This has been used by at least one architect for the finish of some cow barns. The ordinary methods of plastering slap dash and finish work are too well known to need any description or criticism. The difficulty of making a perfect bond between the original masonry and the plastering is the main difficulty from the structural point of view. From the artistic point of view, the plasterers make much of the dressed surfaces that appear in concrete work and they produce very pleasing if not permanent results.

Instruction in Steam Turbine Operation is a novelty recently added to the high school curriculum of the Board of Education of New York City, a 300-kw. Westinghouse-Parsons turbo-generator unit having been installed as a part of the power plant equipment of the new Stuyvesant High School, just completed, and is available for instruction and testing purposes.

The Design of Wayside Stations for Single-Line Railways.

A paper by Frederick George Royal-Dawson, published by the Institution of Civil Engineers.

In the early days of railway construction in India the location and design of station-yards were based more or less on English ideas, which were themselves then in a comparatively undeveloped state. As traffic increased the stations were extended from time to time in a haphazard manner, in the attempt to keep pace with the growth of traffic. But this process could not go on indefinitely, and when the point was reached at which a yard could no longer be adapted to the increased traffic, it had to be entirely remodeled at considerable expense, with complete dislocation of traffic for the time being.

In many engine-changing stations, where the engine-shed had originally been built too close to the main platform, thus preventing the proper expansion of the yard, the press of traffic has at length compelled the removal of the entire locomotive yard to a more remote site. In other stations, again, where insufficient space had originally been left between the goods-shed and the main line, expansions of the goods-yard have had in consequence to be made on the opposite side of the main line, till the constant shunting of all goods-trains across the main line, which this arrangement necessitated, has become such an intolerable nuisance that an entire remodeling has been inevitable. Such remodelings are going on at the present time in all parts of India and absorb funds which might otherwise have been available for other purposes.

The growth of local traffic, however, is not the only factor which has necessitated the remodeling of station-yards. Another factor which has reacted on the design of many minor wayside stations is the modern demand for through trains at high speeds. This demand on the part of the public has synchronized with a growing recognition, on the part of railway managers, of the economic importance of getting the maximum use out of their rolling stock. The public and the managers are thus agreed as to the desirability of a certain percentage of fast trains and the expeditious transportation of goods; and, as safety is of the first importance under these new conditions, the principles of safe working have become a special science, the main fruits of which have been interlocking and automatic block-working. These two mechanical factors of safe working are being introduced gradually throughout the principal lines of India; and, although their use is not compulsory, their omission entails the imposition, in the one case, of speed-limits over facing-points, and in the other case, of irksome rules in connection with "line clear" messages.

Another factor which threatened to influence the design of station-yards a few years ago was the effect of quick-acting brakes on trains entering turnouts. It was considered that with the use of such brakes there was a tendency to enter turnouts at dangerously high speeds, and that the use of split turnouts, by easing the curvature, would mitigate the evil. But other considerations, to which reference will be made later, prevailed, so that the split turnout has never found favor, except perhaps on a few unimportant lines where fast non-stopping trains are not scheduled.

Types of Stations. Omitting large termini and junction-stations, which obviously require special treatment, different localities present such a variety of traffic conditions that wayside station-yards must necessarily be of many different types. Thus, comparing a busy double-line suburban railway, on which the stations are not more than about a mile apart, with a busy double-line section of a trunk-line up-country, having stations, say, six or seven miles apart, it will be seen that,

whereas a wayside station on the former consists of little more than an up line and a down line, each with its own substantial platform, and perhaps a trailing cross-over road, the trunk-line station requires in addition an up and a down lie-bye siding, and a more or less developed goods-yard on one side, to which access is obtained trailing from both the near and the off track, involving in the latter case a diamond-crossing over the near line.

Again, in single-line working the traffic conditions may be such that (*a*) all trains stop as a matter of course at every station, as in small branch lines, or (*b*) there is a large percentage of fast trains which do not stop at every station, as on important trunk-lines having a fluctuating local traffic. In the former case there may or may not be an up and a down platform, and the station may be approached either by means of a split turnout or otherwise. The number of signals may also be reduced to a minimum, and interlocking is not necessary. But in case (*b*) the station must be designed primarily for the safety of fast through trains, and secondarily for the development of local traffic; and as this class of station plays the most important role in the transportation problem throughout India, the question of a suitable design has been the subject of much discussion from time to time, and is even now far from being settled. In this paper, therefore, the author proposes to confine himself to a consideration of this problem alone, and will begin by reviewing some of the discussions on the subject which have taken place in India during the last few years, and the conclusions arrived at.

Double-line Principle Applied to Single-line Stations. In 1895 Mr. W. H. Cole, then deputy manager of the Eastern Bengal State Ry., having been on special duty in England for the purpose of studying the question, embodied his conclusions in a note on the design of yards for single lines in India. Briefly, the type which he advocated was that shown in Fig. 1, which involves an up and a down line, with corresponding platforms, trains from both sides entering the facing-points on the straight and running through the trailing-points on the turnout. This design was circulated, with others, by Mr. J. R. Bell, then consulting engineer for state railways, in 1896, among various railway officers, for the purpose of obtaining their opinions. On the assumption that the up and down line principle was desirable, the relative merits of this type, as compared with the symmetrical or split-turnout type (Fig. 2), were discussed. The general verdict was that for ordinary trains there was little to choose between the two types, except that the symmetrical type tended to minimize the length of the station. But for fast through trains it was held that the split turnout was a source of danger, and that the Cole type was preferable in that respect. Thus the split turnout became eliminated for the time being from the discussion, as unsuitable for lines having fast through traffic.

It was revived by Mr. F. J. E. Spring, when officiating director of railway construction, in 1902, on the ground that, with the introduction of quick-acting brakes, trains were liable to enter ordinary turnouts at excessive speeds, the effects of which would be mitigated by the use of split turnouts having easier curves. But in the discussion which followed, the verdict of 1896 was confirmed, inasmuch as the split turnout, although favorable to stopping trains, was a source of danger to fast through trains; for, however easy the curve might be, the real point of danger was at the switch, when that was set to divert a fast train from the straight. The danger, it was pointed out, lay in the tendency of the leading outer wheel of an express engine to mount the switch, especially if the wheel-flange were somewhat worn; and, as the safety of fast through trains was of paramount importance, it was held to be essential that at stations subject to fast through traffic the facing points at least must be on the straight.

It still remained to be considered whether the Cole type (Fig. 1) satisfied all requirements, or whether any other type would be preferable. This raised the preliminary inquiry as to whether it was necessary or desirable to preserve the double-line principle. No very clear reason could be given for compelling all trains, whether fast or slow, to take the left-hand road in entering a station beyond the vague plea that it was "English practice." It was thought to simplify matters for the driver, to diminish the risk of collision, and to simplify the signaling, as a train could be admitted by a one-armed home-signal at the facing-points, interlocked so as to be capable of being lowered only when the points were set for the straight. The single-line principle, however, by which all lines would be equally available for up and down traffic, presented no difficulties; for two-armed routing-signals at the points, the higher for the straight and the lower for the turnout, would give the driver all the information he wanted, while the List and Morse system of interlocking, as used on the North Western State Ry., illustrated how, at small cost, it could be made impossible for two trains from opposite directions to be admitted simultaneously on to the same line. Thus it was clearly established that the double-line principle was not necessary for safe working. It only remained to be seen whether it was desirable.

The system, it was pointed out, necessitated two platforms, so that passengers entering or leaving trains on the opposite side to the station-building would have to cross the line, which they would usually do on the level, even if an overbridge were provided. And even although the platform on the off-side might be merely a surface dressing at rail-level, so that the first cost need not be an obstacle, the difficulty of dealing effectively with an up and a down train at the same time without duplicating the staff was another permanent objection. It might be argued that these drawbacks exist at every station on a double line, but on a double line two platforms are a necessity, whereas on a single line, the necessity for two platforms disappears, and the question is reduced to one of expediency. Regarded in this light it is at once apparent that (*a*), with a given staff, trains can be far more economically and effectively dealt with from one platform than from two; and (*b*) with a single platform passengers are not exposed to the danger and inconvenience of having to cross the line.

There remains another side of the question to be considered, namely, the facilities for passing trains of different descriptions. The contingency of a slow train being side-tracked for a fast one in one direction, while another train was admitted from the other direction, necessitated the provision of a lie-bye siding available for trains from either direction, in addition to the two lines for crossing purposes. With the double-line principle of working, a lie-bye siding would have to take off (preferably in a trailing direction) from each through line; that is, two lie-byes would have to be provided, although not more than one would ever be used at one time. On the other hand, it was seen to be possible, by abandoning the double-line principle of working, and by making either line available for trains in both directions, to do with one lie-bye siding only, which would be "trailing" for one direction and "facing" for the other.

Single-line Principle. Thus, the advantages of what may be called the "single-line principle," as opposed to the "double-line principle" in working ordinary wayside stations on a single line, were established, and may be summed up as follows: (*a*) the double-line principle requires two platforms, the single-line principle only one platform; (*b*) the double platform involves a larger and more responsible staff than the single platform; (*c*) the double platform is more dangerous and more inconvenient to passengers than the single platform, and accidents can be prevented only by the erection of an overbridge and by the provision of extra supervision to enforce its use; the cost of the overbridge and the extra supervision are saved in single-platform working; and (*d*) the double-line system involves the construction of at least two lie-bye sidings, while the single line requires only one.

The issue is thus narrowed down to a question of the suitability, or otherwise, of the Cole type (Fig. 1) for single-platform working. From this standpoint it is at once evident that trains would be more favored in one direction than in the other. For, supposing the platform to be placed as shown at *A* in Fig. 1, trains from the right would always have a straight run to the platform, while trains from the left would either have to take the first turnout facing, or shoot past on the straight and, after passing the second turnout trailing, shunt back to the platform. The latter procedure would be appropriate enough in the case of crossing trains, but in the majority of cases when the train from the left had a clear platform it would approach by the turnout as a matter of course.

The defects of the design, however, are most apparent when a slow passenger train from the left and a non-stopping express from the right are approaching the station at the same time. The station master is confronted with the following dilemma: (*A*) if the slow train is admitted directly to the platform line, the fast train would have to be put on to the other line by a facing turnout; (*B*) if, on the other hand, the slow train is put on to the off-line, there would be difficulty in preventing passengers from attempting to cross the intervening track in the face of the fast train. Thus, in the handling of the two trains two alternatives are open, both of which are dangerous. But the danger arises from different sources in the two cases. In case (*A*) the danger lies in the alignment of the off-line, and would disappear if that were made straight, while in case (*B*) the danger lies, not in the alignment, but solely in the relative position of the two trains, and is inherent in any system which allows a fast train to pass between a halted passenger train and a platform. These considerations simplify the issues, for case (*A*) clearly indicates that the run-through line should be straight from end to end, the other line thus becoming a loop, and case (*B*) equally clearly indicates that the run-through line should not be between the loop and the platform.

Platform on Straight vs. Platform on Loop. The principle of the straight run-through, deduced from case (*A*), has now been generally accepted by railway authorities, in supersession of the Cole type. But the principle of the platform on loop, deduced from case (*B*), has not by any means found general acceptance. In fact, when in 1896 and again in 1902 the various Indian railway officers were asked to choose between the two types shown in Figs. 3 and 4, which may be described as "platform on straight" and "platform on loop," respectively, and both of which satisfy the condition of a straight run-through, a surprisingly large number voted in favor of the former, Fig. 3. The reason given for this preference was to avoid the lurch at the turnout to which all stopping trains were subject when the platform was placed on the loop, as in Fig. 4. The danger of allowing a fast train to pass between the platform and a side-tracked passenger train which the former type involved was lightly considered, and in some cases ignored altogether, by the adherents of this type. It was held that the undoubted comfort of the many should out-

weigh the problematical danger of the few. On the North Western State Ry., however, where the ratio of non-stopping to stopping trains, including goods-trains, was comparatively large, namely about one to seven, the verdict was strongly in favor of the platform on the loop, Fig. 4.

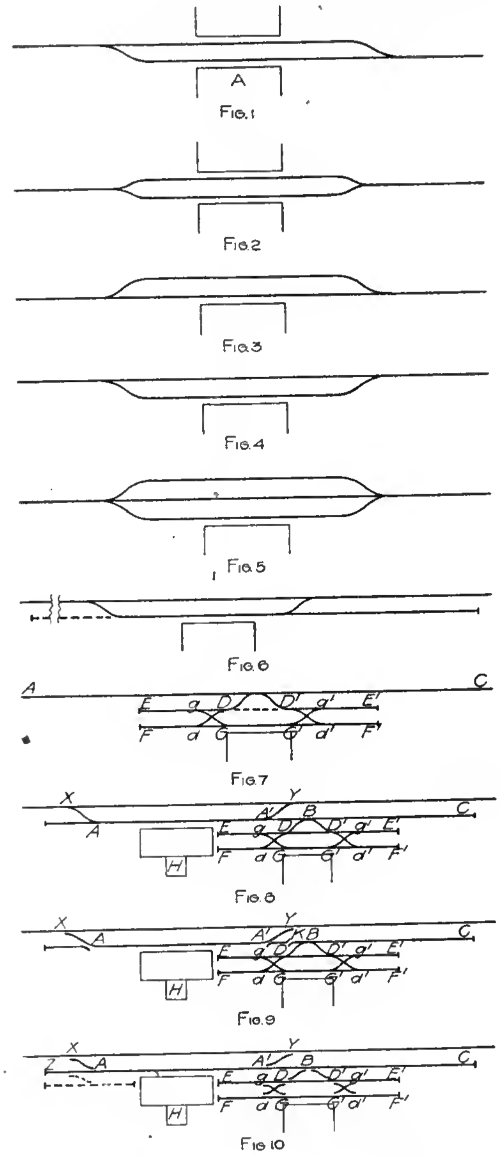
It would thus appear that there were objections to both types, and that the factor which determined the choice for any particular railway was the ratio of fast to slow trains on that railway. This would imply that, as fast traffic increased, the stations of a given railway should be changed from the first to the second type, and vice versa when the fast traffic decreased, a manifestly absurd proposition. Moreover, there is a general tendency on most railways to increase the number of fast trains. It therefore becomes necessary to weigh the objections of each type seriatim.

Taking first the platform on straight type, the reality of the danger of allowing a fast train to dash between a halted passenger train and the platform has been proved over and over again. As an argument it might not carry much weight in a civilized country such as England, where passengers and employees are well able to look after themselves. But in India, no amount of supervision is sufficient to keep foolish and careless passengers and employees from attempting to cross the intervening track in the face of an aproaching express. Time, also, is lost in side-tracking a stopping train to allow a through train to cross, and if time is limited the probability is that the stopping train will be allowed to remain at the platform, while the fast train is diverted over the loop—a dangerous alternative. Moreover, the long stoppage of a train on a siding facilitates evasion of the ticket collector, a drawback which, although not serious, must be considered as inherent in the type. There are thus three permanent objections to this type, while the sole feature in its favor is the straight run for all but crossing trains.

Considering next the platform on loop type, the sole objection to it is the lurch to which stopping trains are subjected on taking the turnout. This lurch, it is contended, is a three-fold evil. It is dangerous when turnouts are taken at excessive speeds, as often occurs when quick-acting brakes are used; it is always unpleasant; and it increases the wear and tear of the permanent way as well as of the rolling stock.

The risk of taking turnouts at excessive speeds is, however, a relative rather than a positive danger. As interlocking prevents the risk of splitting the points, the danger is confined to two sources, namely, the risk of the outer leading wheel of the engine mounting the switch, when the flange is unduly worn, and the overturning tendency due to the necessarily limited superelevation. In either case the risk depends on controllable factors, namely, the condition of the tires, the speed of the train, and the curvature, etc., of the turnout. A practical limit to the speed is derived from the fact that the driver has to bring his train to a standstill at the platform. This in itself is a safeguard, whatever arbitrary restrictions of speed over turnouts may be imposed, for experience shows that however prone a driver may be to ignore speed restrictions, stopping trains do not in practice enter turnouts at a greater speed than about thirty miles per hour. Accepting this limit, there would be no excuse for an engine mounting the switch if the wheel-flanges and the points were kept in reasonably good order, as they should be; in fact, even with flanges worn to a sharp edge, mounting is extremely unlikely to take place in ordinary practice.

With regard to the danger of overturning, or of broken springs, it ought not to be impossible to design a turnout capable of taking a train with safety at thirty miles per hour. On the Indian standard gauge (5 ft. 6 in.), with tracks 15 ft. apart, center to center, curves of about 1,600 ft. radius, with crossings one in twelve and switches 15 ft. in length, are frequently traversed by trains at thirty miles per hour (against rules, it is true) with impunity. If this is held to be dangerous the remedy would appear to lie in easier curves and longer switches, rather than in speed restrictions, for as long as the latter are imposed, much of the advantage of quick-acting brakes is lost, and train movements are unnecessarily hampered.



Different Station Arrangements.

But the author is inclined to believe that the standard, one in twelve turnouts, if scientifically laid out and fitted with 18 ft. or 21 ft. switches, and properly maintained, could be made available for much faster traffic than is at present allowed. In this connection the question of whether a certain amount of superelevation could be given at the points without detriment to the running qualities of the straight road is worthy of investigation. But these are technical details which need not be discussed here. They are alluded to merely for the purpose of indicating the possibility of improving the design of turnouts, so as to take trains comfortably at thirty miles per hour, without materially increasing the length of a station yard.

The foregoing remedies would also have the effect of mitigating, to a large extent, the discomfort of the lurch. The increased wear and tear of rolling stock and permanent way on the turnout is confined in the present case to the extra wear and tear caused by fast trains; but as the majority of the trains using the turnout would not be fast trains, the objection under this head is hardly worth considering.

A simpler remedy than any of the foregoing for the evils of the platform on loop type is suggested by certain existing practices. The first practice to which reference will be made is that on certain railways, when two passenger trains cross at a wayside station, the first train draws up at the platform as a matter of course (whether the platform is on the loop or on the straight), and the second train draws up on the second line, clear of the rear of the first train, where it is at once dealt with. The second train thus does not get the benefit of the platform at all, but, as far as the author has observed, no inconvenience is caused thereby, either to the passengers or to the staff, provided the space between the rails is leveled up and dressed with fine metal, and provided the platform is not inconveniently high. Where, as at many wayside stations, the platforms are of the "flush" or rail-level type, the second train suffers practically no disadvantages whatever over the first.

There is no danger in crossing the track in this case, because the crossing is done in rear of a train that has just arrived, so that no one can get run over unless the first train is backed. Even in the latter contingency the danger is very remote, for at worst the backing could only be due to shunting movements in front, the effects of which would not reach the rear of the train without timely and audible warning. The second practice to which it is desired to draw attention is the use of "flush" or rail-level platforms at many wayside stations. To the average third-class passenger of India a high-level platform is an unnecessary luxury. The carriage foot-boards afford all the facilities necessary for egress and ingress; in fact, on occasions when goods-wagons have to be employed for the conveyance of passengers (as frequently occurs when there is a shortage of carriage stock), it is found that passengers, whether male or female, have no difficulty in getting into them from any platform level. The author does not defend the practice of using goods-wagons for passenger traffic, but the fact is cited in support of the contention that, with proper coaching stock, raised platforms are not indispensable for wayside passenger traffic, either on the 5 ft. 6 in. or the meter gauge.

This point being established, and considering that trains are occasionally dealt with on the second line without inconvenience, the author ventures to suggest that if flush platforms were generally adopted at wayside stations, and extended up to the second track (as they might easily be) there would be no need to bring stopping trains on to the loop at all, except for crossing purposes. If this principle were accepted, the main objection to the platform on loop type of station would disappear altogether, as the loop would then be used only on special occasions, e. g., by the first of two passenger trains which have to cross, or by a passenger train crossing a goods-train. It would then only be necessary for the station staff to see that passengers waiting for a train did not spread themselves beyond the limits of what may be called the permanent or "waiting" platform, which might be slightly raised or otherwise demarcated to emphasize its functions. In short, if the three objections to the platform on straight type be set against the three objections to the platform on loop type, it is found that the former outweigh the latter at every point, for the former contain unpreventable elements of danger, whereas in the latter the danger element is reducible to one of discomfort only, and this can be mitigated or eliminated entirely by the method just suggested.

Position of Platform in Relation to Traffic. Assuming that the platform on loop type is adopted, the next question is whether it matters from which side of the main line the platform takes off. This question has also been ventilated, and the general consensus of opinion is thus summed up by Mr. C. W. Hodson:

(1) Fast or heavy traffic calls for continuous brakes, and the adoption of continuous brakes with fast traffic necessitates interlocked routing signals, which render it unimportant which side of the main line the turnout takes off.

(2) Consequently there is no need to put either the loops or the platform uniformly on any particular side of the line, but in the absence of any special reasons to the contrary the loop may preferably be put on the side on which the line will eventually be doubled.

As regards the latter portion of the second paragraph, the author has seen the principle of uniformity carried to extremes. One side of the line is selected for future doubling (a contingency usually more or less remote), and all platform-loops are placed on that side whether it suits the local traffic or not, with the result that in many cases a fairly important town, which has been keenly interested in the construction of the line, finds itself finally on the wrong side of its station, to which access can be gained only by means of a remote level crossing at the extreme end of the yard. In the opinion of the author, the more elastic principle of locating a platform on whichever side is more convenient to local traffic is preferable, in that it tends to foster better relations with the public, and simplifies the work of the traffic department, while it need not prejudice the question of future doubling; for supposing a loop to occur on the opposite side of the line to that selected for doubling, matters could easily be put right, when the need for doubling arose, by a local realignment involving a lateral deviation of 15 ft. one way or the other from the original main line. In the absence of any special reason to the contrary, it would, of course, be proper, as pointed out by Mr. Hodson, to put the loop on the doubling side. This would occur, for instance, when a crossing station serves half a dozen unimportant villages equally on both sides of the line.

Lie-byes. The location of a lie-bye, to meet the contingency of a slow train being side-tracked for a fast one in one direction, while another train is being admitted from the opposite direction will next be considered. From a traffic point of view, the simplest device would be a second loop on the offside of the main line, as shown in Fig. 5, but the paramount importance of safeguarding fast trains necessitates the use of some form of interlocking, so as to secure the isolation of the run-through line. Traffic conveniences must therefore be governed by the price which the administration is prepared to pay for their safety. Regarded in this light, it is evident that the fewer facing points there are on the main line, the cheaper the interlocking will be, and consequently the simpler the working, whatever system may be adopted. In fact, it may be taken as a general rule that it does not pay to have more than one set of interlocked facing-points each way in an ordinary wayside station.

This being the case, the type illustrated in Fig. 5, which has two sets each way, must be rejected as too expensive, although undoubtedly convenient, and it is therefore necessary to take the lie-bye off the platform loop. But as the platform prevents the lie-bye from taking the form of a second loop, the form eventually adopted is necessarily that of a long dead siding, as shown in Fig. 6. This is the type now generally adopted on state railways, and is the cheapest form from the point of view of [illegible]. The shunting of a train into the lie-bye and its subsequent extrication are tedious and troublesome operations, and in some cases a certain amount of maneuvring is required, as, for instance, when a stopping passenger train from the left and a slow goods-train from the right arrive in succession, and the latter has then to be side-tracked for a fast through train from the right; in fact, in this case, if pressed for time the goods-train could not be got into the lie-bye without great delay, and the probability is that, in order to save time, the passenger train would have to go there while the goods-train occupied the loop. Such cases, however, are usually rare, and the temporary inconvenience involved has hitherto been accepted as inevitable. The inconveineince would still exist even if the lie-bye were placed in the alternative position shown by the dotted line in Fig. 6, or in both positions. On this point the author will have something more to say later on.

Goods-Yards. On the question of the development of a local goods-traffic various opinions have been held, some officers being in favor of having the goods-shed opposite the passenger platform, so as to be under the eye of the station master, rather than on the same side, where it would necessarily be some distance off, imposing on the station master a certain amount of trouble and loss of time in walking backwards and forwards, with the alternative of neglecting either the goods work or the station work. On most wayside stations of this class the superior staff consists only of a station master and his assistant, who work by relief, only one being on duty at a time; and the man on duty has to combine the duties of train signaler and goods clerk. Two or three menials complete the establishment. There is thus no doubt that a goods-shed opposite the station building would be more convenient, from the station master's point of view.

This arrangement, however, means a reversion to the type shown in Fig. 5, which has been shown to be too expensive, by reason of the extra interlocking involved. Moreover, from the point of view of the public, if the passenger platform is on the natural passenger traffic side of the line, as it ought to be, the natural goods-traffic will almost invariably be on the same side. Therefore, the type shown in Fig. 5 would be not only too expensive, but unsuitable to the public. Hence the predilections of the station master have to give way to the combined exigencies of economical working and public convenience; and if it is found in a rush of traffic that one man cannot efficiently attend to both the station and the goods work, the proper remedy would be to engage an extra man temporarily. Thus at every turn the design of a station yard of this class involves a choice of evils; and having arrived at the conclusion that the goods-yard must usually be on the same side as the passenger platform, the next step is to consider how it should be laid out.

In many cases the steps taken for creating a goods-traffic are tentative, in the first instance, and very often an extensive traffic is developed from very small beginnings. It is therefore very desirable that the first sidings laid down, however modest, should form part of the future design of a fully developed yard. The goods-shed has to deal with both outward and inward traffic; therefore the sidings should be so arranged that a goods train from either direction can readily detach and pick up wagons, whether loaded or empty, from suitable sidings in the neighborhood of the goods-shed. Let B (Fig. 7) be a point on the train siding $A\ B\ C$ opposite the goods-shed $G\ G'$. An engine arriving from A with wagons to be detached would draw up in $B\ C$, clear of B, then shunt back over a cross-over $B\ D$, giving direct access to two sidings $D\ E$, DdF, one of which would be kept clear to receive the "inward" wagons, while the other would contain the "outward" wagons, previously assembled in readiness to be attached. Thus, with a minimum of shunting and in the shortest possible time, the engine would have detached its inward and attached its outward load, and returned to $B\ C$ ready to rejoin its train in $A\ B$, and thence proceed on its journey. Similarly, a train arriving from the direction of C would require a corresponding cross-over $B\ D'$ and sidings $D'\ E'$, and $D'd'F'$. It only remains to provide access from both sets of sidings to the goods-shed. This can be done most compactly by providing a platform line $d\ G\ G'd'$ and inserting scissors cross-overs Dd, Gg, $D'd$ and $G'g'$. The movements of individual wagons between the platform and the various sidings would, of course, be effected by hand shunting.

On the North Western State Ry., where this type of goods-yard is in vogue, the sidings are long enough to hold, say, fifteen wagons each, and the platform line a similar number. If further platform accommodation is required one of the scissors cross-overs is simply moved further out, say, to double the distance, and the platform line is extended to hold thirty wagons. Ordinarily, not more than fifteen wagons are ever likely to be received or dispatched in one direction at a time, so that dead sidings long enough to hold fifteen wagons each are found to suffice, but a platform of double that capacity may be necessary in case of up and down traffic being equal in bulk at any time, as sometimes happens. Further accommodation may be given by joining up $D\ D'$, as shown by the dotted line.

For stations in embryo the portions $F\ G$ and $F'\ G'$ and the cross-overs Dd and $D'd'$ are omitted. In the earliest stages, when the traffic prospects do not amount to more than one or two wagons a day in either direction, no platform is provided, and the "yard" consists of a single cross-over $B\ D$ or $B\ D'$, leading from the train line to a short siding $E\ E'$ on which all traffic is dealt with. If a shed is required, it is made portable, so as not to prejudice future extensions.

Accepting Fig. 7 as the normal type of goods-yard, based on common sense principles, the next step is to fit it into the station plan, Fig. 6. It has already been shown that it must be on the platform side. The first device that suggests itself is to merge the approach siding $A\ B\ C$ of Fig 7 into the lie-bye in Fig. 6. This is, in fact, what is usually done, the only objection to it being that, in a certain contingency, already alluded to, a goods train on arrival might find the lie-bye occupied by a passenger train, the main line being cleared for an expected through train. If such a contingency is likely to be of frequent occurrence, a second lie-bye can easily be put in, as shown by the dotted line in Fig. 6, and one of these lie-byes, say, the right-hand one, reserved as the base of the goods-yard. Usually the second lie-bye is not necessary, a short dead siding being sufficient there as a trap.

The yard will then finally take the form shown in Fig. 8. The minimum distance between the station platform and the near end of the goods platform is fixed by the length of the sidings $D\ E$ and $G\ F$, which must be at least equal to the length of fifteen wagons plus the length of the scissors cross-over. The station platform being 600 ft. in length, the distance from the station building H to the nearest point of the goods platform G, amounts to about 850 ft., on the standard gauge. Hence, if the goods platform is 720 ft. in length (sufficient for thirty wagons) the station master's average walk from the station building to the center of the goods platform is 1,210 ft. which in the hot weather might be traversed in five minutes.

Interlocking. The means by which such a yard can be interlocked have still to be considered. On the North Western State Ry., where the List and Morse key-locking system is in use, the goods-yard is trapped at K, between A' and B (Fig. 9), and the points A and A' are kept normally locked off the loop, and cannot be unlocked and set for their respective dead sidings when a loop-signal is lowered at the facing points X or Y of the main line. The result is that no train can be admitted directly into a dead siding from the main line. It has to be brought first on to the loop, where it then has to wait till the

desired road is made. This is done in the following manner: The points A' and the trap K are set and locked normally, as shown in Fig. 9, by means of a Hepper double-key lock at K and a single-key lock at A'. To set the points for the siding, a key, called the "station key," is obtained from the station master, the issue of which locks the loop-keys, thus preventing loop-signals from being lowered while the "station key" is in use. This station key is taken to the double lock at the trap K and inserted in its proper hole and turned. This releases the switch, which must next be reversed and set for the siding. This releases a key, called the "points key," from the other compartment of the double lock. The extraction of the points key prevents the trap from being again reversed, and so locks up the station key for the time being. The points key is then inserted and turned in the lock at A', thus unlocking the points, which can then be reversed and set for the siding. This reversal locks up the points key, so that when the siding is in use neither the points key nor the station key can be extracted and no loop-signal can be lowered. Consequently, if it is desired to admit a running train on the loop, the siding must first be restored to its normal setting and locked off the loop, and the station key returned to the station master before the key for the loop signal can be issued.

It will be understood from the foregoing that any key locking system, although securing at small cost the absolute safety of the running lines, entails a certain amount of delay in bringing the siding into use, and again in restoring it to its normal setting. A rodding system would be more expeditious, but the cost would usually be prohibitive for wayside stations. These drawbacks are beginning to be realized more and more every day. The more complete the interlocking, the more paralyzing is its effect on ordinary traffic operations. The safety of through trains is secured at the expense of station to station traffic. If the interlocking is only partial, ordinary traffic may be expedited, but the security of through trains is no longer guaranteed. On a certain Indian railway, where platforms are almost invariably on the main line, and a second loop takes off the first, the interlocking is confined to the facing points on the main line. Sidings are not trapped, and the only protection is that afforded by the use of Scotch blocks, which may or may not be left open. This cannot be considered a satisfactory state of affairs, but there are only two fast trains a day each way on this line, and as long as these suffer no mishap there is a tendency to be satisfied with existing arrangements, especially as they facilitate the handling of ordinary traffic.

Suggested Modifications. While it is illogical to aprove of partial interlocking, it must be admitted that excessive interlocking sometimes constitutes a serious inconvenience in a rush of traffic. It raises the question whether, after all, a little elasticity should not be permitted in applying to wayside stations some of the tenets of interlocking, which in their entirety constitute a "counsel of perfection" difficult to attain in practice. For instance, the first golden rule of interlocking is the complete isolation of running roads, and the second is the trapping of all lines leading from goods lines and sidings to the running roads. Both these conditions are fulfilled in the North Western State Ry. type of wayside station, the running roads being the main line and the loop. But the isolation of the loop as well as the main line throws difficulties in the way of handling ordinary traffic. Reference to Fig. 9 will show that a train on the lie-bye must be completely locked in before another train can be admitted into the loop. The author contends that as long as the lie-bye is used only by bona fide trains, i. e., trains consisting of vehicles coupled to one another and attached to an engine in steam, it is not necessary to lock it off from the loop, as with such trains there would always be a responsible man at the near end.

If this point is conceded, it is possible to introduce the simple arrangement shown in Fig. 10, where the erstwhile loop becomes a disconnected line, to which access from the main line is gained by cross-overs XA, YA' from the facing points X and Y. Each cross-over would be rodded and worked by a single lever in the same way as simple facing points, whatever system of interlocking were used, the only difference being that the moving of a cross-over would involve a slightly greater effort than the moving of a single set of points. The only extra rodding necessary would be that required to connect X with A and Y with A'. The safety of fast through trains is secured as before.

It only remains to consider what risks may be incurred by a stopping train entering the loop. The first risk is that the cross-over may be reversed too soon after the train has cleared the facing end, which may be unlocked immediately after its passage, and before it has cleared the trailing end, which it would not be practicable to lock. But no more serious accident than burst trailing points would ensue from that remote contingency; and even if these burst trailing points were not detected before the next loop train from the opposite direction entered them facing, the ensuing derailment would not be serious nor likely to foul the main line. Point indicators would, of course, be used. The only other risk is that of runaway wagons fouling the loop. As regards this contingency, there would never be any occasion, nor any inducement (even if there were no orders on the subject) to stable wagons on the lie-bye siding A' B C; and the short dead siding A Z is merely intended as a trap, although possibly a short siding for spare carriages might be connected with it by a cross over, as shown by the dotted lines. Hence, if any loose wagons escaped from the goods-yard they could only get on to the lie-bye when the cross-overs B D, B D' were set for that line. It would then require a wind blowing in the direction C to A or a falling gradient in that direction to cause these wagons to foul the loop.

The gravitation factor of the problem could be met by making the cross-overs B D, B D' fall, say, one in fifty towards the goods-shed sidings, putting the latter at a lower level. As a further precaution the lie-bye might be given a slight fall from A' to C, but this is not altogether desirable, as trains using it would have difficulty in getting out again. It is better that it should be level. Runaways can then be caused only by a sufficiently strong wind blowing from C to A. Wind in this direction would not affect the wagons on the sidings E and F, but it might start those in the sidings E' and F'. The conditions for a runaway then would be (1) the cross-over D' B must be set for the sidings, (2) there must be loose wagons in one of the sidings E' and F', (3) the Scotch blocks must be open, (4) the wind must be in the direction C to A, and must be sufficiently strong to blow wagons up the one-in-fifty gradient over D' B. Hence if any one of the foregoing factors can be circumvented the problem is solved, and there can be no runaways. To circumvent the first three factors, by interlocking or otherwise, would be costly; but the fourth can be nullified by the simple device of erecting a wind-screen to protect the sidings E' and F', if they are not already sheltered by existing local features.

It will be seen that the station is now so interlocked that the safety of the through line is absolutely, and of the loop practically secured, while access to the lie-bye and goods-yard can be obtained at all times without the delay entailed under the systems previously described, where the lie-bye and goods-yard are normally locked off from the loop, as shown in Fig. 9. Moreover, it will be seen that as long as the loop is not required for a running train (which would be the normal state of affairs) the lines B A and B C (Fig. 10) form perfect isolated shunting necks for goods-trains in both directions.

It is true that when a passenger train is halted on the main line opposite the platform the portion of neck B A available for shunting purposes would be temporarily curtailed, so as not to screen the passenger train. But as shunting operations could be suspended at any instant at a sign from the station master this arrangement would present no traffic difficulties. The great advantage is that there are no interlocked traps or points to prevent the siding from being available for use at any moment, and thus a great saving of time is effected when there is any shunting to be done.

This type (Fig. 10) involves a quasi-infringement of the interlocking rules, which prescribe generally for the protection of running roads, without reference to their individual importance. But, as in wayside stations the main line alone is used by fast through traffic, the protection of which is the raison-d'etre for interlocking, while the loop is used only by stopping trains, for which the protection afforded by interlocked traps would not ordinarily be considered necessary, it appears to be a reasonable compromise, in this class of station (assuming that the exigencies of shunting preclude the general adoption of the more perfect type, Fig. 9), to treat only the main line as a running-road for interlocking purposes.

Dead Sidings vs. Loops. The inherent defect of the dead siding form of lie-bye is the delay involved in backing a train into or out of it. When traffic is heavy, such delays mount up. Even with the simplest system of interlocking, the time spent by a heavy train in entering and emerging from a dead siding is almost equal in many cases to that which it would occupy in running between two neighboring stations. On account of this defect, although a yard arranged on the plan just described would reduce the delay to a minimum, traffic officers do not take kindly to the dead siding principle for crossing purposes, and would welcome any loop system that combined facility of movement with safe working. Where the platform is on the straight, it is customary for a second loop to take off the first, and, although in the absence of efficient trapping this arrangement is not conducive to the safety of fast through trains, it undoubtedly saves time when three trains have to be dealt with. It is worth while considering, therefore, whether a second loop can be provided without sacrificing any of the principles involved in the adoption of the type shown in Fig. 10.

Accepting the two hypotheses that a raised platform is not necessary and that tracks may intervene between the "permanent" platform and a stopping passenger train, it would be easy, by setting back the permanent platform another 15 ft., to introduce a second loop between the first loop and the platform. The straight would still be used, in the ordinary course, for the reception of trains, passengers merely having to cross two intervening tracks instead of one; and for the crossing of two trains the straight and the first loop would be used as before. But when three trains have to be accommodated there is no doubt that the second loop would be used on all occasions in preference to the lie-bye. The latter would thus become a goods-siding only. In the case of side-tracking a goods-train and a passenger train, the passenger train would take the platform line and the goods-train the middle line.

as a matter of course, no matter which train arrived first. The goods-train might even be able to carry on its shunting during the interval.

The second loop therefore presents considerable advantages, but it is doubtful whether it could be safely used without complicating the interlocking arrangements. Supposing the interlocking to be initially confined to the facing points of the main line, combined with the use of coupled cross-overs, as described in connection with Fig. 10, the insertion of a second loop would involve two sets of facing points for all trains turned off the main line. If such trains had continuous brakes, it would certainly be necessary to ensure the correct setting of the second facing points before the loop signal was lowered. This could only be done by extending the system of interlocking so as to provide for three-armed interlocked signals at the main line facing points, the third arm referring to the second loop. The expenditure involved in such extra interlocking would not be justified except perhaps at selected stations of growing importance.

But in laying out a new line of railway the future development of wayside stations can never be foreseen with any certainty. It has often happened that a station which has originally been inserted midway between two other stations merely for crossing purposes, and for no other reason, has subsequently developed a local traffic which has necessitated in the course of a few years its expansion out of all recognition. It is therefore necessary, when first laying out a station, no matter how insignificant its traffic prospects may appear at the time, to allow for future development. The author therefore ventures to suggest that when the platform on loop type of station, as shown in Fig. 9 or Fig. 10, is adopted, the permanent platform should be set sufficiently far back to enable a second loop to be put in at any future time, if found necessary. This involves merely placing the station building about 15 ft. farther back than it would otherwise be in the first instance.

In conclusion, the author desires to acknowledge the assistance afforded him in the preparation of this paper, not only by personal intercourse with various railway officers in India, but also by the various publications of the late Technical Section of the Indian Public Works Department, issued under the personal direction of Mr. C. W. Hodson, C. S. I., M. Inst. C. E., late Secretary to the Government of India for Railways.

AN AUTOMATIC RAILWAY CROSSING GATE for electric railways is in use on an interurban electric road near Montreau, Austria. It is a light pole pivoted in a small housing at one side of the roadway, and counterbalanced so as normally to stand vertical. It is operated by a 1-10 h.-p. series-wound electric motor, using current from the trolley wire. The motor is mounted in the housing above the axis of the gate and drives through a reduction gear a worm, on which a cable may be wound. The cable is fastened at one end to the counterbalance weight of the gate and at the other to the worm, the action of the motor being to wind up the cable and raise the counterweight, thus lowering the gate. The last few turns of the worm are of rapidly increasing radius, so that, at the end of the wind, the increased leverage stops and holds the motor; when the current is cut off, the motor releases and the counterweight unwinds the cable and raises the gate. Operation of the gates is rendered automatic by an auxiliary wire, which is strung beside the trolley wire near the crossing, so that the bow collector of the car, in approaching, makes contact with it and admits current from the trolley wire, the auxiliary wire connecting with the motor, which holds the gate down as long as the car is [illegible] the crossing.

Diagrams to Determine the Bearing Power of Piles.

By G. F. Stickney, M. Am. Soc. C. E.

Many structures of the New York Barge Canal must necessarily be built on pile foundations, which will be located in earth of variable supporting power. In the preparation of the plans and specifications, the piles are spaced so as to have a certain maximum loading, and provision is made for driving test piles to determine the length required to bear this load.

In order to secure uniformity in conducting these tests, the following instructions were prepared and Diagrams 1 and 2 were constructed to facilitate the work in the field, as, by their use, the safe load for any pile may be instantly determined.

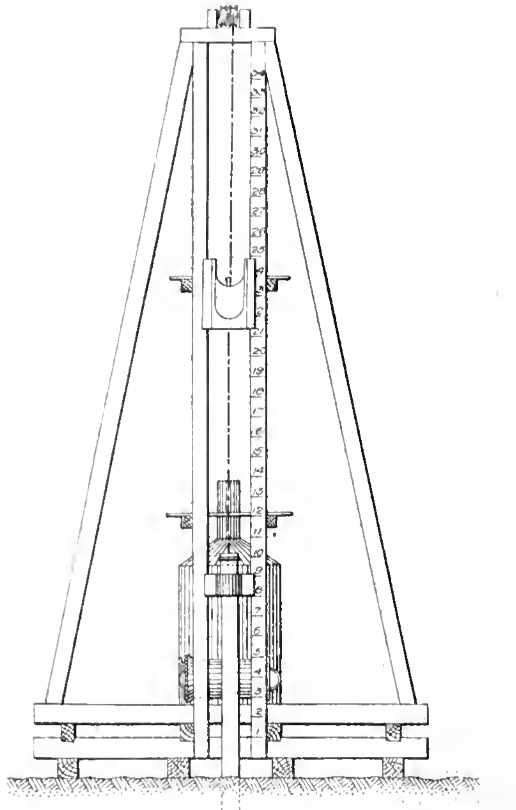
Instructions.—Where test piles are driven, to determine the length required in foundations of structures, the safe load will be determined by the following formulæ:

1. For drop hammer $L = 2wh \div (s + 1)$.
2. For steam hammer $L = 2wh \div (s + 0.1)$.

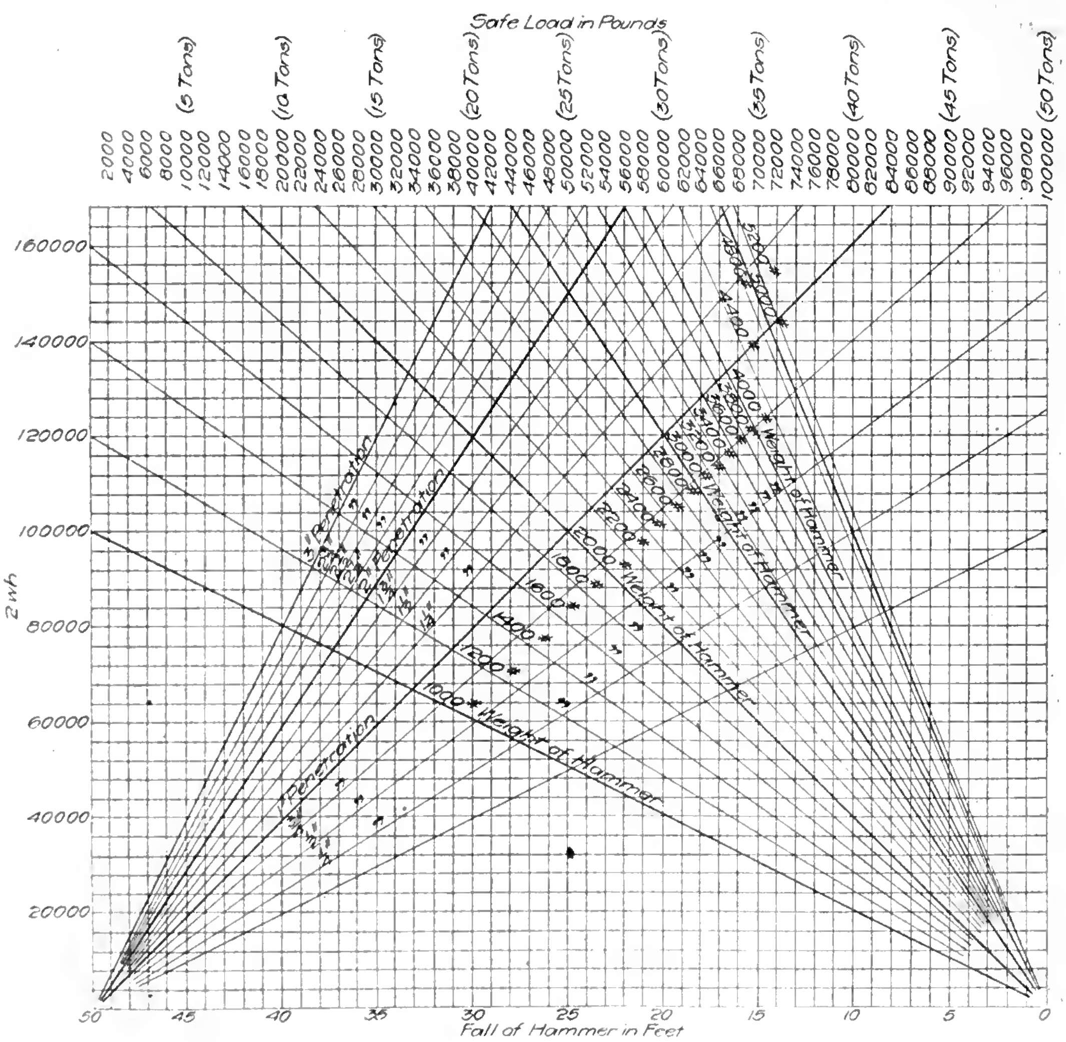
Where L = safe load, in pounds; w = weight of hammer, in pounds; h = fall of hammer, in feet, and s = penetration under last blow, in inches.

The required load is indicated on the plans and in the specifications.

Test piles must be driven in the foundation,



Pile Driver for Testing.



Safe Load on Piles Driven with Drop Hammer.

Follow the diagonal line for the weight of the hammer to its intersection with the vertical line giving the fall of the hammer; from this point follow the horizontal line to its intersection with the diagonal line giving the penetration; from this point follow the vertical line to the top of the diagram where the safe load is stated.

after the same has been fully excavated. One test pile shall be driven for each 500 piles, or less, in the structure, but not less than three piles, of each class, for each structure, and they shall be located so as to develop the conditions over the entire area.

If the test is to be made with a drop hammer, mark the leads of the pile driver in feet (as shown on the accompanying sketch) and ascertain the weight of the hammer. Select a pile somewhat longer than the probable length required and drive same. When the penetration under each blow becomes approximately uniform and but a fraction of a foot, stop the driving and let the hammer rest on top of the pile.

Make a pencil mark on the leads just at the

bottom of the hammer and note the position, as indicated by the scale on the leads.

Now instruct the engine runner to strike ten blows on the pile, raising the hammer to about the same height (15 to 20 ft.) each time, before letting it fall.

Stand in front of the pile driver and note the height reached by the bottom of the hammer before each blow.

On the completion of the ten strokes average the height reached by the hammer.

Let the hammer rest on top of the pile and make a second pencil mark on the leads.

Find the average fall of the hammer by taking the mean of the two pencil marks, on the scale of the leads, and deduct from the average height reached by the hammer. Measure carefully, with a rule, the distance between the pencil marks, in inches, and the result is the total penetration of the pile under the ten blows of the hammer.

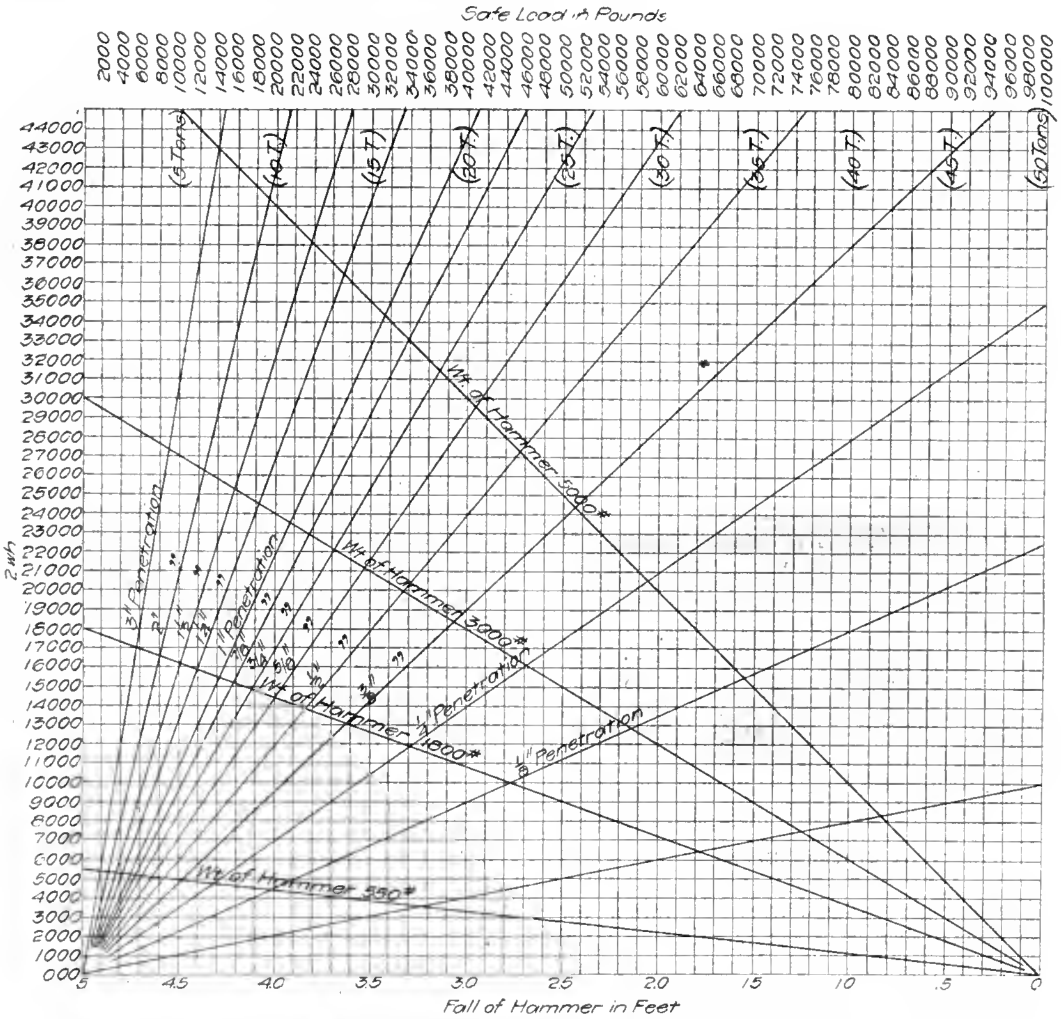
Assume that one-tenth of this amount is the penetration under the last blow.

The weight of the hammer, the fall of the hammer and penetration under the last blow are now known and the safe load may be calculated by the formula, or may be taken off Diagram 1.

Repeat the process, if necessary, until the pile is driven to a depth that gives the required supporting power. Measure the length of pile extending above the plane of the cut-off and deduct from the original length of the pile; the result is the length required.

If the test is to be made with a steam hammer, no particular preparation is necessary beyond learning the weight of the striking part and the normal stroke of the hammer.

The average penetration under ten blows of the hammer should be used as above, and the safe load may be determined, either from the formula or by Diagram 2.



Safe Load on Piles Driven with Steam Hammer.

Follow the diagonal line for the weight of the hammer to its intersection with the vertical line giving the fall of the hammer; from this point follow the horizontal line to an intersection with the diagonal line giving the penetration; on the top of the vertical through this point will be found the safe load.

Book Notes.

A third edition of Mr. Chas. H. Sames' "Pocket-book of Mechanical Engineering" has just appeared. Previous editions were noted at some length in this edition, and it is only necessary to say that in the new edition of this valuable little pocket-book, information has been added concerning high-speed tool steel, based upon the well-known paper presented by Mr. F. W. Taylor before the American Society of Mechanical Engineers a year ago, on the specific heat of superheated steam, on several features of machine design, and on reinforced concrete, the information under the last head being largely based upon the report of the British Committee on reinforced concrete. This pocket-book is sold at $2 by the author, whose address is 542 Bramhall Ave., Jersey City, N. J.

In February of this year, Dr. W. Michaelis read an interesting paper before the thirtieth annual meeting of the Association of German Portland Cement Manufacturers, which has just been translated by his son and published under the title of "The Hardening Process of Hydraulic Cement." It is an explanation of the more important experiments Dr. Michaelis has been conducting for many years for the purpose of ascertaining what phenomena occur when cement hardens, and gives various deduction from these experiments which may be summarized in the following quotations from the monograph: "All the phenomena are easily reduced to and found to be based upon the following two processes: 1, Formation of a colloidal, fundamental substance, composed of calcium hydro-silicates, calcium hydro-aluminates, and calcium hydro-ferrites, which forms the characteristics and essential part of all hydraulic cements and is the cause of their hydraulicity. 2, Formation of crystalloids, as for instance, calcium aluminates, calcium sulphates, calcium and magnesium carbonates and calcium sulpho-aluminates, which as a rule increase, even sometimes considerably increase, the strength of the ground mass in which they are embedded, but which at the same time cause formation of cracks within the hardened colloids, thus admitting solutions and leading to destruction; in other words, existence of properties of crystallation, which are the cause of instability and short life of the hydraulic cement." (Chicago, Cement & Engineering News, 50 cents.)

There are few subjects now attracting more attention from engineers interested in the maintenance of railway track than that of the effect of trains upon rails and their fastenings. The Pennsylvania Railroad Co. is now conducting elaborate tests to ascertain just what is the effect of both steam and electric locomotives on tracks, and when the results of this investigation are made public, the information will be of the highest value. Until then, the engineer will find the most experimental information on the subject in the valuable monograph by G. Cuenot, which has recently been translated by Mr. W. C. Cushing, chief engineer of maintenance of way of the Pennsylvania Lines West. This monograph, entitled "Deformation of Railroad Tracks and the Means for Remedying Them," gives the results of many experiments on the lines of the Paris-Lyons-Mediterranean Ry. This method of securing information is the direct opposite of the elaborate theoretical studies based on assumptions which have been made by a number of German engineers. The deformations studied include creeping, the reduction of gauge on tangents, the spreading of gauge on curves, the compression of tie at its supports, the tearing out of screw spikes, the poor holding of the joints, and the vertical deformation of the rail. The investigations indicate, according to the author, that these deformations are due mainly to the bending of the crosstie and the longitudinal movement of the tracks. The experiments further indicate that the portion of the tie which actually transmits an appreciable load to the ballast is quite limited, extending 13 to 16 in. from the point of application of the load in the tests under consideration. The author believes that the rail joint should be redesigned and supported by a tie, on the ground that elasticity is given to the track by the tie, by the sinking in the ballast and the roadbed. The best results, in his opinion, will be attained by the use of a strong composite crosstie consisting of relatively short ties of wood, one under each rail, connected by suitable bars and reinforced by steel plates. This tie can be made so as to give a stronger and more elastic track than the usual form, he states. It is evident that these conclusions will not be accepted by most American engineers until they have been thoroughly studied and submitted to further tests, yet the monograph is such a valuable contribution to the subject of track deformation that it deserves a very careful study. (New York, The Railroad Gazette, $2.00.)

Letters to the Editor.

HOW CONCRETE FAILURES CAN BE AVERTED.

SIR: There are three vital points that should be taken into consideration by the owner before placing a reinforced concrete building contract: First, the design; second, the inspection of materials; third, the execution of the work.

As a general rule, the owner knows but very little about the theoretical design of structures. He has in mind the type of building, the spac-

ing of columns and the story heights, and a general idea of the outside appearance, elevation, sizes of windows, etc. The structural design should be handled by an engineer—always an engineer—and always one with a history behind him of successful work in reinforced concrete. By successful, we mean an engineer whose records of design are not records showing a long series of experiments dotted here and there with failures, but rather a record showing a large number of buildings without a failure. The owner should carefully examine these records before he places his order for design.

The logical place of doing blacksmith work on steel reinforcement is in a central blacksmith shop, where men are constantly employed on the same line of work, and not on the job using labor that is not familiar with the construction and where shop facilities are few. The steel work for beams and girders should be fabricated into frames and shipped to the job complete ready to drop into the forms. Bearing these ideas in mind, the owner can rest free regarding a correct design.

In order to reduce inspection work on the job, the simplest system of steel work should be selected. The simplest system is essentially a built-up girder and beam system shipped to the job ready for placement, thus throwing the blacksmith inspection at the shop where it belongs. The cement used on reinforced concrete should be carefully tested, preferably at the mill, so that cement when it lands on the job is ready to use. The inspection of the work in progress should be made by a man thoroughly familiar with cement, concrete and steel reinforcement.

The owner should restrict the bidders to reliable contractors with good financial backing, who have successfully executed a number of reinforced concrete contracts. The contract should be finally placed with a firm thoroughly versed in every phase of reinforced concrete construction. If owners who are contemplating the erection of reinforced concrete structures will adhere strictly to the points related above, the possibility of failure will be a minimum.

Very truly yours,

E. N. Hunting.

Youngstown, Dec. 10.

Failures of Steel Beams.

Sir: I have recently had a peculiar experience with some structural steel which I think may be of interest to your readers. I am constructing a power house at Fall River, Mass., for the American Thread Co., and used for the boiler house roof 65-lb., 20-in. standard I-beams, their length varying from 25 to 30 ft.

In unloading the first shipment of these beams they were rolled off the side of a flat car, falling about 4 ft. onto level soft earth. One of the beams was broken as shown in the illustration herewith. The break was perfectly straight and extended from one flange, through the web, to the opposite flange. The fracture was perfectly new and showed no signs of defects. It was also found that a crack had developed from some rivet holes in the top flange, running from the rivet holes to the outside of the flange.

In handling two other beams of this same shipment they were tipped off some timber rolls, dropping about 6 in. to the ground, and in handling in this way the beams developed cracks in one of the flanges, in each case through a section where rivet holes had been punched. These cracks extended from one side of the flange to the opposite side and into the web slightly.

The manufacturers of these beams examined them, took samples from them and reported in a few days that they were absolutely unable to assign any cau e for the beams acting in this peculiar way, that both chemical and physical tests showed them fully up to standard specifications.

I decided to use the balance of the shipment that showed no signs of fracture, after testing them under full load conditions. In order to do this I built a platform and loaded it with brick, and then placed a beam under the platform and raised the load on it, thus bringing the maximum strain upon these beams. They all withstood this test, even the ones that had cracked through the flange, and as I was in a great hurry to get the roof on the boiler house I accepted them and have used them. The three beams that showed rupture have been replaced.

I had chemical analyses made of the beam that cracked, taking samples from twelve different points, Nos. 1, 2 and 3 being at one end; Nos. 4, 5 and 6 at one side of the crack, Nos. 7, 8 and 9 at the other side of the crack, and Nos. 10, 11 and 12 at the second end. These analyses are as follows:

No.	C.	Mn.	P.	S.
1	0.21	0.60	0.102	0.045
2	0.21	0.61	0.099	0.048
3	0.21	0.61	0.1004	0.059
4	0.22	0.64	0.111	0.054
5	0.21	0.62	0.112	0.052
6	0.21	0.65	0.133	0.071
*7	0.22	0.66	0.123	0.065
8	0.19	0.64	0.131	0.062
9	0.22	0.65	0.133	0.06
10	0.19	0.61	0.114	0.057
11	0.23	0.62	0.137	0.064
12	0.22	0.63	0.133	0.073

*A determination of the silicon at this point was also made, giving 0.014.

These analyses all show very high percentage of phosphorus and it seems to me this is where the trouble lay.

A Cracked Beam.

I shall be glad to know from your various correspondents whether or not they have ever experienced anything of this kind with structural steel, and I would also like to know if there is any way that one may be sure of not putting such material into structures. It seems to me there ought to be some method devised so that each and every beam could be carefully tested, if we are going to receive such material from reputable manufacturers.

Yours very truly,

Samuel M. Green.

Holyoke, Mass., Dec. 14.

Power Development near Chattanooga.

Sir: Referring to the description in the Dec. 7 number of The Engineering Record, of the Chattanooga & Tennessee River Power Co.'s plant, we wish, as consulting engineers for W. J. Oliver, to correct certain statements made in this article concerning the conditions governing the construction of the work and the progress made.

The matter of the fulfillment of the contract made between Anthony N. Brady, of New York, the banker financing the work, and W. J. Oliver, the contractor, is now in dispute, and all of the work has been temporarily shut down until the differences are adjusted. The original contract between these two parties was signed in October, 1905, but little progress was made for a year and a half, due principally to high water. It might be noted here that during the past year slack water navigation on the Tennessee River was possible during the entire year. This is the first time on record that such was the case.

In the spring of this year, the Power Company realizing that, through no fault of the contractor, it would be impossible to complete the work within the specified time limit of two years, made a supplemental agreement extending the period of time 20 months from May 10, 1907. It was specified in this contract that a superintendent should be employed by the contractor, acceptable to the engineer, and at the suggestion of Col. John Bogart, engineer for Mr. Brady and consulting engineer for the Power Co., such a man was employed. Little progress, however, was made under his management, until finally, in August, the contractor supplanted this superintendent with a man of his own choice, and since that time the work has progressed rapidly.

In your description of this plant it is mentioned that at the time of writing (middle of October) "the only evidences of progress are shown in the partly completed core wall for the embankment and a coffer dam for the lock, which has been raised to only 10 ft. above low water mark." Referring to the records of this work, I find that the entire core wall was completed Oct. 5, and the photographs shown of the wall, lock, basin and cableway tower were taken about August 10, instead of at the time of writing. On Oct. 15 there had been installed a complete contractor's plant, costing several hundred thousand dollars, and on that date 450 men were on the contractor's pay roll.

At the present date all the lock excavation is completed, it having been found necessary to go 6 ft. below the grade called for by the plans. Extensive quarries have been stripped and opened up, and derricks erected and 5,000 cu. yd. of stone taken out. A railroad three miles in length to the dam was completed Nov. 20. This road was graded and rail laid in six weeks. I might add that the soundings and test pits showing the depth of rock were inaccurate, and this caused considerable delay in the construction of the coffer dams. It was necessary to extend the foundation in the core wall 17 ft. below the original foundation line shown on the profile, and a bed of indurated gravel over-lying the lock had an average thickness of 15 ft. instead of 7 ft. as shown.

The work on the south side of the river has likewise made good progress during the past three months, and at the present time the tail race, forebay and power house foundation have been excavated to an average depth of about 20 ft. The delay in this work was caused by increasing the cross-section of the embankment from a 2:1 slope to a 4:1 slope, requiring a large additional amount of earth excavation to be raised a distance of 60 ft. to place on this embankment, whereas this earth, as contemplated on the original plan, could have been wasted. This embankment is partially completed, and, as previously mentioned, the concrete core wall of the embankment was completed Oct. 5.

The writer, accompanied by Major Thos. B. Lee, of Charlotte, N. C., chief engineer of the Southern Power Co., has, during the past week, made a thorough inspection of the work done and of the contractor's plant installed and we are both of the opinion that the work has made reasonable progress, considering the conditions which have been encountered, and that the plant is a complete one, in excellent working condition (most of it being new) and entirely adequate for the purpose intended.

I do not wish to go through the merits of the case now, but I think it is only proper that the conditions of this work be correctly set forth.

Very truly yours,

Washington, Dec. 14. Francis R. Weller.

CURRENT NEWS SUPPLEMENT

JULY 6, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Annual Convention, City of Mexico, July 8-13, 1907.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York. Semi-annual meeting, Milwaukee, Wis., July 18-19, 1907.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Col.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

AN IMPORTANT CONTRACT FOR MASONRY AND EARTHWORKS.

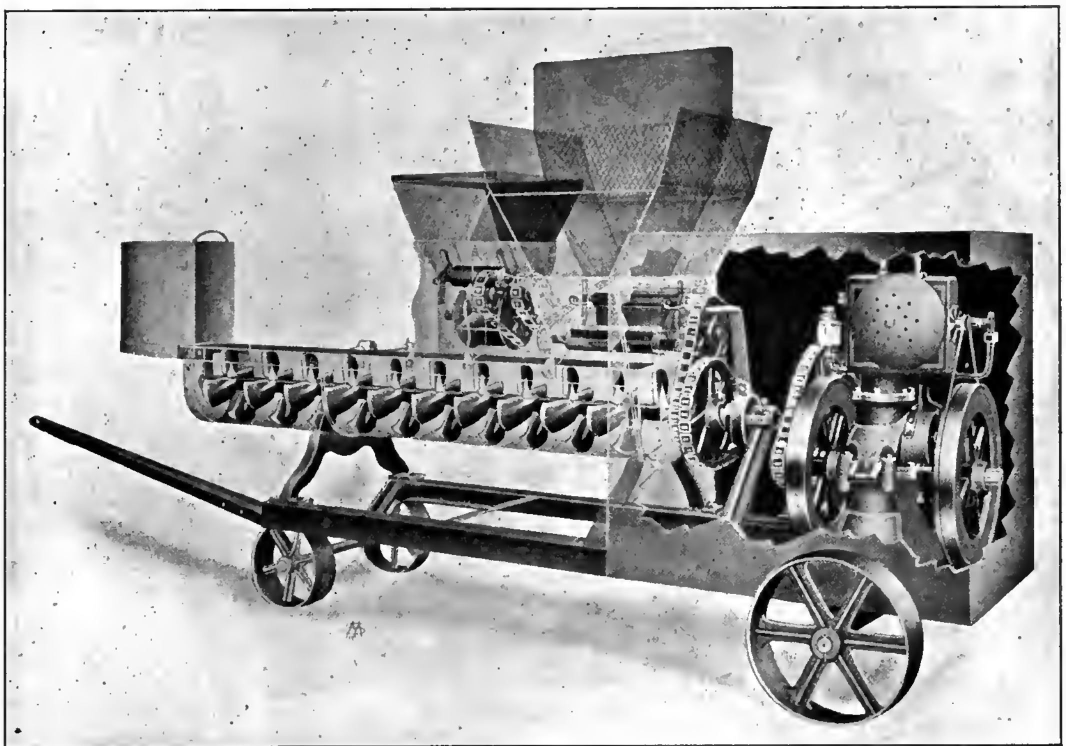
The Board of Water Supply of New York City has called for bids on the largest single contract ever undertaken by an American city, except that for the coonstruction of the first New York subway. It is for building the great masonry and earth dams of the Ashokan Reservoir in the Catskill Mountains, which were briefly described in this journal on May 11 The terms of the contract contain a number of very important innovations which are likely to make the work unusually attractive, such as the payment of interest on all sums due the contractor and not promptly settled.

The Board of Water Supply last week received permission from the Board of Estimate anad Apportionment to change the line of the Catskill Aqueduct from the Ashokan Reservoir to the Hudson River, and the application for the change will now be submitted to the State Board of Water Supply. The new line leaves the reservoir, near Esopus gorge, about five miles west of the previously chosen point, and then runs southward from five to eight miles west of the original line and crosses the Hudson River about eleven miles below the crossing previously selected. The most favorable site for the crossing is at Storm King Mt., where the river is not quite a mile wide, and where a deep rock tunnel can probably be driven. To prepare for the contingency, however, that further study may prove the crossing at this point to be impracticable, the Board has presented in its application an alternative line, differing only in the river crossing, which is at Denning Point under Newburgh Bay, where the river is about one and one-half miles wide, and should this route be selected the shield method or some system of sinking the tube in sections, or an equivalent method, would have to be used.

Indications are, however, that a satisfactory crossing can be made at Storm King Mt. The new route west of the river not only affords a better line, but shortens the Rondout Aqueduct, a feeder of the Catskill Aqueduct, about seven miles, and taps the Ashokan Reservoir at a more favorable point, where the water is much deeper than in the shallower eastern end of the reservoir.

A NEW CONCRETE MIXER.

About two years ago a continuous concrete mixer having a number of new features was devised, but its owners did not push it and eventually sold it to the Eureka Machine Co., of Indianapolis. This company submitted it to the most severe tests and made whatever improvements seemed desirable in the light of this experience. As now built it is a combination of two machines, one for measuring accurately the several materials for the concrete and the other for mixing them. In the "Eureka" machine, as the new mixer is called, the measuring device consists of a number of pocketed cylinders, which are rather clearly shown in the accompanying phantomized drawing. Above the cylinders for measuring the sand, gravel and crushed stone are rollers held in place by springs. These rollers serve to keep the pockets of the feeder just full of material, and at the same time provide sufficient flexibility so that rough, coarse material will pass through the machine without catching or giving any trouble. The so-called sand bin will handle material up to 2-in. screen, and the crushed stone bin up to 3-in. screen size.



THE EUREKA CONTINUOUS CONCRETE MIXER.

The mixing is done in a pug mill containing a large number of plow-shaped paddles, specially designed to handle coarse material without danger of catching and to stir the material effectively. The cement and sand or gravel are discharged together at the upper end of the mixing trough. They are mixed together first; then the coarse aggregate, crushed stone or large gravel, is added and thoroughly mixed in; then the material meets a spray of water, and after this the mass is thoroughly mixed before it is discharged from the machine, a hood on the discharge end being provided to take care of the output while changing wheelbarrows.

The output of the machine is limited principally by the ability of getting material to it, about 12 to 15 cu. yd. per hour being the maximum. The machine can be worked at this rate with a crew of five men, the makers state. This rate is on an absolutely continuous run of the machine, but in practice this cannot often be attained, as there are always interruptions of one kind or another in getting the material to or from the machine. At Schenectady, N. Y., recently thirty-nine large wagon loads of sand and gravel were put in the mixer in four hours.

The mixer is regularly equipped with 3½-h.p. air-cooled gasoline engine, or with steam engine and boiler, as wanted, or they can be furnished with water-cooled gasoline engines or electric motors. A simple jaw clutch on the slow speed shaft is used to stop and start the machine without having to stop the engine. This places the machine absolutely under the control of the operator all the time.

The factory of the company has been located at Jackson, Mich., but it is just completing at Lansing, Mich., a new factory, giving much better facilities.

WILLIAM FINDLAY SHUNK.

William Findlay Shunk, civil engineer, died at his home in Harrisburg, Pa., on Saturday, June 22. He was born at that city on Sept. 26, 1830, and was the son of Governor Francis Rawn Shunk and the grandson of Governor William Findlay, for whom he was named. He was educated at the old Harrisburg Academy and at Dickinson College, and then entered the navy as a midshipman in 1846. At the death of his father, Governor Shunk, he resigned from the navy and began his career as an engineer on the Pennsylvania R. R. He was for a time in the U. S. Coast Survey and in the government service during the war. During the early years of his professional work he was the chief engineer of the Dutchess & Columbia R. R., the Connecticut Western R. R. and the Lewisburg & Spruce Creek R. R.

He was an associate engineer on the construction of the present Pennsylvania elevated structure at the Broad St. Station Terminal in Philadelphia, and went from there to New York in 1877 to take charge of the design and construction of the Metropolitan Elevated R. R. His was the master mind in the planning of the 9th Ave. Elevated R. R. with the reversed curve on Phoenix columns. at 110th St., so long an object of wonder to the out-of-town visitors before the city was so built up as to shut the structure out of view. The Second Ave. Elevated R. R. was his design also.

At the opening of the elevated railroad in New York, the passengers were required to put their tickets in the chopping boxes *after* they had ridden. At that time two rates of fare existed, 10 cents for all except certain morning and evening rush hours, called commission

hours, when the fare was five cents. If a person got on a train during the commission hours and got off during the non-commission hours the ticket choppers required a 10-cent ticket. The result of this was riot, as people refused to pay the additional fare. Many people mislaid or lost their tickets in addition, and upon being refused permission to leave the stations until they had deposited tickets in the chopping boxes, they fought their way out. Mr. Shunk straightened this all out in a moment, by issuing orders requiring the dropping of the tickets in the boxes *before* the passengers entered the stations.

He left the Metropolitan Elevated R. R. in the spring of 1881, and in that summer made surveys for a railroad at Rockaway Beach and for a line from New York to Danbury, Conn., in possible opposition to the New Haven R. R. In the fall of 1881 he took up the South Penn R. R. survey, having in 1865 made preliminary surveys and partly selected a route for a road from Harrisburg to Pittsburgh. This work was put under construction and carried on until the late fall of 1885, when the project was abandoned as it stood. He was connected with the building of Washington Bridge across the Harlem River for a short time in the summer of 1886, and in the spring of 1887 he became chief engineer of the Kings County Elevated R. R. in Brooklyn, which kept him busy until the spring of 1889. During this time he was on a commission appointed by the Aqueduct Commission to examine and report on the Quaker Bridge site for a dam across the Croton River.

In 1890 he organized the expedition to South America under the Inter-Continental R. R. Commission, taking personal charge of the party which started from Guyaquil and worked north until Panama was reached. He found a feasible line with easy grades the whole length of that part of South America, and in years to come it will doubtless be followed when the time is ripe for the construction of a railroad in that country. This survey was practically completed in 1893, but a year or more was required in the preparation of the report of the Commission.

Following that work he returned to South America as chief engineer of Guayaquil & Quito R. R., as difficult and heart-breaking a railroad survey as was ever yet undertaken, especially when one considers that he had by this time passed his sixty-fifth year.

Upon his return from South America he retired to his garden spot, as he termed it, at Lucknow, near Harrisburg, and, save for a few years as engineer of the State Forestry Commission of Pennsylvania, gave up his professional work.

He was the first to recognize the need of a handy book of rules and tables for solving the field problems of railroad location, and in 1854 published such a work, which was rewritten and revised in 1879 under the title of the "Field Engineer," and is now in its 16th edition.

By nature he was one of the most kindly men, quick to help, ready to do one a good turn and untiring in his energy and love of work. His modesty and unassuming simplicity of manner occasionally gave an unobservant stranger the impression that he was not wide awake, but woe betide the man who, thinking thus, endeavored to do anything dishonorable in his dealings with him. His command of English was remarkable and his letters are treasures of language. Through his life he was possessed of the desire to do good, and his best epitaph can be taken from the preface to his own work, in which he says, "In dismissing the work from his hands, the precarious snatches of time occupied in its preparation, by day and by night, during the past two years, which might have been more agreeably spent in reading, talking or musing, recur to the writer's mind; and the thought arises, To what end or from what motive do people undertake these technical labors? Why should Forney and Bourne toil to simplify steam for our apprehension; Nystrom to compile mechanical, Molesworth and Trautwine to systematize civil engineering; Henck to prepare his elegant manual of field mathematics; Box to illustrate hydraulics; and Shreve, with lucid pen, to make clear for us the stresses in truss or arch? The ordinary [illegible] here have no place. There is neither fame nor profit in these drudging enterprises. At best the author gives name to his book; he remains impersonal—known but indirectly and but to a class. How then shall we account for his labors? I take it, the Father of mankind has not only made our minds to hunger for knowledge as our bodies for food, but has also imposed upon us a kindly law of communion, by virtue whereof we cannot do otherwise, without violence to generous nature, than share with our fellows whatsoever we have learned that seems new and useful. Under this law these beneficial works would appear to have had their being, and thus pure are they from the stain of selfishness.

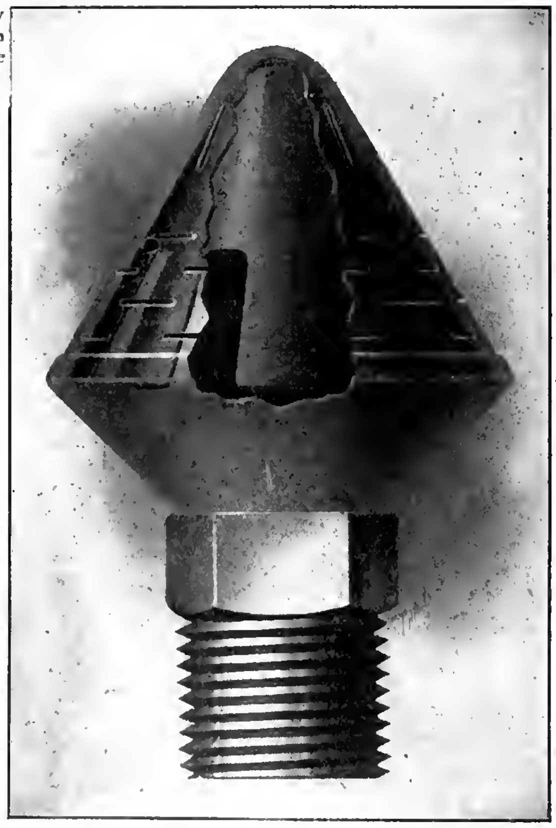
"Though the present writer would not arrogate equal fellowship in the eminent brotherhood named, yet he may justly claim like pureness from unworthy motive, and certainly feels like comfort at heart to that which they must know, for having discharged, in what measure it has been laid upon him, the divine obligation."

THE SCAIFE MECHANICAL FILTER STRAINERS.

About two years ago a new type of strainer for mechanical filters was put under test by the Wm. B. Scaife & Sons Co., of Pittsburg, and proved such a success that the company has adopted it for mechanical filters and also for the filters forming a part of the Scaife and the We-Fu-Go water softening and purifying apparatus. Suitable provisions for washing mechanical filters are essential for their satisfactory use, and a great deal of attention has been paid to them. For some years mechanically operated rakes were employed exclusively to break up the bed of filter sand and permit the impurities accumulating in it to flow away with the wash water, which was admitted below the bed. Subsequently compressed air was employed to agitate the sand, and lately it has been found that jets of water from the strainers, forced out of them in the opposite direction to that taken by the water during filtration, answered the requirements of most cases.

Of the many strainers that have been put on the market, the greater number have been circular disks of perforated metal, the perforations being either round or narrow rectangular slots. In the ordinary operation of the filter this type of strainer gives satisfactory results; that is, it prevents the sand from passing out with the filtered water, but when it becomes necessary to reverse the flow of water to wash the sand bed, a large quantity of water is required and little velocity is obtained on account of the size and number of the openings in the strainer. It is important in washing that the wash-water should have a high velocity. This, however, is hardly possible with the ordinary type of strainer, unless wash-water under a heavy pressure is used, because such a large number of them are required to get sufficient flow of the effluent from the low head in the filter. With the majority of strainers, the area of the openings is many times larger than the area of the supply line which carries the water for washing the filter. The small perforations in the strainers also cause a great deal of friction, and the area of these perforations must be much in excess of the actual area of the pipe outlet from the filter, in some cases as much as four or five times as great. This beng the case, a large quantity of water must be introduced to get an appreciable velocity, and even then it is often difficult to get a sufficient jet from each strainer to give a thorough washing.

DIRECTION OF JETS FROM NEW STRAINER.



CONSTRUCTION OF NEW SCAIFE STRAINER.

The Scaife strainer is a radical departure from those generally in use. It consists of an inner and outer cone, the inner cone being movable and of such shape that the openings in the outer cone are partially closed off when washing. The number of openings which are closed off can be adjusted in each particular case, so that the area discharging water into the filter-bed can be accurately adjusted to the size of the wash-out pipe.

The inner cone is held in place when washing by the pressure of the wash-water, as the stream entering the strainer strikes the closed portion of this cone, thus holding it firmly in place. This strainer has an ample area of openings to deliver the filtered water, but when washing, the inner cone reduces the area of the slots in the outer cone, so that the combined area of all the strainers is a little less than the area of the pipe through which the wash-water is introduced. In this way a uniform pressure can be maintained in each individual strainer, to give a high velocity of the wash-water through the openings of the strainer, which are arranged to give a radial discharge, thus insuring a thorough washing of every part of the sand-bed.

PERSONAL NOTES.

Mr. F. H. Cooke has been commissioned as a civil engineer in the United States Navy.

Mr. S. J. Merrill has been appointed master mechanic of the Union Pacific R. R. at Denver, Colo.

Mr. W. J. Black has been appointed assistant engineer of construction of the New York, New Haven & Hartford R. R., in charge of New Haven improvements.

At the fortieth annual commencement of the West Virginia University, Morgantown, W. Va., the establishment of a chair of mining engineering was announced.

The United States Civil Service Commission will hold an examination in the large cities of the country, July 17-18, of candidates for the position of aid in the coast and geodetic survey.

Lieut.-Col. Smith S. Leach, corps of engineers, U. S. A., has been relieved of his duties as a member of the general staff, and ordered to take up others in the office of the chief of engineers.

Mr. George Bradish has been appointed city engineer of La Crosse, Wis., succeeding Mr. Walter S. Woods, who resigned to become the engineer of the La Crosse Water Power Co., at Hatfield, Minn.

Mr. L. A. Downs, roadmaster of the Chicago division of the Illinois Central R. R., has been made assistant chief engineer of maintenance of way and has been succeeded as roadmaster by Mr. G. E. Boyd.

Mr. Calvin W. Hendrick, chief engineer of the Baltimore Sewerage Commission, has been granted an extended vacation so that he may study English sewage disposal plants. He will sail late in August.

Mr. J. A. Simmons, division engineer of the Natchez division of the Missouri Pacific Ry. system, at Vidalia, La., has resigned, and has been succeeded by Mr. J. A. Wright, road master on the Valley division.

Mr. W. H. Sellew has been promoted to the position of principal assistant engineer of the Michigan Central R. R., with offices at Detroit, and has been succeeded as division engineer by Mr. W. C. Cleveland.

Mr. George L. Watson has resigned the position of assistant chief engineer of the Fidelity Construction Co., Detroit, Mich., and has opened an office as consulting engineer in the Baxter Building, Philadelphia, Pa.

The office of assistant chief engineer of the Illinois Central and the Yazoo & Mississippi Valley roads has been abolished, and Mr. H. R. Safford, who held it, has been made chief engineer of maintenance of way of those lines.

Mr. Wallace Greenalch, superintendent and engineer of the Bureau of Water of Albany, N. Y., has succeeded Mr. Charles M. Bissel as commissioner of public works of Albany, Mr. Bissel having resigned to become fiscal supervisor of state charities.

The following are the members of the recently created New Jersey State Potable Water Commission: Foster M. Voorhees, Elizabeth; Richard Morrell, Passaic; Henry H. Humphries, Camden; George F. Wright, Paterson; J. H. Bacheller, Newark.

Mr. F. R. Coates, vice-president of the Wallace-Coates Engineering Co., Chicago, and formerly chief engineer of The Great Western Ry., is president and general manager of the San Pete Valley R. R. Co., recently organized at Salt Lake City, Utah.

Mr. Lewis B. Stillwell, New York City, recently received the honorary degrees of master of science and doctor of science from Lehigh University, S. Bethlehem, Pa., and Wesleyan University, Middletown, Conn., respectively. Mr. Stillwell took part of his undergraduate course at the latter university.

The recently organized Machinery Club of the City of New York has engaged quarters in the Fulton Terminal Building on Church St. The club will be primarily a lunching club, but it is expected that the unusual superiority of the appointments and the convenient location will make it a general rendezvous for the machinery trade in the city. The following officers have been elected: President, F. H. Stillman; vice-president, R. C. McKinney; treasurer, Walter L. Pierce; secretary, Theodore Waters.

Mr. P. Carroll has been appointed division engineer of the Missouri Pacific Ry. at Little Rock, Ark., and Mr. E. C. Welch to a similar place at De Soto, Mo. Mr. J. F. Peters has been transferred to the office of the principal assistant engineer at St. Louis.

Mr. H. B. Clement, formerly with Messrs. Carrere & Hastings, architects, New York City, has joined the architectural firm of Malcomson & Higginbotham, Detroit, Mich. The firm will be known hereafter as Malcomson, Higginbotham & Clement.

Mr. O. H. Gentner, Jr., of Philadelphia, has been engaged as assistant engineer in charge of estimating and drafting in the reinforced concrete department of the General Fireproofing Co., Youngstown, O. During the past nine years he has been connected with the design and construction of many reinforced concrete structures and has been associated, in Philadelphia, with Messrs. G. W. & W. D. Hewitt and Ballinger & Perrott, architects, and Mr. J. A. Patterson, consulting engineer, and in New York City with Messrs. Tucker & Vinton, the Unit Concrete Steel Frame Co. and the Vulcanite Paving Co.

Mr. Thomas Tait, chairman of the Victorian Railway Commission, reached this country June 29 on his return trip to Melbourne. Mr. Tait has made an extensive tour in Europe, where he has visited the important railways which have been changed from steam to electric power. The electrification of the Victorian steam railways and the cable system in Melbourne is under consideration by the railway commission, but the details of the system to be adopted have not yet been selected, as this will be left to the expert of the system, Mr. Charles H. Merz, of London, who has been engaged to make an exhaustive report on the subject.

The membership of the two New York State Commissions, created by the public utilities act, recently passed by the New York Legislature, has been announced as follows: For the First District (New York City), William R. Willcox, William McCarroll, Edward M. Bassett. Milo R. Maltbie, John E. Eustis; for the Second District (all other counties in the State): Frank W. Stevens, Thomas M. Osborne, Charles H. Keep, James E. Sague, Martin C. Decker. These commissions will take up the work formerly done by the State Railroad Commission, the Rapid Transit Commission, the State Gas and Electricity Commission and the State Inspectors of Gas Meters.

Mr. Charles D. McKelvey, of Paterson, N. J., has been appointed inspector of railroads of New Jersey by Mr. J. W. Congdon, president of the State Board of Railroad Commissioners. Mr. McKelvey began his railroad career in 1865 as a telegrapher and after serving on various roads as brakeman, conductor and train dispatcher he became in 1883 assistant superintendent of the New Jersey Midland R. R. Subsequently he was superintendent of the New York, Susquehanna & Western R. R., general manager of the Grand Central Station of the New York Central & Hudson River R. R., in New York City, general supreintendent of the New York, Susquehanna & Western R. R., and general superintendent of the Ohio Southern R. R.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Arkadelphia, Ark.—The question of constructing water works is reported under consideration here; probable cost, $30,000.

Pine Bluff, Ark.—See "Power Plants, Gas and Electricity."

**Los Angeles, Cal.*—Bids were opened on June 14 by the Bd. of Pub. Wks. for furnishing Portland cement for Los Angeles Aqueduct, a conduit 225 miles long to be built by the municipality from Owens Valley to Los Angeles for the purpose of furnishing city an adequate water supply. (*a*) 30,000 bbls. Portland cement, delivery to commence 60 days after execution of contract, to continue in such quantities and at such times as may be required, but not more than 5,000 bbls. in any one calendar month. (*b*) 1,250,000 bbls. Portland cement, exclusive of aforesaid 30,000 bbls., delivery to commence 12 mos. after execution of contract and to continue in such quantities and at such times as may be required, but not more than 30,000 bbls. in any one calendar month. (*c*) includes all Portland cement mentioned in items *a* and *b*. The award of contract for *a* (30,000 bbls) was let on June 18 to the California Portland Cement Co., of Colton, Cal. The freight from the factory of Mojave, the point of delivery, is 38 cts. per bbl. *b* and *c* have not been acted upon. For furnishing the large amount named in *b* and *c* the city is considering the advisability of building and operating its own cement plant. The following is the complete list of bids received (price given per bbl.): California Portland Cement Co., Colton, *a* $1.75 (awarded contract), *b* $1,325, Southern California Cement Co., Riverside, Cal., *a* $1.27½; Iola Portland Cement Co., Iola, Kan., *b* $1.60; Pacific Portland Cement Co., Cement, Cal., *b* $1.40; West Bldg. Material Co., Napa, Cal., or Davenport, Ia., *a* $1.20, *b* and *c* $1.05; Carl Leonardt, Cement, Cal., *a* $1.70, *b* $1.40.

Ukiah, Cal.—See "Power Plants, Gas and Electricity."

Denver, Colo.—The Denver Union Water Co. is reported to have decided to expend $700,000 in improving the water plant during the present year. David H. Moffat, Pres.

Manitou, Colo.—It is reported that the city will soon take steps to construct a reservoir on French Creek, to cost about $100,000.

Platteville, Colo.—It is reported that maps have been filed for the Wild Cat Reservoir, to be built in the vicinity of Platteville by Frank McCarthy, of Denver. The water of Platte River will be brought up over an area of 24 square miles by means of a dam 30ft. high. The capacity of the reservoir will be 500,000 cu. ft., and its supply will be drawn from South Platte River and tributaries above Big Thompson River. It is proposed to use the reservoir for direct irrigation for some 200,000 acres of land in eastern Weld County.

Pensacola, Fla.—It is stated that bids are wanted until July 9 for $225,000 water works, $100,000 sewer and $100,000 paving bonds.

Moscow, Idaho.—The City Council is reported to have on June 21 rejected all bids received for constructing water works, and the work will be done by the city. The city will also purchase all supplies and material for same.

Chicago, Ill.—Bids will be received until July 11 by the Bd. Local Improv. (H. S. Dietrichs, Pres.), for constructing water service pipes in portions of several streets.

Durand, Ind. Ter.—Water bonds to the amount of $35,000 are reported to have been issued for water works extension.

Lafayette, Ind.—See "Power Plants, Gas and Electricity."

Hartley, Ia.—The Town Council is reported to be considering the question of issuing $10,000 bonds for water works improvements.

Garnet, Kan.—Burns & McDonnell, 709 Dwight Bldg., Kansas City, Mo., is preparing plans and specifications for a filtration plant for Garnet.

Frankfort, Kan.—This city has voted to issue bonds for water works, and plans are now being prepared by Burns & McDonnell, 709 Dwight Bldg., Kansas City, Mo.

Homer, La.—The citizens are reported to have voted to construct water works.

De Quincy La.—See "Power Plants, Gas and Electricity."

Cumberland, Md.—The City Council is reported to be considering the question of constructing water works.

Paw Paw, Mich.—See "Power Plants, Gas and Electricity."

Houghton, Mich.—The City Council is reported to have authorized C. M. E. Craig, City Engr., to prepare plans for enlargement and development of the water system, to cost about $70,000.

**Henderson, Minn.*—W. D. Lovell, of Minneapolis, is reported to have received the contract for water works (bids opened June 14), for $9,580.

Kenyon, Minn.—W. C. Fraser, of Rochester, Minn., is reported to be preparing estimates of cost for a water tank and tower.

Jackson, Miss.—The citizens are reported to have voted on June 26 in favor of issuing $216,000 bonds for the purchase of the plant of the present water company.

Kansas City, Mo.—The Bd. of Pub. Wks. is stated to have decided to follow the recommendation of Geo. H. Benzenberg, Consulting Engr., Milwaukee, Wis., for water works improvements which include additional basins: new intake further up Missouri River at Quindaro; new centrifugal pump, 25,000,000 gal. daily capacity at Quindaro pumping station; another 20,000,000 gal. high pressure pump at Turkey Creek pumping station; a new 48-in. cast iron flowline from the Kaw tunnel to Turkey Creek station; the present lime mixing and solution tanks for clarifying of water to be duplicated, and additional capacity for storing fuel at Turkey Creek.

Billings, Mont.—The ranchers, living at mouth of Big Horn, have organized a ditch company and have had survey made to irrigate their lands; probable cost of canal and pump, $20,000. Henry Gerharz, of Billings, Engr. in charge.

Rondolph, Neb.—It is reported that bids are wanted until July 22 for laying about 5,000 ft. 4-in. and 1,500 ft. 6-in. c. i. water mains. C. S. Milliard, City Clk.

Tilden, Neb.—It is stated that bids will be received until July 11 (readvertisement) by F. L. Putney, Village Clk., for constructing water works. There will be required standpipe, concrete pump house, 2½ miles of pipe, etc. Iowa Eng. Co., Engrs., Clinton, Ia.

Oxford, Neb.—M. A. Earl & Co., of Muskogee, Ind. Ter., and Chicago, Ill., are preparing plans for water works for Oxford.

Elizabeth, N. J.—Bids will be received at the office of the Elizabeth Water Co., 68 N. Broad St., Elizabeth, until July 15, for laying about 3 miles of 36-in. water pipe, as advertised in The Engineering Record. John Kean, Pres.

Honeoye Falls, N. Y.—The Village Trus. are reported to be considering the question of constructing water works and a sewerage system.

New York, N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity for furnishing, delivering and laying water mains in New Chambers, Water, Oliver, Henry anad Pike Sts. and in James Sl.

Bids will be received by the Bd. of Water Supply (Thos. Hassett, Secy., 279 Bway.) until Aug. 6 for the construction of the main dams for Ashokan reservoir near Brown Station in the towns of Olive and Marbletown, Ulster County, as advertised in The Engineering Record. J. Waldo Smith, Ch. Engr.

**Olean, N. Y.*—D. E. Barrows, Water Comr., writes that the contract for concrete lining for distributing reservoir at Cook's Hill, South Olean (bids opened July 1), has been awarded to Casey & Murray, of Rochester, for $31,080.

Buffalo, N. Y.—The Aldermanic Com. on Water is reported to have decided to report in favor of buying a site at Kensington, Grider and Colfax Sts. for the building of a water tower. The water tank will be 70 ft. high and hold about 500,000 gals. Bids for the work will be asked for soon.

**Carthage, N. Y.*—The following are reported to be the bids opened by the Bd. of Water Comrs. June 24 for the construction of water works: Field, Barker & Underwood, Philadelphia, Pa., $60,035; H. B. Failing, Baldwinsville, $58,842 (awarded contract); E. D. Bennett. Pulaski, $71,192; Burns, Haley & Burns, Watertown, $80,888.

Troy, N. Y.—Bids will be received until July 9 by Hiram W. Gordiner, Comp., for $76,000 additional water works bonds.

Wilson, N. C.—R. J. Grantham, of Wilson, is preparing plans for a filtration plant, to cost from $7,000 to $10,000. Bids for same will be received on July 15.

Maxton, N. C.—Preliminary surveys are now being made by J. M. Bundy, of Laurinburg, for water works and a sewerage system, to cost about $50,000. Report will be ready in about 3 weeks. Mr. Williams is Mayor.

Cleveland, O.—The lowest bid opened on June 28 for 1,400 tons 3 to 48-in. c. i. pipe was submitted by the U. S. Cast Iron Pipe & Fdy. Co., of Cleveland, for $50,000. The Semisteel Co., of Cleveland, was lowest bidder for special castings 3 to 48 in. for $8,692.

Sandusky, O.—Bids will be received by the Bd. of Pub. Service (Wm. Ohlemacher, Pres.) until Aug. 5 for the sale of a duplxe compound condensing Worthington pumping engine, with a capacity of raising 3,000,000 gal. of water in 24 hours 200 ft. above water in the pump well, as advertised in The Engineering Record. This pump was installed in 1876 and taken out in 1902.

The following are reported to be the bids opened on June 29 by the Bd. of Pub. Service for the filtration plant: Jackson Filter Mfg. Co., St. Louis, Mo., 6,000,000-gal. plant, with 1,000,000-gal. clearance or clear well storage, $75,000; with 500,000-gal clearance, $73,000. Thos. Lightbody, Youngstown, O., 6,000,000-gal. plant, complete, clear water well covered, $70,164; with tile roof instead of slate on building, $500 extra. Leonard-Martin Constr. Co., Chicago, Ill., plant complete, $70,000; with 1,000,000-gal. clear well storage, $77,000. Norwood Eng'g Co., Florence, Mass., six different plans, embodying use of different types and capacities of pumps, and varying arrangements: Plan 1, $87,357; plan 2, $88,357; plan 3, $85,482; plan 1½, $80,132; plan 4, add to cost of 1, 2 and 3, $9,500, this to provide a clear well capacity of 1,000,000 gals.; plan 5, decreasing capacity, take off $5,200 from plans 1, 2 and 3. Pittsburg Filter Mfg. Co., plant complete, $91,800; extras increase cost, if ordered. New York Continental Jewel Filtration Co., New York, N. Y., plant complete, $99,675.

Guthrie, Okla.—An election will probably soon be held to vote on issuing $30,000 bonds for filter plant and water mains; also for 6,000 ft. of storm sewer. W. W. Miller, City Engr.

Frederick, Okla.—The citizens are reported to have voted to issue $10,000 water extension and $25,000 sewer bonds.

Johnson City, Tenn.—The City Council has passed on first reading the ordinance authorizing the city to vote on issuing bonds for the purpose of buying its own water works.

Lehi, Utah.—The City Council is reported to be considering the question of constructing water works.

Burlington, Vt.—Bids will be received by the Filtration Com. (J. W. Goodell, Secy., 257 Pine St.) until July 22 for the construction of a mechanical filter plant complete, with all appurtenances, as advertised in The Engineering Record. Engineers, Hering & Fuller, 170 Bway., New York, N. Y.

**Items marked thus give the names of parties awarded contracts.*

Spokane, Wash.—Chas. McIntyre, City Engr., is reported to have recommended the sinking of wells near the pumping station as a new source of water supply; cost of proposed work about $25,000.

North Milwaukee, Wis.—Bids will be received until July 15 by Emil H. Klamp, Village Clk., for furnishing and laying about 1,200 ft. c. i. water pipes, setting stop gates, hydrants, etc.

Wausau, Wis.—The State Assembly has passed a bill granting the Wisconsin Valley & Improv. Co., of Wausau, a corporation composed of paper mill owners, a franchise to construct and maintain a large system of water reservoirs on tributaries of Wisconsin River north of the south line of Lincoln County.

**East Troy, Wis.*—Contracts for constructing water works (bids opened June 21) have been awarded as follows: Pipe and specials, U. S. Cast Iron Pipe & Fdy. Co.; hydrants, valves and valve boxes, Rensselaer Mfg. Co.; power house, Albert Ebert; pump, Gould Co., and 15-h.p. gasoline engine to Lacy and Clancy. Engineer, W. G. Kirchoffer, of Madison.

Bloomer, Wis.—Bids will be received by the Village Clk. until July 12 for the construction of a complete system of water works, consisting of steel tank, gasoline engine and deep well pump, small brick building and distribution pipe line system. Engineer, Oscar Claussen, of St. Paul, Minn.

Toronto, Ont.—C. H. Rust, City Engr., has submitted to the Bd. of Control, his report on the extension of the water system, which he estimates will cost abot $710,000. The work includes a new pumping engine with a daily capacity of 15,000,000 gals. to cost $250,000; new hydrants to cost $4,786; a 6,000 gal. pump at high level pumping station, $60,000; meters, $100,000, etc. Election to vote on issuing bonds for same will be submitted to ratepayers on Sept. 14.

North Battleford, Sask.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Lamar, Colo.—Bids will be received by C. W. Heaton, Town Clk., until July 15 (readvertisement) for the construction of a sanitary sewer system, requiring 66,805 lin. ft. 8, 12, 15, 18 and 21-in. vit. sewer pipe, etc. Engineer's estimate, $77,000.

Hartford, Conn.—Bids will be received by the Bd. of Contract and Supply (Jas. P. Berry, Secy.), at Mayor's office, until July 8, for the construction of sewer in Asylum St.; estimated cost $15,000.

**Washington, D. C.*—The lowest and successful bid opened on June 17 by the Comrs. D. C. for constructing junction sewer at 10th and B Sts. N. W., was submitted by Warren T. Brenizer Co. at the following bid: 1,775 c. yds. Excav., $2.50; 20 c. yds. sewer brick masonry, $17; 35 c. yds. vitri. brick masonry, $26; 190 c. yds. concrete "B," $10.90; 275 c. yds. concrete "C," $10, and 175 lin. ft. 6-in. pipe underdrain, 30 cts; total cost, $10,561. The R. D. Beall Co. bid for this work $11,366.

*The lowest and successful bid opened on June 17 by the Comrs. D. C. for constructing junction sewer at 17th and B Sts. was submitted by Warren F. Brenizer Co. for $3,431.

The Cranford Paving Co. bid on June 18 for constructing sewers as follows: Sect. A—1,300 cu. yds. tunnel excav. in rock under canal, $6.40; 225 cu. yds. sewer brick masonry, $1,950; 40 cu. yds. vitrified brick masonry, $24; 170 cu. yds. concrete "B," $9.50; 220 cu. yds. concrete "D," $9.00; total, $17,262; Sect. B—1,800 cu. yds. excav., 95 cts.; 45 cu. yds. sewer brick masonry, $16.50; 90 cu. yds. vitrified brick masonry, $21; 1,025 cu. yds. concrete "B," $8.20; 200 cu. yds. rock excav., $1.90, and 1,000 cu. yds. embankment, 30 cts.; total, $13,427. D. E. McComb, Supt. of Sewers.

Bids were opened on June 20 for sewers, and the following are the lowest bids received on each division: E. G. Gummer, 612 F St., n. w., submitted lowest on Sewer A, Sewer B and Sewer C at $1,636, $2,383 and $2,163 respectively; Lyon Bros. was lowest on Sewer D, $1,312, and Jas. A. Coyle, lowest on Falls Branch sewer at $13,840.

Pensacola, Fla.—See "Water."

East St. Louis, Ill.—Chas. S. Lambert, City Clk., writes that the proposed sewerage system will cost about $750,000. W. J. Crocken, City Engr.; Silas Cook, Mayor.

Marshall, Ill.—H. O. Weldon, City Clk., writes that the proposed sewerage system will cost about $20,000, but nothing definite will probably be done before fall. Engineer, C. A. Purdun, of Marshall.

Chicago, Ill.—Bids will be received until July 11 by the Bd. Local Improv. (H. S. Dietrichs, Pres.), for constructing a system of brick and vitrified tile pipe sewers in portions of several streets.

*The contract for constructing sewer in State St., between 30th and 55th Sts., is reported to have been awarded to McCarthy & Cleary for $228,000.

**Pana, Ill.*—The contract for constructing the west end sewerage system is reported to have been awarded to John Ham, of Litchfield, for $20,479.

East St. Louis, Ill.—At a public meeting held here recently, it is reported, that plans for the proposed outlet sewer were approved, they will cost about $744,000. W. J. Crocken, City Engr.

**Elkhart, Ind.*—The Bd. of Pub. Wks. is reported to have on June 19 awarded to the Northern Constr. Co., of Elkhart, the contract for constructing sewer in Dist. 10 for $62,370. C. Defrees, of South Bend, bid for this work $68,375.

Indianapolis, Ind.—A sewer 6 miles long, draining the territory between Rural St. and Emerson Ave., and Michigan and 16th Sts., and connecting with the E. Michigan St. sewer, is being planned by Blaine H. Miller, City Engr. It will cost about $200,000.

Evansville, Ind.—W. J. Dunn, City Clk., writes that it is proposed to construct a brick and concrete sewer on Kentucky Ave. Jas. D. Saunders is Engr. and W. F. Wunderlich is Clk. Bd. of Pub. Wks.

Cedar Falls, Ia.—Bids will be received until July 11 by the City Council for furnishing material and constructing sewers in portions of Bluff, 12th, Normal and Main Sts., requiring about 2,957 lin. ft. 8-in. and 130 ft. 6-in. sewer pipe, 11 manholes, etc. W. H. Merner, Mayor.

**Waterloo, Ia.*—Local press reports state that the contract for the construction of about 5 miles of sewers (bids opened June 17) has been awarded to W. N. Dearborn, of Cedar Rapids, at the following bid: 1,590 ft. 48-in. concrete, $6.50; 14,045 ft. 36-in. concrete, $4; 340 ft. 33-in. pipe, $4.50; 4,970 ft. 30-in. pipe, $3.60; 900 ft. 24-in. pipe, $2.30; 340 ft. 18-in. pipe, $1.60; 1,310 ft. 15-in. pipe, $1.15; 1,320 ft. 12-in. pipe, 85 cts.; 58 manholes, each, $30; 2 bulkheads, each, $150; total cost, $93,219. The other bids received were: W. N. Dearborn, Cedar Rapids, $93,219; M. Ford, Cedar Rapids, $101,940; People's Constr. Co., Davenport, $108,942, and Independent Constr. Co., Davenport, $111,493.

Eureka, Kan.—Bids will be received until July 31 by J. H. Smythe, City Clk., for furnishing material and constructing 1,143 ft. 8-in. sewers. C. C. Huntington, City Engr.

New Orleans, La.—Bids will be received by the Sewerage and Water Bd. (F. S. Shield, Secy.) until Sept. 11 for the furnishing and laying of approximately 110 miles of sewers, from 8 to 27 in. and 5 to 17 ft. deep, to include about 1,230 manholes and 443 flush tanks, as advertised in The Engineering Record. The work will be divided into 4 contracts. Geo. G. Earl, Gen. Supt.

Baltimore, Md.—Bids will be received until July 10 by the Bd. Awards (J. Barry Mahool, Pres.), for sinking a test well on the site of the proposed sewage pumping station, to be 12 ft. sq. on top outside sheeting, and to be carried to a depth of 30 ft. below the surface of the ground.

**Taunton, Mass.*—The Sewer Com. is reported to have awarded contract for extension of sewer main on W. Water St. to the Geo. M. Bryne Co., of Boston, for $15,257.

Muskegon, Mich.—C. S. Gamble, City Engr., writes that contracts will probably soon be let for sewer No. 8 which will require about 3 miles of sewers, 24 to 8 in.

Lansing, Mich.—H. A. Collar, City Engr., writes that bids will be received on July 15 by the City Clerk for sewers in Park Pl. addition to consist of 6,320 ft. of 8, 10, 15, 18, 20 and 24-in. pipe; estimated cost, $18,099.

Iron River, Mich.—Bids will be received by Chas. A. Otto, Village Clk., until July 17 for the construction of the sewers in Main Sewer Dist. No. 1 as advertised in The Engineering Record. Engineers, E. G. Bradbury and G. P. Shute, 85 N. High St., Columbus, O.

Sedalia, Mo.—The City Council on June 19 passed ordinances providing for the construction of sewers in Sub Districts A, B and C of sewer Dist. 22.

Holdredge, Neb.—M. A. Earl & Co., of Muskagee, Ind. Ter., and Chicago, Ill., are making surveys for a sewerage system for Holdredge.

Plainfield, N. J.—Andrew J. Gavett, City Surveyor, writes that the lowest bid opened on June 20 for constructing storm sewers was submitted by C. M. Meeker, of Plainfield, as follows: 990 ft. 36x29-in. concrete sewer, 5 to 6 ft. cut, $3.25; 5 manholes, ea., $45; 20 branches, 12-in., ea., $2; and 1,553 ft. 33-in. circular pipe, concrete or cement block sewer, 6 to 7 ft. cut, $3.50.

West Orange, N. J.—Sewer bonds to the amount of $142,000 are reported sold.

Silver City, N. M.—C. C. Whiteball is reported to have secured a franchise for a sewerage system.

New York, N. Y.—Bids will be received until July 16 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers in several streets, including Grand Boule., E. 180th St., Kingsbridge Road, Garison Ave., Burnside Ave., etc. Engineer's estimate, 8,458 lin. ft. 12-in., 2,777 lin. ft. 15-in., 1,502 lin. ft. 18-in., 254 lin. ft. 24-in. and 260 lin. ft. 30-in. sewer pipe; 98 manholes, 19,485 cu. yds. rock to be excavated and removed, 14 M ft. lumber, etc.

Albion, N. Y.—E. H. Warner, Village Clk., writes that an election will probably soon be held to vote on issuing $200,000 bonds for the construction of a sewerage system. No engineer yet appointed.

Batavia, N. Y.—The Sewer Investigating Com. is stated to have reported to the Bd. of Aldermen on June 19, approving the plans of Alex. Potter, of N. Y. City, for the proposed sewerage system. They will probably be submitted to vote of people in the near future.

Honeoye Falls, N. Y.—See "Water."

Otisville, N. Y.—Bids will be received by the Bd. of Health, N. Y. City (Thos. Darlington, M. D., Pres.), until July 10 (readvertisement) for furnishing and delivering vitri. sewer pipe, c. i. manhole covers and Portland cement to the Tuberculosis Sanatorium at Otisville, Orange Co., N. Y. Deliveries will be required to be made, freight prepaid, to the Otisville station on the Erie R. R.

Buffalo, N. Y.—Separate bids will be received until July 10 by the Dept. Pub. Wks. (Francis G. Ward, Comr.), for constructing a 24-in. brick sewer in La Salle St., 15, 12 and 10-in. tile sewer in Ladner Ave., 10-in. tile sewer in Newfield St.

Maxton, N. C.—See "Water."

**Fargo, N. D.*—The Supervisors of Fargo Township are reported to have awarded contract for a 24-in. main sewer and a lateral 24-in. sewer to Jas. Kennedy, of Fargo; cost about $16,000.

Cincinnati, O.—City Engr. Danenhower is reported to have submitted to the Bd. of Pub. Service estimates as follows: For fixing and repairing breaks in McLean Ave. sewer, $13,000, and Bold Face Creek, $24,000.

The cost of sewering Fairmount, Rosa, Thompson, McBrayer, Luckey and Trade Aves. will be $16,436, according to report of City Engr. Danenhower.

Portsmouth, O.—The following are the bids opened on June 22 by the Bd. of Pub. Service for construction of sanitary sewer on Gay St.: Kaps Bros., $9,284; Kelley Bros., $9,152, and Samuel Monroe & Son, $9,025. Bidders all of Portsmouth.

Oxford, O.—It is reported that the question of constructing a sewerage system is again being discussed by the Village Council.

Cleveland Heights, O.—It is stated that bids will be received until July 16 by Wm. G. Phare, Village Clk., 204 American Trust Bldg., Cleveland, for constructing sewers in Taylor Road. Wm. E. Evers Eng. Co., The Arcade, Cleveland, are the Engrs.

Guthrie, Okla.—See "Water."

Frederick, Okla.—See "Water."

York, Pa.—The State Dept. of Health has approved the plans of Hering & Fuller, of New York, N. Y., for the completion of the sanitary sewerage system and the construction of the outfall sewer and the disposal plant; the citizens will now be called on to vote Sept. 10 on the question of issuing $400,000 bonds for same. The citizens will also vote same time on the question of issuing $250,000 bonds for paving.

Carlisle, Pa.—We are informed that it is proposed to build an entire sewerage system and disposal plant as soon as plans are completed and approved by State Health Comr. T. Chalkley Hatton, of Wilmington, Del., is Designing and Superv. Engr.

Ritzville, Wash.—Press reports state that bids will be received by City Clk. until July 9 for the construction of sewers. The plans and specifications provide for 5,600 lin. ft. of sewers, two filter beds and a septic tank, and will be installed under the supervision of Prof. O. L. Waller, of Pullman, and M. K. Snyder, C. E., of Ritzville.

Snohomish, Wash.—J. B. Snyder and R. P. McAdams, of Everett, bid on June 18 for 5,186 ft. of 24 to 8-in. pipe sewers, with 11 manholes, 1 flush tank, etc., a lump sum bid of $18,200.

Watertown, Wis.—Frank S. Weber, City Clk., writes that bids are about to be asked for the construction of a sewerage system. E. B. Parsons, City Engr.

Oshkosh, Wis.—Bids will be received until July 20 by the Bd. Pub. Wks. (W. A. Marden, Chmn.), for constructing sewers in portions of Sherman and Graham Sts.

Marshfield, Wis.—Bids will be received until Aug. 1 by M. G. Fleckenstein, City Clk., for constructing a sewer on 6th St.

North Battleford, Sask.—See "Power Plants, Gas and Electricity."

BRIDGES.

Notes Arranged Alphabetically by States.

San Diego, Cal.—The Street Comrs. are reported to be preparing to construct 5 reinforced concrete bridges at C, D, F, G and I Sts., at an estimated cost of $50,000.

Placerville, Cal.—The Bd. of Supervisors of El Dorado County are stated to have accepted the bid of Mervy, Elwell & Co. for a steel bridge at Wisconsin Bar to replace the structure recently washed away. The cost is $11,260.

Athens, Ga.—Bids will be received until July 15 by the Comrs. of Roads & Revenues of Clarke County at Athens (Jas. Barrow, Clk.), for repairing the substructure and building a new steel 147½-ft. span at the Princeton Bridge over Oconee River in said county.

Mt. Pulaski, Ill.—Bids will be received until July 15 by the Lake Fork Special Drainage Dist. (W. E. Birks, Chmn. Comrs.), for constructing 5 steel bridges in said drainage dist., three to be 60 ft. long and two 80 ft., all being 12 ft. wide.

Bluffton, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until July 13 for the construction of 19 new bridges, spans varying from 14 to 40 ft. C. S. Brineman, Co. Aud.

Columbia City, Ind.—It is stated that bids will be received until July 23 by the Bd. Co. Comrs. (John M. Mowrey, Chmn.) for constructing steel and concrete bridges, concrete abutments and concrete arches. Saml. F. Tremley, Co. Aud.

Lincoln, Kan.—It is stated that bids are wanted until July 16 for erecting a stone arch bridge. Address County Clk.

Algiers, La.—Bids will be received until July 15 at the office of Alfred Hiller Co., Ltd., in New Orleans for the foundation work, etc., on the Algiers viaduct as follows: Concrete footings, including excavation and creosoted piling in place, and concrete reinforced retaining walls, a lump bid to be submitted; also separate bids for furnishing in place the earth approaches complete, including the paving on top thereof; bids will also be received for furnishing on the ground of the site of the viaduct all the necessary creosoted timber.

Baltimore, Md.—It is stated that Roads Engineer Shirley has reported to the Highways Commission that the proposed bridge to be constructed on the Washington road over the Baltimore and Ohio railroad tracks will cost $11,000, one-half of the cost to be paid by the railroad company and the other half by the county. The bridge will have a 106-ft. span and will be 30 ft. wide, with a 6-ft. walk on each side.

**Medford, Mass.*—Bids for constructing an additional span to Cradock bridge and boat lock at Main St., Mystic River Reservation, Medford, were opened on June 18 by the Metropolitan Park Com. (John R. Rablin, Engr.), 14 Beacon St., Boston. The Austin Eng. & Constr. Co., of Boston, secured the contract as the following bid: 7,700 cu. yds. earth grading, $1; 560 lin. ft. coffer dam, $8.50; 2,000 lin. ft. spruce piles, 23 cts.; 300 lin. ft. concrete pile, 45 cts.; 1,680 cu. yds. concrete masonry, 1:3:6, $7; 1,150 cu. yds. concrete masonry, 1:2½:5, $10; 120 ft. concrete and steel bridge span, $2,700; total, $39,015. Jones & Meehan, of Boston, bid for this work $52,750.

Pittsfield, Mass.—An order is reported to have been passed by Bd. of Aldermen providing for an appropriation of $5,000 for constructing a concrete bridge over outlet near Pontoosuc Lake Dam, replacing present structure.

**Hackensack, N. J.*—W. H. Taylor, of Hackensack, Clk. Bd. Freeholders, writes that the C. W. Dean Co., 136 Liberty St., New York, N. Y., on June 28 secured the contract for constructing bridge at Monroe St., Passaic, for $38,870. Other bidders were: F. R. Long Co., $42,758, and Schwiers-Sutton Co., $44,137.

..Bids will be received by the Bd. of Chosen Freeholders at Hackensack until July 16 for constructing a concrete bridge stone-faced across Dumont Ave., Dumont; a steel beam concrete stone-faced bridge at Washington Ave., Bergenfield, and a concrete bridge with stone facing at Madison Ave., Dumont.

**Items marked thus give the names of parties awarded contracts.*

Allendale, N. J.—Bids will be received until July 15 by the Com. of the Bd. of Chosen Freeholders at the Allendale House, Allendale (A. H. Ackerman, Chmn.), for the construction of a plate girder bridge near Packer's, in Saddle River Boro., N. J.

New York, N. Y.—The Bd. of Estimate and Apportionment on June 28 authorized the use of 1,800,000 bonds for completing construction of Blackwell's Island Bridge.

An appropriation of $45,000 for betterments to Brooklyn Bridge is reported to have been provided for by the Bd. of Estimate and Apportionment on June 28.

**Canandaigua, N. Y.*—Philip J. O'Keefe, Town Clk., writes that Z. T. Darrow & Son, of New Berlin, has secured the contract for construction of concrete arch in Canandaigua, 120 ft. long with 10-ft. span, filling over same and removing bridge (bids opened May 27).

**Athens, O.*—E. R. Walker, Co. Aud., writes that the contract for constructing bridge over Hocking River at Athens (bids opened June 22) has been awarded to the Capitol Constr. Co., Columbus, for $11,780.

Wapakoneta, O.—It is stated that bids will be received until July 12 by the Co. Comrs. for constructing 2 bridges across Auglaize River, 1 in Duchouquet Township and the other in Logan Township. W. H. Meyer, Co. Aud.

Cincinnati, O.—Bids will be received until July 12 by the Co. Comrs. (Fred. Dreihs, Clk.) for the following: Specifications 635, reinforced concrete bridge and approaches thereto on Ohio Pike at Ferris, Anderson Township; Specifications 631, improving culvert on Cleves and Bridgetown Pike, Miami Township; Specification 598, 5-ft. circular concrete culvert on Montgomery Pike, Sycamore Township; Specification 536, concrete box culvert on Compton Road, Springfield Township.

Sidney, O.—It is stated that bids will be received until July 12 by J. C. Rosser, Co. Aud., for constructing a 1-span high-truss single-track bridge over Nine Mile Creek.

**Mt. Union, Pa.*—The contract for constructing masonry work on the bridge to be constructed at Mt. Union is reported to have been awarded to Lemuel A. Green, of Huntingdon for about $11,000.

Shamokin, Pa.—Bids will be received until July 9 by the Bd. Co. Comrs. (Frank Erdman, Chmn.) at Sunbury, for erecting an iron bridge on Arch St., crossing Carbon Run, Shamokin.

Towanda, Pa.—Bids will be received until July 9 by the Bd. Co. Comrs. (E. D. Harkness, Chmn.) for constructing several bridges throughout the county.

Providence, R. I.—It is stated that the Rhode Island Co. (F. N. Bushnell, Ch. Engr.) has decided to construct a viaduct from Exchange Pl. to summit of College Hill.

Houston, Tex.—Geo. Horton, County Engr., writes that it is proposed to construc a bridge over San Jacinto River on the Montgomery Road at Humble; cost about $7,000. John B. Ashe, Co. Aud.

Spokane, Wash.—Estimates of the cost of the proposed new city bridges, it is stated, have been prepared as follows, by City Eng. Chas. McIntyre: For a steel structure on Washington St., 1224 ft. long with a 48-ft. roadway, $386,000; a reinforced concrete bridge, 40 ft. wide, with asphalt and brick paving, $264,000. A bridge over the north channel of Howard St., 252 ft. long and 40 ft. wide, built of reinforced concrete, $38,000; the Stevens St. bridge, 152 ft. long, with steel girders, $9,900; Mission Ave. bridge, $58,050 for a reinforced concrete structure, $51,040 for a steel structure and $29,852 for a wood and steel bridge; reinforced concrete bridge on Monroe St., 990 ft. long and 50 ft. wide $320,000.

Marlinton, W. Va.—The County Court of Pocahontas County will soon ask for bids for the erection of 3 highway bridges across Greenbrier River, each to be about 200-ft. span and set on concrete abutments, one to be erected at Cass, one at Cloverlick, and one at Sitlington.

La Crosse, Wis.—The following bids were reported opened for constructing 45 ft. reinforced concrete bridge over the lagoon in Pettibone Park: Marsh Bridge Co., Des Moines, Ia., 2 bids, $4,988, & $5,200; Security Bridge Co., Minneapolis, Minn., $6,200; Chas. W. Noble, La Crosse, 2 bids, $4,544 and $4,950; Illinois Bridge Co., Chicago, Ill., $7,000, and La Crosse Bridge & Steel Co., La Crosse, 3 bids, $7,490, $7,685, and $7,925.

Milwaukee, Wis.—Bids will be received until July 9 by the Bd. Pub. Wks. (Chas. J. Poltsch, Chmn.) for constructing a stationary concrete bridge with concrete abutments, and all appurtenances thereto, across the Kinnickinnic River, at the intersection of 3d Ave., 14th Ward.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Pensacola, Fla.—See "Water."

**Edwardsville, Ill.*—Chas. A. Sheppard, City Engr., writes that John Hamm, of Litchfield, has secured the contract for paving as follows, bids opened June 17: Vandalia st. and St. Andrews Ave., 9,900 sq. yds. brick paving, on 5-in. concrete foundation, $1.64; and 6,060 lin. ft. granitoid 8-in. curb and 6½-in. gutter 2 ft. wide, 73 cts.; total, $20,660; and for paving Hillsboro Ave. 9,800 sq. yds. brick on 5-in. concrete foundation, $1.67, and 6,700 lin. ft. curb, 73 cts.; total, $21,257.. Total of other bids received were: (a) Vandalia St. and St. Andrews Ave.; (b) Hillsboro Ave.; Hyten & Fahrig, Edwardsville, *a*, $22,339; *b*, $23,041; O. F. Dunlap, Edwardsville, *a*, $22,680; *b*, $23,964, and A. F. Franks, Jacksonville, *a*, $23,430; *b*, $26,104.

Danville, Ill.—W. H. Martin, City Engr., writes that the Interurban Constr. Co. of Danville has secured the contract for paving (bids opened June 13) at the following bid: 25,000 yds. brick pavt., $1.32; 9,000 cu. yds. excav., 30 cts.; 5,000 ft. reset curb, 7 cts.; 800 ft. marginal curb, 25 cts.; 1,150 ft. 18-in. sewer, 78 cts.; 1,075 ft. 15-in. sewer, 68 cts.; 1,800 ft. 12-in. sewer, 58 cts.; 46 single inlets, $20, and 20,000 ft. 4x18 sandstone curb, 35 cts.

Ancona, Ill.—It is stated that bids will be received until July 12 by the Highway Comrs. of Reading Township (C. A. Helper, Chmn.) for graveling Bloomington Rd.

**Bloomington, Ill.*—The contract for 12,777 sq. yds. vitr. brick pavement and 8,230 lin. ft. curb and gutter (bids opend June 28) has been awarded to Crescent Contr. Co., of Peoria, for $26,458. C. F. Fauntz, City Engr.

McLeansboro, Ill.—New bids will be received until 1 P. M. on July 9 by G. W. Hogan, Pres. Bd. Local Improv., for furnishing material and constructing the following: Sec. A, 23,641 sq. yds. brick pavt.; 14,092 lin. ft. 4x20 straight curb; 798 lin. ft. 4x14 protection curb, 518 1-10 lin. ft corners 3 ft. radius; 10,127 cu. yds. excav.; 1,596 cu. yds. fill. Sec. B, 20,544 sq. yds. brick pavt.; 13,790 lin. ft. 4x20 straight curb; 748 lin. ft. 5x14 protection curb; 423 9-10 lin. ft. corners, 3 ft. radius; 7,763 cu. yds. excav.; 536 cu. yds. fill. Bids to be submitted as a whole and upon each section separately; probable cost, $90,000. H. E. Beasley, Engr., Centralia; Harry Anderson, City Attorney. The bids for this work were to have been opened on June 21, but no bids were received, owing to raise in rates by R. R. companies.

Paris, Ill.—Bids will be received by J. H. C. Gist, Pres. Bd. Local Improv., until July 8 for 16,821 sq. yds. brick pavement on concrete foundation on N. Central Ave. and S. Main St., as advertised in The Engineering Record. W. T. Blackburn, City Engr.

Sterling, Ill.—City Engr. John Avey is reported to have estimated the cost of paving a portion of 1st Ave. at $11,787.

Chicago, Ill.—Bids will be received until July 11 by the Bd. Local Improv. (H. S. Dietrichs, Pres.), for grading and paving with repressed vitrified block asphalt, granite blocks, etc., portions of numerous streets.

**Nappanee, Ind.*—The Central Construction Co., of Rochester, is reported to have been awarded a $100,000 paving contract in this city.

**Clinton, Ind.*—B. F. Harrison, City Clk., writes that the lowest bid and successful bid opened on June 10 for paving was submitted by Harris & Dorsey, of Terre Haute, as follows: 3,300 cu. yds. excav., 25 cts.; 2,088 lin. ft. straight cement curb, 30 cts.; 150 lin. ft. circular cement curb, 50 cts.; 530 lin. ft. straight marginal stone curb, 4x18, 40 cts.; 9,155 sq. yds. brick pavt., including concrete base, cement filler, sand cushion and expansion joints, $1.45; 1,195 sq. yds. brick pavt., including concrete base, cement fill, sand cushion and expansion joints, along and between stress railway track, $1.70; total, $17,045. Totals of the other bids: W. F. Frey, Lafayette, $17,262; H. C. Finley, Hoopeston, $17,318, and Foulks & Froeb, Terre Haute, $17,700.

Sullivan, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until July 11 for the construction of a macadamized road in Fairbanks Township. Length of road 19,923 ft. E. E. Russel, Co. Aud.

Spencer, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until July 18 for the construction of a macadamized road upon and along the county line between the said counties of Morgan, Owen and Putnam. G. O. Mitten, Co. Aud.

Cedar Falls, Ia.—Bids will be received until July 11 by the City Council for furnishing material and paving portions of Main, 22d and 23d Sts., requiring about 15,600 sq. yds. brick pavt., with macadam foundation, 3,600 lin. ft. curb, etc.

Sigourney, Ia.—A. M. Neas, City Clk., writes that the following are the bids, opened on June 5, for 15,000 sq. yds. brick paving on 6-in. concrete foundation: (price given per sq. yd.): J. C. Like, Des Moines, $2.08; Burlington Constr. Co., Burlington, $2.16; J. W. Turner Improv. Co., Des Moines, $2.15; Ind. Constr. Co., Davenport, $2.20, and Magden & Sheely, Des Moines, $2.05. Awarded contract.

**Waterloo, Ia.*—W. A. Bryant & Sons Co., of Waterloo, are stated to have secured the contract (bids opened June 20) for paving with brick and asphalt in West Waterloo, at $2 and $1.79 per sq. yd., respectively; 21,724 yds. of asphalt and 4,556 yds. of brick required for the proposed improvement.

Ft. Leavenworth, Kan.—Bids will be received here until July 19, by Capt. J. E. Normoye, Q. M., U. S. A., for paving Grant Ave. from Meade to Metropolitan Ave., including curbs, gutters, drains, etc., at this post.

Leavenworth, Kan.—The City Council is reported to have passed a resolution providing for the paving of portions of Olive and Marshall Sts.

Topeka, Kan.—The Phoenix Brick & Constr. Co., of St. Joseph, Mo., is reported to have secured the $80,000 brick paving contract in Topeka.

Hopkinsville, Ky.—Bonds amounting to $100,000 for road improvements in Christian County are reported sold.

Baltimore, Md.—Bids will be received by the Bd. Awards (J. Barry Mahool, Pres.) until July 10 for grading, curbing and paving with macadam a portion of Belle Ave.

Pittsfield, Mass.—The bids received June 12 for paving South St. are stated to have been as follows: Asphalt, Barber Asphalt Co., Boston, by A. S. Johnson, $2.92 per sq. yd.; total, $40,880; bitulithic, Warren Bros., Boston, $2.75 per yard, 2½-in. surface, total of $39,942, with special rate of $5 per yd. about street railway tracks; wood blocks, J. F. Kerwin, of New Brunswick, N. J., $3.50 per yd., total, $49,000.

Pittsfield, Mass.—The Bd. of Aldermen is stated to have passed an order providing for an appropriation of $5,000 for paving Cottage Row.

**Royalton, Mich.*—Frank A. Toush, Township Clk., St. Joseph, Mich., writes that the contract for macadamizing Niles and Hollywood Roads (bids opened June 4), has been awarded to Aug. Shultz, of Baroda, for $9,922.

Muskegon, Mich.—C. S. Gamble, City Engr., writes that bids will be received on July 15 for paving with bituminous macadam Western Ave.; cost about $50,000. He further states that plans have been prepared for paving portions of Terrace, 1st, 2d and 3d Sts.; cost, about $10,000.

Detroit, Mich.—The lowest bids opened by Comr. Haarer June 20 for the paving of five sections of streets are reported as follows: Larned St., with creosoted block, Thos. E. Currie, $9,863; Brady St., creosoted block, W. W. Hatch & Sons, $16,294; Watson St., brick, Jas. Hanley, $6,081; Riopelle St., brick, Thos. E. Currie, $11,391; Hastings St., Thos. E. Currie, $2,825.

Duluth, Minn.—Hugh Steele is reported to be the lowest bidder for paving 4th Ave. W., at $14,054, and Geo. A. King lowest for paving Tioga St., at $13,430.

*Russell & Holmquist are stated to have secured the contract for paving a portion of John Ave., for $26,021.

Ft. Snelling, Minn.—B. W. Moore, of St. Paul, is reported to have submitted the lowest bid at $4,375, June 15, for road work at Ft. Snelling.

Shakopee, Minn.—The City Council is reported to have opened bids as follows for grading the Trestle Road: Jas. Forrestal, Scandinavian American Bank Bldg., St. Paul, 70 cts. per cu. yd., and J. J. Mergens, $4,450.

St. Paul, Minn.—Bids will be received until July 15 by Edw. G. Krahmer, Co. Aud., for macadamizing a portion of Edgerton St. and grading and improving Bald Eagle Lake Ave.

The lowest bids received by the Co. Comrs. on June 17 for constructing macadam or gravel roads are reported to have been as follows: Forrestal & Co., Scandinavian American Bank Bldg., Edgerton St. from Forest Cemetery to Station 72 and 30, $16,500; Larpenteur Ave., White Bear Ave., and North St. Paul Rd., $7,227; Rice St. and Kettle River Rd., $8,095; St. Paul, White Bear and Bald Eagle Rd., from the south to the north of White Bear village limits, $5,531 Lexington Ave, $13,985; Lake Ave., Forrestal & Co., $3,465; Minnehaha St., $3,260; Dale St., $6,260; Forrestal & Co., $6,260; Bald Eagle Lake Rd. from Mounds View and Bald Eagle Rd., northerly to Station 44, Hane & Nelson, $2,968.

It is stated that bids will be received by the Bd. Co. Comrs. until July 15 for improving a portion of Edgerton St. Probable cost, $13,385. Edwd. G. Krahmer, Co. Aud.

Winona, Minn.—The lowest bid opened on June 10 by City Council for macadamizing W. 4th and Wilson Sts., about 6 blocks, was submitted by Braley & Abell, at the following bid: Macadam, $1 per sq. yd.; brick gutter, 35 in., 55 cts. per lin. ft.; retaining curb, 25 cts. per ft.; new curb, 39 cts. per ft., and reset curb, 8 cts per ft.

It is stated that bids are wanted until July 8 for macadamizing Center St., about 7 blocks. H. B. Walling, City Engr.

Kirksville, Mo.—Bids will be received at the office of J. C. Carothers, City Clk., until July 15 for paving a portion of Franklin St. with vitr. paving brick or block, on a 5 or 6-in. concrete base, approximately 16,700 sq. yds. paving and 8,536 ft. concrete curb and gutter, as advertised in The Engineering Record. H. Selby, Mayor.

Joplin, Mo.—The City Council is reported to have passed a resolution providing for the paving of a portion of Wall St.

**St. Joseph, Mo.*—Rackliffe & Gibson, 619 Edmond St., are stated to have secured the contract for paving a portion of 24th St. with Hassam pavement at $1.50 per sq. yd.

*The Bd. of Pub. Wks. is stated to have decided to reject all bids received for paving with brick a portion of Kemper St. According to reports new bids will be received.

St. Louis, Mo.—Bids will be received until July 12 by the Bd. Pub. Improv. (A. J. O'Reilly, Pres.), for improving portions of several streets by paving with granite blocks and vitrified paving brick.

Springfield, Mo.—It is stated that bids will soon be received for paving with brick a portion of Boonville St.

Paterson, N. J.—The Bd. of Works is stated to have awarded the contract for repairing asphalt on Main and Market Sts. to John R. Lee, 2d National Bank Bllg., at $3.50 per yd.

Jersey City, N. J.—The Street and Water Bd. is reported to have adopted a resolution providing for an appropriation of $69,681 for repaving portion of Ocean Ave.

*The Bd. of Wks. on June 20 is stated to have awarded contracts for paving as follows: Van Keuren & Son, Grand and Prior Sts., with telford, Leslie St., $9,855; S. 10th St., $23,831; S. 15th St., $25,926. The Jersey Paving Cor., 45 Clinton St., brick paving, Fillmore St., $6,813; Houston St., $16,608; Woodside Ave., $10,604. The Barber Asphalt Co., Halsey and Academy Sts., Newark, 9th Ave., $4,569.

Salem, N. J.—Bids will be received by the Bd. of Chosen Freeholders (John F. Ayres, Dir.) until July 8 for the construction of a state and county road, known as Aldine Road, 1.326 miles, as advertised in The Engineering Record.

Jamesburg, N. J.—Bids will be received by the Trus. of the State Home for Boys (Edw. Spaeth, Pres.) until July 8 for macadamizing roads to and around buildings, together with necessary grading, as advertised in The Engineering Record.

**Newark, N. J.*—The Jersey Paving Corp., 45 Clinton St., is reported to have secured the following contracts for brick paving: Fillmore St., $6,813; Houston St., $16,608; Woodside Ave., $10,604. The Barber Asphalt Co., Halsey and Academy Sts., is stated to have obtained the contract of paving 9th Ave., for $4,569.

North Tonawanda, N. Y.—The Ward Road, from the No. Tonawanda city line to the town line of Lewiston will be improved by the state this summer, according to reports.

Rochester, N. Y.—Whitmore, Rauber & Vicinus, 279 South Ave., are reported to have submitted a bid at $5.25 per sq. yd. for paving with wood block 4' east spans of Platt St. Bridge.

*The Bd. of Contract and Supply is reported to have awarded contracts for paving as follows: Clifford St., with brick, to Whitmore, Rauber & Vicinus, 279 South Ave., for $47,893; resurfacing Webster Ave. with Town-

**Items marked thus give the names of parties awarded contracts.*

send block, F. A. Brutsch & Son, 826 Clinton Ave. S., $29,095.

New York, N. Y.—Bids were opened on June 20 by Louis F. Haffen, Pres. Bronx Boro., for paving as follows:

Clay Ave. from E. 166th St. to 167th St. and from 168th St. to Wendover Ave.: (a) 18,330 sq. yds. iron slag pavt.; (b), 2,700 cu. yds. concrete; (c), 8,250 lin. ft. old curb; (d), totals: Atlanta Contr. Co., *a*, $3.49; *b*, $4.74; *c*, 30 cts.; *d*, $79,529; Sicilian Asphalt Paving Co., *a*, $3.25; *b*, $5.10; *c*, 40 cts.; *d*, $73,948.50; Asphalt Constr. Co., *a*, $3.09; *b*, $5; *c*, 35 cts.; *d*, $73,327.

Prospect Ave. from Tremont Ave. to E. 189th St. Lowest bidder, Continental Asphalt Paving Co., 16,348 sq. yds. asphalt block, $1.89; 2,570 cu. yds. concrete, $4.48; 8,900 lin. ft. old curb, 34 cts.; total, $45,437. Totals of other bids: Barber Asphalt Paving Co., $45,792, and Hastings Pavt. Co., $46,839.

Trinity Av., from Westchester Ave. to E. 161st St. Lowest bidder, Barber Asphalt Paving Co., 8,918 sq. yds. asphalt blocks, $159½; 1,360 cu. yds concrete, $5.50; 4,200 lin. ft. old curb, 42 cts.; total, $23,468. Continental Asphalt Paving Co., $24,149; Asphalt Constr. Co., $25,335, and Hastings Pavt. Co., $24,622.

Creston Ave. from Burnside Ave. to E. 184th St.: Lowest bidder, Barber Asphalt Paving Co., 9,540 sq. yds. asphalt blocks, $1.60; 1,520 cu. yds. concrete, $5.50, 5,550 lin. ft. old curb, 37 cts.; total, $25,677. Totals of other bids: Continental Asphalt Paving Co., $26,086; Hastings Pavt. Co., $27,286.

The Barber Asphalt Co. submitted the lowest bid on paving other streets in Bronx Boro. with asphalt (bids opened June 20), as follows: Park Ave. E. from E. 183rd St. to Pelham Ave., $15,023; E. 170th St. from Franklin Ave. to Boston Rd., $6,507; Beekman Ave. from E. 141st St. to St. Mary's Park, $6,115, and E. 185th St. from Park to 3rd Ave., $6,423.

Bids will be received until July 16 by Louis F. Haffen, Pres. Boro Bronx, for constructing the Transverse Rd. at E. 204th St., and at Burnside Ave. in connection with the Grand Boule. and Concourse. Engineer's estimates: 15,755 cu. yds. earth excav., 3,100 cu. yds. rock excav., 40,750 cu. yds. filling and back-filling, 4,600 cu. yds. dry rubble masonry, 4,100 cu. yds. cyclopean masonry, 1,000 cu. yds. Class "A" and 10,450 cu. yds. Class "B" concrete, 19,000 sq. ft. waterproofing, 540 cu. ft. granite newels, fenders and coping, 970 lin. ft. 18-in., 1,375 lin. ft. 12-in. and 440 lin. ft. 10-in. vitri. stoneware pipe drain, 126 spurs for house connections, 24 manholes, 4,200 sq. yds. paved gutters, 745,000 lbs. steel and iron (exclusive of railings), 3,550 sq. ft. woven wire fabric, 6,350 lin. ft. new bluestone curb, 39,350 sq. ft. cement and 1,750 sq. ft. bluestone flagging, 3,600 sq. ft. new bridgestone, 9,000 sq. yds. asphalt blk., 8,050 sq. yds. iron slag and 1,500 sq. yds. macadam pavt., 183 lin. ft. Type "A," 2,345 lin. ft. Type "B" and 1,750 lin. ft. Type "C" railing, etc.; also regulating curbing and flagging the sidewalks, etc., on 193d St., Shakespeare and Nereid Aves., and building approaches, etc., on Manida St., paving with granite block Devoe Ave. Engineer's estimate: 2,550 sq. yds. new granite blk. pavt., on a sand foundation, laid with sand joints, and keeping the pavt. in repair for yr. from date of acceptance, 73,400 cu. yds. earth and 4,050 cu. yds. rock excav., 18,030 cu. yds. filling, 6,785 lin. ft. new curb, furnished and set, 26,250 sq. ft. new flagging, furnished and laid, 4,425 sq. ft. new bridgestone for crosswalks, furnished and laid, 1,000 lbs. c. i. inlet frames and covers, in place; also same time and place for furnishing and delivering to the Bureau Highways 15,000 cu. yds. best quality 1½-in. and 5,000 cu. yds. ½-in. broken stone, tran rock, lime or native stone; also furnishing and delivering to the Bureau Highways a double cylinder steam road rollers, Buffalo-Pitts or equal (size, 15 gross tons).

**Elmira, N. Y.*—S. A. Warner, City Clk., writes that Costello & Neagle, of Elmira, have secured the contract for paving E. Church St., about 7,800 sq. yds. (bids opened June 24).

Kenmore, N. Y.—The citizens are stated to have voted to issue $60,000 bonds for street improvements.

Brooklyn, N. Y.—The Hasting Pavt. Co., 25 Broad St., N. Y. City, submitted the following bids, which were opened by the Park Bd. of N. Y. City on June 20: For furnishing all labor and materials necessary for repairing walks in Prospect Park, with asphalt tiles together with all work incidental therto, 140,000 sq. ft., 26 cts. per sq. ft.; total, $36,400, and 68,000 sq. ft. asphalt tiles on sand foudation, and 3,000 cu. yds. excav. in Sunset Park for $19,220.

Bids will be received until July 17 by Bird S. Coler, Boro. Pres., for regulating and repairing with asphalt on 58th, Halsey, Macon and Ross Sts., Hampton Pl. and Throop Ave., also regulating, grading, curbing and laying sidewalks on several streets, including Coney Island Ave., Schenck Ave. and 71st St. Engineer's estimate includes 97,560 sq. ft. cement sidewalks, 33,200 lin. ft. new curb, 14,900 sq. yds. asphalt, 1,910 sq. yds. asphalt block, 12,930 cu. yds. earth excav., etc.
Parks (Moses Herrman, Pres.), New York City, for fur-
Bids will be received until July 18 by the Comrs. of nishing material and constructing asphalt tile walks in Bedford, Bushwick, Fulton, Saratoga and Irving Sq. Parks, Boro Brooklyn.

The Bd. of Aldermen on June 25 voted to grant Bird S. Coler, Boro. Pres., $100,000 with which to repair asphalt pavements.

*Bids were opened on June 28 by Bird S. Coler, Pres. Brooklyn Boro for paving as follows:

Regulating and paving with asphalt on a concrete foundation 11th Ave. from 15th to 18th Sts. Successful bidder, Brooklyn Alcatraz Asphalt Co., 407 Hamilton Ave., Brooklyn, at $1.18 per sq. yd. for 6,820 sq. yds. asphalt pavt., and $5.75 per cu. yd. for 960 cu. yds. concrete; total, $13,568. Totals of other bids: Barber Asphalt Paving Co., 114 Liberty St., N. Y. City, $14,298; Uvalde Asphalt Paving Co., 1 Bway., N. Y. City, $14,032, and Cranford Co., 52 9th St., Brooklyn, $14,313.

*Regulating and paving with asphalt on concrete foundation Foster Ave., from Flatbush Ave. to E. 17th St., and from E. 14th St. to Coney Island Ave. Successful bidder, Cranford Co., 52 9th St., Brooklyn, as follows: 15,930 sq. yds. asphalt, $1.24; 2,250 cu. yds. concrete, $5.85; total, $32,913. Totals of other bids: Barber Asphalt Paving Co., $33,918, and Uvalde Asphalt Paving Co., $33,412.

*Regulating, grading, curbing and laying sidewalks on Grand St., as extended from Hooper St. to Bridge Plaza. Successful bidder, Matthew T. Meagher, 1127 Willoughby Ave., Brooklyn, as follows: 3,562 lin. ft. new curb set in concrete, $1; 50 lin. ft. old curbstone reset, 50 cts.; 8,000 cu. yds. earth excav., 69 cts.; 59,340 sq. ft. cement sidewalk, 15 cts.; total, $18,862. Totals of other bids: Chas. Cranford, 44 Court St., Brooklyn, N. Y., $20,893; John Monahan, Pilling St., Brooklyn, $19,145; Bracken M'Avency Co., ft. 6th St., Brooklyn, $20,401; O'Grady Bros., 72 N. 8th St., Brooklyn, $19,972, and Builders' Truck and Material Co., Troy Ave., Brooklyn, $18,862.

Columbus Barracks, O.—Bids for construction brick road pavement, concrete sidewalks, gutters, etc., at this post will be received by H. B. Chamberlin, Constr. Q. M., U. S. A., until July 19.

Cincinnati, O.—It is stated that bids will be received until July 10 by the Bd. Pub. Service (M. J. Keefe, Clk.), for grading, paving and curbing a portion of Grandin Road, estimated to cost $21,988; also until July 15 for grading and paving Beechmont Ave., estimated to cost $99,790. Chas. N. Dannenhower, City Engr.

*The County Comrs. on June 25 are stated to have awarded the contract for improvement of Colerain Pike to N. Ruehel at $49,905.

Bids will be received until July 26 by the Bd. Co. Comrs. (Fred Dreilis, Clk.), for improving Harrison Pike, Harrison, O.; Whitewater, Colrain and Harrison Townships, as per specification 651; also Hamilton Pike, Mt. Healthy Springfield Township, as per specification 61.

*The Bd. of Pub. Service on June 20 is reported to have awarded contracts for the wood block paving as follows: United States Wood Preserving Co., 29 Bway., New York, N. Y., Albany Ave., $39,544; Cross Lane, $5,725; McMillan St., to Kirchner Constr. Co., cor. 8th and Plume Sts., $30,645.

Bids will be received until July 19 by the Bd. Co. Comrs. (Fred Dreihs, Clk.) for improving Lisk Run Pike, Green Township as per specification No. 638; also, until July 29 for improving Colerain Pike, Colerain Township, as per specification No. 621.

Findlay, O.—It is stated that bids will be received until July 20 by the Co. Comrs. for constructing 3 miles of stone pipe in Orange Township.

Painesville, O.—State Highway Comr. Sam'l Huston, Columbus, O., is asking for bids for a highway proposed under the new Ohio law, to be let at Painesville on July 23rd.

Cleveland, O.—Bids will be received until July 27 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.), for repairing the pavement on Bentleyville Rd., Chagrin Falls Township; also repairing the pavement on Berea Rd. A. B. Lea, Co. Engr.

Columbus, O.—E. F. McGuire, Secy. Bd. Pub. Service, writes that bids will be rceived on July 12 for constructing an asphalt repair plant.

**Marion, O.*—The Bd. of Pub. Service is reported to have awarded the contract for constructing stone sidewalks on Mound and John Sts., Cummin, Cleveland and Wilson Aves., to H. W. Mann at 16 cts. and 15½ cts. per sq. ft.

**Newport, O.*—The Bd. of Aldermen is stated to have awarded contracts for repaving with brick as follows: 11th St. to Collopy & Co., at $23,016; 3d, 5th, 7th, 10th Sts., to R. L. Schoolfield, at $3,957, $3,465, $3,270 and $4,306, respectively; Hamlet and 8th Sts., to E. J. Knoepfle, at $2,307 and $4,180, respectively.

Archbold, O.—It is stated that bids will be received by O. W. Hill, Village Clk., until July 15 for paving Depot St.

Monroeville, O.—The following bids are reported opened June 17 for paving with brick Main St.: Kellogg & Blume, of Norwalk, $4,026; Stowers & Jones, of Monroeville, $4,209; Lee & Griggs, of Clyde, $3,623.

Elyria, O.—It is stated that bids will be received by the Bd. Co. Comrs. until July 12 for grading, draining and macadamizing sundry roads. L. A. Fauver, Co. Surv.

El Reno, Okla.—L. G. Adams, City Clk., writes that it is proposed to pave with brick certain streets. Engineer, R. N. Whittlesey, of El Reno.

**Portland, Ore.*—The Pacific Bridge Co., Mohawk Bldg., is reported to have secured the contract for paving E. Taylor St. for $16,769.

Bridgeton, Pa.—The Borough Council is reported to have passed an ordinance providing for the paving of numerous streets at an estimated cost of $75,000.

Wilkesbarre, Pa.—Bids will be received at the office of Jas. M. Norris, County Controller, until July 18 for paving with vitrified paving block on Broad St., in Hazle Township; also, same time and place, for furnishing and delivering the vitrified paving block for paving Broad St. in Hazle Township, both proposals advertised in The Engineering Record.

*The contract for paving Curtis St. with Mack brick is reported to have been awarded to Fitzpatrick & McConville at $1.57 per sq. yd.

Harrisburg, Pa.—It is stated that contracts will soon be let for 27,945 sq. yds. paving, including improvement of Hummel, Dauphin, Elm and 17 Sts.

**Manor, Pa.*—The City Council is reported to have awarded the contract for paving throughout Manor to Hastings & Barrett, of Charleroi, at $1.30 per sq. yd.

**Pittsburg, Pa.*—Contracts are reported to have been awarded as follows for constructing McKees Rocks and Forest Grove Rd., McKees Rocks and Steubenville Pike to Collins, Gardner Co., for $51,163 and $51,518 respectively; Milltown and Unity Road, Unity and Trestle Road, to W. E. Howley, Bijou Bldg., at $17,262 and $21,080 respectively.

Houston, Tex.—Bids for paving 70,865 sq. yds. with brick and excavating 13,270 cu. yds, is reported to have been opened June 17 by City Council. The city to furnish the brick. Kelso & Vantian, $80,911; W. S. Hipp, $75,151; Municipal Paving Co., $75,410; A. T. Lucas, $60,950.

Bids will be received until July 12 by John B. Ashe, Co. Aud., for paving Houston and Crosby Rds.

Ogden, Utah.—The following work has been fully determined on to be done in this city. Bids will be called for on each job separately and at different times: Washington Ave. sidewalks, over 24 blocks; Orchard Ave. sidewalks, 1 block; Orchard Ave. curb and gutter, 1 block; 27th St. curb and gutter, 7 blocks; Wall Ave. curb and gutter, 2 blocks; Wall Ave., asphaltum pavt., 1 block; Monroe Ave. sewer, 1 block. Each block comprises 660 ft. A. H. Parker, City Engr.

**Seattle, Wash.*—The Bd. of Pub. Wks. is stated to have awarded contracts as follows: Regrading Westlake Ave., to Hans Pederson, $16,379; to Oltosen & Jenson for $39,710.

Centralia, Wash.—It is sated that bids are being received for paving with bitulithic Tower Ave., at a cost of about $45,000.

**Bluefield, W. Va.*—Kelley Bros., of Portsmouth, O., has secured the contract for paving 8 streets with vitr. brick on concrete foundation, about 48,000 sq. yds.; amount of contract estimated at $107,000.

La Crosse, Wis.—The County Bd. is stated to have decided to construct a highway between West Salem and Mindoro, to cost about $7,000.

Fond du Lac, Wis.—The paving of streets as follows is reported contemplated: 3d St. with brick, W. 2d St., tar macadam, and Park Ave. with asphalt.

Milwaukee, Wis.—Bids will be received until July 9 by the Bd. Pub. Wks. (Chas. J. Poetsch, Chmn.) for resurfacing with asphalt on the present concrete foundation, a portion of Jefferson St.

Neenah, Wis.—Bids will be received until July 13 by the Bd. Pub. Wks. (Robt. Jameson, Chmn.), for furnishing material and constructing a vitrified block pavement on N. Commercial St.

North Battleford, Sask.—Bids will be received until Aug. 7 by S. Cookson, Secy.-Treas., for $7,000 street grading and sidewalk bonds.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Greensboro, Ala.—The Greensboro Water & Light Co. is planning to establish an all-night service and install meters. Jas. E. Webb, Jr., is mgr.

Uniontown, Ala.—This city is contemplating installing meters in the next fiscal year, and will also install larger hydraulic pumps. S. T. Townsend, Supt. Water and Light Plant.

Pine Bluff, Ark.—The Pine Bluff Water & Light Co. is reported to have decided to build new water works and electric light plant on W. 4th Ave.

San Francisco, Cal.—The following are the bids opened on June 14 by Capt. B. F. Cheatham, Q. M., U. S. A., for installing electric lighting system, etc., at Forts Barry and Baker: *a*, wiring buildings; *b*, furnishing fixtures; *c*, construction primary and secondary device; *d*, furnishing transformers, arc light, etc.; *e*, construction sub station; *f*, construction pumping plant; *g*, furnishing current; H. S. Tittle, 229 Minna St., *a*, $1,230; *b*, $4,048; *c*, $20,405; *d*, $6,550; *e*, $4,870; *f*, $9,240; A. C. Mattingly, 300 Polk St., *a*, $1,855; *b*, $5,500; *c*, $15,475; *d*, $7,370; *e*, $4,400; *f*, $7,100. Levy Elec. Co., 1005 Post St., *a*, $3,200, King Constr. Co., 1333 Eddy St., *e*, $2,800; C. S. Rankin, 724 Gough St., *e*, $5,441, and Bay Counties Power Co., 925 Franklin St., *g*, 3 cts. per kw.

Ukiah, Cal.—It is stated that bids will be received until July 13 by the Bd. Trus. at Ukiah for purchase of a franchise of the Snow Mountain Water & Power Co. to erect and maintain transmission line in the town of Potter Valley.

Denver, Colo.—The Central Colorado Power Co. is reported to have filed a mortgage of $20,000,000 in the Clerks' offices of Larimer, Grand, Summit, Lake, Eagle, Pitkin, Garfield and Denver Counties. The company will have three plants, which will have a combined capacity of 125,000 h.p. The property covered includes the De Remer water power location at Shoshone falls above Glenwood Springs, where work is already under way, about 25,000 h.p.; also the Gore canon plant; and the third power plant will be located on Roaring Fork near Aspen. In addition the company will have 6 storage reservoirs, 2 on upper Roaring Fork and 4 on Grand River. The mortgage is reported to have been filed by Lunt, Brooks & Wilcox, of Colorado Springs, Mgrs. of the company.

Winsted, Conn.—The Winsted Gas Co. is contemplating increasing its power plant and will install two 100-kw. Curtis steam turbines and 250 h.-p. boilers, and will also change the system to 60 cycles. Henry Skinner, Mgr.

Washington, D. C.—See "'Miscellaneous.'

Kilbourne, Ill.—E. H. Parker is reported to have decided to establish an electric light plant.

Bloomington, Ill.—Bids will be received until July 9 by Harry E. Rhoads, City Clk., for reconstrucing electric light plant. There will be required one 350-kw. generator, 400 Series A. C. arc lamps, drawing 6.6 amperes, with regulators and transformers; one surface condenser, with air and circulation pumps, capacity 12,000 lbs. steam per hour, etc.; also one smaller direct-connected unit, consisting of simple automatic engine and 60-kw. generator. A. T. Malthy, Consulting Engr., 803 Great Northern Bldg., Chicago. Probable cost, $40,000.

Beardstown, Ill.—The Beardstown Electric Light & Power Co. is contemplating building a coal gas plant this year with 6 miles of main and a 50,000 cu. ft. gas holder, two benches of "sixes" retorts. W. E. McCollough is mgr.

Cornell, Ill.—M. J. Rhodes, owner and mgr. of the Cornell Electric Light Plant, is now erecting a new building, and contemplates changing the system from 125 to 60 cycles, and also to install an exhaust steam heating system this season.

Winchester, Ind.—The Citizens' Water & Light Co. proposes changing its D. C. to A. C. and will need 1,500 incandescent lamps, 2 500-light transformers and 1 300-light transformer.

Corydon, Ind.—The Corydon Light, Water & Ice Co. contemplates equipping its plant with a new engine and dynamo this fall.

**Items marked thus give the names of parties awarded contracts.*

Kokomo, Ind.—The Kokomo, Marion & Western Traction Co. (consolidated with Kokomo Ry. & Light Co.) proposes installing a new 1,000-kw. turbo alternator.

**Lafayette, Ind.*—The Lane-Pike Co., of Lafayette, is reported to have secured the contract for an electric light plant at the Indiana State Soldiers' Home, for about $10,000. The Lafayette Eng. Co., of Lafayette, secured the contract for a water tank for the Home at about $3,000.

Ft. Wayne, Ind.—Bids were opened on June 24 by the Bd. of Pub. Wks. (Edw. J. Lennon, Chmn.) for the construction of a municipal electric light and power plant, and the following are reported to be the bids received (Engineer, Owen Ford, of St. Louis, Mo.): Moellering Constr. Co., Ft. Wayne, for constructing dam across Spy Run Creek, $1,238; B. Borkenstein, Ft. Wayne, power station and coal storage complete, $17,500; dam across Spy Run, $1,576; W. Nassenstein, Ft. Wayne, power plant and coal storage, $21,281; H. Hilgemann & Bro., Ft. Wayne, power plant and coal storage, $19,900; Alphons Custodus Chimney Co., Chicago, Ill., stack 160 ft. high, $4,844; Heine Chimney Co., Chicago, stack 160 ft. high, $4,822; stack 120 ft. high, $2,500; Weber Steel Concrete Co., Chicago, Ill., stack 160 ft. high, $3,400; stack 120 ft. high, $2,250; Atlas Constr. Co., St. Louis, Mo., stack 160 ft. high, $3,630; Adams-Bagnall Co., Cleveland, O., 430 arc lamps for $88,770, or $20.40 each; cut-outs, $1,548; F. Bissell Co., Toledo, O., pole line and wiring system and underground work, $23,100; Ryan Constr. Co., Indianapolis, transformers, $4.50; No. 6 wire, $28 per mile; No. 8 wire, $26.50 per mile; poles ranging from $3.75 to $5; Ricard Boiler & Engine Co., Toledo, boilers, equipment and stack connections submitted in 3 plans, respectively, $10,528, $14,328 and $14,878; Oldberger Condenser Co., New York, N. Y., No. 2 condenser and equipment, $6,491; No. 3, $9,567; O. K. Eng'g Co., St. Louis, boilers and equipment and stack connections, $12,535, and $872 for breeching; International Gas Power Co., St. Louis, Mo., producer gas power plant, gas engines, steam engine reserve, direct-connected generators and exciters, $79,100; S. M. Jones Co., Toledo, producer gas power plant, etc., without dynamos, $53,000; Thompson Sons Mfg. Co., Beloit, Wis., gas power plant, gas engines, complete with producers, $63,376; American-Diesel Eng. Co., New York, N. Y., producer gas plant, etc., with two oil engines, including tanks, $81,100; Western Electric Co., Chicago, Ill., 4 bids for producing plant, including generators and exciters, aggregating $55,876; Westinghouse Electrical Co., Pittsburg, Pa., are lamps, transformers, switchboard, appliances and station electrical work, $21,195; including metal flare lamp, $28,085; Westinghouse Machine Co., St. Louis, Mo., steam turbine generators and exciters, $41,543; McWilliams & Co., Louisville, Ky., complete plant, buildings, and equipment and distributing system, $200,000; also a divided bid providing combinations of certain sections and omitting others, so the three bids are $96,000, $123,000 and $174,000, but each of these omits certain parts of the total; Ft. Wayne Electric Wks., Ft. Wayne, bid on several portions of work as follows: For arc light transformers, switchboard appliances, station equipment and arc lamps, $24,868; are lamps, $17,316 and $17,846; for direct-current system, $30,497.60, and with luminous arc light system, $32,049; steam turbine generators and exciters, $48,150; feed water heater, boiler feed pumps, separators, pipe work and connections, $44,480; for complete pole line and wiring system and underground work, $31,900; Electrical Steam & Eng. Wks., St. Louis, Mo., 3 bids on complete plants without boilers, engines, omitting also turbine generators and gas plant; there were separate provisions as to different sections and the figures were $79,900 to $83,394; McBride Electrical Co., St. Paul, Minn., feed water boiler, pumps, separators, arc lamp transformers, station electrical work, etc., arc lamps, pole line and wiring system, etc., transformers and connecting public buildings and power station and storage, $84,835; C. L. Olds Constr. Co., Ft. Wayne, pole line and wiring and underground work, transformers and connecting public buildings, from $45,137 to $49,391; Sterling Consolidated Boiler Co., Chicago, Ill., two boiler propositions, $14,592 and $15,025, with $2,680 extra for superheaters.

*We are informed that contracts for the above municipal plant were awarded as follows on June 26: To Ft. Wayne Electric Works, Ft. Wayne, for Sec. 3—Steam turbine generators and exciters; Sec. 4—Condenser equipment; Sec. 7—Arc lamp transformers, switchboard, appliances and station electrical work; Sec. 8—Arc lamps, and Sec. 10—Transformers and connecting public buildings, for a total of $73,899. To McBride Electric Co., of St. Paul, Minn., for Sec. 9—Pole line and wiring system and underground work (distributing system, and Sec. 11—Power plant and coal storage, for a total of $56,002. To O. K. Eng. Co., of St. Louis, Mo., Sec. 1—Boilers and equipments and stack connections, and Sec. 5—Feed-water heater, boiler feed pumps, separators, pipe work and connections, a total of $19,220. To Alphons Custodis Chimney Contr. Co., of Chicago, Ill., for Sec. 2—Stack, $4,300, and to Moellering Constr. Co., of Ft. Wayne, Sec. 12—Dam in Spy Run, $1,238.

Atoka, Ind. Ter.—The Atoka Light & Power Co. (L. B. Griffing, Mgr.), is contemplating installing a street lighting arc circuit, establishing a day service and making general improvements to its service.

Duncan, Ind. Ter.—The Duncan Light & Power Co. contemplate installing before fall an alternator of 75-kw. capacity, and will also probably install an ice plant.

Mason City, Ia.—The Peoples' Gas & Electric Co. will soon place a contract for a 500-kw. generator direct connected to a 26x48 Corliss engine. The company is planning to furnish a 3-phase power circuit and an alternating-current day service in addition to the direct-current service which the company now furnishes after Aug. 1. The company has secured several contracts to furnish electricity for power purposes. A. W. Zahm, mgr.

Oskaloosa, Ia.—The Oskaloosa Traction & Light Co. will purchase 1 500-h.p. engine, 1 300-kw. 3-phase alternator, 60 cycles, 1 200-kw. Ry. generator and increase station equipment.

Albia, Ia.—The Albia Electric Light & Power Co. propose installing an engine, generator and pump for street railway service.

Manchester, Ia.—F. W. Hoag Electric Light & Power Plant proposes installing a new 80 to 100-h.p. horizontal return flue boiler.

Hiawatha, Kan.—The directors of the Hiawatha Electric Light Co. are reported to have voted to increase the capital stock from $20,000 to $30,000.

Jeanerette, La.—Ed. Stokoe is owner of the Jeanerette Electric Light Plant, which is said to be contemplating adding a Corliss engine direct connected to a 100-kw. Bullock generator to the plant.

De Quincy, La.—C. H. Jenks, of Fayette, Miss., is engineer for the proposed water works and electric light plant. Nothing definite has yet been done.

Westfield, Mass.—Press reports state that contract will soon be let for the proposed new gas holder, with a capacity of 150,000 cu. ft.; probable cost, $25,000. Oren E. Parks, City Engr.

Houghton, Mich.—F. W. McNair, Pres. Michigan College of Mines, writes that Prof. O. P. Hood, of Houghton, has completed plans for the power house and service tunnel to be constructed at the college, and bids for same will be received on July 11; probable cost, $43,000.

**Paw Paw, Mich.*—The contract for constructing a hydro electric power plant and dam on Paw Paw River and certain water works and electric light improvements (bids opened June 25), has been awarded to the Falkenau Electrical Constr. Co., of Chicago, Ill., for $34,964. Engr., A. J. Hammond, of South Bend, Ind.

**Marshall, Minn.*—John R. Gray, City Recorder, writes that J. B. Robertson, Fifillan Blk., St. Paul, has secured the contract for improving electric light plant for $14,497.

Nashwauk, Minn.—The Nashwauk Water & Light Co. (G. A. Lindsay, Supt.), is contemplating making some changes in its present lines, and with the new line will take about 7,000 ft. of wire.

University Place, Neb.—R. E. Shelley, City Clk., writes that Baker & Early, of Lincoln, are preparing plans for an electric light plant to cost about $15,000.

**Niagara Falls, N. Y.*—Wm. C. Thayer, of East Aurora, is reported to have secured the contract for installing outside electric lighting system for State Reservation (bids opened June 21), for about $13,000.

Babylon, L. I., N. Y.—The State Comr. of Gas and Electricity has reported favorably the application of Suffolk Co. Lighting Co. for authority to transact business in Babylon.

Waverly, N. Y.—The State Comr. of Gas and Electricity has granted permission to Sayre Electric Co., of Sayre, Pa., to transact business in Waverly, and also to lease the distributing system of the Waverly Electric Light and Power Co.

Webster, N. Y.—A certificate of authority has been granted to Webster Gas Co. by the State Comr. of Gas and Electricity to operate in Webster, and to issue $10,000 capital stock.

New York, N. Y.—Bids will be received by John H. O'Brien, Comr Water Supply, Gas and Electricity, until July 16, for hauling and laying water mains in West Farms Rd. and in Jennings, Manida and 178th Sts.

New York, N. Y.—Bids will be received until July 15 (readvertisement) at the office of Geo. B. McClellan, Mayor, Chmn. Armory Bd., for furnishing and installing electric lighting fixtures, etc., in 12th Regt. Armory, Boro. Manhattan. Robinson & Knust, Archts., 164 5th Ave., Manhattan.

Corinth, N. Y.—The Corinth Electric Light & Power Co. is reported incorporated, with a capital of $25,000, to operate in Saratoga County. Incorporators: Warren Curtis, of N. Y. City; Warren Curtis, Jr., of Corinth, and E. B. Coolidge, of Glens Falls.

Lowville, N. Y.—The State Gas Commission at Albany is reported to have granted permission to Beaver River Light & Power Co. to conduct business in Lowville also to issue $40,000 stock and $120,000 bonds, and to acquire the stock of the Wetmore Electric Co., now operating in that place.

Tryon, N. C.—G. Hamilton Holmes, of Tryon, Ch. Engr., Tryon Electric Light, Water & Power Co., writes that the water works is nearing completion, and surveys have been completed and plans are now being prepared for power development; cost of proposed power plant, $65,000. Todd Russell, Gen. Mgr.

Sandusky, O.—The Sandusky Gas & Electric Co. is contemplating installing a 120-kw., alternating-current generator this year. E. A. Beckstein, Mgr.

Columbus, O.—Bids will be received until July 30 by the Bd. of Trus. of the Columbus State Hospital (Geo. Stockton, M. D., Secy.), for furnishing and installing complete an engine, dynamo, switchboard and feed wires in the power house and for furnishing material and labor for cement work in the basement of the main building.

Hazelton, Pa.—The Consumers' Electric Light & Power Co. is reported to have decided to build a sub-station.

Kittanning, Pa.—Jas. McCullough, Jr., F. A. Moesta, John A. Fox, C. J. Moesta and H. E. Moesta are stated to have purchased the plant of the Kittanning Electric Light Co. These men own the Kittanning & Ford St. Ry. Co., and by the terms of the purchase secure rights of way for an extension of their road to Mosgrove, 5 miles north of Kittanning.

Charleston, S. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until July 16, to furnish at the navy yard, Charleston, a quantity of motor-drive outfits, conductor and conduit and fittings. Applications for proposals should refer to Schedule 59. E. B. Rogers, Paymaster Gen'l, U. S. N.

Ft. Sam Houston, Tex.—Bids will be received July 24 by L. J. Fleming, Constr., Q. M., U. S. A., for the following work at this post: Furnishing and installing electric lighting fixtures in the following buildings: Post exchange and gymnasum, post hospital, officers' club, and 2 double stable guard and shop buildings; for the electric wiring in 2 double stable guard and shop buildings; for furnishing pole lines and making service connections to all the buildings before mentioned.

Petersburg, Va.—According to decree recently entered in the U. S. Dist. Court by Judge Waddill, the Virginia Passenger and Power Co. is authorized to expend $50,000 for improvements to the service in this city. The money will be used to install a complete arc lighting system for street lighting in Petersburg, also increasing the water power plant.

Manchester, Va.—The Electric Light Com. of Council, on June 27, recommended that Council construct a municipal electric light plant to cost about $40,000.

Seattle, Wash.—The Seattle Electric Co. is reported about to erect two sub-stations to cost $20,000 each.

Cranbrook, B. C.—The Cranbrook Electric Light & Power Co. (M. Quain, Supt.) is reported to have decided to install a 700-kw. generator, 6,600 volts with step-down transformers. It is also proposed to construct dam on St. Marys River.

Hamilton, Ont.—The Hamilton Cataract Light & Power Co. (W. C. Hawkins, Gen. Mgr.), is reported to have filed plans with the Ontario Ry. and Municipal Bd. for a transmission line through Barton and Saltfleet Townships.

North Battleford, Sask.—Bids will be received until Aug. 7 by S. Cookson, Secy.-Treas., for $100,000 water works, sewerage and electric lighting bonds.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—It is reported that the City Council has granted to the Warren Co., a franchise to operate an electric railway through certain streets of the city.

Los Angeles, Cal.—The Los Angeles-Pacific Ry. Co., is stated to have secured a franchise for either a double or four-track electric line from 4th and Western Aves. on Western to the city limits of Hollywood. The company is also applying for a franchise within the city of Hollywood, which will be a continuation of this proposed line. It is said the road will be built within six months.

Denver, Colo.—Incorporation papers for the new electric railway to connect Denver and Greeley to be known as the "Denver & Greeley Railroad," were taken out a few days ago. Frank J. Green, John C. Mosher, E. J. Decker, J. D. Houseman, J. F. Church, of Denver, are reported interested. The company was incorporated with a capital of $50,000, but over $1,000,000 will be expended on the line.

Springfield, Ill.—It is reported announced that the Springfield Consolidated Ry. Co. expects to erect a car house and repair shop.

Chicago, Ill.—The Secretary of State is stated to have issued a license to incorporate the Chicago & Wisconsin Traction Co., with principal officers in Chicago and with a capital of $10,000. The road is to be constructed from Chicago in a northerly direction through the counties of Cook and Lake to points on the State line between Illinois and Wisconsin. Incorporators: H. R Yaryan, Lewis E. Starr, Walter F. Wantke, Philip R. Lynch and Geo. W. Miller, all of Chicago.

Northbridge, Mass.—The Selectmen of Northbridge are reported to have signed the franchise granting the Worcester & Blackstone Valley St. Ry. Co. (J. W. Anderson, Supt. Millbury, Conn.), the right to connect its tracks at Plummers with the tracks of the Uxbridge & Blackstone St. Ry. Co.

Jefferson City, Mo.—The St. Louis, Mountain Grove & Southern Ry. Co., of Mountain Grove, is reported to have secured a charter from the Secretary of State. Capital, $300,000. The road is to be 30 miles long, extending from Mountain Grove to Bryant Creek. J. J. Hedges, of Springfield; J. Allbands, of St. Louis, and P. M. Johnston, of Elmo, Ill., are directors.

Rochester, N. Y.—It is stated that the Rochester, Scottsville & Caledonia Electric R. R. Co. proposes extending its line from the present westerly terminus to Le Roy, Stafford and Batavia, a distance of 16 miles.

The Rochester Ry. Co. is reported to be procuring necessary right of way from property owners for the construction of a double track in Andrews St. for the purposes, it is said, of the new union terminal station for interurban roads, for which a large tract of property on Clinton Ave. North and extending from An-

Chittenango, N. Y.—It is reported that at the meeting of the Bd. of Village Trustees, the franchise for which the Syracuse & Chittenango Ry. Co., made application recently was granted.

Buffalo, N. Y.—It is reported that the Buffalo Southern R. R. Co. (C. Brizzer, Ch. Eng., Orchard Park), is planning to build from Buffalo to East Aurora, a distance of about 13 miles.

Sheridan, N. Y.—Henry Graves, Highway Comr. of Sheridan, is stated to have granted a franchise to the Buffalo, Lake Erie & Western Traction Co. to lay tracks across certain highways in Sheridan.

Auburn, N. Y.—The Auburn & Northern Electric R. R. Co. (T. H. Mather, Ch. Engr., Syracuse), is stated to have filed certificates of extension of its line, to begin at the intersection of State and W. Genesee Sts, in Auburn, and continue westward to the city limits, thence through the towns of Aurelius to the Cayuga county line, a distance of approximately 9 miles. The road is then to cross the Cayuga and Seneca canal and Cayuga Lake and go westerly to the village of Seneca Falls, a distance of 2.44 miles.

Hempstead, N. Y.—The State Railroad Comrs. are stated to have authorized the building of a street railroad from Hempstead through Rockville Center to East Rockville, a distance of 5 miles; by the Sea Shore Municipal Ry. Co. Capital, $150,000.

Rochester, N. Y.—The Railroad Comrs. are stated to have granted a certificate of necessity to the Buffalo, Genessee & Rochester Ry. Co., which proposes to build a double-track surface railroad from Depew to Rochester, a distance of 60 miles. The road will run through Lancaster, Crittenden, Corfu, Batavia, LeRoy, and Chili. Capital, $7,500,000.

Hornell, N. Y.—The Board R. R. Comrs. is stated to have granted a certificate of necessity to the Hornell, Bath & Lake Keuka Ry. Co. Capital, $1,000,000. Length of the road about 50 miles.

Portland, Ore.—The Oregon & Washington Lumber Mfrs's. Association, it is said, will co-operate with the Cottage Grove Commercial Club in plans for the building of a railway from Portland to Cottage Grove via the Coast Forks of the Willamette River to connect with the road about to be constructed from Roseburg to Marshfield. A. C. Dixon of the Cottage Grove Commercial Club is reported interested.

Irwin, Pa.—It is stated that the Manor Valley Ry. Co. expects to place contracts during the next 4 weeks

**Items marked thus give the names of parties awarded contracts.*

for the construction of an extension 4 miles in length, to the Pittsburg & Westmoreland Ry. Co., Jas. Bryan, Ch. Engr., Park Bldg., Pittsburg.)

Cowanstonnock, Pa.—The Kittanning & Leechburg Ry. Co. (F. A. Moeston, Gen. Mgr., Kittanning), is reported to have awarded contracts for grading and material for a miles of track from Wrikboro to Cowanstonnock.

Lansdowne, Pa.—The Borough Council is reported to be considering a proposition from the Sharon Hill, Lansdowne and Upper Darby St. Ry. Co. for a franchise over certain streets in the borough. The new line is to be a branch of the United Power & Transportation Co., of Chester. The proposed route is from Sharon Hill Ave. to the terminal at 69th St., Philadelphia.

Bradford, Pa.—The Western New York and Pennsylvania Traction Co. (W. R. Page, Gen. Mgr.), is reported to have announced that an electric line from Eldred to State Line which would connect with the Bradford-Olean line, will be constructed.

Newberry, S. C.—The City Council is stated to have granted a franchise to the South Carolina Public Service Corp. for a right of way on several streets for the construction of an electric car line, obect of the corporation being to include this city in the chain of towns which will be connected by a trolley line.

Chattanooga, Tenn.—It is reported to have been announce that the Chattanooga Rys. Co. (D. J. Duncan, Gen. Mgr.), will construct a surface line to the summit of Lookout Mountain. Other improvements of an extensive nature are also to be made by the company immediately. Surveys have also been made for a line to Lula Lake and Minnehaha Falls, at which point it is proposed to put in a park.

Ft. Worth, Tex.—It is stated that the Northern Texas Traction Co. is planning to build about 2 miles of street railway track in North Ft. Worth.

Vancouver, Wash.—Mayor J. R. Harvey is reported to have signed the ordinance granting to Walter H. Moore the franchise for a street railway on 11th, Jefferson and 13th St. and Kaufman Ave. to the city limits.

Vancouver, B. C.—Jas. Milme, Gen. Supt. of the British Columbia Electric Ry. Co., Ltd., is reported to have announced that the construction during the next two years of about 60 miles of road from Westminster to Chilliwack, B. C., is contemplated. This does not include extensions to the lines in Vancouver, Westminster and Victoria.

Ft. Francis, Ont.—The construction of an electric railway from Fort Francis to Duluth is reported under consideration. Power will be available upon completion of the power dam at International Falls on Rainy River. W. H. Elliott, of this place, is interested.

Pt. Arthur, Ont.—The City Council is reported to have decided to double track the municipal electric street railway system at a cost of approximately $55,000. Following are some of the materials required: 620 tons of 56-lb. nails, 18 tons of spikes, 4 tons of bolts, 18,480 ties, 14,868 lbs. of 00 trolley wire, 280 trolley hangers, 300 double pull-overs, 1,500 lbs. 7-strand No. 2 wire. J. M. McTeikue is clerk.

RAILROADS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—Local press reports state that the Chicago, Rock Island & Pacific R. R. Co. (J. M. Stark, Asst. Engr., Little Rock), have completed plans for terminals, to cost $400,000, and have 15 miles of trackage. It also proposes erecting shops and roundhouse in southeastern part of city.

Augusta, Ga.—It is reported that the Georgia & Florida R. R. Co. has rejected bids opened on the connecting link contract, and will again ask for new bids. The work calls for the construction and laying down of several hundred miles of track between Augusta and Madison, Fla., involving the expenditure of several hundreds of thousands of dollars.

Pelham, Ga.—The Southern Eng. Contr. Co., of Atlanta, applied for a charter to build and operate a railroad from Pelham to Leary and Newton, Ga. A draw bridge will be erected over Flint River at Newton. This road will connect the Central of Georgia and the Atlantic Coast Line.

Richmond, Ind.—It is reported that the City Engr. of Richmond and the Pittsburg, Cincinnati, Chicago & St. Louis Ry. Co. (Nettelton Neff, Div. Supt., Richmond) will soon ask bids for the construction of a subway at W. 2d St. and the tracks of the company.

Schoharie, N. Y.—The Town Bd. is reported to have granted the Schenectady & Margaretville R. R. Co. the privilege of grade crossings over the several highways in town. The Village Bd. has also granted the same privilege.

Cleveland, O.—The Pennsylvania R. R. Co. is reported to have submitted plans for overhead and subway crossings to cross approaches to new gravity switching yard near Bedford. One is to be an overhead construction for Independence Road to cost $89,700, and the other for Dunham Road; for this road 2 schemes for subways and 2 for overhead bridges have been prepared. The overhead crossing would cost $133,500; the subways either $110,800 or $85,700.

Portsmouth, O.—The following are the bids opened on June 22 by the Bd. of Pub. Service for erecting the new City Hospital: The Williams Lumber Co., $28,229; the Smith Lumber Co., $26,999, anad Edw. W. Pfeiffer, $26,923 (bidders all of Portsmouth.

Philadelphia, Pa.—The Finance Com. on June 27 decided to apportion $1,000,000 for the abolition of grade crossings in southern part of city.

Pierre, S. D.—The United States Central Ry. Co. is reported to have been incorporated here with Paterson, N. J., and Delhi, N. Y., parties as incorporators; capital, $50,000,000. The road is to extend from Portland, Me., 7,000 miles to San Francisco, touching New York and Chicago.

Salt Lake City, Utah.—See "Business Buildings."

Ft. Monroe, Va.—Bids will be received by Capt. R. H. C. Kelton, Q. M., U. S. A., Ft. Monroe, until July 30 for the reconstruction and extension of railroad track at Ft. Monroe; also for a locomotive, 2 passenger cars and a double-trucked flat car, as advertised in The Engineering Record.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Auburn, Ala.—The plans of Wm. T. Warren, of Birmingham, it is stated, have been accepted for the dining hall and dormitory to be erected at the Alabama Polytechnic Inst., at Auburn; probable cost, $25,000.

It is stated that plans are to be prepared for an agricultural building also to be erected at the Inst., at a cost of $75,000.

Little Rock, Ark.—Gibbs & Sanders, of Little Rock, are reported to have prepared plans for a wing to be erected to the State Hospital for Nervous Diseases and also a barn.

San Francisco, Cal.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until July 30, to furnish two 100-h.-p. stationary water-tube boilers at the naval training station, San Francisco. Applications for proposals should refer to Schedule 54. E. B. Rogers, Paymaster Gen'l, U. S. N.

Berkeley, Cal.—J. V. Mendenhall, Town Clk., writes that the plans of Bakewell & Brown, of San Francisco, have been selected for the town hall which is to be erected at a cost of about $100,000. Work is expected to commence within 120 days.

Redwood City, Cal.—Jos. H. Nash, Clk. Bd. of Superv., writes that all bids opened on June 17 for the erection of court house have been rejected and new bids will be received on July 29. Archt., Glen Allen, 330 Turk St., San Francisco.

**Meriden, Conn.*—The following are the bids opened on June 13 at office of the Superv. Archt. Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, hetaing apparatus, electric conduits and wiring) of the U. S. Post Office Bldg. at Meriden: Woodbury & Leighton Co., Boston, Mass., $92,945; C. H. McCane Co., Philadelphia, Pa., $99,799; Fissel & Wagner, New York, N. Y., $93,997; Maguire & Penniman Co., Providence, R. I., $100,041; Richardson & Burgess, Washington, D. C., $101,174; The H. Walsh & Lines Co., Meriden, $94,623; E. K. Watson Co., Warren, R. I., $96,649; A. E. Stannard, New York, N. Y., $100,000; Connors Bros. Co., Lowell, Mass., $96,200, and Wheaton Bldg. & Lumber Co., Putnam, $88,500 (awarded contract).

**Hartford, Conn.*—The Chas. T. Wales Co., of New York, N. Y., is reported to have secured the general contract to erect the Morgan Memorial at Wadsworth Atheneum. The total cost of this building is to be about $650,000.

Washington, D. C.—All bids opened on June 22 at the office of the Dept. of Interior, for erection of an assembly hall at the Government Hospital for Insane has been rejected. The following are the bids received: Cramp & Co., Philadelphia, Pa., $108,200; Brennan Constr. Co., Washington, $113,000, and Arthur Cowsill, Washington, $113,000.

It is reported that Acting Secretary of War Oliver has approved the recommendations of Quartermaster Gen'l Chas. F. Humphrey for the construction of buildings at a number of army posts. The posts where buildings are to be constructed, besides smaller appropriations for storehouses, stables, paint shops, etc., at various places, are stated to include: Ft. Bayard, N. M., 2 double sets non-commissioned staff officers' quarters, administration building and building for convalescent officers, etc., $39,650; Columbus barracks, O., recruiting depot, 3 double sets lieutenants' quarters, quartermaster storehouse and wagon shed, $82,375; Ft. Ethan Allan, Vt., double set civilian employes' quarters, $9,450; Honolulu, one field officers' quarters, one four-set bachelor officers' quarters, 2 single non-commissioned staff officers' quarters, etc., $153,920; Ft. Jay, N. Y., one double set non-commissioned staff officers' quarters and a quartermasters' storehouse, $23,520; Ft. Lincoln, N. D., civilian employes' quarters, etc., $12,900; Ft. MacKenzie, Wyo., quartermasters' stable, storehouse, etc., $46,600; Ft. McPherson, Ga., quartermasters' stable and wagon shed, $28,325; Madison Barracks, N. Y., quartermaster's stable, wagon shed and teamsters' quarters, $28,325; Philadelphia depot, addition and alteration to quartermaster's storehouse, $47,755; Plattsburg Barracks, N. Y., quartermaster's stable and wagon shed, $18,755; Presidio of Monterey, Cal., enlarging bank barracks, double set non-commissioned staff officers' quarters and paint shop, $8,795; Ft. Thomas, Ky., quartermaster's stable and wagon shed, $20,400; Ft. Wayne, Mich., hank barracks, etc., $32,450; Ft. Wood, N. Y., one double set captain's quarters, $29,850; Ft. Wright, Wash., enlarging guardhouse, $13,850; Ft. Yellowstone, Wyo., field officers' quarters, $17,000.

Albert Kelsey and Paul P. Cret, of Philadelphia, Pa., are stated to have been selected as the archts. to design the new building for the International Bureau of American Republics, which is to be erected at 17th, 18th, B and C Sts., and is to consist of 4 sections, to be known as administration, library, assembly and service, and to cost $600,000. Prizes awarded are stated to have be nas follows: First, $3,000, Edw. Pearce Casey, and Arthur Dillon, 1 Nassau St., New York City; second, $2,000, to John Russell Pope, New York City; third, $1,000, to Peter De Gellieke, Jr., and Wm. T. L. Anderson, New York City.

Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until July 16, for constructing additions to the naval hospital, ft. of 24th St. N. W., Washington, D. C., symmetrical with the northeast pavilion solarium, and connecting corridor. Plans and specifications may be had from the Archt., Wood, Donn & Deming, 808 17th St. N. W., upon deposit of $5, $2 of which will be refunded on return of drawings in good order. Applications for proposals should refer to Schedule 65. E. B. Rogers, paymaster Gen'l, U. S. N.

Bids will be received by Elliott F. Woods, Supt. U. S. Capitol Bldg. and Grounds, Washington, D. C., until July 10, for furnishing interior wood doors and jamb casings for the office building, House of Representatives, Washington.

Chas. Balderson, of Philadelphia, Pa., is reported to have prepared plans for a building which the Thomas Jefferson Memorial Assoc. of the U. S. proposed erecting in Washington to the authors and signers of the Declaration of Independence. The cost of the building is estimated at $500,000.

It is stated that Dist. Comr. Morrow has approved the plans o fthe Quartermaster of the Marine Corps, to erect 5 sets of quarters for officers of the Marine Corps on 8th, 9th, G and I Sts.

It is reported that tentative plans have been submitted for the Chamber of Commerce Bldg., which it is proposed erecting at a cost of about $400,000. C. J. Bell, Chmn. sub-committee.

St. Augustine, Fla.—W. P. Bryan, Chmn. Bd. of Control, Jacksonville, writes that bids will probably be called for in about 60 days for erecting two dormitory buildings for the Deaf and Blind Institute at St. Augustine; probably cost, $70,000. Archts., Edwards & Walter, of Columbia, S. C.

Chicago, Ill.—The City Council on June 17, it is stated, approved the engaging of Holabird & Roche, 1618 Monadnock Bldg., as the archts., and John M. Ewen, as consulting engineer for the new city hall, which is to be erected at a cost of $4,500,000.

The Norwegian Lutheran Church of America, at its convention in Northfield, Minn., on June 19, it is stated, decided to raise $60,000 with which to erect an addition to the deaconess home and hospital connected with church in Chicago. It is stated that building operations will commence as soon as $30,000 is raised.

The South Park Comrs., it is reported, have had plans prepared for a 2-story field house to be erected at Wentworth Ave. and 26th St., at a cost of $100,000.

Later official reports state that bids will be received on July 20 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a 2-story and basement brick and stone public bathhouse at 12th Pl. and Union St.

Cambridge, Ill.—Temple, Burows & McLane, of Davenport, it is stated, have been commissioned by the Bd. of Superv. to prepare plans for a heating plant to be erected near the court house and jail at Cambridge, to be of brick and cut stone and cost about $10,000.

West Pullman, Ill.—Bids will be received until July 9 by John J. Hanberg, Comr. Pub. Wks., Chicago, for erecting a 2-story and basement brick and stone fire engine house at 11938-42 S. Peoria St, West Pullman. Bids to be submitted on the following: Masonry and concrete work; cut stone work; carpentry; iron work; sheet metal, gravel roofing and steel ceiling work; plumbing, sewage and gas fitting; steam heating.

Logansport, Ind.—Adrian & Adrian, of St. Louis, Mo., it is stated, have prepared plans for the 3-story St. Joseph Hospital, which is to be erected at 25th and High Sts., and cost about $60,000.

Richmond, Ind.—It is reported that the Bd. Trus. Eastern Indiana Hospital for the Insane (J. W. Mahan, Pres.), will receive bids until July 9 for furnishing material and erecting 2 brick cottages and appertenances. J. A. Hasecoster, Archt., Colonial Bldg.

Marion, Ind.—It is reported that J. W. Sanderson, Treas. Nat. Military Home, will receive bids until July 25 for the erection of an addition to the hospital and a bath house.

Lafayette, Ind.—It is stated that all bids recently received for erecting a hospital at the Indiana State Soldiers' Home have been rejected and new bids are asked by the Bd. of Trus. Cost is not to exceed $50,000.

Muscatine, Ia.—A. S. Lawrence, Co. Aud., writes that J. E. Mills, of Detroit, Mich., is preparing plans for court house and jail, to cost about $135,000.

Webster City, Ia.—The following are the bids opened on June 17 at the office of the Superv. Archt., Washington, D. C., for the construction (complete) of the U. S. Postoffice at Webster City: General Constr. Co., Milwaukee, Wis., $57,164; Northern Constr. Co., Milwaukee, Wis., $61,800; Southern Constr. Co., St. Louis, Mo., $63,000; F. H. Latimer, Kansas City, Mo., $67,669; C. E. Atkinson, Webster City, $51,747; J. H. Weise, South Omaha, Neb., $53,861, and Bartlett & Kling, Cedar Rapids, $58,376.

Mason City, Ia.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., until Aug. 15, for the construction of U. S. Post Office at Mason City, as advertised in The Engineering Record.

Des Moines, Ia.—The citizens on June 20 voted to issue bonds to the amount of $350,000 for the erection of a city hall.

Wellington, Kan.—The citizens are stated to have voted in favor of issuing $25,000 bonds for a new city hall and fire department headquarters. Plans for the building, it is stated, have been accepted.

Ft. Dodge, Kan.—It is stated that bids will be received until July 10 by the Bd. Mgrs., Kansas State Soldiers' Home, for erecting a barracks and dining hall combined; also a double and single cottage.

Ft. Leavenworth, Kan.—Bids will be received here until July 19 by Capt. J. E. Normoyle, Constr. Q. M., U. S. A., for constructing the following buildings: One wagon shed and one stable and plumbing, electric wiring and lighting fixtures in stable, at this post.

Wellington, Kan.—It is reported that the citizens have voted in favor of issuing $25,000 bonds for a city hall and fire department headquarters.

Louisville, Ky.—The Baptists are reported to be considering the erection of a hospital to cost about $200,000.

Shreveport, La.—The following are reported to be the bids opened June 18 for erecting the city hall: Southern Constr. Co., of St. Louis, Mo., $83,500; Garson Bros., of Shreveport, $92,900; Hugh McClennan, of Chicago, Ill., $87,000; Henderson, Shearer & Miller, of Lufkin, Tex., $85,500.

Alexandria, La.—The Public Library Bldg. Com., it is stated, has accepted the plans of Crosby & Henkel, of New Orleans, for the library, which is to be erected at a cost of $13,000.

**Springfield, Mass.*—The Central Bldg. Co., of Worcester, is reported to have secured the contract to erect the Wesson Maternity Hospital at Hyde and Myrtle Sts., which is to cost, including equipment, $200,000.

New Bedford, Mass.—Mayor Ashley has signed the order for the remodeling city hall into a library.

**Ft. Andrews, Mass.*—The contract for erecting an administration building at Ft. Andrews has been awarded to Chas. E. Currier Co., 110 Summer St., Boston, for $21,544 (bids opened June 1 by Capt. Geo. L. Goodale, Q. M., U. S. A., Boston.

**Items marked thus give the names of parties awarded contracts.*

Salem, Mass.—The Woodbury & Leighton Co., of Boston, are reported to have secured the contract to erect the Registry of Deeds and Probate Bldg., at $339,339.

Pittsfield, Mass.—A site on Sumner St., it is stated, has been selected for the armory to be erected for Company F, and plans for the building are to be prepared by J. W. Howes, of Holyoke.

**Fall River, Mass.*—John Crowe, 78 Bedford St., it is reported, has secured the contract to erect the Union Hospital at about $150,000.

Greenfield, Mass.—It is stated that it is proposed to erect a 2-story library to cost $10,000.

**Boston, Mass.*—Mack & Moore, 22 Chapman St., are reported to have secured the contract to erect the public bath and gymnasium on N. Bennett St., at $70,000.

Ludlow, Mass.—The Manufacturers' Assoc. is said to be having plans prepared for a hospital which they propose erecting in connection with the girls boarding house on Chestnut St.

**Kalamazoo, Mich.*—The contract for addition to Burgess Hospital (bids opened June 25) has been awarded to Shepard Oliver, of Kalamazoo.

Ionia, Mich.—It is reported that the State Legislature has appropriated $40,000 for the Woman's Annex to the State Asylum.

**Hastings, Minn.*—P. A. Hoffman, Co. Aud., writes that the contract for erecting jail (bids opened June 25), has been awarded to Diebold Safe & Lock Co., of Canton, O., for $13,000.

Mt. Vernon, Mo.—Bids will be received until July 13 by the Bd. Mgrs. State Sanatorium, to be opened at the office of Dr. Wm. Porter, Rm. 422 Commercial Bldg., St. Louis, for erecting a 2-story brick patients' villa at Mt. Vernon. W. H. Hohenschild, Archt., Rolla.

Potosi, Mo.—Bids will be received until July 27 by the County Court (John O. Long, Clk.), for erecting a brick court house; probable cost $30,000. H. H. Hoenschild, Archt., Rolla.

St. Louis, Mo.—It is reported that Robt. H. Stockton has given $50,000 toward the erection of the Christian Orphan Home, which is to cost about $50,000, and is to be erected on the Kings Highway and Euclid Ave.

Ft. Omaha, Neb.—It is stated that plans have been sent to the Quartermaster at Ft. Omaha, for a steel baloon house, 200x100 ft., which is to be erected at the post at a cost of about $30,000. Bids for the construction will be asked soon. It is also stated that a brick generation house 2 stories high, 84x46 ft., is to be erected in connection with the baloon house and that a brick wireless telegraph station will also be erected in connection with the same.

Omaha, Neb.—John Latenser, Bee Bldg., is reported to have been engaged to prepare plans for 3 buildings to be erected for the Good Shepherd Convent at 40th and Jones Sts., the cost to be $40,000.

Concord, N. H.—B. A. Kimball is reported to have plans for a $100,000 building for the New Hampshire Historical Society.

Vineland, N. J.—Bids will be received until July 11 by the Bd. Mgrs. Home for Soldiers, Sailors, Marines and Their Wives and Widows (Ernest C. Stahl, Secy.) at the office of the Comrs. Charities and Corrections, Trenton, for furnishing material and installing a heating plant at above home in Vineland.

Paterson, N. J.—Edwards & Rogers, of Paterson, are reported to have prepared plans for the orphan asylum to be erected on Market St., at an estimated cost of $125,000. L. A. Piaget, Chmn. Bldgs. & Grounds Com.

New York, N. Y.—See "Miscellaneous."

Buffalo, N. Y.—The State Prison Comn., at Albany, it is stated, has approved the plans for the addition which it is proposed erecting to the Erie County Jail at a cost of about $50,000.

Otisville, N. Y.—Bids will be received until July 16 by the Bd. Health (Thos. Darlington, M. D., pres.), New York City, for furnishing and delivering timber, lumber, moulding, etc., to the Tuberculosis Sanatorium at Otisville, Orange Co., during the year 1907. Deliveries will be required to be made, freight prepaid, Otisville Station, Erie R. R.

New York, N. Y.—Bids will be received until July 15 by the Armory Bd. (Geo. B. McClellan, Chmn.), for: Item No. 2—For excavation and removal of rock and other material from the site of the proposed armory for the Twenty-second Regt. Engineers, Ft. Washington Ave., 168th and 169th Sts., in the Boro. of Manhattan.

Cortland, N. Y.—Bids will be received by the Bd. of Water Supply at the office of Thos. Hassett, Secy., Room 911, 299 B'way, N. Y. City, until July 23 for the erection of a field office building at Cortland for division and section engineers in the employ of the Bd. of Water Supply, as advertised in The Engineering Record.

Columbus Barracks, O.—The lowest bids on various parts of the work in connection with the erection of a hospital installing an electric lighting system with a sub-station at this post, bids for which were received May 31 by Capt. H. B. Chamberlain Q. M., U. S. A., are stated to have been as follows: For the construction of the hospital building proper, Geo. Abernathy, Columbus, $96,179; Fitzpatrick and Hoepfner, Columbus, plumbing, gas piping, electric wiring and heating, the figures being, respectively, $12,895, $398, $2,870 and $14,997; the Electric Supply and Constr. Co., Columbus, for the inside wiring, at $12,200; the McBride Electric Co., of St. Paul, on the fixtures and the outside wiring, $12,925 for both. The Electric Supply and Constr. Co., Columbus, electrical appliances, $1,825; Westinghouse Electric & Mfg. Co., Cleveland, certain electrical appliances, $2,400; the Electrical Supply & Constr. Co., sub-station, $2,330.

*Capt. Chamberlain, Q. M. of the Columbus barracks, is stated to have awarded five contracts in connection with the erection of the new hospital at the barracks as follows: Geo. Abernathy, construction of building; Fitzpatrick & Hoepfner, plumbing, gas piping and heating; McMaster's Electric Supply Co., electric wiring.

**Columbus, O.*—John Scott, Clk. Franklin Co. Comrs., writes that the contract for plumbing, electric wiring, etc., of Franklin County Court House (bids opened June 21) has been awarded to the Electrical Constr. & Supply Co., of Columbus, for $5,715.

It is reported that Dauben & Ryan have prepared plans for a 3-story addition to the Mercy Hospital; estimated cost, $20,000.

Dayton, O.—Bids will be received until July 24 by the Bd. Trus. (Chas. Winchet, Chmn.) at the office of W. E. Russ, Archt., 1300 Conover Bldg., for erecting the County Memorial Bldg. Three separate bids are to be submitted, as follows, including excavation, common concrete, armored concrete, brick, cut stone, sheet metal and roofing, tile structural and ornamental iron work, marble, carpentry, plumbing, etc.; electric wiring; ventilating and heating. Probable cost, $250,000.

Stover Bros., Canby Bldg., it is stated, are preparing plans for the market house which is to be erected at a cost of $100,000. Two sets of plans are to be submitted, one for a market house 400x52 ft., containing 112 stalls and cold storage accommodations, and the other for 124 stalls and 58 cold storages.

Lakewood, O.—J. L. Cameron, 8 Public Sq., Cleveland, it is stated, is preparing plans for the Lakewood Hospital, which is to be erected at Belle and Detroit Aves., Lakewood, at a cost of $20,000.

Elyria, O.—The Elyria Hospital Assoc., it is reported, is preparing to erect a $100,000 hospital.

Grapeville, Pa.—The directors of the St. Paul's Orphans' Home of the Reformed Church, at Butler, it is stated, are planning the removal to Grapeville, and have had plans prepared for the buildings on the cottage plan, the cost to be about $100,000.

Philadelphia, Pa.—It is reported that Brockie & Hastings, 328 Chestnut St., have been commissioned to prepare plans for refacing the buildings of the University of Pennsylvania Hospital, in Spruce St., between 34th and 36th Sts., so that they will conform in appearance to the recently erected buildings, of brick, with stone trimmings. The cost will be about $300,000.

Appropriations for additional property for new buildings for 6 police and patrol stations were approved by Councils' Finance Com., and will be reported to Councils. They include a new building in the 21st Dist., $65,000; for a new police and patrol station in the 27th Ward, $65,000; $80,000 for building to take the place of the present station in 5th St. above Race St.; the old police station in Lombard St. below 8th St. is also to be replaced, $65,000 was appropriated, and $80,000 was set aside to build a combination police and patrol station at 19th and Oxford Sts. in the 29th Ward.

Bids will be received until July 11 by Brockie & Hastings, Arcnts., 328 Chestnut St., for erecting permanent improvements to the North Pavilion, Philadelphia Museums, 34th and Vintage Ave.

Morristown, Tenn.—Bids will be received until July 15 by O. R. Carver, Chmn. Bldg. Com., for erecting a city hall. Probable cost, $12,000.

Ogden, Utah.—The following are the bids opened on June 24 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of an extesion to the U. S. Postoffice at Ogden, not including heating and conduits and wiring: Tom Lovell & Sons, Denton, Tex., $70,991, and The Campbell Bldg. Co., Salt Lake City, $63,698.

**North Yakima, Wash.*—It is reported that the contract to erect a building on the fair grounds has been awarded to Corbett & Raymond at $13,924.

Waaddah Island, Neah Bay, Wash.—Bids will be received until July 18 by S. I. Kimball, Gen'l Supt. U. S. Life-Savg. Service., Treas. Dept., Washington, D. C., for the construction of a life-saving station on Waaddah Island, Neah Bay, Wash.

**Seattle, Wash.*—The Iowa Mfg. Co., of Oskaloosa, Ia., has secured the contract for heating the U. S. Post office (bids opened June 11) for $17,720.

*It is reported that the contract to erect the administration building at the Alaska-Yukon Pacific Exposition has been awarded to O. H. Anderson, of Seattle, at about $14,362.

Charleston, W. Va.—It is reported that the directors of the Chamber of Commerce are preparing to erect a $50,000 building.

Wausau, Wis.—Bids will be received until July 9 by John King, Co. Clk., for erecting a County Home on the Asylum grounds. Jos. P. Jogerst, Archt., Livington Bldg.

Milwaukee, Wis.—Competitive plans and specifications will be received until July 31 by the Bd. Pub. Wks. (Chas. J. Poesch, Chmn.), for a public natatorium to be erected on Richards and Center Sts.; cost not to exceed $45,000. The architect whose plans are accepted will be required to superintend construction of building.

The Co. Bd., it is stated, has passed a resolution authorizing the Co. Clk. to receive bids for erecting a court house according to plans prepared by H. C. Koch, 120 Wisconsin St.

Richd. E. Schmidt, Garden & Martin, of Chicago, Ill., are reported to be the archts. for the St. Marys Hospitalfi, which is to be erected of steel, brick, terra cotta and concrete.

*Frank M. Harding, representing the Wisconsin Steel & Constr. Co., of Waukesha, it is stated, has received the contract to erect the cattle stables at the State Fair Grounds at $32,000.

Ft. D. A. Russell, Wyo.—Bids were opened on June 15 by Capt. V. K. Hart, Q. M., U. S. A., Cheyenne, for construction, etc., of new post hospital as follows: Construction, The Morrison Constr. & Mfg. Co., Denver, Colo., $184,790; Thos. H. O'Neil, Denver, Colo., $185,700, and Atkinson Bros., Colorado Springs, Colo., $183,940.

(*a*) Heating (*b*) plumbing (*c*) marble: G. B. Larimer, Denver, Colo., *a*, $20,240; Johnson-Rowe-Daly Co., Omaha, Neb., *a*, $20,450; *b*, $12,938; *c*, $8,200; Healy, P. & H. Co., St. Paul, Minn., *a*, $18,704; *b*, $12,392; *c*, $13,700; Barnes & Stephens, Colorado Springs, Colo., *a*, $19,000; *b*, $12,350; *c*, $7,537; St. John Bros. Plumbing Co., Colorado Spring, Colo., *a*, $18,682; *b*, $14,300; *c*, $7,612.

The Electric Constr. Co., of St. Paul, Minn., bid for wiring $6,798, and fixtures $1,703, and F. E. Newbery & Co., of St. Louis, Mo., bid for fixtures and wiring $7,904.

Montreal, Que.—It is stated that plans for the city jail will be completed by July 12. W. A. Weir, Minister of Pub. Wks.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Chalifourz Bldg. and the partly completed building being erected by H. H. Mayberry, it is reported, have been destroyed by fire. Later reports stated that the Chalifourz Bldg., owned by J. L. Chalifourz & Co., may be rebuilt at once.

J. G. Parley, of Anniston, is reported to be contemplating the erection this fall at 3d Ave. and 20th St., Birmingham, of a 10-story steel frame office building.

Little Rock, Ark.—See "Railroads."

San Francisco, Cal.—The members of the Society of California Pioneers, it is reported, contemplate erecting a building on the site of the structure which was destroyed, and have taken up a mortgage of $250,000 for the purpose.

Sacramento, Cal.—It is reported that the directors of the Sacramento Hotel Co. (Arthur Miller, Secy.), has decided to erect a $500,000 hotel.

Los Angeles, Cal.—The Academy Investment Co. is reported incorporated, with Alfred Solano as Pres. and Charleton F. Burke, Secy., for the purpose of erecting a riding club house on Grand Ave. at a cost of about $75,000. Plans for the building are reported accepted, and the cost, including furnishings, will be about $135,000.

Denver, Colo.—Plans are being prepared by John J. Huddart, Bank Blk., Denver, and the same will be completed about Oct. 1 for the B. P. O. E. Bldg., to cost about $90,000.

Hartford, Conn.—It is reported that fire in the terminal yards of the Central New England R. R. (W. J. Backus, Ch. Engr., Hartford), did considerable damage destroying the repair buildings and roundhouses.

**Bridgeport, Conn.*—It is stated that the contract to erect a brick and stone power house 130x105 ft. for Eaton, Cole & Burnham Co., has been awarded to the H. Wales Lines Co., of Meriden.

**Meriden, Conn.*—The H. Wales Lines Co., 134 State St., is reported to have secured the contract to erect a 1-story 135x50 ft. steel frame and concrete carpenter shop for the Winchester Repeating Arms Co.

Jacksonville, Fla.—Bids will be received until July 15 by the St. Johns River Terminal Co. at the office of W. B. Darrow, Supt., Jacksonville, for furnishing material and erecting warehouses at Bay and Marsh Sts. for the said company.

**Urbana, Ill.*—W. F. Baird, is reported to have secured the contract to erect the opera house at a cost of about $30,000.

Peoria, Ill.—Herbert E. Hewett, 24 Arcade Bldg., it is stated, will have plans ready about Aug. 1 for the contractors so that bid for the construction of the Y. W. C. A. Bldg. may be submitted.

Lakeview, Ill.—It is reported that the members of the First Presbyterian Church propose erecting a parish house to cost $20,000. Rev. Frank N. Carson, pastor.

Jeffersonville, Ind.—The two local lodges and Company No. 9, Uniform Rank, Knights of Pythias are reported to have under consideration plans for jointly building a 3-story lodge room and armory on Pearl St. near Court Ave., drawings for which have been prepared.

Burlington, Ia.—Bids will be received until July 9 at the office of H. I. Goddard, Archt., for erecting the superstructure of a 4-story fireproof business building.

**Davenport, Ia.*—It is reported that the Thompson-Starrett Co., of New York, N. Y., has secured the contract to erect the glucose plant at about $50,000.

Wichita, Kan.—G. T. Nolley, of the Nolley Furniture Co., it is stated, intends erecting at Santa Fe Ave. and Kellogg St. a 4-story furniture warehouse, to cost about $20,000.

Ft. Scott, Kan.—H. M. Finch, Gen. Secy. Y. M. C. A., writes that bids will be received about July 20 for the erection of a Y. M. C. A. building to cost about $30,000. Architect, W. S. Huff, of Ft. Scott.

Louisville, Ky.—J. Brownstein, 841 Eighth St., will erect a store and apartment building to cost $22,500. E. E. Albus, Archt., 728 E. Madison St.

Slidell, La.—The Covington Grocery & Grain Co., of Covington, is reported to have received plans for the fireproof building which they propose erecting in Slidell at a cost of $12,000.

Harrison, Me.—Bids are wanted by the Bldg. Com. (W. H. Briggs, Chmn.), for erecting a I. O. O. F. block to be 2-story with towers 120x48 ft.

**Baltimore, Md.*—Geo. Bunnecke & Son, 305 St. Paul St., it is stated, have secured the contract to erect the 3-story store building at 221 W. Lexington St., for Mrs. Mary V. Wylie at a cost of $20,000.

Boston, Mass.—It is stated that a 6-story building is to be erected at North St. and North Sq. for Stabile & Co., at a cost of $50,000.

Duluth, Minn.—It is stated that a building permit has been issued to W. W. Seekins to erect a combined greenhouse and store on Superior St., to cost $18,000, according to plans prepared by F. L. Young, Palladio Bldg.

**Bemidji, Minn.*—The Jerard Plumbing Co., of Bemidji, is reported to have secured the contract to install plumbing in the hotel being erected by Mayor & Home at $2,145.

Brainard, Minn.—The Sleeper Blk. is reported to have been destroyed by fire on June 25.

Hattiesburg, Miss.—Geo. Kennedy is reported to be having plans prepared for a $12,000 office building.

St. Louis, Mo.—L. Gordon, it is stated, will erect at 1204 Washington Ave. a 7-story mercantile building to cost $123,000. Mauran, Russell & Gardner, 721 Olive St., are said to be preparing the plans.

H. F. Roach, 721 Olive St. is said to have prepared plans for the 7-story building to be erected a 10th and Olive Sts. by F. G. Wickham and others. Probable cost, $150,000.

*Jas. Stewart & Co., Lincoln Trust Bldg., are reported to have secured the contract to erect the Bank of Commerce Bldg at an estimated cost of $1,000,000.

Kansas City, Mo.—It is stated that the members of the "N. & E." Society propose erecting a building costing about $30,000.

J. G. Sanger, it is reported, intends erecting a 3-story brick and stone hotel at 1315 Linwood Boule., at a cost of $55,000.

It is stated that the Trus. of the Grand Ave. M. E. Church have approved the plans for the 15-story office building which is to be erected at 9th and Grand Aves.

Omaha, Neb.—It is stated that plans are being prepared and bids for the construction will soon be asked for the 6-story warehouse which is to be erected for the Fairbanks, Morse & Co. at a cost of about $65,000.

**Items marked thus give the names of parties awarded contracts.*

The negroes are stated to have raised $10,000 with which it is proposed erecting a Y. M. C. A. Bldg.

Newark, N. J.—It is reported that the members of the North Reformed Church contemplate erecting a parish house on Broad St. adjoining the church, the cost to be about $22,000, not including site. Rev. Jas. I. Vance, pastor.

E. M. Waldron & Co., 69 Littleton Ave., are reported to have secured the contract for the extensive alterations and remodeling of the 6-story office building at 776 Broad St. for the Mercantile Realty and Improvement Co.; cost about $25,000.

Atlantic City, N. J.—The John D. Allen Co., of Philadelphia, Pa., is reported to have completed plans for a 13-story hotel and theatre building, which is to be erected for Geo. B. Burch at Arkansas Ave. and the Boardwalk. The building is to be 207x318 ft. of steel frame construction and brick and limestone trimmings, and is to cost about $1,500,000.

New York, N. Y.—Plans have been filed for the following buildings: 6-story brick stores and tenemts. to be erected at Whitlock Ave. and Tiffany St. for Albert Rothermel, cost $67,500, Harry T. Howell, archt.; 4-story brick parish house at Grand Ave. and 181st St. for Church of God Mission House, cost $25,000, Albrecht & Schope, archts.; 10-story brick and stone loft building at Canal and Sullivan Sts. for Alex. M. Powell, cost $250,000, Henri Fouchaux, archt.; two 6-story brick and stone stores and tenemts. at Grand and Mulberry Sts. for Francis R. Stabile, cost $75,000, Chas. M. Straub, archt.; 8-story brick and stone store and left building at Lafayette and Walker Sts. for Lafayette Bldg. Co., cost $280,000, Schwartz & Gross and B. N. Marcus, archts.; 5-story brick and stone stable at Washington and Charlton Sts. for Dr. Geo. W. Meyer, cost $47,500, John M. Baker, archt.; 6-story brick and stone store and tenemt. at 2d Ave. and 4th St. for Rosehill Realty Co., cost $45,000, Chas. M. Straub, archt.; 6-story brick and stone store and tenemt. at 2d Ave. and 4th St. for Sugarman & Adelstein, cost $42,000, Edw. A. Meyers, archt.; 6-story brick and stone store and tenemt. at 2d Ave. and 5th St. for Hyman Levin, cost $45,000, Chas. M. Straub, archt.; 3-story brick and stone theatre at 200 W. 46th St. for 46th St. and Bway. Realty Co., cost $130,000, Herts & Tallant, archts.; 12-story brick and stone office building at 103 Park Ave. for 103 Park Ave. Co., cost $650,000, Mulliken & Moeller, archts.; 6-story brick and stone stores and tenemts at 912 2d Ave. for Michael Voccoli, cost $34,000, Chas. M. Straub, archt.; 11-story brick and stone store office and loft building at 5th Ave. and 35th St. for The 35th St. and 5th Ave. Realty Co., cost $1,000,000, Clinton & Russell and Geo. A. Boehm, archts.; three 6-story brick and stone stores and tenemts. at 79th St. and Ave. A for Jacob Sherman, cost $135,000 all, Henry G. Harris, archt.; 6-story brick and stone store and tenemt. at 118th St. and 1st Ave. for Israel Grossman, cost $50,000, Chas. M. Straub, archt.; 4 and 5-story brick and stone extension to store and office building of the Columbus Circle Arcade Co. at 8th Ave. and 57th St., cost $40,000, Hedman & Schoen, archts.

Cohoes, N. Y.—It is reported that Capt. Ira D. Reaves is arranging to erect an 8-story business building.

Little Falls, N. Y.—W. Neill Wilson, of Pittsfield, is reported to have been directed to complete plans for the hotel which is to be erected here by M. G. Bronner and others so that bids for the construction may be asked about July 15.

Rockaway Beach, L. I., N. Y.—A syndicate, headed by Thos. P. Lally, of Richmond Hill, it is stated, has purchased 45 lots at Rockaway Park on which it is proposed erecting an apartment hotel and making improvements to the site which will cost a total of about $3,000,000.

Brooklyn, N. Y.—Plans have been filed for the following buildings: A 4-story brick store and tenemt. to be erected at Chester St. and Livonia Ave. for Carman & Kennedy, at a cost of $75,000; L. Danancher, archt., 377 Rockaway Ave. Three-story brick storage building and 3-story stables and shed at Nostrand Ave. and President St., for the Transit Development Co., 85 Clinton St., to cost $35,000 and $120,000 respectively. Three-story brick factory on Dumont Ave., for Silver & Schwenstein, 501 Pennsylvania Ave., cost $20,000; L. Danancher, 377 Rockaway Ave., is the archt.

The Empire Circuit Co., it is reported, has secured a site at Flatbush Ave. anad State St. on which it is proposed erecting a theatre to cost about $160,000.

Plans have been filed for a 3-story brick boilerhouse to be erected at Gold and John Sts. at a cost of $750,000; owner and archt., the Edison Electric Illuminating Co., 360 Pearl St.

Plans have been filed for a 5-story and basement brick and stone store and tenement, to be erected on Meserole St. and Manhattan Ave., at a cost of $45,000, by Jung & Gardner; Shampan & Shampan, 772 Bway., are the archts.

Plans have been filed for the following buildings: 4-story brick store and tenemt. to be erected at Nostrand and Lincoln Aves. for W. A. A. Brown, at a cost of $20,000; Elsenlo & Carlson, Archts., 5819 5th Ave.; 4-story brick factory at Roebling and N. 9th Sts. for Weson, Longman & Co.; cost, $55,000; W. Ryan, Archt., 162 Ryerson St.

Buffalo, N. Y.—The 13 railroads entering Buffalo, it is stated, propose erecting on the Fillmore Ave. site, East Buffalo, a union station to cost the railroads $10,000,000, and the city for approaches, sewers, water connections, etc., $500,000. Mayor J. N. Adam is said to be in favor of the plans. W. J. Wilgus, Constr. Dept., N. Y. Central & Hudson River R. R., New York, N. Y., is reported to be Chmn. of the Railroad Com.

Plans have been filed for a one story brick factory to be erected at 854 E. Ferry St. by Michael Hayman & Co., at a cost of $22,000 and also for a 5-story fireproof store and warehouse to be erected at Court and Pearl Sts. by the McNaughton Realty Co., at a cost of $75,000.

Bowling Green, O.—Fred. M. Gerard is reported to be contemplating the erection of a $12,000 business building.

Guthrie Okla.—The A. O. U. W. Lodge No. 1, it is reported, is arranging to erect a 3-story building.

Philadelphia, Pa.—The Philip Haibach Contr. Co., 2530 Thompson St., is stated to have secured the contract to erect a 2-story brick clubhouse for the Philadelphia Schuetzen Verein, on Olney Ave., near Tabor Station. The building will measure 25x53 ft, and cost $37,000. Koelle, Speth & Co. are the architects.

**Pittsburg, Pa.*—The Oliver estate, it is reported, has awarded the contract to Jas L. Stuart, Constr. Eng., 311 6th Ave., to erect an 8-story power building in Strawberry Al., and to be of structural steel with reinforced concrete floor system, and have approximately 100,000 sq. ft. area.

Allegheny, Pa.—Chas. Bickel, of Pittsburg, it is stated, is preparing plans for a warehouse to be erected on West Parkway, Allegheny, at a cost of about $100,000 by Boggs & Buhl.

Bristol, Va.-Tenn.—The Interstate Hotel Co. is reported to be arranging to erect a hotel and opera house estimated to cost $150,000.

Hillsboro, Tex.—The Citizens' Hotel Co. is reported organized with Judge W. C. Wear as pres. and gen. mgr., and E. S. Davis, secy. and treas., to erect a hotel at a cost of $40,000.

Salt Lake City, Utah.—The Salt Lake City Union Depot & R. R. Co. is reported formed with E. T. Jeffrey, pres., and E. A. Greenwood, Secy., and a capital of $200,000 for the purpose of erecting a depot for the use of the Denver & Rio Grande and the Western Pacific Railroads. In addition to the depot the company will construct about 20 miles of switches and tracks.

**Richmond, Va.*—The contract to erect the 4-story 50x100 ft. R. R. Y. M. C. A. Bldg. is stated to have bee nawarded to Wm. R. Dougherty, of Philadelphia, Pa. Probable cost $50,000.

Wheeling, W. Va.—Giesey & Faris, Masonic Temple, it is stated, have been engaged to prepare plans for the Y. M. C. A. Bldg., which is to be erected at 20th and Market Sts., at a cost of about $100,000.

Ottawa, Ont.—The Ottawa Terminal Ry. Co. is reported incorporated for the purpose of taking over the agreements made between the Grand Trunk Ry., the city, the Dominion Government and others respecting the erection of a central station in Ottawa. It is stated that a hotel is to be erected in conjunction with the station, the cost to be respectively about $250,000 and $500,000. Plans will be completed, according to reports, about July 15, and the construction work commenced in about 6 months.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Decatur, Ala.—The members of the St. Paul Episcopal Church, it is reported, propose erecting an edifice to cost $15,000.

Washington, D. C.—Wood, Donn & Deming, 808 17th St., n. w., are reported to have been engaged by M. J. Lawrence, of Cleveland, O., for a stone residence which he intends erecting at Wyoming and Connecticut Aves., Washington.

Atlanta, Ga.—Bruce & Everett, English American Bldg., it is reported, have prepared plans for an edifice to be erected at Houston and Courtland Sts. for the Congregational Church (colored) at a cost of about $25,000.

**New Albany, Ind.*—The Bldg. Com. of the Central Christian Church, it is reported, has awarded the contract to erect an edifice at Spring and 13th Sts. as follows. The total cost of the work is to be about $25,000: Brick work, Geo. Taskey & Son, Seymour; carpenter work, J. W. Mann; artificial stone work, Michel & Condra; excavations, Wm. Newhouse.

Terre Haute, Ind.—Bruce Bement is reported to be contemplating the erection of an apartment house on South Center and Walnut Sts., according to plans prepared by W. W. Floyd, McKeen Blk., at a cost of $50,000.

New Orleans, La.—The plans of John Henry, archt. and builder, for the 2 apartment houses which are to be erected, one at Bienville and Dauphine Sts., and the other on Dauphine St. are reported to have been accepted. The total cost of the improvement, it is stated, will be about $100,000.

Chicopee Falls, Mass.—It is stated that 2 apartment houses are to be erected on Linden St. by Louis A. Lafrance, of Holyoke, at a cost of about $20,000 each.

**Pittsfield, Mass.*—Geo. E. Laster, of Pittsfield, it is reported, has secured the contract to erect a residence on Wendell Ave. for Geo. C. Chesterman, to cost $50,000.

**Duluth, Minn.*—John Jacobson is reported to have secured the contract to erect the edifice for the First Norwegian Danish Methodist Church at about $25,000.

Minneapolis, Minn.—Bids will be received until July 20 at the office of E. L. Masqueray, 312 Dispatch Bldg., St. Paul, for the following work upon the site and building for the Pro-Cathedral, Hennepin Ave., 16th and 17th Sts.: Grading; excavation; concrete foundations; granite ashlar for crypt story; masonry work for crypt story. A charge of $5 will be made for plans and specifications.

Webb City, Mo.—The Methodists are said to be contemplating the erection of a $100,000 edifice.

St. Louis, Mo.—It is stated that John I. Beggs is having plans prepared by Barnett, Haynes & Barnett, Olive and 9th Sts., for a brick, stone and reinforced concrete residence to be erected at a cost of $200,000.

Fullerton, Neb.—It is stated that bids are wanted until July 19 for erecting a 50x80 ft. brick edifice for the M. E. Society; probable cost, $16,000. Eisenhaut-Colby-Pottenger Co., archts., Sioux City, Ia.

Newark, N. J.—Floyd Y. Parsons, of New York, N. Y., is reported to have completed plans for an edifice which is to be erected for the members of the Grace M. E. Church at a cost of about $20,000.

P. Bessmer is reported to have accepted plans for a 4-story apartment house as prepared by Hyman Rosensohn, 188 Market St.; estimated cost, $30,000.

M. B. Silberstein, 225 Springfield Ave., is reported to have prepared plans for a 4-story apartment house to be erected by Simon Slaff, estimated to cost $40,000.

Winston-Salem, N. C.—Frank P. Milburn, of Columbia, S. C., is reported to have been engaged to prepare plans for an apartment house, "The Alberta," which is to be erected here, 4 stories, of brick, and cost about $14,000.

Pittsburg, Pa.—John McSorley is reported to have plans completed for a $75,000 apartment house to be erected at South Negley Ave. and Elmer St., East End.

*Eichenbauh & Madden, 177 Shady St., are reported to have secured the contract to erect the $30,000 brick residence on Irwin Ave. for H. B. Cress, to cost $30,000.

It is reported that the contract to erect an $18,000 apartment house at Ellen and Wilson Aves. for Patrick McSteen has been awarded to Wm. M. Fox.

Crafton, Pa.—O. M. Topp, Westinghouse Bldg., Pittsburg, is reported to have completed plans for an edifice which is to be erected for the Episcopal Church of the Nativity at a cost of $30,000.

Harrisburg, Pa.—It is stated that the members of the St. Paul Baptist Church contemplates erecting an edifice, costing about $11,000.

Watertown, S. D.—It is stated that bids will be received until July 15 by the Bldg. Com (Irvin H. Myers, Secy.), for erecting the chapel of the First Church of Christ (Scientist).

Salt Lake City, Utah.—Ware & Treganza, 62 Hooper Bldg., are reported to have prepared plans for a residence to be erected for W. Lester Manum at an estimated cost of $15,000.

Aberdeen, Wash.—It is reported that plans have been accepted for an edifice to be erected for the Presbyterian Church at a cost of $20,000.

Reedsburg, Wis.—It is reported that the congregation of the Methodist Church contemplates erecting an edifice costing about $20,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Leupp, Ariz.*—The contract to erect a school for the Navajo Indian Reservation (bids received June 15 at Washington, D. C.), is reported to have been awarded to Jas. H. Owen, of Los Angeles, Cal. The contract calls for the installation of a water system, sewers, a lighting plant and all necessary outbuildings. The Government will spend upward of $75,000 on the school.

Paragould, Ark.—Bids will be received until July 25 (extension of date) by J. A. Morgan, Secy. Special School Dist., for furnishing material and erecting a 2-story and basement high school.

Palo Alto, Cal.—Coxhead & Coxhead, of San Francisco, are reported to have prepared plans for a school for young ladies, which is to be erected in the residential district of Palo Alto by Miss Harker at a cost of about $35,000.

Macon, Ga.—Pres. S. Y. Jameson is said to be having plans prepared for a library to be erected at Mercer Univ., at a cost of about $40,000.

Moscow, Idaho.—Jas. A. MacLean, Pres. Univ. of Idaho, writes that all bids opened on June 11 for administration building have been rejected, and new bids will be received on Aug. 7. The lowest bid received for this work is reported to have been submitted by Campbell Bros., of Salt Lake City, Utah. They bid for the main building and left wing, $239,000 and for building as a whole, $291,500.

Pana, Ill.—F. A. Cutler, Clk. High School Bd., writes that the citizens on June 29 voted to issue $50,000 bonds for a high school.

**Indianapolis, Ind.*—John Cleland, Bus. Dir. Bd. Educ., writes that the contract for heating school at Pennsylvania and 33d Sts (bids opened June 25) has been awarded to Hayes Bros., 437 Indiana Ave., for $5,048, and for plumbing same to Clark Bros. for $3,185.

De Soto, Ind.—It is reported that bids will be received until July 16 by the County Supt. Chas. A. Van Matre, at Muncie, for a 2-story brick school to be erected in DeSoto according to plans prepared by Mahurin & Mahurin, of Ft. Wayne.

Forest, Ind.—Bids will be received by the Bd. of School Trus. until July 18 for the erection of a high school, to cost about $30,000. Archts, J. T. Johnson & Co., of Indianapolis.

**Tipton, Ind.*—The contract for plumbing, heating and wiring high school has been awarded to Compton & Sons, of Tipton, for $8,145. J. T. Johnson & Co., Title Archts., Indianapolis.

**Newton, Kan.*—It is stated that the contract to erect a brick dormitory and hospital at the Menoite College has been awarded to Horace Williams, of Wichita, at approximately $40,000.

**Topeka, Kan.*—Stingley Bros., of Manhattan, are reported to have secured the contract to erect a domestic arts and science building for the State Agricultural College, not including plumbing, electric wiring, etc., at $69,500.

**Monroe, La.*—The Bd. of Control of the State Reform School, it is reported, has awarded the contract to erect the main building to Paillett & Kirk, of Monroe, at $28,875.

Baltimore, Md.—Baldwin & Pennington, American Bldg., are reported to have been engaged to prepare plans for a college building to be erected for the Mt. St. Mary College, the cost to be about $100,000.

Wellesley, Mass.—The $125,000 required in order to secure a Carnegie Library for Wellesley College, it is reported, has been raised.

**Haverhill, Mass.*—The following are the bids opened on June 19 for erecting the Haverhill School: E. T. Wilson, $45,527; A. Beurneuf, $38,950; F. C. Alexander, $38,653; Kelley Bros., $36,887; H. H. Libbey, $35,985, and John M. Roche, $34,836 (awarded contract).

**Water Valley, Miss.*—Thos. Poole has secured the contract to build a school for Water Valley for $25,000. H. J. Scherell, Memphis, Tenn., has contract for plumbing at $2,000, and Sodiman Heat & Power Co. has the plumbing contract at $3,000. P. J. Krouse, Archt., Meridian, Miss.

Bay City, Mich.—It is reported that bids will be received until July 12 for erecting the Denison School according to plans prepared by Clark & Munger, Shearer Bros. Bldg.; cost not to exceed $25,000.

Chelsea, Mich.—It is stated that the citiizens have voted to erect a 2-story high school at a cost of $30,000.

Houghton, Mich.—It is stated that a library and museum building is to be erected at the Michigan College of Mines to cost about $75,000.

**Bessemer, Mich.*—Danl. Egan, of Ashland, Wis., is reported to have secured the contract to erect the high school (bids for which were received June 19), at about $50,000.

St. Paul, Minn.—It is reported that several local archts. have been engaged by the Bd. of Educ. to prepare plans for 4 high schools which the Bd. plans to erect as soon as bonds are authorized by the City Council.

**Shakopee, Minn.*—Aug. Woehling & Co., of Shakopee, are reported to have secured the contract to erect a school for the Union School B d.at $11,261.

Missoula, Mont.—The Trus. of the Univ. of Montana, it is stated, have rejected all bids received for erecting

**Items marked thus give the names of parties awarded contracts.*

a library at the Univ., as they exceeded the amount available, which is $40,000.

*Dent, Minn.—Hamkens & Geiser are reported to have secured the contract to erect the brick school.

Aurora, Minn.—F. S. Young, of Duluth, is reported to be preparing plans for a $12,000 school for Aurora.

*Albert Lea, Minn.—It is reported that the contract to erect an addition to the east end of the Albert Lea College has been awarded to Nels C. Sorenson, of Albert Lea, at about $11,000.

Independence, Mo.—The citizens are stated to have voted in favor of issuing $30,000 bonds for erecting an addition to the Columbia and the high school buildings.

Jersey City, N. J.—The Bd. of Finance has appropriated $80,000 to enable the Bd. of Educ. to erect an addition to school No. 14 on Union St., plans for which have been prepared.

*Bordentown, N. J.—It is stated that the contract to erect a dormitory at the Industrial School for Negro Youths has been awarded to J. W. Lanning of Trenton, at $18,000.

*Trenton, N. J.—S. W. Mather & Sons, 30 S. Clinton Ave., are reported to have secured the contract to erect a school for St. Mary's parish to cost about $26,000.

East Orange, N. J.—Bids will be received until July 22 by the Bd. of Educ. (Warren A. Clapp, Secy.), for erecting the Lincoln School.

Dunkirk, N. Y.—All bids received June 24 for erecting an addition to the high school have been rejected, as they exceeded the estimated cost, which was $62,000.

Patchogue, L. I., N. Y.—It is stated that an additional $20,000 has been voted for the erection of a 16-room school. Bonds to the amount of $60,000 were previously voted for this school.

*New York, N. Y.—Gillis & Geoghegan, 537 West Bway., N. Y. City, have secured contracts for installing, ventilating and heating apparatus in (a) School 23, Flushing, Boro. of Queens, for $15,000; (b) School 39, Far Rockaway, Boro. of Queens, for $31,485, and (c) School 152, Boro. Brooklyn, for $34,450 (bids opened June 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City. The other bidders were: R. J. Sovereign & Co., Inc., a $15,600, b $34,900, c $34,900; E. Rutzler Co., a $16,179, b $36,833, c $36,833; Isaac B. Merritt, a $15,150; Wm. J. Olvany, a $16,463; Blake & Williams, b $34,532, c $34,532; Frank Dobson, Inc., b $38,750, c $38,750.

Bids will be received until July 15 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction, etc., of School 93, Boro. Brooklyn; repairs to ventilating and heating apparatus in School 96, Boro. Manhattan; general construction, etc., of School 56, Richmond Hill, Boro. Queens.

Auburn, N. Y.—School bonds amounting to $140,000 are reported to have been sold.

Avon, N. Y.—It is stated that school bonds amounting to $40,000 have been sold.

*Corona, L. I., N. Y.—The following are the bids opened on July 1 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City., for installing, ventilating and heating apparatus in School 16, Corona, Boro. of Queens: R. J. Sovereign Co., Inc., $38,120; E. Rutzler Co., $39,000; Blake & Williams, $37,727; Baker, Smith & Co., 83 W. Houston St., $36,996 (awarded contract), and Frank Dobson Co., Inc., $37,350.

Chapel Hill, N. C.—Frank P. Millburn, of Columbia, S. C., is reported to have been engaged to prepare plans for the biological building at the Univ. of North Carolina.

Kenmare, N. D.—It is stated that the citizens have voted in favor of issuing $20,000 bonds to erect a high school.

Columbus, O.—The Bd. of Trus. of the State Univ., it is stated, has adopted the plans for the 2-story brick girls' dormitory which is to be erected at the Univ. at a cost of about $60,000.

Educ. (J. O. Pepple, Clk.), until July 18 for furnishing material and erecting a 2-story and basement brick and stone high school. Bids to be submitted separately on plumbing and steam heating, steam blast system with automatic regulation. Plans and specifications may be had upon a deposit of $25.

Mt. Healthy, O.—Bids will be received until July 24 by Wm. Fischvogt, Clk. Bd. Educ., Special School Dist. No. 13, Springfield Township, Mt. Healthy, R. F. D. No. 4, for furnishing material and erecting a school in Steeles Subdivision; also same place, until July 10, for erecting a school on Vanzant Rd., near Hamilton Pike.

Bucyrus, O.—It is stated that bids will be received until July 18 by the Bd. Educ. (J. S. McCarroll, Clk.), for $17,500 school bonds.

Pittsburg, Pa.—John T. Comes, 929 5th Ave., is reported to have been engaged to prepare plans for the 12-room brick parochial school which is to be erected at Grandview Ave. and Bingham St., Mt. Washington, for the R. C. congregation of St. Mary of the Mount. Probable cost, $70,000.

McKees Rocks, Pa.—Robinson & Winkler, archts., of Pittsburg, are reported to be receiving bids for 2 brick schools to be erected in Stowe Township near McKees Rocks, one to contain 8 rooms and the other 6 rooms and the total cost to be $45,000.

Philadelphia, Pa.—Wm. H. Eddleman, 453 Green Lane, Roxborough, was granted a permit to build a 3-story brick and stone school, 66x103 ft., for the parish of St. Mary's R. C. Church, on Conarroe and Silverwood Sts. The cost will be $55,000. Ralph E. White, Pennsylvania Bldg., is the architect.

Memphis, Tenn.—The Bd. of Educ., it is stated, has directed B. C. Alsup, Randolph Bldg., to prepare plans for a 12-room brick school to be erected on Carr Ave., and for a 4-room annex to the Lauderdale St. School.

Knoxville, Tenn.—It is stated that plans are about completed for the agricultural college building which is to be erected at the Univ. of Tennessee. Bids for the construction will be asked soon.

Smithville, Tex.—Bids will be received until July 10 by Roger Byrne, Chmn. Bldg. Com., City Council, for erecting a 2-story and basement brick and stone school. Guy S. Boyce, Archt., Austin.

Brenham, Tex.—It is stated that the plans of C. H. Page, Jr., of Austin, for the $30,000 public school to be erected on N. Market St. have been adopted.

Richmond, Va.—The Bd. of Aldermen has authorized the Bd. of School Trus. to have plans and specifications prepared for a high school to cost $350,000.

Everett, Wash.—Bids will be received on July 15 for the erection of a school, to cost about $50,000. Architect, Jas. Stephen, New York Blk., Seattle; Chas. E. Frost, Secy. School Bd.

Madison, Wis.—The Trus. of the Univ. of Wisconsin, it is stated, intend erecting a women's building and gymnasium.

*Beloit, Wis.—Pearce Bros., of Rockford, Ill., are reported to have secured the contract to erect the Merrill School at $13,450.

*Fond du Lac, Wis.—J. M. Thompson, of Fond du Lac, is reported to have secured the contract to erect the manual training school at $15,000.

Janesville, Wis.—The School Bd. is planning the remodeling of the 3d Ward School at a cost of $20,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Youngstown, O.—We are informed that no bids were received on June 29 by the Bd. Health (Clate A. Smith, Secy.) for the collection, removal and disposal of garbage for a period of 5 years.

Ft. D. A. Russell, Wyo.—Bids will be received until July 22 by Capt. V. K. Hart, Constr., Q. M., U. S. A., Cheyenne, for furnishing material and constructing a garbage crematory at Ft. D. A. Russell.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Little Rock, Ark.—The Chicago, Rock Island & Pacific R. R. (H. G. Clark, Dist. Engr., Little Rock), it is reported, intends erecting a round house, terminals, yards and shops southeast of this city.

Little Rock, Ark.—See "Railroads."

Santa Ana, Cal.—J. E. Coffin, of Los Angeles, is reported to be the Vice-Pres. of the Pacific Straw Board & Paper Co., which proposes locating here for the purpose of manufacturing straw board, chip board and roofing paper, the output to be about 20,000 tons annually.

Los Angeles, Cal.—See "Water."

Davenport, Ia.—The Glucose Co., it is reported, intends erecting a 6-story addition, 200x95 ft., to its plant, to cost approximately $25,000.

Kansas City, Kan.—The Chicago, Rock Island & Pacific R. R. (J. B. Berry, Ch. Engr., Chicago, Ill.), it is stated, will erect railroad shops here, consisting of 12 buildings.

*Pittsfield, Mass.—A contract is reported to have been awarded by the General Electric Co., Pittsfield Works, for erecting a shop building 65x100 ft., of steel frame and brick walls, to Beckwith & Pike, of Pittsfield, Mass.

Joplin, Mo.—It is stated that the new mill of the Kantenwein Mining Co., at Block City, which was almost completely destroyed by the storm on June 10, will be rebuilt immediately. The new plant will comprise a 175-ton mill and modern equipment throughout.

Newark, N. J.—It is stated that the Celluloid Co. intends erecting an addition to its plant on St. Charles St., to cost $30,000.

*Skaneateles, N. Y.—The contract for the erection and completion of the plant of the Skaneateles Paper Co. at Skaneateles has been awarded to the Consolidated Eng. & Constr. Co., of Syracuse. It consists of 5 buildings, all of which will be brick, steel and reinforced concrete. Geo. F. Hardy, 309 Bway., N. Y. City, is the engineer.

Youngstown, O.—The Youngstown Sheet & Tube Co., it is reported, will proceed at once in the matter of building 3 new pipe mills. There will be 2 Buddweld and 1 Lapweld, which will greatly increase the capacity and make the output of the pipe department between 20,000 and 22,000 tons a month.

Cleveland, O.—The Cleveland Furnace Co. (F. T. Croxton, Pres.) is stated to have plans completed for doubling the capacity of its furnace plant at a cost of $1,000,000.

Hamilton, Ont.—An addition to the Westinghouse Co.'s plant at Hamilton, it is reported, is being agitated.

London, Ont.—The London Concrete Machinery Co., it is stated, will build an addition to its plant.

Peterborough, Ont.—The Colonial Weaving Co., according to reports, has decided to increase its capital stock to $110,000, and to double the size of its plant.

Sault Ste. Marie, Ont.—The Algoma Steel Co., according to reports, will at once commence the erection of a blast furnace to cost about $1,000,000. Its erection will be followed at once with a big coke plant to supply the steel plant.

Ft. William, Ont.—Geo. Alsip, of Winnipeg, Man., it is stated, has purchased property at Ft. William, and will establish a brick-making industry, etc.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Ft. Morgan, Ala.—Bids will be received by Capt. L. F. Garrard, Jr., Q. M., U. S. A., Box 605, Mobile, Ala., until July 23, for furnishing material for filling and top soiling the reservation and repairing wharf at Ft. Morgan, Ala.

Piggott, Ark.—It is reported that bids will be received until July 16 by the Bd. of Directors of the St. Francis Drainage Dist. of Clay and Greene Counties, at Piggott (Geo. W. Seitz, Secy.), for enlarging a total of 12 miles of levee; building 7 1-5 miles of levee and dredging 30½ miles of main drainage ditch, including clearings, tools and labor necessary to complete same. Plans and profiles may be had for $10.

Los Angeles, Cal.—See "Water."

Washington, D. C.—Bids will be received by Maj. Spencer Cosby, Corps. Engrs., U. S. A., Washington, until July 29 for constructing riprap jetties in Occoquan, Nomini and Urbana Creeks and Milford Haven, Va., as advertised in The Engineering Record.

Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until July 9, to furnish at the navy yard and naval station a quantity of naval supplies, as follows: Washington, D. C.: Schedule 16—Dust collector system, trimming press. Schedule 35—Bronze rod, flexible copper tubing, brass tubing. Schedule 36—Bar steel, nickel steel forgings, castings. Schedule 37—Recoil springs. New York, N. Y., and Guantanamo, Cuba, etc.: Schedule 31—Rebuilding brick wall. Schedule 36—Rails, frogs, etc. Schedule 37—Ties, c. i. pipe and specials, valves, sewer pipe, cement block machine, etc. Schedule 38—Asphalt. Schedule 40—Galvanized iron. Newport, R. I.: Schedule 11—Construction of walks. Schedule 12—Construction of walls. Schedule 13—Dredging. Schedule 14—Installation of steam distributing system. Schedule 16—Turbine bucket cutting machines. Portsmouth, N. H.: Schedule 38—Hoop brass and iron. Boston, Mass.: Schedule 39—Gaskets. Norfolk, Va.: Schedule 33—Creosoted piles. Charleston, S. C.: Schedule 15—1 hand resawing machine. Pensacola, Fla.: Schedule 15—1 traveling crane. Also until July 16: Portsmouth, N. H.: Schedule 61—Sheet copper, galvanized sheet steel, copper pipe, etc. Schedule 62—Hemlock, white pine, steel cement, etc. New York, N. Y., and Guantanamo, Cuba, etc.: Schedule 55—Steel cars, etc. Schedule 60—Steel plates. Schedule 61—Copper pipe. Schedule 67—Rolled bronze, copper, bar iron and steel. League Island, Pa.: Schedule 59—Electrical conductor and conduit. Schedule 61—Galvanized sheet steel, ingot tin, copper pipe. Schedule 66—Drills, pipe fittings, valves, etc. Schedule 67—Brass, bronze, copper, bar iron and steel. Pensacola, Fla.: Schedule 63—Bolts, etc., yellow pine plank and piles, bar iron. Schedule 64—Iron or steel pipe, valves, etc. Norfolk, Va.: Schedule 55—Portland cement, gravel, sand, ties, steel angles, rails. New Orleans, La.: Schedule 63—Electrical supplies. Also until July 23: Mare Island, Cal.: Schedule 46—Broken stone, sand, Oregon pine, corrugated steel, steel shapes and plates, rails. Schedule 47—Broken stone, Portland cement, brick, sand, lumber, platinum, bar iron, corrugated steel, steel shapes and plates, rails, etc. Schedule 48—Steel plates. Schedule 49—Oregon pine, tallow wood, iron or steel pipe, steel tubing, copper pipe, etc. Puget Sound, Wash.: Schedule 48—Steel, plates, shapes, bars, billets and beams. Schedule 52—Rolled bronze, bar steel, galvanized sheet steel, brass, copper, and iron or steel pipe, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l, U. S. N.

Takoma (Washington), D. C.—Bids will be received by Maj. J. T. Crabbs, Q. M., Walter Reed Army Hospital, Takoma Substaton, Washington, D. C., until July 18 for constructing concrete conduit on reservation of hospital, approximately 1,000 ft. long, 8 ft. wide and 5 ft. high, covered with concrete slabs, as advertised in The Engineering Record.

Streator, Ill.—The Streator Fuel Co. is reported to have decided to sink a coal shaft; cost, $25,000.

Richmond, Ind—See "Railroads."

Carroll, Ia.—It is stated that bids will be received until July 24 by the Bd. Co. Superv., for constructing a ditch. Peter Stephany, Co. Aud.

Emmetsburg, Ia.—Bids will be received until Aug. 7 by the Bd. Co. Superv. for constructing drainage improvements in the following districts: Nos. 12, 15, 16, 17, 18, 19 and 24. Bids to be submitted separately on each district. Sim. R. Stedman, Co. Aud.

Houghton, Mich.—See "Power Plants, Gas and Electricity."

Petit Rocher, N. B.—It is stated that bids will be received until July 15 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of an extension from the breakwater to the shore at Petit Rocher.

Oswego, N. Y.—The citizens are reported to have voted on June 25 to issue $7,000 bonds for the construction of a dam across Susquehanna River in Owego.

Brooklyn, N. Y.—Bids will be received by Park Bd. (Moses Herrman, Pres.), New York City, until July 18, for furnishing material and constructing riprap sea wall along Bay Ridge Parkway, from Wakeman Pl. to Ft. Hamilton Ave., Boro. Brooklyn, together with all work incidental thereto.

The Bd. of Aldermen is reported to have on June 25 voted to give Park Commissioner Kennedy an appropriation of $266,567 for the maintenance of park system in Brooklyn and Queens. Some of the money is to be expended as follows: $60,000 for a shelter and locker house in McLaughlin Park; $35,000 for making improvements to Eastern Parkway; $25,000 for Highland Park, and $50,000 for Sunset Park.

New York, N. Y.—The Municipal Art. Comn on June 27 approved the designs for pier buildings for the Chelsea improvement, running from 11th to 23d Sts., North River, and to cost several million dollars.

Bids will be received by Jas. W. Stevenson, Comr. of Bridges, until July 18 for furnishing and delivering spruce plank for the Brooklyn Bridge during the year 1907.

Panama.—The following are the bids opened on June 28 by the Isthmian Canal Comn. at Washington, D. C., for one or two suction dredges: Maryland Steel Co., Sparrows Point, Baltimore, Md., 2 dredges (one in 150 days and two in 185 days), f. o. b. cars or vessel at factory, $173,500; Merrill Stevens Co., Jacksonville, Fla., one dredge 240 days, f. o. b. factory, $99,800; The Moran Co., Seattle, Wash., one dredge 8 months at works, $133,000; Newport News Shipbuilding & Dock Co., New York, N. Y., two dredges, 270 and 300 days, del. at Newport News, $165,000; Atlantic Equipment Co., 111 Bway., New York, N. Y., two dredges, one 320 days and two 410 days, delivered beside vessel in New York, $236,500; The Bucyrus Co., South Milwaukee, Wis., one 235 days and two 260 days, on cars in New York, or on ship for $550 each additional, one to cost $98,800, and two for $191,800; Lobnitz & Co., 32 Bway., New York, N. Y., two dredges, 250 days, in New York, $188,560.

Bids will be received by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until July 16, for furnishing steam shovels, unloader plows, car replacers, jacks, rail benders, iron pipe and fittings, valves, bibbs, gauge cocks, steel wool, etc., as per Circular 374.

San Juan, P. R.—Bids will be received until Aug. 3 by L. H. Grahams, Comr. of the Interior, San Juan, for the repair and rental for a period of 15 years of the iron pier located at La Puntilla in the city of Mayaguez. The necessary repairs have been estimated at $36,394.

*Sabine Pass, Tex.—Bids were opened on June 15 by Capt. J. F. McIndoe, Corps. Engrs., U. S. A., New Orleans, La., for jetty work at Sabine Pass, and the bid of Chas. Clarke & Co., of Galveston, has been recommended for acceptance. They bid for sandstone and granite, half in half, $2.59⅞ cts. per ton; total cost, $259,875. About 100,000 tons of material will be required.

**Items marked thus give the names of parties awarded contracts.*

PROPOSALS OPEN.

For Proposals see Pages 90, 92, 93, 94, 96 and 97.

WATER.

Bids Close.		See Eng. Record
Jul. 9.	Water wks., Jackson, Mo.	Jun. 8
Jul. 10.	Force mains, Columbus, Ohio. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 10.	Pumps, Chicago, Ill.	Jun. 29
Jul. 11.	Water wks., Tilden, Neb.	Jul. 6
Jul. 11.	Mains, New York, N. Y.	Jul. 6
Jul. 11.	Pipe, Chicago, Ill.	Jul. 6
Jul. 12.	Water wks., Bloomer, Wis.	Jul. 6
Jul. 13.	Water wks., Ukiah, Cal.	Jul. 6
Jul. 15.	**Water works, Eunice, La. Adv. May 25.**	**May 25**
Jul. 15.	Main, Kenmare, N. D.	Jun. 29
Jul. 15.	Lansing, Mich.	Jul. 6
Jul. 15.	Pipe, North Milwaukee, Wis.	Jul. 6
Jul. 15.	Filter plant, Wilson, N. C.	Jul. 6
Jul. 15.	Laying pipe, Elizabeth, N. J. Adv. Jul. 6.	Jul. 6
Jul. 16.	System, Sayre, Okla.	Jun. 22
Jul. 16.	Water works, Comfrey, Minn.	Jun. 29
Jul. 16.	Mains, New York, N. Y.	Jul. 6
Jul. 20.	Reservoir dam, St. Paul, Minn. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 22.	Filter plant, Burlington, Vt. Adv. Jul. 6.	Jul. 6
Jul. 22.	Mains, Randolph, Neb.	Jul. 6
Jul. 31.	Water wks., North Battleford, Sask.	Jun. 22
Aug. 5.	Pump engine for sale, Sandusky, O. Adv. Jul. 6.	Jul. 6
Aug. 6.	Dams, New York, N. Y. Adv. Jul. 6.	Jul. 6
Aug. 19.	**Filter plans, Sacramento, Cal. Adv. Jun. 1 to 15.**	**Jun. 1**
Aug. —.	Water wks., Rockingham, N. C.	June. 29
Sep. 4.	Hauling and laying pipe, New Orleans, La. Adv. Jun. 29 to Jul. 6.	Jun. 29
———	**Laying pipe, Hoosick Falls, N. Y.**	**May 1.**
———	**Water wks., West Newton, Pa.**	**May 18**
———	System, Sherrard, Ill.	Jun. 29

SEWERAGE AND SEWAGE DISPOSAL.

Jul. 8.	Washington, D. C. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 8.	Hartford, Conn.	Jul. 6
Jul. 9.	Ritzville, Wash.	Jul. 6
Jul. 10.	Cresson, Pa.	Jun. 15
Jul. 10.	Columbus, O. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 10.	Buffalo, N. Y.	Jul. 6
Jul. 10.	Baltimore, Md.	Jul. 6
Jul. 10.	Otisville, N. Y.	Jul. 6
Jul. 11.	Chicago, Ill.	Jul. 6
Jul. 11.	Cedar Falls, Ia.	Jul. 6
Jul. 12.	Eldorado, Kan.	Jun. 29
Jul. 13.	Norwood, O. Adv. June 29, Jul. 6.	Jun. 29
Jul. 15.	Brookings, S. D.	Jun. 15
Jul. 15.	Steubenville, O.	Jun. 29
Jul. 15.	Lamar, Colo.	Jul. 6
Jul. 16.	Torrington, Conn. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 16.	Cleveland Heights, O.	Jul. 6
Jul. 16.	New York, N. Y.	Jul. 6
Jul. 17.	Iron River, Mich. Adv. Jul. 6.	Jul. 6
Jul. 20.	Pensacola, Fla.	Jun. 29
Jul. 20.	Oshkosh, Wis.	Jul. 6
Jul. 22.	Willoughby, O.	Jun. 22
Jul. 22.	Philadelphia, Pa. Adv. Jul. 6.	Jul. 6
Jul. 25.	Frankfort, Ind.	Jun. 29
Jul. 31.	North Battleford, Sask.	Jun. 22
Jul. 31.	Eureka, Kan.	Jul. 6
Jul. —.	Brazil, Ind.	Jun. 1
Jul. —.	Belleville, Ill.	Jun. 15
Aug. 1.	Marshfield, Wis.	Jul. 6
Aug. 5.	Olympia, Wash. Adv. Jul. 6.	Jul. 6
Aug. 6.	Alexdandria, La. Adv. Jun. 26, Jul. 6.	Jun. 29
Aug. —.	Rockingham, N. C.	Jun. 29
Sep. 1.	**Eatonton, Ga.**	**Apr. 13**
Sep. 1.	**Alton, Ill.**	**Jun. 8**
Sep. 11.	New Orleans, La. Adv. Jul. 6.	Jul. 6

BRIDGES.

Jul. 9.	Beatrice, Neb.	Jun. 29
Jul. 9.	Trenton, N. J.	Jun. 29
Jul. 9.	Shamokin, Pa.	Jul. 6
Jul. 9.	Towanda, Pa.	Jul. 6
Jul. 9.	Milwaukee, Wis.	Jul. 6
Jul. 10.	Nashville, Tenn. Adv. Jun. 8 to Jul. 6.	Jun. 8
Jul. 10.	Toledo, O. Adv. Jun. 15, 22.	Jun. 15
Jul. 11.	Washington, D. C. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 12.	Indianapolis, Ind.	Jun. 22
Jul. 12.	Cincinnati, O.	Jun. 29
Jul. 12.	Sidney, O.	Jul. 6
Jul. 12.	Cincinnati, O.	Jul. 6
Jul. 15.	New Orleans, La.	Jun. 15
Jul. 15.	Lethbridge, Alta.	Jun. 29
Jul. 15.	Jefferson, O.	Jun. 29
Jul. 15.	Barnstable, Mass.	Jun. 29
Jul. 10.	Moravia, N. Y.	Jun. 29
Jul. 10.	Indianapolis, Ind. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 15.	Mt. Pulaski, Ill.	Jul. 6
Jul. 15.	Algiers, La.	Jul. 6
Jul. 15.	Allendale, N. J.	Jul. 6
Jul. 15.	Athens, Ga.	Jul. 6
Jul. 16.	Toronto, Ont. Adv. Jun. 1 to Jul. 6.	Jun. 1
Jul. 16.	Lincoln, Kan.	Jul. 6
Jul. 16.	Hackensack, N. J.	Jul. 6
Jul. 19.	Ft. Snelling, Minn. Adv. Jun. 15 to 29.	Jun. 15
Jul. 20.	San Juan, P. R.	Jun. 8
Jul. 20.	Culpeper, Va. Adv. Jun. 22, 29.	Jun. 22
Jul. 23.	Columbia City, Ind.	Jul. 6

PAVING AND ROAD MAKING.

Jul. 8.	Salem, N. J. Adv. Jul. 6.	Jul. 6
Jul. 8.	Paris, Ill. Adv. Jul. 6.	Jul. 6
Jul. 8.	Jamesburg, N. J. Adv. Jul. 6.	Jul. 6
Jul. 9.	Steubenville, O.	Jun. 22
Jul. 9.	Wilmington, Del. Adv. Jun. 29.	Jun. 29
Jul. 9.	Wadsworth, O.	Jun. 29
Jul. 9.	Cambridge, O.	Jun. 29
Jul. 9.	McLeansboro, Ill.	Jul. 6
Jul. 10.	Atlantic City, N. J. Adv. Jun. 22, 29.	Jun. 22
Jul. 10.	St. Bernard, O.	Jun. 29
Jul. 10.	Atlantic City, N. J. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 10.	Cincinnati, O.	Jul. 6
Jul. 10.	St. Clairsville, O.	Jun. 29
Jul. 10.	Brooklyn, N. Y.	Jun. 29
Jul. 10.	Baltimore, Md.	Jul. 6
Jul. 11.	Sullivan, Ind.	Jul. 6
Jul. 11.	Cedar Falls, Ia.	Jul. 6
Jul. 11.	Chicago, Ill.	Jul. 6
Jul. 12.	Petersburg, Ind.	Jun. 22
Jul. 12.	Glendale, O.	Jun. 22
Jul. 12.	Cincinnati, O.	Jun. 29
Jul. 12.	Hudson, Mich. Adv. Jun. 29.	Jun. 29
Jul. 12.	Elyria, O.	Jul. 6
Jul. 12.	Oneona, Ill.	Jul. 6
Jul. 12.	Houston, Tex.	Jul. 6
Jul. 12.	Columbus, O.	Jul. 6
Jul. 12.	St. Louis, Mo.	Jul. 6
Jul. 13.	Balls Bluff, Va.	Jun. 29
Jul. 13.	Bluffton, Ind.	Jul. 6
Jul. 13.	Neenah, Wis.	Jul. 6
Jul. 15.	**Dyer, Tenn.**	**Jan. 26**
Jul. 15.	St. Paul, Minn.	Jun. 29
Jul. 15.	Green Bay, Wis.	Jun. 29
Jul. 15.	Archbold, O.	Jul. 6
Jul. 15.	St. Paul, Minn.	Jul. 6
Jul. 15.	Kirksville, Mo. Adv. Jul. 6.	Jul. 6
Jul. 16.	New York, N. Y.	Jul. 6
Jul. 16.	Cleveland Heights, O.	Jun. 22
Jul. 16.	Snohomish, Wash.	Jun. 22
Jul. 16.	Chardon, O.	Jun. 29
Jul. 17.	Ft. Leavenworth, Kan.	Jun. 29
Jul. 17.	Brooklyn, N. Y.	Jul. 6
Jul. 18.	Brooklyn, N. Y.	Jul. 6
Jul. 18.	Spencer, Ind.	Jul. 6
Jul. 18.	Wilkesbarre, Pa. Adv. Jul. 6 (2 prop.).	Jul. 6
Jul. 19.	Cincinnati, O.	Jun. 29
Jul. 19.	Columbus Barracks, O.	Jul. 6
Jul. 19.	Ft. Leavenworth, Kan.	Jul. 6
Jul. 20.	Crawfordsville, Ind.	Jun. 22
Jul. 20.	Greencastle, Ind.	Jun. 29
Jul. 20.	Findlay, O.	Jul. 6
Jul. 23.	Painesville, O.	Jul. 6
Jul. 26.	Cincinnati, O.	Jul. 6
Jul. 27.	Cleveland, O.	Jul. 6
Jul. —.	Belleville, Ill.	Jun. 15
Jul. —.	Hudson, Mich.	Jun. 15
Jul. —.	**Camden, N. J.**	**Apr. 20**
Aug. 1.	Greencastle, Ind.	Jun. 29
Aug. 5.	Olympia, Wash. Adv. Jul. 6.	Jul. 6
Aug. 6.	Reynoldsville, Pa.	Jun. 29

POWER PLANTS, GAS AND ELECTRICITY.

Jul. 9.	Jackson, Mo.	Jun. 8
Jul. 9.	Arlington, O.	Jun. 22
Jul. 9.	Franchise, St. Helens, Cal.	Jun. 29
Jul. 9.	Bloomington, Ill.	Jul. 6
Jul. 10.	Crystal Falls, Mich.	Jun. 29
Jul. 11.	Houghton, Mich.	Jul. 6
Jul. 13.	Georgetown, O. Adv. Jun. 15, 22.	Jun. 15
Jul. 13.	Ukiah, Cal.	Jul. 6
Jul. 15.	Bradford, Pa.	Jun. 22
Jul. 15.	New York, N. Y.	Jul. 6
Jul. 16.	Sayre, Okla.	Jun. 22
Jul. 16.	West Point, N. Y. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 16.	Charleston, S. C.	Jul. 6
Jul. 24.	Ft. Sam Houston, Tex.	Jul. 6
Jul. 30.	Columbus, O.	Jul. 6
Jul. 31.	North Battleford, Sask.	Jun. 22
Jul. —.	**Rowlesburg, W. Va.**	**Mar. 16**
Sep. 3.	Winnipeg, Man. Adv. Jun. 15 to Jul. 6.	Jun. 15

BUILDINGS.

Jul. 8.	School, Canton, N. Y. Adv. June 29, Jul. 6.	Jun. 29
Jul. 9.	Post office, Colorado Springs, Colo. Adv. Jun. 8, 15.	Jun. 8
Jul. 9.	Pub. bldg., Otisville, N. Y.	Jun. 22
Jul. 9.	Boilers in prison, Deerlodge, Mont.	Jun. 29
Jul. 9.	School, Indianapolis, Ind.	Jun. 29
Jul. 9.	Bus. bldg., Burlington, Ia.	Jul. 6
Jul. 9.	Pub. bldg., Richmond, Ind.	Jul. 6
Jul. 9.	Pub. bldg., West Pullman, Ill.	Jul. 6
Jul. 9.	Pub. bldg., Wausau, Wis.	Jul. 6
Jul. 10.	Post office extension, Knoxville, Tenn. Adv. Jun. 8, 15.	Jun. 8
Jul. 10.	School, Cleveland, O.	Jun. 15
Jul. 10.	Hospital, Bangor, Me.	Jun. 22
Jul. 10.	Church, Wichita, Kan.	Jun. 29
Jul. 10.	Pub. bath, New York, N. Y.	Jun. 29
Jul. 10.	Pub. bldg., Ft. Dodge, Kan.	Jul. 6
Jul. 10.	School, Mt. Healthy, O.	Jul. 6
Jul. 10.	School, Smithville, Tex.	Jul. 6
Jul. 11.	School, Wapakoneta, O.	Jun. 15
Jul. 11.	Htg. pub. bldg., Vineland, N. J.	Jul. 6
Jul. 11.	Improv. pub. bldg., Philadelphia, Pa.	Jul. 6
Jul. 12.	Htg. jail, Pennington, S. D.	Jun. 29
Jul. 12.	School, Sandusky, O.	Jun. 29
Jul. 12.	Pub. bldg., Bathgate, N. D.	Jun. 29
Jul. 12.	School, Bay City, Mich.	Jul. 6
Jul. 13.	School, Wheelersburg, O.	Jun. 29
Jul. 13.	Pub. bldg., Georgetown, O.	Jun. 29
Jul. 13.	Pub. bldg., Mt. Vernon, Mo.	Jul. 6
Jul. 15.	**Bus Bldg., Tacoma, Wash.**	**Jun. 1**
Jul. 15.	Post bldgs., Ft. Slocum, N. Y. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 15.	**Post office, Sheboygan, Wis.**	**Jun. 15**
Jul. 15.	School, Nelson, B. C. Adv. Jun. 22, 29.	Jun. 22
Jul. 15.	**Jail, Tuscumbia, Ala.**	**Jun 22**
Jul. 15.	**Courthouse alterations, Wilkesbarre, Pa.** Adv. Jun. 22 to Jul. 6.	**Jun. 22**
Jul. 15.	Hospital, Paris, Tex.	Jun. 29
Jul. 15.	Schools, Banning, Cal.	Jun. 29
Jul. 15.	Church, Watertown, S. D.	Jul. 6
Jul. 15.	City hall, Morristown, Tenn.	Jul. 6
Jul. 15.	School, Everett, Wash.	Jul. 6
Jul. 15.	Pub. bldgs., New York, N. Y.	Jul. 6
Jul. 15.	Bus. bldgs., Jacksonville, Fla.	Jul. 6
Jul. 15.	Schools, New York, N. Y.	Jul. 6
Jul. 16.	School, Minneapolis, Minn.	Jun. 15
Jul. 16.	School, Newark, N. J. Adv. Jun. 15.	Jun. 15
Jul. 16.	School, Newark, N. J.	Jun. 22
Jul. 16.	Add. to hospital, Washington, D. C.	Jul. 6
Jul. 16.	Pub. bldg., Otisville, N. Y.	Jul. 6
Jul. 16.	Schools, De Soto, Ind.	Jul. 6
Jul. 17.	P. O. bldg., St. Joseph, Mo. Adv. Jun. 22, 29.	Jun. 22
Jul. 18.	**Exten. to post office, Chattanooga, Tenn.**	**Jun. 15**
Jul. 18.	**Rep. to court h'se, Williamsport, Ind.**	**Jun. 15**
Jul. 18.	**Windows for National Museum, Washington, D. C.** Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 18.	Htg. C. H., Wilkesbarre, Pa. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 18.	Pub. bldg., Waddah Island, Wash.	Jul. 6
Jul. 18.	School, Wapakoneta, O.	Jul. 6
Jul. 18.	School, Forest, Ind.	Jul. 6
Jul. 19.	**Post office, Gainesville, Fla.** Adv. Jun. 15, 22.	**Jun. 15**
Jul. 19.	Bus. bldg., Booneville, Ind.	Jun. 29
Jul. 19.	Hospital, Athens, O.	Jun. 29
Jul. 19.	Church, Fullerton, Neb.	Jul. 6
Jul. 19.	Post bldg., Ft. Leavenworth, Kan.	Jul. 6
Jul. 20.	Pub. bldg., Struthers, O.	Jun. 29
Jul. 20.	Bus. bldg., Jacksonville, Fla.	Jun. 29
Jul. 20.	School, Claremont, Cal.	Jun. 29
Jul. 20.	Church, Minneapolis, Minn.	Jul. 6
Jul. 20.	Pub. bathhouse, Chicago, Ill.	Jul. 6
Jul. 22.	Court house, Casper, Wyo.	Jun. 29
Jul. 22.	School, East Orange, N. J.	Jul. 6
Jul. 23.	Pub. bldg., Cortland, N. Y. Adv. Jul. 6.	Jul. 6
Jul. 23.	Church, Ames, Ia.	Jun. 22
Jul. 23.	Pub. bldg., Cheyenne, Wyo.	Jun. 29
Jul. 24.	Post office, Aurora, Ill.	Jun. 22
Jul. 24.	School, Antler, N. D.	Jun. 29
Jul. 24.	Pub. bldgs., Dayton, O.	Jul. 6
Jul. 24.	School, Mt. Healthy, O.	Jul. 6
Jul. 25.	Enlarging jail, New Roads, La.	Jun. 29
Jul. 25.	Add. to hospital, Marion, Ind.	Jul. 6
Jul. 25.	School, Paragould, Ark.	Jul. 6
Jul. 27.	Pub. bldg., Boston, Mass.	Jun. 29
Jul. 27.	Court house, Potosi, Mo.	Jul. 6
Jul. 29.	Courthouse, Redwood City, Cal.	Jul. 6
Jul. 30.	Y. M. C. A. bldg., Ft. Scott, Kan.	Jul. 6
Jul. 30.	Pub. bldg., San Francisco, Cal.	Jul. 6
Jul. 31.	Post office, Owosso, Mich.	Jun. 29
Jul. 31.	Pub. bldg. plans, Milwaukee, Wis.	Jul. 6
Jul. —.	**Indus. plant, Chicago, Ill.**	**May 25**
Jul. —.	**Htg. college, Raleigh, N. C.**	**Jun. 1**
Aug. 5.	Post office, Crookston, Minn.	Jul. 6
Aug. 7.	Univ. bldg., Moscow, Idaho	Jul. 6
Aug. 9.	Asylum, Monticello, Ind.	Jun. 29
Aug. 12.	Post office, Mason City, Ia. Adv. Jul. 6.	Jul. 6
Aug. —.	**Hospital, Saskatoon, Sask.**	**May 4**
Sep. 1.	**Bus bldg., Walla Walla, Wash.**	**Apr. 28**
Sep. —.	Hotel, New Orleans, La.	Jun. 29
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
———	**Jail, Huntsville, Tenn. Adv. May 11.**	**May 11**
———	**Bus. bldg., Lawton, Okla.**	**May 25**
———	Bus. Bldg., Charles Town, W. Va. Adv. Jun. 15, 22.	Jun. 15
———	Bus. bldg., Harrison, Me.	Jul. 6

MISCELLANEOUS.

Jul. 9.	Iron flagstaff, St. Louis, Mo.	Jun. 22
Jul. 9.	Street cleaning, Brooklyn, N. Y.	Jun. 29
Jul. 9.	Supplies, Washington, D. C.	Jul. 6
Jul. 10.	Dredging, etc., New York, N. Y. Adv. Jun. 15 to Jul. 6.	Jun. 15
Jul. 10.	Levee wk., New Orleans, La.	Jun. 22
Jul. 10.	Ditches, etc., Jerseyville, Ill.	Jun. 15
Jul. 10.	Improv. channels, Des Moines, Ia. Adv. Jun. 29.	Jun. 29
Jul. 10.	Street cleaning, Oakland, Cal.	Jun. 29
Jul. 10.	Drain, Esterville, Ia.	Jun. 29
Jul. 11.	Lumber, etc., Charleston, S. C. Adv. Jun 22 to Jul. 6.	Jun. 22
Jul. 11.	Tunnel, Houghton, Mich.	Jul. 6
Jul. 12.	Sea wall, Ft. Morgan, Ala. Adv. Jun. 8 to 29.	Jun. 8
Jul. 12.	Dredging, Seattle, Wash.	Jun. 22
Jul. 12.	Elevators, St. Paul, Minn.	Jun. 29
Jul. 12.	Improv. creek, Albany, N. Y. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 13.	Canal, Collinston, La. Adv. Jun. 15, 22.	Jun. 15
Jul. 15.	Sea wall, Ft. St. Philip, La. Adv. Jun. 1 to 22.	Jun. 1
Jul. 15.	River improv., Urbana, O.	Jun. 15
Jul. 15.	Harbor improv., Petit Rocher, N. B.	Jul. 6
Jul. 16.	Garb. plant, Newport, R. I.	Jun. 29
Jul. 16.	Steam shovels, etc., Panama	Jul. 6
Jul. 16.	Supplies, Washington, D. C.	Jul. 6
Jul. 16.	Levee work, Piggott, Ark.	Jul. 6
Jul. 17.	Dredging, Block Island, R. I. Adv. Jun. 15 to Jul. 6.	Jun. 15
Jul. 17.	Dredging, New York, N. Y. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 17.	Garbage crematory, Ft. Myer, Va. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 18.	Dam, Cincinnati, O. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 18.	Aqueduct, Durhamville, N. Y. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 18.	Flood protection wk., Grand Rapids Mich. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 18.	Conduit, Takoma, D. C. Adv. Jul. 6.	Jul. 6
Jul. 18.	Plank, New York, N. Y.	Jul. 6
Jul. 18.	Sea wall, Brooklyn, N. Y.	Jul. 6
Jul. 20.	R. R. grading, Pensacola, Fla. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 20.	Removal of ledge, Portsmouth, N. H.	Jun. 29
Jul. 20.	Cranes, Bremerton, Wash.	Jun. 29
Jul. 20.	Dredging, Charleston, S. C. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 22.	Crematory, Ft. D. A. Russell, Wyo.	Jul. 6
Jul. 23.	Repairing wharf, Ft. Morgan, Ala.	Jul. 6
Jul. 23.	Supplies, Washington, D. C.	Jul. 6
Jul. 24.	Dredging, New York, N. Y. (2 props.). Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 24.	Dredging, Jacksonville, Fla. Adv. Jun. 22 to Jul. 6.	Jun. 22
Jul. 24.	Ditch, Carroll, Ia.	Jul. 6
Jul. 26.	Pier wk., Holland, Mich. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 27.	Dredging, Woodbridge, N. J. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 27.	**Dry dock, Bremerton, Wash.**	**Jun. 1**
Jul. 29.	Dredging, Nome, Alaska	Jun. 22
Jul. 29.	Jetty wk., Washington, D. C.	Jul. 6
Jul. 30.	Dredging, Newark, N. J. Adv. Jun. 29, Jul. 6.	Jun. 29
Jul. 30.	R. R. wk., locomotive, etc., Ft. Monroe, Va. Adv. Jul. 6.	Jul. 6
Jul. 30.	Ferry terminal work, St. George, S. I. Adv. Jul. 6.	Jul. 6
Aug. 1.	Ditch, Marshalltown, Ia. Adv. Jun. 29.	Jun. 29
Aug. 3.	Pier, San Juan, P. R.	Jul. 6
Aug. 5.	Garb. disposal, etc., Harrisburg, Pa. Adv. Jun. 29.	Jun. 29
Aug. 7.	Dredging, San Juan, P. R. Adv. Jun. 29, Jul. 6.	Jun. 29
Aug. 7.	Ditch, Emmetsburg, Ia.	Jul. 6
Aug. 20.	Wharf, etc., San Diego, Cal. Adv. Jun. 22, 29.	Jun. 22
Sep. 3.	**Wharf plans, Gothenburg, Sweden. Adv Apr 27 to May 18.**	**Apr. 13**
———	**R. R. work, Indianapolis, Ind.**	**Jun. 8**

CURRENT NEWS SUPPLEMENT

JULY 13, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York. Semi-annual meeting, Milwaukee, Wis., July 18-19, 1907.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Col.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

PERSONAL NOTES.

Mr. D. A. Reed, of Duluth, Minn., is at the head of the Minnesota Engineering Co., recently organized in that city.

Mr. H. H. Hadsell, assistant bridge engineer for the Illinois Central R. R., has resigned to become connected with the Leonard Martin Construction Co., of Chicago.

Mr. Richard T. Fox, of Chicago, has been engaged by a citizens' committee of Boston to investigate the condition of the streets and street department of the latter city.

Prof. William R. Hoag has retired from the faculty of the civil engineering department of the University of Minnesota and will engage in private practice in Minneapolis.

Mr. George P. Carver has opened an office in the Exchange Building, 53 State St., Boston, Mass., as a specialist in the design and construction of reinforced concrete structures.

Mr. B. J. Fallon, formerly assistant engineer on the Chicago, Burlington & Quincy R. R., has been appointed engineer of maintenance on the Metropolitan West Side Elevated R. R., of Chicago.

Mr. Gilbert C. White has opened an office as a consulting engineer in Durham, N. C. He will give special attention to water-works, sewerage, street improvements and kindred engineering problems.

Mr. William S. Menden, chief engineer of the Brooklyn Rapid Transit Co., Brooklyn, N. Y., has been appointed general superintendent of the company, succeeding Mr. Dow S. Smith, resigned.

Dr. Walter Bensel, sanitary superintendent of the Department of Health of New York City, has been appointed Street Cleaning Commissioner of that city, succeeding Mr. McDonough Craven, resigned.

Mr. B. J. Sigmund has resigned as chief assistant engineer with Messrs. Tucker & Vinton, New York City, to accept a similar position with the Concrete Engineering & Supply Co., of the same city.

Mr. Wm. D. Batchelor, of Nutley, N. J., who for the past fifteen years has been chief engineer of the structural department of Milliken Bros., Inc., New York City, has resigned owing to the recent failure of the firm.

Mr. L. E. Moore, instructor in theoretical and applied mechanics, University of Illinois, has been appointed assistant professor of civil engineering in the Massachusetts Institute of Technology, succeeding Prof. F. P. McKibben, resigned.

Mr. H. H. Knowlton, division engineer, of the Cleveland, Cincinnati, Chicago & St. Louis Ry., at Shelbyville, Ind., has been appointed engineer of maintenance of way on the Cairo division of that railroad, with headquarters at Mt. Carmel, Ill.

Mr. George R. Bascom, until recently a pitometer expert in charge of waste-water investigations for the water department of Philadelphia, is now engaged with Messrs. John A. & Edward S. Cole, consulting engineers of Chicago and New York.

Mr. Luis Barragan, chief engineer of the water-works of San Luis Potosi, Mexico, is in this country studying water purification plants. He has investigated the water-works of San Antonio, St. Louis, Charleston, W. Va., Washington and Philadelphia.

Smith, Emery & Co., Inc., inspecting, testing and chemical engineers and chemists, have removed their general offices from Oakland, Cal., to their new building at 651 Howard St., San Francisco. The Oakland office and laboratory will remain at 1068 Broadway.

Mr. Curtis Hill, of St. Louis, has been appointed State Highway Engineer of Missouri by the State Board of Agriculture. He will begin at once the engineering work on the highway between St. Louis and Kansas City, authorized at the last session of the legislature.

Messrs. G. L. Hosmer, C. B. Breed and George E. Russell have been promoted to be assistant professors of civil engineering in the Massachusetts Institute of Technology. Messrs. Hosmer and Breed are the authors of a text-book of surveying published a year ago.

Maj. Chester Harding, Corps of Engineers, U. S. A., in charge of the construction of the municipal building for the District of Columbia, has been ordered to Panama and report to Col. G. W. Goethals for duty as division engineer of the Gatun division of the Panama Canal.

Mr. Mortimer G. Barnes, of Petersburg, Neb., has been appointed a division engineer of the Board of Water Supply, of New York City, and Messrs. Stephen Koronski and Clifford Lynde, of Philadelphia and Oil City, Pa., respectively, have been appointed assistant engineers in the same department.

Mr. Ira A. McCormack has resigned the position of assistant to the general manager of the New York Central & Hudson River R. R. to become president and general manager of the Randolph & Cumberland Ry., between Cameron and Hillsons, N. C. This company is to construct 216 miles of new road.

Mr. Joseph Hobson, chief engineer of the Grand Trunk Ry. System, with headquarters in Montreal, has been appointed consulting engineer of the system and has been succeeded as chief engineer by Mr. Howard G. Kelley, formerly chief engineer of the Minneapolis & St. Louis R. R. Mr. William McNab has been appointed principal assistant engineer.

Dr. Henry S. Pritchett, president of the Massachusetts Institute of Technology for the past seven years, who resigned about six months ago, ended his service with the college recently. Owing to the failure of the trustees to secure a permanent head for the school, Arthur Ames Noyes, professor of theoretical chemistry, is to act as president until the vacancy is filled.

Brig.-Gen. Barry, U. S. A., commanding the Army of Cuban Pacification, has written a letter to Gen. Alexander Mackenzie, Chief of Engineers, U. S. A., in which he commends highly the services rendered during the past few months by the 2d and 3d Battalions of Engineers in Cuba. These battalions have returned to the United States and are stationed at Washington Barracks and Fort Leavenworth, respectively. Gen Barry Says: "Their discipline has been excellent: all work required of them has been expeditiously performed, and in road building, reconnaissance, surveying and map making they have exceeded expectations and astonished the natives."

Mr. A. W. Dow, of New York, formerly inspector of asphalts and cements for the City of Washington, D. C., and Mr. F. P. Smith have formed a partnership under the firm name of Dow & Smith, as consulting engineers on road surfacing and reservoir waterproofing, the distillation and refining of oils and all work involving the use of asphalts or bitumens of any kind. Mr. Dow is well known as a specialist in paving materials and Mr. Smith has had a long experience in refining and laying asphalts, both in this country and abroad, having been chemist and asphalt expert for the Alcatraz Co., the Union Oil Co. of California, the British Paving Co., Ltd., and the A. L. Barber Asphalt Co. and chemist for the United States Navy Department for a number of years.

The Interstate Commerce Commission has appointed the following commission to conduct tests of signal systems and other safety devices: Prof. M. E. Cooley, chairman; Capt. A. Ames, Jr., Messrs. Frank G. Ewald and B. B. Adams. The American Railway Association has appointed the following committee to co-operate with the federal commission: General Inspector F. C. Rice of the Burlington system, General Superintendent A. M. Schoyer of the Northwestern road, Vice-President W. G. Besler of the Central R. R. of N. J., General Superintendent A. T. Dice of the Philadelphia & Reading Ry., Chief Engineer E. C. Carter of the Northwestern road, and Asst. General Manager Moon of the Lake Shore road. This committee has offered to provide tracks and other facilities for the tests.

Mr. Hermann von Schrenk, pathologist in charge of investigations of timber diseases and methods for their preventing, in the United States Department of Agriculture for the past ten years, and Messrs. E. B. Fulks and Alfred L. Kammerer, who were connected with the timber preserving work of the Department of Agriculture for several years and for the past two years have been conducting timber preserving investigations for various railway companies, have opened an office in St. Louis, Mo., as consulting timber engineers, under the firm name of Von Schrenk, Fulks and Kammerer. The firm announces that it is ready to make reports on logging methods, manufacture of lumber, wood pulp manufacture, the seasoning and preservation of timber, railway timber, bridge and track construction, and kindred matters.

The Society for the Promotion of Engineering Education, at its recent convention in Cleveland, O., elected the following officers for next year: President, Chas. S. Howe, Case School of Applied Science; first vice-president, C. A. Waldo, Purdue University; second vice-president, W. G. Raymond, University of Iowa; third vice-president, A. L. Williston, Pratt Institute; treasurer, W. O. Wiley, New York; councillors for three years: F. W. Atkinson, Brooklyn Polytechnic Institute; M. E. Cooley, University of Michigan; W. S. Franklin, Lehigh University; William Keith, Syracuse University; W. B. Russell, New York Central R. R.; C. F. Scott, Westinghouse Electric Co., and H. B. Smith, Worcester Polytechnic Institute. The society voted to invite the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Society of Chemical Industry and the American Mining Institute to join in a movement to promote elementary technical education.

Louis J. Magee, well known as an electrical engineer and authority on the construction and operation of electric street railways, died recently at his home in New York City, aged 45 years. He was born in Malden, Mass., and was graduated from Wesleyan University in 1885. In the same year he entered the shops of the Thomson-Houston Electric Co. with which he was associated for several years, being at one time manager of its European office at Hamburg. He organized and was resident manager at the Union Electric Co., of Berlin, which was merged with the General Electric Co., of Germany, in 1903. In the last three years he had much to do with the arrangements between the General Electric Co., of Schenectady, and the German company in exchanging men for the widening of technical experience. Mr. Magee was a frequent contributor to trade and technical magazines. He was a member of scientific societies here and abroad, and of the Lawyers' and Engineers' clubs, of New York City.

Major [illegible] F. Hodges, assistant to the Chief of Engineers, Corps of Engineers, U. S. A., after the reorganization of the Washington headquarters of the Isthmian Canal Commission as planned by the Secretary of War will have charge of the purchasing of all supplies and materials for the canal work and will be "general chief of office" in Washington. Mr. Joseph B. Bishop, secretary of the Isthmian Canal Commission, will, in accordance with the reorganization plans, proceed to the Isthmus about Aug. 1 and will make his headquarters there hereafter. Under the new plan the Washington office will be reduced to the smallest organization compatible with efficient service. The auditing division will be abolished, as much of the correspondence division will be transferred to the Isthmus as is practicable, and there will remain in the Washington office only the purchasing division, the disbursing division, and three sections devoted to records, appointments and correspondence, respectively. Lieut.-Col. Smith S. Leach has been appointed to succeed Major Hodges as assistant to Gen. Alexander Mackenzie, Chief of Engineers, U. S. A. Col. Leach is a member of the General Staff.

BUSINESS NOTES.

The Metropolitan Engineering & Construction Co., Chicago, has been awarded a contract for paving about 10,000 square yards of streets in Ravenswood, a suburb of Chicago, with Sarco Brand of asphalt made by the Standard Asphalt & Rubber Co.

In order to handle its large trade in electric generators and motors in soutern Ohio, the Cleveland office of the Crocker-Wheeler Co., has opened a sub-office at Columbus, in the Columbus Savings & Trust Co. Bldg. It will be in charge of Mr. Chas. W. Cross.

Mr R. E. Fox, Jr., has resigned the management of the New York office of the Platt Iron Works Co., to become secretary and manager of The Engineer Co., 111 Broadway, New York city. Mr. Fox was for three years manager of the southern territory of the former company, with headquarters at Atlantic, Ga. The Engineer Co. manufactures and installs the balanced draft system of furnace regulation.

The Terry Steam Turbine Co., Hartford, Conn., has just secured the order for eight 300 h. p. steam turbines for the new Waterside plant of the New York Edison Co., 39th Street and First Avenue, New York city. These turbines are to be used direct connected to centrifugal pumps and are for boiler feed purposes. The capacity of each turbine pump unit will be 1,000 gal. per minute, against a pressure of 300 pounds. The New York Edison Co. has been using three of these steam turbine driven centrifugal pumps for boiler feed for the past year.

Medusa water-proof compound, made by the Sandusky Portland Cement Co. is being used on the following work: exterior plaster of the Coliseum, Niagara Falls, N. Y., to prevent discoloration and efflorescence caused by the spray of the Falls; Tryst Crystal Ice & Storage Co., reinforced concrete tanks; Hygeia Ice & Storage Co., Poughkeepsie, N. Y.; bakery of Baur Bros., Pittsburg; American Car & Foundry Co., Pendleton Investment Co., and Dair's Estate Bldg., St. Louis swimming pool, foundation and cellar of the Olympic Club building, San Francisco.

The car dumping machine, recently installed by the McMyler Mfg. Co., at the Hanna docks, in Sandusky, has been making some unusual good records, eighty cars being unloaded in five hours on one occasion. The machine was built by the Riverside Bridge Co., of Martin's Ferry, O.

R. Hoe & Co., New York, have added a new foundry to their plant, and will equip it with a Newton cupola and three ten-ton overhead electric traveling cranes made by the Northern Engineering Works, Detroit, Mich.

The Bonner Portland Cement Co. has awarded the contract for the engineering on its new plant at Bonner Springs, Kan., to the Freeborn Engineering & Construction Co., Kansas City, Mo. Work on the construction is already under way.

The Eureka Machine Co. moved into its new factory at Lansing, Mich., on July [illegible]. The building is a [illegible] concrete structure, and gives the company [illegible] the larger capacity necessary for meeting [illegible].

Mr. [illegible], president of the Chicago Portland Cement Co., [illegible] denial of the report that his company [illegible] a consolidation with the German-American Portland Cement Works and the [illegible] Cement Manufacturing Co.

The Kansas City Portland Cement Co., Kansas City, [illegible], has just completed [illegible] from the plans of W. H. Caffery, of the same city, and is now building another mill at Bonner Springs, Kan. Limestone [illegible] obtained in [illegible] raw materials. [illegible] crushers, Hamilton [illegible] engines, Jeffrey hammer [illegible], Allis-Chalmers [illegible] Kuppel industrial [illegible] Griffin mills [illegible]. The kiln room [illegible] kilns.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Florala, Ala.—S. M. Fambrough, in care of J. B. McCrary & Co., of Atlanta, Ga., is preparing plans for water works and a sewerage system, to cost about $30,000.

Los Angeles, Cal.—The following are the bids recently received by the Dept. of Public Works, Aqueduct Dept., for (*a*) 13,000 ft. 6 in. No. 16 gage, riveted sheet steel pipe, delivered f. o. b. cars Los Angeles; (*b*) 5,000 ft. 8 in. No. 14 gage riveted sheet steel pipe, f. o. b. cars Los Angeles: F. K. Simonds Co., Los Angeles, Cal., *a* 24¾ cts, *b* 30½ cts; Lacy Mfg. Co., Los Angeles, *a* 23 cts., *b* 33 cts.; J. D. Hooker Co., Los Angeles, *a* 22 cts. *b* 33 cts.

Wauchula, Fla.—H. E. Whitehead, of Tampa, writes that it is proposed to construct water works at Wauchula, to cost about $10,000, work to be done by day labor.

Millen, Ga.—See "Power Plants, Gas and Electricity."

Milner, Idaho.—Bids will be received until Aug. 1 by Paul S. A. Bickel, Ch. Engr., Twin Falls, North Side and & Water Co., Milner, for constructing 16 miles of canal containing about 30,000 perch of rough rubble masonry, 25,000 cu. yds. lava rock excav., 680,000 cu. yds. earth embankment.

East Moline, Ill. The City Council is reported to be considering the question of constructing municipal water works.

Decatur, Ill.—Albert Leach, City Clk., writes that bids will be received on July 26 for water works, to cost about $32,000. Engineer, D. W. Mead, 401 State St., Madison, Wis.

Chesterton, Ind.—Bids will be received by the Chesterton Water Co. until July 20 for the construction of water works, as advertised in The Engineering Record.

Poteau, Ind. Ter.—Bids are wanted for construction of pumping station. Plans and specifications can be had from M. W. Murray, Mayor.

Eufaula, Ind. Ter.—Bids will be received until July 16 by this city for the purchase of boilers, pumps, heaters, boiler feed pumps, hydrants and valves, c. i. pipe and other water works material. The O'Neil Eng. Co., Engrs., Dallas, Tex.

Lamont, Ia.—A contract for constructing waterworks for Lamont is reported to have been awarded to the Des Moines Iron & Bridge Co., of Des Moines, for $4,100, which calls for a steel tower 118 ft. high, steel tank with a capacity of 30,000 gals., and distributing mains. The contract for the well, pumping engine and building has not yet been awarded.

Wyandotte, Mich.—We are informed that the Bd. of Pub. Wks. is now ready to communicate with sanitary engineers relative to preparing necessary plans and specifications for construction of a filtration plant in connection with the present water-works. Address all communications to Jas. G. Pinson, Secy. Bd. of Pub. Wks.

Hoboken, N. J.—The Water Bd. is reported to have on June 26 opened bids for building a 30-in. water main from 17th St. to Ferry St. on Bloomfield St.; Kavanagh & Heagney, $84,408; Palisade Constr. Co., $88,176; Tumilty & Cutley, $92,380; John C. Tierney $94,516; Henry Waddington, $97,744, and M. T. Connolly, $117,420.

Ft. Hancock, N. J.—Bids will be received by M. N. Falls, Constr. Q. M., U. S. A., until Aug. 9 (readvertisement), installing a filtration plant at Ft. Hancock, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids were opened on July 3 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying force mains and removing existing force mains at site of Ridgewood pumping station: J. H. Holmes, 87 Nassau St., $59,707; Hammond & Sloane, 60 Wall St., $58,258; Borough Constr. Co., 21 Court St., $65,368; John F. Mead, $52,525; and Schawmut Constr. Co., 41 Park Row, $56,784.

*Press reports state that the Bd. of Estimate on July 8 authorized Deputy Com. Cozier to enter into a contract with Cyrus Titus to furnish Brooklyn with an additional supply of water amounting to 10,000,000 gals. per day. This water will be obtained by Mr. Titus within the borough limits by a system of sunken wells. He is to receive $55 for each million gals., and at the end of 5 years his plant is to become the property of city.

**Mineola, L. I., N. Y.*—Engr. Walter E. Sexton, 46 N. 12th St., Philadelphia, Pa., writes that bids were opened on June 21 by the Village Trus., for water works, and contracts were awarded as follows: To Camden Iron Wks., Philadelphia, Pa., 4-in. pipe $36.90 per ton, and 6, 8 and 10-in. pipe $35.40, special castings 3 cts. per lb.; to Fairbanks & Co., Philadelphia, Pa., fire hydrants, valves and valve boxes; to Platt Iron Wks., Philadelphia, Pa., pumps, $1,160; to Alma Mfg. Co., Philadelphia, Pa., 25-h.p. engine, $960; to Belmont Iron Wks., Philadelphia, Pa., tank and tower, $8,477; and to Fritz & Partridge, Dover, N. J., for laying 4-in. pipe 22 cts., 6-in. pipe 25 cts., 8-in. pipe 28 cts., and 10-in. pipe 32 cts., setting pump $500, building power house $1,473, setting hydrants $3 ea. building pump pit $1,095, and concrete work $8 per yd.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., until July 20 for the construction of two covered slow sand filters each about ½ of an acre in extent, as advertised in The Engineering Record.

Buffalo, N. Y.—Bids will be received until July 18 by F. G. Ward, Comr. Pub. Wks., for building foundations for new water works pumping station, on lands bet. Jersey St., Porter Ave., the New York Central R. R., and Harbor line.

New York, N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity, until July 16, for hauling and laying water mains in West Farms Rd., and in Jennings, Manida and 178th Sts.

The following are the bids opened on July 3 by John H. O'Brien, Comr. of Water Supply, Gas and Electricity, for (*a*) 5,600 tons straight pipe, (*b*) 600 tons of specials: U. S. Cast Iron Pipe & Fdy. Co., 71 Bway., *a*, $32.00; *b*, $65; M. T. Drummond Co., 182 Bway., *a*, $32.20; *b*, $54; John Fox & Co., 258 Bway., *a*, $35.35; *b*, $57.40; Warren Fdy. & Machine Co., 170 Bway., *a*, $34.90; *b*, $60.

The lowest bid opened July 3 by John J. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in Blondell, Barnes, Byron, Devoe, Edwards, Ellison and other streets was submitted by the Wilton Constr. Co., 115 Elliott Ave., at a total of $68,969. They bid for 915 tons straight pipe, $36.45; 40 tons specials, $763; 75 tons gate boxes, $53; 20 cu. yds. rock without blast, $30 cts.; 2,500 cu. yds. rock, 30 cts.; 90 cu. yds. masonry, 30 cts.; 17,300 cu. yds. earth, 30 cts.; 17,600 cu. yds. fill, 30 cts.; 13,900 lin. ft. 12-in. pipe to lay, 29 cts.; 17,700 lin. ft. 6-in. pipe to lay, 15 cts.; 50 lin. ft. 4-in. pipe to lay, 15 cts.; 550 lin. ft. 4-in. screw pipe, $3.50; to set ate. valves and hydrants ea., 50 cts., and for pavt. 1 ct. per sq. yd., and curb 1 ct. per cu. ft. Totals of other bids: L. D. Gregory, 125 th St. and 1st Ave., $75,806; Wm. F. Norton, 27 W. 140th St., $85,169, and Burns & Rodgers, 1929 Amsterdam Ave., $76,149.

Bids will be received by the Bd. of Water Supply (Thos. Hassett, Secy., 299 Bway.), until Aug. 6 for the construction of the main dams for Ashokan reservoir near Brown Station in the towns of Olive and Marbletown, Ulster County, as advertised in The Engineering Record. J. Waldo Smith, Ch. Engr.

Irvington, N. Y.—Bids will be received until July 23 by the Bd. of Water Comrs. (Jas. G. Orton, Clk.) for furnishing material and laying about 3,000 ft. 12-in. c. i. water pipe, making connections, and doing all work in connection with the same.

Jamestown, N. Y.—Bids will be received until Aug. 1 by the Bd. of Water Comrs. (Clement B. Jones, Secy.), for laying a water main of appromimately 12,000 ft. of 16-in. and 750 ft. of 12-in. pipe, as advertised in The Engineering Record.

Flushing, L. I., N. Y. Bids will be received until July 22 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City., for water main, etc., to building for Parental School on road bet. Flushing and Jamaica, about 1,700 ft. south of Hempstead turnpike, Flushing, Boro. of Queens.

Hamilton, O.—Bids will be received by the Bd. of Pub. Service until July 18 for furnishing material, etc., and erecting chimney, receiving well and pipe and special castings and the engine and boiler foundations, etc., as advertised in The Engineering Record.

Pulaski, O.—The Pulaski Water Co. is reported organized with a capital of $20,000 by Norman N. Rogers and Chas. Simpson, of Pulaski, and David Tod, of Youngstown. The company has purchased the Sarah A. Kyle property in Pulaski and will furnish water to New Castle and Youngstown.

Portsmouth, O.—It is stated that active steps are being taken here to improve the water supply.

**Medina, O.*—T. C. Brooks & Sons, of Jackson, Mich., has secured the contract for water pipes and development of natural filter (bids opened June 21 by the Bd. of Pub. Service) at a total of $25,360, including hydrants, valves, etc. They bid for 24,432 ft. excav. in trench, 12 cts.; 7,600 ft. 4-in. c. i. pipe, laid, 42 cts.; 1,566 ft. 6-in. c. i. pipe, laid, 70 cts.; 13,338 ft. 8-in. c. i. pipe, laid, $1.09; 50 ft. 12-in. c. i. pipe, laid, $2.04; 1½ ton c. i. specials, $100 per ton; 730 ft. 8-in. vitr. pipe, laid, 20 cts.; 630 ft. 6-in. vitr. pipe, laid, 20 cts.; 693 cu. yd. excav. at river, $1.20; 76 cu. yd. concrete, $10; 10 1-in. steel rods, 4 ft. long, 20 cts.; 36 cu. yd. gravel backing, 50 cts.; flash boards, $15. Totals of other bids: Nugent & Smith, Medina, O., $36,875; Devine, Wilson & Applegate, Alliance, $27,724; Medina Concrete Co. & E. A. Brown, Medina, O., $28,972; Phillips & Bixel, Cleveland, O., $28,071; Nitschke & Gibbons, Cleveland, $32,803; Wildes & Davison, Akron, $27,397; Tibbets & Loomis, Medina, $30,669; Jos. Winterbottom, Cleveland, $29,190. Engineers, E. G. Bradbury and G. P. Shute, of Columbus.

Frederick, Okla.—We are informed that all contracts have been let for water works and sewerage improvements, bonds for which were recently voted.

Freewater, Ore.—Chas. L. Swain, of Freewater, has secured franchise for water works; probable cost, $50,000.

Portland, Ore.—We are informed that the citizens in June voted to issue $275,000 bonds to purchase fire boat and lay water mains for fire protection on 6 blocks on both sides of Willamette River. Thos. E. Devlin, City Aud.

Ft. Adams, R. I.—Bids will be received by Capt. Willis C. Metcalf, Q. M., U. S. A., Ft. Adams, until Aug. 5 for the construction of a 400,000 gal. reservoir, 3 shelters for springs and laying pipe from springs to reservoir at Sandertown, R. I.; also laying pipe from reservoir to and across Narragansett Bay to a connection with reservoir at Ft. Greble, Dutch Island, as advertised in The Engineering Record.

Memphis, Tenn. Bids will be received until July 15 at the office of Ennis M. Douglas, City Register, for $200,000 water bonds.

Binghamton, Tenn. The citizens are reported to have voted to issue $30,000 bonds for water-works and a sewerage system.

Commerce, Tex. Bids will be received until July 18 by this city for the purchase of boilers, pumps, heaters, boiler feed pumps, deep well pumps, c. i. pipe, hydrants and valves. The O'Neil Engr. Co., Engrs., Dallas.

Graham, Tex.—The City Secy.-Treas. writes that bids will be received on Aug. 1 for water works; probable cost $15,000. Engineer, J. B. Hawley, of Ft. Worth.

Brownsville, Tex. See "Power Plants, Gas and Electricity."

Ladysmith, Wis. The City Council is reported to have decided to issue bonds for the extension of water works, also for the erection of a school.

**Items marked thus give the names of parties awarded contracts.*

Winnipeg, Man.—G. C. Whipple, of New York, N. Y., is stated to have submitted a report on water supply in which he states that if Red River is adopted as a supply it will be necessary to filter and soften the water, and recommends a mechanical filter.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Florola, Ala.—See "Water."

San Jose, Cal.—Bids will be received until July 22 by the Bd. Co. Superv. (Henry A. Pfister, Clk.), for constructing septic tank sewer system at the County Poorhouse, near Milpitas.

Oakland, Cal.—Bids will be received until July 24 by Bd. Pub. Wks. (Walter B. Fawcett, Secy.), for constructing concrete sewers in portions of 2d, Webster and Grove Sts.

New Britain, Conn.—There will probably be one section of about 2 miles of sewer work let here this fall for sanitary and storm water purposes. W. H. Cadwell, Engr. in charge.

Waterbury, Conn.—It is reported that Wm. H. Sandland, City Clk., will receive bids until Aug. 19 for $100,000 sewer bonds.

Hartford, Conn.—Bids opened on July 8 by the Bd. of Contract and Supply for the Ann St. sewer have been rejected and new bids will be received on July 15. Three bids were received for this work as follows: Falvey & Kelley, of Boston, $19,170; F. B. & W. H. O'Neil, Hartford, $19,390, and Charles H. Slocomb, Hartford, $19,535.

Washington, D. C.—Bids will be received by the Com. D. C. until July 15, for the construction of sewers. Henry B. F. Macfarland, Comr.

The only bid received and opened on July 7 by the Comrs. D. C. for constructing sewers was submitted by the Warren F. Brenizer Co., 2d anad O Sts. S. E., at the following bid: 2,475 cu. yds. excav., $1.75; 33 cu. yds. brick masonry, $17; 28 cu. yds. vitri. masonry, $24; 60 cu. yds. concrete "B," $9; 75 cu. yds. concrete "C," $9; 305 lin. ft. 24-in. terra cotta pipe laid, $1.40, and 675 lin. ft. 6-in. terra cotta pipe drain, 30 cts.; total cost, $7,409. D. E. McComb, Supt. of Sewers.

Millen, Ga.—See "Power Plants, Gas and Electricity."

Cordele, Ga.—Bids will be received until July 22 by the Council and R. L. Wilson, Mayor, for furnishing material and constructing a system of sanitary sewers embracing about 9 miles pipe sewers, from 8 to 18 in. in diameter, 72 manholes, 25 automatic flush tanks, etc. J. B. McCrary & Co., Consulting Engrs., Atlanta. S. C. Stallings, Resident Engr., Cordele.

Benton, Ill.—The City Council is reported to have passed a resolution providing for the issue of $16,500 bonds for the construction of sewers.

Waukegan, Ill.—Bids will be received until July 19 by the Bd. of Local Improv. (Fred W. Churchill, Secy.), for constructing a system of sewers, including 200 lin. ft. 48-in. reinforced sewer, 2,400 lin. ft. 48-in., 1,300 lin. ft. 36-in., 830 lin. ft. 30-in., 2,330 lin. ft. 27-in., and 594 lin. ft. 24-in. concrete sewer; 1,375 lin. ft. 21-in., 1,230 lin. ft. 18-in., 2,740 lin. ft. 15-in., 2,285 lin. ft. 12-in. and 3,380 lin. ft. 9-in. vitrified pipe sewers, with necessary bulkhead, manholes, etc. M. R. Miller, Supt. Pub. Wks.

**Ottawa, Ill.*—Chas. F. Wilson, Public Engr., Leland Bldg., Ottawa, writes that the following are the bids opened on June 18 by the Bd. of Local Improv. for the construction of a sewerage system: (*o*) Green & Sons, 84 La Salle St., Chicago (awarded contract); (*b*) Nash Bros., 84 La Salle St., Chicago; (*c*) H. D. Hallett, Aurora.

	*a	b	c
200 ft. 60-in. circular concrete sewer (in tunnel).........	$12.20	$13.50	$5.50
975 ft. 50x75-in. concr. sewer.	11.20	11.50	11.40
10 ft. tapering sewer 60 in. to 50x25 in..................	15.20	16.00	11.40
1050 ft. 50x75-in. concr. sewer.	9.20	8.90	6.30
805 ft. 40x60-in. concr. sewer.	8.70	8.60	4.20
832 ft. 30x45-in. concr. sewer.	5.70	6.70	4.20
800 ft. 28x42-in. concr. sewer.	6.20	6.60	4.20
760 ft. 24x36-in. concr. sewer.	5.20	5.00	4.00
1,440 ft. 24-in. pipe sewer (in ravine)	2.25	2.60	3.00
1,760 ft. 24-in. pipe sewer (in deep cut)	2.25	2.40	2.40
3,049 ft. 20-in. pipe sewer....	2.00	2.25	2.00
7,701 ft. 18-in. pipe sewer....	2.00	2.25	2.00
8,701 ft. 15-in. pipe sewer....	1.50	2.10	1.10
8,057 ft. 12-in. pipe sewer....	1.00	1.50	1.00
4,558 ft. 10-in. pipe sewer....	.90	1.00	.90
6,475 ft. 8-in. pipe sewer.....	.60	.80	.50
5,150 ft. 8-in. pipe, inlet connections	.60	.80	.50
18,800 ft. 6-in. pipe, house connections	.30	.50	.40
1,496 ft. brick manholes......	2.50	3.00	4.00
235 ft. street inlets..........	10.20	12.00	7.20
151 cu. yds. concrete walls...	10.20	11.00	10.00
147,220 lbs. iron castings.....	.02	.02½	.03
3,780 lbs. wrought iron......	.03	.03	.06
35,000 ft. sheet piling........	30.00	40.00	40.00
1,600 cu. yds. gravel.........	2.00	2.00	2.00
1,320 cu. yds. mud..........	1.00	1.50	1.00
200 cu. yds. rock (tunnel)....	6.00	8.00	5.00
36,000 cu. yds. rock (open cut)	1.75	2.00	2.40
Totals	$190,874	$222,857	$201,405

Columbus, Ind.—W. H. Rights, City Engr., writes that new bids will be received by Lawrence Orr, City Clk., on Aug. 5 for 9,838 ft. of main and lateral sewers.

Evansville, Ind.—It is reported that bids are being asked by the Trus. of the Southern Indiana Hospital for Insane for the construction of a sewage disposal plant. C. E. Loughlin, Med. Supt.

Richmona, Ind.—Local press reports state that no bids were received on June 28 for the construction of a sewerage system, 4 miles in length, and disposal plant; new bids will be received by the Bd. of Pub. Wks. (C. W. Merrill Chmn.). Probable cost of work, $50,000. Fred. R. Charles is City Engr.

Ames, Ia.—Bids will be received until July 18 by the City Council, for constructing sanitary sewers in portions of College, Lincoln, Carroll and Kellogg Sts., requiring about 2,924 ft. 8-in. vitr. sewer pipe and 6-in. agricultural drain tile. A. B. Maxwell, City Clk.

Spencer, Ia.—Bids will be received until July 19 by the City Council for constructing sewers in portions of 2d and 3d Sts., requiring 1,756 ft. 8-in. vitr. pipe. R. L. Taylor, City Clk.

Hiawatha, Kan.—W. B. Hazen, of St. Joseph, Mo., is preparing plans and specifications for two lateral sewers in Dist. 2.

**Horton, Kan.*—T. W. Roberts, of Independence, Mo., has secured the contract for constructing 9,315 ft. of lateral sewers for Dist 1 (bids opened July 1) for about $8,312. Enginer, W. B. Hazen, of St. Joseph, Mo.

Wichita, Kan.—Plans are reported to have been completed and forwarded for approval to State Bd. of Health at Topeka, for the West Side sanitary sewer, which will cost about $80,000.

Bogalusa, La.—J. H. Randolph, of Baton Rouge, is reported to have returned from Bogalusa, where he completed design for a $150,000 sewerage system for the Great Southern Lumber Co., which is to be installed at Bogalusa.

**Brookline, Mass.*—The lowest and successful bid opened on June 28 by the Metropolitan Water and Sewer Bd. at Boston, for constructing a portion of Sec. 82, contract 57 extension of the high level sewer, South Metropolitan system, Brookline, was submitted by T. J. O'Connell, 158 Adams St., Dorchester, at the following bid: 1,350 lin. ft. earth excav. and refill in trench, 6 ft. 6-in.x7 ft. sewer, $8.75; 50 cu. yds. brick masonry (Portland) in manholes, $16; 2,000 cu. yds. concrete masonry (Portland) in trench 6 ft. 6-in.x7 ft. sewer, $8; 300 cu. yds. rock excav. in trench, $6; total, $30,412. Totals of other bids: Geo. M. Bryne Co., 7 Water St., Boston, $40,725; Falvey & Kelly, 15 Intervale Park, Dorchester, $38,925; Chas. G. Craib & Co., Winthrop, $38,475; Bruno, Salomone & Petitti, 23 Court St., Boston, $37,412; Geo. J. Regan, 92 Stoughton St., Dorchester, $37,287; Jas. Driscoll & Son, Brookline, $37,200; Jones & Meehan, 10 Tremont St., Boston, $36,100, and Coughlan & Sheils, 104 Hanover St., Boston, $30,415.

Canton, Miss.—Press reports state that bids will be received by City Council until July 16 for the construction of a sewerage system to cost about $35,000. Engineer, Walter Kirkpatrick, of Jackson, Miss. O. S. Miller, Mayor.

Trenton, N. J.—Bids will be received until July 16 by the Common Council for constructing a sewer in a portion of Home and Walter Aves., also a drain in portion of Ohio Ave. Harry B. Salter, City Clk.

The Common Council on July 2 passed ordinances providing for the construction of sewers in Hillcrest, Stuyvesant, Parkside, N. Clinton, Beechwood and Whitaker Aves.

Amsterdam, N. Y.—Bids will be received until July 17 by the Sewer Comrs. (Almarin T. Young, Secy.) for furnishing material and constructing a 15-in. storm sewer in a portion of Chestnut St.

Troy, N. Y.—Bids will be received until July 19 by Bd. Contract & Supply (Jas. M. Riley, Clk.) for furnishing material and constructing 665 ft. of 20-in. salt-glazed vitr. pipe sewer in Defreest Ave., including 4 manholes, 4 catch-basins and 216 ft. 6-in. laterals; also 650 ft. 8-in. salt-glazed vitrified pipe sewer in 2 alleys, including 240 ft. 6-in. laterals and 3 manholes.

Henderson, N. C.—It is reported tha bids will be received until July 24 by Henry T. Powell, City Clk., for constructing an extension to the sewer system.

Wahpeton, N. D.—Wm. R. Purdon, City Aud., writes that the proposed sewers to be constructed in Dist. 4 will cost about $7,000. Engineer, Saml. Crabbe, of Fargo.

**Lebanon, O.*—M. E. Gustin, Village Clk., writes that the contract for constructing sanitary sewers (bids opened July 1) has been awarded to Gough & Co., of Muncie, Ind., for $10,182.

Youngstown, O.—Bids will be received until July 19 by the Bd. Pub. Service (W. H. McMillin, Clk.), for furnishing material and constructing a sewer in a portion of Summit St. and a portion of E. Federal St.

Bucyrus, O.—It is stated that bids will be received until July 19 by Chas. Meyer, Clk. Bd. Infirmary Dirs., for constructing a sewage disposal plant.

New Bremen, O.—Bids will be received by A. M. Steinebrey, Village Clk., until Aug. 3 for about 16,000 sq. yds. paving, etc., on different streets; also for about 3,000 ft. of sanitary sewers, as advertised in The Engineering Record.

Medina, O.—It is reported that bids will be received until July 22 by O. O. Van Deusen, Village Clk., for $23,000 general sewer bonds.

Bids will be received until July 16 by the Village Council for constructing sewers and sewage disposal works, as advertised in The Engineering Record. O. O. Van Deusen, Village Clk.

Brooklyn, N. Y.—The following are the bids opened on June 12 by Bird S. Coler, Pres. Brooklyn Boro., for constructing Sect. 1, Div. 2, of Gold St. sewer system: (*a*) John J. Creem, (*b*) Jenks & Asserson Constr. Co., (*c*) Borough Constr. Co. (bidders all of Brooklyn):

	a	b	c
173 lin. ft. outlet, Sec. A.........................	$160.00	$170.00	$152.00
175 lin. ft. outlet, Sec. B.........................	160.00	121.00	153.00
80 lin. ft. connecting chamber.....................	160.00	117.50	200.00
1,775 lin. ft. 162-in. circular sewer..................	107.00	90.50	102.00
1,431 lin. ft. 156-in. circular sewer..................	98.00	81.50	90.00
928 lin. ft. 150-in. circular sewer..................	87.00	76.50	88.00
20 lin. ft. 3 ft. by 4 ft. 6 in. egg-shaped sewer......	10.00	33.00	20.00
160 lin. ft. 24-in. pipe sewer......................	5.00	4.88	4.35
230 lin. ft. 18-in. pipe sewer......................	4.00	5.75	3.30
1,400 lin. ft. 15-in. pipe sewer......................	3.00	5.33	2.50
5,900 lin. ft. 12-in. pipe sewer......................	2.50	4.80	2.00
30 lin. ft. 24-in. pipe temporary drain.............	5.00	4.00	4.35
160 lin. ft. 15-in. pipe temporary drain.............	3.00	3.50	2.45
295 lin. ft. 12-in. pipe temporary drain.............	2.00	1.54	2.00
4,130 lin. ft. 12-in. pipe sub drain....................	1.00	1.22	1.35
3 manholes, Class "A".........................	000.00	800.00	792.00
7 manholes, Class "B".........................	250.00	800.00	198.00
2 manholes, Class "C".........................	200.00	800.00	200.00
1 manhole on 3 ft. by 4 ft. 6 in. egg-shaped sewer..	50.00	100.00	80.00
74 manholes on pipe sewer......................	60.00	75.00	72.00
53 sewer basins reconnected......................	50.00	50.00	27.00
1,100 M ft. sheeting and bracing......................	25.00	54.60	37.50
420 M ft. found. plank..........................	20.00	54.60	33.00
2,400 cu. yds. found. concrete......................	4.00	8.40	8.30
90,000 lin. ft. bearing piles..........................	.15	.37	.31
50 M ft. pile capping..........................	20.00	54.60	50.00
2,700 lin. ft. oak fender piles......................	.50	.60	.50
260 M ft. yellow pine sheet piling and wales.........	85.00	100.00	72.50
2,280 cu. yds. riprap on cobblestone fill, inside coffer dam.	1.00	.94	1.00
370 cu. yds. riprap, outside coffer dam.............	1.00	.94	1.00
Totals	$604,259	$640,365	$623,799

St. Paul, Minn.—It is stated that bids will be received until July 17 by Louis Betz, City Compt., for $150,000 sewer bonds and $50,000 park bonds.

Virginia, Minn.—Bids will be received by Albert E. Bickford, City Clk., until July 23 for constructing sewers in Dists. Nos. 3E, 2, 3D and 3C.

Kansas City, Mo.—Bids will be received until July 18 by the Bd. of Pub. Wks., for furnishing material and constructing sewers in Sewer District No. 297. E. A. Harper, City Engr.

Aurora, Neb.—The City Council is reported to have directed H. C. Gardner, of Lincoln, to prepare plans for a sewerage system, estimated to cost $10,000.

Plainfield, N. J.—Bids will be received by Common Council until Aug. 5 for the construction of sanitary sewers, also same time and place for storm sewers; both proposals advertised in The Engineering Record. Jas. T. MacMurray, City Clk. Andrew J. Gavett, City Surveyor.

Orange, N. J.—All bids opened on July 1 for constructing concrete storm sewer in the east branch of Rahway River are stated to have been rejected, being considered too high. It was decided to procure new bids, a timber flume being substituted for the concrete.

Newark, N. J.—Bids will be received until July 18 by Bd. Street & Water Comrs. (Morris R. Sherrerd, Ch. Engr.), for constructing Meadow Brook sewer system Sect. 1. The following is about the amount of work to be done: 3,970 ft. of 18-in., double strength pipe sewer, and 320 ft. of 12-in., 2,370 ft. of 10-in., and 7,120 ft. of 8-in., deep and wide socket pipe sewer; 18,500 ft. of 6-in. vitr. pipe house connections, 850 ft. of 6-in. iron pipe house connections, 1,250 ft. of 8-in. iron pipe, 3,000 ft. of 8-in. underdrain, 68 manholes complete, including 17 junction and chimney manholes, 2 flush tanks complete, 200 cu. yds. excav. for brook, pumping station complete.

Salem, O.—Bids will be received by the Bd. of Pub. Service until July 17 for furnishing material and constructing a trunk line sewer as advertised in The Engineering Record.

**Delphos, O.*—The contract for building new sewer system (bids opened June 21) is reported to have been awarded to Paul & Kerschner, of Dayton. H. Ricker & Sons, of Delphos, secured contract for furnishing the tiles.

**Youngstown, O.*—Jas. Kane is reported to have secured contracts for constructing sewers in Caldwell, Manning and Wells Sts. of the Riverview Sect., No. 1, for $17,200, and for sewers in Belle Ave., Central, Parkwood and Manning Aves. and Crescent St., Riverview Sect., No. 2, for $7,180.

Frederick, Okla.—See "Water."

Harrisburg, Pa.—The following are reported to be the bids opened on July 5 by the Bd. of Pub. Wks. for constructing Mish Hollow sewer: Henry Opperman, Harrisburg, $36,344; Geo. B. Stucker, $38,189; Brady & Snavely, $39,203, and Thos. B. Bryson, New York, N. Y., $48,077.

Greenville, Pa.—We are informed that new bids will be received by J. M. Hittle, Boro. Secy., until July 16 for constructing about 468 ft. 18 in. and 1,793 ft. of 20-in. terminal sewer and about 2.8 miles of sanitary sewers, 8, 10, 12, 18 and 20-in. diam.

Allentown, Pa.—The City Council is reported to have passed an ordinance providing for the issue of $118,000 bonds to be used for sewers, paving, the purchase of a park site and for fire department purposes.

McKees Rocks, Pa.—Bids will be received until July 16 by J. P. Gillen, Boro. Clk., for constructing sewers in Camp St. and Thomson Ave. of terra cotta (double strength) pipe; block stone or brick paving on Thom-

* *Items marked thus give the names of parties awarded contracts.*

[illegible] Ave., brick paving on Bell Ave. and Gillen alley; grading, curbing and brick paving on Grove, Greydon and [illegible] Sts. S. L. Gardner, Boro. Engr., Chartiers and [illegible] Sts.

Philadelphia, Pa.—The Subcommittee reports apportioning the new loan of $1,000,000 for main sewer extension in about 28 streets were recommended by Councils' Com. on June 26. Included among the more important items is the extension of the Wissahickon low level intercepting sewer through Fairmount Park to Walnut lane, and the Wissahickon high-level cut-off in Stickley St., Hunting Park Ave. and Bristol St.

Bids will be received by Geo. R. Stearns, Dir. Dept. Pub. Wks., until July 22, for construction of sewers appurtenant to abolishment of grade crossings along line of the Phila., Germantown & Norristown R. R. and Richmond branch of Phila. & Reading Ry. Contracts 101 to 107 inclusive, as advertised in The Engineering Record. Cost reported to be about $250,000.

**Dunmore (Scranton), Pa.*—Spruks Bros., 518 Alder St., Scranton, is reported to have secured contracts for constructing sewers in the 3d and 6th Wards at $14,300 and $24,000 respectively.

BRIDGES.

Notes Arranged Alphabetically by States.

Woodland, Cal.—Bids will be received until Aug. 1 at Woodland and Fairfield by the Clks. of Yolo and Solano Counties, for constructing a reinforced concrete bridge across Putah Creek, consisting of three 115-ft. spans. C. F. Hadsall, Clk. Yolo County, Woodland.

San Jose, Cal.—Bids will be received until July 22 by the Bd. of Superv. at San Jose for constructing a concrete bridge over Wildcat Creek at Fruitvale Ave. Henry A. Pfister, Co. Clk.

**Jacksonville, Fla.*—J. W. Richards, Dyal-Upchurch Bldg., Jacksonville, Engr., Atlantic & East Coast Terminal So., writes under date of July 2, that the contract for erection of plate girder bridge, approximately 107-ft. span, has been awarded to the Virginia Bridge Co., Atlanta, Ga., and contract for the erection of freight and office buildings in this city, has been awarded to W. P. Richardson & Co., of Jacksonville, Fla.

Rome, Ga.—It is stated that bids will be received by the Bd. of Co. Comrs. (J. F. Hillyer, Clk.) until Aug. 5, for constructing 60-ft. span steel truss bridge across Silver Creek.

**New Brighton, S. I., N. Y.*—The following are the bids opened June 18 at the office of Geo. Cromwell, Pres. Richmond Boro. for constructing sewers in Tompkins Ave., Sewer Dist. No. 1D, in 1st Ward: (*a*) John F. Clancy, 408 Bway., Long Island City (awarded contract); (*b*) Murphy Bros., 25th Ave. and Cropsey Ave., Brooklyn; (*c*) John E. Donovan, Port Richmond; and (*d*) Jos. Johnson's Sons, Bway., West New Brighton.

	a	*b*	*c*	*d*
407 lin. ft. reinforced concrete sewer, 1 ft. 8 in. x 2 ft 6 in.	$8.35	$8.00	$8.00	$8.50
1,285 lin. ft. salt-glazed vitr. 20-in. pipe sewer	5.15	7.00	6.30	7.50
1,283 lin. ft. salt-glazed vitr. 18-in. pipe sewer	4.50	6.00	6.55	6.25
2,347 lin. ft. salt-glazed vitr. 15-in. pipe sewer	3.90	8.00	5.65	5.75
1,359 lin. ft. salt-glazed vitr. 12-in. pipe sewer	3.20	4.00	5.50	4.50
989 lin. ft. salt-glazed vitr. 10-in. pipe sewer	2.50	2.00	4.00	4.00
147 lin. ft. salt-glazed vitr. 8-in. pipe sewer	2.05	1.50	2.50	2.75
22 manholes	64.00	70.00	80.00	60.00
28 drop manholes	102.00	120.00	175.00	150.00
1 M ft. foundation timber and planking	40.00	35.00	60.00	40.00
10 cu. yds. concrete	11.00	7.50	10.00	10.00
2 cu. yds. brick masonry	15.00	14.00	15.00	20.00
10 cu. yds. additional excav.	.80	5.00	1.00	1.50
68 M ft. sheeting, retained	25.00	7.00	1.00	45.00
32 reinforced concrete receiving basins, with 1¼-in. galvanized wrought-iron bars.	180.00	150.00	125.00	100.00
200 sq. ft. add. reinforcing metal	.15	.25	.05	.05
50 lin. ft. additional 12-in. vitr. culvert pipe	2.50	2.00	1.00	3.00
2 iron hoods for basin traps	9.00	5.00	10.00	8.00
50 sq. ft. 3-in. bluestone flag	.50	1.00	.40	.50
2 vault covers	25.00	10.00	5.00	8.00
430 lin. ft. 5x16-in. bluestone curb	1.25	1.00	1.25	1.25
Totals	$45,515	$58,103	$57,109	$58,581

Providence, R. I.—W. F. Slade, Comr. of Pub. Wks., is reported to have authorized preliminary work to be started for the $60,000 improvement at Field's Point in connection with the precipitation plant, at which the city's sewage is treated.

Woonsocket, R. I.—Bids will be received by the Bd. of Sewer Comrs. until July 18 for about 1,500 ft. 8-in. sanitary sewer and about 600 cu. yds. rock excav., as advertised in The Engineering Record. Frank H. Mills, City Engr.

Covington, Tenn.—It is reported that bids will be received until July 22 by F. R. Fisher, Town Recorder, for $15,000 sewer bonds.

Binghamton, Tenn.—See "Water."

Chattanooga, Tenn.—The two lowest bids opened on July 2 by the Bd. of Pub. Wks. for constructing sewers in Dists. 7 and 9 were submitted by T. J. Shea, of New Orleans, for about $84,500, and Guild & Co., of Chattanooga, at about $88,750.

Houston, Tex.—The City Engr. is reported to have been authorized to prepare plans and specifications for the drainage of streets crossed by the several railways of the city preliminary to the remedying of the drainage of the entire city including the construction of two large storm sewers.

Beaumont, Tex.—Local press reports state that the Council on July 2 rejected bids recently received for the construction of sewers, and the work will be done under supervision of the City Engr.; estimated cost, $64,580.

Bonham, Tex.—Plans and estimates are reported as being prepared for the construction of a sewerage system.

Aberdeen, Wash.—Bids will be received until July 24 by P. F. Clark, City Clk., for constructing sewers in Sewer Dists. C and D, to consist of about 5 miles vitrified clay pipe sewers, from 6 to 24-in., with lampholes, Y's, etc.; manholes to be of concrete; flush tanks to be of concrete, with the Miller automatic system. H. W. [illegible]tman, City Engr.

[illegible] Wash.—See "Paving and Roadmaking."

[illegible], B. [illegible]—See "Paving and Roadmaking."

Racine, Wis.—It is stated that bids will be received [illegible] by the City Clk. for rebuilding and lowering sewer [illegible] of Washington Ave. P. H. Conroy, Chmn. Bd. Pub. Wks.

Milwaukee, Wis.—Bids will be received until July 16 by Bd. Pub. Wks. (Chas. J. Poetsch, Chmn.) for constructing brick and pipe sewers in West Sewerage Dist.

Watertown, Wis.—E. B. Parsons, City Engr., writes that bids are wanted until July [illegible] for the construction of a sewerage system, to cost about [illegible].

**Platteville, Wis.*—Robt. Nelson, of Racine, has secured the contract for constructing sewers (bids opened June 28), at the following bids: 2,610 ft. [illegible]-in. pipe, 85 cts.; 2,440 ft. 10-in. pipe, [illegible]; [illegible] ft. 8-in. pipe, 75 cts.; 1,340 ft. 6-in. pipe, [illegible] manholes, ea. $33; 2 flush tanks, ea. $7[illegible]; [illegible] ft. [illegible]-in. c. i. pipe, $[illegible]; [illegible] ft. 12-in. c. i. pipe, $[illegible], and [illegible] cu. yds. [illegible] excav., $5 cu. yd. J. C. Hughes & Co., of [illegible], secured the contract for the septic tank at [illegible].

Elberton, Ga.—It is reported that bids will be received by the Comrs. of Elbert and Wilkes Counties until July 27 for constructing steel bridge across Broad River at Bells Ferry. (Elberton, C. H. of Elbert County.)

Caldwell, Idaho.—The City Council is reported to be considering the building of 2 bridges over the Indian Creek, on Bank and Kimble Aves. The bridges will be of concrete and iron and will involve an expenditure of $15,000.

Ottawa, Ill.—The McKinley syndicate and the city of Ottawa are reported to be considering the construction of a bridge over Illinois River, to cost about $125,000.

Wichita, Kan.—It is stated that bids will be received until July 29 by the Bd. Co. Comrs. at the office of Claude N. Cartwright, Co. Clk., Wichita, for furnishing material and constructing a reinforced concrete bridge over Arkansas River at Douglas Ave., Wichita.

Williamsport, Md.—On application of the Washington & Berkeley Bridge Co. the Bd. of County Comrs. are stated to have granted permission to the company to erect a toll bridge across the Potomac River. The bridge will cost about $75,000.

Pittsfield, Mass.—We are informed that it is proposed to build a concrete bridge over outlet near Pontoosuc Lake dam to cost about $5,000. Engineer, Arthur B. Farnham, of Pittsfield.

Bids will be received until July 17 by the Bd. Pub. Wks. (Louis B. Cummings, Clk.), for constructing a concrete arch bridge across Housatonic River at Mill St.

Boston, Mass.—The Bd. of Aldermen on July 1 passed the bill providing for a loan of $60,000 to the Bridge Dept. for the reconstruction of Mt. Washington Ave. bridge.

**Grand Rapids, Mich.*—L. W. Anderson, City Engr., writes that the following are the bids opened on June 20 for constructing superstructure of steel bridge over Grand River at Ann St.: Elkhart Bridge & Iron Co., Elkhart, Ind., $40,000; Capital Constr. Co., Columbus, Ohio, $38,750; Attica Bridge Co., Attica, Ind., $40,995; Penn Bridge Co., Beaver Falls, Pa., $40,838; Groton Bridge Co., Owosso, Mich., $44,250; Toledo, Massillon Bridge Co., Toledo, Ohio, $39,300; Cowing Eng. Co., Cleveland, Ohio, $41,790; and Joliet Bridge Iron Co., Joliet, Ill., $36,500 (awarded contract). Date of completion Dec. 20, 1907.

Hattiesburg, Miss.—Separate bids will be received until July 31, at the office of the City Clk., for the construction of 4 steel highway bridge over Gordon's Creek, spans to range from about 65 to 75 ft., to be of plate girder type, 30 ft. wide. J. H. Putnam, City Engr.

**Reno, Nev.*—W. A. Fogg, Co. Clk., writes that the contract for constructing the superstructures of two steel bridges across Truckee River (bids opened June 24) has been awarded to Mervy-Elwell Co., of San Francisco, Cal., for $8,250.

Hackensack, N. J.—Bids will be received until July 16 by the Finance Com. of the Bd. of Chosen Freeholders, at Hackensack (Adolph Kruger, Chmn.), for $80,000 bonds issued to construct a bridge from Court St., Hackensack, to Court St., Bogota; also, same date, for $18,000 bonds to construct a bridge across the Passaic River to replace Wagaraw Bridge.

New York, N. Y.—The following are the bids opened on July 2 by Jas. W. Stevenson, Comr. of Bridges, for cutting recesses and wells for additional anchorage in West and East Anchor Piers of Blackwell's Island Bridge over East River, bet. Borough of Manhattan and Queens: Haggerty Cont. Co., 215 W. 125th St., $14,921; Williams Eng. & Const. Co., 13 Park Row, $5,205; and Snare & Triest Co., 143 Liberty St., $24,440.

Trenton, N. J.—The Board of Freeholders is stated to have decided to rebuild the bridge over the Assunpink Creek at Whitehead's Mills. The repairs will consist of steel and concrete superstructure and a complete concrete floor. The floor, piers and abuttments will be extended in order to make the bridge 20 ft. wide.

New York, N. Y.—Bids will be received until July 23 by Jas. W. Stevenson, Comr. Bridges, New York City, for making test borings at the site of a new bridge over the East River, between the Boroughs of Manhattan and Brooklyn; also, same date and place, for the construction of trolley railway approaches to the Brooklyn Bridge, in the Boro. of Brooklyn; also, same time and place, for removing columns at Sands and Washington Sts., in the Boro. of Brooklyn, Brooklyn Bridge.

Columbus, O.—Bids will be received until Aug. 5 by the Co. Comrs. for furnishing material and doing the following work: Eng. estimate No. 753. Constructing the approaches, etc., to the Chillicothe pike bridge over Big Walnut Creek in Hamilton township; Eng. estimate No. 779. Superstructure. Eng. estimate No. 780. Substructure of the Pegg bridge on west side of Olentangy River, Clinton township. Plans "A." Eng. estimate No. 781. Superstructure of the Pegg bridge. Plan "B." Eng. estimate No. 782. Substructure of the Pegg bridge. Plans "B." Eng. estimate No. 783. Reinforced concrete arch bridge, Luten's patent for the Pegg bridge. Plans "C." W. C. Cussins, Co. Aud.

*The County Comrs. are stated to have opened bids June 24 and awarded contracts as follows: For constructing substructure of Leonard Ave. viaduct in Hamilton Township to J. A. Tebingle for $20,819; sidewalks and concrete work to Schilling Bros. for $12,863; repairing roadway leading to viaduct to Geigle & Garnes for $8,908.

Cleveland, O.—Bids were opened on June 24 by the Bd. of Pub. Service for the Eagle Ave. S. W. Bridge: *Substructure*—Lowest bidder, Jos. Duff Constr. Co.: Removal of old structure, $1,500; 2,000 cu. yds. excav., $1.25; 16,000 ft. foundation piles, 22 cts.; 2,400 cu. yds. concrete 1:3:6 Portland cement, $6.50; 80 cu. yds. stone coping, 15 cts.; and 3,000 cu. yds. grading, 20 cts.; total, $24,920. Totals of other bids: Wm. Kupper, $25,300; Hanahan & King, $26,730; C. H. Fath & Son Constr. Co., $27,900; Northern Ohio Paving & Constr. Co., $28,400; Carland & Hecker, $28,540; Concrete Steel Constr. Co., $28,680; Hunkin Bros. Constr. Co., $28,712; Alex. Tuhman, $32,010; L. Garrett, Kent, O., $37,070 (bidders of Cleveland, unless otherwise mentioned).

Superstructure—(*a*) 130 tons steel and iron, per ton; (*o*) totals: Interstate Eng. Co., Bedford, O., *a* $86, *b* $11,180; King Bridge Co., Cleveland, O., *a* $94, *b* $12,220.

Chardon, O.—Bids will be received until July 29 by the Comrs. of Geaugh and Cuyahoga Counties, at Chardon, for furnishing material and constructing and repairing several bridges and the abutments at the iron bridge on Bainbridge Road. Julius C. Dorn, Clk. Co. Comrs.

Mt. Gilead, O.—It is reported that bids will be received until July 16 for construction of superstructure of steel bridge over Whetstone Creek, Washington Township. W. C. McFarland, Co. Aud.

St. Clairsville, O.—Bids will be received by A. W. Beatty, Co. Aud., until July 22, for superstructure, substructure and concrete culverts for county bridges, according to reports.

Sandusky, O.—It is stated that bids will be received by the Board of Commissioners of Erie County until July 16 for substructure and superstructure of a bridge over Mills Creek, on Monroe St. Chas. Kubach, Co. Aud.

New Winchester, O.—It is stated that bids will be received until July 17 by H. N. Oberlander, Chmn. Bd. Co. Comrs., for constructing an iron bridge near New Winchester. J. I. Smith, Co. Aud.

Cleveland, O.—Bids will be received until July 27 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for constructing a concrete steel culvert, Chagrin Falls Township, per report No. 1503.

Philadelphia, Pa.—Councils' Com. on Surveys on June 26 approved ordinances providing for new bridges in different parts of the city. The full list of new bridges to be built and old ones to be repaired is as follows: Widening Chestnut St. Bridge over Schuylkill River, raising approaches and building a bridge over 30th St., $290,000; Belmont and Girard Ave., over Pennsylvania R. R., $85,000; Columbia Ave., over Connecting Ry., $54,100; Wyoming Ave., over Frankford Creek, $140,000; 12th St., under Connecting Ry., $70,000; to widen Chestnut St. Bridge, raise approaches and build bridge over 30th St., $290,000; Belfield Ave., under Tabor branch Phila. & Reading Ry., $50,000; Large St., under Frankford branch Phila. & Reading Ry., $40,000; 29th St. and Montgomery Ave., over Connecting Ry., $82,000; 66th Ave., North, over North Penn Ry., $26,000; Woodland Ave., over Cobb's Creek, inter-county bridge, $36,000; 54th St., over Philadelphia, Baltimore & Washington R. R., $44,000; Ontario St., under Richmond branch Phila. & Reading Ry., $40,000; Montgomery Ave., over Connecting Ry., $64,000; Roberts Ave., over Connecting Ry., $40,000; 61st St., over Baltimore & Ohio R. R., $25,000; 62d St., over Phila., Washington & Baltimore R. R., $50,500. Of the total bridge cost the city will bear $1,000,000, the railroads concerned assuming the remainder. Most of the bridges will be entirely new, connecting districts that have hitherto had no direct means of communication with each other.

Newcastle, Pa.—Bids will be received until July 16 by the Co. Comrs. (John F. Pitts, Chmn.), at New Castle, for constructing the following bridges: 2-span steel bridge over Slippery Rock Creek, in Slippery Rock Township; 1-span superstructure of reinforced concrete bridge over Jameson's Run, Plaingrove Township; 1-span superstructure of reinforced concrete bridge over Brush Run, in Slippery Rock Township; 1-span steel superstructure with concrete substructure over Little Beaver Creek, in Little Beaver Township; concrete arch in North Beaver Township over Chamber's Run; 1-span reinforced concrete over Potter's Run, in Washington Township; 1-span reinforced concrete in Wayne Township, village of Wurtemburg.

*Items marked thus give the names of parties awarded contracts.

Kittanning, Pa.—It is stated that bids will be received by the Co. Comrs. (Benj. Oswald, Clk.) until July 18, for masonry work in connection with bridges over Sugar and Pine Creeks.

Wheatland, Pa.—The City Council is stated to have passed an ordinance giving the Shenango Iron & Steel Co. the right to build a steel bridge over Council Ave.

Wilkesbarre, Pa.—Bids will be received until July 18 by Jas. M. Norris, Co. Compt., Wilkesbarre, for repairing and reconstructing bridge over Mill Creek on Mock St. in Miners Mills Boro.

Easton, Pa.—At a joint meeting of the Comrs. of Northampton and Lehigh Counties on June 28 it was decided to build a reinforced concrete bridge over Monocasy Creek bet. Bethlehem and West Bethlehem; it will be 60 ft. wide, having 2 sidewalks 8 ft. in width and 2 trolley tracks in center. L. A. Francisco, of Easton, and the County Engineer of Lehigh, R. S. Rathbun, of Allentown, were ordered to prepare plans and specifications for the bridge as soon as possible, and present them to the two Boards of Comrs. for approval. The structure will be about 460 ft. long and 67 ft. from water level to roadway. In all probability 5 arches of about 80 ft. span will be used. The cost will be from $90,000 to $100,000. When the plans are approved the contract will be let by Northampton County, at Easton.

Harrisburg, Pa.—The following are the bids opened on July 5 by the Bd. of Pub. Wks. for the reconstruction of Mulberry St. bridge of reinforced concrete: McCormick & Co., Philadelphia, $260,046; Coder & Miller, Harrisburg, $299,486, anad Scofield Co., Philadelphia, $475,558.

Nasonville, R. I.—Bids will be received until July 18 by Seagrave & Lincoln, Engrs, 35 Commercial Bldg., Woonsocket, for constructing a stone arch bridge over Branch River at Nasonville. Wm. Orrell, Chmn. Com., Burrillville.

Memphis, Tenn.—Bids will be received until July 16 by Ennis M. Douglass, City Register, for constructing a reinforced concrete deck for the Madison Ave. bridge over Bayou Gayoso. The deck is about 40x66 ft. and will contain approximately 200 cu. yds. concrete and 20,000 lbs. of steel reinforcements.

**Bryan, Tex.*—The Commissioners Court is reported to have awarded the contract for building the iron bridge across the Brazos River at Koppe's Ferry to the Missouri Valley Bridge Co., of Kansas City, for $17,190.

Koukauna, Wis.—It is reported that bids will be received by L. C. Wolf, City Clk., until July 16, for the construction of a stone arch bridge across Russell tailrace.

Wawanesa, Man.—It is reported that bids will be received by J. W. Rathwell until July 20 for constructing steel bridge with concrete foundations.

Santiago, Chile, So. A.—The Government of Chile will erect several bridges in Chile, and bids for same will be received at the Ministry of Industries and Public Works in Santiago until Sept. 30. Specifications may be examined at the Legation in Chile, Washington, D. C., and at the office of Wessel, Duval & Co., 25 Broad St., New York, N. Y.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The paving of portions of 3d Ave. and Walnut St. with brick is reported contemplated.

Denver, Colo.—Bids will be received by the Bd. of Pub. Wks. (G. E. Randolph, Pres.) until 11 A. M. July 16, for paving and otherwise improving Broadway Paving Dist. No. 3. Pavement will consist of 2-in. sheet asphalt wearing surface, 1 in. binder and 5 in. concrete base; brick gutters will be 30 in. wide set in ½ in. Portland cement mortar on a 4 in. concrete base. J. B. Hunter, City Engr., is Engr. in charge; probable cost of work, $69,218.

The Bd. of Pub. Wks. on June 25 is reported to have received bids as follows for grading, curbing and improving the Evans Improvement Dist., which will begin at Broadway and W. Colfax Ave., and extend to Cherry Creek: J. Fred Roberts, $51,217; the National Constr. Co., $52,144; the Commonwealth Constr. Co., $59,646, and the Gaffey & Keefe Co., $58,463.

Waterbury, Conn.—The State Senate has passed the bill authorizing this city to issue $150,000 street improvement bonds.

Stamford, Conn.—It is reported that the City Treas. will receive bids until Aug. 1 for $50,000 street paving bonds.

**Washington, D. C.*—Geo. B. Mullin is reported to have submitted the lowest bid, at $11,742, for grading and regulating portions of Newark, Kenyon, Chesapeake and other streets.

Jacksonville, Fla.—Bids will be received until July 22 by the Bd. Pub. Wks. for grading an area approximately 24,380 sq. yds., furnishing and placing in position 9,992 lin. ft. stone curbing and 52 circular corner stones of a radius of 6 ft. and furnishing and laying 24,380 sq. yds. vitrified paving blocks on Florida Ave. and Forsyth St. Philip Priolean, City Engr.

Danville, Ill.—It is stated that bids will be received until July 20 by M. J. Barger, Treas. Danville Branch N. H. D. V. S., for repairing concrete walks.

**Quincy, Ill.*—Henry Rees is reported to have secured the contract for paving a portion of 2d St. with brick at $1.47¼ per sq. yd.

**Charleston, Ill.*—Geo. W. Brewer, of Charleston, is reported to have secured the contract for paving Jackson St., for $7,768.

Oak Park, Ill.—B. C. Brandstadt, Secy. Bd. Local Improv., writes that bids will be received on July 16 for the construction of 169,000 sq. ft. of concrete sidewalk.

Tipton, Ind.—The Comrs. of Tipton County will, it is reported, receive bids until July 26 for the construction of gravel road No. 1 in Cicero Township. Length of road 10,560 ft. J. F. Barlow, Co. Aud.

Covington, Ind.—It is stated that the Comrs. of Fountain County will receive bids until Aug. 6 for the construction of 5 separate gravel roads in Jackson Township aggregating 9.8 miles. Wm. B. Gray, Co. Aud.

New Castle, Ind.—The Town Board will, it is reported, receive bids until July 16, for grading and graveling and laying cement walks on C and D Aves. G. E. Malim, Clk.

Kokomo, Ind.—It is stated that Morton Linden, Union, Monroe and East Sts. are to be paved with brick and cement sidewalks to be constructed thereon.

The Comrs. of Howard County are stated to have granted petitions for 44 gravel roads, in all over 100 miles. Bids will be in order as soon as plans and specifications can be made.

Muncie, Ind.—Resolutions have been passed for the improvement of E. Adams, E. Charles, W. Seymour Sts. with brick, 20,000 sq. yds.; also for resurfacing of E. Main, W. Jackson and N. High Sts. with sheet asphalt, about 6,000 sq. yds. John O. Potter, City Engr.

**Brazil, Ind.*—Michaels & Minnick, of Muncie, are reported to have secured the contract for constructing cement sidewalks on Depot, W. McDonald, Hendrix, Illinois, Tennessee and Vermont Sts., prices per lin. ft. range from 45 cts. to 58 cts.; paving with brick alley north of High School, at $1.54 per ft.; Kitkpatrick Bros., of Greenfield, are stated to have been awarded contracts for constructing cement sidewalks on W. Shattuck, Morton Sts., at 57 to 60 cts. per lin. ft., and paving Blaine St. and First Alley south of National Ave. with brick, at $1.25 and $1.29 per sq. yd.; Ralph M. Campbell secured the contract for cement sidewalks on Park, W. Halbert, Compton Sts. and N. First Ave., at 53 and 54 cts. per lin. ft.

Des Moines, Ia.—O. P. Herrick Constr. Co. is reported to have submitted to the Bd. of Pub. Wks. July 3 bids as follows: 3d St., 2,417 sq. yds. brick at $1.44; 13th St., 3,366 sq. yds. brick at $2.12; 2d St., 3,608 sq. yds. brick at $1.44 and $1.74 (price given per sq. yd.).

Bids will be received until July 30 by Bd. Pub. Wks. (W. W. Wise, Chmn.), for about 1,225 lin. ft. curbing with Portland cement on W. 16th St.; combined curb and gutter (Portland cement); about 1,800 lin. ft. on W. 26th St., and 2,199 lin. ft. on 6th Ave. and 6th Ave. bridge; paving with No. 1 repressed vitrified brick on 6-in. Portland cement foundation, and Portland cement top filler on W. 12th St., 4,403 sq. yds., and E. 1st and E. 2d Sts., 11,168 sq. yds.

Greensburg, Ky.—L. W. Coakley, Treas. of the Green County Turnpike Co., writes that the date of opening of bids for constructing a pike about 11 miles in length has been extended from July 1 to Aug. 1.

**Mayfield, Ky.*—Chas. B. Quinn is reported to have secured the contract for paving with brick a portion of Broadway at $1.98½ per sq. yd.

**Baltimore, Md.*—The contract for paving portions of Catherine and Hollins Sts. (bids opened July 3) has been awarded to Filbert Paving & Const. Co., 18 Builders Exchange Bldg., Baltimore, at $2.20 per sq. yd. for sheet asphalt; total cost $17,016.

Bids will be received until July 17 by the Bd. of Awards (J. Barry Mahool, Pres.) for grading, curbing, guttering and paving with Macadam a portion of Fern Hill Ave.

Upper Marlboro, Md.—Bids will be received until July 16 by th Co. Comrs. (Henry St. J. L. Briscoe, Clk.) at Upper Marlboro for improving the public highway between District Line and Seat Pleasant, known as Central Ave., Sect. 1, by grading and macadamizing about ½ mile of road.

Towson, Md.—E. S. Bosley, Clk. Highway Com., writes that J. F. Parks, of Timonium, bid on June 27 $12,965 for macadamizing about 2½ miles of the Oregon Rd., Sec. A and B, and the Falls Rd., Sec. A. Contract not yet awarded.

Hagerstown, Md.—Bids will be received until July 30 by Luther Peleman, Clk. Bd. Aldermen, for paving a portion of S. Potomac St. with sheet asphalt. A guarantee to keep said street in repair is to be submitted with bid. A separate bid required for each 5, 10 and 15 year period.

Boston, Mass.—The Bd. of Aldermen on July 1 passed the loan bill providing $400,000 for street improvements and $250,000 for the Street Layingout Dept.

The following are the lowest bids opened on July 2 by the Masachusetts Highway Comr. for State highways: Canton Road, L. C. Carchia, $6,360; Becket Road, R. F. Hudson, $3,831; Williams and Goshen Roads, Worcester Broken Stone Co., $4,771.

Bids will be received until July 16 by the Massachusetts Highways Comrs. at Boston, for building a section of highway in the town of Bridgewater, 3,700 ft.; in the town of Southbridge, 4,100 ft., and surfacing 4,000 ft. in Northampton, and 3,500 ft. in Southampton.

Detroit, Mich.—Bids will be received until July 16 by the Dept. Pub. Wks. (J. J. Haarer, Comr.) for furnishing and delivering f. o. b. cars in the city's Western Dist. yard, or f. o. b. on any spur track or siding, creosoted blocks of best quality, sufficient to pave about 24,500 sq. yds. Bidders will furnish their own specifications and formula of their treatment given their blocks; also to furnish a 5-yr. guarantee of the blocks when laid in pavement.

Commissioner Haarer is reported to have opened bids on June 20 for paving (*a*) Larned, (*b*) Brady, (*c*) Watson, (*d*) Propelle, and (*e*) Hastings Sts., the following being the lowest bidders: Thos. E. Currie, creosoted block, *a* $9,863, brick, *d* $11,392, medina, *e* $2,826; W. W. Hatch & Sons, creosoted block, *c* $16,294; Jas. Hanley, 40 Fort St., W., with brick, *c* $6,081.

**Lansing, Mich.*—The contract for paving South St.—two blocks—has been awarded to M. E. Fitzpatrick, $5,992.

**St. Paul, Minn.*—The County Board on June 20 is is stated to have awarded the following contracts for road improvements: James Forrestal, Scandinavian American Bank Bldg.—Lexington Road, $13,985; Dale St. Road, $6,260; St. Paul, White Bear and Bald Eagle Road in village of White Bear, $5,531; second section of North St. Paul Road, $4,930; Minnehaha Road, $3,260; Lake Ave. from White Bear village limits to east county line, $3,465. Thornton Bros.—First section of North St. Paul Road, $2,134. Lane & Nelson—Bald Eagle Lake Road, $2,908. The County Auditor is reported to have been directed to receive bids for the Edgerton Road work and the grading of Bald Eagle Lake Avenue, as the bids received were considered too high.

*The contract for resurfacing with asphalt a portion of St. Peter St. is reported to have been awarded to Barber Asphalt Paving Co. at $22,503.

Grand Rapids, Minn.—It is reported that bids will be received until July 18 by M. A. Spang, Co. Aud., for constructing Oaks Rd., also a portion of Vermilion Co. Rd.

**Savannah, Mo.*—J. E. Schnitzins, City Engr., writes that the following are the bids opened on July 1 for 13,775 sq. yds. vitr. block on 5 in. concrete asphalt fill (price given per sq. yd.): B. F. Halsey, St. Joseph, $2.34; Bryon Kelly, St. Joseph, $2.42¼; and Fred M. Clark, Savannah, $2.18 (awarded contract).

**Vicksburg, Miss.*—The Southern Paving & Constr. Co., of Nashville, Tenn., is reported to have secured the contract for paving a portion of S. Washington St. for about $20,000.

Kansas City, Mo.—Bids will be received until July 18 by the Bd. of Pub. Wks. for constructing brick pavement on portions of 4 alleys, paving with asphalt on portions of several streets, including Pennsylvania Ave., Genesee, Kirkwood, McGee and 25th Sts., constructing artificial sidewalks on portions of several streets, including White Ave., Norledge Pl., Campbell, Locust and 22d Sts. R. A. Harper, City Engr.

Butte, Mont.—Alex. Leggat, City Engr., writes that he wishes to procure samples of, and data regarding paving material, particularly such as is adapted to stand under a very heavy traffic on a steep grade.

Dublin, N. H.—Bids will be received until July 16 by the Selectmen and Road Agt. of the town of Dublin for building a road from Dublin village to Harrisville R. R. station.

Concord, N. H.—Bids will be received until July 25 by A. W. Dean, State Engr., Concord, for grading and surfacing with gravel 6,000 ft. of road in Tilton, and 4,500 ft. in the town of Belmont.

Rahway, N. J.—Bids will be received until Aug. 1 by the Road Com. of the Bd. of Chosen Freeholders at Elizabeth, for constructing telford and macadam stone roads on St. George Ave. and on Leesville Ave., in the city of Rahway. The estimated quantities include 10,222 sq. yds. 2-in., 467 sq. yds. 6-in., and 6,159 sq. yds. 12-in. macadam, and 1,400 sq. yds. 12-in. Telford macadam pavement. Jacob L. Bauer, Co. Engr., 215 Broad St., Elizabeth.

**New Brunswick, N. J.*—John Ginder & Son, of Trenton, is reported to have secured the contract for repaving with trap rock a portion of Dennis St. at $2.25 per sq. yd.

Bogota, N. J.—H. P. Ross, Boro. Clk., writes that bids will be received on July 23 for paving with macadam and for bluestone flag and curb; cost about $15,000. Engineer, Lemuel Lozier, of Hackensack. P. F. Hopper, Chmr. Street Com.

Irvington, N. J.—Bids will be received until July 16 by M. Stockman, Town Clk., for grading and flagging portions of Berkshire Pl., Normandy Pl., Rosehill Pl., 14th, 15th and Oak Aves. and Coit St.

Rutherford, N. J.—The Borough Council is stated to have passed ordinances providing for the grading and curbing of Highland, Cross, Riverside and Jackson Aves., and constructing sidewalks on Morse Ave.

Jersey City, N. J.—The Street and Water Bd. is stated to have approved specifications for the following improvements: Colgate St. with Belgian block, Van Reypen St. with asphalt, and Gian Ave.

Bids will be received until July 5 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.), for paving with Belgian 713 sq. yds. on Colgate St., and with asphalt 900 sq. yds. on Van Reypen St., and 1,383 sq. yds. on Graham st.

Harrison, N. Y.—Bids will be received until July 24 by Robt. T. Shore, Town Clk., for grading and macadamizing portions of Underhill, Harrison, Pleasantridge and Mamaroneck Aves., Lake and West Sts.

Dobbs Ferry, N. Y.—It is reported that bids will be received until July 20 for $125,000 street improvement bonds.

Owego, N. Y.—Bids will be received by the Bd. of Village Trus. until July 22 for laying 10,000 sq. yds. brick pavement on concrete base as advertised in The Engineering Record.

Geneva, N. Y.—The following bids are reported opened June 27 by Bd. of Pub. Wks. for paving Cherry and Lyceum Sts., Elmwood Ave. and Elmwood Pl., requiring 14,000 sq. yds. brick and asphalt, 5,000 cu. yds. excav., 10,200 lin. ft. tile, etc., *a*, Metropolitan block; *b*, Mack block; *c*, Corning block; *d*, P. & B. block; John R. Baxter, of Utica, *a*, $41,968; *b*, $41,833; *c*, $38,172; *d*, $18,099; H. C. Schroeder, of Rochester, *a*, $43,818; *b*, $41,784; *c*, $41,784; Mulderry Bros., of Albany, *a* and *b*, $48,766; *c*, $46,596.

Buffalo, N. Y.—Separate bids will be received until July 16 by F. G. Ward, Comr. Dept. Pub. Wks., for paving portions of Pascal St. and St. Joseph Ave., repaving portions of St. Johns Pl., St. Joseph Ave., Lewis, Dearborn, Louisiana and Metcalf Sts.

*T. V. E. Bardol, D. S. Morgan Bldg., is reported to have secured the contract for macadamizing a portion of Chapin Parkway at $29,225.

Lockport, N. Y.—The following bids are reported opened June 24 for paving with brick, grading and curbing Seymour Alley: C. N. Stainthorpe & Co., $3,900, and C. B. Whitmore, $4,039.

New York, N. Y.—Bids will be received until July 19 by J. A. Bensel, Comr. of Docks, for contract No. 1078, furnishing labor and materials required for preparing for and laying asphalt pavement over the deck of the pier at the foot of W. 22d St., North River, over the new-made land in the vicinity of W. 22d St., North River; at the approach to the 39th St. Ferry terminal at Whitehall St., Borough of Manhattan, and at the approach to the Stapleton Ferry terminal at Staten Island.

The following are the bids opened on July 5 at the office of J. A. Bensel, Comr. of Docks, for furnishing material and curbing, flagging and laying granite pavement with crosswalks within area of marginal street on Chelsea section, between W. 19th and W. 23d Sts.,

**** Items marked thus give the names of parties awarded contracts.***

North River M. J. Fitzgerald, $55,640; Atlanta Constr. Co., $62,337; John M. Sheehan, 404 E. 58th St., $54,317 (awarded contract); M. Baird Constr. Co., $60,400; John E. Quinn, $61,000.

Long Island City, L. I., N. Y.—Bids will be received until July 25 by the Bd. Park Comrs., N. Y. City (Moses Herrman, Pres.), for furnishing material and paving with asphalt tiles the walks in Kings Park, Boro. Queens, together with all work incidental thereto.

Scotia, N. Y.—Bids will be received until July 16 by the Bd. of Village Trus. (H. D. Mairs, Village Clk.), for paving with Meca brick on a portion of Mohawk Ave. Emmett Blessing, Village Engr.

Schenectady, N. Y.—The Common Council is reported to have passed an ordinance providing for the paving of a portion of Broadway.

Albany, N. Y.—The Common Council is reported to have passed ordinances providing for the paving of the following streets: Broad, Sherman and Robin Sts.

Mt. Gilead, O.—It is stated that bids will be received until July 23 by W. C. McFarland, Co. Aud., for constructing 3 turnpikes.

Martin's Ferry, O.—It is reported that bids will be opened July 29 for $10,000 bonds for street improvements. W. N. Baggs, Village Clk.

Findlay, O.—It is stated that bids will be received until July 19 for $55,000 Bormoth road, $3,000 Cookson road and $6,500 Battles road bonds. John A. Sutton, Co. Aud.

Ashtabula, O.—It is stated that bids will be received July 20 for $24,000 Walnut St. paving bonds, $6,440 Taylor Ave. paving bonds, $9,660 Lake Ave. paving bonds and $8,220 Elm St. paving bonds. Frank W. Wagner, City Clk.

**Ashtabula, O.*—F. M. Kemp & Sons Co., of Middletown, are stated to have secured a $51,000 contract for paving in Ashtaubula.

Steubenville, O.—It is stated that bids will be received until July 29 by W. T. Vance, City Clk., for paving a portion of Washington St. with hillside block.

Bucyrus, O.—Bonds amounting to $30,000 are reported sold for road improvements in Crawford County.

Orrville, O.—It is stated that bids will be received until July 27 by S. W. Jackson, Village Clk., for improving portions of Mill and Orr Sts.

Portsmouth, O.—Bids will be received until July 23 by the Bd. Pub. Service (Chas. G. Schirrmann, Clk.) for improving portions of Highland Ave., Grant, Gay, Union and 6th Sts., by paving with vitrified or hard-burned brick, requiring 51,971 sq. yds. paving, 23,964 lin. ft. curb., 6,626 lin. ft. 24, 20, 18, 15 and 12-in. sewer pipe. R. A. Bryan, Engr., in charge street paving.

Wellsville, O.—Bids will be received by the Bd. of Pub. Service until July 18, for the improvement of 6th St.: 4,350 sq. yds. brick roadway paving, 2,270 lin. ft. stone curb; also 1,670 sq. yds. roadway paving and 500 lin. ft. stone curb on Riverside Ave. John A. George & Sons., Engrs., East Liverpool.

Cincinnati, O.—Bids will be received until Aug. 2 by the Bd. Co. Comrs. at Cincinnati (Fred Dreihs, Clk.) for improving Muddy Creek Pike in Green Township as per specification No. 626; also New Richmond Pike, Anderson Towoship, as per specification No. 625.

Jefferson, O.—State Highway Comr. Saml. Huston, of Columbus, is advertising a highway proposed under the new Ohio law, for letting at Jefferson, on July 30. Specifications will be mailed to contractors upon request.

Youngstown, O.—The Bd. of Pub. Service is stated to have opened bids June 21 for paving (*a*) Willis Ave. with brick, (*b*) Willis Ave. with block asphalt, (*c*) Watt St. with brick, (*d*) Walout St. with brick and constructing sewer thereon: S. H. De Groodt, *a* $9,518, *c* $3,388, *d* $2,647; Geo. T. Prosser, *a* $9,161, *c* $3,365; Victor Gason, *a* $9,254, *b* $12,666, *c* $3,723, *d* $2,822; John Grady, *a* $10,019, *c* $4,650, *d* $2,894; Martin Fleming, *a* $8,754; Jas. McCarron, of Youngstown, *a* $9,701; Gartland Bros., *a* $10,120, *d* $3,177; Rochford & Cominskey, *a* $10,691, *c* $3,781, *d* $3,296; Mullin, Miller & Caldwell, *b* $12,611; Millet & Hoffman, *b* $13,194, *d* $3,463; E. J. Davis' Sons, 19 N. Phelps St., *d* $3,275; T. P. O'Horo, *a* $7,800.

Bids will be received until July 19 by the Bd. Pub. Service (W. H. McMillin, Clk.) for furnishing material and resurfacing a portion of E. Federal St., grading Darrow and Garlick Sts.

Columbus, O.—Bids will be received July 23 by the Co. Aud. for $5,000 Ben Davis Free Turnpike bonds. Jos. B. Davis, Chmn. Turnpike Comrs.

New Bremen, O.—See "Sewerage and Sewage Disposal."

El Reno, Okla.—Bids will be received until July 25 by L. G. Adams, City Clk., for grading and paving with brick on portions of Rock Island and Bickford Aves., Hayes, Woodson, Russell, Wade and London Sts. and alley in block 82, as advertised in The Engineering Record. R. N. Whittlesey, City Engr.

[illegible]—Bids will be received by W. R. Julian, City Clk., until July 22, for about 192,022 sq. yds. paving and 22,6[illegible] lin. ft. curb. Contractors to furnish their own plans and specifications and state kind of pavement and time of completion.

[illegible]—The Common Council is reported to have [illegible] providing for the paving of portions of [illegible] and Parker Sts. and curbing and constructing sidewalks on portions of Central Ave., 8th and Lloyd Sts.

McKees Rocks, Pa.—See "Sewerage and Sewage Disposals."

Philadelphia, Pa.—See "Miscellaneous."

Ligonier, Pa.—The paving of Market St., at a cost of $[illegible], is reported contemplated.

[illegible]ville, Pa.—Bids will be received by W. A. Graber, Boro. Secy., until Aug. [illegible] for improving Main and [illegible] Sts. by paving with vitrified paving block [illegible] concrete foundation and filled with an asphalt [illegible] covering about 11,700 sq. yds.

Allentown, Pa.—See "Sewerage and Sewage Disposal."

Jacksboro, Tenn.—The Co. Court is stated to have adopted a resolution to issue $100,000 bonds for constructing additional pikes.

Clinton, Tenn.—The issue of road bonds amounting to $100,000 for improvements in Anderson Co. is reported authorized.

Greeneville, Tenn.—The Co. Court of Greene Co. is stated to have authorized the issue of $100,000 bonds for road improvements.

Danville, Va.—J. A. Magruder, City Engr., writes that no satisfactory bids were received on July 1 for the grading and macadamizing of 2½ miles of county road leading into Danville. It is now proposed to do the work with the county force.

**Tacoma, Wash.*—The contract for repaving A St. is reported to have been awarded to B. W. Kibler at $98,710, and the sidewalk contract to A. P. Stoll at $17,965.

Olympia, Wash.—Bids will be received until Aug. 5 for paving Main St., about 8,000 sq. yds., with brick, asphalt or other approved material, ½ mile of concrete curb and gutter, also 2,000 lin. ft. of storm sewers, as advertised in The Engineering Record.

Snohomish, Wash.—Elmer Leufert, Co. Engr., writes that J. B. Snyder and P. B. Adams, of Everett, bid on June 18 for paving 1st St., including 8,080 sq. yds brick on 6-in. concrete foundation, 2,420 lin. ft. armored curb, 1,250 cu. yds. embankment, 3,060 lin. ft. preserved piles, 3,678 lin. ft. cribbing, etc., a lump sum bid of $31,100.

Aberdeen, Wash.—The City Council is reported to have passed a resolution providing for an expenditure of $221,000 for street and sewer improvements.

**Spokane, Wash.*—The contract for grading, curbing and parking portions of 12th Ave., Elm St., is reported to have been awarded to H. L. Lilienthal for $10,088; the contract for improving Cochran St. to Abbott & Joslin, for $3,400.

Bluefield, W. Va.—It is reported that the Board of City Superv. will receive bids until July 27 for $100,000 paving and sewer bonds.

Appleton, Wis.—It is reported that bids will be received until July 26 by E. L. Williams, City Clk., for furnishing material and paving 9 blocks with brick and 6 blocks with creosoted wooden blocks.

**Oshkosh, Wis.*—The Barber Asphalt Co. is reported to have secured the contract for paving with asphalt Main and High Sts. at $2.25 per sq. yd.

Toronto, Ont.—Bids will be received until July 16 by the Bd. of Control (E. Coatsworth, (Mayor), Chmn.), for the following paving: With asphalt on portions of Gladstone Ave., Havelock anad Simcoe Sts.; with Bitulithic on Earl, Linden and St. Patrick Sts.; concrete curbing on Albert St. and Gladstone Ave.; concrete sidewalks on portions of several streets including Admiral Rd., Arthur, Duke and Lennox Sts., and for constructing sewers in Gough Ave. and lane south of Queen St.

**Halifax, N. S.*—Bids were received recently for paving about 24,000 yds. of roadway as follows: Warren Bituminous Paving Co., of Ontario, bitulithic, 2-in. wearing surface and 5-in. concrete base, $2.88 per sq. yd.; 4-in. concrete base, $2.75; Acme asphalt—5-in. concrete base, 1-in. close binder, 2-in. wearing surface, $2.59; Barber Asphalt Paving Co., Trinidad asphalt, $2.59 (awarded contract); Sicily Asphaltum Paving Co., Bermuda asphalt, $2.65. F. W. W. Doane is City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Fresno, Cal.—The Fresno Mutual Light Co. is reported to have petitioned Council for a franchise to erect and maintain conduits and transmission line for distribution of electricity.

Fairfield, Conn.—The State Senate has passed the bill incorporating the Fairfield Light & Power Co.

Washington, D. C.—Bids will be received until July 20 by Elliott Woods, Supt. U. S. Capital Bldgs. and Grounds, for weatherproof and rubber-covered electric wires for House of Representatives Office Bldg. Material to be delivered on reels at the bldg. Erection of same not included.

Millen, Ga.—J. B. McCrary, of Atlanta, is reported to have prepared plans for water works, sewerage and an electric light plant for Millen.

Columbus, Ga.—Engineers in the employ of the Columbus Power Co. are reported to be completing survey of the water power along Chattahoochie River bet. Columbus and West Point, a distance of about 34 miles. The company now has two power plants in operation and is prepared to build another plant.

Swansea, Ill.—Bids will be received by Otto J. Keller, Village Clk., until July 16 for the construction of a complete electric light plant.

Franklin, Ind.—The Franklin Water, Light & Power Co. (J. B. Rogers, Mgr.) expects to get a new franchise in July, when the plant will be remodeled and the following new equipment installed: A new engine direct connected to a 250-kw., 3-phase alternator, a new 125-kw., 3-phase alternator to take place of present machine and belted to the engine already installed. One 75-light transformer to take place of direct-current arc machine, when all arc lamps will be changed to alternating-current series enclosed lamps.

Tulsa, Ind. Ter.—The Tulsa Electric Light Co. is reported incorporated with a capital of $15,000 by P. D. Campbell, and D. N. Martindale, of Tulsa, and H. F. Burt, of Oklahoma City, Okla.

Boston, Mass.—Bids will be received until July 16 by the Trus. of the Boston City Hospital (Geo. M. Rowe, Supt.) for electric wiring the East Boston Relief Station on Porter St., East Boston.

Springfield, Mass.—The Springfield Gas Light Co. has petitioned the State Gas and Electric Light Comm. for authority to issue $350,000 of new stock to pay floating debt, for new construction, extensions, permanent improvements, including extensions of mains, the acquisition of land, purifying house, purifying apparatus, and other purposes.

Marlboro, Mass.—The Marlboro Electric Light Co. is reported to have petitioned the Bd. of Gas and Electric Light Comrs. for permission to issue of additional capital to the amount of $170,000; the proceeds to be used for paving funded and floating debt and for permanent improvements.

Kalamazoo, Mich.—Frank W. Armstrong, of Chicago, Ill., is reported interested in the establishment of a heating and power plant in this city for furnishing power to the manufacturing industries of Kalamazoo.

Midland, Mich.—Surveys are being made by H. von Schon, Wayne County Bank Bldg., Detroit, of the Chippewa River, for the purpose of several power developments.

Maitland, Mo.—The power plant of the Maitland Electric Light & Power Co. is reported to have been destroyed by fire; loss about $10,000.

Newark, N. J.—Bids will be received until July 16 by the Com. on Repairs, Heating and Sanitation of the Bd. of Educ. (R. D. Argue, Secy.), for furnishing material and installing an electric lighting apparatus in the S. 8th St. School. Runyon & Carey, 122 Market St., are the engrs.

Morristown, N. J.—The Bd. of Aldermen on July 5 granted a 50-yr. franchise to the new Morris & Somerset Electric Co.

Blackwell's Island, N. Y.—Bids will be received until July 18 by Robt. W. Hebberd, Comr. of Pub. Charities, N. Y. City, for materials and labor required for complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for buildings and grounds under jurisdiction of Dept. of Pub. Charities, and comprising the Metropolitan Hospital, Dist. Blackwell's Island, Boro. of Manhattan.

Oswego, N. Y.—The citizens are reported to have voted on June 27 to purchase the property of the Country Club upon which to erect a power house in connection with relocation of high dam; the new power house will cost about $75,000.

Spray, N. C.—The Rhode Island Co. of Spray, is reported to have decided to purchase some new machinery and equipment.

Toledo, O.—New bids will be received until July 26 by the Co. Aud. separately or as a whole for all labor and material required in the building of a heating and power house, including stack for same, at the Lucas County Infirmary; also at the same time for installing in the heating and power house, boilers, dynamos, machinery and appurtenances; conduits and piping outside of said power house; probable cost, $27,000. Edwd. Bayer, archt., 1630 the Nicholas Bldg.; J. W. Kerr, Chmn. Co. Comrs.

Mosquite, Ore.—See "Water."

Wilmerding, Pa.—W. J. Hally, of Wilmerding; Philip Geiss, of East Pittsburg, and Henry Harris, of Braddock, will, it is reported, shortly apply for charters for 3 new electric lighting companies to be known respectively as the Braddock, the East Pittsburg, and the North Braddock electric light companies. They intend to work in connection with the United Electric Light Co., of Wilmerding.

Columbia, S. C.—It is reported that the Savannah River Power Co. (H. A. Orr, Pres.), capitaliized at $8,500,000, will develop during the summer the Calhoun Falls property with 35,000 h. p. Cherokee falls, also on the Savannah, 10,000 h. p. Hatton shoals, on the Tugaloo River; Broad River, in Georgia, at Anthony falls, near Elberton, 10,000 h. p., and at Gregg Shoals about 8,000 h. p.

Anderson, S. C.—Hugh McRae, of Wilmington, N. C., is reported to be completing arrangements for the development of Cherokee Falls, 4 miles below Gregg Shoals on Savannah River. Work on the dam, which will commence at once, will furnish 10,000 h. p. The new company will be known as the Calhoun Falls Power Co., and will have a capital of $8,500,000.

Sioux Falls, S. D.—H. M. Byllessby & Co., of Chicago, Ill., are reported to have been retained to make plans for the reconstruction and extension of existing hydraulic plants of the Sioux Fall Light & Power Co. About $15,000 will be expended in rebuilding the present dams and in adding new euipment.

Lawrenceburg, Tenn.—Walter G. Kirkpatrick, of Jackson, Miss., is making plans for municipal power plant comprising concrete dam, turbines, transmission and distribution lines, arc lamps, dynamos, electric pumping, steel tower and tank, water mains; approximately 200 h.p.

Waco, Tex.—The City Council is reported to have granted Jos. J. Henry a franchise for the construction of an electric light and power plant.

Brownsville, Tex.—An election will probably soon be held to vote on issuing $70,000 bonds for water works and an electric light plant. Engineer, W. P. Bullock, of Kansas City, Mo.

**Richmond, Va.*—The contract for laying street mains for gas is reported to have been awarded to R. D. Wood & Co., of Philadelphia, Pa., for $31,230.

Washburn, Wis.—The Council is reported to have authorized the Lighting Com. to purchase the outside electrical equipment and business of the Washburn Electric Light & Power Co. The city has in contemplation the erection of a dam on Sioux River, 2 miles east of city, from which power will be generated to light the city.

Kamloops, B. C.—The City Clk. writes that this ciity expects to enlarge the electric light plant and is making inquiries in regard to producer gas plants.

Hamilton, Ont.—The Lighting Com. of the Bd. of Works is reported to have decided to receive bids until about Aug. 1 for street lighting; also to get prices on gas lighting.

**Items marked thus give the names of parties awarded contracts.*

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Quincy, Ill.—Plans for an interurban system of roads with Quincy as the center, took form some days ago in the incorporation of the Quincy Interurban Co., with a capital of $25,000. The first line to be built will run from Quincy to Hamilton to the north, and Pearl on the south. Directors, Henry F. Dayton, J. Henry Bastert, Ezra Best and others.

Evansville, Ind.—It is stated that Evansviille Ry. Co., incorporated recently, with a capital stock of $1,000,000, marks the consolidation of the Evansville, Rockport & Eastern Ry. Co. with the Evansville & Mt. Vernon Ry. Co. The line will be extended to Cannelton, and it is proposed eventually to build through to Louisville.

Davenport, Ia.—The American Motor Car Interurban Ry. Co. is reported incorporated, with $5,000,000 capital, to build from Waterloo to Davenport or Muscatine. Self-propelled cars will be used. The headquarters of the company will be at Marion, Ia.

Burlington, Ia.—The Burlington & Bonaparte Interurban Electric Ry. Co., is stated to have filed articles of incorporation with the Secretary of State. Capital, $10,000. The company is to construct equipment and operation an electric railway from Burlington via West Point to Bonaparte. The company is also to have the right to furnish power and lights. J. A. Johnson, of Bonaparte, Pres.; H. H. Meeke, of Bonaparte, Treas.; Ed. E. Egan, of Burlington, Sec. The line will be about 38 miles in length.

Red Fork, Ind. Ter.—The Sequoyah Park Co. is reported organized for the purpose of building an electric line and improving Sequoyah Park. It is said that $100,000 will be expended for improvements and electric lines. The road will be 11 miles in length.

**Baltimore, Md.*—Right of way for an electriic line between Baltimore and Halethorpe to be built by the Baltimore. Halethorpe & Elkridge Ry. Co., is reported to have been secured. The line will connect with the United Railways & Electric Co. and will be built within a short time. Capital $100,000.

Boston, Mass.—Bids will be received until July 18 by the Boston Transit Comn. (B. Leighton Beal, Secy.) for constructing entrances and exits at Winter St. for the Washington St. tunnel.

St. Louis, Mo.—Plans for the extension of the McKinley Electric Interurban Ry. System directly east from St. Louis through Illinois, touching at Effingham and Vandalia, Ill., and toward Sullivan, Ind., are reported under consideration. Whether this extension will be made will depend largely on the terms upon which a right of way can be obtained.

Omaha, Neb.—It is reported that over $2,000,000 will be expended this fall and next summer on the Omaha, Beatrice & Lincoln Interurban Ry. by Eastern capitalists, who have just promised to finance the project and push to completion the 55 miles of road between Omaha and Lincoln. The headquarters of the company will be in Omaha. Part of the line is already completed between Omaha and Sarpy Mills, as well as some of the roadbed east from Lincoln.

New York, N. Y.—It has been announced that the New York City Ry. Co. (M. G. Starret, Ch. Engr., 621 Bway.) intends to electrify the old Belt Line car system in First Ave.

New York, N. Y.—See "Bridges."

Ossining, N. Y.—It is stated that the Hudson River & Eastern Traction Co., which is to build an electric railway to connect Peekskill, Ossining and other towns along the Hudson with White Plains, won a victory at a special term of the Supreme Court at Nyack by the dissolution of the injunction obtained some time ago by the Westchester Traction Co., which operated the street railway system of Ossining until its equipment became so delapidated that by an order of the State Railroad Comrs., it was shut down. The new company recently gave a mortgage for $1,000,000 to the Colonial Trust Co. and will now proceed with construction. The road will first be completed in Ossining and then extended to Briar Cliff Manor, Pleasantville, Sherman Park, North White Plains and White Plains.

Phelps, N. Y.—It is reported that the Geneva, Phelps & Newark Electric Road Co., which applied to the town officials about a year ago for a franchise to construct an electric road, and which application was granted with the understanding that the road was to be in operation within two years, is reported to have sold the franchises to the J. G. White Constr. Co., now engaged in building the Rochester, Eastern & Syracuse Road. It is also said that a spur will be built from here to Clifton Springs, and in confirmation of this report a corps of surveyors began work on the line from here to Clifton Springs. It is further stated that work will be commenced on the line from Geneva via Phelps to Newark as soon as the White Constr. Co. completes the Rochester, Syracuse & Eastern as far as Clyde.

Norwich, N. Y.—It is stated that the Chenango Valley Electric Ry. Co. will make application for a franchise to build and operate an electric railway over the same route as asked by the Utica Southern R. R. The Chenango Valley Co. will also ask for the right to lay tracks through Cortland and Canasawacta Sts. Edw. L. Smith, of Towanda, Pa., Pres.; H. C. Stratton, of Oxford, Treas., and J. J. Bixby, Norwich, Secy.

Riverhead, N. Y.—The State Board of R. R. Comrs. is stated to have granted a certificate of necessity to the Suffolk Traction Co., proposing to build a street surface railroad in the county of Suffolk. The length of the road is 27.6 miles, and its termini are the point where Beaver Dam Creek intersects the South Country road in Brookhaven on the east, and the intersection of Deer Park Ave. with the South County road, or Main St. in Babylon, on the west. Capital, $1,200,000.

Utica, N. Y.—A certificate of extensions of the route of the Utica & Mohawk Valley Ry. Co. (C. Loomis Allen, Gen. Mgr.), is stated to have been filed with the County Clerk. The proposed extensions are as follows: an extension or branch consisting of a second track, beginning on Whitesboro St. at the westerly line of the city of Utica and extending westerly along Whitesboro St. An extension consisting of a single track line extending from Deerfield corners westerly along, in and upon the Marcy Road to the so-called Seymour Road. An extension consisting of a single track line from Deerfield Corners along, in and upon the Trenton Road or North Genesee St. to the reservoir. An extension consisting of a second track extending from Deerfield Corners on No. Genesee St. southerly in, along and upon No. Genesee St. to the old channel of the Mohawk River. Provision is also made for the necessary connections, curves and cross-overs for the convenient working of said lines.

Rome, N. Y.—The Rome City Ry. Co. (C. L. Allen, Gen. Mgr., Utica) is stated to have voted to increase its capital from $150,000 to $500,000. A small part of this increase will be used to pay for improvements recently made and the balance will be held in the treasury to pay for extensions that are contemplated.

Buffalo, N. Y.—The Buffalo & Lake Erie Traction Co. is stated to have been granted the right to cross Roberts road in Dunkirk, through Cassety woods and private right of way to Railroad Ave. and connect with the belt line. This practically completes the connecting link from Buffalo to Dunkirk.

The Buffalo, Genesee & Rochester Ry. Co. is stated to have been granted permission by the State Railroad Comn. to lay a double-track electric line between Buffalo and Rochester. The company is authorized to issue a mortgage for $5,000,000. Capital, $7,500,000. Attorney Herbert P. Bissell and a number of other Buffalo business men are interested.

Columbus, O.—The Defiance, Hicksville & Ft. Wayne Ry. Co. is reported incorporated, with a capital of $10,000, by W. E. Golding, H. C. Eplert, M. O. Topliff, E. A. Murphy and M. I. Brown.

Napoleon, O.—It is stated that the Lake Erie, Bowling Green & Napoleon Electric Ry. (E. H. McKnight, Gen. Mgr., Bowling Green) is to be extended from Bowling Green to Tontogany the present summer. This line is planned to eventually enter Napoleon.

Hillsboro, Ore.—The City Council is stated to have granted a franchise to the Oregon Electric Ry. Co. (A. E. Goddard, Secy., 63 Wall St., New York, N. Y.) through t..s city on Base Line St., and also granted a franchise to the United Railways Co. through the city by way of Main St., with the right to use either 1st, 2d or 3d Sts. for connection with the southern limits of the city.

Oxford, Pa.—The construction of the electric railway from Unionville Junction, on the Kennett Square division of the West Chester St. Ry., through this place to Oxford seems assured. Thos. E. O'Connell, Chas. Swayne, W. B. Seals are reported interested.

Parkesburg, Pa.—It is reported that the four-mile break in the Philadelphia-Lancaster electric railway system, between Parkesburg and Christiana, will soon be bridged. A couple of years ago work was begun on the section by the Tennis Constr. Co., but after about 3 miles of the roadbed had been graded the work was abandoned. The new owners of the franchises are said to be the McCall's Ferry Power Co. M. P. Cooper, of Christiana, Right of Way Agent.

Cardington, Pa.—The Philadelphia Rapid Transit Co. (Chas. O. Kruger, Gen. Mgr., 810 Dauphin St., Philadelphia), it is stated, is making arrangements to construct a double-track system from Cardington to Collingate. The company has already obtained the right of way from Cardington to Marshall Road, in Upper Darby Township, to a point near Lansdowne Borough. It is stated that the company contemplates running through Upper Darby Township into the borough of Clifton Heights, thence to Aldan, continuing to Collingdale.

Providence, R. I.—The Rhode Island Co. (A. E. Potter, Gen. Mgr., is reported to have announced that the contemplated improvements consists of building about 11,700 ft. of track on the Cranston cross town line, also extending its present Academy Ave. line about 2,750 ft. A car house will be built on Thurber Ave., one on Academy Ave. and the present Social St. car house in Woonsocket will be rebuilt. In addition to this, an addition of about 8,100 sq. ft. will be built to the repair shop.

Bristol, Tenn.—The Bristol St. Ry. Co. is stated to have granted a franchise to build, equip and operate a street car system in Bristol, Va. Work will begin at once, and a line from State St. to Virginia Institute will be completed and in operation within sixty days. The steel rails have already been purchased.

Rockport, Wash.—The engineers of the Cascade Valley R. R. Co., under L. M. Rice, of Seattle, are working on the final location of the projected electric line from Rockport through the Cascade Pass. W. A. C. Rouse, the president of the company, is reported to have announced that work on actual construction will begin within the next sixty days. Right of way is now being secured, and the final location has been made as far as Marblemount, a distance of 10 miles beyond Rockport.

Chehalis, Wash.—B. J. Weeks, of Tacoma, is stated to have asked the City Council for a franchise for the Centralia-Chehalis Electric Ry. & Power Co. It is proposed to build an interurban electric line between Chehalis and Centralia.

Seattle, Wash.—Articles of incorporation are stated to have been filed for the Puget Sound International Ry. & Power Co., of Portland, Me., by J. H. Drummond, W. G. Chapman, Gertrude M. Horne, of Portland, Me.; Benjamin Joy, J. S. Lovering, P. L. Warren, A. K. Todd and J. E. Rousmaniere, of Boston, Mass. Capital, $2,250,000. The object of the corporation, it is stated, is to build and operate a line of railway between Seattle, Everett, Bellingham and British Columbia. This is the Stone & Webster corporation that will construct the interurban announced some time ago to be built between Seattle and Vancouver, B. C.

**Wheeling, W. Va.*—The contract for the construction of the Fairmount & Mannington Electric Ry. Co. (F. H. Bailey, Gen. Mgr., Fairmount), 15 miles in length and connecting two of the largest towns in the interior of the State, is stated to have been let to the Blodget Constr. Co., of this city.

RAILROADS.

Notes Arranged Alphabetically by States.

Pensacola, Fla.—Application is reported to have been made by business men of Pensacola for a charter for the Pensacola, Alabama & Georgia R. R. Co.

Ottawa, Ill.—The Illinois & Fox River Central R. R. Co. is reported incorporated with a capital of $50,000 to construct a line from a point in or near Chicago to Ottawa. Incorporators: Wm. A. Makutchan, Max Luster, Jos. F. Gearan and others, all of Chicago.

Menominee, Mich.—It is reported that plans are being perfected by the Ann Arbor R. R. Co. (W. F. Bradley, Supt., Owosso, Mich.), to extend the line from Menominee westward to Duluth and Minneapolis, making this city the eastern terminus on the west shore of Lake Michigan.

**Long Lake, Minn.*—The contract for grading 16 miles of road for the Chicago, Milwaukee & St. Paul R. R. Co. along the Wisconsin Valley division is reported to have been awarded to Paulson, Larson & Co., of Minneapolis. The strip extends from Dunfield to Long Lake on the branch that runs from Merril west.

Long Island City, L. I., N. Y.—The Bd. of Estimate and Apportionment of N. Y. City has granted the Long Island R. R. Co. (J. R. Savage, Ch. Engr., Jamaica, N. Y.), a franchise to build two extensions in Queens Co., one known as the Montauk Cut-off, to be a 2-track line entirely within Long Island City, and the other the Glendale Cut-off to be built for a distance of 2 or 3 miles to connect the Montauk Division and New York, Woodhaven & Rockaway Beach line with the main line at Elmhurst. The main line is to be four-tracked.

Marcellus, N. Y.—The State Senate is reported to have passed a bill authorizing the Marcellus & Otisco Lake Ry. Co. to use steam as a motive power.

Rapid City, S. D.—The Wyoming Western Ry. Co. is reported incorporated, with a capital of $4,000,000, with headquarters at Rapid City. This is to be an extension of the "Crouch line" in the Black Hills from Mystic, S. D., to Buffalo, Wyo., a distance of 200 miles, of which 40 miles will be in Pennington County and 160 in Wyoming, Crook and Buffalo Counties, Wyo. Incorporators: Chas. C. Crouch, Jacob S. Grantz, Chas. E. Fulton and Elmere L. Hurlburt, all of Rapid City.

Mill Creek, W. Va.—The Valley River R. R. Co. has been incorporated with a capital of $50,000 to build a line from a point near Mill Creek to a point at or near Clover Creek. Incorporators, John G. Hoffman, Jr., and Frank C. Hoffman, of Wheeling; Lydia E. Shull, of Mill Creek, W. Va., and others.

**Morgantown, W. Va.*—The contract for the construction of the Buckhannon & Northern R. R. from Morgantown to the Pennsylvania line is reported to have been let to the Brady Eng. & Constr. Co., of Parkersburg, W. Va.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Ft. Morgan, Ala.*—Reports state that the contract for rebuilding the property on the reservation at Ft. Morgan, which was swept away by the storm of last Sept., has been awarded to Geo. Ittner, of Atlanta, Ga. The contract, it is stated, will amount to about $25,000, and covers the building of a carpenter shop, work shop, stable, shelter for searchlight, trucks, bakery, oil house, ordinance work shop and other buildings.

Los Angeles, Cal.—The erection of an annex to the city hall, either 2 or 3 stories high and to cost about $20,000, is reported under consideration.

Meriden, Conn.—The House has passed a bill appropriating $90,000 for an armory in Meriden.

Wilmington, Del.—Mayor Wilson in his message to the Council, it is stated, recommended the erection of a new city hall.

Farnhurst, Del.—Bids will be received until July 22 by Connell & Pierson, Archts., Rm. 403, Equitable Bldg., Wilmington, for erecting a building for the Delaware State Hospital for the Insane at Farnhurst. Wm. H. Swift, Chmn. Bldg. Com.

Bartow, Fla.—The erection of a court house at a cost of $75,000 is reported contemplated by the Co. Comrs.

Atlanta, Ga.—The erection of a joint court house and city hall in the city of Atlanta is being agitated.

Bartonville, Ill.—It is stated that State Archt. Zimmerman is preparing plans for a hospital which it is proposed erecting on the Asylum grounds at Bartonville at a cost of about $100,000.

Kankakee, Ill.—The Co. Bd., it is stated, has under consideration the erection of a court house at a cost of $225,000. Address Co. Aud.

Peoria, Ill.—It is stated that all bids recently received for erecting the Graham Hospital have been rejected, the plans are to be modified and new bids asked.

Decatur, Ill.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Aug. 20, for the construction (complete) of the U. S. Post Office at Decatur.

Ft. Benjamin Harrison, Ind.—Bids will be received until July 17 by Geo. H. Penrose, Q. M., U. S. A., for installing a heating system in 1 civilian's employes' quarters at this post.

**Webster City, Ia.*—C. E. Atkinson, of Webster City, has secured the contract for constructing complete U. S. Post Office for $52,144 (bids opened June 17 by the Superv. Archt. Treas. Dept., Washington, D. C.).

Des Moines, Ia.—Geo. F. Poorman, City Clk., writes that the citizens on June 20 voted to erect a city hall to cost about $350,000. Architect not yet selected.

A resolution was adopted by the Aldermen authorizing the Bd. of Pub. Wks. to secure specifications for a fire engine house to be erected on W. 8th St.

Ft. Riley, Kan.—Ziegler Bros., of Junction City, are reported to have submitted the lowest bid for erecting the barracks and coal shed at this post, at $55,000, and Ziegler & Dalton, of Junction City, the lowest bid for the other buildings, including storehouse, granery, etc., at $40,000. Bids for this work were received June 10 by W. M. Whitman, Constr. Q. M., Ft. Riley.

Mayfield, Ky.—The General Assoc. of Baptists of Kentucky, it is stated, has decided to erect a sanitarium to cost about $200,000.

**Items marked thus give the names of parties awarded contracts.*

Bangor, Me.—Bids will be received until July 10 (extension of time) for the general construction of the new wing at the Eastern Maine Insane Hospital, Bangor, and for the general construction, plumbing and heating of the new tubersula bldg. to be erected on the grounds of the said hospital. Chas. E. Field, Chmn. Bldg. Com.

Augusta, Me.—Bids will be received until July 22 by the Bd. of Trus., care Dr. Bigelow T. Sanborn, Supt., for furnishing material and constructing complete (except heating, plumbing and wiring) a stone and brick building with fireproof floors for the State of Maine for the Criminal Insane, located on the Arsenal Grounds at Augusta.

**Frederick, Md.*—The Tuberculosis Comn., it is stated, has awarded the contract to erect the administration building on the Frederick County site to Henry Smith & Sons Co., of Baltimore. There is about $90,000 available for this sanitarium.

Boston, Mass.—The Bd. of Aldermen has passed the loan bill which provides for the following: $30,000 for bath house at Charlestown; $140,000 for buildings and equipment at Consumptives' Hospital; $15,000 for fire house and apparatus in Park Hill, and $15,000 for fire house, site and apparatus, in Orient Heights, East Boston.

**Northampton, Mass.*—Myron C. Bailey, of Northampton, is stated to have secured the contract to erect brick building at Dickinson Hospital at about $40,000.

Ionia, Mich.—The Bd. of Superv., it is stated, has accepted the plans of E. A. Bowd, of Lansing, for the court house, estimated to cost $28,000.

Flint, Mich.—Bids will be received until July 20 by E. D. Black, Secy. Hurley Hospital Bd., for erecting a hospital.

Duluth, Minn.—The members of the Bd. of Trade are said to be considering improving theB d. of Trade Bldg. at a cost of $100,000.

St. Peter, Minn.—J. D. Mills, Secy. Bd. State Control, St. Paul, writes that C. H. Johnston, Manhattan Bldg., St. Paul, is preparing plans for St. Peter State Hospital.

Alexandria, Minn.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Aug. 19, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of the U. S. Post Office at Alexandria.

**Virginia, Minn.*—Jas. Sampson, of Virginia, it is reported, has secured the contract to erect the fire hall, not including heating, wiring and plumbing, at $11,130.

Crookston, Minn.—Bids will be received until Aug. 5 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing (complete) the U. S. Postoffice at Crookston.

St. Louis, Mo.—It is stated that plans are being prepared for fireproofing the poor house at a cost of about $90,000.

The Bd. of Pub. Improvements, it is stated, has rejected all bids recently received for erecting an engine house at Kennerly and Pendleton Sts., and new bids are to be received July 26.

Omaha, Neb.—The Comrs. of Douglas County are reported to have received tentative plans from John Latenzer, Bee Bldg., for a court house to cost about $1,000,000.

Jersey City, N. J.—Bids received June 28 by the Bd. of Hospital Trus. for erecting a power house, laundry, stable and helps' quarters and mortuary chapel and morgue for the new hospital, it is stated, were as follows: The Thompson-Starret Co., of New York, N. Y., was the only concern that put in separate bids for each building. They were as follows, being respectively fireproof anad semifireproof construction: Power house and laundry, $72,000, $68,000; stable and helps' quarters, $54,000, $51,500; morgue and chapel, $21,000, $21,600; total, $147,000, $141,100. The John H. Parker Co., of New York, N. Y., bid $149,364 for the entire work, fireproof construction, no bid on semi-fireproof construction. Other bids for semi-fireproof construction were for the entire work: M. T. Connolly Contracting Co., 242 17th St., $140,437, and Jos. Jewkes & Sons Co., $142,000; the Universal Fireproof Constr. Co., of New York, N. Y., bid $22,150 for the power house, $23,450 for the stable, and $5,300 for the morgue, a total of $50,900, but does not include the heating, lighting and plumbing, or equipment for any of the buildings.

*The contract for the buildings at the City Hospital, as given above, it is reported, has been awarded to the Thompson-Starrett Co., of New York, N. Y., for fireproof construction.

Jamesburg, N. J.—Bids will be received until July 16 by the Trus. of the State Home for Boys (Edw. Spaeth, Pres.), at Jamesburg for erecting a brick and frame cow barn at said Home.

Vineland, N. J.—It is stated that bids will be received until July 16 by the Comr. of Charities and Correction, State House, Trenton, for constructing a heating plant at the home for Soldiers, Sailors, Marines and their Wives and Widows, at Vineland.

Brooklyn, N. Y.—Plans have been filed for a 3-story and basement brick dormitory to be erected at Willoughby and Sumner Aves. for the Roman Catholic Orphan Asylum at a cost of $125,000. Helmle & Huberty, archts., 190 Montague St.

Willard, N. Y.—The Lunacy Comn. and the Bd. of Trus. of the Willard State Hospital, it is stated, have decided to erect a new building at the hospital for tuberculosis cases.

Rochester, N. Y.—Bids will be received until July 17 by F. N. Pifer, Clk. Bd. Contract and Supply, for alterations and additions to the old New York State Armory, cor. Monroe Ave. and Clinton Ave. S., to convert same into a convention hall for the city. J. Foster Warner, archt., 1036 Granite Bldg.

Flushing, L. I., N. Y.—It is stated that steps are to be taken immediately for the erection of a nurses' home at the Flushing Hospital to cost to be about $15,000. Chas. G. M. Thomas, of the House Com., it is stated has been authorized to secure funds.

Rochester, N. Y.—See "Miscellaneous."

Buffalo, N. Y.—It is reported that the erection of a Polish Hospital at a cost of about $100,000 is contemplated. Rev. John Pitass, of St. Stanislaus St., may be able to give further information.

Bids will be received until July 16 by Henry P. Fink, Clk. Bd. Superv., for additions and alterations to the Erie Co. Jail. Est. cost, $31,500.

Blackwell's Island, N. Y.—Bids will be received by the Dept. Pub. Charities, (Robt. W. Hebbard, Comr.) New York City, until July 22, for furnishing all labor and materials required for the tearing down and removal excavation and masonry, steel and iron, roofing and metal work, carpentry, and all other work (except electric, heating and plumbing work, gas and electric fixtures and fitting up) for the erection and entire completion of a day room for male inmates and a day room for female inmates, a reception pavilion for male inmates and a reception room for female inmates, and an operation pavilion in connection with the Home for the Aged and Infirm, Blackwell's Island, City of New York. Also separate bids for electrical conduit, electric wiring and switchboard work, heating, plumbing, gas piping, etc., for above buildings.

New York, N. Y.—The following are the bids opened on June 27 by the Park Board (Moses Herrman, Pres.) for installation of electric equipment, elevators, lifts, book conveyors and pneumatic tubes, in New York public library, Astor, Lenox and Tilden foundations: Harry Alexander, 18 W. 34th St., $186,000; Commercial Constr. Co., 114 E. 28th St., $207,000; Chas. L. Eidlitz Co., 341 W. 71st St., $234,684; J. Livingston, Jr., & Co., 113 E. 22d St., $208,000; Lord Electric Co., 213 W. 40th St., $173,891; Peeb & Powers, 225 4th Ave., $228,000; John Peirce Co., 90 West St., $198,000; Reis & O'Donovan, Inc., 1123 Bway., $209,440; Tucker Electrical Constr. Co., 35 So. Main St., $195,651; and Western Electric Co., 463 West St., $181,449.

Mayor McClellan has approved the bill authorizing the Comrs. of Bridges to erect a municipal building on the new terminal of the Brooklyn Bridge in the Boro. of Manhattan.

The Municipal Art Comn., on June 27, approved designs for the Harlem Hospital Training School for Nurses, to cost $150,000, and designs for the Old Slip Police Station, to cost $175,000.

The following are the bids opened on July 2 by Francis J. Lantry, Fire Comr., for furnishing materials and erection a building for an engine and a hook and ladder company on Belmont Ave. and 183d St., Bronx Boro.: Kelly & Kelley, 45 E. 42d St., $76,752; R. E. Heningham, 1 Madison Ave., $76,702; T. T. Nesbitt Co., 116 Nassau St., $74,448; Calumet Constr. Co., 19 E. 59th St., $65,898; L. J. Rice, 5 E. 42d St., $70,870; A. L. Guidone, 1 Madison Ave., $71,850; Jas. T. Kerr, $68,345, and A. Nugent & Son, 103 E. 125th St., $69,970.

The following are the bids opened same time and place for furnishing material and erecting an extension to the headquarters building on 68th St. near 3d Ave.: Thos. Cockerill & Son, 147 Columbus Ave., $162,500; R. E. Heningham, 1 Madison Ave., $145,941; T. T. Nesbitt Co., 116 Nassau St., $134,569, and Kelly & Kelley, 45 E. 42d St., $134,992.

The following are the bids opened on July 3 by the Comrs. of Parks, N. Y. City, for the erection of a new continuous skylight over the central portion of east wing, the enlargement of the 3-story dome lights, the alteration of the cornice in south gallery on 2d floor of said east wing of the Metropolitan Museum of Art, and all work in connection therewith: Buckley Realty Constr. Co., 624 Madison Ave., $45,000, and Thos. Dwyer, 601 West End Ave., $52,444.

John M. Burke is stated to have given $4,000,00 to the city with which to erect a home and make provisions for the relief of convalescents, the home to be known as the Winifred Masterson Burke Foundation, in honor of Mr. Burke's mother.

Bids will be received until July 18 by John F. Ahearn, Boro. Pres., for the completion of the plumbing and drainage of a public bath, now being erected on east side of Ave. A, between 23d and 24th Sts., New York City, which has been abandoned by the original contractors.

Plans have been filed for enlarging the building of the Home for the Relief of Aged and Indigent Females at Amsterdam Ave. anad 104th St., by adding a 4-story annex 63x100 ft. at the corner of 103d St. The addition will be of brick and stone and cost about $100,000.

Lisbon, N. D.—The erection of an armory at a cost of $12,000 is reported under consideration.

Bismarck, N. D.—The City Council, according to reports, has decided to erect a city hall to cost $20,000.

Cleveland, O.—It is stated that bids will be asked in about a week by the Bd. Pub. Service for the erection of the West Side Market, plans for which have been prepared by Hubbell & Benes, Citizens Bldg.

Columbus Barracks, O.—Three double sets of officers' quarters, a wagon shed and a storehouse, costing in all about $55,000, it is reported, are to be constructed at this post.

**Cincinnati, O.*—Chas. Rosenstiel, 606 Reading Road, is reported to have secured the conrtact to erect an engine house in Hyde Park at $20,812.

Bids will be received until July 23 by the Bd. of Trus. of the Pub. Library (Robt. H. West, Chmn. Bldg. Com.) for remodeling and erecting an addition to the Public Library. Clarence L. Stanley, Clk.

Toledo, O.—See "Power Plants, Gas and Electricity."

Wyoming, O.—It is stated that plans have been submitted for the 2-story brick town hall which is to be erected at a cost of $15,000. A. A. Taylor, Mayor.

Hamilton, O.—It is stated that bids will be received until July 17 by the Bd. of Infirmary Directors (C. A. Patton, Clk.), for erecting a laundry building at the County Infirmary. Fred. G. Mueller, 704 Rentschler Bldg., is the archt.

Oklahoma City, Okla.—The Baptists are said to be planning the erection of a hospital to cost $100,000.

Philadelphia, Pa.—The Finance Com., it is reported, has approved the appropriation of $250,000 for the erection of a Hospital for the Indigent.

The lowest bid received July 2 by the Light House Engr., at Philadelphia, for constructing a dwelling, barn and oil house at Liston's Front Range Light House, Del., is stated to have been submitted by Warner & Blaire, of Clayton, at $11,600.

Carlisle, Pa.—The Cumberland Co. Bd. of Comrs., according to report, will expend $50,000 improving the court house. Address Co. Aud.

Bishopville, S. C.—Bids will be received July 23 by the Court House Comn. (R. W. McLendon, Chmn.) for erecting a court house, plans for which may be had from Edwards & Walter, Archts., Columbia, S. C., on a deposit of $25. Probable cost, $40,000.

Aberdeen, S. D.—The Trus. of St. Luke's R. C. Hospital, it is reported, will expend $30,000 in improvements.

Pulaski, Tenn.—The Co. Court of Giles Co. July 1 made an additional appropriation of $40,000 to rebuild the court house, recently burned. This made $65,000 appropriated, beside the insurance on the old building.

Burlington, Vt.—The following are the bids opened on June 28 by Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., for a marble cornice at U. S. Post Office and Custom House: Mason & Co., Burlington, $29,400; Richardson & Burgess, Washington, D. C., $35,547; and Fissell & Wagner, New York, N. Y., $35,000.

**Ft. Steilacoom, Wash.*—It is stated that contracts have been awarded as follows for improvements to the insane asylum at Ft. Steilacoom: To Knoell Bros., Tacoma, $9,140 for the erection of a new mortuary and a surgery; also the building of an addition to the laundry, Wm. Purtell, at $22,800; for the steam heating plant of the 2 new buildings and also for the remodeling of the heating plant of the whole institution. Aside from the improvements in the heating plant of the institution, the plumbing is to be repaired and remodeled at a cost of about $7,000. Plans for the erection of a house for the superintendent are being prepared by Proctor & Farrell. Probable cost, $10,000.

**Orting, Wash.*—Contracts for work at the State Soldiers' Home at Orting are reported to have been awarded by the State Bd. of Control at Olympia as follows: To A. E. White, of Seattle, for construction of new hospital, $12,500; to Seattle Heat & Plumbing Co., of Seattle, for remodeling heating, $3,600; for heating new hospital, $2,160, and for installing two new boilers, $2,550.

Spokane, Wash.—It is reported that bids will be received until July 19 by the Co. Comrs. for erecting buildings at the county poor farm for consumptives.

Wales, Wis.—Bids will be received until July 23 by the State Bd. of Control at Madison (M. J. Tappins, Secy.) for erecting a superintendent's residence, laundry, stable and pump house upon the grounds of the Tuberculosis Sanitarium, 2 miles north of the village of Wales. Howland Russell, Archt., Hathaway Bldg., Milwaukee.

Sturgeon Bay, Wis.—Jas. S. Halstead, Co. Clk., writes that contracts for jail and sheriff's residence (bids opened June 15) have been awarded as follows: To J. E. Utke, of Marinette, general construction, $11,050; to Halstead Maples, for heating, $951; C. Norton, for plumbing, $878; and to the Champion Iron Co., Wilmington, O., for steel cages, etc., $3,450.

Racine, Wis.—It is stated that bids will be received until July 20 by the City Clk. for erecting an engine house. P. H. Connolly, Chmn. Bd. Pub. Wks.

**Brandon, Man.*—It is stated that the contract to erect the winter fair and stock pavilion has been awarded to the Brandon Constr. Co. at $24,497.

Calgary, Alta.—Plans for the construction of a modern Hospital, consistiing of a main building, maternity hospital, isolation hospital and a nurses' home, to be constructed of red brick, with stone trimmings, at a cost not to exceed the sum of $140,000 will be received by H. R. Dudley Smith, Secy. Treas., not later than noon of Aug. 1st.

Toronto, Ont.—The Civic Property Com., it is stated, has decided to erect a Hospital for Measles on the grounds of the General Hospital, the cost to be about $40,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Phoenix, Ariz.*—Carl Leonardt, H. W. Hellman Bldgs., Los Angeles, is stated to have secured the contract to erect a 5-story loft and office building to be erected in Phoenix for John Noble at a cost of about $195,000.

**Williams, Ariz.*—The contract to erect a reinforced concrete depot, hotel and round house here for the Atchison, Topeka & Sante Fe R. R. is reported to have been awarded to Carl Leonardt, of Los Angeles, at about $100,000.

San Francisco, Cal.—Chas. M. Belshaw has applied for a permit to erect a 2-story brick building on Beale St., near Howard St., at a cost of $65,000.

The Whitney Estate Co. has applied for a permit to erect an 8-story class A store and office building on Geary and Stockton Sts., to cost $415,000, and Helen Sylvester to erect a $40,000 hotel on Eddy St., near Polk St.

Stockton, Cal.—The Stockton Investment Co., it is stated, intends erecting a tourists' hotel to cost about $500,000.

Denver, Colo.—It is stated that a Masonic Temple is to be erected in Denver at a cost of about $400,000.

The Benedict Warehouse and Transfer Co. is reported to have decided to erect an 8-story concrete warehouse in Denver at a cost of $175,000.

Permits are stated to have been issued as follows for erecting a 4-story building on Wazee and 17th Sts., for Hendrie-Bolthoff Mfg. Co., at a cost of $50,000, and a 2-story warehouse on Wazee and 11th Sts., for the Western Warehouse Co., to cost $10,000.

Jacksonville, Fla.—See "Bridges."

**Tampa, Fla.*—H. L. Parker is reported to have secured the contract to erect a freight depot at Jefferson and Twiggs Sts. for the Tampa Northern R. R. at $22,000.

Bloomington, Ill.—It is stated that as soon as plans have been revised new bids will be asked for the erection of the Y. M. C. A. Bldg.

Chicago, Ill.—The Chicago Telephone Co., Washington and Franklin Sts., it is stated, will erect an op-

**Items marked thus give the names of parties awarded contracts.*

erating building at 87 Franklin St., to cost $300,000.

Huel & Schmid, 163 Randolph St., are reported to be the archts. for the 7-story store and loft building to be erected at Randolph and Jefferson Sts., by Ruprecht & Co., at a cost of $175,000.

It is stated that plans are being prepared for an 8-story building to be erected at 427 Dearborn St. by M. A. Donohue & Co., at a cost of $80,000.

The Steele-Wedeles Co. is reported to have secured a site near Dearborn Ave. on the river front on which it is proposed erecting a 10-story steel constructed building.

It is stated that H. M. Hooker Co. will erect a building on W. Washington and Desplaines Sts. at a cost of about $100,000.

Marshall & Fox, 164 Dearborn St., are reported to have prepared plans for the Steger Piano Bldg., to be erected at Wabash Ave. and Jackson Boule., 18 stories high.

**Granite City, Ill.*—Murphy, Way & Murphy, of East St. Louis, are reported to have secured the contract for erecting a 3story, 237x293 ft., brick opera house and hotel at 19th St. and Niedringhaus Ave., for the General Contr. Co.

**Ft. Wayne, Ind.*—The Fuhrman Bros., it is stated, have been awarded a contract for constructing the new Elks Home at $45,575. The heating and plumbing contracts are yet to be let.

**Frankfort, Ind.*—It is reported that John Paden, Frankfort, has been awarded a contract to construct a 2-story and basement building for the local lodge of Elks. J. F. Johnson & Co., Indianapolis, Archts.

**Indianapolis, Ind.*—The trustees of the Y. M. C. A. reported to be ready to receive bids for the erection of a $100,000 building on Illinois and Ohio Sts. Plans have been approved for an 80x120-ft. building 4 stories high.

**Logansport, Ind.*—Wylie Bros., of Chicago, Ill., it is reported, have secured the contract to erect a theatre here at about $39,000.

Gary, Ind.—E. C. Shankland, of Chicago, Ill., is said to be preparing plans for a theatre to be erected here by Chicago capitalists at a cost of $200,000.

Woodward, Ia.—The members of the Odd Fellows Lodge, it is stated, have accepted plans for a $12,000 theatre and lodge building. Address Secy.

Garden City, Kan.—It is stated that a depot, costing about $25,000, is to be erected here by the Atchison, Topeka & Santa Fe R. R. (C. A. Morse, Ch. Engr, Topeka).

Covington, Ky.—John R. Coppin, of Madison Ave., it is stated, has been granted a permit to erect a 7-story concrete office and store building at 7th and Madison Sts., estimated to cost $80,000.

Baltimore, Md.—It is stated that the Maryland & Pennsylvania R. R. Co. (Thos. M. Ward, Engr.) will expend $100,000 in improvements, including the erection of a passenger station on North Ave.

Athol, Mass.—The erection of a Y. M. C. A. Bldg. to cost about $15,000 is reported under consideration.

Attleboro, Mass.—It is stated that $50,000 is being raised to erect a Y. M. C. A. Bldg., of the amount $25,000 has been secured.

**Grand Rapids, Mich.*—The contract for erecting a 4-story warehouse at Ellsworth Ave. and the Railroad Crossing for the International Harvester Co. is reported to have been awarded to Appleyard, Johnson & Co., Powers Theatre Bldg., for about $40,000.

**Port Huron, Mich.*—The contract to erect the Y. M. C. A. Bldg., it is stated, has been awarded to A. J. Smith & Son, of Port Huron, at about $15,650, not including heating, lighting and plumbing.

Menominee, Mich.—The Menominee Sugar Co., it is stated, will erect a warehouse 24x40 ft. to cost $15,000.

Minneapolis, Minn.—Bertrand & Chamberlin, Bank of Commerce Bldg., are reported to be preparing plans for the 4-story brick and reinforced concrete building, which is to be erected for the Federal Ballot Machine in southeast Minneapolis, at a cost of $50,000.

The following are reported to be the bids received recently for erecting the 15-story building "The Arlington," which is to be erected by J. E. Andrus on 1st Ave. and 5th St.: J. L. Robinson, $288,143; Pike & Cook, $304,467; C. E. Haglin, $304,868; H. N. Leighton Co., $215,469; J. & W. A. Elliott, $344,972. Heating—H. Kelly & Co., $27,412; Kelly & Lamb, $27,777; W. F. Porter & Co., $30,000; Tunstead Heating Co., $37,767. Electrical Work—W. J. Gray & Co., $17,250; Northern Eng. Co., $17,300; Minneapolis Electrical & Constr. Co., $17,950; Minneapolis Electric Motor Co., $18,500. Plumbing—Robt. Simpson, $20,800; Kelly & Lamb, $22,500; H. Kelly & Co., $22,747; Chas. Wilkin & Co., $31,500. Marble Work—Northwestern Mantel Co., $69,925; Grant Marble Co., $72,850. Hardware—Warner Hardware Co., $12,426; W. K. Morison & Co., $13,050; Gardner Hardware Co., $13,700. Ornamental Iron—Flour City Ornamental Iron Works, $29,500. Elevators—Otis Elevator Co., $33,070.

*Wm. C. Whitney, archt., Loan & Trust Bldg., it is stated, reports the contract let to F. G. McMillan, 4 S. E. 5th St., for the 5-story brick boarding house at 915-917 Mary Pl., for the Woman's Christian Assoc., It will be 45x100, steel and fireproof construction, steam heat, and cost $50,000.

Winona, Minn.—The members of the Arlington Club, it is stated, are contemplating the erection of a club house at a cost of $18,000.

**St. Paul, Minn.*—E. J. Daly, 38 W. Lawson St., has secured the contract for erecting a 2-story brick garage and club house on 4th, Cedar and Minnesota Sts., for $25,000.

Coleraine, Minn.—The officials of the Duluth, Missabe & Northern R. R. (H. L. Dresser, Ch. Engr., Duluth), are said to be preparing plans for a brick and stone depot to cost $30,000.

Mankato, Minn.—It is stated that plans are being prepared for a 2-story brick fireproof building 47x120 ft., which Londkammer Bros. & Davidson propose erecting at Hickory and 2d Sts.

Hattiesburg, Miss.—New Orleans & Northwestern Ry. Co. (M. L. Byers, Ch. Engr., M. W., St. Louis, Mo.), is said to be planning to build a $125,000 depot here.

Joplin, Mo.—The Joplin Theatre Co. is reported incorporated with Claude Thornton, Pres., and O. S. Picher, Secy., and a capital of $100,000 for the purpose of erecting a theatre.

Springfield, Mo.—The Missouri Pacific Ry. Co., it is stated, will expend $50,000 building a depot here.

**St. Joseph, Mo.*—The contract for erecting a 3-story street and concrete building at 6th and Felix Sts for Block Bros., is reported to have been awarded to Wm. Mignery.

Kansas City, Mo.—A site is reported to have been purchased on Walnut St. on which Dan Ricksecker intends erecting a 7-story business building.

Billings, Mont.—The erection of a Y. M. C. A. Bldg. to cost about $80,000 is reported under consideration.

Omaha, Neb.—Klaw & Erlanger, of New York, N. Y., are said to have decided to erect a $100,000 theatre here.

Plans for remodeling the store fronts of the Ramge Bldg. and the construction of a 3-story addition of reinforced concrete on the lot east of the building are being prepared by Misener & Baker for G. E. Shukert; probable cost, $35,000, according to reports.

Bids will be received until July 15 for addition to and remodeling of the Merchants' National Bank Building, to cost $50,000. Luther Drake, Pres. J. E. Dietrich, Archt., 528 Paxton Bldg.

Bayonne, N. J.—The members of the Republican Club, Bway. and 29th St. (Alfred H. Phillips, Pres.), it is stated, have authorized plans to be prepared for a new club house to cost about $12,000.

New York, N. Y.—Plans have been filed for two 6-story brick and stone stores and tenements to be erected at Ave. A and 16th St. at a total cost of $100,000 for Saml. Greenstein. Edwd. A. Meyers, 1 Union Sq., is the archt.

Plans have been filed for the erection of the following buildings: 6-story brick and stone store and tenement at 15 Baxter St. for Vito Antonio Comper-Cugo and Andrea Defina, cost $25,000, Chas. M. Straub, archt.; 2 6-story brick and stone stores and tenements at 214 Broome St. for Jacob Levy, cost $70,000, Chas. M. Straub, archt.; 7-story brick and stone stable at 14 Hamilton St. for Jos. Goldfine, cost $50,000, Shampan & Shampan, archts.; 20-story brick and stone office and store building at 15 Maiden Lane for Edward Holbrook, cost $750,000, Clinton and Russell, archts.; 6-story brick and stone store and tenement at Spring and Mott Sts. for Saml. Barkin, cost $60,000, E. A. Meyers, archt.; 3 6-story brick and stone stores and tenements at 1st St. and 1st Ave. for Julius Tishman, cost $150,000, E. A. Meyers, archt.; 6-story brick and stone stores and tenements at 236 W. 10th St. for Jacob Lippman and Saml. Root, cost $60,000, E. A. Meyers, archt.; 11-story brick and stone store and loft building at 33 W. 17th St. for Meteor Realty & Constr. Co., cost $250,000. Schwartz & Gross, archts.; 6-story brick and stone store and tenement at 347 E. 17th St. for Henry Tishman, cost $20,000, E. A. Meyers, archt.; 7-story brick and stone store and loft building at 124 W. 18th St. for Jos. Quinn, cost $40,000, C. A. French, archt.; 6-story brick and stone office building at 46th St. and Bway. for Forty-Sixth St. and Bway. Realty Co., cost $100,000, Herts & Tallant, archts.; 6-story brick and stone stable at 214 W. 65th St. for Danl. McCoy, cost $35,000, Erwin Rossbach, archt.; 3-story brick and stone stores and office building at 217 W. 74th St. for Theresa D. Browning, cost $95,000, Israels-Harder, archts.: 1-story brick and stone stores at 125th St. and St. Nicholas Ave. for F. W. Kinsman, cost $25,000, Geo. N. Griebel, archt.; 1-story brick and stone store building at Amsterdam Ave. and 90th St. for John J. Astor, cost $20,000, Jas. McWaters, archt.; 2-story brick and stone garage and stores for Martha B. Mosher, cost $30,000, Chas. E. Birge, archt.; 3 2-story brick stores at 177 th St. and Park Ave. for Richard Webber, cost $35,000, B. & J. P. Walther, archt.; 6-story brick factory at Robbins Ave. and 140th St. for Martha Strick, cost $60,000, F. Massesins, archt.; alterations to 9-story brick and stone office building at 17 Trinity Pl. for Atlas Line Steamship Co., cost $300,000, R. L. Dans, archt.; 6-story brick and stone stores and tenemts. at 145th St. and 8th Ave. for W. & B. Realty Co., cost $240,000, Saml. Sass, archt.

Plans have been filed for a 5-story and basement clubhouse to be erected at 436 E. 27th St. for the Hudson Guild (Chas. Lieberman, Pres.), at a cost of $60,000. Chas. Volz, 160 5th Ave., is the archt., and for remodeling the 5-story apartment hotel at Lenox Ave. and 113th St., at a cost of $100,000, for the Sphinx Realty Co.

Flushing, L. I., N. Y.—A company is stated to have been formed with Geo. W. Pople, Pres., and J. H. Quinlan, Secy., for the purpose of erecting a business building at Bway and Main St.

Brooklyn, N. Y.—Plans have been filed for the erection of an 8-story brick stable and factory at Grant St. and Manhattan Ave., for J. J. Gorman, cost $95,000. R. T. Rasmussen, Archt.

Ft. Slocum, N. Y.—It is stated that $50,000 has been given to the Y. M. C. A. to erect a building at Ft. Slocum.

Charlotte, N. C.—It is stated that the Trus. of the Y. M. C. A. have accepted plans for a $100,000 building.

Lorain, O.—It is stated that the Odd Fellows of Lorain contemplate erecting a 3-story temple on Duane St. at a cost of $45,000.

Isaac Henecker is reported to have secured a site on which he intends erecting a $60,000 business building.

Cleveland, O.—A new vaudeville theatre, it is stated, will be built in Cleveland this winter by B. F. Keith. The new theatre will have a seating capacity of 2,300, and will cost $500,000.

Oklahoma City, Okla.—R. C. Burnham, of Chicago, Ill., is reported to have been engaged to prepare plans for the steel building which Heber P. Harter intends erecting at Main and Harvey Sts., at a cost of $100,000.

Philadelphia, Pa.—It is stated that bids are wanted for enlarging the Art Club Bldg., at a cost of about $100,000. Newman & Harris, Land Title Bldg., are the archts.

Jas. S. Talley has been granted a permit to make interior and exterior alterations to the Hanover Hotel at 12th and Arch Sts., for the Weightman estate. The work will include the construction of a new entrance and new baths, and the building of a mezzanine floor for a cafe and reading room. The cost will be $40,000.

*Doyle & Co., it is reported, have been awarded the contract for erecting a 5-story, 44x100 ft., restaurant and store building for the Childs Dining Hall Co., at 1000 Market St. The cost will be $100,000. Westervelt & Austin, of New York, N. Y., are the archts.

Pittsburg, Pa.—August Loch is reported to be having plans prepared for a 3-story 20x124 ft. brick store building, which he intends erecting at 817 Federal St.

**Allegheny, Pa.*—Cochran & Davis, 104 Erie St., are reported to have secured the contract to erect the plant for the McKinney Mfg. Co. at a cost of $20,000.

**Florence, S. C.*—The contract for the union station and division headquarters which the Atlantic Coast Line Ry. will build at Florence, according to plans by Leitner & Wilkins, of Wilmington, is stated to have been awarded by E. B. Pleasants, Ch. Engr., Wilmington, to C. L. Johnson, of Florence, at $47,000.

Memphis, Tenn.—Alsup & Woods, Randolph Bldg., are reported to be preparing plans for a building which Saml. Mosby contemplates erecting at Monroe Ave. and S. 2d St., at a cost of about $80,000.

Knoxville, Tenn.—It is reported that bids will be received until Aug. 1, by Richards, McCarty & Bulford, Archts., The Ruggery, Columbus, O., for constructing a 10-story bank and office building, 32x145 ft., for the Knoxville Banking Co. Cost, about $160,000.

Houston, Tex.—The Interstate Amusement Co. (Karl Hodlitzelle, Pres.), it is reported, has accepted plans for a theatre. Bids will be received soon. Estimated cost, $100,000.

**Seattle, Wash.*—P. J. Noonan is stated to have secured the contract to erect a 5-story hotel at 1412 Summit Ave. for C. W. Donaldson at about $44,000.

Spokane, Wash.—It is stated that bids are being received to erect a reinforced concrete block at Post and Sprague Sts. for Col. Peyton according to plans prepared by Sweatt & Wetzel.

The hotel and restaurant men of the city are said to be planning the incorporation of a company with a capital of $100,000 for the purpose of erecting a wholesale house to furnish groceries, fruits, etc. J. S. Lichty, Columbia Blk., may be able to give further information.

Marinette, Wis.—Bids for the erection of a Masonic Temple for the Marinette Masonic Asso., according to plans prepared by Pillsbury & McCracken, of Fond du Lac, will be received by the Bldg. Com. (G. H. Landgraf, Chmn.) up to 12 M. July 15th. Separate proposals must be made for heating, plumbing and wiring.

Superior, Wis.—The Masons are said to be planning the erection of a 2-story temple, and have $10,000 towards the project.

Cheyenne, Wyo.—Harry P. Hynds, it is reported, is planning the erection of a $200,000 hotel.

Toronto, Ont.—The members of the Western District Orange Lodge, it is reported, are having plans prepared for a lodge and store building which they propose erecting at a cost of about $30,000.

Montreal, Que.—Mark Workman is reported to have secured a permit to erect a 6-story building on the site of the Orkney Homestead, at a cost of about $125,000.

Portage la Prairie, Man.—The officials of the Great Northern R. R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), it is reported, are planning the erection of a depot here to cost about $30,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Woodlawn, Ala.—La Belle-Kribs, it is reported, have prepared plans for the Baptist Church which is to be erected in Woodlawn at a cost of about $40,000. Rev. Austin Crouch, pastor.

Fayetteville, Ark.—It is stated that the members of the Baptist Church are planning the erection of an edifice to cost $30,000. Rev. W. A. Whittell, Pastor.

Oakland, Cal.—McCall & Wythe are said to be preparing plans for a 4-story apartment house to be erected at 12th and Jefferson Sts.

Los Angeles, Cal.—Robt. March & Co., it is reported, intend erecting an 11-story apartment house at 609 S. Olive St. to cost about $100,000. Parkinson & Bergstrom are the archts.

New Haven, Conn.—It is reported that arrangements are being made by Fred. D. Grave to erect a $60,007 residence.

Tulsa, Ind. Ter.—The members of the Baptist Church, it is stated, propose erecting a $25,000 edifice.

Ames, Ia.—It is stated that bids will be received until July 30 by A. H. Munn, Chmn. Bldg. Com., for erecting an edifice for the M. E. Church. Brown & Davis, archts., 41 E. 4th St., Cincinnati, O.

Waterloo, Ia.—Clinton P. Shockley, of Waterloo, is stated to have been engaged to prepare plans for the Walnut St. Baptist Church, which is estimated to cost $18,000.

**Concordia, Kan.*—It is reported that the contract to erect a chapel at the Nazareth Convent, has been awarded to the Hayde Contr. Co., of Kansas City, Mo., at about $75,000.

Pittsburg, Kan.—It is reported that bids will be received until July 24 by the Bldg. Com. (Oscar Sharp, Chmn.), for erecting the First Baptist Church.

Owensboro, Ky.—J. C. Taylor is reported to be having plans prepared for a residence to be erected at an estimated cost of $40,000.

**Items marked thus give the names of parties awarded contracts.*

Louisville, Ky. It is reported that the members of the Central Baptist Church are preparing to make improvements to the church, which will cost about $20,000. R. B. Semple is a member of the Bldg. Com.

Fred Erhart is stated to have had plans prepared for a brick and stone 6-story apartment house, which he intends erecting on Eastern Parkway at a cost of $60,000.

**Alexandria, La.* The Bldg. Com. of the First Methodist Church, it is stated, has awarded the contract for erecting the edifice to Louis H. Baldwin, of Alexandria, for $24,200. Clark & Mathews, archts., St. Louis, Mo.

Augusta, Me.—The members of the French R. C. Church are said to be preparing to erect a church at a cost of $60,000. Address, Rev. Arthur A. Hamel, pastor.

Rockville, Md.—It is stated that the members of the Rockville Baptist Church intend erecting an edifice costing about $15,000.

Lawrence, Mass.—The Wood Worsted Co. is to build 42 brick apartment houses in the vicinity of its mill.

Lansing, Mich.—Hildner & Eisen, of Detroit, it is stated, have prepared plans for an edifice to be erected here at a cost of $20,000. Rev. E. W. Spathelf, pastor.

**Grand Rapids, Mich.*—Geo. Vanderveen is reported to have secured the contract to erect an apartment house at Morris Ave. and Cherry St. for Wm. Aldrich Tateum. The building is to be 2½ stories and is estimated to cost $30,000.

Jackson, Mich. Bids will be received until July 29 by White & Hussey, archts., Lansing, for erecting the superstructure of a brick church for the Diamond St. M. E. Church.

Jefferson, Mo.—Jacob Moershel, of St. Louis, it is reported, will erect a modern $25,000 residence in the near future, according to plans prepared by Miller & Opel.

Springfield, Mo.—It is reported that Chas. McGregor is having plans prepared for a residence to cost about $15,000.

Centralia, Mo.—The erection of a $12,000 edifice, it is reported, is contemplated by the members of the First Baptist Church.

Joplin, Mo.—It is reported that the members of the Episcopal Church propose erecting a $20,000 edifice. Rev. C. A. Weed, pastor.

St. Louis, Mo.—Barnett, Haynes & Barnett, Olive and 9th Sts., are reported to have prepared plans for a 3-story, 180x130 ft., apartment house which is to be erected at Mullanphy and 21st Sts. by the Mullanphy Bd. at a cost of about $100,000.

Trenton, N. J.—A. R. Chambers, Jr., it is reported, will erect a brick dwelling to cost $30,000.

East Orange, N. J.—Plans have been drawn for an apartment-house to be built by Braun & Chamberlain in Eaton Place, of brick, 4 stories in height, and estimated to cost $40,000. David Goldsmith, of New York, N. Y., has had plans prepared for an apartment-house which he expects to build at Main and Baldwin Sts. at an approximate cost of $75,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone tenement at Henry and Catherine Sts. for Kotzen Realty Co., cost $50,000, Bernstein & Bernstein, archts.; 5 5-story brick and stone tenements at 519 W. 134th St. for Rosenthal Constr. Co., cost $175,000, F. C. Browne, archt.; 4 5-story brick and stone tenements at Convent Ave. and 129th St. for Golde & Cohen, cost $245,000, Sommerfeld & Steckler, archts.; 5-story brick and stone tenement at Wadsworth Ave. and 179th St. for John E. Berry, cost $65,000, Neville & Bagge, archts.; 5-story brick tenement at Bristow and Jennings Sts. for Bates & Oesting, Jr., cost $35,000, Neville & Bagge, archts.; 2 5-story brick tenements at Bathgate Ave. and 175th St. for Ten Brook & Streeter, cost $50,000, Wm. H. Birkmire, archt.; 5-story brick tenement at Clinton Ave. and 169th St. for S. Denubicibus, cost $30,000, Vincent Bonagur, archt.; 2 6-story brick tenements at Washington Ave. and 175th St. for Albert J. Schwarzler, Archt.; 4 3-story brick tenements at Walton and Burnside Aves. for Miller & Cohen, cost $28,000, Sommerfeld & Steckler, archts.

Plans have been filed for a 12-story, 90x169 ft., apartment house, to be built for the Broadway and Cathedral Parkway Realty Co., at Broadway and 110th St. It is to cost $900,000. The architects are Rouse & Sloane, 11 E. 43d St.

Brooklyn, N. Y.—Walter B. Wills, 32 Ditmars St., is reported to have prepared plans for an edifice, which is to be erected by the congregation of the Union Course Baptist Church, the cost to be about $25,000. Rev. John Donaldson, pastor.

Plans have been filed for the following buildings: 4-story brick tenement, to be erected at Lincoln and Nostrand Aves., at a cost of $20,000 for W. A. A. Brown; Fisenlo & Carlson, 5819 5th Ave., are the archts; 4-story brick tenement to be erected at Washington and Greene Aves., for G. Elliott 44 Court St., at a cost of $50,000; G. A. Skizynecte is the archt.

Fayetteville, N. C.—J. L. Harbin, of Lexington, N. C., is stated to have been engaged to prepare plans for the edifice which the members of the Hay St. Methodist Church propose erecting at a cost of $25,000.

Columbus, O.—J. A. Jones, Brunson Bldg., is stated to be preparing plans for a brick and stone residence to be erected in [illegible] Park at a cost of $25,000.

Cleveland, O.—Bishop Horstmann, it is stated, has approved plans for a $[illegible] parochial residence to be erected in connection with the St. Mary's Church.

Delphos, O.—[illegible] E. Walker of Toledo, it is reported, has completed plans for an edifice to be erected for the members of the First Presbyterian Church at a cost of $18,000. Address [illegible] Bldg. Com.

Portland, Ore.—It is stated that Holzman Bros. propose erecting a [illegible]-story apartment house on 11th and Alder Sts. to cost $75,000.

**Bellevernon, Pa.*—The contract to erect an edifice at State and Market Sts. for the congregation of the M. E. Church, it is stated, has been awarded to the Bellevernon Planing Mill Co., at about $11,000.

Harrisburg, Pa.—It is stated that the Bd. Pub. Grounds and Bldgs. has decided to repair the executive mansion at a cost of about $2[illegible].

*The contract to erect an edifice for the 13th St. Methodist Church, it is stated, has been awarded to the P. W. Finn Contr. Co., of Altoona, at $75,000.

**Allegheny, Pa.*—The contract to erect an edifice for the 11th United Presbyterian Church is reported to have been awarded to Rose & Fisher, 821 Penn Ave. at about $50,000.

Turtle Creek, Pa.—The members of the First Christian Church, according to reports, contemplate erecting a $20,000 edifice.

**Hummelstown, Pa.*—The P. W. Finn Contr. Co., of Altoona, is reported to have secured the contract to erect a church here to cost $35,000.

Philadelphia, Pa.—Milligan & Webber, 520 Walnut St., are reported to be preparing plans for a 4-story brick and stone flat to be erected at 34th and Spring Garden Sts. by Jere L. Creese at a cost of about $150,000, including site.

*It is stated that E. Lawler, of Norristown, has secured the contract for building a church at Norristown for the Rev. Lambert Travi, rector of the R. C. Church of the Holy Saviour. The building will be 50x100 ft., brick, with a slate roof. The church will be named the Church of San Salvatore.

It is stated that a permit has been granted to F. C. Michaelsen, 5140 Wyalusing St., to erect the following dwellings: 52 2-story brick and stone dwellings, 14x34.6 ft. each, on Taylor St., north of Dickinson St.; 44 2-story brick and stone dwellings, 15x38 ft. each, on Tasker St., west of 23d St; 2-story brick and stone dwellings, 16x38 ft., on 24th St., north of Tasker St.; two 2-story brick and stone stores and dwellings, 14x45 ft. ea., at Dickinson and Taylor Sts. and Reed and Taylor Sts.; two 2-story brick and stone stores and dwellings, 15x50 ft. ea., 23d and Tasker Sts.; 2-story brick and stone store and dwelling, 20x50 ft., at 24th and Tasker Sts., and two 2-story brick and stone dwellings, 14x34.6 ft. ea., at Dickinson and Taylor Sts. and Reed and Taylor Sts.; total cost, $170,000.

Pittsburg, Pa.—John McSorley, it is stated, has plans completed for a $75,000 apartment house of fireproof to be erected at South Negley Ave. and Elmer St., East End.

Nashville, Tenn.—The Guarantee Constr. Co. is reported to have secured a site at 20th and West End Aves. on which it is proposed erecting 2 apartment houses to cost $20,000 each.

Memphis, Tenn.—John Gainsford, Randolph Bldg., is reported to have prepared plans for the edifice which the members of the Central Baptist Church propose erecting at a cost of $20,000.

Stephen City, Va.—The Trus. of the Methodist Church South, it is stated, have accepted plans for a brick and stone edifice.

Seattle, Wash.—The Seneca Land Co., it is stated, intends erecting on Madison St. and Summit Ave. a 9-story apartment house to cost about $700,000.

Clarksburg, W. Va.—The members of the Goff M. E. Church, it is stated, are planning the erection of a $60,000 red stone edifice at West Pike and 2d Sts.

Halifax, N. S.—Bids will be received until Aug. 7 by G. E. Nichols, Secy. Com., 48 Granville St., for constructing a stone cathedral church at Halifax.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Jonesboro, Ark.*—McDaniel Bros., of Jonesboro, are reported to have secured the contract to erect a school building in the First Ward at $13,302.

San Francisco, Cal.—The Bd. of Superv. has authorized the following appropriations: For the Bergerot School, $39,000; a new school at Berkshire St. and Lippart Ave., $45,000, and the Oceanside School, $39,000.

Los Angeles, Cal.—P. W. Ehlers, Currier Bldg., is stated, to have prepared plans for a brick high school to be erected in Inglewood at a cost of about $50,000.

**Los Angeles, Cal.*—The Machinery and Electrical Co. have secured the contract to install a heating and ventilating plant in the library building for Claremont College.

**Colorado Springs, Colo.*—Honeyman & Auld, 12 Carpenters' Alley, are reported to have secured the contrat to erect a school in School Dist. No. 12, the cost to be about $18,000.

Washington, D. C.—Bids will be received until Aug. 1 by the Bd. Trus., Reform School, D. C. (Crosby S. Noyes, Pres.), for constructing a family building on grounds of the school. Plans may be obtained from the superintendent of the school on a deposit of $10.

Payette, Idaho.—Bids will be received until Aug. 1 for $15,000 school bonds of Independent School Dist. No. 32. J. C. Woodward, Clk., pro tem. Bd. Trus. of Independent School Dist. No. 32.

Rockford, Ill.—Frank A. Carpenter, Brown Bldg., is stated to have submitted to the Bd. of Educ. preliminary plans for the Nelson School.

Bloomington, Ill.—It is stated that the $70,000 necessary in order to secure $30,000 from Andrew Carnegie for a new building for Wesleyan Univ. has been secured.

Lebanon, Ind.—It is stated that S. W. Wiley, Trus. of Harrison Township, Boone County, will receive bids until July 19, for the construction of a new school.

Evansville, Ind.—L. Wenisheimer, Trus. of Knight Township, will, it is reported, receive bids until July 23d. for the construction of a large brick school in Dist. No. 7.

Indianapolis, Ind.—Bids will be received until July 23 by the Bd. of School Comrs. (John E. Cleland, Bus. Director) for excavation, aleration and repairs to school No. 17 and for furnishing material and installing a heating system in said school.

Oelwein, Ia.—Bids will be received until July 29 by A. L. Hunter, Secy. School Bd., for installing a heating plant in the Central School. Two tubular boilers will be required.

**Newton, Ia.*—It is reported that the contract to erect a school not including heating, plumbing and electric fixtures, has been awarded to Loomis Bros., of Cedar Rapids, at about $44,975.

Lawrence, Kan.—The Bd. of Regents of the Univ. of Kansas is said to be planning the erection of buildings at a cost of $200,000 including an engineering building.

Emporia, Kan. It is reported that bids will be received until July 27 by the Clk. of Bd. of Normal School Regents, at Emporia, for erecting branch normal schools at Hays and Pittsburg. It is stated that about $200,000 will be expended in construction and equipment.

**Covington, Ky.*—Contracts for erecting a school at 19th and Mary Sts. are reported to have been awarded as follows: Excavating and masonry, Carl Bros., Cincinnati, O., $6,756; brick work, Kieley & McDermott, $12,714; concrete, Ferro-Concrete Constr. Co., Cincinnati, O., $14,897; mill work, J. A. Brownfield, $746; carpenter work, Jos. Wilbers, 843 Perry St., $4,922; iron work, L. Schreiber Sons & Co., $4,065; plumbing, Geo. Balme, $850; tile roofing and copper work, C. F. Rasch & Sons, $10,322; cut stone work, Enterprise Stone & Granite Co., $5,630; painting, H. Hengehold, $50; total, $60,952.

New Orleans, La.—The Police and Pub. Bldg. Com. is stated to have approved the plans for the school to be erected in the square bounded by Felicity, St. Mary, Chippewa and Annunciation Sts.

Whitecastle, La.—The contract to erect the high school, it is stated, has been awarded to Augustus Barbay, of Whitecastle, at about $20,000.

Cumberland, Md.—A. F. Witherow & Co., of Charleston, W. Va., are reported to have the contract to erect 2 schools at $85,250, exclusive of heating and plumbing. The bond issue of $60,000 was voted affirmatively.

Baltimore, Md.—It is stated that the Univ. of Maryland has been authorized to issue $15,000 bonds to erect an addition to the Law School.

Fall River, Mass.—The erection of a $70,000 school at Spring and Canal Sts., it is reported, is contemplated.

Haverhill, Mass.—School bonds amounting to $49,000 are reported sold.

Melrose, Mass.—The Bd. of Aldermen has voted to appropriate $75,000 to build a 12-room addition to the present high school.

Amherst, Mass.—The plans for the $100,000 Carnegie laboratory building to be erected at Amherst College are reported to be nearly completed and will soon be ready to submit to contractors for bids.

Kalamazoo, Mich.—Bids will be received until July 30 by the State Bd. Educ. (Luther L. Wright, Secy., Lansing), for erecting an addition to the main building of the Western State Normal School, at Kalamazoo, to connect with the new gymnasium. E. W. Arnold, archt., 278 Garfield Ave., Battle Creek.

Detroit, Mich.—Bids will be received until July 16 by the Bd. Educ. (Wm. J. Lee, Secy.), for furnishing material and erecting an addition to the Western High School, Scotten Ave. near Baker St.; also a 4-room addition to the Field School, Field and Agnes Aves.

Stambaugh, Mich.—It is reported that bids will be received until July 20 by T. Gaastra, archt., Kenosha, Wis., for erecting a 3-story school to cost about $11,000. E. E. Allen, Secy. Bd. Educ.

Charlotte, Mich.—It is stated that it has been decided to erect a 4-room addition to the Hawthorne School.

Sault Ste Marie, Mich.—The School Bd. is said to be contemplating the erection of an addition to the High School for a technical department.

Henning, Minn.—It is stated that bids will be received until July 17 by the Bd. of Educ. for installing a ventilating and heating plant and plumbing in new school.

Kansas City, Mo.—It is proposed to erect an addition to the Kansas City Veterinary College, at 1420 Lydia Ave., at a cost of $12,000.

The Sisters of St. Joseph, it is reported, have announced that plans have been practically completed for the South Side College for girls, which will cost, including site, about $200,000.

Helena, Mont.—The citizens are stated to have voted in favor of issuing bonds to erect a central heating plant for the Central and High schools, the public library and auditorium.

Billings, Mont.—Plans are being considered by the School Bd. for a 2-story industrial building to be erected near the present high school building on 4th Ave. north; probable cost, $35,000.

**Butte, Mont.*—The following are reported to be the bids received June 18 for installing a heating plant and for plumbing work in the new industrial school: Walter Forbes, $17,500; I. Krueger, $16,084; Eschle Plumbing & Htg. Co., 51 E. Bway., $14,778 (awarded contract).

*Chas. Goddard, 643 S. Main St., is stated to have secured the contract to erect an additional story to the Emerson School at $10,500.

Helena, Mont.—Bids will be received by Thos. E. Goodwin, Clk. Bd. of Trustees of School Dist. No. 1, 43 Bailey Blk., until July 22, for the purchase of $26,000 school bonds.

Durham, N. H.—Bids will be received until July 20 by the Bldg. Com. of the Bd. of Trus. of New Hampshire College (John G. Tallant, Chmn.) for erecting a dormitory.

Bayonne, N. J.—The lowest bids received for erecting school No. 9, it is stated, were as follows: Construction, the O'Leary Co., $108,000 (not including fence); Calumet Constr. Co., $114,000 (including fence); ventilating and heating, J. J. McLaughlin Co., $16,468; plumbing, Jehning & Peters, $9,679.

Newark, N. J. It is stated that the Lincoln School, which is to be erected on Richelieu Terrace, is to cost about $80,000, according to plans prepared by Louis J. O'Rourke, Scheurer Bldg.

**New York, N. Y.*—The following are the bids opened on July 8 by C. B. Snyder, Supt. School Bldgs., for installing, ventilating and heating apparatus in School 43, Boro. of Bronx. Danl. J. Rice, 5 E. 42d St., $42,000 (awarded contract); Frank Dobson Co., Inc., $44,458; Blake & Williams, $45,282; Baker, Smith & Co., $45,789; E. Rutzler Co., 45,342, and Baldwin Eng. Co., $48,150.

Bids will be received until July 22 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of additions to and alterations in School 4, Boro. of Manhattan; alterations, repairs, etc., to Public School 100, Truant School and Manual Training High School, Boro. of Brooklyn; installing ventilating and heating apparatus in New School 12, Boro of Manhattan; new school 88, Fresh Pond, Boro. of Queens; additions and alterations to the ventilating and heating apparatus in School 35 and School 54, Boro. of Brooklyn; heating repairs, etc., in Schools 7, 44, 47 and 72, Boro. of Queens.

Geneva, N. Y. The Bd. of Trus. of Hobart College, it is stated, are considering the erecting of a private heating plant to heat all the buildings at the college. Probable cost, $25,000 to $40,000.

**Items marked thus give the names of parties awarded contracts.*

Lockport, N. Y.—E. E. Joralemon, of Niagara Falls, it is stated, has been engaged to prepare plans for a high school to be erected to replace the school which was destroyed by fire.

Buffalo, N. Y.—Bids will be received until July 19 by Francis G. Ward, Comr. Pub. Wks., for ventilating, heating, etc., a 6-room brick addition to school in Dist. No. 54 on Main St.

Carthage, N. C.—Bids will be received until July 18 by C. S. Brewer, Clk. Bd. Educ., for $10,000 bonds, issued for the purpose of erecting a graded school.

**Rugby, N. D.*—It is stated that Peter Larson, of Rugby, has secured the contract to erect a school at $10,447.

Kenmare, N. D.—The plans of Frost & Hosmer, of Minot, are reported to have been accepted for the 2-story school which it is proposed erecting at a cost of $20,000.

Melville, N. D.—Bids will be received until July 29 by Phillip Wiseman, Clk. Bd. Trus., for erecting a school, also for heating same. Hancock Bros., of Fargo, are the archts.

Cleveland, O.—Bids will be received until Aug. 5 by the Clk. of the Bd. of Educ. for furnishing material and erecting a school at E. 55th St. and Scoville Ave. S., known as the Technical High School. Bids are to be submitted on the labor and material separately, and to be on the following: Mason work, cut stone, terra cotta, carpenter work, fireproofing, metal studding, furring and lathing, plastering, cement, asphalt and granite work, structural iron and steel, sheet metal, tile roofing and composition roofing. Probable cost $250,000. Chas. Orr, Diir. of Schools.

Wapakoneta, O.—Bids will be received by the Bd. of Educ. (J. O. Pepple, Clk.), until July 18 for furnishing material and erecting a 2-story and basement brick and stone high school. Bids to be submitted separately on plumbing and steam heating, steam blast system with automatic regulation. Plans and specifications may be had upon a deposit of $25.

Cridersville, O.—It is reported that $15,000 school bonds have been sold.

**Nelsonville, O.*—Henry Karg, Westerville, it is stated, has been awarded the contract to erect the $40,000 high school.

Columbus, O.—Bids will be received until Aug. 6 by the Bd. Trus. of the Ohio State Univ. at Columbus (Carl E. Steeb, Secy.) for furnishing material and erecting a woman's dormitory at the Univ.

**Glendale, O.*—G. B. Taylor, Clk. Bd. Educ., writes that the contract for installing ventilating and heating system in Glendale school (bids opened July 3) has been awarded to the Peck-Williamson Htg. & Ventilating Co., of Cincinnati, for $2,988.

Cincinnati, O.—The bids received July 8 by Bd. Educ. for erecting the Hughes High School are stated to have been as follows: L. P. Hazen & Co.'s bid was $720,000; the Noel Construction Co., $711,870; Michael Heintz, $678,092.

Lakewood, O.—Bids will be received until Aug. 9 by the Bd. of Educ. (J. O. Gordon, Clk.), for furnishing material and erecting a school on Elbur Ave. Bids on material and labor and also on each branch of the work are to be stated separately. L. W. Thomas, Archt., 942 Prospect Ave., S. E., Cleveland.

New Castle, Pa.—Helen L. Moseley, Clk. School Bd., writes with regard to high school that architects are to present plans to the Board about the middle of this month.

De Haven, Pa.—Bids will be received until July 25 by School Bd. of Ross Township, care Wm. McIntyre, Secy., R. F. D. No. 2, De Haven, for erecting 2 schools.

South Boston, Va.—Bids will be received until July 16 for erecting a brick school. For information address H. J. Watkins, Clk. South Boston.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Des Moines, Ia.—The City Council has granted the Engle Crematory Co. a 15-yr. franchise to collect dead animals, garbage and waste matter from streets and public properties. The company may also conduct a rendering and desiccating works and has the right to collect garbage and dead animals from private individuals.

Brooklyn, N. Y.—We are informed that no bids were received on July 9 at the office of Dr. Walter Bensel, Street Cleaning Comr., N. Y. City, for furnishing all labor and material required for final disposition of all ashes, street sweepings and rubbish in Brooklyn Boro. The contract is now held by the Brooklyn Rapid Transit Co. and it will expire Oct. 28.

Cincinnati, O.—It is reported that bids will be received July 18 for the purchase of $30,000 refuse disposal bonds. W. C. Culkins, City Aud.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Gadsden, Ala.—The Southern Steel Co. (E. T. Schuler, Vice-Pres.), is reported to have decided to erect at the steel plant at Gadsden a forging plant. The new plant will turn out between 50 and 60 tons of finished car axles per day, and will employ from 150 to 200 men.

Oakland, Cal.—The Oakland Cotton Mills is reported incorporated with W. F. Doig, Secy. and Mgr., for the purpose of erecting a cotton mill on High St.

Bartow, Fla.—Armour & Co., it is reported, will erect a large phosphate plant near here in the near future.

**Columbus, Ga.*—C. F. Binder & Bro., of Atlanta Ave., reported to have secured the contract to erect the plant for the Georgia Fertilizer Wks. at Columbus. The total cost of the plant is reported to be about $250,000.

Chicago, Ill.—Carl Metzger, general sales manager of the Woods Electric Co., is reported to have announced that that concern is about to erect a new $300,000 plant.

**Streator, Ill.*—Cutshall & Flagg, of Brazil, Ind., are reported to have secured the contract to erect an $80,000 sewer pipe factory here for the National Drain Tile Co., of Terre Haute, Ind.

Plymouth, Ind.—The Plymouth Grain Co. is reported incorporated to construct a large elevator and flour mill here. H. A. Shambaugh, Pres.; F. A. Bosworth, Secy.

Armourdale, Kans.—The Geo. B. Swift Co., 905 Security Bldg., is reported to have secured the general contract for the erection of several buildings in connection with the shops of the Chicago, Rock Island & Pacific Ry. Co., at this place. Estimate cost $125,000.

Chicopee, Mass.—It is reported that plans have been prepared for a machine shop to be erected in Chicopee for the Page-Storms Drop Forge Co. It will be a 15nx 50-ft. brick, steel and concrete structure, 2 stories and basement. There will also be a steel shed, 72x40 ft.; annealing building, 65x30 ft.; engine house, 72x40 ft., and drop forge shop, 70x200 ft.

Virginia, Minn.—The Virginia Brewing Co., it is stated, will erect an addition to their brewery at a cost of $50,000.

Columbus, Miss.—The erection of machine shops and roundhouse for the Southern Ry. (W. H. Wells, Engr. Constr., Washington, D. C.), is reported in contemplation, bids for the construction of the buildings, it is stated, having been invited. The buildings nclude a 10-stall roundhouse and modern machine shops, and when completed will have cost about $20,000.

St. Louis, Mo.—The Trinidad Asphalt Mfg. Co., it is reported, intends erecting on the Rankin Ave. site a roofing plant to cost $75,000.

It is reported thot the Continenal Portland Cement Co. has been incorporated with $3,500,000 capital, and David M. Marks, Pres., and Dwight Harrison, Secy., and intends erecting a plant 3 miles south of St. Louis, to have a daily capacity of 3,000 bbls.

It is stated that the Compressed Air & Vacuum Machinery Co. (John S. Thurman, Pres.) intend constructing a manufacturing plant, to cost $200,000, on Jefferson and Lafayette Aves.

The Compressed Air—Vacuum Machinery Co. (ohn S. Thurman, Pres. & Gen. Mgr.), it is reported, has secured a site on Lafayette and Jefferson Aves., on which it is proposed erecting a $200,000 plant for the manufacture of housecleaning apparatus.

Newark, N. J.—The plants of the Consolidated Color & Chemical Co. and the Slip Not Hardware Co. on the Passaic River, near Dock and Brown Sts., are reported to have been destroyed by fire.

Cincinnati, O.—It is stated that a foundry is to be erected by the J. A. Fay & Eagan Co. (Thos. P. Eagan, Pres.) in Bond Hill for the manufacture of all castings used in the making of wood-working machinery.

Youngstown, O.—Improvements costing from $60,000 to $70,000, it is stated, are planned for the Oak St. plant of the United Engineering & Foundry Co. (Chas. Booth, Local Gen. Mgr.). The three 20-ton open hearth furnaces and an addition to the machine shop, according to reports, will be built. A roll casting shop just completed will be equipped with new machinery.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—The following are the bids opened on June 28 by Maj. H. Jervey, Corps Engrs., for dredging in harbor at Mobile about 4,000,000 cu. yds. price given per cu. yd.): Geo. G. Barker, Wilmington, Del., 10 cts. and 7.5 cts. (recommended for award); Southern Dredging Co., Mobile, 10 cts., and John Anderson, Gulfport, Miss., 10.75 cts.

West Memphis, Ark.—Bids were opened on June 26 by the St. Francis Levee Bd. at West Memphis, for levee work aggregating about 1,330,000 cu. yds., and the following are reported to be the lowest bids received: R. L. Leonard, 301,000 yds., bet. Bradley and Mound City, Ark., 32 cts. per yd.; Roach & Stansell, 237,700 yds., bet. Mound City, Ark., and the Choctaw R. R., 29.7 cts. per yd.; R. L. Cheshire, 250,000 yds. at Seyppel, Ark., 18.94 cts. per yd.; R. L. Leonard, 90,000 yds. at Bledsoe, Ark., 24 cts. per yd., and 79,500 yds. below Whitehall, Ark., at 25 cts. per yd.

*We are informed that the only portion of the above work let, was that of the 250,000 cu. yds. levee enlargement to R. L. Cheshire, of Nodena, at 18.94 cts. per cu. yd. The balance of the work was not let on account of high price and no available forces. B. G. Covington is Ch. Engr., St. Francis Levee Bd., 168 Randolph Bldg., Memphis, Tenn.

Angel Island, Cal.—Bids will be received at office of the uartermaster, Depot of Recruits and Casuals, Angel Island, Cal., until July 19, for furnishing material and making repairs to wharf of iron standard piles at that post. John L. Clem, Ch. Q. M.

Norwalk, Conn.—Bids will be received by Maj. Harry Taylor, Corps. Engrs., U. S. A., New London, until Aug. 12 for dredging in Norwalk harbor, as advertised in The Engineering Record.

Wilmington, Del.—The lowest bid opened on June 26 by Maj. C. A. F. Flagler, Corps. Engrs., U. S. A., Wilmington, for dredging Cobansey River, N. J., was submitted by the Bowers Hydraulic Dredging Co., of Camden, N. J., at 29.9 cts. per cu. yd.

**Macon, Ga.*—The Otis Elevator Co., of New York, N. Y., has secured the contract for installing elevator in U. S. Post Office (bids opened June 14) for $5,585.

Rock Island, Ill.—Bids will be received for dredging ditches in Sub. Dist. No. 1, Rock Island County, on July 18., about 63,360 cub. yds. Engineer, Wallace Treichler, of Rock Island.

**Laporte, Ind.*—Luce & Gidley are reported to have secured contract for construction of a ditch in Porter and Lake counties. The ditch will be 40 ft. wide at the starting point. The contractors are reported to be in the market for ditching machinery.

Conway, Ia.—W. B. Hazer, of St. Joseph, Mo., has been selected to make survey and establish a grade system for Conway.

Pocahontas, Ia.—Bids will be received until Aug. 6 by J. A. Terry, Co. Aud., Pocahontas, for furnishing material and constructing the drainage improvement of Drainage Improv. Dist. No. 13, Pocahontas Co., approximately 5 miles of open ditch containing about 97,000 cu. yds. and about 9½ miles of open ditch from 6 to 20-in. in diam.

Portland, Me.—The following are the bids opened on June 29 by Maj. Geo. A. Zinn, Corps. Engrs., U. S. A., for rock excav. in Sasanoa River, about 2,800 cu. yds. (price given per cu. yd.): Simon J. Donovan, Winthrop, Mass., $16.90; Frank W. Carlton, Bath, $9.50; John H. Gerrish, Boston, Mass., $14, and Johnston & Virden, Lewes, Del., $16.35.

**Baltimore, Md.*—The following are the bids opened on June 3 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., for dredging harbors and rivers on east shore of Chesapeake Bay, about 675,037 cu. yds.: Maryland Dredging & Constr. Co., Baltimore, 19 cts. (awarded contract); Chas. P. Greim, Philadelphia, Pa., 21.5 cts.; River & Harbor Improv. Co., Philadelphia, Pa., 21 cts.; Norfolk Dredging Co., Norfolk, Va., 22 cts.; and L. M. Lewis, Norfolk, Va., 21 cts. The Maryland Dredging Co. also submited a bid, same time and place, for dredging Curtis Bay and Spring Garden, Southwest Baltimore, in all 56,250 cu. yds., at 16 cts. per cu. yd.

The following are the bids opened on July 1 at the office of the U. S. Engineer for widening and deepening ship channel: *a*, 8,516,470 cu. yds. soft mud; *b*, 508,348 cu. yds. sand and clay; *c*, 1,621,125 cu. yds. hard sand and stone. Maryland Dredging & Contr. Co., Baltimore, *a*, 8.5 cts.; *b*, 20 cts.; *c*, 23 cts. American Dredging Co., Philadelphia, Pa., *a*, 9.75 cts.; *b*, 23 cts.; *c*, 29 cts. Morris & Cummings Co., New York, N. Y., *a*, 10 cts. Coastwise Dredging Co., Norfolk, Va., *a*, 9.3 cts.; *c*, 25.3 cts.

The Bd. of Awards is reported to have approved the specifications prepared by Harbor Engr. Lackey for deepening the channel leading up to pier of the Baltimore Copper Wks., at Canton.

Bids will be received until July 17 by the Bd. of Awards (J. Barry Mahool, Pres.), for dredging. O. F. Lackey, Harbor Engr.

Ft. Heath, Winthrop, Mass.—The following are the bids opened on June 15 by Maj. Edw. Burr, Corps. Engrs., U. S. A., Boston, for building riprap wall at Ft. Heath: (*a*) Stone in place in riprap, including stone fill and paving, per ton of 2,000 lbs.; (*b*) earth grading and fill, per lin. ft.: John Cashman, Quincy, *a* $3, *b* $5; John B. Graham, Charlestown, *a* $3.54, *b* $1.50; Sylvester I. Hill, Chabeague Island, Me., *a* $3.73, *b* $4.89.

Charlestown (Boston), Mass.—Engr. Geo. P. Carver, 53 State St., Boston, writes that bids will be received until July 25 for the construction of a reinforced concrete coal pocket in Charlestown. Plans and specifications are now ready.

Redwood Falls, Minn.—It is stated that bids will be received until July 18 by L. P. Larson, Co. Aud., for digging and constructing Ditch No. 3.

St. Paul, Minn.—See "Sewerage and Sewage Disposals."

St. Paul, Minn.—Bids will be received until July 27 by Edwd. G. Krabmer, Co. Aud., for digging and constructing Ditch No. 5, estimated to cost $2,277.

Elizabeth, N. J.—W. H. Luster, Jr., City Engr., writes that bids will be received on Aug. 1 by John Kenah, City Clk., for constructing pier, dock and crib; probable cost, $40,000.

Atlantic City, N. J.—Press reports state that Carrere & Hastings, of New York, N. Y., have completed plans for the beautifying of Atlantic City. There are reported to be four divisions of the plans as prepared. The first of these is the development of a civic centre. It is proposed to establish a large square, bounded by Atlantic and Arctic, Tennessee and North Carolina Aves., the new station of the Pennsylvania R. R. to be on one side, a new city hall on the other, and smaller municipal buildings around these; next in importance is the drainage canal, which has been authorized by City Council. In the development of the boardwalk it is proposed to follow the present lines, but to carry the ocean side on arches of concrete, to introduce proper electric lighting and to construct for the convenience of visitors, pavilions and shelters.

New York, N. Y.—Bids will be received July 19 by J. A. Bensel, Comr. of Docks, for contract 1054.—Furnishing material and for preparing for and building freight sheds on piers Nos. 54 and 56, North River, between foot of Little W. 12th and W. 14th Sts., on Chelsea section, with lateral extensions on adjacent bulkhead platforms. Security required $232,000.

Brooklyn, N. Y.—Bids will be received until July 25 by the Comrs. of Parks, N. Y. City (Moses Herrman, Pres.),, for furnishing and delivering limestone and limestone screenings in parks in the horoughs of Brooklyn and Queens.

Oyster Bay, L. I., N. Y.—Bids will be received until July 22 by the Bd. of Superv. (address to Wm. E. Luyster, Clk. Bd. Superv., Mineola) for constructing a sea wall along the harbor or east side of the West Shore Road, in Oyster Bay.

Rochester, N. Y.—Bids will be received until July 22 by Rich'd Gardiner, Purchasing Agt. of Monroe County, at Rochester, for furnishing the following materials: 16 M ft. B. M. of lumber, 50,900 lbs. of deformed steel bars, 3,806 lbs. of 3-in. "I" beams, 400 lbs. of bent steel bolts, 508 cu. yds. of broken stones, 254 cu. yds. of sand, 740 bbls. of Portland cement. Also for furnishing pipes, valves and fittings, and doing the necessary work for putting steam and hot water pipes in tunnels to be built at county buildings, and covering same with a bent nonconductor, 720 ft. of 5-in., 418 ft. of 3½-in., 3,528 ft. of 2-in. pipe.

Albany, N. Y.—Bids will be received until July 31 by F. C. Stevens, Supt. Pub. Wks., for improving the New York State canals as follows: Contract No. 12, Erie Canal, Secs. 6 and 7; Contract No. 14, Erie Canal, Secs. 1, 2 and 3; Contract 35, Oswego Canal, Sec. 1.

Panama.—Bids will be received until July 22 by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comm., for furnishing swivels, chain, wire rope, differential blocks, belve hammer, etc.

Racine, Wis.—It is stated that bids will be received until July 20 by the City Clk. for building 200 ft. of lake shore protection. P. H. Connolly, Chmn. Bd. Pub. Wks.

PROPOSALS OPEN.

For Proposals see Pages 74, 75, 76, 78 and 79.

WATER.

Bids Close.		See Eng. Record.
Jul. 15.	**Laying pipe, Elizabeth, N. J.** Adv. Jul. 6, 13.	**Jul. 6**
Jul. 16.	**System, Sayre, Okla.**	**Jun. 22**
Jul. 16.	**Water works, Comfrey, Minn**	**Jun. 29**
Jul. 16.	Mains, New York, N. Y.	Jul. 13
Jul. 16.	Water works material, Eufaula, I. T.	Jul. 13
Jul. 18.	Pumps, etc., Commerce, Tex.	Jul. 13
Jul. 18.	Foundation for pumping station, Buffalo, N. Y.	Jul. 13
Jul. 18.	Chimney, well, etc., Hamilton, O. Adv. Jul. 13.	Jul. 13
Jul. 20.	**Reservoir dam, St. Paul, Minn** Adv. Jun. 29 to Jul. 13.	**Jun. 29**
Jul. 20.	Water works, Chesterton, Ind. Adv. Jul. 13.	Jul. 13

* *Items marked thus give the names of parties awarded contracts.*

Jul. 22. Filter plant, Burlington, Vt.........Jul. 6
Adv. Jul. 6, 13.
Jul. 22. Mains, Randolph, Neb...................Jul. 6
Jul. 22. Water main at school, Flushing, L. I., N. Y. ....Jul. 13
Jul. 21. Pipe, Irvington, N. Y......................Jul. 13
Jul. 20. Water works, Decatur, Ill. ....Jul. 13
Jul. 20. Filters, West Point, N. Y. Adv. Jul. 13.Jul. 13
Jul. 31. Water wks., North Battleford, Sask....Jun. 22
Aug. 1. Water works, Graham, Tex. ....Jul. 13
Aug. 1. Mains, Jamestown, N. Y..................Jul. 13
Adv. Jul. 13.
Aug. 5. Pump engine for sale, Sandusky, O..Jul. 6
Adv. Jul. 6, 13.
Aug. 5. Reservoir, etc., Ft. Adams, R. I.........Jul. 13
Adv. Jul. 13.
Aug. 6. Dams, New York, N. Y..................Jul. 6
Adv. Jul. 6, 13.
Aug. 9. Filtration plant, Ft. Hancock, N. J....Jul. 13
Adv. Jul. 13.
Aug. 19. Filter plans, Sacramento, Cal...........Jun. 1
Adv. Jun. 1 to 15.
Aug. —. Water wks., Rockingham, N. C......June. 29
Sep. 4. Hauling and laying pipe, New Orleans, La. Adv. Jun. 29 to Jul. 13.........Jun. 29
——— Laying pipe, Hoosick Falls, N. Y....May 1.
——— Water wks., West Newton, Pa. ....May 18
——— System, Sherrard, Ill....................Jun. 29
——— Pump station, Poteau, Ind. Ter........Jul. 13

SEWERAGE AND SEWAGE DISPOSAL.

Jul. 15. Washington, D. C. ....Jul. 13
Jul. 16. Torrington, Conn. ....Jun. 29
Adv. Jun. 29 to Jul. 13.
Jul. 16. Cleveland Heights, O. ....Jul. 6
Jul. 16. Milwaukee, Wis. ....Jul. 13
Jul. 16. New York, N. Y............................Jul. 6
Jul. 16. Trenton, N. J. ....Jul. 13
Jul. 16. Greenville, Pa. ....Jul. 13
Jul. 16. Toronto, Ont. ....Jul. 13
Jul. 16. McKees Rocks, Pa. ....Jul. 13
Jul. 16. Medina, O. ....Jul. 13
Adv. Jul. 13.
Jul. 16. Canton, Miss. ....Jul. 13
Jul. 17. Iron River, Mich. Adv. Jul. 6, 13....Jul. 6
Jul. 17. Salem, Ore. Adv. Jul. 13...............Jul. 13
Jul. 17. Amsterdam, N. Y. ....Jul. 13
Jul. 18. Ames, Ia. ....Jul. 13
Jul. 18. Newark, N. J. ....Jul. 13
Jul. 18. Woonsocket, R. I. Adv. Jul. 13........Jul. 13
Jul. 18. Kansas City, Mo.............................Jul. 13
Jul. 19. Troy, N. Y. ....Jul. 13
Jul. 19. Spencer, Ia. ....Jul. 13
Jul. 19. Bucyrus, O. ....Jul. 13
Jul. 19. Youngstown, O. ....Jul. 13
Jul. 19. Waukegan, Ill. ....Jul. 13
Jul. 20. Pensacola, Fla. ....Jun. 29
Jul. 20. Oshkosh, Wis. ....Jul. 6
Jul. 20. Waterton, Wis. ....Jul. 13
Jul. 20. Racine, Wis. ....Jul. 13
Jul. 22. Willoughby, O. ....Jun. 22
Jul. 22. Philadelphia, Pa. Adv. Jul. 6, 13....Jul. 6
Jul. 22. Cordele, Ga. ....Jul. 13
Jul. 22. San Jose, Cal. ....Jul. 13
Jul. 23. Virginia, Minn. ....Jul. 13
Jul. 24. Henderson, N. C. ....Jul. 13
Jul. 24. Aberdeen, Wash. ....Jul. 13
Jul. 24. Oakland, Cal. ....Jul. 13
Jul. 25. Frankfort, Ind. ....Jun. 29
Jul. 31. North Battleford, Sask. ....Jun. 22
Jul. 31. Eureka, Kan. ....Jul. 6
Jul. —. Brazil, Ind. ....Jun. 1
Jul. —. Belleville, Ill. ....Jun. 15
Aug. 1. Marshfield, Wis. ....Jul. 6
Aug. 3. New Bremen, O. Adv. Jul. 13.........Jul. 13
Aug. 5. Olympia, Wash. Adv. Jul. 6, 13......Jul. 6
Aug. 5. Plainfield, N. J. (2 prop.)..............Jul. 13
Adv. Jul. 13.
Aug. 5. Columbus, Ind. ....Jul. 13
Aug. 6. Alexandria, La. ....Jun. 29
Adv. Jun. 26 to Jul. 13.
Aug. 8. Bloomfield, Ind. Adv. Jul. 13..........Jul. 13
Aug. —. Rockingham, N. C..........................Jun. 29
Sep. 1. Eatonton, Ga. ....Apr. 19
Sep. 1. Alton, Ill. ....Jun. 8
Sep. 11. New Orleans, La. Adv. Jul. 6, 13....Jul. 6

BRIDGES.

Jul. 16. Toronto, Ont. Adv. Jun. 1 to Jul. 13..Jun. 1
Jul. 16. Lincoln, Kan. ....Jul. 6
Jul. 16. Hackensack, N. J...............................Jul. 6
Jul. 16. Sandusky, O. ....Jul. 13
Jul. 16. Kaukauna, Wis. ....Jul. 13
Jul. 16. Memphis, Tenn. ....Jul. 13
Jul. 16. Mt. Gilead, O. ....Jul. 13
Jul. 17. New Winchester, O. ....Jul. 13
Jul. 17. Pittsfield, Mass. ....Jul. 13
Jul. 18. Wilkesbarre, Pa. ....Jul. 13
Jul. 18. Kittaning, Pa. ....Jul. 13
Jul. 18. Nelsonville, R. I. ....Jul. 13
Jul. 19. Ft. Snelling, Minn............................Jun. 15
Adv. Jun. 15 to 29, Jul. 13.
Jul. 19. New Castle, Pa. ....Jul. 13
Jul. 20. San Juan, P. R...................................Jun. 8
Jul. 20. Culpeper, Va. Adv. Jun. 22, 29........Jun. 22
Jul. 20. Wawansea, Man. ....Jul. 13
Jul. 22. San Jose, Cal. ....Jul. 13
Jul. 22. St. Clairsville, O. ....Jul. 13
Jul. 23. Columbia City, Ind...........................Jul. 6
Jul. 23. New York, N. Y. ....Jul. 13
Jul. 27. Cleveland, O. ....Jul. 13
Jul. 27. Elberton, Ga. ....Jul. 13
Jul. 29. Wichita, Kan. ....Jul. 13
Jul. 29. Chardon, O. ....Jul. 13
Jul. 31. Hattiesburg, Miss. ....Jul. 13
Aug. 1. Columbus, O. ....Jul. 13

PAVING AND ROAD MAKING.

Jul. 15. Jersey City, N. J.............................Jul. 13
Jul. 16. New York, N. Y..................................Jul. 6
Jul. 16. Cleveland Heights, O.......................Jun. 22
Jul. 16. Snohomish, Wash. ....Jun. 22
Jul. 16. Chardon, O. ....Jun. 29
Jul. 16. Buffalo, N. Y. ....Jul. 13
Jul. 16. Detroit, Mich. ....Jul. 13
Jul. 16. Denver, Colo. ....Jul. 13
Jul. 16. Upper Marlboro, Md. ....Jul. 13
Jul. 16. New Castle, Ind................................Jul. 13
Jul. 16. Scotia, N. Y......................................Jul. 13
Jul. 16. Toronto, Ont. ....Jul. 13
Jul. 16. McKees Rocks, Pa. ....Jul. 13
Jul. 16. Irvington, N. J. ....Jul. 13
Jul. 16. Oak Park, Ill. ....Jul. 13

Jul. 16. Dublin, N. H. ....Jul. 13
Jul. 16. Boston, Mass. ....Jul. 13
Jul. 17. Ft. Leavenworth, Kan........................Jun. 29
Jul. 17. Brooklyn, N. Y. ....Jul. 6
Jul. 17. Baltimore, Md. ....Jul. 13
Jul. 18. Brooklyn, N. Y. ....Jul. 6
Jul. 18. Spencer, Ind. ....Jul. 6
Jul. 18. Wilkesbarre, Pa. ....Jul. 6
Adv. Jul. 6, 13 (2 prop.).
Jul. 18. Wellsville, O. ....Jul. 13
Jul. 18. Grand Rapids, Minn. ....Jul. 13
Jul. 18. Kansas City, Mo. ....Jul. 13
Jul. 19. Cincinnati, O. ....Jun. 29
Jul. 19. Columbus Barracks, O.......................Jul. 6
Jul. 19. Ft. Leavenworth, Kan. ....Jul. 6
Jul. 19. New York, N. Y. ....Jul. 13
Jul. 19. Youngstown, O. ....Jul. 13
Jul. 20. Crawfordsville, Ind. ....Jun. 22
Jul. 20. Greencastle, Ind. ....Jun. 29
Jul. 20. Findlay, O. ....Jul. 6
Jul. 20. Danville, Ill. ....Jul. 13
Jul. 23. Painesville, O. ....Jul. 6
Jul. 22. Owego, N. Y. Adv. Jul. 13..............Jul. 13
Jul. 22. Jacksonville, Fla. ....Jul. 13
Jul. 22. Lawton, Okla. ....Jul. 13
Jul. 23. Portsmouth, O. ....Jul. 13
Jul. 23. Bogota, N. J. ....Jul. 13
Jul. 23. Mt. Gilead, O. ....Jul. 13
Jul. 24. Harrison, N. Y. ....Jul. 13
Jul. 25. Long Island City, L. I., N. Y.............Jul. 13
Jul. 25. El Reno, Okla. Adv. Jul. 13.............Jul. 13
Jul. 25. Concord, N. H. ....Jul. 13
Jul. 26. Cincinnati, O. ....Jul. 6
Jul. 26. Tipton, Ind. ....Jul. 13
Jul. 26. Appleton, Wis. ....Jul. 13
Jul. 27. Cleveland, O. ....Jul. 6
Jul. 27. Orrville, O. ....Jul. 13
Jul. 29. Steubenville, O. ....Jul. 13
Jul. 30. Des Moines, Ia. ....Jul. 13
Jul. 30. Hagerstown, Md. ....Jul. 13
Jul. 30. Jefferson, O. ....Jul. 13
Jul. —. Belleville, Ill. ....Jun. 15
Jul. —. Hudson, Mich. ....Jun. 15
Jul. —. Camden, N. J. ....Apr. 20
Aug. 1. Greencastle, Ind. ....Jun. 29
Aug. 1. Greensburg, Ky. ....Jul. 13
Aug. 2. Cincinnati, O. ....Jul. 13
Aug. 3. New Breman, O. Adv. Jul. 13..........Jul. 13
Aug. 5. Olympia, Wash. Adv. Jul. 6, 13.......Jul. 6
Aug. 6. Reynoldsville, Pa. ....Jun. 29
Aug. 6. Sharpsville, Pa. ....Jul. 13
Aug. 6. Covington, Ind. ....Jul. 13

POWER PLANTS, GAS AND ELECTRICITY.

Jul. 16. Sayre, Okla. ....Jun. 22
Jul. 16. West Point, N. Y. ....Jun. 29
Adv. Jun. 29 to Jul. 13.
Jul. 16. Charleston, S. C. ....Jul. 6
Jul. 16. Newark, N. J. ....Jul. 13
Jul. 16. Boston, Mass. ....Jul. 13
Jul. 16. Swansea, Ill. ....Jul. 13
Jul. 18. Blackwell's Island, N. Y....................Jul. 13
Jul. 20. Washington, D. C. ....Jul. 13
Jul. 24. Ft. Sam Houston, Tex........................Jul. 6
Jul. 26. Toledo, O. ....Jul. 13
Jul. 30. Columbus, O. ....Jul. 6
Jul. 31. North Battleford, Sask......................Jun. 22
Jul. —. Rowlesburg, W. Va...........................Mar. 16
Aug. 1. Hamilton, Ont. ....Jul. 13
Sep. 3. Winnipeg, Man. ....Jun. 15
Adv. Jun. 15 to Jul. 13.

BUILDINGS.

Jul. 15. Post bldgs., Ft. Slocum, N. Y.........Jun. 22
Adv. Jun. 22 to Jul. 13.
Jul. 15. Pub. bldgs., New York, N. Y.............Jul. 6
Jul. 15. Schools, New York, N. Y..................Jul. 6
Jul. 16. School, Minneapolis, Minn. ....Jun. 15
Jul. 16. School, Newark, N. J. ....Jun. 15
Adv. Jun. 15.
Jul. 16. School, Newark, N. J. ....Jun. 22
Jul. 16. Add. to hospital, Washington, D. C....Jul. 6
Jul. 16. Pub. bldg., Otisville, N. Y.................Jul. 6
Jul. 16. Schools, De Soto, Ind..........................Jul. 6
Jul. 16. Pub. bldgs., Jamesburg, N. J.............Jul. 13
Jul. 16. School, Detroit, Mich. ....Jul. 13
Jul. 16. Jail, Buffalo, N. Y. ....Jul. 13
Jul. 16. Htg. pub. bldg., Vineland, N. J.........Jul. 13
Jul. 16. Hospital, Bangor, Me. ....Jul. 13
Jul. 16. School, South Boston, Va...................Jul. 13
Jul. 17. P. O. bldg., St. Joseph, Mo. ....Jun. 22
Adv. Jun. 22, 29.
Jul. 17. Htg. post bldg., Ft. Benj. Harrison, Ind.Jul. 13
Jul. 17. Alter. to pub. bldg., Rochester, N. Y..Jul. 13
Jul. 17. Htg. school, Henning, Minn..............Jul. 13
Jul. 17. Pub. bldg., Hamilton, O. ....Jul. 13
Jul. 18. Exten. to post office, Chattanooga, Tenn.Jun. 15
Jul. 18. Rep. to court h'se, Williamsport, Ind..Jun. 15
Jul. 18. Windows for National Museum, Washington, D. C. Adv. Jun. 22 to Jul. 6..Jun. 22
Jul. 18. Htg. C. H., Wilkesbarre, Pa..............Jun. 29
Adv. Jun. 29 to Jul. 13.
Jul. 18. Pub. bldg., Waddah Island, Wash.....Jul. 6
Jul. 18. School, Wapakoneta, O. ....Jul. 13
Jul. 18. School, Forest, Ind..............................Jul. 6
Jul. 18. Plumb. bath, New York, N. Y...........Jul. 13
Jul. 19. Post office, Gainesville, Fla. ....Jun. 15
Adv. Jun. 15, 22.
Jul. 19. Bus. bldg., Booneville, Ind................Jun. 29
Jul. 19. Hospital, Athens, O...........................Jun. 29
Jul. 19. Church, Fullerton, Neb......................Jul. 6
Jul. 19. Post bldg., Ft. Leavenworth, Kan.....Jul. 6
Jul. 19. School, Lebanon, Ind. ....Jul. 13
Jul. 19. Htg. school, Buffalo, N. Y.................Jul. 13
Jul. 19. Pub. bldg., Spokane, Wash...............Jul. 13
Jul. 20. Pub. bldg., Struthers, O....................Jun. 29
Jul. 20. Bus. bldg., Jacksonville, Fla...............Jun. 29
Jul. 20. School, Claremont Cal........................Jun. 29
Jul. 20. Church, Minneapolis, Minn.................Jul. 6
Jul. 20. Pub. bathhouse, Chicago, Ill................Jul. 6
Jul. 20. Hospital, Flint, Mich. ....Jul. 13
Jul. 20. Pub. bldg., Racine, Wis. ....Jul. 13
Jul. 20. School, Stambaugh, Mich. ....Jul. 13
Jul. 20. College Bldg., Durham, N. H............Jul. 13
Jul. 22. Court house, Casper, Wyo.................Jun. 29
Jul. 22. School, East Orange, N. J..................Jul. 6
Jul. 22. Pub. bldg., Farnhurst, Del. ....Jul. 13
Jul. 22. Pub. bldg., Blackwell's Island, N. Y..Jul. 13
Jul. 22. Schools, New York, N. Y...................Jul. 13
Jul. 22. Pub. bldg., Augusta, Me....................Jul. 13
Jul. 23. Pub. bldg., Cortland, N. Y.................Jul. 6
Adv. Jul. 6, 13.
Jul. 23. Church, Ames, Ia. ....Jun. 22
Jul. 23. Pub. bldg., Cheyenne, Wyo...............Jun. 29

Jul. 23. Htg. school, Indianapolis, Ind..........Jul. 13
Jul. 23. School, Evansville, Ind. ....Jul. 13
Jul. 23. Court house, Bishopville, S. C.........Jul. 13
Jul. 23. Pub. bldg., Wales, Wis. ....Jul. 13
Jul. 23. Pub. bldg. improv., Cincinnati, O....Jul. 13
Jul. 24. Post office, Aurora, Ill......................Jun. 22
Jul. 24. School, Antler, N. D.........................Jun. 29
Jul. 24. Pub. bldgs., Dayton, O......................Jul. 6
Jul. 24. School, Mt. Healthy, O.....................Jul. 6
Jul. 24. Church, Pittsburg, Kan. ....Jul. 13
Jul. 25. Enlarging jail, New Roads, La.........Jun. 29
Jul. 25. Add. to hospital, Marion, Ind............Jul. 6
Jul. 25. School, Paragould, Ark. ....Jul. 6
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Jul. 29. School, Melville, N. D......................Jul. 13
Jul. 29. Htg. school, Oelwein, Ia. ....Jul. 13
Jul. 29. Church, Jackson, Mich. ....Jul. 13
Jul. 29. Courthouse, Redwood City, Cal..........Jul. 6
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CURRENT NEWS SUPPLEMENT

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AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

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AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

THE WESTINGHOUSE GAS PRODUCER.

The Westinghouse Machine Co. has been experimenting for some years with gas producers, and at last has given out particulars concerning an apparatus which it is about to place on the market for use with anthracite, coke and other non-bituminous materials. Owing to the company's long experience in making gas engines and operating them with various kinds of producers, it has been able to acquire a large amount of information concerning all types of gas-producing plants. Its experimental work has also been conducted with great thoroughness, so that the producer which is now placed upon the market embodies only ideas that have been thoroughly tested for some time and consequently cannot be considered an experimental apparatus, although it is only now offered for sale.

The producer consists in general of a pair of vertical steel shells, one of which is the gas generator proper and is lined with fire-brick and tile, while the other is the combination scrubber-dryer from which the gas is led to the engine or other point of use. The two principal elements, generator and scrubber, are connected by a cast-iron gas main fitted with a water seal cut-out and stack valve, which, by a single movement, opens communication to the purge stack and simultaneously feeds the main to the scrubber, or vice versa. The automatic pressure controlling apparatus is mounted on the main producer shell. On account of the automatic balanced blast of the producer, the amount of gas generated is controlled entirely by the demand for gas, and, therefore, no gas holder is required, regardless of whether the gas is used in engines or for heating purposes.

The fuel is introduced into the double-seal charging hopper, preferably from an overhead bin, and thence distributed to the fuel bed by means of a counterweighted discharge and distribution bell. Accessibility for maintaining a uniform fuel surface is a prime requisite, and the producer top is specially designed to permit ready access to all portions of the bed. The blast must, of course, be composed of the correct proportions of steam and air, and an improved blower is used to keep this proportion constant, although the volume of the mixture is constantly changing with the demand for gas. Air for the blast is drawn through a jacket space covering the top of the generator, thus air-cooling the generator top and returning again to the system the lost heat. Steam is introduced into the preheated blast just before it enters the producer, the blower action of the steam jet being ample to maintain the slight pressure requisite to overcome the resistance of its passing through the fuel bed and scrubber chambers.

The mixture of air and steam is conducted to the fuel through a cast-iron duct built into the producer foundation, communicating with the tuyere box which forms a jacket around the blast pipe, protecting it from the cooling effect of the water in the ash-pit. The tuyere box is surmounted by a sectional cone-shaped blasthead or tuyere proper, so designed as to promote the free distribution of blast and prevent the passage from becoming clogged with ashes.

THE KOEHRING MIXER.

A number of peep holes are provided at the level of the normal ash zone so that the fire may be inspected to guard against the discharge of good fuel by a too rapid removal of the ashes. These holes also permit the introduction of a poker in case there is a bridging tendency from large clinkers. No further attention is required of the operator, except to remove the ashes as they accumulate below the fire zone in the water sealed bottom. The ashes can be removed at any time from the water bottom without in any way affecting the operation of the plant.

The strength and volume of the blast, the proportions of air and steam, and the rate of gas generation are all controlled automatically by a balanced pressure regulating system which is operated entirely by the rate of consumption of the gas. A manometer gauge board mounted in a convenient place on the scrubber shell shows at a glance the relative pressures in the blast pipe, the outlet of the producer, and the outlet of the scrubber or engine supply pipe. These pressure relations remain practically constant during normal operation, any changes serving as an index to conditions of gas supply and demand and also as a tell-tale to the existence of improper conditions in the fuel bed or any other part of the apparatus.

The gas made in these producers is intended for the operation of gas engines, but the apparatus may, of course, be used for furnishing gas for other purposes. Where these other purposes are to be supplied at the same time as the engines, the automatic pressure control feature of the Westinghouse producer is an important advantage. If the generation of gas for heating purpose is the prime consideration and high temperatures rather than a clean gas are desired, the producers may be installed without the scrubber and the gas conducted through hot-gas mains directly to the furnaces. In such cases, bituminous fuels may sometimes be used to advantage according to the makers.

A NEW CONCRETE MIXER.

A new concrete batch mixer, illustrated in the accompanying engraving, is noticeable on account of the fact that the materials are mixed dry and water is added separately after the mixture leaves the drum. The drum itself is cylindrical, with rounded edges on both heads in order to prevent the sticking of sand and cement in the corners. These drums are built in three sizes, for batches of 5 cu. ft., 9 cu. ft., and 22 cu. ft respectively, and may be obtained with gasoline-engine, steam-engine or electric-motor drive. The scoops within the drums are set at alternate and different angles to throw the material in opposite directions, and the tie rods which hold the ends of the drum are placed just below these scoops so that as the material is thrown on them they will assist in scattering it. The loading chute is of large size and very low so that materials can be placed in it readily.

As before stated, the object of the design of this machine is to mix dry only in the drum and add water in the wet-mixing trough. Material can be left in the drum as long as desired and in this way it is possible to mix cement with any desired coloring or waterproofing materials first, then add the gravel or sand, and keep on the mixing process until it is absolutely certain that everything is thoroughly well commingled. When the materials have reached this condition a lever is thrown and the water supply valve opened. The dry mixture falls into the trough, where it is beaten with paddles like those used in continuous mixers. If desired the wet-mixing trough can be replaced by a chute which discharges the materials at an elevation high enough to allow them to fall directly into wheelbarrows. This chute is made in two sections; that outside of the drum is stationary and that inside it tilts up when concrete is not wanted. The mixer is made by the Koehring Machine Co., Germania Bldg., Milwaukee, Wis.

A PROPOSED SOCIETY OF CHEMICAL ENGINEERS.

A meeting of chemists in favor of establishing a society of chemical engineers, who were in attendance at the convention of the American Society for Testing Materials, was held at Atlantic City on June 21. Dr. Charles F. McKenna was made chairman and Mr. William M. Booth secretary. Mr. Richard K. Meade stated that as editor of the "Chemical Engineer," he had issued a call for the meeting because of numerous requests that he should take the initiative in the organization of such a society. He further stated that he had been informed that a society of chemical engineers was in process of organization on the Pacific Coast, and he had been urged to make the movement a national one. He felt that such a society was really needed, and had sounded the profession by some fifty or more letters of inquiry to prominent technical chemists and engineers. A large number of those approached were in favor of the organization of such a society, to be known a the American Society of Chemical Engineers. Those in favor of the organization thought it should have a high standard of admission, somewhat along the requirements of the American Society of Civil Engineers, and that it would prove of great benefit to all qualified technical chemists. It was suggested that the society might, by the appointment of committees, solve many problems of engineering chemistry, widen the field of applied chemistry to the point where chemical plants will be designed as far as the chemical features go, by chemical engineers, discourage unprofessional methods, and, if possible, cause the elimination of incompetent and dishonest followers; it would also be able to indicate the direction of the education of technical chemists along lines most likely to be of benefit to the industries of the country, by commingling the ideas of professional men with those of teachers of applied chemistry; it could help the unification of the methods of technical analysis by committees which should represent both manufacturers and users, and it could encourage patent legislation which will give the greatest security to the inventor of chemical processes and appliances for carrying them out.

The discussion naturally turned first to what the term "chemical engineer" really means. This was answered provisionally by Mr. Booth as follows: Chem-

ists or mechanical engineers who design and construct plants of a nature requiring a thorough fundamental knowledge of applied chemistry may be termed chemical engineers.

The various difficulties in the way of forming a society of chemical engineers were gone into at great length, those who took part being Prof. H. B. Talbot, Mr. H. E. Diller, Mr. E. C. Holton, Prof. J. C. Olsen, Prof. Wm H. Walker, Dr. J. E. Stokes, Mr. Andrew Robertson, Mr. A. D. Little and Mr. Richard K. Meade. Finally it was decided to appoint a committee with power to consider the advisability of organizing a society of chemical engineers. This committee is to correspond with men likely to be interested, and formulate the conditions of membership in such a society. Dr. McKenna named the following as members of the committee: Prof. J. C. Olsen, Mr. A. D. Little, Mr. Richard K. Meade, Prof. Wm. H. Walker, Mr. William M. Booth. Mr. Olsen offered a motion that Dr. McKenna act as chairman of this committee, which was carried.

It is expected that a report will be made some time during the summer.

BRITISH ENGINEERS; AN APPRECIATION.

In an esteemed British contemporary, "Engineering," an unusual communication recently appeared from an engineer who modestly signs himself "H. S. C." Of course, it is merely a playful skit; even the editor took pains to indicate this by heading the letter, "Humors of Engineering." It reads as follows:

Sir.—If engineers were not so conspicuously lacking in a sense of the ridiculous, it would be impossible for many of them to assume the air of dignity and importance they do. After all, the engineer is not so indispensable as he fondly imagines. He is not indispensable at all individually; there are so many of him. This is particularly the case with the young engineer, full of enthusiasm and beautiful ideals.

Many and great are the quiet chuckles that the horny-handed foreman enjoys at the expense of the "young gent from the office." I know a young man in the engineer's department of one of our largest railway companies who made a serious duty of permanent-way curves, and the scientific setting out thereof. He studied Froude's transition curves, and he babbled fearful formulæ in his sleep. To him it was given to set out a deviation from the main line. Days and nights he spent in calculation; midnight oil and language were freely squandered. Still more days he spent upon the site, and did wonderful things with a theodolite, four chainmen, a bundle of wooden pegs, and a sledge hammer. At length a row of pegs was arranged in parabolic symmetry and punctilious accuracy. Then, weary and triumphant, the young man went his way. Then came the ganger with a crowbar and a sledge-hammer, and thus addressed his mate:

"'Ere Bill, give I a hand, and get those 'ere . . . pegs out o' the light, and let's have the . . . line in proper" . . . And they did. When the chief inspected that bit of line, on completion, he complimented his young assistant on the alignment, and that young man became the permanent-way expert of the office. Everybody was pleased, and I was the only one that smiled.

To the pupil belongs the honor of possessing the noblest sense of appreciation of his profession. My little chuckle of amusement is often tempered with a touch of pity when I observe the hours of toil some enthusiastic and thoroughly conscientious youth will spend on a little job which I happen to know has only been given to him in order to "get him out of the way and keep him quiet." See him carefully trace the buildings that no longer exist, and cross them out in red, because that is how they appear on the old and corrected plan beneath, and say if that is not enthusiasm. Go into one of those underground café places where the junior clerk plays dominoes, and consumes coffee and buns, and see the earnest and anæmic-looking youth in the corner, painfully studying an entirely unpractical book on "Building Construction," with a cotton umbrella and a small black bag by his side. That is the engineering pupil. He has a high ideal of his profession, and some day he will be able to earn as much as a pound a week, and call himself "a professional man."

Next to the pupil comes the "surveying assistant" or "general draughtsman." He describes himself in his own mind as "a fully qualified man." There is nothing in heaven or earth or in the waters beneath the earth, that, as an engineer, he is not capable of dealing with. What he actually does is to mark the numbers of the houses in a long street on the ordnance map, and count the lampposts. In the train from Clapham to Waterloo he discourses learnedly to the awe-stricken passengers on the subject of Channel tunnels, dangerous towers, and electric railways, and when he gets to the office he spends the whole morning stencilling the names on a plan, and making it look lovely with a camel-hair brush, and it never strikes him as being funny.

But the funniest of them all is the chief. His great idea is that he is a "busy man." His time is very valuable. So valuable is it that he has not time to be a gentleman. In order to convey to all and sundry a proper idea of his importance, and the terrible amount of work he has to get through, he is very brusque in his manner, and bullies his assistants (in public, if possible), also other people's assistants, if they look as though they will stand it. If he comes from the North, and is less like a gentleman than usual, he is probably a Borough Engineer, and a very great and busy man indeed. So important is he that he has been known to hob-nob with the local Labor member, and other great and influential people like that.

To realize his importance properly you should call at his office, and endeavor to see him without making an appointment beforehand. The Borough Engineer's office is usually at the Town Hall; in fact, the Town Hall is part of the Borough Engineer's office. You cannot miss it. There are notices up everywhere, "To the Borough Engineer's office." You are met by a gorgeous official, arrayed in blue and much fine gold, absolutely regardless of expense (which, of course, comes out of the rates). In reply to your request to see the borough engineer, he silently hands you a printed form to fill in, and on it you write your name, official address, nature of business, time of visit, and whether by appointment or not. Then, if you really have legitimate business, and are not merely looking for work or something downright impertinent like that, the gorgeous official disappears with the form, and leaves you in a draughty corridor for about five minutes. In nine cases out of ten the official will come back drowsily and say, "The engineer is very busy just now. Will you see Mr. ——, the Assistant Engineer?" The Assistant Engineer is probably an untidy-looking young man with a thick provincial accent, and baggy trousers. He will probably be a Borough Engineer himself one day. He looks as if he might. It is really better to see the assistant, because he knows more about the business, and you would be sure to be handed over to him in the long run anyway. Besides, you are not quite so much insulted, unless, of course, you appear to be a person of refinement, or something contemptible of that sort. But sometimes the official comes back and says, "Will you wait a few minutes, the engineer is engaged at present." You decide to wait. After an interval of an hour or so, you are ushered into the presence. In a luxurious office, surrounded by papers and despatch-boxes, sits the great man, who, without saying a word, or noticing your entrance in any way, continues to read a letter for the space of three minutes, while you stand just inside the door and mildly wonder why borough engineers have no manners. Then he seems to realize that there is something alive in the office—a fly, or some other small and annoying thing—and looks up with an impatient expression, and says, "Well?" The interview lasts exactly two minutes, and then he strikes a small table bell, and so far as that Borough Engineer is concerned, you have ceased to exist.

And "when the laborer's task is o'er," that is to say, about three o'clock, the great man goes home to Peckham, or Upper Tooting, and does a bit of gardening.

THE LABOR INFORMATION OFFICE FOR ITALIANS.

It is only within the last 15 years or so that immigration from Italy has become heavy, but of late it has exceeded that of all other nationalities. A very large proportion of the Italians coming to this country are uneducated and poor, and it is extremely desirable that they should be kept out of the clutches of the labor sharks who have exploited them so outrageously in the past. Impressed by this condition of affairs, some well-known Americans, including Augustus A. Healey and G. P. Morosini, organized about a year ago a labor exchange for the purpose of acting as a free intermediary between those seeking employment and those who would employ them. This office was opened under the name of the Labor Information Office for Italians, and is now located at 59 Lafayette St., New York. During the year it has secured employment for 7,195 immigrants and has received applications for help from 319 employers. In addition it has also furnished information concerning work and wages to a good many thousands of Italians. One object of the gentlemen who have established this office is to distribute the immigrants as far as possible throughout the country, and so avoid crowding them into the large cities of the East, which has been an unfortunate recent tendency. By temperament and experience they are of much greater profit to this country in the western and southern agricultural regions than they are in the large cities, and the Office is particularly desirous of sending its men to such places. The extreme poverty of the immigrants prevents their purchasing land, but it would seem that many of them are particularly well fitted for participation in irrigation and other development work in the semi-arid districts where labor is now scarce.

PERSONAL NOTES.

Mr. W. C. Hood, of Lawrence, Kan., has been elected sanitary engineer of the Kansas State Board of Health.

Mr. John C. Grady has been appointed director of the Department of Wharves, Docks and Ferries of Philadelphia.

Civil Engineer U. S. G. White, U. S. N., has been detached from the Navy Department offices at Washington and transferred to the Naval Academy.

Major William C. Langfitt, chief engineer officer of the Army of Cuban Pacification, has been ordered to Washington Barracks as commandant of the Engineer School.

Mr. H. F. Baldwin, formerly chief engineer of the Chicago & Alton Ry., has been appointed chief engineer of the Oregon & Washington R. R., succeeding Mr. E. C. Hawkins.

Mr. Charles A. Hoppin, formerly district superintendent of erection in the New York office of the Allis-Chalmers Co., has been appointed steam engineer of the Peoria Gas & Electric Light Co., Peoria, Ill.

Mr. W. C. Hebbard, division engineer of the New York, Susquehanna & Western R. R., at Jersey City, N. J., has been transferred to Buffalo, and has been succeeded at Jersey City by Mr. T. W. Whitney, formerly division engineer of the Delaware Division of the Erie R. R.

First Lieutenants John J. Kingman and Henry H. Robert, Corps of Engineers U. S. A., have been ordered from the Engineer School at Washington Barracks to duty in the Philippines, under Lieut.-Col. John Millis, in charge of all fortification construction in the Philippine Islands.

Mr. H. Milliken, who for the past two years has been associated with the operating department of the New York Edison Co., has joined the engineering staff of W. S. Barstow & Co., of New York City and Portland, Ore. He will be located permanently as resident electrical engineer in Portland.

Messrs. Chester A. Garfield and Edward T. Grandlienard, of Cambridge, Mass., and Hicksville, N. Y., respectively, have been appointed assistant engineers in the service of the Board of Water Supply of New York City. Mr. Hobert B. Potter, Newark, N. J., has been appointed an assistant engineer.

Messrs. George H. Cushman and J. A. Fairleigh have formed a partnership for the general practice of engineering and have opened offices in the Loveman Building, Chattanooga, Tenn., under the firm name of Cushman & Fairleigh. Mr. John Dowling is associated with them as consulting engineer for blast furnace work.

Messrs. Maurice Gesundheit and Henry Osgood have opened offices at 43 Cedar St., New York City, as manufacturing engineers and business methodizers, under the firm name of Gesundheit-Osgood Co. Mr. Gesundheit was assistant professor for two years at the Victoria University, England; later he was employed for a number of years in improving industrial plants; during the last few years he has served industrial concerns in a supervisory and consulting capacity, with the object of developing their earning power, by improving their methods and accounting, their equipment and processes, as well as their general policies. Mr. Osgood has been connected with several prominent manufacturing companies and has also been engaged in methodizing work.

Sir William Henry Perkins, the eminent technical chemist who visited this country last fall, died in London on Sunday. He was born in that city on March 12, 1838, and was educated at the City of London School, the only school in England at that time where scientific subjects were taught. He studied chemistry under Dr. A. W. Hofmann at the Royal College of Chemistry. When seventeen years old he acted as assistant to Dr. Hofmann in his research laboratory, and one year later read an account of his first research before the Chemical Society. In 1856, while making an experiment at home which had for its object the artificial formation of quinine, he obtained results which led him to the discovery of the aniline purple, or mauve. After experimenting with this coloring matter in Messrs. Pullar's dye works at Perth, and being encouraged by them to follow up the manufacture, he left the College of Chemistry and devoted his time to the development of his new discovery, which was patented in 1856. He then formed a partnership with his father and brother, and the firm was known as Perkins & Sons. The works were erected on the Grand Junction Canal at Greenford Green, Middlesex. The new dye was successfully made in 1857, and supplied first to the silk dyers in London, and then at Macclesfield, and later to calico printers in Scotland and elsewhere. For his discovery of mauve the Société Industrielle of Mulhouse presented to him silver and gold medals. Besides the mauve, he discovered also several other coal tar coloring matters, and after Graebe and Liebermann had made their discovery of the formation of alizarine from anthracene, in 1868, he found two new processes by which this was rendered of practical value.

Mr. A. B. Lewis has been re-elected as borough surveyor of Mahanoy City, Pa.

Mr. Jere A. Hunter, chief of the Bureau of Highways of Philadelphia, resigned July 11.

Mr. Alexander C. Shand, Chief Engineer of the Pennsylvania R. R., sailed for Europe recently.

Mr. T. R. Atkinson, Assistant State Engineer of North Dakota, has been appointed State Engineer to succeed Mr. A. L. Fellows, resigned.

The fourth biennial exhibition of the Pittsburg Architectural Club will be held in the art galleries of the Carnegie Institute early in November.

The New York Testing Laboratory has been removed from Long Island City, N. Y., to Maurer, N. J. The New York City office is at 114 Liberty St.

Capt. George P. Howell, Corps of Engineers, U. S. A., in charge of the defensive works on the coast of South Carolina and of extensive river and harbor work at Charleston, has been ordered to the Philippine Islands for duty in connection with the construction of fortifications.

Mr. Peter Cooper Hewitt, inventor of the glow light that bears his name and the mercury arc rectifier, has built a 27-ft. boat with gliding planes projecting from her side which has attained a speed of 38 miles an hour. The remarkable craft, which is termed a hydroplane, is driven by an eight-cylinder gasoline engine.

Capt. William Kelly, Corps of Engineers, U. S. A., assistant to the Engineer Commissioner of the District of Columbia, has been appointed to supervise the construction of the municipal building for the District of Columbia, succeeding Maj. Chester Harding, who was recently made division engineer of the Eastern division of the Panama Canal.

The associate professorship of civil engineering at the State School of Mines, University of Utah, Salt Lake City, is vacant, and Prof. Richard R. Lyman, head of the department, is now receiving the applications of candidates for the position. A man with experience in surveying and railway engineering is needed, and preferably one who has acted as a teacher.

William Henry Colesberry, a civil engineer, who, since 1863 had been connected with the engineers corps of many of the Eastern railroads, died in Philadelphia, July 12. He entered the service of the Pennsylvania R. R. in 1863, with the corps engaged in the construction of the Connecting Ry., under the late A. J. Cassatt. Later he aided in the survey and construction of the Philadelphia & Erie R. R. In 1868 he was constructing engineer on the Vineland Ry., and in 1871 was chief engineer of the Smyrna & Delaware Bay R. R. In 1876, after spending some years in locating and constructing railroads in the Pennsylvania oil regions, he re-entered the service of the Pennsylvania R. R., and was connected with the various improvements of that road in and about Philadelphia.

Mr. W. J. Wilgus has several times during the past two years suggested his desire to retire from his official connection with the service of the New York Central & Hudson River R. R. Co., but the great work of changing from steam to electric power in the Electric Zone, and the reconstruction of the Grand Central Terminals, made it almost impossible for the company to comply with his wishes. The initial installation of electricity having been completed and the practicability and success of handling the business of the road by the new power having been fully demonstrated by months of successful operation, Mr. Wilgus renewed his request to be relieved at as early a date as practicable, suggesting July 1 as the date. At the earnest request of President Newman, however, Mr. Wilgus has consented to remain in his present position until Oct. 1; and, with this understanding, his resignation effective on that date has been reluctantly accepted. He entered the company's service in June, 1893, as assistant engineer in charge of maintenance of way of the Rome, Watertown & Ogdensburg R. R., and since then has steadily risen by reason of his technical efficiency and administrative ability to the position of vice-president of the New York Central road. The public will regret that he is not to stay in office and complete the great terminal improvements he planned.

The Baldwin Locomotive Works of Philadelphia have issued a pamphlet on the actual efficiency of a modern locomotive, represented by work performed, as compared with the lighter locomotive of twenty years ago, being a reprint of a paper read before the Pacific Coast Railway Club by Mr. Wm. T. Evans. The paper is an analysis of the present stage of steam locomotive development, taking up efficiency, costs and operating results in service on many roads. There is also an appendix on the extra work department of the Baldwin Locomotive Works, in which the extensive facilities of the company for supplying repair parts is outlined, as well as the Baldwin system of interchangeability of small parts of standard locomotives.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Russellville, Ark.—Bids will be received by the Bd. of Water Comrs. (R. M. Newport, Chmn.) until Aug. 20 for furnishing material and constructing water works, as advertised in The Engineering Record. Engineers, M. A. Earl & Co., of Muskogee, Ind. Ter.

Paris, Ark.—The Commercial Club (J. A. Maddox, Secy.), is reported interested in the construction of water works.

**Los Angeles, Cal.*—The Bd. of Pub. Wks., Aqueduct Dept., has awarded to Byron Jackson Machine Co., of San Francisco, the contract for a 12-in sand and gravel dredge pump for $1,250.

Molina, Colo.—It is reported that bids will be received by the Cottonwood Lakea Reservoir Co. (J. A. Kirkendall, Secy.) until July 25, for constructing cement concrete box, with patent headgate, at No. 1 Lake.

Monitou, Colo.—Mr. Nichols, Mayor, writes that the question of constructing reservoir will not be taken up until fall.

Lamar, Colo.—The citizens are reported to have voted to issue $150,000 bonds for the improvement of the water works.

Orchard, Colo.—Bids will be received until Aug. 1 by the Bd. of Directors of the Riverside Irrigation Dist. (R. H. Beem, Secy.), for $747,500 bonds for said Dist.

Bradentown, Fla.—Bids will be received until July 25 by the Bd. of Bond Trus. (A. J. Beck, Secy.), for turnishing material and constructing water works and sanitary sewerage system. Work embraces the following: 183.3 tons c. i. pipe, 4 tons of special castings, 10 fire hydrants, 22 valve and boxes, 500,000 gal. compound duplex pump, boiler feed pump 7½x5x6, 80 h.-p. water heater, open pattern, 80 h.-p. return tubular boiler, 100,-000 gal. tank erected on steel tower 100 ft. high, constructing reservoir, pumping station, pipe line, installing machinery, furnishing material and sinking 8-in. tubular well, per ft., furnshing and constructing approximately 2 miles pipe sewerage, with manholes, flush tanks, etc. Wm. W. Lyons, Engr., Palatka, Fla.

Rome, Ga.—J. N. Hazlehurst, of Mobile, Ala., is reported to have been selected as engineer in charge of water, paving and sewerage improvements for which the citizens recently voted to issue $150,000 bonds.

Catoosa Springs, Ga.—Bids will be received until Aug. 8 by Capt. F. D. Anderson, 12th Calvary, Q. M., Ft. Oglethorpe, Ga., for a deep well and water system at the Government target range at Catoosa Springs, Ga.

Calhoun, Ga.—See "Power Plants, Gas and Electricity."

Winder, Ga.—The citizens are reported to have voted on July 7 to issue $45,000 water bonds.

Boise Barracks, Idaho.—The following are the bids opened on July 1 by Capt. John S. Winn, Q. M., U. S. A., Boise, for constructing water distribution system, consisting of 6,900 ft. of 4-in. c. i. pipe and connections: Saml. T. Davis, Boise, $10,660, and Carlson Lusk Co., Boise, $10,782.

Chicago, Ill.—Bids will be received until July 23 John J. Hanberg, Comr. of Pub. Wks., for furnishing and delivering at the Harrison St. pumping station a new pump barrel and bottom made in 3 sections and 1 valve chamber; also same date for approximately 5,000 ¾-in. corporation ferrules.

*The following are reported to be the bids opened on July 10 by Paul Redreske, Deputy Comr. of Pub. Wks., for foundation work of new Lake View pumping station, Lawrence Ave. and the lake: American Eng. & Constr. Co. (Walter A. Shaw, Pres.), $91,400 (awarded contract); John J. Gallery, $97,000; M. H. McGovern, $106,570; John J. O'Heron, $110,000; D. West & Co., $109,995; Blocki and Brennan, $113,500; Wm. E. McCarthy, $114,000; John P. Dougherty, $115,000; Gindele Bros. Co., $115,735; Roemheld Constr. Co., $127,000, and Geo. W. Jackson, Inc., $149,000.

East Moline, Ill.—Thos. E. Cavely, City Clk., writes that it is proposed to construct a complete system of water works.

**Moline, Ill.*—The Moline Htg. & Constr. Co., of Moline, is reported to have secured the contract for sewers and water main improvements for about $6,000.

Mattoon, Ill.—The Mattoon Water Works & Reservoir Co. will receive bids until 2 P. M. July 24 for building dam, trenching and laying 5 miles of pipe, and furnishing 3 miles of vitr. sewer pipe. Specifications on file in the office of C. L. James, City Engr., of Maltoon.

*Loomis & Rose, of Mattoon, have secured the contract for constructing a reservoir for the Mattoon Water & Reservoir Co. (bids opened July 13) for $8,890.

Cherokee, Ia.—Bids will be received until Aug. 6 by the City Council for constructing approximately 2,000 ft. of 4-in. and 2,000 ft. of 2-in. water main extensions. D. W. McNeal, City Clk.

Decorah, Ia.—Bids will be received until Aug. 5 by the Bd. of Superv. at Decorah, for constructing a water system at the poor farm at Freeport on either the automatic air pressure steel tank of 75 bbl. with 125 lb. pressure to the inch, 12-ft. steel wheel, steel tower 70 ft. high and pump to complete the job, or 500-bbl. tank overhead system, 60 ft. high. I. Linnevold, Co. Aud.

**Bode, Ia.*—The Des Moines Bridge & Iron Wks., of Des Moines, is reported to have secured contract for the erection of an 80-ft. steel tower and 40,000 gal. steel tank for $3,483.

Almena, Kan.—Bonds to the amount of $15,000 have been voted for water works.

Shreveport, La.—The Council is stated to have accepted the report of Dr. Ashton Blanchard, health officer, relative to changing source of water supply. Red River is recommended. Probable cost of work $50,000.

Wareham, Mass.—The citizens are reported to have voted to appropriate $50,000 for the construction of water works.

Marion, Mass.—The citizens are reported to have voted to expend $1,000 for further investigations as to a water supply. Engineer, Louis E. Hawes, 101 Tremont St., Boston.

**Wrentham, Mass.*—We are informed that G. Ferrullo & Co., of Boston, have secured the contract for constructing water works (bids opened July 3), at the following bid: 7,000 ft. 10-in. c. i. pipe, including unloading, hauling, etc., 29 cts.; 10,000 ft. 8-in. c. i. pipe, 27 cts.; 16,000 ft. 6-in. c. i. pipe, 25 cts.; 2,800 ft. 4-in. c. i. pipe, 23 cts.; excavation for foundations per cu. yd., 50 cts.; concrete for stand pipe and pump foundation per cu. yd., $5; rock excav. per cu. yd., $3.75; laying service connection and materials per connection, $10.50 Engr., Edw. M. Blake, 8 Beacon St., Boston.

Ishpeming, Mich.—Bonds to the amount of $35,000 are reported sold, to be used for extending water mains and equiping new pump house.

St. Paul, Minn.—The Water Bd. is reported to have passed a resolution on July 8 requesting Council to authorize the issue of $50,000 bonds to carry on improvements to the outside water system.

Dawson, Minn.—See "Power Plants, Gas and Electricity."

Belleplaine, Minn.—Oscar Claussen, of St. Paul, is preparing plans for water works, to cost about $8,000. It has not yet been definitely determined to build.

Newton, Miss.—Bids will be received until July 23 by the Mayor and Bd. of Aldermen for sinking one or more wells, approximately 300 ft. deep. For specifications apply to Xavier A. Kramer, Consulting Engr., Magnolia.

Speed, Miss.—It is stated that bids will be received by the Mayor and Bd. of Aldermen until Aug. 6 for the erection and sale of a water works system or the maintenance of water works and water supply for public and private use. T. T. Barber, Town Clk.

Savannah, Mo.—Bids were opened on July 2 at the office of L. W. Booker, City Clk., for water works and tank and tower, and the following are the bids received: (Engineers, Burns & McDonnell, Kansas City, Mo.):

*Water works: Municipal Constr. Co., Kansas City, Mo., $29,000; Des Moines Bridge & Iron Co., Des Moines, Ia., $28,777; Mott & O'Bryan, Independence, Mo., $28,500; N. S. Sherman Machinery Co., Oklahoma City, Okla., $27,900; T. C. Brooks & Sons, Jackson, Mich., $25,943; Fred. M. Clark, Savannah, Mo., $25,900 (awarded contract).

*Steel tower, 120 ft. high, and tank, 100,000 gal. capacity: American Bridge Co., $6,420; Horace E. Horton, Chicago, Ill., $5,400; Midland Bridge Co., Kansas City, Mo., $4,989; Des Moines Bridge & Iron Co., Des Moines, Ia., $4,940 (awarded contract).

St. Louis, Mo.—It is stated that Water Comr. Adkins will petition the Bd. of Pub. Improv. for permission to install a battery of boilers at Bissell's Point to cost about $40,000.

Fremont, Neb.—See "Power Plants, Gas and Electricity."

Oxford, Neb.—We are informed that bids are wanted by City Clk. for the purchase of bonds for water works. As soon as bonds are sold, contract will be let for the work. Engineers, M. A. Earl & Co., of Muskogee, Ind. Ter.

Bradshaw, Neb.—C. B. Palmer, Village Clk., writes that bids will be received about Aug. 1 for the construction of water works; cost about $6,000.

Omaha, Neb.—Press reports state that Minard L. Holman, of the firm of Holman & Laird, of St. ouis, Mo., has been engaged by the City of Omaha to prepare preliminary plans and estimates for new water works.

Woodbury, N. J.—We are informed that a committee of Council is investigating the question of constructing water works.

New York, N. Y.—The lowest bid opened on July 11 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in New Chambers, Water, Oliver, Henry and Pike Sts., and in James Sl., was submitted by Wm.T. Norton, 27 W. 140th St., at a total of $79,339, including pipe, hydrants, stop cocks, etc. He bid for 1,050 tons straight pipe $37, 50 tons specials $70, 15 tons flanged pipe $60, 7 tons gate boxes $55, 25 cu. yds. rock $5, 250 cu. yds. rock 1 ct., 150 cu. yds. masonry $2, 8,500 cu. yds. earth 80 cts., 8,500 cu. yds. fill 20 cts., 5,600 lin. ft. 30-in. pipe $1.10, 100 lin. ft. 20-in. pipe 75 cts., 600 lin. ft. 12-in. pipe 50 cts., 800 lin. ft. 6-in. pipe 25 cts., 60 lin. ft. 36-in. flanged pipe $2, 180 cu. yds. brick masonry $15, 100 cu. yds. concrete masonry, $7, 2,500 sq. yds. asphalt pavt. $4.40, 450 sq. yds. granite block $2, 650 sq. yds. pavt. 60 cts. The totals of the other bids received were: Wilton Constr. Co., 115 Elliott Ave., $86,116; L. D. Gregory, 125th St. and 1st Ave., $88,197, and Atlanta Constr. Co., 432 E. 91st St., $81,965.

Martinsburg, N. Y.—J. A. Taylor, Secy. Water Comn., writes that bids will be received until 7 P. M. on July 20 for the construction of water works; probable cost, $10,000. Engineer, S. S. Snell, of Lowville.

Oswego, N. Y.—See "Power Plants, Gas and Electricity."

Honeoye Falls, N. Y.—A. B. Neal, Village Clk., writes that the question of constructing water works and a sewerage system is being discussed. No action taken as yet and no appropriation has been made.

Lestershire, N. Y.—The Water Comrs. are reported to be considering the sinking of a new well.

Albany, N. Y.—The following are the totals of bids opened on July 12 by the State Water Supply Comr. for straightening, deepening and improving Canaseraga Creek, Kishaqua Creek and other ditches in Livingston County, N.

* *Items marked thus give the names of parties awarded contracts.*

Y. The work includes about 677,100 cu. yds. earth excav., [illegible] cu. yds. earth fill. and embkmt.; clearing and grubbing; 15,000 lin. ft. round timber; 89.3 M ft. sawed timber; 400 piles; 1,090 cu. yds. concrete; 358,000 lbs. structural steel for bridges, and 3,800 lin. ft. pipe railing: Graves & Stephens, Cleveland, O., $146,501; Pennell & Ahearn, Yonkers, $169,485, and Gilmor, Horton & Allen, Glens Falls, $172,259.

Shelby, N. C.—J. F. Liddy, City Clk., writes that bonds to the amount of $115,000 will probably be sold in Aug., after which bids will be called for constructing water works and a sewerage system. Engr., H. E. Knox, Jr., of Shelby; J. L. Suttle, Mayor.

Wahpeton, N. D.—Bids will be received until Aug. 5 by Wm. R. Purdon, City Aud., for constructing and placing boilers for the water works plant. The boilers are to be for a 66-in. x 18-ft. boiler and a 72-in. x 18-ft. Separate bids on each boiler.

**Rugby, N. D.*—W. D. Lovell, of Minneapolis, Minn., is reported to have secured the contract for constructing water works at Rugby, for $9,700.

**Harvey, N. D.*—The contract for constructing water works at Harvey is reported to have been awarded to W. D. Lovell, of Minneapolis, Minn., for $8,000.

Columbus, O.—Bids will be received until Aug. 14 by the State Bd. of Pub. Wks. (Chas. E. Perkins, Ch. Engr.), at Columbus, for the construction of a reservoir in Summit County. The work includes about 17,000 cu. yds. of earth embankment, 24 M ft. B. M. timber and planking and 400 cu. yds. concrete masonry.

Youngstown, O.—Bids will be received until July 26 by the Bd. Pub. Service (W. H. McMillin, Clk.), for furnishing 10 tons of soft pig lead, 400 tons c. i. water pipe and special castings, 38 6-in. gate valves and 40 fire hydrants.

Cambridge, O.—It is reported that bids will be received until Aug. 3 for $38,000 bonds, for extending water works system, repairing bridges and for other public improvements. T. R. DeSelm, City Aud.

Norwood, O.—Bids will be received by the Bd. of Pub. Service (L. H. Gebhart, Clk.), until Aug. 3 for furnishing meters and connections to be delivered in quantities of 100 or more as ordered, as advertised in The Engineering Record.

Cincinnati, O.—Local press reports state that bids will be received until Aug. 13 for $500,000 water works bonds.

Greenwich, O.—It is stated that bids will be received until July 23 by J. G. White, Clk. Bd. Pub. Affairs, for rebuilding and reconstructing spillway of the water works.

Mountain View, Okla.—Bids will be received until July 23 for the furnishing material and constructing water works. Amount of bond issue, $20,000. A. E. Stinson, Mayor; W. P. Bullock, Engr.

Guthrie, Okla.—An election will probably soon be held to vote on raising $110,000 bonds for water works, sewer, paving and bridges. W. W. Miller, City Engr.

Mosquite, Ore.—The Bd. of Directors of the Snake River Irrig. Dist. of Mosquite (C. P. Lattig, Ch. Engr.) have authorized the issue of $325,000 bonds to construct a complete hydro-pumping plant for irrigation of district. Bids for bonds and plant will be received on July 30.

Steelton, Pa.—Bids will be received by John D. Young, Boro. Secy., until Aug. 7 for the construction of a filter plant, as advertised in The Engineering Record. Engineer, Jas. H. Fuertes, 140 Nassau St., New York, N. Y.

Dickson, Tenn.—W. T. Turner, Mayor, writes that the question of constructing water works is being discussed. Nothing definite has yet been done. Election will probably be held in near future.

Monterey, Tenn.—See "Power Plants, Gas and Electricity."

Stephenville, Tex.—See "Power Plants, Gas and Electricity."

Mineral Wells, Tex.—The Council is reported to be considering the question of establishing a filter plant.

American Fork, Utah.—The Mayor, City Council and Commercial Club are reported to be considering the question of piping water from Alpine Canyon to American Fork and Lehi.

Bremerton, Wash.—See "Public Buildings."

**Chewelah, Wash.*—See "Power Plants, Gas and Electricity.

Delta, B. C.—J. H. Hutchinson, of Ladner, is reported to be planning to build a water system through Delta and Surrey.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Camden, Ark.—Bids will be received until Aug. 15 by the Comrs. of Improv. Dist. No. 2 (Louis Bauerlein, Secy.), for constructing a sewer in said dist., approximately 12,000 ft. long.

Montrose, Colo.—The question of constructing a sewerage system here is reported to be under consideration.

Hartford, Conn.—Bids will be received by the Bd. of Contract & Supply until July 29 for constructing Sect. A of the Homestead Ave. intercepting sewer, consisting of about 1,070 lin. ft. of concrete conduit, 10 ft. diam. and 650 ft. concrete or brick conduit of egg shaped section 6x4 ft. diam., as advertised in The Engineering Record.

*The Hartford Paving & Constr. Co., of Hartford, is reported to have secured the contract to build the Ann St. sewer (bids opened July 15), for $17,391. It will be of concrete.

Wilmington, Del.—Alex. J. Taylor, Engr. in Charge of Sewers, is reported to have prepared plans for a sewer for the lower end of the 9th Ward, to cost complete about $25,000.

Washington, D. C.—The lowest bid opened on July 15 by the Comrs. D. C. for constructing sewers was submitted by Jas. A. Coyle at the following bid: 6,000 cu. yds. sewer excav., 90 cts.; 45 cu. yds. brick masonry, $20; 3,725 lin. ft. 10-in. pipe sewer, 80 cts., and 2,135 lin. ft. 12-in. pipe sewer 90 cts;; total, $11,201. Totals of other bids: R. J. Beall Constr. Co., $11,936; E. G. Gummell, $13,175, and Lyons Bros., $14,298. D. E. McComb, Supt. of Sewers.

Bids will be received by the Comrs. D. C. until July 29 for construction of outlet to old B St. sewer, as advertised in The Engineering Record.

Bradentown, Fla.—See "Water."

Rome, Ga.—See "Water."

Chicago, Ill.—Bids will be received until July 23 by John J. Hanberg, Comr. of Pub. Wks., for furnishing material and constructing complete the sewage screens, lifting apparatus, operating galleries, ladders and railings and other appurtenances at the Lawrence Ave. pumping station; also, same date, for furnishing material and constructing about 200 lin. ft. of 9-ft. sewer, including stone masonry outfall on pile timber foundation in Canal Pl.

Belleville, Ill.—Bids will be received by the Bd. of Local Improv. until July 27 for 80,750 sq. yds. brick paving, 46,900 lin. ft. curb and 37,943 lin. ft. sewer pipe, as advertised in The Engineering Record. Estimated cost of work, $266,115.

Mattoon, Ill.—See "Water."

Pekin, Ill.—Local press reports state that bids will be received on July 29 by J. H. Soldwedel, City Clk., for theconstruction of the 4th District sewer; cost about $115,000. John R. Siebert, City Engr.

River Forest, Ill.—It is stated that bids will be received until Aug. 5 by the Bd. Local Improv. (F. B. Klock, Pres.) for constructing a sewer in Chicago Ave.

Benton, Ill.—The City Clk. writes that bids will be received until July 22 for tile sewers, to cost about $20,000. J. M. Joplin, Mayor. Engineer, B. S. Crain, of Morton.

Moline, Ill.—See "Water."

Indianapolis, Ind.—Bids will be received until July 24 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.), for constructing a main sewer in portions of Crawfordsville Road and Harding St., consisting in part of circular concrete sewer varying from 3 to 6 ft. in diameter, and in part of pipe sewer from 10 to 24-in.

Bloomfield, Ind.—Bids will be received until Aug. 8 for pipe, branches, junctions, manholes, etc., f. o. b. cars Bloomfield, and for construction complete with or without material or any part of same separate of main and minor sewers in a system of sewerage, etc., as advertised in The Engineering Record. Engr., Geo. Cadogan Morgan, 169 Jackson Boule., Chicago, Ill.; Chas. E. Coombs, Pres. Bd. Town Trus.

Webster City, Ia.—Bids will be received until July 24 for constructing combined storm and sanitary sewers in portions of several streets, including 15, 18, 20 and 24-in. vitrified clay bell sewer pipe. P. M. Banks, City Clk.

**Horton, Kan.*—B. B. Norris, City Clk., writes that the following are the bids opened on July 1 for the construction of 9,315 ft. 8 in. D. S. pipe sewers: T. W. Roberts, Independence, Mo., $8,312 (awarded contract); G. O. Skilbred, St. Joseph, Mo., $8,977; Rackliffe-Gibson Const. Co., St. Joseph, Mo., $10,202, andD. B. Kelley, St. Joseph, Mo., $10,361.

Louisville, Ky.—Local press report sstate that sewer bonds to the amount of $157,000 were sold on July 10. Th balance of the $1,000,000 bonds advertised for may be bought at par and interest until July 31. For further information address Chas. P. Weaver, Secy Bd. of Sewer Comrs.

Salem, Mass.—This city is reported to have voted to build sewers in South Salem at a cost of $100,000.

Jackson, Mich.—The Council is reported to have on July 8 approved plans for sewers.

Winnebago City, Minn.—The citizens are reported to be considering the question of constructing a sewerage system.

**St. Paul, Minn.*—The Bd. of Pub. Wks. on July 8 awarded contract for sewer in Ottawa Ave. and in Sidney and King Sts. to D. W. Moore 902 Edmond St., for $10,397.

Two Harbors, Minn.—Frank Kempffer, Clk. of Dist. Court, writes that the citizens on July 9 voted to issue $40,000 bonds to complete the sewerage system.. Bids will probably be called for about Sept 1.

**Elbow Lake, Minn.*—Ilstrup & Olson, 220 Security Bank Bldg., Minneapolis, has secured the contract for constructing sewers and a septic tank (bids opened July 8), for $4,083.

Morris, Minn.—Bids will be received until Aug. 6 by the Common Council for constructing sewers in Dists. Nos. 4, 5, 8, 9 and 20. C. B. Burpee, City Clk.

Vicksburg, Miss.—Walter G. Kirkpatrick, of Jackson, is reported to have been selected to supervise the construction of sewers, to cost about $200,000.

Kansas City, Mo.—Bids will be received until July 23 by Bd. Pub. Wks. for furnishing material and constructing district sewers in Sewer Dist. Nos. 247, 215 and 15. E. A. Harper, City Engr.

Lewistown, Mont.—M. D. Kimball, City Clk., writes that bids will be received on Aug. 14 for the construction of 1½ miles of sewers; cost about $15,000. Engineer, O. F. Wasmendorff, of Lewistown.

Paterson, N. J.—The House on July 9 passed the bill authorizing Paterson to construct a sewage disposal plant.

Cape May, N. J.—Bids will be received until July 27 by the Cape May Real Estate Co. (Edmund K. Brown, Res. Engr.) for furnishing tools and laying 1,300 lin. ft. 18-in., 100 lin. ft. each of 24 and 12-in. terra-cotta pipe, and building 3 manholes and 6 catch-basins on Beach Ave., Cape May. All material for the work s furnished by the Real Estate Co.

Jersey City, N. J.—Bids will be received until July 22 by the Bt. Street and Water Comrs. (Geo. T. Bouton, Clk.) for constructing sewers in portions of several streets including Terrace Ave., Lincoln and Zabriskie Sts. Estimate of quantities: About 50 lin. ft. ea. of 36-in. and 30-in. brick circular sewer; 2,480 lin. ft. 18-in. vitrified pipe sewer; 500 cu. yds. of rock excav.; 40 cu. yds. of concrete; 70m ft. b. m. sheathing; 12 receiving basins and connections, etc.

Riverside, N. J.—The State Sewerage Comn. is reported to have approved plans for a sewerage system and sewage purification plant for the township of Riverside, Burlington County.

Silver City, N. M.—C. C. Whitehall, who recently secured franchise for sewerage system, writes that the proposed system will cost about $30,000.

Albuquerque, N. M.—City Engineer Gladden is reported to be completing plans for the sewerage system.

Buffalo, N. Y.—Bids will be received until July 26 by Francis G. Ward, Comr. Pub. Wks., for constructing 12, 15 and 18-in. tile sewers in portions of Richland and Durham Aves. and Jackson St.

New York, N. Y.—Bids were opened on July 3 by John F. Ahearn, Pres. Manhattan Boro., for sewers, and the following are the successful bidders:

*Vermilyea Ave. and Hawthorne St., Contract 6, successful bidders, Haggerty Constr. Co., 215 W. 125th St., as follows: 410 lin. ft. brick sewer 3 ft. 6 in. 2 ft. 4 in., $6.70; 130 lin. ft. brick sewer 3 ft. 6 in. 2 ft. 4 in., $8.85; 330 lin. ft. brick sewer 3 ft. 6 in. 2 ft. 4 in., $5.80; 394 lin. ft. brick sewer 3 ft. 6 in. 2 ft. 4 in., $7.93; 175 lin. ft. salt-glazed vitrt. stoneware pipe sewer 15 in., $2.50; 1,166 lin. ft. salt-glazed vitri. stoneware pipe sewer, 15 in., $4.30; 90 lin. ft. salt-glazed vitri. stoneware pipe culvert 12 in., $1.50; 4 receiving basins, circular, $150; 200 cu. yds. rock excav., 1 ct.; 1 M ft. timber and planking for bracing, 1 ct.; 4 M ft. timber and planking for foundations, 1 ct.

*Reconstructing outlet sewer under pier 58 North River, and in Marginal St. east side, between 14th and 18th Sts., with connections, Contract 2, successful bidder, Jos. Moore, 157 E. 89th St., as follows: 852 lin. ft. wooden barrel sewer 4 ft. 6 in., $13; 25 lin. ft. brick sewer 4 ft. 6 in., $18; 100 lin. ft. brick sewer 4 ft. 6 in., $22; 441 lin. ft. brick sewer 4 ft. 6 in., $17.50; 25 lin. ft. brick sewer 4 ft.x2 ft. 8 in., $18; 1,003 lin. ft. brick sewer 4 ft.x2 ft. 8 in., $13; 25 lin. ft. brick sewer 3 ft. 6 in.x2 ft. 4 in., $12.50; 114 lin. ft. salt-glazed vitri. stoneware pipe culvert 12 in., $2; 7 receiving basins, circular, $200; 10 cu. yds. old masonry excav., $5; 1.5 M. ft. of timber and planking for foundation, $40; total, $36,983.

Long Island City, L. I., N. Y.—The following are reported to be the bids opened on July 1 by Jos. Bermel, Pres. Queens Boro.. for (*a*) storm water sewer and appurtenances in Plaisance St., from Hunter's Point Ave. to Newtown Creek, 1st Ward: (*b*) Temporary sewer and appurtenaces in 3d Ave., 10th St. and 5th Ave., College Point, 3d Ward: John F. Clancy, *a*, $7,895; *b*, $14,535; Henry J. Mullin, *a*, $9,896; Hugh Hart, *a*, $9,319; Thos. F. Tuohy & Co., *a*, $12,645; *b*, $22,777; Peace Bros., *a*, $12,429; *b*, $20,397; Jos. A. Boyce, *a*, $10,538; *b*, $22,947; Gabriel Hill, *a*, $7,613; John J. Young, *b*, $17,061.

St. George, New Brighton, S. I., N. Y.—Bids will be received until July 30 by Geo. Cromwell, Boro. Pres., for furnishing material and constructing a combined sewer with appurtenances in a portion of Sewer Dist. No. 8 in the First Ward, to gether with work incidental thereto. Engineer's estimate: 71 lin. ft. of reinforced concrete storm water overflow chamber, including pile and timber foundation, 20 lin. ft. of 2 ft. 6 in. x 3 ft. 9 in. and 406 lin. ft. of 1 ft. 10 in. x 2 ft. 9 in. reinforced concrete sewer, interior diameter, all complete, as per section on plan of the work, 486 lin. ft. 20 in., 671 lin. ft. 18 in., 763 lin. ft. 15 in., 1,028 lin. ft. 12 in., 633 lin. ft. 10 in. and 120 lin. ft. 8 in. salt glazed vitrified pipe sewer, 17 manholes, complete, 4 M ft. yellow pine foundation timber and planking, 6 M ft. of spruce planking, in place and secured, 15 M ft. sheeting, etc.; also for furnishing material and constructing temporary sanitary sewers and appurtenances in portion of Newark Ave., together with the work incidental thereto. Engineer's estimate: 2,110 lin. ft. 8 in. and 2,643 lin. ft. 6 in. salt glazed vitrified pipe sewer, 24 manholes, 3 flush tanks with No. 5 Van Vranken siphon set, and connected with water main, 1 M ft. of foundation timber and planking, 1 M ft. of sheeting, retained, etc.

Brooklyn, N. Y.—Bids will be received until July 24 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in portions of several streets, including 100th, Bay 20th, 54th, Ten Eyck, Chester and E. 23d Sts., and sewer basins in several other streets. Engineers' estimate includes 45 lin. ft. 18-in., 1,298 lin. ft. 15-in., 3,761 lin. ft. 12-in. pipe sewer, 49,800 ft. sheeting and bracing, etc.; also 20 sewer basins.

Honeoye Falls, N. Y.—See "Water."

Amsterdam, N. Y.—Bids will be received until Aug. 2 by the Sewer Comrs. (A. T. Young, Secy.), for constructing sewers in portions of several streets including Arnold, Lincoln and McClellan Aves.

Shelby, N. C.—See "Water."

Grand Forks, N. D.—Bids will be received until Aug. 5 for constructing lateral sewers in portions of 3 alleys. W. V. O'Connor, City Aud.

Wahpeton, N. D.—Bids will be received until July 27 by Wm. R. Purdon, City Aud., for constructing a sewer in Dakota Ave. Engineer's estimate 2,576 lin. ft.; 15, 18, 20 and 24-in. vitrified pipe; 48 24x6, 48 20x6, 44 18x6 and 20 15x6 Y's, 19 catch basins, etc.

**Dickinson, N. D.*—Jas. Kennedy, of Fargo, is reported to have secured the contract for constructing sewers on June 24 at the following bid: 14,982 lin. ft. 8-in. sewer, $1.24; 233 ft. 10-in., $1.35; 366 ft. 12-in., $1.46; 30 straight manholes, ea. $60; 7 junction manholes, ea. $70; 1 standard flush tank, $170; catch basins, ea. $70, and lamp holes, ea. $10.

Norwood, O.—Bids will be received until Aug. 15 by W. E. Wichgar, City Aud., for $9,492 bonds, the proceeds to be used to construct sanitary sewers in Sub. Dist. No. 2 of Main Dist. No. 4.

Dayton, O.—City Engr. Robt. E. Kline is reported to be preparing plans and specifications for the intersecting sewer and pumping station to be located in South Riverdale, to cost about $25,000.

* *Items marked thus give the names of parties awarded con tracts.*

Napoleon, O.—It is reported that bids will be received until July 30 by the Bd. Pub. Service for constructing sanitary sewers in certain streets.

Oberlin, O.—The question of constructing a sewage purification plant is reported as being considered here.

Guthrie, Okla.—See "Water."

El Reno, Okla.—L. G. Adams, City Clk., writes that the citizens on July 9 voted to issue $50,000 bonds for sewers and a city hall.

Scottdale, Pa.—Bids will be received until Aug. 1 by A. L. Porter, Boro. Secy., for constructing a system of sewers, consisting of 2¼ miles of sewer 8 to 36-in. diameter. J. B. Hogg, Boro. Engr., Connellsville.

New Castle, Pa.—It is reported that bids are wanted July 29 for $35,000 sewer bonds.

Sharon, Pa.—Bids will be received until July 30 by Griff W. Nicholls, Boro. Engr., Sharon, for constructing sanitary sewers and appurtenances in portions of Baldwin and Division Aves. and Hill and Cedar Sts.

East Providence, R. I.—The Town Clk. writes that at a recent town meeting an appropriation was made for a comprehensive plan of sewers for the town. The report will be submitted in November.

Webster, S. D.—Bids will be received until July 29 by the City Council for constructing a system of sewerage. Bids will be received on both glazed sewer pipe and concrete sewer pipe, all sizes over and including 18-in., and on glazed sewer pipe, all sizes under 18-in. Carl Malmberg, City Aud.

Bryant, S. D.—F. R. Shepherd, City Aud., writes that the citizens on July 6 voted to issue $8,000 bonds for a drainage and sewerage system. Bids for the bonds will be received on July 26. Engineer, J. M. Raymond, of Raymond, S. D.

**Pierre, S. D.*—The Permanent Concrete Constr. Co., of Pierre, is reported to have secured the contract for constructing sewers (bids opened July 1). The proposal calls for the construction and completion of 3 miles of pipe sewers, from 8 to 27 in. diam., to be built of vitr. clay or cement pipe; 1,900 lin. ft. of concrete sewer, 5 ft. 6 in. x 3 ft. 8 in., and 240 lin. ft. concrete sewer 54 in., with manholes, flush-tanks and catch-basins complete.

Plankinton, S. D.—It is stated that an election will probably soon be held to vote on issuing $8,000 bonds for sewers.

**Chattanooga, Tenn.*—Bids were opened on July 2 by the Bd. of Pub. Wks., for the construction of sewers in Dists. 7 and 9, and T. J. Shea, of New Orleans, secured contracts for both districts at a total of $82,165. Totals of the other bids received were Guild & Co., Chattanooga, $87,968; Noll Constr. Co., Chattanooga, $101,884, and A. L. Patterson & Co., Macon, Ga., $91,500. Robt. Hooke is City Engr.

Portsmouth, Va.—The following are reported to be the bids opened on June 27 by the Sewerage Com. (Dr. A. A. Bilisoly, Chmn.), for furnishing material and constructing discharge pipe line for the 5th Ward sewerage system through grounds of U. S. Naval Hospital: B. L. Duffy Co., of Greenville, N. C., $13,976; Bryan & Co., Jacksonville, Fla., $14,690, and A. J. Phillips and D. G. Porter, of Portsmouth, $14,424.

Tacoma, Wash.—A recommendation will shortly be made to City Council, providing for the construction of a trunk sewer from Division St. to the river at foot of Main Ave.; probable cost, $200,000.

Morgantown, W. Va.—W. C. McGrew, Deputy City Recorder, writes that the citizens on July 6 voted to issue $65,000 bonds for paving and sewers. Engr., D. Utt, of Morgantown.

**Milwaukee, Wis.*—The Bd. of Pub. Wks. is reported to have on July 13 awarded to R. J. Hickey the contract for constructing 744 lin. ft. concrete and iron sewer on Davidson and Walker Sts. at $15.69 per lin. ft; total cost, $11,673.

North Milwaukee, Wis.—Bids will be received by the Village Clerk until Aug. 3 for about 13,000 ft. of 6 to 12-in pipe sewers. Engineer, W. G. Kirchoffer, of Madison.

Janesville, Wis.—Bids will be received until July 25 by the Street Assessment Com. (S. B. Heddles, Chmn.) for the construction of 1,870 ft. 8-in. sewer. C. V. Kerch, City Engr.

Marshfield, Wis.—Bids will be received until Aug. 10 by M. G. Fleckenstein, City Clk., for constructing a sewer in 6th St.

BRIDGES.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—The plans and specifications for 3 bridges submitted to the Bd. of Supervisors by County Surveyor Phinney are stated to have been accepted. The Fairoaks Bridge is to cost $90,000, and the Mormon Island Bridge $26,000, and the Live Oak Bridge $32,500.

Bids will be received until July 25 by the Bd. of Superv. (W. B. Hamilton, Clk.), for constructing a steel truss and reinforced concrete bridge, consisting of 2 steel spans, each 200 ft., and 1 span 70 ft. in length, with concrete piers on pile foundation, and 480 lin. ft. of reinforced concrete bridge, designed with 40-ft. spans; also embankment approaches requiring 15,500 cu. yds. of filling. Approaches and concrete brdge to be surfaced with macadam. Bridge is located accross the American River at Fair Oaks.

**Comanche, Cal.*—The Supervisors of Amador County at Ione are stated to have awarded the contract for constructing a bridge over the Mokelumne at Comanche to the Burrell Constr. Co., of Oakland, for $9,430.

Portland, Colo.—It is reported that bids are wanted by T. W. Jaycox, State Engr., at Denver, until Aug. 2, for constructing steel or concrete bridge across Arkansas River, at Portland.

Florence, Colo.—The County Comrs. are reported to be completing arrangements for construction of a steel and concrete bridge across the Arkansas River near Portland. Estimated cost, $10,000.

Greeley, Colo.—Bids will be received until July 23 by T. W. Jaycox, State Engr., Denver, for constructing a reinforced concrete bridge across the Cache La Poudre River at 5th St., Greeley, to replace present bridge.

Washington, D. C.—The lowest bid opened on July 11 by Maj. Spencer Cosby, Corps Engrs., U. S. A., for reconstruction of Pier 1, Aqueduct Bridge, was submitted by Chas. McDermott, of Washington, at the following bid: Constructing new pier, except concrete footing, $40,000; concrete footing, 120 cu. yds., $20 per cu. yd.; removal of old pier masonry above el. 15 ft., 980 cu. yds., $3 per cu. yd.; removal of old masonry, riprap, etc., below el. 15 ft., 1,530 cu. yds., $9.50; total cost, $59,875. Totals of other bids: Penn Bridge Co., Washington, $83,820; Cranford Paving Co., Washington, D. C., $76,497; Chas. T. Eastburne Co., Inc., Philadelphia, Pa., $78,480; and the Foundation Co., New York, N. Y., $74,600.

Cairo, Ill.—See "Railroads."

East St. Louis, Ill.—Bids will be received until Aug. 1 by the Bd. Local Improv. for rebuilding the Bway. viaduct. W. J. Crocken, City Engr.

Glencoe, Ill.—Bids will be received until July 31 by the Co. Comrs. at Chicago, for constructing a reinforced concrete bridge, 40-ft. span, at Glencoe.

New Albany, Ind.—It is reported that bids will be received until Aug. 8 by the Co. Comrs. for constructing a bridge across Big Indian Creek, between Lafayette and Greenville Townships. Thos. Hanlon, Co. Aud.

Winfield, Kan.—Plans are reported prepared for the S. Summit St. Bridge. It will be 520 ft. long with piers 50 ft. apart. The beams running the entire length of the bridge will be concrete, reinforced with steel. The floor will be of concrete reinforced with steel.

Sunnyhill, La.—It is stated that bids are wanted until Aug. 2 for construction of 3 steel bridges. L. P. Parker, of Franklinton, Secy. Police Jury of Washington Parish.

**Baltimore, Md.*—The Baltimore & Ohio R. R. Co. is reported to have awarded a contract for the masonry work on the new bridge over the Susquehanna River to Eyre-Shoemaker, Inc., of Philadelphia, Pa. The bridge will be more than 7,000 ft. long and will accommodate two tracks. It is estimated that 3 years will be required to complete the bridge, and the cost is $2,000,000.

Boston, Mass.—See "Paving and Roadmaking."

Reno, Nev.—Bids will be received until July 29 by the Co. Comrs. at Reno, for building abutments for 2 steel bridges across Truckee River. W. A. Fogg, Co. Clk.

**Hackensack, N. J.*—The Bd. of Chosen Freeholders of Bergen County are stated to have awarded on July 1 the contract for constructing the Court St. Bridge to F. R. Long & Co. for $79,750.

Le Roy, N. Y.—The construction of a bridge over the Oatka at Main St. replacing present structure is reported contemplated; probable cost, $10,000.

**New York, N. Y.*—The contract for cutting recesses and wells for additional anchorage in the west and east anchor piers of the Blackwell's Island Bridge (bids opened at the office of the Bridge Department July 2), has been awarded to the Williams Eng. & Constr. Co., 1 Park Row, for $5,205.

New Bern, N. C.—Bids will be received until Aug. 5 by the Co. Comrs. (C. E. Foy, Chmn.), at New Bern, for constructing a steel highway drawbridge over Swift Creek at Vanceboro, and also over Brices Creek near New Bern. Matthew & O'Brien, Engrs., Wilmington, N. C.

**Minot, N. D.*—Robt. D. Berry, Co. Aud., writes that the contract for constructing a 60-ft. steel bridge over Canon Ballover (bids opened July 1), has been awarded to the Fargo Bridge & Iron Co., of Fargo, for $3,490.

Findlay, O.—It is reported that bids will be received until Aug. 3 by the Co. Comrs. at Findlay (Isaac Hart, Chmn.), for constructing a steel bridge across Blanchard River in Blanchard Township. Separate bids are to be submitted as follows: Substructure, superstructure; also a bid on abutments with piers of concrete; also piers of native and sand stone masonry above the footing line and concrete stone backing. Bidders may submit plans with bids if so desired.

Cleveland, O.—Bids will be received until Aug. 3 by the Co. Comrs. (Julius C. Dorn, Clk.), for constructing per report No. 1606, concrete abutment, Strongsville Township.

Bids will be received until Aug. 10 by the Co. Comrs. at Cleveland (Julius C. Dorn, Clk.) for constructing a steel concrete bridge in Parma Township, per report No. 1607; also a concrete arch culvert in Parma Township, per report 1612.

Troy, O.—It is repored that bids will be received by the Co. Comrs. until Aug. 5 for constructing superstructure of steel automatic swing bridge over Miami and Erie Canal, at Water St. E. E. Pearson, Co. Aud.

Tiffin, O.—Bids will be opened at the Co. Auditor's office on July 30 for repairing Perry St. bridge, in the city of Tiffin. Estimated cost, $8,000.

Toledo, O.—All bids opened by Bd. Pub. Service, July 10, are reported to have been rejected, being in excess of the appropriation. According to reports new bids will be received.

Hamilton, O.—It is stated that bids will be received until July 30 by C. Pabst, Co. Aud., for constructing the superstructure of a bridge over Nine-Mile Creek on Seven-Mile and Collinsville Pike.

Jackson, O.—It is stated that bids will be received until Aug. 5 by the Co. Aud. for constructing 6 concrete bridges.

Washington C. H., O.—It is stated that bids will be received until Aug. 3 by H. D. Chaffin, Co. Aud., for constructing an iron bridge, 84x14 ft., over Crompton Creek.

**Enterprise, O.*—Jas. L. Martin, Co. Aud., Logan, writes that the contract for constructing steel superstructure across Hocking River at Logan-Lancaster Rd., in Falls ownship (bids opened July 6), has been awarded to Brookville Bridge Co., of Brookville, O., $5,475.

Guthrie, Okla.—The City Council has under consideration the construction of a concrete bridge on 5th St. with a 100-ft. arch; also a steel bridge at 9th St. with 140-ft. span. W. W. Miller, City Engr.

San Juan, P. R.—Alternate bids and plans will be received until Aug. 20 by J. J. Jimenez, Supt. Pub. Wks., San Juan, for furnishing at a dock at San Juan, for furnishing and erecting in place, or erecting only, 3 steel riveted highway bridges, spans 49 ft. 6 in., 2 ft. 3 in., and 35 ft. 3 in. long, for the Mulas, Higuero and Convento Creeks, respectively, located on the Bayamon-Comerio Road.

Ebensburg, Pa.—Bids will be received until July 30 b ythe Co. Comrs. at Ebensburg for a concrete bridge 40 ft. long, over Conemaugh River at Portage; also a concrete bridge 36 ft. long, over Little Paint Creek, in Richland Township; all steel for said bridges to be furnished by the contractor.

Williamsport, Pa.—Bids will be received until Aug. 1 by the Bd. Co. Comrs. (Frank L. Miller, Clk.) for constructing a stone bridge, 44-ft. span, across Plunkett's Creek, near Proctorville; stone arch bridge, 26-ft., span, across Lick Run, Shrewbury Township; stone arch bridge, 22-ft. span, over Wolf Run, Muncy Township; concrete steel deck span across Tombs Run, Watson Township, 22-ft. span.

Clarion, Pa.—It is stated that bids will be received until July 30 by the Co. Comrs. for constructing the substructure and superstructure of a bridge across Clarion River at Mill Creek. H. M. Hufnagel, Co. Clk.

Allegheny, Pa.—It is stated that plans are being considered for the construction of a stone viaduct to extend from Park St. and Grant Ave. to the Allegheny River front; the structure to be about 1,400 ft. long; probable cost, $100,000.

Pittsburg, Pa.—The construction of a bridge over the Pennsylvania R. R. and Pittsburg & Junction R. R. tracks froom Melwood St. to Ella St. in Bloomfield is reported contemplated.

Ft. Worth, Tex.—Bids will be received until July 29 by C. J. McKenna, Co. Aud., for a 30-ft. steel bridge with 12-ft. roadway, resting on solid concrete walls, with 6-ft. wing walls on each side, 2 ft. at bottom and 8 in. at top, over Rocky branch, about 9 miles from Ft. Worth.

Galveston, Tex.—See "Miscellaneous."

Spokane, Wash.—The City Counciil is stated to have reported favorably on the plans of Wallace Coates Co. for a bridge over North Channel at Howard St., a bridge and viaduct over channel and O. R. & N. and Great Northern tracks at Washington St., also authorizing the Wallace Coates Co. to prepare plans for a bridge at Mission St., the estimated cost of the Howard and N. Washington Sts. bridges are $34,500 and $46,712, respectively.

**Milwaukee, Wis.*—The Bd. of Pub. Wks. is stated to have awarded the contract for constructing a concrete bridge over the Kinnickinnic River at 3d Ave., for $4,920.

Shellmouth, Man.—Bids will be received until Aug. 3 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a steel superstructure for the bridge over the Assiniboine River at Shellmouth. A. R. Dufresne, Res. Engr., Winnipeg, Man.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Ashville, Ala.—Bids will be received until Aug. 5 for $85,000 road improvement bonds. John W. Inzer, Chmn. Co. Roads Comrs.

Decatur, Ala.—It is reported that on July 25 the City Authorities will let contracts for paving 57,000 ft. with bitulithic.

**Ensley, Ala.*—The Southern Bitulithic Co., of Birmingham, is reported to have secured the contract for paving portions of Ave. A and 19th St. at $1.90 per sq. yd., or a total of about $40,500.

**Denver, Colo.*—The contract for grading, curbing, etc., North Side Improv. Dist. No. 6 (bids opened June 10), has been awarded to Gaffy & Keefe Constr. Co., 310-311 Exchange Bldg., for $56,894. The contract for laying sidewalks in North Side Improv. Dist. No. 4 (bids opened June 11), has been awarded to J. Fred Roberts, 1850 16th St., for $33,065.

Plainfield, Conn.—Bids will be received until July 26 by the Bd. of Selectmen (Benj. R. Briggs, 1st Selectman) for constructing 2 sections of gravel road.

New Britain, Conn.—The paving of Church St. is reported contemplated.

Hartford, Conn.—The Senate has passed the bond issue bill, which provides for the following: For good roads, $4,500,000, to be expended at the rate of not more than $750,000 a year during the 6 years to Sept. 30, 1913; for State Library and Capitol repairs, $1,500,000, and for arsenal and armory, $500,000. The whole proposition to be submitted to the people at the October town elections this fall.

**Wilmington, Del.*—Francis A. Price, New Castle Co. State Highway Comr., writes that bids were opened on July 9 for constructing macadam roads, and Stewart & Donohue, of Wilmington, secured contracts as follows: Road from Delaware City to Red Lion Creek, 3.25 miles, 12 ft. wide and 6 in. deep, $24,751; road from Red Lion Creek to Tybout's cross-roads, 1.38 miles, 12 ft. wide and 6 in. deep, $10,118; Depot Road, Pancader, hundred .13 of a mile, 16 ft. wide 6 in. deep, $1,267; Depot and Telegraph Roads, White Clay Creek Hundred, $17,900, and Telegraph Road in Mill Creek Hd., 4.26 miles, 12 ft. wide, 8 in. deep.

Francis A. Price further states that bids were opened for other roads on July 9 as follows, and contracts for which have not yet been let: (*a*) Summit Road, 2.35 miles, 12 ft. wide and 6 in. deep; (*b*) road from Mt. Pleasant to Boyd's Corner, 3.46 miles, 12 ft. wide 6 in. deep; Stewart & Donohue, *a*, $16,035; *b*, $22,891; J. A. McManus, Philadelphia, Pa., *a*, $17,042.85; *b*, $25,454; Theobald Harsch, Narbeth, Pa., *a*, $17,800; *b*, $26,562.

Francis A. Price, New Castle Co. State Highway Comr., writes that no bids were received on July 9

** Items marked thus give the names of parties awarded contracts.*

for constructing road in Blackbird Hundred, from Taylor's Bridge to the iron bridge over Smyrna River at Fleming's Landing, a distance of 4.82 miles, road bed to be 9 ft. wide and 9 in. deep. This road was ordered readvertised.

Wilmington, Del.—Bids will be received until July 30 by the Francis A. Price, New Castle County State Highway Comr., 1000½ Market St., Wilmington, for constructing a road in Blackbird hundred, a distance of about 4.82 miles.

Rome, Ga.—See "Water."

Belleville, Ill.—See "Sewerage and Sewage Disposal."

**Paris, Ill.*—W. T. Blackburn, City Engr., writes that the contract for 16,821 sq. yds. brick paving (bids opened July 8) has been awarded to Alan Jay Parrish, of Paris.

Freeport, Ill.—Bids will be received by the Bd. of Local Improv. until July 25 for brick paving on Walnut St., as advertised in The Engineering Record. G. W. Graham, City Engr.

Chicago, Ill.—Bids will be received until July 23 by Bd. of Local Improv. (H. S. Dietrich, Pres.), for furnishing material, curbing and paving on portions of several alleys and streets, including W. 18th, Osgood, 37th and School Sts. and Milwaukee, N. Hoyne, N. Spaulding and N. Oakley Aves. The materials to be used being creosoted wood blocks, asphalt and granite.

**Aurora, Ill.*—Contracts for paving (bids opened July 2) have been awarded as follows: To J. E. Solfisburg & Co., of Aurora, for paving Jackson St., 14,400 sq. yds. brick pavt. on 6 in. concrete base, 2 in. sand cushion, asphalt joint fill, $1.94; and 9,830 ft. combined curb and gutter, 47 cts; total $32,556; and to J. A. Heineman, of Chicago, for Clark St., 3,610 sq. yds. brick pavt on 4 in. Portland concrete base, 2 in. sand cushion, sand fill, $1.75; and 1,930 ft. combined curb and gutter, 55 cts.; total, $7,379.

Green Castle, Ind.—It is reported that the Comrs. of Putnam Co. will receive bids until July 27 for the construction of the following macadamized roads: 11,434 ft. in Green Castle Township, known as the Butter road; 11,720 ft. in Washington Township, known as the McElroy road; 6,005 ft. in Marion Township, known as the Hurst road; 9,011 ft. in Monroe Township, known as the H. G. Brown road; and 10,943 ft. in Madison Township, known as the Rowings road. C. C. Hurst, Co. Aud.

Bloomington, Ind.—The Comrs. of Monroe Co., it is reported, will receive bids until 2 P. M. Aug. 6 for constructing Smithville and Ketcham's Mill free gravel road in Clear Creek Township, said road being 11,200 ft. in length. S. M. Kerr, Co. Aud.

Peru, Ind.—It is reported that bids will be received until Aug. 7 by the Co. Comrs. for grading, draining and paving about 23½ miles of free gravel roads in Richland Township. Chas. Griswold, Co. Aud.

Mt. Vernon, Ind.—It is reported that the Comrs. of Posey Co. will receive bids until 12 M Aug. 5 for the construction of 10 gravel roads, comprising 21.56 miles. S. G. Howard, Co. Aud.

Spencer, Ind.—It is reported that bids will be received until Aug. 5 by the Co. Comrs. for constructing about 1 mile of pike road in Clay Township and 1½ miles in Taylor Township. Also until Aug. 6 for constructing 6,176 ft. of pike road in Jennings Township. Geo. O. Mitten, Co. Aud.

Brazil, Ind.—It is reported that the Comrs. of Clay County will receive bids until 11.30 A. M. Aug. 6 for the construction of a gravel road in Lewis Township, a total length of 10,050 ft. Jas. L. Burns, Co. Aud.

Auburn, Ind.—The lowest bid opened on July 2 by City Council for sheet asphalt paving was submitted by the Western Constr. Co., of Ft. Wayne, at the following bid: Paving roadway on 5-in. concrete foundn., per sq. yd., $1.95; roadway on 6-in. concrete foundn., per sq. yd., $3.40; curb and gutter by T. & C. tracks, per sq. yd., $3.40; curb and gutter, per lin. ft., 60 cts.; earth excav., per cu. yd., 35 cts.; marginal curb, 3x18, per lin. ft., 48 cts.; manholes, ea., $33; catch-basins and connections, ea., $40; catch-basins, inlets and connection, ea., $18; repair and remodel old catch-basins, ea., $7; furnishing and laying 6-in. vitr. pipe, per lin. ft., 30 cts.; 8-in., 48 cts.; 10-in., 56 cts.; 12-in. 65 cts.; 15-in. 75 cts.; and constructing track drips, 6-in. sewer pipe, per lin. ft., 55 cts.; total, $65,650. The only other bid received was that of the Barber Asphalt Co., of Ft. Wayne, for $74,757.

Valparaiso, Ind.—It is stated that bids will be received until July 26 by Robt. B. Ewing, City Ck., for constructing about 1 mile of cement sidewalk.

Indianapolis, Ind.—Bids will be received until July 24 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.), for paving with brick on 6 in. concrete foundation on portion of Brookside Ave.; with creosoted wooden blocks on 6-in concrete foundation on North St. with asphalt on present foundation; on 16th St., with bitulithic on present concrete foundation on Washington St.

Bids will be received until July 26 by the Dept. Pub. Wks (Jos T. Elliott, Pres.), for improving a portion of Orange St. by grading, graveling and rolling the roadway and paving the sidewalks with cement; improving a portion of 21st and New Jersey Sts. by paving with brick; 19th St., paving with asphalt, all to be on 6-in. concrete foundation, and 1st Alley, east of Senate Ave., by paving with brick on 6-in. rolled broken stone foundation, grading and paving sidewalks with cement on portion of Beville Ave.

**Petersburg, Ind.*—F. R. Bilderbuck, Co. Aud., writes that the contract for constructing 1½ miles gravel road in Washington Township (bids opened July 12), has been awarded to Jasper N. Kinman, of Petersburg.

Evansville, Ind.—The only bid received for paving 10th and Chestnut Sts. with asphalt is reported to have been submitted by Western Constr. Co. at $1.98 per sq. yd. and 60 cts. per lin. ft. for concrete curb and gutter.

**Des Moines, Ia.*—The contract for grading Kingman Boule. is stated to have been awarded by the Bd. of Pub. Wks. to O. P. Herrick Co., at $1.04 per yd.

**Dubuque, Ia.*—The McCarthy Improvement Co., of Davenport, is reported to have secured the contract for brick paving about 2 miles of streets in Dubuque, for $65,000.

Des Moines, Ia.—Plans are now being prepared by Geo. D. Dobson, City Engr., for paving Grand Ave., about 6 blocks, from 6th Ave. to Des Moines River, with vitr. paving block. Geo. D. Dobson, City Engr.

*W. A. Bryant & Sons, of Waterloo, have secured the contract for 15,298 sq. yds. sheet asphalt paving, on 6-in. Concrete foundation, at $2.15 per sq. yd., and the Kettle River Quarries Co., of Minneapolis, Minn., have contract for 1,860 sq. yds. creosoted wood block paving on 6th Ave. Bridge, at $2.93 per sq. yd.

Independence, Io.—It is reported that bids will be received until July 30 by Rufus Brewer, City Clk., for 4,049 sq. yds. brick paving and 1,522 lin. ft. curbing on 1st St., and 3,657 sq. yds. brick paving and 1,350 lin. ft. curbing on 2d Ave., n. e.

New Orleans, La.—The Streets and Landings Com. is reported to have reported favorably the following ordinances providing for the paving of Philip, Soraparn, 1st, 2d, 3d, 4th, 6th, 7th, 8th, 9th, Washington, Harmony, Pleasant, Toledano Sts. and Louisiana Ave.

Saco, Me.—Bids will be received until July 24 by the Com. on Macadamizing (H. A. Weymouth, Chmn.), for building 4 sections of highway. The work includes about 23,400 sq. yds. broken stone roadway.

Boston, Mass.—Bids will be received until July 22 by Wm. Jackson, City Engr., for steel and iron curbing, wooden flooring, waterproofing and granite block paving of the draw span and spans 1, 2 and 3 of Northern Ave. Bridge, and giving bond of a surety company in $15,000.

Hudson, Mich.—Fred. P. George, City Clk., writes that all bids opened on July 12 for 9,000 to 12,000 sq. yds. brick paving have been rejected and new bids will be received until 2 p. m. on July 23. Engineers, The Riggs & Sherman Co., of Toledo, O.

**St. Paul, Minn.*—The contract for paving portions of Ottawa Ave., Sidney and King Sts. is reported to have been awarded by the Bd. of Pub. Wks. July 9 to D. W. Moore, 902 Edmund St., at $10,397.

*The Bd. of Pub. Wks. is stated to have awarded the contract for macadamizing and curbing a portion of University Ave. to General Contr. Co. for $20,548.

Minneapolis, Minn.—Bids will be received until July 29 by Hugh R. Scott, Co. Aud., for contract No. 18, Road No. 8.

St. Louis, Mo.—State Highway Engineer Curtis Hill is reported to have been directed to prepare plans for a State highway to be constructed between St. Louis and Kansas City, appropriation available for improvement is $500,000.

Great Falls, Mont.—This city has annulled the contract for brick paving on Central Ave., and will pave same with creosoted block. Plans and specifications are now being prepared. C. W. Swearingen, City Engr.

**Newark, N. J.*—The Bd. of Wks. is stated to have awarded contracts for grading, curbing and flagging, on June 27, as follows: Jersey Paving Co., 45 Clinton St., Alpine, Branford, Concord, Gold, Hunter Sts. and Weston Ave., for $18,807; Van Keuren & Son, Grand and Prior Sts., Jersey City, Peddie and Wainwright Sts., for $29,794; Brown & Rusling Co., Clifton, Earl, Runyon Sts. and Meeker Ave., for $10,477; and to Wm. Ballard, 279 Runyon Ave., Madison Ave., for $14,820.

J. R. Shanley is reported to have secured contracts for paving with granite portions of Bergen, Oliver, Poinier and Beacon Sts. for $79,387.

Bids will be received until July 30 by Essex Co. Park Comrs. (A. Church, Secy.), at 800 Broad St., for 18 000 sq. yds. 8-in. telford roadway in Weequahic Reservation.

Jersey City, N. J.—Bids will be received by the Boulev. Comrs. of Hudson County (John C. Sweeney, Clk.) at 580 Newark Ave., Jersey City, on July 25th, at 3 P. M., for repairing the surface of the macadam roadway, removing the gravel centre and replacing it with macadam, and for treating the roadway with tar, on sections of Hudson Boule. as follows: Between 1st St. and Central Railroad Bridge, Bayonne; between Gates Ave. and McAdoo Ave., Jersey City, and between Communipaw Ave. and Newark Ave., Jersey City. For repairing the surface of the roadway with stone, between Hutton St. and Poplar St., Jersey City; repairing the surface of the roadway by removing the gravel centre and repaving it with macadam, from Hudson Ave. to 40th St., and by resurfacing the roadway with gravel, from 40th St. to Bergenline Ave., North Bergen Township.

**Camden, N. J.*—The Barber Asphalt Co., of Philadelphia, Pa., has secured the contract for paving Pearl St. with asphalt from 9th to 10th St., at $1.74 per sq. yd.; new stone curb, 5x20 in., $1.12 per lin. ft.; curb reset, 25 cts. per lin. ft.

Contract for paving with asphalt, granite or wood block Haddon Ave., Federal St. and Bway. (bids recently received), amounting to about 70,000 sq. yds., have not yet been let. L. E. Farnham, City Engr.

**Atlantic City, N. J.*—E. D. Rightmire, Co. Engr., write that the contract for grading and graveling road from Mays Landing to Donnstown (bids opened July 10), has been awarded to C. W. Mathis & Co., of Tuckerton, for $34,874.

Somers Point, N. J.—Bids will be received by Jas. E. Scull, City Clk., until Aug. 5 for paving with macadam George St. and Main, Annie, Somers and Delaware Aves., consisting of 11,928 sq. yds. macadam, 6,285 lin. ft. bluestone curb, 1,365 lin. ft. curb reset, and 56 lin. ft. radius curb, as advertised in The Engineering Record. E. D. Rightmire, City Engr., Bartlett Bldg., Atlantic City.

Somers Point, N. J.—See "Miscellaneous."

Plainfield, N. J.—Bids will be received by Common Council until Aug. 5 for 15,702 sq. yds. brick pavt., 1,035 lin. ft. new curb, 1,400 lin. ft. curb reset, with surface and underdrains and appurtenances, as advertised in The Engineering Record. Andrew J. Gavett, City Surveyor; Geo. B. Wean, City Clk. pro tem.

Cohoes, N. Y.—Local press reports state that bids will be received by the City Council until Aug. 6 for the paving of Newark St. with brick on concrete base and granite block on sand foundation.

**Albany, N. Y.*—The Bd. Contract and Supply is reported to have awarded on July 9 contracts as follows: Dennison & Co., of Rochester, improving portion of Morris St. for $13,740, and Partridge St., at $7,738; Michael F. Dollard, 86 State St., Judson St., at $7,738.

**Waterford, N. Y.*—The Bd. of Village Trus. is stated to have awarded, July 1, the contract for 5,700 sq. yds. of brick paving on Broad and 9th Sts. to Flynn & Mills, of Waterford, at $19,331.

Rensselaer, N. Y.—The County Bd. of Supervisors are stated to have decided to macadamize the road from Rensselaer to De Freestville.

**Schenectady, N. Y.*—The Bd. of Contract & Supply is stated to have awarded contracts as follows for paving: Schenectady Contr. Co., Broadway, $95,724; and McClellan St. at $2.25 per sq. yd., for asphalt; Union Paving Co., Becker St., at $1.90 per sq. yd. for asphalt.

**Rochester, N. Y.*—The contract for paving N. Goodman St. is reported to have been awarded to Whitmore, Rauber & Vicinus, 279 South Ave., for $20,504.

Brooklyn, N. Y.—Bids will be received until July 31 by Bird S. Coler, Boro. Pres., for regulating, grading, paving and repaving portions of several streets; also laying sidewalks on several other streets, including Delmonico Pl., E. 32d St., 93d St. and Ocean Ave. Engineer's estimate, 21,075 sq. yds. asphalt, 30,527 lin. ft. new curb, 58,220 sq. ft. cement sidewalk, etc.

St. George, New Brighton, S. I., N. Y.—Bids will be received until July 30 by Geo. Cromwell, Boro. Pres., for furnishing and delivering 3,000 tons (2,000 lbs. ea.) of 1½-in. and ¾-in. broken stone and screenings of trap rock or Staten Island syenite, to be delivered wherever and whenever and in quantities as required by the Supt. of Highways in Stone Delivery Dist. No. 2, Boro. Richmond.

Harrison, N. Y.—Bids will be received until July 23 by Robt. T. Shore, Town Clk., for $175,000 highway improvement bonds.

Lynn, N. C.—Bids are wanted for $12,000 Tyron Township good road bonds. Address F. S. Wilcox, Chmn. Finance Com., Lynn.

Fargo, N. D.—It is reported that bids will be received until July 25 by Geo. F. Clark, Clk. Fargo Township, for paving with brick on N. Broadway.

Greenville, O.—It is stated that bids will be received until Aug. 3 by the Co. Comrs. at Greenville, for the York Road improvement. Jos. E. Marker, Co. Surv.

**Dayton, O.*—The Bd. of Pub. Service is stated to have awarded contract for paving as follows: Clay St. to A. W. Roe & Son, for $6,537, and Salem Ave. to J. E. Conley & Co. for $117,557.

It is stated that bids are asked by the Bd. of Pub. Service (W. A. Maynes, Clk.) until July 23, for grading, paving, curbing, etc., portions of various streets. Robt. E. Kline, City Engr.

Bergholz, O.—Road improvement bonds, amounting to $25,000, are reported sold.

Toledo, O.—Jas. Sheehan is reported to have submitted the lowest bid June 24 for paving a portion of Summit St. with brick on broken stone foundation $1.22, and on concrete foundation $1.54 per sq. yd.; probable cost of the improvement is $110,000.

*The Bd. of Pub. Service is stated to have awarded the contract for paving a portion of Irving St. with asphalt to Henry Streicker, 20 St. Clair Bldg., for $12,738.

The paving of Phillips Ave., at a cost of $46,000, is reported contemplated.

Steubenville, O.—State Highway Comr. Saml. Huston, Columbus, O., is advertising a highway proposed under the new Ohio law, for letting at Steubenville on July 30th. Specifications will be mailed to contractors upon request.

**Hamilton, O.*—The contract for grading, graveling, curbing and paving sidewalks of Ross Ave. is reported to have been awarded to the Garver Contr. & Transfer Co. at $8,056.

**Cincinnati, O.*—The Louis Drach Constr. Co., 206 E. 4th St., is reported to have secured the contract for improving the Ohio Pike from Bogart Road to Clermont County for $30,205.

Bids will be received until Aug. 12 by W. C. Culkins, City Aud., for $363,000 street improvement bonds; also, same date, $15,000 bonds, the proceeds to be used to purchase asphalt and repair plant and for equipping and furnishing of said plant.

**Bryan, O.*—The County Comrs. are stated to have awarded the contract for grading and macadamizing about 1 mile of road in Brady Township to Crawford & Spratt, of Toledo, for $7,417.

St. Clairsville, O.—State Highway Comr. Saml. Huston, Columbus, is advertising two highways proposed under the new Ohio law, for letting at St. Clairsville on Aug. 3. Specifications will be mailed to contractors upon request.

Columbus, O.—The Bd. of Pub. Service is reported to have opened bids July 12 as follows for constructing municipal asphalt repair plant: Hetherington & Berner, of Indianapolis, Ind., $11,825, and Iroquois Iron Works, of Buffalo, N. Y., $13,925.

Marietta, O.—It is reported that bids will be opened, July 23, for $7,404 bonds for street improvements Carl Becker, City Aud.

South Charleston, O.—It is reported that bids will be received, July 23, 8 P. M., for $5,500 street improvement bonds. W. L. Wentz, Village Clk.

Bridgeport, O.—It is reported that bids will be opened, July 29, for $10,000 bonds for improving Howard St. W. W. Bragg, Village Clk.

Oberlin, O.—It is reported that bids are wanted by the Village Council until July 27 for paving portions of W. Lorain and N. Professor Sts. C. H. Snyder, Village Clk.

Guthrie, Okla.—See "Water."

Oklahoma City, Okla.—W. C. Burke, City Engr., writes that bids will probably soon be asked for about 55,000 sq. yds. of asphalt pavement with 6-in. concrete base. Bids will be received on either hydraulic or Portland cement. This work will be paid for in either

* *Items marked thus give the names of parties awarded contracts.*

gross or individual tax certificates against the abutting property, payable in 10 equal annual installments, the gross certificates bearing 6 per cent. and the individual bearing 7 per cent. interest.

Ashland, Ore.—It is reported that bids will be received until July 30 by the City Council for furnishing material and macadamizing about 16,860 sq. yds., including grading, concrete curbs and gutters and cross walks. Frank C. Kelsey, Engr., 504 Columbus Bldg., Portland.

Washington, Pa.—Bids will be received until Aug. 6 by the Co. Comrs., at Washington, for improving roadbeds, culverts, etc., on certain highways in the county, in all about 13 miles. Wm. Wylie, Co. Road Engr. for Comrs.

Jenkintown, Pa.—Bids will be received until July 29 by John K. Leatherman, Chmn. Com. on Streets, Roads & Bridges, Boro. Hall., for the resurfacing of 520 lin. ft., the macadamizing of 2,780 lin. ft. of streets and the laying of 500 lin. ft. of brick or block paving in the Boro. Ruddach & McCracken, Boro. Engrs., 401 Leedom St.

Williamsport, Pa.—Bids will be received by the Highway and Sewer Com. until Aug. 3 for furnishing the following, to be delivered at Williamsport: A 20-h. p. boiler and 15-h. p. engine, including fittings; steam jacketed asphalt mixer; fire wagon to heat asphalt tools; portable asphalt melting kettle; sand drier, and 7 or 8-ton tandem asphalt road roller, as advertised in The Engineering Record. Jas. F. Fisher, City Engr.

McDonald, Pa.—Bids will be received until July 29 by Del Allison, Boro. Clk., for grading, curbing and paving a portion of Barr St.

Allegheny, Pa.—The City Counciil is reported to have passed ordinances providing for the paving of Latrobe Alley, Frazier, Warner Sts., Motive, Juno and Ramage Alleys.

**Clarion, Pa.*—G. G. Sloan, Boro. Clk., writes that Johnston & Hastings, of Brookville, have secured the contract for paving Wood and Main Sts., about 6,200 cu. yds., excav., 9,685 lin. ft. curb and 16,780 sq. yds. wire cut brick at a total of $34,161. The other bidders were McGuire & Coats, New Brighton, $35,223; Frank J. Dixon & Bro., Blairsville, $37,064, and Rosers & Maloney, Bellaire, O., $43,374.

Ft. Greble, R. I.—Bids will be received until July 31 by Capt. Willis C. Metcalf, Q. M., U. S. A., in charge of construction, Ft. Adams, for resurfacing of macadam roads and construction and repair of catch basins at Ft. Greble.

Galveston, Tex.—Bids will be received until July 29 by John M. Murch, Co. Aud., for paving the roadway with vitrified Thurber brick from 35th to 39th Sts., approximately 9,610 sq. yds., concrete curbing 1,580 lin. ft., and concrete sidewalks on the approach at 37th St.

Tazewell, Va.—It is stated that bids will be received until July 25 by E. V. Spotts, Mayor, for rebuilding part of a macadam street, approximately 1¼ miles.

Morgantown, W. Va.—See "Sewerage and Sewage Disposals."

Shawano, Wis.—Bids will be received until July 29 by the Com. on Streets and Sidewalks (Gustav. Thomas, Chmn.) for paving with brick on a portion of Main St., including gutters and curb.

**Milwaukee, Wis.*—The Barber Asphalt Co. is reported to have secured the contract for resurfacing with asphalt a portion of Jefferson St. at $1.78 per sq. yd., or a total of $15,173. Bids opened July 9 by Bd. Pub. Wks.

Stevens Point, Wis.—It is repored that bids will be received until Aug. 3 by the Bd. Pub. Wks. for macadamizing, curbing and guttering on Strongs Ave.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

St. Helena, Cal.—H. M. Pittman is reported to have purchased property at Barro Station and will establish there an electric plant to furnish electric light and power to St. Helena and Calistoga.

Norwich, Conn.—The City Council is reported to have authorized the Gas and Electric Comrs. to borrow $30,000 for additions and extensions to the electric light plant, extension of gas mains, etc.

Washington, D. C.—See "Miscellaneous."

Calhoun, Ga.—The citizens are reported to have voted to issue $12,500 bonds to construct electric light plant, and for water works improvements.

Brunswick, Ga.—The City Council is reported to have granted F. D. M. Strachan and associates a 40-yr. franchise for an electric light and gas plant and electric railway.

**Lebanon, Ill.*—C. L. Robinson, City Clk., writes that the Atlas Eng. Co., 607 Chemical Bldg., St. Louis, Mo., has secured the contract for furnishing engine for the electric light plant (bids opened July 8) for $2,000.

**Joliet, Ill.*—It is reported that Jas. O. Heyworth, Railway Exchange, Chicago, has been awarded contract for construction of the hydraulic development of the Economy Light & Power Co., of Joliet, on the Des Plaines River, 9 miles from Morris, Ill., and that he will sub-let contract for 500,000 cu. yds. of grading and levee work required in the development.

Lafayette, Ind.—The Merchants Electric Light & Htg. Co. is reported to have on July 3 let contracts for new equipment and the remodeling of its building, at a cost of about $35,000. Joshua Chew secured contract for additions to plant, and the Lafayette Eng. Co., of Lafayette, for the construction work.

Sioux City, Ia.—Bids will be received until Aug. 6 by the City Clk. for lighting the streets with electric light for a period of 5, 7 or 10 years beginning June 1, 1908. Bids to be on moon and all night schedule and to provide for not less than 80 arc lights of 2,000 c. p. and not less than 880 incandescent lights. Bids to be on both 25 and 32 c. p. T. W. Bayne, Chmn. Com. on Lights.

Bucksport, Me.—The Penobscot Bay Electric Co. is reported formed, with a capital of $200,000 to make, generate, distribute, supply and sell electricity for heating, power, lighting in Bucksport, Orland, Penobscot, Castine, Bluehill, Winterport, Frankfort, Stockton Springs and Verona. Incorporators: Wm. M. Shaw, of Greenville; Albert H. Shaw, of Bath, and Melville H. Blackwell, of Brunswick.

**Baltimore, Md.*—The Consolidated Gas & Electric Co. is reported to have awarded to the Baltimore Ferro-Concrete Co., of Baltimore, the contract for a power house to be erected at Westport; probable cost, $170,000.

Crystal Falls, Mich.—Bids will be received until July 25 (readvertisement) by the City Council for erecting an addition to the power station, as advertised in The Engineering Record. Robt. Munns, City Clk.

Brainerd, Minn.—It is reported that repairs are proposed to the municipal electric light plant.

Minneapolis, Minn.—The Minneapolis Htg. & Transmissioon Co. is reported to have petitioned City Council for a franchise to tunnel the streets of city for 25 years for conduits in which to transmit light and heat.

Dawson, Minn.—Oscar Claussen, of St. Paul, is preparing plans for water works and an electric light plant, to cost about $28,000.

Hattiesburg, Miss.—The Hattiesburg Light & Power Co., the Hattiesburg Traction Co., and the Hattiesburg Gas Co. are reported to have been merged into one company, the Hattiesburg Traction Co. The combined capital is $300,000, and this will be increased at once to $500,000. Extensive improvements will be made in the electric light and gas plants.

**Jackson, Mo.*—Wm. Paar, City Clk., writes that the contract for constructing an electric light plant and pumping station (bids opened July 10) has been awarded to the Electric & Steam Eng. Co., 1122 Chemical Bldg., St. Louis, for $32,022. P. H. Porter, of Clinton, Ky., also bid for this work $34,960.

Holden, Mo.—Bids will be received until July 31 by O. G. Boisseau, Mayor, for $6,000 bonds, the proceeds to be used to enlarge and extend the electric light plant.

Warrensburg, Mo.—The Gas & Electric Development Co., 1328 Chestnut St., Philadelphia, Pa., have sold the plant of the Magnolia Light, Heat & Power Co. to Philadelphia parties. The new company will be known as the Warrensburg Light & Power Co., and will make extensive improvements. The Warrensburg plant will be operated by the Gas & Electric Developement Co.

Tecumseh, Neb.—The citizens are reported to have voted on July 9 to issue $16,000 bonds for an electric light plant.

Fremont, Neb.—The City Council is reported to be considering the question of reconstructing, or building an entirely new municipal water and light station.

Asbury Park, N. J.—The Town Counel is reported to have granted Moore & Clarkson a franchise to construct and operate an electric power plant.

Netcong, N. J.—The Willsbrook Electric Light Co., of Netcong, is reported incorporated to generate, etc., electric current for light, heat and power; capital, $30,000. Incorporators: J. S. Kennedy, H. H. Neiden, and D. M. Cook, of Stanhope.

Madison, N. J.—The Town Council is stated to have passed a resolution on July 9 calling for a report on the advisability of changing the lighting system from 1,100 to 2,200 volts.

**Rosebank, S. I., N. Y.*—The Commercial Constr. Co., 114 E. 28th St., N. Y. City, has secured the contract for installing electric euipment in addition to and alteration in School 13, Rosebank, for $10,078 (bids opened July 8 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City). Griffin & Co., N. Y. City, bid for this work $10,399, and T. Fred Jackson, Inc., N. Y. City, $10,297.

Oswego, N. Y.—Thos. N. Devine, City Clk., writes that plans are now being prepared for power house to be erected in connection with high dam. For further information address F. W. Ormsby, Supt. Water Wks.

Cleveland Heights, O.—Bids will be received until Aug. 6 by Wm. G. Phare, Village Clk (Fairmount P. O), for furnishing material and lightning certain streets and roads in Euclid Heights allotment.

Mosquite, Ore.—See "Water."

Lebanon, Pa.—Bids will be received until Aug. 31 by the Police Com. (Geo. D. Krause, Chmn.) for street lighting. Bids are to be submitted on 2 propositions and are to be for lighting every night and all night, the propositions being as follows: For a term of one year, for 150 or more arc lights of 2,000 c. p. (7.5 amperes, 72 volt) ea., enclosed arcs, and 150 or more series incandescent lights, 24 c. p. (1.12 amperes, 72 volt) ea., also on a 5-year contract, same number of lights.

Britton, S. D.—Bids will be received until July 29 by M. S. Woodard, Co. Aud., for electric fixtures, etc., in the Court House.

Gary, S. D.—The question of constructing an electric light plant is reported under consideration.

Platte, S. D.—John Alsher, of Wagner, is reported to have secured a franchise for an electric light plant.

Monterey, Tenn.—The citizens are reported to have voted to issue $25,000 bonds for water works and an eletric light plant.

Big Spring, Tex. The electric light plant owned by L. L. Stephenson, of Big Spring, is reported to have been destroyed by fire.

Stephenville, Tex.—The Stephenville Light & Water Co., of Stephenville, has been incorporated, with a capital of $10,000, by C. H. Bencini, D. H. Burroughs and W. D. Head.

Terrell, Tex.—A. M. Wooly, City Secy., writes that the citizens on July 9 voted to issue $15,000 bonds for constructing an electric light plant.

Wharton, Tex.—H. P. Phiel, Sr., of Fredericksburg, Tex., is reported interested in the construction of an electric light plant in Wharton.

Waco, Tex.—The Home Light & Power Co. is reported incorporated, with a capital of $25,000, by C. R. Boyton, M. L. Lane and others.

Toyah, Tex.—The Toyah Electric Light Co. is reported organized to operate an electric light plant on Toyah.

Chewlah, Wash.—It is stated that bids are wanted until Aug. 1 for constructing water works and electric plant. F. C. Ranch, Town Clk.

Tacoma, Wash.—We are informed that no bids were opened on July 3 for the proposed municipal power plant, steam, gas or hydraulic. New bids will be received until July 31 by Owen Woods, Comr. of Pub. Wks. The plant will have a capacity of not less than 4,000 h.p. Contractors to furnish their own plans.

Ashland, Wis.—It is reported that biids are wanted Aug. 1 for a municipal electric light plant.

Burkhardt, Wis.—The Burkhardt Mill & Electric Power Co. is reported incorporated, with a capital of $50,000, by Chris. Frank P. and Bertha Burkhardt.

Hamilton, Ont.—Bids will be received until Aug. 6 by S. H. Kent, City Clk., for supplying and lighting 600 or more gas street lamps.

Windsor, Ont.—The plant of the Windsor Gas Co. is reported to have been wrecked by an explosion on July 14.

Chatham, Ont.—This city is reported to be applying to the Ontario Ry. and Municipal Board for permission to submit a by-law to the people, providing for an expenditure of $15,000 for extension of electric light system.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—It is said that the Little Rock Ry. Co. (R. T. Baise, Ch. Engr.), will spend about $350,000 in betterments aside from equipment by the end of the present year if existing plans are carried out.

**Los Angeles, Cal.*—The Hueneme, Malibu & Port Los Angeles R. R. Co. is reported to have awarded contract to W. K. Peasley for the construction of 5 miles of railroad along the beach in the direction of Ventura.

Oakland, Cal.—It is reported that the City Council has granted to the Oakland Traction Co. a franchise for a single or double-track railway line in Lake Shore and Lake Park Aves., connecting with the Grand Ave. line.

**San Mateo, Cal.*—Peter Thorsen and J. Johns, of the San Mateo Constr. & Contr. Co. are stated to have petitioned the Bd. of Trustees for a franchise to operate electric cars in the town and to Burlingame by means of the underground conduit system. The name of the company is to be the People's Ry. Co.

Bridgeport, Conn.—A resolution incorporating the Bridgeport & Danbury Electric Ry. to build an electric road in Connecticut is stated to have been passed by the Legislature. Capital, $1,500,000.

Atlanta, Ga.—A charter is stated to have been granted by the Secretary of State to the Tennessee & Georgia Interurban Ry. Co. The proposed line starts at Rossville and runs through Chickamauga Park to Ringgold and Catoosa Springs, a distance of about 25 miles. Capital, $500,000. Incorporators: Jas. C. Bryan, Jas. L. Jones, W. E. Biggers, W. H. Paine, Jr., Chattanooga, and others.

Tifton, Ga.—The City Council is reported to have granted a franchise to L. P. Thurman, L. W. Myers, W. W. Banks, O. Daniel, J. E. Cochran, F. F. Bussey and J. J. L. Phillips to construct, own and operate an electric line through the principal streets of Tifton.

Brunswick, Ga.—See "Power Plants, Gas and Electricity."

Chrisman, Ill.—The City Council is reported to have granted a franchise to the Paris & Northern Ry. Co. The road will enter the city on McKinley and follow Illinois St. to the city limits.

Evanston, Ill.—The Evanston Council is stated to have granted a franchise to the Chicago Consolidated Traction Co. (J. M. Roach, Gen. Mgr., Chicago), to extend its tracks in North Evanston.

Chicago, Ill.—The Council is reported to have passed the Milwaukee & St. Paul ordinance. It allows the railroad to electrify its Evanston branch north of Wilson Ave. so as to carry the cars of the Northwestern Elevated to the city limits.

Gary, Ind.—The Town Bd. is reported to have granted a franchise to Frank Gavitt and associates, of Whiting, for street railway lines on Broadway, 5th and 11th Aves., in this city.

Indianapolis, Ind.—The Indianapolis Traction & Terminal Co. (Thos. B. McMath, Ch. Engr.), is stated to have secured additional property joining the terminal station, which completes the possession of the entire square. The company will erect thereon additional train sheds, an express depot and additional freight houses.

Columbus, Ind.—After considering a petition of the Indianapolis, Columbus & Southern Traction Co. (A. A. Anderson, Gen. Mgr.), for a franchise over 2d St., the City Council granted the same.

Sapulpa, Ind. Ter.—The citizens of Sapulpa are stated to have closed a deal with E. C. Reynolds to build an electric railway in Sapulpa and to the oil fields southeast of here.

**Atlantic, Ia.*—The Atlantic, Northern & Southern R. R. Co. is stated to have awarded the contract for the grade work on the new railroad to Tompkins to Fitzgerald & Peterson, of Omaha, Neb., at 18 cts. per cu. yd.

Brunswick, Md.—The Town Council is stated to have granted a franchise for the use of certain streets of the town to the Brunswick & Middletown Ry. Co. It is the intention of the company to build an electric line from Brunswick to Middletown by way of the "Maryland Tract," which will intersect the Frederick & Middletown line at Middletown.

**Mankato, Minn.*—It is stated that the Knox Constr. Co., of Chicago, will build the line for the Mankato Electric Traction Co.

* *Items marked thus give the names of parties awarded contracts.*

Hattiesburg, Miss.—See "Power Plants, Gas and Electricity."

New Brunswick, N. J.—The County Freeholders are stated to have on third final reading the ordinance giving the Jersey Central Traction Co. (F. L. Bangs, Supt., Keyport) the right of way over the county bridge across the Raritan, between South Amboy and Perth Amboy, thus giving the company entrance to Perth Amboy.

Jamestown, N. Y.—It is reported that the Chautauqua Traction Co. (C. J. Griffith, Ch. Engr.), will soon begin double-tracking its entire line from Jamestown to Westfield.

Greece, N. Y.—The Rochester Ry. Co. (R. E. Danforth, Gen. Mgr., Rochester), is stated to have received from the Highway Comn. of Greece a franchise to lay a double-track electric railway from the intersection of Lake Ave. and the Ridge Rd. along the middle of the Ridge Rd. to the tracks of the New York Central's Charlotte branch.

Oneida, N. Y.—It has been definitely announced by the Utica & Mohawk Valley Ry. (C. L. Allen, Gen. Mgr., Utica) and all the other electric systems in Central New York that the Andrew-Vanderbilt syndicate would build an electric road from Rome to Oneida. Franchises have already been secured and plans made for the route. It is expected that the new line which the Andrews-Vanderbilt interests propose to build will follow the route laid out by the defunct Rome & Oneida Ry. Co.

Oklahoma City Okla.—It is stated that the Oklahoma City St. Ry. Co. (Chas. W. Ford, Gen. Supt.), will erect its own power house and expend about $175,000 in the installment of machinery and the erection of the building. The dimensions of the structure will be 96x103 ft.

Freeland, Pa.—The Lehigh Traction Co. (A. Markle, Gen. Mgr.), Hazelton), is reported to have decided to extend the trolley tracks to Front St. It was also decided to erect a freight station on Centre St. between the Lehigh Valley station and Front St.

Dauphin, Pa.—The Borough Council is stated to have granted the right of way to the Central Pennsylvania Traction Co. (W. J. Calder, Secy., Harrisburg), to enter the borough. The consent of the abutting property owners must also be secured, and as soon as this is done the company will then extend its line from Rockville to Dauphin.

Carmichaels, Pa.—The Council is stated to have granted a franchise to the Masontown, Smithfield & Brownsville St. Ry. Co. The course of the road is not yet decided upon, but engineers will be put to work immediately and lines will be run from Masontown to Carmichaels, then by way of Jefferson to Waynesburg; also from Carmichaels through Clarksville and Zollarsville, thence via Ellsworth to the river. It is the intention of the company to eventually reach Pittsburg.

Ft. Worth, Tex.—It is stated that the building of an interurban electric railway between Ft. Worth and Mineral Wells is being promoted by Gid. R. Turner, of New Orleans. The distance between the two towns is about 37 miles.
It is reported that plans are being made for building an interurban railway between Ft. Worth and Denton, a distance of about 30 miles. N. M. Lee is reported interested.

San Marcos, Tex.—The San Marcos & Luling Interurban Ry. Co. is stated to have revived its project of building an electric railway between San Marcos and Luling.

Sherman, Tex.—At a meeting of the City Council a franchise to Frank Gavitt and associates, of Whitville-Whitesboro-Sherman Interurban to enter the city and run over certain streets. John King, Gen. Mgr.

Salt Lake City, Utah.—See "Business Buildings."

Ballard, Wash.—The Loyal Street Ry. Co. is reported to have decided to extend the system to Golden Garden Beach.

Centralia, Wash.—The City Council is reported to have granted the Centralia-Chehalis Electric Ry. & Power Co. a franchise whereby it will construct an electric railway between Centralia and Chehalis.

Walla Walla, Wash.—Having organized as a transportation corporation, the directors of the Walla Walla County Fair Association are stated to have decided to make formal request to the City Council for a franchise to build, operate and conduct a street railway system in Walla Walla.

Spokane, Wash—The County Comrs. are stated to have granted a franchise to the Spokane Traction Co. to build a line across Monroe Park north of the city. The proposed line will be an extension of the Traction Co.'s Post St line, which at present stops at Post and Garland

St. Catharines, Ont It is stated that the Niagara, St. Catharines & Toronto Ry. Co. proposes to build extensions during the present season from St. Catharines to Niagara-on-the-Lake Welland and Grimsby Park. The electric line is to be extended from Niagara Falls to Ft. Erie.

RAILROADS.

Notes Arranged Alphabetically by States.

**Cairo, Ill*—Contracts for work on the first section of the Cairo & Tennessee R. R., which will run from Wycliffe, Ky., to Bristol, Tenn., are reported to have been awarded to the Cairo & Atlantic Constr. Co.; the section contracted for being from Wycliffe to Hopkinsville, Ky., a distance of about 108 miles; total distance of entire line proposed will be 462 miles The road will cross Ohio River from Cairo to Wycliffe, and run east near the southern border of Kentucky, passing through Mayfield, Murray, Cadiz, Hopkinsville and Elkton. The line will cross Tennessee River over a bridge 2,000 ft. long, and the Cumberland River over a bridge of 1,000 ft. L. W. Goods, Pres., New York N. Y.; Chas. H. Delano, Gen. Mgr., Mayfield, Ky.

New York N. Y.—We are informed that E. Sheridan, 17 Bway., N. Y. City, would like to correspond with railway contractors who would accept about 40 per cent. cash, balance in bonds, to build a steam railroad.

**Buffalo, N. Y.*—The Grade Crossing Comn. on July 13 opened bids for the city's share of work necessary in the abolition of the crossings on the New York Central R. R. at Bway. and Bailey Ave. (Main Line) and the Belt Line grade crossings of the same road from Kensington to Amherst, and recommended that the contract be let to John Johnson, 548 Perry St., for reinforced concrete. He bid for Group 1, $135,026, and Group 2, $112,785.

Pawhuska, Okla.—A charter has been granted to the Oklahoma & Golden City Ry. Co., with headquarters at Pawhuska, Okla.; Golden City anad Jefferson City, Mo., and with $12,000,000 capital stock to build a line 270 miles northeast from Pawhuska through the Osage, Cherokee, Peoria and Quapaw Indian Nations, and through the counties of Newton, Jasper, Barton, Dade, Cedar, Polk, Hickory, Camden, Morgan, Miller and Cole, in Missouri, to Jefferson City, with a branch line of 75 miles from Jefferson City through Hickory, Polk, Dallas and Greene counties, in Missouri, to Springfield. Incorporators: O. A. Wheelock and W. K. Palmer, Kansas City, Mo.; A. L. Bauer, Jefferson City; John A. Greisl, Golden City; E. M. Dempsey and others, of Pawhuska.

Wilkesbarre, Pa.—Edwin B. Morgan, of Wilkesbarre, Chmn. Grade Com. of Council, is reported to have under consideration the selection of two engineers to come to Wilkesbarre and suggest best plan in the interest of the city for the elimination of grade crossings.

Taylor, Tex.—The Taylor, Somerville & Gulf Ry. Co. has been incorporated to construct a railroad from Taylor southeast via Lexington to Somerville, a distance of 60 miles. Capital, $60,000. T. A. Thompson, of Taylor, Tex., is Pres. and Gen. Mgr.

Canyon City, Tex.—The Canyon City & Northwestern Ry. Co. is reported incorporated, to build a railroad from Canyon City to Yarnall, a distance of about 30 miles. Capital, $100,000. Incorporators: L. G. Conner, W. F. Heller, J. M. Black and others, of Canyon City.

Waco, Tex.—The Waco, Hamilton & Brownwood R. R. Co. has been incorporated, with a capital of $120,000, to build a railroad from Waco to Brownwood, Tex., a distance of 120 miles. Incorporators: Jas. B. Baker, J. S. McLendon, Sam Sanger, of Waco, and others.

Gainesville, Tex.—The Gainesville & Texas Southwestern Ry. Co. has been incorporated with a capital of $100,000, to build a railroad from Gainesville to Mineral Wells, a distance of 80 miles. Incorporators: E. C. Bell, of Toledo, O.; E. M. Wickey, of East Chicago, Ind.; W. W. Newberry, of Chicago, Ill., and others.

Bremerton, Wash.—See "Public Buildings."

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Redwood City, Cal.—It is stated that bids are wanted July 27 by Jos. H. Nash, Clk. Bd. Superv., for erecting a court house. Glenn Allen, Archt., 330 Turk St., San Francisco.

Denver, Colo.—Plans and specifications for the public bathhouse to be located at 20th and Curtis Sts., it is stated, are nearly completed and will in a few days be submitted to the Bd. of Pub. Wks. for approval. When completed the bathhouse will cost in the neighborhood of $75,000.

Hartford, Conn.—Bids will be received until July 25 by the Bd. Contract & Supply (Jas. P. Berry, Secy., pro tem), for furnishing material and making repairs to the City Hall. Brocklesby & Smith, Connecticut Mutual Bldg., archts.

**Bridgeport, Conn.*—Contracts have been awarded by the Co. Comrs. for the erection of the addition to the jail, according to reports, as follows: S. W. Hubbell Bldg. Co., 1660 William St., masonry, $18,356; carpentry, $8,570. C. S. Eames, 639 Water St., plumbing, $8,222; the Heinecke Co., New York, smokestack, $1,290; H. C. Gould, slating, $1,040; Lovering & Garrigues, New York, structural steel, $2,777; United Illuminating Co., electric wiring, $2,477; Stewart Jail Works, Cincinnati, O., cell work, $30,480.

Hartford, Conn.—See "Paving and Roadmaking."

Washington, D. C.—Bids will be received until July 31 by Elliott Woods, Supt. U. S. Capitol Bldgs. and Grounds, Washington, for steel shelving equipment for the office of the Clerk of the Supreme Court of the Dist. of Columbia. Separate bids will be received, same time and place, for marble floors for stair halls., stair cases, wall bases, etc., House of Representatives Office Bldg Plans for the marble work can be secured on a deposit of $25.

Augusta Ga.—It is stated that a committee has been appointed to secure plans for a city hall to cost $200,000.

Atlanta, Ga—W. B. Cummings, Chief of Fire Dept., writes that the contract for erecting fire station on North Ave. (bids opened July 6), has been awarded to Gude & Co., Prudential Bldg., Atlanta.

Chicago, Ill.—The West Park Comrs., it is stated have had plans prepared for 2 field houses to be erected in the new park to be constructed on West Chicago Ave. and Noble St. The South Park Comrs. are reported to have had plans prepared for a 2-story field house to be erected at Wentworth Ave. and 26th St. at a cost of $100,000.
It is reported that the E. P. Stanberg Co., 159 La Salle St., obtained the general contract, except for plumbing and heating, for the George Smith annex to St. Luke's Hospital, to be built on Michigan Ave and 14th St. It will be 6 stories high, 125x135 feet, of fireproof steel construction, and will cost $50,000.

**Lafayette Ind.*—Joshua Chew, of Lafayette, is reported to have secured the contract to erect a hospital at the Soldiers' Home at $44,300.

Richmond, Ind—It is stated that a vacuum heating system is to be installed in the Eastern Indiana Hospital for the Insane, the cost to be $5,000.

Indianapolis, Ind.—The Bd. of Mgrs. of the Methodist Hospital contemplate erecting a $100,000 hospital.

Ft. Dodge, Ia.—The Franciscian Sisters are said to be contemplating the erection of a hospital here to cost $100,000.

**Mt. Pleasant, Ia.*—The Bd. of Control is stated to have been awarded to W. W. Welch, of Clarinda, the contract for the new woman's infirmary at the Mount Pleasant insane hospital; cost, $58,000.

**Wellington, Kan.*—The contract for the erection of the new city hall, it is reported, has been let to Chinoweth & Winger for $23,000.

Louisville, Ky.—D. X. Murphy & Bro., 250 5th St., are stated to have prepared plans for the east wing which is to be erected to the Childrens' Free Hospital.

Louisville, Ky.—The Bd. of Trus. of the Louisville Free Public Library, it is stated, has decided upon a site on Hancock St. on which to erect in the fall the Germantown Branch, at a cost of $25,000.

**Shreveport, La.*—The Southern Constr. Co., of St. Louis, Mo., is stated to have secured the contract to erect the City Hall at $85,500.

Minden, La.—Dr. Longino is reported Pres. of a company which proposes erecting a sanitarium here. Capital $25,000.

Baltimore, Md.—The following are the bids opened on July 10, at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for new plumbing system, etc., in the U. S. Court House and Post Office Bldg. at Baltimore, and extension thereto: Newport News Htg. & Plmbg. Co., Newport News, Va., $33,285; Enterprise Steam & Hot Water Hty Co., Baltimore, $38,000, and H. H. Rothrock & Co., Baltimore, $36,998.
*The contract to erect a shop at the city jail is reported awarded to Milton C. Davis, 140 W. Fayette St., at $40,925.
Bids will be received until Aug. 7 by Bd. of Awards (J. Barry Mahool, Pres.) for erecting a public comfort station on center market space, on Baltimore St. Eugene Levering, Pres. Free Pub. Bath Comn.

Ft. Brady, Sault Ste. Marie, Mich.—Bids will be received by Lieut. Donald W. Strong, Q. M., U. S. A., until July 30 for furnishing material and installing steam heating in 8 sets of quarters, as advertised in The Engineering Record.

Lansing, Mich.—The State Bd. of Agriculture has accepted plans for an agricultural building which will cost $130,000.

**Kalamazoo, Mich.*—The following are reported to be the bids received recently for erecting a central fire station: G. Van Eck, $19,800 (awarded contract); Scheid & Harder, $19,983; David Walton, $20,572; Rickman Bros., $20,790; Jas. Robinson, $21,000; Oliver & Bartlett are stated to have secured the contract for plumbing and heating at a total of $1,582.

Minneapolis, Minn.—Bids will be received until July 23 by the Bd. of Charities and Corrections (W. P. Barton, Secy.) for making alterations to the Central Police Station.

Duluth, Minn.—David Burnham & Co., of Chicago, Ill., it is stated, have been engaged as consulting archts. for the court house.

Cass Lake, Minn.—Bids will be received until July 27 by the Village Council (C. E. Tapley, Pres.), for erecting a lockup and fire hall combined. J. W. Komstadins, Village Recorder. Dempsey & Daugherty, 510 Globe Bldg., Minneapolis, Archts.

Minnehaha, Minn.—Bids will be received until Aug. 13 by the Bd. of Trus. of the Minnesota Soldiers' Home at Minnehaha (address to S. H. Towler, Pres., 123 Nicollet Ave., Minneapolis), for 3 boilers, ea. to be 72 in. x 18 ft.; to be made of the best quality ½-in. open hearth firebox steel, the tensile strength to be not less than 57,000 lbs. nor more than 62,000 lbs. per sq. in., and to be capable of carrying 150 lbs. steam gauge pressure. Bids are to be submitted on the following types: Self-stoking, down draft, extension, shaking grate, and standard stationary grate.

Jackson, Miss.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Aug. 22, for construction of an addition to, and the remodeling of U. S. Postoffice and Court House at Jackson, including plumbing, gas piping, heating apparatus, electric wiring and conduits.

**Jefferson Barracks, Mo.*—The contract to erect the $75,000 sanitary hospital at this post (bids for which were received June 1) is stated to have been awarded to the Hiram Lloyd Constr. Co., of St. Louis, Mo.

Omaha, Neb.—It is reported that plans will soon be ready for contractors to submit bids for the main building of the Clarkson Memorial Hospital at 21st and Howard Sts. Probable cost, $50,000.

David City, Neb.—It is stated that steps are being taken to erect a library to cost $20,000.

**Newton, N. J.*—The contract to erect an additional floor to the quarters of the County Clk. and Surrogate, it is stated, has been awarded to O'Donnell & McManiman, of Newton, at $12,782.

Otisville, N. Y.—Bids will be received until July 30 by the Bd. of Health of New York City (Thos. Darlington, M. D., Pres.), for furnishing materials and installing tubular boilers, laundry machinery and equipment, together with all necessary steamfitting and other work incidental thereto, in the laundry building on the grounds of the Tuberculosis Sanitorium, at Otisville.

New York, N. Y.—The following are the bids opened on July 10 by John F. Ahearn, Pres. Manhattan Boro., for furnishing material (except plumbing work) and erecting public bath at 5 and 7 Rutgers Pl., Boro. of Manhattan: T. T. Nesbitt Co., 116 Nassau St., $163,400, and L. A. Burke & Co., 25 W. 42d St., $175,000.
The following are the bids opened same time and place for plumbing in bath building at 5 and 7 Rutgers Pl., (*a*), plumbing; (*b*), rock excav. per cu. yd.: John Spence, Jr., 215 W. 125th St., *a*, $22,944; *b*, 1 ct.; Geo. E. Gibson, 511 Park Ave., *a*, $22,000; *b*, 25 cts.; Byrne & Murphy, Inc., 890 Park Ave., *a*, $22,300; *b*, $3; M. J. O'Brien, 2142 Bway., *a*, $22,475; J. M. Levins, 140 E. 97th St., *a*, $21,750; *b*, 75 cts.
New bids for constructing the above public bath at 5 and 7 Rutgers Pl. will be received July 29 by John

* *Items marked thus give the names of parties awarded contracts.*

F. Ahearn, Boro. Pres.; also separate bids at same time for plumbing said building.

Bids will be received until July 25 by the Comrs. of Parks (Moses Herrman, Pres.), for all labor and materials required for the erection of a new continuous skylight in the main roof of the east wing, the enlargement of the 3 dome lights over the Hall of Sculpture and the alteration of the cornice in the south gallery on the second floor of said east wing of the Metropolitan Museum of Art, Central Park.

Whitesboro, N. Y.—It is reported that bids will be received until July 26 by W. C. Aldridge, Clk. Village Bd. Trus., for furnishing material and erecting a fire department building.

**Brooklyn, N. Y.*—The Armory Bd. has approved the awarding of the contract for alterations, etc., to Squadron "C" Armory (bids received June 21), to Geo. Stanton, 120 Worth St., New York City, at $15,947.

Bids will be received by the Dept. Health (Thos. Darlington, M. D., Pres.), New York City, until Aug. 6, for furnishing all the labor and materials necessary to erect and complete a fireproof office building at Willoughby and Fleet Sts., Boro. of Brooklyn.

Harts Island, N. Y.—Bids will be received until July 30 by John V. Coggey, Comr. Dept. of Correction, N. Y. City, for furnishing material and erecting an extension to the present boiler house, including a new chimney and underground chimney connections, and the installation of 3 new boilers, 250 h.p. each, at Hart's Island, N. Y.

New Brighton, S. I., N. Y.—Bids will be received until July 29 by Robt. W. Hebberd, Comr. Pub. Charities, N. Y. City, for furnishing material and erecting a new male dormitory at the New York City Farm Colony, Boro. of Richmond.

Wellsville, N. Y.—It is stated that a $15,000 library is to be erected at Main and Jefferson Sts. Alfred S. Brown is a member of the Bldg. Com.

White Plains, N. Y.—The State authorities, according to reports, propose erecting an armory for Company L to cost $75,000.

Ithaca, N. Y.—The following are the bids opened on July 1, at the office of Superv. Archt. Treas. Dept., Washington, D. C., for Construction (complete), including heating apparatus, plumbing, gas piping, electric conduits and wiring, of the U. S. Post Office at Ithaca. The Clemence Constr. Co., Syracuse, $109,859, and Fissell & Wagner, N. Y. City, $101,978.

Asheville, N. C.—Bids will be received until Aug. 6 by the Co. Comrs. (Mark L. Reed, Chmn., Asheville), for erecting an annex to the county jail.

Jamestown, N. D.—Bids will be received until Aug. 5 by John G. Bensch, City Aud., for erecting a brick city hall with stone basement. Bids will be received separately as follows: General contract; ventilating and heating; electric wiring; plumbing. A. J. O'Shea, Archt., Fargo.

Cincinnati, O.—The plans for the public comfort station in the esplanade in Fountain Sq. have been approved by the Bd. Pub. Wks., and it is stated that bids for the construction will be asked soon. Estimated cost $18,000.

Cleveland, O.—The erection of a 2-story contagious disease annex to the City Hospital, to cost $60,000, is reported contemplated.

Youngstown, O.—Separate bids are wanted July 26 by the Bd. Pub. Service (W. H. McMillin, Clk.), for furnishing material and erecting a barn, a market house and a machine shop.

El Reno, Okla.—See "Sewerage and Sewage Disposal."

Oklahoma City, Okla.—The Baptists have been given a site in Oklahoma City on which to erect a state hospital at a cost of $100,000.

Carlisle, Pa.—Tentative plans, it is stated, are being submitted for a county building.

**Philadelphia, Pa.*—Horace Trumbauer, Archt., Land Title Bldg., it is reported, has awarded a contract to Doak & Co., of Philadelphia, for the completion of the Maternity Hospital building of the Hahnemann Hospital, in 15th St., above Race St. The cost will be $125,000.

Wilkinsburg, Pa.—J. L. Beatty, of Pittsburg, is said to be preparing plans for a brick addition to the Columbia Hospital to cost $50,000.

Wilkesbarre, Pa.—It is reported that bids will be received until July 25 for $150,000 court house bonds.

Charleston, S. C.—It is reported that the Government is seeking a site here on which it is proposed erecting a $70,000 building for the immigrants. Comr. Gen. of Immigration Frank P. Sergent, at Washington, D. C., may be able to give further information.

Jackson, Tenn.—The following are the bids recently received by the Superv. Archt. Treas. Dept., Washington, D. C., for heating apparatus for U. S. Post Office at Jackson: Cockrill Bros., Jackson, $5,130; F. A. Claygat & Co., Louisville, Ky., $5,832, and Hoke Plumbing & Htg. Co., Shreveport, La., $6,958.

Murfreesboro, Tenn.—Bids will be received until July 30 by T. E. Hord, Chmn. County Court, Murfreesboro, for remodeling the court house.

**Temple, Tex.*—E. L. Dolen, of Temple, is reported to have secured the contract to erect an addition to the King's Daughters Hospital at a cost of $10,000.

Big Springs, Tex.—The citizens, is is reported, have voted to issue $46,000 bonds for the erection of court house and jail. Address Co. Aud.

Dallas, Tex.—Plans have been completed for a $20,000 jail.

San Antonio, Tex.—The only bid received and opened at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for extension remodeling the U. S. Post Office at San Antonio, including heating, electric wiring, etc., was submitted by P. S. Shields, of San Antonio, for $51,560.

Norfolk, Va.—Bids will be received until July 27 by Col. F. L. Denny, Q. M., U. S. Marine Corps, Washington, for completing the interior woodwork, sanitary floors, plumbing, electric fixtures, etc., Marine Barracks Navy Yard, Norfolk, Va.

Bremerton, Wash.—Plans have been drawn at the Puget Sound Navy Yard for the following buildings to be erected at the magazine site on Ostrich Bay: Two gun cotton houses, one shell house, one filling house, one priming house, one gunners' quarters. Plans are under way for a water system, fire protection system and railroad. For all of this work $83,500 is available and the work will be done within the fiscal year.

Two Rivers, Wis.—Bids will be received until July 29 by O. M. Maxam, Acting Gen. Supt. U. S. Lifesaving Service, Washington, D. C., for constructing a lifesaving station at Two Rivers.

**Marinette, Wis.*—Contracts for erecting the county jail are stated to have been awarded as follows (bids opened June 15): Construction, Julius E. Utke, $11,050; heating, Halstead-Maples, $951; cells, Champion Iron Co., $3,050; plumbing, C. H. Morton, $878.

**Milwaukee, Wis.*—The Bd. of Mgrs. of the State Fair, it is stated, has awarded contracts as follows: Erection of hospital to H. C. Potter, and erection of dining hall to W. T. Carson, construction of walks to the Globe Sidewalk Co.

Mineral Point, Wis.—It is stated that plans will be received until Aug. 5 by Wm. P. Bliss, City Clk., for a municipal building, 64x113 ft., to cost about $30,000.

Vancouver, B. C.—It is reported that bids will be received until July 31 by the Chief Comr. of Lands & Wks. at Vancouver, for erecting a court house.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—Dupre & Co. are reported to have the contract to erect a 3-story brick building for the Knights of Columbus to cost $30,000.

Little Rock, Ark.—The Missouri Pacific R. R. (E. W. Wiggin, Engr. of Bridges & Bldgs., St. Louis, Mo.), is reported to be having a survey made for a roundhouse which it is proposed erecting in Argenta at a cost of $100,000.

**Pine Bluff, Ark.*—R. W. Lane, of Pine Bluff, is reported to have secured the contract to erect a 2-story brick storehouse at 3d Ave. and Chestnut St., at $35,000.

San Francisco, Cal.—John A. Roebling Sons have applied for a permit to erect a 5-story building on Folsom and Hawthorne Sts. at a cost of $200,000, and P. Flurey and Leonidas Flurey for a permit to erect a $30,000 brick structure on Dupont and Sacramento Sts.

It is reported that Meyers & Ward, of San Francisco, are preparing plans for a 3-story building to be erected for the Samuels Lace House at Stockton and O'Farrell Sts., at a cost of $300,000.

Kenneth MacDonald, Jr., is stated to have prepared plans for a store building of monolithic reinforced concrete to be erected by Davis-Schonwasser Co., at Grant Ave. and Sutter St.

The Keystone Realty Co. (Jos. Magnin, Pres.), is reported to have had plans prepared by Oliver & Foulker, for a 6-story apartment hotel to be erected at Washington and Hyde Sts. of brick and reinforced concrete, estimated to cost $350,000.

Los Angeles, Cal.—Morgan & Walls, 232 N. Main St., are reported to have prepared plans for the Gerhard-Eshman Bldg., which is to be erected at 7th St. and St. Vincent Pl., at an estimated cost of $125,000.

**Devore, Cal.*—The contract for the construction of a reinforced concrete passenger depot at Devore, for the Sante Fe system, is reported awarded to Noyes & Boggs, of Los Angeles.

Berkeley, Cal.—The Y. M. C. A. is said to have $25,000 raised toward the $75,000 structure which they propose erecting.

Denver, Colo.—A building permit has been granted to Morgan & Bettsher for a 3-story, 50x125-ft. garage to be erected on Court Pl. and 17th St., and cost $18,500.

**Hartford, Conn.*—A. Whitney, Jr., & Co., of New York, N. Y., are reported to have secured the general contract to erect the State Bank, and the Remington & Sherman Co., of Philadelphia, Pa., the contract to install the steel vaults.

**Bristol, Conn.*—Contracts for erecting the white marble building for the Bristol Trust Co. at Riverside Ave. and Main St. are stated to have been awarded as follows: T. R. Fox & Son, of Hartford, mason work and general contract; Ashley Falls Marble Co., of Ashley Falls, Mass., marble for the exterior; W. E. Caulkins & Son, Hartford, carpenter and bronze work; the Van Norden Co., of Boston, Mass., copper work; Frank A. Schaffer, of Bristol, heating and ventilating; Roberts & Arnold, of Bristol, plumbing and gas fitting; the Ludowici & Celadon Co., of New York, N. Y., tile roofing; Berlin Constr. Co., steel work; the Mosler Safe Co., of Hamilton, O., vault and safe deposit work; Hanlon & Murphy, of Hartford, electrical work; the Eastern Expanding Metal Co., fireproofing; the Spencer Cleaner Co., of Hartford, cleaning and sanitary apparatus for cleaning the building.

Washington, D. C.—A permit has been granted to J. B. Henderson for a 5-story brick store to be erected at 1108 G St., estimated to cost $25,000; architects, Marsh & Peters, 520 13th St., n. w.; builder, Thos. C. Henderson, 224 12th St., s. e.

**Savannah, Ga.*—B. A. & G. N. Williams, of New York, N. Y., are reported to have secured the contract for the marble work; Miles & Brandt, of Atlanta, Ga., the contract for the foundation and brick work and plastering, and the Diebold Safe & Lock Co., the contract for the vaults and locks in the bank building for the Citizens' and Southern Bank.

Boise, Idaho.—A. F. Montandon is said to be having plans prepared for a 4-story store and office building to be erected at 8th and Idaho Sts.

**Chicago, Ill.*—Edw. Katzinger Co. is reported to have the contract to erect the 5-story Masonic Temple on Oakley Ave. and Madison St., at a cost of $100,000. Huel & Schmid, 163 Randolph St., are the archts.

Mrs. Harriet Blair Borland, it is reported, will erect a $75,000 store building at 315 Fifth Ave.

Springfield, Ill.—The Masons, it is stated, contemplate erecting a 3-story brick and stone home at 6th and Jackson Sts., at a cost of about $45,000.

Decatur, Ill.—Diel & Ginzel, of Lincoln, it is stated, have been engaged to prepare plans for the home which the Pythian lodges propose erecting in this city and for which there is $125,000 appropriated.

**Peoria, Ill.*—The contract to erect a 4-story brick warehouse, storage and elevator building at Peoria for the Corno Mills Co. is reported to have been awarded to Wm. M. Allen & Sons, 532 Woolner Bldg., at $15,000.

Rushville, Ind.—The trustees of the local lodge of Redmen, it is reported, have ordered plans prepared for a $25,000 building.

Evansville, Ind.—Harris & Shopbell, 123 U. 4th St., are reported to be preparing plans for a 2-story addition to the American Trust Co.'s Bldg.; estimated cost, $25,000.

Gary, Ind.—It is stated that the Lake Shore & Michigan Southern R. R. and the Baltimore & Ohio R. R. intend erecting a union depot at Gary, to cost about $250,000. S. Rockwell, of Cleveland, O., is Ch. Engr., Lake Shore & Michigan Southern R. R.

Muscatine, Ia.—Mira Hershey, of Muscatine, is reported to have had plans prepared for a 6-story office and bank building, which she proposes erecting at Sycamore and 3d Sts., at a cost of about $160,000.

Des Moines, Ia.—Liebbe, Nourse & Rasmussen, archts., it is stated, have let the contract for the Gibson Bldg. on Locust and 7th Sts. to Jas. Maine & Son, 119 8th St., for $20,000.

Ft. Dodge, Ia.—The late Thos. Snell has made provision in his will to erect a $150,000 building on the Snell estate, to contain a hotel and store.

Emporia, Kan.—The plans of Saylor & Sedden, of Kansas City, for the Elks' 3-story brick and stone bldg., are stated to have been adopted. Probable cost, $20,000.

Mt. Sterling, Ky.—The Chesapeake & Ohio R. R. Co. (H. Pierce, Engr. of Constr., Richmond, Va.), it is stated, is planning the erection of a brick and stone passenger station here to cost $15,000.

Springfield, Mass.—The Hibernians, it is reported, are contemplating the erection of a building to cost, including site, $50,000.

Westfield, Mass.—P. K. J. Mahoney, of Westfield, is reported to have submitted the lowest bid for erecting the building for the Polish Society at $10,700, and Wyckoff, Lloyd & Co., of Springfield, the lowest for plumbing same, at $1,005.

Pittsfield, Mass.—It is stated that plans have been prepared for a roundhouse to be erected at the junction for the Boston & Albany R. R., at a cost of $40,000.

**Lansing, Mich.*—Geo. Haganmeir, 660 Shiawassee St., E., is reported to have the contract to erect a 3-story brick factory for the Auto Body Co.

Luverne, Minn.—The Knights of Pythias, it is stated, intend erecting a 2-story brick and stone business block to cost $12,000.

Duluth, Minn.—The Bethel Assoc. is said to be planning the erection of a $200,000 building. J. T. Moody, Supt., may be able to give further information.

Minneapolis, Minn.—The Fraternity Hall Assoc. is reported formed and proposes erecting a lodge-room building somewhere in the down-town district. W. H. Landis, Pres., and Jas. McMullen, Secy. Estimated cost of building, $50,000.

**St. Louis, Mo.*—A permit has been asked for the 7-story, 184x155-ft. brick and stone mrcantile and warehouse building which is to be erected at 11th and Spruce Sts. for the Graham Paper Co. at a cost of $289,000. Eames & Young Constr. Co., Chestnut and 7th Sts., Archts. Jas. Bright Constr. Co., Lincoln Trust Bldg., contractor.

Kansas City, Mo.—It is stated that plans are about prpepared for a $15,000 brick and stone building to be erected for the Door of Hope Assoc. at 43d St. and Woodland Ave.

F. C. Faris is reported to be preparing plans for a 6-story office and studio building to be erected by the C. H. Shield Photograph Co. at an estimated cost of $82,000.

Joplin, Mo.—Cox & Shumaker, it is reported, have prepared plans for a $35,000 bank and office building to be erected by A. C. Michaels.

Jefferson City, Mo.—It is reported that H. H. Taudy, of Columbia, Mo., has prepared plans for improvements to be made to the hotel owned by Miller & Opal. Estimated cost, $40,000.

Peacock, Mo.—F. W. Caulkins, of Webb City, it is stated, has been engaged to prepare plans for a $30,000 mill for the Kramer, Thomas & Reppy Mining Co., near Peacock.

**Norfolk, Neb.*—It is reported that the contract to erect a passenger depot for the Northwestern R. R. in Norfolk has been awarded to Frank H. Bernritter, of Chicago, Ill. Probable cost, $25,000.

York, Neb.—The Elks are said to be contemplating the erection of a building to cost $25,000, plans for which are now being prepared.

Reno, Nev.—L. E. Hinckley, a real estate dealer of this city, it is reported, intends erecting at 1st and Center Sts. a 6-story office building.

**Newark, N. J.*—A general contract amounting to $21,000 is reported awarded to E. M. Waldron & Co., 1 Cabinet St., for the alteration and addition to the business building at 776 Broad St. The plans, as prepared by McMurray & Pulis, of 22 Clinton St., call for a 3-story addition to the present one-story extension in the rear and the entire interior remodeled. No contracts have been awarded for the plumbing, heating or electrical work. The Mercantile Realty and Improvement Co. owns the building, and, it is stated, will expend $30,000 on the work, including improvements.

It is stated that the Union Bldg. Co. intends erecting a 12-story building at Clinton and Beaver Sts.

Brooklyn, N. Y.—A. R. Whitney, Jr., & Co., 135 Bway., N. Y. City, it is stated, have secured the con-

* *Items marked thus give the names of parties awarded contracts.*

tract to erect a 4-story masonic temple, 100 ft. sq., at Lafayette and Clarmont Aves., to cost approximately $360,000.

New York, N. Y.—Plans have been led for the 16-story, 50x115 ft. office and store building to be erected at No. 160 Bway. for the Lawyers' Title Insurance and Trust Co., now at No. 37 Liberty St. The new building will have a facade of pink Milford granite at the lowest stories and limestone with terra cotta decorations above. The building will cost $700,000. Clinton & Russell, archts., 32 Nassau St.

Bath, N. Y.—The Bd. of Trus. of the State Soldiers' Home, it is stated, has approved plans for the erection of a bakery at the home to cost $11,000.

•*Rochester, N. Y.*—A. Friederich & Sons Co., of Rochester, are reported to have secured the masonry construction work on the new 10-story National Hotel at Main St. W. and Plymouth Ave. S.

Reidsville, N. C.—The Reideville Hotel Co. is reported incorporated with a capital stock of $100,000, for the purpose of erecting a hotel. P. W. Goldewell and Jas. Robinson, incorporators.

•*Akron, O.*—The B. H. Christian Constr. Co., of Akron, is reported to have secured the contract to erect a $75,000 theatre, not including heating, electric wiring, etc.

Cincinnati, O.—Plans for a 10-story building to be erected on College St. by the Robert Mitchell Furniture Co., are being prepared by Archts. Tietig & Lee, Commercial Tribune Bldg. It will be of brick and cost $60,000.

Marietta, O.—Bids will be received until July 25 by W. J. Speer, Chmn. Bldg. Com., for erecting an 8-story bank and office building and a 3-story building for the German Natl. Bank.

It is reported that bids will be received until July 30 by Archt. W. A. Decker, St. Clair Bldg., for erecting a 4-story, brick, limestone and concrete Masonic Temple, 67x90 ft., to cost about $25,000.

Cleveland, O.—The White Automobile Mfg. Co. has been granted a permit for a 6-story administratoin building to be of reinforced concrete, 220x90 ft., and to be built in connection with its present East Side plant. The building will cost $140,000 and have 120,000 ft. of floor space.

Elyria, O.—Brown Bros. are said to be having plans prepared for a $60,000 hotel.

•*Toledo, O.*—The H. J. Speiker Co. is reported to have secured the contract to erect a 4-story brick and reinforced concrete warehouse, 60x100 ft., at 31 Superior St., for Jerome H. Smith. The building will be occupied by the Toledo Mercantile Co., and will cost $30,000.

El Reno, Okla.—Plans have been prepared, according to reports, for a 3-story brick and stone 50x120-ft. temple, which the masons intend erecting at a cost of $40,000

•*Portland, Ore.*—The Contracting Eng. Co. (Fenton Bldg., is stated to have been awarded the contract to erect a 10-story reinforced concrete annex to the Oregon Hotel.

Tillamook, Ore.—It is reported that the Tillamook Bldg. Co. will receive bids until July 27 for the erection of a 2 or 3-story store, office and lodge building, 100x105 ft., built of either brick or concrete, bids to include steam heating. Also separate bids for a steam heating plant.

•*Scranton, Pa.*—The contract to erect a depot here for the Delaware, Lackawanna & Western R. R. is stated to have been awarded to F. D. Hyde, of New York, N. Y., at about $500,000.

•*Philadelphia, Pa.*—Wm. R. Dougherty, 1604 Sansom St., it is stated, has been awarded the contract for erecting a 2-story office building and a 1-story factory for the Wetherill Finished Castings Co., at Erie Ave. and Richmond St. The office building will measure 30x60 ft., and the factory 130x80 ft. The cost will be about $30,000. Stearns & Castor are the archts.

•Lynch Bros., Lippincott Bldg., are reported to have been awarded the contract for building a 3-story and basement garage for Louis Bergdoll at Broad and Wood Sts. The building will be 119x71 ft., and will be of fireproof construction, with an exterior facing of brick and terra cotta. The building will cost about $30,000.

It is reported that Stearns & Castor, archts., Stephen Girard Bldg., have invited bids on plans for altering the store at Broad and Walnut Sts. into a Turkish bath establishment. The cost will be about $75,000.

•*Pittsburg, Pa.*—It is stated that Henry Shenk Co., Lewis Blk., has secured the contract to erect a 6-story addition to the office building of the Pittsburg & Lake Erie R. R. at about $100,000.

Renfrew, Pa.—T. W. Boyd & Co., House Bldg., Pittsburg, are said to be preparing plans for a $20,000 club house to be erected at Renfrew for the Butler Country Club.

Memphis, Tenn.—W. O. Hein, of the Memphis Steam Laundry Co., it is stated, contemplates erecting a 4-story brick and stone building at a cost of about $18,000. Shaw & Pfeil are the archts.

Paris, Tenn.—Robt. J. Neely, it is reported, has accepted plans prepared by H. Stamler, for a 3-story business building estimated to cost $20,000.

•*Temple, Tex.*—It is reported that the contract to erect a banking house for the First National Bank of Temple has been awarded to H. D. McCoy, of Cleburne; estimate cost, $15,000.

Houston, Tex.—Local press reports state that bids will soon be asked for erecting the 11-story, 85x101-ft. Scanlan Bldg. at Main St. and Preston Ave. D. H. Burnham & Co., of Chicago, Ill., are the archts.

San Antonio, Tex.—J. Flood Walker, of San Antonio, is preparing plans for a building for the Elks Assoc.; cost about $25,000.

The plans of Harvey L. Page, 207 Alma Plaza San Antonio, have been accepted for a passenger depot for the International & Great Northern Ry. Co.; cost about $[illegible].

[illegible] Ayres, of San Antonio, is preparing plans for a [illegible] for the San Antonio Golf & Country Club to be erected on Alamo Heights, to cost about $25,000.

Salt Lake City, Utah.—Plans have been approved by the engineers of the company and by Pres. Bancroft for the improvements to be made on the old Exposition suare by the Utah Light & Ry. Co. (R. S. Campbell, Gen. Mgr., Salt Lake City), which include buildings, tracks and other work to be done, at a total expenditure of $635,639.

•*Norfolk, Va.*—The contract to erect the Naval Y. M. C. A. Bldg., a 6-story reinforced concrete and brick building, is reported to have been awarded to E. Tatterson, of Norfolk. Appropriation, $300,000.

Richmond, Va.—A. M. Walkup, of Richmond, is stated to have submitted the lowest bid on July 10 for erecting the R. R. Y. M. C. A. bldg., at $51,900.

It is reported that a site has been selected and plans are to be prepared at once for the $100,000 Y. M. C. A. Bldg., which is to be erected here.

Yakima, Wash.—It is reported that a $100,000 hotel is to be erected on the West Side. Nelson Likens, archt., of Spokane, may be able to give further information.

Spokane, Wash.—It is reported that the directors of the Exchange National Bank contemplate erecting 5 additional stories to the present 2-story annex; also a 10-story building.

The Marshall-Wells Hardware Co., of Duluth, Minn., is reported to have secured a site here on which it is proposed erecting a 6-story business building.

Aaron Kuhn, owner of the Valkenberg & Holland Bdg., is reported to be preparing to expend $25,000 in improvements, which include the installation of an electric elevator instead of the steam elevator now in use.

Seattle, Wash.—Plans have been filed for a brick hall and lodge room building to be erected at 153 14th Ave. for the Danish Brotherhood at an estimated cost of $40,000.

Milwaukee, Wis.—W. A. Comstock, Vice-Pres. of the Milwaukee Northern Electric R. R., is reported to have announced that it is proposed to erect a depot at Green Bay Ave. and Atkinson Road to cost $10,000.

The Modern Steel Structural Co., of Waukesha, Wis., is reported to have been awarded the contract to erect a theatre and office building at 3d St. and Grand Ave. for the Schlitz Brewing Co. It will be 17 stories and cost $1,500,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Bessemer, Ala.—It is stated that members of the Presbyterian Church have accepted plans for a $12,000 church. Address pastor.

Paragould, Ark.—It is reported that J. D. Block is having plans prepared for a $20,000 brick residence.

San Diego, Cal.—The Unitarian Congregation is reported to be preparing to build a church estimated to cost $20,000. Address pastor.

Denver, Colo.—W. E. Fisher & Bro., Ferguson Bldg., are stated to have prepared plans for an edifice to be erected for the Capitol Hill M. E. Church at 14th Ave. and Gilpin St., to cost $30,000. Rev. Frost Craft, pastor.

Danbury, Conn.—It is stated that the members of the First Congregational Church propose erecting a $75,000 edifice. Rev. Harry Chamberlain Meserve, Pastor.

Lyme, Conn.—The church at Old Lyme, which was recently destroyed by fire it is reported, is to be rebuilt at a probable cost of $50,000. Edw. M. Chapman, pastor.

Washington, D. C.—Hornblower & Marshall, 1516 H St., N. W., are said to be preparing plans for a dwelling with all modern improvements to cost $30,000.

Rome, Ga.—J. Paul Cooper, it is stated, intends erecting a $30,000 2-story residence.

Chicago, Ill.—Wm. H. Pruyn & Co., it is stated, will build a 3-story apartment house at Grand Boule. and 44th St. Estimated cost, $100,000.

The members of the Church of the Immaculate Conception, it is stated, will build a new edifice at 31st and Mosspratt Sts; estimated cost, $60,000. Adress pastor.

The German Evangelical Lutheran Emmanuel Congregation at South Chicago, it is reported, will erect a new edifice at 9035 Houston Ave., to cost $35,000.

Richmond, Ind.—The Kramer Manfg. Co. of Richmond is reported to have secured the contract to build the new Trinity Lutheran Church at about $13,000.

Alton, Ia.—It is stated that bids will be received until Aug. 1 by the Bldg. Com. for erecting a pressed brick and Bedford stone church for the R. C. congregation, the cost to be about $40,000. Rev. F. J. Brune, pastor.

Oelwein, Ia.—Geo. Netcott, of Independence, is stated to have submitted the lowest bid for erecting Grace M. E. Church at $22,000.

•*Concordia, Kan.*—The J. S. Hayde Constr. Co., of Kansas City, Mo., is stated to have secured the contract to erect a chapel at Nazareth Convent at $70,000.

Baltimore, Md.—It is reported that Chas. H. Gerwing will erect an $80,000 residence in the near future.

•*Laurium, Mich.*—Chas. D. Anderson, of Laurium, is reported to have been awarded the contract for the erection of a $14,000 Baptist Church.

Minneapolis, Minn.—The J. & W. A. Elliott Co., 905 Lumber Exchange, it is stated, secured the general contract to erect the Plymouth Congregational Church, 19th and Nicollet Aves. Shepley, Rutan & Coolidge, archts., Boston, Mass.; cost, $175,000.

The Trinity M. E. Church will erect a brick veneer edifice on 25th Ave. and Taylor St., to cost about $13,000.

St. Louis, Mo.—It is reported that $150,000 has been given to Washington Univ. to erect a chapel on the grounds.

The Hobar Realty Co., it is stated, intends erecting an apartment house on McPherson and Euclid Aves., to cost about $65,000.

Aaron Fuller, vice-president of Stix, Baer & Fuller Dry Goods Co., has secured a site in Washington Terrace, on which, it is stated, he will build a residence to cost about $50,000.

Omaha, Neb.—Arrangements are being made, according to reports, to build a $17,000 chapel in connection with the new R. C. Cathedral. Address bishop of the diocese.

Reno, Nev.—Frank Golden is said to be planning to build a 5-story fireproof apartment house on State and S. Center Sts.

Jersey City, N. J.—Ernest, Theodore and Oscar Kunath, 516 Sixth Ave., New York, N. Y., it is stated, have accepted plans of John T. Rowland, Jr., 15 Exchange Pl., for two 3-story double apartment houses which they will build on Bramhall Ave., between Sackett St. and Bergen Ave. The buildings will be detached and will be 28x70 ft., and will cost about $24,000.

Montclair, N. J.—Pilcher & Tachau, 109 Lexington Ave., New York, N. Y., it is reported, have been selected to prepare plans for the edifice for the congregation of the First Baptist Church, of Montclair, which will be located on Church St. and Trinity Place. No details have been decided upon, but the structure will be of stone, one story in height and 70x135 ft. The cost will be $70,000 total. Rev. H. E. Fosdick, pastor, and Irving Cairns, 57 Park St., Montclair, Chmn. Bldg. Com.

•*Rochester, N. Y.*—Contracts for erecting the First Universalist Church on Clinton Ave., S., and Court St. are reported to have been awarded by the Bldg. Com. as follows Masonry, to the Gorsline & Swan Constr. Co., Rochester; carpentry, to A. W. Hopeman, 7 Hopeman Pl.; plumbing and heating, to Barr & Creelman, 24 Exchange St.; and electric work, to the Wheeler Green Electric Co., 57 St. Paul St. Probable total cost, $70,000.

Utica, N. Y.—The Trustees of the Church of the Reconciliation, it is stated, have adopted plans prepared by Linn Kinne for an edifice to be erected upon Genesee and Tracy Sts.

Riverhead, L. I., N. Y.—At the parish meeting July 15 the Trus. of the Congregational Church, it is stated, voted to build a new church to cost $25,000.

•*Lexington, N. C.*—W. Lee Harbin, of Lexington, it is reported, has secured the contract to erect the Bay St. Methodist Church, estimated to cost $30,000.

•*Toledo, O.*—Wm. Frank is stated to have secured the contract to erect a 3-story brick flat 54x48 ft. at 123 Indiana Ave. to cost $15,000. L. Tschumy, 108 Summit St., is the archt.

Niles, O.—The Italian R. C. Society, it is stated, has accepted plans prepared by Kling & Zenk, of Youngstown, for a $30,000 church.

•*Knoxville, Tenn.*—The Bldg. Com. of the Highland Ave. M. E. Church, it is stated, has awarded the contract to erect a new edifice at 8th St. and Highland Ave. to R. L. May.

Nashville, Tenn.—H. M. Mills, it is reported, will erect two modern $40,000 residences in the near future.

Amarillo, Tex.—Plans are now being prepared, according to reports, for a $20,000 edifice for the Fillmore St. Presbyterian Church. Address pastor.

Ft. Worth, Tex.—It is reported that R. B. Spencer, of Dublin, Tex., will erect a modern $35,000 residence in Ft. Worth in the near future.

Alexander, Va.—Julian D. Knight is stated to have secured the contract to erect a 4-story apartment house at King and Columbus Sts.

Clarksburg, W. Va.—Bids will be received until July 24 by the Bldg. Com. (Harvey W. Harmer, Secy.) for erecting a stone edifice for the Goff M. E. Church. Mills & Pruitt, Archts., Columbus, O.

Marytown, Wis.—J. E. Hennen, of Fond du Lac, has completed plans for rebuilding St. Mary's R. C. Church and parish house, which was recently destroyed by fire. The church building will be 134x58 ft., and is estimated to cost $18,000.

Princeton, Wis.—The plans by Archt. Julius Heimerel for the Evangelical Lutheran Church at Princeton, it is reported, have been accepted, and a building to cost $35,000 will be erected during the summer.

Milwaukee, Wis.—A permit has been issued for a brick and stone residence to cost $60,000, and garage stable and greenhouse to cost $10,000, to be erected for Jos. E. Uihein on Lake Drive, near Hartford St. Kirchhoff & Rose, 201 Grand Ave., are the archts.

A residence for the school sisters will be built by St. Elizabeth's congregation on Second St., near Burleigh St. Cost, $15,000. The building will be 40x64 ft., three stories high. Herman J. Esser, 82 Wisconsin St., is the archt.

The school sisters of St. Francis, it is stated, contemplate extensive additions to St. Joseph's Convent, 22nd and Greenfield Aves., work on which will be taken up some time early next year; probable cost, $150,000.

Edw. M. Kleser is stated to have completed plans for the combined school and church building which the congregation of St. Mary Czestochowa will erect on Fratney and Chambers Sts. The school portion will have ground dimension of 43x156 ft., and contain eight rooms. An L addition, 59x75 ft., will be used for church purposes. The structure will be of 2 stories and a stone basement, and cost approximately $35,000.

The congregation of Immaculate Conception Church in Bay View will erect a new $30,000 building at Russell and Kinnickinnick Aves. A permit was issued yesterday. The plans were drawn by Buemming & Dick, 1107 Pabst Bldg.

SCHOOLS.

Notes Arranged Alphabetically by States.

New Decatur, Ala.—The School Bd., it is stated, is arranging to erect a $25,000 school.

•*Birmingham, Ala.*—The Benj. F. Barbour Plumbing Co., 2119 3d Ave., is reported to have secured the contract to install a ventilating and heating system in the Paul Hayne School at $3,500.

Vallejo, Cal.—The citizens of the county are stated to have voted in favor of issuing $18,000 school bonds.

Hartford, Conn.—Bids will be received until Aug. 12 by the Com. of Washington School Dist. (Alex. Angus,

• *Items marked thus give the names of parties awarded contracts.*

Chmn., Hartford Natl. Bank), for $100,000 school dist. bonds.

New Haven, Conn.—Local archts. have been asked to submit plans until Aug. 7 to the Special Com. on School Bldgs. of the Bd. of Educ. (G. T. Hewlett, Secy.) for the school to be erected on Greene St.

Washington, D. C.—Bids will be received until July 27 by R. C. Hollyday, Ch. Bureau of Yards & Docks, Navy Dept., Washington, for alterations and repairs to the Meda Medical School at the U. S. Naval Medical School, Washington, as per specification 1552.

Tallahassee, Fla.—Bids will be received until Aug. 5 by the Bd. of Control at Jacksonville (N. P. Bryan, Chmn.) for erecting a dormitory at the Florida Female College, Tallahassee. Applications for plans should be made to Edwards & Walter, Archts., Columbia, S. C., accompanied by a deposit of $25.

Chicago, Ill.—The Chicago Eye, Ear, Nose & Throat College, it is stated, has secured additional grounds and intends erecting an 8-story building for its use at a cost of $125,000.

Peoria, Ill.—It is stated that the rebuilding of the present high school at a cost of $150,000 is contemplated. A wing will be erected this fall at a cost of $30,000.

St. Charles, Ill.—R. B. Watson, of Chicago, is stated to have submitted the lowest bid for erecting 2 cottages at the St. Charles School for Boys at $40,000.

**Middlebury, Ind.*—J. R. Duncan & Son, of Elkhart, are reported to have secured the contract to erect the high school at $15,596.

Hammond, Ind.—It is stated that bids will be received until July 23 by J. T. Hutton, Archt., of Hammond, for erecting a 2-story brick and stone 12-room school, to cost about $50,000.

Economy, Ind.—It is stated that plans have been accepted for a school to be erected at a cost of $15,000. J. M. Manning, Trus. of Perry Township, may be able to give further information.

De Soto, Ind.—It is reported that bids will be received until July 27 (readvertisement) by W. E. Pixley, Trus., Delaware Township, for erecting a school in De Soto.

**Burlington, Ia.*—The Secretary School Board writes that the contract for erecting school for Washington Dist. (bids opened June 20) has been awarded to Henry Pierson & Son, of Burlington, for $18,125.

Des Moines, Ia.—W. H. McCauley, Pres. of the Capital City Commercial College, is reported to have announced that he intends erecting a new building for the college in the business district which will cost about $40,000.

**Ottumwa, Ia.*—The Ottumwa Mill & Construction Co. is stated to have secured the contract to erect the Star School at $17,645.

Davenport, Ia.—An addition is to be erected to St. Ambrose College at a cost of $30,000.

**Lawrence, Kan.*—E. H. F. Schneider, 9 W. Berkley St., is stated to have secured the contract to erect the Manual Training School at $30,574.

Leavenworth, Kan.—It is reported that bids will be received until Aug. 5 by the Bd. of Educ. (Robt. J. Morgan, Clk.) for erecting a school. W. P. Feth, archt.

**New Orleans, La.*—The United Constr. Co. is reported to have secured the contract to erect 4 schools (bids received July 12), at $95,445.

**Lock Raven, Md.*—The contract to erect 2 cottages at the Maryland School for Boys is stated to have been awarded on July 12 by the Bd. of Mgrs. to Henry S. Rippel, 7 Clay St., Baltimore, at $48,000. The cottages are to be fireproof, 2 stories high, 40x70 ft.

West Springfield, Mass.—On July 2 it was voted at the town meeting to erect an addition to the Park St. School. The lowest bids received recently for this addition are stated to have been as follows: L. W. Scott, of Springfield, for the general construction, $19,500, and Chas. A. Ludden, of Chicopee, for the ventilating, heating and plumbing, at a total bid of $5,345.

Boston, Mass.—It is stated that bids will be received until July 29 by the School House Comrs. (J. Clipston Sturgis, Chmn.), for erecting an addition to the Mechanic Arts High School; also installing a ventilating and heating system in same.

**New Bedford, Mass.*—The City Council has awarded contract for schools to H. T. Bullman, 105 Bonney St., and John B. Sullivan & Son Co.

**Adams, Mass.*—It is stated that the Wyckoff-Lloyd Co., of Springfield, has been awarded the contract to install the new ventilating and heating system in the Renfrew school, also the plumbing, for $8,000 and $1,479, respectively.

Salem, Mass.—Kilman & Hopkins, of Boston, it is stated, are the archts. for the high school which it is proposed erecting at a cost of $350,000.

Orange, Mass.—Bids will be received July 24 by the Bldg. Com. (Jas. D. Kimball, Clk.) for erecting a 4-room brick school. Geo. P. B. Alderman, Archt., Holyoke.

Williamstown, Mass.—The Bd. of Governors of Williams College are reported as having plans prepared for a brick and stone dormitory to be erected this year.

Marquette, Mich.—The taxpayers of Republic Township have authorized the Bd. of Educ. to issue $40,000 bonds to erect a high school.

Flint, Mich.—Bids will be received until Aug. 1 by the Bd. of Trus. of Union School Dist. (Thos. Doyle, Chmn.) for erecting a 4-room addition to the Oa kSt. School. Bids to be for the general construction; ventilating and heating; plumbing; electric light wiring. Clark & Munger, archts., Bay City, Mich.

Menominee, Mich.—It is stated that bids will be received until July 30 by Derrick Hubert, Archt., 9 Spies Bldg., for erecting a 3-story agricultural school for the Co. Bd. of Educ., the cost to be about $17,000.

**Austin, Minn.*—A. C. Thomas, of Blooming Prairie, is stated to have secured the contract to erect a brick school at $15,490.

Echo, Minn.—It is stated that bids will be received until July 23 by F. W. Sommerfield, Clk. Bd. Educ., for erecting a school, separate bids to be submitted for heating and plumbing. Wm. Elliott & Son, of St. Paul, are the archts.

Agricultural College, Miss.—Bids will be received until about Aug. 5 by the Executive Com. for erecting a mess hall at the Mississippi A. and M. College. For further information address A. J. Moore, Secy.

Bozeman, Mont.—Bids will be received until July 31 by the Bd. of Trus. of the State College of Agricultural and Mechanical Arts at Bozeman, for erecting a station building. C. S. Haire and J. G. Link, of Helena, are the archts.

**Anaconda, Mont.*—The contract to erect a 3-story parochial school for St. Peter's parish, it is stated, has been awarded to Hamill & Calnan at $34,107.

Kansas City, Mo.—The Bd. of Educ. has instructed C. A. Smith, Dwight Bldg., to prepare plans for an addition to Central high school to cost about $50,000.

St. Louis, Mo.—See "Churches and Dwellings."

St. Louis, Mo.—The following are reported to be the lowest bids opened July 5 by the Bldg. Com. of the Bd. of Educ. for work in the Training School and the warehouse. Bids on the warehouse were received on both a 2 and a 4-story building: The Southern Constr. Co., general work on the Manual Training Building, $78,000; Philip C. Ring, 3841 Finney Ave., plumbing, at $10,002; The Advance Eng. & Constr. Co., heating, at $10,720; general work on the warehouse, Chas. O. A. Brunk, for a 4-story building, $109,000; The E. C. Gerhard Bldg. Co., $85,965, on the 2-story building; Philip C. Ring, for both 2 and 4-story buildings, at $2,615 and $2,665, respectively; heating, the Modern Heating Co., 213 Chestnut St., $6,990 upon the 4-story building; and The J. B. Hughes Heating Co., 1234 Clark Ave., at $3,100 on the 2-story building.

Newark, N. J.—Bids will be received until 4.30 P. M. July 25 by Com. on Schoolhouses Bd. Educ. (R. D. Argue, Secy.), for erecting Lincoln School. Bids to be submitted separately on the following: Mason and fireproofing work, iron and steel work, carpenter work, plumbing work, roofing and cornice work, electrical work, ventilating and heating system, motor and motor wiring.

Plans are stated to be in preparation for a 12-room addition to Belmont Ave. school and a 12-room addition to Bergen St. school.

Phillipsburg, N. J.—The Bd. of Educ. has decided to expend $60,000 in providing additional school room.

Jersey City, N. J.—Supt. of Schools Henry Schnyder, in his annual reports, recommends erecting a new building to replace School No. 3 and an addition to School No. 15.

**Geneva, N .Y.*—It is stated that the contract to erect the Wm. Smith Hall of Science at Hobart College has been awarded to A. B. Morrison, of Geneva, at about $70,000.

**Brooklyn, N. Y.*—The following are the bids opened in July 8 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 157, Boro. of Brooklyn: Peter Cleary, 195 Bainbridge St., $411,900 (awarded contract); P. S. Brennan & Son, $433,000; John Auer & Sons, $418,299; Richd. E. Henningham, $417,824; P. Gallagher, $424,983; Wm. Werner, $462,800.

*The following are the bids opened same time and place for installing, ventilating and heating apparatus, in School 94, boro. of Brooklyn: Baldwin Eng. Co., $46,900; E. Rutzler Co., $43,435; Blake & Williams, $34,961, and Frank Dobson Co., Inc., $34,246 (awarded contract).

**Richmond, S. I., N. Y.*—The following are the bids opened on July 8 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 28, in Richmond, Boro. of Richmond: Ph. Wolff & Son, $45,882; Laurence J. Rice, 208 Bway., N. Y. City, $38,663 (awarded contract); The Dottsford Dickenson Co., $40,875; J. MacArthur, $39,000; Jos. Ohlhausen, $43,400.

Ogdensburg, N. Y.—Geo. Hall, of Pasadena, Cal., is reported to have given this city $100,000 for the erection of a seminary.

Binghamton, N. Y.—Plans for the Fairview School, it is stated, have been accepted, and A. J. Inloes, Secy. Bd. Educ., has been authorized to receive bids for construction.

New York, N. Y.—C. B. J. Snyder, Chf. Archt. of the Dept. of Educ., has filed plans for a second enlargement of old Rivington St. School No. 4, by the addition of a new 5-story annex, 125x100 ft. The improvements are to cost $180,000.

Albany, N. Y.—Bids as a whole will be received until Aug. 15 by Dr. Andrew S. Draper, State Comr. of Educ., Albany, for the construction of the N. Y. State Normal College at Albany, including heating, plumbing, electric work and gas pipiing.

Nyack, N. Y.—Bids will be received by E. S. Van Houtes, Pres. Bd. of Educ., until July 29, for erecting a new school and remodeling present school of the Union Free School Dist. 4, Orangetown, Nyack, as advertised in The Engineering Record. Bids may be submitted for the entire work or for carpenter work, mason work, plumbing or heating and ventilating separately.

**Fargo, N. D.*—The following are reported to be the bids received July 5 for installing a ventilating and heating system in the high school and central building, (*a*) Warner-Webster system; (*b*) Van Auken: T. P. Riley, *a* $9,000, *b* $8,756; E. J. Harrington, *a* $8,749, *b* $8,300; Fargo Plumbing & Heating Co., *a* $8,110, *b* $7,990 (awarded contract).

Bottineau, N. D.—The School of Forestry Bd. is reported to have awarded the contract for the new building to Edmund White, of Bottineau, for $24,200.

Minot, N. D.—It is reported that bids will be received until Aug. 3 for the erection of a 4-room addition to the Central School, including ventilating and heating. Frost & Hosmer, archts.

Granville, N. D.—Bids will be received until Aug. 6 by Bd. Directors of Granville School Dist. No. 25 for erecting a 4-room brick school. Wm. Zimmerman, archt., Minot; W. G. Morrison, Dist. Clk.

Hannaford, N. D.—It is reported that bids will be received until about Aug. 4 by the Bd. of Educ. (A. C. Anderson, Clk.) for erecting a school. Thori, Alban & Fisher, of St. Paul, Minn., are the archts.

Kenmare, N. D.—It is stated that bids will be received until Aug. 1 by Frost & Hosmer, Blaisdell-Bird Bldg., Minot, for erecting a high school to cost about $20,000.

Columbus, O.—Bids will be received until Aug. 5 by Com. on Bldgs., Bd. Educ. (C. E. Morris, Chmn.) for furnishing material and excavating and putting in the foundation for a 21-room school to be erected at Indianola and 16th Aves.

Crown Point, O.—Bids will be received until July 30 by I. A. Seybold, Clk. Madison Township, at Trotwood, for erecting a school in Crown Point, in Madison Township

Mingo, O.—It is stated that bids will be received until July 26 by C. L. Reed, Clk. Bd. Educ., for erecting a school.

Glassport, Pa.—Bids will be received until Aug. 5 by the School Bd. (Boyd Wilson, Secy.), for $50,000 bonds.

Harrisburg, Pa.—A. A. Ritcher, of Reading, is said to be preparing plans for Sunday school building for the United Brethren Church. Estimated cost $40,000. Address pastor.

Waynesburg, Pa.—At a meetiing of the Trus. of Waynesburg College, July 8, according to reports, it was decided that the $15,000 appropriation by the last Legislature be used in erecting a 3-story brick dormitory for women.

Rumford, R. I.—H. B. Smith Co., of Providence, it is stated, has been engaged to prepare plans for the heating plant which is to be installed at the Union Grammar School and for which $1,500 has been appropriated.

Cranston, R. I.—It is stated that all bids received July 1 for erecting several schools have been rejected.

Allendale, S. C.—The erection of a $20,000 school is reported under consideration.

**Aberdeen, S. D.*—The School Bd. is stated to have awarded to C. Lepper the contract to erect the school on the west side at $11,745.

Irwin D. Aldrich, of Big Stone, Secy. Bd. of Regents of Educ., writes that bids will be received by the Bd. of Regents at Spearfish until about Aug. 20 for the erection of a normal school at Aberdeen; cost reported to be about $58,000. Architect, Wm. M. Kenyon, Guaranty Bldg., Minneapolis, Minn.

North Athens, Tenn.—Reports state that Harper College, 4-story brick building, in North Athens, owned by U. S. Grant University, of Athens, wa sstruck by lightning on July 10 and totally destroyed by fire.

Dayton, Tenn.—It is stated that Bearden & Foreman, of Chattanooga, are preparing plans for a $15,000 school.

Athens, Tenn.—Adams & Alsup, of Chattanooga, are stated to be preparing plans for a school to be erected here at a cost of $15,000.

**Knoxville, Tenn.*—It is reported that Brimer & England have the contract for erecting a school on Gratz St. at $21,900.

Chattanooga, Tenn.—The Bd. of Aldermen has passed a resolution providing for the erection of 3 schools at a cost of $160,000.

Chilocco, Okla. Ter.—Bids will be recetved until Aug. 5 by S. M. McCowan, Supt. Chilocco, for furnishing and delivering at the Indian School as required during the fiscal year ending June 30, 1908, about 33,000 ft. of lumber, 15,500 shingles, 78 windows, doors and transoms, 12,400 laths, 275 sq. yds. metal laths, 4,000 brick, 610 ft. window guards, 2 iron stairways complete, 20 squares tin roofing, some bath tubs, sinks, closets, etc., about 890 ft. of valley, gutter, spouting, etc.

**Childress, Tex.*—E. T. S. Williams, of Childress, is reported to have secured the contract to erect a school estimated to cost $15,000.

Arlington, Tex.—The School Bd., according to reports, has decided to erect a $15,000 school. Address Clk. of the Bd.

Cleburne, Tex.—It is reported that arrangements are being made to erect a $75,000 school. Address Prof. G. G. Hall.

College Station, Tex.—Plans and specifications will be received, bids to be opened by the Bd. of Directors of the Agricultural & Mechanical College at Oriental Hotel, Dallas, at 9 A. M. Aug. 3, for the following buildings: At College station: dormitory, $45,000; bath house, $9,000; veterinary hospital, $4,500; at Prairie View: dormitory, $15,000. For information address Chas. Puryear, Dean, College Station.

**San Marcos, Tex.*—J. M. Carroll, Agent and Pres. San Marcos Baptist Academy, writes that the contract for erecting building for the academy (bids opened July 6), has been awarded to Fischer & Lambie, of Austin, for about $107,000.

Uvalde, Tex.—It is reported that a high school will be erected at a cost of $40,000. Adress Clk of School Bd.

Prairie View, Tex.—The Bd. of Directors of the Agricultural College, it is reported, has appropriated $30,000 for improving the Prairie View Branch of the Industrial College.

Weatherford, Tex.—It is stated that a dormitory is to be erected at the Texas Female Seminary to cost $22,000.

Scofield, Utah.—Bids will be received until July 25 by the Bd. School Trus. (F. H. Merreweather, Chmn.) for erecting an 8-room brick school. Bids to be submitted as a whole or separately on the following: Excavation, stone, cement, concrete and brickwork, carpentry, including tin, wrought iron and galvanized ironwork, cement work. Separate bids will be received for heating apparatus.

**Pullman, Wash.*—The Bd. of Control, it is stated, has awarded to A. Valk, of Pullman, the contract

* *Items marked thus give the names of parties awarded contracts.*

to erect the domestic science building at the State College at Pullman to include heating, plumbing and wiring at $23,729; also the contract to erect the veterinary hospital including plumbing, heating and wiring at $10,450.

**Tacoma, Wash.*—John Huntington, it is stated, has been granted a permit to erect the Rogers School on East M and 34th Sts. The structure will be of concrete and 2 stories high, contain 12 school rooms and cost $50,000.

Benton, Wis.—The electors of Dist. No. 1, it is reported, have decided to issue $20,000 bonds for a school H. L. Winskell, Pres. Bd.

Edgerton, Wis.—Florence Child, according to reports, has presented the city $40,000 to be used for the erection of a new high school.

Galesville, Wis.—Schick & Roth, of La Crosse, are reported to have prepared plans for a 2-story brick school to cost $20,000.

West Allis, Wis.—Plans for the $18,000 school for West Allis are being prepared, according to reports, by Chandler & Park, Racine.

Arcadia, Wis.—Schick & Roth, of La Crosse, it is reported, have completed plans for a $20,000 high school to be erected here.

Milwaukee, Wis.—Leehouts & Guthrie, 102 Wisconsin St., it is stated will prepare plans for the fan system of ventilating for the 10th Dist., No. 1, and 11th Dist., No. 1, Schools.

**Oshkosh, Wis.*—J. W. McAllister & Co., of Oshkosh, is reported to have secured the contract for the plumbing and piping in the Read School at $4,000, and the Dukerschein Htg. & Ventilating Co., the contract for the ventilating and heating, at $4,478.

Toronto, Ont.—Bids will be received until July 23 by W. C. Wilkinson, Secy.-Treas. Bd. Educ., for enlarging Grace St., Pape and Perth Aves. schools, alterations to Jarvis St. Collegiate Inst. and other repairs.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Des Moines, Ia.—Warren Walker, Secy. Engle Crematory Co., writes that it is proposed to construct a plant for the utilization and disposal of garbage, dead animals, etc., at a cost of $25,000. Plans are not yet fully completed.

Baltimore, Md.—Bids will be received until July 24 by the Bd. of Awards (J. Barry Mahool, Pres.) for the removal by scow or lighter, and final disposition of street sweepings and other refuse. J. L. Wickes, Comr. Street Cleaning.

**Hattiesburg, Miss.*—Lewis & Kitchen, 433 Wabash Ave., Chicago, Ill., are reported to have on July 5 secured the contract for constructing municipal garbage crematory for $9,960.

Schenectady, N. Y.—The Bd. of Contract and Supply on July 10 rejected the two bids opened on June 26 for the collection and sanitary disposal of ashes, rubbish, garbage and dead animals of the city for 5 years, beginning Oct. 1, 1907. L. B. Sebring, City Engr., Parker Bldg.

Hornell, N. Y.—The question of constructing a garbage crematory is reported under consideration here.

Columbus, O.—Engineer John H. Gregory is reported to have filed with the Bd. of Pub. Service on July 12 specifications for a garbage reduction plant of 100 tons capacity for 24 hours at an estimated cost of $150,000; also a furnace for incinerating rubbish in addition to the garbage reduction. The Rapp and Schwenker farm is stated to have been selected as the site for the plant.

Youngstown, O.—We are informed that a new ordinance is now being considered by City Council for disposal of garbage for 5 yrs. New bids will be called for later Clate A. Smith, Secy. Bd. of Health.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Montrose, Colo.—O. C. Skinner and Geo. Truesdale are reported interested in a company which has been organized for the purpose of erecting a factory to manufacture ice. The plant will cost about $30,000 and will have ten tons' daily capacity and the storage warehouse will hold 50,000 cu. ft. of refrigeration.

Peoria, Ill.—The plant of the Independent Cereal Milling Co is reported to have been purchased by the Corno Milling Co., of East St. Louis, and it is said to be the intention of the new owners to spend $50,000 at once in the erection of an elevator and an addition to the present plant in the Galena Road in Averyville, and the installation of necessary equipment for the prospective increased output.

Boston, Mass.—It is reported that the Foss Cotton Mills intends erecting cotton mills in East Boston at a cost of about $2,500,000.

Willmar, Minn.—The Great Northern Ry. Co. (A. H. Hogeland Ch. Engr., St. Paul), is reported to have purchased a site in the east end of this city on which a locomotive machine shop will be built. The roundhouse will also be enlarged. A new 100-ft. turntable will take the place of the one now in use.

**Minneapolis, Minn.*—It is reported that the Flour City Ornamental Iron Wks has let the contract to J. L. Robinson for its new brick and steel foundry to be erected at 27th Ave. S. and 27th St. The structure will be 75x200 ft., and cost complete $25,000.

New York, N. Y.—Bids will be received until July 31 by Wm. S. Patten, Asst. Q. M. Gen., U. S. A., Depot Q. M., 39 Whitehall St., New York City, for furnishing and delivering alongside of vessel within reach of ship's tackle, in the harbor of New York, a complete ice making and distilling plant.

Double Shoals, N. C.—The Double Shoals Cotton Mills, it is stated, will expend $20,000 for new machinery. This company is now operating 3,000 spindles, and it is reported to be preparing to establish a plant for manufacturing bricks for the erection of an addition.

Sidney, O.—The plant of the American Scraper Co. is reported to have been seriously damaged by fire on July 9.

Philadelphia, Pa.—Ballinger & Perrot, 102 S. 12th St., it is stated, have completed plans and invited estimates for the erection of 2 buildings for the Columbia Mills, at Fifth St. and Columbia Ave. One of the buildings will be 32x35 ft., and will be 4 stories and basement high; the other, 48x76 ft., one story and basement. Both buildings will be of brick, with slag roofs, and will have columns, floors and roofs of slow-burning wood construction.

The Miller Lock Co. has purchased a site at Tacony and Duncan Sts. and intend erecting a 2-story brick and stone fireproof lock factory 220x195 ft. Plans have been prepared by Heacock & Hokanson, 931 Chestnut St.

Permits have been granted to Cramp & Co., Commonwealth Bldg., for the erection of 2 buildings for manufacturing purposes, to be built at 5th and Appletree Sts., for the Smith, Kline & French Co., will be a 6-story concrete, brick and terra cotta structure, 91x61 ft., and cost $100,000. The other for the New York Pie Baking Co., to be erected at Lombard and 25th Sts., will be 2 stories high, 131x74 ft., of fireproof construction with an exterior facing of brick and cost $40,000. Plans for both buildings were drawn by Ballinger & Perrot, 102 S. 12th St.

Pittsburg, Pa.—It is reported that the Pittsburg Steel Co. will issue $4,000,000 bonds for improvements and extensions to the plant.

The Warner Glass Co., it is reported, is planning the enlarging of their plant this summer by the addition of a 6-ring continuous tank, which will give employment to 12 more shops.

Ashaway, R. I.—The Ashaway Clay Co. is reported formed with Geo. L. Babcock, of Plainfield, N. J., Pres., and Frank Hill, of Ashaway, Secy., and a capital of $50,000, for the purpose of building a plant to manufacture high-grade face brick having a capacity of 20,000 bricks per day.

**Chattanooga, Tenn.*—Adams & Sneider, 120 E. 8th St., are reported to have the contract to build a foundry for the American Brake Shoe Co. Estimated cost $40,000.

Spokane, Wash.—The Ford Pump & Engine Co., according to reports, is being organized with head offices in Spokane. The new organization has the patent for a rotary engine and pump, and is contemplating the erection of a factory in Spokane for manufacturing the engines and pumps. Capital, $100,000. Officers: A. F. Ford, Pres.; J. B. Ferguson, Vice-Pres.; B. L. Youngs, Secy. and Treas.

Everett, Wash.—It is stated that the Stetson Post Co. intends erecting mills here at a cost of about $1,000,000. H. A. Chase, of Everett, may be able to giive further information.

Tacoma, Wash.—A permit has been granted to the Northern Pacific Ry. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) for a 100x186-ft. addition to the machine shops at South Tacoma, a blacksmith shop and for a storage building 28x176 ft. The total cost of the 3 structures will be $125,000.

Elm Grove, W. Va.—The Wheeling Enameled-Iron Co., it is stated, will double the capacity of its plant at Elm Grove, and $60,000 will be expended in the general improvements. An additional foundry building 110x63 ft. will be erected adjoining the present one, and will be almost entirely of steel frame construction. The contract for the steel frame material and the steel construction work is reported awarded to the Riverside Bridge Co., of Martins Ferry, and contracts for other work in connection with the improvement have been let to local contracting firms.

Milwaukee, Wis.—Plans have been filed by the Schlitz Brewing Co. for a brewhouse, mill and boiler house to be erected on 2d and Cherry Sts., according to plans by Louis Lehle, of Chicago, Ill., and to cost $300,000.

A building permit is reported issued for a factory and warehouse for the William Berger Bedding Co., to be erected at a cost of $75,000 at Florida and Grove Sts.

**La Crosse, Wis.*—The Foster Construction Co., Empire Bldg., Milwaukee, it is stated, has been awarded the contract for the new Listman mill to be erected at La Crosse. The building will be 6 stories high, of brick and concrete construction.

Walkerville, Ont.—It is stated that application has been made for a charter for the Ontario Structural Steel Co., which expects to erect a plant in Walkerville and employ 500 men. An option has been obtained on a site of 20 acres. The principal steel goods to be manufactured will be structural steel for bridges, sky scrapers and other structural purposes. The promoters of the new company are said to be Henry Drake and Herman Schwein, formerly with the Canadian Bridge Co.

Toronto, Ont.—The Lautz Marble Company, of Buffalo, N. Y., are said to be locating a plant at Toronto. Negotiations are practically completed for a large property in the East End, near the railway tracks. A building, over 200 ft. long, and to cost $40,000, will be built.

Henry Simpson, archt. of Toronto, it is stated, will build a $50,000 factory on site of old Parliament St. School for the Aluminum & Crown Stopper Co. The building will be of mill construction, and 5 stories high.

Stratford, Ont.—It is stated that the Grand Trunk Ry. (Jos. Hobson, Ch. Engr., Montreal, Que.), are to rebuild their Stratford car shops on a large scale. The new shops will be 95x175 ft., and will be run with electricity throughout. One large 120-ton crane will be installed.

Brantford, Ont.—The Ham & Nott Mfg. Co., it is reported, has temporarily abandoned the plan of a branch plant in Ottawa, and will enlarge the local factory at a cost of $40,000.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Pine Bluff, Ark.*—The Dirs. of the Consot Drainage Dist. are reported to have awarded to G. A. McWilliams, of Peoria, Ill., the contract for constructing about 16 miles of drainage canal (bids opened July 2) at 9 cts. per cu. yd. for the main work and 10.25 cts. for the laterals; total cost, about $50,000. Engineer, Willis E. Ayres, Randolph Bldg., Memphis, Tenn.

Oroville, Cal.—The City Council is reported to have adopted the plans of Engineer Hall for flood protection from Feather River. The plans are said to call for a concrete wall, 6 ft. wide at bottom, and 18 in. on top, to cost about $100,000.

Wilmington, Del.—Bids will be received until Aug. 5 by Maj. C. A. F. Flagler, Corps. Engrs., U. S. A., Wilmington, for dredging Salem River, N. J.

Washington, D. C.—Bids will be received by Maj. Spencer Cosby, Corps Engrs., U. S. A., until Aug. 12, for dredging in Potomac and Anacostia Rivers, near Washington, as advertised in The Engineering Record.

Bids will be received until July 23 by the Bureau of Supplies & Accounts, Navy Dept., Washington, for furnishing at the various navy yards and naval stations the following supplies; Portsmouth, N. H., Schedule 45—Milling machine, hydraulic accumulator. Schedule 80—Asbestos packing. Boston, Mass., Schedule 76—Bolts and nuts, screws, pulleys, drills, shovels, files, etc. Schedule 78—Sheet brass and copper, rolled bronze. Schedule 79—Bar iron and steel, galvanized sheet steel, slab zinc, pig lead. Schedule 82—Copper pipe, pipe fittings, valves. Schedule 83—Insulating tape. New York, N. Y., Schedule 76—Bolts and nuts, brass nuts, steel wire and copper nails, scrapers, etc. Schedule 78—Sheet brass. Schedule 79—Sheet lead, steel billets, bars and angles, sheet tin. Schedule 81—Cement compound, etc. Schedule 82—Iron or steel pipe, pipe fittings, gate valves. Schedule 84—Iron castings. Washington, D. C., Schedule 71—Valves, etc., ties, brass and copper tubing, etc., steel tubes, gauges. Norfolk, Va., Schedule 73—Fire brick, steel letters, sheet steel, etc. Schedule 76—Copper and phosphor-bronze wire, bolts and nuts, drills, files, etc. Schedule 78—Rolled bronze, sheet brass. Schedule 79—Galvanized sheet steel. Schedule 82—Brass pipe, brass pipe fittings, valves. Schedule 85—Contruction of wards at naval hospital. New Orleans, La. Schedule 45—Steam hammer, blower, melting furnace. Newport, R. I., Schedule 41—Connection of officers' quarters with steam distributing lines. Schedule 42—Alterations to building. Schedule 72—Motor drive outfits at the navy yard, Charleston, S. C. Applications for proposals should designate the schedule desired by number. E. B. Rogers, Paymaster Gen., U. S. N.

**Fernandina, Fla.*—Bids were opened on July 1 by Lieut.-Col. Dan. C. Kingmen, Corps Engrs. U. S. A., Savannah, Ga., for dredging harbor at Fernandina, about 525,000 cu. yds. *a* price per cu. yd., *b* totals: P. Sanford Ross, Inc., Jersey City, N. J., *a*, 19.75 cts.; *b*, $103,687. Roderick G. Ross, Jacksonville, Fla., *a*, 20 cts.; *b*, $105,000. North American Dredging Co., Brunswick, Ga., *a*, 17.75 cts.; *b*, $93,187 (awarded contract).

Tampa, Fla.—Bids will be received by Maj. Francis R. Shunk, Corps Engrs., U. S. A., Jacksonville, until Aug. 16 for dredging in Tampa Bay, Fla., as advertised in The Engineering Record.

Joliet, Ill.—See "Power Plants, Gas and Electricity."

Rock Island, Ill.—The Drury Drainage Dist. (Wallace Treichler, Engr.) will, on July 30, let contract for 312,000 cu. yds. levee work, and 192,000 cu. yds. ditch work.

**Chicago, Ill.*—The contract for three 5-ton power stiff-leg derricks (bids opened July 8), has been awarded to J. E. Roemheld, Chamber of Commerce Bldg., for $8,450.

Bids will be received until July 23 by John J. Hanberg, Comr. of Pub. Wks., for furnishing apparatus and dredging approximately 8,500 cu. yds. of material from the bottom of slip "A" of the west fork of the south branch of Chicago River.

Piper City, Ill.—Bids will be received by the Comrs. of Vermilion Special Drainage Dist. at the First Natl. Bank Bldg., Piper City, until July 31 for 44,450 cu. yds. of dredge or machine ditch work and 62,460 cu. yds. of scraper ditch work, as advertised in The Engineering Record.

Sullivan, Ind.—It is stated that bids will be received until Aug. 5 by W. H. Jones, Jr., Engr. and Supt., New Lebanon, Ind., for constructing a dredge boat ditch, about 80,000 cu. yds.

Muskogee, Ind. Ter.—Bids will be received until July 27 by J. Geo. Wright, Comr. of Five Civilized Tribes, Muskogee, for drilling apparatus as follows: 2,000 ft. single cylinder, hydraulic-feed diamond-core drill with 12-in. run, drilling capacity 2,000 ft.; a 800 ft. single cylinder hydraulic-feed diamond-core drill, 12-in. run, drilling capacity of 800 ft.

Des Moines, Ia.—We are informed that no bids were received on July 10 by the Bd. of Pub. Wks. (W. W. Wise, Chmn.) for improvement of the channels of Raccoon and Des Moines Rivers. Matter may now be postponed for some time. Geo. D. Dobson, City Engr.

Muscatine, Ia.—It is stated that bids will be received until Aug. 5 by A. S. Lawrence, Co. Aud., for constructing a ditch in Drainage Dist. No. 4.

Dakotah, Ia.—It is stated that bids will be received until July 25 by John Cunningham, Co. Aud., for constructing a ditch or drain in Humboldt Township.

**Boone, Io.*—The contract for constructing county drain No. 37 (bids opened July 8), has been awarded to Fehlersin & Rosackerhler Co., of Boone, for tile, $1,860, and Chas. Peterson, for digging, about $1,260.

**New Orleans, La.*—Christie & Lowe, 107 Camp St., are reported to have secured the contract for constructing sill across Cubits Gap and The Jump, and placing additional mattresses on sill across head of Pass-a-Loutre, Mississippi River (bids opened July 6 by Col. E. H. Ruffner, Corps Engrs., U. S. A., Room N, Custom House) for about $242,000.

Boston, Mass.—The lowest bid opened on June 29 by Maj. Edw. Burr, Corps Engrs. U. S. A., for dredging under continuing contract a 35-ft. channel in Boston Harbor, was submitted by G. H. Breymann & Bros., of Toledo, O. They bid for Sections 5, 6, 7 and 8, 22 cts. per cu. yd. for dredging and $12 per ton for bowlders, and for Sects. 5a, 6a, 7a and 8a, 40 cts. per cu. yd. for dredging and $24 per ton for bowlders.

The Bd. of Aldermen on July 1 passed the loan bill providing $272,500 to the Park Dept. and $24,500 to the Public Grounds Dept.

Bids will be received at the office of the Charles River Basin Comn., 367 Boylston St., until Aug. 5 for building a portion of Cambridge marginal conduit, requiring approximately 2,000 cu. yds. concrete masonry, 40,000 lin. ft. piles and excav. and refill of about 1,900 lin. ft. trench, as advertised in The Engineering Record.

Bids will be received by the Bd. of Harbor and Land Comrs. until Aug. 2 for enlarging and extending the stone jetties at Cuttyhunk harbor, in Gosnold, and excavating a portion of Rock creek, in towns of Eastham and Orleans, as advertised in The Engineering Record.

**New Bedford, Mass.*—The following are the bids opened on July 6 by Lieut.-Col. J. H. Willard, Corps. Engr., U. S. A., Newport, R. I., for dredging in New Bedford and Fairhaven harbors, Mass. (Price given per cu. yd.): Columbia Dredging Co., New York, N. Y., 13.74 cts.; Morris & Cumings Dredging Co., New York, N. Y., 15.9 cts.; International Contr. Co., New York, N. Y., 17.5 cts.; Chas. M. Cole, Fall River, Mass., 14.5 cts.; J. S. Packard Dredging Co., Providence, R. I., 14.9 cts.; Eastern Dredging Co., Boston, 15.6 cts.; Coastwise Dredging Co., Norfolk, Va., 12.7 (recommended for award); Maritime Dredging Co., New York, N. Y., 13 2-5 cts.

**Saugatuck, Mich.*—Bids were opened on June 24 by Col. M. B. Adams, Corps, Engrs., U. S. A., Grand Rapids, for construction of sheet pile revetment and repair of South Pier at Saugatuck Harbor, Mich. The bid of Robt. Love, of Muskegon, has been recommended for acceptance at the following bid: 96 lin. ft. cut down and remov old work, $2; 25,556 lin. ft. oak piles, 36 cts.; 27.041 M ft. oak timber, $65; 319.077 M ft. pine or Douglass fir timber, $46; 516.034 M ft. pine or Douglas fir plank for sheet piles, $49; 21.952 M ft. pine or Douglas fir plank for decking, $45; 39,354 lbs. drift bolts, 4 cts.; 20,318 lbs. screw bolts, 4 cts.; 22,795 lbs. tie rods, 4 cts.; 15,705 lbs. carriage bolts, 5 cts.; 1,716 lbs. spikes, 4 cts.; total, $56,254. Totals of other bids: Burk, Smith & Nelson, Muskegon, $56,967; G. W. Bunker & Co., Grand Rapids, $59,688; Bennett-Schnorbach Co., Muskegon, $65,717; Great Lakes Dredge & Dock Co., Chicago, Ill., $70,025.

Cheboygan, Mich.—Bids will be received by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., Detroit, until Aug. 15 for dredging harbor at Cheboygan, as advertised in The Engineering Record.

**Duluth, Minn.*—Bids were opened on June 28 by Maj. Graham D. Fitch, Corps Engrs., U. S. A., for dredging in harbor of Duluth, and the Duluth-Superior Dredging Co., of Duluth, secured the contract at the following bid: Duluth Canal, 35,000 cu. yds., 25 cts. per cu. yd.; St. Louis Bay, 335,000 cu. yds., 10 cts.; Nemadji River, 550,000 cu. yds., 10 cts.; Superior Entry, 80,000 cu. yds., 25 cts.; total, $117,250. Totals of other bids received: Great Lakes Dredge & Dock Co., Chicago, Ill., $124,775; Zenith Dredge Co., Duluth, $134,687; and Northern Dredge Co., Duluth, $142,475.

Alexandria, Minn.—Bids will be received until July 29 by E. P. Wright, Co. Aud., Alexandria, for digging and constructing the main ditch, branches and forks of County Ditch No. 13, containing approximately 41,029 cu. yds. excav. and estimated to cost a total of $5,129.

Clarksdale, Miss. Bids will be received until July 29 by the Levee Bd. (T. G. Dabney, Ch. Engr.), Clarksdale, for the following levee work: Enlargement, Sections 1 to 17, inclusive, containing 450,000 cu. yds.; Sects. 30 to 34 (except 33), inclusive, 138,500 cu. yds.; banquette on Sects. part 43 to 50, inclusive, 126,400 cu. yds.; Sect. 80 and most of 81, 142,000 cu. yds; part of 16H, all of 17H, part of 18H, 98,900 cu. yds., new levee, part 18H and 19H; upper division (field work), 296,000 cu. yds.; middle division (woods), 195,000 cu. yds.; lower division (field), 298,000 cu. yds.; enlargement, part Sects. 21H and 22H, 51,000 cu. yds.

Jackson Barracks, Mo.—Bids will be received until Aug. 3 by Capt. B. T. Clayton, Q. M., New Orleans, for repairing wharf at Jackson Barracks.

**Dixville, N. H.*—The contract for building a earth dam with reinforced concrete core wall 500 ft. long and 70 ft. high across Mohawk River at Dixville for the Dixville Notch Corporation, has been let to Chas. E. Walbridge, of Plymouth, N. H., and work on it is in progress. It will carry a head of 65 ft. for about 200 ft. Engr., A. W. Dudley, of Manchester.

Portsmouth, N. H.—Bids will be received until Aug. 10 by R. C. Hollyday, Bureau of Yards & Docks, Navy Dept., Washington, D. C., for installing an electric elevator in the naval prison, Navy Yard, Portsmouth, as per specification No. 1553. Estimated cost, $3,250.

Bayonne, N. J.—The City Council is reported to have instructed F. W. Dalrymple, City Engr., to prepare plans and estimates for a recreation pier on Kill van Kull.

Mantua, N. J.—The following are reported to be the bids opened on June 21 by C. A. F. Flagler, Corps Engrs., U. S. A., at Wilmington, Del., for construction of jetty and cribs at the mouth of Mantua River, N. J.: Franklin W. Wills Co., $18,057; Tatnall-Brown Co., $19,691; Robt. B. Morrison, of New Castle, Del., $20,590; Armstrong & Latta Co., Philadelphia, Pa., $22,778; Latta & Ferry Constr. Co., Philadelphia, Pa., $19,198; Edw. F. Fonda Co., New York, N. Y., $22,875; Sanford & Brooks Co., Baltimore, Md., $25,137, and Richard Parrott, Newburgh, N. Y., $18,912.

Long Branch, N. J.—Bids will be received until Aug. 5 by the City Council for constructing a bulkhead on the ocean front near Atlantic Ave. Bryant B. Newcomb, City Clk.

Asbury Park, N. J.—W. T. Hunter, 38 Wall St., New York, N. Y., is Pres. and Ferd. R. Moeller, 837 Broad St., Newark, N. J., is Secy. and Treas., of a company which proposes constructing a pier bet. 1st and 2d Aves. in Asbury Park to cost bet. $300,000 and $350,000.

Somers Point, N. J.—Bids will be received by Jas. E. Scull, City Clk., until Aug. 5 for grading and graveling Harbor Lane and building a bulkhead or wharf on Harbor Lane, as advertised in The Engineering Record. E. D. Rightmire, City Engr., Bartlett Bldg., Atlantic City.

New York, N. Y.—The following are the bids opened on July 10 by Col. John G. D. Knight, Corps Engrs., U. S. A., for dredging (*a*) Coney Island Channel, (*b*) Flushing Bay (price given per cu. yd., scow meas.: N. J. Terminal Dock & Improvement Co., 62 Cedar St., *a* 31.5 cts.; R. G. Packard Co., 130 Pearl St., *a* 35 cts.; Maritime Dredging Co., 78 Broad St., *a* 31 cts., *b* 19⅔ cts.; Morris & Cumings Dredging Co., 17 State St., *a* 27.4 cts.; John & Jos. McSpirit, 118 Wayne St., Jersey City, N. J., *b* 39 cts.; J. M. Briggs, 154 Nassau St., *b* 29.7 cts.

Bids will be received July 26 (extension of date) by J. A. Bensel, Comr. of Docks, for contract 1054.—Furnishing material and for preparing for and building freight sheds on piers Nos. 54 and 56, North River, between foot of Little W. 12th and W. 14th Sts., on Chelsea section, with lateral extensions on adjacent bulkhead platforms. Security required $232.000.

St. George, S. I., N. Y.—Bids will be received by Geo. Cromwell, Boro. Pres., New Brighton, until July 30, for furnishing material and constructing reinforced concrete retaining walls on Jay St. and South St., and other work in connection with the St. George Ferry approach, as advertised in The Engineering Record. Engineer's estimate: 9,400 cu. yds. concrete in place, including forms; 1,100,000 lbs. steel in place; 23,000 cu. yds. excav.; 100 cu. yds. broken stone, for foundation; 2,500 lin. ft. granite coping on parapet wall; 70 lin. ft. special granite coping; 4,950 sq. ft. granite facing; 100 cu. yds. extra concrete for foundation, 1-3-6; 40,000 lin. ft. piles, furnished, driven and cut; 23 granite pedestals.

Oswego, N. Y.—Bids will be received by Col. H. M. Adams, Corps Engrs., U. S. A., Buffalo, until Aug. 17 for constructing stone-concrete superstructure on outer breakwater at Oswego, as advertised in The Engineering Record.

Albany, N. Y.—"Water."

Troy, N. Y.—Bids will be received until July 26 by Bd. Contract & Supply (Jas. M. Riley, Clk.) for furnishing material and repairing city docks at foot of 16th, 17th and 18th Sts. North End.

**Buffalo, N. Y.*—The Aldermanic Com. on Wharves and Harbors on June 24 voted to award contracts as follows: For deepening, widening and straightening Buffalo River and Cazenovia Creek (bids opened May 17): Sec. 2, Buffalo Dredging Co., $587,672; Sec. 3, same company, $213,460; and Sec. 4, Thos. Brown Contr. Co., $88,200. For detail bids received for this work see issue of The Engineering Record of June 8.

Cincinnati, O.—We are informed that no bids were received on June 20 by Lieut.-Col. Wm. Rossell, Corps Engrs. U. S. A., Cincinnati, for constructing concrete dam, etc., at head of Marietta Island, Ohio River.

Bids will be received until Aug. 12 by W. C. Culkins, City Aud., for $10,000 bonds, the proceeds to be used to construct a retaining wall and necessary drains on a portion of Gladstone Ave.; also, same date, for $80,000 bonds, the proceeds to be used to condemn land for extending Burnet Woods Park and for improving the same.

**Sandusky, O.*—Bids were opened on July 5 by Lieut. Col. C. McD. Townsend, Corps Engr., U. S. A., Cleveland, for work in Sandusky harbor as follows: (*a*) 16,000 cu. yds. drilling and blasting or otherwise breaking up bed rock; (*b*), 71,000 cu. yds. excav. and removing bed rock and overlying material. G. H. Breymann & Bros., Toledo, *a*, 4; *b*, $2; Great Lakes Dredge & Dock Co., Chicago, Ill. (successful bidder) *a*, $2.50; *b*, 65 cts.: Lake Erie Dredging Co., Buffalo, N. Y., *a*, $3.50; *b*, $1.95.

Carthage, O.—It is reported that bids will be received until July 29 for furnishing and placing fire escapes on the Central High School.

**Portland, Ore.*—The contract for furnishing about 1,200,000 tons stone (bids opened June 17 at the office of U. S. Engr.), has been awarded to Robt. Wakefield, of Portland, Ore., at $1.10 per ton for 200,000 tons, and $1.12 for 1,000,000 tons.

Panama.—Bids will be received until July 30 by D. W. Ross., Gen. Purchasing Agt., Isthmian Canal Comn., Washington, D. C., for furnishing per Canal Circular 376 the following: Electric fan motors, test pumps and gauges, iron pipe, steel pipe, rivets, etc.

Williamsport, Pa.—See "Paving and Roadmaking."

Erie, Pa.—We are informed that the State has appropriated $150,000 for the State St. dock extension in Erie. It will probably be built under supervision of a committee appointed by the Governor.

Philadelphia, Pa.—City Councils on July 1 substantially forwarded the plans for encircling the city with a chain of parks and connecting boulevards by passing bills for the condemnation of 550 acres of wood, valley and meadow land bordering Pennypacker and Cobb's Creeks.

Brownsville, Pa.—Bids will be received by Maj. H. C. Newcomer, Corps. Engrs., U. S. A., Pittsburg, until Aug. 12, for building a lock with 2 chambers, 2 guide walls and 2 guard walls at Brownsville, as advertised in The Engineering Record.

Providence, R. I.—Chas. R. Makepeace, Chmn. East Side Highway Com., estimates the cost of building a tunnel under Prospect Hill at $400,000, exclusive of cost of land or land damages.

Charleston, S. C.—The only bid received and opened on June 27 by Capt. G. P. Howell, Corps Engrs., U. S. A., for dredging canal bet. Sewee Bay and McClellanville, S. C., was submitted by P. Sanford Ross, Inc., Jersey City, N. J. He bid 42.2 cts. per cu. yd., place meas., at the monthly rate of 30,000 cu. yds., work to be begun within 60 days.

Nashville, Tenn.—The following are the bids opened on June 15 by Lieut. W. G. Caples, Corps. Engrs., U. S. A., for construction, delivery and erection of 2 steel lock gates, filling valves, etc., for each of locks 3 to 7, inclusive, in connection with Cumberland River improvement above Nashville: Baltimore Bridge Co., Baltimore, Md., $95,421; Penn Contr. Co., Pittsburgh, Pa., $91,318; and Penn Bridge Co., Beaver Falls, Pa., $85,100. The Atlanta Machine Wks., Atlanta, Ga., and Chattanooga Car & Fdry. Co., Chattanooga, Tenn., bid only for the valves, a total of $14,425 and $14,391, respectively.

Galveston, Tex.—Bids will be received until July 31 by Capt. John C. Oakes, Corps Engrs., U. S. A., Galveston, for dredging Inland Waterway between Aransas Pass and Pass Cavallo and to mouth of Guadalupe River through San Antonio and Mission Bays. Dredging, snagging and removal of rafts, etc., in Guadalupe River bet. its mouth and Victoria, Tex.

John M. Murch, Co. Aud., writes that Gen. H. M. Robert, late of Engrs. U. S. A., is now at Galveston, investigating and figuring for the county, cost, etc., of proposed causeway and bridge over Galveston Bay and Galveston Island.

Houston, Tex.—Geo. T. Horton, Co. Engr., writes that it is proposed to construct canal in Harris County to connect Brays Bayou with ship canal, at a cost of $15,000. John B. Ashe, Co. Aud.

Ft. Sam Houston, Tex.—Bids well be received by L. J. Fleming, Const. Q. M. U. S. A., until Aug. 5 for furnishing and installing metal frame wire screens in all openings in New Post Hospital, as advertised in The Engineering Record

Charlottesville, Va.—The Albemarle Telephone Co. has had plans and estimates completed for conduit and aerial cable, and would like bids from contractors for constructing same.

Wheeling, W. Va.—Bids will re received by Capt. F. C. Bogg, Corps Engrs., U. S. A., until Aug. 14 for furnishing and delivering iron and steel for bear-trap gates for Dam 18, Ohio River, as advertised in The Engineering Record.

**Ashland, Wis.*—Bids were opened on June 6 by Maj. Graham D. Fitch, Corps Engrs., U. S. A., Duluth, Mnn., for furnishing riprap at Ashland. The bids called for 60,000 tons of rock in place on top and sides of old breakwater, and Alex. Sang, of Duluth, Minn., secured the contract at 99 cts. per ton.; total cost, $59,400. The other bids received were: A. Donald & Co., Ashland, $1.07 per ton; Powell & Mitchell, Marquette, Mich., $1.25; and Northern Dredge Co., Duluth, Minn., 97 cts.

Racine, Wis.—Bids will be received by Maj. W. V. Judson, Corps Engrs. U. S. A., Milwaukee, until Aug. 2, for building crib breakwaters at Racine and Kenosha harbors, as advertised in The Engineering Record.

Superior, Wis.—Maj. Graham D. Fitch, Corps. Engrs., U. S. A., Duluth, Minn., writes that no bids were received on June 24 for building rubble mound breakwater at Superior Entry, Wis.

Casper, Wyo.—We are informed that no bids were received at the office of the U. S. Reclamation Service, Crawford, Neb., on June 5, for building the Pathfinder Dike, situated about 45 miles southwest of Casper, Wyo., and involving about 170,000 cu. yds. of earth excav. and about 16,000 cu. yds of riprap. Work will not be done during the present season. Further particulars may be obtained at the offices of the U. S. Reclamation Service, at Washington, D. C., Crawford, Neb., and Casper, Wyo.

Port Colborne, Ont.—Bids will be received until July 24 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for furnishing and placing stone and concrete blocks along south face of western breakwater at Port Colborne.

Calgory, Alta.—Bids will be received until Aug. 2 by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for an electric elevator at the Public Bldg., Calgary.

PROPOSALS OPEN.

For Proposals see Pages 74, 76, 78 and 80.

WATER.

Bids Close.		See Eng. Record.
Jul. 23.	Pipe, Irvington, N. Y.	Jul. 13
Jul. 23.	Spillway, Greenwich, O.	Jul. 20
Jul. 23.	Pump, barrel, etc., Chicago, Ill.	Jul. 20
Jul. 23.	Water works, Mountain View, Okla.	Jul. 20
Jul. 23.	Well, Newton, Miss.	Jul. 20
Jul. 24.	Dam, etc., Mattoon, Ill.	Jul. 20
Jul. 25.	Water works, Bradentown, Fla.	Jul. 20
Jul. 25.	Box for lake, Molina, Colo.	Jul. 20
Jul. 26.	Water works, Decatur, Ill.	Jul. 13
Jul. 26.	Pipe, etc., Youngstown, O.	Jul. 20
Jul. 29.	Filters, West Point, N. Y. Adv. Jul. 13, 20.	Jul. 13
Jul. 31.	Water wks., North Battleford, Sask.	Jun. 22
Aug. 1.	Water works, Graham, Tex.	Jul. 13
Aug. 1.	Mains, Jamestown, N. Y. Adv. Jul. 13, 20.	Jul. 13
Aug. 1.	Canal, Milner, Idaho	Jul. 13
Aug. 1.	Water works, Bradshaw, Neb.	Jul. 20
Aug. 1.	Water works, Chewelah, Wash.	Jul. 20
Aug. 3.	Meters and connections, Norwood, O. Adv. July 20.	Jul. 20
Aug. 5.	Pump engine for sale, Sandusky, O. Adv. Jul. 6, 13.	Jul. 6
Aug. 5.	Reservoir, etc., Ft. Adams, R. I. Adv. Jul. 13, 20.	Jul. 13
Aug. 5.	Boilers, Wahpeton, N. D.	Jul. 20
Aug. 5.	System at Poor Farm, Decorah, Ia.	Jul. 20
Aug. 6.	Dams, New York, N. Y. Adv. Jul. 6 to 20.	Jul. 6
Aug. 6.	System, Speed, Miss.	Jul. 20
Aug. 6.	Main extension, Cherokee, Ia.	Jul. 20
Aug. 7.	Filter plant, Steelton, Pa. Adv. Jul. 20.	Jul. 20
Aug. 8.	Well, Catoosa Springs, Ga.	Jul. 20
Aug. 9.	Filtration plant, Ft. Hancock, N. J. Adv. Jul. 13, 20.	Jul. 13
Aug. 13.	Reservoir, Columbus, O.	Jul. 20
Aug. 19.	**Filter plans, Sacramento, Cal.** Adv. Jun. 1 to 15.	**Jun. 1**
Aug. 20.	Water wks., Russellville, Ark. Adv. Jul. 20.	Jul. 20
Aug. —.	**Water wks., Rockingham, N. C.**	**June. 29**
Sep. 4.	**Hauling and laying pipe, New Orleans,** La. Adv. Jun. 29 to Jul. 20.	Jun. 29
——	Pump station, Poteau, Ind. Ter.	Jul. 13

* *Items marked thus give the names of parties awarded contracts.*

SEWERAGE AND SEWAGE DISPOSAL.

Jul. 22. Philadelphia, Pa. Adv. Jul 6 to 20....Jul. 6
Jul. 23. Virginia, Minn. ....Jul. 13
Jul. 23. Chicago, Ill. ....Jul. 20
Jul. 23. Kansas City, Mo. ....Jul. 20
Jul. 24. Henderson, N. C. ....Jul. 13
Jul. 24. Aberdeen, Wash. ....Jul. 13
Jul. 24. Oakland, Cal. ....Jul. 13
Jul. 24. Brooklyn, N. Y. ....Jul. 20
Jul. 24. Indianapolis, Ind. ....Jul. 20
Jul. 24. Mattoon, Ill. ....Jul. 20
Jul. 25. Frankfort, Ind. ....Jun. 29
Jul. 25. Webster City, Ia. ....Jul. 20
Jul. 25. Janesville, Wis. ....Jul. 20
Jul. 25. Bradentown, Fla. ....Jul. 20
Jul. 26. Buffalo, N. Y. ....Jul. 20
Jul. 27. Wahpeton, N. D. ....Jul. 20
Jul. 27. Belleville, Ill. Adv. Jul. 20....Jul. 20
Jul. 27. Cape May, N. J. ....Jul. 20
Jul. 29. Hartford, Conn. Adv. Jul. 20....Jul. 20
Jul. 29. Webster, S. D. ....Jul. 20
Jul. 29. Washington, D. C. Adv. Jul. 20....Jul. 20
Jul. 30. Sharon, Pa. ....Jul. 20
Jul. 30. Napoleon, O. ....Jul. 20
Jul. 30. St. George, S. I. ....Jul. 20
Jul. 31. North Battleford, Sask. ....Jun. 22
Jul. 31. Eureka, Kan. ....Jul. 6
Jul. —. Brazil, Ind. ....Jun. 1
Jul. —. Belleville, Ill. ....Jun. 15
Aug. 1. Marshfield, Wis. ....Jul. 6
Aug. 1. Scottdale, Pa. ....Jul. 20
Aug. 2. Amsterdam, N. Y. ....Jul. 20
Aug. 3. New Bremen, O. Adv. Jul. 13, 20....Jul. 13
Aug. 5. Olympia, Wash. Adv. Jul. 6 to 20....Jul. 6
Aug. 5. Plainfield, N. J. (2 prop.)....Jul. 13
Adv. Jul. 13.
Aug. 5. Columbus, Ind. ....Jul. 13
Aug. 5. Grand Forks, N. D. ....Jul. 20
Aug. 5. North Milwaukee, Wis. ....Jul. 20
Aug. 5. River Forest, Ill. ....Jul. 20
Aug. 6. Alexandria, La. ....Jun. 29
Adv. Jun. 26 to Jul. 20.
Aug. 6. Morris, Minn. ....Jul. 20
Aug. 8. Bloomfield, Ind. Adv. Jul. 13....Jul. 13
Aug. 10. Marshfield, Wis. ....Jul. 20
Aug. 14. Lewistown, Mont. ....Jul. 20
Aug. 15. Camden, Ark. ....Jul. 20
Aug. —. Rockingham, N. C. ....Jun. 29
Sep. 1. Falonton, Ga. ....Apr. 13
Sep. 1. Alton, Ill. ....Jun. 8
Sep. 11. New Orleans, La. Adv. Jul. 6 to 20....Jul. 6

BRIDGES.

Jul. 23. Columbia City, Ind. ....Jul. 6
Jul. 23. New York, N. Y. ....Jul. 13
Jul. 23. Greeley, Colo. ....Jul. 20
Jul. 25. Sacramento, Cal. ....Jul. 20
Jul. 27. Cleveland, O. ....Jul. 13
Jul. 27. Elberton, Ga. ....Jul. 13
Jul. 29. Wichita, Kan. ....Jul. 13
Jul. 29. Chardon, O. ....Jul. 13
Jul. 29. Reno, Nev. ....Jul. 20
Jul. 29. Ft. Work, Tex. ....Jul. 20
Jul. 30. Clarion, Pa. ....Jul. 20
Jul. 30. Hamilton, O. ....Jul. 20
Jul. 30. Ebensburg, Pa. ....Jul. 20
Jul. 30. Tiffin, O. ....Jul. 20
Jul. 31. Hattiesburg, Miss. ....Jul. 13
Jul. 31. Glencoe, Ill. ....Jul. 20
Aug. 1. Woodland, Cal. ....Jul. 13
Aug. 1. Williamsport, Pa. ....Jul. 20
Aug. 1. East St. Louis, Ill. ....Jul. 20
Aug. 2. Sunnyhill, La. ....Jul. 20
Aug. 2. Portland, Colo. ....Jul. 20
Aug. 3. Findlay, O. ....Jul. 20
Aug. 3. Washington C. H., O. ....Jul. 20
Aug. 3. Cleveland, O. ....Jul. 20
Aug. 3. Shellmouth, Man. ....Jul. 20
Aug. 5. Columbus, O. ....Jul. 13
Aug. 5. Jackson, O. ....Jul. 20
Aug. 5. Rome, Ga. ....Jul. 13
Aug. 5. New Bern, N. C. ....Jul. 20
Aug. 5. Troy, O. ....Jul. 20
Aug. 8. New Albany, Ind. ....Jul. 20
Aug. 10. Cleveland, O. ....Jul. 20
Aug. 20. San Juan, P. R. ....Jul. 20
Sep. 30. Santiago, Chile ....Jul. 13

PAVING AND ROAD MAKING.

Jul. 23. Painesville, O. ....Jul. 6
Jul. 23. Portsmouth, O. ....Jul. 13
Jul. 23. Bogota, N. J. ....Jul. 13
Jul. 23. Mt Gilead, O. ....Jul. 13
Jul. 23. Chicago, Ill. ....Jul. 20
Jul. 23. Hudson, Mich. ....Jul. 20
Jul. 23. Dayton, O ....Jul. 20
Jul. 24. Harrison, N. Y. ....Jul. 13
Jul. 24. Indianapolis, Ind. ....Jul. 20
Jul. 24. Saco, Me. ....Jul. 20
Jul. 25. Long Island City, L. I., N. Y. ....Jul. 13
Jul. 25. El Reno, Okla. Adv. Jul. 13....Jul. 13
Jul. 25. Concord, N. H. ....Jul. 13
Jul. 25. Decatur, Ala. ....Jul. 20
Jul. 25. Jersey City, N. J. ....Jul. 20
Jul. 25. Freeport, Ill. Adv. Jul. 20....Jul. 20
Jul. 25. Tazewell, Va. ....Jul. 20
Jul. 25. Fargo, N. D. ....Jul. 20
Jul. 26. Cincinnati, O. ....Jul. 6
Jul. 26. Tipton, Ind. ....Jul. 13
Jul. 26. Appleton, Wis. ....Jul. 13
Jul. 26. Valparaiso, Ind. ....Jul. 20
Jul. 26. Indianapolis, Ind. ....Jul. 20
Jul. 26. Plainfield, Conn. ....Jul. 20
Jul. 27. Cleveland, O ....Jul. 6
Jul. 27. Orrville, O. ....Jul. 13
Jul. 27. Belleville, Ill. Adv. Jul. 20....Jul. 20
Jul. 27. Green Castle, Ind. ....Jul. 20
Jul. 27. Oberlin, O. ....Jul. 20
Jul. 29. Steubenville, O. ....Jul. 13
Jul. 29. Shawano, Wis. ....Jul. 20
Jul. 29. Minneapolis, Minn. ....Jul. 20
Jul. 29. Galveston, Tex. ....Jul. 20
Jul. 29. McDonald, Pa. ....Jul. 20
Jul. 29. Jenkintown, Pa. ....Jul. 20
Jul. 30. Ashland, Ore. ....Jul. 20
Jul. 30. Des Moines, Ia. ....Jul. 13
Jul. 30. Hagerstown, Md. ....Jul. 13
Jul. 30. Jefferson, O. ....Jul. 13
Jul. 30. Independence, Ia. ....Jul. 20
Jul. 30. Steubenville, O. ....Jul. 20

Jul. 30. Wilmington, Del. ....Jul. 20
Jul. 30. St. George, S. I. ....Jul. 20
Jul. 30. Newark, N. J. ....Jul. 20
Jul. 31. Ft. Greble, R. I. ....Jul. 20
Jul. —. Belleville, Ill. ....Jun. 15
Jul. —. Hudson, Mich. ....Jun. 15
Jul. —. Camden, N. J. ....Apr. 20
Aug. 1. Greencastle, Ind. ....Jun. 29
Aug. 1. Greensburg, Ky. ....Jul. 13
Aug. 1. Rahway, N. J. ....Jul. 13
Aug. 2. Cincinnati, O. ....Jul. 13
Aug. 3. New Bremen, O. Adv. Jul. 13, 20....Jul. 13
Aug. 3. Greenville, O. ....Jul. 20
Aug. 3. Williamsport, Pa. Adv. Jul. 20....Jul. 20
Aug. 3. St. Clairsville, O. ....Jul. 20
Aug. 3. Stevens Point, Wis. ....Jul. 20
Aug. 5. Olympia, Wash. Adv. Jul. 6 to 20....Jul. 6
Aug. 5. Somers Point, N. J. Adv. Jul. 20....Jul. 20
Aug. 5. Spencer, Ind. ....Jul. 20
Aug. 5. Mt. Vernon, Ind. ....Jul. 20
Aug. 5. Plansfield, N. J. Adv. Jul. 20....Jul. 20
Aug. 6. Reynoldsville, Pa. ....Jun. 29
Aug. 6. Sharpsville, Pa. ....Jul. 13
Aug. 6. Covington, Ind. ....Jul. 13
Aug. 6. Brazil, Ind. ....Jul. 20
Aug. 6. Bloomington, Ind. ....Jul. 20
Aug. 6. Spencer, Ind. ....Jul. 20
Aug. 6. Cohoes, N. Y. ....Jul. 20
Aug. 6. Washington, Pa. ....Jul. 20
Aug. 7. Peru, Ind. ....Jul. 20

POWER PLANTS, GAS AND ELECTRICITY.

Jul. 24. Ft. Sam Houston, Tex. ....Jul. 6
Jul. 25. Crystal Falls, Mich. Adv. Jul. 20....Jul. 20
Jul. 26. Toledo, O. ....Jul. 13
Jul. 29. Britton, S. D. ....Jul. 20
Jul. 30. Columbus, O. ....Jul. 6
Jul. 31. North Battleford, Sask. ....Jun. 22
Jul. 31. Tacoma, Wash. ....Jul. 20
Jul. —. Rowlesburg, W. Va. ....Mar. 16
Aug. 1. Hamilton, Ont. ....Jul. 13
Aug. 1. Ashland, Wis. ....Jul. 20
Aug. 1. Chewelah, Wash. ....Jul. 20
Aug. 6. Cleveland Heights, O. ....Jul. 20
Aug. 6. Sioux City, Ia. ....Jul. 20
Aug. 6. Hamilton, Ont. ....Jul. 20
Aug. 31. Lebanon, Pa. ....Jul. 20
Sep. 3. Winnipeg, Man. ....Jun. 15
Adv. Jun. 15 to Jul. 20.

BUILDINGS.

Jul. 22. Pub. bldg., Blackwell's Island, N. Y. ..Jul. 13
Jul. 22. Schools, New York, N. Y. ....Jul. 13
Jul. 23. Pub. bldg., Cortland, N. Y. ....Jul. 6
Adv. Jul. 6 to 20.
Jul. 23. Church, Ames, Ia. ....Jun. 22
Jul. 23. Alter. to pub. bldg., Minneapolis, Minn. Jul. 20
Jul. 23. Pub. bldg., Cheyenne, Wyo. ....Jun. 29
Jul. 23. Htg. school, Indianapolis, Ind. ....Jul. 13
Jul. 23. School, Evansville, Ind. ....Jul. 13
Jul. 23. Court house, Bishopville, S. C. ....Jul. 13
Jul. 23. Pub. bldg., Wales, Wis. ....Jul. 13
Jul. 23. Pub. bldg. improv., Cincinnati, O. ....Jul. 13
Jul. 23. School repairs, Toronto, Ont. ....Jul. 20
Jul. 23. School, Hammond, Ind. ....Jul. 20
Jul. 23. School, Echo, Minn. ....Jul. 20
Jul. 24. Post office, Aurora, Ill. ....Jun. 22
Jul. 24. School, Antler, N. D. ....Jun. 29
Jul. 24. Pub. bldgs., Dayton, O. ....Jul. 6
Jul. 24. School, Mt. Healthy, O. ....Jul. 6
Jul. 24. Church, Pittsburg, Kan. ....Jul. 13
Jul. 24. School, Orange, Mass. ....Jul. 20
Jul. 24. Church, Clarksburg, W. Va. ....Jul. 20
Jul. 25. Enlarging jail, New Roads, La. ....Jun. 29
Jul. 25. Add. to hospital, Marion, Ind. ....Jul. 6
Jul. 25. School, Paragould, Ark. ....Jul. 6
Jul. 25. School, Scofield, Utah. ....Jul. 13
Jul. 25. Schools De Haven, Pa. ....Jul. 13
Jul. 25. Bank, Marietta, O. ....Jul. 20
Jul. 25. Pub. bldg., New York, N. Y. ....Jul. 20
Jul. 25. School, Scofield, Utah ....Jul. 20
Jul. 25. School, Newark, N. J. ....Jul. 20
Jul. 25. City hall repairs, Hartford, Conn. ....Jul. 20
Jul. 26. Engine house, St. Louis, Mo. ....Jul. 13
Jul. 26. School, Mingo, O. ....Jul. 20
Jul. 26. Pub. bldg., Whitesboro, N. Y. ....Jul. 20
Jul. 26. Market house, etc., Youngstown, O. ....Jul. 20
Jul. 27. Pub. bldg., Boston, Mass. ....Jun. 29
Jul. 27. Bus. bldg., Tillamook, Ore. ....Jul. 20
Jul. 27. Court house, Potosi, Mo. ....Jul. 6
Jul. 27. Schools, Emporia, Kan. ....Jul. 13
Jul. 27. Pub. bldg., Cass Lake, Minn. ....Jul. 20
Jul. 27. School De Soto, Ind. ....Jul. 20
Jul. 27. Pub. bldg. improv., Norfolk, Va. ....Jul. 20
Jul. 27. Court house, Redwood City, Cal. ....Jul. 20
Jul. 27. School, Washington, D. C. ....Jul. 20
Jul. 29. School, Melville, N. D. ....Jul. 13
Jul. 29. Htg. school, Oelwein, Ia. ....Jul. 13
Jul. 29. Church, Jackson, Mich. ....Jul. 13
Jul. 29. School addition, Boston, Mass. ....Jul. 20
Jul. 29. School, Nyack, N. Y. ....Jul. 20
Jul. 29. Pub. bldg., Two Rivers, Wis. ....Jul. 20
Jul. 29. Pub. bldg., New Brighton, S. I. ....Jul. 20
Jul. 29. Bath, New York, N. Y. ....Jul. 20
Jul. 29. Courthouse, Redwood City, Cal. ....Jul. 6
Jul. 30. Y. M. C. A. bldg., Ft. Scott, Kan. ....Jul. 6
Jul. 30. Pub. bldg., San Francisco, Cal. ....Jul. 6
Jul. 30. Pub. bldg. improv., Hart's Is., N. Y. ....Jul. 20
Jul. 30. School, Kalamazoo, Mich. ....Jul. 13
Jul. 30. Church, Ames, Ia. ....Jul. 13
Jul. 30. Masonic temple, Marietta, O. ....Jul. 20
Jul. 30. School, Menominee, Mich. ....Jul. 20
Jul. 30. Remodel court house, Murfreesboro, Tenn. ....Jul. 20
Jul. 30. Htg. post bldgs., Ft. Brady, Mich. ...Jul. 20
Adv. Jul. 20.
Jul. 30. School, Crown Point, O. ....Jul. 20
Jul. 30. Boilers, etc., in laundry, Otisville, N. Y. ....Jul. 20
Jul. 31. Post office, Owosso, Mich. ....Jun. 20
Jul. 31. Pub. bldg. plans, Milwaukee, Wis. ....Jul. 6
Jul. 31. School Bldg., Bozeman, Mont. ....Jul. 20
Jul. 31. Court house, Vancouver, B. C. ....Jul. 20
Jul. 31. Shelving in pub. bldg., Washington, D. C. ....Jul. 20
Jul. 31. Marble in pub. bldg., Washington, D. C. Jul. 20
Jul. 31. Ice making machine, New York, N. Y. ..Jul. 20
Jul. —. Indus. plant, Chicago, Ill. ....May 25
Jul. —. Htg. college, Raleigh, N. C. ....Jun. 1
Aug. 1. School, Washington, D. C. ....Jul. 13

Aug. 1. Hospital plans, Calgary, Alta. ....Jul. 13
Aug. 1. School, Kenmare, N. D. ....Jul. 20
Aug. 1. Church, Alton, Ia. ....Jul. 20
Aug. 1. Addition to school, Flint, Mich. ....Jul. 20
Aug. 1. Bank, Knoxville, Tenn. ....Jul. 13
Aug. 3. College bldg. plans, College Stat'n, Tex. Jul. 20
Aug. 3. School, Minot, N. D. ....Jul. 20
Aug. 4. School, Hannaford, N. D. ....Jul. 20
Aug. 5. Post office, Crookston, Minn. ....Jul. 13
Aug. 5. School, Cleveland, O. ....Jul. 13
Aug. 5. School, Leavenworth, Kan. ....Jul. 20
Aug. 5. Pub. bldg., plans, Mineral Point, Wis—Jul. 20
Aug. 5. College Dormitory, Tallahassee, Fla. ...Jul. 20
Aug. 5. City hall, Jamestown, N. D. ....Jul. 20
Aug. 5. School bldg., material, Chilocco, Okla. .Jul. 20
Aug. 5. School foundation, Columbus, O. ....Jul. 20
Aug. 5. College bldg., Agricultural College, Miss. Jul. 20
Aug. 6. Pub. bldg., Brooklyn, N. Y. ....Jul. 20
Aug. 6. Bldg. at Univ., Columbus, O. ....Jul. 13
Aug. 6. School, Granville, N. D. ....Jul. 20
Aug. 6. Annex to jail, Asheville, N. C. ....Jul. 20
Aug. 7. Univ. bldg., Moscow, Idaho. ....Jul. 6
Aug. 7. Church, Halifax, N. S. ....Jul. 13
Aug. 7. School plans, New Haven, Conn. ....Jul. 20
Aug. 7. Pub. bldg., Baltimore, Md. ....Jul. 20
Aug. 9. Asylum, Monticello, Ind. ....Jun. 29
Aug. 9. School, Lakewood, O. ....Jul. 13
Aug. 12. Post office, Mason City, Ia. ....Jul. 6
Adv. Jul. 6, 13.
Aug. 13. Boilers for htg plant at pub. bldg., Minnehaha, Minn. ....Jul. 20
Aug. 15. School, Albany, N. Y. ....Jul. 20
Aug. 19. Post office, Alexandria, Minn. ....Jul. 13
Aug. 20. Post office, Decatur, Ill. ....Jul. 13
Aug. 20. School, Aberdeen, S. D. ....Jul. 20
Aug. 22. Post office bldg., Jackson, Miss. ....Jul. 20
Aug. —. Hospital, Saskatoon, Sask. ....May 4
Sep. 1. Bus bldg., Walla Walla, Wash. ....Apr. 20
Sep. —. Hotel, New Orleans, La. ....Jun. 29
Dec. —. Industrial plants, Ft. William, Ont. ..May 11
—— Bus. Bldg., Charles Town, W. Va. ...Jun. 15
Adv. Jun. 15, 22.

MISCELLANEOUS.

Jul. 22. Seawall, Oyster Bay, L. I., N. Y. ....Jul. 13
Jul. 23. Repairing wharf, Ft. Morgan, Ala. ....Jul. 6
Jul. 23. Supplies, Washington, D. C. ....Jul. 6
Jul. 23. Dredging, Chicago, Ill. ....Jul. 20
Jul. 24. Dredging, New York, N. Y. (2 props.). Jun. 29
Adv. Jun. 29 to Jul. 20.
Jul. 24. Dredging, Jacksonville, Fla. ....Jun. 22
Adv. Jun. 22 to Jul. 20.
Jul. 24. Ditch, Carroll, Ia. ....Jul. 6
Jul. 24. Breakawater improv., Port Colborne, Ont. ....Jul. 13
Jul. 24. Disposal of street refuse, Baltimore, Md. ....Jul. 20
Jul. 25. Coal pockets, Charlestown, Mass. ....Jul. 13
Jul. 25. Screenings, New York, N. Y. ....Jul. 13
Jul. 25. Ditch, Dakotah, Ia. ....Jul. 20
Jul. 26. Pier wk., Holland, Mich. ....Jun. 29
Adv. Jun. 29 to Jul. 20.
Jul. 26. Dock repairs, Troy, N. Y. ....Jul. 20
Jul. 26. Pier work, New York, N. Y. ....Jul. 20
Jul. 27. Dredging, Woodbridge, N. J. ....Jun. 29
Adv. Jun. 29 to Jul. 20.
Jul. 27. Dry dock, Bremerton, Wash. ....Jun. 1
Jul. 27. Ditch, St. Paul, Minn. ....Jul. 13
Jul. 27. Drilling machines, Muskogee, Ind. Ter. .Jul. 20
Jul. 29. Dredging, Nome, Alaska ....Jun. 22
Jul. 29. Jetty wk., Washington, D. C. ....Jul. 6
Adv. Jul. 6 to 20.
Jul. 29. Levee work, Clarksdale, Miss. ....Jul. 20
Jul. 29. Ditch, Alexandria, Minn. ....Jul. 20
Jul. 29. Fire escapes, Carthage, O. ....Jul. 20
Jul. 30. Dredging, Newark, N. J. ....Jun. 29
Adv. Jun. 29 to Jul. 20.
Jul. 30. R. R. wk., locomotive, etc., Ft. Monroe, Va. Adv. Jul. 6 to 20. ....Jul. 6
Jul. 30. Ferry terminal work, St. George, S. I. .Jul. 6
Adv. Jul. 6 to 20.
Jul. 30. Steel, iron, etc., Panama. ....Jul. 20
Jul. 30. Levee and ditch work, Rock Island, Ill. Jul. 20
Jul. 31. Canal work, Albany, N. Y. ....Jul. 13
Jul. 31. Dredge and scraper work, Piper City, Ill. Adv. Jul. 20 ....Jul. 20
Aug. 1. Ditch, Marshalltown, Ia. ....Jun. 29
Adv. Jun. 29.
Aug. 1. Pier, dock, etc., Elizabeth, N. J. ....Jul. 13
Aug. 2. Jetty work, Boston, Mass. Adv. Jul. 20. Jul. 20
Aug. 2. Crib breakwater, Racine, Wis. ....Jul. 13
Adv. Jul. 13, 20.
Aug. 2. Elevator, Calgary, Alta. ....Jul. 20
Aug. 3. Pier, San Juan, P. R. ....Jul. 6
Aug. 3. Repairing wharf, Jackson Barracks, La. Jul. 20
Aug. 5. Garb. disposal, etc., Harrisburg, Pa. .Jun. 29
Adv. Jun. 29.
Aug. 5. Screens for bldgs., Ft. Sam Houston, Tex. Adv. Jul. 13, 20. ....Jul. 13
Aug. 5. Wharf, etc., Somers Point, N. J. ....Jul. 20
Adv. Jul. 20.
Aug. 5. Ditch, Muscatine, Ia. ....Jul. 20
Aug. 5. Bulkhead, Long Branch, N. J. ....Jul. 20
Aug. 5. Conduit, Boston, Mass. Adv. Jul. 20. .Jul. 20
Aug. 5. Dredge Boat, Sullivan, Ind. ....Jul. 20
Aug. 5. Dredging, Wilmington, Del. ....Jul. 20
Aug. 6. Drain, Pocohontas, Ia. ....Jul. 13
Aug. 7. Dredging, San Juan, P. R. ....Jun. 29
Adv. Jun. 29 to Jul. 13.
Aug. 7. Ditch, Emmetsburg, Ia. ....Jul. 6
Aug. 10. Elevator, Portsmouth, N. H. ....Jul. 20
Aug. 12. Dredging, Norwalk, Conn. ....Jul. 13
Adv. Jul. 13, 20.
Aug. 12. Dredging, Philadelphia, Pa. ....Jul. 20
Adv. Jul. 20.
Aug. 12. Dredging, Washington, D. C. ....Jul. 20
Adv. Jul. 20.
Aug. 12. Lock, etc., Brownsville, Pa. ....Jul. 20
Adv. Jul. 20.
Aug. 14. Iron and steel, etc., Wheeling, W. Va. .Jul. 20
Adv. Jul. 20.
Aug. 15. Dredging, Cheboygan, Mich. ....Jul. 20
Adv. Jul. 20.
Aug. 16. Dredging, Tampa, Fla. Adv. Jul. 20. .Jul. 20
Aug. 16. Jetty work, Galveston, Tex. ....Jul. 20
Aug. 17. Breakawater work, Oswego, N. Y. ....Jul. 20
Adv. Jul. 20.
Aug. 20. Wharf, etc., San Diego, Cal. ....Jun. 22
Adv. Jun. 22, 29.
Sep. 2. Wharf plans, Gothenburg, Sweden. ...Apr. 13
Adv. Apr. 27 to May 18.

CURRENT NEWS SUPPLEMENT

JULY 27, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

THE PETROLITHIC ROLLING TAMPER.

A number of cities in South California have recently constructed a new type of pavement, known as the petrolithic pavement, which is in essence a particularly well-built form of oiled road. The leading feature of this pavement is the very complete compacting of the oiled material by means of a rolling tamper, shown in the accompanying illustration. It was designed to insure the tamping of the material from the lower portions upward to the surface, instead of downwards from the surface. The inventor received the idea from seeing a large flock of sheep walk over a newly plowed road. After the sheep had passed over it, the soil was found to be packed so hard that a pick indented it but a short distance. To obtain this effect with a roller, the circumference of the main roll is covered with tampers, which act like so many feet walking over the earth and packing it down. The specifications for a petrolithic pavement in Los Angeles include the following clause concerning the roller: "The tamping roller shall consist of a roller, the outer surface of which shall be studded with teeth not less than 7 in. long and having a surface area of not less than 4 sq. in. each. The roller itself to be of such a weight that the load upon each tooth shall be not less than 300 lb."

Before this roller is run over the roadway, the latter is plowed up to a depth of about 6 in. In important improvements in Los Angeles, before the plowing is done, the surface is carefully graded and all poor material removed, the depressions being filled up to the final surface. A roller is run over the surface so as to disclose all soft places before the final plowing. It is usual to insure the proper crowning with a road machine, and if there are any clods, a harrow is run over the ground until they are broken up thoroughly. The soil is then usually sprinkled with water and the lower part of the roadway for a thickness of about 2 in. is compacted with the tamping roller, but in some cases oil is sprinkled. An examination of the cut will show how the roller operates to accomplish the consolidation. Each of the teeth sinks to the hilt, so to speak, in the loose soil, leaving below it a compact area about equal to the area of the head of the tooth. The head is larger than the shank, so that when the tooth is pulled out of the hole some dirt falls back into the bottom of the latter. Then when the machine passes over the ground again, it packs the dirt a little nearer the surface, and repeated passages of this sort result in consolidating the earth until finally the tamper rides entirely upon the surface, if the rolling is continued to such a condition.

After the bottom 2 in. have been consolidated in the manner mentioned, oil tanks are driven over the roadway and the oil sprinkled evenly over the surface until one gallon per square yard of roadway has been applied. A cultivator is next run several times over the ground to mix the oil and the earth thoroughly, after which the rolling tamper begins its work again. The action of the tamper not only compresses and packs the soil but also

PETROLITHIC ROLLING TAMPER.

effects somewhat the mixing of the oil and the earth. This is due to the fact that as each tooth of the roller comes out of the hole it made, the head of the tooth acts like a rake upon the soil above the bottom of the hole. This process of oiling and tamping is repeated three times, until 3 gal. of oil per square yard have been thoroughly mixed with a layer of soil 4 in. thick and the oil begins to ooze on the surface of the roadway. Then the surface is ironed down with an ordinary roller and the pavement is thus completed.

This machine has been developed primarily for use with the oil obtained in California, which has an asphaltic base and has long been successfully used for oiling roads. There seems to be no reason, however, why the device should not compact ordinary dirt roads of certain classes in an economical manner. In fact where it is necessary for contracting purposes to haul a considerable amount of material over dirt roads of poor character, a trial of the petrolithic roller might very well be made. The teaming that has to be done on many contracts is an expensive feature of the work, and anything which will reduce this total expense by the payment of a relatively small sum deserves consideration. The roller is made by the Petrolithic Pavement Co., Pacific Electric Bldg., Los Angeles.

AN EXPERT OPINION ON CONVICT LABOR ON ROADS.

During recent years, particularly since the passage of laws in some States prohibiting employing convicts in work which brings their products into competition with those of regular industries, there has been a growing conviction that it would be advisable to use convict labor on road improvements. This proposal has met with opposition on two grounds. The first is that convicts working on a road would prevent its use by timid people and would thus be an unnecessary hardship on the public; this objection has been found quite strong near some cities where the plan was tried. The second ground of opposition to road improvements by convicts is that the latter are subject to conditions which increase the severity of their punishment beyond what the law contemplates. This may be true under some conditions, but it seems certain that there are sections of the Southern States where road work is liked by the convicts. They are well cared for under the supervision of proper authorities, and the regular hours, out-door life and minor privileges impracticable in a jail, are appreciated.

A rather amusing proof of this recently occurred in a State where convict labor on roads has been conducted for some years. For manifest reasons it would be unwise to give the locality, but the facts have been received from a responsible source. The Clerk of the State Convict Road Force applied to the jailer of Blank County for five men for highway work. Six men were sent to him, with this letter from the jailer:

"You will notice that where your order calls for five men, I send you six. No. 6 is Woodrow Harris. Woodrow Harris came to us after your requisition was in hand and after I had sent you my list. You'll have to take Woodrow Harris. He won't stay here. When the gang of five were leaving us to go to you, Woodrow kicked up such an infernal row about being left behind that we just had to let him go. He had been with you before, and he says you treat him O. K. He said if we didn't let him go to the convict camp he would kick holes in the jail. We don't want any holes kicked in this jail, so we have let Woodrow go, and be dog-goned to him."

Woodrow was evidently a man of some education, for he first made his plea for permission to go to the camp in the following verses:

Oh, take me back to the convict camp,
  Put me to work on the grade;
I like the scent of the canvas tent
  And the bunk the sergeant made.
Just take me out of this pesky jail
  To the camp and God's free air,
Away from this shack where the small greyback
  Skiddoos through my uncut hair.

Oh, take me back to the dining tent
  To feed with the bunch again,
Where every man gets a well-filled pan
  And eats till he gets a pain.
Give me a suit of Kentucky jeans,
  The same as you did before,
And I'll serve my time without a whine
  And chip in a few months more.

Take me back to the village of tents,
  I'm sick of the prison cell.
I'm an old hobo and I think I know
  When I strike a good hotel.
Please send me back to-day if you can;
  Just forget about your fee;
I have been there once and served six months
  And the road-man's job suits me.

BUSINESS NOTES.

The Pittsburg Automatic Vise & Tool Co., Pittsburg, has recently made a large shipment of vises to the Portsmouth (N. H.) Navy Yard. A large part of the shipment consisted of very large vises, weighing 695 lbs. each, especially adapted to the severe service in the Navy Yard.

The Blue Seal Portland Cement Co., Kansas City, Mo., is to erect immediately a mill with a capacity of 2,500 bbl. per day at Courtney, Jackson Co., Mo., 11 miles east of Kansas City, on the Sante Fe R. R. Oil or coal will be used for fuel. The contract for the building of the plant has been let to the Fuller Engineering Co., Allentown, Pa.

The Minneapolis Steel & Machinery Co., Minneapolis, Minn., has opened an office in Butte, Mont., in the Phœnix Building, which will handle the increasing trade of that State. Mr. J. E. Lanning will be manager of the new office.

The Raquette River Paper Co., Potsdam, N. Y., has contracted with the Ambursen Hydraulic Construction Co., Boston, for the building of a concrete-steel dam about 20 ft. high and 300 ft. long across the Raquette River at that point.

Robert W. Hunt & Co., Chicago, have been given the

inspection of the material for the Southern Pacific Co.'s rifled pipe line. This embraces 250 miles of 8-in. rifled pipe made by the Lorain plant of the National Tube Co., the pumping machinery and boilers.

A fireproof window sash has been designed by the Brown Hoisting Machinery Co., Cleveland, O., and is now being introduced rapidly. It is made of light structural shapes and in swinging or sliding types, as desired. The glass, which is embedded in putty between light angles, can be readily removed by unscrewing the angles on one side of the sash.

The United States Graphite Co., Saginaw, Mich., has developed a lubricating graphite in which the graphite is held in suspension in oil sufficiently long for it to perform its purposes when fed through oiling pipes. Amorphous graphite reduced to an impalpable powder is used, one teacupful of it being mixed with about a pint of oil.

Mr. John F. Carney, for many years connected with the selling department of The McCrum-Howell Co., but who has been for the past year manager of the heating department of the Barstow Stove Co., Providence, R. I., has accepted the position of manager of the Eastern branch of the National Regulator Co., manufacturers of heat regulating devices, with offices at 1135 Broadway, New York City.

The railroad, coal and machinery interests of New York have been showing their appreciation of the special advantages of the Coal & Iron National Banak as a depositary bank, and its combined capital, surplus and undivided profits have now reached $1,115,000. Mr. M. F. Burns, president of Burns Brothers, the largest retail coal dealers in the world, was elected a director of the bank last month.

The Freeborn Engineering & Construction Co. has moved its office in Kansas City to 605-615 Scarritt Building.

J. H. Wagenhorst & Co., Youngstown, O., manufacturers of electric blue printing machines, report the following partial list of sales: Cleveland Crane & Car Co., Wick Clinc, O.; Warren Steam Pump Co., Warren, Mass.; Vulcan Iron Works, Detroit, Mich.; A. O. Smith Co., Milwaukee, Wis.; Traylor Engineering Co., New York; John S. Cole Co., Charleston, W. Va.; Carnegie Steel Co., Youngstown, O.; District Pumping Station, Washington, D. C.; C. P. & E. R. R. Co., Willoughby, O.; Engene Dietzgen Co., Chicago, Ill.; Pardee Bros. & Co., Lattimer Mine, Pa.; Tennessee Coal, Iron & R. R. Co., Bessemer, Ala. Seven of these are repeat orders.

Mr. Embury McLean has acquired the interests of Mr. H. B. Haigh and Mr. John MacCormack in The Engineer Co., and has become president, Mr. Haigh and Mr. MacCormack having resigned as president and second vice-president, respectively. Mr. North McLean is the treasurer, and Mr. R. E. Fox, Jr., secretary. The company has relinquished its rights in Mr. MacCormack's patents on his stoker, and he will engage independently in its manufacture. This leaves the company free to push the installation of the "balanced draft" system in connection with any type of hand or mechanically stoked boiler furnace. At the present time the system is being used on boilers having a total capacity of about 500,000 h. p.

Mr. Otto Dieckmann, Jr., who has for some time been representing the Atlas Engine Works in St. Louis, has been appointed manager of the direct sales office of the same city.

The Westinghouse Electric Works at East Pittsburg have established another new record. During May the company shipped 750 carloads of electrical machinery, an average of 30 carloads a day, worth about $4,000,000. The high record heretofore was held by August, 1906, when 640 carloads were shipped. The shipments at the Westinghouse Machine Company's shops during May also reached the high-water mark, the company having sent out from the works 90 engines, aggregating 50,000 h.-p. These engines included gas engines from 10 to 1,000 h. p. and steam turbines from 1,000 to 10,000 h.-p.

The sales of the American Motor Roller, made by The Austin-Western Co., Ltd., and described in The Engineering Record of April 6, during its first month on the market, were as follows: City of St. Paul, Minn.; city of Two Harbors, Minn.; Duluth Township, St. Louis Co., Minn.; city of Hoquiam, Wash.; P. B. Moss, Billings, Mont.; Burke Bros., Ft. Smith, Ark.; village of Shelby, Mich.; Fayette Co., W. Va.; Harris Co., Tex.; Bradley Co., Tenn.; city of Charleston, W. Va.; Logan Co., O.; Erie Township, Ottawa Co., O.; Highland Township, Elk Co., Pa.; Cherrytree Township, Venango Co., Pa.; Russell Co., Va.

Mechanical draft for boilers is being installed by the B. F. Sturtevant Co., Boston, Mass., for Kitson Machine Shops, Inc., Lowell, Mass.; R. B. Whitacre & Co., St. Paul, Minn.; State Hospital, Morgantown, N. C.; Bemis & Call, Springfield, Mass.; General Chemical Co., Dundee, N. J.; General Chemical Co., Laurel Hill, L. I.; Lovegrove & Co., Inc., Philadelphia, Pa., and International Paper Co., Otis Mill, Chisholm, Me.

On July 2 the Keuffel & Esser Co. formally opened its two new buildings at Adams and Third Sts., Hoboken, which practically double its facilities. The two structures cover about 30,000 sq. ft. of ground, divided almost equally between the two, and were built of reinforced concrete by the Turner Construction Co. The office building is five stories high and slightly more elaborate in finish than the other. The shipping department occupies the whole of the ground floor, the general offices of the company are on the second floor, and the remaining floors are for stock rooms and storage. The new factory is six stories high. The lower four floors are used for wood-working, and lumber is stored in the rear of the lower two behind a fire wall. The fifth floor is used for paper mounting and the sixth for the manufacture of surveyors' tapes. The wood working machinery is driven by electric motors and an exhaust system is employed to remove the shavings and sawdust, which are fed to the boilers. There are two flights of stairs and two elevators in each building, enclosed by concrete partitions and kalameined doors held open with fusible links. The Keuffel & Esser Co. was established in 1867 by William Keuffel and Hermann Esser. The business was first carried on as an importing trade in a room on Nassau St., New York, the firm name being Keuffel & Esser. In 1868 the firm sought larger quarters on Nassau St., and after moving several times finally located at 127 Fulton St. in 1878, where they have remained for nearly thirty years. The business was incorporated in 1889. Although the business was established in 1867, it was not until 1870 that the firm began manufacturing. In 1871 the manufacturing branch was moved to Hoboken and since then has steadily grown until at the present time there is an extensive group of buildings. The personnel of the company is now: W. Keuffel, president; W. G. Keuffel, vice-president; C. M. Bernegau, treasurer; W. L. E. Keuffel, secretary.

PERSONAL NOTES.

Mr. Frederick Leach, formerly city engineer of Elmira, N. Y., has been appointed city engineer of Hornell, N. Y.

Mr. C. B. Scott, of Arritts, Va., has become resident engineer with the Virginia State Highway Commission, with headquarters at Lynchburg, Va.

Mr. E. D. Fletcher has resigned as chief engineer of the Tacoma Eastern R. R. to become city engineer of Hoquiam, Wash., succeeding Mr. G. D. Robertson, resigned.

Mr. Arnold W. Brunner, an architect of New York City, has been appointed a member of the Municipal Art Commission of New York, succeeding Mr. Walter Cook, resigned.

Mr. Alfred R. James, formerly assistant engineer with the United Railways & Electric Co., Baltimore, Md., has left for Panama, where he will join the engineering corps on the canal.

The United States Civil Service Commission will hold an examination Aug. 7 of candidates for the position of civil engineer and superintendent in the Quartermaster's Department.

Mr. L. N. Whitcraft has resigned as assistant engineer in the office of Mr. W. W. Crosby, State Highway Engineer of Maryland, to become road engineer of Somerset County, Md.

Mr. John F. Stevens, formerly chief engineer of the Isthmian Canal Commission, has been appointed a vice-president of the New York, New Haven & Hartford R. R., and will have charge of the operation of that line.

Mr. William O. Wood, formerly assistant superintendent of the Brooklyn Rapid Transit Co., Brooklyn, N. Y., has become the personal assistant of President Theodore Shonts, of the Interborough Rapid Transit Co., New York City.

Mr. Minard L. Holman, of the firm of Holman & Laird, consulting engineers, St. Louis, Mo., has been engaged by the City of Omaha, Neb., to prepare preliminary plans and estimates for the proposed new waterworks for that city.

Mr. William Graham, who recently resigned as assistant engineer of bridges and buildings of the Baltimore & Ohio R. R. Co., has accepted a similar position with the New York, New Haven & Hartford R. R., with headquarters in New Haven.

Mr. A. Jordahl, formerly with the Reinforced Cement Construction Co., of New York, has joined the engineering staff of W. S. Barstow & Co., of New York and Portland. He will have charge of the reinforced concrete work at the company's New York office.

Mr. E. C. Hawkins, who was recently succeded as chief engineer of the Oregon & Washington R. R. by Mr. H. F. Baldwin, formerly chief engineer of the Chicago & Alton Ry., has sailed for Katalla, Alaska, to take charge of work on the railroad now being built into the Copper River and Yukon region.

The McNichol contracts on which payments of large sums were withheld by the city of Philadelphia on the ground of fraud and collusion, have been approved by the arbitrator in the litigation between the city and the contractors, and the latter have been paid $2,049,330 by the city, in accordance with the decision. This is a large part of the sums retained by the city.

Mr. Mortimer G. Barnes, formerly a member of the engineering force of the Isthmian Canal Commission and at present connected with the engineering staff of the Board of Water Supply of New York, has been appointed a member of the Board of Advisory Engineers of the New York State Barge Canal, succeeding Dr. E. L. Corthell, who resigned a number of years ago.

Mr. L. W. Jones has resigned his position as president of the Pittsburg Filter Mfg. Co., and has also severed his connection with its board of directors. He has been connected with the company since 1903. He proposes to open an office shortly in Pittsburg as consulting engineer, taking up municipal and industrial fitration plants, water softening and sewage disposal plants.

Mr. C. E. Grunsky has opened an office as consulting engineer at 2033 Florida Ave., Washington. For twelve years Mr. Grunsky was engaged in private practice in California, and in addition to this work he has served as the assistant State engineer of California, as a member of the California Rivers and Harbors Commission, as a member of the San Francisco Sewerage Commission, as city engineer of San Francisco for four years, as a member of the Isthmian Canal Commission, and as a consulting engineer in the United States Reclamation Service.

Prof. W. F. M. Goss, who has severed his connection with Purdue University to become dean of the College of Engineering of the University of Illinois, has long been closely identified with the development of motive power on railways and it is understood that his new duties will in no way conflict with the continuation of his investigations along that line. This is gratifying to those who know the strength of his influence in bringing about the scientific testing of locomotives, of which the admirable station of the Pennsylvania R. R. at Altoona is the latest instance, as well as the importance of his work for the Master Car Builders' Association.

The following transfers in the Corps of Engineers, U. S. A., recently have been ordered: Maj. W. W. Harts, from Chattanooga to Nashville, Tenn., in connection with his duties as engineer in charge of the Chatanooga and Nashville engineer districts; Capt. Edward M. Markham, from 2d Battalion of Engineers, Washington Barracks, to the office of the engineer commission of the District of Columbia, as assistant; Capt. Hubert L. Wigmore, to the 2d Battalion of Engineers; Capt. Michael J. McDonough from duty as assistant intructor at the Military Academy to the 3d Battalion of Engineers, Fort Leavenworth, Kan.; First Lieutenants De Witt C. Jones, Francis B. Wilby and Clarence S. Ridley, from 3d Battalion of Engineers to the Engineer School, Washington Barracks; First Lieutenants Douglas MacArthur and Ulysses V. Grant, 3d, from the Engineer School to Milwaukee, Wis., and Boston, Mass., respectively; First Lieutenants William H. Rose, Robert P. Howell, Jr., and Joseph H. Earle, from the Engineer School to the 3d Battalion of Engineers.

Mr. Andrew Rosewater has been declared city engineer of Omaha, Neb., by the Supreme Court of the State in a decision which upholds in every detail the decision rendered by the District Court of Douglas County. In 1903 Mr. Rosewater was appointed for a three-year term. At the end of that period the Mayor of Omaha appointed as Mr. Rosewater's successor, Mr. Jesse Lowe, who was confirmed by the Council, but who refused to qualify for the office. Thirty days after the refusal Mr. Rosewater qualified and continued to discharge the duties of the office. Afterward Mr. Thomas Shaw was elected by the Council and started suit to get possession of the office. It was this suit which has just been decided. The court said: "A city engineer of a city of the metropolitan class holds the office until his successor is duly elected and qualified. The failure to qualify by one who has been appointed as his successor by the Mayor and confirmed by the Council, but who has not taken possession of the office or entered on the discharge of his duties, does not render the office vacant. Upon such a failure to qualify the incumbent may qualify anew under section 15, chapter 10, compiled statutes 1905.. When it is the duty of the Mayor to appoint an officer and he fails to do so the Council may elect, but this power of the Council does not exist when one who has been appointed by the Mayor and confirmed by the Council fails to qualify, leaving an incumbent to hold over until his successor is elected and qualified, in such a case the incumbent may qualify and take the office for the succeeding term."

THE MEXICO CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The 39th annual convention of the Society convened in the City of Mexico on the evening of June 8, in the Minera, this ancient, interesting and appropriate building being placed at the service of the Society by the Federal government, with characteristic and generous hospitality. For the especial pleasure of this annual meeting and the enjoyment of its many and varied entertainments, lavishly provided and artistically presented by the various departments of the Federal government, the Mexico Electric Tramways, Ltd., the Mexican Light & Power Co., the Mexican Ry., the Mexican Central Ry., the Mexican Association of Engineers and Architects, and the Mexican members of the American Society of Civil Engineers and the local committee on entertainment, et al., the visiting members of the Society and guests are indebted primarily to the invitation of President Diaz to hold this convention in the city. By hearty and appropriate resolutions and speeches the recipients of these attentions expressed their lively appreciation of the courtesies extended and the pleasures afforded, and the convention passes to record as one of the most enjoyable in the history of the Society, particularly as one of those happy ooccasions tending to establish cordial relations between the United States and Mexico.

A brief account of the several meetings, touching only the more important or interesting features or business, will first be given, leaving the details to appear in the Society's "Proceedings":

July 8.—At 9 p. m. the convention was called to order in the great audience room of the Minera by Sr. Leandro Fernandez, president of the Mexican Association of Engineers and Architects and Minister of the Department of Communications and Public Works of Mexico, as honorary presiding officer of the meeting. T address of welcome was delivered by Sr. Ramon rola, of the Mexican Society, and was responded by Mr. Onward Bates, vice-president of the American Society, who, in the unavoidable absence of Presi-
The matter was referred to the Board of Directors to
dent Benzenberg, presided over all subsequent meetings. The session was short and the evening was devoted to music and sociability.

July 9.—At 9 p. m. the second session was called to order, and the president's annual address was read. Selection from it were printed in The Engineering Record of July 13. The first business considered was the time and place for the next annual meeting. Out of over 500 expressions from the membership previously received in answer to the usual circular inquiry, over 300 designated Denver as the desired place, the remainder being divided between a dozen or more cities. The matter was referred to the Board of Direction to fix the time and place.

The report of the Special Committee on Rail Sections was then presented. This report had been received by the secretary after his arrival in Mexico, and its consideration was objected to because it had not been received in time to permit its publication and discussion as required by a resolution adopted by the Society in 1894. It was finally received and read and made an order of business for the next annual meeting and in the meantime will be published in the "Proceedings" and discussed by the membership.

July 10.—Morning.—The third session was called to order at 10 a. m., and the professional topics of discussion were at once taken up.

Topic 1—Water Supplies.—The question for discussion was the advisability of controlling watersheds sufficiently to prevent the pollution of impounded supplies, or of allowing a certain amount of contamination and relying on filtration to correct its effects. The subject was opened by a written communication from Mr. George W. Fuller, who pointed out the important influence of local conditions, particularly as to the quality of water which it is desired to obtain, which quality must or ought to meet certain rational requirements of local or state health authorities. Water supplies believed to be good ten years ago, are not in all cases now regarded as satisfactory in quality, and of those now regarded as good, some of them may not be so regarded a few years hence.

The basic thoughts or premises for the discussion are as follows: 1. Water from impounding reservoirs, or any other source, must be substantially free from disease-producing germs. 2. A satisfactory public water supply should be of good appearance, and free from objectionable quantities of mud, turbidity and vegetable stain. 3. A satisfactory supply should be free from objectionable tastes and odors. 4. Impounding reservoirs are of much assistance in the purification of water through natural agencies as regards the removal of bacteria, turbidity and peaty color, but their efficiency varies much with conditions. 5. The elimination of pollution through purchase of land is highly desirable, but in many places is prohibited by its cost. Sanitary control through inspection is helpful, but difficult under existing laws and customs. 6. A well designed and well operated filter plant with its various appurtenances, such as efficient aeration, sedimentation and coagulation, will allow a satisfactory water to be obtained from practically any impounded water supply.

A large proportion of the disease germs disappear from water impounded in a reservoir having a capacity equal to the volume of water removed from it during a period of many weeks or months, but the fact that with present laboratory methods it is very difficult to detect germs in water that has stood some weeks, does not prove that all the germs have died. Our knowledge is limited regarding the passage of disease germs through reservoirs, and the currents and stratification in the latter, but it should be remembered that the disease germs passing through the outlet are not always as low as would result from the stay of these germs in water for the same number of days as the capacity in days of the reservoir. Heavy rains may increase the pollution by washing the filth of months into the reservoir. Notwithstanding its shortcomings the impounding reservoir is a valuable adjunct in many places. One of its weaknesses is that its inefficiency cannot always be detected or corrected in time to avert danger, and this draws attention to the prevention of pollution on the watershed or its correction by filtration.

Sedimentation usually produces sufficient clarification, and the remaining turbidity, if any, is usually due to very fine particles. Tastes and odors, sometimes due to decomposition of organic matter or a vegetable growth in the reservoir, are the most disagreeable physical conditions. Stripping does much in the early life of a reservoir to reduce these tastes and odors, but its effect is not permanent. In order to obtain a thoroughly "clean" supply, filtration or aeration, or both, must be used in connection with an impounding basin. There are, of course, exceptions to this rule.

Both mechanical and slow sand filters have been successfully used for impounded supplies. The cost of plants ranges from $15,000 to $30,000 per million gallons daily capacity, and the cost of operation and capital charges at 5 per cent. for reservoir waters for a plant of moderate size are about $7 per million gallons. Filters remove from 97 to 99.5 per cent. of the bacteria in the applied water.

In deciding whether to obtain control of the watershed or build a filter plant it must be remembered that a pure water is better than a purified one and that any grade of filtered water can be secured by proper methods. For large watersheds it is hardly feasible to purchase the entire area for anything like as small a sum as would permit efficient filtration for all time. If the costs were equal, Mr. Fuller would prefer filtration as giving a suitable supply at all times. A campaign of education is required before the control of watersheds will produce satisfactory results, and the results will be largely in proportion to the vigor with which sanitary laws are enforced. The history of sanitary control of watersheds shows that it does not offer, in Mr. Fuller's opinion, as good protection to the water consumer as does modern filtration. More stringent sanitary laws, better inspection and better understanding of the residents on the watershed will help improve the results. A marked improvement has been made in the last ten years in filtration, and the results to-day are good. A single plant is easier to manage than a population on a large watershed. In England the majority of engineers have provided both for filtration and for the purchase of the watershed.

Mr. Fuller's conclusions are: The purchase and control of the watershed is less efficient and, for projects of much magnitude, more expensive than filtration; sanitary control of a watershed is of much assistance but is difficult under present conditions; the impounding of water makes filtration easier, cheaper, and more effective; there is a growing tendency to provide good sanitary conditions on the watershed, notwithstanding the efficiency of filtration at reasonable cost; it is not advisable to purchase the entire watershed, as the money can be better spent in other ways.

Mr. Herbert Snow, chief engineer of the Pennsylvania Department of Health, sent a written discussion of this topic in which he gave a statement of the series of epidemics of typhoid and enteric diseases that led to the enactment of the present stringent laws regarding water and sewerage works in that State. These epidemics have convinced him that no unfiltered surface water in any way likely to be polluted by sewage is absolutely safe for drinking purposes. Moreover, he does not believe filtration is an absolute safeguard, particularly when the source of supply is subject to sewage pollution. He contended that the interests of public health demand that sewage pollution of public water supplies should cease. Standards of excellence in the design, construction and operation of water filter plants are first essentials to guard the public health, but this safeguard should not be a premium on the use of a water course as a sewer by some upstream municipality. A certain quantity of sewage is bound to find its way into the waters of most inhabitated areas, but the legalizing of a certain amount of pollution of such waters, relying upon filtration to correct its effects, he regarded as a dangerous expedient to practice generally.

Mr. D. D. Clarke sent a written discussion of the topic, in which he held that it is better to secure a supply of unquestioned purity rather than attempt the purification of waters known to be contaminated in the least degree, when financial conditions permit this. He instanced the water works of Portland as an instance of this. The supply comes from a watershed on the western slope of the Cascade Mountains. This was mostly government land at the time of the construction of the works, and the city authorities succeeded in having the tract of 222 square miles withdrawn from settlement as a national reservation. All improved claims within the tract were purchased and other private titles are being extinguished as fast as practicable. The watershed is absolutely uninhabited, and is patroled by government rangers and employes of the city .

A written discussion by Mr. George A. Soper and oral discussions by Messrs. J. Waldo Smith, G. S. Williams, S. Bent Russell, Marroquin y Revira, Chas. B. Ball and J. T. N. Anderson agreed quite generally with the conclusions of Mr. Fuller on the principle involved.

Topic 2, Foundations.—The second topic for discussion was a triple one: (*a*) What is the best system of foundations for heavy structures on ground like that of the City of Mexico, which is an alluvial deposit about 300 ft. deepe (*b*) When used in foundations, will steel, independently or in combination with other materials, last indefinitely when in contact with water? (*c*) Will the strength and durability of concrete in foundations be affected if, before setting, there is an excess of water, a lack of compression, or too rapid drying.

The discussion was opened by a written communication from Mr. John F. O'Rourke, in which he pointed out that the resistance of soft ground to pressure depends largely on the degree to which it is confined. Foundations in such material may be constructed by giving the bearing surface such an area that the load is reduced to one that the material will sustain safely, or by carrying the footings to such a depth that the weight of the adjoining material prevents displacement of the material under the footings. He stated that ground over a considerable surface and an initial settlement was permissible. He had built heavy bridge piers on material into which a man would sink somewhat while standing on it, by distributing the weight over a considerable area in such a way that it had to act as a unit. The same thing is true of piling. A pile that may hardly sustain its own weight after being driven in a marsh will often become so set after staying unloaded for a few days that several heavy blows of a pile-driver may be necessary to start it again. The piles for the false work employed in erecting the first span of the Poughkeepsie bridge, for example, were driven 100 feet below the water level into about 60 feet of silt. They carried from 10 to 20 tons each and when it was necessary to pull them up for use at the second span, it was necessary to strike them a dozen heavy blows with a 6,000-lb. hammer. This started them so that they could be readily driven enough to enable them to be pulled.

Either of these methods might be used in Mexico, provided the ground contained nothing likely to cause the decay of the material used in it. If the ground is clay, it will probably preserve wood as well as water; Mr. O'Rourke stated that he had seen wood which had been perfectly preserved by clay for more than a century. He believed that water would not seriously corrode steel provided the water remained unchanged, and he mentioned a number of examples of steel remaining unaffected by water for many years. He had seen the same thing shown by nails and rods in wooden foundations where they were surrounded by material impervious to air. Casing the steel in concrete he considered an absolute preventative of rusting.

Too rapid drying of the concrete, preventing the setting of the cement, will make the material practically worthless. This is sometimes seen in connection with pneumatic caisson work, where the air that escapes through the concrete in passing out of the air chamber of a caisson is most likely to cause veins through the concrete from which the water evaporates before the concrete has had a chance to set.

The discussion was participated in by Sr. Marroquin y Revira, Maj. L. H. Beach, Messrs. F. G. Jonah, S. Bent Russell, E. M. T. Ryder, Miguel Roboliedo and others. The subject naturally called forth many interesting facts and theories which will appear in the "Proceedings" in due titme.

July 10.—*Afternoon.*—In the afternoon meeting the professional discussions were at once resumed, beginning with topic third.

July 10.—Afternoon.—In the afternoon meeting the was: Will the paving materials of the present be used in the construction of the pavements of the future? A written communication from Mr. George W. Tillson was presented in opening this discussion. It was his opinion that engineers had not made the most of the paving materials at their command and had not studied sufficiently the requirements of each individual street. Although it is acknowledged that the foundations of pavements are very important, they are constantly neglected, and the effect of this neglect is particularly noticeable in the case of block pavements.

Stone block pavements are capable of great improvement by using smaller blocks with their surfaces dressed more closely than is now the practice in this country. If the blocks are smaller and better dressed, the joints can be filled with a bituminous paving composition alone,

without gravel, which will reduce the noise. Mr. Tillson believes that well-dressed granite blocks 3 to 3½-in. thick, laid close together with a bituminous joint, will be very satisfactory on many streets. The noise from brick pavements is an objection to their use which might be materially reduced by using a yielding substance in the joints and bedding the bricks in it as well.

Asphalt pavements are capable of improvement, in his opinion, and he commended the suggestions made for this purpose in Mr. Clifford Richardson's paper, recently printed in this journal. Those suggestions will give, he believes, a pavement that will be successful on many streets where the traffic is now generally considered too heavy for sheet asphalt. Failures with pavements of this material have generally been due to improper designs, and improvements are to be expected by avoiding the defects. Mr. Tillson considers that good asphalt blocks will make satisfactory pavements on steep grades, and referred to elaborate experiments now being made to ascertain a proper method of testing the blocks.

The modern wood pavement, when dry and first laid, is practically ideal, according to Mr. Tillson, and, when its slipperiness in wet weather is overcome, he thinks it is bound to have an important future, particularly if the preservative processes are as satisfactory as those employing them claim. Its cost is likely to increase, however, owing to the constant rise in the price of suitable lumber, and the problem of discovering how many species of wood may be used satisfactorily is now receiving much attention.

In summing up, Mr. Tillson stated that the improvements in pavements in the future are to be brought about by a different use of the materials now in vogue, rather than by the adoption of entirely new materials. By studying the needs of the different streets to be paved, by using the materials now available intelligently, both as to manner and combination, the municipal engineer can bring about results greatly in advance of present practice.

Mr. J. H. Haylow submitted a written communication calling attention to the importance of the part of the pavement adjoining street rails, which always fails first. This is sometimes caused by the faulty construction of the railway roadbed or by the lack of rigidity of the track or by an unsuitable rail section. In his opinion a T-rail should never be used in a street paved with brick, granite or asphalt. With such a rail, he said, the pavement has no protection whatever from the grind of the wheel flanges and steel tires, the groove in the rail rarely being wide enough to be entirely free with the wider flanges and inequalities in the gauge of car tracks, and the pavement is subject to the constant wear of steel tires. Asphalt should never be laid next to the rail, he stated.

Mr Clifford Richardson submitted a written discussion in which he agreed with Mr. Tillson that the failure of most pavements is as much due to lack of foundation as to any other defect, anad this has been particularly the case in Manhattan. Granite block pavements are capable of great improvement, he stated, and he suggested that the form of construction practiced in Liverpool might very well be imitated here. American blocks are not well dressed and are too large to bed properly. He considered that a granite block when well dressed should not be more than 3 in. square. Brick pavements are suitable for streets of moderate traffic, when well made; the careless way in which the bricks are embedded in the sand cushion is often the cause of their defects.

Mr Richardson did not agree, however, with Mr. Tillson's views of wood pavements. He believes that it is almost impossible to replace an opening in such a pavement so that it will remain even under traffic. The Municipal Council of Paris is so dissatisfied with such pavements that it is endeavoring in every way to limit the amount of wood paving that is done. London streets which are to carry heavy traffic must be replaced every seven or eight years, even where a 6-in. block is used. The British and French engineers do not use so much impregnating material as is employed here with the wood blocks, and consider that only enough to prevent rotting is necessary.

Asphalt blocks have proved extremely satisfactory on residence streets for many years, there being one street in Washington so paved in 1883 that is still in very satisfactory condition. These blocks do not seem to resist heavy traffic well, however, as is shown by the pavement on Fourth Avenue, Manhattan, between 32d and 34th Sts., where the blocks began to go to pieces within eighteen months. Mr Richardson believes that a considerable improvement can be made in the quality of the blocks, which will render them less susceptible to temperature changes.

Bituminous concrete pavements are well suited to streets of light traffic, according to Mr Richardson, who referred to such a pavement put down in Muskegon in 1902 and still in good condition after five years of use. In order for them to be successful he believed that they should contain no stone larger than 1 in., and the amount of fine material should be larger than was thought desirable formerly. He does not believe that such pavements are suitable for streets of heavy traffic because the horses' hoofs tear out the coarse stones.

In considering street pavements it is necessary to pay attention to the effect of the many openings made in them for one reason or another. The repairs which are necessary owing to these openings must be considered in determining the total cost of any pavement, for if they are difficult to make properly the low first cost of a pavement which is often torn open does not amount to much.

What is needed in the United States, according to Mr. Richardson, is not new material for the construction of street surfaces, but an improved form of construction of those whoch have been in use for the last twenty years, together with a study of the actual cost per annum per ton of traffic carried per lineal foot of the street. That there is a large field for improvement in the character of our pavements is quite evident, and this improvement must lie with the municipal engineer. The best contractors are always in favor of doing the best work compatible with the price they get.

Messrs. Lawton, P. W. Henry, Horace Andrews, E. M. T. Ryder and G. S. Williams, and Major L. H. Beach also took part in the discussion. It was quite generally agreed that the future improvement in pavements would come through a more scientific use of present materials and perfection of construction rather than in a possible discovery of new and, at present, unknown materials.

Topic 4; Electric Railways.—Two questions were proposed for discussion: (*a*) What are the factors that determine the maximum economical grade for electric railways? (*b*) In establishing direct lines with heavy grades, under what conditions will it be found practicable to use electric locomotives and gas-engine generating stations, rather than traction by steam locomotives? The discussion was opened by a written communication from Mr. George Gibbs, who stated that the first question could only be considered in generalities, either obvious or of little use in a special case. A line is conceivable having grades so located that, with a given train interval, all trains may be ascending simultaneously, so that the power plant and transmission lines must be designed to supply all trains with power at the same time, even if this maximum requirement lasts but a short time. A line with the same maximum grades, but with the grades differently located, might readily have a much lower maximum demand on the power station. Again, the length of a grade is of special significance in electric traction, or short maximum grades, the limit of motor capacity is in the commutation of the current; with long grades, the limit is in the heating of the motors. The grades are generally a factor of less importance in electric traction than in steam, particularly when the trains consist of several motor cars. The facility with which electric trains surmount short heavy grades is particularly important in separating steam and electric lines at crossings. The important points to be considered in laying out an electric line as compared with a steam line are summed up by Mr. Gibbs as follows: 1. The effect of density of traffic in averaging the load requirements at the power house; 2, the effect of location of grades, especially with infrequent service, in averaging load requirements at the power house; 3, the wider latitude in fixing the maximum grades because of the greater adhesion ratio; 4, limiting commutating effects on short grades; 5, the motor-heating effects on long grades; 6, the less effect of grades on speeds because of the greater accelerating ratio.

Even if electric traction should prove desirable, it by no means follows that power may be best furnished from a plant driven by gas engines. From the point of view of economy of power, the gas-engine plant promises well, but from the point of view of availability Mr. Gibbs sees in it two limitations. The first is the small overload capacity of the gas engine, which is disadvantageous for fluctuating railway loads, and the second is the relative small size of producer plant units that have been built up to the present time.

The paper was discussed by Messrs. Onward Bates, R. F. Hayward, W. W. Follett, J. T. N. Anderson and T. A. Corry.

July 10.—Evening. In the evening the last meeting of the convention was held and the remaining professional subject for consideration was taken up.

Topic 5, Gas Engines.—Two questions were presented for discussion: (*a*) What is the best apparatus and most economical system for cleaning producer or furnace gas to be used in gas engines? (*b*) To what extent is ordinary producer gas made from bituminous coal used in gas engines, and what practical results have been obtained by any methods for removing tar and soot? The discussion was opened with a written communication from Mr. James Christie who pointed out that it was necessary to cool as well as clean the gas, but when these ends are attained by a washing apparatus it also becomes desirable to remove the moisture as much as possible. Centrifugal apparatus of large capacity has proved highly efficient and economical of space and water. An American plant is reported to have removed 97 per cent. of the solid impurities in the gas. As a general thing, with large plants, Mr. Christie believed that the water consumption will vary from 10 to 25 gal. per 100 cu. ft. of gas washed and the power required will be from 0.1 to 0.2 h.-p.

When bituminous coal is gasified in a producer at a rate below 10 lb. per square foot of fire bed, the quantity of tar suspended in the gas is comparatively large, the quantity of soot is small, and the temperature of the issuing gas is low. With a rate of 20 to 30 lb., as in some mechanically operated producers, the quantity of tar is small, the discharge of soot is greater and the temperature of the gas much higher. The quality of the gas appears to be about the same in each case. It is necessary to cool this gas, remove the tar and soot, and dry the gas. The utilization of the sensible heat of the gas has been accomplished successfully by applying the heat to generate steam for the producer, or for preheating the air supply, or for both. The tar problem has been handled by separating it by centrifugal action, as is done in St. Louis, and by decomposition by passing the gas through a supplementary bed of incandescent coke or anthracite. Altogether, Mr. Christie did not care to assert that the generation of producer gas from bituminous coal is in a satisfactory state of development as yet.

A written discussion of the two questions was also received from Prof. R. H. Fernald, giving results of some of the tests made by the United States Geological Survey with producer plants. Although many of the coals tested had been high in sulphur, and no attempt was made to remove it, the engine receiving this gas showed absolutely no signs of injury. Curves were given showing a remarkably better utilization of the heat in about eighty soft coals and lignites in the producer and gas engine plant than in the steam plant. Several low-grade coals and lignites were used successfully in the producer which were practically worthless under a boiler. These results gain importance from the fact that the producer used in the tests was made for anthracite coal.

The topic was discussed by Mr. Buchanan, and two written discussions were read by title.

A motion was carried authorizing the appointment of a committee of three to draft and have published in the local press appropriate resolutions conveying the thanks of the Society to the Federal Government and its officials, to the local engineering societies, to the municipal authorities, to the Mexican Electric Tramways, Ltd., to the Light & Power Company, the railways and others for the many courtesies extended. Vice-President Onward Bates then declared the convention adjourned.

Entertainments.—On July 4 most of the members in attendance with the ladies who accompanied them gathered at St. Louis, whence they journeyed in a well equipped special train over the Iron Mountain, Texas & Pacific, International & Great Northern and the National of Mexico lines to Mexico City, arriving at the latter place about 75 strong on July 7, after a delightful trip. Other members arriving by different routes swelled the total number in attendance to about 175.

July 8 was devoted to excursions about the city in seven "specials," as the guests of the street railway company, accompanied by members of the Mexican engineering societies, national engineering school and others, making a party of 300. Zocalo, Guadalupe, Talapain, the Country Club, where a delightful lunch was served; Churuhusco, San Angel, Chapultepec and the power house of the street railway company were visited, and filled the day with continued and a succession of varied and enjoyable experiences.

July 9 was devoted to an interesting inspection of the water works now under construction for the city, and elsewhere described, the members being the guests of the Water Works Commission. The reservoir, the conduit and the various unusual springs, whence come the water, were all seen. The trip occupied the entire day and was made in special trains over the street railway lines and the railway line along the conduit built to facilitate the construction of the latter. On the way out it was announced that at Nativitas one group of the springs at the end of the railway on the south shore of Lake Xochimilco, refreshments would be served. In that out-of-the-way place hand sandwiches were expected as a matter of course, so it is easy to imagine the surprise of the excursionists to find a rustic pavilion artistically decorated and festooned in natural flowers, with the American flag and the emblem of the American Society worked in flowers, hanging long rows of tables with an excellent service. The luncheon that was served took about two hours and was much enjoyed. It was followed by speeches and toasts. Presidents Diaz and Roosevelt, the Water Works Commission, its chief engineer, Sr. Manuel Marroquin y Rivera, the American Society of Engineers, the entertainment committee and others were all toasted and the first lady of the land, Mrs. Diaz, and the ladies present were not forgotten. This delightful occasion was enlivened by excellent music by the military band from the 10th regiment of the Mexican army. The return trip was then made.

July 11 and 12 were occupied by an excursion to

Necaxa, 175 miles northeast of Mexico City, as the guests of the Mexican Light & Power Co., to view the latter's great water power plant, generating and transmitting electrical power to Mexico City and vicinity over distances varying from 170 to 200 miles, whereby the city is lighted; its entire street car service moved, and many industrial plants run. Part of these works were illustrated in The Engineering Record of June 9, 1906. What the visitors saw were Necaxa, once a small and ancient Mexican village, converted into a bustling model construction camp, beautifully situated on a head land, from which, in two magnificent leaps, one from a height of 460 ft. and the other from a dizzy eminence of 740 ft., the waters of Necaxa River plunge in sheer drops to the depths below; the great power house, turbines and generators below, and the storage reservoir, in course of construction, above the falls, and the towers of the transmission lines scaling the heights toward Mexico. All these things are set in tropical mountain scenery of amazing grandeur, the indescribable beauties of which now reveal and then hide themselves as one drops down from the top of the mountains to Necaxa by means of the remarkable railway built for construction purposes, which winds and loops and drops on 8 per cent. grades and curves as sharp as a turn around a street corner. This is a narrow gage road and possible of operation by geared and articulated engines of the Shay type only. It is 20 miles long.

During the inspection of the falls and works, the visitors were lowered and raised over the falls in aerial cages, the first having a drop of 460 and the second 760 ft. This was a novel and interesting experience. These cages accommodate 30 people per trip. They are operated by cable hoists and are guided by and run on steel cables supported by a head frame at the top and by an anchorage at the bottom of the fall, and have an inclination of about 30 degrees from the vertical.

The party stopped over night at Necaxa and, after a sumptuous dinner, spent an enjoyable evening in songs and dancing. Mr. R. F. Hayward, general manager of the company, and his assistants had made every preparation, and the entire excursion was one of comfort and unalloyed pleasure and profit.

On July 13, the Society was received at 10 a. m. at the National Palace by President Diaz; in the afternoon from 1 to 5 o'clock it was entertained at an elaborate banquet at the National Military College at Chapultepec by the Association of Engineers and Architects of Mexico; and, in the evening by the Military College at a reception held in the Minera. All of these functions were thoroughly enjoyable and were marked by appropriate and happy interchanges. The palace and grounds of Chapultepec were open to the visitors, and this beautiful and historic shrine of the Aztecs, now the home of the President, was found to be full of interest. It might be stated here that during the entire stay of the Society in Mexico, the hospitality and attention lavished on its members were most cordial and unbounded.

On July 14 the visitors attended the French celebration of the fall of the Bastile, which was witnessed by a large crowd in Luna Park (the Coney Island of Mexico); and in the afternoon, the national ball game of Mexico, Belota, was an interesting entertainment.

On July 15 the Society were the guests of the Mexican Government in a visit to and inspection of the notable drainage works of the City of Mexico. A special train was run to the head of the Grand Canal on the northern shore of Lake Texcoco, lying east of the city and thence along the canal northward to the entrance to the tunnel which pierces the rims of the drainage basin on the north and gives an outlet to the waters of the valley of Mexico.

The total length of the Grand Canal is 16.8 miles from Lake Texcoco to the point where it enters the tunnel. The tunnel is 6.8 miles long and has a capacity of 618 cu. ft. of water discharged per second. The canal has an equal capacity and varies in depth from 15 to 50 ft., the depth increasing uniformly from Lake Texcoco to the tunnel. At the head of the canal at the lake, the water is controlled by head gates to regulate the level of the water in the lake, and, at the entrance to the tunnel, the flow in the canal is controlled by massive, monumental masonry and gates suitably inscribed. The tunnel is lined with masonry throughout.

The various other historical lakes in the valley drain into Lake Texcoco and all of the sewage and drainage of the city flows into the secondary canals which flow either into Texcoco or the Grand canal, so that the drainage of the valley and the city is now complete, the water having been turned through the Grand canal and tunnel in March, 1906. The drainage of the city was a problem that confronted the Aztecs when the city was founded, and, from that remote time until the completion of the now admirable work, the Spaniards and the Mexicans struggled with it.

As usual during its stay, the Society was entertained with an elaborate banquet enlivened by music from a military band on arrival at the end of the drainage works.

July 16 and 17 were the closing days of the entertainments and were occupied by a trip on July 16 over the Mexican Ry to Orizaba, and on Wednesday to Cuernevaca over the Mexican Central Ry. as the guests of these roads and the Mexican members of the Society.

On the trip to Orizaba, the railway drops from the table land 3,000 ft. in 16 miles to the valley of the Rio Blanco, affording grand views of tropical mountains and vales; the view from the heights above Maltrata down on that beautiful village and its surrounding fields lying only a mile away horizontally but 2,500 ft. below, with the tops of the enclosing mountains piercing the clouds, being especially grand, and exquisitely beautiful in detail. It is idle to attempt a worthy word picture of this view.

The trip the following day to Cuernevaca, the ancient home and capital of Cortez, with its palace, cathedral, and gardens, and also the transitory home of Maximilian, was not less interesting and beautiful in natural scenery. From Mexico City, the railway climbs to an altitude of 10,000 ft. and then drops 5,000 ft. to Cuernavaca. On the return, the train was stopped on top of the mountain and the members gathered around the local committee of entertainment and by hearty speeches and cheers fitly expressed thanks to the committee for the delightful time which its efforts and care had provided, and thus closed one of the most notable and agreeable conventions of the Society.

TRADE PUBLICATIONS.

The Christensen portable air compressor outfit is described in bulletin 1,513 of the Allis-Chalmers Co., Milwaukee. It consists of a motor-driven compressor with automatic governor and fuses, mounted with piping and air reservoir ,on a hand truck, so as to be easily transported to any part of a factory or yard where compressed air is required. The outfit is built in four capacities, for 11, 16, 20 and 50 cu. ft. of free air per minute, the maximum pressure being 100 lb.

A priced schedule of heating radiators has recently been issued by the McCrum-Howell Co., New York, which lists an extensive line of equipment manufactured for both steam and hot water heating. Standard designs of radiators are made in the one, two, three, four and six-column types and in a number of both plain and ornamental patterns. A specialty is made of the pin type of radiator for indirect heating.

A pamphlet devoted to generator valves has recently been issued by the Lunkenheimer Co., Cincinnati, Ohio, which describes interesting attachments for use in gasoline engines. There are also listed gasoline strainers, throttling valves, stop-cocks for gasoline, priming cups, relief cocks, drain cocks and gasoline cocks with spring keys to insure tightness without frequent and troublesome grinding.

An automatic sand and gravel elevator, described in a pamphlet from Shoemaker & Cascaris, Newcomerstown, Ohio, has for its purpose the loading of sand or gravel directly from the bank into cars, either with or without screening. It requires no spotting of the cars under the delivery spout, as it is designed to travel along a track parallel to the cars to be loaded to permit trimming the loads automatically. It is specially adapted for use in connection with concrete construction, although it is claimed that where large quantities of unscreened gravel are being used for railroad ballast, there is no apparatus manufactured that will load it as cheaply as this machine.

The advantages of drying brick and tile by waste heat from the burning kilns are set forth in a pamphlet recently issued by the Green Fuel Economizer Co., Matteawan, N. Y. Special exhauster fans manufactured by this company are adapted for handling the hot gases from the kilns during the periods of cooling off, and where a number of kilns are operated it is stated that a practically continuous supply of hot air may be obtained from them for drying the wet brick or tile fresh from the presses. Suggested arrangements of blowers, connecting ducts and drying houses are illustrated and views of large representative installations of this character are given.

Buffalo disk wheels, both motor and belt driven, are briefly described in a folder from the Buffalo Forge Co., Buffalo, N. Y. The electric disk wheels are kept in stock for immediate shipment, fitted with both General Electric and Peerless motors and wound for 110, 220 and 500 volts, direct current. The disk wheels are similarly kept in stock in all standard sizes fitted with pulleys for belt driving, and the capacities and power required for all sizes of wheels are stated in the folder.

The electrical equipment at the Hornell shops of the Erie R. R., is interestingly described in a pamphlet recently issued by the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa. The power equipment is the result of a careful study of local conditions by Westinghouse, Church, Kerr & Co., with the result that an electrically-driven shop throughout was designed, the advantages of which are clearly set forth in the pamphlet.

The Buffalo Steam Pump Co., Buffalo, N. Y., has issued a leaflet stating the leadng features of shaft and mine pumps of the compound duplex and electrically-driven centrifugal types.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Brundidge, Ala.—The City Clk. writes that the city is now in the market for water works material. Address A. J. Stewart, of Brundidge, Engr. in charge.

Newark, Del.—Bids are wanted until Aug. 3 for installing about 6,000 ft. 4-in. water mains. Address W. R. Kennedy, Newark.

Washington, D. C.—See "Miscellaneous."

Commerce, Ga.—The citizens are reported to have voted to issue bonds to the amount of $45,000 for water works and sewers.

Rome, Ga.—J. R. Cantwell, City Clk., writes that about $50,000 will be expended on water works and $25,000 for sewers. J. N. Hazlehurst, of Rome, is engineer in charge of work.

Elgin, Ill.—See "Power Plants, Gas and Electricity."

Chesterton, Ind.—Bids will be received by the Chesterton Water Co. (C. Jeffrey, Pres.), until Aug. 3 (extension of date), for the construction of water works, as advertised in The Engineering Record.

Louisville, Ky.—Bids will be received by S. Zorn, Pres. Louisville Water Co., 549 Third St., Louisville, until Sept. 8 for pumping engines, boilers, etc., as advertised in The Engineering Record.

Springfield, Mass.—Bids will be received by the Bd. of Water Comrs. until Aug. 21 for the construction of work included under Contract 1, intake dam and tunnel, Little River water supply, as advertised in The Engineering Record. E. E. Lochridge, Ch. Engr., Springfield; Hazen & Whipple, Consulting Engrs., 220 Bway., N. Y. City.

Fitchburg, Mass.—The City Council is reported to have passed an order on July 16 for an $80,000 water loan.

Pittsfield, Mass.—The Bd. of Aldermen is stated to have on July 15 passed an order appropriating $150,000 for the enlargement of the intake reservoirs of Sackett, Hatheway and Mill Brooks, also build new dam to increase city water supply.

Belle Plaine, Minn.—The Village Clk. will receive bids on a complete water works until Aug. 12. The work will comprise a steel tower and steel tank, distribution pipe line system, geared deep well gasoline engine and pump and brick building. Engineer Oscar Claussen, of St. Paul.

Winside, Neb.—Walter Gaebler, Village Clk., writes that the Eisentraut, Colby, Pottinger Co., of Sioux City, Ia., is preparing plans for water works, to cost about $10,000.

Fremont, Neb.—See "Power Plants, Gas and Electricity."

Ft. Hancock, N. J.—Bids will be received until Aug. 21 by Capt. M. N. Falls, Q. M., Ft. Hancock, for furnishing and placing a "Cook" strainer in deep well at this post.

Gloucester City, N. J.—Bids will be received until Aug. 1 by the City Council for furnishing and installing complete one low service 3,000,000 gal. horizontal direct-acting, duplex, compound, brass fitted, condensing steam pumping engine with appurtenances. Geo. C. Wynkoop, City Clk.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 8 by Comrs. of Parks, N. Y. City (Moses Herrman, Pres.), for furnishing material and constructing a pumping plant in Forest Park, Boro. of Queens, together with all the work incidental thereto.

Carthage, N. Y.—It is stated that bids will be received until Aug. 6 by the Village Bd. for $3,000 water for $195,000 water bonds.

**East Hamburg, N. Y.*—The American Pipe Mfg. Co., Fidelity Bldg., Philadelphia, Pa., has awarded contract for the construction of a 10,000,000 gal. distributing reservoir at Windom near Buffalo (bids opened July 8) to Field, Barker & Underwood, Inc., 514 Arcade Bldg., Philadelphia, Pa. Engineer, J. W. Ledoux, 112 N. Broad St., Philadelphia, Pa.

Martinsburg, N. Y.—The Comrs. of the Martinsburg Water Dist. are reported to have petitioned the State Water Supply Comr. for permission to establish water works.

Dunkirk, N. Y.—See "Power Plants, Gas and Electricity."

Attica, N. Y.—Chas. B. Benedict, Pres. of the Bank of Attica, is reported interested in the construction of water works.

**Albany, N. Y.*—The lowest and successful bid opened on July 12 for straightening and improving Canaseraga Creek in Livingston County, was submitted by Graves & Stephens, Cleveland, O., at the following bid: 6 200 squares, cleaning and disposing of brush, per square, 10 cts.; cutting and disposing of trees, $4 to $10 ea.; 677,100 cu. yds. excav., 12 cts.; 10,200 cu. yds. earth fill, and embkmt., 25 cts.; 860 cu. yds. rock fill, and rip-rap in cribs and on slopes, $5; 15,000 lin. ft. round timber in cribs, including iron fastenings, 45 cts.; 80 m. ft. hemlock lumber for sheeting and grillage, $65; 40,200 ft. yellow pine lumber for bridges, $65; 400 foundation piles 15 ft. long, ea. $10; 1,690 cu. yds. Portland cement concrete, including forms, $10; 358,000 lbs. structural steel for bridges, including painting, 6 cts.; 3,800 lin. ft. wrought iron pipe, 1½ in. for railings on bridges, 20 cts.; total, $146,501. Totals of other bids: Pennell & O'Hern, Yonkers, $171,885, and Gilmore, Horton & Allen Co., Sandy Hill, $172,259. Walter McCulloh, of Niagara Falls, is Resident Engr., State Water Supply Comn.

Bemus Point, N. Y.—A water commission consisting of Fred Braker, John O. Johnson and O. W. Brownell, is reported to have been selected, to have charge of constructing water works; probable cost, $15,000.

** Items marked thus give the names of parties awarded contracts.*

Maxton, N. C.—J. M. Bandy, Consulting and Designing Engr., Laurinburg, has completed surveys for the proposed water works and sewerage system, to cost about $50,000.

Marion, O.—The Marion Water Co. of Marion is reported incorporated with a capital of $400,000, by Jas. T. Prendergrast, Wm. E. Scofield, Jas. G. Fairbanks and others.

Sayre, Okla.—The general contract for constructing water works at Sayre was on July 16th let to G. Jaeger, of Rich Hill, Mo., for $21,025. Other bidders: N. S. Sherman Machy. Co., Oklahoma City, Okla., $21,160, and Mellroy & Jones, Fayetteville, Ark., $21,400. The 50,000-gal. tank on 100-ft. tower was let to the Southwestern Bridge Co., of Joplin, Mo., for $2,898. Engineers, Burns & McDonnell, Dwight Bldg., Kansas City, Mo.

Johnstown, Pa.—The City Council is reported to have granted the Manufacturers Water Co. the right to lay mains through the city, as a link in the system to connect the Cambria steel works with the reservoir building at Quemahoning.

Philadelphia, Pa.—Bids will be received by Geo. R. Stearns, Dir. Dept. of Pub. Wks., until Aug. 22 for the improvement, extension and filtration of the water supply. Contract 102, preliminary filters at Torresdale, and Contract 108, Roxborough pipe extension system, as advertised in The Engineering Record.

**Etna, Pa.*—A. R. Dunbar, Boro. Clk., writes that the contract for constructing water mains on Locust, Pine and Butler Sts. (bids opened July 8), has been awarded to Francies & Davis, 290 Bellfield Ave., Pittsburg, for $1,212.

Manila, P. I.—Plans and specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for certain valves and sluice gates for use in the gravity water supply of the city, bids for which will be received at the Municipal Board until Sept. 14, as advertised in The Engineering Record. J. F. Case, Ch. Engr.

Highmore, S. D.—See "Schools."

Temple, Tex.—See "Power Plants, Gas and Electricity."

Beaumont, Tex.—The Beaumont Water Works Co. of Beaumont is reported incorporated with a capital of $500,000. Incorporators, W. S. Davidson, A. L. Williams, M. K. Fletcher and others.

Salt Lake City, Utah.—City Engr. L. C. Kelsey is reported to have furnished the Water Works Com. of City Council an estimate of the cost of replacing the present 3-in. water mains on 2d Ave and a portion of 1st Ave. with 6-in. mains; probable cost $10,381.

Seattle, Wash.—Asst. City Engr. Scott is stated to have submitted report to Fire and Water Comr. of Council for a water main to supply South Park, which he estimates will cost bet. $20,000 and $25,000.

Sunnyside, Wash.—See "Power Plants, Gas and Electricity."

West Salem, Wis.—It is stated that bids will be received until Aug. 6 by the Village Bd. for $3,000 water works extension bonds.

Withee, Wis.—Bids will be received by Marius Andersen, Village Clk., until Aug. 2, for furnishing 2,600 ft. of 6 to 8-in. c. i. pipe, 7 hydrants, 3 6-in. valves, the work of laying the above amount of pipe and the erection of a 30,000-gal. steel tank and tower. For additional information apply to C. H. Phillips, Engr., of Marshfield, Wis.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—The City Council is reported to have ratified ordinances providing for the paving of streets around the public square with brick, and extending the sewer system to East Huntsville.

Arkadelphia, Ark.—Bids will be received by the Comrs. of Sewer Dist. No. 1 until Aug. 15 for the construction of 45,280 ft. of clay pipe sewers, as advertised in The Engineering Record. Engineer, Theo. Hartman, 1122 Center St., Little Rock. J. E. Callaway, Sewer Comr.

Sacramento, Cal.—A resolution was introduced at a meeting of City Trus. on July 1, providing for a bond issue of $200,000 to complete the sewer system for the section south of S and N Sts. and east of 25th St., and for $75,000 bonds for levee raising and broadening from Front St. to Elvas Sta. An election will probably soon be held on question.

Lincoln, Cal.—The Town Trus. are reported to have adopted specifications for a sewerage system.

Truckee, Cal.—We are informed that bids will probably be received about Aug. 1 for the construction of a sewerage system. Engineer, E. C. Wren, of Nevada City, Cal.

**Bridgeport, Conn.*—The Pierce Mfg. Co., 95 Wall St., Bridgeport, is reported to have secured the contract for constructing the Wilmot Ave. trunk sewer (bids opened July 11) at $7.14 per ft.

**Torrington, Conn.*—Walter A. Williston, Boro. Engr., writes that the Pierson Eng. Co., of Bristol, has secured the contract for constructing sanitary sewers (bids opened July 16) at the following bid: 2,800 ft. 20-in. tile pipe, $4.50, 1,066 ft. 15-in., $4.80; 3,681 ft. 12-in., $1.02, 2,157 ft. 10-in., $1, and 10,876 ft. 8-in., 90 cts., and 76 manholes ea. $77 and rock excav. $7 per cu. yd. They also bid for 12-in. c. i. pipe $5.50 and 20-in. c. i. pipe $10, total amount of contract $42,137. Totals of other bids received were: A. W. Bryne Co., $49,952; F. H. Cowan Co., $61,432; Longhi Bros. & Mascetti, $74,389; Fred W. Stowers, $62,132; Eveline Bros., $78,345; F. T. Ley Co., $83,027, and Edw. McManus, $90,836.

**Norwalk, Conn.*—Chas. H. Dilsworth, of the Sewer Com., 45 Wall St., writes that bids were opened July 1 for constructing sewers, consisting of 20 lin. ft. 30-in. brick sewer, 314 lin. ft. 30-in., 468 lin. ft. 18-in., 3,118 lin. ft. 15-in., [illegible] lin. ft. 12-in. and 3,020 lin. ft. 10-in. stoneware pipe sewer, 75 manholes, 12 catch basins, [illegible] 6-in. Y [illegible] 150 cu. yds. solid rock excav., and the following are the totals of bids received: A. M. Cusack, [illegible] St., Boston, Mass., $21,888 (awarded contract); [illegible] Contr. Co., Boston, Mass., $25,270; John [illegible], So. Norwalk, $26,600; E. Chappa, Saugatuck, [illegible]; Michael Spino, Fishkill Landing, N. Y., $28,048; O'Rouke Co., Boston, Mass., $30,804; The Boston & N. Y. Contr. Co., Boston, Mass., $33,474.

New Haven, Conn.—Bids will be received until Aug. 1 at the office of C. W. Kelly, City Engr., for constructing sewers in portions of several streets.

Wilmington, Del.—Alex. J. Taylor, Engr. in charge of sewers, writes that the proposed sewer to be constructed in the lower end of the 9th Ward will be of concrete and cost about $25,000. It will be built by days work.

Wilmington, Del.—See "Paving and Roadmaking."

Washington, D. C.—See "Miscellaneous."

Commerce, Ga.—See "Water."

Rome, Ga.—See "Water."

Litchfield, Ill.—It is reported that the Bd. of Improv. has decided to build a single ring sewer, and will soon ask for bids for its construction.

Evansville, Ind.—W. F. Wunderlich, Clk. Bd. Pub. Wks., writes that bids will be received on Aug. 30 for constructing the Kentucky Ave. sewer; cost about $178,000. J. D. Saunders, City Engr.

Tipton, Ind.—The City Council is reported to have ordered plans and specifications completed and will soon ask for bids for the construction of a sanitary sewer; estimated cost, $30,000.

Lafayette, Ind.—Bids will soon be asked by the Bd. of Pub. Wks., according to reports, for the construction of the Congress St. sewer; estimated cost, $10,000.

Gas City, Ind.—It is reported that bids will be called for in a short time by the City Clk. for the construction of a general sewer system, to cost about $33,500.

Richmond, Ind.—Fred R. Charles, City Engr., writes that bids will be received on Aug. 9 for the construction of a subway on W. 2d St., and sewer system in connection with same; probable cost $40,000. C. N. Merrill, Pres. Bd. Pub. Wks.

Louisville, Ky.—Local press reports state that bids will soon be asked for by the Bd. of Sewer Comrs. for constructing the Happy Hollow sewer to extend from 21st to 27th Sts., north of High Arch; it will be of concrete and cost about $40,000. J. B. T. Breed, Ch. Engr., Sewer Comrs. Consulting Engineer, Harrison P. Eddy, of Worcester, Mass.

Togus, Me.—Bids will be received until July 31 by Maj. A. L. Smith, Treas. Eastern Branch, N. H. D. V. S., Togus, for furnishing material and improving sewerage and drainage system.

Westfield, Mass.—Bids will be received by the Bd. of Selectmen at the office of the Town Clerk until Aug. 3 for building sewers, to include about 3,250 ft. pipe sewer 8 to 18 in. diam. with manholes and catch-basins, as advertised in The Engineering Record. Oren E. Parks, Town Engr.

Iron River, Mich.—We are informed that only one bid was received and opened on July 17 for constructing sewers in Main Dist. No. 1, and the same was rejected. New bids will be received by Village Clk. until Aug. 7.

Austin, Minn.—Bids will be received until Aug. 2 by T. M. Foster, City Recorder, for constructing a sanitary sewer in a portion of Ash St.

**Bemidji, Minn.*—The Jerrard Plumbing Co., of Bemidji, is reported to have secured the contract for constructing 3,920 ft. of sewer and 12 manholes for $5,144.

Kansas City, Mo.—Bids will be received util Aug. 1 by the Bd. Pub. Wks. for constructing Joint Dist. Sewers in Dist. Nos. 2 and 3. E. A. Harper, City Engr.

Westfield, N. J.—Bids will be received until Aug. 5 by Town Council for constructing a trunk sewer from the sewage disposal works to a point near the Madison Hill Road, in Clark Township, a distance of about 2½ miles. Approximate amount of work to be done is as follows: 1 acre clearing and grubbing; 1,430 cu. yds. excav.; 570 cu. yds. embankment; 131 cu. yds. concrete in place; 1,070 lin. ft. 15-in., 1,860 lin. ft. 18-in., 7,890 lin. ft. 24-in. vitrified pipe in place; 1,150 lin. ft. 18-in. and 12 lin. ft. 24-in. c. i. pipe laid; 23 manholes, including covers; 31 sq. yds. dry paving on gravel. A. W. Vars, Town Surv., Broad and Elm Sts.; Lloyd Thompson, Town Clk.

Caldwell, N. J.—The Common Council is reported to be considering the question of constructing a sewerage system.

Orange, N. J.—Bids will be received until Aug. 5 by Willet B. Gano, City Clk., for constructing 1,100 ft. timber flume in the East Branch of Rahway River; also 375 ft. 15-in. storm sewer in Bell St. F. P. Crane, City Engr.

Trenton, N. J.—Bids will be received until Aug. 6 by the Common Council (H. Slater, Clk.) for constructing a sewer in portions of Stuyvesant, Parkside and Hillcrest Aves.; also a drain in a portion of Princeton Ave.

Jersey City, N. J.—The Bd. of Finance has appropriated $6,500 for protection of outlet sewer of Manhattan Ave. at the point where it passes Erie tunnel and open cut.

Madison, N. J.—An election will probably soon be held to vote on the question of constructing a sewerage system and disposal plant, to cost about $125,000.

Riverside, N. J.—I. Kollo, Township Clk., writes that Wm. H. Boardman, 427 Walnut St., Philadelphia, Pa., is engineer for the proposed sewage purification plant, which will cost about $70,000.

New York, N. Y.—Bids will be received until Aug. 6 by Henry S. Thompson, Acting Pres. Boro. Manhattan, and Comr. Pub. Wks., for furnishing material and constructing sewers in Fairview and Sherman Aves., W. 146th, W. 158th, W. 191st, W. 206th, Isham and Emerson Sts. Engineer's estimate: 3,414 lin. ft. salt-glazed vitr. stoneware pipe sewer, 15 in. interior diam.; 1,476 lin. ft. brick sewer, 2 ft. 6 in. x 2 ft. 4 in. interior diam.; 1,270 cu. yds. rock excav.; 11,250 ft. timber and planking for bracing and sheet piling; 10,237 ft. timber and planking for foundations, etc.

Summerville, N. Y.—Bids will be received until Aug. 5 by the Sewer Comn. (Chas. Salmon, Chmn.) for constructing a system of sanitary sewers.

Highland Falls, N. Y.—The Village Trus. are reported to have engaged Knight & Hopkins, of Rome, to prepare preliminary plans for a trunk sewer.

Brooklyn, N. Y.—Bids will be received until July 31 (readvertisement) by Bird S. Coler, Boro. Pres., for furnishing material and constructing relief sewer in Gold St., from Pierhead line to Johnson St., and in Johnson St., from Gold St. to Hudson Ave., section No. 1, division No. 2, Gold St. system. The Engineer's estimate of the quantities is as follows: Outlet Section A, 173 lin. ft; Outlet Section B, 40 lin. ft.; 1,910 lin. ft. 162-in., 1,431 lin. ft. 156-in. and 928 lin. ft. 150-in. circular sewer; 20 lin. ft. 3-ft. x 4-ft. 6-in. egg-shaped sewer, 24-in. 150 lin. ft. 18-in. 730 lin. ft., 15-in. 2,190 lin. ft. and 12-in. 4,645 lin. ft. all of pipe sewer, 30 lin. ft., 24-in. 130 lin. ft. 15-in., 205 lin. ft. 12-in. pipe temporary drain; 4,130 lin. ft., 12-in. pipe sub-drain, manholes, class "A," 3; class "B," 6; class "C," 2; manhole on 3 ft. x 4-ft. 6-in. egg-shaped sewer, 1; manholes on pipe sewer, 72; sewer basins reconnected, 53; sheeting and bracing, 1,100 M ft.; foundation and planking, 420 M ft. (B. M.); class B concrete, 1,000 cu. yds; bearing piles, 50,000 lin. ft.; pile capping, 15 M ft.; oak fender piles, 2,000 lin. ft.; yellow pine sheet piling anad wales, 260 M ft.; rip-rap or cobblestone fill, inside of coffer-dam, 2,280 cu. yds.; rip-rap, outside of coffer-dam, 370 cu. yds., etc. Security, $175,000. For list of bids received for this work on June 12 see issue of The Engineering Record, July 13.

Maxton, N. C.—See "Water."

**Bucyrus, O.*—The contract for sewage disposal plant at the Crawford County Infirmary, Bucyrus (bids opened July 19th) has been awarded to Martin Tiner and John Portman, Bucyrus, for $1,960. E. G. Bradbury and Geo. P. Shute, Engrs., 85 N. High St., Columbus.

Cleveland Heights, O.—Bids will be received until Aug. 20 by W. G. Phare, Village Clk., 204 Am. Trust Bldg., Cleveland, for furnishing material and constructing sewers in Fairmount Boule.

Youngstown, O.—Bids will be received until Aug. 2 by the Bd. Pub. Service (W. H. McMillin, Clk.) for constructing the Elm St. Dist. Sewer in portions of several streets.

Cleveland, O.—Bids will be received until Aug. 6 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing material and constructing a reinforced concrete culvert for Giddings Brook under East Boule.

Cincinnati, O.—Bids will be received until Aug. 16 by the Bd. Co. Comrs. (Fred Dreihs, Clk.) for repairing culverts on Whiskey Run Rd., Springfield Township.

**Cresson, Pa.*—J. B. Rowlson, Clk. of Council, writes that the contract for constructing sewers (bids opened July 15) has been awarded to R. D. Malone, of Hollidaysburg, for $5,645.

Jenkinstown, Pa.—The question of constructing a sewerage system is reported under consideration here.

**Greenville, Pa.*—J. M. Hittle, Boro. Secy., writes that F. E. McQuiston, of Butler, has secured the contract for constructing sewers (bids opened July 16), for a total of $17,986.

Reading, Pa.—An ordinance has been introduced in Council providing for an issue of $40,000 bonds for the construction of the northeast intercepting sewer from 11th and Greenwich to 12th and Walnut Sts.; Rose Valley creek storm water sewer from Neversink and Culvert Sts to the Schuylkill River and Canal St. storm water sewer between 4th and 5th Sts.

St. Marys, Pa.—Bids will probably be called for in about 30 days for a sewerage system for St Marys, to cost about $60,000. Alex. Potter, of New York, N. Y., and T. Chalkley Hatton, of Wilmington, Del., are the Consulting Engrs.

Madison, S. D.—Bids will be received until Aug. 12 by the Regents of Educ. (Irwin D. Aldrich, Secy.), at Spearfish, for constructing a sewerage system at the Madison Normal School, Madison.

Ballinger, Tex.—The Sanitary Sewerage Co., of Ballinger, is reported incorporated; capital $20,000. Incorporators, Tom Ward, J. McGregor and W. A. Newman.

**Ritzville, Wash.*—John Fife, of Spokane, is reported to have secured contract to construct a complete sewer system for about $18,000.

Colville, Wash.—Bonds to the amount of $20,000 have been sold for the construction of a sewerage system. Bids for construction may be called for in Aug. or Sept. and may not be before next spring. Harry E. Bonner, City Engr.; A. B. Sansburn, City Clk.

Sutton, W. Va.—It is stated that bids will be received until July 31 by W. L. Armstrong, Recorder, for constructing about 2,400 ft. of sanitary sewer, laying about 4,500 lin. ft. curbing and about 12,000 sq. ft. brick paving.

Manitowoc, Wis.—Bids will be received until Aug. 3 by Arthur Reichert, City Clk., for furnishing material and constructing sewers in portions of 22d, Main, Chicago and 11th Sts.

Two Harbors, Wis.—Bids will be received until Aug. 5 by the City Council for $46,000 sewerage and drainage bonds. P. J. MacAlpine, City Clk.

Green Bay, Wis.—Bids will be received until Aug. 8 for 9,000 ft. brick or concrete sewers and 10,000 ft. vitr. pipe sewer, as advertised in The Engineering Record. W. W. Reed, City Engr.

Kaukauna, Wis.—Plans are now being prepared by G. P. Hawley, of De Pere, for 3,100 ft. of 10 to 30-in. sewers.

De Pere, Wis.—G. P. Hawley, of De Pere, is preparing plans for 2,000 ft. 8 to 15in. pipe sewers.

Toronto, Ont.—Bids will be received until July 30 by E. Coatsworth (Mayor), Chmn. Bd. Control, for constructing sewers in Doel Ave. and Rosedale Rd.

BRIDGES.

Notes Arranged Alphabetically by States.

Willows, Cal.—The Superv. of Glenn and Butte Counties, it is stated, propose constructing a bridge across Sacramento River near Hamilton City.

* *Items marked thus give the names of parties awarded contracts.*

Sacramento, Cal.—It is reported that M St. has been decided upon as the street at which the bridge for the accommodation of electric cars, teams and pedestrians is to be constructed over the Sacramento River.

**Fresno, Cal.*—The Pacific Constr. Co., 4 California St., San Francisco, is reported to have secured the contract for constructing concrete bridge over San Joaquin River at Skaggs' Crossing, at $44,297.

Stockton, Cal.—The Bd. of Supervisors are reported to have opened bids July 2 for construction 2 bridges on the Copperopolis Road, (*a*) Snow Bridge, (*b*) Upper Copperopolis Bridge: Canton Bridge Co., *a* $6,100, *b* $7,100; M. B. White, *a* $5,887, *b* $6,335; C. G. Sheely, *a* 5,414, *b* $6,296; Pacific Constr. Co., *a* $5797, *b* 6,997; Clark & Henery, *a* $5,900, *b* $7,000; Minneapolis Steel & Machinery Co., *a* $6,850, *b* $7,900, and Denver Bridge Co., *a* $6,182, *b* $6,998.

Waterbury, Conn.—It is stated that bids will be received by the Bd. of Pub. Wks. until July 30, for constructing steel concrete bridge over Mad River at Liberty St. R. A. Cairns, City Engr.

Brookland, D. C.—Bids will be received until Aug. 10 by the Comrs., D. C., at Washington, D. C., for constructing a concrete-steel bridge across the track of the B. & O. R. R. Co. on the line of Monroe St., Brookland, as advertised in The Engineering Record.

**Washington, D. C.*—With the approval of Gen. Mackenzie, Ch. of Engrs., Maj. Cosby the engineer officer in charge of the improvement of the Potomac River, it is reported, has made a contract with Chas. McDermott, of Washington, for the complete reconstruction of pier No. 1 of the Aqueduct bridge across the Potomac at a cost of $59,875. Bids for this work were opened July 11.

Boise, Idaho.—It is stated that the Bd. Co. Comrs. will receive bids until Aug. 5 for $44,000 bridge bonds.

Chicago, Ill.—Bids will be received until Aug. 17 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and building in place all temporary work and furnishing material and labor required for the complete construction of the superstructure of a draw bridge over the west arm of the south fork of the south branch of the Chicago River at S. Ashland Ave.; also, same date and place, for constructing the substructure for said bridge; both proposals advertised in The Engineering Record.

Middleburg, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 6 at Brazil for constructing substructure and superstructure of a bridge across Eel River, west of Middleburg. Jas. L. Burnes, Co. Aud.

**Indianapolis, Ind.*—B. O. Hendricks, Secy. Co. Comrs., writes that the contract for constructing concrete bridges in Garfield Park, Brookside Park and Slades Park, (bids opened July 12) has been awarded to Hillis F. Hackedorn & Co., Indianapolis, for $16,000.

Tipton, Ind.—Bids will be received until Aug. 5 by the Bd. Co. Comrs. at Tipton for constructing an abutment and wing over Parker Branch Ditch, and an extension to the bridge south of the city of Tipton, known as the S. Main St. Bridge. J. F. Barlow, Co. Aud.

Covington, Ind.—Bids will be received until Aug. 6 by the Bd. Co. Comrs. at Covington for constructing 7 bridges in this county; also repairing the Perrysville grade. Wm. B. Gray, Co. Aud.

Warsaw, Ind.—Bids will be received until Aug 7 by the Bd. Co. Comrs. (Albert B. Warner, Chmn.) at Warsaw for constructing 4 steel bridges and 7 pairs of abutments. Bids to be submitted separately on each bridge or abutment.

**Clinton, Ia.*—The Milwaukee Bridge & Iron Co. Milwaukee, Wis., is reported to have been awarded a contract for a bridge over the Mississippi River at Clinton for the Chicago & North-Western R. R.

Des Moines, Ia.—The City Council is reported to have instructed the Bd. Pub. Wks. to receive bids for constructing a Melan arch bridge at Locust St.; probable cost, $100,000.

Atchison, Kan.—Bids will be received until Aug. 6 by the Bd. Co. Comrs. (J. C. Hotham, Chmn.) at Atchison for constructing a 120-ft. steel bridge (three 40-ft. spans) on concrete foundation, on the line between Atchison and Jefferson Counties; also a 20-ft. steel briige on concrete foundations in Mt. Pleasant Township. L. S. Hereford, Co. Engr.

Franklinton, La.—It is reported that bids will be received Aug. 2 by the Police Jury for constructing 3 steel bridges, at Warnerton and at Isabel, on Bogue Chitto River and at Bogalusa on Bogalusa Creek.

Shreveport, La.—P. B. Hill, of Benton, La., Clk. of Police Jury of Bosier Parish, writes that Ira G. Hedrick, of Kansas City, Mo., is preparing plans for the proposed bridge to be constructed over Red River at Shreveport; cost $125,000 to $200,000.

**Havre de Grace, Md.*—The contract for the substructure of double track B. & O. R. R. bridge across Susquehanna River at Havre de Grace is stated to have been awarded to Eyre-Shoemaker, Inc., of Philadelphia, Pa. The contract for the superstructure was awarded a few weeks ago, according to reports, to the American Bridge Co., of New York, N. Y. This bridge will be double track throughout, require about 45,000 cu. yd. of masonry in the substructure and between 14,000 and 15,000 tons of steel in the superstructure. It will be 7,000 ft. in length, require about three years to build, and cost about $2,000,000.

Williamsport, Md.—Mason D. Pratt, of Harrisburg, Pa., has been appointed Chief Engr. of the Washington & Berkeley Bridge Co., of Williamsport, Md., and is now making plans for a reinforced concrete arch bridge across Potomac River at the above point. The bridge will be about 1,500 ft. long, and will be designed to carry a double track interurban trolley line which it is expected in the near future will be built from this point to Martinsburg, W. Va. Mr. Pratt expects to have plans and specifications ready for bidding in about 2 months.

Barnstable, Mass.—Alfred Crocker, Clk. Bd. Comrs. of Barnstable County, writes that all bids opened on July 15 for building steel bridge on masonry piers and abutments to replace present bridge across Bass River, betw. Yarmouth and Dennis and for filling in and constructing a road over a portion of said bridge have been rejected. The following were the bids received: (*a*), substructure; (*b*), superstructure: W. H. Ellis, Boston, Mass, *a*, $29,050; *b*, $15,244; The United Constr. Co., Albany, *b*, $13,850; Berlin Constr. Co., Berlin, Conn., *b*, $14,957; John A. Gill Co., Hull, Mass., *a*, $27,840.

**Jameson, Minn.*—It is stated that the Bd. of Superv. of the town of Jameson has awarded the contract to construct a-1 span steel bridge on 2 wooden piers over Littlefork River, between sections 9 and 10, to the Hennipen Bridge Co., of Minneapolis, at $6,000.

Senatobia, Miss.—Bids will be received until Aug. 5 by the Bd. Co. Superv. (J. A. Wooten, Clk.) at Senatobia for constructing a steel bridge across Coldwater River, known as the Love Bridge.

Greenwood, Miss.—It is reported that bids will be received until Aug. 5 by C. W. Crockett, Co. Clk., for constructing a bench bridge 63 ft. long on Dalmer's Pl.

Trenton, N. J.—City Engr. Swan is reported to be preparing plans for a bridge to carry Seward Ave. across the Belvidere division of the Pennsylvania R. R. to connect with Perrine Ave.

Le Roy, N. Y.—E. Townsend, Town Clk., writes that it is proposed to construct bridge over Oatka River on Main St.; cost reported to be $10,000.

**Ft. Plain, N. Y.*—The Canton Bridge Co., of Canton, O., is stated to have secured the contract to construct the iron bridge over Gavage Creek in town of Palatine, for which the citizens on July 16 voted in favor of issuing $4,500 bonds.

Chillicothe, O.—It is stated that bids will be received by the Co. Comrs. until August 5 for constructing 30-ft. steel bridge, with 14-ft. roadway, on iron substructure incased in concrete. C. H. Pinto, Co. Aud.

**Cincinnati, O.*—A. Desch & Son are reported to have secured the contract for constructing a bridge over the Ohio Pike at Ferris for $15,940.

Carrollton, O.—It is stated that bids will be received until Aug. 5 by N. L. Marshall, Co. Aud., for constructing an iron bridge 50 ft. long over Conotton Creek.

**Pendleton, Ore.*—It is reported that P. S. Easterly & Co., of Walla Walla, Wash., have been awarded the contracts to build the steel bridges, one near Milton, connecting the upper county road running between Walla Walla and Milton, and the steel brdge across McKay creek, 7 miles south of Pendleton, at $2,650 and $2,984, respectively.

Hamburg, Pa.—Bids will be received until Aug. 9 by H. F. Livingood, Co. Compt., at Reading, for constructing a reinforced concrete arch bridge, 40 ft. span, with 2 abutments and 4 wing walls over Mill Creek, Hamburg.

Charleroi, Pa.—The new bridge between Charleroi and Pittsburg over the Monongahela River is stated to have been wrecked by the recent flood caused by heavy rains.

Greenville, S. C.—H. R. Fothergill, of Greenville, Gen. Mgr. of the Greenville Traction Co., writes that the City Engineer has prepared plans for a bridge across Reedy River to be constructed jointly by city and railway company; according to reports it will be a 3-arch concrete bridge and cost about $25,000. Contract has not yet been let.

Spokane, Wash.—The construction of a viaduct over the railroad tracks on N. Division St. is reported contemplated, at a cost of $180,375.

Fond du Lac, Wis.—It is stated that the Bd. Pub. Wks. has been authorized to construct an iron bridge at Grove St., also to repair the bridge over the river at Brooke St.

Hamilton, N. Z.—Waddell Harrington, New Nelson Bldg., Kansas City, Mo., is reported to have been selected to prepare plans for a bridge over Waikato River, in Hamilton, to cost $125,000.

St. Catherines, Ont.—Bids will be received until July 31 by the Dept. Railways and Canals (L. K. Jones, Secy.), Ottawa, for the substructure of the new bridge crossing the Welland Canal on the line of Queenston St., St. Catherines.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—See "Sewerage aand Sewage Disposal."

**Tuscumbia, Ala.*—The contract to construct 13,190 sq. yds. of cement sidewalks is stated to have been awarded to the Adamant Stone & Paving Co., of Nashville, Tenn., at 13.77 cts. per ft.

Montgomery, Ala.—Bids will be received until Aug. 5 by R. S. Williams, City Treas., for paving sidewalks on portions of 4 streets with Hexagon block or Schillinger pavement.

Oakland, Cal.—Superv. Bridge, it is stated, will soon submit to the Superv. a proposition to complete the foothill boule., from the western terminus, 1,500 ft. west of High St. to the city limits. The cost will be about $30,000, and the Superv. will be asked to appropriate $20,000.

Central City, Colo.—It is stated that bids will be received Aug. 2 by T. W. Jaycox, State Engr., Denver, for constructing a wagon road from Tollan to American City.

Killingly, Conn.—Bids will be received until July 31 by the Bd. of Selectmen (John A. Gilbert, 1st Selectman), for constructing a gravel road.

New Haven, Conn.—Bids will be received until Aug. 5 at the office of C. W. Kelley, City Engr., for paving with crushed stone and Belgian block gutters, portions of Prospect, Sachem and Plymouth Sts.

Smyrna, Del.—The Street Com. has been directed to have the principal streets of the city macadamized.

Wilmington, Del.—Bids will be received by the Bd. Directors Street and Sewer Dept. (L. V. Christy, Secy.) until July 30 for furnishing the following materials, which may be required for a period of 1 year from Aug. 1, 1907: Blue gutter stone, foreign and domestic Portland cement, terra cotta pipes, castings, sewer bricks, sidewalk paving bricks, bar sand and river paving sand and gravel.

*Stewart & Donohue, of Wilmington, are stated to have secured the contract to construct road from Mt. Pleasant to Boyd's Corner, a distance of 3.46 miles, for $22,891, and road from Mt. Pleasant Station to Summit Bridge, a distance of 2.35 miles, for $16,035 (bids received July 9).

Bids will be received by the Bd. Dir. Street and Sewer Dept. (L. V. Christy, Secy.) until Aug. 2 for grading, furnishing of material and paving of 5,000, 7,500, 10,000, 20,000, 30,000, 50,000 or 75,000 sq. yds. of either sheet asphalt, bituminous, macadam, bitulithic or Portland cement concrete pavement.

Pensacola, Fla.—Bids will be received by the Bd. of Bond Trus. (L. Hilton Green, Chmn.) until Aug. 27 for grading, paving and curbing certain streets, consisting of approximately 170,700 sq. yds. clay or shale block, asphalt, bitulithic, wood block or macadam, and 115,950 lin. ft. concrete curb, as advertised in The Engineering Record. T. Chalkley Hatton, Ch. Engr., Wilmington, Del.

Rome, Ga.—J. R. Cantwell, City Clk., writes that about $225,000 will be expended for paving. Engineer in charge of work is J. N. Hazlehurst, of Rome.

**Savannah, Ga.*—The City Council is reported to have decided to award the contract for repaving with asphalt portions of Broughton, Bryan, Congress, Harris, Liberty, St. Julian, Bull and Drayton Sts., to the Southern Paving & Constr. Co., for 122,297, and for repairing asphalt pavements on Drayton, Oglethorpe Ave., President and York Sts., for $4,997.

East St. Louis, Ill.—Bids will be received until July 30 by the Bd. Local Improv. (E. J. Eggman, Clk.), for paving 24th St., requiring 2,850 sq. yds. vitr. brick pavt. on a 6-in. concrete foundation, 1,742 lin. ft. combination granitoid, guttering and curbing, etc.

Quincy, Ill.—The City Council has passed an ordinance to pave 10th St., from Oak to Sycamore Sts., at an estimated cost of $25,581.

**McLeansboro, Ill.*—The Bd. of Local Improv. is stated to have awarded the contract to pave the principal streets of the city (bids for which were received July 9) to John Cherry, of Jacksonville, Ill., at $96,000.

Chicago, Ill.—Bids will be received until Aug. 5 by the Bd. of Local Improv. (H. S. Dietrich, Pres.) for repairing brick, asphalt and granite block pavement on sundry streets.

**Oak Park, Ill.*—B. C. Brandstadt, Secy. Bd. of Local Improv., writes that C. D. Smith, of Oak Park, and Edw. Holmstead, of Austin Sta., Chicago, have secured the contract for concrete sidewalks (bids opened July 16), at 12, 13 and 14 cts. per sq. ft. There will be about 169,000 sq. ft. of walks laid.

Beardstown, Ill.—It is stated that bids will soon be received for street paving in Beardstown, at a cost of about $80,000.

Martinsville, Ind.—It is reported that the Bd. Co. Com. will receive bids until Aug. 6 for the construction of about 2½ miles of gravel and macadam road in Ray Township. E. E. Thornburg, Co. Aud.

Rockville, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 7 for the construction of the Crooks and Wimer Rd., Union Township; Penee Rd., Wabash Township, and the Union Chappel Rd., Washington Township, comprising an aggregate of about 11 miles. H. A. Henderson, Co. Aud.

Columbus, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 5 for the construction of 1½ miles of gravel road in Clifty Township. John M. Davis, Co. Aud.

Hartford City, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 8 for constructing a macadam road in Harrison Township, known as the Neal Rd. L. N. Daugherty, Co. Aud.

Washington, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 6 for constructing a rock road known as the Harris Rd.; also 3 gravel roads known as the Alex. Moore, Fairhurst and Stoy Roads, respectively. Thos. Nugent, Co., Aud.

Columbus, Ind.—It is stated that bids will be received by the Co. Comrs. until Aug. 5 for constructing 1½ miles of gravel road in Clifty Township. John M. Davis, Co. Aud.

Muncie, Ind.—It is reported that petitions have been filed for the construction of a number of gravel roads in Delaware County, aggregating about 20 miles. Joe E. Davis, Co. Aud.

Clarinda, Ia.—Bids will be received by C. W. Stuart, City Clk., until Aug. 6 for about 11,398 lin. ft. concrete curb and gutter; also for a 7x7x80 ft. reinforced concrete culvert, as advertised in The Engineering Record.

Des Moines, Ia.—The Council, it is reported, has voted to pave [illegible] St. with brick.

Showhegan, Me.—It is stated that bids will be received by the Co. Comrs. until Aug. 5 for constructing highway from The Forks to Lake Moxie Station.

**Baltimore, Md.*—This city is adding 1,740 sq. yds. of bitulithic to the contracts previously awarded. Warren Bros. Co., of Boston, Mass., will do the work.

*The contract for paving a portion of Belle Ave. is reported to have been awarded to P. Flanagan & Sons, Lexington and Calvert Sts., for $5,622.

Bids will be received until July 31 by J. Barry Mahool, Pres. Bd. of Awards, for curbing and paving with sheet asphalt, asphalt blocks, vitrified bricks or bitulithic, Robert Ave. and Lombard St.

**Boston, Mass.*—Jones & Meehan, 10 Tremont St., have secured the contract for paving draw span and spans 1, 2 and 3 of Northern Ave. Bridge (bids opened July 22 by Wm. Jackson, City Engr.) at $29,685 and 10 cts. per yd. for road pitch furnished and poured. Lawler Bros., 16 City Sq., Charlestown, Mass., bid $31,798 and 18 cts. and Patk. McGovern, 6 Beacon St., $32,900 and 15 cts.

* *Items marked thus give the names of parties awarded contracts.*

Detroit, Mich.—The Wyckoff Pipe & Creosoting Co., Stamford, Conn., is stated to have sumbitted the lowest bid on July 16 for about 24,500 sq. yds. of creosoted paving blocks at $1.48 per sq. yd.

Lansing, Mich.—Bids for paving Saginaw St. will be received by the City Clk. until Aug. 5; estimated cost, $21,420. H. A. Collar, City Engr.

Ironwood, Mich.—It is stated that M. H. Newberry, of Newberry, Mich., has secured the contract to construct 40,000 sq. ft. of concrete sidewalks at about $12,412.

Hayfield, Minn.—It is stated that bids will be received until Aug. 5 by the Village Council for constructing about 2,025 sq. ft. cement sidewalks.

St. Paul, Minn.—The County Surv. is reported to have estimated road work contemplated for the coming year at $81,782.

The Twin City Rapid Transit Co. has been directed to lay granite between its tracks on several streets.

Resolutions are stated to have been passed by the Assembly authorizing the street railway Co. to pave with granite blocks between the tracks in Oakland Ave., from Ramsey to Grand; in University Ave., from Rice to Dale; in 3d St., from 7th to Pleasant, and in 4th St., from Bway. to W. 7th.

Kansas City, Mo.—Bids will be received by the Bd. Pub. Wks. until Aug. 1 for constructing brick or brick block pavements on portions of 6 alleys, repairing asphalt pavement on portions of 9 streets and constructing artificial stone curbing on portions of 3 streets. E. A. Harper City Engr.

Helena, Mont.—It is reported that bids will be received until Aug. 5 by M. Doty, City Clk., for constructing the Le Grand Boule.

Riverton, N. J.—Bids will be received until Aug. 8 by F. G. Brown, Mayor, for furnishing material and constructing about 10,000 sq. ft. cement paving and grading and graveling about 8,000 sq. yds of sidealks. Henry S. Haines Boro Engr., 306 Temple Bldg., Camden.

Roselle Park, N. J.—Bids will be received until Aug. 2 by Mayor and Boro. Council for laying about 8,000 lin. ft. 4 ft. stone flag sidewalk. A. M. Woodruff, Boro. Clk.

Edgewater, N. J.—Bids will be received until Aug. 6 by Geo. A. Carleton, Mayor, and Council, for improving the River Rd. in the Shadyside section of the boro. Watson G. Clark, Boro. Engr., 1125 Bway., New York, N. Y.

**Newark, N. J.*—It is stated that Bd. of Wks. has awarded contracts for the grading, curbing and paving of the following streets to Philip Jannarone: Nye Ave., from Clinton Pl. to the city line, for $8,068; Elizabeth Ave., from Peddie St. to Meeker Ave., for $10,398, and Bragaw Ave., from Clinton Pl. to Sibley Ave., for $8,486; Munn Ave., from South Orange Ave. to the East Orange line, to Frank W. Snyder for $3,041; Bigelow St., from Frelinghuysen Ave. to Elizabeth Ave., to John Derichy, for $3,436; Jelliff Ave., from Runyan St. to Peddie St., to Van Keuren & Son, for $3,159.

**Camden, N. J.*—The Filbert Paving & Constr. Co., of Philadelphia, Pa., is stated to have secured the contract to repave numerous streets at prices ranging from $1.61 to $1.69 per sq. yd. on 5-year guarantee, at from $1.71 to $1.79 per sq. yd. on 10-year guarantee.

Brooklyn, N. Y.—Bids will be received until Aug. 8 by Comrs. of Parks, N. Y. City (Moses Herrman, Pres.), for furnishing materials and constructing asphalt tile walks in Winthrop, Cooper and Seaside Parks, Boro. of Brooklyn, together with all the work incidental thereto.

Hornell, N. Y.—The citizens are stated to have voted in favor of issuing bonds for paving several streets.

Buffalo, N. Y.—The upper house of the Cty Council has passed the resolution to repave High St. from Michigan to Genesee Sts.

Johnstown, N. Y.—Press reports state that bids are wanted until Aug. 2 for $35,000 street improvement bonds.

Albany, N. Y.—State Engr. Skene is reported to have July 10 received bids for repairing State roads as follows: Albany Co., M. F. Dollard $49,732; C. G. Stockwell, $24,615; in Oneida Co., D. V. Ashley, $8,240; Jos. Conners, $8,162; in Jefferson Co., W. H. Burnham, $4,390, Jos. Conners, $3,637; in Onondaga Co., J. Davis, $14,197, J. Conners, $10,825. For the repairing sections of the Delaware Turnpike, Delaware and Slingerlands Rd., there were two bidders: M. F. Dollard, $40,732, and C. G. Stockwell, $24,616.

New York, N. Y.—Bids will be received until July 30 by Louis F. Haffen, Pres. Bronx Boro. for furnishing and delivering broken trap rock, lime or native stone screenings to the Bureau of Highways. Estimated quantities: 15,000 cu. yds. best quality 1½-in. broken stone, trap-rock, lime or native stone, and 5,000 cu. yds. best quality ¼-in. screenings, trap rock, lime or native stone. Samples must be submitted 3 days before date of letting. To be delivered as directed before Dec. 1, 1907.

The Mayor has approved the ordinance providing for an issue of corporate stock in the sum of $6,500, to provide means for the purchase of 2 steam rollers for use in the Boro. of The Bronx.

The lowest bid opened on July 16 by Louis F. Haffen, Pres. Bronx Boro., for constructing transverse road at Burnside Ave., in connection with the Grand Boule and concourse was submitted by T. K. Shaughness, at the following bid: 10,650 cu. yds. earth excav., 40 cts.; 3,000 cu. yds. rock excav., $1.60; 12,000 cu. yds. fill, 15 cts.; 80 cu. yds. cinder fill, $1; 110 cu. yds. selected surfacing material, $1; 5 M ft. lumber, $50; 110 cu. yds. dry rubble masry., $2; 25 cu. yds. rubble masry., in mortar, $5; 470 cu. yds. class "A" concrete, $8; 1,850 cu. yds. class "B" concrete, $6; 20 cu. yds. cinder concrete, $10; 9,500 sq. ft. waterproofing, 15 cts.; 280 cu. ft. granite newels, coping and fenders, $3; 800 lin. ft. 12-in. pipe drain, $3; [illegible] lin. ft. 10-in. pipe drain, $2; 30 spurs, $1; 18 manholes, $60; 7 receiving basins, $200; 4 type "A" inlets, $[illegible]; 2 type "B" inlets, $25; 200 sq. yds. paved gutters, $[illegible]; 200,000 lbs. iron and steel, 4½ cts.; 1,800 sq. ft. woven wire fabric, 10 cts.; 120 lin. ft. 12-in. standard water pipe, $3; 120 lin. ft. 16-in. standard water pipe, $4; 60 lin. ft. 20-in. standard water pipe, $5; 3,000 lin. ft. new bluestone curb, 80 cts.; 85 lin. ft. new granite curb, $1; 275 lin. ft. old bluestone curb, 25 cts.; 16,150 sq. ft. cement flag, 16 cts.; 1,750 sq. ft. new bluestone flag, 25 cts.; 640 sq. ft. old bluestone flag, 5 cts.; 1,300 sq. ft. new bridgestone, 60 cts.; 600 lin. ft. old bridgestone, 10 cts.; 3,750 sq. yds. asphalt block pavt., $1.75; 5,000 sq. yds. iron slag block pavt., $2.50; 1,300 sq. yds macadam pavt., $1; 92 lin. ft. type "A" railing, $8; 845 lin. ft. type "B" railing, $3; 600 lin. ft. type "C" railing, $1.50. Total, $98,191. Totals of other bids for this work were: Haggerty Contr. Co., $132,300; Culgin, Pace Contr. Co., $133,506; Geo. I. Bailey, $109,314.

T. K. Shaughness also submitted lowest bid opened on July 16 to Louis F. Haffen, Pres. Bronx Boro., for constructing transverse road at E. 204th St., in connection with Grand Boule. and concourse, as follows: 5,100 cu. yds. earth excav., 40 cts.; 100 cu. yds. rock excav., $1; 28,750 cu. yds. fill, 40 cts.; 200 cu. yds. cinder fill, $1; 100 cu. yds. selected surfacing material, $2; 5 M ft. lumber, $50; 4,500 cu. yds. dry rubble masry., $2; 780 cu. yds. rubble masry. in mortar, $5; 4,100 cu. yds. Cyclopean masry., $5; 530 cu. yds. class "A" concrete, $8.50; 5,600 cu. yds. class "B" concrete, $6; 40 cu. yds. cinder concrete, $10; 9,500 sq. ft. waterproofing, 15 cts.; 260 cu. ft. granite newels, fenders and coping, $3; 970 lin. ft. 18-in. pipe drain, $3; 575 lin. ft. 12-in. pipe drain, $2; 215 lin. ft. 10-in. pipe drain, $1; 96 spurs, $1; 16 manholes, $50; 5 receiving basins, $200; 4 type "A" inlets, $35; 2 type "B" inlets, $25; 200 sq. yds. paved gutters, $1; 440,000 lbs. iron and steel, 4½ cts.; 1,750 sq. ft. woven wire fabric, 10 cts.; 120 lin. ft. 12-in. standard water pipe, $3; 60 lin. ft. 20-in. standard water pipe, $5; 3,350 lin. ft. new bluestone curb, 80 cts.; 85 lin. ft. new granite curb, $1; 12,200 sq. ft. cement flag, 16 cts.; 2,320 sq. ft. new bridgestone, 60 cts.; 5,250 sq. yds. asphalt block pavt., $1.75; 3,050 sq. yds. iron slag block pavt., $2.50; 1,200 sq. yds. macadam, $1; 91 lin. ft. type "A" railing, $8; 1,150 lin. ft. type "B" railing, $3; 1,150 lin. ft. type "C" railing, $1.50. Total, $147,580. Totals of other bids for this work: Geo. I. Bailey, $162,410; Haggerty Contr. Co., $216,498, and J. B. Malatesta, $156,100.

The lowest bid opened on July 16 for regulating, etc., Manida St. from Lafayette Ave. to Edgewater Road, Bronx Boro., was submitted by F. Falk, at the following bid: 65,000 cu. yds. earth excav., 29 cts.; 3,400 cu. yds. rock excav., $2, and 600 cu. yds. dry rubble masonry, $1.50; total, $26,550. Totals of other bids: D. W. Moran, $25,750, and T. E. Vermilye, $25,504.

The lowest bid opened July 16 for paving Devoe Ave. from West Farms Road to E. 180th St., Bronx Boro., was submitted by the Atlanta Contr. Co. as follows: 2,550 sq. yds. granite block pavt., $2.67; 1,575 lin. ft. old curb, 30 cts.; total, $7,281.

Bids will be received until Aug. 6 by Henry S. Thompson, Acting Boro. Pres. and Comr. Pub. Wks, for regulating and repairing with asphalt block a portion of St. Nicholas Ave.; repairing asphalt block pavement in Boro. Manhattan; regulating, grading curbing and flagging W. 177th St. and Vermilyea Ave. Engineer's estimate: 20,380 sq. yds. asphalt blk. pavt.; 5,000 sq. yds. old asphalt blks., to be relaid; 36,320 sq. ft. new flagstone, furnished and laid; 8,065 lin. ft. new curb, furnished and laid; 13,786 cu. yds. rock excav., etc.

Ilion, N. Y.—The Bd. of Trus., it is stated, has decided to pave a portion of Main St. with brick.

Brooklyn, N. Y.—The lowest bid opened on July 18 by the Dept. of Parks, N. Y. City, for furnishing material and laying asphalt tile walks on sand foundation in parks in Brooklyn Boro., together with all work incidental thereto, was submitted by the Hastings Pavt. Co., 25 Broad St., N. Y. City, at the following bid: 22,777 sq. ft. in Bedford Park, 25¾ cts.; 54,410 sq. ft. in Bushwick Park, 24⅛ cts.; 23,926 sq. ft. in Fulton Park, 23 cts.; 25,752 sq. ft. in Saratoga Park, 25½ cts., and 25,479 sq. ft. in Irving Square Park, 24½ cts.; total, $37,344. The Continental Asphalt Paving Co., 42 Bway., N. Y. City, bid for this work $39,895.

Bids will be received until Aug. 1 by Comrs. of Parks, N. Y. City (Moses Herrman, Pres.) for furnishing material and laying cement sidewalk around Sunset, Amersfort, Fulton, Bedford and Irving Sq. Parks, also constructing complete asphalt tile walks in Lincoln Terrace and Amersfort Parks, all in Boro. of Brooklyn; also furnishing and delivering masons supplies to Prospect Park, Boro Brooklyn.

*John E. Quinn, 227 Linden Ave., has secured the contract for regulating, grading, curbing and laying sidewalks on Coney Island Ave., from Kings Highway to Neptune Ave. (bids opened July 17 by Bird S. Coler, Pres. Brooklyn, Boro.) at the following bid: 18,600 lin. ft. new curb, set in concrete, 98 cts.; 26,770 cu. yds. earth excav., 37 cts.; 84,770 sq. ft. cement sidewalk, 15 cts.; total, $40,848. Totals of other bids: N. Schneider's Sons, 144 21st St., $41,161; Danl. Douglas, 122 Logan St., $43,801; Seaboard Constr. Co., 639 Gates Ave., $46,768; F. J. Gallagher, 571 Park Pl., $41,347; Chas. Cranford, 44 Court St., $42,923, and Bracken McAveney Co., Ft. of 6th St., $43,391.

Stapleton, S. I., N. Y.—Bids will be received until Aug. 6 by J. A. Bensel, Comr. Docks, N. Y. City, for furnishing material required for preparing for the laying asphalt pavement at the approach to the Staten ferry terminal at Staten Island, as per contract No. 1078, Class C.

Fargo, N. D.—The City Council, it is reported, has authorized Engr. Crabbe to receive bids until Aug. 5 for paving a portion of N. P. Ave. with cedar or creosote blocks or vitrified brick.

**Wellsville, O.*—C. R. MacGregor, Clk. Bd. of Pub. Service, writes that John M. Ryan, of E. Liverpool, has secured the contract for paving Riverside Ave. with brick, about 1,670 yds. paving and 550 lin. ft. stone curb; Anderson-McCullom Co., of East Liverpool, for paving 6th St. with brick, 4,350 sq. yds. paving and 2,270 lin. ft. curb (bids opened July 18).

**Cincinnati, O.*—The County Comrs. are stated to have awarded the contract for improving a portion of Springfield Pike to Geo. Leonard for $9,998.

*The contract for widening Grandin Rd. 10 ft. from the east end of the viaduct to Stanley Ave. is stated to have been awarded to the Kirchner Constr. Co., 8th and Plum Sts., at $21,195; Geo. Sconce, Halpin Ave. near Ferris Ave., the contract for the retaining wall at Alpine Pl., at $3,600.

Youngstown, O.—The City Council is reported to have passed an ordinance providing for the paving of a portion of Iowa St.

Bids will be received until Aug. 3 by the Bd. Comrs., Road Dist. No. 1 (North Newton, Secy), for turnpiking about 1½ miles Belmont Ave.; also about 1 mile of Price Rd.

Silverton, O.—The citizens are stated to have voted to issue $7,600 bonds for street improvements.

Alliance, O.—The following bids are reported opened July 1 for paving portions of (*a*) Patterson St., (*b*) Ely St.: Smith Bros., Salem, *a* $22,043, *b* $3,182; Devine, Wilson & Applegate, of Alliance, *a* $21,556, *b* $3,097, and Freshwater & Sons, Chester, W. Va., *a* $21,779.

Steubenville, O.—It it reported that bids will be received by the Bd. Pub. Service until Aug. 19 for paving with brick, portions of certain streets.

Cleveland Heights, O.—Bids will be received until Aug. 20 by Wm. G. Phare, Village Clk., 204 Am. Trust Bldg., Cleveland, for furnishing material and improving a portion of Fairmount Boule. The F. A. Pese Engr. Co., Engrs., 931 Williamson Bldg., Cleveland.

Toledo, O.—Jos. Hofman, Co. Surv., writes that it is proposed to expend about $46,000 for paving. About 16,000 sq. yds. will be laid.

Marion, O.—It is stated that bids will be received by the Bd. of Pub. Service (Wm. Fies, Clk.) until July 30 for constructing sandstone sidewalks on various streets. Geo. E. Dwyer, City Engr.

Lisbon, O.—State Highway Comr. Saml. Huston, Columbus, is advertising a highway (brick construction) proposed under the new Ohio law, for letting at Lisbon, Aug. 10th. Specifications will be mailed to contractors upon request.

New Philadelphia, O.—It is stated that bids will be received until Aug. 1 by the Bd. Pub. Service (G. C. Marsh, Clk.), for paving S. Bway. with vitr. block on gravel foundation.

Defiance, O.—It is stated that bids will be received until July 30 by the Co. Comrs. for graveling sundry streets; also July 31 for graveling sundry other streets.

Bellevue, O.—Geo. Leiber, Village Clk., will receive bids until Aug. 10 for paving Castalia St. and Euclid Ave. with vitr. block; about 15,260 sq. yds. on crushed stone foundation with the necessary excavating, curbing, catch basins and inlets. J. C. Overmyer, of Fremont, Engr. in charge.

Sharon, Pa.—It is stated that bids will be received until July 30 by Griff W. Nicholls, Boro. Engr., for approximately 2,800 sq. yds. brick or asphalt block paving on Ormond Ave.

**Washington, Pa.*—The Co. Comrs., it is stated, have awarded to N. C. Hunter the contract to construct about a mile of road from Burgettstown to Crosscreek Village at about $12,000.

Wilkesbarre, Pa.—It is stated that about $100,000 will be required for repairing asphalt streets, in all about 55,039 sq. yds.

**Erie, Pa.*—Jos. McCormick & Bros. are stated to have secured the contract to pave E. 9th St. with brick at $1.78 per sq. yd. and artificial curbing at 50 cts., and Mayer Bros. the contract to pave Cherry St. with asphalt at $1.69 per sq. yd.

**Pittsburg, Pa.*—The contract for the improvement of the Beaver Grade road for a distance of about 6 miles in the Corapolis district has been let to John F. Howley for $81,378.

All bids are reported to have been rejected for the construction of the Little Deer Creek Valley road, being 11 excess of the estimate, which is $100,000.

Sewickley, Pa.—Bids will be received by Fredk. T. Martin, Boro. Engr., 514 Broad St., until Aug. 6 for the paving with asphalt block of Centennial Ave. Approximate quantities: 1,700 cu. yd. excav., 4,830 sq. yd. asphalt block pavt., 2,630 lin. ft. curb reset, etc.

Chattanooga, Tenn.—Engr. E. E. Betts, of the Chickamauga National Military Park Comn., it is stated, has announced that the government road, which is being surveyed up through McLemore Cove, will be about 15 miles long. Appropriation $10,000.

**Norfolk, Va.*—It is stated that the Bd. of Control has accepted the bid of the Atlantic Bitulithic Co. to repair asphalt pavements at $2 per sq. yd.

Aberdeen, Wash.—P. T. Clark, City Clk., writes that bids will be received on Aug. 21 for clearnig, grubbing, storm water gutters and outlets, graveling, concrete bulkheads, etc.; probable cost $185,000. H. W. Troutman, City Engr.

Bellingham, Wash.—The Bd. of Pub. Wks. is reported to have opened bids July 1 as follows: For improving Prospect St., K. Sauset, for grading, construction of walks, $13,961; for brick pavement, $19,434. Riddle, Kavanaugh & Hawins, grading, concrete sidewalks, etc., $14,303; brick, $22,669. C. E. Lind, grading, sidewalks, etc., $15,370; asphalt at $3.15 per sq. yd., $18,019.

Sutton, W. Va.—See "Sewerage and Sewage Disposal."

**Superior, Wis.*—The contract for paving E. 3d. St. is reported awarded to Anderson, Johnson & Co., at $3,500, and to E. A. Dahl, 1109 N. 6th St., for paving the alley bet. Tower and Ogden Aves. at $1,613.

**Neenah, Wis.*—The Green Bay Concrete Co. is stated to have secured the contract to pave with brick on N. Commercial St. at $15,969.

**Milwaukee, Wis.*—The Bd. Pub. Wks. is stated to have awarded to the Milwaukee Concrete & Sidewalk Co., 307 Grand Ave., the contract to remove all defective sidewalks in the 16th Ward, and replace them with cement sidewalks at 11.9 cts. per sq. ft.

Ft. Mackenzie, Wyo.—Bids will be received until Aug. 5 by Capt. Wm. D. Davis, Q. M., U. S. A., for constructing cement walks, steps and road crossings at this post.

**Chatham, Ont.*—The Warren Bituminous Paving Co., of Toronto, Ont., has received a contract for 7,900 sq. yds. of bitulithic.

* *Items marked thus give the names of parties awarded contracts.*

*Toronto, Ont.—This city has awarded a contract for 2,614 sq. yds. of bitulithic to the Warren Bituminous Paving Co., of Toronto.

Bids will be received until July 30 by E. Coatsworth (Mayor), Chmn. Bd. Control, for constructing asphalt pavements on 5 streets, asphalt block pavement on Strachan Ave., vitr. blk. pavement on Peter St., concrete curb on Delponte and Peter Sts., and concrete walks on 18 streets.

*Ottawa, Ont.—The John Foley Constr. Co., of Ottawa, is reported to have secured the contract to pave Sussex St. from St. Patrick's St. to Government House, about a mile and a quarter, at $91,789. The Barber Asphalt Co. bid $96,700.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Decatur, Ala.—The Decatur Light Power Co. is reported to have under consideration the improvement and extension of its plant.

Santa Rosa, Cal.—Frank Burris, a banker of Santa Rosa, is reported to have secured a franchise to construct a power line along the highways of Sonoma County.

Oroville, Cal.—The Pacific Gas & Electric Co. is reported to be considering the construction of a power plant on French Creek.

San Bernardino, Cal.—The Lytle Creek Power Co. (W. A. Ball, Mgr.), is reported to have decided to install duplicate engines, boilers, generators, etc.

Bishop, Cal.—It is stated that the Bishop Light & Power Co. (J. M. Lennon, Mgr.), proposes changing equipment to generate 500 h.-p.

Schenectady, N. Y.—See "Business Buildings."

Manitou, Colo.—The Manitou Electric Co. (H. H. Van Dusen, Supt.), is reported to have decided to extend its line 3½ miles to Cave of Winds and the Grand Caverns.

Salida, Colo.—The Salida Light, Power & Utility Co. (B. Denson, Mgr.), is reported to have decided to erect new power station and install turbine, dynamo, 6,000 ft. pipe line and 1½ miles of transmission line.

Steamboat Springs, Colo.—The Steamboat Springs Electric Co. (W. E. Carver, Mgr.), is reported to have decided to construct entire new plant this summer of 150 h.-p.

Pagosa Springs, Colo.—The Pagosa Springs Light & Power Co. (E. M. Hampton, Mgr.), is reported to have decided to construct water power plant of 100-kw. with 2 miles of transmission lines.

Washington, D. C.—Bids will be received until Aug. 3 by Eliott Woods, Supt. U. S. Capitol Bldgs. and Grounds, for 125 panel boards and boxes and 6 pull boxes for use in connection with electric wiring House of Representatives Office Building. Delivery at building only, erection not included.

Washington, D. C.—See "Miscellaneous."

Washington, D. C.—See "Public Buildings."

Savannah, Ga.—The City Council on July 17 decided to secure the services of an electrical engineer to prepare specifications for the new contract for city lighting, which will go into effect on Jan. 1, 1908.

Marissa, Ill.—This city is reported to have in contemplation at the municipal electric light plant a meter system. 50 new arc lamps, 100 series incandescent 30 c. p. lamps, extension of lines, etc.

Elgin, Ill.—The Trus. of the Illinois Hospital are reported to have under consideration improvements to the hospital to include a more adequate water system, the erection of three new buildings and the enlargement and improvement of the present power plant.

**Bloomington, Ill.*—Harry E. Rhoads, City Clk., writes that contracts for constructing an electric light plant (bids opened July 9) have been awarded as follows: Engines to the Buckeye Engine Co., Salem, O.; generators to the Western Electric Co., Chicago, and lamps to the Ft. Wayne Electric Co., of Ft. Wayne, Ind.

**Ft. Wayne, Ind.*—We are informed that the City Council on July 16 duly ratified contracts for the municipal electric light plant, bids for which were opened on June 24, and awarded on June 26, and executed by the Bd. of Works on June 28. The contract as awarded and ratified and which appeared in the issue of The Engineering Record of July 6 are as follows: To Ft. Wayne Electric Works, Ft. Wayne, for Sec. 3—Steam turbine generators and exciters; Sec. 4—Condenser equipment; Sec. 7—Arc lamp transformers, switchboard, appliances and station electrical work; Sec. 8—Arc lamps, and Sec. 10—Transformers and connecting public buildings, for a total of $73,899. To McBride Electric Co., of St. Paul, Minn., for Sec. 9—Pole line and wiring system and underground work (distributing system, and Sec. 11—Power plant and coal storage, for a total of $56,002. To O. K. Eng. Co., of St. Louis, Mo., Sec. 1—Boilers and equipments and stack connections, and Sec. 5—Feed-water heater, boiler feed pumps, separators, pipe work and connections, a total of $19,220. To Alphons Custodis Chimney Contr. Co., of Chicago, Ill., for Sec. 2—Stack, $4,400, and to Moellering Constr. Co., of Ft. Wayne, Sec. 12—Dam in Spy Run, $1,238. Total contract price $154,759. Owen Ford, Consulting and Superv. Engr., 710 Security Bldg., St. Louis, Mo.

**Mt. Ayr, Ia.*—A. Bertenlanger, of Omaha, Neb., is reported to have secured the contract for constructing an electric light plant at Mt. Ayr, for $17,626.

Hagerstown, Md.—The citizens are repored to have voted to construct and equip a municipal electric light plant.

**Reading, Mass.*—The Ridgway Dynamo & Engine Co., of Ridgway, Pa., has secured contract for engines for the municipal electric light plant, and the Western Electric Co., of New York, N. Y., contract for generators (bids opened July 5). Engineers, R. D. Kimball Co., of Boston.

St. Joseph, Mich.—Representatives of Chas. A. Chapin, of Chicago, Ill., are reported to have announced that plans are complete for the construction of three additional power dams on St. Joseph River, to cost about $5,000,000. The company now has in operation, or course of construction on the river five other dams.

St. Paul, Minn.—Bids will be received until Aug. 2 by Edw. G. Krahmer, Co. Aud., for heating and lighting the court house and City Hall for a term of 1, 2 and 3 years from Sept. 1, 1907. Bidders to make all necessary repairs and renewals of lamps during term agreed on.

Rochester, Minn.—Engr. Chas. L. Pillsbury, of St. Paul, is stated to have completed his report on the requirements of the municipal electric light plant and recommends its entire rebuilding.

Carrollton, Miss.—The plant of the Carrollton Electric Light & Power Co. is reported to have been destroyed by fire.

Fremont, Neb.—J. W. Andrews, City Engr., writes that plans have not yet been completed for the proposed municipal water and light station, which will cost about $60,000. Contracts for engines and dynamos have been let. E. N. Morse, Chmn. Bd. of Pub. Wks. Chas. A. Chapman, 204 Dearborn St., Chicago, Ill., is Consulting Engr.

Tecumseh, Neb.—Frank L. Densmore, City Clk., writes that John Martz, of Seward, is preparing plans for the proposed electric light plant, to cost about $20,000.

Newark, N. J.—The Common Council on July 12 appropriated $30,000 for the installation of an electric plant in City Hall, and also decided to have the people vote next Nov. on the question of the city building a $1,000,000 plant for the lighting of the streets. The Mayor has signed both resolutions. The new contract with the Public Serivce Corporation will run until Sept, 1912.

Brooklyn, N. Y.—Bids will be received until Aug. 5 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment of addition to and alterations in School 129, Boro. of Brooklyn.

**New York, N. Y.*—The following are the bids opened on July 15 by the Armory Board for furnishing and installing electric lighting fixtures, etc., in the 12th Regt. Armory, Boro. of Mahattan: Jas. Ahearn, $7,769; Isidore Fajane, $6,850; Wm. M. Sheehan & Co., $8,198, and J. M. Knoop, $6,755 (awarded contract).

Blackwell's Island, N. Y.—Bids will be received until Aug. 5 (readvertisement) by Robt. W. Hebbard, Comr. of Pub. Charities, N. Y. City, for materials and labor required for complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for buildings and grounds under jurisdiction of Dept. of Pub. Charities and comprising the Metropolitan Hospital Dist., Blackwell's Island, Boro. of Manhattan.

We are informed that no bids were received for the above work on July 18.

**Dunkirk, N. Y.*—The Water Comrs. are reported to have awarded to the Allis-Chalmers Co., of Milwaukee, Wis., the contract for a 500-kw. turbo-generator for the water works and electric light plant for $19,500.

Norwich, N. Y.—The State Gas and Electric Comn. at Albany is reported to have granted the Oriskany Hydro Electric Co., of Utica, permission to carry on business in the counties of Oneida, Madison and Chenango. It proposes to build an electric power line and railroad from the terminus of the Mohawk Valley line out of Clinton, south to Norwalk. E. H. Risley, of Utica, is reported to be one of the promoters.

Hickory, N. C.—It is stated that bids will be received until Aug. 10 by M. E. Thornton, Hickory, for constructing a concrete rock reinforced dam with power house, across the Catawba River, at Hickory, and installing 3,000-h.p. turbine water-wheels and electrical apparatus and transmission lines for lighting and power purposes.

Randleman, N. C.—See "Electric Railways."

Forest Grove, O.—The Haines Electric Power Co. (E. W. Haines, Mgr.), is reported to be considering the question of developing power, getting 500 ft. head and installing more machinery.

Wilkesbarre, Pa.—The Wilkesbarre Subway Light & Power Co. is reported formed, and has applied to the State for a charter. Dr. Lewis Edwards, County Treas; Frank Darte, an attorney, and Reese Lloyd, a real estate agent, are reported to be among the incorporators. It is stated that the company will not build a plant of its own to generate power, but the same will be obtained from a substation, probably the Laurel Line Co.

Providence, R. I.—A committee is reported to have been appointed consisting of C. D. Kimball and Robt. S. Burlingame, to look into the matter of constructing an electric lighting and heating plant at Rhode Island College; cost about $7,000.

Mitchell, S. D.—John Absher, of Wagner, S. D., Pres. Wagner, Lake Shore & Armour Traction Co., writes that the company is now constructing light and power plants at Armour, S. D., and Plate, S. D., and expect to commence work at Mitchell about Sept. 1st. Will soon commence the construction of 70 miles of suburban line from Wagner to Mitchell, 20 miles, of which right of way has been procured. Will be in the market for 56-lb. rails for this line in the near future, having already negotiated for ties and machinery.

Hubbard City, Tex.—Eugene Sheridan, of the Union Central Light & Ice Co., of Hubbard City, writes that this company is about to construct a plant to supply four of the neighboring towns with electricity, etc., and have issued $25,000 bonds for same. The company wants a construction company or engineer to build, taking the bonds at 85 per cent. net, and would be glad to hear from contractors or engineers direct.

San Angelo, Tex.—John Freeland, of the San Angelo Gas Co., writes that bids will be received until about Aug. 15 for improving the gas plant; cost about $50,000.

Temple, Tex.—The Rogers Water & Light Co., of Temple, is reported incorporated with a capital of $50,000 by John J. Cox, R. L. Brown and others.

Floresville, Tex.—A. W. Strange is reported interested in the construction of an electric light plant.

Sunnyside, Wash.—T. A. Noble, of North Yakima, is reported to have petitioned for a franchise for water works and an electric light plant.

Lander, Wyo.—The Lander Light & Power Co. (E. Amoreth, Jr., Mgr.), is reported to have decided to expend $15,000 in improvements.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Redding, Cal.—It is stated that F. L. Evans has made formal apolicaion to the City Trustees for a franchise authorizing him to operate a double-track electric railway through enumerated streets of Redding, the same to become, ostensibly, a part of the system of the Eureka & Redding Ry., or the Inland Empire.

Canon City, Colo.—The Canon City, Pueblo & La Junta Ry. & Power Co., it is stated, discussed plans and decided to open offices in Pueblo at once and commence the work of building and equipping an electric interurban railway which will extend from Canon City to the Kansas State line. Alfred E. Bent, of Lamar, Pres.; Andrew J. Behymer, of Elwood, Ind., Gen. Mgr.; Geo. D. Kendall, of Pueblo, Secy.; F. E. Pastorius, of Colorado Springs, Treas.

Cairo, Ill.—The Secretary of State is reported to have issued a license to incorporate the Cairo Terminal Traction Co. The road is to be constructed from Cairo to the north line of Pulaski County. The incorporators: L. E. Fischer, Danville, general manager of the Illinois Traction system; Dan Hogan, Mound City, and Judge W. S. Dewey, D. H. Sawyer and H. F. Vogel, all of Cairo.

Charleston, Ill.—The Secretary of State is reported to have issued a license to incorporate the Charleston, Westfield, Marshall & Terre Haute Interurban Ry. Co. It is proposed to construct an interurban road from Charleston, by way of Westfield, through the counties of Coles and Marshall to the Indiana State line, where it crosses the National Road. The principal office is Marshall. Capital $5,000. Incorporators, James Dawson, William B. Schofield, T. M. Berkeley and others.

Sullivan, Ind.—The Board of Comrs. of this county is stated to have granted a franchise to the Terre Haute & Merom Traction Co. The proposed road passes through Fairbanks, Staffordshire, Graysville, Merom and Merom Junction.

Terre Haute, Ind.—A petition is stated to have been filed with the Comrs. of Vigo County for a franchise for the Terre Haute & Merom Traction Co., which proposes to build a line through the county to connect Terre Haute and Merom. The 18 miles of road will be built on private right of way as near as possible.

Marion, Ia.—The American Motor-Car Interurban Ry. Co., of this city, is stated to have filed articles of incorporation with the Secretary of State. Capital, $10,000. The principal nature of the business to be transacted is the acquisition by lease of purchase and the construction, operation and maintenance of interurban and street railways to be operated either by electricity or by self-propelled motor cars. The company first proposes to construct an interurban railway from Marion to Muscatine via Davenport. E. J. Christie, of Marion, Pres.; John T. Christie, of Marion, is Secy. and Treas.

Mayfield, Ky.—A. J. Watts, Mayor of Mayfield, is reported to have sold a street railway franchise to J. W. Williams, of the firm of J. W. Williams & Co. It is reported that in less than about 6 months work will begin on an interurban street railway from Paducah to Mayfield.

Waterville, Me.—The Easton & Wyman water-power privilege on Sebasticook River near Ft. Hill Cemetery in Winslow is reported to have been purchased by the Augusta & Waterville Electric Ry. Co., and the contract for the erection of a dam will soon be awarded. The dam and power station will cost $130,000.

Williamsport, Md.—See "Bridges."

Baltimore, Md.—The Baltimore, Frederick & Hagerstown Electric Ry. Co. is reported to be planning extensions into the coal fields of Maryland and possibly West Virginia and Pennsylvania. The plan, it is understood, proposes making the road an extensive freight-carrying line, and is said to involve an expenditure of $25,000,000. Surveys already made are for a low-grade line. Capital, $15,000,000.

**Boston, Mass.*—The contract for constructing entrances and exits at Winter St. for Washington St. Tunnel (bids opened July 18) has been awarded to Patk. McGovern of 6 Beacon St., for $23,289.

Minneapolis, Minn.—The Minneapolis, Kansas City & Gulf Railway Co., with headquarters at Minneapolis, it is reported, is planning to build a double-track railway operated by electricity from Minneapolis to the Gulf. C. D. Holmes, G. A. Barnett and others are interested in the project.

Kansas City, Mo.—The Kansas City, St. Joseph & Excelsior Springs Electric Ry. is stated to have introduced an ordinance in the City Council to build a tunnel under Locust and Cherry Sts. from 3d St. to the Belt Line.

Randleman, N. C.—A franchise is stated to have been granted to the Randleman Electric Ry. Co. The company proposes to begin at once the erection of a power plant to furnish light and power for the city.

Toledo, O.—It is stated that the Summit Street line of the Toledo Ry. & Light Co. (J. T. Ross, Ch. Engr.) between Michigan and Ohio Sts. will be double tracked this summer.

Defiance, O.—The Defiance, Paulding & Ft. Wayne Railway Co. is reported organized to build an electric railway between Defiance and Ft. Wayne, following the bed of the old Wabash & Erie canal.

Enid, Okla.—A charter is stated to have been issued to the Enid, Blackwell & Osage Interurban Traction Co., of Enid, with $1,000,000 capital, to build 85 miles from Enid to Pawhuska, through the counties of Garfield, Kay, Noble and Osage. Incorporators Geo. W. Bear, Frank Bradfield, S. J. Hudkins, John R. Clover and Guy S. Manatt, all of Enid.

Enid, Okla.—The Enid, Waukomis & Oklahoma City Interurban Ry. Co. is reported incorporated for the purpose of building an electric railway 100 miles in length. R. W. Birttan, of Waukomis, is Pres.

Sayre, Pa.—The Boro. Council is reported to have granted the Waverly, Sayre & Athens Traction Co. permission to extend its lines through the borough.

Harrisburg, Pa.—It is stated that the 2d St. line of the Central Pennsylvania Traction Co. (W. J. Calden,

** Items marked thus give the names of parties awarded contracts.*

Secy. Harrisburg), will be extended from Maclay to Division Sts. within the next year.

Mitchell, S. D.—See "Power Plants, Gas and Electricity."

Memphis, Tenn.—The Clarksdale-Collierville-Covington Interurban Ry. Co. is reported to have filed in the office of the County Register a petition by R. F. Tate, C. F. Farnsworth, A. Walsh, and others for a charter; capital, $50,000. The company is to be a subsidiary of the Lake View Traction Co., and is organized for the purpose of securing franchises for the Memphis-Clarksdale Interurban lines.

Austin, Tex.—The Texas Interurban Co. is stated to have filed its charter. The purpose of the company is to build a system of interurban electric railways with Austin as the center. Capital, $400,000. The incorporators: Thos. Moore, of Elizabeth, N. J.; Ephriam Miller, of White Plains, N. Y.; C. P. Scrivener and S. M. Posey, of Austin. It is announced by the company's representatives that it will soon begin the construction of an interurban line to run from Austin to Lockhart, a distance of about 30 miles. The survey for the proposed road has been made and the right of way obtained for most of the distance.

New Westminster, B. C.—An application is reported to have been made to the City Council by the Burrard, Westminster & Boundary Ry. & Navigation Co., which plans to build an electric railroad to Seattle from this city.

Yarmouth, N. S.—The Hood-Godfrey Electric Ry. Co. has secured a franchise from City Council to construct an electric double track railway from Cumberland to Cliff Sts. A terminal is to be constructed at Cumberland St., while shops, power house, etc., will be erected on the Swain property at the other end of line. A. J. Haines, Pur. Agt., is now in St. John, N. B., attending to the supply of ties. The Ch. Engr., has completed surveys. T. W. Carten, Pres.; Jesse C. Robbins, Secy.; S. C. Hood, Jr., Treas. Work will be started about the middle of Sept., when contracts will be let.

RAILROADS.

Notes Arranged Alphabetically by States.

**San Francisco, Cal.*—The Western Pacific R. R. Co. is reported to have awarded to the Western States Construction Co. (H. A. Whitely, Pres.) the contract for work at a cost of $1,000,000, which includes grading road from 25th St., in the Potrero where it touches Islais Creek, north and northwesterly to 9th and Brannan Sts. On this route one short tunnel will have to be bored through Potrero hills. The company also awarded to Healy & Tibbitts, a contract at $700,000 the work to include building a freight slip and passenger slip on Oakland water front adjoining north wall of Oakland estuary and dredging to proper depth; to also prepare foundations for freight and passenger structures to be used in connection with slips; finish filling in of mole, to be 1,000 ft. wide and 1,000 ft. long.

Cannel City, Ky.—The Ceny, Piedmont & Moorehead R. R. Co. is reported incorporated, to construct a railroad bet. Cannel City and Piedmont; capital, $100,000. Incorporators: S. J. Gish, Central City; V. J. Blow, Nashville, Tnn.; E. C. Hegan, Louisville, and others.

Portland, Me.—The Portland, Gray & Lewiston R. R. Co. is reported incorporated, to construct, operate and maintain a street railroad of standard gauge in Portland, Westbrook, Falmouth, Cumberland, Gray, New Gloucester, Auburn and Lewiston; total length of the road, about 40 miles; capital, $160,000. Directors: Edw. W. Gross, Auburn; Chas. C. Benson, Lewiston; Lewis A. Goudy, Portland; John D. Clifford, Lewiston, and others.

Perry, Okla.—An amended charter has been granted to the Cherryvale, Oklahoma & Texas R. R. to build 700 miles southwest from Cherryvale, Kan., to El Paso, Tex. The following branch lines are provided: From Caney, Kan., to Fayetteville, Ark., 150 miles.; from Pawhuska, Okla., to So. McAlester, Ind. Ter., 200 miles, and from Childress, Tex., via Abilene, to Aransas Pass, Tex., 600 miles. Headquarters are established at Caney, Kan., and Independence, Kan., and Perry, Okla., with $18,000,000 capital stock. Incorporators: S. M. Porter, of Caney, Kan.; A. W. Shiltise, F. D. and J. H. Brewster, of Independence, Kan.; R. E. Wade and John H. Masters, of Perry, Okla.

Butler, Pa.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.) is reported to be planning extensive improvements at Butler. New freight and passenger stations will be erected and yard trackage and freight facilities enlarged.

Knoxville, Tenn.—Application has been made for a charter for the Knoxville, Sevierville & Eastern Ry. Co., with a capital of $500,000, to build to Sevierville, via Rockford, N. C., through the North Carolina line and eventually to Rutherford, N. C. Incorporators: S. B. Luttrel, Wm. P. Chamberlain, D. M. Rose and others.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Tuscumbia, Ala.*—The Co. Comrs., it is stated, have awarded the contract to erect a jail (bids for which were received July 15) to the Stewart Iron Wks., of Cincinnati, O., at $11,872.

Birmingham, Ala.—The erection of a library to cost about $200,000 is reported under consideration.

Little Rock, Ark.—Bids will be received until Aug. 5 by the Bd. State Charitable Institutions (H. T. Hampton, Secy. and Purchasing Agt.) for erecting the following buildings at the Arkansas Hospital for Nervous Diseases: 1 ward building, 1 cow barn, 1 milk house and additions to the hospital. Gibb & Sanders, archts., Reider Bldg.

Colorado Springs, Colo.—The following are the bids opened on July 9 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Postoffice and Court House at Colorado Springs: John Barden, Ft. Worth, Tex., $236,600; Campbell Bldg. Co., Salt Lake City, Utah, $207,700, and J. H. Wiese, So. Omaha, Neb., [illegible].

Pueblo, Colo.—F. W. Cooper, of Pueblo, is said to be preparing plans for a 2-story woman's department building to be erected at the State Insane Asylum at a cost of $50,000. It is stated that bids for the construction will be asked soon.

Stonington, Conn.—Bids will be received at the office of the Light House Engr., Tompkinsville, S. I., N. Y., until Aug. 15 for erecting a keeper's dwelling at Stonington Breakwater Light Station, Conn, as advertised in The Engineering Record.

Washington, D. C.—See "Miscellaneous."

**Washington, D. C.*—The Veneered Door Co., of Athens, O., has secured the contract for corridor and special doors, etc., with jambs, transom, sashes, etc., for House Office Building (bids opened July 10 at the office of Elliott Woods, Supt. U. S. Capitol Bldgs. and Grounds). Bids opened same time for 499 communicating and closet doors were rejected.

Bids will be received until July 31 by Elliott Woods, Supt. U. S. Capitol Bldgs. and Grounds, for furnishing and delivering, only, direct radiators for hot water heating, for the office building, House of Representatives.

Bids will be received until Aug. 9 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, for furnishing and erecting in place in vault No. 9, Rm. 225, second floor of the Treas. Bldg., Washington, new gallery pigeon-hole cases and electrical equipment and removal of present vault fittings.

Ft. Pickens, Fla.—Bids will be received until Aug. 1 at the Treas. Dept., U. S. Life Saving Service (O. M. Maxam, Acting Genl. Supt.) Washington, D. C., for erecting a life saving station on Santa Rosa Island, near Ft. Pickens, Fla.

Elgin, Ill.—See "Power Plants, Gas and Electricity."

Aurora, Ill.—It is reported that bids will be received until Aug. 1 by the City Clk. for the remodeling and additions to the city jail.

Indianapolis, Ind.—It is reported that the Mayor has been authorized to have preliminary plans prepared for a city hall to cost $500,000.

Mason City, Ia.—The Mason City Hospital Co. is reported formed with Dr. F. W. Parsons, Pres., and Dr. J. I. Nicol, Secy., to erect a hospital. Capital $15,000.

The Sisters of Mercy of the Mercy Hospital, of Dubuque, it is reported, have made an offer to this city to erect a hospital to cost $50,000 on condition that the city assist in the cost of the building.

**Marksville, La.*—The Southern Structural Steel Co., of San Antonio, Tex., is stated to have secured the contract to erect a jail at about $22,500.

Quincy, Mass.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 4 for the construction, complete, of U. S. Post Office at Quincy, as advertised in The Engineering Record.

Bessemer, Mich.—Charlton & Kuenzlie, of Marquette, are stated to have been engaged to prepare plans for an almshouse to be erected for Gogebic County at a cost of $25,000.

Ft. Snelling, Minn.—The Allan Black Co., of St. Paul, is stated to have submitted the lowest bid for a steam heating plant in the root house and several other small buildings at $1,950.

St. Paul, Minn.—See "Power Plants, Gas and Electricity."

Kansas City, Mo.—Root & Siemens, Postal Telgh. Bldg., is reported to have prepared plans for a fire station to be erected on 14th and Penn Sts., to cost about $20,000.

Ft. Omaha, Neb.—See "Miscellaneous."

Trenton, N. J.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Aug. 27, for the construction, including heating apparatus, electric wiring and conduits to extension of U. S. Postoffice at Trenton, as advertised in The Engineering Record.

Watertown, N. Y.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 3 for the construction, complete, of U. S. Post Office at Watertown, as advertised in The Engineering Record.

Yonkers, N. Y.—It is stated that bids will be received until Aug. 1 by John T. Geary, City Clk., for erecting a city hall.

New York, N. Y.—Bids will be received until Aug. 1 by Comrs. of Parks (Moses Herrman, Pres.), for furnishing material and erecting a greenhouse in the Botanical Garden, in Bronx Park, and furnishing material and grading and improving grounds north of the Municipal Building in Crotona Park, Boro. Bronx.

*The following are the bids received by the Armory Bd., July 15, for the excavation and removal of rock and other material from the site of the proposed armory for the 22d Regt. Engrs, Ft. Washington Ave., 168th and 169th Sts., Boro. of Manhattan: Thos. Crimmins Contr. Co., $84,400; C. W. Collins, 5189 Bway., $60,000 (awarded contract), and Patrick Reddy, $93,000.

Ellis Island, N. Y. H., N. Y.—Bids will be received at office of Robt. Watchorn, Comr. Immigration, Ellis Island, N. Y. H., until Aug. 1 for furnishing material and construction complete (except plumbing, heating, electric conduits and wiring) of buildings designated Measles Ward C, D, F, G and H; Isolation Wards I, K and L; Staff House to Ward E, from Ward E to Ward F and from Ward B to So. of Ward H pipe trench, etc. Contagious Disease Hospital Group, at the U. S. Immigration Sta., Ellis Island, N. Y. H.

Brooklyn, N. Y.—The following are the bids recently received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for furnishing and installing high pressure tube boilers in postoffice in Brooklyn: N. J. Stanchfield Co., New York, N. Y., $13,314; Evans, Almiral & Co., New York, N. Y., $12,500; Babcock & Wilcox Co., New York, N. Y., $12,755; Phillips, Doup & Co., Brooklyn, $13,700, and J. A. Scollay, Brooklyn, $13,900.

Bids will be received until Aug. 8 by Comrs. of Parks (Moses Herrman, Pres.), New York City, for furnishing material and erecting a shelter house in New Lots Park, Fulton Park and Winthrop Park and a shelter and tennis house in Prospect Park, all in Boro. of Brooklyn.

Rochester, N. Y.—Only one bid is reported to have been received July 17 by the Bd. Contract and Supply for remodeling the old armory into a convention hall, and it was rejected. The plans are to be modified and new bids asked.

Bids will be received until July 31 by F. X. Pifer, Clk. Bd. Contract and Supply, as a whole or separately on the carpentry, masonry, plumbing and the heating of the city bath house on South Ave. Foote & Headley, archts., 347 Cutler Bldg.

Shelby, N. C.—Bids will be received until Aug. 6 by the Bd. Co. Comrs. (J. F. Roberts, Chmn.) at Shelby for furnishing material and erecting a courthouse. H. L. Lewman, archt., 1008 Lincoln Bank Bldg., Louisville, Ky.

**Bathgate, N. D.*—Dinnie Bros., of Grand Forks, are stated to have secured the contract for interior work at the State Asylum for the Blind at $17,395, and Spriggs Bros., of Grand Forks, the contract for heating and plumbing at $11,788.

Bismarck, N. D.—It is reported that plans are being prepared for an addition which it is proposed erecting to the court house.

Youngstown, O.—Bids will be received until Aug. 14 by the Bd. Co. Comrs. (J. C. Hanni, Chmn.) for erecting an addition to the Children's Home. W. B. Jones, Co. Aud.

Canfield, O.—Bids will be received until Aug. 14 by the Bd. Co. Comrs. (J. C. Hanni, Chmn.) at Youngstown, for erecting a tuberculosis hospital at Canfield. W. B. Jones, Co. Aud.

Athens, O.—Bids will be received by the Bd. Trus., Athens State Hospital (Dr. J. T. Hanson, Secy.), until Aug. 20 for furnishing material and erecting an addition and making alterations in the main building at the Athens State Hospital. Frank L. Packard, Archt., Columbus.

Cleveland, O.—Andrew Carnegie is stated to have given to this city an additional $123,000 with which it is proposed erecting 2 branch libraries.

Spring City, Pa.—Bids will be received until Aug. 9 by the Comn. appointed (J. F. Sherwood, Secy.), care of the Governor, Harrisburg, for erecting an institution near Spring City for feeble-minded and epileptics. Plans and specifications may be obtained from Philip N. Johnson, Archt., 1825 Land Title Bldg., Philadelphia, upon a deposit of $200, of which $195 will be refunded upon return of plans.

Erie, Pa.—Bids will be received until July 31 by Louis Wagner, Chmn. Com. of Bldgs., Pa. Soldiers' and Sailors' Home, for erecting a dwelling for the commander of the home. Jos. Frank, archt., 30 Scott's Blk.

**Pennington, S. D.*—Robt. Rudesill, Co. Aud., writes that the contract for installing heating plant in court house (bids opened July 12), has been awarded to Herman & Birnbaum, of Rapid City, for $3,426.

**Paris, Tex.*—Edw. H. McCuistion, Mayor, writes that the contract for erecting 4-story brick hospital (bids opened July 15), has been awarded to Campbell & Owens, of Paris, for $15,900.

Ft. Worth, Tex.—The following are the bids opened on July 8 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for construction of extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Postoffice and Court House at Ft. Worth: John Barden, Ft. Worth, $141,700; Knight, Kenyon & Stevenson Co., Dallas, $135,700.

Houston, Va.—Bids will be received until Aug. 1 by the Bldg. Com., Co. Jail (R. S. Barbour, Chmn.) for erecting a jail. P. Milburn & Co., archts., Washington, D. C.

Milwaukee, Wis.—The Bd. Mgrs. of the State Fair is reported to have awarded the contract to erect an educational and State institutional building at the State Fair to Daniel B. Danielson, of Milwaukee, at $12,000.

Madison, Wis.—The Bd. of Health is said to be considering the erection of a new contagious disease hospital at a cost of $25,000.

Sheboygan, Wis.—The following are the bids opened on July 15 at the office of the Superv. Archt., Washington, D. C., for an extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, to the U. S. Postoffice at Sheboygan: General Constr. Co., Sheboygan, $26,152, and Northern Constr. Co., Sheboygan, $26,000.

Calgary, Alta.—Bids will be received until Aug. 8 by the City Clk. for erecting a city hall. W. M. Dodd, Archt., Alexander Corner; R. E. Speakman, City Engr.

Ottawa, Ont.—Bids will be received until Aug. 7 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for erecting an addition to Rideau Hall.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Los Angeles, Cal.*—The contract for erecting 2-story steel and concrete warehouse on Palmetto St., has been awarded to Pinney & Boyle, for about $20,000. Garrett & Bixby, Archts., 310 Currier Bldg.

Oakland, Cal.—The Atchison, Topeka & Sante Fe Ry. Coast Line (E. F. Henderson, Ch. Eng., Oakland), is stated to have had plans prepared for a freight depot over 600 ft. long to cost $75,000.

San Francisco, Cal.—The Gore Improvement Co. has applied for a permit to erect a $100,000 3-story structure on Market, Pine and Front Sts. of reinforced concrete with steel frames, and O. N. Nordwell to erect a 6-story brick warehouse to cost $90,000 on Battery St., and The Babcock Estate Co. to construct a 2-story brick building at California and Battery Sts., to cost $102,000.

Chicago, Ill.—The Chicago Junction Rys. Co. (J. B. Cox, Ch. Engr., Chicago), it is reported, will build a warehouse 80x250 ft. at 1005 35th St., plans for

* *Items marked thus give the names of parties awarded contracts.*

which have been prepared by Treat & Alschuler; cost, $50,000.

It is reported that Wm. A. Magie will erect a store and flat building, to cost $35,000, at 6312 South Halsted St.

Kohl & Castle, it is stated, have leased the Olympic Theatre and will make improvements at a cost of $75,-000.

**Logansport, Ind.*—The contract to erect the I. O. O. F. Bldg. at 5th and North Sts. is stated to have been awarded to Jas. I. Barnes, of Logansport, at $37,335.

**Ft. Wayne, Ind.*—Albert C. Alter, Chmn. Bldg. Com., writes that the contract for erecting Elks' Home at Ft. Wayne (bids opened July 1) has been awarded to Fuhrman Bros., of Ft. Wayne, for $45,572.

Bids for heating, plumbing, wiring and decorating the above building will soon be received.

Madisonville, Ky.—Shopbell & Harris, of Evansville, Ind., are stated to have been engaged to prepare plans for a 2-story bank building, 50x100 ft., for the Madisonville Savings Co., to cost $10,000.

Medford, Mass.—It is reported that the New England Telegraph & Telephone Co. will soon erect a brick building to cost about $15,000. Harry P. Horton, Mgr.

Detroit, Mich.—It is stated that Dinan Bros. have had plans prepared for a 3-story hotel to be erected at Fort and 3d Sts.

Bovey, Minn.—The Oliver Mining Co. is reported to be planning the erection of a $150,000 office building.

Thief River Falls, Minn.—Jos. Bell DeRemer, of Grand Forks, N. D., is reported preparing plans for a $75,000 2-story brick and stone department store which will be erected here for Rasmus Oen.

**Duluth, Minn.*—Chas. J. Lantry, of Kansas City, Mo., is reported to have secured the contract to construct the terminals in this city for the Wisconsin Terminal Co. Probable cost, $500,000.

**St. Paul, Minn.*—J. O. Linden, 596 E. Lawson St., has secured the contract for erecting hall and lodge room on Reaney St. for the Dayton Bluft Bldg. Co. for $15,000.

Omaha, Neb.—Fisher & Lawrie, Paxton Bldg., are stated to have been directed by Fairbanks, Morse & Co. to complete plans and ask bids for erecting a 6-story 66x132-ft. building to be erected in Omaha at a cost of approximately $70,000.

Schenectady, N. Y.—The Schenectady Illuminating Co. and the Mohawk Gas Co., it is reported, have completed plans for their new office building which will be located in Clinton St., and for the gas house that will be built in Villa Road. Estimated cost, $100,000.

**Canton, O.*—Wm. Shoof & Son, 1922 Tuscarawas St., is reported to have secured contract for erecting a brick office building 53x260 ft. on 1437 Pennsylvania Ave., for the Power-Electric Co., for $30,000.

*The Canton Provision Co. is reported to have let contract to Schillinger Bros. Co., Columbus, for new abattoir and packing house to cost $30,000.

Wilkinsburg, Pa.—A $20,000 brick natatorium, it is reported, has been planned by F. G. Schreihler, 700 Wood St., to be erected on Ross St. for S. Ament.

Greenburg, Pa.—It is reported that the Westmoreland National Bank will erect a $200,000 banking house on Main St., Greensburg, from plans made by Topp & Blair, of Pittsburg.

**Carnegie, Pa.*—A $50,000 brick and stone amusement hall and arcade, it is stated, is to be built at Carnegie for the Carnegie Arcade & Amusment Co. Dushane & Lewis, of Carnegie, are the contractors.

**Philadelphia, Pa.*—Thos. M. Seeds, Jr., is stated to have secured the contract to make additions and alterations to the Art Club House on Broad St., including the erection of 4 additional stories.

Pierre, S. D.—The Gas Belt Auditorium Co., of Pierre, is reported incorporated with a capital of $25,000, for the purpose of erecting a building for convention purposes. John L. Lockhart, John I. Newell and Chas. H. Anderson, incorporators.

Seattle, Wash.—Plans have been filed by the Independent Brewing Co. for a 4-story brick office building, 60x108 ft., to be built at 1518 Second Ave., at an estimated cost of $52,000. R. Robertson, Dexter H. Bank Bldg., is archt.

W. P. White, Washington Bldg., is stated to be preparing plans for a 5-story family hotel to be erected on Olive St. and 7th Ave. by Forester & Co. at an estimated cost of $80,000.

Monfort, Wis.—It is stated that bids will be received until July 31 by P. T. Stevens for erecting a building 27x40 ft. for the Masonic Lodge.

Toronto, Ont.—The Canadian General Electric Co., it is stated, intends erecting at King and Simcoe Sts. a 5-story fireproof, gray brick and terra cotta office building. Darling & Pearson, Mail Bldg., are the archts.

Ottawa, Ont.—It is stated that plans have been filed for the station and hotel to be erected by the Grand Trunk Ry. J. H. Johnston, Res. Engr., Ottawa). The station alone, it is reported, will cost $250,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—It is reported that bids are wanted for erecting a 10-story brick, stone and terra cotta apartment house at Government and Jackson Sts. Jas. A. Lewis is reported interested.

**Waterbury, Conn.*—The Fidelity Constr. Co., 953 Baldwin St., is reported to have secured the contract to erect a flat house on N. Riverside St. and W. Main St. for Chas. A. Colley at a cost of $12,000.

**New Haven, Conn.*—David H. Clark Co., 166 Brewery St., is reported to have secured the contract to erect a residence on Whalley Ave., for Prof. A. B. Woodford, to cost $22,000.

Washington, D. C.—The Southern Methodists, it is reported, are planning the erection of a national church at 9th and K Sts. and Massachusetts Ave., to cost about $300,000. Competitive plans will probably be asked. Dr. W. F. McMurry, of Louisville, Ky., Secy. of the Bd. of Church Extension, may be able to give further information.

**Addieville, Ill.*—It is stated that the contract to erect the German Evangelical Parochial Church at Addieville, has been awarded to Edw. Luecke, of St. Louis, Mo., at $17,000.

Chicago, Ill.—It is reported that Frank G. Gustafson will erect 2 apartment houses, one at Woodlawn Ave. and 48th St., and the other at Kenwood Ave. and 48th St., the total cost to be $100,000.

Des Moines, Ia.—N. T. Guernsey is reported to have awarded to Herbert Maine, the contract to erect a $20,-000 residence at Grand Ave. and 37th St.

Napoleonville, La.—The members of St. Napoleon Church are reported to be planning the erection of a $15,000 edifice.

**Quincy, Mich.*—It is reported that the Quincy Mining Co. has awarded to Edgar Rashleigh, of Houghton, the contract to erect 21 dwellings on the Mesnard location of the Quincy Co.'s property.

St. Paul, Minn.—C. P. Waldon is owner and builder for two sets of flat buildings on Fairmount Ave., near Grotto St., to cost $30,000.

St. Louis, Mo.—Aaron Fuller, Vice-Pres. of the Fuller Dry Goods Co., is reported to be having plans prepared for a $50,000 residence.

Kansas City, Mo.—The members of the Jackson Ave. Christian Church, it is stated, intend erecting a $25,000 edifice.

A permit has been granted to the Eastminster Presbyterian Church to erect a brick and stone edifice at 221 Walrond St. at a cost of $30,000.

Omaha, Neb.—Dr. Frank W. Stabaugh is reported to be considering the erection of a flat at 26th St. and Dewey Ave., to cost $25,000.

*W. H. Parrish, 2616 Burdette St., is reported to have secured the contract to erect a synagogue for the Russian Share Zion congregation at a cost of about $25,000.

Newark, N. J.—Plans have been filed for a 4-story brick dwelling to be erected at 9th St. and 6th Ave., at an estimated cost of $33,000. H. C. Schneider, owner.

**Painesville, O.*—It is reported that the contract to erect an edifice for the M. E. Church has been awarded to W. F. Milford, of Calumet, at $10,234.

Canton, O.—The contract for the new parsonage of St. Mary's R. C. Church is reported to have been awarded to J.L. Van Kirk, 1231 Worley Ave., for about $10,000.

Cincinnati, O.—It is reported that the Sh'erth Israel congregation is preparing to erect a $75,000 synagogue at Reading Road and Ridgway Ave., Avondale. co Stern, Pres. of the congregation.

John A. Payne is reported to be planning the erection of a residence at Rosehill, a part of Avondale, the cost to be $25,000.

Jenkintown, Pa.—It is reported that the stables adjoining the residence of John Wanamaker at Lyndenhurst, which was recently destroyed by fire, were destroyed by fire on July 21.

McDonald, Pa.—It is stated that plans are being prepared for a residence to be erected for Saml. Shane at a cost of $20,000.

**Pittsburg, Pa.*—S. G. Baldensperger is stated to have the contract for the A. J. Vilsack residence, to be erected on North Negley Ave, near Bryant St., at a cost of $19,000.

**Braddock, Pa.*—The Hodder Constr. Co. is reported to have the contract to erect a $20,000 brick apartment house on Talbot Ave for Simon C. Collins.

**Oakland, Pa.*—John Ehrlinger, 71 Van Braam St., Pittsburg, is reported to have secured the contract to erect a brick residence at Grant Boule. and Tennydon Ave., Oakland, for C. A. McFeely to cost about $20,000.

Seattle, Wash.—Plans have been filed for a 2-story addition to be erected to the Summit apartment house which will cost $35,000. The Gaffney estate is the owner.

**La Crosse, Wis.*—Albert L. Gutzke, 323 S. 16th St., is reported to have secured the contract to erect an edifice for the German Lutheran Church at $12,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Livingston, Ala.—School bonds amounting to $25,000 are reported sold.

Hon. John A. Rogers is reported to have donated 500 acres of land on the Trimble Pl., near the city, as a site for an agricultural school. $100,000 will be expended in buildings.

Humphrey, Ark.—It is stated that a $10,000 school is to be erected here.

Covina, Cal.—A. Harvey Collins, Superv. Principal, writes that the citizens on July 1 voted to issue $60,-000 bonds for a high school. Dr. J. D. Reed, Clk. Bd. School Trus.

Ontario, Cal.—It is stated that bids will be received until Aug. 10 by F. S. Allen, archt., Pasadena, for erecting a 1-story 160x190 brick high school; probable cost, $40,000.

Hartford, Conn.—The House has passed a bill appropriating $25,000 for the erection of a new building at the Connecticut School for Imbeciles.

The erection of an addition to cost $50,000 is reported under consideration.

**New London, Conn.*—H. R. Douglas, of Groton, is stated to have secured the contract to erect the Harbor School, including plumbing and electric lighting, at $70,-231.

Norwich, Conn.—The Bd. of Trus. of the Connecticut Agricultural College propose erecting new buildings for the Department of Horticulture. In all there are 5 buildings to be erected; a 2-story horticultural building, 40x70 ft.; 3 greenhouses, each 75 ft. in length, and a smaller greenhouse.

Peoria, Ill.—The Bd. of School Inspectors, it is stated, has accepted plans for the new wing at the High School, which is to cost $30,000, and bids for the construction will be received by the Bldg. Com. Aug. 2.

**Champaign, Ill.*—The contract for the erection of a school at Grove and Fifth Sts. is reported awarded to Chas. C. Gwinn. Contract price, $11,150.

**Princeton, Ind.*—A contract for the construction of the Sherman School, it is stated, has been awarded to Sparks & Shaffner, of Princeton.

**South Bend, Ind.*—The School Bd., it is reported, has awarded a contract to E. Burner & Co. for the construction of a school for $31,239.

Terre Haute, Ind.—It is reported that bids will be received until Aug. 5 by the Bd. Trus. Indiana State Normal School, for erecting a library for said school. J. F. Alexander & Son, Archts, Lafayette.

Norway, Ia.—The citizens are stated to have voted to issue $11,000 bonds for the erection of school. Address Clk. of Bd. Educ.

Pittsburg, Kan.—It is stated that bids will be received until July 30 by the Bd. Regents, State Normal School (L. B. Kellog, Secy.), at Emporia, for erecting a manual training school at Pittsburg. John E. Stanton, archt., Topeka.

Emporia, Kan.—It is stated that bids will be received until Aug. 1 by the Bd. Regents, State Normal School (L. B. Kellog, Secy.), for certain repairs and restoration of walls and foundations to the library, main building, steps and veranda at State Normal School, Emporia.

Owensboro, Ky.—It is reported that bids will be received until July 31 by the Bldg. Com. (C. G. Herr, Chmn.), Bd. Educ., for erecting an 8-room school at Grand and Hickman Aves.

Plaquemine, La.—It is reported that it is proposed to replace the St. John's Free Parochial School, recently destroyed by fire, with a 2-story brick structure to cost about $15,000. Rev. Father Holtgreve, pastor.

Portland, Me.—It is reported that the City Treas. will receive bids until July 29 for $55,000 school bonds.

Catonsville, Md.—It is stated that a $30,000 high school is to be erected here on Frederick Ave.

Haverhill, Mass.—All bids on the heating and ventilating and the plumbing work for the manual training school, it is stated, have been rejected by the committee, and new bids will be received.

Springfield, Mass.—Both boards of the City Council passed on second reading an ordinance authorizing the City Property Com. to erect a 4-room addition to Howard St. School at a cost not exceeding $16,000.

**Bay City, Mich.*—The contract for erecting Denison School (bids opened July 12), has been awarded to Jos. McLean, of Bay City, for $21,348; heating same to Wilson & Wauless, at $3,300. Architects, Clark & Munger, of Bay City.

Houghton, Mich.—It is stated that D. Fred. Charlton, of Marquette, has been engaged to prepare plans for the library and museum building, to be erected at the Michigan School of Mines, at a cost of $75,000.

St. Paul, Minn.—The Council is reported to have decided in favor of a bond issue of $645,000 for the erection of 4 new schools as follows: Sixth Ward school cost, $75,000, exclusive of site and shall accommodate 350 pupils; the East End building, $100,000, exclusive of site, and to seat 450 pupils; the Mechanic Arts building, near the present site of the Central high, $200,000, and to seat 800 pupils; the West End building, $225,000, and to seat 1,100 pupils.

**Duluth, Minn.*—Contracts for school improvements are stated to have been awarded as follows: To Schlenes & Danplaise to construct the superstructure of the Madison school for $23,870; to Stack Bros., 117 W. 1st St., plumbing and install gas in the Franklin school at $1,744.

The lowest bid received for installing a heating plant in Franklin school is stated to have been submitted by the American Htg. Co. at $7,450.

Newark, N. J.—Bids will be received until Aug. 1 (re-advertisement) by the Com. on Schoolhouses, Bd. Educ. (R. D. Argue, Secy.), for furnishing material and doing the mason and fireproofing required in the erection of an addition to the Burnet St. School. Frank F. Ward, Archt., 239 Roseville Ave.

Ravena, N. Y.—Bids will be received until July 31 by J. H. Cochran, Secy. School Bd., for furnishing material and erecting a school. Bids to be submitted as a whole or separately on the following: Masonry; carpentry; roofing; electric work; plumbing and heating. Fuller & Pitcher, archts., 95 State St., Albany.

Rochester, N. Y.—School bonds amounting to $75,000 have been sold.

Brooklyn, N. Y.—Bids will be received until Aug. 5 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing heating apparatus, and also installing electric elevators in the office and storage building for the Bd. of Educ., Boro. of Brooklyn.

Herkimer, N. Y.—It is stated that $35,000 school bonds have been sold, the proceeds to be used to purchase a site on German St. and erect a school.

**Richmond Hill, L. I., N. Y.*—The following are the bids opened on July 15 by C. B. J. Snyder, Supt. School Bldgs., N. Y. C., for general construction, etc., of School 56, Richmond Hill, Queens Boro.: F. T. Nesbitt & Co., 116 Nassau St., N. Y. City, $175,729 (awarded contract); Thos. McKeown, $191,700; Wm. Werner, $184,460; P. Gallagher, $183,953; Chas. H. Peckworth, $189,662; Jas. McArthur, $187,000, and Thos. Cockerill & Son, $183,300.

**Brooklyn, N. Y.*—The following are the bids opened on July 15 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 53, Brooklyn Boro.: Richard E. Heningham, $211,598; Kelly & Kelley, Inc., $217,359; P. Gallagher, 156 5th Ave., N. Y. City, $205,000 (awarded contract); John Auer & Sons, $214,670; Wm. Werner, $219,880; J. &

Items marked thus give the names of parties awarded contracts.

L. Moreland Co., $233,900; F. T. Nesbitt & Co., Inc., $218,748; Wm. H. Luth Co., $219,100; Geo. F. Driscoll, $216,880, and Jas. McArthur, $223,894.

**Patchogue, L. I., N. Y.*—M. E. O'Connor, of Brooklyn, is stated to have secured the contract to erect the 10-room brick school at about $60,000, not including heating and furnishing.

**Canton, N. Y.*—The Secy. St. Lawrence Univ. writes that the contract for constructing complete building for N. Y. State School of Agriculture, St. Lawrence Univ. (bids opened July 8), has been awarded to The Clemence Constr. Co., of Syracuse, for $75,471.

Balfour, N. D.—Bids will be received until Aug. 8 by the School Bd. (C. A. Gee, Clk.) for 2 steam heating plants, 1 tubular and 1 sectional, not to be less than 8 sections, or large enough to heat the present schoolhouse, 4 rooms, 30x30 ft., basement 30x40 ft., and 2 halls 10 ft. wide, requiring 26 radiators for the 4 rooms and 2 halls. All steam pipe leading from basement to rooms to be covered with asbestos and cement, all boilers to be covered with asbestos and bricked up over boilers. All joints to have steam cocks in all main pipes.

Tolley, N. D.—Bids will be received until Aug. 9 by D. C. Hair, Clk. School Bd., at the First Natl. Bank, for erecting a 4-room brick school. Wm. Zimmerman, archt., Scofield Blk., Minot.

**Wapakoneta, O.*—A. D. Pepple, Clk. School Bd., writes that the contract for erecting school (bids opened July 19) has been awarded as follows: Brick and stone work and structural steel to the Buckeye Churn Co., Sidney, O., for $11,390; balance contract to J. M. Hemmiel, Wapakoneta, O., $19,683.

Sandusky, O.—W. E. Carter, Clk. Bd. Educ., writes that bids will be received on July 29 for heating, plumbing, gas piping and electric wiring addition to 7th Ward School.

*The contract for erecting addition to 7th Ward School (bids opened July 12), has been awarded to Lorenz Zorbach, of Central Ave., for $30,200.

Eugene, Ore.—The Trus. of the Divinity School are said to be planning the erection of a brick and stone building to cost $30,000.

**Providence, R. I.*—Contracts for heating apparatus in several schools have been awarded, according to reports, by the Com. on City Property as follows: G. E. Haslam & Co., 147 S. Main St., Academy Ave., $3,968; Benefit St., $2,920; Charles St., $3,110; Killingly St., $1,159; Atwell's Ave. Allen Fire Department Supply Co., Friendship and Eddy Sts., $1,748; Beacon Ave. Thos. I. Hudson, 15 Cranston St., $2,196; California Ave., H. B. Smith Co., 11 S. Main St., $1,200; Harris Ave., $1,200; Messer St., $4,111; Sisson St., $1,200. Eddy St., J. F. Keenan, 42 Beacon St., $1,200. Elmwood Ave., Cox & Stone, $1,657.77. Peace St., Cox & Stone, $3,968; Ring St., $1,281.

Providence, R. I.—See "Power Plants, Gas and Electricity.

Lead, S. D.—Bids will be received by Carrie M. Voight, Clk. Bd. of Educ., until Aug. 1 for furnishing and installing complete blast steam heating and ventilating plants, with central boiler plant, for the high school and Assembly Hall buildings, as advertised in The Engineering Record.

Highmore, S. D.—Bids will be received until Aug. 12 by the Bd. Regents (Irwin D. Aldrich, Secy), at Spearfish for erecting a barn, granary, corn cribs, and exhibit house and an employees' house and putting down and equipping a well on the grounds of the State Experiment Farm at Highmore.

Spearfish, S. D.—Bids will be received until Aug. 20 by the Regents of Educ. (Irwin D. Aldrich, Secy.) care Cataract Hotel, Sioux Falls, for the completion and equipment of the main building at the Spearfish Normal School. Jos. Schwarz, Archt., Sioux Falls.

Aberdeen, S. D.—Official reports state that bids will be received until Aug. 12 by the Regents of Educ. (Irwin D. Aldrich, Secy.) at Spearfish, for erecting a school on the grounds of the Northern Normal and Industrial School at Aberdeen. W. M. Kenyon, Archt., Minneapolis, Minn.

**Smithville, Tex.*—It is stated that the contract to erect a 12-room brick school has been awarded to M. M. Turney, of Smithville, at $17,600.

Ephraim, Utah.—It is reported that $30,000 bonds have been voted for the erection of an 18-room school. Address Clk. Bd. of Educ.

**Norfolk, Va.*—I. J. Lawler & Co., of Norfolk, are stated to have the contract for installing a modern system of plumbing in Atlantic City School No. 1, at $1,809.

La Crosse, Wis.—Van Ryn & De Gelleke, of Milwaukee, are stated to be preparing plans for the State Normal School at La Crosse.

West Allis, Wis.—It is stated that the Bd. of Educ. has adopted plans for a school to cost $18,000. Address Clk. of the Bd.

Green Bay, Wis.—Jos. C. Llewellyn, of Chicago, Ill., is stated to be preparing plans for the West High School, which is to cost about $75,000.

Beloit, Wis.—J. C. Llewellyn, of Chicago, Ill., has prepared plans for a $[illegible] high school to be erected at this place. Address Clk. Board Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Vincennes, Ind.—It is reported that lightning on July 19 destroyed the Vincennes garbage reduction works.

Newport, Ky.—The Bd. of Aldermen is reported to have authorized the Supt. of Pub. Wks. to procure bids for the disposal of garbage.

Brooklyn, N. Y.—Separate bids will be received on contracts 1 and 2 until Aug. 1 (readvertisement) by W. Bensel, Comr. Street Cleaning, New York City, for furnishing material and labor required for the final disposition of all ashes, street sweepings and rubbish in the Boro. Brooklyn, for a period of 5 years, beginning the 28th of Oct., 1907.

Ft. Myer, Va.—The following are the bids opened on July 17 by Capt. B. B. Hyer, Constr. Q. M., U. S. A., for constructing a garbage crematory of 12 tons capacity: Lewis & Kitchen, Chicago, $6,875; W. H. McCray, Washington, $3,562 (building only); Morse-Boulger Co., New York, $6,250; Dixon Eng. & Constr. Co., Toledo, O., $7,865.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Ensley, Ala.—J. W. Barr, Supt. of the steel plant division of the Tennessee Coal, Iron & R. R. Co. is stated to have announced that that company will build a steel mill at Ensley with four 100-ton furnaces each, the contract to be let at once.

Rockford, Ill.—The Redin, Ekstrom & Co., of 7th St., are said to be contemplating the erection of a machine shop 50x100 ft. in the southeast end of the city.

Waukegan, Ill.—The Corn Products Refining Co. will, it is reported, enlarge its glucose plant here by building 20 reinforced concrete grain tanks at a cost of about $75,000. Each will be about 20 ft. in diameter and 85 ft. high, with a capacity of about 20,000 bushels ea.

Indian Harbor, Ind.—The American Steel Foundry Co.'s plant, which was badly damaged by fire, it is reported, is to be rebuilt.

Valley Junction, Ia.—The Valley Junction Cold Storage & Ice Manufacturing Co. is reported formed by E. F. Wagner, H. T. Seyfert and W. P. Irwin for the purpose of constructing a plant costing about $25,000, equipped with the latest machinery for the manufacture of ice, the capacity of the plant being about 25 tons a day.

Davenport, Ia.—It is stated that Frank & Co. are having plans prepared for a foundry which they propose erecting in West Davenport.

Ishpeming, Mich.—The Detroit Iron & Steel Co., it is reported, has decided to double its present capacity of 350 tons of pig iron a day. The enlarged plant will occupy 30 acres of ground, and construction will be started at once. D. R. Hanna, of Cleveland, is Pres. of the company, and Chas. W. Baird, Secy. and Treas.

Virginia, Minn.—J. J. Wagenstein, of Duluth, is said to be preparing plans and specifications for the Virginia Machine & Foundry Co. for a building 130x40 ft. which will be used for a foundry, machine and blacksmith shop. The boiler room will be 25x32 ft.

Duluth, Minn.—The People's Brewing Co., Rm. 400, Burrows Bldg., it is reported, has awarded the contract for the construction of its new building at Oneota to Bollinger Bros., of Pittsburg, Pa. The building will cost $140,000, which cost includes both the building and equipping of the plant, but not the stables, office, etc. Plans and specifications are now being prepared by Bollinger Bros. for the office building. The buildings comprising the plant proper will be of steel, stone, brick and concrete construction. The machinery will all be electrically driven by individual motors. The brewhouse will contain a 175-barrel kettle. There will be two 150 h.-p. boilers and two 40-ton ice machines. Two 40 k. w. generators for power and light purposes. The building will be about 170 ft. x 120 ft, and will be 4 stories high and a tower.

Jersey City, N. J.—Wm. R. Hervey, of Far Rockaway, is stated to have accepted plans prepared by Edw. M. Patterson for a reinforced concrete factory 50x100 ft., which he will erect on 9th St. near Henderson St. at a cost of about $25,000.

Catasauqua, N. Y.—It is reported that about $600,000 will be expended by the Thomas Iron Co. in improvements to its furnaces and railroad facilities. Work will commence at once on a stock railroad leading the Lehigh Valley line to the rear of the furnaces at Hokendauqua. It will run on a high trestle and will cost $400,0000.

Lyons, N. Y.—The New York Car & Truck Co., of Kingston, N. Y., is reported to be considering the removal of its plant to Lyons. The concern is capitalized at $2,500,000, anad manufactures motor trucks for trolley cars, motor snowplows, springs, bolts and automobiles.

Castalia, O.—The Standard Portland Cement Co. is reported incorporated to erect a cement plant here to have a capacity of 2,000 bbls. per day.

Sydney, O.—It is reported that the plant of the American Steel Scraper Co., which was badly damaged by fire recently, will be rebuilt at once.

Canton, O.—The United Steel Co. is reported to have decided to erect a new addition 60x120 ft. with new machinery at a cost of $50,000.

Allegheny, Pa.—The plant of the Cream City Woven Wire Co. on Rebecca St. is reported destroyed by fire.

**Pittsburg, Pa.*—E. C. Wilcox Co., 8 Wood St., is reported to have received the contract for constructing a 4-story brick manufacturing plant and warehouse addition on Penn Ave., near 25th St., for the Pittsburg Screw & Bolt Co., 25th and Liberty Sts. Rutan & Russell, First National Bank Bldg., prepared the plans.

Carlisle, Pa.—The Bellaire Shoe Co. is reported incorporated with D. T. Wister, Pres., and Chas. B. Wagner, Secy., to construct a 3-story brick and cement block factory on W. North St. A part of the machinery will be run by dynamos, also a boiler installed which will consume the gas and dust.

Reading, Pa.—Several additions are to be made, according to reports, to the Reading Iron Co.'s plant. One will be a socket mill, 150x200 ft. A new pipe mill for the manufacture of the larger sizes of wrought iron pipe. All the furnaces are to be heated by gas. The size of pipe to be made will range from 6 to 18 in.

Aberdeen, S. D.—Armour & Co., it is stated, intends establishing a packing plant here to cost about $500,000.

Chattanooga, Tenn.—Jas. A. Wiggs, Jr., owner of the Southern Car Mfg. & Supply Co., of Beaumont, Tex., it is stated, has decided to remove his plant to Chattanooga, and has engaged Adams & Alsup to prepare the plans for the buildings and placed a contract with the Converse Bridge Co. for the steel work. A machine shop 100x170 ft. will be built at once and will be as nearly fireproof as possible. Nothing except steel and concrete will be used in the structure even the window sashes and frames will be of galvanized iron, and the roof of tiling.

Milwaukee, Wis.—The Peoples' Pure Ice Co. is state dto have filed articles of incorporation for the purpose of establishing an artificial ice manufacturing plant on River St., near Juneau Ave. The can system and best machinery will be installed. Arthur L. Richards is reported interested.

The new Federal Rubber Co., which recently purchased the assets of the Milwaukee Rubber Co., it is stated, plans to increase its capital from $100,000 to $620,000. The Federal Co. will enlarge the present plant and build additional works for the recovery of rubber from rubber waste at a site where water and good shipping facilities are available.

Cuba City, Wis.—Plans are reported prepared for a mill to be erected in Cuba City by the Vandeventer Lead & Zinc Co., and provide for a 50-ton concentrator.

Hamilton, Ont.—Plans are reported being prepared by Stewart & Witton, of Hamilton, for a $75,000 building for the Canada Steel Goods Co., Ltd., of Hamilton.

Chatham, Ont.—It is reported that the by-law to grant a loan of $20,000 to the Wolverine Brass Goods Mfg. Co., of Grand Rapids, Mich., was carried at Chatham, Ont. This company will establish a plant, to be in running order by January, 1908. They will give employment to 100 workmen.

Brockville, Ont.—The Brockville Malleable Iron Co., it is stated, is being organized in Brockville with local capital. The directors purpose to establish a plant capable of reducing either 5 tons or 10 tons of castings daily.

Peterboro, Ont.—The Colonial Weaving Co., of Peterboro, it is reported, will erect a new factory 200x60 ft. and install machinery costing $30,000, provided certain conditions are forthcoming from the city. These, it is stated, will likely be granted.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Piggott, Ark.*—Geo. W. Seitz, Secy. Dirs. St. Francis Drainage Dist., of Clay and Green Counties, writes that the contract for constructing ditches (bids opened July 16) has been awarded to A. V. Wills &Sons, of Malden, Mo., at 10.44 cts. per cu. yd. Contract for levee work not yet let.

Arkansas City, Ark.—It is reported that bids will be received Aug. 5 by W. E. Meeks, Co. Clk., for constructing drains and ditches in Drainage Dist. No. 1, approximately 600,000 yds.

New London, Conn.—Bids will be received by Maj. Harry Taylor, Corps Engrs., U. S. A., until Aug. 19 for dredging at mouth of Connecticut River, Conn., as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until July 30 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing a quantity of naval supplies at the various navy yards, etc., as follows: Portsmouth, N. H., Schedule 111—Sheet and angle steel. Schedule 116—Electrical wire, key sockets. Boston, Mass., Sch. 107—Bar steel. Sch. 109—Brass bolts, steel bolts and nuts, eyebolts, hose clamps, files, screws, etc. Sch. 111—Phosphor and rolled bronze, sheet copper and iron, silver and wiping solder, bar steel. Sch. 112—Asbestos cement and packing, etc. Sch. 114—Iron pipe, cocks, valves. Newport, R. I., Sch. 101—Sewer pipe and fittings, extending sewer. Sch. 111—Rolled bronze, brass rod, ebonite. New York, N. Y., Sch. 99—Gravel, sand, grit. Sch. 102—Iron doors, ventilators, etc., copper gutter, rails, spikes, etc., steel trusses, cast-iron pipe and specials, hydrants. Sch. 103—Electrical conduit, wire, and supplies, electric light posts, brick, Portland cement, lime, sand, roofing material, lumber, ties. Schedule 105—Boiler, feed pump, windlass. Sch. 106—Air hose, galvanized pipe. Sch. 108—Railroad track, dump cars. Sch. 114—Copper and lead pipe, valves. League Island, Pa., Sch. 102—Purchases, jacks, tools. Sch. 107—Sheet brass and copper, bronze rod, hardware, valves, copper pipe. Washington, D. C., Sch. 99—Electrical cable, curb stone machine, asphalt paving blocks. Sch. 102—Steel balls, steel, grease cups, brass tubing. Sch. 111—Tool steel. Norfolk, Va., Sch. 87—Construction of brick magazine. Sch. 114—Iron pipe. Charleston, S. C., Sch. 104—Motor drive outfits. Sch. 105—Fuel oil forges. Pensacola, Fla., Sch. 96—Creosoted ties. Sch. 97—Electrical supplies, vulcanized rubber, etc. Sch. 98—Steel rivets, bolts and nuts, packing. Mare Island, Cal., and San Francisco, Cal. Sch. 89—Electrical wire. Sch. 90—Corrugated sheet steel. Puget Sound, Wash., Sch. 88—Submarine telegraph cable, Portland cement, fir, c. i. pipe and specials, wrought-iron pipe, valves, hydrants. Sch. 89—Annunciators, searchlight mirror. Sch. 91—Pig and Norway iron, bar steel, steel floor plates. Sch. 92—Hardware, iron chain. Applications for proposals should designate Schedule desired by number. E. B. Rogers, Paymaster-Gen., U. S. N.

Key West, Fla.—Bids will be received until Aug. 14 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing a new breakwater wall at the U. S. Marine Hospital, Key West.

Savannah, Ga.—Bids will be received by Lieut.-Col. Dan. C. Kingman, Corps Engrs., U. S. A., until Aug. 23 for dredging Skidaway Narrows, Ga., as advertised in The Engineering Record.

Brunswick, Ga.—Bids will be received by Lieut.-Col. Dan. C. Kingman, Corps Engrs., U. S. A., Savannah, until Aug. 22 for dredging in inner and outer harbor at Brunswick, as advertised in The Engineering Record.

Hoopple, Ill.—Bids will be received until Aug. 2 by the Comrs., Drainage Dist. No. 1, Township 18, Range 5 (A. J. Soliday, Chmn.), for the deepening and widening of the main ditch in said drainage district, requiring the removal of about 150,000 cu. yds. materials. F. W. Sears, Engr., Prophetstown.

Richmond, Ind.—See "Sewerage and Sewage Disposal."

Sibley, Ia.—Bids will be received by the Bd. of Superv. of Osceola County until Sept. 10 for the construction of an open ditch requiring about 103,000 cu. yds. excav.,

* *Items marked thus give the names of parties awarded contracts.*

as advertised in The Engineering Record. V. A. Burley, Co. Aud.

Northwood, Ia.—It is stated that bids will be received until Aug. 1 by Iver Iverson, Jr., Co. Aud., for constructing a ditch and tile drain.

Des Moines, Ia.—The City Council on July 17 instructed the Bd. of Pub. Wks. to again ask for bids on the improvement of Raccoon and Des Moines Rivers. Geo. D. Dobson, City Engr.

New Orleans, La.—Bids will be received until Aug. 2 by the Bd. Comrs., Orleans Levee Dist. (T. J. Duggan, Secy.), Rm. 15, Masonic Temple, for constructing a levee and revetment on Dublin St., requiring about 90,000 cu. yds. earthwork and about 77,000 ft. B. M. creosoted pine lumber on 7th St., requiring about 100,000 cu. yds. earthwork; also same place until July 30 for $175,000 Orleans Levee Dist. bonds.

Charles Crawford, Foster Ave. and E. 16th St., *a* 85 cts., *b* $114,750; O'Brien Bros., Inc., 54 South St., *a* 64 cts., *b* $86,400.

Bids will be received until Aug. 7 by Bird S. Coler, Boro. Pres. on the percentage bid system for furnishing material and constructing a crib bulkhead on the 8th Ward Market, bet. 36th and 38th Sts., 2 Ave. and New York Bay. Engineer's preliminary estimate of total cost, $156,934.

New York, N. Y.—The following are the bids opened on July 17 by Col. John G. D. Knight, Corps. Engrs., U. S. A., for dredging in Hudson River, price per cu. yd., scow meas.: The Newburg Dredging Co., Newburg, 24.9 cts.; The International Contracting Co., 17 Battery Pl., 29.8 cts.; Maritime Dredging Co., 78 Broad St., 29.5 cts.; Morris & Cummings Dredging Co., 17 State St., 37 cts.

Bids will be received by the Comrs. of Parks (Moses Herrman, Pres.) for furnishing and delivering 2,000 cu. yds. broken stone of trap rock and 2,000 cu. yds. screenings of trap rock (No. 3, 1907) for parks, Boro. of the Bronx.

Bids will be received until Aug. 6 by J. A. Bensel, Comr. of Docks, for furnishing material and building a new pier at the ft. of James Sl., and for preparing for and building a new bulkhead platform easterly from Boro. Manhattan, as per contract No. 1085. said pier, between James Sl. and Oliver St., East River,

Philadelphia, Pa.—Bids will be received by Maj. J. C. Sanford, Corps Engrs., U. S. A., Philadelphia, until Aug. 12, for dredging in Delaware Bay, at Perrwig Bar, as advertised in The Engineering Record.

A permit has been granted to W. W. Lindsay & Co., Harrison Bldg., to erect for the city a structural steel and reinforced concrete coal elevator 23x34 ft., with a coal pocket and trestle for coal cars and steel coal bins at the Torresdale filtration plant.

Block Island, R. I.—The following are the bids opened on July 17 by Lieut.-Col. J. H. Willard, Corps. Engrs., U. S. A., Newport, for dredging in Block Island (price given per cu. yd.: J. S. Packard Dredging Co., 425 Angell St., Providence, R. I., 40 cts.; Chas. M. Cole, Fall River, Mass., 38 cts., and Maritime Dredging Co., 78 Broad St., New York, N. Y., 39½ cts.

Galveston, Tex.—Bids will be received until Aug. 16 by Capt. John C. Oakes, Corps Engrs., U. S. A., Galveston, for jetty work at mouth of Brazos River, Tex.

**Ft. Morgan, Ala.*—The following are the bds opened on July 12 by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, for constructing sea wall at Ft. Morgan: (*a*) Chas. Clarke, Galveston, Tex. (recommended for award), (*b*) Christie & Lowe, 171 La Salle St., Chicago, Ill.; (*c*) Walsh-McLellan Contr. Co., Mobile; (*d*) Lane Bros. Co., Esmont, Va.

	*a	b	c	d
43,000 cu. yds. excav., sand, etc	$0.35	$0.60	$0.30	$0.48
19,000 cu. yds. concrete	7.38	8.00	15.00	9.00
1,910 M ft. sheet piling	38.00	60.00	45.00	50.00
290 M. ft. sheet piling, creosoted	66.50	100.00	75.00	75.00
20,000 sht. tons riprap, hand placed	4.14	4.40	9.00	5.00
14,500 lbs. iron dowels	.0725	.05	.10	.06
1,750 lin. ft. drilling for dowels	.63	.40	.10	.30
300 lin. ft. vitr. pipe	.45	.30	.20	.50
Totals	$332,224	$410,915	$587,285	$410,435

**Collinston, La.*—The contract for construction work and digging canal for the Coulee Drainage Dist. is reported to have been awarded to Security Constr. Co., of Royal Center, O., at 12 cents per cu. yd., including the clearing of a 75-ft. right of way.

Ft. St. Philip, La.—The only received by Col. E. H. Ruffner, Corps Engrs., U. S. A., New Orleans, on July 15 for constructing sea wall at Ft. St. Philip was submitted by Christie & Lowe, 107 Camp St., New Orleans, for $105,100.

Lowrence, Mass.—It is reported that bids are wanted by Bellevue Cemetery Dirs. until July 30 for the construction of a concrete receiving vault, reinforced roof, stone entrance, 50x50 estimated cost, $13,000. Wm. Lord, Supt.

Detroit, Mich.—The following are the bids opened on July 3 by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., for dredging at Sect. 4, Plan B, Detroit River, about 3,500,000 cu. yds. (*a*), price per cu. yd.; (*b*), total: G. H. Breymann & Bros., Toledo, O., *a*, 25.5 cts.; *b*, $895,500; Arthur H. Vogel, Milwaukee, Wis., *a*, 26.5 cts.; *b*, $927,500; Detroit Dredging Co., Detroit, Mich., *a*, 30 cts.; *b*, $1,050,000; Lake Erie Dredging Co., *a*, 30.5 cts.; *b*, $1,067,500; Buffalo Dredging Co., Buffalo, N. Y., *a*, 32 cts.; *b*, $1,120,000; Great Lakes Dredge & Dock Co., Chicago, Ill., *a*, 35 cts.; *b*, $1,225,000.

Bids were opened same time and place for hire of dredging plant for use in Alpena harbor, and M. Sullivan, of Buffalo, bid for this work $25 per hour.

Fergus Falls, Minn.—The Co. Comrs. are reported to have decided to order the construction of a ditch in Eastern and Effington, and bids will be received early in Aug. About 45,000 cu. yds. earth will be removed; estimated cost, $8,319.

St. Paul, Minn.—An appropriation of $1,600,000 for the improvement of the Missouri River is reported recommended by Capt. E. Schulz, Engr. in charge, in his annual report to Gen. A. MacKenzie. He also asks for $250,000 to maintain improvements between the mouth of river and Sioux City and $100,000 between Sioux City and Ft. Benton.

Kansas City, Mo.—Bids will be received until July 30 by the Bd. Pub. Wks. (Everett Elliott, Secy.) on vacuum cleaning system and 2 direct-connected electric elevators for the general hospital, 24th and Locust Sts.

Ft. Omaha, Neb.—Bids will be received until Aug. 8 by Maj. Thos. Cruse, Q. M., Army Bldg., Omaha, for constructing a balloon house, a hydrogen gas house and wireless telegraph station at Ft. Omaha.

Portsmouth, N. H.—Bids will be received until Aug. 10 by R. C. Hollyday, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for filling in back of quay wall, navy yard, Portsmouth, as per specification No. 1550. Est. cost, $42,000.

Albany, N. Y.—F. C. Stevens, State Supt. Pub. Wks., writes that no bids were received on July 18 for arch culvert or aqueduct at Durhamville, near the city of Oneida.

Governors Island, N. Y. H., N. Y.—Bids will be received by Lieut.-Col. W. L. Marshall, Corps Engr., U. S. A., N. Y. City, until Aug. 26, for furnishing material and building an embankment at Governors Island, N. Y. H., as advertised in The Engineering Record.

Cincinnati, O.—The Park Comn. is reported to have formally asked the Bd. of Pub. Service to petition Council for $100,000 for the construction of a parkway between Burnett Woods and Eden Park.

The following are reported to be the bids opened on July 18 by Lieut.-Col. T. Rossell, Corps Engrs., U. S. A., for constructing dam of concrete, etc., at head of Brown's Island, Ohio River: P. C. Tennur, Louisa, Ky., $55,006, and J. C. Thomas, of Bellaire, O., $74,614.

**Cleveland, O.*—The Buckeye Constr. Co., of Cleveland, has secured contracts for repair of jetties as follows (bids opened June 20 by Lieut.-Col. C. McD. Townsend), Port Clinton harbor, 1,800 tons heavy rip rap stone, $1.85, and 200 tons small rip rap stone, $1.65, and in Vermillion harbor 2,500 tons paving stone, $2.80; 3,500 tons heavy rip rap stone, $1.80; 300 tons small rip rap stone, $1, and 650 lin. ft. preparing old jetties, $3.

*The following are the bids opened on July 5 by Lieut.-Col. C. McD. Townscend, Corps. Engrs., U. S. A., for 800,000 cu. yds. dredging in Cleveland harbor (price given per cu. yd.): Daly & Hannan Dredging Co., Ogdensburg, N. Y., 17.5 cts.; G. H. Breymann & Bros., Toledo, 22 cts.; Great Lakes Dredge & Dock Co., Chicago, Ill., 13.95 cts. (awarded contract); Graves & Stephens, Cleveland, O., 15.5 cts., and Great Lakes Dredging Co., Buffalo, N. Y., 22 cts.

Panama.—Bids will be received until Aug. 2 by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing dump cars.

Bids will be received until Aug. 12 by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing 3 steel dump cars, as per circular No. 380.

Harrisburg, Pa.—Gov. Stuart is reported to have approved the application of the Pure Oil Pipe Line Co., in which ex-Senator Lewis Emery, Jr., is said to be interested for a new pipe line through the southern tier of counties. According to the survey the line is to start in Henry Clay Township, Fayette County, and to end at Marcus Hook, on the Delaware River, traversing Fayette, Somerset, Bedford, Fulton, Franklin, Adams, York, Lancaster, Chester and Delaware Counties. The application was made at Philadelphia by Michael Murphy, Pres.

Norfolk, Va.—The following are the bids opened on June 29 by Maj. Jos. E. Kuhn, Corps Engrs., U. S. A., for dredging harbor at Norfolk, about 7,600,000 cu. yds. (price given per cu. yd.): American Dreding Co., Philadelphia, Pa., 7.45 cts.; Maryland Dredging & Contr. Co., Baltimore, Md., 7.5 cts.; P. Sanford Ross, Inc., Jersey City, N. J., 12.24 cts.; Norfolk Dredging Co., Norfolk, Va., 11.75 cts.; Morris & Cummings Dredging Co, New York, N. Y., 9 cts.; Coastwise Dredging Co., Norfolk, Va., 7.3 cts. (lowest bidder), and Standard Dredging Co., Wilmington, Del., 8.2 cts.

*The Bd. of Control is reported to have awarded contract to the Trussed Concrete Steel Co., 403 Wilson Bld., Baltimore, Md., for the trussed steel bars to be used in improving Little Creek dam, for which $18,000 has been appropriated.

Seattle, Wash.—The following the the bids opened on July 12 by Maj. H. M. Chittenden, Corps. Engrs., U. S. A., for dredging (*a*) Grays Harbor, 12,000,000 cu. yds.; (*b*) Wellapa River, 84,000 cu. yds. (price given per cu. yd.): Puget Sound Bridge & Dredging Co., Seattle, *a* 16.9 cts., *b* 26.9 cts.; Richmond Dredging Co., San Francisco, Cal., *a* 18.75 cts., *b* 31 cts.; North American Dredging Co., San Francisco, Cal., *a* 15.5 cts., *b* 26 cts.; International Contract Co., Seattle, *a* 19.3 cts., *b* 2 .27 cts.

Bremerton, Wash.—Bids will be received at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until Aug. 24 for constructing a concrete quay wall at the Puget Sound Navy Yard, Bremerton, Wash., as per Specification No. 1551.

Ashland, Wis.—Press reports state that the Chicago & Northwestern Ry. Co. (E. C. Carter, Ch. Eng., Chicago, Ill.) will construct an ore dock in Ashland this winter to cost about $500,000.

Peterboro, Ont.—Bids will be received until Aug. 7 by Alex. J. Grant, Supt. Engr., Trent Canal, Peterboro, for the works connected with the construction of Sec. 5, Ontario-Rice Lake Div. of the canal.

**Irvine, Ky.*—Bids were opened on June 4 by Maj. J. G. Warren, Corps Engrs., U. S. A., Cincinnati, O., for constructing Lock and Dam 12, Kentucky River, near Irvine, Ky. Figures were submitted on two plans, and the following are the totals of bids on both plans, also the detail bids on Plan 1: (*a*) Sheridan-Kirk Contract Co., Cincinnati, O., Plan 1, $406,393; Plan 2, $447,429. (*b*) The Hollerbach & May Contract Co., Evansville, Ind., Plan 1, $412,352; Plan 2, $451,112. (*c*) Mason, Hanger & Coleman Co., Richmond, Ky., Plan 1, $496,780; Plan 2, $545,875. (*d*) H. E. Talbott & Co., Dayton, O., Plan 1, $395,669; Plan 2, $434,329. (*e*) Bates & Rogers Construction Co., Chicago, Ill., Plan 1, $514,222; Plan 2, $563,347. (*f*) Ohio River Contract Co., Evansville, Ind., Plan 1, $381,309 (awarded contract); Plan 2, $417,469.

Plan 1—	a	b	c	d	e	*f
88,000 cu. yds. earth excav	$0.58	$0.30	$0.70	$0.45	$0.55	$0.35
200 cu. yds. rock excav.	2.00	3.00	4.00	2.50	4.00	2.00
62,000 cu. yds. embankment	.40	.30	.55	.45	.50	.47
1,800 cu. yds. ballast	2.24	2.50	2.50	1.70	2.60	1.35
35,450 cu. yds. concrete	5.30	6.40	7.15	5.50	8.15	5.00
2,300 cu.yds. paving	9.75	6.00	6.00	7.50	7.00	6.50
1,000 tons Derrick stone	1.70	3.00	3.00	3.00	2.50	2.50
1,200 sq. yds. riprap	2.75	3.00	2.00	2.50	2.00	2.50
37,800 bbls. cement	2.14	2.50	2.30	2.10	2.35	2.40
12 M. ft. B. M. timber	80.00	125.00	100.00	100.00	65.00	100.00
50 M. ft. B. M. shoring	60.00	50.00	60.00	40.00	55.00	100.00
310,000 lbs. iron and steel	.08	.05	.10	.075	.08	.075
45 lin. ft. gages	2.00	3.00	1.00	3.00	2.00	2.00
175 lin. ft. drains	.75	.50	.30	.25	1.00	.45
2,500 lin. ft. fencing	.375	.30	.35	.15	.80	.20

Brooklyn, N. Y.—The following are the bids opened on July 18 by the Dept. of Parks, N. Y. City, for furnishing material and constructing rip-rap sea wall along Bay Ridge Parkway, from Wakeman Pl. to Ft. Hamilton Ave., Boro. of Brooklyn, (*a*) price per ton for 135,000 tons rip-rap, (*b*) totals: Bruker Contr. Co., 21 and 24 State St., *a* 83 cts., *b* $112,050; F. W. Catlin Contr. Co., 307 Washington St., Bklyn., *a* 83 cts.; *b* $112,050;

PROPOSALS OPEN.

For Proposals see Pages 70, 71, 72, 73 and 74.

WATER.

Bids Close.		See Eng. Record
Jul. 29.	Filters, West Point, N. Y. Adv. Jul. 13 to 27.	Jul. 13
Jul. 31.	Water wks., North Battleford, Sask.	Jun. 22
Aug. 1.	Water works, Graham, Tex.	Jul. 13
Aug. 1.	Mains, Jamestown, N. Y. Adv. Jul. 13 to 27.	Jul. 13
Aug. 1.	Canal, Milner, Idaho	Jul. 13
Aug. 1.	Water works, Bradshaw, Neb.	Jul. 20
Aug. 1.	Water works, Cheweiah, Wash.	Jul. 20
Aug. 1.	Pump engine, Gloucester City, N. J.	Jul. 27
Aug. 2.	Pipe hydrants, etc., Withee, Wis.	Jul. 27
Aug. 3.	Meters and connections, Norwood, O. Adv. Jul. 20, 27.	Jul. 20
Aug. 3.	Water wks., Chesterton, Ind. Adv. Jul. 27.	Jul. 27
Aug. 3.	Mains, Newark, Del.	Jul. 27
Aug. 5.	Reservoir, etc., Ft. Adams, R. I. Adv. Jul. 13 to 27.	Jul. 13
Aug. 5.	Pump engine for sale, Sandusky, O. Adv. Jul. 6, 13.	Jul. 6
Aug. 5.	Boilers, Wahpeton, N. D.	Jul. 20
Aug. 5.	System at Poor Farm, Decorah, Ia.	Jul. 20
Aug. 6.	Dams, New York, N. Y. Adv. Jul. 6 to 27.	Jul. 6
Aug. 6.	System, Speed, Miss.	Jul. 20
Aug. 6.	Main extension, Cherokee, Ia.	Jul. 20
Aug. 7.	Filter plant, Steelton, Pa. Adv. Jul. 20, 27.	Jul. 20
Aug. 8.	Well, Catoosa Springs, Ga.	Jul. 20
Aug. 8.	Pumping plant, Long Island City, N. Y.	Jul. 27
Aug. 9.	Filtration plant, Ft. Hancock, N. J. Adv. Jul. 13 to 27.	Jul. 13
Aug. 12.	Water works, Belle Plaine, Minn.	Jul. 27
Aug. 12.	Well, Highmore, S. D.	Jul. 27
Aug. 13.	Reservoir, Columbus, O.	Jul. 20
Aug. 19.	Filter plans, Sacramento, Cal. Adv. Jun. 1 to 15.	Jun. 1
Aug. 20.	Water wks., Russellville, Ark. Adv. Jul. 13 to 27.	Jul. 20
Aug. 21.	Dam and tunnel, Springfield, Mass. Adv. Jul. 27.	Jul. 27
Aug. 21.	Well strainer, Ft. Hancock, N. J.	Jul. 27
Aug. 22.	Filters and pipe exten., Philadelphia, Pa. Adv. Jul. 27.	Jul. 27
Aug. —.	Water wks., Rockingham, N. C.	June. 29
Sep. 4.	Hauling and laying pipe, New Orleans, La. Adv. Jun. 29 to Jul. 27	Jun. 29
Sep. 8.	Pump engine, boilers, etc., Louisville, Ky. Adv. Jul. 27.	Jul. 27
Sep. 14.	Valves and gates, Manila, P. I. Adv. Jul. 27.	Jul. 27
——	Pump station, Poteau, Ind. Ter.	Jul. 13

SEWERAGE AND SEWAGE DISPOSAL.

Jul. 30.	Sharon, Pa.	Jul. 20
Jul. 30.	Napoleon, O.	Jul. 20
Jul. 30.	St. George, S. I.	Jul. 20
Jul. 30.	Wilmington, Del.	Jul. 27
Jul. 30.	Toronto, Ont.	Jul. 27
Jul. 31.	North Battleford, Sask.	Jun. 22
Jul. 31.	Eureka, Kan.	Jul. 6

* *Items marked thus give the names of parties awarded contracts.*

Jul. 31.	Brooklyn, N. Y.	Jul. 27
Jul. 31.	Sutton, W. Va.	Jul. 27
Jul. 31.	Tegus, Me.	Jul. 27
Jul. —.	**Brazil, Ind.**	**Jun. 1**
Jul. —.	**Belleville, Ill.**	**Jun. 15**
Aug. 1.	Marshfield, Wis.	Jul. 6
Aug. 1.	Scottdale, Pa.	Jul. 20
Aug. 1.	Kansas City, Mo.	Jul. 27
Aug. 1.	New Haven, Conn.	Jul. 27
Aug. 2.	Amsterdam, N. Y.	Jul. 20
Aug. 2.	Youngstown, O.	Jul. 27
Aug. 2.	Austin, Minn.	Jul. 27
Aug. 3.	Westfield, Mass. Adv. Jul. 27	Jul. 27
Aug. 3.	New Bremen, O. Adv. Jul. 13, 20	Jul. 13
Aug. 3.	Manitowoc, Wis.	Jul. 27
Aug. 5.	Olympia, Wash. Adv. Jul. 6 to 20	Jul. 6
Aug. 5.	Plainfield, N. J. (2 prop.) Adv. Jul. 13.	Jul. 13
Aug. 5.	Westfield, N. J.	Jul. 27
Aug. 5.	Summerville, N. Y.	Jul. 27
Aug. 5.	Columbus, Ind.	Jul. 13
Aug. 5.	Grand Forks, N. D.	Jul. 20
Aug. 5.	North Milwaukee, Wis.	Jul. 20
Aug. 5.	River Forest, Ill.	Jul. 20
Aug. 5.	Orange, N. J.	Jul. 27
Aug. 6.	Alexandria, La. Adv. Jun. 26 to Jul. 20.	Jun. 29
Aug. 6.	Morris, Minn.	Jul. 20
Aug. 6.	New York, N. Y.	Jul. 27
Aug. 6.	Trenton, N. J.	Jul. 27
Aug. 6.	Cleveland, O.	Jul. 27
Aug. 7.	Iron River, Mich.	Jul. 27
Aug. 8.	Bloomfield, Ind. Adv. Jul. 13	Jul. 13
Aug. 8.	Green Bay, Wis. Adv. Jul. 27	Jul. 27
Aug. 9.	Richmond, Ind.	Jul. 27
Aug. 10.	Marshfield, Wis.	Jul. 20
Aug. 12.	Madison, S. D.	Jul. 27
Aug. 14.	Lewistown, Mont.	Jul. 20
Aug. 15.	Camden, Ark.	Jul. 20
Aug. 15.	Arkadelphia, Ark. Adv. Jul. 27	Jul. 27
Aug. 16.	Cincinnati, O.	Jul. 27
Aug. 20.	Cleveland, O.	Jul. 27
Aug. 30.	Evansville, Ind.	Jul. 27
Aug. —.	**Rockingham, N. C.**	**Jun. 29**
Sep. 1.	**Eatonton, Ga.**	**Apr. 11**
Sep. 1.	**Alton, Ill.**	**Jun. 8**
Sep. 11.	New Orleans, La. Adv. Jul. 6 to 27	Jul. 6

BRIDGES.

Jul. 30.	Clarion, Pa.	Jul. 20
Jul. 30.	Hamilton, O.	Jul. 20
Jul. 30.	Ebensburg, Pa.	Jul. 20
Jul. 30.	Tiffin, O.	Jul. 20
Jul. 30.	Waterbury, Conn.	Jul. 27
Jul. 31.	Hattiesburg, Miss.	Jul. 13
Jul. 31.	Glencoe, Ill.	Jul. 20
Jul. 31.	St. Catherine, Ont.	Jul. 27
Aug. 1.	Woodland, Cal.	Jul. 13
Aug. 1.	Williamsport, Pa.	Jul. 20
Aug. 1.	East St. Louis, Ill.	Jul. 20
Aug. 2.	Sunnyhill, La.	Jul. 20
Aug. 2.	Franklin, La.	Jul. 27
Aug. 2.	Portland, Colo.	Jul. 20
Aug. 3.	Findlay, O.	Jul. 20
Aug. 3.	Washington C. H., O.	Jul. 20
Aug. 3.	Cleveland, O.	Jul. 20
Aug. 3.	Shellmouth, Man.	Jul. 20
Aug. 5.	Columbus, O.	Jul. 13
Aug. 5.	Jackson, O.	Jul. 20
Aug. 5.	Rome, Ga.	Jul. 13
Aug. 5.	New Bern, N. C.	Jul. 20
Aug. 5.	Troy, O.	Jul. 20
Aug. 5.	Tipton, Ind.	Jul. 27
Aug. 5.	Senatobia, Miss.	Jul. 27
Aug. 5.	Carrollton, O.	Jul. 27
Aug. 5.	Greenwood, Miss.	Jul. 27
Aug. 5.	Chillicothe, O.	Jul. 27
Aug. 6.	Middleburg, Ind.	Jul. 27
Aug. 6.	Atchison, Kan.	Jul. 27
Aug. 6.	Covington, Ind.	Jul. 27
Aug. 7.	Warsaw, Ind.	Jul. 27
Aug. 8.	New Albany, Ind.	Jul. 20
Aug. 9.	Hamburg, Pa.	Jul. 27
Aug. 10.	Cleveland, O.	Jul. 20
Aug. 10.	Brookland, D. C. Adv. Jul. 27	Jul. 27
Aug. 17.	Substructure, Chicago, Ill. Adv. Jul. 27	Jul. 27
Aug. 17.	Superstructure, Chicago, Ill. Adv. Jul. 27.	Jul. 27
Aug. 20.	San Juan, P. R.	Jul. 20
Sep. 30.	Santiago, Chile	Jul. 13

PAVING AND ROAD MAKING.

Jul. 30.	Ashland, Ore.	Jul. 20
Jul. 30.	Des Moines, Ia.	Jul. 13
Jul. 30.	Hagerstown, Md.	Jul. 13
Jul. 30.	Jefferson, O.	Jul. 13
Jul. 30.	Independence, Ia.	Jul. 20
Jul. 30.	Steubenville, O.	Jul. 20
Jul. 30.	Wilmington, Del.	Jul. 20
Jul. 30.	St. George, S. I.	Jul. 20
Jul. 30.	Newark, N. J.	Jul. 20
Jul. 30.	New York, N. Y.	Jul. 27
Jul. 30.	Wilmington, Del.	Jul. 27
Jul. 30.	East St. Louis, Ill.	Jul. 27
Jul. 30.	Defiance, O.	Jul. 27
Jul. 30.	Sharon, Pa.	Jul. 27
Jul. 30.	Toronto, Ont.	Jul. 27
Jul. 30.	Marion, O.	Jul. 27
Jul. 31.	Ft. Greble, R. I.	Jul. 20
Jul. 31.	Baltimore, Md.	Jul. 27
Jul. 31.	Killingly, Conn.	Jul. 27
Jul. 31.	Defiance, O.	Jul. 27
Jul. 31.	Sutton, W. Va.	Jul. 27
Jul. —.	**Belleville, Ill.**	**Jun. 15**
Jul. —.	**Hudson, Mich.**	**Jun. 15**
Jul. —.	**Camden, N. J.**	**Apr. 20**
Aug. 1.	**Greencastle, Ind.**	**Jun. 29**
Aug. 1.	Greensburg, Ky.	Jul. 13
Aug. 1.	Rahway, N. J.	Jul. 13
Aug. 1.	Brooklyn, N. Y.	Jul. 27
Aug. 1.	Kansas City, Mo.	Jul. 27
Aug. 1.	New Philadelphia, O.	Jul. 27
Aug. 2.	Cincinnati, O.	Jul. 13
Aug. 2.	Roselle Park, N. J.	Jul. 27
Aug. 2.	Wilmington, Del.	Jul. 27
Aug. 2.	Central City, Colo.	Jul. 27
Aug. 3.	New Bremen, O. Adv. Jul. 13, 20	Jul. 13
Aug. 3.	Greenville, O.	Jul. 20
Aug. 3.	Williamsport, Pa. Adv. Jul. 20, 27	Jul. 20
Aug. 3.	St. Clairsville, O.	Jul. 20
Aug. 3.	Stevens Point, Wis.	Jul. 20
Aug. [illegible]	[illegible], Ohio	Jul. 27

Aug. 5.	Olympia, Wash. Adv. Jul. 6 to 20	Jul. 6
Aug. 5.	Somers Point, N. J. Adv. Jul. 20, 27	Jul. 20
Aug. 5.	Spencer, Ind.	Jul. 20
Aug. 5.	Mt. Vernon, Ind.	Jul. 20
Aug. 5.	Plainfield, N. J. Adv. Jul. 20, 27	Jul. 20
Aug. 5.	Ft. Mackenzie, Wyo.	Jul. 27
Aug. 5.	New Haven, Conn.	Jul. 27
Aug. 5.	Montgomery, Ia.	Jul. 27
Aug. 5.	Helena, Mont.	Jul. 27
Aug. 5.	Hayfield, Minn.	Jul. 27
Aug. 5.	Lansing, Mich.	Jul. 27
Aug. 5.	Fargo, N. D.	Jul. 27
Aug. 5.	Chicago, Ill.	Jul. 27
Aug. 5.	Columbus, Ind.	Jul. 27
Aug. 5.	Shohegan, Me.	Jul. 27
Aug. 6.	**Reynoldsville, Pa.**	**Jun. 29**
Aug. 6.	Sharpsville, Pa.	Jul. 13
Aug. 6.	Covington, Ind.	Jul. 13
Aug. 6.	New York, N. Y.	Jul. 27
Aug. 6.	Brazil, Ind.	Jul. 20
Aug. 6.	Bloomington, Ind.	Jul. 20
Aug. 6.	Spencer, Ind.	Jul. 20
Aug. 6.	Cohoes, N. Y.	Jul. 20
Aug. 6.	Washington, Pa.	Jul. 20
Aug. 6.	Martinsville, Ind.	Jul. 27
Aug. 6.	Washington, Ind.	Jul. 27
Aug. 6.	Edgewater, N. J.	Jul. 27
Aug. 6.	Stapleton, S. I.	Jul. 27
Aug. 6.	Sewickley, Pa.	Jul. 27
Aug. 7.	Peru, Ind.	Jul. 20
Aug. 7.	Columbus, Ind.	Jul. 27
Aug. 7.	Rockville, Ind.	Jul. 27
Aug. 8.	Clarinda, Ia. Adv. July 27	Jul. 27
Aug. 8.	Hartford City, Ind.	Jul. 27
Aug. 8.	Brooklyn, N. Y.	Jul. 27
Aug. 8.	Riverton, N. J.	Jul. 27
Aug. 10.	Lisbon, Ohio	Jul. 27
Aug. 10.	Bellevue, O.	Jul. 27
Aug. 19.	Steubensville, Ohio	Jul. 27
Aug. 20.	Cleveland, O.	Jul. 27
Aug. 21.	Aberdeen, Wash.	Jul. 27
Aug. 27.	Pensacola, Fla. Adv. Jul. 27	Jul. 27

POWER PLANTS, GAS AND ELECTRICITY.

Jul. 30.	Columbus, O.	Jul. 6
Jul. 31.	**North Battleford, Sask.**	**Jun. 22**
Jul. 31.	Tacoma, Wash.	Jul. 20
Jul. —.	**Rowlesburg, W. Va.**	**Mar. 16**
Aug. 1.	Hamilton, Ont.	Jul. 13
Aug. 1.	Ashland, Wis.	Jul. 20
Aug. 1.	Chewelah, Wash.	Jul. 20
Aug. 2.	St. Paul, Minn.	Jul. 27
Aug. 3.	Washington, D. C.	Jul. 27
Aug. 5.	Blackwells Island, N. Y.	Jul. 27
Aug. 5.	Brooklyn, N. Y.	Jul. 27
Aug. 6.	Cleveland Heights, O.	Jul. 20
Aug. 6.	Sioux City, Ia.	Jul. 20
Aug. 6.	Hamilton, Ont.	Jul. 20
Aug. 10.	Hickory, N. C.	Jul. 27
Aug. 31.	Lebanon, Pa.	Jul. 20
Sep. 3.	**Winnipeg, Man. Adv. Jun. 15 to Jul. 20.**	**Jun. 15**

BUILDINGS.

Jul. 29.	School, Nyack, N. Y. Adv. Jul. 20, 27	Jul. 20
Jul. 30.	**Y. M. C. A. bldg., Ft. Scott, Kan.**	**Jul. 6**
Jul. 30.	**Pub. bldg., San Francisco, Cal.**	**Jul. 6**
Jul. 30.	Pub. bldg. improv., Hart's Is., N. Y.	Jul. 20
Jul. 30.	School, Kalamazoo, Mich.	Jul. 13
Jul. 30.	Church, Ames, Ia.	Jul. 13
Jul. 30.	Masonic temple, Marietta, O.	Jul. 20
Jul. 30.	School, Menominee, Mich.	Jul. 20
Jul. 30.	Remodel court house, Murfreesboro, Tenn.	Jul. 20
Jul. 30.	Htg. post bldgs., Ft. Brady, Mich. Adv. Jul. 20, 27.	Jul. 20
Jul. 30.	School, Crown Point, O.	Jul. 20
Jul. 30.	Boilers, etc., in laundry, Otisville, N. Y.	Jul. 20
Jul. 30.	School, Pittsburg, Kan.	Jul. 27
Jul. 31.	**Post office, Owosso, Mich.**	**Jun. 29**
Jul. 31.	**Pub. bldg. plans, Milwaukee, Wis.**	**Jul. 6**
Jul. 31.	School Bldg., Bozeman, Mont.	Jul. 20
Jul. 31.	Court house, Vancouver, B. C.	Jul. 20
Jul. 31.	Shelving in pub. bldg., Washington, D. C.	Jul. 20
Jul. 31.	Marble in pub. bldg., Washington, D. C.	Jul. 20
Jul. 31.	Ice-making machine, New York, N. Y.	Jul. 20
Jul. 31.	Schools, Owensboro, Ky.	Jul. 27
Jul. 31.	Htg. pub. bldg., Washington, D. C.	Jul. 27
Jul. 31.	School, Ravena, N. Y.	Jul. 27
Jul. 31.	City bath, Rochester, N. Y.	Jul. 27
Jul. 31.	Bus. bldg., Montfort, Wis.	Jul. 27
Jul. 31.	Pub. bldg., Erie, Pa.	Jul. 27
Jul. —.	**Indus. plant, Chicago, Ill.**	**May 25**
Jul. —.	**Htg. college, Raleigh, N. C.**	**Jun. 1**
Aug. 1.	**School, Washington, D. C.**	**Jul. 13**
Aug. 1.	Hospital plans, Calgary, Alta.	Jul. 13
Aug. 1.	School, Kenmare, N. D.	Jul. 20
Aug. 1.	Church, Alton, Ia.	Jul. 20
Aug. 1.	Addition to school, Flint, Mich.	Jul. 20
Aug. 1.	Bank, Knoxville, Tenn.	Jul. 13
Aug. 1.	Add. to jail, Aurora, Ill.	Jul. 27
Aug. 1.	Jail, Houston, Va.	Jul. 27
Aug. 1.	Pub. bldg., New York, N. Y.	Jul. 27
Aug. 1.	Htg., etc., school, Lead, S. D. Adv. Jul. 27.	Jul. 27
Aug. 1.	Life save. sta., Ft. Pickens, Fla.	Jul. 27
Aug. 1.	School, Emporia, Kan.	Jul. 27
Aug. 1.	City hall, Yonkers, N. Y.	Jul. 27
Aug. 1.	Hospital bldg., Ellis Island, N. Y.	Jul. 27
Aug. 1.	Fireproofing, etc., for school, Newark, N. J.	Jul. 27
Aug. 2.	Htg. pub. bldg., St. Paul, Minn.	Jul. 27
Aug. 2.	School, Peoria, Ill.	Jul. 27
Aug. 3.	College bldg. plans, College Stat'n, Tex.	Jul. 20
Aug. 3.	School, Minot, N. D.	Jul. 20
Aug. 4.	School, Hannaford, N. D.	Jul. 20
Aug. 5.	Post office, Crookston, Minn.	Jul. 13
Aug. 5.	School, Cleveland, O.	Jul. 13
Aug. 5.	School, Leavenworth, Kan.	Jul. 20
Aug. 5.	Pub. bldg., plans, Mineral Point, Wis.	Jul. 20
Aug. 5.	College Dormitory, Tallahassee, Fla.	Jul. 20
Aug. 5.	City hall, Jamestown, N. D.	Jul. 20
Aug. 5.	School bldg., material, Chilocco, Okla.	Jul. 20
Aug. 5.	School foundation, Columbus, O.	Jul. 20
Aug. 5.	College bldg., Agricultural College, Miss.	Jul. 20
Aug. 5.	Bldgs. at hospital, Little Rock, Ark.	Jul. 27
Aug. 5.	School, Terre Haute, Ind.	Jul. 27
Aug. 5.	Htg. educ. bldg., Brooklyn, N. Y.	Jul. 27
Aug. 6.	Pub. bldg., Brooklyn, N. Y.	Jul. 20
Aug. 6.	Bldg. at Univ., Columbus, O.	Jul. 13
Aug. 6.	School, Granville, N. D.	Jul. 20
Aug. 6.	Annex to jail, Asheville, N. C.	Jul. 20
Aug. 6.	Court house, Shelby, N. C.	Jul. 27
Aug. 7.	Univ. bldg., Moscow, Idaho	Jul. 6
Aug. 7.	Church, Halifax, N. S.	Jul. 13
Aug. 7.	School plans, New Haven, Conn.	Jul. 20
Aug. 7.	Pub. bldg., Baltimore, Md.	Jul. 20
Aug. 7.	Add. to pub. bldg., Ottawa, Ont.	Jul. 27
Aug. 8.	Pub. bldg., Brooklyn, N. Y.	Jul. 27
Aug. 8.	Htg. school, Balfour, N. D.	Jul. 27
Aug. 8.	City hall, Calgary, Alta.	Jul. 27
Aug. 9.	**Asylum, Monticello, Ind.**	**Jun. 29**
Aug. 9.	School, Lakewood, O.	Jul. 13
Aug. 9.	School, Tolley, N. D.	Jul. 27
Aug. 9.	Vault improv. in Treas. Bldg., Washington, D. C.	Jul. 27
Aug. 9.	Pub. bldg., Spring City, Pa.	Jul. 27
Aug. 10.	School, Ontario, Cal.	Jul. 27
Aug. 12.	Post office, Mason City, Ia. Adv. Jul. 6, 13.	Jul. 6
Aug. 12.	Schools, Aberdeen, S. D.	Jul. 27
Aug. 12.	Pub. bldg., Highmore, S. D.	Jul. 27
Aug. 13.	Boilers for htg plant at pub. bldg., Minnehaha, Minn.	Jul. 20
Aug. 14.	Hospital, Caufield, O.	Jul. 27
Aug. 14.	Add. to pub. bldgs., Youngstown, O.	Jul. 27
Aug. 15.	School, Albany, N. Y.	Jul. 20
Aug. 15.	Light-house dwell., Stonington, Conn. Ad. Jul. 27.	Jul. 27
Aug. 19.	Post office, Alexandria, Minn.	Jul. 13
Aug. 20.	Post office, Decatur, Ill.	Jul. 13
Aug. 20.	Add. to hospital, Athens, O.	Jul. 27
Aug. 20.	School, Spearfish, S. D.	Jul. 27
Aug. 22.	Post office bldg., Jackson, Miss.	Jul. 20
Aug. 27.	Post office, Trenton, N. J. Adv. Jul. 27.	Jul. 27
Aug. —.	**Hospital, Saskatoon, Sask.**	**May 4**
Sep. 3.	Post office bldg., Waterton, N. Y. Adv. Jul. 27.	Jul. 27
Sep. 4.	Post office bldg., Quincy, Mass.	Jul. 27
Sep. 1.	**Bus bldg., Walla Walla, Wash.**	**Apr. 20**
Sep. —.	**Hotel, New Orleans, La.**	**Jun. 29**
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
———	**Bus. Bldg., Charles Town, W. Va. Adv. Jun. 15, 22.**	**Jun. 15**
———	Court house plans, Pulaski, Tenn	Jul. 27

MISCELLANEOUS.

Jul. 29.	**Jetty wk., Washington, D. C.**	**Jul. 6**
	Va. Adv. Jul. 6 to 27	**Jul. 6**
Jul. 30.	**Dredging, Newark, N. J. Adv. Jun. 29 to Jul. 20.**	**Jun. 29**
Jul. 30.	R. R. wk., locomotive, etc., Ft. Monroe. Adv. Jul. 6 to 27.	Jul. 6
Jul. 30.	**Ferry terminal work, St. George, S. I. Adv. Jul. 6 to 20.**	**Jul. 6**
Jul. 30.	Steel, iron, etc., Panama	Jul. 20
Jul. 30.	Levee and ditch work, Rock Island, Ill.	Jul. 20
Jul. 30.	Cemetery vault, Lawrence, Mass.	Jul. 27
Jul. 30.	Supplies, Washington, D. C.	Jul. 27
Jul. 30.	Vacuum system, etc., Kansas City, Mo.	Jul. 27
Jul. 31.	Canal work, Albany, N. Y.	Jul. 13
Jul. 31.	Dredge and scraper work, Piper City, Ill. Adv. Jul. 20, 27	Jul. 20
Aug. 1.	Ditch, Marshalltown, Ia. Adv. Jun. 29.	Jun. 29
Aug. 1.	Pier, dock, etc., Elizabeth, N. J.	Jul. 13
Aug. 1.	Tran. rock, New York, N. Y.	Jul. 27
Aug. 1.	Disposal of ashes, etc., Brooklyn, N. Y.	Jul. 27
Aug. 1.	Canal wk., Petersboro, Ont.	Jul. 27
Aug. 1.	Ditch, Northwood, Ia.	Jul. 27
Aug. 2.	Jetty work, Boston, Mass. Adv. Jul. 20.	Jul. 20
Aug. 2.	Crib breakwater, Racine, Wis. Adv. Jul. 13 to 27.	Jul. 13
Aug. 2.	Elevator, Calgary, Alta.	Jul. 20
Aug. 2.	Dump cars, Panama	Jul. 27
Aug. 2.	Ditch, Hoopole, Ill.	Jul. 27
Aug. 2.	Levee, New Orleans, La.	Jul. 27
Aug. 3.	**Pier, San Juan, P. R.**	**Jul. 6**
Aug. 3.	Repairing wharf, Jackson Barracks, La.	Jul. 20
Aug. 5.	**Garb. disposal, etc., Harrisburg, Pa. Adv. Jun. 29.**	**Jun. 29**
Aug. 5.	Screens for bldgs., Ft. Sam Houston, Tex. Adv. Jul. 13 to 27	Jul. 13
Aug. 5.	Wharf, etc., Somers Point, N. J. Adv. Jul. 20, 27.	Jul. 20
Aug. 5.	Ditch, Muscatine, Ia.	Jul. 20
Aug. 5.	Bulkhead, Long Branch, N. J.	Jul. 20
Aug. 5.	Conduit, Boston, Mass. Adv. Jul. 20, 27.	Jul. 20
Aug. 5.	Dredge Boat, Sullivan, Ind.	Jul. 20
Aug. 5.	Dredging, Wilmington, Del.	Jul. 20
Aug. 5.	Ditch, Arkansas City, Ark.	Jul. 27
Aug. 6.	Drain, Pocohontas, Ia.	Jul. 13
Aug. 6.	Pier, New York, N. Y.	Jul. 27
Aug. 7.	**Dredging, San Juan, P. R. Adv. Jun. 29 to Jul. 13.**	**Jun. 29**
Aug. 7.	Ditch, Emmetsburg, Ia.	Jul. 6
Aug. 7.	Crib, bulkhead, Brooklyn, N. Y.	Jul. 27
Aug. 8.	Telegraph sta., etc., Ft. Omaha, Neb.	Jul. 27
Aug. 9.	Subway, Richmond, Ind.	Jul. 27
Aug. 10.	Elevator, Portsmouth, N. H.	Jul. 20
Aug. 10.	Filling, Portsmouth, N. H.	Jul. 27
Aug. 12.	Dredging, Norwalk, Conn. Adv. Jul. 13 to 27.	Jul. 13
Aug. 12.	Dredging, Philadelphia, Pa. Adv. Jul. 20, 27.	Jul. 20
Aug. 12.	Dredging, Washington, D. C. Adv. Jul. 20, 27.	Jul. 20
Aug. 12.	Lock, etc., Brownsville, Pa. Adv. Jul. 20, 27.	Jul. 20
Aug. 12.	Steel barges, Panama	Jul. 27
Aug. 14.	Iron and steel, etc., Wheeling, W. Va. Adv. Jul. 20, 27.	Jul. 20
Aug. 15.	Dredging, Sheboygan, Mich. Adv. Jul. 20, 27.	Jul. 20
Aug. 16.	Breakwater, Key West, Fla.	Jul. 27
Aug. 16.	Dredging, Tampa, Fla. Adv. Jul. 20, 27	Jul. 20
Aug. 16.	Jetty work, Galveston, Tex.	Jul. 27
Aug. 17.	Breakwater work, Oswego, N. Y. Adv. Jul. 20, 27.	Jul. 20
Aug. 19.	Dredging, New London, Conn. Adv. Jul. 27.	Jul. 27
Aug. 20.	**Wharf, etc., San Diego, Cal. Adv. Jun. 22, 20.**	**Jun. 22**
Aug. 22.	Dredging, Brunswick, Ga. Adv. Jul. 27.	Jul. 27
Aug. 23.	Dredging, Savannah, Ga. Adv. Jul. 27	Jul. 27
Aug. 24.	Wall, Bremerton, Wash.	Jul. 27
Aug. 26.	Embankment, Governor's Island, N. Y. H. Adv. Jul. 27	Jul. 27
Sep. 2.	**Wharf plans, Gothenburg, Sweden. Adv. Apr. 27 to May 18**	**Apr. 13**
Sep. 10.	Ditch work, Sibley, Ia. Adv. July 27	July 27

CURRENT NEWS SUPPLEMENT

AUGUST 3, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

A REMOVABLE LOCK FOR STEEL SHEET PILING.

A removable lock for steel sheet piling has been patented recently by Mr. Geo. E. Nye, of the National Interlocking Steel Sheeting Co., Chicago. Standard structural-steel channels or I-beams are used with the lock, two types of which are employed, one for the botom end and one for the top. The locks are all made of cast-steel and are applied and detached without requiring bolts, rivets or fabrication of any kind. Those for the top ends of the piling each consist essentially of a heavy yoke or cap that fits snugly over the top of the web of the channel and carries a lug at each end, which is shaped to fit closely against the outer side of the adjacent webs of the adjoining member and against the back face of the latter. These locks are placed with the lugs alternately on one side and then on the other of the row of sheeting, the alternate members being driven with their flanges in one direction, and the other members with their flanges in the opposite direction. The yoke of each lock forms a driving cap for the members to which it is attached by a driving fit over the web of the latter.

The locks for the lower ends of each member are very similar to those for the tops, except that the yoke of these bottom locks is made with a pointed edge; the lugs on them are also beveled for the same purpose. The bottom locks are also placed alternately on one side and then the other of the row of piling, and are made with one or two lugs, as is desired.

The wall formed by channels or I-beams with these locks is particularly rigid and is considered to be especially adapted to any work in which an unyielding retaining wall is required. At the same time, a large reduction in weight, as compared with other forms of steel piling, is made possible, and the cost is materially reduced by the opportunity afforded to use standard steel sections, without any fabrication whatever. The two locks to each channel weigh 15 lb. apiece for 15-in. standard 33-lb. channels, and when driven weigh 29⅓ lb. per square foot.

The proposals recently received by the United States Government for the construction of a concrete wall over 4,300 ft. in length, for bank protection at Fort St. Philip, La., near the mouth of the Mississippi River, are considered to illustrate the saving that is made possible by this new form of piling. A concrete wall is to be built over the top of a continuous row of steel sheet piling driven to a depth of about 19 ft. and extending well up into the body of the wall. The proposal made by Messrs. Christie & Lowe to use the Nye piling was about $6,000 below any other proposal made by these contractors, who submitted the only bids, using other forms of piling. The Nye piling in this work requires 1,200 tons, as compared with the next lowest section of 1,320 tons, and the highest of 1,430 tons and drives in widths 13½ in. effecting a considerable saving in the cost of driving, as fewer pieces are required.

TOP AND BOTTOM LOCKS ON PILING.

BOTTOM AND TOP OF BOTTOM LOCK.

PERSONAL NOTES.

Mr. I. Austin Miller has resigned as city engineer of Houston, Tex.

Mr. W. T. Scudder has resigned as assistant city engineer of Galveston, Tex.

Mr. J. E. Foote has been appointed assistant city engineer of Little Falls, N. Y.

P. H. Glatfelter, president of the York Mfg. Co., York, Pa., died July 11, at Spring Forge, Pa.

Mr. P. E. Fletcher has been appointed resident engineer in the service of the Illinois State Geological Survey.

Mr. V. E. Ohl has resigned as chief engineer of the Tennessee Coal, Iron & Railroad Co. to become city engineer of Ensley, Ala.

Mr. Tsenyoshi Ohtale, architectural engineer of the South Manchurian Railway Co., is in this country inspecting railway buildings.

Mr. H. A. Raider has been promoted from inspector to assistant engineer in the service of the Baltimore Sewerage Commission.

Mr. R. C. H. Davidson, of London, Eng., has been retained by the Harbor Commissioners of Montreal, Canada, to investigate the development of the harbor of that city.

Mr. G. M. Hall, an irrigation engineer in the service of the United States Department of the Interior, has been sent to Porto Rico to prepare plans for the irrigation of large sugar-growing districts.

Mr. A. C. Brower has been appointed division engineer of the Wichita division of the Missouri Pacific Ry. System, succeeding Mr. E. C. Welch, who has been transferred to a similar position at De Soto, Mo.

Mr. H. M. Hensen, supervisor of bridges and buildings of the Denver, Kansas & Gulf R. R., has accepted a similar appointment with the Colorado Southern, New Orleans & Pacific R. R., at Beaumont, Tex.

Mr. Marshall B. Palmer, resident engineer of the New York State Barge Canal Water Supply Department, at Rome, N. Y., has resigned to take charge of surveys for a high service reservoir and conduit line for Syracuse, N. Y., under the direction of Mr. H. C. Allen, city engineer.

Mr. Benjamin Talbot, formerly steel manager at the Pencoyd Iron Works, has been appointed managing director of the Cargo Fleet Iron & Steel Co., one of the largest concerns of the sort in Great Britain.

Mr. Lewis N. Wilson has resigned as assistant city engineer of Knoxville, Tenn., to become city engineer of Johnson City, Tenn.

Mr. William D. Marks, consulting engineer and statistician, has removed his offices to 623-624 Park Row Building, New York City.

Mr. Morris R. Sherrerd, city engineer of Newark, N. J., has been appointed engineer of the New Jersey State Potable Water Commission.

Mr. E. L. B. Gardiner, of Paterson, N. J., has been elected president of the Consolidated Water Co., Utica, N. Y., succeeding Mr. J. V. Cockroft, retired.

Mr. L. A. Waterbury, instructor in civil engineering at the University of Illinois, has been appointed professor of civil engineering at the University of Arizona.

Mr. Calvin W. Hendrick, chief engineer of the Baltimore Sewerage Commission, sailed from New York for Paris, France, Aug. 1. He will make a tour of inspection of European cities, studying their sewerage works.

Joseph W. Zipperlein, vice-president of the Wm. G. Hartranft Cement Co., Philadelphia, Pa., and an associate of the American Society of Civil Engineers, died, July 22, at his home in Ashbourne, Pa., aged 37 years.

Mr. Mason D. Pratt has been appointed chief engineer of the Washington & Berkeley Bridge Co., Williamsport, Md., and is preparing plans for a 1,500 ft. reinforced concrete bridge over the Potomac River at Williamsport.

A party of eighteen Danish engineers, architects and journalists recently reached New York City and will spend about five weeks in this country studying important engineering works and social conditions in the large cities.

T. F. Osborn, engineer for Mr. Carl Leonardt, contractor, Los Angeles, Cal., died July 20. He was a specialist in reinforced concrete, and at the time of his death was in charge of construction for Mr. Leonardt of a number of large buildings.

The Appalachian Engineering Association will hold its summer meeting at Newport News, Va., Sept. 7, at the Hotel Warwick. Engineers visiting the Jamestown Exposition and those who have the opportunity to attend the sessions of the Association are cordially invited to be present.

Samuel McClintock Hamill, formerly manager of the Brush Electric Co. and vice-president of the Sprague Electric Co., and later associated with the General Electric Co. after the Brush Electric Co. was merged with that concern, died at his home in Schenectady, N. Y., July 29, aged 49 years.

Mr. W. B. Cansey, engineer of maintenance of way of the Chicago & Alton R. R., at Bloomington, Ill., has become superintendent of the Eastern division of the Chicago & Alton, with headquarters in the same city, succeeding Mr. W. L. Derr, who recently resigned to become superintendent of the New York City street railway lines.

The United States Navy Department will hold an examination at the Federal Building, Chicago, Ill., Aug. 16, to establish an eligble register of subinspectors of building construction work at the U. S. Naval Training Station, North Chicago, Ill. For further information address Mr. Truman H. Newberry, Acting Secretary, Navy Department.

Messrs. Carrol Paul, Annapolis, Md.; G. S. Burrell, Mount Vernon, O.; Ralph Whitman, Washington, D. C.; Carl Bostrom, Washington, D. C.; R. M. Warfield, New York, N. Y., and W. C. Furer, Key West, Fla., have been commissioned as assistant civil engineers in the United States Navy Department with the rank of lieutenant, junior grade.

Capt. Edwin R. Stuart, Corps of Engineers, U. S. A., on duty at the Infantry and Cavalry School and Staff College as assistant instructor of engineering, has been detailed to serve also as engineer of the Sixth Lighthouse District, relieving Capt. George P. Howell, who was recently ordered to the Philippine Islands in connection with the construction of fortifications.

Mr. Frederick Skene, State Engineer and Surveyor of New York, recently appointed, as assistant engineers in his department, Messrs. G. H. Haley, W. H. Slingerland, F. C. Woodward, Max Wolff, A. C. Richards, H. C. Olcott, G. R. Halpin, O. M. Severson, G. H. Thomson, W. G. Harger, J. S. Summers, Hall Gleason, F. F. Miller, A. G. Austin, H. W. Benedict, G. A. Ensign, C. L. Crowley, H. S. Blake.

Dr. David T. Day, chief of the Bureau of Mining and Mineral Resources, United States Geological Survey, will be succeeded Aug. 1 by Mr. Edward W. Parker, coal expert in the service of the Geological Survey. The change is to be made at the request of Dr. Day, who will devote his attention to studies of petroleum, continuing in the service of the Survey at his present salary.

Messrs. Robt. S. Peabody, of Boston; Desmond Fitz Gerald, of Brookline; Henry B. Day, of Newton; Thomas J. Gargan, of Boston, and Benjamin N. Johnson, of Lynn, representing architecture, engineering, finance, transportation and law, respectively, have been named as the Metropolitan Improvement Commission recently authorized by the Massachusetts legislature.

Mr. Bion J. Arnold, chief engineer of the board of supervising engineers of the Chicago traction interests; Mr. George W. Weston, assistant chief engineer of the board, and Mr. Harold B. Fleming, representing the Chicago City Railway Company, recently made a tour of inspection in the East, visiting steel mills, car shops and subway and tunnel construction at Philadelphia and New York.

Candidates for several vacancies in the grade of hydrographic surveyor in the Navy Department will be examined by the U. S. Civil Service Commission on Sept. 4 and 5. The work will be done on the south coast of Cuba and is expected to last several years. Applicants must have had five years' surveying experience, of which at least two years was in charge of a party or as transitman. A degree in civil engineering is considered equal to three years' experience.

The New York State Civil Service Commission will hold examinations, Aug. 24, of candidates for positions as assistant civil engineer, bridge designer, bridge draftsman and civil engineering draftsman. The Commission has been unable to secure sufficient eligibles for these positions, and qualified applicants have excellent chances of appointment. The last day for filing applications is Aug. 17. Address Charles S. Fowler, chief examiner, Albany, N. Y.

The following first lieutenants of the Corps of Engineers, U. S. A., have been transferred as indicated: William P. Stokey, from the Military Academy to Havana, Cuba, for duty with the 2d Battalion of Engineers; Henry C. Jewett, to the Military Academy; William D. A. Anderson and Thomas M. Robins, from the Engineer School, Washington Barracks, to Havana, Cuba, for duty with the 2d Battalion of Engineers; Ralph T. Ward, from the Engineer School to Fort Mason, for duty with the 1st Battalion of Engineers.

Mr. H. C. Hale, for many years mechanical engineer and designer with the Webster, Camp & Lane Co. and later manager of the Mineral Ridge Mfg. Co., and Mr. F. B. Duncan, for several years general superintendent of engineering and manufacturing for the Northern Electrical Mfg. Co. and later manager of the Akron Electrical Mfg. Co., have formed a partnership under the name of Hale & Duncan, with offices in the Schofield Bldg., Cleveland. They will act as designing and contracting engineers, making a specialty of electric equipment for mines.

Mr. Joseph W. Hunter, State Highway Commssioner of Pennsylvania, has announced the following appointments, made in accordance with the act recently passed by the legislature reorganizing the highway department: As deputy commissioner, R. D. Beman, Meadville; assistant commissioner, G. W. Ensign, Warren; engineers, C. F. Hamilton, Franklin; F. F. Hallam, McKeesport; C. W. Bosley, Hollidaysburg; E. D. Garrett, Downingtown; G. H. Biles, Philadelphia; J. R. Wilson, Washington; J. T. Gephart, Lancaster; C. W. Hardt, Camp Hill; A. W. Long, Scranton; S. W. Jackson, Meadville; W. A. Wynn, Pittsburg; chief draftsman, C. E. Douglass, New Castle.

Brig.-Gen. Charles Francis Powell, U. S. A., retired, died in St. Paul, Minn., July 30, aged 63 years. He was born in Jacksonville, Ill., and received his early education in the public schools of Milwaukee, Wis. At the breaking out of the Civil War he enlisted in the 5th Wisconsin Volunteers, and rose to be sergeant major of his regiment. In September, 1863, his gallantry on the field of battle won for him from President Lincoln an appointment to West Point. He was graduated in 1867, and was assigned to the Corps of Engineers. During his service he was engineer in charge of the Cascades Canal, of the Columbia River, secretary of the Mississippi River Commission, engineer in charge of the Missouri River survey and improvement, engineer commissioner of the District of Columbia and engineer of the defences of Long Island. He rose to the rank of colonel, and was retired from active service in March, 1906, with the rank of brigadier-general.

William Hamilton Russell, of the New York architectural firm of Clinton & Russell, died recently in Cannes, France, aged 51 years. He graduated from Columbia University in 1878 and soon after entered the office of his great uncle, Mr. James Renwick, the architect of St. Patrick's Cathedral, and was soon admitted to partnership in the firm, which was known as Renwick, Aspinwall & Russell. Later Mr. Russell became associated with Mr. Charles W. Clinton, under the firm name of Clinton & Russell. Mr. Clinton was one of the pioneers in the designing of lofty office buildings, and after Mr. Russell joined him they planned and constructed many of the most notable examples of this style of architecture in New York. Among them are the Atlantic Mutual, Mutual Life, American Exchange National Bank, Broad Exchange, Tontine, Broadway and Consolidated Exchange buildings.

A catalogue of interest to makers of concrete blocks has just been issued by the Pettyjohn Co., Terre Haute, Ind. This company's molding machines and appliances for dry mixtures are well known, but the new Invincible machine is a novelty which will attract special attention because it can be used with wet mixtures. It is made in many sizes, that most generally useful being able to turn out a block 40 in. long or any number of blocks 4 in. or more in size, and having a total length not exceeding 40 in. In view of the marked preference for wet mixtures shown by many architects, the full description of this machine given in the catalogue is decidedly timely. It contains equally thorough descriptions of the other apparatus made by the company, and a large amount of information regarding the selection and manipulation of materials for concrete blocks.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—Local press reports state that work will probably soon commence on the enlargement of the water system at a cost of $150,000.

Redding, Cal.—See "Power Plants, Gas and Electricity."

**Los Angeles, Cal.*—The Bd. of Pub. Works has let contract to the J. D. Hooker Co., of Los Angeles, for 13,000 ft. -in. No. 12 gage riveted sheet steel pipe at 22 cts. per ft., and 5,000 ft. 8-in. No. 14 gage riveted sheet steel pipe at 33 cts. per ft. The pipe is to be used for hydraulic sluicing in the construction of one of the large reservoirs of the $24,000,000 water system that the city is building.

Canon City, Colo.—The City Engr. is reported to have commenced surveying for a water conduit from Cottonwood Creek at Coaldale to Canon City. It is stated that bids will be called for at completion of survey; probable cost, $400,000.

Commerce, Ga. T. A. Little, City Clk., writes that bonds to the amount of $45,000 will be issued for water works and sewers. Engineer not yet selected. C. J. Hood, Mayor.

Juliaetta, Idaho.—The question of constructing water works is reported under consideration here.

Cottonwood, Idaho.—Saml. Goldstone is reported interested in the construction of a pumping plant here.

Springfield, Ill. Maj. L. W. Southwick, Supt. Water Wks., is reported to have recommended the construction of a dam for the improvement of the water supply.

**Mattoon, Ill.*—J. L. Bennett, Secy. Mattoon Water Works & Reservoir Co., writes that the contract for constructing trench and laying approximately 2 miles of c. i. pipe, 12-in., was awarded on July 24th to Gohring & Dunkel, of Tuscola, at 33 cts. per ft., and the contract for 3 miles of vitr. pipe sewers, mostly 18-in., to W. Ed. Millar, Charleston, Ill., at 35½ cts. per ft., for 15-in., 32 cts., and 12-in., 21 cts., and $23 each for manholes.

Chicago, Ill.—Bids will be received until Aug. 7 by the Bd. Local Improv. (H. S. Dietrich, Pres.), for constructing water supply and water service pipes in portions of numerous streets.

Lombard, Ill.—Bids will be received until Aug. 19 by the Village Bd. (H. L. Whitely, Clk.), for furnishing and erecting an elevated steel tank of 60,000 gals. capacity upon a steel tower. W. S. Shields, Engr., 1201 Hartford Bldg., Chicago.

Scottsburg, Ind.—See "Power Plants, Gas and Electricity."

Terre Haute, Ind.—See "Public Buildings."

Grinnell, Ia.—See "Sewerage and Sewage Disposal."

Des Moines, Ia.—The Des Moines Water Works Co. is reported to have decided to expend about $500,000 in improvements.

Almena, Kan.—Bonds recently voted for water works have been found illegal and a new election will be called. Estimates of cost of the new plant are being prepared by Burns & McDonnell, Engrs., Dwight Bldg., Kansas City, Mo.

Independence, Kan.—J. D. Kramer, City Clk., writes that the citizens on July 24 voted to issue $50,000 bonds for extending and enlarging the water works.

Louisville, Ky.—Bids will be received until Aug. 12 by W. G. Dearing, Custodian, for a deep well and pumping apparatus in the U. S. Postoffice and Court House.

**London, Ky.*—The London Water Works Co. is reported to have awarded to Alex. T. Wilson, of Barbourville, the contract to drill wells in East London to supply a system of water works for the entire town.

Carlisle, Ky.—The city is reported to be considering the construction of water works.

**Eunice, La.*—The City Council is reported to have on July 18 awarded contract for water works to P. H. Porter, of Clinton, Ky., for $26,996.

**Carencro, La.* The contract for constructing water works is reported to have been awarded to P. H. Porter, of Clinton, Ky., for about $12,500.

Franklinton, La.—The Police Jury is reported to be considering the sinking of an artesian well in the public square.

**Comfrey, Minn.*—Oscar Erickson, Pres. of Council, writes that the contract for constructing water works (bids opened July 16) has been awarded to Des Moines Bridge & Iron Works, of Des Moines, Ia., for $7,600.

**Moorhead, Minn.*—Jas. Kennedy, of Fargo, N. D., is reported to have secured the contract for furnishing material and laying a water main on Front St. (bids opened July 22), for $5,437.

Jackson, Miss. It is stated that bids will be received until Aug. 6 by Ramsey Wharton, Mayor and the Bd. of Aldermen for $216,000 water bonds.

Exeter, Neb. Plans and specifications are being prepared for new water works at Exeter, to cost $15,000. Bids will be received at an early date for a deep well. Burns & McDonnell, Engrs., Dwight Bldg., Kansas City, Mo.

Falls City, Neb.—See "Power Plants, Gas and Electricity."

Reno, Nev.—See "Power Plants, Gas and Electricity."

**Atlantic City, N. J.*—The Water Dept. is reported to have awarded to the Bethlehem Steel Co., of South Bethlehem, Pa., the contract for a 12,000,000 gal. pump to be installed at the plant at Absecon, for about $45,000.

**Trenton, N. J.* The Water Works Comrs. are re-

** Items marked thus give the names of parties awarded contracts.*

ported to have awarded contracts as follows: To S. W. Mather & Son, of Trenton, for pump house $5,383; Wm. R. Thropp for stand pipe, $12,122, and the Platt Iron Wks. of Ohio for pumping plant, $12,500.

Aztec, N. M.—It is reported that bids will be received until Aug. 10 by the Citizens' Ditch & Irrigating Co., at Aztec, for constructing an irrigation canal 26 miles

Springer, N. M.—The Palo Blanco Land & Irrigation Co. is reported incorporated with a capital of $175,000 for irrigation purposes. Incorporators: Chas. E. Hartley, Chris. Hansen and Chas. F. Hortenstein, all of Springer.

Hagerman, N. M.—O. R. Tanner, Town Clk., writes that the citizens on July 20 voted to issue $4,000 bonds for the construction of water works.

Syracuse, N. Y.—Henry C. Allen, City Engr., is reported to have selected M. B. Palmer, of Rome, to survey site for new high service distributing reservoir and the second conduit line to Skaneateles Lake.

New York, N. Y.—Bids will be received until Aug. 14 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York City, for furnishing and delivering repair and renewal supplies for pumping stations in Boroughs of Manhattan and Bronx, including the following: Extra heavy valves, extra heavy cocks, blacksmiths', machinists', carpenters' and measuring tools, hardware, sheet metal, etc., w. i. pipe, boiler gauge glasses, oil cups, lubricators, grease cups and parts and gauge cock pencils, ground fire brick, cement, etc.; also same date and place for furnishing and delivering repair and renewal supplies for pumping stations in Boro. of Queens, as follows: Valves and cocks, w. i. pipe, pipe fittings and brass unions, tools, hardware and files, boiler gauge glasses, pressure gauges, lubricators, etc., lime, cement, lumber, etc.

**Irvington, N. Y.*—Jas. G. Orten, Clk. Bd. Water Comrs., writes that the contract for laying about 3,000 ft. 12-in. c. i. water pipe (bids opened July 23) has been awarded to Thos. O'Hearn, 335 So. Bway., Yonkers, for $7,400.

Shelby, N. C.—Bids are wanted until Sept. 2 for $100,000 water works and sewerage bonds. For full particulars address Reyburn & Hoey, city attys., Shelby.

Carrington, N. D.—Bids will be received by the City Council until Sept. 2 for the construction of a steel standpipe and foundation for a water works system, as advertised in The Engineering Record.

**Cincinnati, O.*—Aug. Silk is reported to have secured the contract for laying water mains on Glenway, Purcell, Woodlawn and other avenues and streets, for about $9,500.

Bids will be received until Aug. 27 by the Bd. Trus. Comrs. Water Works (Aug. Herrmann, Pres.), for laying about 2,600 lin. ft. 12 and 8-in. c. i. pipe on Grand, Warsaw and Price Aves.; also same time and place for constructing narrow gauge coal and ash handling tracks, and for laying an 8-in. filtered water pipe at the River Pumping Station, and for grading, sodding and constructing driveways, walks and other work in connection therewith, and the delivery of track material at the Main Pumping Station.

Cleveland, O.—The Council on July 23 passed ordinances appropriating for the Water Dept. $80,000 for meters, $2,000 for lead pipe, $10,000 for pig lead, $10,000 for valves, $10,000 for fittings, $15,000 for hydrants and $6,000 for stop cock boxes.

Bids will be received until Aug. 8 by the Bd. Pub. Service (A. R. Callow, Secy.), for furnishing and delivering to the Water Wks. Div., Bd. Pub. Service, 5,000 5/8-in. water meters, with the privilege of 10,000.

Hamilton, O.—Bids will be received by the Bd. of Pub. Service (S. M. Goodman, Chmn.), until Aug. 13 for sand pumping driven wells, placing stop valves in branch pipes of driven wells, driving driven wells, pumping pit and house for centrifugal pumps, two 4,000,000 gal. duty centrifugal or turbine pumps to work against 70 ft. head and water connections, two 100 h.-p. alternating current electric motors and starting devices, 1,000 ft. electric pole line, and furnishing and laying 24-in. discharge pipe, etc., as advertised in The Engineering Record. Engineer, John W. Hill, 506 First Natl. Bank Bldg., Cincinnati.

Harrison, O.—See "Power Plants, Gas and Electricity."

Ashland, O.—Bids will be received until Aug. 12 at the office of A. P. Black, Village Clk., for $45,000 bonds, to be issued for the purpose of repairing, enlarging, replacing and extending the water works pumping station, pumps, engines, boilers and pipe lines of the water works system.

Bids will be received until Aug. 26 by the Bd. Trus. Pub. Affairs for furnishing and installing a water pumping plant at the pumping station to consist of a high duty horizontal cross compound condensing crank and flywheel steam pumping engine, capacity 1,500,000 U. S. gals. per day of 24 hours, and 2 125 h.-p. each internal furace boilers, together with boilers, engines, feed pumps and all apparatus necessary to operate the pumps, and boliers. Plans are on file at the office of A. P. Black, Village Clk.

Pawhuska, Okla.—C. T. Bennett, City Clk., writes that the City Council will consider private lump sum bids for water works and a sewerage system. All bids recently received have been rejected.

Reading, Pa.—The Special Com. on Filtration at a meeting of Council July 29 presented a report recommending a loan of $500,000 to the filtration system to include the entire city water supply.

**Tarentum, Pa.*—The Roberts Mfg. Co., Philadelphia, is reported to have secured the contract for constructing a filtration plant for the Tarentum Water Co., in Brackenridge; cost about $50,000.

Panama.—See "Miscellaneous."

Bonesteel, S. D.—Bids will be received until Aug. 8 by M. P. Dowling, Town Clk. for constructing water works.

Denison, Tex.—This city is reported to have voted to issue $125,000 bonds for the construction or purchase of water works.

**Salt Lake City, Utah*—Thos. C. Callister, Secy. State Ed. Land Comrs., writes that the contract for constructing a reservoir dam and a canal on the Sevier River near Hatch Town, has been awarded to B. Brinton, of Brinton, for $65,936.

**Burlington, Vt.*—J. W. Goodell, Secy. Water Com., writes that the Ley Constr. Co., 29 Bway., New York, N. Y., has secured the contract for constructing filter plant, with electrically operated centrifugal pupmps (bids opened July 22) at a total of $36,729. It bid for 450 cu. yds. earth excav., 60 cts.; 3 m. ft. sheet piling, $75; 500 lin. ft. round piles, 40 cts.; 825 cu. yds. concrete, $9.80; 65,000 lbs. steel rods, 5 cts.; for filter house with appurtenances, lump sum, $6,750; pipes, specials, gates, meter, etc., lump sum, $6,600; loss of head gages, etc., lump sum, $2,650; piping and gutters in filter tank, lump sum, $1,400; filter gravel, lump sum, $235; filter sand, lump sum, $544; coagulating device, complete, lump sum, $1,350; embankment, lump sum, $280; electrically operated contrifugal pumps, lump sum, $4,800. It also bid with steam operated centrifugal pumps, $37,109. Totals of other bids received: (*a*) with steam operated centrifugal pumps, (*b*) electrically operated centrifugal pumps. Union Filter Co., Pittsburg, Pa., *a* $42,771, *b* 43,471; The N. Y. Continental Jewell Filtration Co., 15 Broad St., New York, N. Y., *a* $40,189, *b* $39,869.00; Thre Greer Filter Co., Pittsburg, Pa., *a* $38,429, *b* $38,029; Norwood Eng. Co., Florence, Mass., *a* $40,272, *b* $38,772. Engineers, Hering & Fuller, 170 B'way, New York, N. Y.

Toppenish, Wash.—R. D. Campbell, Town Clk., writes that an election will be held in Aug. to vote on constructing water works, to cost between $10,000 and $14,000. Engineer, W. J. Roberts, of Pullman.

**Viola, Wis.*—The National Constr. Co., of South Bend, Ind., is reported to have secured the contract for constructing water works at Viola.

Cheyenne, Wyo.—The City Council has instructed C. C. Carlisle, City Engr., to prepare plans for remodeling the city water works, the work to include construction of masonry dam 75 ft high, to form storage reservoir, to cost about $40,000; also laying over a mile of c. i. water pipe.

Windsor, Ont.—Bids will be received until Aug. 8 by Stephen Lusted, City Clk., for $10,000 water works bonds.

Halifax, N. S.—Bids will be received until Aug. 13 by the Mayor for supplying 2,900 1/2-in. and 100 3/4-in. water meters. J. J. Hopewell, Clk. of Works.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Ensley, Ala.*—The Southern Bitulithic Co., of Nashville, Tenn., is reported to have on July 18 secured the contract for constructing a storm sewer at Ensley for $18,000.

Paragould, Ark.—The question of constructing a sewerage system here is being discussed.

Fayetteville, Ark.—Bids will be received until Aug. 22 by the Bd. Improv., Sewer Dist. No. 1 (I. G. Combs, Chrmn.) for furnishing material and constructing a system of sewers. Burns & McDonnell, Engrs., 709 Dwight Bldg., Kansas City, Mo.

Oakland, Cal.—Bids will be received until Aug. 14 by the Bd. Pub. Wks. (Walter B. Fawcett, Secy.), for furnishing material and constructing a concrete and ironstone pipe storm sewer in Canning St.

Alamosa, Colo.—It is reported that a sewerage system will be constructed here at a cost of $25,000.

Denver, Colo.—Bids will be received until Aug. 7 at Rm. 31, Clayton Blk. Denver, for furnishing material and constructing the Clayton College pipe line comprising about 4 miles of vitrified clay pipe and steel pipe with manholes and other appurteances according to plans in the office of Peter O'Brien, Civil Engr., Nassau Blk., Denver. Moses Hallett, Trus., estate of Geo. W. Clayton.

**Lamar, Colo.*—C. W. Heaton, City Clk., writes that the following are the bids opened on July 15 for the construction of a sewerage system: P. O'Brien, Denver, Colo., $87,425; National Constr. Co., Denver, Colo., $76,510; T. J. Sayler & Co., Lamar, $76,200, and Gibbons S .Hughes, Denver, Colo., $75,124 (awarded contract).

Commerce, Ga.—See "Water."

Great Lakes, North Chicago, Ill.—Bids will be received at the Bureau of Navigation (W. H. Brownson, Ch.), Navy Dept., Washington, D .C., until Aug. 21 for the laying of sewers and drains at the naval training station, Great Lakes, North Chicago, Ill., as advertised in The Engineering Record.

**Benton, Ill.*—B. S. Crain, of Marion, is reported to have secured the contract for constructing a sewerage system (bids opened July 22), for $17,000.

Collinsville, Ill.—Bids will be received until Aug. 20 by the Bd. of Local Improv., (J. L. R. Wadsworth, Chmn.), for constructing a sanitary septic sewer system in Dist. No. 1.

Chicago, Ill.—Bids will be received until Aug. 7 by the Bd. Local Improv. (H. S. Dietrich, Pres.), for constructing tile pipe sewers in portions of numerous streets; also constructing drains in portions of several streets.

Indiana Harbor, Ind.—The City Council is reported to have decided to expend $500,000 for a sewerage system for East Chicago and Indiana Harbor.

Gas City, Ind.—Bids will be received by Geo. F. Marchal, City Clk., until Aug. 13 for the construction of a sanitary and storm sewer system in different streets and alleys, in all about 3.1 miles, as advertised in The Engineering Record; approximate cost, $24,000. Engineer, T. E. Petrie, City Bldg., Marion, Ind.

Indianapolis, Ind.—Bids will be received until Aug. 9 by the Dept. Pub. Wks. (Jos. G. Elliott, Pres.), for constructing a pipe sewer varying in size from 10 to 15-in., in portions of Market and Davidson Sts.

Chas. A. Brown, Asst. City Engr., writes that the contract for constructing the Kentucky Ave. sewer (bids opened July 17), has been awarded to Morris Defrees, Sacks Bldg., Indianapolis, for $48,000.

*Chas. A. Brown, Asst. City Engr., writes that the contract for constructing the Missouri St. sewer (bids opened July 19) has been awarded to Shehan Constr. Co., 534 Bell St., for $21,000.

Princeton, Ind.—The plans of E. E. Watts, City Engr., are reported to have been adopted for a sanitary sewerage system, to cost about $60,000.

Evansville, Ind.—Bids will be received by the Bd. of Pub. Wks. (Walter F. Wunderlich, Clk.), until Aug. 30 for the construction of the Kentucky Ave. sewer, as advertised in The Engineering Record. Bids will be submitted on both reinforced concrete and brick.

It is reported that the Bd. Pub. Wks. (W. F. Wunderlich, Clk.), will receive bids until Aug. 13 for the construction of a main sewer and 2 local sewers of vitri. pipe from 15 to 10-in.

Davenport, Ia.—Bids will be received until Aug. 6 by the Bd. Pub. Wks. for constructing sewers in Park Lane, Scott, Warren and 9th Sts., in all about 4,590 lin. ft. 12-in. pipe. Thos. Murray, City Engr.

Grinnell, Ia.—Bids will be received until Aug. 6 by E. B. Wiley, Mayor, for furnishing material and constructing a sanitary sewer and extension to the water system, consisting of about 18,400 of vitrified sewer tile and cement and 30 ft. of iron sewer pipe, and 18,400 ft. of water main of iron and galvanized iron pipe. Willis Davis, City Clk.

**Webster City, Ia.*—P. M. Banks, City Clk., writes that the following are the bids opened on July 24 for constructing about 16,631 ft. of sanitary sewers: Sullivan & O'Connor, Webster City, $31,598 (awarded contract); Independent Contr. Co., Davenport, $32,185; Parks & Gerber, Williams, $33,140; E. L. Brown, Ottawa, Ill., $35,923; H. L. Gary, Denison, $38,120, and H. L. Hossack, Ottawa, Ill., $39,787.

Wichita, Kan.—The lowest bid recently received for constructing the West Side sanitary sewer is reported to have been submitted by McIntyre & Teese for $71,978.

Milford, Mass.—Bids will be received until Aug. 8 for 7,000 ft. 6 to 12-in. sewer, 800 ft. 8-in. force main, concrete pump well, pumping station, etc., as advertised in The Engineering Record. Jas. E. Walker, Chmn. Com. Engineer, F. A. Barbour, of Boston.

Athol, Mass.—Bids will be received until Aug. 20 by the Sewer Comrs. (Herbert L. Hapgood, Chmn.), for constructing about 8,500 ft. of sewers.

Iron River, Mich.—Bids will be received by Chas. A. Otto, Village Clk., until Aug. 7 (readvertisement) for the construction of sewers in Main Dist. No. 1 as advertised in The Engineering Record. Engineers E. G. Bradbury and G. P. Shute, 85 N. High St., Columbus, O.

**Lansing, Mich.*—The following are the bids recently received by City Clk. for the Park Pl. sewer: W. H. McKale, $21,000; J. H. Algate, $20,800, and M. E. Fitzpatrick, St. Joseph St., Lansing, $18,000 (awarded contract).

Jackson, Mich.—It is proposed to construct reinforced concrete trunk sewers here at a cost of $30,000. A. W. D. Hall, City Engr.; J. Harrington, City Recorder.

Detroit, Mich.—Bids will be received until Aug. 8 by the Dept. Pub. Wks. (J. J. Haarer, Comr.), for furnishing material and constructing a portion of Schroeder Ave. sewer.

Howell, Mich.—See "Public Buildings."

St. Paul, Minn.—The City Engr. is reported to have submitted to the Bd. of Pub. Wks. estimates for a new system of sewers in the southern part of the 2d Ward, including sewers in Hastings Ave., Point Douglas Road, Douglas St., and other streets; probable cost, $35,000.

**Virginia, Minn.*—A. Bickford, City Clk., writes that the contract for constructing sewers in Dists. Nos. 3E, 3D and 3C (bids opened July 23) has been awarded to C. C. Butler, for $4,798.

Willmar, Minn.—Bids will be received until Aug. 12 by the City Council for furnishing material and constructing sewers in portions of Trott Ave., 8th, 9th and 10th Sts., to comprise approximately 2,520 ft. 12-in. and 1,110 ft. 18-in. pipe. H. Gunderson, City Clk.

Vicksburg, Miss.—Sewer bonds to the amount of $200,000 are about to be sold for the proposed system of house and storm sewers, for which Walter G. Kirkpatrick, of Jacksoin, is preparig plans. H. J. Trowbridge, City Clk.

Canton, Miss.—Walter G. Kirkpatrick, of Jackson, is now preparing plans for a system of house sewers for Canton; about 8 miles in length. O. S. Miller, Mayor.

Webster Groves, Mo.—Bids will be received until Aug. 19 by L. B. Ripley, City Clk., for constructing district sewers with necessary appurtenances in Sewer Dist. No. 1. The principal items of the work are: 50,800 ft. 9 to 18-in. pipe, 54 flush tanks, 1 septic sewage disposal plant, capacity 70,000 gals. daily; also for sewers in Dist. No. 2, principal items, 42,800 ft. 9 to 15-in. pipe, 49 flush tanks, 1 septic sewage disposal plant, capacity 42,000 gal. per day. Specifications, etc., may be obtained at the office of R. E. McMath Surveying Co., 328 Lincoln Trust Bldg., St. Louis.

Kansas City, Mo.—Bids will be received until Aug. 8 by the Bd. Pub. Wk. for contructing sewers in Dist. No. 176, Sewer Dst. No. 2. E. A. Harper, City Engr.

Cape Girardau, Mo.—Bids will be received until Aug. 19 (readvertisement), by Geo. E. Chappell, City Clk., for furnishing material and constructing a complete system of sewerage in Sewer Dist. No. 1, comprising about 12 miles of pipe sewers 8 to 24-in. in diam., together with all necessary appurtenances.

Omaha, Neb.—Bids will be received by Andrew Rosewater, City Engr. until Aug. 26 for the construction of storm water sewers and appurtenences as advertised in The Engineering Record.

Elizabeth, N. J.—Bids will be received until Aug. 15 by the City Council for furnishing material and constructing sewers in 2d and 4th Aves.; Christie and John Sts., requiring about 3,057 lin. ft. 15, 12, 10 and 6-in. pipe, etc. N. K. Thompson, St. Comr.

Asbury Park, N. J.—Bids will be received until Aug. 17 by the Dept. of Water and Sewers (John E. Coffin, Supt.), 711 Asbury Park, for furnishing material and constructing about 10 miles of pipe sewers from 6 to 15-in. diam. with manholes, lampholes, flush tanks, and c. i. pipe complete; also same date and place for fur-

* *Items marked thus give the names of parties awarded contracts.*

nishing material and laying 1,200 ft. 12-in. wrought iron sewer outlet pipe, extending seaward from tide mark. Stuart Rogers, City Engr.

**New Brunswick, N. J.*—The contract for constructing sewers on Codwise, Throop and Easton Aves (bids opened July 1st) has been awarded to Middlesex Contr. Co., of George St.

Newark, N. J.—The Passaic Valley Sewerage Comn. at a meeting in the Prudential Bldg. on July 23 is reported to have authorized Allen Hazen, St. Paul Bldg., New York, N. Y., to prepare estimates on preliminary plans for building the proposed trunk sewer.

Ft. Lee, N. J. The citizens are reported to have voted to construct a sewerage system; probable cost, $420,000.

Riverside, N. J.—Bids will be received by Irven Kollo, Township Clk., until Aug. 19 for the construction of a sewerage system to consist of 10 miles of sewers 8 to 24-in. diam., pump house, engines, pumps, pump well and disposal works, as advertised in The Engineering Record. Engineer Wm. H. Boardman, 427 Walnut St., Philadelphia, Pa.

Madison, N. J.—S. G. Willets, Boro. Clk., writes that an election will probably soon be called to vote on the question of constructing sewerage system and disposal plant; cost reported to be $125,000.

Fulton, N. Y.—O. C. Breed, Ctiy Engr., is reported to be preparing plans and specifications for the construction of laterals to the West Side sanitary trunk sewer.

New York, N. Y.—Bids will be received until Aug. 6 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers in portions of Garrison Ave. and Bronx St., and rebuilding portion of sewer in E. 149th St. Engineer's estimate: 1,200 lin. ft. 12, 15, 18 and 30-in. pipe sewer; 5,900 lin. ft. piles; 14,500 lbs. steel bars, ½ in., ⅝ in. and ¾ in.; 1,410 lbs. steel in 20-in. "I" beams; 22,500 ft. timber, etc.

Bids will be received until Aug. 12 by the Boro. Pres. (Heory S. Thompson, Acting Boro. Pres. anad Comr. Pub. Wks.), for furnishing material and reconstructing outlet sewers and appurtenances, overflows and connections at 42d and 43d Sts., North River, and in 42d and 43d Sts., betw. North River and 11th Ave. Engineer's estimate: 1,150 ft. wooden barrel sewer 4 ft. 6 in., 10 lin. ft. twin brick sewers 4 ft. 6 in. interior diam. Class I, 45 lin. ft. brick sewer 4 ft. 6in.x9 ft. Class II, 100 lin. ft. brick sewer 4 ft. 6-in.x9 ft. Class III, 60 lin. ft. overflow chamber brick sewer of varying interior diam. Class IV, 170 lin. ft. brick sewer 6 ft. 6-in.x9 ft. Class V, 70 lin. ft. twin brick overflow sewers 8 ft.x2 ft. Class VI, 50 lin. ft. twin brick overflow sewer 8 ft.x2 ft. Class VII, 206 lin. ft. brick sewer 4 ft.x2 ft. 8 in. Class VIII, 123 lin. ft. brick sewer 4 ft.x2 ft. 8 in. Class IX, 90 lin. ft. 12-in. salt glazed vitr. stoneware pipe culvert, 4 receiving basins of circular pattern, 50 M ft. timber and plank for bracing and sheet piling, 8 M ft. timber and plank for foun., etc., 50 M ft. timber and plank for approaches.

Buffalo, N. Y.—Francis Ward, Comr. of Pub. Wks., is reported to have presented to the Bd. of Aldermen two plans for a sewer to abate the Cornelius Creek flood. One is for an overflow sewer to cost $95,000, and the other for a reinforced concrete drain to cost about $75,000.

Oneida, N. Y.—It is stated that bids will be received until Aug. 6 for constructing a sewer in a portion of Lenox Ave. T. A. Dapson, Deputy City Clk.

Shelby, N. C.—See "Water."

**Wahpeton, N. D.*—Wm. R. Purden, City Aud., writes that the contract for constructing sewer in Dakota line (bids opened July 27), has been awarded to C. H. Porritt, of Fargo, for $9,732.

St. Bernard, O.—Bids will be received until Aug. 6 by Geo. Schroeder, Village Clk., for constructing a sewer in Carthage Pike. J. A. Stewart, Engr., 712 Traction Bldg., Cincinnati.

Youngstown, O.—Bids will be received until Aug. 12 by the Bd. Pub. Service (W. H. McMillin, Clk.), for constructing sewers in portions of Walnut and Bane Sts.

Bucyrus, O.—It is stated that bids will be received until Aug. 12 by Chas. Meyer, Clk. Bd. Infirmary Directors, for plumbing at the county infirmary and for a sewerage system and disposal plant.

Arlington Heights, O.—We are informed that H. C. Innis, Village Engr., Station R, Cincinnati, has been instructed to prepare plans for a sanitary sewerage system. Will vote on bonds for same at November election.

**Columbus, O.*—The Columbus Machine Co., of Columbus, is reported to have on July 24 secured the contract from the Bd. of Pub. Service for the pumping machinery to be installed in the East Side sewage pumping station for $13,255.

Bids will be received until Aug. 14 by the Bd. Pub. Service (Edw. F. McGuire, Secy.), for constructing sewers in several alleys and a portion of Wall St.

Norwood, O.—Bids will be received by the Bd. of Pub. Service until Aug. 17 for furnishing material and constructing receiving basins and air tanks, and laying 4 and 8-in. pipe in Serpentine Ave. for the purpose of conveying sewage from Duck Creek to Bloody Run, as advertised in The Engineering Record.

Medina, O.—The following are the lowest bids opened on July 16 for sewers at Medina: Dist. No. 1 and 2, J. O'Neill, of Akron, $7,315 and $19,405, respectively; and sewage disposal plants, Medina Contr. Co., Medina, at $1,880 for South Side plant and $1,764 for North Side plant. Engineers, E. G. Bradbury and Geo. P. Shute, 85 N. High St., Columbus.

**Salem, O.*—Devine, Wilson & Applegate, of Alliance, have secured the contract for constructing the trunk line sewer (bids opened July 17), at the following bid: 17,100 cu. yds. earth excav., 64 cts.; 6,250 ft. 24-in. sewer pipe, $1.30; 3,060 ft. 18-in. sewer pipe, 90 cts.; 2,664 ft. 15-in. sewer pipe, 60 cts.; 1,786 ft. 12-in. sewer pipe, 45 cts.; rock excav. $2.00 per cu. yd., and 33 manholes, ea., $45; total cost, $26,520. Ferguson & Purcell, of Lorain, bid for this work $28,267.

Cambridge, O.—Bids will be received by the Bd. of Pub. Service (H. P. Woodworth, Pres.), until Aug. 10 for furnishing material and constructing portion of sanitary system of sewerage, as advertised in The Engineering Record. O. M. Hoge, City Engr.

Eaton, O.—The citizens on July 22 voted to issue $125,000 bonds for the construction of a sewerage system. Bids will probably be called for in Oct. A. L. Reid, City Engr.

New Philadelphia, O. See "Paving and Roadmaking."

**Cincinnati, O.*—The L. Drach Constr. Co., 206 E. 4th St., is reported to have secured the contract for constructing sewer in Main and Excelsior Sts for $6,381.

Delaware, O.—Bids will be received until Aug. 23 by the Bd. Trus. Girls' Industrial Home (T. F. Dye, Secy.) for constructing a sewage disposal plant at above home, to consist of about 5,040 ft. 3, 6, 8, 10 and 12-in. sewer pipe, 3,004 lbs. c. i. specials, 4,764 lbs. steel, 1,378 cu. yds. crushed stone, etc. E. G. Bradbury and G. P. Shute, Engrs., 85 N. High St., Columbus.

Pawhuska, Okla.—See "Water."

Panama.—See "Miscellaneous."

**Harrisburg, Pa.*—Opperman & Opperman, of Harrisburg, are reported to have secured the contract for constructing Mish Hollow sewer (bids opened July 5), for $36,344.

Allegheny, Pa.—The State Comr. of Health is reported to have instructed Simon Kirschler, Dir. Dept. of Charities of Allegheney, to prepare plans for sewage disposal plant for city home and insane asylum at Claremont.

Taylor, Pa. Bids will be received until Aug. 6 by the Town Council (John F. Tubbs, Chrmn.) for constructing a lateral sewer in the 2d Sewer Dist. A. B. Dunning, Boro. Engr., 803 Mears Bldg., Scranton.

**Vermillion, S. D.*—The contract for constructing sewerage system at Normal School (bids opened July 1) has been awarded to Symns-Powers Co., of Sioux Falls.

**Brookings, S. D.*—J. R. Thompson, City Engr., writes that G. W. Haggert, of Fargo, N. D., has secured the contract for sewers and a disposal plant (bids opened July 15), at the following bid: 2,600 ft. 15-in. pipe sewers, $2.18; 200 ft. 12-in. pipe sewers, $1.55; 6,510 ft. 10-in. pipe sewers, $1.31; 48,650 ft. 8-in. pipe sewers, $1.21; total for sewerage system, $58,866. For septic tank and 3 filter beds, $7,785; 1,982 ft. 24-in. outlet sewer, $2.50; 666 ft. 18-in., $1.90, and 200 ft. 12-in., $1.44; total for disposal plant, $14,293. Totals of other bids received were: (*a*), sewerage system; (*b*), disposal plant: G. S. Redmon, Pipestone, Minn., *a*, $59,839; *b*, $14,547; W. J. Gray & Co., Minneapolis, Minn., *a*, $59,353.

Waco, Tex.—Sewer bonds to the amount of $60,000 are reported sold.

**Salt Lake City, Utah.* Jas. Kennedy, of Fargo, N. D., is reported to have secured the contract for constructing sewers in Salt Lake City, for about $212,870.

Spokane, Wash.—The Bd. of Pub. Wks. is reported to have decided to recommend to City Council the construction of a trunk sewer.

Bluefield, W. Va.—We are informed that the Bd. of Supervisors will expend about $25,000 for sewers. Engineer, Geo. H. Hall, of Bluefield.

Marshfield, Wis.—It is stated that bids will be received until Aug. 10 by M. G. Fleckenstein, City Clk., for constructing a sewer in 6th St.

BRIDGES.

Notes Arranged Alphabetically by States.

Talladega, Ala.—It is stated that bids will be received by the Co. Comrs. until Aug. 12 for constructing 2 steel bridges.

**Redding, Cal.*—The Bd. of Supervisors are reported to have awarded the contract July 10 for the construction of a bridge over the Sacramento River at Redding, to the Burrell Bridge & Constr. Co., of Oakland, at $35,970.

**Keswick, Cal.*—The Western Bridge & Constr. Co. is stated to have secured the contract to rebuild the county bridge across Sacramento River at Keswick at $6,800.

Greeley, Colo.—G. A. Houston, of Denver, Deputy State Engr., writes that all bids opened on July 23 for a reinforced concrete bridge over Cache La Poudre River at 5th St., Greeley, have been rejected; bids received ranged from $6,690 to $7,400.

Ripley, Ill.—The Bd. of Superv., it is stated, has been petitioned to construct a bridge over Crooked Creek above Ripley between Brown and Schuyler Counties, to cost about $4,000.

**Indianapolis, Ind.*—The contracts for the 3 concrete bridges to be built in the public parks is stated to have been awarded by the Park Bd., July 10, as follows: To Hillis F. Hackedorn & Co., Brookside bridge $5,875, Garfield bridge $7,518 and Spades Place bridge $2,549.

Indianapolis, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 7 for the construction of 3 bridges and 8 concrete culverts. C. J. Clark, Co. Aud.

Shelbyville, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 6 for the construction of a 75-ft. span reinforced concrete arch bridge over Sugar Creek, Morel Township. Thos. Hawkins, Co. Aud.

Sante Fe, Ind.—Bids will be received until Aug. 7 by the Bd. Co. Comrs., at Peru, for constructing a steel or concrete bridge across Big Pipe Creek south of the town of Santa Fe. Chas. Griswold, Co. Aud.

Plymouth, Ind.—Bids will be received until Aug. 6 by the Bd. Co. Comrs. for constructing 8 iron bridges and one set of abutments for bridge in German Township. H. L. Singrey, Co. Aud.

Princeton, Ind.—The Comrs. of Gibson County are reported to have ordered plans for the construction of an iron bridge over the Patoka River, known as the Severn Bridge.

Marion, Ind.—It is reported that bids will be received until Aug. 6 for constructing 5 concrete arches, one steel bridge with concrete abutments and floor, two concrete retaining walls, one concrete bridge floor, and the roofing of the New Cumberland bridge. Harry Goldwaite, Co. Aud.

Council Bluffs, Ia.—Bids will be received by W. F. Sapp, City Clk., until Aug. 19 for furnishing material and constructing 2 reinforced concrete bridges with retaining walls, etc., across Indian Creek, one at Frank St., the other at 8th St., as advertised in The Engineering Record. S. L. Etnyre, City Engr.

Cedar Rapids, Ia.—The City Council has adopted a resolution directing the City Engr. to prepare plans and estimates of cost of constructing a steel and concrete bridge at 16th Ave.

Salina, Kan.—It is stated that bids will be received until Aug. 8 by J. P. Burns, Co. Clk for two 60 ft. span steel bridges and a 45-ft. span steel bridge.

New Orleans, La.—Two bids are reported to have been been received July 15 by the Council for constructing a bridge across Bayou St. John at Esplanade St. One was considered informal. The other bid was from the Ottumwa Bridge Co., of Ottumwa, Ia., at $47,900.

Conowingo, Md.—The stockholders of the Conowingo Bridge Co., it is reported, have decided to issue $75,000 bonds to rebuild the bridge at Conowingo, which connects Cecil and Harford Counties. J. Hayward Harlow, Engr., Darlington, Md.

**Boston, Mass.*—Jones & Meehan, 1 Beacon St., have secured the contract for alterations to bridge bet. Chelsea and Boston, for $5,740 (bids opened July 25 by the Boston Bridge Comn.). Patk. F. McDonald, Supt. of Bridges.

Menominee, Mich.—The City Council of Menominee and the City Council of Marinette, Wis., are said to be considering the construction of a steel bridge at the first dam to replace present wooden structure.

The lower draw bridge over Menominee River is reported to have been badly damaged by a collision with a steamer, and it is stated it will cost $12,000 to make repairs.

Independence, Mo.—It is stated that bids will be received until Aug. 7 by S. A. Boyer, Co. Clk., for constructing a reinforced concrete bridge with two 30 ft. spans on Holmes Park Rd. over Heart Grove Creek.

Kansas City, Mo.—The Lower House of the Council on July 15 passed an ordinance giving permission to the Commercial Improv. Co. to construct a viaduct on Main St. from 20th to 23d Sts. It will be a foot, wagon road and street car structure, and is to cost about $110,000. The Metropolitan Street Ry. Co. will operate the cars over it as far as 27th St., where connections will be made with the cars using the Main St. tracks. When the viaduct is finished it will be deeded to the city to own and maintain.

South Omaha, Neb. Engineers of the Chicago, Rock Island Pacific Ry. (W. H. Peterson, Bridge Engr., Chicago, Ill.), it is stated, have made surveys and made a report recommending the construction of a viaduct in lower Albright, South Omaha, over the railroad tracks.

Rahway, N. J.—Bids will be received until Aug. 7 at the Court House, Elizabeth, for cnstructing a reinforced concrete bridge across the Robinson Branch of the Rahway River at Rahway. Span 60 ft., width 46 ft. J. L. Baner, Co. Engr., 215 Broad St., Elizabeth.

South Orange, N. J.—It is stated that bids will be received until Aug. 6 by G. F. Drum, Co. Engr., Newark, for constructing a bridge on W. Turrell Ave., South Orange.

Trenton, N. J.—Bids will be received until Aug. 10 (readvertisement) by the Bd. Chosen Freeholders (Ammi R. Schanck, Dir.) for furnishing material and constructing a combination steel and concrete bridge across Hannah Moore's Brook, Hopewell Township. Frank J. Eppell, Co. Engr., also same time and place for constructing a combination steel and concrete bridge over stream crossing Dutch Neck and Grover's Mill Rd., West Windsor Township.

**Utica, N. Y.*—The contracts for the work of repairing and constructing the bridges over Real's Creek and the new channel of the Mohawk River on N. Genesee St., have been let to J. C. Dewhurst. The bridge over Real's Creek will have the wood supports taken out and iron supports substituted. This is made necessary because of the projected electrification of the Deedfield St. car line. Also with this object in view the old rails are being torn out and better ones put in their places. The bridge over the new river channel will be entirely of iron, and although not a new bridge. Two abutments are to be erected on either side of the river.

Rochester, N. Y.—See "Paving and Roadmaking."

Westfield, N. Y.—The citizens are stated to have voted to issue $35,000 bonds, the city portion toward constructing a viaduct over Chautauqua Creek. The structure to be 1,000 ft. long and 50 ft. wide. The Buffalo & Lake Erie Traction Co. to expend $50,000 on the bridge.

**New York, N. Y.*—The following are the bids received July 18 by J. W. Stevenson, Comr. Bridges for furnishing and delivering spruce plank for the Brooklyn Bridge: D. M. Resseguie, $15,720 (awarded contract); Brooklyn Lumber Co., $19,500; Arthur C. Jacobson & Sons, $20,580.

The following are the bids opened on July 23 by Jas. W. Stevenson, Comr. of Bridges, for making test borings at the site of new bridge over East River, bet. Manhattan and Brooklyn Boroughs (price given per cu. yd.): Grant Roher, 299 Bway., $7.41; Williams Eng. & Contr. Co., 13 Park Row, $5.95; Manhatan Drilling Co., $6.75; American Test Boring & Drill Co., $7.68; Healey Sewer Machine & Contr. Co., 21 Park Row, $4.79, and American Diamond Rock Drill Co., $11.25.

The following are the bids opened same time and place for construction of trolley railway approaches to the Brooklyn Bridge, in Brooklyn Boro.; Snare & Triest Co., 143 Liberty St., $106,280; Chas Meads Co., 299 Bway., $95,400, and J. H. Gray & Co., $106,700.

Tarboro, N. C.—Bids will be received until Sept. 2 by the Chmn. Bd. Co. Comrs. for constructing a steel bridge 20 ft. long, 18 ft. wide, with 60-ft. draw across Tar River, near Tarboro.

New Lexington, O. It is stated that bids will be received until Aug. 6 by Geo. T. Drake, Co. Aud., for constructing a bridge over Rush Creek, at Main St., East Liverpool.

Cleveland, O. The City Council is reported to have

passed an ordinance providing for an appropriation of $22,000 to complete Jefferson Ave. bridge.

Lebanon, O.—Bids will be received by S. A. Stillwell Co. Aud., until Aug. 24, for constructing superstructure over Little Miami River at Mathers Mill, 2 miles south of Oregonia to consist of a 2-span high truss steel bridge, with permanent floor, each span 135 ft. on pin centers, and a clear roadway of 16 ft. also for substructure for same, consisting of a new abutment and pier and refacing of one old abutment. Samuel D. Henkle, Co. Surv.

Mt. Gilead, O.—It is stated that bids will be received until Aug. 15 by W. C. McFarland, Co. Aud. for constructing the substructure and superstructure of a steel bridge over Whetstone Creek.

Port Clinton, O.—It is reported that bids will be received until Aug. 17 by the Bd. Co. Comrs. for furnishing material and constructing the superstructure for a bridge ,to have 65-ft. span, 16-ft. roadway across Crane Creek, Allen Township; also constructing substructure of said bridge. Henry Pafenbach, Co. Aud.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service (M. J. Keefe, Clk.) until Aug. 16 for furnishing material and reconstructing and repairing Liberty St. viaduct and approaches from Garrard Ave. to State St. as advertised in The Engineering Record.

Towanda, Pa.—Local press reports state that bids will be received by the County Comrs. (E. D. Harkness, Chmn.) until Aug. 15 for the construction of James St. bridge across Susquehanna River bet. the townships of North Towanda and Wysox.

Philadelphia, Pa.—The members of the Southwest Improv. Assoc., it is stated, have prepared a resolution to be presented to the Mayor, asking for a new bridge at 61st and Yocum Sts., over the Baltimore & Ohio R. R. tracks.

**Nashville, Tenn.*—W. M. Pollard, Co. Judge, writes that the contract for building concrete piers for two highway bridges across Cumberland River, reinforced concrete viaduct approaches for Sparkman and Jefferson St. bridges and furnishing borrow pits and filling certain parts of approaches of said bridges (bids opened by the Cumberland Bridge Com. of Davidson County on July 10) has been awarded to Foster & Creighton, of Nashville, for $510,000.

Mt. Pleasant, Tenn.—The County Road Comrs., it is stated, have decided to construct 2 steel bridges to replace present bridges on Mt. Pleasant Pike. Columbia is the county seat of Maury County.

**Ogden, Utah.*—The contract for constructing two 50-ft. span concrete arch bridges (bids opened July 23) has been awarded to United Concrete Co., of Ogden, for $4,874. A. F. Parker ,City Engr.

Ft. Myer, Va.—Bids will be received until Aug. 20 for constructing bridge on Military Rd. to Ft. Myer, Va., by Maj. Gray Zalinski, Q. M., U. S. A., Washington, D. C.

Seattle, Wash.—The constructng of a briuge from Marion St. and First Ave. across the car tracks to the wharves, is reported contemplated.

**Toronta, Ont.*—The contract for the steel superstructure for the Lansdowne bridge, is stated to have been awarded the Cleveland Bridge and Engineering Co., Darlington, England, for $53,443, which includes the erection and supply of girders.

**Ottawa, Ont.*—The Transcontinental Ry. Co. has awarded the contract for the construction of 5 steel bridges on the Quebec Le Tugue section of the National Transcontinental Ry.. to the Dominion Bridge Co, of Montreal, Que., for $150,000.

Hamilton, N. Z.—Engineers Waddell & Harrington, New Nelson Bldg., Kansas City, Mo., write that the date of receiving bids for the proposed bridge over Waikato River at Hamilton, New Zealand, has not yet been decided upon; probable cost, $125,000 to $150,000.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—It is stated that bids will be received until Aug. 8 by the Mayor and Bd. of Adermen for constructing cement sidewalks and curbs on various streets. W. M. Faulk, Mayor.

Huntsville, Ala.—Bids are wanted until Aug. 17 for paving with vitrified brick streets bounding the Public Square. For further information address the Mayor.

**Greenville, Ala.*—The contract for paving about 12,000 sq. yds. with vitr. brick has been awarded to the Crockett Paving Co., of Birmingham. Part of the pavement is to be laid on a concrete base at $2.25 per sq. yd., and the remainder on a sand foundation at $1.75 per sq. yd. The prices quoted not including excavation. Arthur Pew, Consulting Engr., Atlanta, Ga.

Selma, Ala.—The City Clk. writes that bids will probably be called for in about 60 days for paving. Material not yet decided upon. Engr., J. Smith, of Selma. V. B. Atkins, Mayor.

Birmingham, Ala.—The West End Council is reported to have passed a resolution providing for the paving of several streets at a cost of $170,000.

Whipple Barracks, Ariz.—Bids will be received until Aug. 24 by Capt. Chas. C. Walcutt, Jr., Prescott, for constructing roads and walks at Whipple Barracks.

**Denver, Colo.*—The contract for laying pavement in Broadway Paving Dist. No. 3 (bids opened July 16) has been awarded to the Colorado Co., of Denver, for $69,218.

**New London, Conn.*—The Connecticut Hassam Paving Co., of Boston, Mass., is reported to have secured the contract for paving with Hassam pavement Methodist St., at $1.80 per sq. yd.

New Britain, Conn.—We are informed that it is proposed to pave Church St. from Main to Elm St., about 3,500 sq. yds., before fall. Bitulithic will probably be used. F. H. Oldershaw, City Engr.

New Haven, Conn.—The Permanent Paving Comn., it is stated, voted on July 18 to pave with wood blocks on a portion of State St., with Hassam on a portion of Oak St., and with macadam on portions of Plymouth, Carlisle, Prospect, Sachem and Winthrop Sts.

Wilmington, Del.—Bids will be received until Aug. 6 (extension of date) by the Francis A. Price, New Castle County State Highway Comr., 1009½ Market St., Wilmington, for constructing a road in Blackbird hundred, a distance of about 4.82 miles.

Pinckneyville, Ill.—The paving of the public square and portions of several other streets, in all 11,000 sq. yds., at a total cost of $30,000, is reported contemplated. W. W. Burke, City Clk., writes that about $26,000 will be expended for vitrified brick paving. Engineer, Geo. Kennedy, Jr., of Murphysboro. W. A. Nesbit, Clk. Bd. Local Improv.

Carthage, Ill.—It is stated that $5,100 street paving bonds are to be issued.

Beardstown, Ill.—A. G. Smith, City Clk., writes that bids will be received on Sept. 3 for 38,460 sq. yds. brick pavement on concrete base, estimated cost $81,528. Engineer, C. W. Brown, of Jacksonville.

Danville, Ill.—It is stated that a portion of Green St. will be paved at a cost of $9,195.

Champaign, Ill.—J. W. Stipes, of Champaign, is stated to have secured the contract for paving Chalmer St. at $19,499.

Cairo, Ill.—Wilbur B. Thistlewood, City Engr., writes that the Bd. of Local Improc. will receive bids Aug. 15 for paving with brick Washington Ave.—51,646 sq. yds.

Chicago, Ill.—Bids will be received until Aug. 7 by the South Park Comrs. (E. G. Shumway, Secy.), for furnishing material and paving a portion of Michigan Ave. driveway with asphalt, bitulithic, creosoted wooden block and other kinds of bituminous or treated block pavement.

Kankakee, Ill.—The Bd. of Pub. Wks. is stated to have appropriated $28,000 for improving streets.

Indianapolis, Ind.—Bids will be received until Aug. 9 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.) for paving with creosoted wooden blocks portions of Meridian, St. Clair and 16th Sts.

East Chicago, Ind.—It is stated that the City Council will receive bids for the improvement, grading and paving of the four principal streets; estimated cost, $150,000.

Covington, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 16 for constructing the Glascock gravel road, 11,820 ft. long. Wm. B. Gray, Co. Aud.

Bedford, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Aug. 17 for constructing 8,217 ft. macadamized road. W. G. Owens, Co. Aud.

Shelbyville, Ind.—It is reported that the City Council will receive bids until Aug. 6 for grading and paving with gravel Jackson St.; also constructing 5-ft. cement walks. H. J. Clark, City Clk.

**Crawfordsville, Ind.*—The Comrs. of Montgomery and Putnam Counties are stated to have awarded the contract July 20 for grading, graveling the county line gravel road to Johnson & Johnson of Crawfordsville, for $7,800.

Ft. Washington, Ind.—Bids will be received until Aug. 26 by the Constr. Q. M., U. S. A., for grading and draining the drill grounds at this post. Plans and specifications may be had upon a deposit of $10.

Terre Haute, Ind.—Poplar St. from 3rd to 13th St., is to be paved with brick. Edgar Schmidt, City Engr.

Des Moines, Ia.—Bids will be received until Aug. 7 by the Bd. Pub. Wks. (W. W. Wise, Chmn.), for paving portions of 6th, Forest and Arlington Aves., and an alley with No. 1 repressed vitrified paving brick on a 6-in. Portland cement concrete foundation, in all about 26,118 sq. yds.

Ottumwa, Ia.—Resolutions of necessity have been passed for paving with vitr. brick sundry streets and alleys; approximate quantities: 5,200 lin. ft. of Portland cement curb. and 7,000 sq. yds. of paving. Bids will probably be received some time in August. Other paving work is contemplated. Jos. T. Brady, City Engr.

Ft. Leavenworth, Kan.—The following bids are reported opened July 19 by Capt. J. E. Normoyle for grading. curbing and paving Grant Ave.: E. Jones, $97,000; Boyd Bros., $94,000; Jas. Stanton, $110,000, oiled asphalt, $70,000; O. C. Chapin, brick pavement, not including guttering ,and curbing, $82,000.

Paola, Kan.—It is reported that bids are wanted until Aug. 6 for paving certain streets with brick on concrete foundation. E. D. McLaughlin, City Clk.

Elizabethtown, Ky.—It is reported that bids are wanted until Aug. 6 for paving certain portions of several streets. R. S. Bush, City Clk.

**Ashland, Ky.*—A contract for 15,716 sq. yds. of brick paving has been awarded to the Southern Bitulithic Co., of Nashville, Tenn.

Ft. St. Philip, La.—Bids will be received until Aug. 21 by Capt. B .T. Clayton, Q. M.. U. S. A., New Orleans, for constructing roads, drains and sidewalks at Ft. St. Philip.

New Orleans, La.—Capt. Hardee has submitted to the chairman of he Budget Committee estimates of the city's portion of the paving of certain streets as follows: University Pl., from Canal to Tulane Ave., $4,300; South Pierce St., from Canal St. to Tulane Ave., $7,000; Opelousas Ave., from Brooklin to Atlantic Ave., $42,000; Esplanade Ave.. from Claiborne to Galvez St., lower side, $14,000, and Esplanade Ave., from Galvez to Broad St., both sides, $30,000.

**Saco, Me.*—H. A. Weymouth, Mayor, writes that the contract for macadamizing four sections of highway (bids opened July 24) has been awarded to Edw. Adams, G. Louis Burnham and W. H. Poor, of North Andover, for $8,994.75.

**New Bedford, Mass.*—An additonal contract for 8,000 sq. yds. of bitulithic has been awarded the Warren Bros. Co., of Boston.

Everett, Mass.—About $23,000 has been appropriated by the City Government for sidewalks. Chris Harrison, City Engr.

**Hudson, Mich.*—Fred P. George, City Clk., writes that the contract for paving about 12,900 sq. yds. (bids opened July 23) has been awarded to McKinney Bros., of Toledo, O., for $23,500.

Scottville, Mich.—Bids will be received until Aug. 10 by W. C. Freedy, City Clk., for furnishing material, grading, guttering and macadamizing a portion of Main St., requiring about 2,100 cu. yds. earth excav., 1,775 sq. yds. cobble stone gutters, 4,428 sq. yds. of macadam paving, and about 6 M. ft. temporary hemlock curbing.

Ecorse, Mich.—Bids will be received until Aug. 13 by Richd. C. Montie, Village Clk., for paving and sewering River Rd. Geo. Jerome, Village Engr., 1102 Majestic Bldg., Detroit.

Muskegon, Mich.—The only bid received July 15 for for the entire work of paving Western Ave, including building of sewer, is stated to have been submitted by the Central Bitulithic Paving Co., of Detroit, at $59,893.

New bids will be received by P. P. Misner, City Recorder, until Aug. 12 for furnshing material and paving Western Ave. with brick, asphalt, asphalt macadam or other first-class pavement, as advertised in The Engineering Record.

Detroit, Mich.—Bids will be received until Aug. 12 by the Dept. Parks and Boule. (Philip Breitmeyer, Comr.) for resurfacing Lafayette Boule. with creosoted block and constructing a brick roadway on Northern Grand Boule.; also furnuishing Kentucky rock asphalt and trap rock, rip-rap size, as may be required.

**St. Paul, Minn.*—Wm. Devine is stated to have received the contract for repairing the Emerson and Kinnane Road, at $8,432; also the contract for the Edgerton St. road at $10,913.

**Duluth, Minn.*—It is stated that paving contracts have been awarded by the Bd. Pub. Wks. as follows: 4th Ave. with cedar blocks to Hugh Steele, at $12,692, and Lake Ave to J. A. Preston at $12,662.

Mankato, Minn.—It is reported that a portion of 5th St. is to be macadamized at a cost of $5,000.

Winona, Minn.—The City Engr., it is reported, will prepare plans for macadamizing Gilmore East and West Burns Valley and Catholic cemetery hill roads.

Marshfield, Mo.—Bids will be received until Aug. 30 by W. P. McKnight, City Clk., for about 98,000 ft. of macadamized streets anad 7,200 ft. of stone guttering.

**Independence, Mo.*—The Kansas Bitulithic Co., of Kansas City, Mo., has secured a contract for 9,350 sq. yds. of bitulithic

**Nashua, N. H.*—The contract for constructing 2 miles of State road in Nashua (bids opened July 5) ha sheen awarded to Osgood Constr. Co., of Nashua.

Concord, N. H.—Bids will be received until Aug. 8 by A. W. Dean, State Engr., Concord, for constructing a gravel road in Hookett, cost about $3,100; also a trap rock road in Concord, cost about $7,000.

Elizabeth, N. J.—Bids will be received until Aug. 15 by the City Council for paving Court St. and Waverly Pl. and flagging 7th St., requiring 3,230 sq. yds. trap block pavt., 1,480 sq. yds. telford pavt., 1,720 lin. ft. new flag, 2,340 lin. ft. new curb, 1,390 sq yds. trap block gutters, etc.

**Elizabeth, N. J.*—The contract for paving with asphalt a portion of Walnut St. is reported to have been awarded to the Barber Asphalt Co., Halsey and Academy Sts., for $31,058.

Westfield, N. J.—Bids will be received until Aug. 19 by the Town Council for regulating, grading and macadamizing a portion of Euclid Ave. Estimated quantities: 555 cu. yds. excav., exclusive of sub-grading; 3,837 sq. yds. macadamizing; 227 sq. yds. cobble gutters. A. W. Vars, Town Surveyor, Broad and Elm Sts.; Lloyd Thompson, Town Clk.

Gloucester City, N .J.—The citizens are stated to have on July 23 voted in favor of issuing $75,000 bonds to continue the improving of the streets in the eastern and other sections of the town.

East Orange, N. J.—An ordinance has passed first reading in the City Council providing for the laying of an 8-ft. sidewalk the entire length of Main St.

**Brunswick, N. J.*—The contract for paving about 5,000 sq. yds. with brick (bids opened July 15) has been awarded to John F. Kerwin, of Guilden St., for $11,600.

**Salem, N. J.*—The contract for constructing the Alloway and Aldine Road (bids received July 8) is stated to have been awarded to Sutton & Corson, at $10,320. The only other bid was submitted by B. F. Sweeten & Son at $10,950.

The building of a gravel road between the city of Salem and village of Quinton, according to reports, has been abandoned. The taxpayers did not want a gravel road. Bids for this road were received same time as above road.

**Buffalo, N. Y.*—The German Rock Asphalt Cement Co., D. S. Morgan Bldg., is reported to have secured the contract for repaving a portion of High St. with asphalt for $36,920.

New York, N. Y.—Bids will be received until Aug. 14 by J. A. Bensel, Comr. of Docks, for furnishing materials and repairing the asphalt pavements on the North and East Rivers, together with all work incidental thereto. Contract No. 1094. Class 1—For repairing the asphalt pavement between the north side of W. 56th St. and a point about 150 ft. north of the north side of Pier (new) 29, near the ft. of Vestry St., North River. Class 2—For repairing the asphalt pavement between Battery Pl. and a point about 140 ft. north of the north side of Pier (new) 29, near the ft. of Vestry St., North River, and asphalt pavement on the East River.

**Moravia, N. Y.*—S. P. Hull, of Cortland, on July 22 secured the contract for paving Central St. for $11,045.

* *Items marked thus give the names of parties awarded contracts.*

[illegible] N. Y.—Wm. F. Barton, Village Clk., writes that the contract for laying 10,000 sq. yds. brick pavement (bids opened July 22) has been awarded to R. W. Henson, of Geneva, at $1.20 per sq. yd.

[illegible] N. Y.—Fred R. Hazard, Village Pres., of Solvay, Fred M. Power, Supervisor of the town of Geddes, and others, have petitioned the State Fair Comm. for a 60-ft. right of way over State Fair property. It is proposed to construct a highway from Solvay to the Van Vleck Rd., and the plans include a $60,000 overhead bridge.

Brooklyn, N. Y.—Bids will be received until Aug. 8 by the Park Bd. (Moss Herrman, Pres.), New York City, for furnishing material and constructing a cement sidewalk and curb around Parade Ground, Prospect Park, Boro. Brooklyn.

Herkimer, N. Y.—This city has added 5,075 sq. yds. of bitulithic to the contract previously awarded Warren Bros. Co., of Boston, Mass.

**Rochester, N. Y.*—Warren Bros. Co., of Boston, Mass., will pave Lake View Ave. The contract calls for 21,500 sq. yds. of bitulithic.

*The Bd. of Contract is stated to have awarded contracts as follows for paving: Monroe Ave., asphalt from Culver Road to Highland Ave., Rochester Vulcanite Pavement Co., 27 Main St., E., $14,495, brick to be laid between the car tracks; brick pavement on Wilson St., F. C. Lauer & Sons, Rochester, $5,884; Cady St., brick pavement, H. B. Hooker & Son, Wilder Bldg., $28,585; Adams St., macadam pavement, William Fuller, 16 State St., $18,006; B'way, resurfacing, H. N. Cowles, 47 Tacoma St., $3,530. Bids were rejected for paving Reservoir Ave. as excessive; the specifications will be changed and the work readvertised.

*The Bd. of Contract & Supply is stated to have awarded the contract for paving with creosote wood block Platt St., Bridge to Whitmore, Rauber and Vicinus, for $10,728.

**Yonkers, N. Y.*—A contract for 10,000 sq. yds. of Acme asphalt has been awarded the Warren Asphalt Paving Co., of Cambridge, Mass.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 15 by the Park Bd. (Moses Herrman, Pres.), New York City, for furnishing material and laying cement sidewalks around Rainey and Ashmead Parks; also until Aug. 8 for constructing asphalt tile walks in Flushing and College Point Parks, all in Boro. Queens.

New York, N. Y.—Bids will be received until Aug. 6 by Louis F. Haffen, Pres. Boro. Bronx, for paving with asphalt blocks on a concrete foundation, Hunt's Point and Grant Aves., Timpson Pl.; paving with iron slag blocks on a concrete foundation, Clay Ave.; curbing and flagging sidewalk on Summit Pl. and E. 199th St. Engineer's estimate, 17,035 sq. yds. completed asphalt blk pavt., and keeping same in repair for 5 years from date of acceptance, 18,330 sq. yds. completed iron slag blk pavt., and keeping the same in repair for 1 year from date of acceptance, 1,350 cu. yds. rock excav., 300 cu. yds. of filling, 6,375 lin. ft. new curbs, furnished and set, 11,650 sq. ft. new flag, furnished and laid, 5,757 cu. yds. concrete, including mortar bed, etc.; also furnishing and delivering 2 new double cylinder steam road rollers, horizontal boilers, Buffalo pitts, or equal (size 15 gross tons); to be furnished and delivered to the yard of the Bureau of Highways, 143d St. and College Ave., 30 days from date of execution of the contract.

Bids will be received by Comr. of Docks until Aug. 8 for furnishing material, curbing and flagging and for laying granite pavement with crosswalks within the area of the marginal St. on the Chelsea section, bet. W. 11th and W. 19th Sts., North River, as per contract No. 1081.

Brooklyn, N. Y.—Bids will be received until Aug. 14 by Bird S. Coler, Boro. Pres., for furnishing material, regulating, grading, laying sidewalks and repairing several streets including Butler, President and 44th Sts., Christopher Ave. and De Sales Pl. Engineer's estimates includes: 21,890 lin. ft. new curb, 40,670 cu. yds. earth excav., 2,450 sq. yds. asphalt block, 9,350 lin. ft. concrete curb, 6,535 sq. yds. asphalt, 113,260 sq. ft. cement sidewalk, etc.

Albany, N. Y.—Mayor Gaus is reported to have signed the ordinance providing for the paving of portions of Yates St. and McCarty Ave.

**Asheville, N. C.*—The Atlantic Bitulithic Co., of Richmond, Va., has secured a contract for 4,203 sq. yds. of bitulithic.

Durham, N. C.—Plans are being prepared for extending the Durham and Roxboro County Road, a distance of 10 or 12 miles, to the Person County line. The work will include excav. and 6-in. macadam and will be let by contract. Gilbert C. White, Durham, N. C., Engr.

New Philadelphia, O.—Geo. C. Marsh, Clk. Bd. of Pub. Service, writes that bids will be received on Sept. 1 for paving S. B'way, and constructing two 8-in. pipe sewers on 5th and 8th Sts.

Celina, O.—It is stated that bids will be received until Aug. 10 by M. Lutz, Engr., care of the Co. Aud., for grading, curbing and macadamizing Romer anad Jones Rd.

Findlay, O.—It is stated that bids will be received until Aug. 10 by Bd. Co. Comrs. (J. W. Montgomery, Chmn.), for constructing 2 miles of stone pike, known as Wilson and Deming Rds.

Cincinnati, O.—Engineer Danenhower, it is stated, estimates the cost of paving with macadam on Delhi Ave. at $23,459.

*Contracts for paving have been awarded by the Bd. of Pub. Service as follows: To W. A. Glazer & Co., [illegible] Reading Rd., for grading and paving Beechmont Ave. (bids opened July 15), for $[illegible]; to Kirchner Constr. Co., 8th and Plum Sts., for grading, paving and curbing Grandin Rd. (bids opened July 10), for $[illegible], and to Drach Constr. Co., 206 E. 4th St., [illegible] concrete steps at head of Main St. to Mt. Auburn, [illegible]

The Co. Comrs. are stated to have awarded on July 23 contracts as follows for improving Lick Run Pike to Nick Ruebel at $59,482, Reading Pike to Geo. Leonard at $14,434, Rich Rd. to W. Taulman at $5,454, Langdon Rd. to W. H. Settle at $4,757, and Taylor Creek Rd. to J. Fagaly at $3,543.

**Columbus, O.*—E. F. McGuire, Secy. Bd. Pub. Service, writes that the contract for constructing asphalt repair plant (bids opened July 12) has been awarded to Hetherington & Berner, of Indianapolis, Ind., for $11,825.

East Liverpool, O.—It is stated that bids will be received until Aug. 10 by the Co. Comrs. at Lisbon for constructing a road between this city and Wellsville. Road to be paved with brick set on edge. J. C. Kelly, East Liverpool, is the engr.

Barnesville, O.—It is stated that bids will be received until Aug. 6 by F. Waldo Hilles, Village Clk. for grading and paving a portion of Walton Ave. and Park St.

Euclid, O.—It is stated that bids will be received until Aug. 12 by H. S. Dunlap, Village Clk., for grading, draining and paving with macadam a portion of Euclid Road.

Columbus, O.—Bids will be received until Aug. 14 by the Bd. Pub. Service (Edw. F. McGuire, Secy.), for improving portions of several streets including Beck, Bennett and High Sts., Cleveland, Champion and Hubbard Aves.

Bids will be received until Aug. 8 by the Bd. Pub. Service (Edwd. F. McGuire, Secy.), for paving portions of 12 streets.

Newark, O.—Bids will be received by the Co. Comrs. of Licking County, at Newark, until Aug. 22, for the complete construction of 4.32 miles of macadam road. Plans and specifications on file in the office of J. L. Gilpatrick, Co. Surv. H. L. Maddocks is Co. Engr.

Hamilton, O.—An ordinance is stated to have been passed authorizing an issue of $31,000 in bonds for improving Dayton St.

Engineer Dillon is reported to have submitted to City Council the estimated cost of paving a portion of Eaton Road at $10,506 with sheet asphalt, bitulithic, bituminous macadam or vitrified brick, also the cost of paving a portion of Block St. at $6,924.

Youngstown, O.—Bids will be received until Aug. 12 by the Bd. Pub. Service (W. H. McMillin, Clk.) for paving a portion of Iona St.

**Wilkesbarre, Pa.*—The contract for paving Broad St. in Hazle Township (bids opened July 18) has been awarded to John A. Leffler, of Hazleton. The contract for the block has been let to Richmond Clay Products Co., of Reading.

Monessen, Pa.—It is stated that bids will be received until August 9, by J. F. Irwin, Boro. Clk. fr grading, curbing and paving with vitrified block approvimately 17,500 sq. yds. W. A. Miller, Chmn. Street & Roads Com.

Ambler, Pa.—The citizens are stated to have voted to issue $35,000 street improvement bonds.

Application for State aid in reconstructing 3 sections of roads in New Britain Township, in all about 39,680 ft., is stated to have been filed in the State Highway Dept. at Harrisburg.

**Dorranceton, Pa.*—Balton G. Coons, of Dorranceton, is stated to have secured the contract to pave on Wyoming Ave. with Williams Grove vitrified brick block on concrete foundation at $2.24 per sq. yd.

Reading, Pa.—The Mayor has signed the bill authorizing the paving with granite block of a portion of Poplar St., also that bids be asked for paving with brick a portion of Cotton St.

The City Council on July 29 passed ordinances providing for paving as follows: With vitr. shale block, bitulithic or wood block, portions of 4th and Chestnut Sts; also portions of Buttonwood and 3d Sts., material not specified.

**York, Pa.*—Hartley & Zeigler, of West York, are stated to have secured the contract to macadamize the streets of the Boro of West York.

**Providence, R. I.*—This city has awarded a contract for 21,000 sq. yds. of bitulithic to Warren Bros. Co., of Boston, Mass.

**Marshall, Tex.*—The Texas Bitulithic Co., of Dallas, Tex., has secured a contract for 27,684 sq. yds. of bitulithic.

Taylor, Tex.—The Attorney-General has approved the $15,000 public square paving bonds.

Dallas, Tex.—The Park Bd. has adopted a resolution appropriating $6,500 to construct sidewalks 14 ft. wide at the Fair Grounds of granite screenings. It is stated bids will be asked at once for the work.

Tacoma, Wash.—Nelson & Hanson are stated to have submitted the lowest bid for constructing sidewalks in Dist. No. 386 at $3,945.

Fond du Lac, Wis.—It is stated that bids will be received until Aug. 12 by J. F. Hohensee, City Clk. for paving with brick on a portion of 4th and 3d Sts.

Ashland, Wis.—It is stated that bids will be received until Aug. 22 by the Bd. Pub. Wks. for paving with asphalt on 7th St.

Appleton, Wis.—It is reported that the City Engr. is receiving bids until Aug. 15 for paving 10 blocks with brick.

Two Rivers, Wis.—It is stated that bids will be received until Aug. 9 by John Gesell, Chmn. Bd. Pub. Wks., for grading, graveling, macadamizing and curbing part of Williams St.

**Green Bay, Wis.*—The Andrews Asphalt Paving Co. is stated to have secured the contract (bids opened July 15) for the Ashland Ave. asphalt paving $28,886; for E. Mason St., $23,944; and for School Pl., $5,772.

Windsor, Ont.—Bids will be received until Aug. 8 by Stephen Lusted, City Clk., for $20,000 macadam pavement bonds.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Citronelle, Ala.—The City Council is reported to have granted a franchise to the Citronelle Light & Power Co. The company is composed of business men of Hattiesburg, Miss. An ice plant is also promised by these same parties as soon as the electric light plant is complete.

San Francisco, Cal.—Bids will be received until Aug. 29 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for furnishing and delivering motors, rheostats, chain drives, air compressor, circuit breakers, conduit, wire, etc., at the U. S. Postoffice and Court House, etc., San Francisco.

Boulder, Colo.—The Perfect Light Co. is reported incorporated with a capital of $50,000 by C. W. Sanborn, W. L. Seely and others.

Washington, D. C.—Bids were opened on July 20 at the office of the Supt. U. S. Capitol Bldg. and Grounds for weatherproof and rubber covered electric wire for office building, House of Representatives. The National Electrical Supply Co., Washington, D. C., bid on the entire material $24,338, and on weather-proof wire only $20,701, and for the rubber covered wire only $3,637. The Simplex Electrical Co., Boston, Mass., submitted 3 bids for rubber covered wire only, namely, $3,803, $4,780 and $4,880.

Bids will be received at the Bureau of Supplies and Accounts at the Navy Dept., Washington, D. C., until Aug. 6 to furnish at the navy yards and naval stations a quantity of naval supplies, as follows: Boston, Mass., Sche. 94—Milling attachment, etc. Sche. 120—Spruce, yellow pine. Sche. 121—Electric operating equipment. Norfolk, Va., Sche. 94—Turret lathe. Sche. 118—Arches and jamb bricks, retort cement. Sche. 131—Portland cement. Charleston, S. C., Sche. 94—Emery grinders. Sche. 121—Motor drives. Portsmouth, N. H., Sche. 95—Planing machines. Sche. 118—Cells, iron wire, electro-mechanical gongs. League Island, Pa., Sche. 122 and pump, Sche. 126 white oak; Washington, D. C. Sche. 119—Copper tubing, sheet copper, brass, lead, galvanized steel, black iron and tin. Sche. 120—Steel tank. Sche. 125—Drill chucks, reamers, turning tools, etc. Sche. 126—White and yellow pine. Sche. 127—Drill rod. Mare Island, Cal., Sche. 137—Brick, windows, lumber piles, paper wall board. Sche. 138—Redwood, Oregon pine. Puget Sound, Wash., Sche. 136—Chucks, drills. Sche. 139—Iron pipe and fittings. Portsmouth, N. H., Sche. 150—Motor. Sche. 153—Bolt sand nuts, drills, etc. Sche. 154—White pine, spruce. Sche. 155—Zinc plates, tool steel. Sche. 158—Brass, copper and galvanized pipe, pipe fittings, valves. Also until Aug. 13 as follows: Boston, Mass., Sche. 135—Vertical boring mill, pipe flanging machine. Sche. 149—Plumbing fixtures, valves. Sche. 155—Rolled bronze, brass sheet. New York, N. Y., Sche. 117—Searchlight projectors, generating sets, incandescent lamps, portable testing sets, testing generators, keyboards, gonda cells, dynamotors, interior fittings and fixtures, branch boxes, etc., switch handles, steel and brass enameled conduit and fittings, conductor, etc. Sche. 134—Hydraulic accumulator. Sche. 155—Rolled bronze, brass sheet, bar iron, plain and corrugated galvanized sheet steel, bar and plate steel, sheet tin and zinc. Sche. 158—Iron or steel pipe, pipe fittings, brass unions. League Island, Pa., Sche. 151—Incandescent lamps, arc-lamp globes and parts, switches, rubber-covered wire, electrical supplies. Washington, D. C., Sche. 148—Air drills, sheet copper and lead. Sche. 151—Incandescent lamps, globes and repair parts for arc lamps, switches, flexible steel conduit, electrical supplies. Sche. 158—Loricated iron pipe. Charleston, S. C., Sche. 133—Construction of pent-house, cutting out rudder pit in dry dock. Sche. 149—Motors. New Orleans, La., Sche. 140—Tile drain pipe, etc. Key West, Fla., Sche. 141—Yellow pine. Pensacola, Fla., Sche. 140—Yellow pine, metallic shingles, galvanized iron coping, etc. Sche. 141—White oak, yellow pine. Sche. 142—Brick, Portland cement, etc., spikes, bilge pumps, windlasses, copper sheathing, galvanized iron, bar steel. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l, U. S. N.

Hawaii.—Bids will be received until Aug. 22 by the Light House Engr., Tompkinsville, S. I., N. Y., for furnishing one first order lantern for Makapuu Point, Hawaii, Light Station.

Pekin, Ill.—It is reported that plans have been prepared by the Pekin Electric Light Co. for improvements, which will cost about $50,000.

Scottsburg, Ind.—The question of lighting the city by electricity and building water works is reported as being agitated here. A franchise may be granted.

Princeton, Ind.—It is reported that bids will be received by the Consumers Gas and Light Co., until Aug. 5 for the construction and equipment of artificial gas plant; estimated cost, $60,000.

Seelyville, Ind.—F. M. Fauvre, Pres. of the Louisville & Eastern R. R. Co., of Louisville, Ky., is reported interested in a company about to be formed for the construction of a power plant near Seelyville, to transmit electricity to Indianapolis.

Red Fork, Ind. Ter.—For the purpose of developing water power for factory uses, steps are being taken toward making a cut-off of Arkansas River north of this place. The project embraces a canal 3 miles long. The canal will take water from Arkansas River 2 miles west of Red Fork; estimated cost of the work, including power dam, $700,000. J. A. Mackin and Dr. C. H. Bland are reported interested.

**New Hampton, Ia.*—Shepard & Hutton are reporten to have secured contract for constructing power plant for $8,611.

Galena, Kan.—The Galena Light & Power Co. (E. St. George Noble, Mgr.), is making arrangements for a complete change in present system.

Versailles, Ky.—The Electric Light Co. (Harry Reid, Mgr.), will extend line to Midway, Ky., several miles.

* *Items marked thus give the names of parties awarded contracts.*

Pittsfield, Mass.—Ley & Co., of Springfield, are reported to have secured the contract to build a subway from the Stanley power houses on east shore of Silver Lake to the Morningside and lower East St. shops. The subway, which is to be of concrete, will be 7 ft. high and 6½ ft. wide, ½ mile in length, and will be used as a conduit for steam pipes and electric power, testing and lighting wires. All of the wires and pipes now above ground will be placed in this conduit as soon as it is finished in the fall; cost about $25,000.

Concord, Mass.—A complete coal handling plant will be installed in Municipal Electric Light plant. Estimates are wanted.

Charlotte, Mich.—It is reported that the Michigan Power Co. proposes constructing a line to Charlotte to furnish street lighting.

Pontiac, Mich.—E. E. Betchell, Consulting Engr. of the Pontiac Lighting Co., is reported to be preparing plans for remodeling the power plant of this company. Engines, boilers and generators will be installed. T. H. Weber is Supt.

Bovey, Minn.—Frank McCormick, of Duluth, is reported to have secured a franchise for electric lighting.

Water Valley, Miss.—It is proposed to purchase 300 h. p. water tube boiler for the City Electric Light and Water Plant (T. M. Early, Mgr.).

Browning, Mo.—J. L. Kille, City Clk., writes that the citizens on July 22 voted to issue $6,000 bonds for an electric light plant. No engineer engaged as yet.

Billings, Mont.—The citizens are reported to have voted to grant a franchise to P. A. Williams, of Chicago, Ill., for the construction of a central heating plant and distributing system.

Harlowton, Mont.—John L. Bright, of Lewistown, is reported interested in the construction of an electric light plant at Harlowton.

Tecumseh, Neb.—Frank Dinsmore, City Clk., writes that bids are wanted until Aug. 19 for the construction of an electric light plant to cost about $20,000. Engineer, John Martz, of Seward.

Falls City, Neb.—John R. Crook, City Engr., writes that the citizens on July 16 voted to issue $25,000 bonds for water works, $10,000 for eelctric lighting and $5,000 for park work.

Reno, Nev.—Maj. J. A. Driffil, of Oakland, Cal., Pres. of the Ely Electric Co., and Carl Lennhart, of Los Angeles, are reported to be in this city, and state that the company will immediately begin the construction of a 1,000 h. p. electric plant and a large reservoir. The water for this reservoir will be furnished by Cave Creek and will be piped from the reservoir to the city, where it will be used for municipal purposes. A portion of the water will be used to operate the electric power plant.

Madison, N. J.—S. G. Willets, Boro. Clk., writes that the Light Com. has under consideration the doubling of the capacity of the electric light plant and may recommend same to Council at the Aug. meeting. Nothing definite has yet been done.

Schenectady, N. Y.—Press reports state that about $191,000 of the $3,232,000 that the Hudson River Electric Power Co., of Glens Falls, has made application to the Public Service Comn. at Albany to issue bonds for, will be spent on a transmission line between Schenectady and Ballston. The land needed for the new dam that the company will construct on the Sacandaga River will cost about $885,000, the dam and canal and power station at Conklinville will cost $802,000. A transmission line from Conklinville to Ballston with a connection to Spier Falls will cost $271,000, and a transmission line from Utica to Amsterdam will cost $709,000. C. E. Parsons, Ch. Engr., Glens Falls.

Lyons, N. Y.—The Wayne County Electric Co. (R. W. Kiple, Mgr.), is reported to be planning to enlarge its power plant.

Watertown, N. Y.—Eaton & Brownell, 54 Smith Bldg., have completed plans, specifications and estimates for the development of water power for the Watertown Marble Co., and they are in the hands of the owners for approval. It is doubtful if anything will be done this year.

West Point, N. Y.—Bids will be received by Maj. J. M. Carson, Jr., Q. M., U. S. M. A., until Aug. 19 for furnishing iron lamp posts and lanterns for electric street lights, as advertised in The Engineering Record.

Blackwell's Island, N. Y.—Bids will be received until Aug. 15 by Robt. W. Hebberd, Comr. Dept. Pub. Charities, N. Y. City, for furnishing materials and labor required for complete conduiting, electric wiring, and all other work in connection with the installation of a complete electric lighting and power system for all buildings and grounds under the jurisdiction of the Dept. of Pub. Charities, and comprising the city hospital Dist., Blackwell's Island, Boro. of Manhattan.

**New York, N. Y.*—Contracts for installing electric equipment in schools in Manhattan Boro. (bids opened July 22 by C. B. J. Snyder, Supt. School Bldgs.) have been awarded as follows: School 14 to Spiro Co., 121 Delancey St., $4,875, and School 29 to Reis & O'Donovan, Inc., 1123 Bway., for $4,740.

Bids will be received until Aug. 12 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in the additional story of Public School 80, Boro. of Brooklyn, in addition to and alterations in Public School 13, and in addition to and alterations in Public School 19, both in Boro. Richmond, in Schools 91 and 66, Boro. of Manhattan, and for alterations to electric system in Morris High School, Boro. of the Bronx.

**Bath, N. Y.*—The Village Trus. are reported to have abandoned the idea of municipal ownership of the electric plant, and have entered into a contract with Bath Electric Light Co. to continue lighting of village upon expiration of present lighting contract in Sept. The company promises to install a duplicate set of machinery in the power plant.

Harrison, O.—The Harrison Electric & Water Co., of Harrison, is reported incorporated with a capital of $30,000 by Wm. F. Boyd, Edwd. Avesmer, Saml. L. Farland and others to acquire and operate the electric and water plant in Harrison and West Harrison.

Fremont, O.—The Fremont Power & Light Co. is reported to have completed plans for harnessing Sandusky River at this place, and erecting a power plant to cost $100,000, with an electrical output of 2,000 h.p.

Oklahoma City, Okla.—A. B. Hulit, of Chicago, Ill., is reported to have petitioned for an electric light and power franchise.

Coquille, Ore.—It is stated that the Coquille River Electric Co. (Frank Morse, Mgr.) will install a 150 kw. G. E. alternator, 3 phase, 2,300 volts.

Panama.—See "Miscellaneous."

Philadelphia, Pa.—It is stated that John R. Wiggins & Co., contractors, 721 Heed Bldg., will shortly erect a 2-story brick transforming station, 30x108 ft., at 1113 Arch St., for the Philadelphia Electric Co.; cost about $85,000. John T. Windrim, Archt., Commonwealth Bldg.

Aiken, S. C.—The Carolina Light & Power Co. (Harry Sudlow, Mgr., Aiken) is reported to have purchased the Anderson Shoals water power on Little Horse Creek, and will develop same with a view to erecting a plant there.

Aberdeen, S. D.—C. T. Freehauf, of Cresco, Ia., is reported to have petitioned for a franchise for an electric light plant.

Gary, S. D.—T. M. Anton, Town Clk., writes that it is proposed to construct an electric light plant at a cost of $5,000.

San Angelo, Tex.—It is stated that bids are asked until Aug. 15 by the San Angelo Gas Co. for improving the company's plant. A building, 30x70 ft., 20 ft. high, is to be erected and which, with equipment, will cost $50,000.

**Bryan, Tex.*—Mr. Preston, of the Bryan Water, Light & Power Co., is reported to have awarded contract for a 1-story brick building 50x60 ft. to Wheelock & Allen, of Bryan. The new building will be large enough to accommodate duplicate machinery.

Waco, Tex.—J. Henry, of Denver, Colo., with others are reported to have been at Bryan, Tex., on July 18 gathering data relative to the power plant they propose to establish in the lignite fields of Central Texas for the purpose of furnishing power to all towns from Waco to Houston.

Wausau, Wis.—The Wisconsin Valley Improv. Assoc. is reported to be considering the further development of Wisconsin River. G. D. Jones, Secy.

Ladysmith, Wis.—The John Hein Co. is reported to have decided to develop 12,000 h.p. at Big Falls, 10 miles north of Flambeau River.

J. C. Young is reported to have secured permission to construct dam on Jump River.

Marinette, Wis.—Perley Lowe, of Chicago, Ill., is reported to have in contemplation the development of Peshtigo River at Places Rapids, and transmitting same to Marinette.

Campbellford, Ont.—Bids will be received until Aug. 15 by Mayor W. J. Doxsee, for rock-cutting, concrete work, turbine wheels, generators anad about 2¼ miles of transmission line for power development at Middle Falls on the Trent River. John S. Fielding, Consulting Eng., 15 Toronto St., Toronto.

Kamloops, B. C.—The City Clerk writes that this city is at present gathering information in regard to producer gas plants, but is not yet ready to receive bids.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Dothan, Ala.—It is reported that Wm. Crawford has requested the City Council for a street railway franchise to build and maintain a park about 3 miles out of the town, and therefore desires the use of Main St. in order to build the line.

San Diego, Cal.—The City Council is reported to have voted to grant the application of E. Bartlett Webster for a railroad franchise on A St., down 4th to F and out to 25th St. An ordinance was adopted by the Council accepting the bid of the San Diego Electric Ry. Co. for the franchises of B St. from 4th to the water front, and from C St. on 4th to B St.

Vallejo, Cal.—The Vallejo, Benicia & Napa Valley R. R. Co. (L. J. Perry, Gen. Mgr., Napa) proposes constructing an electric railway into Sacramento, making the Napa branch a feeder. The terminals will be Vallejo and Sacramento.

Napa, Cal.—Richard Hotaling, of the Napa & Lakeport R. R. Co., is reported to have in contemplation the building of an electric railway in the counties of Marin, Sonoma, Napa and Lake. The line will start at a point on Richardson Bay, opposite Sausalito, and run by way of Corte Madera to San Rafael.

Santa Rosa, Cal.—The Petaluma & Santa Rosa Ry. Co. (E. M. Van Frank, Gen. Mgr., Petaluma) is planning to extend its road from Sebastopol to Lake Jonive about a mile north of that town.

San Diego, Cal.—A concurrent resolution has been adopted by City Council granting a franchise to the Point Loma Electric R. R. Co. for a loop line from Roseville to Ocean Beach.

Waterbury, Conn.—The Waterbury & Milldale Tramway Co. is reported organized with Chas. H. Clark, Pres.; John H. Cassidy, Sec.; Edwin S. Todd, Treas.

Covington, Ga.—Application for charter of incorporation for the Middle Georgia Interurban Ry. Co. is stated to have been filed by Chas. F. Howe, Milledgeville; Wm. F. Smith, Robert F. Smith, Samuel P. Smith, Flovilla, and others. It is proposed to construct, equip and maintain a line of railroad from Griffin, Jackson, Mansfield and Social Circle, through the said counties of Spalding, Butts, Jasper, Newton and Walton, with branch or branches from some convenient point or points to Flovilla, in Butts County, and Monticello, in Jasper County. The length of the new line will be about 70 miles, running in an easterly and northerly direction. Capital, $200,000.

Fitzgerald, Ga.—The City Council is stated to have been requested to grant to S. T. Holtzendorf, W. T. Whiteny and B. K. Waldridge, of New York, and T. M. Parsons and C. A. Holtzendorf, of this city, and L. C. Holtzendorf, of Valdosta, a franchise to operate an electric railway within Fitzgerald and to suburban points.

Atlanta, Ga.—The Atlanta & Carolina Constr. Co. is reported to have surveyed the route of the proposed line between Atlanta anad Augusta. The route will be from Atlanta to Lithonia, thence to Conyers, Monroe, Athens, Washington and Augusta. W. English, Pres.; Matthew Mason, vice-pres. and Gen. Mgr.; M. T. Edgerton, Secy. Capital, $5,000,000.

Gary, Ind.—The Gary Street & Interurban Ry. Co. is reported incorporated with a capital of $400,000, to build and operate street and interurban railroads in and connecting Gary, Tolleston, Hammond, East Chicago and Whiting. Directors: Frank N. Gavitt, C. B. Manbeck and M. N. Casterman.

Angola, Ind.—The Railroad Comn. is stated to have granted a petition from the St. Joseph Valley Traction Co. and the Angola Light & Power Co. for a grade crossing of traction lines near Angola, reserving the right to cause the crossing to be changed later.

South McAlester, Ind. Ter.—The power house of the Choctaw Ry. & Electric Co. (J. H. Merrill, Gen. Supt.) was completely wrecked recently by the bursting of a fly-wheel.

Sapula, Ind. Ter.—It is stated that E. C. Reynolds and associates will commence work at once on the electric line in Sapula, and also to the oil fields south of the city.

Red Fork, Ind. Ter.—Articles of incorporation of the Midcontinent Traction Co. are reported to have been filed. The articles set forth the construction of an interurban electric line connecting Red Fork, Tulsa, Sapulpa and the Glenn Pool oil fields, a distance of 20 miles.

Newport, Ky.—The Bd. of Aldermen is stated to have passed the ordinance granting the South Covington & Cincinnati Ry. Co. the right to lay a track on 12th St.

Paducah, Ky.—It is stated that the Paducah Traction & Light Co. (H. T. Brown, Ch. Engr.) contemplates building an extension into Mechanicsburg.

Portland, Me.—The Portland, Gray & Lewiston R. R. Co. is reported incorporated, to build and operate an electric railway through Falmouth, Gray, New Gloucester, Auburn and Lewiston; capital, $150,000. Stockholders: Ed. W. Gross, of Auburn; Chas. C. Benson, of Lewiston; Lewis A. Goudy, of Portland, and others.

Baltimore, Md.—The Maryland Electric Rys. Co. is planning to build a number of extensions in and about the city. The following are the extensions to be made: From Highlandtown to Orangeville; from Towson to Lutherville; from Wilkens Ave. to Elkridge; from Catonsville to Towson; from Dickeyville to Loraine Cemetery, and a line through Guilford.

Springfield, Mass.—A franchise is stated to have been granted to the Springfield St. Ry. Co. to build a new line on Broadway.

Boston, Mass.—Bids will be received until Aug. 15 by the Boston Transit Comn. (B. Leighton Beal, Secy.) for constructing entrance and exit at Water and Devonshire Sts., for the Washington St. Tunnel.

Mankato, Minn.—Articles of incorporation are stated to have been filed by the Mankato Electric Traction Co. with the Secretary of State to build an electric railway in Mankato. Capital, $200,000. Incorporators: A. J. Whipple, Glencoe, Ill.; Celin C. H. Tyffe, Chicago; A. M. Hewes, Chicago, and others are reported interested.

Scranton, Miss.—It is reported that M. J. McDermott and Sidney Lowenstein, of the Bank of Mobile, Ala., and others are interested in the construction of an electric railway between Scranton and Mobile, about 40 miles in length; capital, $500,000.

Billings, Mont.—Yegen Bros., of Billings, are stated to have presented a petition to the City Council asking that a special election be held for the purpose of submitting to the voters the question of granting to the petitioners a franchise for the construction of a street railway. Yegen Bros. have recently completed an electric plant on the banks of the Yellowstone River, and it is presumed that in case the franchise is granted the electric power generated there will be used in the operation of a street railway.

Nyack, N. Y.—The West Shore Traction Co. is reported to have been granted authority by the New York State Board of Railroad Comrs. to construct a 25-mile high-speed electric road from Tomkins Cove along the Hudson River to the State line at Carteret, Rockland County; to increase its capital from $250,000 to $500,000, and to issue a first mortgage of $900,000. It is reported that the line will be ultimately extended from the State line to Jersey City and will enter New York City by way of the McAdoo tunnel. The company is being promoted by Searing & Co., bankers, of New York.

New York, N. Y.—See "Bridges."

Columbus, O.—A plan has been made for the connection of Columbus and Pittsburg by trolley. The intention is for the Wheeling Traction Co. to extend its line West by way of Barnesville and Neff's to meet the Columbus, Newark & Zanesville. In the other direction, the Rapid Transit Co. is to extend its road by way of Hickory, Pa., to Carnegie, where it will connect with the Pittsburg lines.

Elyria, O.—The Elyria Southern Ry. Co. is reported incorporated, with a capital of $100,000, by W. J. Elliott, F. N. Carpenter, W. E. Moser and others to build an electric railway between Elyria and West Salem.

Cleveland, O.—The Elyria Southern Ry. Co. is reported incorporated for the purpose of building an electric railway between Elyria and West Salem. Capital, $100,000. Incorporators: W. J. Elliott, F. N. Carpenter, W. E. Moser, J. M. Storr and F. L. Sargent.

Cuyahoga Falls, O.—Plans are stated to have been made for straightening the Akron, Bedford & Cleveland Division of the Northern Ohio Traction & Light Co. (R. Trumbull, Ch. Engr., Akron), from a point 5 miles north of here to Bedford. In some places it has been planned to move the track more than a mile east of where it now runs. If the plans are carried out, the road will have a private right of way.

**Columbus, O.*—John T. Adams, of Columbus, is reported to have secured the contract for ballasting the Indiana, Columbus & Eastern (W. Kesley Schoepf, Pres., Cincinnati) between this city and Springfield.

Lima, O.—Through condemnation proceedings, the Indiana, Columbus & Eastern (T. A. Nealy, Secy.,

* *Items marked thus give the names of parties awarded contracts.*

[illegible] is stated to have cleared up the right of way between Bellefontaine and this city. The steam line from here to Defiance is ready to electrify, and it is believed that the company will have cars running through from Cincinnati to Toledo some time this fall.

El Reno, Okla.—The El Reno Ry. Co. is reported to reported to have been granted a charter to build a steam or electric line 60 miles westward of Oklahoma City via El Reno to Geary, at an estimated cost of $100,000. Incorporators: J. W. Maney, Oklahoma City; John Maney, Henry Shafer, H. K. Shafer and Herman Mittmer, all of El Reno.

Hillsboro, Ore.—The City Council is reported to have granted a franchise to the Oregon Electric Co. on E. Line St., and also a franchise to the United Rys. Co. by way of Main St., with right to use 1st, 2d or 3d Sts. for connection with southern limits of city.

Johnstown, Pa.—It is reported that a contract will be let shortly to Umbenhauer & Co. for the grading of a 10-mile section of the Johnstown & Ebensburg R. R., which will connect Ebensburg and Johnstown. This work will include all excavating, the necessary concrete and masonry construction at culverts, etc., and the spanning of Elk Lick Creek with a bridge.

Scranton, Pa.—An extension of its line from Minooka to Rocky Glen is reported to be the latest improvement being considered by the Scranton Ry. Co. (Frank Caum, Gen. Mgr.). Surveyors of the company have gone over a proposed route and have reported that the proposition is feasible. The shortest route of the extension is about 2½ miles. The route proposed is from Minooka to Oak Hill and across country to the glen.

Denton, Tex.—Plans for an interurban line from Ft. Worth to Denton and from Denton to Gainesville via Slidell have been practically completed. It is reported that Stone & Webster people, of Boston, Mass., are behind the project.

Ft. Worth, Tex.—The Northern Texas Traction Co. (H. M. Flanders, Ch. Engr.) is stated to have filed with the City Secretary of North Fort Worth an application for a franchise to extend the Main St. line north from the Stock Yards to a point on Washington Heights.

Seattle, Wash.—The Priest Rapids Ry. Co. is reported incorporated by W. R. Rust, of Tacoma; H. K. Owens, M. B. Haynes and E. H. Gins, with a capital of $1,000,000, for the purpose of building and operating an electric railway 90 miles long in Douglas County. R. R. Rust is stated interested.

Waterville, Wash.—Articles of incorporation are stated to have been filed by the Northern & Southern Ry. Co., of Waterville, by A. L. Rogers, M. B. Howe, L. W. Matthews and A. E. Case. Capital, $7,000,000. The principal object is to build a railroad, either steam or electric, or both, from Waterville to Pasco. The line is to be about 175 miles long.

Vancouver, B. C.—The British Columbia Electric Ry. Co. is reported to be considering the extension of its system at Ft. Langley. R. H. Sperling, of Vancouver, Gen. Mgr.

Winnipeg, Man.—The City Council is stated to have notified the Winnipeg Electric Ry. Co. to proceed with the proposed extensions.

Woodstock, Ont.—It is reported to be the intention of the new owners of the Woodstock, Thames Valley & Ingersoll Electric Ry. Co. to construct the line between Ingersoll and Woodstock.

RAILROADS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—It is reported that the Mobile, Jackson & Kansas City R. R. Co. (H. S. Jones, Ch. Engr., Mobile) will extend its line to the Ohio River at once. The road now extends as far as Middleton, Tenn. About $1,500,000 will be expended in improvements.

Denver, Colo.—The Denver & Rio Grande R. R. Co., (E. J. Yard, Ch. Engr., Denver), is reported to be preparing to double-track its road from Denver to Pueblo.

Boise, Idaho.—The Intermountain Ry. Co. is reported incorporated to build a railroad 45 miles in length from Boise River, near Barber dam, to Centerville. The incorporators are said to be stockholders in the Barber Lumber Co.

Columbus, Miss.—The Columbus, Memphis & Pensacola R. R. Co. is reported to have decided to extend its line from Columbus to Pickensville, Ala., a distance of about 25 miles.

Webb City, Mo.—Bids will be received until Sept. 1 by the St. Louis, Bartlesville & Pacific R. R. Co. (F. M. Overlees, Pres., Bartlesville, Ind. Ter.), for constructing and equipping said road from Webb City, Mo., to Pond Creek, Okla.

Jamestown, N. Y.—The management of the Jamestown, Chautauqua & Lake Erie Ry. Co. (C. M. Harrison, Supt., Jamestown) is reported to have secured permission from the bondholders of the road to issue $150,000 bonds to make improvements on the road, to include new ties, rails, roadbed and equipment.

Langdon, N. D.—The American Midland R. R. Co. is reported incorporated with a capital of $20,000,000 to build a line from Langdon, N. D., to near Galveston, Tex.; the proposed line is to have an estimated length of 2,100 miles. Directors: F. C. Guss, B. F. Hegler, Jr., and C. H. Haviglness, of Guthrie, Okla.; Henry Oppenheimer, Frank Jerome Hoyle and others of New York, N. Y.

Cameron, N. C.—The Randolph & Cumberland R. R. Co. (C. S. Newer, Supt., Carthage, N. C.) proposes extending from Cameron, N. C., southeast to Southport, on the Atlantic, a distance of [illegible] miles.

Ten Mile, Pa.—A charter has been granted to the Monongahela Coke R. R. Co. to build a railroad in Washington County from the Waynesburg R. R. to Ten-Mile village, 7½ miles long; capital, $[illegible]. M. C. Milholland, Pres., Pittsburg.

Kingsville, Tex.—E. W. [illegible] and other [illegible] of that city are reported to have taken [illegible] steps to build a railroad between Kingsville and San Antonio, a distance of about [illegible] miles. The proposed road will connect with the St. Louis, Brownsville & Mexico R. R. at this place.

Manchester, Vt.—Arrangements are reported to have been completed for the construction of a new railroad line between Manchester and Granville, N. Y. The new line will be about 25 miles long, and will connect at Manchester with the Rutland R. R., and at Granville with the Delaware & Hudson system. The road will be known as the Mettowee Valley R. R. The Mettowee Valley road will absorb the Manchester, Dorset & Granville R. R., and will continue the line from South Dorset to Granville. Casper L. Leach, Pres.

Pullman, W. Va.—It is stated that bids will be received until Aug. 15 by M. K. Duty, Pres. Lorama R. R., Pennsboro, W. Va., for building the road from Goose Neck to Pullman, W. Va., 5 miles.

Superior, Wis.—The Interstate Transfer Ry. Co., of Superior, is reported incorporated, to construct a railroad connecting Superior and Duluth, a distance of 20 miles; capital $500,000. Incorporators, Sol L. Perrin and W. W. Savage, of Superior, and Jos. B. Cotton, Geo. L. Reis and Wm. A. McGonagle, of Duluth, Minn.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The erection of a wing at the St. Vincent Hospital to cost about $50,000 is reported under consideration.

Levy, Ark.—It is reported that plans are being prepared for an orphanage to be erected by the Roman Catholic Church at a cost of $100,000. Address Bishop of the Diocese of Little Rock.

Mena, Ark.—The Kansas City Southern R. R. Co. (A. F. Rust, Res. Engr., Kansas City, Mo.), it is reported, is having plans prepared for a hospital to be erected at Mena at a cost of $45,000.

Eureka, Cal.—Bids will be received until Sept. 11 by Geo. Cousins, Clk. Bd. Co. Superv., for erecting a county jail with either brick walls and wood floors or concrete throughout and constructing cell and grating work. Plans and specifications may be had upon a deposit of $25.

*Fruitvale, Cal.—The Sisters of Mercy, it is stated, have awarded the contract to heat the main building of the home at Bray Ave. and Old Country Rd. to the Harris O'Brien Plumbing Co., at $8,047.

Ft. Mason, Cal.—It is stated that preliminary plans are being perfected in the quartermaster general's office at Washington, D. C., for improvements to be made at Ft. Mason with the appropriation set by the Legislature, which is $1,500,000. Of this amount, $750,000 is available immediately. The improvements to be made provide for the construction of a general supply depot for the army, consisting of a wharf sufficiently large to accommodate 4 transports, 6 warehouses, each 60x200 ft. and 3 stories high, and an administration building, together with officers' quarters sufficient to accommodate the officers on duty in connection with the depot.

Redding, Cal.—It is reported that the Bd. of Superv. intend erecting a Hall of Record at a cost of $40,000.

*Norwich, Conn.—Vine S. Stetson is stated to have the general contract for making improvements to the jail, and the Van Dorn Iron Co., of Cleveland, O., the contract for the steel cells. The total cost of the improvements will be about $15,000.

Norwich, Conn.—The House has passed favorably on a bill for new buildings at the Norwich Hospital for the Insane. Appropriation, $300,000.

Danbury, Conn.—Governor Woodruff has signed the bill appropriating $35,000 for the erection of a new building for the Danbury Hospital. Preliminary plans for the building have been made by Philip N. Sutherland, Danbury.

Chicago, Ill.—Richard E. Schmidt, 172 Washington St., is reported to be preparing plans for a hospital to be built at Congress and Lincoln Sts. for the Univ. Hospital, represented by Dr. A. K. Steele.

Evansville, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 5 for erecting a large barn and a laundry building at the Orphan Asylum. Harry Stinson, Co. Aud.

East Chicago, Ind.—The City Council, it is reported, has ordered plans prepared for a city hall estimated to cost $50,000.

Terre Haute, Ind.—It is reported that plans are being prepared and bids for the construction of an addition to the jail to include a private water works system, a heating plant and a laundry will soon be asked by the Co. Comrs. Estimated cost, $75,000.

Bloomfield, Ind.—Bids will be received until Sept. 3 by the Co. Aud. at Bloomfield, for furnishing material and erecting complete a cell house and cell work in the Green County jail. J. W. Gaddis, Archt., Vincennes.

Williamsport, Ind.—R. L. Winks, Co. Aud., writes that bids are wanted on Aug. 31 for erecting a jail.

*The contract for erecting court house (bids opened July 18) has been awarded to Jahr & Cope, of Champaign, Ill., for $68,050.

Waterloo, Ia.—The Franciscan Sisters, it is stated, intend erecting here next spring a hospital to cost $100,000.

New Orleans, La.—A site on Independence St. is reported to have been decided upon on which the Government will erect an immigration station at a cost of about $70,000.

Bids will be received until Aug. 6 by Chas. Dittman, Chmn. Ex. Com., 628 Gravier St., for erecting a glass range and greenhouse for the City Park. Julius Koch, Archt., Rm. 501-4 Denegre Bldg.

*Augusta, Me.—Dr. B. T. Sanborn, Supt. Bd. Trus. for State Insane, writes that the contract for constructing brick building on Arsenal grounds (bids opened July 22) has been awarded to C. E. Hoxie, of Augusta, for $31,675.

Baltimore, Md.—Bids will be received until Aug. 7 by the Bd. of Awards for erecting truck house No. 15. Edw. D. Preston, Inspector of Bldgs.

Howell, Mich.—Bids will be received until Aug. 15 by Dr. Henry J. Hartz, Secy., 27 Adams Ave., east, Detroit, for furnishing material and erecting complete a main sanatorium, administration building and connections, and a wing to same; also for dining-room extension to present building, to be erected on the grounds in the vicinity of Howell. Bids are to be made as follows: First, for general construction including main administration building and connections, and wing and dining-room extension complete; 2, separate proposals for main administration building and connections complete, exclusive of wing and dining-room extension; 3, separate proposals for dining-room extension complete; 4, plans and bids for sewage disposal purification plant.

Grand Rapids, Mich.—A. W. Buckley, of Chicago, Ill., is reported to be preparing plans for a children's home which is to be erected by D. A. Blodgett, at a probable cost of $50,000.

Ionia, Mich.—Bids will be received until Aug. 14 by H. J. Holbrook, Co. Clk., for erecting a County House; probable cost, $35,000. Edwyn A. Bowd, Archt., Lansing.

Flint, Mich.—Rickman & Sons, of Kalamazoo, it is reported, submitted the lowest bid on July 20 for erecting the Hurley Hospital at $37,000.

*Rochester, Minn.—The Bd. of Control, it is reported, has awarded to J. G. Robertson, of St. Paul, the contract for a boiler, costing $3,072, to be installed at the Rochester Hospital for the Insane.

Red Wing, Minn.—Mrs. Amelia L. Graham, it is stated, has transferred to John H. Rich, C. F. Hjermstad and W. H. Putnam $30,000 in real estate and money with which to erect an old peoples' home.

*Potosi, Mo.—John O. Long, Clk. Co. Comrs., writes that the contract for erecting court house (bids opened July 27), has been awarded to W. R. Oder, of Canton, Mo., for $30,544.

*Kansas City, Mo.—Everett Elliott, Secy. Pub. Wks., writes that the contract for plumbing General Hospital (bids opened July 9) has been awarded to MacMahon Plumbing & Heating Co. for $19,286.

St. Joseph, Mo.—The following are the bids opened on July 17 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for miscellaneous changes and repairs at the U. S. Postoffice, St. Joseph: Hiram Floyd Bldg. Co., St. Louis, $52,711; J. McGonigle, Leavenworth, Kan., $39,292, and Window, Mantle & Tile Co., St. Joseph, $54,901.

Billings, Mont.—It is reported that the citizens have voted in favor of granting a franchise to a Chicago Co. for the purpose of establishing a central heating plant in this city to cost about $50,000.

Lewistown, Mont.—It is reported that the contract recently awarded for erecting the court house has been rescinded. It is stated that the plans are to be revised and new bids asked. Appropriation, $100,000.

Lincoln, Neb.—It is reported that all bids received July 17 for erecting the cattle barn at the State Fair Grounds have been rejected, as they exceeded the appropriation which is $20,000.

*Goldfield, Nev.—John Shea is stated to have secured the contract to erect the court house at $80,800.

Concord, N. H.—The following are the bids recently received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for steam heating U. S. Postoffice at Concord: Lee Bros., Concord, $2,372; C. H. Sanborn, Boston, Mass., $2,587, and English & Co., Boston, Mass., $2,683.

Wildwood, N. J.—It is stated that plans have been approved for a city hall to cost $25,000.

Jersey City, N. J.—It is stated that plans for the tuberculosis hospital have been completed, and it is reported that bids for the construction will be asked by the Bd. of Freeholders soon. Probable cost, $30,000.

Camden, N. J.—It is stated that a hospital for contagious and infectious diseases is to be erected here at a cost of $50,000.

Buffalo, N. Y.—The following are reported to be the bids received by the Bd. of Superv. July 16 for erecting an addition to the jail, all of which are reported to have been rejected: Mosier & Summer, $43,500; Buffalo General Building Co., $44,594, with $500 additional for screen doors and prison doors; C. A. Crigui, plumbing and drainage, $1,593, and gas fitting, $125.

Lima, N. Y.—Henry Chase, of Avon, is reported to reported to have submitted the lowest bid for erecting the town hall at $13,136.

Brooklyn, N. Y.—The Bd. of Aldermen of N. Y. City on July 23 appropriated $160,150 for a hospital at Coney Island.

The Mayor of New York City has approved the ordinance providing for an issue of Corporate Stock in the sum of $350,000 for the purpose of providing means for the construction of a new women's prison in Raymond St.; the construction in connection therewith of an administration building for the Raymond St. Jail; the painting of cells and interior walls of the present men's prison and the making of certain alterations in the civil prison of said jail said work to be done under the jurisdiction of the President, Boro. of Brooklyn.

New York, N. Y.—The Bd. of Aldermen on July 23 adopted the report of the Finance Com. allowing $1,300,600 for buildings for the Dept. of Charities.

It is stated that plans have been filed by McKim, Mead & White, archts., 160 5th Ave., for enlarging the Metropolitan Museum of Art in Central Park at 82d St. The additions will be 2 and 3 stories high, one annexed to the museum library on the south 116x183 ft.; the second to be added to the exhibition halls on the north, 54x119, and the third to be 15 ft. frontage and 21 ft. deep at the east of the Hall of Sculpture. The 3 additions are to cost $450,000.

It is stated the Municipal Art Comn. has approved designs for the 8th Ward market building, at 26th St. and 2d Ave., Brooklyn. There will be 150 structures in all, costing $1,050,000. There will be a tower, or administration building, 2 piers, one of which will have a public bath and comfort station, and about 140 2-story buildings, to be rented by the city for market purposes. The commission also approved the design for the Training School for Nurses of the Harlem Hospital, at

* Items marked thus give the names of parties awarded contracts.

Lenox Ave. and 136th St., to cost $145,000, and for a stable at Coney Island for the Street Cleaning Dept., to cost $50,000.

Gov. Hughes has signed a bill providing for the erection of a municipal office building at the Manhattan terminal of the Brooklyn Bridge. The measure entitles the Comr. of Bridges to employ an architect to draw plans for this building.

West Point, N. Y.—Bids will be received by Maj. J. M. Cason, Jr., U. S. M. A., until Aug. 10 for furnishing and installing reinforcing for girder under south wall of library tower, as advertised in The Engineering Record.

Bakersville, N. C.—Bids will be received until Aug. 15 by Jos. Bowditch, Chmn. Bd. Co. Comrs., for furnishing material and erecting a courthouse. H. L. Lewman, Archt., 1008 Lincoln Bank Bldg., Louisville, Ky.

Lumberton, N. C.—Bids will be received until Aug. 20 by the Bd. Co. Comrs. (J. W. Carter, Chmn.), for erecting a court house; probable cost, $50,000. Frank P. Millburn & Co., archts., Washington, D. C.

Lisbon, N. D.—Haxby & Gillespie, of Fargo, are reported to be preparing plans for an armory to be erected for Battery A and the regimental band at a cost of about $14,000.

Bismarck, N. D.—Bids will be received until Aug. 24 by I. W. Healy ,Co. Aud., for erecting additions and making repairs on the courthouse; also for heating and plumbing said building.

Bucyrus, O.—See "Sewerage and Sewage Disposal."

Cleveland, O.—The City Council has passed an ordinance appropriating $60,000 for the erection of a contagious disease hospital.

Cleveland, O.—Bids will be received until Aug. 8 by the Bd. Pub. Service (A. R. Callow, Secy.) for the completion of the superstructure of the power house for the Municipal Electric Light plant.

Delaware, O.—Bids will be received by T. T. Dye, Secy. Bd. Trus. Girls' Industrial Home, until Aug. 23 (readvertisement), at the office of Mariott & Allen, archts., Hayden Clinton Natl. Bank Bldg., Columbus, for whole or separate bids on labor and material for the rebuilding of Cottage No. 2 at above home, Delaware, and are to include excavating, stone masonry, concrete and cement work, brick masonry including structural iron, sheet metal work, carpentry, hardware, etc., plumbing and gas fitting; also same time and place for furnishing material and completing the Industrial and Technical Bldg. Girls' Industrial Home, Delaware.

Pendleton, Ore.—It is stated that a city hall and jail is to be erected at Cottonwood and Alta Sts., at a cost of about $40,000.

**West Chester, Pa.*—Wm. H. Jones, of West Chester, it is stated, has secured the contract to erect a gymnasium here for $25,000. This building has been given to the town by Philip W. Sharples.

**Pittsburg, Pa.*—The Iron City Htg. Co., Bessemer Bldg., is stated to have secured the contract to install a ventilating system and steam heating plant in St. Francis Hospital on 44th St., at about $54,50c

Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treasury Dept., until Sept. 16 for the construction (except elevators), of the U. S. Marine Hospital, at Pittsburg, as advertised in The Engineering Record.

Philadelphia, Pa.—Bids will be received until Aug. 15 by Col. F. L. Denny, Q. M., U. M. C., Washington, D. C., for constructing an addition to the Philadelphia Depot 1110 S. Broad St. Plans and specifications may be secured from the Quartermaster upon a deposit of $100.

**Rapid City, S. D.*—Herman & Birnbaum, of Rapid City, it is reported, have secured the contract to install a heating plant in the court house at $3,400.

Knoxville, Tenn.—The following are the bids opened on July 10 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for construction of extensions, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring and lift) to the U. S. Postoffice and Court House, Knoxville: Blue Ridge Constr. Co., Asheville, N. C., $183,763; David Gelaz Sons Co., Knoxville, $142,000; Thomas & Turner, Knoxville, $163,957; Ambrose B. Stannard, New York, N. Y., $152,525, and Geo. Moore's Sons Co., Nashville, $133,000.

Nashville, Tenn.—Chas. Ferguson, the Arcade, is said to be preparing plans for the Davidson County Bldg., which is to be erected on the State Fair Grounds at a cost of about $18,000.

Memphis, Tenn.—The Methodists, it is stated, propose erecting a hospital here to cost $200,000.

Pulaski, Tenn.—The Bldg. Com. of the Court House desire to have plans submitted to them for a court house, 3 stories, fireproof, estimated to cost $65,000 to $70,000. G. H. McMillion, Co. Judge.

Houston, Tex.—Geo. F. Horton, Co. Engr., is reported to be preparing plans for a court house.

Portsmouth, Va.—Geo. A. Fuller Co., of New York, N. Y., it is reported, submitted the only bid recently for erecting an addition to the Naval Hospital at Portsmouth at $246,500. Appropriation $200,000.

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Constr. Q. M., U. S. A., until Aug. 15 for alterations and additions to officers' quarters No. 1 Signal Corps Post, Ft. Myer, as advertised in The Engineering Record.

Milwaukee, Wis.—It is reported that bids will be received until Aug. 15 by the Auditorium Com. for erecting an auditorium according to plans prepared by Ferry & Clas, 419 Bway.

Superior, Wis.—It is reported that the Co .Bd. will soon ask bids for erecting the asylum here.

Wales, Wis.—Bids will be received until Aug. 6 (readvertisement) by the State Bd. Control (Herman Grotophorst, Pres.) Madison, for erecting a stable and laundry upon the grounds of the Wisconsin State Tuberculosis Sanatorium, situated about 2 miles north of the village of Wales. Howland Russell ,Archt., Hathaway Bldg., Milwaukee.

National Home, Wis.—Bids will be received until Aug. 14 by J. E. Armitage, Treas., Northwestern Branch, N. H. D. V. S., National Home, for erecting officers' quarters.

**Wausau, Wis.*—The following are reported to be the bids received by the Com. on City Property for the general construction of the Marathon County Home: John Anderes & Son, Wausau, $21,600 (awarded contract); Miller & Krause, $23,715; W. H. H. Dean, $25,000; Northern Constr. Co., Milwaukee, $26,200. Contracts on other parts of the work are reported awarded as follows: Ventilating and heating, National Blower Wks., Milwaukee, $3,950; sewerage and plumbing, Danielson Plumbing & Heating Co., Wausau, $3,465; electrical work and wiring, Wausau Electric Co., Wausau, $470.

*The contract to erect a hospital for the Sisters of the Divine Saviour is stated to have been awarded to John Anderes & Sons, of Wausau.

London, Ont.—The Isolation Hospital to be erected here by the Provincial Bd. of Health will consist of 3 buildings, an administration building and wards for scarlet fever and diphtheria cases, the total cost to be $50,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—The erection of a union station here to cost about $80,000 is reported under consideration. The Alabama Ry. Comrs. may be able to give further information.

Redlands, Cal.—It is stated that Myron Hunt and Elmer Grey, of Los Angeles, have been engaged to prepare plans for improvements to be made to the Casa Loma Hotel at Redlands at a cost of $50,000.

Grand Junction, Colo.—Bids will be received until Aug. 12 by J. B. Boyer, Archt., Grand Junction, for furnishing material and erecting a 3-story brick, stone and concrete building for the Elks. Plans can be had on a deposit of $25. W. D. Davies, Chmn. Bldg., Com.

Colorado Springs, Colo.—It is stated that bids will be received until Aug. 10 by the Masonic Bldg. Assoc. (Dr. W. A. Campbell, Chmn.), for erecting a lodge building; probable cost, $40,000.

Waterbury, Conn.—The New York, New Haven & Hartford R. R. Co. (Edw. Gagel, Ch. Engr., New Haven) is preparing plans for the erection of a new round house with a capacity of 14 engines, car barns for the storage of passenger coaches and a general repair shop, all of these buildings to be located upon the site near the Meriden junction in Waterbury.

New Haven, Conn.—It is reported that plans have been prepared for McCusker & Schroeder, the Church St. coal merchants, for a building to be erected on Church St. Estimated cost $16,000.

**Washington, D. C.*—A permit has been granted to the Security Storage Co. to erect a 6-story brick warehouse at 1140 15th St. n. w., to cost $90,000. Hill & Kendall, Corcoran Bldg., are the archts.; John McGregor, 729 12th St., n. w., is the builder.

*Edw. Brady & Son, of Baltimore, Md., it is stated, have secured from the Baltimore & Ohio R. R. the contract to erect near the new Union Station in Washington 3 airing sheds for the equipment of Pullman cars, a 4-story brick and concrete storehouse and a power house; probable cost, $200,000.

Pensacola, Fla.—The Directors of the First Natl. Bank, it is stated, have accepted plans for a 10-story office building.

St. Augustine, Fla.—The contract to erect the Seminole Theatre and business block for the Realty & Theatre Co., it is stated, has been awarded to the Fall City Constr. Co., of Louisville, Ky. Probable total cost ,$100,000.

Rockford, Ill.—A. E. Freburg, it is reported, will erect a $12,000 building at Third Ave. and 7th St.

**Moline, Ill.*—A. Carlson, of Moline, it is reported, has secured the contract to erect a foundry and other improvements, and 2 buildings for the W. H. Cooper Hardware Saddlery Co., at an estimated cost of $40,000.

Highland Park, Ill.—It is reported that arrangements are being made to enlarge the home for the Aged and Disabled R. R. Employees at a cost of $75,000.

**Elgin, Ill.*—The Wollaeger Mfg. Co., of Milwaukee, Wis., it is reported, has the contract for improvements to be made to the Home Bank Bldg., at a cost of $20,000.

**Decatur, Ill.*—It is reported that the contract for building the new Wabash roundhouse and machine shop has been let to Jas. Stewart & Co., of Chicago.

**Chicago, Ill.*—The International Harvester Co. is reported to have awarded contract for erection of a 5-story warehouse, 179x258 ft. at 26th and Leavitt St., to the Federal Improvement Co., The Rookery. Amount of contract, $200,000. Postle & Mahler, Archts, Marquette Bldg.

**Kewanee, Ill.*—V. Jobst, of Peoria, it is stated, has secured the contract to erect a business block for the Star-Courier to cost $60,000.

Linton, Ind.—A site is reported given to the Y. M. C. A. on which it is proposed erecting a $20,000 building.

Lafayette, Ind.—The members of the Masonic Lodge, it is reported, are planning the erection of a temple to cost $30,000.

Waterloo, Ia.—It is stated that the Knights of Columbus are considering the forming of a stock company for the purpose of erecting a building to cost about $15,000.

**Des Moines, Ia.*—It is stated that the contract for the plumbing and heating apparatus of the new Majestic Theatre has been awarded to the Wallace-Linnane Co.; cost $6,150.

Nortonville, Ky.—Harris & Shopbell, Evansville, Ind., are reported to be preparing plans for a company store for the Nortonville Mercantile Co. It will be of brick, 2 stories high, and will cost $10,000.

**Springfield, Mass.*—F. P. Morey, 88 Quincy St., is stated to have secured the contract to erect a club house for the Country Club; probable cost, $30,000.

**Crystal Falls, Mich.*—It is stated that the contract to erect a bank building, has been awarded to Julius Utke, of Marinette, Wis., at about $15,000.

Moorehead, Minn.—The stockholders of the Gardner Hotel Co., of Fargo, it is stated, have purchased a site at Roberts St. and First Ave., N., on which to erect a hotel estimated to cost $150,000.

Coleraine, Minn.—The Oliver Mining Co., according to reports, intends erecting a headquarters building, to cost about $100,000.

Hibbing, Minn.—It is reported that the Duluth, Missabe & Northern Ry. Co. (H. L. Dresser, Ch. Engr., Duluth), intends erecting a hotel here for the employees, the cost to be about $20,000.

Kansas City, Mo.—D. Ricksecker is reported to have decided to erect a brick store building at Walnut and 9th Sts., to cost about $100,000.

A permit has been issued for a 6-story building to be erected by J. S .Lillis at 11th and Walnut Sts., at a cost of $62,000.

The members of the Kansas City Country Club, it is reported, are planning improvements to cost about $40,000, which will include the remodeling of the club house at a cost of about $25,000.

Omaha, Neb.—The Improved Order of Redmen, it is stated, is considering the erection of a building here to cost about $50,000.

East Orange, N. J.—The officials of the Delaware, Lackawanna & Western R. R. (Lincoln Buch, Ch. Engr., Hoboken, N. J.), it is reported ,intends erecting a new passenger station here to cost about $30,000

Newark, N. J.—Permits have been granted for the following buildings: 4-story brick warehouse to be erected at 123 Plane St. for Geo. T. Hatt, cost $22,000; 6-story brick store and showroom at 49 Market St. for Roth & Co., cost $50,000; 2-story brick office building at Franklin St., city of Newark, owner, cost $89,472.

Rome, N. Y.—The following are stated to be the bids opened July 15 by the Directors of the Y. M. C. A. for the erection of a building, (*a*) fireproof, (*b*) wood: E. H. Owens, complete, fireproof, $42,837.67; for the mason work alone, *a*. $25,216.76, *b* $22,236, wood; carpenter work, *a* $14,415, and *b* $15,967. Parry & Jones, mason work, *a* $28,279, *b* $27,619. Lawrence Carey, carpenter work, *a* $17,277, *b* $17,727. R. A. Putnam, carpenter work, *a* $13,636.61, *b* $14,625.91. G. W. Gerwig, carpenter work,*a* $17,515, *b* $18,290. Niece & Moose, carpenter work, $16,756. W. P. Snyler, mason work, $22,610.

Plattsburg, N. Y.—It is stated that a Y. M. C. A. Bldg. costing about $20,000 is to be erected here.

Buffalo, N. Y.—Plans have been filed for the West Side Y. M. C. A. Bldg. to be erected at Ferry and Hampshire Sts., at an estimated cost of $40,000.

New York, N. Y.—Plans have been filed for a 5-story hotel to be built at Lexington Ave. and 127th St. for the Children's Aid Society as owner, and to be occupied as a hotel for boys under the guidance of the society. It is to cost $100,000. Parish & Schroeder, 5 W. 31st St., are the archts.

**Schenectady, N. Y.*—Walter Wellman, 922 State St., is reported to have secured the contract to erect a theatre on S. Centre St. for Herman Ury at a cost of $20,000.

Long Beach, L. I., N. Y.—The Long Beach Hotel (A. J. Quinn, Mgr.), it is reported, was destroyed by fire on July 29.

Devils Lake, N. D.—J. A. Burrichter, of Reno, Nev., it is stated, is interested in the erection of a theatre here to cost $30,000, plans for which have been prepared.

Grand Forks, N. D.—The Great Northern R. R. (R. E. Taft, Engr. Constr., St. Paul, Minn.) is reported to be planning the erection of a $125,000 depot for Grand Forks.

Cincinnati, O.—It is stated that a permit has been asked for a 6-story parish house to be erected in connection with Christ Church on 4th St.

Delaware, O.—The Red Men, of Ohio, it is stated, are contemplating the erection of a home at a cost of about $250,000.

Cleveland, O.—A. E. Sprackling, Citizens' Bank Bldg., it is reported, has prepared plans for alterations to be made to the Hotel Euclid at a cost of $50,000.

Columbus, O.—Richard, McCarthy & Bulford, Ruggery Bldg., are said to be preparing plans for the store which the F. & R. Lazarus Co. will erect this fall at High and Town Sts. The building will be 5 stories high, structural steel construction and completed will cost about $250,000. It is reported that contracts for the building will be let before Oct. 1st, as it is said to be the desire of the company to begin the erection of the new building on that date.

Oklahoma City, Okla.—The Odd Fellows, it is reported, are planning the erection of a $40,000 building. Jas. Lowrie is a member of the committee having the matter in charge.

J. W. Van Meter, of Oklahoma City, it is reported, is preparing plans for a 6-story and basement office building to be erected for Levy Bros., at a cost of $125,000.

Eugene, Ore.—W. M. Renshaw is reported interested in a stock company being organized for the purpose of erecting a $50,000 hotel.

Harrisburg, Pa.—It is stated that plans will be received until Sept. 30 by W. L. Gorges, for a Masonic Temple to be erected at a cost of $90,000.

Harrisburg, Pa.—Mrs. R. H. Graupner is stated to have had plans prepared for a 6-story hotel to be erected at 5th and Market Sts., at a cost of $150,000.

**Memphis, Tenn.*—It is reported that the contract to erect the 9-story fireproof hotel for Isele Bros., has been awarded to the Selden-Breck Co. ,of Memphis, at $364,633.

* *Items marked thus give the names of parties awarded contracts.*

Several buildings on Front St. including the Oliver-Finne Grocery Co.'s bldg., the Memphis Paper Co. and the Memphis Cold Storage plant are reported destroyed by fire.

Victoria, Tex.—The members of the Iroquois Club, it is stated, are planning the erection of a 3-story brick building.

Galveston, Tex.—H. C. Banker, of Orange, it is reported, has been engaged to prepare plans for a hotel to be erected in Galveston at a cost of $125,000.

Markham, Tex.—Bids are wanted for erecting a 50x120-ft. brick storehouse. For plans and specifications address Markham Mercantile Co.

San Antonio, Tex.—The Directors of the Woods National Bank, it is reported, are considering the erection of a 10-story steel office building at Houston and Losoyo Sts. Probable cost, $150,000.

**Lexington, Tex.*—The Directors of the Farmers' Union Warehouse Co., it is reported, have awarded the contract to erect a $20,000 warehouse to the Farmers and Bankers' Warehouse Co. ,of Houston, Tex.

Norfolk, Va.—E. M. Jordan, of Norfolk, has been granted a permit to erect a $35,000 3-story brick and concrete storage warehouse at 548 Granby St.

Tacoma, Wash.—G. W. Bullard, archt., Provident Bldg., writes that bids will be received about Sept. 1 for the erection of the Y. M. C. A. Bldg.

Edmund Croft, John C. Donnelly and others are reported interested in the erection of a 23-story building on C St. to cost about $2,000,000.

The Lawler-Miller Co., it is stated, will erect a 4-story brick building on C and Commerce Sts., to cost $25,000.

Hoquiam, Wash.—Reid & Briggs, of Aberdeen, it is reported, have prepared plans for a hotel to be erected here at a cost of about $75,000.

Bellingham, Wash.—W. W. Eley, Mgr. for the Considine & Sullivan Theatrical Circuit, it is reported, has purchased a site for a $50,000 playhouse.

**Wausau, Wis.*—Miller & Krause, of Wausau, it is reported, have secured the contract to erect the office building at 4th and Scott Sts., for the Wisconsin Valley Trust Co. ,at a cost of $30,000.

Marinette, Wis.—Chas. D. Heath, Mgr. of the Marinette Hotel, it is stated, is planning making improvements to the hotel to cost about $25,000.

Victoria, B. C.—Fire on July 23, it is stated, destroyed a number of buildings, causing a loss of about $250,000.

Vancouver, B. C.—It is stated that a 10-story building to be known as the Marine Block is to be erected by Ex-Alderman Cook at a cost of $200,000.

Toronto, Ont.—A permit has been issued for a 4-story brick publishing house to cost $40,000 to be erected by the Hunter-Rose Co. on Sheppard St.

**Ottawa, Ont.*—The contract to erect the Y. M. C. A. Bldg., it is stated, has been awarded to Peter Lyall Sons, of Montreal, Que., at about $217,500.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Cordele, Ga.—The members of the First Baptist Church, it is reported, are contemplating the erection of an edifice to cost $40,000.

Rockford, Ill.—It is stated that a $35,000 edifice is to be erected for the members of the South Park Salem Lutheran Church. Rev. Alfred Appell, pastor.

Downer's Grove, Ill.—Wm. J. Brinkman, of Chicago, is reported to have prepared plans for a church to be erected at a cost of $25,000. Rev. J. Boldman, pastor.

Garden City, Kan.—The Methodists are reported to be planning the erection of a church to cost $20,000. Rev. J. W. Fitzpatrick, pastor.

Pittsburg, Kan.—The members of the Presbyterian Church, it is reported, are preparing to erect a $30,000 edifice.

Covington, Ky.—Lyman Walker is reported to be preparing plans for a $12,000 apartment house to be erected by Thos. Cody.

**Alexandria, La.*—It is stated that the contract to erect the Methodist Church, has been awarded to L. H. Baldwin for $24,200.

Bangor, Me.—It is reported that Linn Kinne is preparing plans for an edifice for the Church of the Reconciliation to be erected at Genesee and Tracy Sts.

Jackson, Mich.—Bids will be received until Aug. 12 (change of date) at the office of White & Hussey, Archts., Lansing, for the erection of the superstructure of the Diamond St. M. E. Church.

Duluth, Minn.—A permit has been issued for the residence to be erected for Geo. Spencer at 23d Ave. E. and 2d St., at $18,000. Bray & Nystrom, Palladio Bldg., are the archts.

Lexington, Mo.—It is reported that the congregation of Methodist Episcopal Church South is planning the erection of a $30,000 edifice. Rev. C. E. Pattille, pastor.

Omaha, Neb.—F. B. Kennard is having plans prepared for an apartment house costing $50,000. Fisher & Lawrie, Archts., Paxton Bldg.

Portland, Ore.—It is reported that the members of the First United Brethren Church are planning the erection of a $40,000 church.

Washington, Pa.—John Slater is reported to be having plans prepared for a $20,000 residence to be erected at Grant and Lincoln Sts.

**Cranston, R. I.*—Maguire & Penniman, Providence, are stated to have secured the contract to erect St. Ann's R. C. Church at about $30,000.

Bristol, Va.-Tenn.—It is stated that a $50,000 edifice is to be erected for the members of the Methodist Church. Rev. E. G. Hutchinson, Presiding Elder.

Norway, Ont.—Bids will be received until Aug. 8 by Chas. J. Wagner, Archt., 28 Toronto St., Toronto, for erecting a parish house and Sunday school building on Woodbine Ave., Norway.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Athens, Ala.*—The contract to erect the 8th Dist. Agricultural School, it is stated, has been awarded to Glidwell Bros., of Fayetteville. Probable cost, $15,000.

Montevallo, Ala.—Bids will be received until Aug. 20 by the Bldg. Com. (W. F. Spink, Chmn.), Alabama Girls' Industrial School, for erecting new buildings and additions to the dormitory. Wm. Ernest Spink, Archt., 812 Title Guarantee Bldg., Birmingham.

Storrs, Conn.—Competitive plans will be received until Aug. 31 by Thos. D. Bradstreet, State Compt., Hartford, for a Horticultural Hall and greenhouses at Conn. Agricultural College, Storrs. Appropriation, $50,000.

Hartford, Conn.—Bids will be received until Aug. 12 at the Hartford Nat'l Bank by the Washington School Dist. Com. (Alex. Angus, Chmn.) for $100,000 school bonds.

Washington, D. C.—Plans are reported being prepared by the Comrs. D. C. for the erection of a 4-room addition to the Emery School.

**Moscow, Idaho.*—Bids will be received until Aug. 20 (readvertisement) by Mrs. S. H. Hays, Secy. Bd. Regents, University of Idaho, for erecting the superstructure of an 80x238-ft. 3-story Administration Bldg., for above university. Bids to be submitted as follows Brick masonry; cut stone and terra cotta; reinforced concrete; fireproofing; structural steel; roofing tile and sheet metal; carpentry and superintendence; plumbing. Plans and specifications may be obtained from J. E. Tourtelotte & Co., Archts., Boise, upon a deposit of $15.

Farmington, Ill.—The citizens, it is stated, have voted to issue $16,000 bonds to erect a school.

Rockford, Ill.—The Trus. of Rockford College, it is stated, are planning the erection of a dormitory and a heating plant to cost a total of $100,000.

**Hammond, Ind.*—J. T. Hutton, Archt. of Hammond, writes that the contract for erecting a school (bids opened July 23) has been awarded to Erick Lund, of Hammond, for $43,645.

Ft. Dodge, Ia.—Bids will be received until Aug. 21 by J. B. Butler, Pres. School Bd., for erecting and rebuilding the High School.

Barbourville, Ky.—It is stated that plans are being prepared for a dormitory and for a 6-room annex to the Baptist Inst.

New Orleans, La.—It is stated that the following are the bids received July 22 for erecting the school at St. Mary, Chippewa and Annunciation Sts.: John O. Chisholm & Co., $18,150; Markel & Van Meter, $18,985, and Michel Chesse & Co., $16,420.

Winnfield, La.—The Bd. of Directors of the High School, it is stated, has accepted plans for a $75,000 School.

White Castle, La.—Bids will be received until Aug. 16 by the Bd. Trus., Iberville Parish (C. J. Brown, Secy.), Plaquemine, for $30,000 bonds ,to be issued for the purpose of erecting a high school in White Castle; also 2 smaller Dist. School and remodeling 1 Dist. School.

Jennings, La.—It is stated that $40,000 school bonds have been sold. Plans for the school have been prepared.

**Orange, Mass.*—H. C. Wood & Co., of Westfield, it is reported, has secured the contract to erect a 4-room brick school on Myrtle St., to cost $14,307.

**Adrian, Mich.*—The contract to erect the high school, it is stated, has been awarded to Thos. Foy, of Kalazoo, at $61,463.

Marquette, Mich.—Local press reports state that bids will be received until Aug. 22 by the Bd. Educ. (Cyrile Houle, Secy.) for erecting a high school, also for plumbing and sewerage for same. Specifications may be had from the Secy. on a deposit of $10. J. D. Chubb, Archt., Chicago, Ill.

Elizabeth, Minn.—Bids will be received until Aug. 12 by J. P. Greenagel, Clk. School Dist. No. 37, for erecting a 2-story brick school.

**Carver, Minn.*—Olaf Hansen & Son are reported to have secured the contract to erect a high school at a cost of about $15,000.

**Echo, Minn.*—F. W. Summerfield, Clk. Bd. Educ., writes that the contract for heating and plumbing school (bids opened July 23) has been awarded to B. Benson, of Willmar, for $1,494.

Leadwood, Mo.—The Secy. Bd. of Educ. writes that the citizens on July 24 voted to issue $25,000 bonds for the erection of a school. Architects, Riester & Rubach, of Belleville, Ill.

Reno, Nev.—The School Trus., it is stated, are considering plans submitted for the $50,000 school to be erected at Ralston and 2d Sts.

Ely, Nev.—It is stated that he citizens have voted in favor of issuing $35,000 bonds to erect a high school.

Durham, N. H.—Bids will be received until Aug. 12 (readvertisement) by the Bldg. Com. Bd. Trus. (John G. Gallaot, Chmn.) New Hampshire College, for erecting a dormitory at said college.

Montclair Heights, N. J.—Bids will be received until Aug. 13 by the Bldg. Com., New Jersey State Normal School (Edw. Russ, Chmn.) at the office of the Comr. Charities and Corrections, Trenton, for furnishing material and erecting a boiler house and installing a heating plant at the Normal School, Montclair Heights.

Bayonne, N. J.—It is reported that the Bd. of Educ. on July 25 rejected all the bids received recently for erecting School No. 9 and will readvertise.

The Bd. of Educ. on July 29 appointed S. Edson Gage, of New York, N. Y., and Donald G. Anderson to prepare plans and specifications for the proposed new No. 10 School and to supervise the construction of the building.

Brooklyn, N. Y.—Bids will be received until Aug. 12 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for completing abandoned ventilating and heating contracts in Schools 149, 151 and addition to School 109, all in Boro of Brooklyn.

**Binghamton, N. Y.*—The contract to erect an addition to Fairview School, it is stated, has been awarded to Shirley & Simpson at $10,479.

Olean, N. Y.—The Bd. of Educ., it is stated, has selected a site in East Olean on which it is proposed erecting a $35,000 school, plans for which are being prepared by E. E. Joralemon, of Niagara Falls.

**Carrington, N. D.*—The Fargo Plumbing & Htg. Co., of Fargo, is reported to have secured the contract to install a ventilating and heating system in the school at $5,480.

Minot, N. D.—It is stated that bids will be received until Aug. 17 by the School Bd. for erecting a 2-story school, 34x60 ft., for Minot Special School Dist. Frost & Hosmer, Blaisdell-Bird Bldg. are the archts.

Cleveland, O.—The City Council has passed an ordinance appropriating $40,000 for the erection of a dormitory at Warrensville.

Ashland, O.—Bids will be received until Aug. 16 by the Bd. Educ. (Geo. A. Ullman, Clk.) for installing a ventilating and heating plant, sanitary plumbing and gas piping in the new Walnut St. School. Vernon Redding, Archt., Mansfield.

Bellefontaine, O.—It is stated that bids will be received until Aug. 7 by Luther B. Sough, Clk. Bd. Educ., for plumbing and electric work in the high school.

Wheelersburg, O.—Bids will be received until Aug. 17 by the Bd. of Educ. (J. B. Fullerton, Clk.), for heating the school buildings. Dole, Wiegand & Oppenhamer, Archts., Ft. Wayne, Ind.

Mt. Healthy, O.—Bids will be received until Aug. 14 (readvertisement) by Wm. Fischvogt, Clk. Bd. Educ., Special School Dist. No. 13, Springfield Township, Mt. Healthy, R. F. D. No. 4, for furnishing material and erecting a school on Vanzant Rd., near Hamilton Pike. Martin Fisher, Archt., 2156 Central Ave., Cincinnati.

Cincinnati, O.—It is reported that plans have been prepared for a high school to be erected by the Jesuits at Gilbert and Lincoln Aves.

Enid, Okla.—The School Bd., it i sstated, has decided to erect 2 schools, 1 to cost $20,000 and the other $10,000.

Florence, Pa.—The Township Bd. of Educ., it is stated, has decided to erect a brick school at a cost of about $16,000.

Hartsville, S. C.—Bids will be received until Sept. 20 by the Bd. Trus. (School Dist. No. 32, (M. S. McKinnon, Chmn.) for $25,000 bonds, to be issued for the purpose of erecting and equipping a school.

Brenham, Tex.—Bids will be received until Aug. 10 by C. W. Winkelman, Secy. School Bd., for erecting a brick school. C. H. Page, Jr., & Bro., Archts., Austin.

San Antonio, Tex.—The Attorney General, it is stated, has approved the issue of $200,000 school bonds.

Pullman, Wash.—It is reported that bids will be received until Aug. 10 by the Secy. State Bd. Control at Olympia, for erecting a recitation building for the State College at Pullman. Probable cost, $125,000.

Puyallup, Wash.—It is reported that improvements costing about $127,000 are to be made at the Indian School at Puyallup by the Government. The improvement will include an electric light plant, wood working and mechanical departments for the Indians, and new school rooms and teachers' quarters.

**Tulalip, Wash.*—Jos. Mersh is stated to have secured the contract to erect a residence and warehouse at the Indian School at Tulalip.

Waukesha, Wis.—Bids will be received until Aug. 6 by the State Bd. Control (Herman Grotophorst, Pres.), Madison, for erecting a building at the Industrial School for Boys, Waukesha. Ferry & Clas, Archts., Milwaukee.

Milwaukee, Wis.—The Bldg. Com. of the St. John's Cathedral, it is stated, will receive bids until Aug. 6 for erecting the St. John's Cathedral Inst., according to plans prepared by Buemming & Dick, 1107 Pabst Bldg.

Montreal, Que.—Plans have been completed for the new engineering building at McGill Univ., to take the place of the one destroyed by fire in April. A building permit has been granted to the McGill authorities. The new structure will be fireproof, and it is estimated to cost about $275,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Baltimore, Md.*—The contract for removal by scow or lighter, and final disposition of street sweepings and other refuse (bids opened July 24 by the Bd. of Awards, J. Barry Mahool, Pres.), has been awarded to the Acme Sand Co., at 30 cts. per cu. yd.

Jersey City, N. J.—Bids will be received by the Bd. Street and Water Comrs. (Geo. G. Bonton, Clk.), until Aug. 12, for the collection and removal of ashes and garbage and kitchen refuse from all streets of city, from Dec. 1, 1907, to Nov. 30, 1908, or from Dec. 1, 1907 to Nov. 30, 1912.

Cincinnati, O.—Plans for the two dumping stations were approved on July 25 by the Bd. of Pub. Service. Council will be asked for authority to spend $57,000 for the station at 2d and Commerce Sts., and $19,000 for the canal station.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Citronelle, Ala.—See "Power Plants, Gas and Electricity."

Hartford, Conn.—The House has passed a bill authorizing the establisment of a municipal ice plant.

Chicago, Ill.—The Adams & Westlake Co., it is stated, will build a 7-story building, 100x100 ft., on Ohio St., between Franklin and Orleans Sts., as an addi-

* *Items marked thus give the names of parties awarded contracts.*

tion to its plant. It will be of fireproof steel and mill construction, and cost $125,000. Plans are being prepared by Jenney, Mundie & Jensen, 171 La Salle St.

It is stated that the Mechanical Rubber Co. is having plans prepared for a 2-story 50x132 ft. factory to be erected at 1066 Grand Ave., and cost $50,000.

Chicago, Ill.—Bids will be received until Aug. 16 by the Bus. Mgr. of the Bd. of Educ. for machinery for woodworking, machine shops, forge room, foundry, etc. in Lyman Trumbull Manual Training High School.

Booneville, Ind.—The American Society of Equity (Gurley Taylor, Pres.), is reported to have ordered plans prepared for a steel grain elevator; estimated cost, $30,000.

**Clinton, Mass.*—J. W. Bishop & Co., of Worcester, it is reported, have secured the contract to erect a mill on Union St. for th Bigelow Carpet Co. at about $300,000.

**Pittsfield, Mass.*—The General Electric Co. Pittsfield Works are stated to have let contract for building a large foundry building 365x150 ft. as follows: Mason and carpenter work to Beckwith & Pike, Pittsfield, and structural steel work to McClintic-Marsball Constr. Co., of New York and Pittsburg.

Marquette, Mich.—The Lake Shore Engine Wks., it is stated, intend erecting a plant to cost about $100,000.

Battle Creek, Mich.—M. J. Morehouse of Chicago, Ill., is stated to have prepared plans for a building to be erected for the Toasted Corn Flakes Co. at a cost of $90,000. Equipment to cost $60,000 additional.

Minneapolis, Minn.—It is reported that the Washburn Car Coupler Co. intends erecting a plant at 34th St. and Hiawatha Ave.

Painted Post, N. Y.—The Ingersoll-Rand Co., it is reported, contemplates making improvements to its plant here at a cost of $60,000.

Brooklyn, N. Y.—The Brooklyn Rapid Transit Co. (John F. Calderwood, Gen. Mgr.), it is reported, intends erecting a repair shop and stable on Nostrand Ave. and President Sts., to cost about $300,000.

Dunkirk, N. Y.—The Bd. of Trade is reported to have secured for this city the erection of a plant by Chas. Morley Co., for the manufacture of silk gloves and silk goods. Chas. Morley, of Amsterdam, Pres. and Gen. Mgr. of the company.

Memphis, Tenn.—The plant of the Memphis Cotton Oil Co. in New South Memphis, which was recently badly damaged by fire, it is reported, is to be rebuilt.

Chattanooga, Tenn.—Col. W. I. Young, is reported interested in the Wachovia Cotton Co., which proposes erecting a cotton mill on the north side of the river to cost $1,000,000.

Dallas, Tex.—Lewis M. Dabney and T. E. Ferguson has petitioned th Bd. of City Comrs. for a franchise to install a refrigeration plant in th city of Dallas and a system of pipes and mains for the distribution of such refrigeration.

Brownsville, Tex.—It is stated that plans have been submitted at the Columbus, O. office for the sugar mill to be erected by the Ohio & Texas Sugar Co. at Brownsville at a cost of $250,000.

Cuba City, Wis.—Plans are reported prepared for a mill to be erected in Cuba City by the Vandeventer Lead & Zinc Co., and provide for a 50-ton concentratior.

**Winnipeg, Man.*—The contract to erect a shop 650x160 ft. at Ft. Ronge for the Canadian Northern Ry. is stated to have been awarded to Kelly Bros. & Mitchell for about $200,000.

Hamilton, Ont.—The Berlin Machine Co., it is stated, has secured a permit to erect a plant on Berlin Ave., East Hamilton, to cost about $150,000.

Cobalt, Ont.—Bids are wanted for furnishing material and erecting a concentrating mill at Cobalt. Address Cobalt Concentrators, Limited, 1226-7 Trader Bank Bldg., Toronto.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Santa Barbara, Cal.—Bids will be received until Aug. 10 by Alfred Davis, City Clk., for constructing a bulkhead on the East Boule. as per two separate plans, one prepared by F. C. Finkle and one by Thos. Nixon.

Washington Barracks, D. C.—Bids will be received until Sept. 30 by Maj. E. Eveleth Winslow, Corps Engrs., U. S. A., Washington Barracks, for construction of experimental field searchlight outfit.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received until Aug. 14 by Elliott Woods, Supt. U. S. Capitol Bldgs and Grounds, for 2 passenger elevators for the U. S. Court House, Washington, D. C.

Bids were opened on July 29 by Maj. Spencer Cosby, Corps Engrs., U. S. A., for constructing rip-rap jetties, and Chas. G. Smith & Son, of Washington, submitted lowest bid as follows: 100 cu. yds. rip-rap stone in Occoquan Creek, Va., $1.97; 1,000 cu. yds. rip-rap stone in Nomini Creek, Va., $3.34; 900 cu. yds. riprap stone in Urbana Creek, Va., $3.93, and 400 cu. yds. rip-rap stone in Milford Haven, Va., $4.48; total, $10,048. Lyons Bros., of Brookland, D. C., bid for the work $12,300.

**Takoma, Washington, D. C.*—Maj. J. T. Crabbs, Q. M., Walter Reed Army Hospital, writes that the contract for constructing concrete conduit at Walter Reed Army General Hospital (bids opened July 18) has been awarded to The Cranford Paving Co., Washington, for $14,250 (time of completion 40 days).

Honolulu, H. I.—Bids will be received by Capt. C. W. Otwell, Corps Engrs., U. S. A., Honolulu, until Sept. 9 for dredging Honolulu harbor, as advertised in The Engineering Record.

Council Bluffs, Ia.—Bids will be received until Aug. 21 by the Bd. of Superv. for $21,638 Pigeon Creek Drainage Dist. bonds. W. C. Cheyne, Co. Aud.

Portland, Me.—Bids will be received by Maj. Geo. A. Zinn, Corps Engrs., U. S. A., until Aug. 30 for rock excavation in Cape Porpoise Harbor, Me., as advertised in The Engineering Record.

Hadley, Mass.—Bids will be received until Aug. 9 by the Harbor and Land Comrs. (Geo. E. Smith, Chmn., State House, Boston), for furnishing and placing 4,500 tons ri-rap on the southeasterly bank of the Connecticut River in the town of Hadley. E. E. Davis, Engr., Lambie Blk., Northampton.

Boston, Mass.—Bids will be received until Aug. 30 by Maj. Edw. Burr, Corps Engrs., U. S. A. Boston, for dredging in Weymouth Back River, Mass.

Grand Rapids, Mich.—L. W. Anderson, City Engr., writes that the lowest bid opened on July 18 by the Bd. of Pub. Wks., for flood protection was submitted by Jos. Rusche, 4 Portsmouth Terrace, Grand Rapids. He bid for 4,050 cu. yds. concrete, main wall, So. of Leonard St., $5.25; 8,400 earth excav. South, $1.25; 18,125 cu. yds. rock on main work, South, $1.85; 60 cu. yds. concrete walls and steps at Myrtle St., $13; 25 cu. yds. earth excav., Myrtle St., 50 cts.; 10 cu. yds rock excav., Myrtle St., $10; 4,725 cu. yds. earth excav., river bed, N. C. Dams., $1; rock sold to contractors per cu. yd., 10 cts.; total amount of contract $70,911. Totals of other bids, John J. O'Heron & Co., 6 Wabash Ave., Chicago, Ill., $73,645, and Appleyard, Johnson & Co., $82,508. Albert Prangle bid only for work south of Leonard St., $99,042.

**Holland, Mch.*—Bids were opened on July 26 by Col. M. B. Adams, Corps Engrs., U. S. A., at Grand Rapids, for repairs of north pier at Holland Harbor, and the bid of Bennett-Schnorbach Co., of Muskegon, has been recommended for acceptance as follows: 28,000 cu. yds. dredging, 34 cts.; 9,632 lin. ft. oak piles, 36 cts.; 856 M ft. oak timber, $61; 115 M ft. pine or Douglas fir timber, $46; 157 M ft. plank for sheet piles, $54.90; 6,518 M ft. plank for decking, $46; drift, screw and carriage bolts and tie rods and spikes, 4 and 5 cts. per lb.; 403 cords stone fill, per cord, $9.50; 2,336 cu. yds. sand fill, 30 cts.; total, $33,844. Burk, Smith & Nelson, of Muskegon, bid for this work $35,716.

Fergus Falls, Minn.—It is stated that bids will be received until Aug. 9 by the Co. Bd. at Fergus Falls, for constructing a drainage ditch in towns of Eastern and Effington.

**St. Paul, Minn.*—Bids will be received until Aug. 19 by the Bd. Co. Comrs., for constructing a concrete and cobblestone culvert under Snail Lake Rd. on Atlantic Ave. in Sec. 24, Town 30, Range 23. Edwd. G. Krahmer, Co. Aud.

Bayonne, N. J.—F. W. Dalrymple, City Engr., writes that plans are now being prepared for a recreation pier for Bayonne.

Woodbridge, N. J.—The following are the bids opened on July 27 by Col. D. W. Lockwood, Corps Engrs., U. S. A., Army Bldgs., N. Y. City, for dredging in Woodbridge Creek, N. J. (price given per cu. yd.): J. M. Briggs, 154 Nassau St., New York, N. Y., 28.8 cts., and John & Jos. McSpirit, 118 Wayne St., Jersey City, N. J., 33 cts.

Ithaca, N. Y.—Bids are wanted by Bailey, Johnson & Saunders, Ithaca, for 15,000 cu. yds. earth excav. and 1,000 cu. yds. second and third class concrete, as advertised in The Engineering Record.

Mineola, L. I., N. Y.—The lowest bid opened on July 22 by the Nassau County Superv. for constructing sea wall along West Shore Road, is reported to have been submitted by W. E. Warren, of Mt. Vernon, at $4.83 per cu. yd.

New York, N. Y.—The following are the bids opened on July 24 by Lieut.-Col. W. L. Marshall, Corps. Engrs., U. S. A., for dredging Bay Ridge and Red Hook Channels (price given per cu. yd. meas. in vessels). About 1,563,366 cu. yds. to be dredged; amount available for work $430,000: Morris & Cummings Dredging Co., 17 State St., 18.4 cts.; W. H. Beard Dredging Co., 21 State St., 24 cts.; International Contr. Co., 95 Broad St., 25.8 cts.; Midland Land & Improv. Co., 62 Cedar St., 19.92 cts.

The following are the bids opened on July 24 by Col. John G. D. Knight, Corps Engrs., U. S. A., for dredging Schodack Creek, Hudson River (price given per cu. yd. scow meas.): Maritime Dredging Co., 78 Broad St., N. Y. City, 21.9 cts.; The Hudson River Dock & Dredging Co., 22 Broad St., Waterford, N. Y., 27.95 cts.; cost of proposed work, about $4,800.

Bids will be received by Myles Tierney, Acting Pres. Bd. Trus. Bellevue and Allied Hospitals, until Aug. 12 for furnishing materials and constructing a tunnel connecting the Training School for Women Nurses with pavillions A and B of the new Bellevue Hospital, Boro. Manhattan.

Bids will be received until Aug. 13 by J. A. Bensel, Comr. Docks, for furnishing all the labor and materials required for preparing for and building freight sheds on piers 57, 58 and 59, between W. 14th and W. 19th Sts., North River, with lateral extensions on the adjacent bulkhead platforms as per contract No. 1,090.

Bids will be received until Aug. 12 by Bd. Trus. Bellevue & Allied Hospitals (Myles Tierney, Acting Pres.), for a vacuum dust sweeping and cleaning plant for the Pathological Dept. and male dormitory of new Bellevue Hospital on 1st Ave. and 26th anad 29th Sts., Boro. of Manhattan.

Bids will be received until Aug. 12 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing an electric elevator in Stuyvesant High School, Boro. Manhattan, and constructing 2 grand stands, one on Athletic Field in Astoria, Boro. Queens, the other on Athletic Field, Boro. Richmond.

Albany, N. Y.—Winslow M. Mead, Deputy Supt. of Pub. Wks., writes that the State Engineer and Surveyor has been authorized to prepare specifications for the arch culvert or aqueduct at Durhamville, near the city of Oneida, for which no bids were received on July 18; after plans are completed new bids will be called for.

Ft. Ontario, N. Y.—Bids will be received by Lieut. W. F. Harrell, Constr. Q. M., U. S. A., until Aug. 20 for construction of an iron and wire fence at this post, as advertised in The Engineering Record.

Cincinnati, O.—The lowest bid opened on July 18 by Lieut.-Col. Wm. T. Ressell, Corps. Engrs., U. S. A., for constructing dam at head of Brown's Island, Ohio River, was submitted by P. C. Turner, of Louisa, Ky., at the following bid. 165 cu. yds. excav., ledge rock, $3; 5,400 cu. yds., excav., loose material, $2.25; 90 lin. ft. anchor bolt holes, 60 cts.; 110 piles, ea. $10; 8,600 lbs. iron tie rods, anchor bolts, etc., 6 cts.; 2,000 cu. yds. stone 9 to 18 cu. ft., $6; 2,100 cu. yds. stone ¾ to 3 cu. ft., $3.50; earth fill (if required) per cu. yd., 75 cts.; 2,625 cu yds. concrete, $7; 40 bbls. extra cement, $2.25; total $52,130. John C. Thomas, of Belleview, O., bid for this work $56,815.

Cleveland, O.—It is stated that bids will be received until Aug. 6 by the Bd. Pub. Service (A. R. Callow, Secy.), for furnishing material and constructing a reinforced concrete culvert for Giddings Brook, under East Boule.

Cincinnati, O.—See "Water."

Panama.—Bids will be received by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Com., Washington, D. C., until Aug. 9 for furnishing cast iron pipe and fittings, gate valves, vitrified sewer pipe, electrical fixtures, gauge testing machine, steel, dipper arm for dipper dredge, repair parts for steam shovels, etc., as per circular 379; also until Aug. 12 for furnishing 3 steel barges, as per circular No. 380.

Philadelphia, Pa.—Bids will be received by Maj. J. C. Sanford, Corps. Engrs., U. S. A., Philadelphia, until Aug. 30 for constructing 2 steel, twin screw suction dredges for New York Harbor, N. Y. ,as advertised in The Engineering Record.

Block Island, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, until Aug. 28 for dredging entrance channel to Great Salt Pond, Block Island, as advertised in The Engineering Record.

McClellanville, S. C.—Bids will be received by Capt. E. R. Stuart, Corps Engrs., U. S. A., Charleston, until Aug. 20 for dredging canal, between Sewee Bay and McClellanville, as advertised in The Engineering Record.

Charleston, S. C.—The following are the bids opened on July 25 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for dredging Navy Yard, Charleston, S. C. (Specification No. 1545): (*a*) Price per cu. yd. for dredging, (*b*) total cost of removing cofferdam and sawing off sheet piling. Howard Trumbo, cor. Duval and Fleming Sts., Key West, Fla., *a* 18.49 cts, *b* $5,000; Roderick G. Ross, 204 East Bay St., Jacksonville, Fla., *a* 16 cts.; *b* $4,000; Coastwise Dredginfg Co., 810 Bank of Commerce Bldg., Norfolk, Va., *a* 22 cts., *b* $9,995; North American Dredging Co., 13-21 Park Row, New York, N. Y., *a* 14.9 cts., *b* $5,000, additional marl. dredging 60 cts. per cu yd.; Cataract Dredging Co., 701 Maryland Trust Bldg., Baltimore, Md., *a* 17⅜ cts., *b* $3,300.

The only bid received and opened on July 20 by Capt. G. P. Howell, Corps Engrs., U. S. A., for dredging Winyah Bay, S. C., about 175,000 cu. yds., was submitted by P. Sanford Ross, Inc., Jersey City, N. J., at 19.9 cts. per cu. yd.

Dallas, Tex.—The plans of J. E. Flanders, 354 Jackson St., are reported to have been adopted by the Park Board for an arch at the main entrance of the fair grounds; probable cost, $8,000.

Dallas, Tex.—See "New Industrial Plants."

Galveston, Tex.—Bids will be received by Capt. John C. Oakes, Corps Engrs., U. S. A., until Aug. 31 for jetty work at Galveston, as advertised in The Engineering Record.

Bremerton, Wash.—Bids were opened on July 27 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D .C., for Dry Dock No. 2, of concrete and granite at the Navy Yard, Puget Sound, Wash. (Specification 1542) and the following are the totals of bids received for work complete; certain deductions and modifications were presented by the first four bidders: Independent Asphalt Paving Co., Pioneer Bldg., Seattle, $1,240,000; Wm. Norton Concannon, 9 Mission St., San Francisco, Cal., $1,730,862; F. McLellan & Co., Inc., 435 Burke Blk., Seattle, $1,192,284; the Scofield Co., Pennsylvania Bldg., Philadelphia, Pa., $1,602,000, and the International Contract Co., N. Y. Block, Seattle, $1,594,140.

PROPOSALS OPEN.

For Proposals see Pages 86, 88, 89, 90 and 92.

WATER.

Aug. 5.	Reservoir, etc., Ft. Adams, R. I. Adv. Jul. 13 to Aug. 3.	Jul. 13
Aug. 6.	Dams, New York, N. Y. Adv. Jul. 6 to Aug. 3.	Jul. 6
Aug. 6.	**System, Speed, Miss.**	**Jul. 20**
Aug. 6.	**Main extension, Cherokee, Ia.**	**Jul. 20**
Aug. 6.	Water exten., Grinnell, Ia.	Aug. 3
Aug. 7.	Filter plant, Steelton, Pa. Adv. Jul. 20 to Aug. 3.	Jul. 20
Aug. 7.	Pipe, Chicago, Ill.	Aug. 3
Aug. 8.	**Well, Catoosa Springs, Ga.**	**Jul. 20**
Aug. 8.	Pumping plant, Long Island City, N. Y.	Jul. 27
Aug. 8.	Water wks., Bonesteel, S. D.	Aug. 3
Aug. 8.	Meters, Cleveland, O.	Aug. 3
Aug. 9.	**Filtration plant, Ft. Hancock, N. J.** Adv. Jul. 13 to Aug. 3.	**Jul. 13**
Aug. 9.	C. i. pipe, Panama	Aug. 3
Aug. 10.	Irrigation canal, Aztec, N. M.	Aug. 3
Aug. 12.	Water works, Belle Plaine, Minn.	Jul. 27
Aug. 12.	Well, Highmore, S. D.	Jul. 27
Aug. 12.	Well, etc., Louisville, Ky.	Aug. 3
Aug. 13.	Meters, Halifax, N. S.	Aug. 3
Aug. 13.	**Reservoir, Columbus, O.**	**Jul. 20**
Aug. 13.	Wells, pumps, etc., Hamilton, O. Adv. Aug. 3.	Aug. 3
Aug. 14.	Supplies, New York, N. Y.	Aug. 3
Aug. 19.	**Filter plans, Sacramento, Cal.** Adv. Jun. 1 to 15.	**Jun. 1**
Aug. 19.	Steel tank, Lombard, Ill.	Aug. 3
Aug. 20.	**Water wks., Russellville, Ark.** Adv. Jul. 13 to 27.	**Jul. 20**
Aug. 21.	Dam and tunnel, Springfield, Mass. Adv. Jul. 27, Aug. 3.	Jul. 27
Aug. 21.	Well strainer, Ft. Hancock, N. J.	Jul. 27
Aug. 22.	Filters and pipe exten., Philadelphia, Pa. Adv. Jul. 27, Aug. 3.	Jul. 27

** Items marked thus give the names of parties awarded contracts.*

Aug 26. Pump engine, Ashland, O. ....Aug. 3
Aug. 27. C. i. pipe, etc., Cincinnati, O. ....Aug. 3
Aug. —. Water wks., Rockingham, N. C. ....June. 29
Aug. 22. Filters and pipe exten., Philadelphia, Pa.Jul. 27
Adv. Aug. 3.
Sep. 4. Hauling and laying pipe, New Orleans,
La. Adv. Jun. 29 to Aug. 3..........Jun. 29
Sep. 8. Pump engine, boilers, etc., Louisville,
Ky. Adv. Jul. 27, Aug. 3..............Jul. 27
Sep. 14. Valves and gates, Manila, P. I..........Jul. 27
Adv. Jul. 27.

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 6. Alexandria, La. ....Jun. 29
Adv. Jun. 26 to Jul. 20.
Aug. 6. Morris, Minn. ....Jul. 20
Aug 6. New York, N. Y..........................Jul. 27
Aug. 6. Trenton, N. J..........................Jul. 27
Aug. 6. Cleveland, O. ....Jul. 27
Aug. 6. New York, N. Y. ....Aug. 3
Aug. 6. Davenport, Ia. ....Aug. 3
Aug. 6. St. Bernard, O. ....Aug. 3
Aug 6. Taylor, Pa. ....Aug. 3
Aug. 6. Grinnell, Ia. ....Aug. 3
Aug. 6. Oneida, N. Y. ....Aug. 3
Aug. 7. Iron River, Mich. Adv. Aug. 3........Aug. 3
Aug. 7. Chicago, Ill. ....Aug. 3
Aug. 7. Denver, Colo. ....Aug. 3
Aug. 8. Bloomfield, Ind. Adv. Jul. 13..........Jul. 13
Aug. 8. Green Bay, Wis. Adv. Jul. 27, Aug. 3.Jul. 27
Aug. 8. Milford, Mass. Adv. Aug. 3............Aug. 3
Aug. 8. Kansas City, Mo. ....Aug. 3
Aug. 8. Detroit, Mich. ....Aug. 3
Aug. 9. Richmond, Ind. ....Jul. 27
Aug. 9. Panama ....Aug. 3
Aug. 9. Indianapolis, Ind. ....Aug. 3
Aug. 10. Marshfield, Wis. ....Jul. 20
Aug. 10. Cambridge, O. Adv. Aug. 3............Aug. 3
Aug. 12. Madison, S. D..........................Jul. 27
Aug. 12. Youngstown, O. ....Aug. 3
Aug. 12. Willmar, Minn. ....Aug. 3
Aug. 12. New York, N. Y. ....Aug. 3
Aug. 12. Bucyrus, O. ....Aug. 3
Aug. 13. Gas City, Ind. Adv. Aug. 3............Aug. 3
Aug. 13. Evansville, Ind. ....Aug. 3
Aug. 14. Lewistown, Mont. ....Jul. 20
Aug. 14. Oakland, Cal. ....Aug. 3
Aug. 14. Columbus, O. ....Aug. 3
Aug. 15. Camden, Ark. ....Jul. 20
Aug. 15. Arkadelphia, Ark. ....Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 15. Howell, Mich. ....Aug. 3
Aug. 15. Elizabeth, N. J. ....Aug. 3
Aug. 16. Cincinnati, O. ....Jul. 27
Aug. 17. Norwood, O. Adv. Aug. 3............Aug. 3
Aug. 17. Asbury Park, N. J..........................Aug. 3
Aug. 19. Riverside, Cal. Adv. Aug. 3............Aug. 3
Aug. 19. Cape Giradeau, Mo. ....Aug. 3
Aug. 19. Webster Groves, Mo. ....Aug. 3
Aug. 20. Cleveland, O. ....Jul. 27
Aug. 20. Collinsville, Ill. ....Aug. 3
Aug. 20. Athol, Mass. ....Aug. 3
Aug. 21. Great Lakes, N. Chicago, Ill............Aug. 3
Adv. Aug. 3.
Aug. 22. Fayetteville, Ark. ....Aug. 3
Aug. 23. Delaware, O. ....Aug. 3
Aug. 26. Omaha, Neb. Adv. Aug. 3............Aug. 3
Aug. 30. Evansville, Ind. Adv. Aug. 3........Jul. 27
Aug. —. Rockingham, N. C. ....Jun. 29
Sep. 1. Eatonton, Ga. ....Apr. 13
Sep. 1. Alton, Ill. ....Jun. 8
Sep. 2. Shelby, N. C. ....Aug. 3
Sep. 3. New Philadelphia, O. ....Aug. 3
Sep. 11. New Orleans, La. Adv. Jul. 6 to Aug. 3.Jul. 6
Oct. —. Eaton, O. ....Aug. 3

BRIDGES.

Aug. 6. Middleburg, Ind. ....Jul. 27
Aug. 6. Atchison, Kan. ....Jul. 27
Aug. 6. Covington, Ind. ....Jul. 27
Aug. 6. Plymouth, Ind. ....Aug. 3
Aug. 6. Shelbyville, Ind. ....Aug. 3
Aug. 6. Marion, Ind. ....Aug. 3
Aug. 6. New Lexington, O. ....Aug. 3
Aug. 6. South Orange, N. J. ....Aug. 3
Aug. 7. Warsaw, Ind. ....Jul. 27
Aug. 7. Indianapolis, Ind. ....Aug. 3
Aug. 7. Santa Fe, Ind. ....Aug. 3
Aug. 7. Independence, Mo. ....Aug. 3
Aug. 7. Rahway, N. J. ....Aug. 3
Aug. 8. New Albany, Ind. ....Jul. 20
Aug. 8. Salina, Kan. ....Aug. 3
Aug. 9. Hamburg, Pa. ....Jul. 27
Aug 10. Cleveland, O. ....Jul. 20
Aug 10. Brookland, D. C. Adv. Jul. 27, Aug. 3...Jul. 27
Aug. 12. Talladega, Ala. ....Aug. 3
Aug 13. Trenton, N. J. ....Aug. 3
Aug 15. Tonawanda, Pa. ....Aug. 3
Aug. 15. Mt. Gilead, O ....Aug. 3
Aug 16. Cincinnati, O. Adv. Aug. 3............Aug. 3
Aug 17. Substructure, Chicago, Ill............Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 17. Superstructure, Chicago, Ill............Jul. 27
Adv. Jul. 27, Aug. 3.
Aug 17. Port Clinton, O. ....Aug. 3
Aug 19. Council Bluffs, Ia. Adv. Aug. 3........Aug. 3
Aug 20. San Juan, P. R..........................Jul. 20
Aug 20. Ft. Myer, Va. ....Aug. 3
Aug 24. Lebanon, O. ....Aug. 3
Sep 2. Tarboro, N. C. ....Aug. 3
Sep. 30. Santiago, Chile ....Jul. 13

PAVING AND ROAD MAKING.

Aug 6. Wilmington, Del. ....Aug. 3
Aug. 6. Reynoldsville, Pa. ....Jun. 29
Aug 6. Sharpsville, Pa. ....Jul. 13
Aug. 6. Covington, Ind. ....Jul. 13
Aug. 6. New York, N. Y. ....Jul 27
Aug 6. Brazil, Ind. ....Jul. 20
Aug. 6. Bloomington, Ind. ....Jul. 20
Aug 6. Spencer, Ind ....Jul. 20
Aug. 6. Cohoes, N. Y ....Jul. 20
Aug 6. Washington, Pa ....Jul. 20
Aug 6. Martinsville, Ind ....Jul. 27
Aug. 6. Washington, Ind. ....Jul. 27
Aug 6. Edgewater, N. J ....Jul. 27
Aug 6. Stapleton, S. I. ....Jul. 27
Aug 6. Sewickley, Pa. ....Jul. 27
Aug 6. New York, N. Y ....Aug. 3
Aug 6. Paola, Kan. ....Aug. 3

Aug. 6. Shelbyville, Ind. ....Aug. 3
Aug. 6. Clarinda, Ia. Adv. Jul. 27 ....Jul. 27
Aug. 6. Elizabethtown, Ky. ....Aug. 3
Aug. 6. Barnesville, O. ....Aug. 3
Aug. 7. Peru, Ind. ....Jul. 20
Aug. 7. Columbus, Ind. ....Jul. 27
Aug. 7. Rockville, Ind. ....Jul. 27
Aug. 7. Des Moines, Ia. ....Aug. 3
Aug. 7. Chicago, Ill. ....Aug. 3
Aug. 8. Hartford City, Ind. ....Jul. 27
Aug. 8. Brooklyn, N. Y. ....Jul. 27
Aug. 8. Riverton, N. J. ....Jul. 27
Aug. 8. Concord, N. H. ....Aug. 3
Aug. 8. New York, N. Y. ....Aug. 3
Aug. 8. Columbus, O. ....Aug. 3
Aug. 8. Long Island City, N. Y. ....Aug. 3
Aug. 8. Brooklyn, N. Y. ....Aug. 3
Aug. 8. Tuscaloosa, Ala. ....Aug. 3
Aug. 9. Two Rivers, Wis. ....Aug. 3
Aug. 9. Indianapolis, Ind. ....Aug. 3
Aug. 9. Monessen, Pa. ....Aug. 3
Aug. 10. Lisbon, Ohio ....Jul. 27
Aug. 10. Bellevue, O. ....Jul. 27
Aug. 10. Cecilina, O. ....Aug. 3
Aug. 10. Findlay, O. ....Aug. 3
Aug. 10. Scottville, Mich. ....Aug. 3
Aug. 10. East Liverpool, O. ....Aug. 3
Aug. 12. Detroit, Mich. ....Aug. 3
Aug. 12. Youngstown, O. ....Aug. 3
Aug. 12. Fond du Lac, Wis. ....Aug. 3
Aug. 12. Muskegon, Mich. Adv. Aug. 3............Aug. 3
Aug. 13. Ecorse, Mich. ....Aug. 3
Aug. 14. Brooklyn, N. Y. ....Aug. 3
Aug. 14. New York, N. Y. ....Aug. 3
Aug. 14. Columbus, O. ....Aug. 3
Aug. 15. Long Island City, N. Y. ....Aug. 3
Aug. 15. Cairo, Ill. ....Aug. 3
Aug. 15. Appleton, Wis. ....Aug. 3
Aug. 15. Elizabeth, N. J. ....Aug. 3
Aug. 16. Covington, Ind. ....Aug. 3
Aug. 17. Huntsville, Ala. ....Aug. 3
Aug. 17. Bedford, Ind. ....Aug. 3
Aug. 19. Steubensville, Ohio ....Jul. 27
Aug. 19. Westfield, N. J. ....Aug. 3
Aug. 20. Cleveland, O. ....Jul. 27
Aug. 21. Aberdeen, Wash. ....Jul. 27
Aug. 21. Ft. St. Philip, La. ....Aug. 3
Aug. 22. Ashland, Wis. ....Aug. 3
Aug. 22. Newark, O. ....Aug. 3
Aug. 24. Whipple Barracks, Ariz. ....Aug. 3
Aug. 26. Ft. Washington, Md. ....Aug. 3
Aug. 27. Pensacola, Fla. Adv. Jul. 27, Aug. 3..Jul. 27
Aug. 30. Marshfield, Mo. ....Aug. 3
Sep. 3. Beardstown, Ill. ....Aug. 3
Sep. 3. New Philadelphia, O. ....Aug. 3

POWER PLANTS, GAS AND ELECTRICITY.

Aug. 5. Blackwells Island, N. Y..........................Jul. 27
Aug. 5. Brooklyn, N. Y..........................Jul. 27
Aug. 6. Cleveland Heights, O. ....Jul. 20
Aug. 6. Sioux City, Ia. ....Jul. 20
Aug. 6. Hamilton, Ont. ....Jul. 20
Aug. 6. Washington, D. C. ....Aug. 3
Aug. 9. Panama ....Aug. 3
Aug. 10. Hickory, N. C..........................Jul. 27
Aug. 12. New York, N. Y. ....Aug. 3
Aug. 13. Washington, D. C..........................Aug. 3
Aug. 13. Hamilton, O. Adv. Aug. 3............Aug. 3
Aug. 15. Blackwells Island, N. Y..........................Aug. 3
Aug. 15. Campbellford, Ont. ....Aug. 3
Aug. 15. San Angelo, Tex. ....Aug. 3
Aug. 19. West Point, N. Y. Adv. Aug. 3........Aug. 3
Aug. 19. Tecumseh, Neb. ....Aug. 3
Aug. 22. Hawaii. ....Aug. 3
Aug. 29. San Francisco, Cal. ....Aug. 3
Aug. 31. Lebanon, Pa. ....Jul. 20
Sep. 3. Winnipeg, Man. ....Jun. 15
Adv. Jun. 15 to Jul. 20.

BUILDINGS.

Aug. 5. Htg. educ. bldg., Brooklyn, N. Y......Jul. 27
Aug. 6. Pub. bldg., Brooklyn, N. Y..........Jul. 20
Aug. 6. Bldg. at Univ., Columbus, O..........Jul. 13
Aug. 6. School, Granville, N. D..........Jul. 20
Aug. 6. Annex to jail, Asheville, N. C..........Jul. 20
Aug. 6. Court house, Shelby, N. C..........Jul. 27
Aug. 6. Pub. bldg., Wales, Wis..........Aug. 3
Aug. 6. Pub. bldg., New Orleans, La..........Aug. 3
Aug. 6. School, Waukesha, Wis..........Aug. 3
Aug. 7. Univ. bldg., Moscow, Idaho..........Jul. 6
Aug. 7. Church, Halifax, N. S..........Jul. 13
Aug. 7. School plans, New Haven, Conn......Jul. 20
Aug. 7. Pub. bldg., Baltimore, Md..........Jul. 20
Aug. 7. Add. to pub. bldg., Ottawa, Ont......Jul. 27
Aug. 7. School, Bellefontaine, O. ....Aug. 3
Aug. 7. Pub. bldg., Baltimore, Md. ....Aug. 3
Aug. 7. Indus. plant, Camden, N. J..........Aug. 3
Aug. 8. Pub. bldg., Brooklyn, N. Y..........Jul. 27
Aug. 8. Htg. school, Balfour, N. D..........Jul. 27
Aug. 8. City hall, Calgary, Alta..........Jul. 27
Aug. 8. Pub. bldg., Cleveland, O..........Aug. 3
Aug. 8. Church, Norway, Ont. ....Aug. 3
Aug. 9. Asylum, Monticello, Ind..........Jun. 29
Aug. 9. School, Lakewood, O. ....Jul. 13
Aug. 9. School, Tolley, N. D..........Jul. 27
Aug. 9. Vault improv. in Treas. Bldg., Washington, D. C. ....Jul. 27
Aug. 9. Pub. bldg., Spring City, Pa..........Jul. 27
Aug. 10. School, Ontario, Cal. ....Jul. 27
Aug. 10. School, Pullman, Wash. ....Aug. 3
Aug. 10. Pub. bldg., West Point, N. Y..........Aug. 3
Adv. Aug. 3.
Aug. 10. Bus. bldg., Colorado Springs, Colo.....Aug. 3
Aug. 10. School, Ft. Dodge, Ia. ....Aug. 3
Aug. 12. Post office, Mason City, Ia..........Jul. 6
Adv. Jul. 6, 13.
Aug. 12. Schools, Aberdeen, S. D. ....Jul. 27
Aug. 12. Pub. bldg., Highmore, S. D..........Jul. 27
Aug. 12. School, Elizabeth, Minn. ....Aug. 3
Aug. 12. Church, Jackson, Mich. ....Aug. 3
Aug. 12. School, Brooklyn, N. Y..........Aug. 3
Aug. 12. Bus. bldg., Grand Junction, Colo......Aug. 3
Aug. 12. Plmbg. pub. bldg., Bucyrus, O. ......Aug. 3
Aug. 12. School, Durham, N. H. ....Aug. 3
Aug. 13. Boilers for htg. plant at pub. bldg., Minnehaha, Minn. ....Jul. 20
Aug. 13. School, Montclair Hts., N. J..........Aug. 3
Aug. 14. Hospital, Canfield, O. ....Jul. 27
Aug. 14. Add. to pub. bldgs., Youngstown, O...Jul. 27

Aug. 14. School, Mt. Healthy, O..........Aug. 3
Aug. 14. Pub. bldg., National Home, Wis..........Aug. 3
Aug. 14. Pub. bldg., Ionia, Mich..........Aug. 3
Aug. 15. School, Albany, N. Y..........Jul. 20
Aug. 15. Light-house dwell., Stonington, Conn...Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 15. Add. to pub. bldg., Philadelphia, Pa....Aug. 3
Aug. 15. Courthouse, Bakersville, N. C..........Aug. 3
Aug. 15. Pub. bldg., Milwaukee, Wis. ....Aug. 3
Aug. 15. Post bldg. alter., Ft. Myer, Va..........Aug. 3
Adv. Aug. 3.
Aug. 15. Sanatorium, Howell, Mich..........Aug. 3
Aug. 16. School, White Castle, La. ....Aug. 3
Aug. 16. Indus. plant, Chicago, Ill..........Aug. 3
Aug. 16. Htg. school, Ashland, O. ....Aug. 3
Aug. 17. Htg. School, Wheelersburg, O. ....Aug. 3
Aug. 17. School, Minot, N. D. ....Aug. 3
Aug. 19. Post office, Alexandria, Minn..........Jul. 13
Aug. 20. Post office, Decatur, Ill..........Jul. 13
Aug. 20. Add. to hospital, Athens, O..........Jul. 27
Aug. 20. School, Spearfish, S. D..........Jul. 27
Aug. 20. Courthouse, Lumberton, N. C..........Aug. 3
Aug. 20. School, Montevallo, Ala. ....Aug. 3
Aug. 22. Post office bldg., Jackson, Miss.......Jul. 20
Aug. 22. School, Marquette, Mich. ....Aug. 3
Aug. 23. Pub. bldg., Delaware, O. ....Aug. 3
Aug. 24. Add. to courthouse, Bismarck, N. D...Aug. 3
Aug. 27. Post office, Trenton, N. J..........Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 31. School, Storrs, Conn. ....Aug. 3
Aug. 31. Jail, Williamsport, Ind. ....Aug. 3
Aug. —. Hospital, Saskatoon, Sask..........May 4
Sep. 1. Bus bldg., Walla Walla, Wash.......Apr. 20
Sep. 1. Y. M. C. A. bldg., Tacoma, Wash......Aug. 3
Sep. 3. Post office bldg., Waterton, N. Y.......Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 3. Pub. bldg., Bloomfield, Ind..........Aug. 3
Sep. 4. Post office bldg., Quincy, Mass.......Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 5. Pub. bldg., Evansville, Ind..........Aug. 3
Sep. 11. Jail, Eureka, Cal. ....Aug. 3
Sep. 16. Hospital, Pittsburg, Pa. Adv. Aug. 3..Aug. 3
Sep. 30. Bus. bldg. plans, Harrisburg, Pa....Aug. 3
Sep. —. Hotel, New Orleans, La. ....Jun. 29
Dec. —. Industrial plants, Ft. William, Ont...May 11
—— Bus. Bldg., Charles Town, W. Va....Jun. 15
Adv. Jun. 15, 22.
—— Court house plans, Pulaski, Tenn ....Jul. 27
—— Bus bldg., Markham, Tex..........Aug. 3
—— Indus. plant., Cohalt, Ont. ....Aug. 3

MISCELLANEOUS.

Aug. 6. Drain, Pocohontas, Ia. ....Jul. 13
Aug. 6. Pier, New York, N. Y..........Jul. 27
Aug. 6. Culvert, Cleveland, O. ....Aug. 3
Aug. 7. Dredging, San Juan, P. R..........Jun. 29
Adv. Jun. 29 to Jul. 13 and Aug. 3.
Aug. 7. Ditch, Emmetsburg, Ia. ....Jul. 6
Aug. 7. Crib, bulkhead, Brooklyn, N. Y......Jul. 27
Aug. 7. Canal work, Peterboro, Ont. ....Jul. 27
Aug. 8. Telegraph sta., etc., Ft. Omaha, Neb...Jul. 27
Aug. 9. Subway, Richmond, Ind..........Jul. 27
Aug. 9. Testing mach., etc., Panama..........Aug. 3
Aug. 9. Ditch, Fergus Falls, Minn..........Aug. 3
Aug. 9. Riprap, Hadley, Mass..........Aug. 3
Aug. 10. Elevator, Portsmouth, N. H..........Jul. 20
Aug. 10. Filling, Portsmouth, N. H..........Jul. 27
Aug. 10. Bulkhead, Santa Barbara, Cal..........Aug. 3
Aug. 12. Dredging, Norwalk, Conn..........Jul. 13
Adv. Jul. 13 to Aug. 3.
Aug. 12. Dredging, Philadelphia, Pa..........Jul. 20
Adv. Jul. 20, 27.
Aug. 12. Dredging, Washington, D. C..........Jul. 20
Adv. Jul. 20 to Aug. 3.
Aug. 12. Lock, etc., Brownsville, Pa..........Jul. 20
Adv. Jul. 20 to Aug. 3.
Aug. 12. Steel barges, Panama ....Aug. 3
Aug. 12. Tunnel, New York, N. Y..........Aug. 3
Aug. 12. Vacuum system, New York, N. Y......Aug. 3
Aug. 12. Garb. disp., Jersey City, N. J........Aug. 3
Aug. 12. Elevator, New York, N. Y..........Aug. 3
Aug. 13. Pier sheds, New York, N. Y..........Aug. 3
Aug. 14. Iron and steel, etc., Wheeling, W. Va..Jul. 20
Aug. 14. Breakwater, Key West, Fla. ....Jul. 27
Adv. Jul. 20 to Aug. 3.
Aug. 14. Elevators, Washington, D. C..........Aug. 3
Aug. 15. Dredging, Sheboygan, Mich. ....Jul. 20
Adv. Jul. 20 to Aug. 3.
Aug. 15. El. ry. wk., Boston, Mass..........Aug. 3
Aug. 15. R. R. work, Pullman, W. Va..........Aug. 3
Aug. 16. Dredging, Tampa, Fla..........Jul. 20
Adv. Jul. 20 to Aug. 3.
Aug. 16. Jetty work, Galveston, Tex. ....Jul. 27
Aug. 17. Breakwater work, Oswego, N. Y......Jul. 20
Adv. Jul. 20 to Aug. 3.
Aug. 19. Dredging, New London, Conn..........Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 19. Culvert, St. Paul, Minn. ....Aug. 3
Aug. 20. Wharf, etc., San Diego, Cal..........Jun. 22
Adv. Jun. 22, 29.
Aug. 20. Dredging, McClellansville, S. C........Aug 3
Adv. Aug. 3.
Aug. 20. Fence at post, Ft. Ontario, N. Y......Aug. 3
Adv. Aug. 3.
Aug. 20. Dredging, Boston, Mass. ....Aug. 3
Aug. 22. Dredging, Brunswick, Ga..........Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 23. Dredging, Savannah, Ga..........Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 24. Wall, Bremerton, Wash. ....Jul. 27
Aug. 26. Embankment, Governor's Island, N. Y. H. Adv. Jul. 27, Aug. 3..........Jul. 27
Aug. 26. Jetty wk., Jacksonville, Fla..........Aug. 3
Adv. Aug. 3.
Aug. 27. Track wk., Cincinnati, O. ....Aug. 3
Aug. 28. Dredging Block Island, R. I..........Aug. 3
Adv. Aug. 3.
Aug. 30. Dredge, Philadelphia, Pa. Adv. Aug. 3.Aug. 3
Aug. 30. Rock excav., Portland, Me..........Aug. 3
Adv. Aug. 3.
Aug. 31. Jetty wk., Galveston, Tex. Adv. Aug. 3.Aug. 3
Sep. 1. R. R. wk., Webb City, Mo..........Aug. 3
Sep. 2. Wharf plans, Gothenburg, Sweden....Apr. 13
Adv. Apr. 27 to May 18
Sep. 9. Dredging, Honolulu, H. I. Adv. Aug. 3.Aug. 3
Sep. 10. Ditch work, Sibley, Ia..........Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 30. Searchlight outfit, Washington Barracks, D. C. ....Aug. 3
—— Excav. and concrete wk., Ithaca, N. Y.Aug. 3
Adv. Aug. 3.

CURRENT NEWS SUPPLEMENT

AUGUST 10, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

THE BOSTON DRY-DOCK CASE.

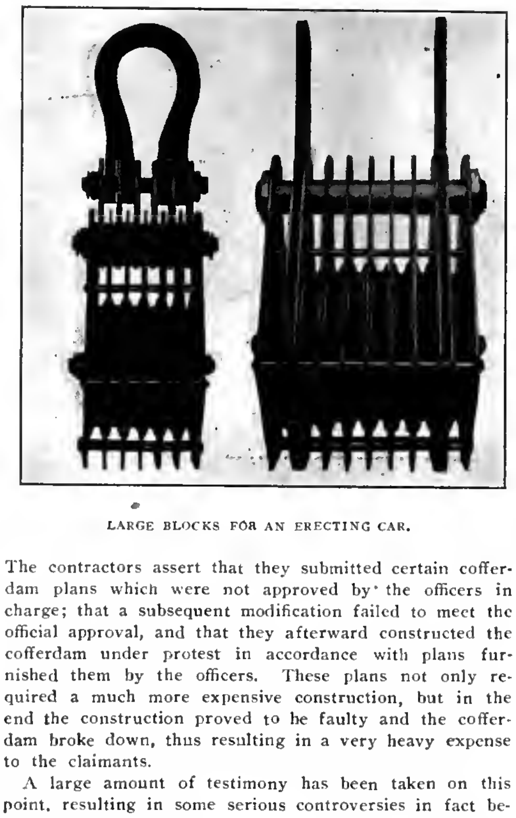
The taking of testimony has now been concluded in the claim against the United States arising out of the construction of the Boston Dry Dock, which has been before the Court of Claims since February, 1905, and the briefs of counsel will soon be prepared. The case is one of very general interest to the engineering profession. O'Brien & Sheehan were the original contractors for this dock, the contract bearing date of March 14, 1899. They continued work for over three years under it, when their financial difficulties required the work to be taken up under a supplementary contract by the City Trust, Safe Deposit & Surety Co., of Philadelphia. They continued the work at a very large loss until the year 1905, when the company went into the hands of a receiver. The work was completed by J. Hampton Moore as receiver, who now appears as claimant in the Court of Claims.

The total amount claimed is $592,522.95. The largest single item is over a quarter of a million dollars, arising out of the delay in the inspection of the stone entering into the work. The two other chief items arise out of a change of plan claimed to have been made after the work was in progress, and out of the plan used in the construction of the cofferdam.

A large amount of evidence has been taken to show that the inspection of the stone was unnecessarily delayed. If that question of fact can be settled in favor of the contractors, the question of law will have to be determined as to the measure of damages for the delay. It appears that during the period of delay an enormous rise occurred in the price of stone. The claimants take the position that the rule for fixing the damages permits the rise in prices to be considered as a natural consequence of delay. In support of this, a number of past decisions of the Court of Claims are cited.

The claim upon the substitution of plans asserts that a plan known as plan D, was the approved plan upon which they contracted to build. This was a modification of two previous plans of different dimensions and it conformed to the dimensions of the lesser plan, the claimant asserts. The contractors worked on this theory for two years, when they were officially informed that the dimensions in plan D were erroneous and should have conformed to the dimensions of the larger plan originally submitted. This increased the amount of excavation and the quantity of concrete, resulting in an increase of cost of about $50,000. The contractors maintain that the correctness of their original position was clearly shown by contemporary construction during the two years when they were building according to the lesser dimensions. They rely upon the doctrine declared by the Supreme Court of the United States that the immediate practical construction of a contract by two parties settles the true meaning of uncertain provisions.

The third claim, based upon the construction of the cofferdam, presents very complicated questions of fact.



LARGE BLOCKS FOR AN ERECTING CAR.

The contractors assert that they submitted certain cofferdam plans which were not approved by the officers in charge; that a subsequent modification failed to meet the official approval, and that they afterward constructed the cofferdam under protest in accordance with plans furnished them by the officers. These plans not only required a much more expensive construction, but in the end the construction proved to be faulty and the cofferdam broke down, thus resulting in a very heavy expense to the claimants.

A large amount of testimony has been taken on this point, resulting in some serious controversies in fact between the witnesses.

It is hoped that the case may be brought to a hearing in the Court of Claims during the coming term. The receiver is represented by Messrs. George A. & William B. King, of Washington, D. C., and the interests of the United States are looked after by Mr. P. M. Ashford, one of the assistants to the Attorney-General in the Department of Justice.

LARGE BLOCKS FOR AN ERECTING CAR.

The Lucius Engineering & Contracting Co. is now building two 60-ton derrick cars for use in the construction of the Harlem River branch of the New York, New Haven & Hartford R. R. Each car will have three six-sheave blocks and one eight-sheave block. The latter is used at the top of the mast of the car, and its six inside sheaves will be used as a six-sheave block, one outside sheave will take the lead line from the top lift, and the other outside sheave the lead line from the falls. By using an eight-sheave block in this way it is possible to do away with the two lead-line sheaves generally placed at the top of the mast.

The eight-sheave block is 5½ ft. high and weighs 2,650 lb. It has a 5-in. head bolt and sheaves 24 in. in diameter, with phosphor-bronze bushed grooves for a ⅞-in. cable. The block is attached to the mast by a 5-in. pin, which goes in holes drilled in two 10x1-in. straps.

The six-sheave blocks are 6 ft. 10 in. high and weigh 2,160 lb. The shackle is 4 in. in diameter and the shackle bolt, head-bolt and sheave pin are 3 in. in diameter. The hanger straps are ⅞x8 in. The sheaves are 24 in. in diameter and have phosphor-bronze bushings for a ⅞-in. cable. The plates are ⅜ in. thick, and there are two 1½x7-in. straps. These blocks have been made by the W. W. Patterson Co., of Pittsburg, Pa.

TRADE PUBLICATIONS.

The Buffalo Forge Co., of Buffalo, N. Y., has recently issued a folder concerning improved types of planing mill exhausters, dust separators and volume blowers and exhausters. The leaflet gives dimensions and a price list of the apparatus in the various sizes.

The Kinnear Mfg. Co., Columbus, Ohio, has recently issued two attractive booklets, one on car barn doors and the other on wood rolling doors for round houses. The company has had extensive experience in the installation of rolling doors for electric railway car barns and has perfected an arrangement for automatically closing the gap in the trolley wire when the door is raised, and also for the rapid operation of the doors by electric motors. In steam railroad round houses, where sulphurous fumes in the smoke from the locomotives is liable to prove destructive to steel work, there has arisen a demand for rolling doors of wooden construction; this has recently been met by this company by a new design of wooden rolling door that is non-corrosive, water and weather proof and easy to operate.

The Jeffrey Mfg. Co., Columbus, Ohio, has issued an illustrated supplement to its general catalogue of Jeffrey conveying machinery for saw mills, lumber mills and wood working industries. In it are illustrated many installations of Jeffrey log hauls, log conveyors, chain refuse conveyors, sawdust conveyors and other apparatus for rapidly handling materials and refuse in saw mills and wood working plants.

Alberger cooling towers are described in a new catalog of the Alberger Condenser Co., New York. It contains a detailed explanation of the purpose of the cooling tower for use with condensing steam engines and turbines and also for refrigerating plants. The tower is described in both the natural and artificial draft forms and favorable arrangements of apparatus are suggested for power plant installations.

The Emerson Steam Pump Co., Alexandria, Va., have recently issued a 20-page booklet of testimonials from parties who have used its pumping apparatus.

The Robins Conveying Belt Co., New York, has just issued a leaflet describing the installation of a package conveyor system in the new store of B. Altman & Co., Fifth Ave., New York. It illustrates the general layout of the belt and the central discharging point where the packages are received. There are three conveyors 30 in. in width, 71, 91 and 191 ft. in length, respectively, and there is one large flat belt, 36 in. wide and 75 ft. long, guarded by skirt boards designed for carrying unwrapped packages. The belts are driven by electric motors through worm reduction gears.

Booklet 20A, recently issued by the Ingersoll-Rand Co., New York City, describes the new Temple-Ingersoll electric air drill. This drill solves the problem of employing electric current in driving rock drills. The drill is air-operated, with special advantages of its own, especially in increased force of the blow struck and saving of power.

The Strang Gas-Electric Car Co., New York, has issued a pamphlet describing a system of motor-car propulsion having a six-cylinder gasoline engine which drives a generator, with storage battery auxiliary, furnishing current to electric railway motors driving the car in the usual way. An account is given of trials made of cars already built, together with results in operation on a number of lines. Several motor cars of this system are under construction for the Chicago & Alton and other lines.

The details of the standard heavy-duty Twin City Corliss engine are fully illustrated and described in Catalogue 101, issued by the Minneapolis Steel & Machinery Co., Minneapolis, Minn. The engine is illustrated in all details from bed frame to valve gear, the latter

being shown in two forms, one for ordinary speeds and the other for high speeds. Typical installations of the engine for use in a number of different classes of service, are also illustrated.

The Falk Co., Milwaukee, Wis., has issued a 92-page, 8x10-in. pamphlet descriptive of its products. A large section is devoted to the steel department, a specialty being made of open-hearth steel castings. This department is outlined in detail from pattern shop to foundry floor and a large number of particularly difficult castings are illustrated. A department is maintained for gears and pinions, another for special track work for street railways, while a third is devoted to the Falls cast-welded rail joint for street railways, all of which are fully described.

The Universal Form Co., 122 Centre St., New York, has issued a catalogue describing a form of wood framing covered on one side with sheet steel, and made in various sizes, that adopted as the standard unit being 3 ft. square. Auxiliary units and corners enable the forms to be used for columns, floorbeams and slabs, belt courses and similar combinations of inside and outside corners. The units are fastened together by dowels in the metal corners, and by a dished washer which fits over the corners.

Different styles of interlocking steel sheeting are described in a bulletin issued by the National Interlocking Steel Sheeting Co., Chicago. Eleven styles adapted to various classes of work are illustrated, and accompanied with data regarding their sires and weights.

The Trussed Concrete Steel Co., of Detroit, Mich., has issued a large sheet containing illustrations of its new type of expanded metal for reinforcing concrete. This sheet contains also tables giving the strength of the expanded metal of different numbers, and the strength of slabs of various spans and thicknesses reinforced with it.

A handbook relating to the design, selection and use of steam and power-driven air compressors of many types, from small plants for a few drills, to large machines where the maximum economy is desired, has recently been issued by the Sullivan Machinery Co., Chicago. The machines themselves are described in detail and elaborate tables of their dimensions and capacities are given. The book also contains a large amount of useful information concerning the selection of auxiliary apparatus, and numerous tables of value to designers of compressed air plants.

The Universal system of machine moulding of Ph. Bonvillain and E. Ronceray, 9 Rue des Envierges, Paris, is described in detail in a catalogue in English recently issued. This system is a departure from the usual machine moulding with pattern plates. Both cylindrical and complicated cores can be molded in this machine, and the pamphlet shows work done for complicate automobile engine cylinders and crank cases, stove parts and sanitary castings.

Recent bulletins from the General Electric Co. describe the new line of Form P belt-driven alternators that have recently been placed on the market; new designs of switchboard panels for series arc or incandescent lighting from constant-current transformers; the Edison "Gem" high-efficiency incandescent units with bowl holophane reflectors and the new security "snap" sockets for incandescent lamps. The Form P alternators are compact machines built in sizes from 30 to 200 kw. at 2,300 volts in single, two or three-phase, and specially adapted for factory lighting and small plants. The new socket is an improvement over the former style in that the shell is attached to the base by spring catches that snap into place instead of the usual screws. A valuable wiring table has also been issued giving an approximate rule for sizes of wires for three-phase transmission lines for voltages from 2,000 to 30,000.

The Joyce-Cridland Co., Dayton, O., has issued an eight-page folder describing several types of lifting jacks for stone yards and quarries.

Direct current motors and generators manufactured by the Barriett Electric Mfg. Co., Cincinnati, O., are illustrated in a recent pamphlet. The machines are of the protected and the semi and fully enclosed types.

The Buckeye Traction Ditcher Co., Findlay, O., has issued two pamphlets illustrating trench excavating machines for heavy and light work, respectively. The lighter machines are adapted for digging tile drain trenches, and the pamphlet devoted to them discusses farm drainage.

The care of electric mine locomotives in service is explained in a bulletin recently issued by The Jeffrey Manufacturing Co., Columbus, O. It is an eighty-page, well-illustrated book, and contains much valuable information concerning the operation and repair of such locomotives.

Crushing and road machinery manufactured by the Climax Road Machine Co., Marathon, N. Y., is described in a pamphlet recently issued by that company. Portable machinery of practically every kind necessary for stone crushing and road making is illustrated. The company also builds highway bridges.

The Carbolineum Wood Preserving Co., New York City, has issued a pamphlet describing "carbolineum," a preservative which is applied to the surface of wood with a paint brush. Letters are given from those who have used the preparation.

The construction of concrete sewers with collapsible steel centering is described in a 67-page book recently issued by the Blaw Collapsible Steel Centering Co., Pittsburg, Pa. There are excellent illustrations showing steel forms for sewers of various shapes. Two chapters discuss the design of concrete sewers and the use of concrete in sewer construction, and a set of specifications for concrete sewers is given.

M. de Frise's system of water sterilization by the use of ozone is described and compared with purification by filtration, in a pamphlet recently issued by M. de Frise, 38 Rue du Louvre, Paris, France. Briefly, the process consists in passing ozonized air bubbles through the water, the ozone being generated electrically. A large experimental plant is in operation at the municipal water-works of Paris at Saint-Maur and records of analyses of the effluent from it are given.

Hydraulic machinery for the manufacture of concrete stone is illustrated in Catalogue E, recently issued by the Fisher Hydraulic Stone & Machinery Co., Baltimore, Md. Methods of building and structures built of hydraulic pressed concrete stone are also illustrated.

The Portland Cement Co., Denver, Colo., has issued a booklet describing the manufacture and properties of Ideal Colorado Portland cement and giving instructions for its use for a variety of purposes. Structures in which Ideal Colorado cement was used are illustrated.

Sanitary metal factory equipment and specialties are described in a pamphlet recently issued by the Manufacturing Equipment & Engineering Co., Boston, Mass., which manufactures individual wash-bowls, arranged in single or double batteries of any number, all-metal lockers, soda and potash kettles, shop and factory stools, work benches for all requirements, bench drawers with rolling bearing slides, storage racks, transporting racks and emergency hospital equipment. The sanitary wash-bowls have separate supply and waste, and the lockers are of a circular type, with doors of small dimensions which furnish ample access to the interior and still do not obstruct the corridors.

Bulletin 143 of the B. F. Sturtevant Co. describes electrical generating sets with simple horizontal engines. Details of both the generator and engine construction are shown, together with principal dimensions of the direct-connected units for a great many capacities from 6 to 75 kw.

The Canton-Hughes Pump Co., Canton, Ohio, has issued a pamphlet descriptive of the line of pumping machinery which it manufactures. The details of the steam cylinders and valves are shown and illustrations of pumps in all sizes and for all services are illustrated, from small duplex pumps for oil to high-duty pumping engines for water-works service. A specialty is made of high-pressure pumps, pumps for handling tar and heavy liquids and also condensing apparatus.

The C. W. Hunt Co., New York, has published an introduction to the general line of machinery manufactured by this company for the handling of coal. The apparatus referred to includes steeple towers, parabolic boom towers, overhead bridges, elevators and conveyors and the machinery and tackle necessary for their operation.

A new rock drill catalog has just been issued by the Chicago Pneumatic Tool Co., Chicago, Ill., devoted to the Chicago Giant rock drills and kindred appliances. Special attention is called to the method of lubrication, which is a distinguishing feature of this drill. Several pages are devoted to rock drill steels, and also to the Franklin air compressors.

The Standard Concrete-Steel Co. has issued a series of 8x13-in. bond paper prints illustrating the details of the Guy B. Waite systems of fireproof floor arches. These systems have been approved by the Bureau of Buildings of New York City, and the paper prints are supplied to users of the systems to be filed with the Bureau in accordance with its requirements.

Fire brick, of various grades, shapes and sizes, are described in a pamphlet recently issued by the Garden City Sand Co., Chicago, Ill. There are suggestions on furnace construction and fire brick requirements.

Steel standpipes, water towers, storage tanks and smoke-stacks, built by Messrs. Tippett & Wood, Philipsburg, N. J., are illustrated in a 32-page pamphlet recently issued. Tables showing the capacity of various tanks per foot of depth, the pressure of water for different depths and the properties of fire streams, are given.

Catalog 268, recently issued by the Studebaker Bros. Mfg. Co., South Bend, Ind., describes dump wagons and carts, street sweeping machines, sprinkling wagons and hand carts made by that company. Several pages are devoted to a description and illustration of a new contractor's bottom dumping wagon which has just been put on the market.

The Portland Cement Company of Utah, Ltd., Salt Lake City, has issued a handsome 114-page book illustrating a great variety of structures in which its Red Diamond brand of cement has been used and giving a brief account of the development of the Portland cement industry.

Bulletin W-29, issued by the Ferro-Concrete Construction Co., Cincinnati, O., contains illustrations of buildings erected by that company and points out the special features of each structure.

Record 61, recently issued by the Baldwin Locomotive Works, has for its subject "The Steam Locomotives of the Future," an article by Lawford H. Fry. It is a discussion of the present state of steam locomotive development, with a forecast of possible tendencies of development in the future. The effects of the enormous growth of railway traffic upon locomotive development are outlined and the advantages derived from various improvements in locomotive construction referred to. Among the illustrations are views of the large Mallet articulated compounds recently built in this country.

Abrasive machinery for use in the marble industry is explained in a well-prepared 50-page catalog recently issued by the Royden Marble Machinery Co., New York City. The advantages of the carborundum process of handling the marble from the gang saws is discussed and the various machines used in this connection described. These include the drum rubber, the turning head coper, the gang coper, the cut-off coper and other special machinery, including moulders and marble lathes. This company also makes a specialty of mosaic machines for the method of laying from spools, and floor polishing machinery. The catalog concludes with an article on abrasives with special reference to their use in connection with the finishing of marble, slate and soft stones.

A method of securing nailing strips to concrete floors, devised by Mr. W. B. Ruddick, 400 East 165th St., New York City, and used in the Singer Sewing Machine Building, Elizabethport, N. J., is described in a folder recently issued by him. Wire clips are inserted in the fresh concrete by a special device with which several clips can be placed at once. The portion of the wire projecting above the floor surface is bent over near its end at such a height that the bent end can be driven into the side of the nailing strip. The clips are placed on both sides of each strip.

Reinforced concrete mills and factories built according to the Kahn system are described in a handsome 32-page pamphlet recently issued by the Trussed Concrete Steel Co., Detroit, Mich. Another pamphlet issued by the same company discusses reinforced concrete in general and presents the principles and advantages of the Kahn trussed bar.

BUSINESS NOTES.

The H. W. Johns-Manville Co., 100 William St., New York, has completed arrangements for the exclusive sale of the "Magic" boiler compound. This has been on the market for some time but is comparatively unknown, as it has never been pushed. A folder describing its purpose and method of use has just been issued by the company.

The steel buildings for the machine shop and foundry of the Bartlesville Foundry & Machine Works, Bartlesville, I. T., will be built by the Southwestern Bridge Co., Joplin, Mo. The latter company has also been awarded a contract for a 50,000-gal. tank and tower for Sayre, Okla.

The Atlantic Coast Line Ry. Co. has installed at the South Rocky Mount plant a 5-ton, 72-ft. span, 3-motor electric traveling crane built by the Northern Engineering Works, Detroit.

The Parker Boiler Co., Philadelphia, has received the following orders: Austin Manufacturing Co., Harvey, Ill., one 365-h.p. boiler; Southern Indiana Hospital for the Insane, Evansville, Ind., three 300-h.p. boilers; Perth Amboy Chemical Co., Perth Amboy, N. J., one 267-h.p. boiler.

Among recent sales of electric generating sets the B. F. Sturtevant Co., Boston, Mass., report the following: Electric Construction Co., Richmond, Va.; McCann Ice Plant, Philadelphia, Pa.; Bethlehem Brewing Co.; New Bethlehem, Pa.; Smith & Hammond Lumber Steamers; Eberhard Faber Pencil Co., Brooklyn, N. Y.; Metric Metal Works, Erie, Pa.; Hanover National Bank Bldg., New York City; Sedalia Ice, Lt. & Fuel Co., Sedalia, Mo.; H. J. Kunzig, Philadelphia, Pa., and Board of Water Supply, New York City.

The New York State Steel Co., Buffalo, N. Y., has placed a second order for a 4,000-h.-p. We-Fu-Go water softening and purifying system with the Wm. B. Scaife & Sons Co. Other sales of Scaife and We-Fu-Go systems are reported as follows: The Andrews Steel Co., Newport, Ky., 3,750 h.-p.; National Home for Disaled Volunteer Soldiers, Dayton, O., one 300,000 gal. per 24-hour system, two 1,200 gal. per hour system; American Sheet & Tin Plate Co., Pittsburgh, Pa., 5,000 h.-p.; Rochester & Pittsburgh Coal & Iron Co., DeLancey, Pa., 1,500 h.-p. (2nd contract); Youngstown Sheet & Tube Co., Youngstown, O., 15,000 h.-p.; Pennsylvania Salt Mfg. Co., Natrona, Pa., 5,000 h.-p. (2nd contract); Norwalk Iron & Steel Co., Norwalk, O., 1,000 h.-p.; McConway & Torley Co., Pittsburgh, Pa., 1,000 h.-p.

The Power Specialty Co., New York, manufacturers of Foster superheaters, have made arrangements for the exclusive selling rights in the United States, Canada and Mexico of Duval metal packing. A complete stock of the packing in standard sizes will be kept on hand in order to fill orders promptly.

The Sandusky Portland Cement Co., Sandusky, O., has been compelled to quadruple its capacity for making its Medusa waterproof compound for concrete. It has been employed lately on the important buildings of the Metallic Casket Co., Springfield, O.; the Brandenstein buildings, San Francisco; the Mechanics and West Bank, San Francisco; the Delger Bldg., San Francisco; the Proctor & Gamble soap works, New York; the Packard garage, New York; Pugh printing building, Cincinnati, and Bostwick-Braun warehouse, Toledo.

The forty-fifth annual picnic of the Lunkenheimer Co., Cincinnati, one of the important events in the social side of the industrial affairs of the city, was held on July 27. Three special trains of 15 cars each took the people to a park about 25 miles from the city, where the company provided a vaudeville entertainment, a large band, an orchestra and prizes for various events. The employees and their families during these picnics are the guests of the company from the time they leave the city until they return, and are under no expense whatever.

The Foundation Co,. New York, has been awarded a contract for sinking a 21x17-ft. mine shaft through about 70 ft. of water-bearing material on the Swarzy Range, near Isheming, Mich. The company will also put in the foundations for the new Lawyer's Title Insurance & Trust Co. building at 160-164 Broadway, New York.

The Northern Engineering Works, Detroit, has recently supplied electric cranes to the Toledo Gas & Electric Co.; Murphy Power Plant, Detroit; and the Georgia Marble Finishing Works, Canton, Ga.

IMPORTANT HEARING ON REINFORCED CONCRETE.

Attention is particularly called to a public hearing that will be held at 3 p. m., Aug. 14, in the Aldermanic Chamber of the New York City Hall by the Reinforced Concrete Committee of the Municipal Building Code Revision Commission. Engineers and contractors interested in reinforced concrete construction will be given an opportunity to present their views concerning regulations relating to the subject, and the Committee will be pleased to receive these in the form of briefs, in triplicate. The present regulations of the Borough of Manhattan will be used as a basis of discussion.

It is needless to point out that this hearing is of the highest importance to those interested as designers of reinforced concrete works or contractors for their execution. The Committee, of which Mr. Rudolph P. Miller is chairman, may reasonably be expected to present a report which will set forth the best conservative practice, and it deserves to have the hearty assistance of all who are interested in preventing poor design and careless construction. A recent decision of the New York courts makes the mere fact of collapse of forms used in reinforced concrete buildings a prima facie proof of negligence on the part of the contractor, rendering him liable for all resulting injuries, but even this drastic judicial ruling will not be so useful as clear building regulations which permit all good design and construction while barring out everything that is unsafe. The formulation of such regulations is a difficult task, however, and the Committee accordingly deserves all the support engineers and contractors can give it.

A NEW TRACTION STEAM SHOVEL.

The accompanying illustration gives a fair idea of a traction steam shovel made by the Avery Mfg. Co., Peoria, Ill. It has been developed from its new under-mounted engine, which is a result of studies made to strengthen such engines in order to furnish the maximum resistance to the heavy strains arising in construction work. The main purpose of traction engines until recently has been to run threshing machinery, a service which did not develop the same kind of stresses that arise in heavy hauling. Accordingly the boiler, which is an important element in the frame of the older type of traction engine, began to show signs of inability to resist the hard service incident to hauling constantly, and for the latter service the company has developed a machine in which the cylinders are mounted on an independent steel frame and the boiler is entirely relieved of other strains than those due to raising steam. In addition to this fundamental change, the company introduced a number in some of the details, such as a screw shaft guide which eliminates the slackness of the chain guide, or, if desired a steam guide.

The steam shovel with which this engine can be equipped is rated at 1 to 5 cu. yd. of dirt per minute, according to the character of the material, and it can also be used for loading ore, sand and gravel into wagons and cars. By removing the shovel, the lifting crane can be used for unloading heavy material from flat cars or loading them, and for picking up and transporting heavy articles.

The tender used with the engine is heavily built and carried by an 18-in. faced wheel. It is attached to the engine and guided in such a way that it is always directly in line, whether moving forward or backing up. It has a water capacity of about one ton.

A NEW TRACTION STEAM SHOVEL.

PERSONAL NOTES.

Mr. V. D. Cockey has been appointed an assistant engineer in the service of the Baltimore Sewerage Commission.

Mr. Heiskell Weatherford has been elected city engineer of Memphis, Tenn., succeeding Mr. James A. Amberg, resigned.

Mr. G. P. De Wolf has been appointed assistant chief engineer of the Mexican International Ry., with offices at Ciudad Porfirio Diaz, Coahuila, Mexico.

Mr. E. B. Carter, for a number of years general roadmaster of the Florida East Coast Ry, has resigned to become connected with the U. J. White Co., of Dupont, Fla.

Mr. A. R. Hirst, until recently assistant engineer in the Highway Division of the Maryland Geological Survey, has been appointed State Highway Engineer of Wisconsin.

Mr. W. D. Wheeler has been promoted to fill the position of chief engineer of the Minneapolis & St. Louis R. R., left vacant by the resignation a few weeks ago of Mr. H. G. Kelley.

Mr. O. Rickert, division engineer of the Baltimore & Ohio R. R. at Grafton, W. Va., has resigned to become engineer of maintenance of way on the Missouri Pacific Ry. System.

Mr. Arthur K. Cox, of Iowa City, Ia., has established an annual prize of $100 for the best graduation thesis in the College of Engineering of Iowa University, from which he was graduated.

The Engineers' Club of Central Pennsylvania made an excursion, Aug. 3, to Minqua, Pa., to inspect the hydro-electric power development of the McCall's Ferry Power Co., on the Susquehanna River.

Lieut.-Col. John Millis, Corps of Engineers, U. S. A., in charge of all fortification construction in the Philippine Islands, has been granted three months' leave of absence. He will return to the United States by way of the Suez Canal.

Mr. E. J. Molera, consulting civil and electrical engineering and architect and president of the Academy of Sciences, San Francisco, has been appointed a member of the Board of Supervisors of San Francisco by the newly elected Mayor, Dr. Edward R. Taylor.

Mr. W. J. Bergen, assistant engineer of The New York, Chicago & St. Louis R. R., at Cleveland, O., has been appointed assistant to the chief engineer, Mr. E. E. Hart. Mr. C. B. Hoyt will succeed Mr. Bergen as superintendent of track maintenance and construction.

John T. Brady, president of the well-known building contracting firm of John T. Brady & Co., New York City, died of paralysis in that city Aug. 5, aged 55 years. Since he was first struck by paralysis, seven years ago, he had not been actively engaged in business.

Mr. Frederic C. Dunlap, chief of the Bureau of Filtration of Philadelphia, has been made chief of the Bureau of Water of that city, succeeding Mr. Frank L. Hand, who resigned some time ago, and the Bureau of Filtration has been abolished, its work being taken up by the Bureau of Water.

Mr. J. F. Hasskarl, principal assistant to Maj. James C. Sanford, Corps of Engineers, U. S. A., in charge of improvements on the Delaware River, has been appointed assistant director of the Department of Wharves, Docks and Ferries of Philadelphia, under Mr. John C. Grady, whose appointment as director of that department was mentioned recently in these columns.

The Connecticut Society of Civil Engineers will make a trip of inspection of engineering work in the Naugatuck Valley, Aug. 14. Among the works viewed will be an electric railway involving very heavy work, the sewage filtration plant and sewage experiment station of Waterbury, and railroad grade abolition and station construction in the same city. Messrs. D. S. Brinsmade and J. F. Jackson, New Haven, are president and secretary, respectively.

Mr. Tinius Olson, of Tinius Olson & Co., testing machine makers, Philadelphia, Pa., recently was made a Knight of the Order of St. Olavs by King Haakon, of Norway. The order, of which the king is head, is composed of natives of Norway who have won fame in letters, law, theology, science and invention. The decoration was conferred on Mr. Olson for his studies of metals and his inventions of machines for their investigation.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Fruita, Colo.—The citizens are reported to have voted to issue $25,000 bonds for the construction of a reservoir, and the installation of a mountain water system.

Sterling, Colo.—The directors of the North Sterling Irrigation Dist. are reported to have voted to issue bonds to the amount of $1,400,000 for the construction of the Glendale and Point of Rock reservoirs, with inlet and outlet ditches. The district comprises about 70,000 acres of land.

**Molina, Colo.*—I. A. Kirkendall, Secy. Cottonwood Lakes Reservoir Co., writes that the contract for constructing cement concrete box at headgate No. 1 Lake (bids opened July 25), has been awarded to Miller & Sieg, of Molina, for $1,975.

New Haven, Conn.—The New Haven Water Co. is reported to have decided to build on Mill Rock, Hamden, a stand-pipe or water tower of about 400,000 gal. capacity, to supply the Prospect Hill Dist. of the 9th Ward.

Bradentown, Fla.—It is stated that bids will be received until Aug. 14, by the Bd. Bond Trus., (A. J. Beck, Secy.) for boring a well and laying pipe. Wm. W. Lyon, Engr., Palatka.

Ft. Dade, Fla.—Bids will be received by Lieut. J. A. Thomas, Constr. Qm., U. S. A., until Aug. 30, for constructing a 150,000 gal. steel tank and trestle and ice plant at this post, as advertised in The Engineering Record.

Atlanta, Ga.—R. M. Clayton, City Engr., is reported to have completed surveying and measuring the new reservoir at Hemphill station.

Rome, Ga.—We are informed that bids will probably be called for in about 60 days for water works improvements, to cost $50,000, and sewers to cost $25,000. Engineer, J. N. Hazlehurst, of Atlanta. C. E. McLin, Pres. Bd. Pub. Wks.

Herrin, Ill.—Paul D. Herrin, Cashier of the City National Bank, is reported to have petitioned for a franchise for water works.

Geneseo, Ill.—Alvord & Burdick, 1207 Hartford Bldg., Chicago, has prepared specifications for an addition to the pumping facilities of the City Water Works, the estimated cost of which is about $5,100, including a gasoline engine, triplex pump outfit and an addition to the pumping station. Bids for pumping machinery will be received until Aug. 19, specifications may be procured by application to J. F. Liebknecht, City Clk.

Milltown, Ind.—The Town Board is reported to have granted W. H. Rose, of Corydon, a franchise for water works.

Primghar, Ia.—M. Tschirgi & Son, of Dubuque, are preparing plans for water works to cost about $10,000. W. H. Downing, City Clk.

Louisville, Ky.—It is stated that bids will be received by the Bd. of Pub. Wks. until Aug. 20 for furnishing and erecting 29 fire hydrants. Jos. P. Claybrook, Ch. Engr.

[illegible], Ia.—The O'Neil Eng. Co., of Dallas, Tex., is reported to have completed plans for water works; [illegible] $25,000.

[illegible], Me.—W. I. Brown, Clk. Water Bd., writes [illegible] opened on Aug. 1 for the construction of a sedimentation basin for the City of Bangor. New bids will probably soon be received. The work includes head house, a covered reinforced concrete basin of a total capacity of 1,500,000 gals. in two compartments, complete, with all excavation and embankments and piping with the basin and walls. Engr., Geo. W. Fuller, 170 Bway., New York, N. Y.

Cumberland, Md.—Bids will be received by the Bd. of Water Comrs. until Aug. 26 for furnishing and installing complete a pumping engine of 5,000,000 gal. capacity, as advertised in The Engineering Record.

Westborough, Mass.—Bids will be received until Aug. 23 by the Trus. of the Westborough Insane Hospital at the office of Geo. S. Adams, M. D., Supt., for laying about 3,880 ft. 12-in. c. i. water pipe from 9 to 13 ft. deep, approximately, and other work pertaining thereto. J. J. Van Valkenburgh, Engr., South Framingham.

Fitchburg, Mass.—Walter A. Davis, City Clk., writes that no new work is contemplated in connection with $80,000 water loan recently passed by Council. The work is almost complete. Thos. C. Lovell, Supt. Water Wks. David A. Hartwell, City Engr.

Cloquet, Minn.—The citizens are reported to have voted July 30 to issue $50,000 bonds to complete the water works.

**Hastings, Minn.*—The Des Moines Bridge & Iron Co. of Des Moines, Ia., is reported to have secured contracts for constructing water works at $38,350 and a sewerage system at $31,125.

Dawson, Minn.—See "Power Plants, Gas and Electricity."

St. Paul, Minn.—We are informed that no bids were received on July 20 by Capt. Edw. H. Schulz, Corps. Engrs., U. S. A., P. O. Box 654, St. Paul, for the reconstruction of Sandy Lake Reservoir Dam.

New York, N. Y.—The following are the bids opened on Aug. 6 by the Bd. of Water Supply, N. Y. City, for the construction of the main dams for Ashokan reservoir near Brown Station in the towns of Olive and Marbletown, Ulster County: (*a*) Stewart, Kerbaugh, Shanley Co., $13,979,813; (*b*) O'Rourke Eng. Constr. Co., $14,707,750; (*c*) John Pierce Co., $10,315,350; (*d*) MacArthur Bros. Co. & Winston Co., $12,669,775; (*e*) Bradley Contr. Co., $13,931,250 (bidders all of N. Y. City).

	a	*b*	*c*	*d*	*e*
Removing steel pipes, lump sum	$34,000	$5,000	$20,000	$10,000	$10,000
Control of stream flow, Olive Bridge Dam, lump sum	15,950	25,000	15,000	10,000	30,000
Control of stream flow, Middle Dike, lump sum	14,288	10,000	7,500	10,000	20,000
95,000 cu. yds. earth excav., Class A	.45	1.50	.60	1.40	.60
50,000 cu. yds. earth excav., Class B	2.00	3.00	1.00	2.50	1.50
1,700,000 cu. yds. earth excav., Class C	.52	.75	.30	.68	1.00
210,000 cu. yds. earth excav., Class D	1.00	1.50	.35	.50	.50
140,000 cu. yds. rock, Class A	3.00	5.00	2.50	3.00	3.00
210,000 cu. yds. rock, Class B	1.00	1.75	1.50	1.60	1.75
75,000 cu. yds. rock, Class A	2.00	1.75	1.25	1.00	1.75
40,000 sq. yds. special preparation of rock surfaces	.80	.50	1.00	.50	2.00
2,500,000 cu. yds. embankment fill, Class A	.64	.60	.42	.60	.60
3,200,000 cu. yds. embkmt and fill, Class B	.64	.58	.37½	.60	.65
1,200,000 cu. yds. embkmt. and fill, Class C	.80	.95	.35	.50	.75
110,000 cu. yds. embkmt. and fill, Class D	.80	1.50	.50	.50	.55
45,000 cu. yds. embkmt. and fill, Class E	.75	.50	.50	.50	.50
210,000 cu. yds. soil for surface dressing	1.50	1.00	.40	.50	1.25
1,100,000 bbl. Portland cement	1.53	2.00	1.90	1.50	2.10
280,000 cu. yds. concrete masonry	5.60	5.50	4.25	4.90	4.00
475,000 cu. yds. Cyclopean masonry, Class A	4.10	3.30	3.00	3.40	3.00
55,000 cu. yds. Cyclopean masonry, Class B	5.05	3.10	3.00	3.90	3.50
64,000 cu. yds. concrete block	9.20	8.50	8.50	11.50	7.50
100 cu. yds. reinforced concrete	9.25	10.00	12.50	20.00	25.00
8,000 cu. yds masonry fill. of openings for control of stream flow	5.20	4.50	8.10	1.50	4.00
5,000 cu. ft. grout of Portland cement	.25	.50	.30	.50	2.00
1,000 lin. ft. drilling small holes in rock, etc	.65	1.00	.50	1.00	1.00
125,000 sq. ft. face dressing of concrete	.40	.15	.15	.10	.50
95,000 cu. yds. dry rubble paving	4.15	3.00	2.50	2.50	2.50
10,000 cu. yds. riprap	3.30	2.00	1.50	1.50	2.00
75 tons c. i. pipe and special castings	140.00	120.00	90.00	101.00	100.00
80 tons steel castings	280.00	300.00	160.00	150.00	150.00
25,000 lbs steel for reinforcing concrete	.05	.06	.06	.07	.05
590,000 lbs wrought iron, c. i., etc	.08	.15	.05	.08	.05
4,000 lbs bronze work	.70	.50	.50	.50	1.00
2,500 lin ft. furnishing and placing of small wght. i. pipe.	.80	.50	.40	.50	.50
900,000 lbs. caring for and setting metal furnished by city.	.02	.04	.02	.02	.03
200 acres clearing	130.00	50.00	100.00	140.00	75.00
11,500 lin. ft. vit. pipe, not exceeping 10-in	.80	.50	1.50	.50	1.00
10,000 lin. ft vit. pipe, not more than 18-in	1.50	1.00	3.00	1.25	1.50
11,000 cu. yds. crushed stone and gravel	1.75	2.50	2.00	1.25	2.00
950 M ft. lumber	65.00	75.00	40.00	50.00	60.00

Kansas City, Mo.—Bids will be received until Sept. 3 by the Bd. Pub. Wks., Everett Elliott, Secy., for furnishing and delivering f. o. b. cars Kansas City, the following: 50 tons 4-in., 1,110 tons 6-in., 260 tons 8-in., 370 tons 10-in., 220 tons 12-in., 700 tons 16-in., and 20 tons each of 20, 24, 30, 36 and 42-in. c. i. pipe, also 2,200 tons 48-in. c. i. pipe and 50 tons special castings for pipe 24-in. and greater in diam.; also same time and place for 1,000 lin. ft. riveted steel pipe, having a minimum internal diam. of 48-in., made of soft steel plate ½ in. thick; bids will also be received for furnishing 6,000 lin. ft. additional 48-in. steel riveted pipe.

Bradshaw, Neb.—C. B. Palmer, Jr., Village Clk., writes that bids for the proposed water works will be opened on Aug. 30.

Jersey City, N. J.—Bids will be received until Aug. 28, by the Mayor and Council for $95,000 water bonds. Jas. H. Londrigan, City Clk.

North Wildwood, N. J.—The Wildwood Water Co. is reported incorporated to operate water works in the Borough of North Wildwood; capital $100,000. Incorporators, H. H. Hoffman, Chas. F. Sanders, Edmund Wratherby, of Wildwood, N. J.

Hudson, N. Y.—The citizens are reported to have voted on July 29 to issue $15,000 bonds to lay out new street and provide adequate water and sewer facilities on Secon Hill.

**Rochester, N. Y.*—Ripton & Murphy are reported to have on July 31 secured contract for new water mains in 10th, 12th, 13th, 17th and 22d Wards, for about $10,645.

Martinsburg, N. Y.—C. F. Pitcher, Town Clk. writes that contract has been let for water works, recently reported.

Honeoye Falls, N. Y.—The Village Trus. are reported to have selected W. J. White, of Buffalo, to make complete survey for water works and a sewerage system.

Geneva, N. Y.—The Bd. of Pub. Wks. is reported to have decided to ask City Council to appropriate $10,000, with which to enlarge water mains, which bring the water from storage ponds to city.

Rochester, N. Y.—Water and local improvement bonds to the amount of $640,000 are reported sold.

**Buffalo, N. Y.*—The following are reported to be the bids opened on July 8 by F. G. Ward, Comr. Pub. Wks., for building foundations for new water works pumping station, on lands bet. Jersey St., Porter Ave., the New York Central R. R., and harbor line: Buffalo Dredging Co., $142,500 (awarded contract); Frank V. E. Bardol, $144,900; Jos. F. Stabell Co., $148,000, and A. F. Chapman & Co., $150,000.

Newton, N. C.—See "Power Plants, Gas and Electricity."

Kings Mountain, N. C.—See "Power Plants, Gas and Electricity."

Mohall, N. D.—The citizens are reported to have voted to issue bonds for water works.

Elmore, O.—The citizens are reported to have voted on July 23 to construct water works.

Niles, O.—The Citizens' Water Co., of Niles, is reported incorporated, with a capital of $50,000. Directors: J. B. Barnard, Jos. J. Silveria, O. E. Walpert and others.

Ashland, O.—Bids will be received until Aug. 26 by the Bd. Trus. Pub. Affairs for furnishing and installing a water pumping plant at the pumping station, as advertised in The Engineering Record.

Jacksonville, Ore.—D. B. Fleck, of Portland, is reported to have petitioned for a franchise for water works.

Homestead, Pa.—Bids will be received until Aug. 16 by And. Hill, Boro. Clk. for furnishing c. I. pipe T's, stop gate valves, check valves and specials for a new water line; also distributing and laying c. i. pipe from 13th Ave. to new water tower at the reservoir; also disconnecting the present 14-in. line and lowering part of the same and reconnecting to the new line and setting gates, etc.

**Philadelphia, Pa.*—A contract aggregating $75,000 for c. i. pipe for the Water Bureau is reported to have been awarded on July 31 by the Dept. of Supplies to J. K. Dimmick & Co., New Land Title Bldg., Philadelphia. The pipe is to be used in extensions of the water service in West Philadelphia and the north-eastern district.

Bids will be received by Geo. R. Stearns, Dir. Dept. Pub. Wks., until Aug. 29 for Contract 110, electric machinery for Torresdale pumping station and Contract 119, sand washer pumps for Torresdale filter plant, as advertised in The Engineering Record.

Sisseton, S. D.—See "Schools."

Lewisburg, Tenn.—Bids will be received by the Board of Mayor and Aldermen until Aug. 20 for standpipe, foundation for same, c. i. water pipe, specials, etc., required in the construction of water works as advertised in The Engineering Record. L. J. Nance, Chmn. Water Com.; Engineer, Geo. Cadogan Morgan, 808 Royal Insurance Bldg., Chicago, Ill.

Lawrenceburg, Tenn.—See "Power Plants, Gas and Electricity."

Richmond, Va.—Supt. Bolling, of the Water Dept., is reported to be in favor of installing an electric power and pumping station at old pump house, to be used for lighting and pumping.

Victoria, B. C.—It is stated that bids will be received by Wm. W. Northcott, Pur. Agt., until Sept. 3 for supplying 5,000 ft. of 6-in and 15,000 ft. of 4-in. c. i. water pipe.

Portage La Prairie, Man.—The citizens are reported to have voted to issue $50,000 bonds for improving the water system.

Montreal, Que.—Bids will be received by the City Clk. until Sept. 6 for the construction of a reinforced concrete conduit for water supply. About 9 ft. diam. and 27,300 ft. long, as advertised in The Engineering Record. Geo. Janin, Supt. and Ch. Engr. Water Wks.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Douglas, Ariz.—It is reported that plans and estimates are being prepared for a sewerage system.

Redlands, Cal.—The City Trus. are reported to have ordered plans prepared for a sewer system about 1 mile in length in the east section of city, on Stillman, Highway and Stuart Aves.

**Oakland, Cal.*—The Contra Costa Constr. Co. is reported to have secured the contract for constructing the 2d intercepting sewer for $11,059.

**Hartford, Conn.*—F. C. Ford, City Engr., writes that the lowest and successful bid opened on July 29 for constructing Sect. A of the Homestead Ave. intercepting sewer system was submitted by Andrew W. Bryne, 79 Milk St. Boston, Mass., at the following bid: 990 ft. 120-in. standard section concrete conduit, $22; 125 ft. 120-in. heavy section concrete conduit, $55; 1,100 ft. 48x72-in. egg-shaped concrete sewer, $10.40; 40 ft. 44-in. circular brick sewer, $13; 4 concrete manholes, ea., $50; 3 standard manholes, ea., $50; 2 syphon manholes, ea., $125; 10 house connections, ea., $15; 8 vitrified tile slants, ea., $1; days' time to complete, at $5 per day, 125 days; total cost, $41,998. Totals of other bids received: F. B. & W. H. O'Neil, 24 Pawtucket St., Hartford, $58,770; Chas. H. Slocomb, 55 Adelaide St., Hartford, $48,407; Eveline Bros., Waterford, N. Y., and New Britain, Conn., $47,286; F. T. Ley & Co., Inc., Springfield, Mass., $68,044; Falvey & Kelly, 15 Intervale Park, Dorchester, Mass., $43,774; Hartford Paving & Constr. Co., 703 Main St., Hartford, $42,691; and Russell Contr. Co., 156 5th Ave., New York, N. Y., $42,111.

Ansonia, Conn.—The State Legislature has passed a bill, authorizing Ansonia to issue $50,000 sewer bonds.

* *Items marked thus give the names of parties awarded contracts.*

Ft. Dade, Fla.—Bids will be received by Lieut. J. A. Thomas, Constr. Qm., until Aug. 30, for the construction of storm water drains at this post, as advertised in The Engineering Record.

Rome, Ga.—See "Water."

**Waukegan, Ill.*—M. R. Miller, Supt. Pub. Wks., writes that D. West & Co., 69 Loan & Trust Bldg., Milwaukee, Wis., has secured the contract for constructing the North Side sewer (bids opened July 19) at the following bid: 200 lin ft. 48 in. reinforced concrete, 4 ft. deep, $11.76; 2,400 lin. ft. 48 in. concrete, 3 ft. deep, $4.88; 1,300 lin. ft. 36 in. concrete, 10.6 ft. deep, $3.95; 830 lin. ft. 30 in. concrete, 11.2 ft. deep, $3.80; 2,330 lin. ft. 27 in. concrete, 16.3 feet deep, $3.45; 594 lin, ft. 24 in. concrete, 11.7 ft. deep, $3; 1,375 lin, ft. 21 in. vitr. pipe, 12.7 ft. deep, $2.18; 1,230 lin, ft. 18 in. vitr. pipe, 10 ft. deep, $1.85; 2,740 lin. ft. 15 in. vitr. pipe, 11.2 ft. deep, $1.78; 2,285 lin. ft. 12 in. vitr. pipe, 10.8 ft. deep, $1.65; 3,380 lin. ft. 9 in. vitr. pipe, 9.8 ft. deep, $1.42; 1,500 lin. ft. 6 in- vitr. pipe risers, 28 cts.; 200 lin. ft. 20 in. pipe, $5.33; 62 manholes, $40; 1 catch basin, $35; 1 lamp hole, $10; 15 flushing devices, $20; 200 cu. yds. concrete masonry, $9; 1 cu. yd. brick masonry, $17; 1 m. ft. lumber, $30; 1 cu. yd. excav., $1; 1 bulkhead, $175; 800 lin. ft. piles. 42 cts.; total $58,089. Totals of other bids received: H. D. Hallett, Aurora, Ill., $65,714; E. R. Harding, Racine, Wis., $62,891.

Pekin, Ill.—We are informed that all bids opened on July 29 by J. H. Soldwedel, City Clk., for constructing the 4th Ward sewer have been rejected, and new bids will be received on Aug. 12 at 8 p. m.; cost about $115,000. John R. Siebert, City Engr.

Herrin, Ill.—The City Council is reported to be considering the question of constructing a sewerage system.

Minonk, Ill.—The City Council is reported to have approved the plans of W. H. Irwin, of Ottawa, for a sewer system for Minonk.

Joliet, Ill.—The Council is reported to have authorized the Bd. of Local Improv. to prepare plans for a sewer system in certain portions of the 7th Ward.

Quincy, Ill.—Plans are reported as being about complete for the North End sanitary sewer. F. L. Hancock, City Engr.

Indianapolis, Ind.—Bids will be received until Aug. 14, by the Bd. Pub. Wks., (Jos. T. Elliott, Pres.) for constructing 10-in. pipe sewers in portions of Tecumseh, Pratt, 10th St. and an alley.

South Bend, Ind.—It is reported that bids will be received until Aug. 13 by the Bd. Co. Comrs. (W. A. McIery, Chmn.) for constructing a pipe sewer in Emerson Ave.

Peru, Ind.—The Bd. of Pub .Wks. is reported to have rejected bids recently received for the construction of 5 lateral sewers and will ask for new bids at once.

St. Louis, Mo.—Sewer Comr. Fardwell is reported to be preparing plans for the construction of a tunnel through the hill at Forest Park for the purpose of changing course of River Des Peres; it will be about 1¾ miles in length, 20x45 ft. wide, and cost several million dollars.

St. Louis, Mo.—See "Paving and Roadmaking."

Bozeman, Mont.—Harry A. Bolinger, City Clk., writes that it is proposed to construct pipe sewers, at a cost of $30,000. Engineer, C. M. Thorpe, of Bozeman.

Butte, Mont.—Alex. Leggat, City Engr., is reported to be preparing plans for a storm sewer to be located in the gulch west of Elcelsior Ave. It will be about 2,000 ft. long and will be 4x4x5½ ft. in diam. Bids will be called for on two plans, one of reinforced cement sewer, and the other of stone, with brick arch.

Wildwood, N. J.—Bids will be received until Aug. 13 by the Boro. Street Com. (Evans G. Slaughter, Chmn.), for reconstructing about 12,000 lin. ft. of the sewerage system of the Boro. L. M. Rice, Boro. Engr.

Newark, N. J.—Bids will be received until Aug. 15, by the Bd. Street and Water Comrs. (M. R. Sherrerd, Ch. Engr.) for constructing the Tyler St. sewers and branches, requiring 3,780 ft. 12, 10 and 8-in. deep and wide socket pipe, 3,880 6-in. house connections, 17 manholes, etc., also constructing the N. 13th St. sewer, requiring 1,425 ft. 12 and 10-in. pipe, 280 ft. 6-in. house connections, 9 manholes, etc.

North Plainfield, N. J.—The Borough Sewer Comn. (C. W. McCutcheon, Chmn.) has presented its report to Council, advising that a contract be entered into with the city of Plainfield for the disposal of the Borough sewage, and that collecting and outfall sewers to the city works be installed in accordance with the plans of Hering & Fuller, of New York, N. Y.

Honeoye Falls, N. Y.—See "Water."

Rochester, N. Y.—A site has been purchased on Winton Road and University Ave., in Brighton, for a new pumping station, to be erected in connection with the new sewer system, for the 21st Ward.

Medina, N. Y.—The citizens are reported to have voted to extend the trunk sewer beyond Glenwood Lake, at a cost not to exceed $16,000.

Long Island City L. I., N. Y.—Bids will be received until Aug. 15 by Jos Bermel, Boro. Pres., for constructing a temporary sewer in Chestnut St. and White-stone Ave. Engineer's estimate, 1,375 lin. ft., 12 in. Vitr. salt glazed or cement concrete pipe, sewer; 10 manholes, 10 M. ft. timber for bracing and sheet piling, etc.

Fulton, N. Y.—O. C. Breed, City Engr, writes that about $20,000 will be expended for vitr. pipe sewers.

Newark N. J.*—The following are the bids opened on July 18 by the Street and Water Comrs. for constructing Meadow Brook sewerage system, Sec. 1: (*a*) Chas. Oppolito, Orange; (*b*) Jas. A. Christie, Newark; (*c*) Pasqualle Cestone. Montclair; (*d*) G. M. Richards, Newark; (*e*) Fusco & Miele, Montclair, and (*f*) Wm. J. McCloud & Co., **Elizabeth (awarded contract) (Edw. S. Rankin is Engr. Dept of Sewers and Drainage.)

	a	*b*	*c*	*d*	*e*	**f*
3,970 ft. 18-in. d. s. pipe sewer	$3.90	$2.95	$3.00	$1.75	$8.87	$3.25
320 ft. 12-in. d. and w. pipe sewer	2.10	2.40	2.00	1.62	1.87	1.60
2,370 ft. 10-in. d. and w. pipe sewer	1.45	2.30	1.50	1.33	1.69	1.15
7,120 ft. 8-in. d. and w. pipe sewer	1.40	1.85	1.20	1.00	1.27	1.06
18,500 ft. 6-in. house connections	.50	.45	.32	.85	.49	.40
850 ft. 6-in. iron soil pipe	1.50	1.55	.70	1.35	1.77	1.25
1,250 ft. 8-in. iron pipe	2.00	2.35	2.25	2.10	2.09	2.00
3,000 ft. 8-in. underdrain pipe	.55	.75	1.00	.60	1.17	.25
68 manholes	50.00	52.00	50.00	40.00	67.00	60.00
2 flush tanks	125.00	140.00	110.00	80.00	125.00	125.00
200 cu. yds. excav	1.50	.50	.50	.40	.52	1.00
Pumping station complete	7,500.00	6,690.00	6,400.00	6,500.00	5,700.00	6,500.00
Totals	$55,684	$56,538	$47,096	$48,495	$76,162	$46,430

Denison, Ia.—Bids will be received until Aug. 19 by the City Council for constructing 1,415 ft. 8-in. vitr. sewer pipe in Pine and E. Prospect Sts. O. M. Criswell, City Clk.

Abilene, Kan.—J. A. Graves, City Clk. writes that it is proposed to construct sewers in Dists. 4 and 5 at a cost of $5,000. A. L. Romig, City Engr.

Louisville, Ky.—Bids will be received by the Comrs. of Sewerage until Aug. 28 for the construction of the first sewer under recent $4,000,000 bond issue to be known as Happy Hollow Sewer, Contract 1. as advertised in The Engineering Record. J. B. F. Breed, Ch. Engr.

Togus, Me.—Maj. A. L. Smith, Treas. Eastern Branch, N. H. D. V. S., writes that no contract was let on July 31 for improving sewerage and drainage system, all bids received being too high.

**Westfield, Mass.*—The contract for building Sect. 13 of storm water sewer (bids opened Aug. 3) has been awarded to H. J. Crandall & Son Co., of East Boston, for $3,008.

Athol, Mass.—Bids will be received until Aug. 20 for the construction of about 8,500 ft. of sewers as advertised in The Engineering Record. Herbert L. Hapgood, Chmn. Sewer Comrs.

Battle Creek, Mich.—C. L. Simkins, 169 Parish St., has prepared plans for the Bd. of Pub. Wks. for a reinforced concrete storm water sewer to be constructed in Lake Ave. from Fountain St. to Tennyson Ave.; cost about $10,000.

Winnebago, Minn.—It is stated that bids will be received until Aug. 15, by the Village Council for constructing sewers with manholes, etc. J. H. Fherin, Village Clk.

Hastings, Minn.—See "Water."

Staples, Minn.—Bids will be received until Aug. 15 for a santary sewer system, consisting of approximately 9,000 ft. of sewer lines and a small concrete septic tank. Engineer, Oscar Claussen, of St. Paul.

Webster Groves, Mo.—Bids will be received until Aug. 19 by L. B. Ripley, City Clk., for constructing district sewers with necessary appurtenances in Sewer Dist. No. 1, as advertised in The Engineering Record. Engineers, R. E. McMath Surveying Co., 328 Lincoln Trust Bldg., St. Louis.

Hudson, N. Y.—See "Water."

Dunkirk, N. Y.—Prof. Ogden ,of the State Dept. of Health, is reported to have advised Mayor Einstein that the city should do away with the numerous sewer outlets at the lake front by constructing an intersecting sewer to carry all sewage to a point east of city near Battery Point.

Brooklyn, N. Y.—The lowest bid opened on July 31 by Bird S. Coler, Pres., Brooklyn Boro., for furnishing material and constructing relief sewer in Gold and Johnson Sts., Sec. 1, Div. 2, Gold St. system, was submitted by Rogers & Haggerty, 1929 Amsterdam Ave., N Y. City, at the following bid: 173 lin. ft. outlet Sect. A, $143.97; 40 lin. ft. outlet Sect. B, $152.35; 80 lin. ft. connecting chamber, $161.28; 1,910 162-in. circular sewer, $93.25; 1,431 lin. ft. 156-in. circular sewer, $57.33; 928 lin. ft. 150-in. circular sewer, $50.38; 20 lin. ft. 3x4-ft. 6-in. egg-shaped sewer, $21.45;150 lin. ft. 24-in. pipe sewer, $3.38; 730 lin. ft. 18-in. pipe sewer, $2.99; 2,190 lin. ft. 15-in. pipe sewer, $3.20; 4,645 lin. ft. 12-in. pipe sewer, $2.47; 30 lin. ft. 24-in. pipe temporary drain, $4.16; 130 lin. ft. 15-in. pipe temporary drain, $3.20; 205 lin. ft. 12-in. pipe temporary drain, $2.47; 4,130 lin. ft. 12-in. pipe sub-drain, 65 cts.; 3 manholes, Class "A," $260; 6 manholes, Class "B," $200; 2 manholes, Class "C," $130; 1 manhole on 3x4-ft. 6-in. egg-shaped sewer, $52; 72 manholes on pipe sewer, $50; 53 sewer basins reconnected, $25; 1,100 M ft. sheeting and bracing, $30; 420 M ft. foundation plank, $30; 1,000 cu. yds. Class "B" concrete, $7; 50,000 lin. ft. bearing piles, 30 cts.; 15 M ft. pile capping, $30; 2,000 lin. ft. oak fender piles, 50 cts.; 260 M ft. yellow pine sheet piling and wales, $80; 2,280 cu. yds. riprap or cobblestone fill, inside of coffer-dam, 75 cts.; 370 cu. yds. riprap, outside of coffer-dam, 75 cts.; total, $475,476. Totals of other bids were: Paul C. Grening Const. Co., Brooklyn, $478,856; M. C. Madsen, Brooklyn, $558,390; Builders Trucking & Material Co., Brooklyn. $520,097, and John J. Creem, Brooklyn, $570,521.

Bids will be received until Aug. 14 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in 2d, 17th, 8th and New York Aves., 43d, E. 7th, 58th, 56th, 74, 60 th, Dobbin, 55th, Commerce and 54th Sts., and sewer basins in several streets. Engineer's estimate, 11,999 lin. ft. 36, 30, 24, 18, 15 and 12-in. pipe sewer; 12,630 lin. ft. 6-in. house connection drain; 119 manholes; 58,500 ft. sheeting and bracing, etc.

North Tonawanda, N. Y.—The City Council is reported to be considering the question of calling an election to vote on issuing bonds for the construction of a sewer system, east of Division St., probable cost $75,000.

Whitesboro, N. Y.—Bids will be received until Aug. 19 by the Bd. Trus., for reconstructing certain portions of the sewerage system. J. C. Eberly, Jr., Village Clk. W. G. Stone, C. E., Mann Bldg., Utica.

Newton, N. C.—See "Power Plants, Gas and Electricity."

Casselton, N. D.—The question of constructing a sewerage system is reported under consideration.

Port Clinton, O.—It is reported that bids are wanted until Aug. 19 for constructing a branch sewer in Sewer Dist. No. 10. J. J. Burke, City Clk.

Cleveland, O.—Bids will be received until Aug. 13 by the Bd. Pub. Service (A. R. Callow, Secy.) for constructing sewers in portions of 9 streets.

Ironton, O.—The City Engr. is reported to have recommended the construction of a $60,000 sewer and flood defense.

Wadsworth, O.—The City Council is reported to be considering the question of constructing a sewage disposal plant.

**Dayton, O.*—Paul & Kerschner are reported to have secured the contract for the construction of the Riverdale intercepting storm sewer and pumping station (bids opened July 26) at $21,456 using concrete. The Backus Constr. Co. bid for this work, $22,310.

*Wm. Hilt is reported to have secured the contract for constructing Rubicon Creek storm sewer for $15,945.

**Cincinnati, O.*—Contracts for constructing sewers have been awarded by the Bd. of Pub. Service as follows: To J. E. Mahoney, 719 Whittier St., for sewer in Ravine, bet. Circle and Seegar Ave., $8,984, and for a sewer in Maria and Sturm Sts., $9,928, and to T. Maloney, 1858 Forest Ave., for sewer in Corben Pl. and Right of Way, $11,975.

Canal Dover, O.—This city will receive bids until Aug. 31 for the construction of a combined sewer system of sewer pipe; estimated cost, $18,037. Geo. E. Arnold, Engr., New Philadelphia, O.

Baden, Pa.—Bids will be received until Aug. 26 by the Town Council (L. F. Northrop, Secy.) for constructing a system of sanitary sewers. J. P. Leaf, Boro. Engr., Rochester, Pa.

Fayetteville, Tenn.—The question of constructing a sewerage system is reported under consideration here.

**Tacoma, Wash.*—The Lister Constr. Co. has secured the contract for constructing sewers in Dist. 166 (bids opened July 31) for $34,450.

North Yakima, Wash.—W. J. Roberts, Engr. of the State Dept. of Health, is stated to have decided to report in favor of a sewage disposal plant for North Yakima.

South Bend, Wash.—V. Heath, City Clk., writes that the plans of Dunn & Dunn, of Seattle, have been approved for a sewerage system to cost about $30,000. It has not yet been determined how much work will be done this year.

Aberdeen, Wash.—H. W. Trautman, City Engr., writes that all bids received on July 24 by F. F. Clark, City Clk., for constructing sewers in Sewer Dists. C and D, to consist of about 5 miles vitr. clay pipe sewers, from 6 to 24-in., with lampholes, Y's, etc.; manholes to be of concrete; flush tanks to be of concrete, with the Miller automatic system have been rejected and new bids will be called for.

West Allis, Wis.—Press reports state that bids are about to be asked for an intercepting sewer system, septic tanks and filter beds for the disposal of sewage.

Elroy, Wis.—Bids will be received by J. M. Dix, City Clk., until Aug. 31, for the construction of 6,643 ft. of 6 to 18-in. pipe sewers. W. G. KKirchoffer, Engr., Madison.

BRIDGES.

Notes Arranged Alphabetically by States.

San Diego, Cal.—As soon as City Engr. Crowell receives the profile drawing of the boulevard leading to the proposed bridge over Los Penasquitas River plans and specifications will be prepared for the bridge, it is stated; appropriation available, $7,200.

Portland, Colo.—It it stated that competitive plans and specifications will be received until Aug. 16 by T. W. Jaycox, State Engr., Denver, for a one or two-span 125-ft. reinforced concrete steel bridge.

Waterbury, Conn.—The following are reported to be the bids opened on July 30 by the Bd. of Pub. Wks. for constructing steel concrete bridge over Mad River at Liberty St.: Edw. McManus, $16,116; Gardner G. Riggs, $15,718, and Fred T. Ley & Co., Springfield, Mass., $15,171.

Hartford, Conn.—The Legislature passed a bill authorizing the Connecticut River Bridge and Highway Dist. to issue $500,000 bonds.

Des Moines, Ia.—Bids will be received until Aug. 20 by the Bd. Pub. Wks. (W. W. Wise, Chmn.), for constructing a 5-span reinforced concrete highway bridge across the Des Moines River at its intersection with Locust St.

Plaquemine, La.—Bids will be received until Sept. 9 by the Bridge Com. of Iberville Parish, at Plaquemine, for constructing substructure, superstructure and approaches of a steel draw bridge over Bayou Plaquemine. Plans and specifications may be had upon a deposit of $15. Jules A. Hebert, Clk. of Police Jury.

**Pittsfield, Mass.*—The Bd. of Pub. Wks. has let contract for building a reinforced concrete arch bridge over Housatonic River at Mill St. to H. C. Wood & Co., of Westfield, for $5,119. Span 50 ft. width of roadway, 21 ft.; one sidewalk 6 ft. wide.

Port Huron, Mich.—The following are reported to be the bids received July 19 by the City Clk. for constructing a bridge over the canal at the Stone Road (Contractors of Port Huron) (*a*) plank floor; (*b*) concrete floor: Jenks-Dresser Co., *a* $6,750, *b* $7,385; Kaumeier &

Buffalo, N. Y.—See "Railroads."

* *Items marked thus give the names of parties awarded contracts.*

[illegible]—It is stated that bids will be received until Aug. [illegible] by the Bd. Co. Comrs. for constructing [illegible] stone abutments for the Young's Ford Bridge. [illegible] Martin, Co. Aud.

[illegible]—It is stated that bids will be received until Aug. 23 by the Bd. Co. Comrs. for constructing a bridge over Mills Creek on Monroe St. Chas. Ku-[illegible], Co. Aud.

[illegible], O.—It is stated that bids will be received by [illegible] Remick, Co. Aud., until Aug. 19, for constructing reinforced concrete bridge.

Youngstown, O.—Bids will be received until Aug. 19 by the Bd. Co. Comrs., for constructing a riveted highway bridge over Beaver Creek in Goshen Township. W. B. Jones, Co. Aud.

Columbus, O.—Bids will be received by the Co. Comrs. at Columbus until Sept. 4 for labor and material necessary to build, construct and complete the following work: Engineer's estimate No. 818. —Superstructure and roadway construction of the Holt bridge in Franklin Township. Engineer's estimate No. 819.—Concrete encasing of the pier of the Chenoweth Mill Bridge in Pleasant Township. Engineer's estimate No. 820.—Hauling and spreading furnace slag on the east approach of the Clickenger Bridge in Hamilton Township. Blue print copies may be obtained of the Co. Surv. at $1 ea. Other plans for the construction of the superstructure and roadway construction of the Holt Bridge are also invited.

**Harrisburg, Pa.*—McCormick & Co., of Philadelphia, are stated to have secured the contract for reconstructing Mulberry St. Bridge of reinforced concrete for $260,040. Bids opened July 5 by Bd. Pub. Wks.

Beaver, Pa.—It is stated that the Pittsburgh & Lake Erie R.R. Co. (J. A. Atwood, Ch. Engr., Pittsburg) will construct a cantilever bridge over the Ohio River, between Monaca and Beaver.

**Scranton, Pa.*—Charles R. Acker, Dir. of Pub. Wks., is reported to have recommended for award contracts as follows: Steel bridge over Lackawanna River at Lackawanna Ave., to York Bridge Co., of York, at $83,997, and concrete bridge at Green Ridge St., to John F. Whittaker, at $31,994.

Emporium, Pa.—Bids will be received until Aug. 20 by the Bd. Co. Comrs. (J. W. Lewis, Chmn.), for constructing the substructure and superstructure of a highway bridge in Shippen Township.

Laurens, S. C.—G. G. Lynch, of Augusta, Gen. Supt. Charleston & Western Carolina R.R. Co., writes that it is proposed to construct a steel viaduct over South Tyger River, between Laurens and Spartanburg, to cost about $40,000.

Pateros, Wash.—Bids will be received until Aug. 16, by the State Highway Bd., (Jas. M. Snow, Secy) at Olympia for constructing a bridge across the Methow River at Pateros, near the Columbia River on State Road No. 10 in Okanogan Co. Bowenman & McCloy, Consulting Engrs., New York Blk., Seattle.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Decatur, Ala.*—W. A. McCalla, City Engr., writes that the Southern Bitulithic Co., of Nashville, Tenn., has secured the contract for 25,000 sq. yds. bitulithic at $2.15 and 6,000 sq. yds. vitr. brick at $2.20; and the Columbus Concrete Co., of Columbus, Miss., the contract for 10,800 sq. yds. of cement sidewalk at $1.07¾, and 4,000 lin. ft. curb 28 cts (bids opened July 25).

**San Francisco, Col.*—The Bd. of Wks. is reported to have awarded the contract for repaving a portion of Market St. to the City Street Improvement Co., Mills Bldg., for $78,000.

Stockton, Col.—Clark & Henry, of Stockton, are reported to have submitted the lowest bid for paving with asphalt Center, El Dorado, San Joaquin, California, Market, Main and Channel Sts., at $135,432.

Berkeley, Col.—The paving of Shattuck Ave. and Center St. with asphalt is reported contemplated.

**San Mateo, Col.*—The Barber Asphalt Co., of Los Angeles, is stated to have secured the contract for paving 2 miles of asphalt Sts. for about $100,000.

New Haven, Conn.—Bids will be received until Aug. 19 at the office of C. W. Kelly, City Engr., for constructing a crushed stone pavement on Carlisle St., a bitulithic pavement on State St., and a Hassam pavement on Oak St.

Waterbury, Conn.—The Legislature is stated to have passed the bill authorizing the issue of $200,000 street improvement bonds for Waterbury.

New Britain, Conn.—This city contemplates building permanent and improved pavement on several streets this year.

**Jacksonville, Fla.*—Philip Priolean, City Engr., writes that contracts for paving (bids opened July 22) have been awarded as follows: To D. M. Baker, Jacksonville, Fla., for Forsyth St. with Graves' brick, $1.59½ per sq. yd., and to Georgia Eng. Co., Augusta, Ga., with Augusta brick on Florida Ave., at $1.55 per sq. yd. There will be approximately 24,[illegible] sq. yds. of paving, 9,992 lin. ft. stone curb, and 52 circular corner stones of a radius of 6 ft.

Bids will be received until Aug. 26 by the Bd. Pub. Wks., for furnishing material and paving Adams St., requiring about 6,000 sq. yds. vitr. paving brick or blocks, 2,576 lin. ft. stone curbing, etc. Philip Priolean, City Engr.

Rome, Ga.—We are informed that bids will probably be called for in about 4 months for paving, to cost about $225,000. Engineer, [illegible] Hazlehurst, of Atlanta. C. E. McLin, Pres. Bd. Pub. Wks.

**Freeport, Ill.*—G. W. Graham, City Engr., writes that Wm. Ascher, of Freeport, has secured the contract for paving Walnut St. (bids opened July 25), at the following bid: 26,763 sq. yds. brick paving, $1.30; 14,-[illegible] cu. yds. excav., 30 cts.; 12,940 ft. sandstone curb, [illegible] cts.; [illegible] intakes, ea., $[illegible]; 3,600 sq. ft. cement walk, [illegible] cts.; 450 ft. 15-in. sewer, 90 cts.; total, $48,-[illegible]. Totals of other bids: M. Ford, Cedar Rapids, of Tipton and Clinton Cos., will receive bids at the Co. Court House, at Tipton, until Aug. 19, for the construc- Ia., $50,870; Keys & McNamara, La Salle, $53,891, and J. W. Stuart, Freeport, $53,010.

Bloomington, Ill.—Bids will be received at the office of E. F. Fauntz, City Engr., until Aug. 15, for 4,000 sq. yds. brick pavement on 4 in. concrete base, 3,000 ft. curb and gutter and 3,500 ft., 12, 15 and 18 in. pipe sewer.

Chicago, Ill.—Bids will be received until Aug. 13 by the Bd. Local Improv. (H. S. Dietrich, Pres.) for constructing cement sidewalks on portions of numerous streets.

Springfield, Ill.—The following bids are reported opened July 27 for paving with asphalt *a* State St., *b* Walnut St., Barber Asphalt Paving Co., Stock Exchange Bldg. *a* and *b* $2.32; Capital City Concrete Constr. Co., *a* $1.86, *b* $1.90; John E. Bretz, *a* and *b* $1.86.

Muncie, Ind.—It is stated that the Bd. of Pub. Wks. will soon receive bids for the resurfacing of Walnut St. with asphalt and paving Adams St. with asphalt.

South Bend, Ind.—It is reported that bids will be received until Aug. 13 by the Bd. Pub. Wks. (W. A. Mclery, Chmn.) for paving with brick a portion of Broadway and an alley; also curbing and cement walks on Bartlett St.

Terre Haute, Ind.—It is stated that bids are wanted by the Co. Comrs. until Aug. 17, for constructing 4,730 ft. of gravel road in Otter Creek Township. Jerome W. Denehie, Co. Aud.

Terre Haute, Ind.—The Bd. Pub. Wks. is stated to have opened bids as follows for paving a portion of 5th Ave. Foulkes-Forbes Co., $15,300; Roberts & Co., $14,900 and Keegan Bros., $17,500.

Tipton, Ind.—It is reported that the Bd. Co. Comrs. tion of a gravel road on the line between Tipton and Clinton Cos. J. B. Barrow, Co. Aud., Tipton.

**Green Castle, Ind.*—A contract for the construction of 5 miles of gravel road on the county line is stated to have been awarded to Mahoney & Allen, of Green Castle at $17,300.

Monticello, Ind.—It is stated that the comrs. of White Co. will ask for bids as soon as plans and specifications can be made for the construction of 16 miles of gravel road in Monon Township.

Huntington, Ind.—It is stated that bids will be received by the City Clk. until Aug. 13 for constructing brick pavements and macadam roadways on portions of 4 streets. J. B. Vernon, City Engr.

Iowa City, Ia.—The City Council is stated to have passed a resolution providing for the paving with brick of several streets at a probable cost of $50,000.

Clinton, Ia.—Bids will be received until Aug. 13 for construction of cement walks on N. 2d St., including 2,000 cu. yds. grading, 2,430 ft. curb, 38 yds. wall and 30,800 sq. ft. cement walk. Engineer, Chas. P. Chase, of Clinton. H. H. Van Meter, City Clerk.

Ft. Riley, Kan.—Bids will be received by Capt. Wm. Whitman, Q. M., U. S. A., until Aug. 14, for constructing 750 lin. ft. macadam road and for furnishing and delivering where directed on present road system within this post approximately 2,500 cu. yds. of crushed rock.

Greensburg, Ky.—L. W. Coakley, Treas. of the Green County Turnpike Co., writes that the date of opening of bids for constructing a pike about 11 miles in length has again been extended from Aug. 1 to Aug. 13.

New Orleans, La.—The bids of the Concrete Constr. & Contr. Co. and the Barber Asphalt Paving Co., Hermen Bldg., are stated to have been recommended for award for paving portion of Gravier St. with granite block, at $11,118, and Chestnut St. with asphalt, at $5,892, respectively.

New Orleans, La.—The Budget Com. is stated to have decided to pave the following streets: University Pl., Esplanade, Opelousas Aves. and S. Pierce St. at a cost of $97,300.

Baltimore, Md.—The following bids are reported opened July 31 for paving portions of *a* Robert St. and *b* Lombard St. Warren Bros. Co., Boston, Mass., bitulithic, *a* $2.28 and *b* $2.42; Maryland Pavement Co., 63 Lexington St., asphalt blocks, *a* $2.35 and *b* $2.50; Filbert Paving & Constr. Co., sheet asphalt, *a* $2.15 and *b* $2.35; Patrick Reddington, 325 St. Paul St., vitrified brick, *a* $2.15 and *b* $2.29, (price given per sq. yd.)

**Saginaw, Mich.*—The following are the bids opened on Aug. 5 for paving Saginaw St.: Farrell Bros. & Algate, $21,550 (awarded contract); M. E. Fitzpatrick, $23,600; S. E. Clark, $21,600, and W. H. McKale, $21,-850.

Detroit, Mich.—The following are reported to be the lowest bids opened July 30 by Comr. Haarer for repaving Brady St.: Jas. Hanley, 40 Fort St., at $15,371, and Larned St., Thos. E. Currie, at $9,267, Ferdinand St. with cedar, $9,618.

Dundee, Mich.—Bids will be received by the Council until Aug. 20 for about 13,000 sq. yds. brick pavement and necessary curbing and drainage, as advertised in The Engineering Record. Engineers, The Riggs & Sherman Co., of Toledo, O.

**St. Paul, Minn.*—The Bd. Pub. Wks. has awarded the contract for resurfacing with asphalt a portion of 7th St., about 10,510 sq. yds., to the Barber Asphalt Paving Co., of Minneapolis, at $1.75 per sq. yd.

Winona, Minn.—The City Council on July 29 instructed the City Engr. to prepare plans and specifications for paving Center St., 7 blocks, and Main St., 5 blocks, with vitr. brick block and stone curb; also Alley 23, original plot (20x300 ft.).

Bids will be received Aug. 19 for macadamizing Lafayette St. (2 blocks), including stone curb and brick gutter.

**St. Louis, Mo.*—The Bd. of Local Improvements is stated to have awarded contracts as follows: Reeb Bros., for paving 5 streets at $130,940 and Hoeffken Bros., for paving and sewering 2 streets at $73,882.

Butte, Mont.—The paving of N. Main St. is reported contemplated.

Pembroke, N. H.—Bids will be received until Aug. 19 by A. W. Dean, State Engr., Concord, for grading and surfacing with gravel about 5,000 ft. of Merrimack Valley Rd., in Pembroke.

**Kingsland, N. J.*—The contract for laying concrete walks throughout Kingsland is stated to have been awarded to Reid & Wehrle, at $5,938.

Jersey City, N. J.—The Bd. of Street and Water Comrs. is stated to have adopted specifications for the paving of a portion of Van Reypen St. with asphalt.

Camden, N. J.—Bids will be received until Aug. 15 by Jas. E. Hewett, Chmn., Finance Com. of City Council for $150,000 paving bonds.

Wildwood, N. J.—Bids will be received until Aug. 13 by the Boro. Street Com. (Evans G. Slaughter, Chmn.), for constructing about 40,000 sq. yds. of macadam streets with cement gutters. L. M. Rice, Boro. Engr.

Woodcliff Lake, N. J.—Bids will be received until Aug. 20 by the Mayor and Boro. Council for macadamizing Mill and Pascack Rds., Woodcliff Heights Rd. and Glen Rd., in all about 12,849 ft. H. G. Hering, Jr., Boro. Engr., Hillsdale.

Etna, N. J.—Bids will be received until Aug. 23 by the Mayor and Boro. Council for building a macadam road known as Kinderkamack Rd., a distance of about 6,132 ft. H. G. Hering, Jr., Boro. Engr., Hillsdale; Jas. G. Hopper, Boro. Clk.

Hoboken, N. J.—It is stated that bids will be received by the City Council until Aug. 28 for repaving portions of 3d and Grand Sts. Jas. H. Londrigan, City Clk.

**Geneva, N. Y.*—The Bd. of Pub. Wks. on Aug. 1 is reported to have awarded the contract for paving Cherry and Lyceum Sts., Elmwood Ave. and Elmwood Pl. to John R. Baxter, of Utica. The pavement is to be 24 ft. wide and of Metropolitan block. Contract price, about $41,840.

New York, N. Y.—Bids will be received by J. A. Bensel, Comr. of Docks, until Aug. 19, for furnishing material, grading and constructing pedestrian approaches to the ferries bet. W. 22d and W. 23d. Sts., and for granite pavement bet. W. 13th and W. 14th Sts., North River, Boro. Manhattan, as per Contract No. 1096.

Bids will be received until Aug. 22 by the Park Bd. (Moses Herrman, Pres.), for furnishing and delivering 50,000 Belgian blocks (No. 1, 1907) for parks, Boro. Bronx.

Hudson, N. Y.—See "Water."

Syracuse, N. Y.—Bd. of Contract and Supply is stated to have opened bids July 22 for paving a portion of Plum St. Fred J. Baker, Johnsonburg block with sandstone, $15,313; same block with cement curbing, $16,193; Central City Paving Co., Johnsonburg block with sandstone curbing, $16,190; same block with cement curbing, $17,400.

Lockport, N. Y.—The Bd. of Supervisors is stated to have voted to improve the extension of Griswold St. 5½ miles in length at a cost of $72,000.

Long Island City, L. I. N. Y.—Bids will be received by Jos. Bermel, Boro. Pres., until Aug. 15, for regulating and grading the Boule. from Webster Ave. to Broadway. Engineer's estimate: 555 cu. yds. of rock excava., 4,866 cu. yds. earth excava., 300 lin. ft. 24-in. iron drain pipe in place; also same time and place for furnishing and delivering to the Bureau of Highways, Boro. Queens, 3,500 broken stone of trap rock, size, 1¼ in. and 1,500 cu. yds. trap rock screenings.

**Rochester, N. Y.*—The Bd. Contract and Supply is stated to have awarded the contract for paving Driving Park Ave. to T. C. Lauer & Sons Co., for $31,770.

Syracuse, N. Y.—The Bd. Contract and Supply is stated to have opened bids as follows for paving a portion of Green St. Warner-Quinlan Co., 438 S. Salina St. (4 bids) $14,889 to $15,574, Saml. Bown, $16,424 and Central City Paving Co., $15,613.

**Harrison, N. Y.*—R. T. Shore, Town Clk., writes that the contract for grading and macadamizing Underhill, Harrison and other streets, (bids opened July 24) has been awarded to John Twinane, of White Plains, for $7,872.

Brooklyn, N. Y.—Bids will be received until Aug. 21 by Bird S. Coler, Boro. Pres., for paving and repairing portions of Bushwick and Denton Pa., Driggs and Morgan Aves., Boerum, Box, Dupont, Eagle, Granite and Guernsey Sts., laying sidewalks on 87th and 71st Sts., and constructing cement concrete sidewalks on various streets. Engineer's estimate: 24,345 sq. yds. asphalt pavt., 2,330 sq. yds. iron slag blk. pavt., with cement joints; 2,320 sq. yds. granite blk. pavt., with tar and gravel joints; 2,940 sq. yds. medina sandstone pavt., with cement joints; 24,900 sq. ft. cement sidewalk; 97,488 sq. ft. cement concrete sidewalk; 4,471 cu. yds. concrete; 18,660 lin. ft. new curbs, etc.

Brooklyn, N. Y.—The following are the bids opened on Aug. 1 by Moses Herrman, Pres. Park Bd., N. Y. City, for furnishing materials and constructing complete asphalt tile walks in (*a*) Lincoln Terrace, 36,230 ft., and (b) Amersfort Park, 28,660 ft., Boro. of Brooklyn; (*c*) totals: Continental Asphalt Paving Co., *a* and *b* 27½ cts., *c* $17,845; the Hastings Pavt. Co., *a* 26 cts., *b* 25½ cts., *c* $16,728.

The lowest bid opened on Aug. 1. by Moses Herrman, Pres. Park Bd., N. Y. City., for furnishing materials and laying cement sidewalks around Sunset, Amersfort, Fulton, Bedford and Irving Square Parks, Boro. of Brooklyn, in all about 75,864 sq. ft., was submitted by Walter L. Castle, at 15, 15¾ and 16 cts. per sq. ft.; total, $11,769. Totals of other bids: Bonacci & Vincelli Contr. Co., $12,518, and Chas. Cranford, $12,195.

*Chas. Cranford, 44 Court St., has secured the contract for regulating, grading, curbing, sodding parks and laying sidewalks on Ocean Ave., from Ave. G to Ave. H, and from Ave. I to Kings Highway (bids opened July 31) by Bird S. Coler Pres., Brooklyn Boro., at the following bid: 8,080 lin. ft. new curb, in concrete, $1; 990 cu. yd. earth excav., 40 cts.; 3,220 cu. yds. earth fill, 20 cts.; 12,960 lin. ft. concrete curb around parking, 30 cts.; 39,910 sq. ft. cement sidewalk, 14 cts.; 5,440 sq. yds. sod for parking, 40 cts.; total, $22,030. Totals of other bids: James Quinn, Jr., 1483

* *Items marked thus give the names of parties awarded contracts.*

Ave. A, N. Y. City, $26,147; Danl. Douglass, 122 Logan St., Brooklyn, $27,210; Bracken McAveney Co., foot 6th St., Brooklyn, $23,193; N. Schneider's Sons Co., 144 21st St., Brooklyn, $24,596; Bonacci & Vincelli Contracting Co., 672 Degraw St., Brooklyn, $23,711.

Lima, O.—It is stated that bids will be received until Aug. 13 by the Bd. Pub. Service (L. L. Crumrine, Secy.) for paving with vitr. brick or macadam a portion of S. Broadway.

Cincinnati, O.—The Bd. of Public Service is stated to have approved plans for the boulevard to connect Bunnet Woods and Eden Parks at a probable cost of $85,000.
It is stated that the Madison Road is to be resurfaced with macadam at a cost of $21,000.
City Engineer Danenhower is reported to have estimated the cost of improving a portion of Ehrman Ave. at $15,711.

Celina, O.—It is stated that bids will be received until Aug. 17 by G. A. Weis, Co. Aud., for $28,500 and $22,000 pike bonds.

Ottawa, O.—It is stated that bids will be received until Aug. 17 by the Bd. Co. Comrs., for constructing stone roads in 3 townships. J. G. Maidlow, Co. Engr.

Sandusky, O.—Bids will be received until Aug. 20 by B. J. McGory, Clk. Bd. Pub. Service, for grading, curbing and paving portions of Osborne, Lawrence, Washington and Monroe Sts.

Barberton, O.—The City Engineer is stated to have completed estimates for paving portions of several streets for $25,000.

**Cincinnati, O.*—The County Cmrs. are stated to have awarded contracts for street improvements on July 30 as follows: J. Ruehl & Bro., Atlas Bank Bldg., Colerain pike, from corporation line to Mt. Airy, $41,120; Harrison pike, from East Miami road to State St. in Harrison, O., to W. S. Nugent, $47,585; Hamilton pike, from North Bend Road to Mt. Healthy, to O. E. Robinson 4647 Hamilton Ave., $11,351.

**Youngstown, O.*—The Bd. Pub. Service is stated to have awarded the contract for repaving E. Federal St. to Jas. McCarron, of Youngstown, at $9,187.

Dayton, O.—Bids will be received until Sept. 3 by Edw. Phillips, City Aud., for $12,500 bonds for the purpose of providing money for the improvement of Stewart St.

Mt. Gilead, O.—It is stated that bids will be received until Aug. 23 by W. C. McFarland, Co. Aud., for constructing the Climax Free Turnpike.

Portland, Ore.—The paving of Grand Ave. with bituminous macadam is reported contemplated; estimated cost, $32,986.

**Jenkintown, Pa.*—The Town Council is stated to have awarded to Bolger & Cummins, of Germantown, the contract for 2,780 lin. ft. macadam streets, 500 lin. ft. of brick paving throughout Jenkintown, for $8,022. Bids opened July 29.

**Nanticoke, Pa.*—The contract for paving with Porter brick Espy St. is stated to have been awarded to Jas. Badman, for $5,930.

**Washington, Pa.*—The State Highway Dept. at Harrisburg is reported to have awarded the contract for paving the road through West Waynesburg to Patrick Fidge, of Pittsburg, for $21,250.

**Lancaster, Pa.*—J. N. Fritchey & Son, Manetta and Rice Aves., are stated to have secured the contract for paving Center Sq. and two squares on N. Queen St., at $2.69 per sq. yd. for Mack block.

Pittsburg, Pa.—Bids will be received until Aug. 26 by the Bd. Co. Comrs. for constructing the Perrysville Plank Rd, Ross Township, about 1.8 miles; also the Homestead and Duquesne Rd., Mifflin Township, about 5½ miles. Geo. T. Barnsley, Co. Road Engr., 26 Courthouse; F. P. Booth, Co. Comp.

Smethport, Pa.—Bids will be received by W. G. Holder, Town Clk., until Aug. 29 for about 22,056 sq. yds. paving, as advertised in The Engineering Record.

Jacksboro, Tenn.—Bids will be received until Sept. 2 by the Co. Road Comrs. for $100,000 road bonds.

Galveston, Tex.—The following bids are reported opened July 29 by County Auditor Murch for paving with brick 9,610 sq. yds. of the County Seawall Boulc.: Kelso & Vautrin, $1.60 per sq. yd., and Wm. Lucas, $1.64½ per sq. yd.

**Norfolk, Va.*—The Bd. of Control is stated to have awarded the contract for asphalt paving portion Marshall Ave. to Barber Asphalt Paving Co., at $2.08 per sq. yd.

**Tacoma, Wash.*—Contracts for paving (bids opened July 31) have been awarded as follows: To Independent Paving Co., for L. I. D. No. 330, for $141,877, and the Barher Asphalt Paving Co., for L. I. D. No. 325, for $41,800.

**Seattle, Wash.*—The State Highway Bd. is stated to have awarded the contract for constructing a road from Riverton Drawbridge in King County to the Tacoma Bridge Co., at $29,751.

Olympia, Wash.—It is reported that bids will be received by J. M. Snow, Secy. State Highway Comn., until Aug. 16 for constructing State Road No. 3.

Showano, Wis.—The lowest bid opened July 29 by the Com. on Streets and Sidewalks is stated to have been submitted by Chris Johnson, of Oshkosh, at $18,921.

Fond du Loc, Wis.—It is stated that macadam is proposed on Park Ave., with granite top.
The Bd. of Pub. Wks., it is reported, has been authorized to ask bids for brick paving on 4th St. from Main to Everett Sts., and 3d St. from Main to Marr Sts.; also for tar macadam on Follett St. from Amory to Doty Sts.

**Appleton, Wis.*—E. L. Williams, City Clk., writes that the contract for brick paving (bids opened July 26) has been awarded to Hackworthy Constr. Co., Appleton, for $73,259.

Janesville, Wis.—It is stated that bids will be received until Aug. 23 by the Street Assessment Com., (S. B. Heddles, Chmn.) for paving with macadam, a portion of St. Lawrence Ave.

**Oshkosh, Wis.*—It is stated that bids will be received by the Bd. Pub. Wks., until Aug. 17, for paving with asphalt a portion of Church St.

Winnipeg, Man.—The Bd. of Wks. is stated to have decided to pave a portion of Nena St., at $46,952.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Heber, Ark.—W. H. Horton is reported to have secured a franchise for an electric light and heating plant for Heber.

Newport, Ark.—The City Council is reported to be in favor of establishing a municipal lighting plant at this place.

Cottonwood, Cal.—Jas. Barry and Chas. Tozer are reported interested in a company about to be formed here for electrical purposes. They propose to procure a dam site at Beegum, Cal., on Beegum Creek, and have filed application for 10,000 miner's inches of water.

Pasadena, Cal.—C. C. Glass, Mgr. of the Municipal Electric Light plant, is reported to have submitted to Mayor Early a report on an underground distributing system. He estimates the cost at $72,744 to install conduits for electric light work in the fire district, which comprises the business section in general.

San Jose, Cal.—J. A. Belloli is reported to have petitioned the Bd. of Superv. for a franchise along the roads of Santa Clara County for the transmission of power from Milpitas to Alviso.

Los Angeles, Cal.—Preliminary surveys are reported as being made by the Pacific Light & Power Co. (E. A. Beck, Supt, Los Angeles), for a power plant in San Gabriel Valley.

Napa, Cal.—The Bd. of Superv. has granted D. L. Beard a franchise to maintain and erect poles ad wires over the county for the transmission of electric light and power.

San Jose, Cal.—The Daniels Flat Water & Power Co. is reported incorporated with a capital of $1,000,000. The principal place of business will be San Jose, the works being located in Tuolumne County. The company proposes securing and holding of water rights and constructing and maintaining electric railways and light and power plants. Directors, Wm. Bogen and L. E. Hanchett, of San Jose, and F. J. Koster, W. H. Metson and L. W. Smith, of San Francisco.

Redding, Cal.—The stockholders of the Pacific Power Co. (A. A. Martin, Gen. Mgr.) are reported to have voted to appropriate $30,000 for the completion of work and a line into Red Bluff.

Colorado Springs, Colo.—The Colorado Mining, Land & Power Co. is reported incorporated to manufacture and generate electricity and gas, operate trolley, telegraph and telephone lines, build smelters, reservoirs and construct irrigation ditches in El Paso, Grand, Garfield, Boulder, Mesa and Weld Counties. Incorporators: Wm. M. Hagir, John T. Carey anad Alfred S. V. Carpenter, of Colorado Springs.

New Britain, Conn.—The amendment to the charter of the Stanley Works, by which that company is empowered to increase its capital stock from $1,500,000 to $3,000,000, to dam the Housatonic River in Kent, to erect a power plant there, and to erect poles and string wires from that town to New Britain, so that its factory may be operated by electricity, was passed in the State Senate on July 24.

Lake City, Fla.—John D. Carley is reported to be preparing to develop the water power of Suwanee River near Lake City.

Douglas, Ga.—The following machinery,etc., will be installed at the municipal electric light plant at an early date: A 200 kw. ac. generator, 2,200 volts, 60 cycles, 2 phase; a 250 h. p. corliss or four-valve engine; a 100 h. p. Cole boiler; a 12½ kw. d. c. 125-volt generator; a 12-in. artesian well; an air compressor. Ingersoll Rand and extensive line improvements and day.circuit. L. M. Alford, Mgr.

Marseilles, Ill.—W. D. Boyce, of Marseilles, is reported interested in the construction of a water power plant for the purpose of supplying electricity in Ottawa, Morris and other towns.

Mt. Carroll, Ill.—The Mt. Carroll Elec. Light Co. (J. W. Webb, Mgr.) contemplate constructing new pole lines and possibly addition of a small water power plant.

Pana, Ill.—The Pana Gas & Electric Co. (H. D. Larabee, Mgr.) propose installing a new generator and to replace one engine and generator by direct connected set.

Henry, Ill.—Separate bids will be received by the Bldg. Com., (Peter Merdian, Secy.) or Rev. L. Zumbuehl, until Aug. 16, for installing steam heating plant with pipes and radiators complete, in a brick church, 110x40 ft;; also electric wiring and furnishing and installing electric light fixtures in same.

Bloomington, Ill.—Bids will be received until Aug. 14, by Harry Rhoads, City Clk., for installing surface condenser for the electric light plant to take care of 12,000 lbs. steam per hour, to be bronze fitted, and not less than 15-in. stroke, and to be erected in complete running order, including foundations and piping. A. T. Maltby, Consulting Engr., 803 Great Northern Bldg., Chicago.

**Princeton, Ind.*—We are informed that the Practical Gas Constr. Co., of North Chicago, Ill., has secured the contract for constructing an artificial gas plant for the Consumers' Gas & Light Co.; cost reported to be about $60,000.

Peru, Ind.—The Peru Chemical Gas Co. is reported incorporated to construct and equip an artificial gas plant. J. O. Cole, Wm. Hart, and J. T. Armitage, are the directors.

Lowell, Ind.—Clifford Wiley is reported to have purchased the local electric light plant. The new owner will install a new plant, and the Lowell Light & Power Co. will be the name of the new company.

Hagerstown, Ind.—It is stated that an election will soon be held to vote on purchasing the local electric light plant. If same is purchased it will be enlarged and improved.

Davenport, Ia.—A permit is reported to have been issued to the Independent Light & Power Co. for the erection of a 2-story brick power plant in the west end of city.

Pittsburg, Kan.—See "Business Buildings."

Ft. Leavenworth, Kan.—Bids will be received until Aug. 15, by Capt. J. E. Normoyle, Q. M. U. S. A., for electric wiring Sherman Hall and Annex at this post.

Pocomoke City, Md.—The Stevenson Electric Light Co. (R. P. Stevenson, Mgr.) expect some time this fall to install a 100-h.-p. boiler and a 25-kw. direct-connected unit.

Cambridge, Md.—The Bd. of Comrs. of Cambridge, is reported to have granted an electric franchise to John H. Burgess, Jr., and W. H. Medford, representing Baltimore capitalists. The franchise is for 30 years, renewable for the same length of time with an option of purchase by the town in 15 years.

L'Anse, Mich.—It is reported that C. D. Shea, City Recorder, will receive bids until Aug. 14 for constructing a water power plant. E. P. Burch, Engr., Minneapolis, Minn.

Wyandotte, Mich.—Jas. G. Pinson, City Clk., writes that the citizens voted July 29 to issue $20,000 bonds for improving electric light plant.

Dawson, Minn.—The village of Dawson will receive bids on a combined water works and electric light plant until Aug. 20; estimated cost, $28,000. Engineer, Oscar Claussen, of St. Paul.

Billings, Mont.—Press reports that that Yegen Bros., of Billings, will begin at once construction of an electric light system to furnish light and power to residents of Billings. At a recent meeting of City Council permission was granted to the firm to place poles and string wires in the principal thoroughfares.

Camden, N. J.—See "New Industrial Plants."

Newark, N. J.—Bids will be received until Aug. 23 by the Special Com. on Electric Lighting of the Common Council for furnishing and installing an electric light plant in City Hall to include the following: 3 engines and 3 electric generators, steam piping, etc., switchboard instruments, wiring, etc., foundations and masonry; entire equipment. Jas. M. eymour, Consulting Engr., 51-5 Lawrence St., Jas. F. Connelly, City Clk.

**Jersey City, N. J.*—The Bd. of Freeholders is reported to have on Aug. 1 awarded to Reis & O'Donovan, 1123 Bway., New York, N. Y., contract for electric light wiring of new almshouse, at $2,280, and contract for electric light and gas fixtures to Ferdinand Fleshauer, of West Hoboken, for $2,400.

Silver City, N. M.—A. D. Coleman, Electrical Engr., 1608 Amsterdam Ave., New York, N. Y., in care of Trimfidi, writes that the Forest Power Co., of which D. E. Woods is pres., will construct an electric plant, to cost about $250,000.

Newburgh, N. Y.—The Newburgh Electric Light, Heat & Power Co., is reported to have petitioned the Pub. Service Comn. at Albany, for permission to issue $250,000 additional stock, to be used to improve its electric light plant and perfect the line to Poughkeepsie.

**Tonawanda, N. Y.*—The Tonawanda Power Co. is reported to have, on July 30, secured the contract for lighting the city with electricity, at $57.50 per lamp per year.

West Point, N. Y.—See "Miscellaneous."

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., until Aug. 26, for furnishing and installing an electrical distributing and street lighting system, as advertised in The Engineering Record. Proposals from manufacturers of electric cables only will be considered.

**Elmira, N. Y.*—Chas. Georgia, of Elmira, is reported to have secured the contract for installing the electric equipment in the foundry of the La France Fire Engine Co., on the south side.

Brooklyn, N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York City, until Aug. 15 (readvertisement) for furnishing, installing, maintaining and reserving for the use of high-pressure fire service, all apparatus and equipment necessary for generating and transmitting 1,830 kw. of 3-phase, 6,600 volts, 25-cycle electric power, and furnishing and delivering this power under terms of this contract to Aug. 15, 1908, at each of the high pressure fire service pumping stations, located in the Boro. of Brooklyn, at Furman and Joralemon Sts., and at Willoughby and St. Edwards Sts., respectively.

Blackwell's Island, N. Y.—Bids will be received until Aug. 22 by Robert W. Hibberd, Comr. Pub. Charities, N. Y. City, for materials and labor required for complete conduiting, electric wiring, and all other work in connection with installation of a complete electric lighting and power system for all buildings and grounds under jurisdiction of Dept. of Pub. Charities, and comprising the New York City Home for Aged and Infirm, Blackwell's Island, Boro. of Manhattan.

New York, N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity, until Aug. 15 (readvertisement) for furnishing, installing, maintaining and reserving for use of high-pressure fire service, all apparatus and equipment necessary for generating and transmitting 3,250 kw. of 3-phase, 6,600 volts, 25-cycle power, under terms of contract to Aug. 15, 1908, at each of the high-pressure fire service pumping stations, located in the Boro. Manhattan, at Oliver and South Sts., and at Gansevoort and West Sts., respectively; also same date and place for furnishing electric current for lighting and power purposes to the equipment owned by the city now installed or to be installed on the Williamsburg Bridge, for the terms from Aug. 15 to Dec. 31, both inclusive in the Boro. of Manhattan.

Rochester, N. Y.—The Bd. of Superv. is reported to have passed a resolution authorizing the Purchasing Agent to procure bids for the construction of a lighting plant for the court house, at a cost not to exceed $7,900.

* *Items marked thus give the names of parties awarded contracts.*

*Niagara Falls, N. Y.—The State Reservation Comn. is reported to have on Aug. 2 awarded contract for construction of lighting system on state lands in this city to the F. P. Little Electrical Co., of Buffalo, for $13,731, is to be completed within 90 days.

Newton, N. C.—Bids will be receved until Aug. 15 by W. B. Gaither, Mayor, for $75,000 improvement bonds to be issued for water, sewer and lighting.

Kings Mountain, N. C.—The citizens are reported to have voted to issue $50,000 bonds for water works and an electric light plant.

Hamilton, O.—Bids will be received by the Bd. of Public Service until Aug. 13 for furnishing materials and labor for the following items: Sand pumping driven wells; placing stop valves in branch pipes of driven wells; driving driven wells; pump pit and house for centrifugal pumps, two 4,000,000-gallon daily (not duty, as previously stated) centrifugal or turbine pumps to work against 70-ft. head, and water connections; two 100 h.-p. alternating current electric motors, and starting devices; electric pole line, 1,000 ft. long; furnishing and laying 24-in. water discharge pipe, etc. Engineer, John W. Hill, First Natl. Bank Bldg., Cincinnati.

Toledo, O.—It is stated that bids will be received by the Bd. of Co. Comrs. until Aug. 14 for improving portion of Phillips Ave.; also until Aug. 10 for grading, draining and macadamizing. D. T. Davies, Jr., Co. Aud.

Elyria, O.—The Elyria Milling & Power Co. (G. H. Arnold, Pres.) writes that it has just completed specifications for the following machinery to be installed: One 200-h.p. water turbine, one 175-kw. generator, one 175-h.p. gas engine, all direct-connected.

It is reported that the city of Elyria will shortly vote on issuing $75,000 bonds for the erection of a municipal electric light plant.

Milton (P. O. West Milton), O.—Bids will be received until Sept. 16 by John Coates, Clk. Village of Milton, for lighting said village with 30 arc lights and a few incandescent clusters. Successful bidders will be given franchise and commercial light privileges.

Arlington, O.—O. T. Castor, Village Clk., writes that bids for bonds, also construction of electric light plant, will be opened on Aug. 27 by Village Council.

Columbus, O.—The Trus. of the Columbus State Hospital, on July 30 are reported to have awarded the contract to the Electric Supply & Constr. Co., for a dynamo, switchboard and additional wiring, for $7,200, and a contract for a cement floor and pipe conduits in the main building to the Blakeslee Concrete Block & Machine Co., for $5,759.

*The Bd. of Pub. Service is reported to have approved the contract with the Allis-Chalmers Co., of Milwaukee, Wis., for a turbo-generator for the municipal electric light plant.

Cherokee, Okla.—The Cherokee Light, Ice & Power Co. is reported incorporated with a capital of $50,000 by E. T. Carpenter, J. W. Howard and others.

Guthrie, Okla.—The City Council is reported to have granted a franchise to the Guthrie Gas Light & Fuel Co.

Cottage Grove, Ore.—The electric light plant of the Williamette Valley Co. at Cottage Grove is reported to have been destroyed by fire; loss about $20,000; Russell Welch, Mgr., Eugene, Ore.

Panama.—Bids will be received by D. W. Ross, the Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Aug. 22, for furnishing sanitary fixtures, soil pipe and fittings, railway water tanks and standpipes, D. C. Engine and dynamo, switchboard, shop machines, locomotive springs, governors, electrical fixtures, magneto batteries, wire, hand drills, galvanized-iron roofing, etc., as per circular No. 382.

Philadelphia, Pa.—See "Water."

Lawrenceburg, Tenn.—Bids will be received until Aug. 20 by Jas. T. Dunn, City Secy., for $25,000 water and light bonds.

San Antonio, Tex.—The San Antonio Gas & Electric Co. is reported to have decided to construct a large addition to its plant.

Marshall, Tex.—It is stated that bids will be received until Aug. 14 by H. S. Rice, City Secy., for constructing about 22 miles of concrete sidewalks and street crossings.

Wharton, Tex.—John W. Maxcy, Binz Bldg., Houston, has been employed by A. P. Borden & Co., of Wharton, to prepare plans and specifications for a power plant for the irrigation of 20,000 acres of rice land.

Richmond, Va.—See "Water."

Tacoma, Wash.—The following are the bids opened on July 31 by Owen Woods, Comr. of Pub. Wks., for the construction of the municipal power plant: Geo. Milton Savage Co., hydraulic power plant of 10,000 h.p., $1,750,000; steam turbine plant of 4,000 h.p., $440,000; Jas. C. Drake, steam or turbine plant of 4,000 h.p., $500,000. The bids were submitted to Council to select the best bid with the view of submitting the proposition to the people.

Spokane, Wash.—The Big Bend Light & Power Co. is reported organized to furnish light and power to cities and towns in Big Bend County. Incorporators, D. B. Fotheringham and H. L. Bleeker, of Spokane, and Eugene Men'e, of Medical Lake.

Prentice, Wis.—Chas. Ferguson, of Antigo, is reported interested in the construction of a dam on Jump River, for the development of the water power for electrical purposes.

Campbellford, Ont.—Bids will be received until Sept. 5, (extension of date) by Mayor W. J. Doxsee, for rock-cutting, concrete work, turbine wheels, generators, etc., for 4,000 h.p., and about 2¼ miles of transmission line for power development at Middle Falls on the Trent River. John S. Fielding, Consulting Engr., 15 Toronto St., Toronto.

Dawson, Yukon District, Canada.—Press reports state that A. B. Palmer, manager of the Yukon Smelting & Power Co., which has projected a smelter and power scheme for the Whitehorse district, states that plans are being prepared to build a smelter at Whitehorse with a capacity of 2500 tons of ore a day. Also plans to install a plant, and to furnish electrical power for the mines being considered.

Montreal, Que.—The Shawinigan Water & Power Co. is reported to have acquired the controlling interest in the North Shore Power Co. and will largely increase the output of the plant of the North Shore Co. by the installation of modern electrical machinery.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Stockton, Cal.—An ordinance is stated to have been passed granting the Central California Traction Co. (E. P. Hilborn, Gen. Mgr.), a franchise in this city.

San Jose, Cal.—The San Jose, Los Gatos Interurban Ry. Co. (F. E. Chapin, Gen. Mgr.), is stated to have applied to the Bd. of Superv. for a frachise for a single-track electric railway over certain highways in the county of Santa Clara.

Redding, Cal.—F. L. Evans is stated to have applied to the City Trustees for a franchise to operate a double-track electrical railroad through streets of Redding, and same to become a part of the system of the Eureka & Redding Ry.

Oakland, Cal.—The Oakland Traction Cons. Co. (W. F. Kelly, Gen. Mgr.) is reputed to have made application to the City Council for a franchise for a street car line to run along 13th Ave.

**Waterbury, Conn.*—John Fagan's Sons is stated to have been awarded the contract for the construction of 4 miles of the Woodbury-Waterbury Electric Railway. Their contract begins at Quassapaug and runs through Woodbury Center.

Nauvoo, Ill.—The Mississippi Valley Electric Ry. Co. is reported to having awarded the contract for the construction of its road to Ft. Madison, Ia., to the Federal Constr. Co. of New York, N. Y.

New Orleans, La.—It is said that the New Orleans St. Ry. Co. (H. J. Dressel, Supt.), is contemplating an extension of its Orleans St. line from the City Park race track to the lake shore and then to West End, where a connection will be made with the double tracks from Canal St. along the New Basin.

Hagerstown, Md.—It is reported that the Chambersburg, Greencastle & Waynesboro Electric Ry. Co. (I. J. Durall, Ch. Engr., Meadowlands) which owns and operates the electric railway running from Greencastle to Pen-Mar Park via Waynesboro, have in contemplation the building of an extension from Greencastle to Chambersburg, and a short line from Shady Grove, where their system connects with the Hagerstown Electric Ry., to the proposed Chambersburg-Greencastle line, the point of intersection being about 3 miles north of Greencastle.

Shelburne Falls, Mass.—The Shelburne Falls & Colrain St. Ry. Co., (C. A. Marcy, Mgr., Colrain) is stated to have received the franchise from the Selectmen of Buckland for the proposed extension across the river from Bridge St. to the Boston & Maine station.

Adrian, Mich.—M. Antoine Robert, of Montreal, Que., is reported to be promoting an electric railway which will run from Adrian to Detroit. It will be known as the Detroit & Adrian Traction Co., and it will be capitalized at $2,000,000. It is said that the company has received liberal franchises from Adrian, Tecumseh and Milan. Outside the cities the road will be built on a private right of way.

**Jackson, Mich.*—W. E. Tench & Co., of Detroit, are stated to have secured the contract for the grading of the proposed Lansing-Jackson Electric Ry. by the Northern Constr. Co.

Joplin, Mo.—The Joplin & Pittsburg St. R. R. Co. is stated to have filed with the City Clk. its acceptance of the amended franchise granted by the City Council. D. B. Holmes. Work on the construction of the interurban line between Joplin and Pittsburg will be started as soon as a right of way can be obtained.

Utica, N. Y.—The Utica Southern R. R. Co. has filed its maps in Oneida and Madison Counties and is reported to be preparing to extend the line from Hamilton to Norwich, a distance of about 22 miles. The surveys will be begun shortly. The total length of the line will be 43 miles, and the Waterville branch will be 5 miles.

Syracuse, N. Y.—The Bd. of Trustees of East Syracuse is stated to have granted the Syracuse Rapid Transit Ry. Co. (C. L. Allen, Gen. Mgr.), a franchise to double track its line from the western boundary of the village, through Burnet Ave. to Clark St., bridging over the New York Central tracks, to Manlius and Hartwell ts., near Ellis St.

Canandaigua, N. Y.—It is stated that the Canandaigua-Southern Ry., between Atlanta, Steuben County, and Canandaigua, is to be built this fall. Only the 6 miles between Atlanta and Naples will be completed at first. Franchises have been secured from Cohocton, Atlanta and Naples.

Flushing, L. I., N. Y.—It is stated that the New York & Queens County Ry. Co., (F. L. Fuller, Gen. Mgr., Long Island City) intends to make extensions of its lines to Whitestone and Bayside in the near future. A tract of 6 acres of land on the Flushing Meadows was recently purchased to be used for the laying out of storage yards and auxiliary power plant and the construction of car houses and repair shops.

Cleveland, O.—The Toledo & Ft. Wayne Electric Ry. Co., of Cleveland, $10,000 capital is stated incorporated by F. J. Pinney, H. J. Nord, Lewis A. Goldstein, Thos. C. Willard and John E. Lowry. They will construct, maintain and operate an electric railway connecting Toledo and Fort Wayne, Ind., and passing through Lucas, Defiance and Williams Counties, Ohio, and Allen County, in Indiana.

Wellington, O.—Right of way is stated to have been secured through Penfield Township, east of here, for the new Elyria Southern Electric Ry. W. E. Elliott, W. E. Moser, F. N. Carpenter, J. M. Starr and J. J. Sargent are the incorporators, with $100,000 capital.

Eugene, Ore.—The required $60,000 stock subscription for the electric railway which Stephen Carver proposes to build from Eugene to the mouth of the Sinslaw River, is stated to have been secured and construction is assured. The next step will be the organization of a company with Mr. Carver as president, after which construction will begin. It is planned to build at least 10 miles this summer and fall and to complete the first 30 miles by next summer.

Lancaster, Pa.—Papers are stated to have been filed at the Court House here for the extension of the Lancaster & York Furnace St. Ry. lines from Pequea to York Furnace, and thence across the Susquehanna River on a new bridge, making a connection between the Lancaster and York County systems.

Providence, R. I.—Ahern Bros. are reported to have received two contracts, the first to build the 6-mile extension of the electric road from Westerly to Pleasant View, and the second one to build a branch track to Ashaway, a distance of about 5 miles.

San Angelo, Tex.—J. H. Ransom, of Hereford, Tex., is stated to have petitioned for a franchise to build an electric railway in San Angelo. The City Council has passed the franchise to the third reading, and if it is finally passed actual work will begin within six months.

Wenatchee, Wash.—Articles of incorporation of the Chelan Electric Co. are stated to have been filed. Capital, $500,000, to build an electric railway from Wenatchee to the western part of Washington. J. T. McChesney, Pres., and E. C. Mony, Secy.

Centralia, Wash.—The City Council is reported to have granted a franchise to the Centralia-Chehalis Electric Ry. & Power Co. to construct an electric railway between Chehalis and Centralia.

Spokane, Wash.—The Spokane & Inland Empire Ry. Co. (J. B. Ingersoll, Gen. Mgr.), is stated to have announced that they have in contemplation the building of a line from Colfax to Walla Walla, Wash., and the extension of system from Moscow to Lewiston, Idaho.

Madison, Wis.—The Interstate Transfer Ry. Co., of Superior, is stated to have filed articles of incorporation in the office of the Secretary of State. The company proposes to build a road connecting Superior and Duluth, a distance of 20 miles. Capital, $600,000. Incorporators: Sol. L. Perrin and W. W. Savage, of Superior, and Joseph B. Cotton, Geo. L. Rels and Wm. A. McGonagle, all of Duluth.

RAILROADS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—At recent meetings of the Bd. of Directors of the Alabama Terminal Co. was decided to amend charter so as to locate and construct a railroad from Bone Gap to Adamsville also, or to increase the capital of the company from $2,000,000 to $3,000,000.

Pensacola, Fla.—Press reports state that bids have been asked for grading all of the Pensacola & Northeastern R. R., which is to extend from Pensacola to Andalusia, Ala., and also for 20 miles of the Pensacola, Alabama & Western R. R., which will run to Memphis, Tenn. The distance of the Andalusia road is 85 miles, making a total of 105 miles.

Hawkinsville, Ga.—A charter has been granted to the Gulf Line Ry. Co. This is said to be a renewal and extension of the charter of the Flint River & Gulf R. R. now in operation from Hawkinsville through several of the counties named in the petition. It is proposed to operate the Gulf Line Ry. through the counties of Pulaski, Wilcox, Turner, Worth, Mitchell, Florida line in Decatur, thence through Florida to the Grady & Decatur to a point on the Gulf coast; the length of the line in Georgia will be about 130 miles, and capital $400,000. Incorporators: C. A. Alford and R. H. Pinson, of Sylvester; T. R. Bennett and W. N. Spence, of Camilla; Morgan Tompkins and T. H. Bridges, of Hawkinsville, and others.

Pinebloom, Ga.—The Ocilla, Pinebloom & Valdosta R. R. Co. is reported to have secured a charter to construct a railroad from Ocilla to Valdosta, 45 miles in length; capital $200,000. Chas. E. Gray and J. L. Cochran are among the incorporators.

Abbeville, Ga.—Chas. D. Caffery, of Lafayette, is reported interested in the construction of a railroad from Eunice by way of Lafayette to Abbeville.

McAlester, Ind. Ter.—The McAlester Southwestern R. R. Co. is reported formed by A. S. McKenon, Dr. E. N. Allen and C. F. Dawley, of McAlester, to construct a railroad from near Sallisaw to the Red River, in Comanche County, Okla.; capital, $5,000,000; length of road is 250 miles.

Worcester, Mass.—The State R. R. Comrs. are reported to have approved plans of the Special Grade Crossing Comn. for the abolition of grade crossings at the station of the Boston & Albany R. R. (Walter Shephard, Ch. Engr., Boston) and New York, New Haven & Hartford R. R. (E. Gagel, Ch. Engr., New Haven, Conn.) in Worcester. The plans involve the expenditure of $3,000,000. The matter will now go to the Superior Court for a final decree authorizing the work of abolition.

Dillon, Mont.—See "Business Buildings."

**Buffalo, N. Y.*—The City Council on July 31 approved award of contracts to John Johnson, 548 Perry St., for substructure of subway in Bway at Bailey Ave. at $135,026, and for substructures of viaducts in Kensington, Dewey, Leroy and Jewitt Aves. and Main and Amherst Sts. over Belt Line tracks, at $112,785. This is the city's share of grade crossing work on the crossings of the N. Y. Central R. R., bids for which were opened on July 13 by the Grade Crossing Comr.

**Buffalo, N. Y.*—Press reports state that the New York Central & Hudson River R. R. Co has awarded to the Eyr Shoemaker Corp., of Philadelphia, Pa., the contract for eliminating all its grade crossings within the city limits of Buffalo for $4,000,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—Bids will be received by E. G. Foster, Chmn. Bldg. Com., until Aug. 17 for the erection of a 2-story jail and jailers' residence for Scott County,

* *Items marked thus give the names of parties awarded contracts.*

as advertised in The Engineering Record. Architect, J. G. Barnwell, of Chattanooga, Tenn.

San Francisco, Cal.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., until Sept. 17, for repairs to stonework, miscellaneous repairs, alterations and painting at the U. S. Mint Building, San Francisco.

Claremont, Cal.—The Claremont Hospital Assoc. is reported incorporated with Hayward G. Thomas and Frank L. Adams as members for the purpose of erecting a modern hospital.

Agnews, Cal.—It is stated that plans are under consideration for the hospital to be erected here at a cost of about $800,000 by the State Lunacy Comn. to replace present structure. Geo. C. Sellon, State archt.

Denver, Colo.—The members of the Chamber of Commerce are said to be planning the erection of a $300,000 building.

New Britain, Conn.—McKim, Mead & White, of New York, N. Y., are reported to have been engaged by the City Building Comn. to oversee the work of making changes in city building. It is expected the plans will be ready in about a month.

**Hartford, Conn.*—The State Arsenal and Armory Comn. on Aug. 2 awarded contract for building armory on the roundhouse site to A. R. Whitney, Jr., & Co., of New York, N. Y., for $463,884, and this provides for a granite or marble exterior, for oak interior, for emergency gas lighting in the drill room and for plate glass. The Comn. advised that some light colored stone be used to harmonize with the Capitol and proposed library. Architect, Benj. W. Morris, N. Y. City.

Farnhurst, Del.—The following are reported to be the bids received July 27 by the Trus. of the Delaware State Hospital for the Insane at Farnhurst (Connell & Pierson, Wilmington, are the archts.): Lynch Bros., of Philadelphia, Pa., $57,544; William D. Haddock & Co., Wilmington, Del., $54,004; J. Hirons Dover, $52,525, and C. E. Anderson, Wilmington, $51,357.

Washington Barracks, D. C.—Bids will be received until Sept. 3 by Maj. W. C. Lanagfitt, Corps Engs., U. S. A., Washington Barracks, for constructing 2 double sets of non-commissioned officers' quarters at Washington Barracks.

Gainesville, Fla.—The only bid received and opened on July 10 at the office of Superv. Archt. Treas. Dept., Washington, D. C., for the construction (complete) of the U. S. Post Office at Gainesville, was submitted by the King Lumber Co., of Charlottesville, Va., for $64,423.

Atlanta, Ga.—The Senate is stated to have passed the bill authorizing the City Council of Atlanta to issue $500,000 bonds to erect a city hall.

The erection of a tuberculosis sanitarium to cost about $25,000 is reported under consideration.

It is stated that competitive plans will soon be asked for the combined court house and city hall which it is proposed erecting.

Morgan & Dillon, Prudential Bldg., it is reported, have completed plans for engine house No. 11 which is to be erected at an estimated cost of $18,000.

Aurora, Ill.—The following are the bids opened on July 24 at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for construction complete of the extension to U. S. Post Office, at Aurora: Doan & Ambruster, Aurora, $20,223, and W. J. McAlpine, Dixon, $23,600.

Elgin, Ill.—V. H. Podstata, of Elgin, Supt. Illinois Hospital, writes that it is proposed to expend about $125,000 in improvements to include the erection of 3 new cottages and improvements to ventilating and heating system W. Carbys Zimmerman, State Archt., Chicago, Ill., has prepared plans for same.

Chicago, Ill.—Bids will be received until Aug. 15 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a 3-story and basement brick and stone police station and municipal court building at 40th Ave. and Fillmore St. Separate bids to be submitted on the following: Masonry and concrete work, iron and steel work, gravel roofing, etc., carpentry, etc., stone work, plumbing, gas fitting, etc., electrical work, steam heating, etc.

Illinois.—Plans are being prepared, according to reports, by W. Carbys Zimmerman, of Chicago, for new buildings to be erected in connection with 4 of the principal State institutions, in accordance with appropriations made at the last session of the legislature. Two cottages are to be erected at the Soldiers' Home in Quincy. They will be 2 stories high and of brick and stone, and cost $110,000. In connection with the Illinois Western Hospital for Insane at Watertown plans are being prepared for a 2 and 3-story building to cost $100,000. For the Illinois General Hospital for the Insane at Bartonville plans are being prepared for a 2-story hospital. It will cost $88,000.

Terre Haute, Ind.—The plans of J. S. Sherman, for remodeling the Union Hospital, it is stated have been accepted. The cost is to be about $30,000.

Lafayette, Ind.—It is reported that bids will soon be asked for erecting a sanitarium to cost $20,000. W. J. Stone may be able to give further information.

**Peru, Ind.*—It is reported that the Bd. Comrs. will receive bids until Aug. 29, for the construction of a cottage at the Lafayette's State Soldiers' Home.

Des Moines, Ia.—Wm. E. D. Rummel, Secy. and Mgr. of the Still College of Osteopathy, is reported interested in the erection of a hospital for osteopathy to cost about $50,000.

Bids will be received until Aug. 22 by the Bd. Pub. Wks. (W. W. Wise, Chmn.), for erecting a 2-story brick fire station.

Humboldt, Ia.—Bids will be received until Aug. 15 at the office of C. Messer, for erecting and completing, including (heating and plumbing) of a public library of native stone now on the ground.

Cedar Rapids, Ia.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 23, for the construction (except elevator) of an extension, remodeling, etc., to the U. S. Post Office and Court House at Cedar Rapids.

Muscatine, Ia.—Bids will be received by Jas. Knox Taylor, Superv. Archt. Treasury Dept., Washington, D. C., until Sept. 10, for the construction (complete) of U. S. Post Office at Muscatine.

Anthony, Kan.—Bids will be received until Aug. 28 by the Bd. Co. Comrs. (Henry Krider, Chmn.) for erecting a Court House on Court House Sq. Plans and specifications may be had for $15, of which $5 will be returned. Geo. P. Washburn & Son, Archts., Ottawa. R. F. Chevraux, Co. Clk.

Springfield, Mass.—John M. Donohue, of Springfield, is reported to be preparing plans for a 3-story brick and fireproof building for Infants' Home for the Springfield Diocese, to cost about $50,000.

Boston, Mass.—Bids will be received until Aug. 15 by the Bd. Park Comrs. (Chas. E. Stratton, Chmn) 64 Pemberton Sq., for erecting a shelter in Marine Park on the Iron Pier.

Boston, Mass.—Bids will be received until Aug. 13 by the Bd. Trus., City Hospital (Geo. H. M. Rowe, Supt.), for erecting a pavilion, to be known as the Measles Ward, on the grounds of the South Dept., of the Boston City Hospital, 74 Massachusetts Ave. Wm. H. Besarick, Archt., 15 School St.

Sault Ste. Marie, Mich.—It is stated that the erection of a fire hall to cost $15,000 is being agitated.

**Flint, Mich.*—The contract to erect the Hawley Hospital is stated to have been awarded to Geo. Rickman & Son, of Kalamazoo, at about $50,000.

Newberry, Mich.—Bids will be received until Aug. 20 by the Bd. Trus. Upper Peninsular Hospital for the Insane (Dr. E. H. Campbell, Secy.), for erecting the Administration Bldg., 1 cottage and 2 cloister connections. Charlton & Kuennzli, archts., Marquette.

Kalkaska, Mich.—It is stated that bids will be received until Aug. 15 by the Co. Clk. for erecting a jail and sheriff's residence. Jacob N. Wolfe, Chmn. Bldg. Com.

New Ulm, Minn.—It is reported that the German Evangelical Society is arranging to erect a $30,000 hospital.

**Rochester, Minn.*—The Northwestern Mantel Co., of Minneapolis, it is stated, has secured the contract for the marble and tiling for the wings of the Rochester Hospital for the Insane at $6,317.

St. Paul, Minn.—It is stated that the Com. of the Bd. of Fire Comrs. is considering plans for a fire house to be erected in the 12th Ward at a cost of about $50,000, including equipment.

St. Paul, Minn.—The Assembly, it is stated, has passed a bill appropriating $50,000 for the establishment of a fire house in the 8th Ward and for equipment.

**Farmington, Minn.*—Arthur Woods, of Owatonna, it is stated, has secured the contract to erect a city and fire hall here at a cost of about $20,000.

Hibbing, Minn.—The Pub. Library, it is stated, has directed J. J. Wagenstein, of Duluth, to prepare plans for the Carnegie Library to be erected at a cost of $25,000.

Ft. Snelling, Minn.—It is reported that bids will soon be asked for erecting a drill hall 100x300 ft. at this post to cost about $65,000, and also for grading the reviewing grounds at a cost of $15,000.

St. Louis, Mo.—Duffner & Stecker, 715 Locust St., it is reported, submitted the lowest bid on July 26 for erecting engine house No. 46, at $16,700.

Butte, Mont.—It is reported that the citizens have voted in favor of issuing $75,000 bonds to erect a court house.

Butte, Mont.—I. D. Freund is reported to be president of a hospital association, which has been organized for the purpose of erecting a 4-story hospital in Butte. Plans for the building are being prepared.

Camden, N. J.—Bids will be received until Aug. 15 by Jas. E. Hewett, Chmn., Finance Com. City Council, for $50,000 hospital bonds.

Camden, N. J.—Kaighn & Draper, are stated to have submitted the lowest bid for erecting an addition to the city jail at $12,820. Appropriation $10,000.

**Cortlandt, N. Y.*—We are informed that the contract for the construction of a field office building, for division and section engineers in the employ of the Bd. of Water Supply, in Cortlandt (bids opened July 23 by the Bd. of Water Supply at N. Y. City) has been awarded to Danl. Carpenter, of Ossining, N. Y.

Tuxedo, N. Y.—Dr. Rushmore is reported to be interesting the residents of Tuxedo in erecting a hospital in Tuxedo at a cost of about $50,000.

Medina, N. Y.—The citizens are stated to have voted to issue $30,000 bonds to be used in addition to the insurance on hand for the erection of a municipal building.

New York, N. Y.—See "Miscellaneous."

Riverhead, L. I.—Bids will be received at the office of John Bagshaw, Clk. Bd. of Superv., until Aug. 15, for the erection of additions and alterations to the Court House at Riverhead. I. H. Green, archt, Sayville, N. Y.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 15, by Jos. Bermel, Boro. Pres., for repairs to the Kings Co. jail; also building a brick wall, enclosing the court yard of said jail.

Buffalo, N. Y.—Bids will be received at the office of the Superv. Archt. Treas. Dept., Washington, D. C., until Sept. 16 for the construction (except elevators) of U. S. Marine Hospital at Buffalo, as advertised in The Engineering Record.

Bids will be received until Sept. 3 (readvertisement) by Henry P. Fink, Clk. Bd. Superv., for erecting an addition and making alterations at the Erie Co. Jail. Bids may be submitted as a whole or separately on the followinge: Masonry, carpentry, setting cut stone, fireproofing, roofing, etc., steel work, iron doors and guards, plumbing and gas fitting, electric wiring and fixtures, heating fixtures.

New York, N. Y.—The following are the bids opened July 20 for furnishing material and erecting a public bath at 5 and 7 Rutgers Pl., Boro. of Manhattan: F. T. Nesbitt Co., 116 Nassau St., $163,400 and $2 per cu. yd. rock excav.; P. Gallagher, 1180 Bway., $162,700 and $2 rock excav., and Zibman Cont. Co., 1068 Bway., $162,000 and $1 rock excav.

The following are the bids opened, same time and place, for plumbing work in public bath at 5 and 7 Rutgers Pl.: J. P. Levins, $21,700 and 75 cts per cu. yd. rock excav.; M. J. O'Brien, $21,003 and 1 ct for rock excav., and Kenney Renner Co., $22,300 and 1 ct rock excav.

Sealed bids will be received by John F. Ahearn, Pres. Boro' Manhattan, until Aug. 14, for furnishing all the labor and material required for general alterations, decorations, etc., to provide additional space in the Criminal Court Bldg. on Centre and White Sts., Boro. Manhattan.

*Kelly & Kelly, Inc., 45 E. 42nd St., have secured the contract for constructing greenhouses in Botanical Garden, Bronx Park (bids opened Aug. 1 by Moses Herrman, Pres. Park Bd.); they bid for constructing houses 1, 2, 3, 4 and 5 $62,706 and with house 6 $60,307.

La Moure, N. D.—Plans and specifications will be received by the Bd. Co. Comrs. until Oct. 3 for a court house to cost between $60,000 and $100,000. F. W. Field, Co. Aud.

Columbus Grove, O.—It is stated that bids will be received until Aug. 17 by the Village Council for heating and plumbing the new city building Harry F. Busche, Village Clk.

Orient, O.—Bids will be received by the Bd. of Trus. Ohio Institution for Feeble-Minded Youth (E. J. Emerick, M. D., Secy., Columbus), until noon Aug. 22, for furnishing material and installing the heating system in the dining hall at the custodial farm at Orient. F. L. Packard, Archt., Columbus.

Columbus, O.—Bids will be received until Aug. 20 by O. Griffin, Secy. Park Comn., Felton and St. Clair Aves., for remodeling the heating system in Palm House, Frank Park Conservatory.

Cincinnati, O.—L. P. Hazen & Co., Reading Road and Elsmore Ave., are stated to have submitted on July 20 the only bid for the entire work of erecting the contagious disease wards and power plant of the new hospital to be erected on Burnet Ave., at $317,500.

Architect Harry Hake, Union Trust Bldg., is reported to have been instructed by the Public Service Board to prepare working plans for the new Evanston engine house.

Cleveland, O.—Bids will be received until Aug. 28 by the Bd. Pub. Service (A. R. Callow, Secy.), for furnishing material and erecting a market house at W. 25th St. and Lorain Ave.

Sandusky, O.—Bids will be received until Aug. 21 by the Bd. Co. Comrs. for furnishing material and remodeling the old hospital building of the Co. Infirmary into a dormitory. O. W. Marble, archt., 212 Columbus Ave.; Chas. Kubach, Co. Aud.

Portland, Ore.—It is stated that bids will be received until Aug. 28 by the Co. Clk. for improvements and alterations to be made on the Multnomah County armory at 10th and Church Sts. Richard Martin, Jr., archt., Dekum Bldg.

Wilkinsburg, Pa.—It is stated that bids will be received until Aug. 15 for erecting a 4-story addition to the Columbia Hospital Probable cost, $80,000. John L. Beatty, archt., Pittsburg.

Pittsburg, Pa.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 16 for the construction (except elevators) of the U. S. Marine Hospital at Pittsburg.

It is reported that the erection of a men's pavilion for insane at the Pittsburg City Home and Hospital at Marshalsea, at a cost of $25,000, is being considered in connection with the rebuilding of the buildings destroyed by fire recently.

The Pittsburg City Hospital and Home at Marshalsea is reported to have been badly damaged by fire on July 31.

*It is stated that E. F. Brown has secured a contract for an $18,750 brick addition to the building of the Little Sisters of the Poor at Penn Ave. and Rebecca St., and the Iron City Heating Co. a contract for a steam heating system in the same building, to cost $11,360.

Providence, R. I.—It is stated that plans are about completed by Fontaine & Kinnicutt, of Woonsocket, for the 3-story brick building, which is to be erected for the Rhode Island Inst. for the Deaf at Hope and Cypress Sts.

Yankton, S. D.—The Benedictine Sisters, according to reports, propose erecting a hospital to cost about $50,000.

Chattanooga, Tenn.—The following are the bids opened July 18 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (complete) of the extension to the U. S. Post Office and Court House at Chattanooga: Jos. Trumby, Chattanooga, $160,276; H. A. Bishop, Chicago, Ill., $140,000, and Geo. Moores Sons, Nashville, $90,580.

**Knoxville, Tenn.*—Geo. Moore's Sons Co., of Nashville, has secured the contract for constructing extension to U. S. Post Office (bids opened July 10 by the Superv. Archt. Treas. Dept., Washington, D. C.), for $132,500.

Beaumont, Tex.—The citizens are reported to have voted in favor os issuing $20,000 bonds to erect a city market, and $30,000 to erect 3 additional fire stations.

Richmond, Tex.—The citizens of Ft. Bend County are reported to have voted to issue $75,000 bonds for building a court house.

**Ft. Worth, Tex.*—The contract for constructing complete the extension and remodeling of U. S. Post Office, including plumbing, gas pipe, heating apparatus and wiring, (bids opened July 8) has been awarded to John Burden, of Ft. Worth, for $111,421.

Seattle, Wash.—It is reported that the Alaska-Yukon-Pacific exposition Comn. of the State of Washington has selected Bebb & Mendel and Saunders and Lawton, of Seattle, to prepare plans of the Washington State and Forestry buildings, respectively

Graham & Myers, Lowman Bldg., are said to be the archts. for the Saml. and Jessie Kenney Presbyterian Home for the Aged, to be erected at a cost of about

* *Items marked thus give the names of parties awarded contracts.*

$75,000. The main building is to be 3-story brick, 60x120 ft.

Milwaukee, Wis.—It is reported that the Bd. of Supers. will ask competitive plans for a court house to cost about $1,500,00.

It is reported that an appropriation has been asked to build a $60,000 addition to the Layton Hospital, located at 21st St.

Bids will be received until Aug. 26 by the Bldg. Com., Auditorium Bd. (Alvin P. Kletzsch, Pres.), for furnishing material and erecting an auditorium at State and Cedar Sts. Bids may be submitted as a whole or separately on the following: Cut stone, artificial stone, iron work, sheet metal and roofing, carpentry, plumbing and gas fitting, electric work, elevators, marble work, ventilating and heating. Duplicate plans and specifications may be had from Ferry & Clas, archts., 419 Bway., upon a deposit of $50.

Application has been made for a permit to erect a 3-story brick and stone annex to the Milwaukee Hospital at Cedar St. to cost $60,000.

**Sheboygan, Wis.*—The Northern Constr. Co., of Milwaukee, has secured the contract for constructing complete, an extension and the remodeling of U. S. Post Office, including plumbing, heating, electric wiring, etc., (bids opened July 15) for $25,885.

Superior, Wis.—Bids will be received until Aug. 21 by Chas. L. Flagstad, Co. Clk., Sta. A., Superior, for erecting the main building of the Co. Insane Asylum, about 4 miles from Superior. Carl Wirth, Archt., Bank Commerce Bldg.

Casper, Wyo.—F. H. Sawyer, Co. Clk., writes that no bids were received on July 22 for the erection of a 2-story brick and stone court house. No date has yet been set for the receiving of new bids. Architect, C. A. Randall, of Casper.

Winnipeg, Man.—The bid of the Vulcan Iron Co. for the cell work at the new police station at $10,888, it is stated, has been recommended for award.

Simcoe, Ont.—Bids will be received until Aug. 16 by the Dept. Pub. Wks. (Fred Gelinas, Secy.) Ottawa, for erecting a public building at Simcoe.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Cullman, Ala.—It is stated that plans submitted by Fred Gordon Shaw, of Meridian, Miss., have been accepted for the buildings which are to be erected near here by the Alabama Odd Fellows as a Home for their Widows and Orphans. The buildings to be erected include a 3-story administration building, school, chapel infirmary and a number of cottages. The total estimated cost is $200,000. The administration building is to be erected at once under the supervision of the archt.

Ft. Smith, Ark.—Bids will be received until Aug. 22 by C. D. Mowen, Secy. Ft. Smith Hotel Co., for erecting (except heating, plumbing and mechanical appliances) a 6-story 160-room, reinforced concrete hotel. Plans and specifications may be had from Herbert E. Hewitt, archt., 22 Arcade Bldg., Peoria, upon a deposit of $25.

San Francisco, Cal.—McDougall Bros., 330 Pine St., are reported to be the archts. for the 7-story Y. M. C. A. bldg., to be erected on Leavenworth St. and Golden Gate Ave.

Permits have been asked for the following buildings: The Holmes Investment Co., to erect an 8-story, class A building on Post St., east of Kearny, to cost $75,000, and D. O. Mills to erect a 10-story class A office building on Bush St., to cost $340,000 ,and Simon Clayburn to erect a 4-story brick building on Geary St. near Grant Ave. to cost $50,000.

**Los Angeles, Cal.*—The contract for ornamental wrought iron and cast bronze, for Hamburger Department store, at 8th St. and Broadway, is reported to have been let to the Winslow Bros., of Chicago, Ill., for $120,000.

**Oakland, Cal.*—Roberts Bros. are reported to have secured the contract to erect a $20,000 concrete building for Taft & Pennoyer.

**Marysville, Cal.*—Frank M. Herbert, of Sioux City, Ia., it is stated, has secured the contract for the brick work on the new theatre which is to cost a total of $30,000.

Grand Junction, Colo.—Bids will be received until Aug. 27 by J. B. Boyer, archt., Grand Junction, for furnishing material and erecting a 3-story basement and roof garden, brick stone and concrete Elk's Temple.

Colorado Springs, Colo.—H. Hoyt Stevens, of the Alta Vista, it is reported, intends making improvements to the building to cost $50,000.

Denver, Colo.—It is reported that Gouger & Tott will erect a $50,000 hotel.

The Directors of the American Mining Congress, it is stated, propose erecting a $1,000,000 mining temple.

**Wilmington, Del.*—Contracts for various parts of the work in connection with the erection of the $200,000 Y. M. C. A. Bldg., it is stated, have been awarded as follows brick work—Excavations and concrete, Dorsey & Smith, of Philadelphia, Pa., structural steel, Belmont Iron Wks., Chester, cut stone work, Diamond Brick Co., Wilmington, granite and blue stone, B. Ridgeway & Sons, Philadelphia, Pa.; roofing, sheet metal work and skylights, Decker & Sons, Philadelphia, Pa.; terra cotta fireproofing, Henry Maurer & Son, Perth Amboy, N. J.; mill work, American Car and Foundry Co. (formerly Jackson & Sharp Co.), Wilmington; electrical work, Garrett, Miller & Co., Wilmington; plastering, L. P. Curlett & Co., Wilmington, carpentry, W. Howard May, Wilmington, wire lathing and partitions, Merritt & Co., Philadelphia, Pa.

Daytona, Fla.—The members of the Indiana River Haulover & Outing Club, according to reports, propose erecting a club house to cost $30,000.

Jacksonville, Fla.—Geo. L. Drew, Secy. Bldg. Com., Masonic Assoc., 106 Main St., writes no contract was let on July 20 for furnishing material and erecting the 7-story Masonic Temple and office building, bids being all too high. The matter was referred back to Grand Lodge, which meets in January; probable cost of building $[illegible]. J. M. Weathers Co., archts., Memphis, Tenn.

The Florida Life Insurance Co. (M. D. Johnson, Pres.) is reported to be considering plans for the erection of an 8 or 9-story office building, on Forsyth and Main Sts.

Pensacola, Fla.—It is reported that the Trus. of the American National Bank have accepted plans for a $200,000 banking and office building.

**Atlanta, Ga.*—F. Gude & Co., according to reports, have secured the contract to erect for the Atlanta Athletic Club at East Lake, a club house to cost $40,000.

Joliet, Ill.—The officials of the Joliet & Southern Traction Co., (L. D. Fisher, Ch. Engr., Joliet), according to reports, propose erecting a station at Joliet and Van Buren Sts. to cost about $40,000.

**Chicago, Ill.*—The contract for building warehouse for the International Harvester Co., at 26th and Leavitt Sts., is reported to have been awarded to the Federal Improvement Co. The building is to be 5 stories, 179x258 ft., and is to cost $200,000. Postle & Mahler, Archts., 204 Dearborn Bldg.

Decatur, Ill.—Bids will be received until Aug. 18 by E. R. Wright, Secy. Pythian Home Bd., Taylorville, for furnishing material and erecting the Illinois Pythian Home at Decatur. Bids to be submited on the following: General contract, ventilating and heating, plumbing, sewerage and gas fitting, electric work. Plans and specifications may be had from Deal & Ginzel, archts., Lincoln, upon a deposit of $10.

Terre Haute, Ind.—The Knights of Columbus Home Assoc., is reported incorporated with a capital of $40,000 for the purpose of erecting a building. Chas. R. Duffin, Chmn. Bd. Trus.

Brazil, Ind.—A. L. Wright is reported to be preparing plans for a 3-story business and lodge hall to be erected for the I. O. O. F.

Jeffersonville, Ind.—Clarke & Loomis, of Louisville, Ky., according to reports, have been engaged to prepare plans for the 2-story Bedford stone banking building to be erected for the Citizens' Natl. Bank (John C. Zulauf, Mgr.), at Spring St. and Court Ave.

Indianapolis, Ind.—Miss Mary Clippinger is reported to have secured a site on E. Market St. on which she intends erecting a 5-story office building.

Hammond, Ind.—It is reported that C. E. Kohl has ordered plans prepared for a theatre to cost about $50,000.

Davenport, Ia.—The Y. M. C. A. Trus., it is stated, have secured a site on which it is proposed erecting a $100,000 building.

Muscatine, Ia.—Mira Hershey, it is stated, will erect a 6-story 70x100 ft. reinforced building to cost $160,000.

**Pittsburg, Kan.*—It is reported that F. C. Borden, of Wichita, has the contract for erecting the $100,000 Century Building at 4th St. and Bway. The building will be equipped with an electric plant.

Wichita, Kan.—U. G. Charles is reported to have completed plans for an $18,000 lodge building to be erected by Odd Fellows Assoc.

**Ashland, Ky.*—Jas. King, of Ashland, it is reported, has secured the contract to erect a business building to cost $22,000.

Louisville, Ky.—The Citizens' Trust Co. is reported incorporated with a capital of $25,000 for the purpose of erecting a business building. G. W. Lowman, E. J. Howard and M. Z. Stannard are the directors.

New Orleans, La.—The Cod Club, recently organized, it is reported, will erect a clubhouse. Capital, $25,000.

Ruston, La.—Several buildings, including the union depot are reported to have destroyed by fire, on July 28.

Waterville, Me.—It is reported that $50,000 has been raised for erecting a Y. M. C. A. Bldg.

Baltimore, Md.—A permit, it is stated, has been issued to the Merchants and Miners' Transportation Co. for an office building and 2 sheds to be erected at Pier 3, on Pratt St. The structure will cost $100,000.

**Holyoke, Mass.*—It is stated that Casper Ranger, 10 Bond St., has secured the contract to erect a brick stockhouse at Front and Hamplen Sts., for the Lyman Mills, the cost to be $40,000.

Minneapolis, Minn.—It is stated that plans have been prepared for an 8-story addition to the 12-story Metropolitan Life building, commonly known as the "Guaranty Loan" building at Second Ave. South and 3d St. The cost of the addition will be nearly $300,000. A new elevator system to cost $50,000 will also be required.

Bertrand & Chamberlin, Bank of Commerce Bldg., are said to be preparing plans for a brick factory to be erected on Central and 13th Aves., N., for the Northland Knitting Co. It will be 50x200 ft., 2-story, with gravel roof, plumbing, electric and gas lighting and steam heating. Geo. McNamee, Pres. A. W. Stevens, Sec.; cost, $20,000. They are also preparing plans for a building at 4th St. and 5th Ave. S., by the Augsburg Publishing Co. It will be 60x100 ft., 4-story and basement, of pressed brick and cut stone, reinforced concrete fireproofing interior work, with electric conduits, gas and steam heating. Plans will be ready for excavating and foundation work soon, and, it is reported, the contract will be let before Sept. 1, to complete this portion of the work this fall. Estimated cost, complete, $75,000.

E. H. Hewitt, archt., 715 4th Ave. S. is preparing plans for a guild house to be erected on Hennepin Ave., near Oak Grave St., for the St. Mark's Episcopal parish. It will be of pressed brick and cut stone. Bids will be taken soon for the work; cost, $25,000.

*The H. N. Leighton Co., 213 S. 6th St., it is stated, has the contract to erect the 3-story reinforced concrete warehouse for the City Sash and Door Co., at $40,000.

The following are reported to be the bids received recently by Long & Long, archts., 830 Hennepin Ave., for erecting a warehouse for the Kellogg-Mackey-Cameron Co., at 4th St. and 9th Ave., S.; J. & W. A. Elliott, 906 Lumber Exchange, $62,982; the H. N. Leighton Co., $63,938; Pike & Cook, $67,900; Groff & Cook, $68,682; John Wunder, $69,964; J. L. Robinson, $70,054; Charles F. Haglin, $70,492.

It is stated that the Barnet & Record Co., Lyceum Bldg., secured the general contract to erect 16 additional tile and steel grain tanks for the North Star Malting Co. plant at Main St. and 18th Ave., N. E. Cost, $35,000.

Duluth, Minn.—It is reported that the Empire Co. intends erecting a theatre to cost about $100,000.

St. Paul, Minn.—It is reported that the Masonic Lodge is contemplating the erection of a temple to cost $250,000.

Hattiesburg, Miss.—The Elks Home Assoc. is reported incorporated and will erect a $50,000 building.

St. Louis, Mo.—J. B. Legg, archt., 715 Locust St., is reported interested in a syndicate which proposes erecting a 15-story hotel at 8th and St. Charles Sts., to be known as St. Charles Hotel.

The McNair & Harris Realty Co., it is reported, has had plans prepared by Mauran, Russell & Garden, 721 Olive St., for an 18-story office building to be erected at Bway. and Pine St., at a cost of $800,000.

Arthur C. Dinglestedt and others are reported to be planning the erection of a building at Delmar and Taylor Sts., to contain a roof theatre, roof garden, skating rink, etc. The cost to be about $300,000.

Walter W. Candy is reported to have purchased a site for the erection of a 5-story business building at St. Charles and 7th Sts.

St. Louis, Mo.—Jas. H. McTage, it is reported, is having plans prepared by A. D. Groves, for a 9-story hotel to be erected at 9th and Pine Sts.

**Kansas City, Mo.*—G. W. Huggins, 216 Shukert Bldg., is reported to have secured the contract for erecting at 8th and Walnut Sts. a brick store building, to cost about $30,000, for Arragon Bldg. Co.

*Hacke & Sexton are reported to have secured the contract for erecting a brick store building for the Jones Co.; cost, about $200,000. Architect, C. A. Smith, Dwight Bldg.

St. Josph, Mo.—The Citizens' Telephone Co. is reported to have accepted plans for the erection of a $65,000 building.

Lewistown, Mont.—J. H. Kent, of Helena, is reported to have completed plans for a business block to be erected by John P. Barnes and his associates on the site of the old Day house. The building will be 4 stories high, the first of native stone the rest of pressed brick.

Dillon, Mont.—The Oregon Short Line R. R. (Wm. Ashton, Ch. Engr., Salt Lake City, Utah) is reported to have decided to expend about $250,000 on improvements here, to consist of a new passenger depot, a new freight depot, the parking of the grounds about the new station and a general rearrangement of the yards.

Goldfield, Nev.—The Lodge of Elks, it is reported, is planning the erection of a building on Columbia St. to cost $50,000.

Dover, N. J.—E. C. Barry, prop. of the Denville Hotel, it is stated, has purchased a site near Dover on which it is proposed erecting a $25,000 hotel.

Atlantic City, N. J.—Newlin Haines, prop. of the St. Charles Hotel, it is reported, is contemplating the erection of a hotel on Connecticutt Ave. and the Boardwalk to cost about $3,000,000.

Rochester, N. Y.—Plans have been filled for the building to be erected for the Genesee Amusement Co. on St. Paul St., at a cost of $75,000.

**Fulton, N. Y.*—E. J. Carver, of Fulton, it is reported, has secured the contract to erect a power house for the Oswego Falls Pulp and Paper Co., at a cost of about $66,000.

**Albany, N. Y.*—M. L. Ryder Bldg. Co., 217 Lark St., is stated to have the contract to erect the First Natl. Bank Bldg. at 35 State St., the Jas. Hunter Htg. & Constr. Co., 1 Church St., the contract for the heating plant in said building, and M. Delehanty's Son, 32 Green St., the contract for the plumbing. The total cost of the work is to be about $125,000.

New York, N. Y.—Plans have been filed for the 5-story home and institution for seamen to be erected at Jane and West Sts. by the American Seamen's Friend Society, of which Rev. Chas. D. Stoddard is Pres.

Long Beach, L. I., N. Y.—It is reported that plans are now being prepared for a $1,500,000 hotel to be erected by Jason Waters, Prop. of the Windsor Hotel, Atlantic City, N. J., on the site of the structure which was destroyed by fire on July 29. The building will be of rinforced concrete steel and contain 800 rooms, each provided with a bath.

Jamaica, L. I., N. Y.—The Jamaica & Long Island Realty Co. (Ernest M. Hungerford, Secy.), 187 Montague St., Brooklyn, it is reported, propose erecting a combination 6-story hotel and theatre in Jamaica to cost about $250,000.

Brooklyn, N. Y.—The Salvation Army, it is stated, has had plans prepared for an industrial home which it is proposed erecting at a cost of about $40,000. C. C. Foster, Asst. to Staff Captain Sylvester, 28 Raymond St., may be able to give further information.

Fargo, N. D.—The Gardner Hotel Co., it is stated, has had plans prepared for a hotel to be erected at a cost of $150,000.

Ashtabula, O.—It is stated that $30,000 of the $50,000 needed to erect the Y. M. C. A. Bldg has been raised.

Cincinnati, O.—The Kroger Grocery & Baking Co., it is stated, has filed plans for a 3-story concrete bakery and canning building, to be erected at Florence Ave. and Des Moines St. Estimated cost, $80,000.

Cincinnati, O.—Saml. C. Tatum Co., manufacturers of machinery, Water and John Sts., it is stated has secured a permit to erect a 5-story brick and steel $32,000 plant in Colerain Ave., between Monmouth and Michigan Sts.; also a one-story foundry to cost $20,000.

Columbus, O.—The members of York Lodge, No. 563, F. and A. M., it is reported, propose erecting a temple at High St. and Smith Place Ave. to cost about $20,000.

**Dayton, O.*—Bids were opened on July 24 by the Bd. of Trus. (Chas. Winchet, Chmn.) for erecting county memorial building and W. Stillwell, of Lafayette, Ind., secured contract for general construction at $155,491, and the Hatfield Electrical Co., of Indianapolis, Ind., for electrical work at $[illegible],469.

All bids received for ventilating and heating the above memorial building opened on July 24 have been rejected and new bids will be received.

Oklahoma City, Okla.—J. H. Gauthier is reported to be preparing to erect a $[illegible] business building.

* *Items marked thus give the names of parties awarded contracts.*

Pittsburg, Pa.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore), it is stated, is considering the erection of warehouses on the 3 city blocks extending from 21st to 24th Sts., and from Smallman St. to Mulberry Ave. The cost, including ground, is reported to be about $3,500,000.

The members of the Y. M. C. A. propose raising $100,000 with which to erect a new building.

*John Ehrlinger, 71 Van Braam St., is stated to have secured the contract to erect a 3-story brick store and flat at Center Ave. and Kirkpatrick St., to cost $23,500.

A permit has been granted for six 4-story brick warehouses to be erected by Jos. W. Craig on 20th and Pike Sts., at a cost of $85,000.

**Philadelphia, Pa.*—A contract was awarded to W. W. Rea's Sons, 1815 Frances St., according to reports, for the erection of a cigar manufactory for Theobald & Oppenheimer at 4th and Cambridge Sts. The building will be five stories and basement, of slow-burning mill construction, 68x186 ft., and cost $90,000.

Philadelphia, Pa.—The Liederkranz Singing Society, it is reported, has secured a site on which it is proposed erectng a 3-story brick, stone and terra cotta building at a cost of $40.000, according to plans prepared by Carl P. Berger, Penn Sq. Bldg.

The members of the Columbia Turnverein, it is stated, have engaged Carl P. Berger, Penn Sq. Bldg., to prepare plans for a club house to be erected at 27th and Cabot Sts., at a cost of $25,000.

*Lynch Bros., Lippincott Bldg., it is stated, have been granted a permit to erect a 3-story brick and stone garage at Broad and Wood Sts., for Louis Bergdoll at a cost of $50,000.

**Yorkville, S. C.*—The J. J. Keller & Co., of Rock Hill, according to reports, have secured the contract to erect the Lockmore mills at Yorkville. The mill is to have 6,000 spindle capacity, and is to cost about $100,000.

Chattanooga, Tenn.—The Bldg. Com. is considering the plans submitted for the Y. M. C. A. Bldg.

Knoxville, Tenn.—Plans are not yet ready for the proposed 10-story bank and office building to be erected here for the Knoxville Banking Co.; probable cost, $160,000. Architects, Richards, McCarty & Bulford, The Ruggery, Columbus, O.

Memphis, Tenn.—It is reported that Mrs. Mary H. Winters is considering the erection of a 4-story store and flat building estimated to cost $50,000.

**Texarkana, Tex.*—The State Savings & Trust Co., it is reported, has awarded the contract for a 5-story business structure on E. Broad St. to Hugh McClennan, of Chicago, Ill. The building is to be of stone, fire brick and steel exclusively. The total cost will be about $150,000.

Silsbee, Tex.—The Santa Fe Hotel, recently burned, will, it is reported, be rebuilt. Plans are stated as being prepared for a $75.000 building.

**San Antonio, Tex.*—The Stewart Constr. Co., of St. Louis, Mo., it is reported, has secured the contract to erect the passenger station for the International & Great Northern R. R. to cost approximately $200,000.

San Angelo, Tex.—The San Angelo Opera House Co. (Chas. W. Hobbs, Pres.), is reported to be considering the erection of a $50,000 opera house.

Danville, Va.—Press reports state that bids will be received until Aug. 15 by Frank Talbott, Chmn. Bldg. Com., for erecting a Y. M. C. A. Bldg. Amberg Chesterman, archt., Lynchburg.

**Richmond, Va.*—It is reported that the contract to erect the R. R. Y. M. C. A. Bldg. has been awarded to A. M. Walkup, of Richmond, at about $60,000.

Seattle, Wash.—It is stated that Wm. S. Ames, of St. Louis, Mo., is the archt. for a 15-story office building to be erected in Seattle.

Maynooth, Ont.—Bids will be received until Aug. 15 by Geo. Collins, Mgr., Central Ontario Ry. Co., Trenton, for constructing a concrete station and platforms at Maynooth, on the Whitney extension.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Woodlawn, Ala.—The members of the Methodist Church, it is reported, are preparing to build a $25,000 edifice. Henry W. R. Hendricks, Pastor.

San Francisco, Cal.—The Women's Occidental Bd. of Missions of the Presbyterian Church has applied for a permit to erect a Japanese mission at Sacramento St. and Prospect Pl. The building will be a 3-story brick and will cost $48,000.

Denver, Colo.—A. J. Aste is reported to have taken out a permit to erect a $30,000 apartment house on Logan and 20th Aves.

Atlanta, Ga.—J. N. Brown, Peters' Bldg., is reported to have secured the contract for the erection of a $20,000 residence.

Columbus, Ga.—About $16,000 of the $20,000 needed to remodel the First Baptist Church is reported to have been raised.

Henry, Ill.—See "Power Plants, Gas and Electricity."

Chicago, Ill.—H. Woods, a South Water St. commission merchant, is reported to have decided to build a residence on Hawthorne Place, near Sheridan Road; it will be 2 stories and attic high, 37x70 ft., and will be constructed of pressed brick and terra cotta, with tile roof; cost, $40,000.

Alton, Ia.—Rev. L. J. Brune, Pastor, R. C. Church, writes that contract will probably be let about Aug. 20 for the erection of an edifice, cost reported to be about $40,000.

Iowa City, Ia.—Bids will be received until Aug. 29 by Wm. J. McChesney, Secy. Bd. Regents, State Univ. of Iowa, for erecting a residence for the president. Proudfoot & Bird, Archts., 625 Flynn Bldg., Des Moines.

New Orleans, La.—It is stated that Theo. Brune, 404 United Cotton Bldg., has prepared plans for a $150,000 edifice to be erected for the Mater Dolorosa R. C. Church edifice.

Shreveport, La.—W. J. Blanchard is reported to be preparing to have a residence erected at this place, estimated to cost about $23,000. Architects, Hugh McLennon & Co., First Natl. Bank Bldg., Chicago, Ill.

**Cambridge, Mass.*—John B. Byrne, 228 Main St., has secured the contract for erecting a convent for St. Mary's Church at Norfolk and Worcester Sts.; cost, $50,000. Architect, E. T. P. Graham, 7 Boylston St.

*J. B. Byrne, 228 Main St., has contract for R. C. Church to be erected on Pearl and Lake Sts.; cost about $65,000.

Grosse Pointe Farms, Mich.—J. L. Hudson is reported to be planning to erect a $50.000 residence at this place, about 4 miles from the Country Club.

**Mankato, Minn.*—C. M. Masters, of Mankato, it is stated, has secured the contract for the steam heating system in St. Peter and Paul's R. C. Church, on N. 5th St., to cost $1,852.

Duluth, Minn.—Frank L. Young & Co., Palladio Bldg., are reported to have prepared plans for the Endion M. E. Church, to be erected on 19th Ave. and 1st St., to cost about $35,000.

St. Louis, Mo.—The members of the Carondelet Christian Church, according to reports, have accepted plans prepared by J. H. Lynch, 715 Locust St., for a $25,000 edifice to be erected at Dover Place, Carondelet. Address Rev. G. E. Ireland.

Edward T. Nugent is reported to have decided to erect a residence at this place from plans prepared by Haynes & Barnett; estimated cost, $20,000.

Omaha, Neb.—L. O. Perley is reported to have completed plans for a residence to be erected at W. Dodge St., at a cost of $25,000.

J. W. Thomas is reported to have decided to erect a brick apartment house at 38th Ave. and Farnham St., to cost about $50,000.

R. C. Strehlow, Contractor, 3813 Charles St., is reported as having plans prepared by F. A. Henninger, N. Y. Life Bldg., for a 3-story apartment house, 165x40 ft. wide, to be erected on 16th and Yates Sts., to cost about $75,000.

Reno, Nev.—Senator Geo. S. Nixon is reported as having plans prepared for the erection of a $100,000 residence at Reno.

Jersey City, N. J.—St. Mark's Episcopal Church and mission house, it is reported were destroyed by fire on Aug. 4.

New York, N. Y.—Plans have been filed for a 6-story apartment house to be built for T. J. McLaughlin's Sons, at B'way. and 143d St., to have accommodation for 44 families; cost, $250,000. Schwartz & Gross, Archts.; also for two 6-story apartment houses, each with accommodations for 24 families, to be built for Emanuel Krulewitch, in 148th St. and Convent Ave.; cost, $320,000. Neville & Bagge, Archts.; also for 2 5-story and basement dwelling houses to be built for Jas. A. McCrea at 41 and 43 E. 65th St.; cost, $100,000. Robt. W. Gibson, Archt.

Watertown, N. Y.—It is stated that plans, specifications and bids will be received until Aug. 22 by R. W. Barker, Chmn. Bldg. Com., for ventilating and heating State St. M. E. Church.

Youngstown, O.—John Todd is reported to have prepared to have a residence erected at this place in the near future, to cost about $50,000.

Cleveland, O.—Harry Cone is reported to have completed plans for a residence to be erected for J. W. Shuster, to cost about $20,000.

**Oakland, Pa.*—Thos. Reilly, of Philadelphia, it is reported, has secured the contract to erect a 3-story brick convent for the Sisters of Mercy on 5th Ave. and Craft Ave. to cost $400,000.

**Rydal, Pa.*—Horace Trumbauer, Archt., Philadelphia, it is stated, has awarded to D. W. Sperry, 1305 Arch St., Philadelphia, a contract for erecting a 3-story stone dwelling and a 2-story Stone stable, costing $50,000, for H. M. Nathanson at Rydal.

Philadelphia, Pa.—The congregation of the Mickve Israel, it is reported is considering the erection of a synagogue to cost about $60,000.

A permit has been granted to Jere L. Cresse to erect a 4-story brick and stone apartment house on 34th and Spring Garden Sts. Estimated cost, $50,000. Milligan & Webber, 520 Walnut St., are the archts.; and to Jas. J. Hartnett, to erect 60 two-story brick brick dwellings, 15x34-ft. each, one on the east and west sides of Wanamaker St., north of Master St.; the total cost will be $96,000.

Dallas, Tex.—Pres. E. O. Tenison, of the City National Bank, it is stated, is having plans prepared for a residence to cost about $25,000.

Dallas, Tex.—Col. J. T. Trezevant is reported to be preparing to erect a residence on Gillespie St. and Cedar Springs Ave., at a cost of $28,000.

Ft. Worth, Tex.—W. C. Stonestreet is reported to have purchased property on Belle Pl. for a residence, to cost about $20,000.

Houston, Tex.—O. H. P. Rudesill & Sons, 1012 Texas Ave., it is reported, have completed plans for a $15,000 edifice to be erected by the Friendship Baptist congregation. W. P. Pullman, pastor.

Elkins, W. Va.—The Lutheran congregation, it is stated, is preparing to build an $18,000 church. Address Pastor.

Spokane, Wash.—Arthur W. Cowley, it is reported, has completed plans for a 3-story apartment house, estimated to cost $80,000, to be erected by the Wellington Investment Co.

Seidsburg, Wis.—It is stated that the members of the St. Peter's Lutheran Church are preparing to erect a $40,000 edifice. Address Pastor.

SCHOOLS.

Notes Arranged Alphabetically by States.

Tuscan, Ariz.—The School Bd. is reported to have appropriated $27,000 to erect schools.

**Berkeley, Cal.*—The Bd. of Regents, it is stated, has awarded to the Contra Costa Constr. Co., the contract for the concrete foundation work for the Doe Library to be erected at the Univ. of California at $33,000. The entire building is to cost about $2,000,000.

San Francisco, Cal.—Stone & Street, it is stated, have submitted plans for the Bay View School.

Denver, Colo.—It is stated that an 8-room brick and stone addition is to be erected to the Academy of the Sacred Heart at Maryland and Taylor Aves.

**Denver, Colo.*—Reynolds & Temple are stated to have secured the contract to erect a dormitory for the Univ. of Denver at about $15,000.

**Boulder, Colo.*—The contract for the new engineering shop at the University of Colorado, it is reported, has been awarded to Ike O. Wilson, of Boulder, for $30,000.

Rockville, Conn.—It is stated that a site has been donated and about $160,000 is available for the Geo. Sykes Manual Training School.

Shelton, Conn.—The following are reported to be the bids recently received for erecting a school: General contract, Beardsley Bldg. Co., $44 220; mason work and fireproofing, T. O'Brien & Son, Bridgeport, $37,500; J. A. Lunn Bldg. Co., Bridgeport, $23,807; carpenter work, Glover & Ritchie, $5,621; roofing, P. Carey & Co., New York, N. Y., $310; plumbing, E. W. Peck & Co., Derby, $2,800; W. P. Kirk & Co., Bridgeport, $2,510; D. H. Kelly, Derby, $2,443; heating and ventilating Merrill & Co., Boston, Mass., $5,764; D. H. Kelly, Derby, $4,973; plumbing, heating and ventilating, Rourke Bros. Co., New Haven, $5,889.

Moscow, Idaho.—The Bd. of Educ. is stated to have awarded to A. L. Vroman, of Moscow, the contract for the heating system and plant for the high school.

**Elkhart, Ind.*—It is stated that the contract for the erection of a power house at the Central School has been awarded to Thos. Foy at $7,964 and for the plumbing at said school to Lane-Pyke Co., of Logansport at $4,670. The contract for the heating has not been awarded as yet.

Indianapolis, Ind.—D. A. Bohlen & Son, Majestic Bldg., are reported to have been engaged by the Sisters of St. Agnes to prepare plans for a 3-story brick and stone academy to be erected at Meridian and 14th Sts. at an estimated cost of $250,000.

Indianapolis, Ind.—Bids will be received until Aug. 13 by the Bd. School Comrs. (J. E. Cleland, Bus. Dir.), for installing, complete, a furnace, gravity heating and ventilating apparatus at School No. 19, Palmer and Quill Sts. Herbert L. Bass & Co., archts., Commercial Club Bldg.

**Richmond, Ind.*—The Bldg. Com. of Earlham College, according to reports, has awarded the contract for the heating plant to Chas. H. Johanning, of Richmond, at $12,000.

**Colfax, Ind.*—Wilcox & Norwood, of Lebanon, are reported to have secured the contract to erect a school here at about $25,000.

Greencastle, Ind.—Bohlen & Son, of Indianapolis, it is reported, have been engaged to prepare plans for a library to be erected at DePauw Univ., 2 stories high, 82x124 ft., and estimated to cost $50,000.

Ames, Ia.—Bids will be received until Aug. 21 by the Bd. Trus. Iowa State College (E. W. Stanton, Secy.), for poultry and dairy farm buildings. Proudfoot & Bird, archts., 625 Flynn Bldg., Des Moines.

Webster City, Ia.—Bids will be received until Aug. 20 by O. A. Hall, Pres. Bd. Educ., for furnishing and installing new boilers and remodeling heating apparatus in the 2 Central School buildings and the erection of boiler house.

Ft. Dodge, Ia.—Bids will be received until Aug. 21 by J. B. Butler, Pres. School Bd., for rebuilding the High School.

**Emporia, Kan.*—Jos. H. Hill, Pres. State Normal School, writes that the contract for erecting branch normal schools at Hays and Pittsburg (bids opened July 27), has been awarded to Leeper & Smith, of Topeka, Kan.; total bid, $97,213.

**Pittsburg, Kan.*—L. B. Kellogg, secy. Bd. of Regents, writes that the contract for erecting a manual training school (bids opened July 30) has been awarded to Leeper & Smith, Topeka, for $97,213.

Portland, Me.—Bids will be received until Aug. 23 by the Com. on Pub. Bldgs. (Nathan Clifford, Chmn.), for the masonry and carpentry for the new Durham St. School. John Calvin Stevens and John Howard Stevens, archts., Oxford Bldg.

Springfield, Mass.—Bids will be received until Aug. 15 by the Com. on city property, (A. F. H. Pittsburg, Chmn) for erecting an addition to Howard St. school. Kirkham & Parlett, archt., 25 Harrison Ave. Separate bids will be received for installing a ventilating and heating system; also plumbing in the addition to said schools.

Pittsfield, Mass.—Wm. Nugent, Secy. School Com., writes that no plans have yet been made for the school to be erected at Finn and 1st Sts.; it will probably be several months before contract is let; it will cost about $75,000.

Saginaw, E. S. Mich.—A new school to cost about $25,000, will soon be erected on the east side.

Lansing, Mich.—It is stated that bids will be received until Aug. 13 by E. M. Lawton, Supt., for erecting a brick chapel at the State Industrial School for Boys. Edwyn A. Boyd, of Lansing, archt.

**Bay City, Mich.*—It is stated that the contract for the plumbing in the West Side school has been awarded to Mann & Ackermann, of Bay City at $2,212.

Rapid River, Mich.—C. D. Chubb of Marquette, is stated to have been engaged to prepare plans for a 2-story 60x65 ft. high school to cost $20,000.

Marquette, Mich.—Charlton & Kuenzli, of Marquette, it is reported, are preparing plans for the museum and library building which is to be erected at the Michigan College of Mines.

* *Items marked thus give the names of parties awarded contracts.*

Negaunee, Mich.—Bids will be received until Aug. 22 by Cyrille Houle, Secy. School Bd., for erecting a high school at Negaunee (not Marquette, as stated in Aug. 3 issue). Plans and specifications may be had upon a deposit of $10. John D. Chubb, Archt., 112 Clark St., Chicago, Ill. Separate bids will be received, same time and place, for plumbing, sewerage and gas-fitting for above school.

Republic, Mich.—Bids will be received until Aug. 26 by the Bd. Educ. (Peter W. Pascoe, Secy.), for erecting a High and Grade School. Charlton & Kuenzli, archts., Marquette.

Crookston, Minn.—It is stated that bids will soon be asked by the State Bd. of Educ. for erecting a $50,000 dining hall and dormitory at the State School at Crookston. Clarence H. Johnston, State Archt., Manhattan Bldg., St. Paul, drew the plans.

*J. E. O'Brien & Co. are reported to have secured the contract for plumbing the washington School, at $860, and the Crookston Plumbing Co. for heating same, at $1,250 (bids opened July 25).

Minneapolis, Minn.—The Bd. of Regents, of the State University, it is stated, has secured land for the university hospital, at Washington Ave. s. e., Pleasant and State Sts. A fireproof memorial hospital will be erected, costing $115,000.

Webster Groves (St. Louis), Mo.—F. B. Miller, Secy. Bd. of Educ., writes that the Citizens on July 27 voted to issue $60,000 bonds for erecting a new school in the Webster Grove School Dist.

**Bozeman, Mont.*—J. H. Baker, acting Secretary State College of Agriculture, writes that the contract for erecting station building for State College Agriculture, (bids opened July 31) has been awarded to Edw. Wagner, of Helena, for $58,945.

**Alliance, Neb.*—The contract for building the Catholic parochial school is reported to have been awarded to F. Hughes, of Council Bluffs, Ia., for $22,642. The building is to be 54x78 ft. and 4 stories high.

Newark, N. J.—Bids received July 16 by the Com. on Schools, Bd. of Educ. for the Technical High School, are stated to have been in excess of the amount available, which is $400,000. The lowest bids received on various parts of the work are as follows: Masonry, Walter E. Isetts, $320,000; carpenter work, Henry M. Doremus & Co., $91,000; plumbing Jæhnig & Peoples, Inc. $62,730; excavating work, Frank Cavalleizzo, $35,000; iron and steel contract, Post & McCord, $124,000; ventilating and heating system, Storms & Co., $78,973; electrical work, Browe Co., $16,887; painting, A. F. Hinrichsen, $4,865, and excavating, Frank Cavalluzzo, $35,000.

*The following are reported to be the contracts awarded by the Com. on Schoolhouses, Bd. Educ., for erecting a 14-room addition to the Burnet St. School (bids received July 16): Iron and steel work, Clements Iron Works, $11,100; carpenter work, Chas. Schaedel & Bro., $13,950; painting, Chas. Stopper, $1,127; plumbing, Ralph B. Schmidt & Co., 62 Ann St., $5,803; roofing and cornice work, Baier & Conrad, 336 Hunterdon St., $5,418; electrical work, Browe Co., 16 Clinton St., $1,715; steam heating and ventilating, Earl & Cook Co., 311 Orange St., $5,733; ventilating apparatus, Earl & Cook Co., $3,434. Bids on masonry work were re-advertised, new bids opened Aug. 1, contract awarded on that date, according to reports, to Isaac R. Guerin, 2 William St., at $49,766.

The following are reported to be the lowest bids received July 25 by the Com. on Schoolhouses, Bd. of Educ., for erecting the Lincoln School, appropriation $80,000: Mason work, Patk Reynolds, $62,000; iron and steel work, Goeller Iron Wks., $13,968; carpenter work, Wm. G. Sharwell & Co., $19,968; plumbing, Jaehnig & Peoples, $3,593; roofing, Baier & Conrad, $6,860; electrical work, The Browe Co., $2,079; heating and ventilating, Storms & Co., $10,265; motor and motor wiring, Bentley Bros., and the General Electrical Equippers, $465 each. Total, $120,494, and the architects fee brings the net total up to $126,519.

It is stated that the plans of Alfred Peter, Market and Washington Sts., for the addition to Bergen St. School, have been accepted.

The Com. of Schoolhouses of the Bd. of Educ., at its meeting on Aug. 2 voted to have Henry J. King, 22 Clinton St., archt. for the Warren St. School, ask alternate bids on the mill construction plan for this school.

Bordentown, N. J.—Bids will be received until Aug. 13 by W. D. Forbes, Chmn., Com. on Manual Training and Industrial School for Colored Youth at the office of the Comrs., Charities and Corrections at Trenton, for furnishing material and erecting a laundry building at said school.

East Orange, N. J.—It is stated that all bids received July 22 for erecting the Lincoln School in the 4th Ward exceeded the appropriation.

Hackensack, N. J.—The Bd. of Educ. is reported to be considering plans submitted for a 10-room school to be erected at Fairmount.

Phillipsburg, N. J.—The Bd. of Educ., it is stated, has decided to erect two 8-room buildings at a total cost of $60,000.

Nyack, N. Y.—It is reported that $75,000 school bonds have been sold.

**Buffalo, N. Y.*—Theo. Guenther & Co., are reported to have secured the contract for the plumbing and gas fitting in the 2-story brick addition to School No. 54 at $1,350.

Lockport, N. Y.—It is reported that the following are the bids received Aug. 1 by the Bd. of Educ. for reconstructing the High St. School: John C. Fogle, $21,657; L. C. Wille, $17,615; L. J. Blackley, $16,995.75; John Moon (2 bids), $17,343.70, and $16,000; Frank Berg, $21,129. Heating: Fuller-Warren Co., $1,500; American Heating & Warming Co., $2,413.

**Fresh Pond, L. I., N. Y.*—The following are the bids opened on July 22 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus in School 88, Fresh Pond, Boro. of Queens: Frank Dobson Co., Inc., $36,900; R. J. Sovereign Co., $38,750; Wm. J. Olvany, $40,940; George A. Suter & Co., $37,671; Blake & Williams, 210 W. 20th St., N. Y. City, $36,238 (awarded contract).

**New York, N. Y.*—The following are the bids opened on July 22 by C. B. J. Snyder for general construction, etc., of additions to and alterations in School 4, Boro. of Manhattan: Thos. Cockerill & Son, $207,500; Thos. J. Waters, $207,500; H. M. Weed & Co., $228,000; Richard E. Heningham, $209,485; Patk. Sullivan, $218,400; P. Gallagher, $208,850; Edmund D. Broderick, $197,900; A. L. Guidone, $204,350; J. & L. Moreland Co., $198,980, and Bottsford-Dickinson Co., 1170 Bway., $196,000 (awarded contract).

Bids were opened same time and place for installing, ventilating and heating apparatus in School 12, Manhatan Boro.: E. Rutzler Co., $63,600; Walker & Chambers, $63,985; Frank Dobson Co., Inc., $69,698; Jas. Curran Mfg. Co., $62,761; Wm. J. Olvany, $71,348, and Blake & Williams, 210 W. 20th St., $60,492 (awarded contract).

Plans have been filed for a 4-story and basement, 53x100 ft., school to be built at 1st Ave. and 56th St. for the R. C. Church of St. John the Evangelist, of which the Rev. Dr. J. F. Flood is rector. Cost, $80,000. Franklin A. Green and John A. Van Pelt, are the archts.

Ellendale, N. D.—Separate bids will be received by E. F. Bodle, Pres., Bd. Trus., until Aug. 20, for installing a heating and plumbing system in dormitory building of state industrial school.

**Carrington, N. D.*—At a recent meeting of Council a resolution is reported to have been adopted accepting the bid of C. Ash & Co., of St. Paul, Minn., at $23,000, according to plans and specifications of Haxby & Gillespie, and authorizing contractor to proceed at once with the erection of boiler house and foundation for school, and that erection of school be postponed until 1908.

Bowbells, N. D.—Fremont D. Orff, 613 Lumber Exchange, Minneapolis, Minn., it is reported, has plans for an 8-room brick school to be erected for Bowbells; cost, $20,000.

Wahpeton, N. D.—Bids will be received by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., until Aug. 29, for furnishing material and constructing employes' quarters with plumbing, steam heat and electric lighting, also a barn and a workshop both with plumbing and electric lighting, all of brick, at the Indian school, Wahpeton. For further information apply to James C. Clifford, Supt. Indian School, Wahpeton.

**Sandusky, O.*—W. E. Carter, Clk. Bd. Educ., writes that the following contracts have been awarded in connection with 7th Ward School: To Brohl & Appell, Sandusky, for ventilating and heating, $10,552; plumbing and gas piping, Hoffman & Conklin, Columbus, $4,105, and electric wiring, Hillyear Electric Co., Mansfield, $290.

Newark, O.—Bids will be received until Aug. 19 by the Bd. Educ. (D. M. Keller, Clk.), for furnishing and installing a ventilating and heating system in the new High School Annex, and changing heating system in the old building. Vernon Redding, archt., Mansfield.

Toledo, O.—Bids will be received until Aug. 26 for furnishing material and erecting a school, including all plumbing and drainagge, electric wiring and the heating and ventilation at the Co. Children's Home. Bacon & Huber, archts., 755 The Spitzer Bldg.; D. T. Davies, Jr., Co. Aud.

**Westerville, O.*—Harry Karg, of Westerville, is reported to have secured the contract to build the Carnegie library at Ottenbein University.

Sabina, O.—It is stated that bids will be received by W. H. Dakin, Clk. Bd. Educ., until Aug. 12 for $40,000 school bonds.

Walter, Okla.—Bids will be received until Aug. 15 by the Bd. Educ., (Chas. G. Mudd, Clk.) for erecting a 10-room school.

Lancaster, Pa.—It is stated that the Trus. of the Stevens' Orphan Home have decided to erect a workshop at the Stevens' Industrial School to cost $20,000.

Allegheny, Pa.—The citizens are stated to have voted in favor of issuing $150,000 bonds for a school in the 10th Ward.

Wilkesbarre, Pa.—It is stated that bids will be received until Aug. 13 by John F. Morris, Chmn. Bldg. Com., for erecting a 4-room school.

**Cranston, R. I.*—Contracts for erecting the 5 schools are stated to have been awarded by the School Com. July 22 as follows: Auburn—General contract, E. K. Watson Company, $18,995; heating, Fuller & Warren, $2,198; plumbing, H. H. Dauphinee, $1,069; total, $22,262. South Auburn—General contract, E. K. Wilson Co., $7,289; heating, Fuller & Warren, $625; plumbing, H. H. Dauphinee, $648; total, $8,562. Edgewood—General contract, E. Turgeon, $20,345; heating, Braley & McLaughlin, $1,845; plumbing, Davey Bros., $1,320; total, $23,510. Arlington—General contract, E. Turgeon, $20,345; heating, Gordon E. Haslam Company, $2,880; plumbing, Davey Bros., $1,320; total, $24,545. Thornton—General contract, L. J. Pierce Co., $15,825; heating, Braley & McLaughlin, $1,225; plumbing, Davey Bros., $940; total, $17,990.

Brookings, S. D.—E. E. Hewitt, of Minneapolis, Minn., is reported to be preparing plans for a ladies' dormitory at the State College, for which the State Legislature is reported to have appropriated $50,000.

Vermilion, S. D.—Bids will be received until Aug. 20 by the Regents of Educ. (Irwin D. Aldrich, Secy.), care of Cataract Hotel, Sioux Falls, for steam heating in the addition to East Hall at the State Univ. at Vermilion. Jos. Schwarz, archt., Sioux Falls.

Sisseton, S. D.—It is stated that the Bureau of Indian Affairs, Washington, D. C., is contemplating making improvements to the Indian School at Sisseton which include the installation of a heating system and water plant. The water system will include a tower 60 ft. high.

Nashville, Tenn.—The Bd. of Educ. is said to be considering the erection of a school on Grove Ave. to cost about $17,000.

Memphis, Tenn.—It is stated that $300,000 school bonds have been sold.

Uvalde, Tex.—A. O. Watson, of Austin, it is stated has submitted plans which have been accepted by the School Bd. for a school to cost about $30,000.

Salt Lake City, Utah.—It is reported that the School Bd. has decided to erect a $15,000 addition to the Summit School on 1 3rd St.

**Spokane, Wash.*—The contract to erect an administration building and gymnasium on the high school grounds, it is reported, has been awarded to L. Lassett at $30,200.

**Everett, Wash.*—Geo. MacKenzie, of Everett, is stated to have secured the contract to erect the Washington School on Rockefeller Ave. at $43,000. The other bids received were Lance & Peters, $53,085; A. E. White, $54,590; R. B. McAdam, $46,500; A. D. McAdam, $47,345. The building is to be a twelve-room structure with basement, and will be constructed of stone and brick.

Bids for plumbing, heating and ventilating were all rejected.

Milwaukee, Wis.—The Statutory Com. of the School Bd., it is stated, has accepted the plans submitted by Guthrie Leenhouts, 102 Wisconsin St., for the 11th Dist. School No. 1.

West Allis, Wis.—The Council is reported to have decided to erect an 8-room school in the 1st Ward, to cost about $18,000.

Superior, Wis.—Van Ryn & De Gelleke, of Milwaukee, it is stated, have been engaged to prepare plans for the addition which it is proposed erecting to the State Normal School at Superior. The building is to be 54x84 ft. of solid brick and cost about $50,000.

Nelson, B. C.—E. C. Arthur, Secy. Bd. School Trus., writes that the $60,000 school bonds have not yet been sold, and it is probable that no contract for the erection of the 12-room school (bids for which were to have been received until July 15) will be let until 1908.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Canon City, Colo.—It is reported that the city of Canon City will donate $2,500, and the towns of South Canon and Prospect Heights have agreed to provide the balance of $4,000 for the purchase of a site of ground, about 2 miles south of this city, for the Tri-Billion Smelting Co., of New York, N. Y., on which they will erect a $200,000 smelting plant. The plant will have a capacity of 50 tons a day on the start. It will be constructed in units of 50-ton capacity, and added to as the business increases. Work will begin on the plant as soon as title to the ground can be secured.

Middletown, Conn.—The plant of the Wilcox & Crittenden Co., on South Main St., is reported to have been badly damaged by fire on July 31. The company manufactures marine hardware.

Ft. Dade, Fla.—See "Water."

Chicago, Ill.—The plant of the Chicago, New York & Boston Refrigerator Co. at 51st St. and Central Park Ave. is reported to have been badly damaged by fire on July 30.

It is reported that the Raymond Lead Co. has secured a site and intends erecting a plant to cost about $500,000.

Des Moines, Ia.—C. C. Cross & Co., Good Blk., are reported to have completed plans for a 3-story 80x40-ft. building to be erected for the Allen B. B. E. Flour Co. (E. W. Allen, Vice-Pres.) at a cost including equipment of $25,000.

Bellevue, Mich.—A. F. Gertsell, Easton, Pa., has bought for the North American Portland Cement Co., of which he is vice-president, about 400 acres of cement rock lands, where a mill of about 3,000 bbl. capacity will be erected. The company has perfected plans for the construction of other plants elsewhere.

St. Louis, Mo.—The General Compressed Air & Vacuum Machinery Co. (John S. Thurman, Pres.), 4436 Olive St., it is stated, has increased its capital stock from $120,000 to $750,000 for the building of a new factory on Jefferson Ave., between Lafayette and Geyer Aves., to cost about $200,000 and cover an acre of ground.

**Paterson, N. J.*—H. Walter Baer is stated to have awarded to the David Henry Bldg. Co., 6 Smith St., the contract to construct a silk mill on the Riverside Section of the city. The plans, which were prepared by Franklin Von Winkle, Colt Bldg., provide for a main mill building 205x52 ft. 8 in., 2 stories high, with basement story under one-half, in addition to silk soaking-room, and separate engine and boiler rooms. In addition to power plant, the new mill will afford about 25,000 sq. ft. of manufacturing space, and will be provided with spacious fireproof silk vaults, offices, elevators, etc. The mill plant will cost about $50,000.

Camden, N. J.—Ballinger & Perrot, 102 S. 12th St., Philadelphia, Pa., it is reported, have completed plans for 2 additional factories and a power plant to be erected for the Victor Talking Machine Co. in Camden at a cost of $200,000. Bids are due on Aug. 7. The 2 additional factories will be erected at 2d and Cooper Sts., and the power plant to be installed will have a capacity of 4,000 h.-p. One of the new buildings will be 92x174 ft., with one story and basement and provisions for five additional stories to be erected later. The other will be 6 stories 80x173 ft. Both buildings will be built of brick with stone trimmings. The column, floor and roof construction will be of reinforced concrete with slag roof covering. Concrete saw-tooth skylights will also be provided in the roof. There will be a tower fire escape in each building, and a passenger elevator and a large freight elevator.

Kingston, N. Y.—G. W. Van Slyke and Wallace N. Horton, of the firm of G. W. Van Slyke & Horton, of Albany, have, it is stated, with the Lopez-Grau Co., of Kingston, purchased a lot 100x230 ft in Kingston on which a modern brick factory, 66x160 ft. and 4 stories high, will be built and equipped with the very latest cigar machines. 1,000 hands will be employed.

West Albany, N. Y.—We are informed that Reed & Stem, 5 E. 42d St., N. Y. City, have prepared plans for the following work contemplated at West Albany for the New York Central & Hudson River R. R. Co.: Boiler, tender and tender truck shop; size of building to be 125x430 ft.; total cost of building, $210,000.

Akron, O.—The Interstate Gypsum Co. (M. F. Dirnberger, Attorney), whose main office is to be in Buffalo, N. Y., is stated to have filed articles of incorporation with a capital of $150,000, and intends erecting a mill in Akron, to cost about $75,000.

Welland, Ont.—Bemis Bros., of Boston, Mass., it is reported, propose erecting a bag factory here, to cost about $1,500,000.

* *Items marked thus give the names of parties awarded contracts.*

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Brooklyn, N. Y.—We are informed that no bids were received on Aug. 1 for furnishing labor and material required for the final disposition of ashes, street sweepings and rubbish in Brooklyn Boro., the period of the contract to be for 5 yrs., beginning Oct. 28, 1907.

Philadelphia, Pa.—The Comrs. of Lower Merion Township are reported to have decided to install a garbage disposal plant, and have instructed Robley A. Warner, C. E., Supt. of Health and Drainage, to make complete survey, etc., and report to Board on disposal of ashes and garbage. State Senator Algernon B. Rogers is Pres. Bd. Comrs. Lower Merion Township.

Ft. D. A. Russell, Wyo.—The lowest bid opened on July 22 by Capt. V. K. Hart, Constr., Q. M., U. S. A, Cheyenne, for furnishing material and constructing a garbage crematory at Ft. D. A. Russell is reported to have been submitted by Lewis & Kitchen. of Chicago, Ill., at $7,800.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received by Maj. H. Jervey, Corps Engrs., U. S. A., until Oct. 5, for building lock and dams Nos. 2 and 3 and Lock-tenders house, Tombigbee River, Ala., as advertised in The Engineering Record.

Franklin, Ark.—Bids will be received by Capt. G. M. Hoffman, Corps Engrs., U. S. A., Vicksburg, Miss., until Oct. 5, for building Lock and Dam No. 8 in Ouachita River at Franklin Shoals, Ark., as advertised in The Engineering Record.

Jacksonville, Fla.—Bids will be received by Maj. Francis R. Shunk, Corps. Engr., U. S. A., until Aug. 26, for building jetties at Biscayne Bay, Fla., as advertised in The Engineering Record.

The following are the bids opened on July 24 by Maj. Francis R. Shunk, Corps. Engrs., U. S. A., for dredging in St. Johns River, about 165,000 cu. yds. soft material and clay and rock (price given per cu. yd.): North American Dredging Co., New York, N. Y., $3.99; Roderick G. Ross, Jacksonville, Fla., $3.10; P. Sanford Ross, Inc., Jersey City, N. J., $3.03, and Southern Dredging Co., Mobile, Ala., $3.98.

**Chicago, Ill.*—The Otis Elevator Co., of New York, N. Y., has secured the contract for installing dumbwaiter in U. S. Post Office for $2,095.

**Marshalltown, Ia.*—F. G. Dunahugh, Aud. of Story County at Nevada, Ia., writes that the contract for constructing ditch or drain in Marshall-Story Drain Dist. No. 1 (bids opened Aug. 1) has been awarded to Tho. Dangerfield, of Rinard, Ia. The work to consist of the following: Sec. 1, 5,130 ft. open ditch, about 6,500 cu. yds.; Sec. 2, 5,000 ft. 30-in. and 2,800 ft. 26-in. tile; Sec. 3, 3,000 ft. 20-in., 3,400 ft. 18-in. 5,400 ft. 16-in. and 4,200 ft. 12-in. tile; Sec. 4, 5,500 ft. 16-in., 1,200 ft. 14-in. and 1,800 ft. 12-in. tile; Sec. 5, 2,000 ft. 20-in., 4,100 ft. 18-in. and 2,900 ft. 14-in. tile; Sub Branch 1 of Sec. 5, 1,800 ft. 12-in. and 200 ft. 14-in. tile.

Boone, Ia.—It is stated that bids will be received until Aug. 13, by the Co. Aud. for constructing drain No. 30, in 10 sections.

Ft. McHenry, Md.—Bids will be received until Aug. 14 by J. Barry Mahool, Pres. Bd. Awards, Baltimore, for constructing a pile and timber pier and for certain other work connected therewith for use of the Naval Reserves, Ft. McHenry. O. F. Lackey, Harbor Engr.

Sandwich, Mass.—Bids will be received by the Bd. of Harbor and Land Comrs. at Boston, until Aug. 16 for improving entrance to Scorton harbor at East Sandwich, as advertised in The Engineering Record. Frank W. Hodgdon, Ch. Engr., Boston.

Boston, Mass.—Bids were opened on Aug. 2 by the Harbor and Land Comrs. as follows:

Excavating channel at Rock Creek, Eastham and Orleans, 14,000 cu. yds. (price per cu. yd.): Chas. H. Thomas, Middleboro, Mass., 43 cts.; W. H. Ellis, 17 Milk St., Boston, 49 cts.

Building stone jetties at Cuttyhank Harbor, 4,000 tons (price per ton): E. S. Belden & Sons, 217 Laurel St., Hartford, Conn., $3.59; and Thomas & Connor, Middleboro, Mass., $2.54.

Detroit, Mich.—Bids will be received until Aug. 26 by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., Detroit, for furnishing and delivering about 600 M ft. timber at St. Marys Falls Canal.

Grand Rapids, Mich.—The Bd. of Pub. Wks., (Chas. M. Wilson, Pres.) on July 25 rejected bids received on July 18 for constructing 4,000 cu. yds. concrete walls, excavating 18,000 cu. yds. rock and 8,000 cu. yds. earth in connection with flood protection work at Grand Rapids, all being too high and will receive new bids. L. W. Anderson, City Engr.

Ft. Snelling, Minn.—Bids will be received until Sept. 3 by Maj. Amos W. Kimball, Constr. Q. M., U. S. A., St. Paul, for constructing a ditch at Ft. Snelling.

**St. Paul, Minn.*—The Otis Elevator Co., of New York, N. Y., has secured the contract for installing elevator in U. S. Post Office, for $6,245.

**Breckenridge, Minn.*—The State Drainage Bd. at St. Paul on July 31 awarded contracts for constructing Otter Tail River cut-off in Wilkin County and the Grand Marais extension in Polk County to the Standard Drainage Co., of Windom, at 9.3 cts. and 10.5 cts. per cu. yd., respectively.

**Billings, Mont.*—Gaynon & Co. have secured the contract for constructing Danford drain ditch in Yellowstone County, for $25,000. Henry Gerharz, of Billings, Engr. in Charge.

Portsmouth, N. H.—The following are the bids opened on July 20 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for blasting in front of Quay Wall, Navy Yard, Portsmouth, N. H. (Specification No. 1,548): (*a*) Dredge whole area complete in accordance with plan; (*b*) for complete work with modifications. R. G. Packard Co., 130 Pearl St., New York, N. Y., *a* $169,000; Eastern Dredging Co., 247 Atlantic Ave., Boston, Mass., *a* $126,867, *b* $122,867; Johnston & Virden, Lewes, Del., *a* $122,900, *b* $119,900.

Camden, N. J.—Bids will be received until Aug. 15, by Jas. E. Hewett, Chmn., Finance Com., City Council, for $15,000 Park bonds.

Hackensack, N. J.—Bids will be received by the Hackensack Improv. Comn. until Aug. 20 for the construction of a flat topped concrete drain connecting the brook with the sewer in Union St., together with wing walls, air flap, guard rail, etc., as advertised in The Engineering Record. Engineer, Lemuel Lozier, Bank Bldg.

Newark, N. J.—The following are the bids opened on July 29 by Col. D. W. Lockwood, Corps Engrs., U. S. A., Army Bldg., New York, N. Y., for dredging in Newark Bay and Passaic River, N. J. (price given per cu. yd. scow meas.): Midland Land & Improvement Co., 62 Cedar St., New York, N. Y., 16.25 cts.; Morris & Cummings Dredging Co., 17 State St., New York, N. Y., 23.2 cts.; P. S. Ross, Inc., 277 Washington St., Jersey City, N. J., 36.4 cts.; the International Contr. Co., 17 Battery Pl., New York, N. Y., 26 cts.; the W. H. Beard Dredging Co., 21 State St., New York, N. Y., 22.9 cts.

Albany, N. Y.—The following are the totals of bids opened on July 31 by F. C. Stevens, State Supt. Pub. Wks., for improving the New York State canals as follows:

Contract 12, Erie Canal—Secs. 6 and 7—Excavation of the canal, protection of sides, construction of Lock 23 and appertaining structures; bridges. abutments and bridge approaches and other incidental details, bet. deep water at west end of Oneida Lake, Sta. 2720, and Mosquito Point Bridge over Seneca River at east end of Contract No. 5, Sta. 5074. Length of contract, 43.73 miles: One bidder, Stewart, Kerbaugh, Shanley & Co., 527 5th Ave., N. Y. City, $3.391,716. Engineer's estimate, $3,082,500.

Contract 14, Erie Canal—Sects. 1, 2 and 3.—Dredging channel in Mohawk River bet. west end of Contract 11, Sta. 305, and a point near upper Mohawk aqueduct, at Rexford Flats, Sta. 1046; for constructing dam 2 below Crescent Aqueduct, Sta. 305; Dam 3 and Lock 7 above Vischer's Ferry, Sta. 839; Dam 9 and Lock 13 at Yosts, Sta. 2954; Dam 10 and Lock 14, at Canajoharie, Sta. 3307; Dam 11 and Lock No. 15, at Ft. Plain, Sta. 3554; retaining dam at Mindenville, Sta. 3865; highway changes; culverts, and incidental work appertaining thereto. Length of contract, 15 miles: The Scofield Co., Pennsylvania Bldg., Philadelphia, Pa., $3,357,776; Arthur W. Luce, 100 Bway, N. Y. City, $2,935,763; Stewart, Kerbaugh, Shanley & Co., 527 5th Ave., N. Y. City, $3,163,137. Engineer's estimate, $2,875,570.

Contract 35, Oswego Canal—Sect. 1.—Excavating canal and protecting sides; constructing Locks 7 and 8; bulkheads, culverts, spillways and incidental details between 0.56 of a mile above Utica St. Bridge, Sta. 1164+00, and harbor line north of Bridge St. Bridge, Sta. 1208+85, at Oswego, N. Y. Length of contract, .85 of a mile: Stewart, Kerbaugh, Shanley & Co., 527 5th Ave., N. Y City, $865,689; Gilmour-Horton-Allen Co., Sandy Hill, N. Y., $739,261. Engineer's estimate, $752,760.

**Mineola, L. I., N. Y.*—Revised bids for constructing sea-wall on east side of Shore road at Oyster Bay are reported to have been opened on Aug. 5 by the Nassau County Superv. and the Abbott-Gamble Co., 32 Bway., N. Y. City, secured the contract for both sections of wall, at $5.16 per cu. yd.

New York, N. Y.—Bids will be received by J. A. Bensel, Comr. Docks, until Aug. 19, for furnishing materials and putting in place rip-rap stone, as per Contract 1191.

Bids will be received by J. A. Bensel, Comnr. Docks, until Aug. 21, for furnishing material and building freight sheds on Piers Nos. 60, 61 and 62, and on the adjacent bulkhead platforms or lateral extensions bet. W. 19th and W. 22d Sts., on the North River, Boro. Manhattan, as per Contract 1091.

The lowest bid opened on Aug. 1 by Moses Herrman, Pres. Park Bd., for furnishing material and grading and improving grounds north of the Municipal Building in Crotona Park was submitted by A. E. Guidone, at the following bid: 500 cu. yds. earth excav., 80 cts.; 5,000 cu. yds. rock excav., $1.80; 25 cu. yds. concrete in found., $5; 50 cu. yds. rubble masry. in found., $5.50; 100 cu. yds. broken range Ashler masry., $9.50; 675 cu. ft. limestone masry., $3.50; 20 walk basins, ea., $80; 600 lin. ft. 8-in. vitr. pipe, $1.25; 250 lin. ft. blue-stone steps, $1.95, and 100 sq. yds. asphalt walk, $3.05; total, $16,255. Totals of other bids: Tony F. Carfagno, $18,135; Leahy Contr. & Constr. Co., $17,125; McHarg-Barton Co., $17,162; Chas. Schneider, $17,350, and Frank T. Willigan, $22,534.

Bids will be received by J. A. Bensel, Comr. of Docks, until Aug. 15, for furnishing material and repairing and rebuilding a portion of the pier at the ft. of W. 132d St., North River, known as Pier No. 122, as per contract 1,087.

Bids will be received by Denis A. Judge, Deputy and Acting Comr. Docks, until Aug. 15 for furnishing lumber as per contract No. 1058 (class 3).

**New York, N. Y.*—The following are the bids opened on July 26 by J. A. Bensel, Comr. of Docks, for furnishing and building freight sheds on piers Nos. 54 and 56, North River, bet. foot of Little W. 12th and 14th Sts., on the Chelsea section, with lateral extensions on the adjacent bulkhead platforms: Snare & Triest Co., 143 Liberty St., $1,132,580 (awarded contract); R. P. & J. H. Staats, $1,219,000; Post & McCord, Inc., $1,154,000, and Geo. B. Spearin, $1,240,167.

West Point, N. Y.—Bids will be received by Maj. J. M. Carson, Jr., Q. M., U. S. M. A., until Aug. 26 for furnishing treated iron pipe for electric ducts, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received by J. A. Bensel, Comr. Docks, New York City, until Aug. 16 for furnishing material and placing filling in rear of ferry structures at 39th St. Boro. Brooklyn, as per contract 1,088.

The Sinking Fund Comn is stated to have received favorable report on proposition of Dock Comr. Bensel to get lands on South Brooklyn waterfront for docks. It is part of his proposition to expend $29,000,000 for improvements of New York City's docking properties. These lands lie between 28th and 36th Sts. and 57th and 61st Sts. and 2d Ave. and the bay. The land for which the purchase was approved will cost about $6,000,000. The improvements will cost $10,000,000. Some of the piers are to be 1,200 ft. long and will be steel and fireproof.

Stapleton, S. I., N. Y.—Bids will be received by J. A. Bensel, Comr. of Docks, New York City, until Aug. 16 for furnishing materials and placing filling in the rear of the ferry structures at Canal St., Stapleton, Boro. Richmond, as per contract 1,089.

Dayton, O.—Bids will be received until Sept. 3 by Edw. Phillips, City Aud., for $31,000 bonds, to provide money to purchase land for park purposes and for improving same.

Panama.—See "Power Plants, Gas and Electricity."

Panama.—Bids will be received by D. W. Ross, Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Aug. 14, for furnishing motor car, railway water tanks and accessories, duplex pumps, boilers, steel, brass, drag scrapers, friction wheels for dredge, dipper lips for steam shovels, ore cement, mechanical shakers, etc., as per Circular 381.

The following are the bids recently received by the Isthmian Canal Comn. at Washington, D. C., for dump cars: (*a*) all metal, 12 yds. capacity; (*b*) double dump cars, 4 yds. level full: Standard Steel Car Co., Pittsburg, Pa., *a* $622,500, delivery at New York, Dec. 1, 1907, to Apr. 1, 1908; Western Wheel & Scraper Co., Aurora, Ill., *a* $645,000, *b* $25,415, delivery at New York, Oct. 1 to Mar. 1; W. J. Oliver Mfg. Co., Knoxville, Tenn., *a* $562,500, *b* $25,725, delivery at New Orleans, La., Oct. 1, 1907; Russell Wheel & Fdry. Co., Detroit, Mich., *a* $697,500, delivery at New York, Nov. 15 to Mar. 10, 1908; American Car & Fdry. Co., New York, *a* $554,000, delivery at New York, Jan. 15 to Mar. 1; Continental Car & Equipment Co., New York, N. Y., *b* $19,515, delivery at New York in Nov.; Kilgore-Peteler Co., Minneapolis, Minn., *b* $28,635, *b* alternate $28,175; Arthur Kappel, Pittsburg, Pa., *a* $665,000, *b* $34,500, delivery in New York, June 1, 50 cars, Class 2 delivery Feb. 1, 100 cars; Kilgour & Jacobs Mfg. Co., Columbus, *a* $215,000, deliver 25, New York, Jan 15, then 25 monthly, b $25.875, alternate *a* 50 cars, $107,500.

**Potsville, Pa.*—The Lehigh Coal & Navigation Co. is reported to have awarded to the Portland Contrg. Co., of Pottsville, a contract for the construction of a mine tunnel between Mauch Chunk and Nesquehoning by which 13 collieries in the Panther Creek Valley will be drained. The tunnel will be 7,200 ft. in length.

Erie, Pa.—Governor Stuart is reported to have appointed a commission of five, including Chas. Olds, M. H Taylor, Henry Beckman, all of Erie, to have charge of the construction of a public steamboat landing or wharf on state lands at the port of Erie; the recent State Legislature appropriated $150,000 for its construction.

Providence, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps. Engrs., U. S. A., Newport, until Sept. 4 for dredging in Providence Harbor, R. I., as advertised in The Engineering Record.

**Norfolk, Va.*—The Chas. McDermott Constr. Co., of Washington, D. C., is reported to have secured the contract for grading work in connection with the steel pier of the Virginia Ry., now under construction at Sewall Point; contract price for this work is $49,000.

Bids will be received by Maj. Jos. E. Kuhn, Corps Engrs., U. S. A., until Sept. 4 for dredging harbor at Norfolk, as advertised in The Engineering Record.

Bremerton, Wash.—Press reports state that all bids opened on July 27 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for Dry Dock No. 2, of concrete and granite at the Navy Yard, Puget Sound, Wash. (Specification 1542) have been ejected, as none of the bids submitted contemplated completing the dry dock as desired by the Navy Dept. appropriation, $1,250,000.

Two Rivers Harbor, Wis.—Bids will be received by Maj. W. V. Judson, Corps. Sngrs., U. S. A., Milwaukee, until Sept. 3, for removing old pier, building pile pier, dredging, etc., at Two Rivers Harbor, Wis., as advertised in The Engineering Record.

Toronto, Ont.—Bids will be received until Aug. 13 by E. Coatsworth (Mayor), Chmn. Bd. Control, for sheet piling on north side of Keating's channel, near foot of Cherry St.

PROPOSALS OPEN.

For Proposals see Pages 65, 66, 67,68 and 70.

WATER.

Aug. 13. **Reservoir, Columbus, O.** ....**Jul. 20**
Aug. 13. Wells, pumps, etc., Hamilton, O......Aug. 3
Adv. Aug. 3.
Aug. 14. Supplies, New York, N. Y............Aug. 3
Aug. 14. Well, etc., Bradentown, Fla. ....Aug. 10
Aug. 15. Pump engine, Gloucester City, N. J..Aug. 10
Aug. 16. C. i. pipe,, Homestead, Pa............Aug. 10
Aug. 19. **Filter plans, Sacramento, Cal.........Jun.**
Adv. Jun. 1 to 15.
Aug. 19. Steel tank, Lombard, Ill. ....Aug. 3
Aug. 19. Pump sta. add., etc., Geneseo, Ill....Aug. 10
Aug. 20. **Water wks., Russellville, Ark. ....Jul. 20**
Adv. Jul. 13 to 27.
Aug. 20. Water wks., Lewisburg, Tenn........Aug. 10
Adv. Aug. 10.
Aug. 20. Water wks., Dawson, Minn...........Aug. 10
Aug. 20. Fire hydrants, Louisville, Ky.........Aug. 10
Aug. 21. Dam and tunnel, Springfield, Mass....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 21. Well strainer, Ft. Hancock, N. J.......Jul. 27
Aug. 22. Filters and pipe exten., Philadelphia, Pa.Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 22. Filters and pipe exten., Philadelphia, Pa.Jul. 27
Adv. Aug. 3.
Aug. 23. Laying pipe, Westborough, Mass.....Aug. 10
Aug. 26. Pump. plant, Ashland, O. ....Aug. 10
Adv. Aug. 10.
Aug. 26. Pumping engine, Cumberland, Md....Aug. 10
Adv. Aug. 10.
Aug. 27. C. i. pine, etc., Cincinnati, O. ....Aug. 3
Aug. 29. Electric machinery and sand washer pumps, Philadelphia, Pa. ....Aug. 10
Adv. Aug. 10.
Aug. 30. Tank and trestle, Ft. Dade, Fla......Aug. 10
Adv. Aug. 10.

* *Items marked thus give the names of parties awarded contracts.*

Aug. 30. Water wks., Bradshaw, Neb. ....Aug. 10
Aug. —. Water wks., Rockingham, N. C. ....June. 29
Sep. 2. Standpipe, etc., Carrington, N. D. .....Aug. 3
Adv. Aug. 3, 10.
Sep. 3. Pipe, Victoria, B. C. ....Aug. 10
Sep. 3. C. I. pipe, Kansas City, Mo. ....Aug. 10
Sep. 4. Hauling and laying pipe, New Orleans, La. Adv. Jun. 29 to Aug. 10. ....Jun. 29
Sep. 6. Concrete conduit, Montreal, Que. .....Aug. 10
Adv. Aug. 10.
Sep. 8. Pump engine, boilers, etc., Louisville, Ky. Adv. Jul. 27 to Aug. 10. ....Jul. 27
Sep. 14. Valves and gates, Manila, P. I. ....Jul. 27
Adv. Jul. 27.

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 12. New York, N. Y. ....Aug. 3
Aug. 13. Gas City, Ind. Adv. Aug. 3 ....Aug. 3
Aug. 13. Evansville, Ind. ....Aug. 3
Aug. 13. Cleveland, O. ....Aug. 10
Aug. 13. South Bend, Ind. ....Aug. 10
Aug. 13. Wildwood, N. J. ....Aug. 10
Aug. 14. Lewistown, Mont. ....Jul. 20
Aug. 14. Oakland, Cal. ....Aug. 3
Aug. 14. Columbus, O. ....Aug. 3
Aug. 14. Brooklyn, N. Y. ....Aug. 10
Aug. 14. Indianapolis, Ind. ....Aug. 10
Aug. 15. Camden, Ark. ....Jul. 20
Aug. 15. Arkadelphia, Ark. ....Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 15. Howell, Mich. ....Aug. 3
Aug. 15. Elizabeth, N. J. ....Aug. 3
Aug. 15. Long Island City, N. Y. ....Aug. 10
Aug. 15. Staples, Minn. ....Aug. 10
Aug. 15. Newark, N. J. ....Aug. 10
Aug. 15. Winnebago, Minn. ....Aug. 10
Aug. 16. Cincinnati, O. ....Jul. 27
Aug. 17. Norwood, O. Adv. Aug. 3, 10 ....Aug. 3
Aug. 17. Asbury Park, N. J. ....Aug. 3
Aug. 19. Riverside, Cal. Adv. Aug. 3, 10 ......Aug. 3
Aug. 19. Cape Girardeau, Mo. ....Aug. 3
Aug. 19. Webster Groves, Mo. Adv. Aug. 10 ..Aug. 3
Aug. 19. Port Clinton, O. ....Aug. 10
Aug. 19. Whitesboro, N. Y. ....Aug. 10
Aug. 19. Denison, Ia. ....Aug. 10
Aug. 20. Cleveland, O. ....Jul. 27
Aug. 20. Collinsville, Ill. ....Aug. 3
Aug. 20. Athol, Mass. Adv. Aug. 10 ....Aug. 10
Aug. 21. Canal, Dover, O. ....Aug. 10
Aug. 21. Great Lakes, N. Chicago, Ill. ....Aug. 3
Adv. Aug. 3, 10.
Aug. 22. Fayetteville, Ark. ....Aug. 3
Aug. 23. Delaware, O. ....Aug. 3
Aug. 26. Omaha, Neb. Adv. Aug. 3, 10 ....Aug. 3
Aug. 26. Baden, Pa. ....Aug. 10
Aug. 28. Louisville, Ky. Adv. Aug. 10 ....Aug. 10
Aug. 30. Evansville, Ind. Adv. Aug. 3 ....Jul. 27
Aug. 30. Ft. Dade, Fla. Adv. Aug. 10 ....Aug. 10
Aug. —. Rockingham, N. C. ....Jun. 29
Sep. 1. Eatonton, Ga. ....Apr. 13
Sep. 1. Alton, Ill. ....Jun. 8
Sep. 2. Shelby, N. C. ....Aug. 3
Sep. 3. New Philadelphia, O. ....Aug. 3
Sep. 11. New Orleans, La. ....Jul. 6
Adv. Jul. 6 to Aug. 10.
Aug. 31. Elroy, Wis. ....Aug. 10
Oct. —. Eaton, O. ....Aug. 3

BRIDGES.

Aug. 13. Trenton, N. J. ....Aug. 3
Aug. 15. Tonawanda, Pa. ....Aug. 3
Aug. 15. Mt. Gilead, O. ....Aug. 3
Aug. 15. Logan, O. ....Aug. 10
Aug. 16. Cincinnati, O. Adv. Aug. 3 ....Aug. 3
Aug. 16. Pateros, Wash. ....Aug. 10
Aug. 16. Portland, Colo. ....Aug. 10
Aug. 17. Substructure, Chicago, Ill. ....Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 17. Superstructure, Chicago, Ill. ....Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 17. Port Clinton, O. ....Aug. 3
Aug. 19. Council Bluffs, Ia. Adv. Aug. 3 ......Aug. 3
Aug. 19. Youngstown, O. ....Aug. 10
Aug. 19. Andover, O. ....Aug. 10
Aug. 20. San Juan, P. R. ....Jul. 20
Aug. 20. Ft. Myer, Va. ....Aug. 3
Aug. 20. Emporium, Pa. ....Aug. 10
Aug. 20. Des Moines, Ia. ....Aug. 10
Aug. 23. Sandusky, O. ....Aug. 10
Aug. 24. Lebanon, O. ....Aug. 3
Sep. 2. Tarboro, N. C. ....Aug. 3
Sep. 4. Columbus, O. ....Aug. 10
Sep. 9. Plaquemine, La. ....Aug. 10
Sep. 30. Santiago, Chile ....Jul. 13

PAVING AND ROAD MAKING.

Aug. 13. Ecorse, Mich. ....Aug. 3
Aug. 13. South Bend, Ind. ....Aug. 10
Aug. 13. Clinton, Ia. ....Aug. 10
Aug. 13. Huntington, Ind. ....Aug. 10
Aug. 13. Lima, O. ....Aug. 10
Aug. 13. Greensburg, Ky. ....Aug. 10
Aug. 13. Chicago, Ill. ....Aug. 10
Aug. 13. Wildwood, N. J. ....Aug. 10
Aug. 14. Brooklyn, N. Y. ....Aug. 3
Aug. 14. New York, N. Y. ....Aug. 3
Aug. 14. Columbus, O. ....Aug. 3
Aug. 14. Ft. Riley, Kan. ....Aug. 10
Aug. 14. Toledo, O. ....Aug. 10
Aug. 14. Marshall, Tex. ....Aug. 10
Aug. 15. Long Island City, N. Y. ....Aug. 3
Aug. 15. Cairo, Ill. ....Aug. 3
Aug. 15. Appleton, Wis. ....Aug. 3
Aug. 15. Elizabeth, N. J. ....Aug. 3
Aug. 15. Bloomington, Ill. ....Aug. 10
Aug. 15. Long Island City, L. I., N. Y. ....Aug. 10
Aug. 16. Covington, Ind. ....Aug. 3
Aug. 16. Olympia, Wash. ....Aug. 10
Aug. 17. Huntsville, Ala. ....Aug. 3
Aug. 17. Bedford, Ind. ....Aug. 3
Aug. 17. Oshkosh, Wis. ....Aug. 10
Aug. 17. Ottawa, O. ....Aug. 10
Aug. 17. Terre Haute, Ind. ....Aug. 10
Aug. 19. Steubenville, Ohio ....Jul. 27
Aug. 19. Westfield, N. J. ....Aug. 3
Aug. 19. Tipton, Ind. ....Aug. 10
Aug. 19. Winona, Minn. ....Aug. 10
Aug. 19. Pembroke, N. H. ....Aug. 10
Aug. 19. New York, N. Y. ....Aug. 10
Aug. 19. New Haven, Conn. ....Aug. 10
Aug. 19. Toledo, O. ....Aug. 10
Aug. 20. Cleveland, O. ....Jul. 27
Aug. 20. Sandusky, O. ....Aug. 10
Aug. 20. Woodcliff Lake, N. J. ....Aug. 10
Aug. 20. Dundee, Mich. Adv. Aug. 10 ....Aug. 10
Aug. 21. Aberdeen, Wash. ....Jul. 27
Aug. 21. Ft. St. Philip, La. ....Aug. 3
Aug. 21. Brooklyn, N. Y. ....Aug. 10
Aug. 21. Carrollton, O. ....Aug. 10
Aug. 22. Ashland, Wis. ....Aug. 3
Aug. 22. New York, N. Y. ....Aug. 10
Aug. 22. Newark, O. ....Aug. 3
Aug. 23. Mt. Gilead, O. ....Aug. 10
Aug. 23. Janesville, Wis. ....Aug. 10
Aug. 23. Etna, N. J. ....Aug. 10
Aug. 24. Whipple Barracks, Ariz. ....Aug. 3
Aug. 26. Ft. Washington, Md. ....Aug. 3
Aug. 26. Jacksonville, Fla. ....Aug. 10
Aug. 26. Pittsburg, Pa. ....Aug. 10
Aug. 27. Pensacola, Fla. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 29. Smethport, Pa. Adv. Aug. 10 ......Aug. 10
Aug. 30. Marshfield, Mo. ....Aug. 3
Sep. 3. Beardstown, Ill. ....Aug. 3
Sep. 3. New Philadelphia, O. ....Aug. 3
Sep. 3. Dayton, O. ....Aug. 10

POWER PLANTS, GAS AND ELECTRICITY.

Aug. 12. New York, N. Y. ....Aug. 3
Aug. 13. Washington, D. C. ....Aug. 3
Aug. 13. Hamilton, O. Adv. Aug. 3 ....Aug. 3
Aug. 14. L'Anse, Mich. ....Aug. 10
Aug. 14. Bloomington, Ill. ....Aug. 10
Aug. 15. Blackwells Island, N. Y. ....Aug. 3
Aug. 15. San Angelo, Tex. ....Aug. 3
Aug. 15. Ft. Leavenworth, Kan. ....Aug. 10
Aug. 15. Brooklyn, N. Y. ....Aug. 10
Aug. 16. Henry, Ill. ....Aug. 10
Aug. 19. West Point, N. Y. Adv. Aug. 3, 10 ..Aug. 3
Aug. 19. Tecumseh, Neb. ....Aug. 3
Aug. 20. Dawson, Minn. ....Aug. 10
Aug. 22. Hawaii ....Aug. 3
Aug. 22. Blackwell's Island, N. Y. ....Aug. 10
Aug. 22. Panama ....Aug. 10
Aug. 23. Newark, N. J. ....Aug. 10
Aug. 26. West Point, N. Y. Adv. Aug. 10 ....Aug. 10
Aug. 27. Arlington, O. ....Aug. 10
Aug. 29. San Francisco, Cal. ....Aug. 3
Aug. 31. Lebanon, Pa. ....Jul. 20
Sep. 3. Winnipeg, Man. ....Jun. 15
Adv. Jun. 15 to Jul. 20.
Sep. 5. Campbellford, Ont. ....Aug. 10
Sep. 16. Milton, O. ....Aug. 10

BUILDINGS.

Aug. 13. Boilers for htg plant at pub. bldg., Minnehaha, Minn. ....Jul. 20
Aug. 13. School, Montclair Hts., N. J. ....Aug. 3
Aug. 13. School, Indianapolis, Ind. ....Aug. 10
Aug. 13. Hospital pavilion, Boston, Mass. ......Aug. 10
Aug. 13. School, Bordentown, N. J. ....Aug. 10
Aug. 13. School, Wilkesbarre, Pa. ....Aug. 10
Aug. 13. School, Lansing, Mich. ....Aug. 10
Aug. 14. Hospital, Canfield, O. ....Jul. 27
Aug. 14. Add. to pub. bldgs., Youngstown, O. ..Jul. 27
Aug. 14. School, Mt. Healthy, O. ....Aug. 3
Aug. 14. Pub. bldg., National Home, Wis. ......Aug. 3
Aug. 14. Pub. bldg., Ionia, Mich. ....Aug. 3
Aug. 14. Pub. bldg., New York, N. Y. ....Aug. 10
Aug. 15. School, Albany, N. Y. ....Jul. 20
Aug. 15. Light-house dwell., Stonington, Conn. ..Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 15. Add. to pub. bldg., Philadelphia, Pa. ...Aug. 3
Aug. 15. Courthouse, Bakersville, N. C. ....Aug. 3
Aug. 15. Post bldg., add'n, etc., Ft. Myer, Va. ..Aug. 3
Adv. Aug. 3.
Aug. 15. Sanatorium, Howell, Mich. ....Aug. 3
Aug. 15. School, Springfield, Mass. ....Aug. 10
Aug. 15. Courthouse, Riverhead, N. Y. ....Aug. 10
Aug. 15. School, Walter, Okla. ....Aug. 10
Aug. 15. Bus. bldg., Maynooth, Ont. ....Aug. 10
Aug. 15. Pub. bldg., Boston, Mass. ....Aug. 10
Aug. 15. Pub. bldg., Humboldt, Ia. ....Aug. 10
Aug. 15. Jail, Kalkaska, Mich. ....Aug. 10
Aug. 15. Hospital addition, Wilkinsburg, Pa. ....Aug. 10
Aug. 15. Y. M. C. A. bldg., Danville, Va. ......Aug. 10
Aug. 16. School, White Castle, La. ....Aug. 3
Aug. 16. Indus. plant, Chicago, Ill. ....Aug. 3
Aug. 16. Htg. school, Ashland, O. ....Aug. 3
Aug. 16. Pub. bldg., Simcoe, Ont. ....Aug. 10
Aug. 16. Church, Henry, Ill. ....Aug. 10
Aug. 17. Htg. School, Wheelersburg, O. ....Aug. 3
Aug. 17. School, Minot, N. D. ....Aug. 3
Aug. 17. Jail, Huntsville, Ala. Adv. Aug. 10..Aug. 10
Aug. 17. Htg. pub. bldg., Columbus Grove, O..Aug. 10
Aug. 18. Bus. bldgs., Decatur, Ill. ....Aug. 10
Aug. 19. Post office, Alexandria, Minn. ....Jul. 13
Aug. 19. School, Newark, O. ....Aug. 10
Aug. 20. Post office, Decatur, Ill. ....Jul. 13
Aug. 20. Add. to hospital, Athens, O. ....Jul. 27
Aug. 20. School, Spearfish, S. D. ....Jul. 27
Aug. 20. Courthouse, Lumberton, N. C. ....Aug. 3
Aug. 20. School, Montevallo, Ala. ....Aug. 3
Aug. 20. Htg. school, Ellendale, N. D. ....Aug. 10
Aug. 20. Church, Alton, Ia. ....Aug. 10
Aug. 20. School, Webster City, Ia. ....Aug. 10
Aug. 20. Pub. bldg., Newberry, Mich. ....Aug. 10
Aug. 20. Htg. school, Vermilion, S. D. ....Aug. 10
Aug. 21. School, Ft. Dodge, Ia. ....Aug. 10
Aug. 21. Pub. bldg., Superior, Wis. ....Aug. 10
Aug. 21. Pub. bldg., New York, N. Y. ....Aug. 10
Aug. 21. Remodeling hospital, Sandusky, O. ....Aug. 10
Aug. 21. School, Ames, Ia. ....Aug. 10
Aug. 22. Post office bldg., Jackson, Miss. ......Jul. 20
Aug. 22. School, Negaunee, Mich. ....Aug. 10
Aug. 22. Pub. bldg., Orient, O. ....Aug. 10
Aug. 22. Htg. church, Watertown, N. Y. ....Aug. 10
Aug. 22. Pub. bldg., Des Moines, Ia. ....Aug. 10
Aug. 23. Pub. bldg., Delaware, O. ....Aug. 3
Aug. 23. School, Portland, Me. ....Aug. 10
Aug. 24. Add. to courthouse, Bismarck, N. D. ..Aug. 3
Aug. 26. School, Republic, Mich. ....Aug. 10
Aug. 26. School, Toledo, O. ....Aug. 10
Aug. 26. Pub. bldg., Milwaukee, Wis. ....Aug. 10
Aug. 27. Post office, Trenton, N. J. ....Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 27. Bus. bldgs., Grand Junction, Colo. ....Aug. 10
Aug. 28. Courthouse, Anthony, Kan. ....Aug. 10
Aug. 28. Pub. bldg., Cleveland, O. ....Aug. 10
Aug. 28. Hotel, Ft. Smith, Ark. ....Aug. 10
Aug. 28. Improv. armory, Portland, Ore. ....Aug. 10
Aug. 29. School, Wahpeton, N. D. ....Aug. 10
Aug. 29. Pub. bldg., Peru, Ind. ....Aug. 10
Aug. 29. Pub. bldg., Long Island City, N. Y. ..Aug. 10
Aug. 29. Residence, Iowa City, Ia. ....Aug. 10
Aug. 31. School, Storrs, Conn. ....Aug. 3
Aug. 31. Jail, Williamsport, Ind. ....Aug. 3
Aug. —. Hospital, Saskatoon, Sask. ....May 4
Sep. 1. Bus bldg., Walla Walla, Wash. ......Apr. 20
Sep. 1. Y. M. C. A. bldg., Tacoma, Wash. ......Aug. 3
Sep. 3. Post office bldg., Waterton, N. Y. ......Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 3. Pub. bldg., Bloomfield, Ind. ....Aug. 3
Sep. 3. Pub. bldg., Washington Barracks, D. C. Aug. 10
Sep. 3. Add. to jail, Buffalo, N. Y. ....Aug. 10
Sep. 4. Post office bldg., Quincy, Mass. ......Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 5. Pub. bldg., Evansville, Ind. ....Aug. 3
Sep. 11. Jail, Eureka, Cal. ....Aug. 3
Sep. 16. Marine Hospital, Buffalo, N. Y. ......Aug. 3
Adv. Aug. 3, 10.
Sep. 16. Marine hospital, Pittsburg, Pa. ......Aug. 10
Sep. 17. U. S. Mint bldg. repairs, San Francisco, Cal. ....Aug. 10
Sep. 19. Post office, Muscatine, Ia. ....Aug. 10
Sep. 23. Post office exten., Cedar Rapids, Ia...Aug. 10
Sep. 30. Bus. bldg. plans, Harrisburg, Pa. ...Aug. 3
Sep. —. Hotel, New Orleans, La. ....Jun. 29
Oct. 3. Court house plans, La Moure, N. D. ..Aug. 10
Dec. —. Industrial plants, Ft. William, Ont. ...May 11
—— Bus. Bldg., Charles Town, W. Va. ....Jun. 15
Adv. Jun. 15, 22.
—— Court house plans, Pulaski, Tenn ....Jul. 27
—— Bus bldg., Markham, Tex. ....Aug. 3
—— Indus. plant., Cobalt, Ont. ....Aug. 3

MISCELLANEOUS.

Aug. 12. Dredging, Philadelphia, Pa. ....Jul. 20
Adv. Jul. 20 to Aug. 10.
Aug. 12. Dredging, Washington, D. C. ....Jul. 20
Adv. Jul. 20 to Aug. 10.
Aug. 12. Tunnel, New York, N. Y. ....Aug. 3
Aug. 12. Vacuum system, New York, N. Y. ......Aug. 3
Aug. 12. Garb. disp., Jersey City, N. J. ....Aug. 3
Aug. 12. Elevator, New York, N. Y. ....Aug. 3
Aug. 13. Pier sheds, New York, N. Y. ....Aug. 3
Aug. 13. Piling, Toronto, Ont. ....Aug. 10
Aug. 13. Drain, Boone, Ia. ....Aug. 10
Aug. 14. Iron and steel, etc., Wheeling, W. Va. ..Jul. 20
Adv. Jul. 20 to Aug. 10.
Aug. 14. Breakwater, Key West, Fla. ....Jul. 27
Aug. 14. Elevators, Washington, D. C. ....Aug. 3
Aug. 14. Pier, Ft. McHenry, Md. ....Aug. 10
Aug. 14. Motor car, etc., Panama ....Aug. 10
Aug. 15. Dredging, Cheboygan, Mich. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 15. El. ry. wk., Boston, Mass. ....Aug. 3
Aug. 15. R. R. work, Pullman, W. Va. ....Aug. 3
Aug. 15. Lumber, New York, N. Y. ....Aug. 10
Aug. 15. Pier wk., New York, N. Y. ....Aug. 10
Aug. 16. Dredging, Tampa, Fla. ....Jul. 20
Adv. Jul. 20 to Aug. 10.
Aug. 16. Jetty work, Galveston, Tex. ....Jul. 27
Aug. 16. Harbor wk., Sandwich, Mass. ....Aug. 10
Adv. Aug. 10.
Aug. 16. Filling in Stapleton, N. Y. ....Aug. 10
Aug. 16. Filling in Brooklyn, N. Y. ....Aug. 10
Aug. 17. Breakwater work, Oswego, N. Y. ......Jul. 20
Adv. Jul. 20 to Aug. 10.
Aug. 19. Dredging, New London, Conn. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 19. Culvert, St. Paul, Minn. ....Aug. 3
Aug. 19. Riprap, New York, N. Y. ....Aug. 10
Aug. 20. Drain, Hackensack, N. J. ....Aug. 10
Adv. Aug. 10.
Aug. 20. Wharf, etc., San Diego, Cal. ....Jun. 22
Adv. Jun. 22, 29.
Aug. 20. Dredging, McClellansville, S. C. ......Aug. 3
Adv. Aug. 3, 10.
Aug. 20. Fence at post, Ft. Ontario, N. Y. ......Aug. 3
Adv. Aug. 3, 10.
Aug. 20. Dredging, Boston, Mass. ....Aug. 3
Aug. 20. Htg. pub. bldg., Columbus, O. ....Aug. 10
Aug. 21. Pier work, New York, N. Y. ....Aug. 10
Aug. 22. Dredging, Brunswick, Ga. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 22. Sanitary fixtures, etc., Panama ......Aug. 10
Aug. 23. Dredging, Savannah, Ga. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Aug. 24. Wall, Bremerton, Wash. ....Jul. 27
Aug. 26. Embankment, Governor's Island, N. Y. H. Adv. Jul. 27 to Aug. 10 ....Jul. 27
Aug. 26. Jetty wk., Jacksonville, Fla. ....Aug. 3
Adv. Aug. 3, 10.
Aug. 26. Timber, Detroit, Mich. ....Aug. 10
Aug. 26. Treat. iron for electric ducts, West Point, N. Y. Adv. Aug. 10 ....Aug. 10
Aug. 27. Track wk., Cincinnati, O. ....Aug. 3
Aug. 28. Dredging Block Island, R. I. ....Aug. 3
Adv. Aug. 3, 10.
Aug. 30. Dredge, Philadelphia, Pa. ....Aug. 3
Adv. Aug. 3, 10.
Aug. 30. Rock excav., Portland, Me. ....Aug. 3
Adv. Aug. 3, 10.
Aug. 30. Ice plant, Ft. Dade, Fla. ....Aug. 10
Adv. Aug. 10.
Aug. 31. Jetty wk., Galveston, Tex. ....Aug. 3
Adv. Aug. 3, 10.
Sep. 1. R. R. wk., Webb City, Mo. ....Aug. 3
Sep. 2. Wharf plans, Gothenburg, Sweden....Apr
Adv. Apr 27 to May 18.
Sep. 3. Pier wk., Two Rivers, Harbors, Wis. ..Aug. 10
Adv. Aug. 10.
Sep. 3. Ditch, Ft. Snelling, Minn. ....Aug. 10
Sep. 4. Dredging, Norfolk, Va. Adv. Aug. 10. Aug. 10
Sep. 4. Dredging, Providence, R. I. ....Aug. 10
Adv. Aug. 10.
Oct. 5. Lock and dam, Franklin, Ark. ....Aug. 10
Adv. Aug. 10.
Oct. 5. Lock and dam, Mobile, Ala. ....Aug. 10
Adv. Aug. 10.
Sep. 9. Dredging, Honolulu, H. I. ....Aug. 3
Adv. Aug. 3, 10.
Sep. 10. Ditch work, Sibley, Ia. ....Jul. 27
Adv. Jul. 27 to Aug. 10.
Sep. 30. Searchlight outfit, Washington Barracks, D. C. ....Aug. 3
—— Excav. and concrete wk., Ithaca, N. Y. Aug. 3
Adv. Aug. 3.

CURRENT NEWS SUPPLEMENT

AUGUST 17, 1907.

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ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

THE NEWAYGO SEPARATOR FOR CEMENT MILLS.

Mr. W. J. Bell, of the Newaygo Portland Cement Co., Newaygo, Mich., has designed and thoroughly tested a separator in which the frame is rigid; the frame is not shaken, but the screen cloth itself is vibrated like a piano wire. This apparatus is styled the Newaygo Separator, and is an inclined vibrating screen, framed and enclosed in steel. The screen cloth is automatically kept in strong, uniform tension, and is vibrated by small hammers constantly tapping its protected surface. This simple device for producing vibrations is stated to secure astonishingly rapid and sharp movements, yet of small amplitude, which give material in process of screening the least possible projection, and offer it innumerable opportunities to pass through clean screen openings before the tailings escape at the foot. Owing to the rapid and effective vibrations of the screen cloth, the small cleansing shocks cannot become deadened because the screen automatically maintains its required tension.

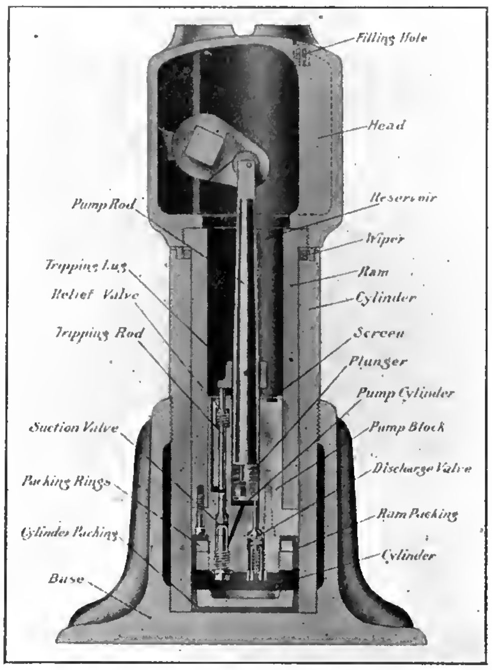
All its surface works all the time, and it is considered no small advantage that coarse wire and meshes can be used to produce the desired output with the same screening area, for large wires are clearly more durable than small ones. In an inclined, vibrating screen, coarse wire can be successfully used for very fine work, because inclining the screen surface diminishes the size of the openings, and the little sharp vibrations keep the openings clear.

The fineness of output can be controlled to a considerable extent by changing the inclination of the screening surface. The screen, or screens, (one or two screens of any mesh up to 100 may be used) can be readily withdrawn for replacement or cleaning. The output that may be obtained from Newaygo Separators is from ½-in. up to 200 mesh, with capacities varying from 40,000 lbs. per hour down to 1,000 lbs., according to the material and fineness of screen cloth.

Mr. Bell has seventeen of these inclined, vibratory separators in constant use at the Newaygo Portland Cement Works, and believes that they solve the problem of simple, economical screening. The Sturtevant Mill Company, of Boston, Mass., has underwritten this separator, and hereafter it will be sold exclusively by them.

A NEW HYDRAULIC JACK.

A type of hydraulic jack shown in the accompanying illustration has recently been brought out by the Joyce-Cridland Co., of Dayton, Ohio. It consists essentially of two hollow concentric steel cylinders machined to sliding contact with each other. The outer cylinder is fixed in a steel base and the joint packed with a copper cup to withstand great pressure. The inner cylinder is closed at the top by the "head" and at the bottom by the "pump block," thus making a reservoir, in which the filling



A NEW HYDRAULIC JACK.

liquid is held. The pump block derives its name from the small pump contained therein and connected through the piston rod to the lever outside. Movement of the lever forces the liquid through suitable valves into the space between the lower end of the pump block and the bottom of the outer cylinder, thus pushing the base and head apart with a positive movement.

The filling device consists of a plug with two valves one opening inwardly and the other outwardly, both being held to their seats by springs of sufficient stiffness to prevent the liquid escaping as the jack is laid down, but sufficiently elastic to allow the entrance and escape of air to and from the cistern as the ram is worked up and down.

A wiper, placed around the ram at the top of the cylinder, is saturated with oil and, in addition to wiping off any dirt from the ram as it passes down into the cylinder, lubricates the sliding surfaces, keeping them smooth and unscored. Should this foreign matter be allowed to enter the cylinder, it would also cut the packing on the pump block and get under the valves, rendering them leaky. The liquid is strained by a fine screen on top of the pump block, through which all liquid must pass before reaching any delicate working parts and surfaces.

When the plunger is raised, the suction valve is drawn from its seat and oil passes through the filter screen, through the passage shown in the extreme left of the pump block, past the suction valve and into the pump cylinder. When the plunger is lowered, the suction valve closes and the liquid forces the discharge valve open, passes by it and through the openings in the side of the valve cap into the cylinder, thus raising the ram. The illustration shows the plunger at the lower end of the normal stroke, in which position the end of the pump rod touches the discharge valve stem and at the same time the tripping lug further up on the pump rod comes into contact with the suction valve stem. A slight additional length of stroke trips the jack, opens both these valves and allows the liquid to pass back to the cistern by the same channels through which it came. A lug on the operating lever coming in contact with a stop on the outside of the ram head prevents the stroke from being prolonged so far that the end of the plunger would touch the valve openings. The speed at which the jack may be lowered in this way is regulated by the pressure which the operator exerts on the lever.

A valve is provided on the upper end of the tripping rod, which prevents the pump taking air when the level of the liquid has fallen below the tripping rod. This valve is held by a spring of sufficient stiffness to prevent its unseating under the suction of the pump plunger, but it yields to the positive action of the tripping lug.

The tripping mechanism is positive and under the direct control of the operator. It does not depend upon springs and cannot fail to act. In starting, the lever is turned with the lug pointing up, raised slightly to remove the pressure in the pump cylinder and to allow the suction valve to fall from its seat, then lowered slowly to allow the liquid to flow back from the pump cylinder to the reservoir.

THE KANSAS CITY PORTLAND CEMENT WORKS.

A 2,000-bbl. mill has recently been completed by the Kansas City Portland Cement Co. on the Atchison, Topeka & Santa Fe R. R. near Kansas City. It is built from the plans of Mr. W. H. Caffery and is located at the base of a high bluff composed of alternate strata of limestone and shale.

Tramway tracks lead from the base of quarry to the crusher building, cars being conveyed to the inside and dumped. The building is located on the side of the bluff on a bench quarried out of solid rock, built of concrete, and is 100 feet above the center of the main building. The crushed rock and shale pass by gravity from crushers to the dryers, which are located in a separate dry house, built on a bench below the crusher building. Below the crusher building are located the dry storage bins. These bins are built of concrete and have a capacity of 900 cu. yds. The tops of these bins are built up to a level with the floor of the dryer building, and extend partially under it. The crusher building is equipped with two Austin gyratory crushers, which are operated by electric motors. In the dry room are two rotary dryers, each 60 ft. long and 6 ft. in diameter. Dry shale storage is provided for with a bin built beside the rock storage bins. The capacity of this bin is 300 cu. yds.

Special weighing cars are operated on narrow gauge tracks which extend into the dry material bins from the edge of the bluff at the bottom of which is located the main plant. This track is all under cover and the man in charge at this plant has telephone connection with the chemical laboratory. The main mill building is 100x530 ft., and is 30 ft. in height to eaves. The foundations of this building are all of concrete, the superstructure being steel frame, sided with 2 in. of 1 to 3 cement mortar, laid on expanded metal. A concrete floor is laid throughout this building.

Eighty per cent. of the power used in the entire plant is supplied directly by the machines, and the other twenty per cent. is transmitted electrically. The power plant occupies a space of 110x100 ft. in the main building, and is divided from the remainder of the interior of this building by dust proof walls, constructed in the same manner as the outside walls.

The engine room contains two 1,000 h.-p. cross-compound condensing straight Corliss engines and three 200 k.-w. 440 volt, three-phase, alternating-current generators, two of which are each directly connected to a 300 h.-p. four-valve Hamilton engine, the third being held in reserve, is connected by belt to a main line shaft. The engines are all operated condensing being served by a C. H. Wheeler surface condenser.

Water is supplied to the plant from a pumping plant located on the river bank above high water mark. Here Worthington centrifugal pumps are used, being operated by electric motors. The bottom of the pump pit is below extreme low water mark. Water is siphoned into the pump pit through two 14-in. pipes, a small air pump being used to start the flow.

The raw materials machine room contains six Jeffrey hammer mills ,and six Allis-Chalmers tube mills, all be-

ing belted to the main line shaft extending through the room. In addition to screens built in these mills, the materials are passed through rotary screens, the tailings of which are passed back to the hoppers by bucket elevators.

The finished raw product of the tube mills is raised by bucket elevators to screw conveyors, which deliver same to the housings of the kilns in the adjoining kiln room.

The kiln room is 100x210 ft., and contains four 8x125 ft. rotary kilns, and three 6x60 ft. rotary clinker coolers. Four kilns are set in pairs, with one housing to each pair. The kilns are fired by oil, at three pounds pressure, the Little low pressure system with blower and large nozzle being used. Each kiln is driven separately by a 30 h.-p. variable speed motor. Rotary coolers are also each driven separately by 30 h.-p. variable speed motors. Clinker is delivered by a bucket elevator from the kilns to coolers. Coolers discharge into one-yard, side-dump, ball-bearing Koppel cars, which are raised to an elevated track by a motor driven freight elevator.

The clinker storage bin, built of reinforced concrete, has a clinker capacity of 50,000 barrels. The finishing room is 68x126 ft. in size, and contains 14 Bradley Griffin mills, and four standard Allis-Chalmers tube mills. Bucket elevators handle the product from Griffin mills to tube mills.

From the elevator, the finished product is delivered to cement stock house by screw conveyors. The stock house is built of reinforced concrete divided into four bins, which have a total capacity of 125,000 barrels. The packing room in the stock house is equipped with electrically driven packing machines, and automatic scales. Two switch tracks, each 1,000 ft. long, extend alongside the stock house, giving ample room for cars.

THE SYLPHON REGITHERM.

A new system for controlling the temperature in rooms, developed by Mr. W. M. Fulton, of Knoxville, Tenn., is based on the use of a device called the Sylphon Regitherm. The system operates by moving the dampers of the heating furnace or boiler by means of a "motor" forming a part of the regitherm, which is placed in the room or hall from which the temperature is to be controlled. The motor is a metal vessel with deep corrugations in its wall like those of a Japanese lantern. This wall is a single piece of metal, which not only give flexibility to the vessel, but also a very large radiating surface. Although such a wall 5 in. in diameter and 3 in. long weighs but 12 ounces, it readily resists a hydraulic pressure of 100 lb. to the square inch. Within this vessel is hermetically sealed a small amount of a volatile liquid having a vapor which changes its pressure at the rate of 0.5 lb. per square inch for each degree change in temperature. This liquid does not have to be replenished. The head of the vessel is 30 sq. in. in area, so that a change of a single degree in the temperature develops a force of 15 lbs. within the motor. This force is sufficient to expand the end of the vessel a distance of half an inch, which movement is magnified eight-fold in being transmitted to the dampers in the furnace flue. Means are provided within the regitherm to neutralize the spring in the vessel, so that there is no increased resistance offered by the expansion or contraction. It is stated that a change of a single degree in the room where the device is placed is sufficient to move the damper, if the latter is balanced and moves freely. The closed vessel operates a short lever arm at the back of the regitherm, causing it to rise with a rising temperature and fall with a falling temperature. A small wire cable leads from this lever arm to the damper. The range of operation is from 60 degrees to 80 degrees, and it can be adjusted to operate at any temperature within these limits by simply turning a key. The strength of the motor is shown by the fact that a man weighing 150 lbs. will be lifted several inches by it inside of a minute by placing a lighted candle under it. This device is being manufactured by the Fulton Company, of Knoxville.

THE WEST POINT, GA., HYDRAULIC DEVELOPMENT.

Among recent development in the South the undertaking of the West Point Mfg. Co., of West Point, Ga., is one of the most extensive. This company through its engineers, Mr. Chas. T. Main, of Boston, and his hydraulic expert, Mr. John F. Porter, is constructing a dam across the Chattahoochie River at Langdale, Ala., a few miles below West Point, and a 200x40-ft. reinforced concrete power house.

The hydraulic equipment will consist of two 39 in. and eight 60 in. Improved New American Turbines of the vertical shaft type and arranged for installation in open concrete flumes. These turbines will operate under 13 ft. head and develop over 3,000 h.-p. The vertical shafts will be extended sufficiently to place the gearing and harness work for the horizontal shafts on the power house floor approximately 10 ft. above head water level. Each of the 39 in. wheels will drive by means of bevel mortise gears a horizontal shaft at 165 r. p. m., from which a 100-kw. exciter will be belted. Four of the 60 in. turbines will drive a 750-kw. 150 r. p. m. three-phase revolving field, 60-cycle generator, there being two turbines on each side of the generator, connected by bevel gears to horizontal shafts which will be directly coupled to both ends of the generator shaft. The other four 60 in. turbines will be divided into two units, each consisting of two wheels geared to a common jack shaft and direct connected to a 550-kw. 150 r. p. m. three-phase revolving field 60 cycle generator.

There will be 19 sets of head gates for regulating the flow of the water into the wheel chambers, each of these gates being about 8½ ft. wide and 10½ ft. high, of the double stem type and operated by special worm wheel and spur rack hoisting mechanisms.

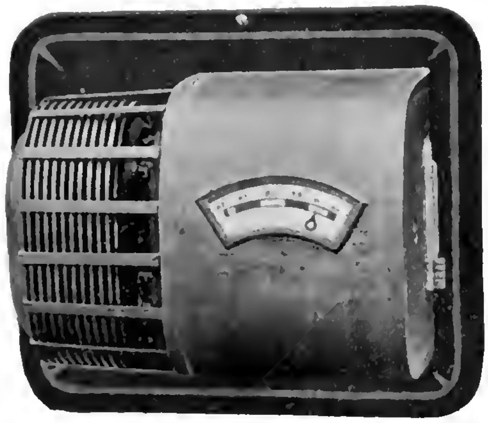
The water wheel machinery complete with all gearing, harness work, head gate hoists, trash racks, etc., is being built by the Dayton Globe Iron Works Co., of Dayton, Ohio, while the electrical apparatus will be furnished by the Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa.

PERSONAL NOTES.

Louis C. Dittler, engineer of the street department of Newark, N. J., died recently at his home in that city, aged 53 years.

Mr. La B. Harrison, of New York City, has been appointed division engineer of the Eastern Division of the New York State Canals.

Mr. E. L. Trowbridge has been appointed assistant to the engineer of construction of the Louisville & Nashville R. R., at Nashville.



THE SYLPHON REGITHERM.

Mr. Harry Magoun, superintendent of the Marine Department of the Maryland Steel Co., has resigned to become assistant to the president of the New York Shipbuilding Co.

Mr. S. B. Storer, consulting electrical engineer, has opened an office at 732 University Block, Syracuse, N. Y., where he will give special attention to power transmission problems and enterprises, and investigations and reports of electrical and industrial undertakings.

Maj. William C. Langfitt, Corps of Engineers, U. S. A., commandant of the Engineer School and Washington Barracks, has been appointed a member of the board to consider field equipment for engineer troops, in place of Maj. E. E. Winslow, Corps of Engineers, relieved.

Mr. J. Robertson Stewart has resigned as assistant engineer of the Chicago track elevation of the Pennsylvania R. R. to become chief engineer of the George C. Callahan Co., of Chicago, for whom he will be in charge of concrete work on the Illinois Central R. R., at Memphis.

Messrs. James Wigman and Albert Martin, formerly employed by Messrs. Lewis & Kitchen, of Chicago, the latter as chief engineer, have formed a partnership, under the firm name of Martin & Wigman, for the practice of general engineering and contracting at Green Bay, Wis.

The Fourth Annual Convention of the National Association of Cement Users will be held at Buffalo, N. Y., Jan. 20 to 25, 1908. The old 65th Regiment Armory has been engaged for the exhibition, and the convention probably will be held in the same building. Mr. Richard L. Humphrey, of Philadelphia, is president.

Lieut.-Com. William H. G. Bullard, U. S. N., has been appointed as head of the department of electrical engineering that is to be established at the United States Naval Academy. Prof. Stimson J. Brown has been designated as head of the combined department of mathematics and mechanics, to succeed Prof. William W. Hendrickson, retired.

Mr. W. W. Horn, formerly superintendent of the Memphis Asphalt Co.'s plant at Memphis, Tenn., and of Mr. A. G. Pugh's plant in Columbus, O., has been engaged by the Board of Public Service of the latter city to superintend the construction of the Columbus municipal asphalt repair plant, and to act as general superintendent of asphalt repair work when the plant has been completed.

At the meeting of the Association of American Portland Cement Manufacturers at the Marlborough-Blenheim Hotel, Atlantic City, Sept. 11, Mr. E. S. Larned will read a paper on what the cement industry needs in the control and regulation of the cement block trade, Mr. R. L. Humphrey will give an illustrated talk on the work of the Structural Materials Testing Laboratory at St. Louis, and Mr. J. B. Porter will discuss electrical equipment in cement plants.

Mr. L. H. Taylor, supervising engineer in charge of the Government reclamation project at Fallon, Nev., has resigned, but will remain in the service as consulting engineer until the works, which are about completed, are put in service. Mr. J. M. Quinton, supervising engineer for Colorado and Utah, is to have his territory extended to include Nevada, and Mr. R. R. McGregor, at present assistant to Mr. Taylor, will have direct charge of the work at Fallon.

Mr. John C. Ostrup, of New York City, has been appointed to the chair of structural engineering at the Stevens Institute of Technology, Hoboken, N. J. He is a graduate of the Polytechnic School in Copenhagen, and has had wide experience in structural work, particularly elevated railways, having been closely associated with the construction of the Chicago elevated lines and designing engineer of the Boston Elevated R. R. Upon the completion of the latter road he engaged in private practice as a consulting engineer. Later he was associated with the American Bridge Co.

Prof. Charles Henry Benjamin has resigned as professor of mechanical engineering at the Case School of Applied Science, Cleveland, Ohio, to become dean of the Schools of Engineering of Purdue University, Lafayette, Ind., succeeding Prof. W. F. M. Goss, who resigned recently to become dean of the College of Engineering of the University of Illinois. Prof. Benjamin has been associated with the Case School as professor of mechanical engineering since 1899, prior to which time he was, for three years, engaged in engineering practice and, for six years, instructor and professor of mechanical engineering in the University of Maine, of which institution he is a graduate.

BUSINESS NOTES.

The Building Engineering Co. has been organized in Los Angeles, Cal., and has opened offices in the Citizens' National Bank Building. Mr. C. Wesley Roberts, the president, designed and constructed the Lankershim and the Citizens' National Bank Building, Los Angeles. Mr. E. R. Robinson, formerly operating chief engineer of the Los Angeles Pacific R. R., is chief engineer for the company, and Mr. J. W. Mitchell, attorney. The company's specialty will be reinforced concrete construction.

Milliken Brothers (Inc.), New York, are continuing in full operation their structural steel and ornamental metal departments, and are prepared to quote favorable deliveries on all kinds of steel and iron fabrication.

The Pennsylvania R. R. has installed in its Altoona shops a 5-ton, 3-motor electric traveling crane of 55 ft. span, built by the Northern Engineering Works, Detroit, Mich.

The Superior Steel Co., Carnegie, Pa., has placed an order with the Wm. B. Scaife & Sons Co., Pittsburg, for a 4,750 h.-p. addition to its We-Fu-Go water softening and purifying plant. The water is taken from Chartiers Creek and makes the company independent of the city supply.

The Chapman Valve Manufacturing Co. has combined its St. Louis storerooms and offices and located at 16 S. Twelfth St. Within the last year the company has doubled the capacity of its factory.

Important orders for school house ventilating apparatus recently taken by the B. F. Sturtevant Co., Boston, Mass., include the following: Oyler School, Cincinnati, O.; Caney School, Kansas City, Mo.; New School, Independence, Kan.; Elliott School, Lincoln, Neb.; Old High School, Kansas City, Mo.; No. 9 School, Rochester, N. Y.; Framingham High School, South Framingham, Mass.; Winchell School, Boston, Mass.; Lynchburg High School, Lynchburg, Va.; Public School, Biwabik, Minn.

The Philadelphia office of the Edison Portland Cement Co. will be moved on Sept. 1 to the Arcade Building, and will be in charge of Mr. James T. Wakeman as local representative. The office of Mr. E. Meyer, manager of sales, will be at the St. James Building, New York.

Ehret's slag roofing, which is guaranteed against natural wear and tear for ten years by its makers, the Warren Ehret Co., Philadelphia, is the subject of a well-illustrated trade circular. The roofing is applied either to wooden or concrete roofs, and consists of four layers of felt covered with a composition of which slag is the most important component. The illustrations show buildings roofed with this material.

TRADE PUBLICATIONS.

A small book regarding the materials made by the Expanded Metal & Corrugated Bar Co., St. Louis, and their use in the construction of fireproof buildings, has just been issued. In addition to stating the claims of the corrugated bar, it illustrates different types of reinforced concrete floor construction and gives a table of safe loads for floor slabs for different spans, together with the thickness of the slab and the reinforcing recommended.

The Northern Engineering Works, Detroit, has issued a booklet describing a great variety of types of electric and hand-operated cranes and hoists. Most of the illustrations show the apparatus in use. Electric traveling cranes ranging in capacity from 5 to 50 tons, air hoists and jacks, jib cranes of every type, locomotive cranes, clam-shell bucket, cranes and hoists for handling coal, sand and similar material, and overhead tracks and trolleys, are shown.

The National Construction Co., Buffalo, has sent out a catalogue of its portable and sectional houses, which describes their construction and advantages. Either wood or steel can be used n their construction, and the finish can be either very plain or quite elaborate, to accord wth the taste of the purchaser. They are listed in all sizes from 6x9 ft. to 36 ft. square. One of the uses of such buildings to which attention is called in particular is for the storage of automobiles, since they are readily installed on any part of the property if the owner should not have a sutable shelter for a car.

The Shone system of sewerage is described quite completely in a pamphlet sent out recently by the Shone Co., Chicago. As shown by the list of installations printed at the end of the book, the system is used not only for sewering towns and cities but also in hotels, office buildings, factories, theatres and similar large structures. The descriptions of the installations of the pneumatic ejectors in the sewerage works of Rogers Park, Ill., Winona, Minn., the World's Fair, Chicago and at Fair Haven, Mass., give an excellent idea of the difficulties which the ejector aims to overcome and of the assistance it is intended to afford in solving difficult sewerage problems.

Crown pneumatic hammers are described in detail in bulletin 2010 of the Ingersoll-Rand Co. They are made in five sizes for chipping, calking, scaling, and flue beading, and in four sizes with a long stroke for driving rivets from the smallest size up to 1¾ in. diameter. The bulletin also gives an interesting account of a displacement air meter by which the performance of these tools has been tested.

Several mechanical draft plants of large size are illustrated in a booklet recently published by the Green Fuel Economized Co., Matteawan, N. Y. Among the installations are those for the East St. Louis & Suburban Ry., and for the new Hoboken terminal of the Lackawanna R. R. Numerous diagrams show clearly the method of applying mechanical draft to plants originally installed without it, as well as its use in plants expressly designed for it. Attention is called to the Green fuel economizer, which the company frequently installs in connection with its draft system.

A description of its plant and the process used in treating timber with creosote is published in a brief pamphlet from the Gulfport Creosoting Co., Gulfport, Miss. The plant contains three cylinders, each 7 ft. in diameter, two of them being 120 ft. long each and the third 96 ft. long, their total monthly capacity being 2,000,000 ft. B. M. The timber treated includes piles, telephone poles, bridge timbers, railroad ties, cross arms, conduits, paving blocks and similar classes of material. The specifications recommended by the company for both the timber and the creosote oil are given in detail.

The Everett-McAdam continuous electric blueprint machine, made by the Revolute Machine Co., New York, is fully described in a recent catalogue. The prints are made while the tracing and paper are revolved about a glass cylinder inside which are two or more mercury vapor lamps. The speed of ordinary rapid electric blueprint paper through the machine is 4 to 5 ft. per minute.

McLaughlin Bros., Inc., Baltimore and Philadelphia, have issued a pamphlet covering their work as engineers and constructors, containing views of different classes of buildings erected by them.

The Chester B. Albree Iron Works Co., Allegheny, Pa., has devised a handy diagram for obtaining graphically by a single simple reading the length of round, countersunk and cone-head rivets, for thicknesses of plates, or grip, up to 8 in., and for all diameters of rivets. Copies of the diagram mounted on cardboard will be sent on application.

A book of specifications for applying hydrolithic waterproofing to floors, foundations, walls, columns, girders and conduits has been published by the E. J. Winslow Co., Chicago. Typical designs are also given in a set of drawings showing the hydrolithic system applied to quite a variety of waterproofing conditions.

An illustrated bulletin showing rails, ties, switches, frogs, turntables and rolling stock for industrial and portable railways has been received from the Arthur Koppel Co., Pittsburg, Pa. The illustrations of rolling stock for such railways show a great variety of steel dump cars, and mine, ore, charging, platform and steel-handling cars.

The five types of Simplex concrete piles which are used for various purposes are described in a pamphlet distributed by the Foundation Co., New York. It explains the construction and special field of each type, and gives illustrations of many structures which have foundations of such piles.

Centrifugal and turbine pumps are discussed in a bulletin recently issued by the D'Olier Engineering Co., Philadelphia, Pa. The advantages of the volute and turbine types for various classes of service are pointed out and the mechanical details of construction are described. Suggestions are also offered in regard to securing information necessary to select the best pump for a given service.

The electrification of the West Jersey & Sea Shore R.R. is interestingly described in a pamphlet by the General Electric Co. The line runs between Philadelphia and Atlantic City, and the pamphlet describes the power plant, transmission system, inspection shed, third rail installation, rolling stock, motor and control equipments, trucks and brakes. Other bulletins recently issued by the General Electric Co. relate to the standard G. E. cast-iron grid rheostats for electric railway purposes, the parts of all standard General Electric electric railway controllers for both stationary and car motors, and the Thomson single-phase high torque induction watt meters.

Wire-glass windows as a fire protective measure is the subject of a comprehensive article published in a recent issue of the Journal of Fire, special reference being had to the wire glass product of the Mississippi Wire Glass Co. Wire glass, it is stated, was invented to prevent breakage, but its advantages as a fire stop were an unexpected and important result and have been emphasized by the results obtained in the Baltimore and San Francisco conflagrations. Extended reference is made to its advantages for this purpose and a list of wire glass installations in different parts of the country each notable for its size, is added.

The Sarco Fuel Saving & Engineering Co., New York, has recently issued a circular concerning a new form of grate bar for use in the Roney stoker. The bar is so constructed as to avoid burning out and obtains greater life, as well as greater steaming capacity for a given size of grate

A new edition of its catalogs of pipe threading and cutting machinery has recently been issued by the Curtis & Curtis Co., Bridgeport, Conn., makers of the Forbes patent die stock. The complete line of the latter stocks for either hand or power operation, is listed, together with repair parts for these machines. The catalog also includes an extensive list of hand tools for pipe threading and also pipe and machine bolt taps.

The Kewanee flange union is described in a circular recently issued by the Western Tube Co., Kewanee, Ill., which is a new product of this company. It is a brass seated malleable iron union with flange attachments, the seat of which is ground spherical so that the union seats properly and is tight even when the piping is not in perfect alignment.

Buffalo forges are illustrated in a folder recently issued by the Buffalo Forge Co., which calls special attention to the fact that the No. 200 Buffalo hand blower is now built with four legs and a clamp brace between them, together with a new style of head, fastening the blower to the stand, the whole enabling the outfit to be knocked down and easily packed for shipment. The No. 660 down-draft is now made with one length of cast-iron pipe, so that the entire outfit is practically all of cast-iron and should withstand the most severe service.

The Fort Wayne Electric Works has recently issued a number of pamphlets describing belted direct-current generators, enclosed alternating-current multiple arc lamps, and type A alternating-current transformers. Important improvements have been introduced in all of this apparatus, which are described at length.

The Van Auken system of vacuum heating is described in a series of pamphlets and folders recently issued by the Consolidated Engineering Co., Chicago. The details and operation of the system are well illustrated and the uses of the Belvac thermofier are described. This is used in this system to permit all air and water of condensation to pass freely, but prevents any steam from being wasted into the returns. The details of the thermofier and its method of connection to the system are also illustrated.

Bulletins recently issued by the General Electric Co. include a brief description of the company's direct current fan motors for 1907, a treatise upon commutating pole railway motors, and a description of electric crane motors adapted to drum hoists. Other bulletins show that in generating machinery a new line of C .Q. generators and balancer has been brought out in sizes up to 17½ kw., which correspond in form or construction to the type CQ motors recently placed on the market, and also a new line of direct-current multipolar generators, known as type R, has been developed, in capacities from 25 to 200-kw., the details of which are presented in a separate bulletin. Another bulletin describes the General Electric train lighting system, in considerable detail, using the Curtis turbine generator sets on the locomotive.

"Drying Materials in Industrial Plants" is the title of a pamphlet just issued by the Green Fuel Economizer Co., of Matteawan, N. Y., which takes up the drying of various materials, as fabrics, clothes, malt, lumber, baking powder, paper, paper pulp, sugar, etc. Besides describing and illustrating the fans, blowers, steam coils, etc., manufactured by this company for use in drying plants, an interesting account is given of the nature of drying and the text is illustrated by drawings and photographs of plants for many different purposes. This pamphlet also describes the Green air heater, which utilizes the waste heat in the flue gases from boiler or other furnaces for heating and drying purposes.

Two pamphlets from the Arlington Manufacturing Co., Canton, O., describe paints made especially for coating galvanized iron and for the special purposes required on railroads. Among the list of paints of the latter class are those for structural steel work, wooden and steel freight cars, station buildings and car signs.

The Davenport Locomotive Works has issued a pamphlet on locomotives for railroad contractors, describing the merits of its product. A partial list of users of Davenport locomotives is given.

Information on tarviating heavily-traveled macadam streets, furnished by Mr. Linn White, engineer of the South Park Commissioners, Chicago, has been published in pamphlet form by the Barrett Manufacturing Co. During 1906 the Park Board treated 106,000 sq. yds. of heavily-traveled boulevards, including parts of Michigan Avenue, and Grand and Drexel Boulevards. The method of applying the Tarvin, the amount used and cost per square yard, and the results are given in detail.

The Morris single rope dumper, for dumping coal, ore, rock, and similar material automatically is described in a catalog of the Bergen Point Iron Works, Bayonne, N. J. The dumper uses a round tub which engages a tipping frame at the point where it is to be discharged, and the continued pull of the hoisting rope empties the tub, which is released as soon as the rope is slackened. This device makes it unnecessary to have more than one man for hoisting and dumping. The dumper is usually fitted with a discharge chute, and the entire apparatus is readily portable and can be swung into position with a simple tackle, a convenience that will be readily appreciated for unloading ships, handling concrete, and in such places where portability is required. The catalogue also shows wheel-barrow tubs, a very low spoil car, and a dumping frame for the same, and numerous views of coal-handling machinery designed by Augustus Smith, president of the Bergen Point Iron Works.

A catalog of 114 pages describes fully the Miracle concrete block, the machinery for making it and the methods employed. Interchangable face plates for 69 different styles of finish can be supplied with the machines. Special moulds are also made for cornices, ornamental belt courses, sills, lintels, columns and balusters and sewer pipe. Much space is devoted to illustrations of buildings constructed with Miracle blocks and to letters from contractors who have used the company's machines. The machines are made by the Miracle Pressed Stone Co., Minneapolis, Minn.

The Weber subterranean pump is described in a folder issued by Geo. H. Samson Co., Boston, Mass. This is a pump operating on the principle of direct displacement by air and is specially adapted for handling acids, gritty water or semi-solids and is manufactured in the mine, quarry, river supply and sewage disposal types. It is stated that there are no floats or special degree of submersion required and that air is returned to the compressor under pressure after the water is discharged by means of which a considerable factor of economy in operation is secured.

"More Holes for Less Money" is the title of a small folder recently issued by the Knecht Bros. Co., Cincinnati, Ohio, devoted to the Knecht friction drive drill. This is an upright sensitive drill built in both belt and motor-driven patterns and has a friction-cone drive for rapidly varying the drilling speeds. It has a graduated scale on the latter to indicate the proper speeds for any drill up to its limit in capacity, 9-16 in.

The Percival Reinforced Concrete Steel Tie Co., Galveston, Tex., has issued a pamphlet describing its reinforced concrete ties, which were illustrated in this journal about a year ago.

A catalogue describing a new make of concrete measuring and mixing machinery has come from Mr. A. F. Nims, Rochester, N. Y. The measurer can be used for any proportions and with stone up to maximum dimensions of 5 in., and gauges the proper quantities accurately. It operates by gravity and has a large daily measuring capacity. The mixer is of the cubical type and is run by a 5-h.p. gasoline engine.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

[illegible], Ala.—See "Power Plants, Gas and Electricity."

Sterling, Colo.—D. A. Bartbolow, of Sterling, Secy. North Sterling Irrig. Dist., writes that bids will be received on Aug. 20 for the proposed reservoirs, ditch, etc., to cost about $1,400,000. Engineer, Walter Pearl, 214 Commonwealth Bldg., Denver.

Lamar, Colo.—Bids will be received until Sept. 2 at the office of C. W. Heaton, Town Clk., for $150,000 bonds for the proposed extension and improvement of the water works system.

East Hartford, Conn.—Engr. C. Henry Olmsted, of East Hartford, on Aug. 2, submitted to the voters of the East Hartford Fire Dist., his report on increasing the water supply of the district. He estimates the cost of laying new water main from reservoirs in East Glastonbury through Hillstown to connect with present main at Burnside Ave. and Church St., a distance of 7⅛ miles, at $73,305. J. Goodwin is Town Clk.

Wilmington, Del.—The Water Dept. is reported to have authorized Theo. A. Leisen, Ch. Engr., to prepare specifications for a filtration plant.

Pensacola, Fla.—Bids will be received until Sept. 7 at the Bureau Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., for constructing a 100,000-gal. steel tank and tower, Navy Yard, Pensacola, Fla., as per specification No. 1,558.

Bids will be received until Sept. 7 at the Bureau Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., for installing a water system at the navy yard, Pensacola, Fla., as per specification No. 1,559; estimated cost, $38,000.

**Atlanta, Ga.*—The Special Com. of Council and Water Bd. is reported to have on Aug. 8 decided to purchase the New York sectional wash filter plant from the New York Continental Jewel Filtration Co., of New York, N. Y., for $30,000.

Lewiston, Idaho.—The North Lewiston Water Co., Ltd., is reported incorporated. The company has secured water rights on a number of springs and land adjoining Lewiston and on the hillside to north of Clearwater River. It is proposed to tunnel into the hillside to bed rock, following course of small springs which appear on surface, and then by a system of side tunnels to concentrate flow of a number of springs into one stream. Incorporators: J. L. Chapman, Albert Davis, Chas. Mix and others.

Shelley, Idaho.—A committee is reported to have been appointed consisting of N. C. Mickelson, W. A. Hudson and H. Harrington to investigate and report on the question of constructing water works.

Middletown, Ill.—The City Council is reported to be considering the question of constructing water works.

Chicago, Ill.—Mayor Busse on Aug. 9 signed the supplemental contract by which the Rogers Park Water Co. is to sell its property to city for $300,000.

Chicago, Ill.—Bids will be received until Aug. 31, by John J. Hamberg, Comr. Pub. Wks., for furnishing and delivering to this city about 2,100 1-in. 1¼ in., 1½ in., 2 in., 3 in., 4 in., and 6 in. water meters.

Virden, Ill.—This city is considering the question of building water works to cost $50,000 and a sanitary sewer system with purification plant, to cost $100,000, for which Richard H. Phillips, Consulting Engr., Sec. Bldg., St. Louis, Mo., is preparing plans and estimates, and it is not likely that more than the main trunk sewer, costing $20,000 to $25,000, will be built this fall. Bond issue for water works will be submitted within a few weeks; sewers will be built under the special assessment plan.

Kewanna, Ind.—The Kewanna Water Co. is reported organized with a capital of $15,000 by L. O. Leasure, C. W. Snipp and others.

Milltown, Ind.—W. H. Roose, of Corydon, who recently secured franchise for water works at Milltown, writes that the proposed work will cost about $15,000. Contract will not be let for about 8 or 10 weeks.

Bartlettsville, Ind. Ter.—This city is reported to be considering the question of constructing municipal water works.

Wesley, Ia.—The City Clk. writes that the citizens voted Aug. 5 to construct water works. Oscar Nelson, Mayor.

Murray, Ky.—See "Power Plants, Gas and Electricity."

Bangor, Me.—W. I. Brown, Clk. Water Bd., writes that new bids will be received on Aug. 22 for coagulating basin, head house, including screening, coagulant and laboratory departments, complete with appurtenances. Engineer, Geo. W. Fuller, 170 Bway., New York, N. Y.

Boston, Mass.—The City officials are reported to be considering a plan of Wm. Jackson, City Egr., for the installation of a system of water mains from Charles River basin, for additional fire protection, etc. It is estimated that it would cost about $250,000 to install the service and pumping station.

Lynn, Mass.—Geo. I. Leland, City Engr., writes that the question of improving and increasing the water supply is being considered. W. S. Johnson, Consulting Engr., 101 Tremont St., Boston.

Pontiac, Mich.—H. C. Monroe, Supt. Water Wks., is stated to have prepared a report on improvements and extensions needed at this time, and estimates the cost at $110,552 to include 12 miles of 4, 6 and 8-in. mains to all outlying districts, a new pump, new boiler and 8 wells.

Graceville, Minn.—See "Power Plants, Gas and Electricity."

Jackson, Miss.—Bids will be received by the Mayor and Bd. Aldermen until Sept. 3 for $216,000 bonds for the purchase of the existing plant from the Light, Heat & Water Co. Ramsey Wharton, Mayor.

**Newton, Miss.*—The Town Council is reported to have awarded to Sperry & Lukins, of Artesia, N. M., contract at $1,200 for boring an artesian well for water works about to be constructed.

It is reported that contract will soon be let for the proposed water works. Engineer, N. A. Kramer, of Magnolia.

Washington, Mo.—This city has given the Washington Water & Light Co. notice of its desire to purchase its water system at the expiration of the water franchise in June, 1908. The city and company have agreed upon Wm. H. Bryan, Consulting Engr., of St. Louis, to make detailed inspection of plant, and report its physical condition, and appraise present cash value.

Wood River, Neb.—See "Power Plants, Gas and Electricity."

Beaver City, Neb.—The citizens are reported to have voted on Aug. 5 to issue bonds for water works.

**North Platte, Neb.*—The Secy. of the Interior at Washington, D. C. has executed the following contracts in connection with the earthwork on the distribution system for the North Platte irrigation project, Neb.-Wyo.: About 10 miles of laterals to the Burke Constr. Co., of Mitchell, Neb., involving the excavation of approximately 128,000 cu. yds. of material, $30,159; about 10 miles of laterals to Detrick, Rush & Hoth, of Bayard, Neb., involving 96,100 cu. yds. of excav., $16,703, and about 40 miles of laterals to M. E. Getter, of Mitchell, Neb., involving 230,100 cu. yds. of excav., $37,628.

Roswell, N. M.—Engineer C. F. Ellis is reported to have completed plans for water works, for which, it is stated, an election will be held in Sept; probable cost, $82,000.

Pleasantville, N. Y.—Bids are wanted by the Bd. of Water Comrs. until Aug. 26, for constructing storage reservoir with earth dam, masonry core wall, spillway, gate house and pipe conduit. Engineers, Byrne & Darling, Barrett Bldg., White Plains. W. S. Moore, Village Clk.

**Long Island City, L. I., N. Y.*—The following are the bids opened on Aug. 8 by the Comrs. of Parks, N. Y. City, for furnishing material and constructing a pumping plant in Forest Park, Boro. of Queens: Gus Hildebrand, $17,770; Jas. MacArthur, $12,500; Mellarg-Barton Co., $10,222 (awarded contract); and John Spence, Jr., $13,825.

Winston-Salem, N. C.—The citizens are reported to have voted Aug. 6 to issue $150,000 bonds for street improvements, sewerage system and water works.

Wahpeton, N. D.—All bids received on Aug. 5 by Wm. R. Purdon, City Aud., for constructing and placing boilers for the water works plant have been rejected and new bids will be received on Aug. 24. The boilers are to be for a 66-in. x 18-ft. boiler and a 72-in. x 18-ft. Separate bids on each boiler.

**Cincinnati, O.*—The Bd. of Pub. Service is reported to have on Aug. 9 awarded contract for water mains to U. S. Cast Iron Pipe Co. for $22,000.

Youngstown, O.—The Council has authorized a survey of the territory in Berlin Township looking to the construction of a dam to furnish Youngstown with an additional water supply.

**Cleveland, O.*—The Bd. of Pub. Service is reported to have on Aug. 9 awarded the contract for 5,000 water meters, with the privilege of increasing the order 10,000, to the Buffalo Meter Co., of Buffalo, N. Y.

Lima, O.—See "Power Plants, Gas and Electricity."

Oklahoma City, Okla.—Mayor Scales is reported to have authorized City Engr. Burke to prepare estimates for sewer and water extensions to cost about $325,000.

Bristol, Pa.—According to recent decision of Judge Stout, the Town Council has received authority to establish water works.

Sharon, Pa.—The City Council is reported to have under consideration the filtration of the water supply.

Lebanon, Pa.—State Health Comr. Dixon, at Harrisburg, is reported to have approved the proposed new source of supply for the city of Lebanon. It will be taken from Swatara Creek.

Mechanicsburg, Pa.—The Water Co. is reported to have decided to construct new reservoir, pumping station and filter plant.

Ft. Adams, R. I.—Capt. Willis C. Metcalf, Qm., U. S. A., 209 Thames St., Newport, writes that M. A. McCormick, 4 Sherman St., Newport, bid, on Aug. 5, for the construction of a 400,000 gal. reservoir, 3 shelters for springs and laying pipe from springs to reservoir at Sanderstown, R. I.; also laying pipe from reservoir to and across Narragansett Bay to a connection with reservoir at Ft. Grehle, Dutch Island, as follows: 3 spring shelters, $6,500; 1 reservoir (re-inforced concrete), $22,000; extra excav. per cu. yd., 45 cts.; extra concrete per cu. yd., $8; extra rubble masonry, per cu. yd., $4; land and submerged pipes, $49,000.

**Belle Fourche, S. D.*—The Secretary of the Interior at Washington, D. C., has executed contract with H. T. Adams, of Belle Fourche, for construction of Sec. 2, Schedule 1, of the laterals under the Belle Fourche irrigation project, to consist of 9 miles of ditch, and involving 54,050 cu. yds. excav., for $15,287; to J. E. Hilton, of Belle Fourche; for the construction of a portion of the south canal, involving 220,500 cu. yds. excav., $46,000, and to J. W. McNeel, of North Platte, Neb., for construction of about 10 miles of the Indian Creek lateral, involving 236,950 cu. yds. excav., $53,007.

Bonesteel, S. D.—Bids will be received until Aug. 20 (readvertisement) by M. P. Dowling, Town Clk., for constructing a complete system of water works.

Dickson, Tenn.—W. T. Turner, Mayor, writes that an election will be held Sept. 5 to vote on issuing bonds for water works.

Bardwell, Tex.—The Bardwell Water Co. is reported incorporated with a capital of $7,000 by W. S. Robertson, R. O. Roach, W. B. Whittington and others.

Dallas, Tex.—It is stated that bids are wanted until Aug. 20 for 250 tons 6-in. c. i. standard water main. D. F. Sullivan, Water Wks. and Sewerage Comr.

Ft. Worth, Tex.—The City Engineer is reported to be preparing plans for a filtration plant.

Crockett, Tex.—The City Council is reported to be considering the question of constructing water works.

Norfolk, Va.—Bids will be received until Sept. 14 at the office of the Bureau Yards and Docks, Navy Dept., Washington, D. C. (R. C. Hollyday, Ch.), for constructing a steel tank and tower, navy yard, Norolk, as per specification No. 1,557.

Seattle, Wash.—The City Council is reported to have passed a resolution, providing for a system of salt water mains in the business section of the city; estimated cost, $240,000.

Aberdeen, Wash.—The City Council is reported to be considering the question o securing an additional water supply.

Elkins, W. Va.—Bids are wanted until Sept. 5 for the purchase of $40,000 water and sewerage bonds, as advertised in The Engineering Record. Geo. Henry, City Clk.

Medford, Wis.—C. H. Phillips, of Marshfield, has prepared estimates for water works to cost $300,000. A special election will be called soon to vote on the issue of bonds.

Linden, Wis.—The citizens are reported to have voted to issue bonds for water works.

Prentice, Wis.—See "Power Plants, Gas and Electricity."

Fond du Lac, Wis.—At a recent meeting of Council a resolution is reported to have been passed, authorizing the City Clk to procure bids for pipe line to bring water supply from lake by gravity pressure.

Fond du Lac, Wis.—Bids will be received until Aug. 26 by the Bd. Pub. Wks. (L. A. Pettibone, Chmn.), for furnishing material and constructing a gravity water pipe line from Lake Winnebago to Reed St.

Thermopolis, Wyo.—We are informed that this city has in contemplation the construction of water works to cost about $75,000.

Massey Station, Ont.—The Ontario Ry. & Municipal Board is reported to have approved a bylaw providing for the issue of $10,000 bonds for the extension of the water works of Massey, Algoma Dist.

Sudbury, Ont.—The by-law providing for the extension of the water works and sewers of Sudbury is reported to have been approved by the Ontario Ry. & Municipal Board.

Amherthurg, Ont.—The citizens are reported to have voted to issue $2,500 bonds for water works improvements.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Alamosa, Colo.—The City Clk. writes that B. D. Critchlow, of Alamosa, is making surveys and estimates for a sewerage system. As soon as completed bids will be asked.

Mullan, Idaho.—The question of constructing a sewerage system is reported to be under consideration.

Chicago, Ill.—Bids will be received until Aug. 31 by John J. Hamberg, Comr. Pub. Wks., for furnishing material and completing the construction of the Lawrence Ave. Pumping Station, on Lawrence, near Evanston Aves.; also completing the construction of an intake tunnel for Lawrence Ave. conduit at Lawrence Ave. and Lake Michigan being a portion of Sec. N, intercepting sewers.

Joliet, Ill.—H. A. Stevens, City Engr., writes that two sewer systems are being planned, one in the 7th ward, to cost about $15,000, the other in the 1st ward to cost $31,000. Contract will not be let until the spring.

Minook, Ill.—C. R. Denson, City Clk., writes that it is proposed to construct a sewerage system to cost about $25,000. The ordinance for the work has not yet been passed. Engineer, Wm. Meyer, of Minook.

Herrin, Ill.—Fred E. Roland, City Clk., writes that it is proposed to construct a sewerage system at a cost of $20,000. Engineer, W. T. Pierce, of Herrin.

Virden, Ill.—See "Water."

Sterling, Ill.—Local press reports state that the City Engr. is preparing estimates of cost of constructing the north end sewer system.

Indianapolis, Ind.—The Bd. of Pub. Wks. is reported to have adopted resolution providing for extension of the E. Michigan St. sewer in Michigan, St. Clair and 10th Sts.

Bloomfield, Ind.—All bids opened Aug. 8 for pipe, branches, junctions, manholes, etc. f. o. b. cars Bloomfield, and for construction complete with or without material or any part of same separate of main and minor sewers in a system of sewerage, etc., have been rejected and new bids will be received on Aug. 26. Engineer, Geo. Cadogan Morgan, 169 Jackson Boule., Chicago, Ill.; Chas. E. Coombs, Pres. Bd. Trus.

Richmond, Ind.—Fred. R. Charles, City Engr., writes that the city was unable to let contracts on Aug. 9 for work in this city and will again receive bids on Aug. 30 for the following, as the city is very anxious to let contracts for this work: A sewerage system 4 miles in length, and disposal plant, in the southwest part of city; probable cost, $50,000; also construction of subway on W. 2d St., and a sewer system in connection with same; probable cost, $40,000; also a street to be made, by grading and macadamizing 1,300 ft. in length, and a sewer in connection with same; probable cost of both, $9,000. Length of sewer, 1,116 ft. John F. Taggert, City Clk.

Muscatine, Ia.—Bids will be received until Aug. 26 by the City Council for constructing standard vitrified tile sewers in portions of several streets. Edw. H. Ruby, City Clk.

Clear Lake, Ia.—The question of constructing a sewerage system is reported under consideration here.

* *Items marked thus give the names of parties awarded contracts.*

Des Moines, Ia.—It is stated that bids will be received until Aug. 23 by the Bd. Pub. Wks. (W. W. Wise, Chmn.), for constructing sewers in Chester Boule.

Iowa City, Ia.—The City Engr. is reported to be preparing plans and specifications for new sewers.

Clinton, Ky.—John B. Evans is reported to have received franchise for sewers.

Alexandria, La.—Bids for the construction of approximately 5 miles of 8-in., 01-in., 12-in. and 14-in. vitr. pipe sewers and accessories will be received by the Mayor and Bd. of Aldermen until Sept. 3 (readvertisement) as advertised in The Engineering Record. Ira W. Sylvester, City Engr.

Lansing, Mich.—Roy Robb, of Mason, County Surveyor, is reported to be making preliminary surveys in East Lansing, with a view to constructing a sewerage and drainage system.

Fairmount, Minn.—Bids will be received until Aug. 26 by E. L. Lewis, City Clk., for constructing sewers in portions of Blue Earth Ave., 1st, 4th, and Park Sts. A. Marston, Engr., Ames, Ia.

Lamberton, Minn.—The question of issuing bonds for the construction of a sewerage system is reported under consideration.

**Morris, Minn.*—C. B. Burpee, City Clk., writes that the contract for constructing sewers in Dists. 4, 5, 8, 9 and 20 (bids opened Aug. 6) has been awarded to Tanner Bros., of Morris, for $6,800.

Independence, Mo.—The City Council is reported to have passed an ordinance providing for an appropriation of $11,000 for improving the septic sewerage system on the east and west sides of city. R. T. Procter, City Engr.

Kansas City, Mo.—Bids will be received until Aug. 22 by the Bd. Pub. Wks., for constructing Joint Dist. Sewers in Div. No. 3. E. A. Harper, City Engr.

Nevada, Mo.—It is reported that bids will be received by S. L. Higgins, City Clk., until Aug. 20, for constructing Dist. Sewer, No. 14.

Aurora, Neb.—Dennis Saylor, City Clk., writes that the citizens on July 30 voted to issue $10,500 bonds for the construction of a sewerage system. Engineer, A. A. Hartquest, of Auroa, assisted by H. C. Gardner, of Lincoln.

Columbus, Neb.—Andrew Rosewater, of Omaha, is stated to have completed report for a sewerage system for Columbus, which he estimates at $14,500.

New Brunswick, N. J.—See "Paving and Road-making."

Trenton, N. J.—Bids will be received until Aug. 20 by the Common Council for constructing sewers in Stuyvesant and Beechwood Aves.; also a drain in Princeton Ave. Harry B. Salter, City Clk.

South Orange, N. J.—The citizens of South Orange Township are reported to have voted to authorize the Township Com. to issue bonds for $35,000, the proceeds to be used to purchase from the township of Millburn, 25 per cent. of its capacity in the joint trunk sewer.

Wildwood, N. J.—Bids will be received until Aug. 20 by the Boro. Street Com. (Evans G. Slaughter, Chmn.), for reconstructing about 12,000 lin. ft. of the sewerage system of the Boro. L. M. Rice, Boro. Engr.

Ft. Lee, N. J.—The Boro. Council is reported to have authorized Engineer Eckerson to prepare plans and specifications for the Deadbrook sewer, to take in the Edgewater system and sewers east and west on Main St. This is the first work to be done on the proposed sewerage system.

Medina, N. Y.—W. B. Eckert, Village Clk., writes that Fred K. Wing, of Buffalo, is preparing plans for pipe sewers to cost about $12,000.

Brooklyn, N. Y.—Bids will be received until Aug. 28 by Bird S. Coler, Boro. Pres., or furnishing material and constructing sewer in Scott Ave., portion of Section I. Engineer's estimate: 2,946 lin. ft. 180-in. circular sewer, 106 lin. ft. 180-in. horseshoe sewer, 174 lin. ft. drop section, 19 lin. ft. connecting section, 745 lin. ft. 48-in. sewer, 470 lin. ft. 15-in. and 5,600 lin. ft. 12-in. pipe sewer, 1,000 lin. ft. 12-in. pipe sub-drain, 1,100 lin. ft. 12-in. temporary drain pipe, 1 manhole, Class "A," 6 Class "B," 4 Class "C," 3 Class "D," 6 Class "E," 1 Class "F," 74 manholes on pipe sewers. 12 sewer basins, reconnected, 680 M ft. sheeting and bracing, 100 M ft. foundation plank, 5 cu. yds. Class "A," and 1,000 cu. yds. Class "B" concrete. Security, $175,000.

Troy, N. Y.—Bids will be received until Aug. 23 by the Bd. Contract and Supply (Jas. M. Riley, Clk.) for furnishing material and constructing a sewer of 20-in. salt-glazed vitr. drain pipe in a portion of Stone and Deirfreist Ave.

New York, N. Y.—Wm. G. Leeson, 537 W. 149th St., bid on Aug. 6 for furnishing material and building sewer and appurtenances in Sherman Ave., Isham and Emerson Sts., Manhattan Boro., as follows: 938 lin. ft. brick sewer 3x6 in. x 2 ft. 4 in., $7; 402 lin. ft. brick sewer 3 ft. 6 in. x 2 ft. 4 in., $6; 1,760 lin. ft. salt-glazed 15-in. vitr. stoneware pipe sewer, $5.70; 135 lin. ft. salt-glazed 12-in. vitr. stoneware pipe culvert, $1; 6 receiving basins, ea., $175; 570 cu. yds. rock excav., $2.25, and 528 M ft. timber and plank for foundation, $35; total, $21,662.

The lowest bid opened on Aug. 12 at the office of the President of Manhattan Boro. for furnishing material and reconstructing outlet sewers and appurtenances, overflows and connections at 42d and 43d Sts., North River, and 42d and 43d Sts., bet. North River and 11th Ave., was submitted by Robt. J. Rooney, at the following bid: 1,350 lin. ft. wooden barrel sewer 4 ft. 6 in. $17; 10 lin. ft. twin brick sewers 4 ft. 6 in., $50; 45 lin. ft. brick sewer 4 ft. 6 in. x 9 ft., $40; 196 lin. ft. brick sewer, 4 ft. 6 in. x 9 ft., $40; 60 lin. ft. overflow chamber brick sewer of varying diam., $40; 170 lin. ft. brick sewer 6 ft. 6 in. x 9 ft., $40; 70 lin. ft. twin brick overflow sewers 8 ft. x 2 ft., $35; 50 lin. ft. twin brick overflow sewer 8 ft. x 2 ft., $35; 206 lin. ft. brick sewer 4 ft. x 2 ft. 8 in., $20; 123 lin. ft. brick sewer 4 ft. x 2 ft. 8 in., $20; 90 lin. ft. salt glazed vitr. stoneware pipe culvert 12 in., $4; 4 receiving basins circular, ea., $250; 15 cu. yds. old rock masry., $5; 50 M ft. timber and plank for bracing and sheet piling, $25; 50 M ft. timber and plank for approaches, $20; total, $56,755. Totals of other bids: Atlanta Constr. Co., $64,332, and Jos. Moore, $58,180.

Castile, N. Y.—W. J. White, 159 Dearborn St., Buffalo, is reported to be completing plans for a sewerage system.

Lancaster, N. Y.—The State Bd. of Health at Albany is reported to have approved the plans of Joos & Gatchell, Prudential Bldg., Buffalo, for a sewerage system and disposal plant.

Winston-Salem, N. C.—See "Water."

**Minot, N. D.*—The City Council is reported to have, on Aug. 9, accepted the bid of Illstrup & Olson, of Minneapolis, Minn., for constructing the sewerage system for $19,096.

Canton, O.—Bids will be received until Sept. 3 for sewers, to cost about $9,945, as advertised in The Engineering Record. W. E. Sarver, City Engr.

Youngstown, O.—Bids will be received until Aug. 30 by the Bd. Pub. Service (W. H. M. Mullin, Clk.) for furnishing material and constructing sewers in a portion of Falls Ave.

Canal Dover, O.—It is reported that bids will be received by the City Clk., until Aug. 31, for sewers to cost about $18,037.

Portsmouth, O.—It is stated that bids will be received until Aug. 22 by Filmore Musser, City Aud., for $10,000 sanitary sewer bonds.

Toledo, O.—Breyman Bros. & McNeil, of Toledo, are reported to have submitted the lowest bid on Aug. 5 for the Parkwood sewer, known as Sewer No. 999, over 2 miles long, 6 ft. diam. at mouth and 24 in. diam. at end, for $12.75 per ft.

Akron, O.—The lowest bid recently received for the trunk sewer west of Portage Path and the filter beds is reported to have been submitted by Dan O'Mara, 545 W. Market St., for $12,650.

Ironton O.—An election will be held on Sept. 5 to vote on issuing $45,000 bonds for sewers.

Oklahoma City, Okla.—See "Water."

**Philadelphia, Pa.*—We are informed that the following are the totals of bids opened on July 22 by the Dept. of Pub. Wks. for sewers to be constructed in connection with the work of abolishment of grade crossings on the P. G. & N. and Richmond Branch of the Philadelphia & Reading Ry. (Geo. S. Webster is Ch. Engr. Bureau of Surveys.) (*a*) Contract 101, P. G. & N. Elevated; (*b*) Contract 102, P. G. & N. Elevated; (*c*) Contract 103, P. G. & N. Elevated; (*d*) Contract 104, P. G. & N. Elevated; (*e*) Contract 105, P. G. & N. Elevated; (*f*) Contract 106, Richmond Branch Elevated; (*g*) Contract 107, Richmond Branch Elevated. Millard Constr. Co., *a* $32,862, *b* $39,685, *c* $45,957, *d* $75,204, *e* $39,763, *f* $33,437, *g* $45,463; Mack Paving Co., *a* $56,027, *b* $51,144, *c* $85,572, *d* $125,530, *e* $60,302, *f* $63,440, *g* $92,007; David Peoples, *a* $37,251, *b* $41,403, *c* $60,256, *d* $100,006, *e* $55,840, *f* $36,304, *g* $46,412; R. P. Bennis, *d* $92,600, *e* $41,082; Michael O'Rourke, *f* $45,152, *g* $61,568; David McMahon, *a* $41,175, *b* $35,452, *c* $51,127; Robt. Higgins, *a* $48,512, *b* $39,222, *c* $57,934; M. & J. B. McHugh, *a* $42,876, *b* $43,202, *c* $65,260, *g* $57,408; McGaw & Gray, *a* $55,096, *b* $56,350, *c* $87,902, *e* $65,239; Lombardic & Pascuzzie, *b* $42,610, *g* $60,235; John McMenamy, *c* $104,858, *f* $50,840, *g* $77,287; Robert P. Ryan, *a* $43,766, *b* $50,595, *f* $62,305, *g* $76,557. Millard Constr. Co. secured contracts for Contracts 101, 103, 104 and 105, and David McMahon for Contract 102.

Philadelphia, Pa.—The B'd. of City Surveyors on Aug. 12 approved plans for the construction of main sewers and extensions at an aggregate cost of about $221,000, as follows: Thomas Run (extension), reconstruction of Market St. sewer east of 36th; extensions of the Wissahickon low level intercepting sewer and the Wissahickon high level cut-off sewer; extension of Bingham sewer; extension of Jackson St. sewer; 12th St. sewer, 9th St. and reconstruction of the Pine St. sewer. Plans for construction of several branch sewers estimated to cost in all about $100,000. Contracts for all the work will probably be let by Geo. R. Stearns, Dir. Dept. Pub. Wks., next month.

Wilkesbarre Pa.—Plans for a sewer to be constructed on Union St., from N. Pennsylvania Ave. to river, have been prepared by B. K. Finch, Engr. of Sewers of City, and have been submitted to the Lehigh Valley R. R. Co. for consideration. The plans call for a sewer of either reinforced concrete or brick 7 ft. in diam., large enough to carry away all surface water of that section; probable cost, $100,000. Alfred Hand is City Engr.

West Middlesex, Pa.—Griffith Nicholas, of Sharon, is reported to be preparing plans for a sewage disposal plant.

Reading, Pa.—The Finance Com. on Aug. 5 reported favorably the bill, providing for a loan of $40,000 for building sewer and making other improvements.

Lesterville, S. D.—The Town Council is reported to be considering the question of constructing a sewerage system.

Bryant, S. D.—F. R. Shepherd, City Aud., writes that bids will be received on Sept. 9 for the construction of a drainage and sewerage system. Engineer, J. M. Raymond, of Raymond, S. D.

**Waco, Tex.*—Chas. Derr, of Oklahoma City, Okla., is reported to have secured the contract for extending the sanitary sewerage system of Waco for about $50,000.

Seattle, Wash.—The City Council has passed the ordinance providing for the construction of the North Trunk sewer, which will cost about $3,500,000. It will drain nearly all the city north of Madison St., and property in vicinity of Lake Washington as far south as Yeser Way.

Centralia Wash.—The citizens are reported to have voted on July 30 to issue $22,500 bonds for the construction of a trunk sewer.

Elkins, W. Va.—See "Water."

**Wausau, Wis.*—Miller & Krause, of Wausau, and Carl Lotz, of Wausau, are reported to have secured contracts for constructing sewers on Aug. 4 at $6,700 and $7,900 respectively.

**North Milwaukee, Wis.*—The contract for laying 15,300 ft. of vitr. pipe sewers has been awarded to F. E. Kaminski, of Berlin, at the following prices: 6-in. pipe, 50 cents; 8-in., 63 cts.; 10-in., 75 cts., and 15-in., 95 cts; manholes, $37; total cost, $11,950.

Fernie, B. C.—Bids will be received by J. W. Nunn, City Clk., until Aug. 23 for the construction of a covered concrete septic tank 100 ft. long x 30 ft. wide, as advertised in The Engineering Record. Robt. Potter, City Engr.

Sudbury, Ont.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

Ingot, Cal.—It is stated that bids are wanted by the Bd. of Superv., (S. N. Witherow, Clk.) until Sept. 3, for constructing stringer and truss bridge across Cow Creek at Ingot.

Sacramento, Cal.—Bids are reported to have been opened by the Bd. of Super. on July 25 for the Fairoaks Bridge across the American River, near Fairoaks, as folows: E. E. Berry, Sacramento, $100,000. James McGilvray and E. O. Birge, Sacramento, $98,000. Cotton Bros. & Co., Oakland, $97,600. C. J. Matthews, Sacramento, $94,500. Midland Bridge Co., Kansas City, $93,970. Healy, Tibbitts Constr. Co., San Francisco, $92,970. San Francisco Bridge Co., San Francisco, $89,760. Pacific Constr. Co., San Francisco, $89,357. Burrell Bridge & Constr. Co., Oakland, $88,973. Clark & Henry Constr. Co., Sacramento, $88,400. Murvy, Elwell Co., San Francisco, $85,300. Hyde, Harjes & Co., Oakland, $85,000. Western Bridge & Constr. Co., Omaha, Neb., $84,933.

The lowest bid opened July 31 for constructing the Bridge House Bridge is reported to have been submitted by the Western Bridge & Constr. Co., at $18,800.

**Woodland, Cal.*—C. F. Hadsall, Co. Clk., writes that the following are the bids opened on Aug. 1 for constructing a reinforced concrete bridge across Putah Creek, consisting of three 115-ft. spans: W. N. Concanon, Fairfield, $46,903 (awarded contract); F. P. Smith & Bro. & W. S. C. Stevens, Davisville, $54,669; Pacific Constr. Co., San Francisco, $47,793, and Healy-Tibbits Constr. Co., San Francisco, $39,866.

Denver, Colo.—At a meeting held at the Mayor's office on Aug. 3 the engineers of the several rairoads entering Denver from the north and east, it was agreed that the railroad companies construct a viaduct over the tracks at 19th and Wazee Sts. to North Denver at a cost of $400,000.

**Brookland, D. C.*—Bids were opened on Aug. 10 by the Comrs. D. C. at Washington for the construction of a concrete-steel bridge across track of the Baltimore & Ohio R. R. Co. on line of Monroe St., Brookland, D. C., and C. B. Clark & Co., 10 E. Lexington St., Baltimore, Md., secured the contract for same as follows: Excavation, $1 per cu. yd.; foundation concrete, $7 per cu. yd.; concrete above foundation, $8 per cu. yd.; structural steel, 5 cts. per lb., and steel reinforcement, 3 cts. per lb.; total cost, $28,480. Totals of other bids: Penn Bridge Co., Beaver Falls, Pa., $32,744, and Jas. J. Overn, 335 Delaware Ave., N. E., Washington, D. C., $31,000.

Pensacola, Fla.—See "Railroads."

Chicago, Ill.—Bids will be received until Aug. 20 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and constructing the new sub-structure and superstructure for a temporary highway bridge over the north branch of the Chicago River, near Kinzie St.

**East St. Louis, Ill.*—W. J. Crocken, City Engr. writes that bids were opened on Aug. 1 by the Bd. of Local Improv. for rebuilding Broadway viaduct over Cohakia Creek, and the lowest and successful bid was submitted by the Rude Eng. Co., of East St. Louis, at the following bid: 1,160 cu. yds. excav., $3; 560 cu. yds. concrete in piers, $12.50; 500 cu. yds. concrete in roadway, $10; 700,000 lbs. steel work, per hundred lbs., $5; 6,000 sq. ft. brick paving, 20 cts.; 20 M ft. flooring, $35, and painting entire structure (lump sum), $300; total, $52,680. Totals of other bids received: Union Bridge & Constr. Co., Kansas City, Mo., $53,175; Pan American Bridge Co., New Castle, Ind., $63,704, and Wright-Gallagher Constr. Co., St. Louis, Mo., $55,748.

Terra Haute, Ind.—It is reported that bids will be renewed by the Co. Comrs. until Aug. 24, for constructing Fletcher Chappel bridge, of concrete, steel reinforced, with 35-ft. span. Jerome W. Denehie, Co. Aud.

Lafayette, Ind.—The County Comrs. are reported to have ordered plans and will soon ask for bids for the construction of a bridge across the Wabash River at Grandville; estimated cost, $50,000.

**Indianapolis Ind.*—The County Comrs. are stated to have awarded Aug. 7 the contract for constructing a bridge over Crooked Creek in Washington Township to Geo. W. Fife, for $7,170.

**Atchison, Kan.*—Edw. Iverson, Co. Clk., writes that the contract for constructing bridge on line between Atchison and Jefferson Counties (bids opened Aug. 6), has been awarded to Missouri Valley Bridge & Iron Co., of Leavenworth, for $5,175.

Catlettsburg, Ky.—Bids will be received by J. G. Warren, Corps Engrs., U. S. A., Cincinnati, O., until Sept. 3 for constructing service bridge at Lock 1, Big Sandy River, Catlettsburg, Ky., as advertised in The Engineering Record.

New Orleans, La.—All bids opened July 15 by City Council for the bascule bridge over Bayou St. John at Esplanade St. are reported to have been rejected.

Barnstable, Mass.—Alfred Cocker, Clk. Bd. Co. Comrs., writes that new bids will be received on Aug. 26 for the construction of a highway bridge over Bass River, between Yarmouth and Dennis. Engineer, S. Everett Tinkham, 715 Tremont Temple, Boston. Geo. I. Briggs, Chmn. Co. Comrs.

Springfield, Mass.—Bids will be received by the City Treas., until Aug. 27, for the superstructure for a steel bridge over the Boston & Maine R. R. on line of Abbe Ave., with clear span of 178 ft. 6 in., 24 ft. roadway, and one 6 ft. sidewalk; also complete construction of concrete-steel structure over Mill River on line of Peconsic Ave., clear span 24 ft., length 100 ft. Chas. M. Slocum, City Engr.

* *Items marked thus give the names of parties awarded contracts.*

St. Louis, Mo.—The City Council is reported to have passed a bill providing for the location of the municipal free bridge at Chonteau Ave.

Glasgow, Mont.—It is stated that bids will be received until Sept. 4 by W. B. Shoemaker, Village Clk., for constructing a 150-ft. span combination tubular pier bridge over Rock Creek.

Newark, N. J.—Plans, specifications and bids will be received until Aug. 27 by the 11th Ward Bridge Com. (Chas. J. Watson, Chmn.) at the Bd. Freeholders committee Room, Co. Court House, for constructing a substantial bridge over the Morris Canal on Central Ave. Geo. F. Drum, Co. Engr.

**New York, N. Y.*—The Healy Sewer Machine & Constr. Co., 21 Park Row, is reported to have secured the contract at $4.79 per lin. ft. for test borings at the site of new bridge over East River between Boros. of Manhattan and Brooklyn. Bids opened by the Dept. of Bridges July 23.

Hempstead, L. I., N. Y.—Bids will be received by John H. O'Brien, Comr. of Water Supply, Gas and Electricity, New York City, until Aug. 21 for furnishing material and constructing piers for two bridges over the Wantagh stream, and to do certain grading of Seaman's Rd., in the town of Hempstead.

Cincinnati, O.—Superintendent Bouscaren, of the Depart. of Track Elevation, completed plans for the proposed Hopple St. Viaduct. He estimates a concrete structure would cost $318,443.63 and a steel viaduct $332,649.13. The proposed viaduct would cross the B. & O. S. W. Railroad, Mill Creek and Spring Grove Ave.

Jefferson, O.—It is stated that R. C. Remick, Co. Aud., will receive bids until Sept. 2 for constructing a reinforced concrete bridge, on the State Road, Hartsgrove Township. J. S. Matson, Co. Surv.

Cleveland, O.—Bids will be received until Aug. 21 by the Bd. Pub. Service (A. R. Callow, Secy.), for furnishing material and constructing complete ready for the pavement the steel superstructure of a viaduct on Kinsman Rd., S. E., over the Pennsylvania R. R.

Trenton, O.—It is reported that the Co. Comrs. at New Philadelphia, O., will, on Sept. 2, receive bids for the construction of a 72-ft. span steel bridge 12 ft. wide with concrete floor, over Ohio Canal at Trenton; cost, about $2,100.

Philadelphia, Pa.—The Bd. of City Surveyors, on Aug. 12 approved plans for a 3-arch concrete bridge ot be constructed over Tacony Creek and Ashdale St., to cost about $100,000.

**Hamburg, Pa.*—The County Comrs. are stated to have awarded the contract for constructing a bridge over Mill Creek at State St. to L. H. Focht & Son for $5,189. Bids opened Aug. 9.

Panama.—Bids will be received until Aug. 28 by D. W. Ross, Genl. Purchasing Officer Isthmian Canal Comn., Washington, D. C., for furnishing a steel railroad bridge as per circular No. 384.

Greenville, S. C.—It is reported that bids will be received by J. P. Goodwin, Superv. of Greenville County, Greenville, S. C., and S. O. Jackson, Superv. of Anderson County, Anderson, S. C., until Aug. 20, for constructing two bridges across Saluda River.

**Nashville, Tenn.*—H. M. Jones, Engr., Cumberland River Bridge Comn., Cole Bldg., writes that the following is the detailed bid of Foster & Creighton, of Nashville, the successful bidders for concrete piers for two highway bridges across Cumberland River, reinforced concrete viaduct approaches for Sparkman and Jefferson St. bridges and furnishing borrow pits and filling certain parts of approaches of said bridges (bids opened July 10); total cost, about $510,000.

Sparkman St. Bridge: 47,700 cu. yds. fill, 55 cts.; 5,163 cu. yds. concrete Class "A," $17.65; 1,844 cu. yds. concrete Class "B," $10.25; 1,420,500 lbs. steel plain bars, 2.6 cts.; steel deformed bars, per lb., 3 cts.; 45 light posts, ea., $20; 4,800 sq. yds. creosoted block paving, $2.65; 41,500 lbs. c. i., 3.2 cts.; 2,334 cu. yds. concrete Class "A," $13.18; 3,538 cu. yds. concrete Class "B," $12.37, and 31,758 lbs. steel reinforcement, .03 cts.

Jefferson St. Bridge: 52,800 cu. yds. fill, 55 cts.; 5,232 cu. yds. concrete Class "A," $17.65; 895 cu. yds. concrete Class "B," $10.25; 1,312,571 lbs. steel plain bars, 0.26 cts.; steel deformed bars, per lb., .03 cts.; 45 light posts, ea., $20; 5,205 sq. yds. creosoted block paving laid, $2.65; 28,253 lbs. c. i., 0.32 cts.; 2,188 cu. yds. concrete Class "A," $13.18; 3,795 cu. yds. concrete Class "B," $12.37; 34,152 lbs. steel reinforcement, .03 cts.

Chattanooga, Tenn.—The only bid received Aug. 1 for constructing the Ringgold Bridge over East Chickamauga Creek in Chattanooga Chickamauga National Park, is reported to have been submitted by the American Bridge Co., of New York, N. Y., at $6,045.

Fairmount, W. Va.—The contract for completing the stone work on the bridge over Monongahela River is reported to have been awarded to Calvin D. Conaway, and for the iron work the Massillon Bridge Co., Massillon, O., secured the contract at $53,000, the structure to be 560 ft., containing 3 spans.

**Morgantown, W. Va.*—The Canton Bridge Co., of Canton, O., is reported to have secured the contract for constructing a steel bridge over Hartman's Run for $19,500.

Fond du Lac, Wis.—Bids will be received by the Bd. Pub. Wks. until Aug. 20 for furnishing material and constructing a steel girder bridge across the West branch of the Fond du Lac River at Johnson St. L. A. Pettibone, City Engr.

Eau Claire, Wis.—See "Power Plants, Gas and Electricity."

**Toronto, Ont.*—Thos. McQueen, Secy. Bd. of Control, writes that the contract for constructing steel railway bridges and hand railing for Lansdowne Ave. Subway (bids opened July 16), has been awarded to The Cleveland Bridge & Eng. Co., Ltd., Darlington, Eng.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Ashville, Ala.—St. Clair County road improvement bonds amounting to $85,000 are reported sold.

Marysville, Cal.—Bids will be received by the Village Council until Aug. 22 for curbing and paving with vitr. brick, Plum St. from 4th to 8th St., as advertised in The Engineering Record. J. C. Kennedy, City Engineer.

**Stockton, Cal.*—Geo. Sievers, City Aud., writes that the contract for paving with asphalt 1,066,000 sq. ft. (bids opened July 22), has been awarded to Clark & Henery Constr. Co., of Stockton, for $135,432.

**Wilmington, Del.*—The Levy Court is reported to have awarded the contract (bids opened Aug. 6) for constructing a road in Blackbird Hundred a distance of 4.82 miles, to Theo. F. Harsch, for $27,750.

Bids will be received by the New Castle County State Highway Comr. (Francis A. Price, Comr., 1009½ Market St.) until Sept. 3 for building a macadam road, as advertised in The Engineering Record.

**Washington, D. C.*—The Comrs. of Dist. Columbia are reported to have awarded the contract for paving a portion of S. Capitol St. with asphalt to the Cranford Paving Co., Home Life Bldg., at $4,800.

Lincoln, Ill.—An ordinance is stated to have been passed providing for the paving with brick block N. Kickapoo St. at an estimated cost of $21,384.

East Peoria, Ill.—The paving with brick a portion of Main and Washington Sts. is reported decided upon, at a cost of about $48,000.

Downers' Grove, Ill.—Bids will be received by the Bd. Local Improv. (J. W. Hughes, Chmn.) until Aug. 20, for grading, draining and macadamizing Linscott Ave. and E. Parkway, requiring about 2,775 sq. yds. granite top, macadam pavt., etc. J. S. Lozier, Engr., Downer's Grove.

Sterling, Ill.—The City Council is reported to have opened bids as follows for macadamizing 19 blocks of streets: John Mee, $12,999; Landis Bros., $14,103, and W. N. Nevins, $11,473.

**Chicago, Ill.*—The Bd. Local Improvements is stated to have awarded contracts for paving as follows: Parker Washington Co., with creosoted blocks Cottage Grove Ave., $126,000, Milwaukee Ave., $47,000 and Jos Hanreddy with asphalt School and adjacent streets, $96,500.

Monticello, Ind.—It is stated that bids will be received until Sept. 3 by J. L. Ackerman, Co. Aud., for grading, draining and paving several roads with stone.

Frankford, Ind.—The Comrs. of Clinton County have granted petitions for 14 gravel roads, and bids for their construction will be in order as soon as plans and specifications are completed.

Lafayette, Ind.—The Bd. of Pub. Wks. it is stated, will ask for bids for the naving of Schuyler Ave.; alos for a sewer in Union St.

Terre Haute, Ind.—Bids will be received until Aug. 24 by the Comrs. of Vigo Co. for the construction of 7,941 ft. of stone road, said road being known as Road No. 9. Engineer Geo. R. Grimes, of Terre Haute.

Peru, Ind.—Chas. Griswold, Co. Aud., writes that no bids were received on Aug. 7 by the Co. Comrs. for grading, draining and paving about 23½ miles of free gravel roads in Richland Township.

**Martinsville, Ind.*—B. E. Thornburgh, Co. Aud., writes that the contract for constructing 2½ miles gravel and macadam road in Ray Township (bids opened Aug. 6), has been awarded to M. R. O. Campbell, of Frankfort, for $17,107.

Bluffton, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 6 for the construction of 23 gravel roads.

Valparaiso, Ind.—It is stated that Robt. B. Ewing, City Clk., will receive bids until Aug. 23 for paving several streets with vitrified paving block on a macadam foundation; with combined cement curb and gutter, etc.

Cedar Rapids, Ia.—Bids will be received until Aug. 20 by the Bd. Pub. Improv. (W. C. Byers, Chmn.) for furnishing material and constructing vitrified repressed brick block on macadam foundation portions of Washington and Bever Aves., 8th and 5th Sts.; also a portion of 13th St. with vitrified brick block on a 4-in. sand cushion.

Iowa City, Ia.—It is reported that bids are wanted by City Council until Aug. 21 for brick pavement on about 13 blocks and macadam on one block; probable cost, $40,000.

Waterloo, Ia.—The City Council is reported to have rejected all bids opened July 31 for paving streets on the east and west sides. According to reports new bids will be received Aug. 26. C. T. Wilson, City Engr.

Des Moines, Ia.—Bids were opened on Aug. 7 by the Bd. of Pub. Wks. for paving as follows: 6th Ave., repressed paving brick on 6-in. Portland cement foundation and asphalt fill, 4,160 sq. yds.; Jas. Campbell bid for this work $2.38; Forest Ave., vitr. paving block on 6-in. natural cement concrete foundation, $19,450 sq. yds., 2 bids, Cook Constr. Co. and Jas. Herribin, they each bid $1.07 per sq. yd., and for paving W. 54th St. with creosoted wood block on 6-in. Portland cement foundation, 4,558 sq. yds., O. P. Herrick received contract for this at $2.369 per sq. yd.

Lake Charles, La.—Bids will be received until Sept. 3 for the construction of about 15 miles of cement sidewalks, and brick or cement curb, as advertised in The Engineering Record.

Hingham, Mass.—The lowest bid opened on Aug. 6 by the State Highway Comn. at Boston, for state highway work at Hingham was submitted by the Lane Quarry Co., of Hingham, for $4,394.

**Lansing, Mich.*—Farrell Bros & Algate are stated to have secured the contract for paving Saginaw St. with Saginaw block, for $21,550.

**St. Paul, Minn.*—The Bd. of Pub. Wks., on Aug. 8, awarded contract for curbing, leveling, filling and sodding Capitol Ave., from Hamline Ave. to Aldine St., to Jas. Forrestal, Scandinavian American Bank Bldg., for $6,976.

Fulton, Mo.—It is stated that bids are wanted by W. R. Pemberton, City Clk., until Aug. 20, for laying about 7,000 sq. yds. vitr. paving, curb., etc.

**Great Falls, Mont.*—The Kettle Rivers Quarries Co., of Minneapolis, Minn., has secured the contract for paving Central Ave. with 3½-in. creosoted wood block on concrete foundation as follows: Creosoted block, $3.09 per sq. yd; 5½-in. concrete base, $6.50 per cu. yd.; filler course, repairs to old concrete base, $8.50 per sq. yd.; concrete headder or marginal blocks or stops, 37 cts. per ft., compacted earth fill in old trenches, 60 cts. per cu. yd.

Riverton, N. J.—F. J. Brown, Mayor, writes that all bids opened on Aug. 8 for 30,000 sq. ft. cement paving have been rejected, and it has not yet been decided when new bids will be received. E. H. Pancoast, Chmn. Highway Com.

Bayonne, N. J.—Bids will be received by the City Council until Aug. 20 for furnishing material and paving 41st St., from Ave. C to Ave. E, with asphalt, about 4,290 sq. yds., with concrete curb and gutter, as advertised in The Engineering Record. W. C. Hamilton, City Clk.; F. W. Dalrymple, City Surveyor.

Wildwood, N. J.—Bids will be received until Aug. 20 by the Boro. Street Com. (Evans G. Slaughter, Chmn.), for constructing about 40,000 sq. yds. of macadam streets with cement gutters. L. M. Rice, Boro. Engr.

Somers Point, N. J.—All bids opened on Aug. 5 for laying macadam pavement on the numerous streets or avenues to consist of 11,928 sq. yds. macadam, 6,285 lin. ft. new blue stone curb, 1,365 lin. ft. curb reset and 56 lin. ft. radius curb; also the bids opened same time for grading and graveling Harbor Lane, and building a bulkhead or wharf on Harbor Lane, in the city of Somers Point, have both been rejected and new bids will be received by Jas. E. Scull, City Clk., at Somers Point until Aug. 19. Engineer E. D. Rightmire, of Atlantic City.

**Newark, N. J.*—B. M. Shanley Sons Co., 859 Broad St., is reported to have secured the contract for constructing 18,000 sq. yds. of roadway in Weequahic Park, for $15,480.

**New Brunswick, N. J.*—Abraham Jelin has secured the contract for paving French St. with Mack blocks, about 4,100 sq. yds., at $2.65 per sq. yd.; also the 10-in. terra cotta sewer on Wyckoff St., at 80 cts. per lin. ft.

Camden, N. J.—The construction of a road to connect Camden and Cape May is reported decided upon by the Cumberland County Bd. Freeholders at a cost of about $15,000.

Hempstead, L. I., N. Y.—See "Bridges."

New York, N. Y.—Bids were opened on Aug. 6 by Louis F. Haffen, Pres. Bronx Boro., for paving as follows: Clay Ave., from E. 166th St. to Wendover Ave.; (*a*) 18,330 sq. yds. iron slag block pavt., (*b*) 2,760 cu. yds. concrete, (*c*) 8,250 lin. ft. old curb, (*d*) total: Sicilian Asphalt Paving Co., *a*, $3.25; *b*, $6; *c*, 40 cts.; d, $79,432; Asphalt Constr. Co., *a*, $2.75; *b*, $4.75; *c*, 40 cts.; *d*, $66,817.

Lowest bid for paving Hunt's Point Ave., from Southern Boule. to Lafayette Ave., was submitted by the Barber Asphalt Paving Co. at the following bid: 12,700 sq. yds. asphalt block pavt., $1.70; 1,850 cu. yds. concrete, $5.50; 3,450 lin. ft. new curb, 97 cts., and 100 lin. ft. old curb, 32 cts.; total, $35,143. Totals of other bids: Asphalt Constr. Co., $36,692; Hastings Pavt. Co., $36,106, and Continental Asphalt Paving Co., $37,643.

The Barber Asphalt Paving Co. submitted lowest bids on Aug. 6 for paving with asphalt Timpson Pl. at $5,155, and Grant Ave. at $9,283.

W. F. Murray submitted lowest bid on Aug. 6 for regulating, grading, laying new flag, etc., on E. 199th St. at $17,922.

Brooklyn, N. Y.—The lowest bid opened on Aug. 8 by the Comrs. of Parks, N. Y. City, for furnishing materials and constructing cement sidewalk and curb around Parade Ground, Prospect Park, Boro. of Brooklyn, was submitted by Bonacci & Vincelli Constr. Co., 672 DeGraw St., as follows: 40,622 sq. ft. cement walk, 15 cts.; 4,145 lin. ft. cement curb, 40 cts.; 2,000 cu. yds. top soil, 78 cts.; total, $9,311.

The following are the bids opened on Aug. 8 by the Comrs. of Parks, N. Y. City, for furnishing materials and constructing asphalt tile walks on sand foundation in parks, Boro. of Brooklyn, as follows: (*a*), Winthrop Park, 74,000 sq. ft; (*b*), Cooper Park, 40,000 sq. ft.; (*c*), Seaside Park, 51,000 sq. ft.; (*d*), total cost of work: Continental Asphalt Paving Co., *a*, *b* and *c*, 26¾ cts.; *d*, $44,137; Hastings Pavt. Co., *a* and *b*, 24 cts.; *c*, 24¼ cts.; *d*, $39,727.

Albany, N. Y.—Bids will be received by Fred. Skene, State Engr. and Surveyor, until Sept. 3 for improving public highways Nos. 236 to 396, until Sept. 4 for roads Nos. 399 to 527 and until Sept. 5 for Roads Nos. 523 to 656, as advertised in The Engineering Record.

**Binghamton, N. Y.*—Arthur D. Osborn is reported to have secured the contract for paving with brick Chenango St. at $1.99 per sq. yd.

Mt. Vernon, N. Y.—Press reports state that bids are wanted until Aug. 20 for $25,000 highway improvement bonds.

Winston-Salem, N. C.—See "Water."

Elizabeth City, N. C.—Bids will be received until Sept. 2 by R. T. Whitehurst, City Clk., for $30,000 bonds to be issued for the purpose of general street improvements, and $20,000 for stone curbing.

Canton, O.—Bids will be received until Sept. 3 for about 42,000 sq. yds. vit. block paving, as advertised in The Engineering Record. Probable cost, $80,425. W. E. Sarver, City Engr.

**Toledo, O.*—Jas. Sheehan is reported to have secured the contract for paving with brick Summit Ave. at $58,415.

Dillonvale, O.—It is stated that bids will be received by the Village Council until Aug. 23 for paving sundry streets and an alley with hard burnt paving block or brick; Ross Blazer, Village Clk.

Woodsfield, O.—It is stated that bids will be received until Aug. 30 by Geo. P. Door, Village Clg., for grading, draining and macadamizing a portion of W. Court St.

Portsmouth, O.—It is stated that bids are wanted until Aug. 22 for $52,750 street improvement bonds. Fillmore Musser, City Aud.

St. Bernard, O.—Bids will be received until Sept. 3 by Geo. Schroeder, Village Clk., for constructing

* *Items marked thus give the names of parties awarded contracts.*

artificial stone sidewalks for portions of Church St., Bank and Sullivan Aves.

Guthrie, Okla.—Bids will be received on Aug. 22 for 10 blocks of paving on Cleveland Ave. Bids are wanted on two-course brick or blocks, and one-course brick or block and on asphalt. W. W. Miller, City Engr.

Ashland, Ore.—M. F. Eggleston, City Recorder, writes that no bids were received on July 30 for 16,860 sq. yds. macadam. New bids will probably be called for by City Council.

Reading, Pa.—Bids will be received until Aug. 23, by Elmer H. Beard, City Clk., for furnishing material and paving portions of several streets.

Ridgway, Pa.—Bids will be received by Geo. F. Greiner, Boro. Clk., until Aug. 31, for improving W. Main St., the work to include 2,000 cu. yds. excav.; 8,100 sq. yds. brick pav. on concrete foundation; 6,200 lin. ft. curb; 700 cu. yds. masonry; 575 cu. yds. concrete found., etc.

Lebanon, Pa.—Geo. B. Stucker, of Harrisburg, is reported to have submitted the lowest bid for 23,000 ft. state highway in Mill Creek Township, at $37,000.

**Sharon, Pa.*—The contract for paving 2,800 sq. yds. with asphalt block on Ormond Ave. is reported to have been awarded to Wm. McIntyre & Sons at $2.13 per sq. yd.

Jacksboro, Tenn.—It is stated that the Bd. Co. Rd. Comrs. (R. B. Bard, Chmn.), will receive bids until Sept. 3 for road construction.

Salt Lake City, Utah.—The Bd. of Pub. Wks. is stated to have rejected all bids opened Aug. 5, for constructing cement sidewalks.

Yorktown, Va.—It is stated that bids will be received until Sept. 3 by the Bd. Co. Superv. for constructing 2 miles of road.

**North Yokimo, Wash.*—The City Council on Aug. 6 is stated to have awarded contracts as follows: Jas. McKirn, of North Yakima, for paving with brick a portion of Yakima Ave. at $71,153 and the Barber Asphalt Paving Co. of Spokane, a portion of the same street with asphalt at $55,669.

Milwaukee, Wis.—The Bd. Pub. Wks. is reported to have rejected all bids received for macadamizing portions of 4th and Cherry Sts.

Fond du Lac, Wis.—It is stated that bids will be received by the Bd. Pub. Wks. (L. A. Pettibone, Chmn.) until Sept. 2 for paving a portion of E. 1st St. with brick and paving a number of other streets with asphalt and constructing combined curb and gutters.

Madison, Wis.—It is stated that bids will be received by O. S. Norsman, City Clk., until Sept. 13 for macadamizing a portion of Jefferson St.

Oshkosh, Wis.—It is stated that the Bd. Pub. Wks. (W. A. Marden, Chmn.) will receive bids until Aug. 24 for constructing tar macadam roadways for several streets.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Safford, Ariz.—The question of constructing water works and an electric light plant is reported under consideration.

Hot Springs, Ark.—The City Council has granted to Atwood Benton, representing the Consumers' Electric Co., a franchise for an electric light plant to be completed within a year; probable cost of plant, $135,000.

Russellville, Ark.—See "Electric Railways."

Washington, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Sept. 3, to furnish at the navy yards and naval stations the following supplies: Mare Island, Cal., Sch. 144—Annealing furnace. Sch. 190—Oregon pine, redwood, lumber. Sch. 191—Soil pipe, pipe fittings, radiators and valves, plumbing fixtures. Sch. 192.—Incandescent lamps, electric fixtures, mastic roofing, brick, etc., locomotive boiler. Sch. 194—Spikes, differential blocks, hack-saw blades, etc., drills, machinists' sets, pipe sets. Sch. 195—Rolled bronze, brass rod, sheet brass, lead and steel, ingot copper, bar iron, slab and sheet zinc. Sch. 198—Brass and steel pipe, pipe fittings, etc. Puget Sound, Wash., Sch. 189—Creosoted piles, plumbing fixtures, gate valves, expansion traps. Sch. 201—Incandescent lamps, electrical fittings, fir lumber; also until Aug. 20 as follows: Portsmouth, N. H., Sch. 167—Portland cement, sand, steam pipe, pipe fittings, valves, asbestos pipe covering. Boston, Mass., Sch. 178—Mandrels for lathe, valve reseating machine, etc. Newport, R. I., Sch. 168—Motors. Sch. 181—Battery cells. New York, N. Y., Sch. 143—Wireless telegraph apparatus. Sch. 169—Insulators, porcelain tubes, resistances, dry cells, etc. Sch. 170—Hydrometers, iron pipe, pipe fittings., sewer pipe, plumbing fixtures. Sch. 171—Yellow pine, doors, etc. Sch. 172—Asbestos roofing, steel tower. Sch. 177—Water meters. Sch. 181—Portable voltmeters and ammeters. Sch. 182—Direct differential blocks, sewer pipe. Sch. 183—White ash, white cedar, white pine, spruce, yellow pine. Sch. 184—Sheet brass, steel beams. Annapolis, Md., Sch. 178—Duplex and boiler feed pumps, tools, etc. Sch. 179—Electrical instruments, fuel saving recorder. Sch. 180—Portland cement, bricks, gravel, etc. Sch. 181—Copper conductor, etc. Sch. 182—Brass and iron gate valves, etc. League Island, Pa. Sch. 168—Electric panel boards. Sch. 183—White oak. Washington, D. C., Sch. 167—Steel, piles, yellow pine. Sch. 173—Motor, starting panel, circuit breaker. Sch. 174—Steel-wire rope, steel forgings. Sch. 175—White and yellow pine. Sch. 182—Corundum stones, etc. Sch. 184—Tool steel. Norfolk, Va., Sch. 167—Radiators, radiator valves. Sch. 182—Brass pipe. Sch. 187—Portland cement. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Genl., U. S. A.

Aurora, Ill.—The City Council is reported to have under consideration the improving of the electric light plant.

Greenfield, Ill.—The City Council is reported to have granted A. Y. Collins a franchise for an electric light plant.

Trenton, Ill.—Bids will be received until Aug. 27 for furnishing and erecting addition to building, engine, dynamo, switchboard, heater, boiler feed pump, piping and pole line material, for extending present direct-current, 3-wire lighting system. Specifications are on file at office of Newton Rule, City Clk., at Trenton, and at the office of the Engineer, W. A. Fuller, 1122 Chemical Bldg., St. Louis, Mo.

Indianapolis, Ind.—It is reported that the Bd. Trus. Woman's Prison (Faunce McKee, Pres.), will receive bids at the office of R. P. Daggett, archt., 804 Lemcke Bldg., until Aug. 28 for the installation of a heating and lighting plant in the Woman's Prison.

Hazelton, Ind.—C. L. Howard, City Clk., writes that a petition is being circulated for an election to vote on the construction of an electric light plant.

Evansville, Ind.—The Evansville Gas & Electric Light Co. is reported to be considering the placing of its wires underground.

Clay City, Ind.—The City Council is reported to be considering the question of constructing a municipal electric light plant.

Rockwell City, Ia.—F. S. Moore is reported to have purchased the electric light plant and will improve same.

Webster City, Ia.—The City Council is reported contemplating adding an engine and dynamo to the electric plant.

Murray, Ky.—W. O. Wear, City Clk., writes that bids will be received on Aug. 23 for the purchase of $20,000 bonds for water and electric light improvement.

Williamsburg, Ky.—The Williamsburg Electric Light Co. is reported incorporated with a capital of $5,000 by E. E., L. A. and Lida Nelson, all of Williamsburg.

Portland, Me.—Bids will be received until Sept. 3 by the Bd. Co. Comrs. (Jas. H. McDonald, Chmn.), for the engine, generator and electric wiring for the County Building. Geo. Burnham, archt., 120 Exchange St.

Gardner, Mass.—The Gardner Electric Light Co. has petitioned the Gas Comrs. at Boston, to issue $35,000 additional capital stock and $65,000 bonds for payment of floating debt and extension of plant and service.

**Westfield, Mass.*—The Bd. of Selectmen is reported to have on Aug. 5 awarded contract for building gas-holder to the Cruse-Kempe Co., of Philadelphia, Pa., for $20,600. The other bids received were: Davis & Farnham Mfg. Co., Waltham, $20,833; Kerr-Murray Mfg. Co., Ft. Wayne. Ind., $21,700; Deily & Fowler, Philadelphia, Pa., $23,300, and the Bartlett-Haywood Co., of Brooklyn N. Y., $26,500.

North Abington, Mass.—The Massachusetts Gas & Electric Light Comn., it is stated, has authorized the Electric Light & Power Co., of Abington and Rockland (F. N. Sanderson, Supt., North Abington) to increase its capital stock for the purpose of making additions to its plant.

**Crystal Falls, Mich.*—Robt. Munns, City Clk., writes that the contract for building an addition to power station (bids opened July 25), has been awarded to the Falkenau Electrical Constr. Co., of Chicago, Ill.

Wyandotte, Mich.—Bids will be received until Aug. 21 at the office of Jas. G. Pinson, City Clk. for the purchase of $20,000 bonds, to be issued for the purpose of improving, enlarging and extending the Public Lighting Plant.

Bay City, Mich.—The City Council has decided to remove the east side electric lighting station from its present location to the old water works building on west side of river; probable cost of proposed change, is $30,000.

Grand Rapids, Mich.—The Council has granted a franchise to the Grand Rapids-Muskegon Power Co. W. A. Foote, Gen. Mgr.

Duluth, Minn.—The Interurban Power Co. is reported incorporated, with a capital of $100,000, to improve lakes, bays and streams in aid of navigation; to furnish water to municipalities; to generate and sell electric power for all public purposes; the construction and operation of canals, etc. Incorporators: Chas. C. and Francis A. Cokefair and Wm. Harrison, office in Providence Bldg.

Graceville, Minn.—It is reported that this city proposes changing pumping system, and will soon be in market for an air compressor. H. A. Rartz, Supt. City Water & Light Plant.

Jefferson City, Mo.—Bids will be received by Matt. W. Hall, Warden, Missouri State Penitentiary, until Aug. 20 for covering boiler house, steam boilers, electric power plant, steam heating, electric wirng, etc., Jefferson City, Mo. Ruebel & Wells, Consulting Engrs., 303 Chemical Bldg., St. Louis.

Rolla, Mo.—It is reported that an appropriation of $10,000 has been made for an electric plant at Soldiers' Home.

Wood River, Neb.—An election will probably soon be held to vote on issuing $16,000 bonds for water works and an electric light plant.

**Stanton, Neb.*—The Olds Mfg. Co. is reported to have secured the contract to install an electric light plant.

Rockaway, N. J.—E. L. Thompson, of Dover, is reported to have purchased the plant of the Rockaway Electric Light Co., and proposes improving same.

Little Falls, N. Y.—The citizens are reported to have voted in favor of issuing $10,000 bonds to improve the electric light system.

Long Island City, L. I., N. Y.—The New York & Queens County Electric Light & Power Co. (J. N. Bissell, Gen. Mgr., Long Island City), has applied to the Public Service Comn. for permission to issue $2,000,000 bonds for extensions, equipment and refunding.

**New York, N. Y.*—Contracts for installing electric equipment in school (bids opened Aug. 12 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City), have been awarded as follows: To T. Fred. Jackson, Inc., 592 Columbus Ave., for School 66, Manhattan Boro., at $11,785, and School 19, Richmond Boro., $2,120; and to Griffin & Co., 150 Nassau St., for School 91, Manhattan Boro., $15,394.

Sherburne, N. Y.—The village is reported to be considering the establishment of a municipal lighting plant to cost about $15,000.

Toledo, O.—J. W. Kerr, Chmn. Co. Comrs., writes that all bids opened recently for building and equipping new power house at County Infirmary have been rejected.

Lima, O.—The City Council is reported to be considering the installation of an electric plant as an auxiliary to present pumping plant at water works.

Walter, Okla.—H. F. Tripp, City Clk., writes that the Walter Electric Light & Power Co. has received franchise to construct electric light plant; probable cost of work, $25,000.

Lawton, Okla.—The Lawton Lighting Co. is reported incorporated with a capital of $100,000 by D. E. Stephenson, of Ansonia, O., and others.

York, Pa.—At a meeting of the stockholdrs of the York Gas Co. on Aug. 15 it was decided to increase the capital from $600,000 to $1,000,000. The money will be used for the installation of a high-pressure system and making other improvements for extending the service to nearby towns.

Martinsburg, Pa.—The Morrison's Cove Electric Light & Power Co. is reported incorporated with a capital of $50,000 for the purpose of generating electricity for lighting, power, heating and manufacturing purposes. Incorporators: J. W. Wagner, of Barbara; J. W. Suther, of Indiana, and others.

Rapid City, S. D.—The Rapid City Electric & Gas Co. (A. Emerick, Supt.), proposes installing 3-phase, 60-cycle, 100-kw. alternator and steam unit.

Rapid City, S. D.—The Dakota Power Co. is reported formed, and has secured an option on ground on Rapid Creek, which it will harness at a point about 2 miles below Placerville. It will generate about 10,000 h. p., and furnish power to Rapid City and surrounding small towns.

Park City, Tenn.—The City Council has passed on second reading an ordinance granting the Knoxville Ry. & Light Co., of Knoxville., a franchise to light the streets of Park City.

Graham, Va.—C. W. Keister, a citizen of Graham, writes that it is proposed to construct an electric light and power plant here, but would like some party with experience and capital to assist with same.

Buchanan, Va.—The James River Water Power Co. is reported incorporated with a capital of $500,000 to construct a power plant on James River; E. C. Hoffman, of Buchanan, is reported interested.

Port Angeles, Wash.—This city proposes enlarging the municipal electric light plant to be operated by water power instead of steam, and will issue bonds to the amount of $80,000 for same. The new plant will be of 350 h.-p. Specifications have not yet been prepared. John Hallahan, Mgr.

**Seattle, Wash.*—Contracts are reported to have been awarded as follows for addition to municipal electric light plant: To the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., for two 4,000-h.-p. alternators and to the Ft. Wayne Electric Wks., Ft. Wayne, Ind., for 17 1,500-kw. transformers, to be used in connection with 60,000- volt transmission line to Seattle.

Elkins, W. Va.—Bids will be received by the Co. Court (Lee Crouch, Clk.) until Aug. 26 for electric fixtures and gas fixtures for the courthouse now being erected.

Menomonie, Wis.—The Chippewa Valley Electric Light & Power Co., of Eau Claire, is reported to have been the only bidders recently for lighting the city of Menomonie for a term of 7 years beginning next January. It offers to furnish all-night lights of 2,000 cp for $75 per year, or $70 if more than 50 arc lights are used.

Rhinelander, Wis.—Oneida Gas Co. is reported incorporated with a capital of $50,000, by Dick Lowell, Alfred Pafer and others.

Prentice, Wis.—The Prentice Light, Power & Water Co. is reported incorporated with a capital of $3,000. A. F. Ziegler is one of the incorporators.

Green Bay, Wis.—F. H. Josslyn, of Oshkosh, is reported to have petitioned for a franchise for a light plant.

Menominee Falls, Wis.—It is reported that the Menominee Falls Electric Light Co. has been incorporated with a capital of $15,000 by Richd. C. Wanger, J. K. Kremers, and others.

**Milwaukee, Wis.*—John L. Beggs, Pres., and F. J. Boehm, Asst. Secy., are reported to have signed the contract of St. Ry. Co. with city to light the streets at $65 per lamp per yr.

Engineers R. W. Hunt & Ho. have presented the Bd. of Pub. Wks. an estimate of cost of the first work proposed on the municipal electric lighting plant under the specifications they have prepared. The estimated cost of the gas producer plant is $100,000 and of the engines, $400,000.

Eau Claire, Wis.—The Special Com. appointed by City Council to investigate question of building a combined bridge and dam at lower end of city is stated to have reported that the project is feasible and desirable. If a dam is built it will develop power for commercial purposes and raise Chippewa River about 5 ft., and form a lake for boating and yachting.

Lander, Wyo.—O. C. Edwards, Pres. Landers Irrigation & Improvement Co., writes that this company is erecting a hydro-electric power plant at this place, and is in the market for 4,300 ft. riveted pipe, turbines, generators, centrifugal pumps, direct-connected to motors having capacity 10,000 gal. per minute, with 60-ft. head of elevation. For the power plant it has 300-ft. of head with a supply of 9,000 cu. ft. per minute. Engineer, J. C. Edsall, of Lander.

St. Thomas, Ont.—The Ontario Ry. anad Municipal Board is reported to have approved the by-law providing for the issue of $7,000 bonds for extension of gas and electric light works.

* *Items marked thus give the names of parties awarded contracts.*

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Russellville, Ark.—The Russellville & Ozark Mountain Traction, Light & Power Co. has been incorporated with capital of $200,000 by Adam J. Robinson, J. C. Wilson, Jas. Gould and others to build electric lines from Russellville to other towns and to furnish Russellville and other towns with electric power and lights. The first road the company proposes to build is from Russellville to Dover.

It is reported that Edwin Cook, 401½ Main St., Pine Bluff, has completed plans for a masonry and concrete dam for the Russellville & Ozark Mountain Traction, Light & Power Co., to be constructed across Illinois Bayou, near Russellville, and bids will be received for same until Aug. 24.

Los Angeles, Cal.—The Los Angeles-Pacific R. R. Co. is stated to have made arrangements to build a standard-gage branch line with Sherman as the terminus, equipped with a third-rail system. C. H. Ellison, Ch. Engr.

Atlanta, Ga.—Articles of incorporation, it is stated, will be filed for an electric railway from Greenville, S. C., to Spartansburg, with a total length of about 31 miles. A. A. Gates, C. C. Good, H. H. Prince and O. K. Maulden are incorporators.

Naperville, Ill.—It is reported that the Aurora, Elgin & Chicago Electric Ry. Co. (Chas. Jones, Ch. Engr., Wheaton) is planning a branch to Naperville.

Terre Haute, Ind.—The St. Louis, Terre Haute & Quincy Traction Co. is stated to have announced that the company will let construction contracts about September. The line will be built for heavy freight traffic, with easy grades and curves. It will extend from Terra Haute, Ind., to Marshall, Mattoon, Taylorville, Verden, Roodhouse, Pittsfield and Quincy, Ill., 250 miles. Surveys for 140 miles have been made and right of way is obtained. Edward Yates, Pres., Springfield, Ill.

Tulsa, Ind. Ter.—The Mid-Continent Traction Co., recently incorporated in Indian Territory, it is stated, will build an interurban electric railway to connect Tulsa, West Tulsa, Red Fork, the Glenn Pool oil fields and Sapulpa. F. L. Smart, Kansas City, President; Graham Burnham, Tulsa, Secy. and Genl. Mgr. The line is to be 21 miles in length.

Des Moines, Ia.—It is stated that the Des Moines City Ry. (Frank S. Cummins, Ch. Engr.) intends to extend its line across the new Sixth Ave. bridge over the Des Moines River to Highland Park.

Lansing, Mich.—It is stated that contracts have been let to W. E. Tench & Co., 210 John R. Street, Detroit, for the construction work of 40 miles of electric railway for the Lansing-Jackson Interurban Ry., T. W. Atwood, Pres.

Traverse City, Mich.—The Carter Constr. Co. is stated to have petitioned for a franchise to construct and operate a street railway here.

St. Joseph, Mich.—The Indiana & Michigan Electric Co. is reported to have in contemplation the construction of an electric railway from this city to Grand Rapids, either via Kalamazoo or South Haven and Saugatuck. It is proposed ultimately to extend the line around the south end of the lake to Chicago.

Kansas City, Mo.—The County Court is stated to have granted W. E. Winner a 20-ft. right of way for an electric railway along the Blue Valley Boulevard. The electric line is to connect with the Swope Park Line of the Metropolitan St. Ry.

Morristown, N. J.—The road committee of the Essex County Bd. of Freeholders is stated to have granted a franchise to the Morris County Traction Co. to lay tracks on Springfield Ave., from Main St., Milburn, to Maplewood. The road will connect Summit and Newark.

Tiffin, O.—Council is stated to have granted a franchise to the Cleveland & Indianapolis Electric Ry. Co. The line is being built from Bluffton to Norwalk.

Findlay, O.—The Toledo Urban & Interurban Ry. Co. (Chas. F. Smith, Mgr.), is reported to have announced intention to extend the road from this point to Kenton.

Waynesburg, Pa.—The City Council is stated to have passed an ordinance granting a franchise to the Brownsville, Carmichaels & Waynesburg Electric Ry.

Wilkes-Barre, Pa.—The Comnrs. of Wilkes-Barre Township are stated to have granted a franchise to the Traction Co. for the extension of its line from the Empire to Laurel Run. Work will shortly be commenced on the extension of its line from the Empire to Laurel Run. Work will shortly be commenced on the extension. Thos. A. Wright, Gen. Supt., Wilkes-Barre.

Huntingdon, Pa.—It is stated that the Juniata Electric St. Ry. Co., of Huntingdon, intends building a road from Huntingdon to Lewistown.

Gettysburg, Pa.—It is stated that negotiations are in progress for the connection of the lines of the Washington, Frederick & Gettysburg Ry. Co. and the Great Falls & Old Dominion Ry. Co. by the construction of about 20 miles of line.

Slatington, Pa.—Right of way is reported to have all been secured for the Franklin & Towamensin St. Ry. The road will be 9 miles long and will extend from Slatington to Towamensing.

Nashville, Tenn.—R. E. Chamber, of Cincinnati, O., is reported interested in a proposition to build an electric railway to connect Louisville, Ky., with Nashville.

RAILROADS.

Notes Arranged Alphabetically by States.

Pensacola, Fla.—Bids will be received at the office of the Interstate Contract Co., 224 Brent Bldg., until Sept. 5, for grading, masonry and bridges on 105 miles of railroad for the Pensacola, Alabama & Western R. R., as advertised in The Engineering Record.

Hartwell, Ga.—A charter has been granted to the Georgia Carolina Ry. Co. to construct a railroad 60 miles in length from Athens, Ga., through Clarke, Madison, Franklin and Hart Counties to the Savannah River, and thence to Anderson, S. C.; capital, $1,000,000, and principal office in Hartwell, Ga. Incorporators: A. H. Hodgson, of Athens; A. N. Alford, J. W. Williams and W. L. Hodges, of Hartwell; D. W. Brooks, of Royston; Berry T. Mosely, of Danielsville, and others.

Aberdeen, Miss.—C. B. Hopkins, of Aberdeen, Secy. Columbus, Memphis & Pensacola R. R. Co., writes that the citiens of Aberdeen and Columbus voted on Aug. 1 in favor of issuing $30,000 and $50,000 respectively to aid in construction of this line. He further states that V. M. Murphy is in charge of the proposed work.

Grand Forks, N. D.—W. A. Coleman, of Carrington, is reported interested in the construction of a railroad from Grand Forks to Carrington.

Panama.—R. C. Hoffman & Co., of Baltimore, Md., is reported to have submitted the lowest bid on Aug. 8 at $95,250 for furnishing material for the partial relocation of the Panama R. R. The specifications calls for 3,000 tons of steel rails, a large number of angle bars, 100,000 crossties, bridge timber, culvert pipe and other material incident to railroad construction.

**Moose Jaw, Sask.*—The Canadian Pacific R. R. Co. is reported to have awarded to J. D. McArthur the contract for constructing an extension from Moose Jaw to Lacombe and Edmonton, for about $300,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Redwood City, Cal.*—Jas. Nash, Co. Clk., writes that the contract for erecting court house (bids opened July 29), has been awarded to J. J. O'Brien Constr. Co., of San Francisco, for $160,000.

Denver, Colo.—It is stated that a 3-story building is to be erected at W. 29th Ave. and Osceola St. for St. Clara's Orphanage at a cost of about $75,000. F. W. Paroth, archt.

Middletown, Conn.—Bids will be received until Aug. 22 by the Bldg. Com., Conn. Hospital for Insane, care Frank B. Weeks, for the masonry, carpentry, steel work, fireproofing and sheet metal work for an amusement hall for the Conn. Hospital for the Insane. Wm. D. Johnson, archt., 26 State St., Hartford.

Takoma, Washington, D. C.—Bids will be received until Aug. 23 by Maj. J. T. Crabbs, Q. M., Walter Reed Army Gen'l Hospital, for the construction, including plumbing, gas piping and electric lighting of a double set of hospital corps sergeants' quarters at above hospital. Plans and specfications may be had upon a deposit of $25.

Washington, D. C.—Bids were opened on July 31 at the office o Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, for the following:

Interior marble work in 2d and 3d stories of Bay "V" Senate office Bldg., Vermont Marble Co., Proctor, Vt., $44,600; B. A. & G. N. Williams, 5 and 7 E. 42d St., New York, N. Y., $47,750.

Interior stone work in House office building: (*a*), entire work; (*b*), on Rotunda section on all floors, including halls and staircases; (*c*), basement floor; (*d*), 1st floor; (*e*), 2d floor; (*f*), 3d floor: Vermont Marble Co., Proctor, Vt., *a*, $143,000; *b*, $59,900; *c*, $20,300; *d*, $23,600; *e*, $22,100; *f*, $17,100; Blue Ridge Marble Co., Nelson, Ga., *c*, $15,028; *d*, $18,250; *e*, $17,368; *f*, $13,850; also from Blue Ridge Marble Co. an alternate bid of $14,665 for all marble work in entire building except portion included in Rotunda Section and excepting also the marble work in floors. Rutland-Florence Marble Co., Fowler, Vt., *d*, $15,635.

For direct radiators for House office building: Shirley Radiator & Fdy. Co., Indianapolis, Ind., $8,905; J. L. Mott Iron Wks., Washington, D. C., $9,115; U. S. Radiator Co., Dunkirk, N. Y., $9,267; H. B. Smith Co., 728 Arch St., Philadelphia, Pa., $9,620; J. B. Clow & Sons, Chicago, Ill. (2 bids), $9,682 and $10,807.

Bids will be received at the Bureau of Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., until Sept. 14, for constructing three brick buildings at the Naval Hospital Reservation, Washington, D. C.

Pensacola, Fla.—Bids will be received until Sept. 14 at the Bureau Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., for constructing 2 brick buildings, one for a locomotive shed and the other for a paint shop, at the Navy Yard, Pensacola, as per specification No. 1,555.

Augusta, Ga.—The City Council is reported to have selected Lewis T. Gooderich to prepare plans for the city hall to be erected at a cost of about $200,000.

Great Lakes, North Chicago, Ill.—Bids will be received at the Bureau of Navigation, Navy Dept. (W. H. Brownson, Ch., Washington, D. C.), until Aug. 26 for furnishing material and completing the construction of houses for officers' quarters for the naval training station, Great Lakes, North Chicago, Ill.

Elgin, Ill.—Bids will be received until Sept. 7 at the Ill. Northern Hospital (Dr. V. H. Podstate, Supt.) for erecting a farm cottage and a woman's cottage at above hospital. W. Carbys Zimmerman, State Archt., 1101 Steinway Hall, Chicago.

Indianapolis, Ind.—See "Power Plants, Gas and Electricity."

New Castle, Ind.—Bids will be received until Sept. 2 by the Bd. Trus. Indiana Village for Epileptics (Enoch G. Hogate, Secy.), for erecting 2 cottages. W. S. Kaufman & Son, Archt., Richmond.

Evansville, Ind.—It is reported that bids will probably soon be asked for by the Evansville Assoc. of Relief of Tuberculosis (Dr. J. Y. Welborn, Pres.) for the erection of a hospital.

Sioux City, Ia.—The erection of an auditorium in Sioux City at a cost of $30,000, is reported contemplated.

**Waterloo, Ia.*—Contracts for erecting the west side fire station are stated to have been awarded as follows: General construction to C. W. Campbell, of Waterloo, at $12,996, and plumbing and heating to Ellis & Foster, 610 Commercial St., at $2,081.

Liberal, Kan.—It is stated that bids will be received by the Bd. Co. Comrs. until Aug. 31 for erecting a 2-story, 64 x 64 ft. brick court house; probable cost, $13,000. J. M. Smith, Archt., 405 S. Main St., Hutchinson.

Leesville, La.—C. H. Page, of Austin, Tex., is reported to have been selected to prepare plans for the court house to be erected in Leesburg, at a cost of $100,000.

Baltimore, Md.—The Directors of the Dr. Saml. Leon Frank Memorial Hospital, according to reports, have decided to have Louis Levi archt., American Bldg., alter the original plans for the hospital, which called for one 5-story building and to erect instead 2 buildings, one an administration building 3½ stories high, and a ward building. There will also be erected in connecton with these buildings a laundry and boiler house. The cost of the hospital is to be about $80,000.

Boston, Mass.—The plans of Freeman, Funk & Wilcox are reported to have been selected for the 3-story engine house to be erected at High, Washington and Walnut Sts, at a cost of $60,000.

Owosso, Mich.—The following are the bids opened on July 31 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Owosso: Geo. Richmond, Kalamazoo, $48,450; Frachtel & Scherman Co., Saginaw, $56,980; General Constr. Co., Milwaukee, Wis., $58,780; Northern Constr. Co., Milwaukee, Wis., $56,000, and W. J. McAlpine, Dixon, Ill., $56,930.

Crookston, Minn.—The following are the bids opened on Aug. 5, at the office of Jas. Knox Taylor, Superv. Archt. Treasury Dept., Washington, D. C. for the construction (complete) of the U. S. Post Office at Crookston, Minn.: Northern Constr. Co., Milwaukee, Wis., $57,449; General Constr. Co., Milwaukee, Wis., $55,454; J. W. Miller, St. Paul, $56,633; J. Schell, Litchfield, Minn., $87,700, and Launtzen Bros., Fergus Falls, $50,990.

Kansas City, Mo.—The Bd. of Pub. Wks. is stated to have approved plans for an engine house to be erected at Virginia St. south and Independence Ave., at a cost of $22,250.

Jefferson City, Mo.—See "Power Plants, Gas and Electricity."

**St. Joseph, Mo.*—J. A. McGonigle, of Leavenworth, Kan., has secured the contract for miscellaneous repairs to U. S. Post Office (bids opened July 17) for $29,672.

Paris, Mo.—It is reported that the Monroe Co. Comrs. are preparing to build a court house at a cost of $75,000.

**Great Falls, Mont.*—Saml. Stephenson, Secy. Bd. Trus. Montana Deaconess Hospital, writes that the contract for erecting a building for this hospital (bids opened July 29), has been awarded to Lease & Richards, of Great Falls, for $45,000.

**Elizabeth, N. J.*—Contracts for remodeling the city hall are reported to have been awarded on Aug. 5 as follows: Lammerding & Devine, 277 Broad St., mason work, $10,434; John J. Ludwig & Co., 569 4th Ave., carpenter work, $8,215; L. H. Hoffman & Co., 1184 E. Grand St., steam fitting, $2,495; H. A. Rath & Co., 1217 E. Broad St., plumbing, $2,054; Martin & Eggersted, painting, $580; total, $23,778.

Overbrook, N. J.—Percy B. Taylor, 122 Market St., Newark, it is stated, has been engaged by the Pub. Bldgs. Com. of the Bd. of Freeholders as special engineer to determine what heating and ventilating apparatus is needed at the new Overbrook Hospital.

Trenton, N. J.—Bids will be received until Aug. 24 by the Bd. Mgrs. (Thos. P. Fay, Pres.) State Home for Girls, for furnishing material and erecting an Assembly Hall at said home.

Troy, N. Y.—Bids will be received until Aug. 23 by the Bd. Contract. and Supply, (Jas. M. Riley, Clk.) for furnishing material and erecting a greenhouse at Prospect Park.

Brooklyn, N. Y.—Bids will be received by Hugh Bonner, Deputy and Acting Fire Comnr., New York City, until Aug. 28, for furnishing material and erecting a building for an Engine and Hook and Ladder Co. on Rockaway Ave. and Ave. F., Boro. Brooklyn.

**Schenectady, N. Y.*—The Bd. of Mgrs. of Ellis Hospital, it is stated, has decided to erect a south wing to the main building and an addition to the Whittemore Home for Nurses, the two to cost about $45,000. Contracts for the work are reported awarded as follows: John McDermott, 108 Romeyn St., masonry; S. K. Taylor, carpentry work; Levi Case & Co., 412 Warren St., plumbing and heating; Shaffer & Barry, painting; Jas. F. Burns, electrical work.

Riker's Island, N. Y.—The State Prison Comn. on Aug. 6 approved the general scheme for the penitentiary for New York County, which is to cost $3,000,000, and to be located on Riker's Island.

Brooklyn, N. Y.—The following are the bids opened on Aug. 8 by the Comrs. of Parks, N. Y. City, for furnishing material and erecting the following: (*a*), shelter and tennis house in Prospect Park; (*b*), shelter house in Winthrop Park, both in Brooklyn Boro.: Geo. F. Driscoll, Brooklyn, *a*, $66,666; *b*, $32,500; Richd. E. Heningham, 1 Madison Ave., N. Y. City., *a*, $66,000; Geo. Hildebrand, N. Y. City, *a*, $78,440; Jas. MacArthur, N. Y. City, *a*, $86,277; *b*, $32,000; Daniel J. Ryan, Brooklyn, *a*, $69,470.

Bids will be received until Aug. 29 (readvertisement) by Comrs. of Parks (Moses Herrman, Pres.), New York City, for furnishing material and erecting a shelter house in New Lots Park, Fulton Park and Winthrop Park and a shelter and tennis house in Prospect Park, all in Boro. of Brooklyn.

Niagara Falls, N. Y.—It is stated that Braas Bros. Co., 1110 Whitney Ave., have secured the contract for the carpentry and masonry work on the addition to the Memorial Hospital, at $50,000.

New York, N. Y.—Bids by Hugh Bonner, Deputy and Acting Fire Comr., will be received until Aug. 28, for furnishing material and erecting a building for an engine company on White Plains Ave., near 230th St., Boro. Bronx.

Bids will be received by Arthur J. O'Keefe, Acting Police Comnr., Aug. 26, for furnishing material and making alterations to the interior (excepting as to heating and ventilating system, boilers and steam piping) of the building on Grand and Centre Sts., Boro. Manhattan, for headquarters for the Police Dept.

Salisbury, N. C.—Plans are reported to have been submitted to the Co. Comrs. for a court house. The erection of a building costing $50,000 is contemplated.

**Shelby, N. C.*—W. H. Eskridge, Clk. Co. Comrs., writes that the contract for erecting a court house (bids opened Aug. 6), has been awarded to Falls City Constr. Co., of Louisville, Ky., for $66,797.

* *Items marked thus give the names of parties awarded contracts.*

**Jamestown, N. D.*—Geo. G. Busch ,City Aud., writes that the contract for erecting city hall (bids opened Aug. 5), has been awarded to Hogland Bros., Hasty, Minn., for $21,690.

Toledo, O.—The Co. Comrs., it is stated, have rejected all bids received July 26 for the construction of a heating plant at the County Infirmary. The Comrs., it is reported, will take no further action on plant until next January.

Portsmouth, O.—It is stated that bids are wanted until Aug. 22 for $30,000 city hospital bonds. Fillmore Musser, City Aud.

**Youngstown, O.*—The Bd. of Public Service is reported to have awarded contracts as follows for erecting market house on W. Boardman St.: Excavating, brick and iron work, Jos. Millham, $26,165; roofing and sheet metal work, John R. Squire, $2,829; plumbing, Jacob Brenner, $1,055, and electrical work, Electrical Wiring Co., $1,422; total cost, $34,471.

**Cincinnati, O.*—L. P. Hazen & Co., Reading Rd. and Elsmore Ave., are reported to have been awarded the contract for the contagious wards and power building of the new hospital building, in Burnet Ave., at $317,500.

Athens, O.—Frank L. Packard, archt., of Columbus, is reported to have let to Geo. L. Penzel the contract for the new infirmary building to be erected at the Athens State Hospital to cost $20,000.

Hamilton, O.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 24 for the construction complete of U. S. Post Office at Hamilton, as advertised in The Engineering Record.

National Military Home, O.—It is stated that bids will be received until Aug. 23 by W. H. Ortt, Treas., Central Branch, N. H. D. V. S., for an addition to hospital and for tuberculosis ward.

Orient, O.—It is stated that bids will be received until Aug. 22 by E. J. Emerick, M. D., Secy. Ohio Institution for Feeble Minded Youth, Columbus, for installing heating system in the dining hall at the Custodial Farm, Orient. Frank L. Packard, Archt., Columbus.

Pendleton, Ore.—T. F. Howard, of Pendleton, is reported to be preparing plans for a 72x80 ft. 2-story city hall to be erected here at a cost of about $28,000.

**Scranton Pa.*—The contract for the erection of the receiving building and detention ward, the ambulance station, and the boiler house, which will be built by the State Hospital has been awarded to Edwin S. Williams, care of Edward Langley, Connell Bldg., for $30,400.

**Connellsville, Pa.*—The State Armory Bd. is reported to have awarded the contract to erect an armory here to Hurst & Co., of Mt. Pleasant, at $28,000.

Philadelphia, Pa.—Jas. G. Doak & Co. are stated to have been granted a permit to build a 6-story brick and stone ward building for the Hahnemann Hospital at 15th and Race Sts. Cost will be $125,000.

A building containing the laundry and lighting and heating plant of the Pennsylvania Hospital for the Insane in West Philadelphia, is reported destroyed by fire.

Wilkesbarre, Pa.—Court House bonds, amounting to $150,000, have been sold.

Spring City, Pa.—The following bids are reported opened Aug. 9 by the Chmn. appointed with J. T. Sherwood, Secy., at the office of the Governor at Harrisburg for erecting a hospital for feeble minded and epileptics near Spring City: Doak & Co., Philadelphia, $514,645; McCaul & Co., of Philadelphia, $462,051; Rong & Co., of Wilkesbarre, $490,115, and Messers, Wiggins & Co., of Philadelphia, $430,600.

*The contract for the above, which includes the erection of 5 buildings and dormitories for the State Hospital for Epileptics at Spring City is repoted to have been awarded, on Aug. 12, to John R. Higgins & Co., of Philadelphia, for $251,504. The contract for grading and excavating same was awarded to McCormick & Co., also of Philadelphia, for $53,188.

Columbia, S. C.—It is stated that bids will be received by W. D. Starling, Superv., until Sept. 5 for additions, alterations and roofing the court house. Shand & La Faye, Archts., 1328 Main St.

Nashville, Tenn.—Bids will be received until Aug. 21 by the Co. Criminal Court and Jail Com., at the office of W. G. M. Campbell, 222½ Union St., for erecting the criminal court and jail. Bids to be submitted separately on the following: Carpentry, etc.; sheet iron and tin work; skylight, etc. Wheeler, Runge & Dickey, Archts., 74 Arcade.

Murfreesboro, Tenn.—It is stated that bids will be received until Aug. 27 (readvertisement) by T. E. Hord, Chmn. County Court. Murfeesboro, for remodeling the court house. James H. Teamon, Archt., Nashville.

Ft. Bliss, Tex.—Bids will be received at the office of the Constructing Quartermaster, U. S. A. until Sept. 10 for alterations to two lavatory buildings at this post, plumbing and concrete work, as advertised in The Engineering Record.

Richmond, Va.—It is stated that a building is to be erected here for the Wernle Home for Orphan Lutheran Children, at a cost of $35,000.

De Pere, Wis.—It is reported that the Special Bldg. Com. of the Co. Bd. has requested plans to be submitted in competition until Oct. 15 for a 3-story and basement court house and a 2-story and basement jail. The jail must be fireproof and the court house as near fireproof as the money available will permit. The cost of the entire work, including heating, plumbing, electric work, architect's fee, etc., is not to exceed $300,000.

Casper, Wyo.—F. H. Sawyer, Co. Clk., writes that new bids will be received on Aug. 22 for the erection of a court house, to cost about $40,000. Archt., A. M. Randall, of Casper.

**Victoria, B. C.*—F. J. Fulton, Chief Comr. Lands and Works, Victoria, writes that the contract for erecting court house (bids opened July 31) has been awarded to McDonald, Wilson & Snider, of Vancouver.

Sudbury, Ont.—Bids will be received by H. F. McNaughton, Secy. Pub. Wks. Dept., until Aug. 27, for erecting a court house and registry office at Sudbury. Plans on file at the office of DeMorest & Stull, Sudbury.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Anniston, Ala.*—The directors of the Farmers' Union Warehouse Co., it is reported, has let the contract for erecting warehouse in this city to the Fireproof Constr. Co., of Atlanta, Ga. Estimated cost, complete, $16,000.

Cullman, Ala.—It is stated that bids will be received until Aug. 28 by L. N. Buell, Brighton, for ecting a brick, stucco and concrete building for Grand Lodge, I. O. O. F. at Cullman. Fred Gordon Shaw, Archt., Mezza-Woods Bldg., Meridian, Miss.

Redondo, Cal.—Plans are being prepared, according to reports, for the new plunge and bath house which will be constructed here by H. E. Huntington at a cost of $200,000.

Los Angeles, Cal.—The plans for the Salvation Army 7-story building to be erected on 4th and Main Sts., it is stated, have been prepared by Dennis & Farwell, 414 Currier Bldg. The cost will be about $75,000.

Hudson & Munsell, Stinson Bldg., according to reports, have prepared plans for a 7-story reinforced concrete and brick building to be erected on Clay and 3d Sts., by the Elks Hall Assoc.

San Francisco, Cal.—Permits have been asked for the following buildings:

Boardman & Tompkins, to erect a 5-story steel and brick store and loft building at California and Front Sts., to cost $100,000. Meyerstein & Rothchild, to erect a 6-story class C building on Grant Ave. and Geary St., to cost $105,000. F. Kronenberg, for a 6-story building at Main and Market Sts., to cost $60,000, and Dr. C. F. Buckley, a 2-story brick building, costing $40,000, to be built on Market St., near Marshall Sq. The San Francisco Gas & Electric Co., to reroof its power-house structure, on 22nd, 23rd, Louisiana and Georgia Sts. Cost, $60,000.

**Springfield, Ill.*—The R. Hass Electric Co., according to reports, intends erecting a 3-story business building estimated to cost $30,000. The Culver Constr. Co., of Springfield, it is stated, has secured contract to erect the Y. M. C. A. Bldg. at $28,697 and the R. Hass Electric Co., the contract for the underground sewerage and plumbing of said building at $758.

Ft. Wayne, Ind.—The Bd. of Directors of the Ft. Wayne Hotel, according to reports, have engaged an archt. to act with Chas. R. Weatherhogg, Hamilton Natl. Bank Bldg., in the preparation of plans for the hotel. There is at present about $200,000 subscribed for the building.

Newcastle, Ind.—The Terra Haute, Indianapolis & Eastern Traction Co. is reported to have purchased a site and will begin at once the construction of a passenger and freight station. The building will be 92 x 140 ft.

Greencastle, Ind.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. (H. F. Houghton, Gen. Supt. Indianapolis) is reported to be considering the erection of a depot on Madison and Jackson Sts.

Lafayette, Ind.—The Lafayette Insurance Co. is reported to be seeking a site on which it is proposed erecting a $100,000 office building.

Louisville, Ky.—The Whiteside Babink Co. is reported to have secured a permit to erect a 4-story concrete bake shop at 14th St. and Bway. The building will have granite floors and cost $50,000.

Clinton, Mass.—J. W. Bishop & Co., of Worcester, Mass., is stated to have secured contract for the erection of a mill on Union St., for the Bigelow Carpet Co., at about $300,000.

**Bay City, Mich.*—The Wenonah Building Co., which will build Bay City's new hotel is stated to have awarded the contract for the erection of same to the Moses Constr. Co., of Chicago, Ill.; estimated cost, $225,000.

Minneapolis, Minn.—The Chute Realty Co. will erect a 2-story brick store building at 415 1st Ave., S. E., to cost about $21,000.

The North Star Malting Co. will erect 10 tile and steel grain tanks at Main St. and 18th Ave., N. E., to cost about $35,000.

E. H. Erickson will erect a 2-story brick building with stores at 2443 4th Ave. S., to cost about $25,000.

Duluth, Minn.—John Christie will receive bids about Aug. 24 for a 6-story reinforced concrete office building. W. T. Bray, archt.; E. K. Coe, consulting Engr., 1411 E. 3d St.

Little Falls, Minn.—It is stated that Harrison & Peterson are contemplating the erection of a 1-story solid brick business block, 50x100 ft., on Bway. and Wood St.

**St. Paul, Minn.*—Geo. J. Grant, 61 E. 96th St., has secured the contract for erecting 5-story stone, brick and concrete building, for hall and lodge rooms, at 9th and Cedar Sts., for the Y. M. C. A.; cost, about $300,000.

A permit is stated to have been issued for the erection of a 4-story brick building at Sibley, and 3rd Sts., for Jos. Strong, at a cost of $90,000.

**Colraine, Minn.*—E. M. Johnson, 407 Kasota Bldg., Minneapolis, Minn., is reported to have the contract for the erection of a modern office building for the Oliver Iron Mining Co., to cost $35,000.

Louisville, Miss.—TThe Merchants' and Farmers' Bank (R. B. Talbert, Cashier) will receive bids until Aug. 20 for erecting a banking house.

**Springfield, Mo.*—The contract for the Missouri Pacific R. R. freight station and office building at Springfield, it is reorted, has been awarded to the Steininger Constr. Co., of St. Louis. The building will be 43x291 ft., and will cost about $30,000, including equipment.

Omaha, Neb.—A permit is stated to have been issued for the erection of a brick and stone building by the Merchants' National Banak in the rear of its present building on 13th St. The building will be 4 stories, 36x43 ft. J. E. Dietrich, 540 Ramge Bldg., is the architect, and Parsons & Kleine the contractors; cost is $30,000.

Trenton, N. J.—Mahlen R. Morgerun is reported to have completed plans for a $100,000 hotel to be erected on Warren St. by the Trenton Hotel Co.

Atlantic City, N. J.—Seymour Davis and Paul A. Davis are reported to be preparing plans for a 5-story, 200x400 ft. fireproof structure to take the place of the present Hotel Windsor at Illinois Ave. and the beach, at a cost of $400,000, for G. J. Waters.

Newark, N. J.—The Newark Turnverein is reported to have adopted plans and specifications of T. H. Ogden Co., 9 Clinton St. for a turn hall to be erected in Newark, at a cost of about $25,500.

**Camden, N. J.*—The Bd. of Trus. of Camden Aerie, Fraternal Order of Eagles, it is stated, has awarded the contract for erecting their new home to Geo. Bachman, of Camden, at about $50,000. The building is to be 4 story, of brick, stone and terra cotta.

Rochester, N. Y.—Plans have been filed for the new building to be erected by the Genesee Amusement Co. in St. Paul St., to be used for a skating rink and for bowling alleys. Cost, $75,000.

Rome, N. Y.—The Bldg. Com. of the Y. M. C. A. on Aug. 2, it is stated, opened bids for plumbing as follows: John R. Harper, $4,075; Chas. H. Jackson, $5,300; O'Shea & Larkin, $4,628; Russ & Sons, $4,694.

Buffalo, N. Y.—The freight house of the Erie R. R. Co. at Exchange and Louisiana Sts. is reported destroyed by fire. Francis L. Stuart, Ch. Engr., 11 Bway., New York City.

Long Beach, L. I., N. Y.—It is stated that Seymour Davis and Paul A. Davis are preparing plans for a 5-story, 630x328 ft., marble terra cotta and brick hotel to be erected at Long Beach for G. J. Waters at a cost of $1,000,000.

**Newburgh, N. Y.*—The contract to install a steam heating plant in the Turn Verein Bldg. is reported to have been awarded to Albert C. Smith & Co., of West Newburgh.

Long Island City, L. I., N. Y.—Mrs. Russell Sage is reported to have given $50,000 for the erection of a Young Men's Christian Association Bldg. for the employees of the Long Island R. R. at Long Island City.

**Durham, N. C.*—H. L. Smith is reported to have secured the contract to erect the Y. M. C. A. Bldg. at $32,000.

Devils Lake, N. D.—Clark Kelly is reported to have secured plans for an opera house to be erected at Devils Lake, at a cost of $30,000.

Cincinnati, O.—Charles B. Kessing, according to reports, will erect a 4½-story store building on Pearl St. Estimated cost $18,000.

Athens, O.—Bids will be received until Aug. 31 by the Bd. Dirs., Athens Masonic Temple Co. (W. E. Peters, Secy.) for erecting a 4-story Masonic Temple. Elmer L. Gerber, Archt., 20 Patterson Bldg., Dayton.

**Marietta, O.*—W. J. Speer, Chmn. Bldg. Com., German Natl. Bank, writes that the contract for erecting an 8-story bank and office building (bids opened July 25), has been awarded to Dickison & Beardsley, of Marietta, for $87,556.

Oklahoma City, Okla.—H. P. Harter and Henry M. Scales are reported to have accepted the plans of Wm. Stevens, of Oklahoma, for the 7-story steel and concrete office building to be erected at Main and Harvey Sts., at a cost of $100,000. According to reports the contracts will soon be let.

Lancaster, Pa.—The Fulton Market Co. is reported to have decided to erect a market house at N. Plum St. and Hand Ave.

Pittsburg, Pa.—A permit is stated to have been issued to Thos. J. Keenan for the erection of a 17-story building at 7th and Liberty Aves.

Greensburg, Pa.—Topp & Bair Westinghouse Bldg., are reported to have prepared plans for a 2-story office building to be erected in Greensburg for the Westmoreland Realty Co., at a cost of about $45,000.

Conway, Pa.—The Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia), it is reported, has appropriated $700,000 for railroad shops, roundhouse, power plant and coaling station, to be erected at the Conway yards, 25 miles west of Allegheny, on the Fort Wayne road. Surveys have already been made, and, it is stated, the work will begin within the next 2 months. The roundhouse will be a 42-stall house. The power house, 60x40 ft.; an engine coring plant, 30x40 ft. Other buildings will be 25x35 and 25x40 ft. The water plant will be complete, and the coaling station will be especially modern.

Providence, R. I.—Plans have been completed, it is reported, for the brick and concrete 280x142 ft. car barn to be erected at Mt. Pleasant by the Rhode Island Co. (F. N. Bushnell, Ch. Engr., 170 Westminster St.), at a cost of $80,000.

The City Realty Corp. (Marsden J. Perry, Pres.) is reported to have selected a site at Westminster, Orange and Middle Sts. for the erection of a building for the Union Trust Co.

Woonsocket, R. I.—The Rhode Island Co. (T. N. Bushnell, Providence), is reported to have prepared plans for a car barn and repair shop 2-story, 480x127 ft, to be erected on Social St. and Diamond Hill Rd.

Bristol, Tenn.—The Bristol Lodge A. F. & A. M. is reported to have purchased a site on E. State St. for a temple to cost about $30,000.

Knoxville, Tenn.—Danl. Driscol, Bros. & Co. will expend $30,000 enlarging the Gay St. Bldg. Building will be equipped with a sprinkler system.

Memphis, Tenn.—The warehouse of the Webber Mauer Grain Co. in western section of the city is reported destroyed by fire.

Nashville, Tenn.—It is reported that Greenfield-Talbot-Binney-Battle Co. will erect a warehouse on Harrison St. Estimated cost, $25,000.

Temple, Tex.—The Sante Fe Ry. Co. (F. G. Pettibone, Gen. Mgr., Galveston, Tex.) is reported to be considering the erection of a passenger station here, either of brick or stone.

The Fred Harvey Hotel Co. will, it is stated, soon build an addition of about 20 rooms.

San Antonio, Tex.—C. C. Gibbs is reported to be preparing to erect an 8-story business building at Houston St. and Ave. D., at an estimated cost of $100,000.

Riverside, Tex.—Elbert G. Rall is reported to have purchased a site adjoining the Rock Island R. R. tracks

** Items marked thus give the names of parties awarded contracts.*

in Riverside for the erection of a grain elevator and warehouse at a probable cost of $150,000.

San Antonio, Tex.—It is reported that Henry T. Phelps, Hicks Bldg., is preparing plans for a $150,000 building to be erected by the Woods National Bank Co.

Lynchburg, Va.—The directors of the First National Bank, it is stated, have accepted the plans of Lewis & Burnham, of Lynchburg, for its proposed banking-house, which will be erected at 10th and Main Sts. The building is to be 2 stories, of Corinthian style, and the banking-room will be finished in Georgia marble. The cost is estimated at $70,000 exclusive of the furnishings.

Hinton, W. Va.—It is stated that bids will be received by R. H. Graham until Aug. 26 for erecting a 4-story 50x140-ft. pressed brick and limestone lodge building, office and store for the Big Four Improvement Co.; probable cost, $50,000. J. B. Stewart, Archt., Huntington.

Elkins, W. Va.—Bids will be received until Sept. 10 at the office of Hon. Septimus Hall, New Martinsville, for erecting the I. O. O. F. Home Building at Elkins. Alexander & Chaplin, archts., New Martinsville.

La Crosse, Wis.—It is stated that plans will soon be prepared for a Y. M. C. A. Bldg. to be erected at 7th and Main Sts.

Manitowoc, Wis.—Bids are wanted until Aug. 22 for the additions and alterations to the North Side Opera House. Wm. J. Raeuber, archt., 826 S. 8th St.

**Winnipeg, Man.*—The Canadian Northern Ry. Co. is stated to have awarded the contract to Kelley Bros. & Mitchell for the erection of a shop to cost $200,000. M. H. McLeod, Gen. Mgr.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Alpine, Cal.—L. V. Harkness is reported having plans prepared for the erection of a $30,000 residence on El Moline and Oak Knoll St., near Alpine.

Chicago, Ill.—It is stated that plans have been completed for a $75,000 church to be erected at Western Ave. and Congress St. for the Church of Our Precious Blood; estimated cost, $30,000. Address pastor.

It is reported that plans are being prepared by Henry L. Newhouse, 4630 Prairie Ave., for a 3-story 100 x 61 ft. apartment house to be erected at Michigan Boule. and 51st St., the cost to be $100,000; also plans for a 3-story apartment house, 50 x 172, to be located on Ingleside Ave. and 50th St., to cost $60,000.

Lafayette, Ind.—It is stated that the Seventh Day Adventists will erect a 3-story brick building on Riverside Rd., at a cost of about $25,000.

Winona, Ind.—The members of the Methodist Church are said to be preparing to build a $50,000 edifice. Address pastor.

Pella, Ia.—Bids will be received until Aug. 26 by Herman Rietveld, for erecting the Second Reformed Church.

Louisville, Ky.—It is stated that D. Fred. Erhart will erect a modern $60,000 residence at this place in the near future after plans prepared by Arthur R. Smith, Norton Bldg.

**Minneapolis, Minn.*—It is reported that the following are the bids received recently for the excavating and foundation work for the R. C. procathedral to be erected at Hennepin Ave. and 16th St., according to plans prepared by E. Masqueray, of New York, N. Y.: (*a*), stone, and brick (*b*), deduct for concrete: Pike & Cook, 415 5th St., *a* $68,880 (awarded contract); *b* $3,000; the H. N. Leighton Co., *a*, $74,924; *b*, $1,250; Charles F. Haglin, *a* $75,500; *b*, $1,250; J. & W. A. Elliott, *a*, $82,650; *b*, $7,900; Trainor Bros., *a*, $85,000; John Wunder, *a*, $86,612; *b*, $10,589; J. L. Robinson, *a* $86,043; *b*, $2,600; J. H. McKenzie & Co., *a*, $68,943; Lauer Bros., St. Paul, *a*, $106,360; *b*, $2,166.

It is reported that Rev. Robert H. Matthews has plans for a residence to be erected on Fremont Ave. S and Franklin St., to cost $20,000.

Jefferson City, Mo.—The congregation of the Christian Church is reported to have perfected plans for an edifice on site of present church at a cost of about $25,000.

Newark, N. J.—Nathan Myers, 238 Washington St., is reported to be preparing plans for a 5-story brick apartment house to be erected at Plane and Court Sts., for Henry L. Baumann, at a cost of about $65,000.

Newark, N. J.—It is stated that the First Church Evangelical Assoc. (Lutheran) has had plans prepared by Francis Avercamp, 129 Pennsylvania Ave., for a brick church to be erected at Avon Ave. and S. 17th St. It is estimated that the building will cost $22,000.

Bayonne, N. J.—The Congregation of the St. Joseph's Slavonian Catholic Church has purchased a site on 25th St. and Ave. E for the erection of a church and parish house, at a cost of about $45,000.

Brooklyn, N. Y.—Plans have been filed for the erection of two 5-story brick apartments at Jay St. and Myrtle Ave. for John E. Damerel; cost, $60,000. Wm. J. Wilthey, Archt.

Cincinnati, O.—The Bd. of Trus. of the First Presbyterian Church is stated to have decided to install a heating system, at a cost of $5,000.

Delphos, O.—It is stated that bids will be received until Aug. 30 by D. J. Breese, Chmn. Bldg. Com. of the Presbyterian Congregation, Box 155, for erecting an edifice. F. E. Walker, Archt., Toledo.

Lorain, O.—It is reported that the St. Joseph's Catholic congregation contemplates the erection of a $100,000 church. Rev. Reichlin, pastor.

Jenkintown, Pa.—It is reported that John Wanamaker will rebuild Lindenhurst, his country home near Jenkintown, which was destroyed by fire. Plans for the new residence, it is stated, have been prepared by Horace Trumbauer, Land Title Bldg., Philadelphia, and as soon as they are [illegible] accepted estimates will be taken.

**Lock Haven, Pa.*—[illegible] & Wells, Heed Bldg., Philadelphia, are [illegible] been awarded the contract for erecting a [illegible] residence, 76x40 ft., at Lock Haven for [illegible] Kistler, at $35,000.

Spokane, Wash.—Roy Bungay is reported to have purchased a site on 5th Ave. and Monroe St. for a $50,000 apartment house.

West Allis, Wis.—The Trus. of the Church of the Immaculate Conception is reported to have purchased a site will erect a $34,000 church. Rev. Thos. Regan, pastor.

Toronto, Ont.—Permits have been issued by the City Architect for 3 University residences to be erected on Hoskin Ave., each to cost $50,000. Eden Smith, Canada Life Bldg., is the archt.

Waterford, Ont.—It is stated that bids will be received until Aug. 22 by J. Lewis Thomas, Archt., 374 Central Ave., for erecting Trinity Church.

Toronto Junction, Ont.—It is stated that contracts will soon be let by the Bd. Trus. Annette St. Methodist Church for the erection of an edifice, to cost about $40,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Livingston, Ala.—T. B. Smith, Mayor, is asking for figures on a 2-story brick school; steam heat, tin roof, etc. P. J. Krouse, Archt., Meridian, Miss.

Little Rock, Ark.—Chas. L. Thompson, of Little Rock, is reported to have been selected to prepare plans for an 8-room school to be erected at 18th and Cross Sts., at an estimated cost of $25,000.

The Bd. of Educ. is reported to have decided to erect an 8-room school on the Glenwood Park property at a cost of $25,000. Gibb & Sand, of Little Rock, archts.

Washington, D. C.—The Dunigan Plumbing Co., 717 12th St., N. W., is stated to have submited the lowest bid for repairs to the plumbing in Berret School at $2,985.

**Tallahassee, Fla.*—N. P. Bryan, Chmn. Bd. Control Jacksonville, writes that the contract for erecting dormitory for Florida Female College (bids opened July 5), has been awarded to the W. T. Hadlow Co., of Jacksonville, for $43,000. Architects, Edwards & Walter, of Columbia, S. C.

**Rockford, Ill.*—The Bd. of Education on Aug. 5 is stated to have awarded the contract for erecting the John Nelson School on 14th St., at $41,874.

Joliet, Ill.—The following are reported to be the bids opened by the School Board on July 22 for the erection of a school on the site now occupied by the Roosevelt School, according to plans of J. H. Barnes, Young Bldg.: J. G. Wilhelmi, $81,973; Hansen & Peterson, $96,900; Henry Latz, $82,528; and W. H. Roney, $94,500.

Terra Haute, Ind.—The following bids are repoted opened Aug. 5 by Bd. Trus. Indiana State Normal School for erecting a library: Solomon Brewer, of Terre Haute, $97,643; W. F. Stillwell, of Lafayette, $107,097; The Bedford Stone & Construction Co., of Indianapolis, $113,473, and John A. Schumacher, of Indianapolis, $118,000; August Ohm, of Terre Haute, $93,000 (awarded contract).

Wingate, Ind.—The School Bd., it is reported, has decided to erect a $30,000 school.

Syracuse, Ind.—Bids will be received until Sept. 10 by the School Bd. (H. W. Buchholz,, Secy.) for erecting a building. Griffith & Fair, Archts., Bass Blk., Ft. Wayne.

Anderson, Ind.—It is reported that competitive plans are to be submitted Aug. 23 to J. B. Pearcey, School Supt. for the 3-story High School to be erected at Lincoln and 14th Sts. The building is to be of either stone or pressed brick and stone.

Whiteville, Ky.—John Kittinger, School Trus., writes that the citizens on Aug. 3 voted to levy a tax for school purposes.

Greensburg, La.—The citizens are stated to have voted to erect a school.

Portland, Me.—Fredk. A. Thompson, 156 Free St., it is stated, has been engaged to prepare plans for the new State Industrial School for the Blind, for which an appropriation of $40,000 has been made by the Government.

Pittsfield, Mass.—Archt. J. McA. Vance, 24 North St., it is reported, will soon ask bids for erecting an 8-room school to cost about $25,000.

Boston, Mass.—The following are reported to be the lowest bids opened on Aug. 1 by the Schoolhouse Comn. for schools at follows: Quincy Dist. Manual Training School, Whitcomb & Kavanaugh, $13,796, and Adams Dist. Elementary School, Cahill Constr. Co., $16,150.

*Wm. Crane, of Cambridge and Boston, is reported to have secured the contract for erecting Mechanics' Art High School on Scotia St. for $350,000. Wheelwright & Haven, archts., Boston.

Calumet, Mich.—The Board of Control of the Michigan College of Mines is reported to have appointed D. Fred Charlton, of Marquette, to prepare plans for the library and museum to be erected next year. Contract for structure wll probably be let Apr. 1, 1908. ?t will be a fireproof bulding, costing complete with book stacks, mineral cases, vaults, etc., $75,000.

**Chisholm, Minn.*—The School Bd. is reported to have awarded contracts for heating and plumbing the high school to Frank S. Spencer at $14,800, and Schirmer Bros., at $5,511, respectively.

Mankato, Minn.—Plans are stated to have been completed by Mr. Johnson, State Archt. for the model building and gymnasium of the Mankato Normal School. According to reports the contract will soon be let; probable cost, $65,000.

Canton, Miss.—The Com. appointed to select site for the Episcopal College is reported to have selected a site near Court Sq. in Canton. Bishop Bratton, Chmn. of Com.

Omaha, Neb.—Johnson & Anderson are stated to have received the contract for erecting a school at 16th and H Sts., for $32,200.

East Orange, N. J.—Bids will be received until Aug. 26 by Arthur A. Richmond, Chmn. Com. on Bldgs., Bd. Educ., for erecting the Lincoln School, cor. Central and Maple Aves.

Newark, N. J.—Bids for furnishing material and erecting the following school house additions will be received by the Com. on School Houses (R. D. Argue, Secy.) Bd. Educ., until Aug. 23, Belmont Ave School; Archts., Hurd & Sutton, Union Bldg. Consulting Engr., Percy B. Taylor, 800 Broad St. Bergen St. School: Archt., Alfred Peter, 238 Washington St. Consulting Engr., Percy B Taylor, 800 Broad St. Bids may be submitted on the following as a whole or separately, except for steam heating and air moving apparatus, which must be bid on separately: Mason and fireproofing work, iron work, carpentering, plumbing, roofing and cornice work, electrical work, steam heating, air moving apparatus, etc.

Newark, N. J.—It is stated that Kitchell & O'Rourke, Scheurer Bldg., will prepare new plans for the Lincoln School to be erected in Richelieu Terrace; appropriation available, $80,000.

Bayonne, N. J.—Bids were opened Aug. 8, according to reports, by the Bd. Educ. as follows for erecting School No. 9, Calumet Constr. Co., $121,742, and the O Leary Co., $118,500. Plumbing and heating: Jahning & Peoples, $10,434; Knight & Burns, $10,550; Storm & Co., $10,334.

Westfield, N. J.—The erection of an 8-room addition to the Walnut St. School is reported contemplated.

Springville, N. Y.—At the annual school meeting it was voted to erect a school costing $75,000.

Lockport, N. Y.—The Bd. of Educ., it is stated, has rejected all bids received Aug. 1 for reconstructing the High St. School. J. E. Jeroleman, of Niagara Falls, is the archt.

Rochester, N. Y.—Bids will be received until Aug. 22 by the Bd. Educ. (J. S. Mullan, Secy.), for removing the 2 present boilers at No. 4 School, Jefferson Ave. and furnishing and setting up 2 horizontal tubular steam boilers for 100 lbs. pressure.

Roxboro, N. C.—Bids are wanted until Aug. 26 for $20,000 graded school bonds. Address Wm. D. Merritt, attorney.

Rowland, N. C.—McMillen & Cooper, of Wilmington, are reported to have prepared plans for a school to cost about $11,000.

Cleveland, O.—The Bd. of Education is stated to have awarded contracts as fololws for the Technical High School: Structural iron and steel work to the National Iron & Ware Co., 971 Hamilton St., for $42,996; excavation and masonry to D. C. Griese & Walker Co., 1417 Prospect St., S. E., for $51,866 and fieproofing to the National Concrete Co. at $27,000.

Cleveland, O.—It is stated that F. F. Barnam is preparing plans for a high school to be erected at E. 107th St., at a cost of $200,000.

It is stated that bids will be received until Sept. 3 by the Clk. Bd. Educ., for completing an annex to the Milford School. Chas. Orr, Dir. Schools.

Cincinnati, O.—It is reported that the Bd. Educ. rejected all bids for construction of Hughes High School, except that of the Gordon Engineering Co., for excavations at $20,720, and that of John Sperry & Son, 270 Calhoun St., for concrete foundations at $61,296. The estimate on the building have been raised from $510,000 to $650,000, and the Clerk directed to readvertise for bids.

**Columbus, O.*—H. P. Judd, Clk. Bd. Educ., writes that contracts for work on the Indianaola Ave. School (bids opened Aug. 5), have been awarded as follows: Brick work, Adam Schneider, 431 S. 4th St., $5,400; carpenter work, Aug. Roehr, Star Hotel, $3,330; cut stone work, Fish Stone Co., Columbus, $3,750, and excavation, John Braun, 564 E. Fulton St., $2,340.

*The contract for erecting the Women's dormitory for the Ohio State University is reported to have been awarded to E. K. Hibbs, of Columbus, for $57,000.

**Salem, Ore.*—The contract for constructing the Mechanic Arts School building in connection with the Corvallis Agricultural College, is reported to have been awarded to A. F. Peterson & Co., of Portland, for $37,363, and contract for heating the building to Gardner & Kendall, of Portland, at $3,525.

New Castle, Pa.—Helen L. Moseley, Clk. School Bd., writes that plans for the proposed new high school are to be submitted on Aug. 29.

**Kutztown, Pa.*—The contract to erect a gymnasium at the Keystone State Normal School at Kutztown, is reported to have been awarded to Robt. S. Rathburn, of Allegheny, for $40,000.

Bethlehem, Pa.—The Trus. of the Moravian College and Theological Seminary is reported to have awarded to Howard E. Stoudt the contract for the erection of the library building. The structure will be built of stone, 3 stories, 44x45 ft.

St. George, S. C.—Bids will be received until Sept. 3 by the Bldg. Com. (M. S. Connor, Clk.), St. George Special School Dist. No. 5, for erecting a brick school. C. Gadsen Sayre, archt., Anderson.

Flandreau, S. D.—Bids will be received until Sept. 4 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and erecting a brick industrial building, with plumbing, steam heat and electric light at the Flandreau School. For further information apply to Chas. S. Peirce, Supt. School, Flandreau.

Nashville, Tenn.—The City Councils is stated to have passed a bill providing for the issuance of $300,000 High School bonds, the proceeds from the sale of which to be devoted to the purchase of a site and the erection and equipping of a High School.

Rutland, Vt.—The School Comrs. have asked for an appropriation of $20,000, to build an extension to the high school. Harvey R. Kingsley, Clk. School Board.

Penetanguishene, Ont.—Bids will be received until Aug. 20 by W. H. Hewson, Town Clk., for $23,000 High School bonds and $15,000 Public School bonds.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Middletown, Conn.—The Wilcox, Crittenden & Co., Mfgrs. of marine hardware, will, it is reported, rebuild plant recently burned.

Stamford, Conn.—The Engineering Specialty Co., of Meriden, is reported to be considering the erection of a 2-story factory, 40x150 ft., at Stamford.

** Items marked thus give the names of parties awarded contracts.*

New Castle, Del.—The Deemer Steel Casting Co. is reported formed, with a capital of $250,000, by Selden S. Deemer anad Edw. T. Price, for the construction here of a plant for the manufacture of steel castings. Plans are now being prepared.

Augusta, Ga.—W. J. Moore, Secy. Augusta Chamber of Commerce, is reported interested in the construction of an iron and steel plant at Augusta.

Montgomery, Ill.—The Lyon Metallic Co. is reported to have decided to erect an addition to its present plant at a cost of about $25,000.

**Evansville, Ind.*—Geo. George & Sons, 1308 Walnut St., it is reported, have secured the contract for the erection of a planing mill annex to cost about $20,000 for the Hercules Buggy plant. Harris & Shoppell, archts., 123 N. 4th St.

Bloomfield, Ind.—It is reported that the Bloomfield Vitrified Brick & Tile Co., will soon receive bids for the construction and equipment of a manufacturing plant. T. H. Schmutz, Chanute, Kan.; and C. C. Stein & Lloyd Begeman, of Westphalia, Ind., are directors.

Bonnieville, Ky.—Mrs. Marie Jamison will put in a paving and front brick plant for an extensive output, and desires complete mud and dry press equipment.

Baltimore, Md.—The Camden elevator of the Baltimore & Ohio R. R. (D. D. Carothers, Ch. Engr., Baltimore), at Henrietta and Howard Sts., is reported to have been destroyed by fire Aug. 8. It is said to be the intention of the railroad officials to seek a new site and erect a new building at once.

Newark, N. J.—It is stated that application for a permit to erect a $75,000 concrete power house has been made by the Celluloid Co., of Ferry St. The plans call for a one-story building of reinforced concrete, 99½x 220 ft., and 2 stacks each 175 ft. in height. The building will be erected at 83 to 99 Fillmore St., adjoining the company's works.

Rochester, N. Y.—The Bausch & Lomb Optical Co. has filed plans for an addition to the factory in St. Paul St., which will cost $150,000; it will be 236x124 ft. and 5 stories high. The company is also making preparations to add 2 stories to present factory.

Olean, N. Y.—The Chamber of Commerce is stated to have secured for Olean the Feder Silk Throwing Co., which will erect a 1-story 90x150 ft. mill to cost $20,000 and about $25,000 worth of machinery to be installed. Capacity 1,000 lbs. of silk a week.

Barberton, O.—The Diamond Match Co. is reported to be having plans prepared by Chas. Henry & Son, of Akron, for a 4-story addition, 125 ft. long, with a wing 60x100 ft., office building, to be erected at the plant here.

Shamokin, Pa.—John H. and Chas. K. Eagle, owners of the Eagle Silk Mills at Fairview, are reported to have purchased property on Rock and Race Sts. on which to erect a 3-story silk mill, bids for which will be asked as soon as the plans which are now being prepared by W. U. Jury, of Shamokin, are completed.

Memphis, Tenn.—The warehouse and grain elevator of Webb & Murray, recently burned, according to reports, will be rebuilt.

Tomahawk, Wis.—The Tomahawk plant of the United States Leather Co. is reported destroyed by fire on Aug. 2.

Milwaukee, Wis.—The file works of F. Westfahl & Co. at Cherry and 31st Sts., which were destroyed by fire Aug. 6, it is reported, will be rebuilt.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Baltimore, Md.—Bids will be received until Sept. 4 by the Bd. Awards (J. Barry Mahool, Pres.) for the removal and final disposition of garbage, dead animals and market refuse of this city from Jan. 1, 1908, until Jan. 1, 1918. J. L. Wickes, Comr. St. Cleaning.

Milwaukee, Wis.—The City Council on Aug. 5 passed a resolution providing for the appointment of Rudolph Hering, of New York, N. Y., to prepare plans and specifications for a garbage plant.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Nome, Alaska.—Maj. W. M. Chittenden, Corps Engrs., U. S. A., Seattle, Wash., writes that the only bid received on July 29 for dredging and excavating in St. Michael Canal, Alaska, about 177,000 cu. yds., was submitted by the North American Dredging Co., of San Francisco, Cal., at $1.45 per cu. yd.

Bradley, Ark.—Bids will be received until Sept. 11 by W. H. Baker, Secy. Long Prairie Levee Bd. for the construction and raising of levee from Buncom Springs to Louisiana and Arkansas line, about 450,000 yds.

Little Rock, Ark.—Bids will be received at the office of Lund & Hill, Engrs. of Dist. No. 1, Pulaski County, at Little Rock, until Sept. 7 for the construction of 7 miles of open ditch, requiring about 143,000 cu. yds. earth excav., a reinforced concrete conduit, 84 in. diam., and 2,635 ft. long, as advertised in The Engineering Record; estimated cost, $76,500.

San Francisco, Cal.—Col. Wm. H. Heuer, Corps Engrs., U. S. A., retired, is reported to have completed plans for improvement of San Francisco water front and building of 180 wharves, which will give 60 miles of berth room for vessels engaged in the commerce of this port. Col. Heuer's work will be done under the direction of the Merchants' Committee.

Oakland, Cal.—Park bonds to the amount of $992,000 are reported sold.

Colorado Springs, Colo.—Local press reports state that new bids for the new drainage tunnel will be received by the Cripple Creek Drainage & Tunnel Co. Two sets of specifications will be prepared; one set will provide for completion of new drainage tunnel at its present dimensions, 7 x 10 ft.; the other set will provide for a smaller bore, 5 x 8 ft.

Stamford, Conn.—Bids will be received by Maj. Harry Taylor, Corps Engrs., U. S. A., New London, until Sept. 7 for dredging in Stamford Harbor, Conn., as advertised in The Engineering Record.

Wilmington, Del.—Bids will be received by Maj. C. A. F. Flagler, Corps Engrs., U. S. A., until Aug. 28 for jetty construction at new mouth Broadkill River, Del., as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until Sept. 7 at the Bureau Yards and Docks, Navy Dept. (R. C. Hollyday, Ch. Washington, D. C.), for dredging and removing about 20,000 cu. yds. material from channel, Navy Yard, Washington, as per specification No. 1556. Est. cost, $38,000.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Great Lakes, North Chicago, Ill.—Bids will be received at the Bureau of Navigation, Navy Dept., (W. H. Brownson, Chmn.) Washington, D. C., until Aug. 26 for furnishing material and grading at the naval training station, Great Lakes, North Chicago, Ill.

Joliet, Ill.—Bids will be received until Sept. 3 by the Bd. Comnrs., Spring Creek Drainage Dist., 221 Barber Bldg., (Geo. H. Monroe, Chmn.) for the excavation of channels, about 90,000 cu. yds. and constructing concrete walls, about 10,000 cu. yds. for said district.

**Sullivan, Ind.*—W. H. Jones, Jr., of Lebanon, Engr. and Supt. writes that Asbury H. Manuel, of Merom, Ind., has secured the contract for dredge work, tile drains, levees, etc., (bids opened Aug. 5) for $20,000.

Burlington, Ia.—Acting on report of engineers who have just finished survey of bottom lands north of Burlington in Des Moines County, the Bd. of Supervisors is reported to have on Aug. 6 decided to go ahead with the drainage project which affects 28,000 acres of lowlands. The cost of drainage will be $255,000.

Ft. St. Phillips, La.—Bids will be received until Aug. 30 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., New Orleans, for constructing interlocking steel pile sea wall at Ft. St. Philip.

New Orleans, La.—Bids will be received by Capt. J. F. McIndoe, Corps Engrs., U. S. A., until Sept. 10 for dredging in Southwest Pass, Mississippi River, as advertised in The Engineering Record.

Bar Harbor, Me.—Bids will be received by Maj. Geo. E. Zinn, Corps Engrs., U. S. A., Potland, until Sept. 10 for construction of breakwater, near Bar Harbor, Me., as advertised in The Engineering Record.

Baltimore, Md.—Bids will be received until Aug. 21 by the Bd. Awards (J. Barry Mahool, Pres.), for borings on the sites of the new piers 4, 5 and 6. O. F. Lackey, Harbor Engr.

**Hadley, Mass.*—Danl. O'Connell & Sons, of Holyoke, are reported to have secured the contract for furnishing and placing 4,500 tons rip-rap bank of Connecticut River at Hadley at $1.60 per ton. Bids opened Aug. 9 by the Harbor & Land Comrs. at Boston.

Ipswich, Mass.—Bids will be received at the office of the Bd. of Harbor and Land Comrs, Room 131 State House, Boston, until Aug. 23, for dredging shoals in Ipswich River in the town of Ipswich, to consist of about 8,700 cu. yds.

Detroit, Mich.—Bids will be received until Aug. 26 by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., Jones Bldg., for hire of dredging plant for use in Detroit River

Claksdale, Miss.—T. G. Dabney, Ch. Engr., Yazoo-Mississippi Delta Levee Dist., writes that levee contracts were awarded by this Levee Board on July 29 as follows: To W. A. Shippey, 298,000 cu. yds. (new work), 22 cts. per cu. yd.; Jack O'Grady & Co., 195,000 cu. yds. (new work), 25.9 cts.; Martin Jennings, 472,000 cu. yds. (of which 296,000 is new work), 19 to 23.3 cts.; J. H. Watkins & Co., 188,000 cu. yds., 19 to 23.3 cts.; W. L. Mosby, 97,000 cu. yds., 19.1 to 33.3 cts.; R. L. Cheshire, 77,500 cu. yds, 23 and 24 cts. The character of this work, where not designated, is enlargement of old levee.

**Two Harbors, Minn.*—The contract for the steel ore dock to be known as No. 6, has been awarded to Barnett & Record, of Duluth and Superior, Wis. It will be 1,008 ft. long and 73 ft. high. The deck on top will be 57 ft. wide and will accommodate 4 railroad tracks.

Ivanhoe, Minn.—Artbur E. Morgan, Engr. of St. Cloud, writes that contracts will be let on Aug. 20 for 5 ditches at Ivanhoe, some tile, but mostly dredge work; estimated cost, $24,275.

Elizabeth, N. J.—W. H. Luster, Jr., City Engr., writes that the lowest bid opened on Aug. 1 for constructing pier, crib and shed was submitted by Rhodes & Maumee, for $28,000

**Geneva, N. Y.*—The contract for erecting retaining wall along south bank of Castle Creek, west of Main St., is reported to have been awarded, on Aug. 10, to John Mennell at $8.10 per cu. yd.

Rye, N. Y.—Ralph L. Crow, 289 4th Ave., N. Y. City, wants bids to furnish fill, delivered either spread or alongside retaining wall at Pine Island, Milton Point, Rye. About 3,000 cu. yds. required.

Ft. Wood, N. Y. H., N. Y.—Bids will be received by G. C. Burnell, Constr. Q. M., U. S. A., until Aug. 30 for foundations, painting and erecting a 100-ft. iron flagstaff at this post, as advertised in The Engineering Record.

Brooklyn, N. Y.—The following are the bids opened on Aug. 7 by Bird S. Coler, Boro. Pres., for furnishing material and constructing a crib bulkhead on 8th Ward Market, bet. 36th and 38th Sts., 2d Ave. and New York Bay on the percentage bid system. Engineer's preliminary estimate of total cost, $156,934: Geo. B. Spearin, 90 West St., N. Y. City, 95.248 per cent.; B. Rolf, 39 Cortlandt St., N. Y. City, 98.4 per cent.; Phœnix Constr. Co., 41 Park Row, N. Y. City, 92.5 per cent.; W. H. Jenks, 59 Pearl St., N. Y. City, 111.3-5 per cent. and R. P. & J. H. Staats, 29 Bway., N. Y. City, 99 per cent.

New York, N. Y.—Bids will be received by Col. John G. D. Knight, Corps Engrs., U. S. A., Army Bldg., N. Y. City, until Sept. 2 for constructing and repairing dikes in Hudson River, as advertised in The Engineering Record.

Bids will be received until Aug. 27 by J. A. Bensel, Comr. Docks, for furnishing material and delivering about 3,000 cu. yds. sand and 7,500 cu. yds. broken stone.

Bids will be received by Henry S. Thompson, Acting Boro. Pres. and Comr. Pub. Wks., until Aug. 26, for the installation and construction of a suction or vacuum cleaning system in the Criminal Courts Bldg., Centre and White Sts., Boro. Manhattan.

The Otis Elevator Co., 17 Battery Pl., has secured contract for installing electric elevator in Stuyvesant High School, (bids opened Aug. 12) for $3,800.

The Bd. of Educ. on Aug. 12, awarded contract for erecting grandstands in athletic fields to Jas. MacArthur, at $23,800 for one in Queens Boro., and $33,700 for one in Richmond Boro.

Cleveland, O.—Bids will be received until Sept. 10 by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., 813 Prospect Ave. S. E., for extension of breakwater at Cleveland Harbor.

Fairport, O.—Bids will be received until Sept. 10 by Lieut.-Col. C. McD. Townsend, Corps Engrs., U. S. A., 813 Prospect Ave., S. E., Cleveland, for extension of west breakwater at Fairport Harbor.

Cincinnati, O.—Bids will be received by Lieut.-Col. Wm. T. Rossell, Corps Engrs., U. S. A., Cincinnati, O., until Sept. 11 for constructing dams of concrete, etc., at head of Brown's Island, Ohio River, and for building dike and shoe protection in Ohio River, near head of Grand Chain, Ill., as advertised in The Engineering Record.

Panama.—Bids will be received until Aug. 26 by D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing steel barges as per circular No. 383.

The following are the bids opened on Aug. 12 by the Isthmian Canal Com. at Washington, D. C., for 3 steel dump barges: (*a*) according to specifications, (*b*) on bidders plans: Newport News Shipbuilding & Dock Co., to deliver in New York, N. Y., (*a*) $66,000, 150 days; (b) $69,000, 175 days; Lewis Nixon, New York, N. Y., Colon delivery in 90 to 150 days, (*a*) $76,950; U. S. Steel Products Export Co., New York, N. Y. delivery (225 days) (*a*) $85,575; Maryland Steel Co., Baltimore, Md., deliver at Sparrow's Point, Md. (90 to 150 days), (a) $59,495; Merrill-Stevens Co., Jacksonville, Fla; deliver Jacksonville, (150 days) (*a*) $97,500; (*b*) $105,000; The Moran Co., Seattle, Wash.; deliver in 6 months, (*a*) $66,645; (*b*) $55,500.

Harrisburg, Pa.—The State Water Supply Comn. is reported to have had plans made for the construction of dikes at Matamoras, Pike Co., and in Falls Twp., Bucks Co., near Bristol, to keep the Delaware River from flooding the lands; the State appropriated $15,000 for this work.

Erie, Pa.—Clark Olds, Chmn. State Wharf Comn., writes that plans are not yet complete for the proposed wharf to be constructed here at a cost of $150,000.

**Philadelphia, Pa.*—The only bid received and opened by Maj. J. C. Sanford, Corps Engrs., U. S. A., for dredging in Delaware River at Perriwig Bar, was submitted by the American Dredging Co., of Philadelphia, Pa., at 33 cts. per cu. yd., scow meas., and the same was recommended for acceptance.

National Soldiers' Home, Va.—Bids will be received by B. A. Beeson, Treas. Southern Branch N. H. D. V. S., until Aug. 26 for filling behind Jones Creek revetment about 5,000 yds.

Tacoma, Wash.—Bids will be received until Sept. 2 by Maj. H. M. Chittenden, Corps Engrs., U. S. A., 602 Burke Bldg., Seattle, for dredging and bulkheading at Tacoma Harbor.

Seattle, Wash.—Bids will be received until Sept. 5 by Maj. H. M. Chittenden, Corps. Engrs., U. S. A., 602 Burke Bldg., Seattle, for dredging Swinomish Slough, Wash.

Two Rivers, Wis.—L. K. Pitz and Rudolph Groll, of Manitowoc, are reported to have secured the contract to erect a life-saving station for the government at Two Rivers for $15,400.

Morrell Station, P. E. I.—It is stated that bids will be received until Aug. 27 by Fred. Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the breakwater at St. Peter's Bay, Kings County, P. E. I. J. B. Hegan, Resident Engr., Charlottetown, P. E. I.

Mimico, Ont.—Bids will be received until Aug. 20, by H. G. McNaughton, Secy. Pub. Wks. Dept., Toronto, for constructing a concrete superstructure to the wharf at the Mimico Asylum.

PROPOSALS OPEN.

For Proposals see Pages 70, 72, 73, 74 and 76.

WATER.

Aug. 20.	Water wks., Russellville, Ark. Adv. Jul. 13 to 27.	Jul. 20
Aug. 20.	Water wks., Lewisburg, Tenn. Adv. Aug. 10.	Aug. 10
Aug. 20.	Water wks., Dawson, Minn.	Aug. 10
Aug. 20.	Fire hydrants, Louisville, Ky.	Aug. 10
Aug. 20.	Water wks., Bonesteel, S. D	Aug. 17
Aug. 20.	Main, Dallas, Tex.	Aug. 17
Aug. 21.	Dam and tunnel, Springfield, Mass. Adv. Jul. 27 to Aug. 17.	Jul. 27
Aug. 21.	Well strainer, Ft. Hancock, N. J.	Jul. 27
Aug. 22.	Filters and pipe exten., Philadelphia, Pa. Adv. Jul. 27 to Aug. 10.	Jul. 27
Aug. 22.	Filters and pipe exten., Philadelphia, Pa. Adv. Aug. 3.	Jul. 27
Aug. 22.	Basin, head house, etc., Bangor, Me.	Aug. 17
Aug. 23.	Laying pipe, Westborough, Mass.	Aug. 10
Aug. 24.	Boilers, Wahpeton, N. D.	Aug. 17
Aug. 26.	Pump. plant, Ashland, O. Adv. Aug. 10.	Aug. 10
Aug. 26.	Pumping engine, Cumberland, Md. Adv. Aug. 10, 17.	Aug. 10
Aug. 26.	Irrig. work, Sterling, Colo.	Aug. 17
Aug. 26.	Pipe line, Fond du Lac, Wis.	Aug. 17
Aug. 26.	Reservoir, etc., Pleasantville, N. Y.	Aug. 17
Aug. 27.	C. i. pipe, etc., Cincinnati, O.	Aug. 3
Aug. 29.	Electric machinery and sand washer pumps, Philadelphia, Pa. Adv. Aug. 10, 17.	Aug. 10
Aug. 30.	Tank and trestle, Ft. Dade, Fla. Adv. Aug. 10, 17.	Aug. 10
Aug. 30.	Water wks., Bradshaw, Neb.	Aug. 10

* *Items marked thus give the names of parties awarded contracts.*

Aug. 31. Meters, Chicago, Ill. .... Aug. 17
Aug. —. **Water wks., Rockingham, N. C. .... June. 29**
Sep. 2. Standpipe, etc., Carrington, N. D. .... Aug. 3
Adv. Aug. 3 to 17.
Sep. 3. Pipe, Victoria, B. C. .... Aug. 10
Sep. 3. **C. I. pipe, Kansas City, Mo. .... Aug. 10**
Sep. 4. **Hauling and laying pipe, New Orleans,**
La. Adv. Jun. 29 to Aug. 17 .... Jun. 29
Sep. 6. Concrete conduit, Montreal, Que. .... Aug. 10
Adv. Aug. 10, 17.
Sep. 7. Steel tank, etc., Pensacola, Fla. .... Aug. 17
Sep. 7. System, Pensacola, Fla. .... Aug. 17
Sep. 8. Pump engine, boilers, etc., Louisville,
Ky. Adv. Jul. 27 to Aug. 17 .... Jul. 27
Sep. 14. Valves and gates, Manila, P. I. .... Jul. 27
Adv. Jul. 27.
Sep. 14. Tank and tower, Norfolk, Va. .... Aug. 17

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 20. Cleveland, O. .... Jul. 27
Aug. 20. Collinsville, Ill. .... Aug. 3
Aug. 20. Athol, Mass. Adv. Aug. 10 .... Aug. 10
Aug. 20. Trenton, N. J. .... Aug. 17
Aug. 20. Wildwood, N. J. .... Aug. 17
Aug. 20. Nevada, Mo. .... Aug. 17
Aug. 21. Canal, Dover, O. .... Aug. 10
Aug. 21. Great Lakes, N. Chicago, Ill. .... Aug. 3
Adv. Aug. 3, 10.
Aug. 22. Fayetteville, Ark. .... Aug. 3
Aug. 22. Kansas City, Mo. .... Aug. 17
Aug. 23. Delaware, O. .... Aug. 3
Aug. 23. Des Moines, Ia. .... Aug. 17
Aug. 23. Troy, N. Y. .... Aug. 17
Aug. 26. Baden, Pa. .... Aug. 10
Aug. 26. Bloomfield, Ind. .... Aug. 17
Aug. 26. Fairmont, Minn. .... Aug. 17
Aug. 26. Fernie, B. C. Adv. Aug. 17 .... Aug. 17
Aug. 26. Muscatine, Ia. .... Aug. 17
Aug. 26. Omaha, Neb. Adv. Aug. 3 to 17 .... Aug. 3
Aug. 28. Louisville, Ky. Adv. Aug. 10, 17 .... Aug. 10
Aug. 28. Brooklyn, N. Y. .... Aug. 17
Aug. 30. Evansville, Ind. Adv. Aug. 3 .... Jul. 27
Aug. 30. Ft. Dade, Fla. Adv. Aug. 10, 17 .... Aug. 10
Aug. 30. Richmond, Ind. .... Aug. 17
Aug. 30. Youngstown, O. .... Aug. 17
Aug. 31. Chicago, Ill. .... Aug. 17
Aug. 31. Canal Dover, O. .... Aug. 17
Aug. 31. Elroy, Wis. .... Aug. 10
Aug. —. Rockingham, N. C. .... Jun. 29
Sep. 1. Eatonton, Ga. .... Apr. 13
Sep. 1. Alton, Ill. .... Jun. 8
Sep. 2. Shelby, N. C. .... Aug. 3
Sep. 3. New Philadelphia, O. .... Aug. 3
Sep. 3. Alexandria, La. Adv. Aug. 17 .... Aug. 17
Sep. 3. Canton, O. .... Aug. 17
Sep. 9. Bryant, S. D. .... Aug. 17
Sep. 11. New Orleans, La. .... Jul. 6
Adv. Jul. 6 to Aug. 17.
Oct. —. Eaton, O. .... Aug. 3

BRIDGES.

Aug. 20. San Juan, P. R. .... Jul. 20
Aug. 20. Ft. Myer, Va. .... Aug. 3
Aug. 20. Emporium, Pa. .... Aug. 10
Aug. 20. Des Moines, Ia. .... Aug. 10
Aug. 20. Fond du Lac, Wis. .... Aug. 17
Aug. 20. Greenville, S. C. .... Aug. 17
Aug. 20. Chicago, Ill. .... Aug. 17
Aug. 21. Cleveland, O. .... Aug. 17
Aug. 21. Hempstead, N. Y. .... Aug. 17
Aug. 23. Sandusky, O. .... Aug. 10
Aug. 24. Lebanon, O. .... Aug. 3
Aug. 24. Terre Haute, Ind. .... Aug. 17
Aug. 26. Barnstable, Mass. .... Aug. 17
Aug. 27. Newark, N. J. .... Aug. 17
Aug. 27. Springfield, Mass. .... Aug. 17
Aug. 28. Panama .... Aug. 17
Sep. 2. Tarboro, N. C. .... Aug. 3
Sep. 2. Jefferson, O. .... Aug. 17
Sep. 2. Trenton, O. .... Aug. 10
Sep. 3. Catlettsburg, Ky. .... Aug. 17
Adv. Aug. 17.
Sep. 3. Ingot, Cal. .... Aug. 17
Sep. 4. Columbus, O. .... Aug. 10
Sep. 4. Glasgow, Mont. .... Aug. 17
Sep. 9. Plaquemine, La. .... Aug. 10
Sep. 30. Santiago, Chile .... Jul. 13

PAVING AND ROAD MAKING.

Aug. 19. New York, N. Y. .... Aug. 10
Aug. 20. Cleveland, O. .... Jul. 27
Aug. 20. Sandusky, O. .... Aug. 10
Aug. 20. Woodcliff Lake, N. J. .... Aug. 10
Aug. 20. Dundee, Mich. Adv. Aug. 10 .... Aug. 10
Aug. 20. Bayonne, N. J. Adv. Aug. 17 .... Aug. 17
Aug. 20. Downers Grove, Ill. .... Aug. 17
Aug. 20. Cedar Rapids, Ia. .... Aug. 17
Aug. 20. Wildwood, N. J. .... Aug. 17
Aug. 20. Fulton, Mo. .... Aug. 17
Aug. 21. Aberdeen, Wash. .... Jul. 27
Aug. 21. Ft. St. Philip, La. .... Aug. 3
Aug. 21. Brooklyn, N. Y. .... Aug. 10
Aug. 21. Carrollton, O. .... Aug. 10
Aug. 21. Hempstead, N. Y. .... Aug. 17
Aug. 21. Iowa City, Ia. .... Aug. 17
Aug. 22. Ashland, Wis. .... Aug. 3
Aug. 22. New York, N. Y. .... Aug. 10
Aug. 22. Newark, O. .... Aug. 3
Aug. 22. Guthrie, Okla. .... Aug. 17
Aug. 22. Marysville, Cal. .... Aug. 17
Adv. Aug. 17.
Aug. 23. Mt. Gilead, O. .... Aug. 10
Aug. 23. Janesville, Wis. .... Aug. 10
Aug. 23. Etna, N. J. .... Aug. 10
Aug. 23. Valparaiso, Ind. .... Aug. 17
Aug. 23. Dillonvale, O. .... Aug. 17
Aug. 23. Reading, Pa. .... Aug. 17
Aug. 24. Whipple Barracks, Ariz. .... Aug. 3
Aug. 24. Terre Haute, Ind. .... Aug. 17
Aug. 24. Oshkosh, Wis. .... Aug. 17
Aug. 26. Ft. Washington, Md. .... Aug. 3
Aug. 26. Jacksonville, Fla. .... Aug. 10
Aug. 26. Pittsburg, Pa. .... Aug. 10
Aug. 27. Pensacola, Fla. .... Jul. 27
Adv. Jul. 27 to Aug. 17.
Aug. 29. Smethport, Pa. Adv. Aug. 10, 17 .... Aug. 10
Aug. 30. Marshfield, Mo. .... Aug. 3
Aug. 30. Richmond, Ind. .... Aug. 17
Aug. 30. Woodsfield, O. .... Aug. 17
Aug. 31. Ridgway, Pa. .... Aug. 17
Sep. 2. Elizabeth City, N. C. .... Aug. 17
Sep. 2. Fond du Lac, Wis. .... Aug. 17
Sep. 3. Beardstown, Ill. .... Aug. 3
Sep. 3. New Philadelphia, O. .... Aug. 3
Sep. 3. Dayton, O. .... Aug. 10
Sep. 3. St. Bernard, O. .... Aug. 17
Sep. 3. Jacksboro, Tenn. .... Aug. 17
Sep. 3. Lake Charles, La. .... Aug. 17
Adv. Aug. 17.
Sep. 3. Yorktown, Va. .... Aug. 17
Sep. 3. Monticello, Ind. .... Aug. 17
Sep. 3. Albany, N. Y. .... Aug. 17
Adv. Aug. 17.
Sep. 3. Canton, O. .... Aug. 17
Sep. 3. Wilmington, Del. .... Aug. 17
Adv. Aug. 17.
Sep. 4. Albany, N. Y. Adv. Aug. 17 .... Aug. 17
Sep. 5. Albany, N. Y. Adv. Aug. 17 .... Aug. 17
Sep. 6. Bluffton, Ind. .... Aug. 17
Sep. 13. Madison, Wis. .... Aug. 17

POWER PLANTS, GAS AND ELECTRICITY.

Aug. 20. Dawson, Minn. .... Aug. 10
Aug. 20. Washington, D. C. .... Aug. 17
Aug. 20. Jefferson City, Mo. .... Aug. 17
Aug. 22. Hawaii .... Aug. 3
Aug. 22. Blackwell's Island, N. Y. .... Aug. 10
Aug. 22. Panama .... Aug. 10
Aug. 23. Newark, N. J. .... Aug. 10
Aug. 26. West Point, N. Y. Adv. Aug. 10, 17 .... Aug. 10
Aug. 26. Elkins, W. Va. .... Aug. 17
Aug. 27. Arlington, O. .... Aug. 10
Aug. 27. Trenton, Ill. .... Aug. 17
Aug. 28. Indianapolis, Ind. .... Aug. 17
Aug. 29. San Francisco, Cal. .... Aug. 3
Aug. 31. Lebanon, Pa. .... Jul. 20
Sep. 3. Winnipeg, Man. .... Jun. 15
Adv. Jun. 15 to Jul. 20.
Sep. 3. Washington, D. C. .... Aug. 17
Sep. 3. Portland, Me. .... Aug. 17
Sep. 5. Campbellford, Ont. .... Aug. 10
Sep. 16. Milton, O. .... Aug. 10

BUILDINGS.

Aug. 20. Post office, Decatur, Ill. .... Jul. 13
Aug. 20. Add. to hospital, Athens, O. .... Jul. 27
Aug. 20. School, Spearfish, S. D. .... Jul. 27
Aug. 20. Courthouse, Lumberton, N. C. .... Aug. 3
Aug. 20. School, Montevallo, Ala. .... Aug. 3
Aug. 20. Htg. school, Ellendale, N. D. .... Aug. 10
Aug. 20. Church, Alton, Ia. .... Aug. 10
Aug. 20. School, Webster City, Ia. .... Aug. 10
Aug. 20. Pub. bldg., Newberry, Mich. .... Aug. 10
Aug. 20. Htg. school, Vermilion, S. D. .... Aug. 10
Aug. 20. Bus. bldg., Duluth, Minn. .... Aug. 17
Aug. 20. Pub. bldg., Middletown, Conn. .... Aug. 17
Aug. 20. Htg. Pub. Bldg., Jefferson City, Mo. .... Aug. 17
Aug. 20. Bank, Louisville, Miss. .... Aug. 17
Aug. 21. School, Ft. Dodge, Ia. .... Aug. 10
Aug. 21. Pub. bldg., Superior, Wis. .... Aug. 10
Aug. 21. Pub. bldg., New York, N. Y. .... Aug. 10
Aug. 21. Remodeling hospital, Sandusky, O. .... Aug. 10
Aug. 21. School, Ames, Ia. .... Aug. 10
Aug. 21. Court and jail, Nashville, Tenn. .... Aug. 17
Aug. 22. Post office bldg., Jackson, Miss. .... Jul. 20
Aug. 22. School, Negaunee, Mich. .... Aug. 10
Aug. 22. Pub. bldg., Orient, O. .... Aug. 10
Aug. 22. Htg. church, Watertown, N. Y. .... Aug. 10
Aug. 22. Pub. bldg., Des Moines, Ia. .... Aug. 10
Aug. 22. Schools, Rochester, N. Y. .... Aug. 17
Aug. 22. Htg. pub. bldg., Orient, O. .... Aug. 17
Aug. 22. Church, Waterford, Ont. .... Aug. 17
Aug. 22. Court house, Casper, Wyo. .... Aug. 17
Aug. 22. Alter. to bus. bldgs., Manitowoc, Wis. .... Aug. 17
Aug. 23. Pub. bldg., Delaware, O. .... Aug. 3
Aug. 23. School, Portland, Me. .... Aug. 10
Aug. 23. Hospital, Takoma, D. C. .... Aug. 17
Aug. 23. Add to hospital, Nat. Mil. Home, O. .... Aug. 17
Aug. 23. School, Newark, N. J. .... Aug. 17
Aug. 23. Pub. Bldg., Troy, N. Y. .... Aug. 17
Aug. 24. Add. to courthouse, Bismarck, N. D. .... Aug. 3
Aug. 24. Pub. Bldg., Trenton, N. J. .... Aug. 17
Aug. 26. School, Republic, Mich. .... Aug. 10
Aug. 26. School, Toledo, O. .... Aug. 10
Aug. 26. Pub. bldg., Milwaukee, Wis. .... Aug. 10
Aug. 26. Bus. bldg., Hinton, W. Va. .... Aug. 17
Aug. 26. Church, Pella, Ia. .... Aug. 17
Aug. 26. School, East Orange, N. J. .... Aug. 17
Aug. 26. Alter to Pub. Bldg., New York, N. Y. .... Aug. 17
Aug. 27. Post office, Trenton, N. J. .... Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 27. Bus. bldgs., Grand Junction, Colo. .... Aug. 10
Aug. 27. Remodeling court house, Murfreesboro, Tenn. .... Aug. 17
Aug. 27. Court house, Sudbury, Ont. .... Aug. 17
Aug. 28. Courthouse, Anthony, Kan. .... Aug. 10
Aug. 28. Pub. bldg., Cleveland, O. .... Aug. 10
Aug. 28. Hotel, Ft. Smith, Ark. .... Aug. 10
Aug. 28. Improv. armory, Portland, Ore. .... Aug. 10
Aug. 28. Bus. bldg., Cullman, Ala. .... Aug. 17
Aug. 28. Htg. prison, Indianapolis, Ind. .... Aug. 17
Aug. 28. Pub. Bldg., New York, N. Y. .... Aug. 17
Aug. 28. Pub. Bldg., Brooklyn, N. Y. .... Aug. 17
Aug. 29. School, Wahpeton, N. D. .... Aug. 10
Aug. 29. Shelter houses, Brooklyn, N. Y. .... Aug. 17
Aug. 29. Pub. bldg., Peru, Ind. .... Aug. 10
Aug. 29. Pub. bldg., Long Island City, N. Y. .... Aug. 10
Aug. 29. Residence, Iowa City, Ia. .... Aug. 10
Aug. 29. School plans, New Castle, Pa. .... Aug. 17
Aug. 30. Church, Delphos, O. .... Aug. 17
Aug. 31. School, Storrs, Conn. .... Aug. 3
Aug. 31. Jail, Williamsport, Ind. .... Aug. 3
Aug. 31. Court house, Liberal, Kan. .... Aug. 10
Aug. 31. Bus. bldg., Athens, O. .... Aug. 17
Aug. —. Hospital, Saskatoon, Sask. .... May 4
Sep. 1. Bus. bldg., Walla Walla, Wash. .... Apr. 20
Sep. 1. Y. M. C. A. bldg., Tacoma, Wash. .... Aug. 3
Sep. 2. Pub. bldg., New Castle, Ind. .... Aug. 17
Sep. 3. Post office bldg., Waterton, N. Y. .... Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 3. Pub. bldg., Bloomfield, Ind. .... Aug. 3
Sep. 3. Pub. bldg., Washington Barracks, D. C. .... Aug. 10
Sep. 3. Add. to jail, Buffalo, N. Y. .... Aug. 10
Sep. 3. School, St. George, S. C. .... Aug. 17
Sep. 3. Add to school, Cleveland, O. .... Aug. 17
Sep. 4. Post office bldg., Quincy, Mass. .... Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 4. School, Flandreau, S. D. .... Aug. 17
Sep. 5. Pub. bldg., Evansville, Ind. .... Aug. 3
Sep. 5. Add to court house, Columbia, S. C. .... Aug. 17
Sep. 7. Bldgs. at hospital, Elgin, Ill. .... Aug. 17
Sep. 10. Bus. bldg., Elkins, W. Va. .... Aug. 17
Sep. 10. Plmbg., etc., post Bldg., Ft. Bliss, Tex. .... Aug. 17
Adv. Aug. 17.
Sep. 11. Jail, Eureka, Cal. .... Aug. 3
Sep. 14. Pub. bldg., Washington, D. C. .... Aug. 17
Sep. 14. Pub. bldg., Pensacola, Fla. .... Aug. 17
Sep. 16. Marine Hospital, Buffalo, N. Y. .... Aug. 3
Adv. Aug. 3, 10.
Sep. 16. Marine hospital, Pittsburg, Pa. .... Aug. 10
Sep. 17. U. S. Mint bldg. repairs, San Francisco, Cal. .... Aug. 10
Sep. 19. Post office, Muscatine, Ia. .... Aug. 10
Sep. 23. Post office exten., Cedar Rapids, Ia. .... Aug. 10
Sep. 24. Post office bldg., Hamilton, O. .... Aug. 17
Adv. Aug. 17.
Sep. 30. Bus. bldg. plans, Harrisburg, Pa. .... Aug. 3
Sep. —. Hotel, New Orleans, La. .... Jun. 29
Oct. 3. Court house plans, La Moure, N. D. .... Aug. 10
Oct. 15. Court house plans, De Pere, Wis. .... Aug. 17
Dec. —. Industrial plants, Ft. William, Ont. .... May 11
——— **Bus. Bldg., Charles Town, W. Va. .... Jun. 15**
Adv. Jun. 15, 22.
——— Court house plans, Pulaski, Tenn .... Jul. 27
——— Bus bldg., Markham, Tex. .... Aug. 3
——— Indus. plant., Cobalt, Ont. .... Aug. 3

MISCELLANEOUS.

Aug. 19. Riprap, New York, N. Y. .... Aug. 10
Aug. 20. Drain, Hackensack, N. J. .... Aug. 10
Adv. Aug. 10.
Aug. 20. Wharf, etc., San Diego, Cal. .... Jun. 22
Adv. Jun. 22, 29.
Aug. 20. Dredging, McClellansville, S. C. .... Aug 3
Adv. Aug. 3 to 17.
Aug. 20. Fence at post, Ft. Ontario, N. Y. .... Aug. 3
Adv. Aug. 3 to 17.
Aug. 20. Dredging, Boston, Mass. .... Aug. 3
Aug. 20. Htg. pub. bldg., Columbus, O. .... Aug. 10
Aug. 20. Ditch work, Ivanhoe, Minn. .... Aug. 17
Aug. 20. Wharf, Mimicoe, Ont. .... Aug. 17
Aug. 21. Pier work, New York, N. Y. .... Aug. 10
Aug. 21. Borings for pier, Baltimore, Md. .... Aug. 17
Aug. 22. Dredging, Brunswick, Ga. .... Jul. 27
Adv. Jul. 27 to Aug. 17.
Aug. 22. Sanitary fixtures, etc., Panama .... Aug. 10
Aug. 23. Dredging, Savannah, Ga. .... Jul. 27
Adv. Jul. 27 to Aug. 17.
Aug. 23. Dredging, Ipswich, Mass. .... Aug. 17
Aug. 24. Wall, Bremerton, Wash. .... Jul. 27
Aug. 24. El. Ry. Dam, etc., Russellville, Ark. .... Aug. 17
Aug. 26. Embankment, Governor's Island, N. Y. H. Adv. Jul. 27 to Aug. 17 .... Jul. 27
Aug. 26. Jetty wk., Jacksonville, Fla. .... Aug. 3
Adv. Aug. 3 to 17.
Aug. 26. Timber, Detroit, Mich. .... Aug. 10
Aug. 26. Treat. iron for electric ducts, West Point, N. Y. Adv. Aug. 10, 17 .... Aug. 10
Aug. 26. Steel barges, Panama .... Aug. 17
Aug. 26. Grading, Gt. Lakes, N. Chicago, Ill. .... Aug. 17
Aug. 26. Filling in Nat. Soldiers Home, Va. .... Aug. 17
Aug. 26. Hire of dredg. plant, Detroit, Mich. .... Aug. 17
Aug. 26. Vacuum cleaning system, New York, N. Y. .... Aug. 17
Aug. 27. Track wk., Cincinnati, O. .... Aug. 3
Aug. 27. Broken stone, etc., New York, N. Y. .... Aug. 17
Aug. 27. Ex. to breakwater, Morrell Sta., P. E. I. .... Aug. 17
Aug. 28. Dredging Block Island, R. I. .... Aug. 3
Adv. Aug. 3 to 17.
Aug. 28. Jetty work, Wilmington, Del. .... Aug. 17
Adv. Aug. 17.
Aug. 30. Dredge, Philadelphia, Pa. .... Aug. 3
Adv. Aug. 3 to 17.
Aug. 30. Rock excav., Portland, Me. .... Aug. 3
Adv. Aug. 3 to 17.
Aug. 30. Ice plant, Ft. Dade, Fla. .... Aug. 10
Adv. Aug. 10.
Aug. 30. Flagstaff, Ft. Wood, N. Y. H., N. Y. .... Aug. 17
Adv. Aug. 17.
Aug. 30. Sea wall, Ft. St. Philip, La. .... Aug. 17
Aug. 31. Jetty wk., Galveston, Tex. .... Aug. 3
Adv. Aug. 3 to 17.
Sep. 1. R. R. wk., Webb City, Mo. .... Aug. 3
Sep. 2. Wharf plans, Gothenburg, Sweden .... Apr. 27
Adv. Apr. 27 to May 18.
Sep. 2. Dredging, Tacoma, Wash. .... Aug. 17
Sep. 2. Repair dykes, etc., New York, N. Y. .... Aug. 17
Adv. Aug. 17.
Sep. 3. Pier wk., Two Rivers, Harbors, Wis. .... Aug. 10
Adv. Aug. 10 to 17.
Sep. 3. Ditch, Ft. Snelling, Minn. .... Aug. 10
Sep. 3. Walls, etc., Joliet, Ill. .... Aug. 17
Sep. 4. Dredging, Norfolk, Va. .... Aug. 10
Adv. Aug. 10, 17.
Sep. 4. Dredging, Providence, R. I. .... Aug. 10
Adv. Aug. 10 to 17.
Sep. 4. Garb. disp., Baltimore, Md. .... Aug. 17
Oct. 5. Lock and dam, Franklin, Ark. .... Aug. 10
Adv. Aug. 10 to 17.
Oct. 5. Lock and dam, Mobile, Ala. .... Aug. 10
Adv. Aug. 10 to 17.
Sep. 5. Dredging, Seattle, Wash. .... Aug. 17
Sep. 5. R. R. work, Pensacola, Fla. .... Aug. 17
Adv. Aug. 17.
Sep. 7. Dredging, Stamford, Conn. .... Aug. 17
Adv. Aug. 17.
Sep. 7. Dredging, Washington, D. C. .... Aug. 17
Sep. 7. Drainage work, Little Rock, Ark. .... Aug. 17
Adv. Aug. 17.
Sep. 9. Dredging, Honolulu, H. I. .... Aug. 3
Adv. Aug. 3, 10.
Sep. 10. Ditch work, Sibley, Ia. .... Jul. 27
Adv. Jul. 27 to Aug. 10.
Sep. 10. Exten. to b'kwater, Cleveland, O. .... Aug. 17
Sep. 10. Exten. to breakwater, Fairport Harbor, O. .... Aug. 17
Sep. 10. Dredging, New Orleans, La. .... Aug. 17
Adv. Aug. 17.
Sep. 10. Breakwater, Bar Harbor, Me. .... Aug. 17
Adv. Aug. 17.
Sep. 11. Dam, etc., Cincinnati, O. .... Aug. 17
Adv. Aug. 17.
Sep. 11. Levee wk., Bradley, Ark. .... Aug. 17
Sep. 30. Searchlight outfit, Washington Barracks, D. C. .... Aug. 3
——— Excav. and concrete wk., Ithaca, N. Y. Aug. 3
Adv. Aug. 3
Fill, Rye, N. Y. .... Aug. 17

CURRENT NEWS SUPPLEMENT

AUGUST 24, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

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ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

THE NEW EMPIRE BRIDGE WORKS, ELMIRA, N. Y.

The Empire Bridge Co.'s extensive improvements to its plant at Elmira, N. Y., which have been under way since early in 1907, are progressing rapidly, and it is anticipated that the enlarged plant will be in full operation before the end of the year. All of the buildings are now well under way, most of the new machinery has been delivered and is being installed as fast as the progress of the buildings will admit.

This plant is located at Elmira Heights, and when completed will cover an area of about 15 acres. It is served by the Erie, Delaware, Lackawanna & Western and the Pennsylvania roads. The property was formerly known as the North Shop of the Elmira Bridge Co., by which it was built in 1895, and operated up to 1900, in connection with an older establishment of the same kind located in Elmira proper and known as the South Shop. The property passed into the hands of the American Bridge Co. on its organization in 1900, and was subsequently acquired by the present owners, who for several years have had in contemplation the improvements now under way.

Operations have heretofore been conducted in a single 90x400 ft. building, while the enlarged plant contemplates not only an extension to the original building, known as the Main Bridge Shop, making it 215x528 ft. in size, but the construction of a boiler and power house, machine shop, templet shop, and a forge shop. All buildings are of steel construction, column bearing, with brick curtain walls, concrete foundations, and slate or slag roofs.

The present plant and equipment gives employment to about 250 men and has an output of about 15,000 tons of steel bridge and building work per annum. When the enlarged establishment is in full operation more than double this number of men will be required, and with the installation of new machinery, which is all of the most modern type, together with additional handling facilities for heavy material, the output will be quadrupled, thus making one of the largest and best equipped producers of structural work in the East and in this respect placing it well towards the top of the list of structural shops of the world.

Direct current at 220 volts will be used throughout the plant for the operation of machinery and for lighting purposes, each machine being equipped with an independent motor. Enclosed arc lamps of the long flame type will be used for general lighting, with incandescent lamps for auxiliary and individual lighting, and the lighting equipment will be such as to admit of operation of the works with equal facility by night as by day.

About two miles of standard gauge railroad track is being laid for switching purposes, and switching service is performed by a 40-ton private locomotive. In addition there is also being built about two miles of narrow-gauge track throughout the plant for the conveyance of material on hand pushed buggies.

Two 100-ton track scales, one at the receiving end of the shop and the other at the finishing end, will record the weight of all car loads of raw material received and finished product shipped out.

The water supply comes from a system of wells which have already been sunk, and a purifying system has been installed to prepare the water for boiler purposes. A complete drainage and sewerage system has also been provided, together with thoroughly sanitary toilet equipment.

Fire protection is afforded by a complete and independent system of piping supplied by a pump of high capacity capable of maintaining six 1⅛-in. streams at a pressure of 125 lbs. The fire pump is automatic in its action and will be kept under steam and ready for immediate use at all times. A fire brigade will be organized among the workmen in the shop, who by frequent drilling are to be kept thoroughly proficient in the handling of the fire fighting equipment. An emergency hospital, in charge of a competent nurse, and equipped with all necessary surgical appliances, will be maintained on the premises for rendering first aid to injured employees.

The boiler house is 42x90 ft., in which the boiler plant consists of four 250 h.-p. water tube boilers, equipped with mechanical stokers, damper regulators and feed water regulators, and fed by two compound duplex pumps, each of which is of sufficient capacity to supply all boilers. The engine-room, which is 80x60 ft. in size, contains two 300-kw. generators, driven by horizontal tandem compound condensing engines, and one 100-kw. generator of the same type, driven by a vertical cross compound condensing engine, two air compressors of total capacity of 3,600 cu. ft. per minute, besides other minor engines. The entire width of the power house is spanned by a 20-ton electric crane for use in the installation of machinery and for subsequent handling of the machinery when necessary.

The machine shop building is 60x240 ft. Planers, slotters, boring mills, heavy lathes, and other machines for the execution of heavy work will be installed in the main aisle, which is 30 ft. wide, and served by a 15-ton crane running the entire length of the shop, while machine tools for lighter work will occupy the 15-ft. wings on either side, the entire area of which is covered by traveling jib cranes of special design.

A 60x240 forge shop will be devoted in part to the manufacture of bolts, nuts and rivets, and the remainder of the building to bending, forging, tempering and the making of loop rods and light eye-bars.

The 50x224-ft. templet shop will be fitted with saws, planers, boring machines and other wood working machinery needed for templet and pattern making purposes, and the basement of the same building will be used as a storage room for plant supplies and miscellaneous material.

The main bridge shop is 215x528 ft. In this building will be placed punches, chord boring machines, drill presses, shears, rotary planers, plate shears, reamers, hydraulic riveters and other machines necessary to the handling of main members of bridges and buildings of the heaviest type. There will be a system of 10 and 20-ton cranes overhead for general service and in addition all small machines will be served by special jib cranes for the handling of individual pieces. An extension, measuring 55x80 ft., at the west end of the main shop will provide space in which to take care of detail material.

The receiving yard, at one end of the main bridge shop for the storage and handling of raw material, and the shipping yard, at the other end of the same building, for loading and shipping the finished product, are each served by two electric traveling cranes on separate runways 600 ft. long. The combined storage area of these two yards is about 225,000 sq. ft., all of which is covered by skids to protect the material from rust by contact with the ground.

SEWAGE DISPOSAL AT PHILADELPHIA.

Director Stearns of the Department of Public Works of Philadelphia and Chief Geo. S. Webster of the Bureau of Surveys have recently visited Massachusetts cities possessing sewage-disposal works, as a preliminary measure to the organization of a division of the Bureau of Surveys, which shall have charge of the preparation of plans. An appropriation of $7,500 was made by Councils for the services of an expert in the preliminary work of this year. The general plan will be intrusted to a commission.

For the protection of the health of people of the State Dr. Samuel G. Dixon, State Commissioner of Health, obtained the passage of a bill in the last Legislature requiring all cities and towns in the State to make preparations for the scientific disposal of sewage. The time allowed was left to the discretion of the commissioner of health. In the case of Philadelphia it was agreed that five years would be plenty of time in which to make the plans and decide upon the system to be adopted.

This agreement was put in the form of an ordinance, carrying with it an appropriation for some preliminary work. While five years is allowed for the completion of the plan, the city must show to the State Commissioner each year that it is making progress. The bill was passed last spring, but the Department of Public Works has not taken up the work until now.

LARGE GAS ENGINES.

The accompanying illustration shows the type of gas engine now being built by Allis-Chalmers Co., Milwaukee, for the power house of the Indiana Steel Co.'s new works at Gary, Ind., and for other large installations.

These engines have the largest cylinder diameter of any gas engine yet built in this country, the sizes being 44 in. in diameter by 54 in. stroke. They have the same volumetric capacity as the engines built for the California Gas & Electric Co., which are 42 in. in diameter by 60 in. stroke. An engine of this size on blast-furnace gas of about 80 to 85 B. t. u. will give a safe maximum horse-power in the neighborhood of 4,000, but will work up to approximately 5,000 h.p. on the richer gases. The valve gear is located between the engines, concentrating the gear on a twin tandem in a way that makes it convenient for the operating engineer. This engine, as shown, is of the cut-off type, the quantity of gas and the time of admission both being under the control of the regulator. Allis-Chalmers Co. is building thirty-six units of the size mentioned. In one power house at Gary there will be seventeen units of that size, fifteen of which will be connected to 25-cycle alternators (rated at 2,000 kw., but which will, of course, have large overload capacity), and two will be direct-connected to direct-current generators, also of 2,000 kw. rated capacity. The power house is approximately 125 ft. wide and 1,000 ft. long. Another power house being built at Gary, of the same width and one-half this length, is also to be equipped with Allis-Chalmers units.

The weight of the engine is, in round numbers, 1,500,000 lb.; the crank pins are 20 in. in diameter; the shaft is 30 in. in diameter in the bearing; and the flywheel is 23 ft. in diameter, weighing 200,000 lb. The speed of this engine is 83⅓ r. p. m. The pistons and rods are water-cooled, water being introduced at the center and flowing forward to a discharge in the frame for the front piston and backward to a discharge in the tail guide for the rear piston, each piston having its separate supply. For dismantling or for cleaning, the rod is made in two parts joined at the central slide, the rear half going out at the rear of the engine and the other half going out through the frame, which is made open at the top for convenience.

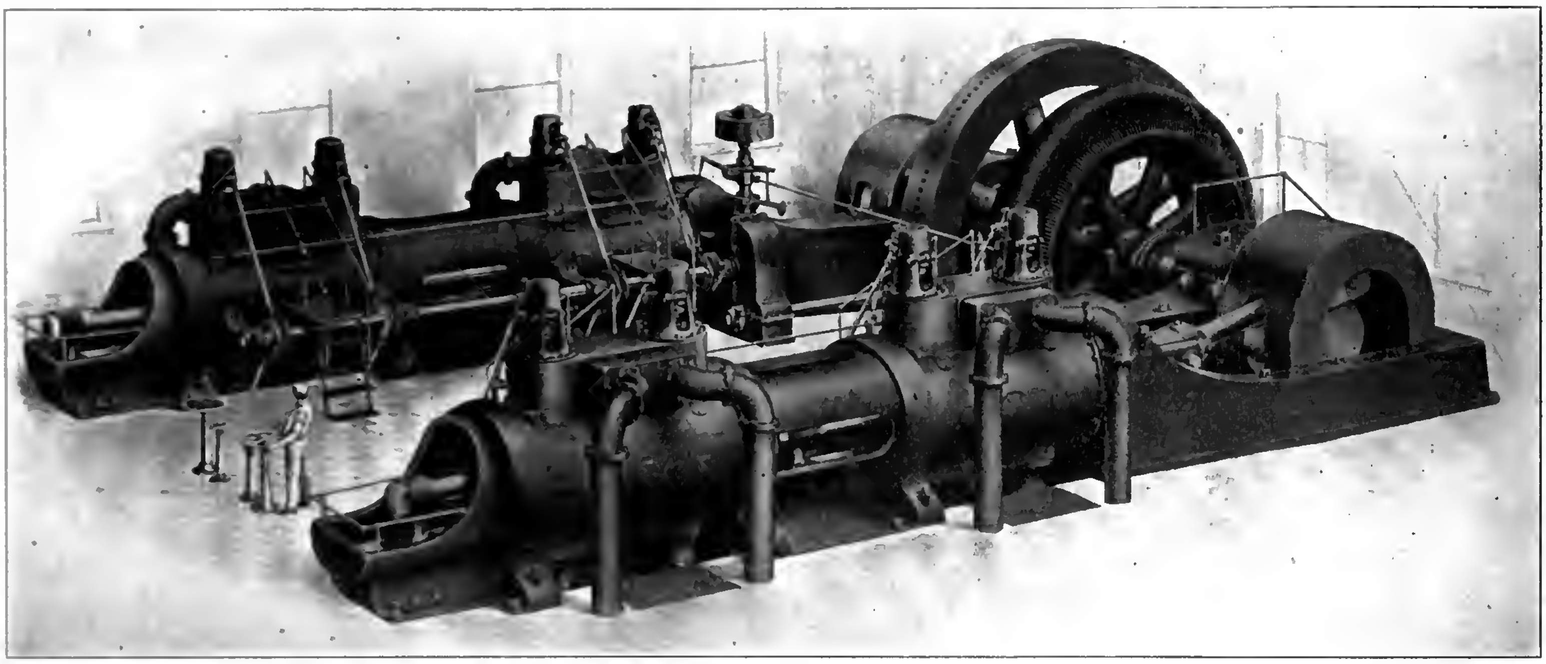
The frames for this engine weigh approximately 90 tons each, and one-half of each frame is buried in the foundation, in order to raise the floor line to a point

w[illegible]ke the slides on the valve gear readily accessible.

Within the past year Allis-Chalmers Co. has taken orders for thirty-six gas engines of 4,000 h.p. each, or an aggregate of 144,000 h.p., twenty-five of which are to be installed as a part of the mammoth new plant now in course of construction by the Steel Corporation at Gary, Indiana, seven for the Homestead plant of the Carnegie Steel Co., and four in the South Chicago works of the Illinois Steel Co. It will require 2,300 cars to transport these machines from the works of the Milwaukee Company to the different plants of the Steel Corporation, where they will be installed. The wide use of gas engines by the United States Steel Corporation marks an important step in the progress of steel manufacture in this country, as they are designed to operate upon the hitherto "waste" gas developed by the blast furnaces; thus inaugurating an important economy in steel production.

The majority of the Allis-Chalmers gas engines on order will drive electric generators of standard Allis-Chalmers type, 25-cycle, 3-phase. These machines are to be used for generating the necessary power to operate the heavy induction-motor driven rolls, the tilting and feed tables for the various passes, the hot saws, hot and cold pull ups, transfer tables, straightening machines, and cold saws, and other auxiliary machinery of the mills which are now ordinarily operated by means of steam power.

In addition to the gas-engine-driven electrical units, orders have also been placed with the Allis-Chalmers Co. for twelve gas-driven blowing engines. The Gary plant will have eight blowing engines, and the Homestead plant of the Carnegie Steel Co. has ordered the remaining four units. Each blowing engine has a capacity of 3,500 h.p., and will deliver 30,000 cu. ft. of free air per minute against a pressure of 18 lb. per sqare inch, which is ordinarily the maximum. All of the gas-driven blowing engines purchased by the steel company's plants will be equipped with "slick" type blowing tubs, the American patent rights covering which are owned by Allis-Chalmers Company.



FOUR-CYCLE DOUBLE ACTING TWIN TANDEM GAS ENGINE.

PERSONAL NOTES.

G. C. Hewitt, a consulting mining engineer, of Colorado Springs, Colo., died at his home in that city Aug. 12, aged [illegible] years.

Messrs. Elvin J. Becker, A. L. Northrop and Elmer C. [illegible] have been appointed assistant engineers on the New York State Engineer's staff.

Dr. Rudolph Hering, of the firm of Hering & Fuller, consulting engineers, New York City, has been retained by the city of Milwaukee to recommend a method of disposal for the garbage of that city.

Mr. C. G. Delo, engineer of maintenance of way of the Chicago & Alton R. R., at Kansas City, Mo., has been transferred to Bloomington, Ill., in the same capacity, succeeding Mr. W. B. [illegible], promoted.

Mr. John R. Freeman, of Providence, R. I., has been retained by the New York State Water Supply Commission to direct the investigation of the water power resources of the State ordered by the Fuller Act of this year.

Prof. L. G. Carpenter, of Fort Collins, Colo., has been retained by the provincial government of British Columbia to investigate various engineering problems, particularly those intended to furnish relief from difficulties due to existing water conditions.

Mr. W. A. Creek has been appointed county surveyor of Cedar County, Missouri, by Gov. Folk, succeeding Mr. F. M. Hackleman, resigned, and Mr. J. C. Smith has been appointed county surveyor of Crawford County, to fill the vacancy occasioned by the death of Bascom O. Butt.

Mr. David W. Ross, who has been succeeded as purchasing agent for the Panama Canal by Maj. Harry F. Hodges, Corps of Engineers, U. S. A., is to become the managing director of the Magnus Metal Co., of New York, and the Hewitt Mfg. Co., of Chicago, associated concerns.

Dr. Charles Stewart Wurts, for twelve years vice-president of the Cambria Iron & Steel Co., and a director for many years after he ceased to be vice-president, died Aug. 14, in Philadelphia. He was 78 years old and had not been actively engaged in business for several years.

Thomas Andrews, widely known for many years for his pioneer work in metallography, died some weeks ago at his home near Sheffield, England. He was a member of a family identified for many generations with the iron industry, and his well-known investigations were prompted by problems presented by the behavior of steel in service, particularly on railway rolling stock.

Mr. Wilbur J. Watson has resigned as bridge engineer of the Osborn Engineering Co., and has opened offices in the Citizens' Building, Cleveland, Ohio, as a specialist in the design, inspection and construction of bridges, buildings and special structures of steel and reinforced concrete. Mr. Watson has been associated with the Osborn Engineering Co. since 1898 and has had wide experience in the sort of work which he will make his specialty.

The United States Civil Service Commission will hold examinations in the large cities of the country on the dates indicated, of candidates for positions as follows: Nautical expert in the Hydrographic Office of the Navy Department, Sept. 18; computer, Naval Observatory, Washington, D. C., Sept. 11-12; mechanical draftsman in the office of the Chief of Ordnance, War Department, Sept. 18-19-20; chemist qualified as cement tester, for duty in the Reclamation Service, Sept. 18.

Maj. Lansing H. Beach, Corps of Engineers, U. S. A., on duty at the Infantry and Cavalry School and Staff College, Fort Leavenworth, Kan., as assistant commandant and instructor of engineering, has been ordered to Jacksonville, Fla., to relieve Maj. Francis R. Shunk, in charge of defensive works on the east coast of Florida and river and harbor work in that vicinity. Maj. Shunk has been ordered to St. Paul, Minn., to relieve Capt. Edward H. Schulz, in temporary charge of the improvement to the Mississippi River between St. Paul and Minneapolis, and in charge of improvements on the Missouri River.

Mr. A. W. Thompson, superintendent of the Wheeling division of the Baltimore & Ohio R. R., has been promoted to be chief engineer of maintenance of way with headquarters at Baltimore, succeeding Mr. J. B. Dickson, who has resigned to become assistant general manager of the Erie R. R. Mr. Thompson will be succeeded at Wheeling by Mr. O. Rickert, division engineer of the Monongahela division, who in turn will be succeeded by Mr. W. C. Barrett, now division engineer of the Wheeling division. Mr. F. J. Batchdler has been transferred from division engineer of the Shenandoah division to the same office on the Wheeling division, and has been succeeded in his former office by Mr. J. B. Myers, assistant engineer of the Cumberland division.

Mr. F. B. Maltby, who has been connected with the Panama Canal work as principal assistant engineer for the past two and one-half years, has resigned to become associated with Messrs. Dodge & Day, engineers and constructors, of Philadelphia, as chief engineer. Mr. Maltby is a graduate of the University of Illinois, with long experience in railroad construction, municipal engineering, and irrigation, and has been connected at various times with the Wisconsin Central, Missouri Pacific, Great Western and Illinois Central roads. He had charge, for the United States Government, of all the dredging operations in the lower Mississippi River and designed and built the lock and movable dam on the Osage River in Missouri. Mr. Maltby designed over $1,250,000 worth of dredging plant for the Panama Canal work and the preliminary plans and construction work for the Gatun lock and dam were under his direction.

BUSINESS NOTES.

The Stone & Webster Engineering Corporation, constructing engineers, Boston, have moved to their own building at 147 Milk St., corner of Batterymarch St.

Mr. C. J. Connell has been appointed assistant secretary in charge of the Accounting Department of the Universal Portland Cement Co., Chicago, and Mr. Frederick Blanchard has been appointed credit manager.

The general offices of the Pittsburgh Bridge & Iron Works, have been moved to the plant in Rochester, Pa.

On account of the increased business of the Dayton Pneumatic Tool Co., in the Buffalo district, an agency has been established with Root, Neal & Co., 178-180 Main St., Buffalo, N. Y. The latter concern will carry in stock a complete line of Dayton and Green pneumatic hammers as well as repair parts and accessories.

On account of the large sales of vises to the U. S. Government by the Pittsburgh Automatic Vise & Tool Co., Mr. H. M. Kearns has been appointed special Government representative by the company.

The Ambursen Hydraulic Construction Co., Boston, Mass., is building two dams, respectively 30x150 ft. and 27x250 ft., for the Grass River Paper Co., at Pyrites, N. Y.

Special catalogue No. 4 of the Tiffin Wagon Co., Tiffin, O., is devoted to illustrations and descriptions of the many different types of dumping and contractors' wagons made by the company. Specifications are given of bottom dump wagons with capacities from 1½ to 2½ cu. yd., four bucket steel dumping wagons, wooden contractors' carts, and two-wheeled steel-bucket carts for garbage removal and quarry use. The steel bucket wagons, designed for hauling stone, gravel, dirt and ashes, have four steel buckets with round bottoms pivoted about 3½ ft. above the ground, and are dumped by inverting the buckets. The two-wheeled round-bottom steel bucket carts, built in capacities from 1 to 1¾ cu. yd., have the bucket hung between the wheels, are very low and have no axle.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Beebe, Ark.—See "Power Plants, Gas and Electricity."

Monrovia, Cal.—The City Council is reported to have approved the plans of O. K. Parker, of Los Angeles, for pumping plant for water works.

Los Angeles, Cal.—Water Wks. Supt. Wm. Mulholland has presented to the Bd. of Water Comrs. a report recommending improvements to the water works to cost about $480,000, to include the enlargement of the Buena Vista pumping plant, to cost about $65,000; improving pumping station at Crystal Springs to cost $65,000, roofing of Ivanhoe and Bellevlue reservoir to cost about $17,000 and the purchase of 5,700 tons of pipe.

Fruita, Colo.—I. H. Whittemore, City Clk., writes that it is proposed to construct a reservoir here, at a cost of $25,000. Engineer, Fred Lowenhagen, of Fruita.

Tallahassee, Fla.—The citizens are reported to have voted on Aug. 13 in favor of municipal ownership of water works.

Millen, Ga.—See "Power Plants, Gas and Electricity."

Tifton, Ga.—The citizens are reported to have voted to issue $15,000 bonds to complete the water works and $15,000 for sewers.

Bloomington, Ill.—City Engr. Chas. F. Fautz is reported to have completed his report for 20-in. fire protection water main, which he estimates at $72,600.

Chicago, Ill.—Bids will be received until Aug. 27 by the Bd. Local Improv. (H. S. Dietrich, Pres.) for constructing water service pipes in Greenlake and Southport Aves.

Duquoin, Ill.—Press reports state that bids will be received on Aug. 26 for the construction of combined systeem of water works and sewers.

Lake Forest, Ill.—The City Council is reported to be considering the construction of municipal water works.

Weleetka, Ind. Ter.—See "Power Plants, Gas and Electricity."

Decorah, Ia.—It is reported that bids will be received until Sept. 10 (extension of date) by the Bd. of Superv. at Decorah, for constructing a water system at the poor farm at Freeport on either the automatic air pressure steel tank of 75 bbl. with 125 lb. pressure to the inch, 12-ft. steel wheel, steel tower 70 ft. high and pump to complete the job, or 500-bbl. tank overhead system, 60 ft. high. I. Linnevold, Co. Aud.

Arcadia, La.—The Town Council is reported to have selected an engineer to prepare plans and specifications for water works. When completed the question of constructing same will be voted upon.

**Pittsfield, Mass.*—This city through its Bd. of Water Comrs. has contracted with the Ambursen Hydraulic Construction Co. of Boston, for a reservoir dam on Ashley Brook to create additional water supply. The dam is on a gravel foundation, the general dimensions being 32 ft. in height by 465 ft. long. The designs are prepared by the contracting company and the work will be executed under the general supervision of Arthur B. Farnham, City Engr.

**Lowell, Mass.*—The Holly Pump Co. is reported to have secured the contract on Aug. 12 for installing a pump for $26,900.

Escanaba Mich.—The Escanaba Water Co. (Geo. L. Weaver, Pres.) is reported to be preparing to construct a filter plant.

Grosse Pointe Farms, Mich.—Bids will be received until Aug. 31 at the office of J. G. Armstrong, Village Clk., for furnishing and laying about 2¾ miles 6, 8 and 10-in. c. i. water pipes, together with 33 fire hydrants, and all valves, specials and details complete.

Lawton, Mich.—The National Constr. Co., of South Bend, Ind., will have charge of the construction of water works for Lawton, to cost about $11,000.

Stambaugh, Mich.—Bids will be received until Sept. 9 by the Village Council for improving the water works, as advertised in The Engineering Record.

Grand Rapids, Mich.—Consulting Engr. Alvord, of Chicago, Ill., has presented to the Lake Michigan Water Comn. a preliminary report on the installation of the Lake Michigan water plant, with a daily capacity of 25,000,000 gal., which he estimates will cost $2,470,000. L. W. Anderson is City Engr.

Cokato, Minn.—The citizens are reported to have voted to construct water works.

**Belle Plaine, Minn.*—W. D. Lovell, of Minneapolis, has secured the contract for constructing water works, including steel tower and tank (bids opened Aug. 12), for $8,786. Engineer, Oscar Claussen, of St. Paul.

Seminary, Miss.—The Town Council is reported to have decided to sink an artesian well, and also install a system of water works.

Sanders, Mont.—Bids will be received until Aug. 31 by the Sanders Co-operative Ditch Co. (Dr. J. R. Thompson, Secy.) for constructing an irrigation ditch, to consist of the excavation and placing an embankment of about 175,000 cu. yds. material. Henry Gerharz, Engr., Billings.

**Winside, Neb.*—Walter Gaebler, Village Clk., writes that the contract for constructing water works (bids opened Aug. 16) has been awarded to Sioux City Fdry. & Machine Co., of Sioux City, Ia., for $10,000.

Norfolk, Neb.—Bids will be received until Aug. 30 by Julius Hulff, City Clk., for furnishing material and constructing a water main on a portion of 7th St.

Kearney, Neb.—Geo. E. Ford, City Clk., writes that an ordinance has passed first reading in Council providing for the construction of water works to cost about $100,000.

Wood River, Neb.—See "Power Plants, Gas and Electricity."

**Grand Island, Neb.*—H. E. Clifford, City Clk., writes that the contract for constructing 7 blocks 6-in. c. i. pipe water mains (bids opened July 7) has been awarded to E. C. McCashland, of Grand Island, for $3,225.

Belvidere, N. J.—The City Council is reported to have granted the Buckhorn Springs Water Co., a franchise to furnish Belvidere with water to be brought from Scott Mountain, 1½ miles from city. Jos. M. Rosenberry and Silas Gibbs are reported to be among the incorporators.

Orange, N. J.—Press reports tstate that bids will be received on Sept. 9 for the construction of reinforced reservoir, gate-house, etc., at West Orange.

Paulsboro, N. J.—Bids will be received until Aug. 29 by Chas. M. Gwilliam, Boro. Clk., for $46,000 water bonds.

Brooklyn, N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York City, until Aug. 28, for furnishing, delivering and laying water mains and removing existing water mains in Bedford, Clinton, Greenpoint, Harrison, Johnson, Manhattan, Meserole and Nassau Aves.; Humboldt, Keap, Lorimer, Meserole, Oakland, Provost, Scholes, Waterbury and White Sts., and in Delmonico Pl., Boro. Brooklyn.

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrman, Pres.) until Aug. 29, for furnishing, delivering and laying c. i. water pipe and appurtenances in the Harlem River driveway, bet. 155th and 177th Sts.

Rome, N. Y.—The State Water Supply Comn. is reported to have granted permission to the city of Rome to procure a new system of water from Fish Creek for a gravity system.

Spencerport, N. Y.—Dr. H. M. Roberts, P. F. Coleman and W. H. Link, of Herkimer, are reported to have petitioned the Village Trus. for a franchise for water works and sewers.

Rocky Mount, N. C.—See "Power Plants, Gas and Electricity."

Grand Forks, N. D.—Bids will be received until Aug. 30 by W. V. O'Connor, City Aud., for constructing a water main in 8th St and Ione Ave.

Columbus, O.—Bids will be received until Aug. 30 by the Bd. Pub. Service (E. F. McGuire, Secy.) for laying c. i. force mains in Dublin Pike, Dublin Ave. and Spring St., Franklin Township and in the city of Columbus; as per contract No. 17, requiring about 2,420 tons c. i. pipe, 11,000 lbs. iron castings, 26 gate valves, varying in size from 3-in. to 36-in. 130 tons bell and spigot special castings, 4 tons flange special castings, 7,500 lbs. twisted steel rods, 2,200 cu. yds. macadam, 2,500 lbs. manhole steps and tie rods, etc. Henry Maetzel Ch. Engr., Bd. Pub. Service.

Hamilton, O.—Bids were opened on Aug. 13 by the Bd. of Pub. Service as follows: (Engineers John W. Hill & Sons, First Natl. Bank Bldg. Cincinnati): The Press ler Prospecting & Eng. Co., Cincinnati, 20 sand pumping wells, ea., $35; driving 8-in. wells, $4.50 per ft; 1,343.3 cu. yds. trench excav., $1.10 and 106.5 tons pipe-laying, 24-in., $10. Dravo-Doyle & Co., Pittsburg. Pa., 2 centrifugal pumps, ea., $3,750; 2 A. C. motors, ea., $2,800 and one 1,000-ft. pole line, $1,250. D. R. P. Dimmick, Cincinnati, 6,000 lbs. specials, 4½ cts.; 98 tons 24-in. c. i. pipe, $33.50 and 11,000 lbs. H. & S. specials, 3½ cts.; 1,343.3 cu. yds. trench excav., 80 cts. and 106.5 tons pipe-laying 24-in., $12. W. H. Louthan, Hamilton, 670 cu. yds. excav. pump pit, $2.50; 220.3 cu. yds. concrete pump pit, $11; 126.6 cu. yds. puddle pump pit, $2; 1 superstructure pump pit, $1,0-0; 13,000 lbs., structural steel pump pit, 3¾ cts.; 1 steel door pump pit, $40; 2 4 m. g. d. centrifugal pumps, $2,000; 2 100-h.-p. A. C. motors, $2,695, and 1 1,000-ft. pole line, $1,050.

Elmore, O.—E. Jaiger, City Clk., writes that it is proposed to construct water works at a cost of $25,000. Engineer, Geo. Harrop, of South Bend, Ind.

New Carlisle, O.—The question of constructing water works is reported under consideration here.

Oklahoma City, Okla.—Bids will be received by W. C. Burke, City Engr., until Aug. 31 for installing a water softening plant of 50,000 gal. daily capacity at the city water works pumping station, as advertised in The Engineering Record.

Enid, Okla.—An election will soon be held to vote on issuing $285,000 bonds for sewers, $10,000 for septic tanks and $15,000 for water works extension.

Shawnee, Okla.—The City Council is reported to have decided to improve the water system.

Corvallis, Ore.—See "Power Plants, Gas and Electricity"

**Steelton, Pa.*—The following are reported to be the totals of bids opened on Aug. 6 by Boro. Council for the construction of a filter plant: Lea Constr. Co., of New York, N. Y., $80,482; Coder & Miller, of Harrisburg, $89,583; Bunting Constr. Co., of Flushing, N. Y., $71,553 (awarded contract).

Pawtucket, R. I.—The following are reported to be the bids opened on Aug. 15 for the construction of new pumping station; Wilmarth & McKillop, $42,120; F. G. Rowley Co., $45,000; Cruise & Simley, $46,391; Robt. Wilson, $49,950, and H. F. Ross Co., $64,300.

McEwen, Tenn.—Plans are reported to have been completed for water works.

Marian, Tex.—The City Council is reported to be considering the question of establishing water works.

Berclair, Tex.—C. B. Lucas is reported interested in the construction of water works.

Temple, Tex.—The Citizens Com. is stated to have recommended to City Council that an election be held to vote on issuing $150,000 bonds for the construction of water works.

Prosser, Wash.—The City Council is reported to have appropriated $10,000 for a deep well.

Winnipeg, Man.—See "Public Buildings."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Douglas, Ariz.*—The City Clerk writes that the McQuatters Plumbing & Machinery Co. is now completing the sewerage system, which will cost about $75,000. Engineer. F. H. Olmstead, of Los Angeles, Cal.

**Arkadelphia, Ark.*—Robinson Bros., of Pine Bluff, are reported to have secured the contract for the construction of the 45,280 ft. of clay pipe sewers opened by the Comrs. of Sewer District No. 1 on Aug. 15 for $28,362.

**Camden, Ark.*—B. C. Pouncey, of Helena, is reported to have secured the contract for constructing 10,000 ft. of sewers in Dist. 2 (bids opned Aug. 15), for $6,200.

Lodi, Cal.—It is reported that plans and estimates are being prepared for a sewerage system.

Colusa, Cal.—The Town Trus. are reported to be considering the question of constructing a sewerage system.

**Denver, Colo.*—Moses Hallett, Trus. of the Estate of Geo. W. Clayton, Room 31, Clayton Blk., Denver, writes that the contract for furnishing material and constructing the Clayton College pipe line comprising about 4 miles of vitr. clay pipe and steel pipe with manholes and other appurtenances according to plans of Peter O'Brien, Nassau Blk., Denver, has been awarded to the Gaffy & Keefe Constr. Co., of Denver, for $52,000.

Golden, Colo.—The Council is reported to have passed an ordinance creating sanitary sewer Dist. No. 1, comprising all the city south of Clear Creek; probable cost of proposed sewers, $25,000.

**Gainesville, Fla.*—This city on Aug. 10 awarded contract for 6 miles of 4-in. house branches to F. H. Beemann, of Gainesville, at about $19,000.

Tifton, Ga.—See "Water."

Duquain, Ill.—See "Water."

Springfield, Ill.—Bids will probably be called for in about 60 days for a sewer to drain southeastern part of city, to be 5,000 ft. long, of which 2,500 ft. will be 6-ft. brick and 2,500 ft. of 4-ft. brick; estimated cost, $35,000.

Carlinville, Ill.—The Council is reported to have adopted an ordinance providing for the construction of sewers.

**South Bend, Ind.*—Staples & Ackerman, of South Bend, are reported to have secured the contract for constructing the Emerson St. pipe sewer for $4,500.

Indianapolis, Ind.—Bids will be received until Aug. 28 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.) for constructing a pipe sewer, varying in size from 15 to 18-in. in a portion of Central Ave.

Peru, Ind.—It is stated that bids will be received until Aug. 27 by the Common Council for constructing 4,000 ft. of 10-in. vitrified tile sewer. Wm. O'Hara, City Clk.

Columbus, Ind.—It is stated that bids will be received until Sept. 3 by Lawrence F. Orr, City Clk., for 9,838 ft. of main and lateral sewers. W. H. Rights, City Engr.

Independence, Kan.—J. D. Kramer, City Clk., writes that the question of constructing sewers on the west side of city is being considered, but nothing definite yet done. W. F. Keller, Ciy Engr.

**Westfield, Mass.*—Oren E. Parks, Town Engr., writes that the contract for constructing sewers (bids opened Aug. 3) has been awarded to Daniel A. Dorey, of Natick, for $3,300.

Gardner, Mass.—The citizens are reported to have voted Aug. 7 to appropriate $15,000 for the construction and extension of the sewerage system and sewage disposal plant.

Springfield, Mass.—The Com. on Sewers and Drains is reported to have decided to recommend the construction of sewers in Carew and Armory Sts., to cost about $20,000 and on Long Hill St., at a cost of $6,700.

**Howell, Mich.*—The Trustees of the State Sanitarium for Tuberculosis at Howell, will build a sewage dsiposal plant. Contractor Chas. G. Jewett, of Howell, Consulting Engineer; Burton J. Ashley, 6515 Normal Ave., Chicago, Ill.

Iron River, Mich.—All bids opened on Aug. 7 by Village Council for the construction of sewers in Main Dist. No. 1 are reported to have been rejected, being too high, and it is said that new bids will not be called for again until the spring. Chas. A. Otto, Village Clk., Engineer, E. G. Bradbury and G. P. Shute, 85 No. High St., Columbus, O.

**Morris, Minn.*—Tanner Bros., of Minneapolis, are reported to have secured the contract for additional sewers in Morris for $7,000.

Bozeman, Mont.—Harry A. Bolinger, City Clk., writes that bids will be received on Sept 5 for the construction of pipe sewers, to cost about $36,000. C. M. Thorpe, City Engr.

Billings, Mont.—Plans are being prepared for a main sewer to consist of 12, 15, 18 and 21-in. pipe, and 3,500 lin. ft. concrete culvert 8 ft. wide and 5 ft. high; estimated cost, $87,000. Henry Gerharz, City Engr.

Butte, Mont.—About $15,000 will be expended for concrete sewers, plain or reinforced. Alex. Leggat, City Engr. M. A. Berger, City Clk.

Joplin, Mo.—Plans are reported to be on file at the office of the City Engr., for new storm sewer, which will cost about $606,213, and take about 10 years to construct. The work is divided into 7 districts, namely 1 to 7. The work will all be let by contract. The cost of the different divisions of the sewers, according to the estimates of the engineers, will be: Joplin main, $120,796; Joplin St. main, $24,679; Kentucky Ave. mains,

* *Items marked thus give the names of parties awarded contracts.*

$14,105, [illegible] St. mains, $16,431; Willow Branch main, $18,[illegible]; Central main, $160,271; northwest mains, $28,-860, W. Joplin mains, $40,130; Smelter Hill mains, $13,150; Division St. mains, $21,948, and Broadway mains, $18,780.

N. B. Spillman, City Engr., writes that an election will be held in the near future to vote on issuing $600,000 bonds for the construction of new storm sewers.

Asbury Park, N. J.—John L. Coffin, Supt. Water & Sewers, writes that the following are the bids opened on Aug. 17 for furnishing material and laying about 1,200 ft. 12-in. wrought-iron sewer outlet pipe, extending seaward from tidemark: Chas. Ippolito, Orange, $12,000; J. Thompson & Co., Avon, $10,500; Watson Machine Co., Paterson, $7,200; Merritt & Chapman Co., New York, N. Y., $5,738; McCay Eng'g Co., Baltimore, Md., $5,375; and A. B. Marsden & Co., Utica, N. Y., $4,900.

**Pekin, Ill.*—John R. Siebert, City Engr., writes that the following are the bids opened on Aug. 12 by the Bd. of Local Improvements for constructing sewers: (*a*) E. R. Harding, Racine, Wis. (awarded contract); (*b*) Independent Constr. Co., Davenport, Ia.; (*c*) Peoples Constr. Co., Davenport, Ia.; (*d*) Chas. W. O'Neil, Peoria. (Informal, rejected).

	*a	b	c	d
Tile Sewers				
10,110 lin. ft. 8-in.	$0.56	$0.79½	$0.75	$0.69
12,672 lin. ft. 12-in.	.80	.96½	.98	.89
10,435 lin. ft. 15-in.	1.10	1.23½	1.09	1.18
5,265 lin. ft. 18-in.	1.50	1.39	1.59	1.45
5,105 lin. ft. 20-in.	1.80	1.80½	1.09	1.85
Brick Sewers (Egg Shaped).				
3,495 lin. ft. 18x27-in.	2.00	1.79½	2.19	1.75
2,320 lin. ft. 20x30-in.	2.10	1.76	2.20	2.00
1,555 lin. ft. 22x33-in.	2.60	1.90¼	2.90	2.25
720 lin. ft. 24x36-in.	3.20	3.38½	3.25	2.65
1,205 lin. ft. 26x39-in.	3.50	3.55½	3.75	2.65
1,595 lin. ft. 28x42-in.	3.70	3.67	3.90	3.15
330 lin. ft. 30x45-in.	3.80	3.95½	4.05	4.00
320 lin. ft. 32x48-in.	4.00	4.64	4.65	4.50
320 lin. ft. 34x51-in.	5.00	4.86½	5.81	4.75
Brick Sewers (Circular).				
320 lin. ft. 42-in.	6.00	5.25½	5.99	4.50
660 lin. ft. 52-in.	6.20	5.71¾	8.19	6.00
1,504 lin. ft. 62-in.	10.00	8.00	10.00	8.00
135 manholes	42.00	60.00	45.00	40.00
47 flush tanks	45.00	57.50	50.00	41.00
142 catch-basins	48.00	65.00	55.00	50.00
1 outlet abutment	400.00	672.00	500.00	300.00
100 cu. yds. extra excav.	6.95	8.00	9.00	.....
Totals	$113,977	$119,103	$122,470	$113,447

Aurora, Neb.—A. O. Hartquest, City Engr., writes that bids are to be received at once for the proposed sewerage system to cost about $10,500. Dennis Saylor, City Clk.

Norfolk, Neb.—Separate bids will be received until Aug. 30 by Julius Hulff, City Clk., for furnishing material and constructing Dist. Sewer No. 1; main sewer on a portion of 1st St., taking up and replacing the main sewer pipes at the mouth of the main sewer where same enters into the Elkhorn River.

Fairview, N. J.—The citizens are reported to have voted to construct a sewerage system; the estimated cost of main trunk and main lateral will be about $195,000.

**Plainfield, N. J.*—Andrew J. Gavett, City Surveyor, writes that T. Foster Callahan, of Elizabeth, has secured the contract for constructing sanitary sewers (bids opened Aug. 5) at the following bid: 1,151 lin. ft. 8-in. sewer, under 6 ft. deep, 48 cts.; 11,860 lin. ft. 8-in. sewer, 6 to 8 ft. deep, 55 cts.; 5,753 lin. ft. 8-in. sewer, 8 to 10 ft. deep, 64 cts.; 1,463 lin. ft. 8-in. sewer, 10 to 12 ft. deep, 70 cts.; 430 lin. ft. 10-in. sewer, under 6 ft. deep, 57.5 cts.; 555 lin. ft. 10-in. sewer, 6 to 8 ft. deep, 64 cts.; 743 lin. ft. 10-in. sewer, 8 to 10 ft. deep, 75 cts.; 370 lin. ft. 10-in. sewer, 10 to 12 ft. deep, 83 cts.; 50 lin. ft. 10-in. sewer, 12 to 13 ft. deep, 85 cts.; 1,617 lin. ft. 8-in. cast iron sewer, under 6 ft. deep, $1.25; 608 lin. ft. 8-in. c. i. sewer, 6 to 8 ft. deep, $1.45; 72 lin. ft. 10-in. c. i. sewer, under 6 ft. deep, $1.90; 200 lin. ft. 10-in. c. i. sewer, 6 to 8 ft. deep, $2.10; 273 10-in. c. i. sewer, 8 to 10 ft. deep, $2.30 450 lin. ft. 10-in. c. i. sewer, 10 to 12 ft. deep, $2.50; 34 manholes, under 8 ft. deep, ea., $44.50; 14 manholes, 8 to 10 ft. deep, ea., $47.50; 6 manholes, 10 to 14 ft. deep, ea., $52.50; 687 branches on 8-in. sewer, ea., 55 cts.; 60 branches on 10-in. sewer, ea., 90 cts.; 30 crosses on 8-in. c. i. sewer, ea., $6.50; 4 tees on 8-in. c. i. sewer, ea., $3; 1 cross on 10-in. c. i. sewer, $9; 3 tees on 10-in. c. i. sewer, ea., $4; 19 flush tanks, ea., $75; 2,795 lin. ft. 4-in. vitr. pipe house connections, 30 cts.; 150 lin. ft. 4-in. c. i. house connections, 95 cts.; total, $24,089. Totals of other bids: John Callery, Weehawken, $26,058; C. M. Meeker, Plainfield, $25,083; E. W. Chamberlain, Westfield, $32,614; Cavalluzzo & Zizzo, Newark, $40,454; Jas. J. Fusco, Montclair, $35,583; MacNenamin & Hillpot, Bound Brook, $20,520; Warren B. Travell, Plainfield, $27,630; T. J. McGovern, Trenton, $37,704; Eveline Bros., New Britain, Conn., $30,272.

Andrew J. Gavett, City Surveyor, writes that the lowest bid opened on Aug. 5 for constructing storm sewers was submitted by C. M. Meeker, of Plainfield, at the following bid: [illegible] 343 lin. ft. [illegible] sewer, $2.80; 5 manholes, ea., $45; [illegible] ea., $3; total, $7,405. Totals of other bids: Eveline Bros., New Britain, Conn., $17,176; T. J. McGovern, Trenton, $[illegible]18; Warren B. Travell, Plainfield, $8,[illegible]; [illegible] Smith, Plainfield, $7,834; and MacNenamin & Hillpot, Bound Brook, $10,-351.

Cape May, N. J.—The [illegible] Council is reported to have instructed City [illegible] Townsend to prepare plans for improved [illegible] drainage.

Riverside, N. J.—The date of opening of bids for the construction of a sewerage system to consist of 10 miles of sewers 8 to 24-in. diam., pump house, engines, pumps, pump well and disposal works, has been extended from Aug. 19 to Sept. 2, as advertised in The Engineering Record. Engineer, Wm. H. Boardman, 427 Walnut St., Philadelphia, Pa. Irven Kollo, Township Clk.

South River, N. J.—Chas. Anderson, City Clk., writes that it is proposed to construct a sewerage system, to cost about $30,000. Engineer, Josiah Tice, of New Brunswick.

Long Island City, L. I., N. Y.—Bids will be received until Aug. 29 by Jos. Bermel, Boro. Pres., for constructing sewers and appurtenances in portions of 10th, 19th and 17th Sts., Wilbur, 12th, Metropolitan and 7th Aves. Engineer's estimate: 12,015 lin. ft. 6, 12, 15 and 18-in. vitr. salt-glazed or cement concrete pipe sewer; 573 lin. ft. salt-glazed or cement concrete culvert pipe sewer; 52 manholes; 140 M ft. timber for bracing and sheet piling; 28,500 ft. timber for foundation, etc.

Syracuse, N. Y.—Bids will be received until Aug. 27 by R. J. Shanahan, Compt., for $50,000 intercepting sewer bonds.

Kingston, N. Y.—Bids will be received by the Bd. Water Supply at the office of Thos. Hassett, Secy., No. 299 Broadway, New York, N. Y., until Sept. 3, for constructing a portion of an intercepting sewer in the City of Kingston, Ulster County, N. Y. Engineer's estimate: 5,500 cu. yds. earth excav.; 350 cu. yds. rock excav.; 4,813 lin. ft. 24-in. vitr. sewer pipe, 77 lin. ft. 24-in. c. i. pipe; 19 manholes, cutting through bulkhead at outfall, cleaning up.

Spencerport, N. Y.—See "Water."

Grand Rapids, N. D.—It is stated that bids are asked by City Council until Sept. 2 for constructing a lateral sewer. W. V. O'Connor, City Aud.

**Columbus, O.*—The contract for the construction of the sewage force main is reported to have been awarded on Aug. 15 to the York Constr. Co., at $39,915.

Oakley, O.—It is stated that bids will be received until Aug. 27 by David K. Mason, Village Clk., for constructing sewers in Dist. No. 2.

Norwood, O.—It is stated that bids will be received until Aug. 31 by the Bd. Pub. Service (L. H. Genhart, Clk.), for constructing storm water sewers in a portion of the ravine east of Montgomery Pike.

Asbury Park, N. J.—John L. Coffin, Supt. Dept. Water & Sewers, writes that the following are the bids opened on Aug. 7 for the construction of about 10 miles of pipe sewers: (*a*) A. E. Marsden & Co., Utica, N. Y.; (*b*) Bartholomew & Smith, Asbury Park; (*c*) Chas. Ippolito, Orange; (*d*) Jas. C. Fusco, Montclair; (*e*) Charlton & Weston, Yonkers, N. Y.; (*f*) N. J. Contr. & Eng. Co., Newark; (*g*) Hardman & Deidrichson, Perth Amboy.

	a	b	c	d	e	f	g
1,100 ft. remov. 10-in. sewer and replacing with 15-in.	$1.50	$2.50	$2.70	$5.77	$2.30	$3.50	$1.05
15 manholes in above sewer	40.00	50.00	48.00	47.00	45.00	60.00	35.00
Pipe sewers laying and refilling—							
1,160 ft. 12-in. pipe, cut 6 to 8 ft.	.90	1.00	.85	2.13	.82	.80	.85
150 ft. 10-in. pipe, cut 6 ft. and under	.60	.70	.70	1.65	.74	.55	.80
2,475 ft. 10-in. pipe, cut 6 to 8 ft.	.75	.90	.72	1.77	.74	.75	.80
11,811 ft. 8-in. pipe, 6 ft. and under	.50	.60	.54	1.09	.62	.50	.70
17,627 ft. 8-in. pipe, 6 to 8 ft.	.60	.70	.62	1.13	.65	.70	.72
1,565 ft. 8-in. pipe, 8 to 10 ft.	.75	.80	.82	1.27	.70	.95	.75
11,550 ft. 6-in. pipe, 6 ft. and under	.40	.50	.40	.69	.45	.45	.55
1,735 ft. 6-in. pipe, 6 to 8 ft.	.50	.60	.52	.77	.48	.65	.60
68 ordinary manholes	35.00	40.00	38.00	47.00	45.00	40.00	35.00
33 junction manholes	53.00	45.00	41.00	60.00	45.00	40.00	50.00
1[illegible] flushing manholes	40.00	45.00	48.00	75.00	45.00	60.00	35.00
156 lamp holes	5.00	10.00	6.00	10.00	7.00	7.00	5.00
2 flush tanks, A	40.00	45.00	90.00	57.00	70.00	125.00	90.00
1 flush tanks, B	45.00	45.00	88.00	50.00	70.00	125.00	90.00
4 flush tanks, C	.....	45.00	110.00	45.00	70.00	125.00	90.00
2 flush tanks, D	.....	50.00	105.00	40.00	70.00	125.00	90.00

**Youngstown, O.*—Anthony O'Horo is reported to have secured the contract for constructing the Elm St. sewer for $5,551.

Stillwater, Okla.—The City Council is reported to be considering the construction of a sewerage system.

Enid, Okla.—See "Water."

Wilkesbarre, Pa.—B. K. Finch, Engr. of Sewers, writes that bids have not yet been asked for the construction of the sewer in Union St. from No. Pennsylvania Ave. to river; it will be of brick and cost about $100,000. Fred H. Gates, City Clk.

McAdoo, Pa.—The Boro. Council is reported to be considering the question of constructing a sewerage system.

Reading, Pa.—The City Council on Aug. 12 passed ordinances as follows: Providing for the construction of house sewers in Dist. 13, and make provision for improvement bonds to the amount of $80,000, instead of $60,000; providing for the construction of house sewers in Dist. 11, at cost of $190,000, instead of $160,000; and to amend ordinances for the construction of house sewers in Dist. 4, at cost of $155,000, instead of $130,-000; Dist. 6, at a cost of $190,000, instead of $160,000; Dist. 5, at a cost of $190,000, instead of $170,000.

Allegheny, Pa.—The Finance Com. of Council has reported favorably the ordinance providing for the construction of a sewage plant at Allegheny City Home at Claremont, to cost about $10,000.

**York, Pa.*—John A. Raeyling is reported to have secured the contract for construction of storm sewer on W. Jackson St. from Tylers Run easterly, at $4.25 per lin. ft.

Sumter, S. C.—Bids will be received until Sept. 5 by the Sewerage Comrs. (C. M. Hurst, Secy.) for constructing a sanitary sewerage system, to consist of about 14 miles pipe, 18 to 22-in.; manholes, flush tanks, etc. Wm. H. Lyon, Consulting Engr., Sumter.

Webster, S. D.—Bids will be received until Sept. 3 (readvertisement) by the City Council for constructing a system of sewerage. Bids will be received on both glazed sewer pipe and concrete sewer pipe, all sizes over and including 18-in., and on glazed sewer pipe, all sizes under 18-in. Carl Malmberg, City Aud.

Johnson City, Tenn.—See "Paving and Roadmaking."

Chattanooga, Tenn.—Local press reports state that bids will be received until Sept. 16 for the construction of Chestnut St. sewer to extend from 9th St. to the river.

Olympia, Wash.—See "Paving and Roadmaking."

Morgontown, W. Va.—Fred C. Flenniken, City Recorder, writes with regard to proposed paving and sewers, that the work will not be let by contract, but will probably be done by city force account.

Lake Mills, Wis.—Bids will be secured by N. H. Falk, City Clk., until Sept. 13 for the construction of about 9,777 ft. 6 to 24-in. vitr. pipe sewers, 26 manholes and 10 catch-basins. Engineer, W. G. Kirchoffer, 31 Vroman Bldg., Madison.

Beloit, Wis.—It is stated that bids will be received until Sept. 4 by the Bd. Pub. Wks. for constructing sanitary sewers in sundry streets.

BRIDGES.

Notes Arranged Alphabetically by States.

**Winters, Cal.*—The Bd. Supervisors of Yolo County are reported to have awarded the contract for constructing the concrete bridge over Putat Creek at Winters to W. M. Concannon, 490 Orchard St., for $46,903.

Adin, Cal.—It is stated that bids will be received by the Bd. of Superv. (L. S. Smith, Clk., Alturas), until Sept. 16, for constructing bridge across Ash Creek, at Main St., Adin.

Santa Barbara, Cal.—It is stated that bids will be received by C. A. Hunt, Co. Clk., at Santa Barbara, until Sept. 3, for constructing bridge across San Jose Creek at Hollister Ave., Third Road Dist.; constructing bridge across Santa Inez River, Fourth Road Dist., and repairing bridge across Santa Maria River, Fifth Dist.

Yosemite, Cal.—Bids will be received until Sept. 10 by Maj. H. C. Benson, 14th Cavalry, Acting Supt., Yosemite National Park, Yosemite, for constructing a Class C steel bridge across Merced River in Yosemite Valley to replace present wooden bridge. Piers of present bridge to be strengthened and old bridge to be used for false work.

**Sacramento, Cal.*—The Bd. of Superv. is stated to have awarded the contract (bids opened July 25), for constructing the Fair Oaks Bridge over the American River near Fairoaks to the Western Bridge Co., for $63,000.

Farmington, Cal.—Bids will be received by Eugene D. Graham, Clk. Bd. Superv., at Stockton, until Sept. 3, for the construction of a two-span steel bridge over Oregon slough, near the R. R. station, Farmington.

**Los Angeles, Cal.*—A contract is stated to have been been awarded by the Salt Lake Ry. Co. to the Atlantic, Gulf & Pacific Constr. Co., 220 Market St., San Francisco, for the substructure of the new bridge which is to span the San Gabriel River at West Long Beach. It will be a single rolling lift bridge, with a span of 180 ft., and will rest upon three concrete piers.

Sedalia, Colo.—It is stated that bids will be received until Sept. 3 by T. W. Jaycox, State Engr., Denver, for constructing a 100 ft. reinforced concrete bridge across Plum Creek at Sedalia.

Sandpoint, Idaho.—It is stated bids will be received by the Co. Comrs. (Ignatz Weil, Clk.), at Rathdrum, until Sept. 2, for constructing bridge across Pack River at Sandpoint.

**Chicago, Ill.*—John J. Hanberg, Comr. Pub. Wks., is reported to have opened bids Aug. 17 and awarded contracts for constructing bridge over a branch of Chicago River, as follows: Superstructure, to King Bridge Co., of Cleveland, O., for $29,500; and substructure to Fitzsimons & Connell Co., for $50,000.

Rock Island, Ill.—The Council is stated to have approved plans prepared by City Engineer Treichler for the construction of a 117-ft. bridge over the canal, at an estimated cost of $8,000.

Danville, Ind.—It is stated that bids will be received by the Co. Comrs. at Danville until Sept. 2, for construction of Hazelton-Hadley bridge in Guilford Township.

Indianapolis, Ind.—Bids will be received until Aug. 28 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.), for constructing a retaining wall at the W. Washington St. bridge over White River.

* *Items marked thus give the names of parties awarded contracts.*

Wichita, Kan.—Bids will be received until Sept. 9 by the Bd. Co. Comrs. (E. P. Martin, Chmn.) for furnishing material and constructing a reinforced concrete bridge over the Arkansas River on Douglas Ave. Plans and specifications may be had upon a deposit of $10. Geo. H. Bradford, Engr., Wichita.

Millbury, Mass.—The citizens are reported to have voted on Aug. 19 to issue $3,500 bonds for building a reinforced concrete bridge over Blackstone River at S. Main St. A committee has been appointed on same with Fred W. Moore, Chmn.

Greenfield, Mass.—Bids will be received by the Bd. of Selectmen (E. B. Blake, Chmn.). until Aug. 31 for the construction of a reinforced concrete highway bridge of 25-ft. span and 20-ft. roadway over Hinsdale Brook on Green River Road, as advertised in The Engineering Record. Engineers Clapp & Abercrombie Co., 90 Main St., Greenfield; probable cost, $1,400.

Vicksburg, Miss.—It is stated that bids will be received by the Bd. of Co. Superv. (J. D. Laughlin, Clk.), and the Bd. of Aldermen, until Sept. 4, for construction of concrete arch bridge over Glass Bayou at Cherry St., and concrete-steel bridge at City Cemetery Road, near Rigby Place. H. J. Trowbridge, City Clk.

Albany, Mo.—W. A. Henton, of Albany, County Surveyor, writes that he will receive bids until Sept. 3 for the construction of a 180-ft. steel bridge on old piers, 162-ft. span on tubes, 80-ft. approach, two 20-ft. I-beam spans and one 24ft. I-beam span, all to be steel, except floor.

Laurel Springs, N. J.—Bids will be received until Sept. 9 by the Bd. of Freeholders at Camden (Geo. W. Whyte, Chmn.), for constructing an iron truss bridge 64 ft. long over Laurel Lake at Laurel Springs. J. J. Albertson, Co. Engr.

Rahway, N. J.—Bids will be received until Sept. 4 by the Bd. of Chosen Freeholders at Elizabeth, for the construction of a reinforced concrete bridge at New Church St., Rahway, over Robinson Branch of the Rahway River.

Le Roy, N. Y.—The citizens are stated to have voted to construct a bridge over the Oatka River at Main St., at a cost of $20,000.

Long Island City, L. I., N. Y.—Bids will be received by J.W. Stevenson, the Comr. Bridges, until Sept. 5, for the construction of the steel and masonry approach, in the Boro. of Queens, of the Blackwell's Island Bridge over the East River, between the Boros. of Manhattan and Queens.

Cincinnati, O.—The following bids are reported opened Aug. 16 for reconstructing the Liberty St. Viaduct: Strobel Steel Constr. Co., Monadnock Blk., Chicago, Ill., $173,000, and T. J. Brackett, $175,000. Appropriation available, $139,000.

St. Clairsville, O.—It is stated that bids will be received until Sept. 2 by A. W. Beatty, Co. Aud., for constructing the substructures and superstructures of sundry bridges and culverts.

Eaton, O.—It is stated that bids will be received until Sept. 5 by C. W. Eidson, Co. Aud., for constructing the superstructures of sundry bridges.

Cleveland, O.—Bids will be received until Sept. 14 by the County Comrs. (Julius C. Dorn, Clk.). for constructing concrete steel bridge in Strongsville Township as per report 1639.

Chandler, Okla.—Bids will be received until Sept. 2 by the Bd. Co. Comrs., at the office of J. E. Rea, Co. Clk., for furnishing material and constructing 4 steel bridges in this county.

Towanda, Pa.—Bids will be received by the Bd. Co. Comrs. (E. D. Harkness, Chmn.) at Towanda, until Aug. 29, for constructing a 46-ft. plate girder bridge, with 24-ft. roadway across Sugar Creek, Troy Borough; also a bridge across Sugar Creek between Troy and West Burlington Townships. Bids on latter bridge to be on either a truss span 86 ft. center to center, 14-ft. roadway or a concrete arch bridge.

Pittsburg, Pa.—An ordinance is stated to have been passed authorizing the Mayor and Dir. Dept. Pub. Wks. to receive bids for repairing Center Ave. Bridge over Pennsylvania R. R. tracks; at a cost of $7,000.

It is stated that the Wabash R. R. Co. (A. O. Cunningham, Ch. Engr., St. Louis, Mo.), plans to construct a bridge over W. Carson St. in the West End for the Westside Belt R. R. Co.

Philadelphia, Pa.—See "Railroads."

Galveston, Tex.—See "Miscellaneous."

Winnipeg, Man.—It is stated that bids will be received by Magnus Peterson, Secy. Civic Bd. of Control, until Sept. 4, for construction of wooden Howe truss bridge, consisting of 10 spans of 80 ft. each and one draw span of 160 ft.

Canton, China.—Bids will be received by the Canton River Bridge Co., Ltd. (Lau Chin Ting, Chmn.) until Oct. 19 for the constructio nof a steel cantilever and girder bridge, 1,102 ft. in length, in the Front Reach, Canton, on site about 740 ft. to west of the Dutch-folly-Fort, as advertised in The Engineering Record.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

*Decatur, Ala.—The Southern Bitulithic Co., of Nashville, Tenn., has secured contract for 31,921 sq. yds. of bitulithic.

*Ensley, Ala.—This city has contracted with the Southern Bitulithic Co., of Nashville, Tenn., for 21,500 sq. yds. of bitulithic.

Idaho Springs, Colo.—It is stated that bids will be received until Sept. 3 by T. W. Jaycox, State Engr., Denver, for construction and repair of 1¼ miles of wagon road at Floyd Hill on road from Idaho Springs down South Fork of Clear Creek near line between the Counties of Jefferson and Clear Creek.

Denver, Colo.—See "Miscellaneous."

Ellington, Conn.—Bids will be received by the Bd. of Selectmen (J. H. Lynch, 1st Selectman), until Aug. 28, for constructing a section of gravel road.

New Britain, Conn.—Edw. Wiegand, Pres. Bd. of Pub. Wks., writes that it is proposed to lay about 3,500 sq. yds. bitulithic; probable cost of proposed paving $9,000. F. H. Oldershaw, Ciy Engr.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Sept. 3 for grading Albemarle St., as advertised in The Engineering Record.

*Columbus, Ga.—The contract for bitulithic with the Southern Bitulithic Co., of Nashville, Tenn., has been increased 1,250 sq. yds.

Springfied, Ill.—Bids will be received by the Local Bd. of Improv. at the City Hall on Aug. 26, at 3 p. m. for brick pavement 30 ft. wide in Walnut St., with a 4x24 in. sandstone curb, 6 in. concrete foundation and sand filler; estimated cost $34,206.

*Rockford, Ill.—The contract for macadamizing W. Lincoln Ave. is reported to have been awarded to John Fair, of Rockford, at $17,800.

Indianapolis, Ind.—Bids will be received until Aug. 28 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.) for paving with bitulithic a portion of 30th St., and with brick the first alley west of College Ave.; also constructing cement sidewalks on portions of 16th, 23d and 32d Sts.

*Indianapolis, Ind.—The Western Constr. Co., of Lafayette, Ind., has secured contract for 14,125 sq. yds. of bitulithic.

Decatur, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 6 for the construction of a macadamized road in Monroe Township known as the Bollinger Macadam Road No. 4; also a gravel road in Preble Township known as the Fred. Blomberg Road. C. D. Lawton, Co. Aud.

Bloomington, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 4 for the construction of pike roads Nos. 1, 2, 3 and 4, in Salt Lake Township; total aggregate length, 12,290 ft. Sam'l M. Kerr, Co. Aud.

Lebanon, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept 24 for constructing a gravel road known as the Ezra Good Road. B. F. Simmons, Co. Aud.

*Boonville, Ind.—The County Comrs. on Aug. 6 are stated to have awarded contracts for constructing 4 rock roads in Campbell Township to Pelzer & White for $24,256.

Greencastle, Ind.—It is stated that bids will be received until Aug 31 by C. C. Hurst, Co. Aud., for macadamizing 13,000 ft. road; also same date for macadamizing 15,633 ft. of road. V. E. McCammack, Chmn. Bd. Co. Comrs.

South Bend, Ind.—The Council has passed resolutions for brick pavements on Park Ave., Grand View and Ford St., about 3,000 sq. yds.; also for 104,000 sq. ft. of cement walk and 25,000 ft. concrete curb. A. J. Hammond, City Engr.

*G. C. Sageman, of South Bend, has secured the contract for brick pavement on Bway. for $11,426.

Valparaiso, Ind.—It is stated that bids will be received until Sept. 2 by Stephen P. Corboy, Co. Aud., for constructing a stone road.

Salem, Ind.—It is stated that bids will be received until Sept. 2 by the Co. Comrs. for constructing the old state road in Gibson Township.

Covington, Ind.—It is stated that bids will be received by the Co. Comrs. until Sept. 3, for constructing 4 stone pikes aggregating 9½ miles in length and two gravel roads, about 5 miles in length. W. B. La Baw, Veedersburg, Co. Surv.

Des Moines, Ia.—The following bids are reported recently received for 36,000 sq. yds. brick paving as follows: *a* W. 12th St. *b* Des Moines St., *c* W. Court Ave., *d* W. 2d St., *e* W. 5th St.: O. P. Herrick, *a* $2.09, *c* $2.03, *d* $1.585. *e* $2.09; Jas. Horrobin, *a* $2.15, *b* $2.145. *d* $1.63; J. W. Turner Improvement Co., *b* $2.17; Geo. M. King, *b* $2.25; J. W. Campbell *c* $1.49 (price given per sq. yd.).

*The Bd. Pub. Wks. is stated to have awarded the contract for paving 19,450 sq. yds. with vitrified paving brick on Forest Ave. to Jas. Horrabin at $1.97 per sq. yd. (bids opened Aug. 7).

It is stated that all bids opened by Bd. of Pub. Wks. Aug. 7 for paving 4,160 sq. yds. on 6th Ave., have been rejected. According to reports new bids will be received.

Bids will be received until Sept. 13 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for improving Library Ave., requiring about 1,084 sq. yds. asphalt pavement and about 562 lin. ft. curb.

*Hutchinson, Kan.—An additional contract for 5,543 sq. yds. of bitulithic has been awarded to the Kansas Bitulithic Co., of Kansas City, Mo.

Independence, Kan.—J. D. Kramer, City Clk., writes that it is proposed to pave about 23 blocks with brick. Nothing definite yet done. W. F. Keller, City Engr.

Greensburg, Ky.—L. W. Coakley, Treas. Green County Turnpike Co., writes that the contract was not let on Aug. 13 for constructing about 11 miles of pike. The matter has been postponed indefinitely.

Baltimore, Md.—Bids will be received until Aug. 28 by the Bd. Awards (J. Barry Mahool, Pres.) to grade, curb, gutter and pave with macadam a portion of Chelsea Terrace.

*The Bd. of Awards is stated to have awarded contracts for paving as follows: Lombard St. with brick, to Patrick Reddington, 325 St. Paul St., for $2,262, and Robert Ave. with brick to F. E. Schneider, at $10,957.

It is stated that the Bd. of Awards approved the specifications providing for the paving of a portion of Chelsea Terrace.

Stockton, Md.—Bids will be received until Sept. 3 by the Bd. Co. Comrs. at Snow Hill, for improving the public highways between Stockton and George's Island and between Stockton and Snow Hill, known as the George's Island and the Stockton-Snow Hill Roads, respectively. J. Edwd. White, Co. Treas.

Boston, Mass.—Bids will be received until Aug. 27 by the Massachusetts Highway Comn., Boston (W. E. McClintock, Chmn.) for constructing about 3,800 ft. of road in town of Barnstable and 4,500 ft. of road in town of Methuen and city of Haverhill.

*Lynn, Mass.—An additional contract for 3,938 sq. yds. of bitulithic has been awarded to Warren Bros. Co., of Boston.

Fall River, Mass.—Highway Improvement bonds amounting to $20,000 are reported sold.

*Detroit, Mich.—The Central Bitulithic Co., of Detroit, has received contract for 5,276 sq. yds. of bitulithic.

St. Paul, Minn.—Bids will be received by the Bd. Co. Comrs. until Sept. 16 for improving a portion of Larpenteur Ave. Edwd. G. Krahmer, Co. Aud.

Kansas City, Mo.—Bids will be received until Aug. 29 by the Bd. Pub. Wks. for furnishing material and constructing asphalt pavements on portions of 5 streets and constructing artificial stone sidewalks on portions of 8 streets.

Independence, Mo.—An additional contract for 1,600 sq. yds. of bitulithic has been awarded to the Kansas Bitulithic Co., of Kansas City, Mo.

Billings, Mont.—This city is preparing plans for two paving contracts, one to cost $103,000 and the other $20,000. Henry Gerharz, City Engr.

*Helena, Mont.—Adami Bros. are stated to have secured the contract (bids opened Aug. 5) for grading Le Grande Boule., at $3,285.

*Butte, Mont.—R. M. Bardsen secured contract on Aug. 11 for paving N. Main St., 2 blocks, with granite block, at $6.65 per sq. yd.

Alex. Leggat, City Engr., writes that bids will probably be called for about Mar. 1 for paving, to cost about $100,000.

Concord, N. H.—Bids will be received until Aug. 28 by A. W. Dean, State Engr., for grading and surfacing with gravel a portion of the Newmarket Rd. in the town of Durham, and the main road in the town of Middleton.

*Plainfield, N. J.—Andrew J. Gavett, City Surveyor, writes that C. M. Meeker, of Plainfield, has secured the contract for paving (bids opened Aug. 5), at the following bid, using Brady's Run brick for paving: W. Front and E. Front Sts. and Watching and Park Aves., $2.38 pr. sq. yd. and Somerset St. and E. 4th St. and Arlington Ave., $2.40 per sq. yd.; 1,035 lin. ft. new curb 60 cts.; 1,400 lin. ft. curb reset, 20 cts.; 300 lin. ft. drain tile, 20 cts.; 150 lin. ft. 18-in. surface drain, $1; 365 lin. ft. of 15-in., 80 cts.; 250 lin. ft. 12-in., 60 cts.; 2 manholes, ea., $45; 7 inlets, ea., $20; total, $39,441. Totals of other bids received: Eveline Bros., New Britain, Conn., $55,536; Russell Contr. Co., New York, N. Y. (3 bids using different kinds of brick), $44,337, $46,390 and $44,568; M. Noonan, Germantown, Pa., $44,352; Reeves Smith, New Britain, Conn., $44,515; John F. Kerwin & Co., New Brunswick, N. J., $43,889; Hassam Paving Co., Worcester, Mass. (4 bids), $40,261, $37,734; $43,209 and $38,366; T. J. McGovern, Trenton, $36,743.

Camden, N. J.—The City Council is reported to have passed an ordinance providing for the paving of a portion of Jefferson Ave.

*Newark, N. J.—A contract for 18,150 sq. yds. of bitulithic has been awarded to the Standard Bitulithic Co., of New York, N. Y.

Bridgeton, N. J.—Bids will be received until Sept. 11 by Geo. Reeves, Chmn. Pub. Road Com., Bd. Chosen Freeholders at Court House, Bridgeton, for improving a road in Landis Township, about 5¾ miles in length. Approximate quantities: 16,420 cu. yds. earth excav., 9,232 cu. yds. compact gravel; arch bridge at Burn Mill stream; 10 ft. additional to present bridge at Blackwater stream; box culvert 2½ ft. x 20 ft. at station No. 215. Walter M. Sharp, Co. Engr., Bridgeton.

Riverton, N. J.—Bids will be received until Aug. 28 by the Highway Com. (Edwd. H. Fancoast, Chmn.), for furnishing material and constructing about 30,000 sq. ft. cement paving and for grading, graveling or sodding about 8,000 sq. yds. sidewalk. Henry S. Haines, Boro. Engr., 306 Temple Bldg., Camden.

Elmira, N. Y.—Bids will be received until Sept. 4 by the Bd. Pub. Wks. for paving portions of Railroad Ave. with vitrified block and asphalt on a concrete foundation, in all about 2,200 sq. yds. paving and 2,090 lin. ft. curbing, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received until Sept. 4 by Bird S. Coler, Boro. Pres., for regulating, grading and paving with asphalt a portion of Roebling St., repaving with granite a portion of Plymouth St. and laying sidewalks on portions of President and 39th St. and Prospect Pl. Engineer's estimate: 18,620 sq. yds. asphalt pavt.; 3,700 sq. yds. granite blk. pavt., with tar gravel and joints; 102,105 sq. ft. cement sidewalk; 13,235 lin. ft. new curb, etc.

Buffalo, N. Y.—Separate bids will be received until Sept. 4 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for paving and repaving portions of 10 streets.

Jamestown, N. Y.—Bids will be received until Sept. 2 by the Bd. of Estimate and Review (F. A. Dorman, Chmn.), for furnishing material and constructing approximately 23,000 ft. of cement curb and gutter, 36 concrete catch basins and 10 manholes. C. G. Jones, City Engr.

*Syracuse, N. Y.—The Bd. of Contract and Supply on Aug. 13 is stated to have awarded the contract for paving Plum St. with Johnsonburg block to Fred J. Baker, for $15,228.

Cohoes, N. Y.—Bids will be received until Sept. 3 by the Common Council for paving and curbing with new or second-hand granite blocks, portions of Olmstead and Factory Sts.; also constructing a concrete sidewalk on the Cohoes Co.'s Canal at North Mohawk St., known as Black Bridge. Chas. H. Van Auken, City Engr.

*Ilion, N. Y.—The Bd. of Street Comrs. is stated to have awarded the contract for paving a portion of Main St. to John R. Baxter, of Utica, at $7,448.

*Hempstead, L. I., N. Y.—The Highway Comrs. of Hempstead are stated to have awarded to Andrews Bros., of Mineola, the contract for macadamizing Elmont Road, at a cost of $17,154.

* *Items marked thus give the names of parties awarded contracts.*

New York, N. Y.—Bids will be received by the Park Board (Moses Herrman, Pres.), New York City, until Aug. 2, for paving with sheet asphalt upon a concrete foundation the carriageway, for furnishing and setting where required new curbstones, and resetting elsewhere the existing curbstones, and for alterations to the drain age, all in 5th Ave., bet. 50th and 60th, and bet. 90th and the Plaza at 110th St.; for paving and repaving with rock asphalt mastic where directed, the walks of Central and other parks; repaving where directed the cement walks of small parks, all in Boro. Manhattan; also same time and place, furnishing and delivering two steam road rollers to the Dept. Parks, Boroughs of Brooklyn and Queens.

Bids will be received by Moses Herrman, Pres. Park Bd., until Aug. 20, for furnishing and delivering North River road gravel for drives in Central Park.

**New York, N. Y.*—The Sicilian Asphalt Paving Co. has secured contract for repairing the asphalt pavement between north side of W. 20th St. and a point about 150 ft. north of north side of Pier (new) 29, near the ft. of Vestry St., North River, at $1.55 and $1.88 per sq. yd. and the Uvalde Asphalt Paving Co., secured contract for repairing asphalt pave bet. Battery Pl. and a point about 140 ft. north of the north side of Pier (new) 29, near the ft. of Vestry St. North River, and asphalt pavement on East River, at $1.60 and $1.65 per sq. yd. (bids opened Aug. 14 by J. A. Bensel, Com. of Docks).

**Long Island City, L. I., N. Y.*—The contract for regulating and grading the Boulevard from Webster Ave. to Bway., Long Island City, is reported to have been awarded on Aug. 14 by Jos. Bermel, Pres. Queens Boro., to Grace Bros., for $56,849.

Rocky Mount, N. C.—See "Power Plants, Gas and Electricity."

**Asheville, N. C.*—A contract for 6,500 sq. yds. of bitulithic has been awarded the Atlantic Bitulithic Co., of Richmond, Va.

Euclid O.—Bids will be received until Sept. 16 by H. S. Dunlop, Village Clk., for furnishing material and paving a portion of Euclid Rd. with macadam.

**Cincinnati, O.*—The County Comrs. accepted the bid of H. Nagel, $34,002, for improvement of New Richmond Pike from California schoolhouse to Clermont County line, also the $11,549 bid of John Nichoson & Son for improvement of Muddy Creek Pike from Bridgetown Pike to Muddy Creek Road.

*The Bd. of Pub. Service is reported to have awarded the contract for repairing asphalt streets to the Barber Asphalt Paving Co., Traction Bldg., at $18,000.

St. Bernard, O.—Bids will be received until Sept. 3 by Geo. Schroeder, Village Clk., for constructing artificial stone sidewalks on portions of several streets.

Cleveland Heights, O.—It is stated that bids will be received until Sept. 10 by Wm. G. Phare, Village Clk., Lee Road, for establishing a grade, grading, draining and paving with macadam Lee Road.

Wauseon O.—It is stated that bids will be received until Aug. 30 by J. E. Merrill, Co. Aud., for grading and graveling sundry roads.

Cadiz O.—It is stated that bids will be received until Sept. 2 by John S. Lacey, Co. Aud., for macadamizing 4,400 ft. of road.

Struthers, O.—Bids will be received until Sept. 15 by L. S. Creed, Village Clk., for $5,000 bonds to be issued for the purpose of resurfacing and improving the streets.

Bergholz, O.—Bids will be received until Sept. 5 the Trus. of Springfield Township (W. A. Taylor, Clk. Bergholz), for the grading and macadamizing of about 5 miles of road in Springfield Township between Bergholz and East Springfield. R. H. Lee, Engr., Carrollton.

Columbus O.—The 77th General Assembly has appropriated $300,000 for state aid in road construction and maintenance; 53 counties will each receive an appropriation of $3,409. Sam'l Huston, of Columbus, State Highway Comr.

Cincinnati O.—It is stated that bids will be received by the Bd. of Pub. Service (M. J. Keefe, Clk.), until Aug. 29, for grading, paving, etc., portions of Beekman St. Estimated cost, $24,354; until Sept. 12, for grading, paving, etc., portions of Palm Ave., estimated cost, $6,316 and until Sept. 11, for grading, paving etc. portions of Kirby Ave. 9th, Clinton, Townsend and Tremont Sts., estimated costs, $40,546, $28,129, $27,376, $5,691 and $20,073 respectively. C. N. Dannehower, City Engr.

Cincinnati, O.—Bids will be received until Aug. 30 by the Bd. of Co. Comrs. (Fred. Dreihs, Clk.) for improving Camargo Pike, as per specification No. 609, and Reading Pike, as per specification No. 669.

**Toledo O.*—A contract for 7,000 sq. yds. of bitulithic has been awarded to H. P. Streicher & Co., of Toledo.

Sibert n O.—Separate bids will be received until Sept. 12 by A. A. Sprague, Village Clk., for furnishing material and constructing cement sidewalks on portions of 13 streets.

El Reno, Okla.—Bids will be received by L. G. Adams, City Clk., until Sept. 5 for constructing 38,913 sq. yds. vitr. brick pavement with asphalt filling to be laid on a 5 in. base of concrete; also 4,922 lin. ft. stone curbing.

**Washington Pa.*—The County Comrs. on Aug. 9 are stated to have awarded contracts for constructing roads as follows: Howley Constr. Co. of Pittsburg, the West Middletown extension from terminus of present improved highway extending westward toward Buffalo $30,000, also the Canonsburg Westland Road beginning at Canonsburg Borough line extending to the east borough line of Houston then from west borough line of Houston to Westland a distance of 2 miles for $27,000, the Dry Run Road beginning at the borough line of Monongahela and extending to Ginger Hill, a distance of 3 miles, to the Ft. Henry Constr. Co. of Wheeling, W. Va., $28,000.

Towanda Pa.—Bids will be received until Aug. 30 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 6,600 ft. of road, 16 ft. wide and 4,638 ft. 14 ft. wide in Troy Township; also 7,361 ft. 16, 18 and 22 ft. wide in Troy Boro; all in Bradford County.

Norristown, Pa.—Bids will be received until Aug. 29 for grading 16,600 cu. yds. in one piece and 24,600 cu. yds. in another, as advertised in The Engineering Record. Dr. U. G. Miller, Chmn. Highway Comn.; S. Cameron Corson, Boro. Engr.

Oakmont, Pa.—Bids will be received until Sept. 2 by the Boro. Council (address to the Boro. Clk.) for grading, curbing and paving Oakmont Ave. Approximate quantities: 10,000 cu. yds. grading, 7,100 lin. ft. curbing and 16,000 sq. yds. paving; also, same time and place, separate bids for grading portions of 9th, D, and 10th Sts. Further information may be had from Douglass & McKnight, Boro. Engrs., 1710 Union Bank Bldg., Pittsburg.

Scranton, Pa.—Bids will be received until Sept. 3 by C. R. Acker, Dir. Dept. Pub. Wks., for laying flagstone sidewalks on portions of several streets.

Pittsburg, Pa.—State Highway Comr. Jos. W. Hunter, at Harrisburg, is reported to be preparing to begin the construction of a new and modern highway extending from the county line of Allegheny County into Westmoreland County and terminating at Irwin. The proposed road will be about five miles long. It will begin at the west borough line of Irwin and follow the line of the present pike to a point west of Circleville. From there an entirely new road will be constructed in a southwesterly direction to connect with the Allegheny County road, near McKeesport. Estimated cost is $42,000. According to reports bids will soon be received.

An ordinance is stated to have been passed authorizing the Mayor and Dept. Pub. Wks. to receive bids for macadamizing Mansfield Ave. at a cost of about $7,000, also the paving of Gross St. at a cost of $13,000.

Providence, R. I.—Bids will be received by the State Bd. Pub. Roads (John H. Edwards, Chmn.), Providence, until Sept. 4, for constructing highways in the following towns, length given being approximate only: Glocester and Burrillville, 5,280 ft.; East Providence, 10,000 ft.; Lincoln, 3,000 ft.; Foster, 5,280 ft.; Coventry, 31,680 ft.; Tiverton, 2,640 ft.; Little Compton, 5,280 ft.; Jamestown, 5,280 ft.; Portsmouth, 3,000 ft.; Glocester, 10,560 ft.; Richmond, 5,280 ft.; Narragansett, 7,920 ft.; Warwick, 15,840 ft.

Ft. Moultrie, S. C.—Bids will be received until Sept. 14 by J. M. Fulton, Q. M., U. S. A., for constructing roads and walks at this post.

Yorkville, S. C.—It is stated that bids will be received until Sept. 1 by I. W. Johnson, Chmn. Street Com., for macadamizing sundry streets.

Rogersville, Tenn.—The Citizens of Hawkins County are reported to have voted to issue $200,000 bonds for constructing pikes throughout Hawkins County.

Johnson City, Tenn.—Bids will be received by E. E. Ellsworth, City Recorder, until Sept. 5 for paving portions of Main, Market and other streets, in all about 48,000 sq. yds., with vitr. brick, bitulithic asphalt, Hassam, or other good material; also 22,000 sq. ft. cement sidewalk, 4,600 lin. ft. concrete curb and 4,200 ft. 8-in. vitr. sewers with necessary Y's, manholes, etc., as advertised in The Engineering Record. L. N. Wilson, Jr., City Engr.

Olympia, Wash.—New bids will be received until Sept. 2 for paving Main St., about 8,000 sq. yds., with brick, asphalt or other approved material, ½ mile of concrete curb and gutter, also 2,000 lin. ft. of storm sewers, as advertised in The Engineering Record. J. R. Dever, City Clk.

Morgantown, W. Va.—See "Sewerage and Sewage Disposal."

**Milwaukee, Wis.*—The contract for paving with cedar blocks Fond du Lac and Lisbon Aves. is reported to have been awarded by the Bd. Pub. Wks., Aug. 13, to Otto Koenig, at $1.37¾ per sq. yd.

Neenah, Wis.—It is stated that bids will be received until Aug. 31 by the City Clk. for macadamizing Main St.

Janesville, Wis.—It is stated that bids will be received until Sept. 6 by the Street Assessment Com. for grading, curbing and paving with brick on a portion of E. Milwaukee Sts.

**Toronto, Ont.*—The Bd. of Control on Aug. 14 is stated to have awarded contracts for paving, as follows: Godson Contr. Co., Shanley St., at $2,678; Toronto St., $2,079; Czar St., $1,284. Warren Bituminous Paving Co., of Toronto, Oakland Ave., $2,595; Poplar Plains Rd., $9,303; Gwynne Ave., $7,176. C. H. Rust, Warren Rd., $6,660; Richmond St., $5,544; Court St., $2,067; Anderson St., $2,545.

The Warren Bituminous Paving Co., of Toronto, has a contract for 14,672 sq. yds. of bitulithic.

**St. Boniface, Man.*—This city has increased its yardage for bitulithic with Bitulithic & Contracting Co., Ltd., of Winnipeg by 1,800 sq. yds.

**Armherst, N. S.*—5,600 sq. yds. of bitulithic has been added to the contract previously awarded to the Warren Bituminous Paving Co., of Toronto, Ont.

**Regina, Sask.*—An additional contract for 1,000 sq. yds. of bitulithic has been awarded to Bitulithic & Contracting Co., Ltd., of Winnipeg, Man.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Beebe, Ark.—We are informed that there is some talk here of constructing water works and an electric light plant, but nothing definite has yet been done.

Decatur, Ala.—The Decatur Light, Power & Fuel Co., is reported to have decided to expend about $30,00 in improvements.

Seward, Alaska.—The Seward Light & Power Co. proposes installing a 100 h. p. engine. A. P. Dickinson, Sc. and Mgr.

Alameda Cal.—The City Council is reported to have recommended an issue of $50,000 bonds for improving the electric light plant.

Los Angeles, Cal.—The City Gas Co. (F. J. Sartori, Prest.), is reported to have petitioned for a franchise for a gas plant.

Willows, Cal.—The Bd. of Superv. is reported to have granted the Snow Mountain Power Co. an electric light franchise in Willows.

Wilmington, Del.—The Street and Sewer Dept. is reported to be considering the question of building a system of conduits for city wires, the space to be sub-let to companies using wires.

Washington, D. C.—Bids will be received at the Bureau Supplies and Accounts Navy Dept., Washington, D. C., Aug. 27, to furnish at the navy yards and naval stations a quantity of naval supplies, as follows: Portsmouth, N. H., Sch. 165—Band saws, planer and joiner. Sch. 209—Dump tubs. Sch. 211—Steam pipe, pipe fittings, angle and gate valves. Boston, Mass., Sch. 220—Tools, hose-gate valves, steel, etc. New York, N. Y., etc., as follows: Sch. 209—Wire lath, galvanized iron wire and bolts. Sch. 210—Steel. Sch. 212—Drilling machine. League Island, Pa., Sch. 210—Steel rails. Sch. 211—Iron pipe, pipe fittings, etc. Naval Academy, Annapolis, Md., Sch. 166—Pipe cutting and threading machine, turbo-generator. Washington, D. C., etc., Sch. 213—Motors. Sch. 214—Milling attachment, pneumatic drills and hammers, brass tubes, armor plates. Sch. 224—White pine. Norfolk, Va., Sch. 208—Electrical instruments, battery cells, electrical supplies, etc. Sch. 209—Tool grinders, condenser, drills, etc. Sch. 215—Electric spares. Sch. 218—Electric wire and cable, volt-meters. Sch. 220—Brass pipe, galvanized iron thimbles. Charleston, S. C., Sch. 164—Traveling crane. Sch. 165—Rotary shear, band saw machine. Sch. 215—Motor drive. Key West, Fla., Sch. 202—Portland cement, steel wire fabric, yellow pine. New Orleans, La., Sch. 204—Pressure blower, forges, oil pumping apparatus, tools. Sch. 205—White and yellow pine, cypress, rolled bronze, iron, steel. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l, U. S. N.

Millen, Ga.—It is stated that bids will be received about Sept. 12 by H. O. Bell, Mayor, for an electric light and water plant for this place. Probable cost, $30,000. J. B. McCrary & Co., Engrs., Atlanta.

Rathdrum, Idaho.—Rathdrum Electric Co. contemplates erecting new transmission lines and installing new trans formers. H. R. Saunders, Mgr.

Lewiston, Idaho.—The Lewiston Gas Co. is reported to have decided to install two new retorts, and extend the mains.

Huntingburg, Ind.—The Miessuer Bros. Co. will install a new 175-kw. generator and an engine of 250 h.-p. F. G. Katterbury, Mgr.

Churubusco, Ind.—A new alternator will be installed in the plant of the Churubusco Water & Light Co. this fall. Miss T. Kingdon, Owner and Mgr.

Lebonon, Ind.—The Citizens Electric Light & Ice Co. is said to be contemplating increasing capacity of plant, and will install a 175-kw. 3-phase, 60 cycle 2,200-volt generator and a 250 h.-p. Deisel engine. G. H. Wing, Mgr.

Martinsville, Ind.—The citizens are contemplating making improvements to the municipal electric lght plant, which include the installation of a new dynamo, engine and new lamps. B. E. Lewis, Mgr.

Weleetka, Ind. Ter.—The Weleetka Light & Water Co. is said to be planning extensive additions and improvements to its water works system to include 80 h.-p. pump, 80,000 gal. tank and 6,000 gal. reservor, and may install a 200-kw. dynamo. D. F. Campbell, Mgr.

Guthrie Center, Ia.—Plans are being made by the Guthrie Center Electric Light Co. to increase capacity of plant this fall. An engine, generator and two transformers will be installed.

Britt, Ia.—The Britt Light & Power Co. is said to be contemplating installing a street lighting circuit for incandescent lamps, and will erect a pole line for 50 lamps. L. M. Goodman, Mgr.

New London, Ia.—The citizens are contemplating extending the municipal electric lighting system to Danville to supply the village with electricity for lighting purposes. Gilbert Johnson, Mgr.

Burlington, Ia.—The Burlington Electric Light & Power Co. is said to be making arrangements to install a 60 h.-p. gas engine and alternator.

St. Ansgar, Ia.—The Wood Working Co. proposes changing its electric plant from steam to water power. C. H. Miller, Mgr.

Corroll, Ia.—Geo. H. Long, of Grand Rapids, Mich., is reported to have purchased electric light plant and will improve same.

**Sioux City, Ia.*—A. A. Smith, City Clerk, writes that the contract for lighting the streets by electricity (bids opened Aug. 6), has been awarded to the Sioux City Gas & Electric Co. of Sioux City, for 10 years at $75 per lamp for 2,000 c. p. arc, and $20 for 32 c. p. incandescent lamps.

Garnett, Kan.—The Garnett Electric Light Co. has in contemplation the establishing of a fan circuit. G. B. State, Mgr.

Iola, Kan.—Extensions and improvements are contemplated to the municipal electric lighting plant, to include installation of a 150 h.-p. tubular boiler, and a 100 kw. alternating-current, 2,200-volt 60-cycle generator. W. E. Rutledge, Supt.

Caney, Kan.—The Caney Electric Light & Power Co. is considering the question of installing a 150-kw. 1,100-volt generator. John Heckman, of Coffeyville, Mgr.

Princeton, Ky.—The Princeton Light & Power Co. is contemplating installing 47 additional street arc lamps. G. G. Flower, Mgr.

London, Ky.—Plans are reported as being made to install a new engine in the plant of the London Elecrtic Light & Power Co. W. F. Raymer, Mgr.

Mayfield, Ky.—The Mayfield Water & Light Co. is said to be contemplating an extension of 4 miles to its streets lighting service, and 6 miles of water mains.

Paris, Ky.—The Paris Eectric Light Co. is contemplating increasing the capacity of its plant, and establishing a day service. The company will install an engine and hoiler. L. S. Allen, Mgr.

Uniontown, Ky.—Tht Uniontown Light & Power Co. is planning to install an additional boiler in its plant. G. F. Cecil, Mgr.

Richmond, Ky.—The Richmond Electric & Power Co. proposes installing a 150 h.-p. hoiler. A. J. Forbes, Mgr.

Sturgis, Ky.—The West Kentucky Coal Co. contemplates adding new machinery to its electric power plant. W. A. Chandler, Mgr.

* *Items marked thus give the names of parties awarded contracts.*

Lake Charles, La.—The Lake Charles Ice, Light & Water Works Co. is contemplating installing a 100-kw. Westinghouse-Parsons turbo-generator set and a 300 h.-p. boiler in its plant in Sept. T. J. Bird, Mgr.

South Berwick, Me.—The Berwick & Salmon Falls Electric Light Co. is said to be contemplating about 20 miles of extension to its lines. E. E. Proctor, of Wakefield, Mass., Mgr.

Oakland, Md.—The Youghiogheny Light & Power Co., of Garrett County, is reported to have been incorporated at Oakland. It is proposed to locate a power plant below Deep Creek Falls, 7 miles north of Oaklank, at which point the wasted water power of the Swallow Falls in Yough River, the Deep Creek falls and the Muddy Creek falls nearby, wil be concentrated and utilized for the purpose of generating power. It is proposed to supply electric light to Oakland, Mauntain Lake, Deer Park, Grantsville, Accident, Friendsville and other towns in Garrett County, Kingwood and other towns in West Virginia and towns on the southern border of Pennsylvania. It is the purpose also to supply power for proposed trolley roads, one of which would run from Frostburg to Uniontown, over a section of the old National pike.

Baltimore, Md.—Bids will be received until Aug. 28 by the Bd. Awards (J. Barry Mahool, Pres.) for the electrical equipment for the illumination of Baltimore St. Robt. J. McCuen, Supt. Lamps and Lighting.

Boston, Mass.—Bids will be received until Aug. 30 by the Schoolhouse Comn. (R. Clipston Sturgis, Chmn.), 120 Boylston St., for installing electrical system in extension to Mechanic Arts High School, Scotia St. Wheelwright & Haven, Archts., 220 Devonshire St.; French & Hubbard, Engrs., Albany Bldg.

L'Anse, Mich.—C. D. Shea, Village Clk., writes that bids will be received until Sept. 3 for the construction of the proposed water power plant. Engineer, E. P. Burch, of Minneapolis, Minn.

Minneapolis, Minn.—The City Council has passed an ordinance providing that the city estimates for next year include an item of $500,000 for a lighting plant.

Hattiesburg, Miss.—The Union Electric Co., of Hattiesburg, has applied for a charter, with a capital of $5,000. A. N. Sexton and C. J. Sutherland, of Hattiesburg, are reported interested.

Helena, Mont.—S. T. Hauser, former Governor of Montana, is reported interested in the construction of a third dam across Missouri River for the development of electrical power, a portion of which will be utilized for a pumping plant, which will reclaim 35,000 acres of land in Prickly Pear Valley, below the city; probable cost of proposed work, $1,000,000.

Stevensville, Mont.—Geo. I. Walters, of Victor, is reported interested in the development of water power here and the installation of an electric light plant.

**University Place, Neb.*—R. E. Shelley, City Clk., writes that the contract for constructing an electric light plant (bids opened July 27) has been awarded to Bicker & Lowell, of University Place, for $3,890.

Tekamah, Neb.—The citizens are reported to have voted to issue bonds for the construction of an electric light plant.

Wood River, Neb.—D. D. O'Kane, Village Clk., writes that contract will probably be let in about 30 days for the construction of water works and an electric light plant.

Paulsboro, N. J.—Bids will be received by Chas. M. Gwilliam, Boro. Clk., until Aug. 29 for the installation of a gas plant, as advertised in The Engineering Record. Engineer Wm. H. Boardman, 426 Walnut St., Philadelphia, Pa.

Bids will be received until Aug. 29 by Chas. M. Gwilliam, Boro. Clk., for $35,000 gas bonds.

Secaucus, N. J.—Bids will be received until Aug. 29 by the Boule. Comrs. (John Sweeney, Clk.), 580 Newark Ave., Jersey City, for the work of dismantling, moving forward, resetting and repairing 4 boilers; installing separator, valves, and refitting steam pipes, etc., to same, at the Power House, Secaucus.

New York, N. Y.—Bids were opened on Aug. 15 by John H. O'Brien, Com. Water Supply, Gas & Electricity, for furnishing, maintaining and installing power, etc., at pumping stations as follows: The New York Edison Co., Elm and Duane Sts., bids Furman and Joralemon Sts., and Willoughby and St. Edwards St. stations, Brooklyn Boro., 1½ cts. per kw. hour and $3,660 per mo. for installing, maintaining, etc. of same, and at Oliver and South St. and Gansevoort and West Sts. stations Boro. of Manhattan, 2½ cts. per kw. hour and $6,500 per month for furnishing, installing, etc.

Brooklyn, N. Y.—Bids will be received until Sept. 4 at the Bureau Yards and Docks (R. C. Hollyday, Ch.), Navy Dept., Washington, D. C., for furnishing 15 motor-generator sets and accessories for the Navy Yard, Brooklyn, N. Y., as per specification No. 1560. Est. cost, $72,000.

Irondequoit, N. Y.—The Rochester Ry. & Light Co., of Rochester, is reported to have secured franchise to supply heat, light and power to the town of Irondequoit; estimated cost of this improvement is $20,000.

Albany, N. Y.—John R. Freeman, Providence, R. I., has been retained by the State Water Supply Commission to investigate the water power resources of the State and outline plans for developing some of the powers. New York, unlike most other States, owns the heds of most inland streams, and can undertake power developments without spending large sums to acquire ownership. It is proposed to organize several field parties immediately.

Little Valley, N. Y.—M. L. Ansell, Village Clerk, writes that bids will be received on Aug. 30, for improvements to the electric light plant, probable cost of work, $10,000. Engineer G. S. Boller, of Little Valley.

Blackwell's Island, N. Y.—The following are the bids opened on Aug. 15 by Robt. W. Hebberd, Com. of Pub. Charities, N. Y. City, for furnishing material and installing complete electric lighting and power system for all buildings and grounds under Dept. of Public Charities, and comprising City Hospital Dist. Blackwell's Island, Boro. of Manhattan: (*a*) Aggregate price for whole work, and embracing entire completion of work. (*b*) Aggregate price for whole work as modified by the Alternate installing underground conduit lines with service boxes, manholes, transformers vaults and the like complete: Ideal Electrical Constr. Co., 1133 B'way, *a* $68,920, *b* $120,700; Thompson Bonney Co., 45 York St., Bklyn. *a* $72,360, *b* $126,940; T. Blanchard, 142 5th Ave., *a* $69,440, *b* $122,345.

Rocky Mount, N. C.—Bids will be received until Sept. 1 by W. L. Thorp, Mayor, for $135,000 water, light and street improvement bonds.

Tryon, N. C.—G. Hamilton Holmes, of Tryon, Ch. Engr. Tryon Electric Light & Power Co., writes that plans for the proposed development have been changed and a larger plant is now proposed; probable cost $110,000.

Springfield, O.—The stockholders of the new north side lighting and heating company, are reported to have on Aug. 13 decided to incorporate with a capital of $50,000. The name of the company is not yet decided upon. The site for plant has been purchased and contract will soon be let for the erection and equipment. A. J. Eisenmayer, is acting chairman of company.

Arlington, O.—It is reported that bids are wanted until Aug. 27 for constructing an electric light plant. O. T. Castor, Village Clk.

Bucyrus, O.—It is reported that preliminary plans are being prepared for a municipal electric light plant.

Columbus, O.—Bids will be received until Sept. 17 by the Bd. of Trus. of the Columbus State Hospital (Geo. Stockton, M. D., Secy.), for furnishing and installing complete at the power house at the said hospital an engine, dynamo and switch board. Frank L. Packard, Archt., Columbus.

El Reno, Okla.—The Canadian Light, Heat & Power Co. is reported incorporated, with a capital of $100,000, by Henry Schafer, J. W. Many, and others.

Eugene, Ore.—Geo. M. Miller, of Eugene, writes that it is proposed to construct a power plant at Swisshome, to cost between $50,000 and $100,000. Joaquin Miller, of Diamond, Cal., is also reported interested.

Corvallis, Ore.—Wm. H. Adams, Secy. of the Oregon Gas Mfg. Co., Room 401 Tilford Bldg., Portland, writes that this company has secured a franchise for the construction of a gas plant and the installation of necessary pipe line system. It has option on present water pipe line system with about 7 miles of pipes. It is proposed to utilize these pipes and to add to same about 3 miles of pipe before winter. Tihs company also proposes supplying gas to the cities of Astoria, Salem, Baker City, Pendleton, La Grande, and other cities, and has also received a franchise in Albany, Ore., and will install about 10 miles of pipe. Within a year the company will have nearly 100 miles of pipes reaching the nearby towns.

Bend, Ore.—We are informed that the city has in contemplation the question of purchasing present electric plant, and installing a gravity water system. H. C. Ellis, City Recorder.

Panama.—See "Miscellaneous."

Elizabethtown, Pa.—The Boro. Council is reported to have granted an electric light franchise to the Elizabethtown & Marietta Electric Light Co.

Philadelphia, Pa.—The United Gas Improv. Co. is reported to have decidd to expend about $2,000,000 in improvements to include construction of holders in West Philadelphia, with a capacity of 3,000,000 cu. ft. and a 30-in. main from Point Breeze works to storage plant at 9th and Norris Sts.

Finleyville, Pa.—Charters are reported to have been granted to the Finleyville Electric Light Co. and the Courtney Electric Light Co., each with a capital of $5,000. The incoporators are the same in both companies as follows: Jacob V. Van Wagener, John F. Cockhurn and Clarence W. Scheck, all of Pittsburg.

Gary S. D.—Oscar Claussen, of St. Paul, Minn., is reported to be preparing plans for the proposed electric light plant. T. M. Anton, Town Clk.

Columbia, Tenn.—The City Council is reported to be considering the question of improving the electric light plant.

Park City, Tenn.—The City Council has adopted on final reading the ordinance and contract with Knoxville Ry. & Light Co., of Knoxville, providing for lighting Park City with 20 arc lamps.

**Knoxville, Tenn.*—Press reports state that W. J. Oliver, of Knoxville, will receive contract to construct the dam, canal tunnel and power house on Little Tennessee River for the Knoxville Power Co., for about $2,500,000.

Ashland, Wis.—The only bid recently received for the construction of the municipal electric light plant is stated to have been submitted by W. E. Ule, of Stevens Point, for about $130,000. It is stated that new bids will be called for.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—The Sacramento & Lake Tahoe Ry. Co. is reported to have filed several notices of location in Placer County for water rights, dam and reservoir sites, etc., on the middle fork of the American River, for the storage of water for the generation of electric power. The railway will cross the American River near Folsom, and use the old railroad grade at the Owen King place, running east of Loomis and continuing up through Long Valley.

Lakeport, Cal.—It is stated that the Sonoma & Lake County R. R., which has been granted an exclusive franchise by the Lakeport Bd. of Trustees, is about to build an electric railway from Lakeport to Cloverdale, which will pass through Adams Springs, Highland Springs, Saratoga and Bartlett. The company will commence the construction of the line as soon as arrangements are completed for a connection with San Francisco. The line will cover a distance of 27 miles, will handle passenger and freight traffic and will cater to tourist trade. The company is composed of nine Lake County and Ukiah capitalists, who hold the entire 10,00 shares. J. F. Fulton, Genl. Mgr.

St. Augustine, Fla.—It is stated that the St. Johns Light & Power Co. (J. F. Miller, Ch. Engr.) expects to build about 5 miles of track during the next three months. It is said that the company will also purchase considerable rolling stock.

Danville, Ill.—The Danville & Eastern Illinois Ry. Co. certified to an increase of capital from $5,000 to $500,000. This road is to be built from Danville to Terre Haute, Ind.

Chicago, Ill.—The Chicago & Interurban Ry. Co., with a capital of $100,000, is reported to have secured a license to incorporate. The road is to be constructed from Chicago south through Harvey, South Holland, Calumet, Thornton, Chicago Heights, Crete, to Joliet, Blue Island, Riverdale, Dalton, Hammond and other towns. Incorporators: J. W. McGill, John W. Humphrey, Claude E. Fitch, L. E. Eaton, J. M. Miller, H. D. Moreland and Fred F. Myers.

Evansville, Ind.—The Evansville & Mt. Vernon Traction Co. is stated to have decided to ballast the line between this city and Mt. Vernon with broken stone and make a number of improvements.

Muscatine, Ia.—It is stated that a survey is under way for a projected electric railway to Davenport. It is reported that R. A. Roberts, of St. Louis, Mo., is interested.

Parsons, Kan.—The City Council is stated to have granted C. L. Brinser a franchise for a street railway line which is to be part of an interurban system. There will be two lines, one extending north to Chanute and Pittsburg, and the other south to Altamount and Edna, and then on to Coffeyville.

Danville, Ky.—The Danville Light, Power & Traction Co. is reported to be considering the construction of an electric railway here and a line taking in Lancaster, Stanford, Hustonville, Junction City and Harodsburg.

Somerset, Ky.—The Somerset & Nashville R. R. Co. is reported incorporated, with a capital of $10,000, to build an electric railway from Somerset to Nashville.

**Boston, Mass.*—The Boston Transit Comn. has awarded the contract for constructing entrance and exit at Water and Devonshire Sts. (bids opneed Aug. 15) to Coughlan & Sheets Co., 104 Hanover St., for $2,686.

Kirkwood, Mo.—Extensive improvemnts are reported under way on the Hodiamont branch of the United Railways Co. system. The entire line from De Hodiamont to Kirkwood will be practically rebuilt.

Ithaca, N. Y.—The Common Council is stated to have granted a franchise to the Ithaca St. Ry. Co. (J. N. Bennett, Ch. Engr.) for a double track.

Asheville, N. C.—The towns of Waynesville and Canton will be connected by an electric railway, according to reports. It is stated that the Champion Fibre Co., of Canton, is interested in the project. The distance between the two places is about 10 miles.

Grand Forks, N. D.—The incorporation of the Northwestern Interurban Ry. Co. with a capital of $1,000,000, for the purpose of building electric railways in Grand Forks and Crookston, an interurban line connecting the two cities, and a line eastward from Crookston to connect with the Soo is reported under consideration by J. L. Lambrecht, Pres. Traction Securities Co., and Dr. Stewart, both of Minneapolis, Minn.

Mansfield, O.—The Massillon, Wooster & Mansfield Traction Co. is reported incorporated, with a capital of $10,000, by G. A. Bartholomew, W. C. Rhodes, J. H. Cousins and E. R. Lewis. The purpose of the company is to build and operate an electric railway between Mansfield and Massillon through Richland, Ashland, Wayne and Stark Counties.

Spring City, Pa.—It is stated that the Montgomery & Chester Electric Ry. Co., operating an electric line between Spring City and Phœnixville, has decided to erect a bridge over the Pickering Valley Railroad at Ironsides.

Pottsville, Pa.—A proposed route is stated to have been outlined for an electric railway from Pottsville to Glen Carbon, through Barry, Hegins and Hubley Townships, of Schuylkill County, and then through Dauphin County to Millersburg. The distance from Glen Carbon to Harisburg is 38½ miles, and the cost to build this road would be about $1,500,000. W. E. Harrington, Pres., of the Eastern Railways Co., is reported interested.

Tarentum, Pa.—A franchise is stated to have been granted the Tarentum, Saxonburg & Butler St. Ry. Co.

Dravosburg, Pa.—The Council of Dravosburg is reported to have passed an ordinance giving the Dravosburg St. Ry. Co. rights in the borough.

Waynesboro, Pa.—The Chambersburg, Greencastle & Waynesboro St. Ry. Co. and the Blue Mountain House Co. are reported to have under consideration the construction of an electric railway extension from Pen Mar to the Blue Mountain House and High Rock.

Scranton, Pa.—It is stated that the Northern Electric St. Ry. Co. will soon build a steel viaduct 500 ft. long, also 6 miles of rail and overhead construction.

Anderson, S. C.—The link in the electric railway operated by the Anderson Traction Co. necessary to join Belton, Greenville and Anderson will be built at once, it is stated. Geo. E. Coughlin, Gen. Mgr.

Memphis, Tenn.—The South Memphis Traction Co. is stated to have applied to the County Register for a charter to construct several new lines in South Memphis. According to oresent plans five lines will be built, two from Memphis to South Memphis. Another line is to be a cross line going from the river up Mallory Ave to Lauderdale, at which point a connection will be made with the line recently completed by the Memphis St. Ry. Co. James F. Hunter, W. E. Gage, W. G. Thomas and others are reported interested.

* *Items marked thus give the names of parties awarded contracts.*

Roanoke, Va.—The Roanoke St. Ry. & Elec. Co., it is said, will build an extensive line in the southwestern part of the city.

Kennewick, Wash.—The Priest Rapids Ry. Co. is stated to have filed papers of incorporation with the Secretary of State at Olympia, declaring its purpose to build an electric railway from Kennewick to Wenatchee. Capital, $1,000,000. W. R. Rust, Pres.; M. B. Haines, Vice-Pres. and Treas.; E. H. Guie, of Seattle, Secy. The principal office of the company will be at Seattle. The route of the new road is down the Columbia River Valley almost on a straight line from Wenatchee to Kennewick. The distance is more than 100 miles.

Madison, Wis.—Daniel B. Ely, of New York, N. Y., is reported to be interested in the proposed electric railway to connect Madison and Jamesville, Wis., 36 miles, running through Macfarland, Stoughton and Edgerton. The line will be of entirely new construction, and right of way, which is mostly all obtained, will be private. No contracts have been let as yet.

RAILROADS.

Notes Arranged Alphabetically by States.

East St. Louis, Ill.—A charter has been granted to the East St. Louis & Eastern Ry. Co., with principal office in East St. Louis, and a capital of $2,500, to construct a line from a point near Belleville to a point in the county of St. Clair, Ill. Incorporators: L. G. Haynes, T. W. Gregory, G. C. Pierce and others.

**Indianapolis, Ind.*—The Bd. of Pub. Wks. has awarded contract for track elevation at Massachusetts and Valley Aves. and Hazel St. to the American Constr. Co. for $11,650.

Catasauqua, Pa.—A charter has been granted to the Crane R. R. Co. to construct a line from Whitehall Township, Lehigh County, at a point on the Lehigh Valley R. R. to Catasauqua, 3 miles; capital $30,000. Leonard Pickett, Pres., Catasauqua.

Philadelphia, Pa.—The Board of City Surveyors has passed favorably upon plans for the abolition of grade crossing along the line of the Philadelphia and Trenton Branch of the Pennsylvania R. R. The plans include the steel and masonry construction work between Venango and Cambria Sts. The bridges along the route will be of steel and masonry.

Ft. Worth, Tex.—The Missouri, Kansas & Texas R. R. Co. (S. B. Fisher, Ch. Engr., St. Louis, Mo.), is reported to have adopted plans for extensive terminal improvements in Texas. In Ft. Worth and Dallas about $600,000 will be expended.

Superior, Wis.—The Soo R. R. Co. (Thos. Greene, Ch. Engr., Minneapolis, Minn.) is reported to have filed an amendment to its articles of incorporation in the State Secretary's office, declaring its intention to build a branch line from Brooten, Minn., to Superior; 15 miles of line will be in Wisconsin, all in Douglas County.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Selma, Ala.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., until Sept. 30 for the construction (including plumbing, gas piping heating apparatus, electric conduits and wiring) of the U. S. Post Office at Selma.

**Visalia, Cal.*—The Bd. of Superv., it is reported, has awarded W. D. Trewhitt of Hanford the contract to construct the additions to the court house, and to install an elevator and modern heating system at $40,000.

New London, Conn.—Bids will be received until Sept. 4 by Col. F. L. Denny, Quartermaster Marine Corps, Washington, D. C., for repairs and improvements to buildings belonging to the Marine Corps, Naval Station, New London. Jas. Sweeney, Archt., 80 State St., New London.

**Farnhurst, Del.*—C. E. Anderson, of Wilmington, it is stated, has been awarded the contract for the erection of a building for the insane at Farnhurst at $34,470 (bids received Aug. 17). Other bids received were A. S. Reed & Brother Co., $36,993; William D. Haddock, $35,825; J. A. Hirons, Dover, $34,980; Lynch & Bro., Philadelphia, $34,198.

Atlanta, Ga.—P. Thornton Marye, Equitable Bldg., it is stated, has recommended to the County Comrs. that a 6-story building costing about $881,303 be erected for the city hall and court house building.

Savannah, Ga.—The following are the bids recently opened at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for heating apparatus, for U. S. Custom House at Savannah: Newport News Htg. & Plumbing Co., Newport News, Va., $3,840; Robinson Bros., Pine Bluff, Ark., $4,452; and Atlanta Steam Htg. Co., Atlanta, $3,645.

Forsyth, Ga.—Bids will be received until Sept. 10 by the Bd. Comrs. and Revenues (J. S. Jossey, Chmn.) for heating the court house.

Great Lakes, North Chicago, Ill.—The following are the bids opened on Aug. 15 at the office of the Bureau of Navigation, Navy Dept., Washington, D. C., for buildings at the naval training station as follows: *(a)* storehouse, *(b)* bathhouse, *(c)* brig, *(d)* stable, *(e)* receiving bldgs., *(f)* galley and laundry; *(g)* 6 dormitories. Northern Constr. Co., Milwaukee, Wis., *a* $70,000, *b* $60,000, *c* $24,300, *d* $23,830, *e* $28,640, *f* $26,000, *g* $139,400, or all for $370,000; Noel Constr. Co., Baltimore, Md., *a* $72,428, *b* $61,062, *c* $25,227, *d* $23,821, *e* $45,706, *f* $24,611, *g* $114,055, or all for $392,000; McArthur Bros., Chicago, Ill., all for $97,475.

Chicago, Ill.—The city has had plans prepared for 2 new police stations with municipal court rooms. One will be erected at 40th Ave. and Fillmore St. It will be 3 stories, 60x120 ft. and cost $50,000, and the other a 3 story building, 57x167 ft., to be built at N. California and Shakespeare Aves., and cost $60,000. Plans for the buildings have been prepared by City Archt. Chas. F. Hermann, City Hall.

Edwardsville, Ill.—The plans of J. W. Kennedy, of East St. Louis, it is stated, have been accepted for the addition to the Madison County Hospital; cost, $13,[illegible]

Rockport, Ind.—It is stated that the court house is to be remodeled at a cost of $40,000. Frank J. Schlotter, Evansville, is the archt.

Ligonier, Ind.—It is reported that the Library Bd. (Mrs. Jacob Streets, Chmn.) will receive bids until Sept. 2 for erecting a library.

New Castle, Ind.—Bids will be received until Sept. 5 by the Bd. Trus., Indiana Village for Epileptics (Enoch G. Hogate, Secy.) for erecting 2 cottages. W. S. Kaufman & Son, Archts., Richmond.

Muscatine, Ia.—Bids will be received until Sept. 26 by the Bd. Co. Superv. (W. H. Fishburn, Chmn.) for furnishing material and erecting complete (excepting furnishing) a fireproof court house. Jos. E. Mills, Archt., 510 Washington Arcade, Detroit, Mich.; A. S. Lawrence, Co. Aud.

Des Moines, Ia.—The Iowa Sanitarium Co., in which Dr. Habernicht is interested, intends, according to reports, to erect a sanitarium on W. Grand Ave., to cost $50,000.

Mason City, Ia.—The following are the bids opened on Aug. 12 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of U. S. Post Office at Mason City: I. W. Miller, St. Paul, Minn., $73,237; Hennessy Constr. Co., St. Paul, Minn., $74,272; Gen'l Constr. Co., Milwaukee, Wis., $68,298; Northern Constr. Co., Milwaukee, Wis., $66,000; G. B. Strickler, Washington, D. C., $75,445; J. H. Weise, Omaha, Neb., $69,246, and Bartlett & Kling, Cedar Rapids, $75,635.

Liberal, Kan.—Bids will be received until Sept. 6 by the Bd. Co. Comrs., for erecting a court house. J. M. Smith, Archt., 405 S. Main St., Hutchinson.

**Baltimore, Md.*—The Newport News Htg. & Plumbing Co., of Newport News, Va., has secured the contract for plumbing work in U. S. Post Office at Baltimore (bids opened July 10) for $33,283.

*M. C. Davis, 140 W. Fayette St., is stated to have secured the contract to erect truckhouse No. 15 (bids received Aug. 7), at $19,000.

**Chelsea, Mass.*—The contract to erect a hospital at the Soldiers' Home at Chelsea, it is reported, has been awarded to Geo. Howard & Sons Co., of Brockton, at about $75,000.

**Owosso, Mich.*—Geo. Rickman's Sons Co., of Kalamazoo, has secured the contract for constructing U. S. Post Office at Owosso (bids opened July 31) for $46,050.

Alexandria, Minn.—The following are the bids opened on Aug. 19 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the U. S. Post Office at Alexandria: P. M. Hennessy, St. Paul, $28,000; Lauritzen Bros., Fergus Falls, $26,487; Northern Constr. Co., Milwaukee, Wis., $24,635, and Everson, Earle & Co., Alexandria, $27,000.

St. Joseph, Mo.—It is stated that plans have been submitted for addition to the Ensworth Medical Hospital to cost $25,000 and for an addition to the college to cost about $10,000.

Jefferson Barracks, Mo.—Bids will be received until Sept. 12 by O. W. Bell, Q. M., U. S. A., for furnishing and installing boilers in officers' quarters.

Lewiston, Mont.—The Co. Comrs. Aug. 8 adopted the plans for a concrete and brick court house to cost about $90,000.

Omaha, Neb.—Bids will be received until Aug. 31 by the Bd. Co. Comrs. at the office of D. M. Haverly, Co. Clk., for erecting a tuberculosis ward at the County Hospital. Thos. R. Kimball, Archt., McCague Bldg.

South River, N. J.—It is statel that the citizens have voted in favor of issuing $20,000 bonds to erect a town hall.

Binghamton, N. Y.—It is stated that bids will be received until Sept. 4 by the State Comn. in Lunacy at the Capitol, Albany (T. E. McGarr, Secy.), for the construction, heating, plumbing and electric wiring of dining-room and kitchen addition to chronic building at the Binghamton State Hospital, Binghamton.

Willard, N. Y.—It is stated that bids are wanted by the State Com. in Lunacy, Capital, Albany (T. E. McGarr, Secy.), until Sept. 4, for construction, heating, plumbing and electric wiring of tuberculosis pavilion at the Willard State Hospital, as advertised in The Engineering Record.

**Riverhead, L. I., N. Y.*—The contract for additions and alterations to the court house, it is stated, has been awarded to D. Stanley Corwin and Harry Adams, of Greenport, at $12,400.

Geneva, N. Y.—Bids will be received until Sept. 5 by L. P. Haviland, Chmn. Bldg. Comn., State Agricultural Experiment Station at Geneva for the construction, heating, plumbing, electric work and gas piping for 3 staff residences and 2 cottages for laborers at above station. G. L. Heins, State Archt., Albany.

Syracuse, N. Y.—Bids will be received until Aug. 27 by R. J. Shanahan, Compt., for $200,000 court house bonds.

New York, N. Y.—Bids will be received by Park Bd. (Moses Herrman, Pres.) until Aug. 29, for furnishing material, erecting and completing addition "F" to the Metropolitan Museum of Art, Central Park, w. side of 5th Ave., opposite 83d St., Boro. Manhattan. McKim, Mead & White, Archts., 160 5th Ave.

Brooklyn, N. Y.—Bids will be received by the Dept. Pub. Charities (Robb W. Hebberd, Comr.), New York City, until Sept. 4, for furnishing material, erecting and completing (with the exception of fitting up) a new pathological building at the Kings Co. Hospital, Boro. Brooklyn. Raymond F. Almirall, Archt., 51 Chambers St., Boro. Manhattan.

Salisbury, N. C.—E. H. Miller, Registrar of Deeds, writes that bids will probably be called for about Nov. 1 for the erection of a court house to cost between $50,000 and $75,000. Architects, Frank P. Milburn & Co., of Washington, D. C.

**Marshall, N. C.*—The Blue Ridge Constr. Co., of Asheville, N. C., it is reported, has the contract for erecting a $26,000 court house.

**Jamestown, N. D.*—Contracts for work in connection with additions to the cell house at the Penitentiary are stated to have been awarded as follows: Mill work, to Bardwell, Robinson & Co., Minneapolis, Minn., at $1,190; plumbing and heating to E. J. Harrington, of Fargo, at $11,940; roofing, to Fargo Cornice & Ornamental Co., of Fargo, at $2,122.

Lima, O.—The following are reported to be the bids opened Aug. 13 by the Memorial Com. for erecting the Memorial Bldg. for the County of Allen: John Sueltzer, Ft. Wayne, Ind., $95,535; Smith & Sherrick, Lima, $99,500; H. Ellenberger, Chicago, Ill., $102,080; J. O. Bullinger, Portland, Ind., $100,000; B. F. Zadeck, Chicago, Ill., $116,230; Superior Contr. Co., Toledo, $112,400; Noel Contr. Co., Dayton, $103,500; Val Heil, Lima, $105,038.

Youngstown, O.—Bids will be received until Sept. 16 by the Bd. Co. Comrs. (J. C. Hanni, Chmn.) for erecting an addition to the Children's Home. W. B. Jones Co. Aud.

Cleveland, O.—Albert E. Skeel, 1069 Rose Bldg., is preparing plans for a contagious disease hospital for the city, to cost about $60,000. Contract will be let in about 40 days.

It is stated that steps are to be taken at once to erect the Museum of Art in Wade Park according to plans prepared by Hubbell & Benes, Citizens' Bldg. Probable cost, $1,000,000.

Pendleton, Ore.—Thos. Fitzgerald, City Recorder, writes that the proposed city hall will cost about $35,000. Architect, T. F. Howard, of Pendleton.

Philadelphia, Pa.—Bids will be received at the office of Maj. C. A. F. Flagler, Corps Engrs., U. S. A., until Sept. 10 for erecting the superstructure, etc., of the light house at the harbor of Refuge, Light Station, Delaware Bay, Del., as advertised in The Engineering Record.

Pittsburg, Pa.—Local press reports state that bids for erecting the Soldiers and Sailors' Memorial Hall for Allegheny County will be asked by the Co. Comrs. in about a week. Total cost of building is to be about $1,250,000. Palmer & Hornbostel, of New York City, are the archts.

Ft. Sam Houston, Tex.—Bids will be received until Sept. 12 by L. J. Fleming, Const. Q. M., U. S. A., for the construction, plumbing and electric wiring, at this post, of a dead house.

Seattle, Wash.—It is stated that Max Umbrecht, Globe Blk., will prepare plans for the Washington Children's Home to be erected at Ravenna Heights. It will be 2 stories high and cost about $45,000.

La Crosse, Wis.—It is stated that plans are being prepared for an addition to the library to cost $20,000.

Milwaukee, Wis.—The members of the Light Horse Squadron Armory Assoc., it is reported, contemplate erecting a $40,000 armory.

**Two River, Wis.*—L. K. Pitz and Rudolph Groll, of Manitowoc, it is reported, have been awarded the contract for building the government Life Saving Station in this city, for about $15,000 (bids received July 20).

**Vancouver, B. C.*—It is reported that the contract to erect the court house (bids received July 31) has been awarded to Macdonald, Snyder & Wilson, of Vancouver, at $400,000.

Winnipeg, Man.—Press reports state that the Bd. of Control will receive bids for a building to house turbine for water works; probable cost, $20,000.

Kingston, Ont.—Bids will be received until Sept. 9 by the Dept. Pub. Wks. (Fred Gelinas, Secy.), Ottawa, for alterations, additions and repairs to Block C, Tete du Pont Barracks, Kingston. H. P. Smith, Archt., Kingston.

Sherbrooke, Que.—It is stated that bids are asked by Fred Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont., until Aug. 29 for the construction of a drill hall at Sherbrooke.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Anniston, Ala.—It is reported that the Southern Ry. Co. (J. A. Dodson, Supt. Constr., Atlanta, Ga.) has accepted plans for a $75,000 depot at this place.

**Montgomery, Ala.*—N. J. Bell, it is reported, has awarded to Wells Bros., of New York, N. Y., the contract to erect a 14-story store and office building at Lee and Montgomery Sts., to cost about $450,000.

Birmingham, Ala.—It is reported that the Union Land Co. intends erecting a hotel at 5th Ave. and 26th St. to cost $18,000.

San Mateo, Cal.—Lewis P. Hobart, it is reported has prepared plans for a hotel, "The Peninsula," to be erected here at a cost of about $250,000.

Sacramento, Cal.—The Sacramento Hotel Co. is reported orgnized with a capital of $150,000 to erect a hotel at Kane and Kay Sts.

San Francisco, Cal.—R. Sprague is reported to have applied for a permit to erect a 2-story brick building at 1st and Market Sts. at a cost of $58,000.

Berkeley, Cal.—W. L. Busk is reported interested in the erection of a theatre to cost about $125,000.

**Washington, D. C.*—A permit is stated to have been issued to the Washington Terminal Co. for a store house, coach house, oil house at Eckington Yards at T St., at an estimated cost of $154,700. M. Long, Archt.; Edward Brady & Sons, Builders.

Cordele, Ga.—Dave Browder is said to be having plans and specifications prepared for a 4-story pressed brick, marble and stone $50,000 hotel, to be erected on Wall and 7th Sts.

Lewiston, Idaho.—It is reported that the plans for the new depot to be erected jointly by the Northern Pacific and the O. R. & N. Railroads at a cost of about $100,000, are being completed and the construction work will be

* *Items marked thus give the names of parties awarded contracts.*

started within 60 days. W. L. Darling, of St. Paul, Minn., Ch. Engr. Northern Pacific R. R.

Chicago, Ill.—The Republic Metalware Co., it is stated, will construct a warehouse at 1532 to 1536 Wabash Ave., 65x175 ft., of brick and stone, and cost $250,000. The foundations were put in about a year ago, but nothing further was done at that time.
Jos. A. Patten is reported to have purchased a site at Michigan Boule. and Harmon Pl., foo the erection of a 10-story fireproof steel building at a cost of $450,000.
The Western Newspaper Union is negotiating for a new building on Plymouth Court. The building will be 10 stories and cost $300,000.
The International Harvester Co. will erect a 5-story 180 x 258 ft. warehouse at 26th and Leavitt Sts. at a cost of $300,000, according to reports.
It is stated that T. Nundenson will build a theater on Halsted t., near Polk St., plans for which are being prepared by Francis M. Barton. The building will be 4 stories, 120 x 148 ft., of granite, pressed brick, and heavy ornamental iron.
It is reported that plans are being prepared for a theater to be erected at Halsted and Sixty-second Sts. for the Englewood Stock Co. It will be 5 stories, 84 x 125 ft. of pressed brick and stone, the interior being of fireproof construction.
Troat & Abluscher, 277 Dearborn St., is stated to have let the general contract for the construction of a factory building at Washington and Desplaines St., for the Browne-Sharpe Co., 16 S. Clinton St., to Wm. Adams, 145 La Salle St. Building will be 8 stories high, 79 x 90 feet, and cost $175,000.
H. R. Wilson, 218 La Salle St., it is stated, has completed plans for a building which Jacob L. Kesner proposes erecting for Daube, Cohn & Co., at 369 5th Ave., at a cost of $150,000.
It is reported that plans are being prepared for a 7-story reinforced concrete building, 100x100 ft., to be erected by the Home Herald Co., at La Salle Ave. and Ohio St. at a cost of $100,000.
The E. J. Lehmann estate will construct 2 additional stories to the mercantile building at 200 to 206 Randolph St. to cost $50,000.
The Pittsburg, Ft. Wayne & Chicago Ry. will build an engine-house and annex at 55th St. It will be 161 x288 ft., one-story high, and cost $100,000. D. H. Burnham & Co., 9 Jackson Boule. are the archts.
Moeller Bros., clothing merchants, will construct a 4-story, 50x115 ft., addition to their building at 600 N. Paulina St.; cost $35,000.

Lafayette, Ind.—The directors of the American Natl. Bank (Wm. S. Baugh, Pres.), it is stated, contemplate erecting on the site of the present building a 6-story office building.

**Vincennes, Ind.*—The Modern Constr. Co., of Terre Haute, it is reported, has secured the contract to rebuild the plant of the Old Vincennes Distilling Co. at a cost of about $25,000.

Des Moines, Ia.—It is reported that a site has been accepted on which it is proposed erecting the coliseum at a cost of $60,000; D. B. Fleming is a member of the sub-committee having the matter in charge.

Wichita, Kan.—It is reported that the Atchison, Topeka & Santa Fe R. R. (C. A. Morse, Ch. Engr., Topeka), intend making improvements to the depot here at a cost of about $20,000.

**Baltimore, Md.*—The contract for erection of 4-story office building at Light and Barre Sts. for the Baltimore Steam Packet Co. is reported to have been awarded to John Hiltz & Sons Co., 3 Clay St., for $25,000.
*A permit is stated to have been issued to the Maryland Storage Co. to build a 6-story concrete warehouse at York and Johnson Sts., as planned by William H. Emory. The structure will be 93x195 and will be erected by th Hopkins-Barnett Co. at a cost of $140,000.

Riverside, Mich.—Jos. Mills, Washington Arcade, Detroit, is reported to have secured a permit for the erection of a 3-story brick temple for Riverside Lodge, I. O. O. F., at Hubbard Ave. and Baker St. ,at a cost of $50,000.

Minneopolis, Minn.—Long & Long, archts., 830 Hennepin Ave., have plans for a building to be erected on First Ave. N., and 4th St. It will be 28x157 ft., 5 stories and basement, pressed brick front, galvanized iron work, mill construction interior, with freight elevator, plumbing, electric wiring and gasfitting, steam heating. J. R. Roddy, Harrisburg, Pa., owner; cost, $30,000.

Kansas City, Mo.—Howe, Holt & Cutler, Bayard Bldg., are preparing plans for brick store building to be erected on 10th and McGee Sts. for W. E. Minor, to cost about $40,000.

Carterville, Mo.—It is reported that plans are being prepared for a 2-story brick building to be erected for the Miners Bank at a cost of $10,000.

**O'Neil, Neb.*—B. E. Short, of Sioux City, Ia., it is stated, has secured the contract to erect for the Knights of Columbus a 2-story brick building costing about $15,000.

Atlantic City, N. J.—The John D. Allen Co., Betz Bldg., Philadelphia, Pa., it is stated, is completing plans and will invite estimates about September 1 for a $500,000 hippodrome and theatre building, to be erected at Mississippi Ave. and the Boardwalk, Atlantic City, for Nixon & Zimmerman. The structure will be 6 stories high, 80x200 ft., of reinforced concrete construction, with exterior walls of brick and stone. Foundations for the theatre were built a year ago.

Brooklyn, N. Y.—Plans have been filed for a 5-story brick tenement and stores, to be erected at Meserole St. and Union Ave., at a cost of $80,000, by Jung & Gardner, 988 Bway.; architects, Shampan & Shampan, 772 Bway.; and for a 4-story brick factory, 140x139 ft., slate roof, to be erected at Hamilton Ave. and Smith St., cost $100,000. F. W. Devoe and C. T. Reynolds, 101 Fulton St., owners; Ernst Green, 5 Beekman St., N. Y. City, Archt.

**Sherman, N. Y.*—The Durolithic Co., 16 Builders' Exchange, Buffalo, has secured the contract for erecting a building for the Mohawk Condensed Milk Co at Sherman. Architect, Jas. R. Tyler, of Rochester. The building to be 40x202 ft., 4 stories high. The first floor reinforced concrete, balance mill construction; exterior walls of sand lime brick, chimney 127 ft. high, boilers 450 h.p., elevators, sprinkler system, steam heat, composition roof, ventilators and skylights.

Long Island City, L. I., N. Y.—Plans have been filed for a 2-story shop and building to be erected at Winthrop Ave. and Barclay St. at a cost of $75,000 for Astoria Light, Heat & Power Co., 4 Irving Pl., N. Y. City.

Maspeth, L. I., N. Y.—The members of the Second Ward Democratic Club of the Boro. of Queens, it is reported, contemplate erecting a club house costing about $25,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 8-story brick and stone warehouse at 95 Vandam St., for Louise A. Davids, at a cost of $60,000; Renwick, Aspinwall & Tucker, Archts. Twelve-story brick and stone office building at 507 5th Ave., for estate of John R. Ford, at a cost of $200,000; Buchman & Fox, Archts. Two-story brick, iron and concrete garage at 206 W. 101st St. for Unexcelled Garage Co., cost $25,000; Koehler & Farnsworth, Archts. Seven-story brick and stone theatre at Central Park W. and 62d St. for New Theatre Co., cost $1,700,000; Carrere & Hastings, Archts. Three-story brick and stone stable at 712 11th Ave. for Geo. J. Schuster, cost $20,000; John H. Knubel, Archt. Two-story brick and stone office building at Manhattan St. and Bway. for Charter Constr. Co., cost $65,000; Schwartz & Gross, Archts.; 6-story brick factory at 136th St. and Willow Ave., for International Mfg. Co., cost $130,000; Lewis R. Kaufman, Archt. Four-story stone extension to 5-story brick and stone store and loft at 49 W. 45th St. for Jos. Keen, cost $25,000; Alfred E. Barlow, Archt. Alterations to 3-story brick and stone engine house at 417 E. 55th St. for Peter Doelger, cost $20,000; Mortensen & Co., Archts.; 7-story brick and stone apartment at Riverside Drive and 94th St. for Jos. Freedman, cost $125,000; Henry C. Pelton, Archt.
Plans have been filed by McKim, Mead & White, archts., 160 5th Ave., with Buildings Superintendent Murphy for a 22-story office building, to be erected on the north side of Exchange Pl., from Bway. to New St. The facade will be of marble and terra cotta. There will be 8 elevators. The Downtown Bldg. Co., 66 Bway., (Harris A. Dunn, Pres.), is the owner. The cost is estimated at $1,700,000.

Center Moriches, L. I., N. Y.—The Hotel Brooklyn is reported destroyed by fire Geo. F. Hallock, proprietor.

Goldsboro, N. C.—Bids will be received until Aug. 28 by E. B. Pleasants, Ch. Engr., Atlantic Coast Line R. R. Co., Wilmington, for erecting the Union Station at Goldsboro.

Youngstown, O.—Owsley & Boucherle, Wick Bank Bldg., it is stated have about completed plans for the Scott & Jones Blk., to be erected of pressed brick, semi-fireproof, and cost about $40,000.

Mansfield O.—Bids will be received until Aug. 31 by W. S. Cappeller, for erecting a theatre building 63x 105 ft. with store room adjoining, on Walnut St., near 4th St.

**West Chester, Pa.*—Thomas M. Seeds, Jr., of Philadelphia, is reported to have been awarded the contract to build a 2-story stable and coachman's house near West Chester for P. M. Sharpless. C. B. Keen is the archt. The cost will be about $35,000.

Philadelphia, Pa.—F. Russell Stuckert has awarded to Wm. Steele & Sons Co., 1600 Arch St., contract for erecting a $150,000 fireproof building for the Horn & Hardart Baking Co., at 202-210 S. 10th St. The building will be 2 stories and basement high, 188x109 ft., of reinforced concrete and brick construction. The structure will be occupied by a large restaurant, baking rooms and kitchen, and there will also be offices on the upper floors. There will also be a large roof garden.

Pittsburg, Pa.—Permits have been issued for the following buildings: To the Jones & Laughlin Steel Co., to erect an 8-story brick and steel office building, on Ross St. and Third Ave., Second Ward, to cost $375,000; to Leonard Schlather, to erect a 7-story brick warehouse on Liberty Ave. and 12th St., Ninth Ward, cost, $36,-800; and to E. M. Meyer, to erect a 7-story brick warehouse, at Liberty Ave., near 12th St., Ninth ward, cost, $36,000.

**Woonsocket, R. I.*—It is reported that the Rhode Island Co. has awarded the contract to erect a brick car barn and repair shop on Social St. to E. K. Watson & Co., of Warren. The building complete is to cost about $125,000.

**Aberdeen, S. D.*—Casper Lepper is reported to have secured the contract to erect a 3-story building for the Aberdeen Wholesale Grocery Co. to cost about $25,000.

Aberdeen, S. D.—Wm. Parsons & Son, of Duluth, Minn., are said to be the archts. for a 4-story hotel which it is proposed erecting here.

Jellico, Tenn.—The officials of the Louisville & Nashville R. R. and the Southern Ry. are reported to have submitted plans for a union station which they propose erecting at a cost of about $60,000. W. H. Courtenay, Ch. Engr., Louisville & Nashville R. R., Louisville, Ky.

Orange, Tex.—It is stated that the Southern Pacific R. R. Co. (W. Hood, Ch. Engr., San Francisco, Cal.), intends erecting a brick passenger station here.

Bellows Falls, Vt.—The Island House is reported destroyed by fire. Bellows Falls Machine Co., proprietors.

Seattle, Wash.—Edw. Arthur Miller, New York, Blk., it is stated, has completed plans for a 2-story fireproof garage to be erected on Bway. for Melville Hart at a cost of $25,000.

Tacoma, Wash.—Plans are being prepared, according to reports, for a 6-story store and office building to be erected at 21st St. and Pacific Ave. by the F. S. Harmon Co. at a cost of about $75,000.

Clarksburg, W. Va.—The Clarksburg Masonic Bldg. Co. is reported incorporated with a capital of $50,000 for the purpose of erecting a building for the Masons.

Milwaukee, Wis.—Plans are reported prepaed for a 5-story addition which Randolph Bros. propose erecting to the Terminal Hotel at a cost of about $50,000.

Ottawa, Ont.—The Cabinet, it is stated, has approved the plans for the station and office building which the Grand Trunk Ry. (Jos. Hobson, Ch. Engr., Montreal, Que.), intends erecting in Ottawa.

Toronto, Ont.—Whole and separate bids will be received by J. P. Hynes, Archt., Bank of Commerce Bldg., 199 Yonge St., until Aug. 31st, for the erection of buildings for the McDonald Horse Exchange, Western Cattle Market, Toronto.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Eufaula, Ala.—The First Baptist Church which was recently destroyed by fire, it is reported, is to be rebuilt at a probable cost of $15,000.

**Fayetteville, Ark.*—W. A. May & Co., of Ft. Smith, Ark., it is stated, have the contract for the erection of an edifice for the First Baptist Church at Fayetteville, costing $35,000.

San Francisco, Cal.—Achille Paladini is reported to have applied for a permit to erect a 3-story brick building at Clay and Montgomery Sts., at a cost of $30,000.

Denver, Colo.—A. S. Miller has been granted a permit to erect a 3-story brick apartment house on Pennsylvania St., to cost $40,000.

Wilmington, Del.—E. L. Rice, Jr., 815 Market St., is reported to have prepared plans for an apartment house to be erected at 1005 Delaware Ave. for Matthew D. Murphy, at a cost of $50,000.

Pensacola, Fla.—It is stated that the members of the First Methodist Church have accepted plans prepared by Badgley & Nicholas, of Cleveland, O., for a $100,000 edifice. J. B. Cummings, Chmn. Bldg. Com.

Chicago, Ill.—A Polish Catholic Church that will cost $250,000 is to be erected at 51st and Throop Sts. Plans for the structure have been drawn by Wm. J. Brinkmann, 163 Randolph St., under the supervision of the Rev. J. G. Jendrijejck, the pastor. The building will be 2 stories.
All Saints' R. C. Church will huid a two-story church and school building at 10808 Wabash Ave., constructed of pressed brick anl stone and cost $50,000.
John Dubach will build a 3-story apartment house at 1013 56th St.; cost $40,000.

Swayzee, Ind.—It is reported that plans are being prepared and bids will soon be asked by the Bd. Trus. of the Christian Church for the erection of a new edifice on the site of the one recently destroyed by fire.

Owensville, Ind.—It is reported that bids will be received until Sept. 15 by the Bd. Trus., M. E. Church, for erecting an edifice; probable cost, $10,000.

New Albany, Ind.—The Trus. of St. Mary's Parish in Lafayette Township, according to reports, will soon ask bids for erecting an edifice to cost $25,000.

Hopkinsville, Ky.—The members of the Church of Christ, according to reports, will expend $20,000 improving the church. G. L. Lockhart, Nashville, Tenn., archt.

Baltimore, Md.—The members of the 4th Baptist Church, it is reported, propose erecting an addition to the edifice to cost $25,000. Rev. Dr. Joshua E. Wills, pastor.

Park Rapids, Minn.—It is stated that bids will be received until September 13 by Rev. P. O'Meara, pastor St. Peter's Church, for erecting a brick edifice. A. J. Blix, Archt., St. Cloud, Minn.

Carondolet (P. O. St. Louis), Mo.—It is stated that the Christian City Mission Society has accepted the plans of J. H. Lynch, 715 Locust St., St. Louis, for its new $25,000 church, to be erected at Dover Pl. and Alabama Ave., in Carondelet.

Falls City, Neb.—It is reported that Rev. H. Rex is arranging for the erection of an edifice for the members of the Roman Catholic Church to cost $25,000.

South Omaha, Neb.—The members of St. Francis R. C. Church, at 32d and H Sts., it is stated, propose erecting a new edifice to cost about $90,000.

Syracuse, N. Y.—The plans of M. D. Makepeace, Everson Bldg., Syracuse, for the brick edifice to be erected for the West Solvay M. E. Church have been approved. Probable cost $15,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone tenement at Willett and Delancey Sts., for Kotzen Realty Co., cost $45,000, Bernstein & Bernstein, Archts.; 2 six-story brick and stone tenements at Amsterdam Ave. and 156th St., for Abraham Silverson, cost $130,000, Geo. T. Pelham, Archt.; 22 three-story brick dwellings at Faile and Aldus Sts. for American Real Estate Co., cost $220,000, H. H. Morrison, Archt.; 5-story brick tenement at 194th St. and Bainbridge Ave. for Chas. V. Halley, cost $25,000, Clement B. Brun, Archt.

Cincinnati, O.—The Trus. of the First Church of Christ (Scientist), it is reported, have arranged for plans to be prepared for an edifice to be erected on Park Ave., Walnut Hills, at a cost of about $100,000.

Pittsburg, Pa.—A permit has been issuel for the 3-story brick Convent of Mercy to be erected at 5th Ave. and Terrace St. at a cost of $250,000.

Philadelphia, Pa.—Alexander Chambley is reported to have been granted a permit to build a 3-story church at Broad St. and Moyamensing Ave. for the congregation of the James Evans Memorial Presbyterian Church. The building will be 70x100 ft., and will be of brick and stone; cost, $35,000. Chas. E. Oelschlager, archt.
A. Whitehead, 1940 De Lancey St., it is stated, has been granted a permit to erect a 3-story stone residence on School Lane for W. J. Turner to cost $28,000.
J. E. Mooney, it is reported, has prepared plans for a flat house to be erected at 46th and Walnut Sts. for Berwind & Hoopes. The cost will be about $200,000. It will be 6 stories, 100 ft. square.

**San Angelo, Tex.*—W. A. Griffin, of San Angelo, is reported to have the contract to erect for the Presbyterian Society a $25,000 parsonage.

Milwaukee, Wis.—Plans for a $60,000 residence to be erected on Terrace Ave. and Lafayette Pl. for Emil Ott, vice-pres. and manager of the William Steinmeyer Co., have been filed by Archts. Ferry and Clas, 419 Bway.

* *Items marked thus give the names of parties awarded contracts.*

SCHOOLS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The School Bd. according to reports, has directed plans to be prepared for schools to cost $250,000.

New Haven, Conn.—It is reported that Brown & Von Beren, Exchange Bldg., have completed plans for 2 schools to cost about $25,000.

Greencastle, Ind.—C. W. Coffin, Secy. De Pauw Univ., writes that O. D. Boblen, Majestic Bldg., Indianapolis, is preparing plans for the library, to cost about $50,000. Edwin H. Hughes, Pres. of Univ.

**Veedersburg, Ind.*—The contract to erect a school, it is reported, has been awarded to W. C. Pollard at about $13,000.

Sioux City, Ia.—Bids will be received until Sept. 2 by the School House Com. Bd. Educ. (Frank E. Scott, Chmn.) at the office of T. C. Prescott, United Bank Bldg., for the necessary carpenter and mason work required for installing a ventilating, heating and plumbing system in the Worcester School, Dace and Wall Sts. Also separate bids for installing a ventilating and heating system and such changes in plumbing as are shown for said building necessary to complete the above system in a satisfactory manner.

Lawrence, Kan.—Bids will be received until Sept. 17 by the Regents of the Univ. of Kansas for erecting an engineering building on the campus of the Univ. at Lawrence and also for furnishing material and installing a system of heating, plumbing and electric wiring in said engineering building.

New Orleans, La.—The Bd. of Administrators of the Tulane Educational Fund, it is stated, has authorized the Bldg. Com. to have plans prepared by Andry & Bendernagel, 211 Camp St., for the Richardson Memorial Bldg. to be erected on the campus at a cost of $150,000; Andry & Bendernagel have prepared plans for an addition to the Chemical Bldg. which is to cost $50,000. A dormitory is to be erected for the medical students, plans to be prepared by Du Buy, Churchill & Labouisse.

Fall River, Mass.—The following are reported to be the bids received Aug. 14 for erecting a school on Maple St.: Fall River Quarry and Constr. Co., $82,282; Mitchell Nicholson, $80,599; Beattie & Wilcox, $77,777; Patk. Corfigan, $69,753; Wm. A. Borden, $78,000; John Crowe, $88,658; J. A. Donnelly, $73,769; Jas. B. Taylor, $75,770.

**Springfield, Mass.*—The Secretary City Property Com. writes that the contract for erecting an addition to Howard St. school (bids opened Aug. 15), has been awarded to Daniel C. Shea, of Springfield; cost reported to be about $16,000.

St. Clair Heights, Mich.—The citizens have decided to issue $25,000 bonds to erect a 4-room addition to the school.

Stambaugh, Mich.—Bids will be received until Aug. 27 by the School Bd. (Erick Erickson, Clk.), for furnishing material and erecting a school. T. Gaastra, Archt., Kenosha, Wis.

Battle Creek, Mich.—It is reported that bids will soon be asked for erecting a high school to cost $150,000.

Moorhead, Minn.—It is stated that plans are being considered for a State normal school to be erected here at a cost of about $50,000.

Mankato, Minn.—The plans for the new detached building for the use of the training department of the State normal school, it is stated, have been approved and referred to the State Bd. of Control at St. Paul, and bids for the construction will probably soon be asked.

**Crookston, Minn.*—Contracts for erecting the dormitory of the branch agricultural school at Crookston, it is reported, have been let by the State Board of Control as follows: Construction, to Larson & Larson, of Crookston, for $34,541; plumbing and heating plant to the Crookston Plumbing & Heating Co. at $5,557.

Sims, Minn.—It is stated that bids will be received until Aug. 30 by I. O. Lundberg, Pres. School Bd., for erecting a brick school. Wm. Elliot & Son, Archts., St. Paul.

Moss Point, Miss.—Bids will be received until Sept. 3 by C. M. Fairley, City Clk., for $10,000 school bonds.

Somerville, N. J.—The citizens have voted to issue $16,000 bonds to erect a 4-room school.

West New York, N. J.—Press reports state that bids will be received until Sept. 9 for $105,000 school bonds.

Haddon Heights, N. J.—The erection of a high school to cost $17,000 is reported contemplated.

Olean, N. Y.—It is reported that bids will be received until Aug. 30 by the Bd. Educ. (M. M. Holoe, Clk.), Olean, for erecting a school at East Olean; probable cost $35,000.

**Rosebank, S. I., N. Y.*—The following are the bids opened on Aug. 12 by C. B. J. Synder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus in School 13, Rosebank, Boro. of Richmond: R. J. Sovereign Co., Inc., N. Y. City, $37,279; Blake & Williams, N. Y. City, $36,600; Frank Dobson Co., Inc., [illegible] N. Y. City, $32,250 (awarded contract), and Wm. J. Olvany, N. Y. City, $33,380.

Syracuse, N. Y.—Bids will be received until Aug. 27 by R. J. Shanahan, Compt., for $[illegible] Salina School bonds.

New York, N. Y.—Bids will be received until Sept. 3 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing ventilating and heating apparatus in new School 66, also erecting outside iron stairs at Schools 104, 58 and 119, all in Boro. Manhattan; completing the abandoned contract for the ventilating and heating apparatus for additions to and alterations in School 109, and in new School 131, both in Boro. Brooklyn.

Hudson, N. Y.—Bids will be received by Chas. H. Strong, Pres. Bd. Mgrs. N. Y. Training School for Girls at Hudson, until Sept. 11, for constructing, heating, plumbing and electric work for 3 new cottages, and alterations to Industrial Buildings at Hudson, as advertised in The Engineering Record. G. L. Heins, State Archt., Albany.

Albany, N. Y.—The following are the bids for construction of State Normal College opened by A. S. Draper, Comr. of Educ., on Aug. 15: E. A. Stephens & Co., Binghamton, $358,692 (600 days); Feeney & Sheehan, Albany, $380,000 (500 days); Peter Keeler Bldg. Co., Albany, $383,840 (650 days); Mosier & Summers, Buffalo, $190,000 (500 days); Hudson Valley Constr. Co., Troy, $409,400 (600 days); M. L. Rider Bldg. Co., Albany, $415,063 (250 days); J. C. Robinson & Sons, N. Y. City, $413,730 (365 days); Galdwin Starritt, N. Y. City, $449,000 (350 days); Morris Kantrowitz, Albany, 437,000 (750 days); R. T. Ford Co., Rochester, $497,000 (750 days).

Rocky Mount, N. C.—Bids will be received until Sept. 1 by W. L. Thorp, Mayor, for $20,000 school bonds.

Roulette, N. D.—It is stated that bids will be received until Sept. 9 by Theo. A. Thorssen, Clk. School Bd., for erecting a brick school for Leonard School Dist. No. 9.

New England, N. D.—It is stated that bids will be received until Aug. 31 by the Bd. of Educ. (Susie Harrison, Clk.), for erecting 8 schools.

**Kenmore, N. D.*—Architects Frost & Hosmer, of Minot, write that the contract for erecting a high school (bids opened Aug. 10) has been awarded to D. A. Dinnie, of Minot, for $22,571.

Bids for heating and plumbing the above school will be let on Sept. 10.

Youngstown, O.—Heller Bros. Co., W. End Raven Ave., it is stated, has secured the contract to erect the 3-story brick and stone Sts. Cyril and Methodus parochial school. The entire structure is to cost about $40,000.

Akron, O.—It is stated that bids will be received until Aug. 29 by J. F. Barnhart, Clk. Bd. Educ., for erecting a school on Portage Path. Harpster & Bliss, Archts., 56 Central Savings & Trust Bldg.

Columbus Grove, O.—It is stated that bids will be received until Sept. 2 by L. E. Lee, Clk. Bd. Educ., Sugar Creek Township, for erecting a 2-story brick and stone school.

Cleveland, O.—Bids will be received until Sept. 9 by the Clk. Bd. Educ. for completing an annex to the Harvard school. Chas. Orr, Dir. Schools.

Kane, Pa.—J. E. Henretta, Secy. Special School Bldg. Com., writes that on Sept. 4 an architect will be selected to prepare plans for a high schood, to cost about $90,000.

Lancaster, Pa.—Bids will be received until Aug. 28 by the Property Com. City School Bd. (W. H. Roland, Chmn., 20 S. Duke St.) for furnishing material and installing a low pressure steam-heating and ventilating apparatus in the S. Duke and S. Mulberry Sts. Schools; also erecting outside toilet annexes and certain interior alterations to the above schools.

**Glenside, Pa.*—It is stated that Cheltenham Township's Bd. of School Directors has awarded the contract for erecting a public school at Glenside to Michael E. Hauser, of Glenside, for $20,494.

Lead, S. D.—Carrie M. Voigt, Clk. Bd. of Educ., writes that all bids opened on Aug. 1 for furnishing and installing complete blast steam heating and ventilating plants, with central boiler plant, for the high school and assembly hall buildings, have been rejected, and the matter of procuring new bids has been postponed until the spring of 1908.

Morristown, Tenn.—It is stated that a $20,000 school is to be erected at the Morristown Normal and Industrial College.

College Station, Tex.—Chas. Puryeau, Dean of Agricultural and Mechanical College, writes that no plans were accepted on Aug. 3 for the proposed buildings to be erected at College Station and Prairie View. For further information address the president, H. H. Harrington, at College Station.

**Brenhom, Tex.*—The contract to erect the $30,000 school is reported awarded to F. W. Wood.

Tomahawk, Wis.—Henry Wildhagen, of Ashland, it is reported, has submitted plans for a 2-story high school to cost $40,000.

Beloit, Wis.—Bids will be received until Sept. 3 by Dr. E. C. Helm, Secy. Bd. Educ., for erecting a high school. J. C. Llewllyn, 1516 First Natl. Bank Bldg., Chicago, Ill.

Olympia, Wash.—The following are reported to be the bids opened Aug. 10 by the State Bd. of Control at Olympia for new buildings for the State College at Pullman and for the normal schools at Cheney and Ellensburg and for plumbing work for the Ft. Steilacoom asylum:

Remodeling plumbing at Ft. Steilacoom hospital (all bidders of Tacoma): W. B. Coffee Plumbing Co., $7,231; T. H. Bellingham, $8,107; A. M. Goddard, $7,850; Ben Olson Co., $8,499.

Training school at normal school, Cheney; total appropriation for building, including plumbing, $65,000; For building alone: Hastie & Dougan, Seattle, $80,040; John T. Huetter, Spokane, $86,715; M. C. Murphy, Spokane, $86,000; Lance & Peters, Seattle, $80,000; A. E. White, Seattle, $79,842. For plumbing: W. B. Coffee Plumbing Co., Tacoma, $4,504; Jas. Smythe Plumbing Co., Spokane, $4,950. Heating system Cheney normal, appropriation $10,000: Jas. Smythe Plumbing Co., Spokane, $13,950; Inland Heating & Ventilating Co., Spokane, $12,900.

Ellensburg normal school, training school building, including plumbing and equipment, total appropriation $65,000. Building alone: A. E. White, Seattle, $75,400; Lance & Peters, Seattle, $72,850; Jones & Woodman, Seattle, $80,400; M. C. Murphy, Spokane, $78,887; John T. Huetter, Spokane, $81,201; Hastie & Dougan, Seattle, $73,644. Plumbing: W. B. Coffee Plumbing Co., Tacoma, $4,283; Jas. Smythe Plumbing Co., Spokane, $4,750. Heating system, Ellensburg normal, total appropriation, $10,000: Seattle Heating & Plumbing So., $17,200; Rautman Plumbing & Heating Co., Seattle, $18,850.

Recitation building and equipment, Pullman, total appropriation $125,000; building, except heating: Hastie & Dougan, Seattle, $110,947; D. C. Murphy, Spokane, $113,063; Lance & Peters, Seattle, $116,900. Heating, Arnold-Evans Co., Spokane, $7,870; G. H. Sutherland Co., Walla Walla, $7,560.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Gadsden, Ala.—Plans are reported completed for the axle forging plant to be built at the plant of the Southern Steel Co. in Gadsden. Plans are said to be in the hands of Gen. Supt. Nicholls at Alabama City. It is also reported that an annex is to be constructed to the plant for rolls to make smaller billets.

Tucson, Ariz.—Henry Till is said to be contemplating the erection of a brewery here to cost about $50,000.

Los Angeles, Cal.—The Duquesne Brewing Co. is reported incorporated with a capital of $500,000 and has secured a site on Albion and E. Main Sts., on which it is proposed erecting a brewery estimated to cost $250,000; capacity, 50,000 bbls. A. K. Martell, Mgr.; Ralph Moss, Secy.

San Francisco, Cal.—The Pacific Steel Corporation in which Jas. A. Moore, of Seattle, Wash., is interested, it is stated, proposes establishing a plant on San Francisco Bay to cost about $30,000,000 for the manufacture of structural steel, pig iron and bar iron.

Denver, Colo.—It is stated that Schwarzschild & Sulzberger (G. F. Sulzberger, Vice.-Pres. and Gen. Mgr.) propose erecting a packing plant here.

**Parkville, Conn.*—B. H. Hibbard Co., of New Britain, is reported to have secured the contract to erect at Parkville for the Royal Typewriter Co., of Brooklyn, N. Y., 2 4-story brick buildings, each 300x50 ft., and some smaller buildings at one end of the larger structure. The company plans to erect a $350,000 plant eventually, but only part of it is to be built at present.

Washington, D. C.—Bids will be received until Sept. 16 by Maj. Spencer Cosby, Corps. Engrs., U. S. A., Washington, for constructing a machine shop building at the Washington Filtration Plant.

Chicago, Ill.—Plans have been completed for a paint factory and warehouse to be erected at 90 to 106 Seward St. for the Health & Milligan Mfg. Co. The buildings will be from one to 3 stories in height and will cost $250,000.

It is stated that the Saml. Cupples Woodenware Co. has secured a lease of the site at St. Clair and Illinois Sts. and intends erecting a factory.

Wm. Seufferle, who conducts a cooperage plant at Livingston and Linn Sts., according to reports, contemplates enlarging the plant.

Michigan City, Ind.—Bids are wanted by B. Kronthal & Co., Michigan City, for erecting a 2-story brick factory. Bid on plumbing and heating to be submitted separately.

New Albany, Ind.—The New Albany Veneering Co. is reported to have filed articles of incorporation with a capital of $100,000. Incorporators: Chas. W. Inman, E. Vernon Knight and others. The company has a site on E. 14th and Water Sts., on which it is proposed erecting a plant to employ 100 operators.

Muncie, Ind.—H. P. Gamble, Jay Winchester and Chas. McClintock, it is stated, intend erecting a plant here to manufacture oil engines.

Cumberland, Md.—It is reported that the plant of the Cumberland Steel Co. has been destroyed by fire. The loss is estimated at $350,000. The plant produced accurate steel castings. The buildings occupied covered an area of 350x1,200 ft.

**West Albany, N. Y.*—We are informed that the contract for general construction of boiler shop at West Albany, for the N. Y. Central & Hudson River R. R. Co. (Bids opened July 25) has been awarded to R. Richards & Son, of Utica. Louis F. Shoemaker & Co., of New York City, are reported to have secured the contract for the steel framework.

**Philadelphia, Pa.*—The William Steele & Sons Co., 1600 Arch St., it is stated, have secured the contract to erect a $250,000 bread baking plant for the Freihofer Vienna Bread Baking Co., on 19th, 20th and Clearfield Sts. and Indiana Ave. The buildings will be constructed of reinforced concrete, brick and terra cotta, and will be fireproof throughout. There will be a one-story bread-baking building, 360x142 ft.; a 1-story "home" bakery, 189x104 ft.; a 3-story shipping building, 360x92 ft., and a 1-story power plant, 70x102 ft. Besides these a cold storage plant, 153x54 ft., will also be constructed.

*It is stated that Cramp & Co., Commonwealth Bldg., have the contract to erect a 3-story and basement manufacturing building at 6th St. and Columbia Ave. for the Henry Sheip Manufacturing Co. The building will be 96x121 ft. and of fireproof construction. The walls will be of brick and the columns, floors and roof of reinforced concrete. There will be a 30,000 gal. sprinkler tank erected on the roof and a 3,000-gal. house supply tank. A freight elevator also will be installed. The building will cost about $75,000.

*Smith, Hardican Co., Perry Bldg., it is stated, has been awarded the contract for erecting a 4-story and basement store and manufacturing building for the Stewart Electrical Co., on Filbert St., east of 7th St. It will be 54x27 ft., and fireproof throughout. The materials will be concrete, brick and stone. Provisions will be made for the erection of two additional stories later. Edwin F. Bertolett, West End Trust Bldg., is the archt.

Beaumont, Tex.—It is reported that the Kirby Lumber Co. will erect a saw mill near Beaumont to have a capacity of from 70,000 to 200,000 ft. per day. To be equipped with double band saw, and a gang saw will likely be added. It will be fitted with electric lights, a large dry kiln and possibly a planer will be erected in the vicinity.

Norfolk, Va.—Edw. S. Cramp, of Philadelphia, Pa., associated with George W. Norris, of the banking firm of Edward L. Smith & Co., of Philadelphia, Pa., it is reported, has secured 1,000 ft. frontage on the main harbor in this city, and will immediately begin the construction of a large shipbuilding plant. In addition to doing all kinds of repair work, the plant, which will have a working capital of $500,000, will be constructed so as to be in a position to make bids for the construction of the largest type of battleship. Edw. S. Cramp, it is stated, will be Pres. of the concern.

Milwaukee, Wis.—The Milwaukee Electric Ry. & Light Co. (C. J. Davidson, Ch. Engr., Milwaukee) is said to be securing land on which it is proposed erecting new car shops.

* *Items marked thus give the names of parties awarded contracts.*

STREET CLEANING AND GARBAGE DISPOSAL.

Ft. Benj. Harrison, Ind.—Bids will be received until Sept. 13 by Geo. H. Penrose, Quarter Master, U. S. A., for a garbage crematory at this post, as advertised in The Engineering Record.

MISCELLANEOUS.

Notes Arranged Alphabetically by States

San Francisco, Cal.—The Bd. of Harbor Comrs. is reported to have received an offer from the Western Pacific Ry. Co. (H. P. McCartney, Asst. Engr., San Francisco) to construct a ferry slip and landing pier north of Islais Creek, on condition that the State will build a sea wall for that purpose and also keep the dock in repair; cost of sea wall is estimated at about $130,000.

Santa Ana, Cal.—H. Clay Kellogg, Engineer, is reported to have submitted to the Bd. of Directors of the Newbert River Protection Dist. a report of the probable cost of making a defined channel for the Santa Ana River north of 5th St. bridge crossing Santa Ana River to the ocean, a distance of 10.6 miles, and building levies, bulkheads and jetties, which he estimates at $183,534.

Bids will be received by Capt. J. F. McIndoe, Corps. Engrs., U. S. A., Custom House, until Sept. 6, for furnishing about 9,000 tons rock for New Orleans harbor.

Bids will be received by the Bd. of Comrs. of Port of New Orleans, (Wm. A. Kernaghan, Vice and Acting President), Nos. 601-602 Hibernia Bank and Trust Bldg., until Sept. 17, for furnishing and delivering such lumber and piling as may be ordered for repairs, etc., for a period of one year from date of contract. C. A. Bell, Engr., 506 Hibernia Bank Bldg.

Gardiner, Me.—Bids will be received by Maj. Geo. A. Zinn, Corps. Engrs., U. S. A., Portland, until Sept 19, for building training walls and dredging in Kennebec River below Gardiner, as advertised in The Engineering Record.

Boston, Mass.—Bids will be received by Maj. Edw. Burr, Corps. Engrs. U. S. A., unti Sept. 19. for removal of wreck of canal boat in Great Chasy River, N. Y., as advertised in The Engineering Record.

Bids will be received by the Bd. of Harbor and Land Comrs., Room 131 State House, Boston, until Sept. 6 for building dike at Herring River, Wellfeet, as advertised in The Engineering Record Constructing Engineers, Whitman & Howard, 220 Devonshire St., Boston.

**Albert Lea, Minn.*—The contract for constructing Fossom ditch, No. 11, is reported to have been awarded to the Mulgrew-Boyce Co. for $6,521.

Boston, Mass.—The following are the bids opened on Aug. 5 at the office of the Charles River Basin Com., 367 Bolyston Street, Boston (Hiram A. Miller, Ch. Engr.), for building a portion of Cambridge Marginal Conduit. (*a*) Pat. McGovern, 6 Beacon St., Boston (awarded contract); (*b*) Jones & Meehan, 10 Tremont St., Boston; (*c*) Bruno, Solomone & Petitti, 23 Court St., Boston; (*d*) James Driscoll & Son, Brookline; (*e*) Falvey & Kelley, 15 Intervale Park, Dorchester.

	a	*b*	*c*	*d*	*e*
1900 lin. ft. earth excav. and refill for conduit	$11.00	$12.00	$16.50	$16.00	$28.00
180 cu. yds. earth excav. in trench below masonry and underdrain	3.00	2.00	2.00	3.00	4.00
180 cu. yds. gravel refill in trench below masonry and underdrain	2.00	2.00	1.50	2.00	2.00
39,500 lin. ft. piles in place	0.20	0.30	0.20	0.25	0.20
1800 lin. ft. underdrains	0.65	0.60	0.50	1.00	0.50
2000 cu. yds. concrete masonry (1:2½:4½) in conduits and sewer	9.00	9.30	9.00	9.50	10.00
100 cu. yds. concrete masonry for backing	4.50	4.65	4.50	4.75	5.00
20 cu. yds. brick masonry	18.00	20.00	20.00	16.00	20.00
120M. ft. B. M. sheeting left in place	35.00	20.00	30.00	30.00	20.00
40 tons iron and other metal work	20.00	22.00	25.00	25.00	15.00
16M. ft. B. M. spruce lumber in place in timber platforms	40.00	40.00	50.00	35.00	40.00
Totals	$55,320	$59,835	$65,030	$67,930	$87,620

Stockton, Cal.—Bids will be received until Sept. 16 by R. C. Tumelty, City Engr., for building concrete bulkhead on north side of Stockton channel; estimated cost $10,000.

Denver, Colo.—The City Park Board has adopted the plans of Geo. E. Kessler, Fidelity Bldg., Kansas City, Mo., for a system of parks and parkways and connecting boulevards in the Montclair Dist.

**Middletown, Conn.*—The Bldg. Com. of the Trus. of the Connecticut Hospital for Insane is repoted to have awarded contracts as follows for building new wharf and industrial trolley at the institution. The machinery and apparatus to the C. W. Hunt Co., of Hoboken, N. J., and for building trolley to the A. E. Sanford Co., of New York, N. Y., wharf and dredging to C. C. Goodrich, of Hartford; cost of work will be about $45,000.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received by Maj. Spencer Cosby, Corps. Engrs. U. S. A., until Sept. 18, for dredging in Occoquan, Urbana and Carters Creeks, and Mattaponi River, Va., as advertised in The Engineering Record.

Key West, Fla.—The only bid received and opened on Aug. 14 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for construction of a new breakwater wall at U. S. Marine Hospital, Key West, was submitted by Ferguson & Wood, of Key West, for $7,292.

Tampa, Fla.—The following are the bids opened on Aug. 16 by Maj. Francis P. Shunk, Corps. Engrs., U. S. A., Jacksonville, for dredging in Tampa Bay about 594,000 cu. yds. (price given per cu. yd.): Bowers Southern Dredging Co., Galveston, Tex., 26 cts.; and Southern Dredging Co., Mobile, Ala., 32 cts.

Rock Island, Ill.—Bids will be received until Sept. 10 by Maj. C. S. Richie, Corps. Engrs., U. S. A., for furnishing and delivering f. o. b. cars, fir lumber

*R. H. Williams is reported to have secured the contract for constructing 8 miles of levee extending from Drury's Landing to Copperas Creek for about $60,000. About 500,000 cu. yds. material will be removed.

Anderson, Ind.—It is stated that bids will be received until Aug. 31 by the Co. Surveyor, for constructing a 14 to 18-in. drain tile ditch. Edwin J. Wilcox, Supt. of Constr.

Estherville, Ia.—It is stated that bids will be received until Sept. 11 and Sept. 12 by Roy J. Ridley, Co. Aud., for constructing ditches Nos. 23, 30, 31 and 32.

Louisville, Ky.—The only bid received and opened on Aug. 16 by the Bd. of Pub. Wks. for new retaining wall for cut-off embankment is reported to have been submitted by the Henry Bickel Co., at $6,111. The same was rejected and new bids will be received on Aug. 27.

Plaquemine, La.—Bids will be received until Sept. 16 by J. T. McIndoe, Corps. Engrs., U. S. A., Custom House, New Orleans, for placing about 20,000 cu. yds. earth filling behind lock walls at Plaquemine.

New Orleans, La.—Bids will be received by the Bd. of Comrs. Orleans Levee Dist. (Chas. T. Tenni, Pres.), Rm. 15, Masonic Temple, until Aug. 27, for the construction of a portion of the new levee, with retaining walls, in the 3d Dist. from Elmira to Mazant Sts., requiring about 50,000 cu. yds. earthwork, 2,700 lin. ft. retaining wall and 100,000 ft. B. M. lumber in revetment; also construction portion of the new levee, with retaining walls, in the 4th Dist., from 7th to 3d Sts., requiring about 30,000 cu. yds. earthwork and 2,500 lin. ft. retaining wall; also construction of a banquette on the land side of the levee in the 6th and 7th Dists., from Protection levee down to Walnut St.

Crookston, Minn.—It is stated that bids will be received until Aug. 27 by N. A. Hoffard, Co. Aud., for digging and constructing ditch No. 70.

Vicksburg, Miss.—Bids will be received until Sept. 6 by Capt. J. F. McIndoe, Corps. Engrs., U. S. A., 1539 Louisiana Ave., New Orleans, La., for furnishing about 15,000 tons rock at points on the Mississippi River, below Vicksburg.

**New York, N. Y.*—The following are the bids opened on Aug. 6 at the office of J. A. Bensel, Cmr. of Docks, for furnishing material and preparing for building a new pier at the foot of James Slip and for preparing for a new bulkhead platform easterly from said pier, bet. James Slip and Oliver St., East River: Butler Bros. Hoff Co., 1170 Bway, $31,036 (awarded contract); Phœnix Cons. Co., $36,479; Wm. H. Jenks, $40,800; Bernard Rolf, $35,333; G. B. Spearin, $33,683; R. P. & J. H. Staats, $32,990.

Buffalo, N. Y.—Bids will be received until Sept. 5 by the Dept. Pub. Wks. (F. G. Ward, Comr.), for constructing a pile pier on the south line of Jersey St.

Skaneateles, N. Y.—Bids will be received until Aug. 28 by F. C. Stevens, State Supt. Pub. Wks., Albany, for constructing a protection wall on the west side of the Skaneateles Lake outlet in the village of Skaneateles.

Schenectady, N. Y.—City Engr. Sebring, and former City Engr. Fitzgerald, representing the Brandywine Ice Co., are reported to be preparing plans for the reconstruction of Brandywine pond dam.

Syracuse, N. Y.—Bids will be received until Aug. 27 by R. J. Shanahan, Compt., for $160,000 local improvement bonds.

**Long Island City, L. I., N. Y.*—Jos. Bermel, Pres. Queens Boro., is reported to have on Aug. 15 awarded to the Casey Constr. Co., the contract for brick wall around Queen County jail for $8,996 and to T. F. Tuohy & Co., the contract for 1,500 cu. yds. broken stone and 1,500 cu. yds. screenings, all of trap rock for $11,250.

Stapleton, S. I., N. Y.—Bids will be received by J. A. Bensel, Comr. Docks, New York City, until Aug. 20, for furnishing material and building structures with necessary appurtenances on pier at foot of Canal St., Stapleton, Boro. Richmond, as per Contract 1,077.

West Point, N. Y.—Bids will be received by the Quartermaster at West Point until Sept. 9 for the construction of 2 emplacements for 6-in. guns mounted on disappearing carriages, as advertised in The Engineering Record.

**Albany, N. Y.*—Winslow M. Mead, Deputy Supt. State Bd. of Pub. Wks., writes that Stewart, Kerhaugh, Shanley & Co., 527 5th Ave., N. Y. City, has secured the contract for the work on Contract 12 in connection with State canal work (bids opened July 31). Their detail bid is as follows: Clearing, lump sum, $8,800; 12,200 cu. yds. grubbing, 33 cts.; 1,190,000 cu. yds. all excav. in Div. No. 1, $1.089, 700,000 cu. yds. all exca. in Div. No. 2, 56.1 cts.; 1,930,000 cu. yds. all exca. in Div. No. 3, 30.8 cts.; 3,270,000 cu. yds. all exca. in Div. No. 4, 18.7 cts.; 50 M. ft. sheeting and bracing, $55; 122,000 cu. yds. forming embank., 16.5 cts.; 2,100 cu. yds. lining, $1.65; 690 M. ft. sawed lumber (yellow pine or Douglas fir), $60.50; 4 M. ft. white oak lumber in miter sills and gates, $110; 86 M. ft. sawed lumber (white oak), $88; 16 M. ft. sawed lumber creosoted yellow pine or Douglas fir), $110; 51,500 lin. ft. round timber in cribs, 16.5 cts.; 5,600 cu. yds. stone fill in cribs, $1.65; 175 found. piles, 12 ft. long, each, $3.30; 160 found. piles, 20 ft. long, each, $5.50; 37 mooring piles, 16 ft. long, each, $4.40; 85 mooring piles, 25 ft. long, each, $7.70; 3,140 docking piles 25 ft. long, each, $6.875; 28,000 cu. yds. second-class concrete, $7.15; 700 cu. yds. reinforced concrete, $11; 10 cu. yds. first-class masry. bridge coping, $33; 30,000 cu. yds. wash wall, $2.75; 120 sq. yds. cobblestone paving, 82.5 cts.; 440 cu. yds. third-class riprap, $2.75; 664,0000 lbs. structural steel, 5.5 cts.; 185,000 lbs. metal in lock gates, 7.7 cts.; 80,000 lbs. metal in needle dams, 6.6 cts.; 26,000 lbs. metal in lock valves, 13.2 cts.; 98,500 lbs. metal reinforcement, 4.4 cts.; 35,200 lbs. iron castings, plain, 38.5 cts.; 22,500 lbs. iron castings, machined, 6.6 cts.; 3,000 lin. ft. wooden fence, 22 cts.; 240 fender fastenings, each, $3.30; removing old tree dam at Oak Orchard, lump sum, $1,100; Raising bridge superstructure, lump sum, $1,100; Maintaining highway traffic, lump sum, $6,600; deduct price to be paid to the State of New York for buildings in place, lump sum, $2,700; deduct price to be paid to the State of New York for bridge superstructures removed, lump sum, $1,350; total, $3,391.716.

Panama.—Bids will be received at the office of D. W. Ross, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Aug. 30, for furnishing locomotives, as per Circular No. 385; also until Sept. 3 for the following: Sanitary fixtures, locomotive coaling cranes, hoisting engines, vertical boiler, steam roller, wire cable, hydraulic jacks, frogs, Portland cement, lumber, etc., as per Circular No. 386.

Bids will be received until Sept. 18 by the General Purchasing Officer Isthmian Canal Comn., Washington, D. C., for furnishing, as per circular No. 387, the following: Steam riveting machine, pneumatic tools and hoist, electric drills, repair parts for steam shovels, testing apparatus for power plant, vacuum pump, electric motor, steel, iron, rivets, cotters, boiler and condenser tubes, etc.

*The Isthmian Canal Comn. at Washington, D. C., reported to have awarded to the Bucyrus Co., of South Milwaukee, Wis., the contract for 7 steam shovels at $9,680 ea. and to the Marion Steam Shovel Co., of Marion, O., the contract for 7 steam shovels at $10,037 ea. and same company for 6 unloader plows at $1,070 each.

Brownsville, Pa.—The following are the bids opened on Aug. 12 by Maj. H. C. Newcomer Corps. Engrs. U. S. A., Pittsburg, for building a lock with 2 chambers, 2 guide walls and 2 guard walls, at Brownsville, Pa., on Monongahela River. (*a*) Dravo Contrac. Co., Pittsburg Pa.; (*b*) T. A. Gillespie Co., Pittsburg, Pa.; (*c*) H. E. Talbott & Co., Dayton, O.

	a	*b*	*c*
55,000 cu. yards earth excav	$1.10	$0.80	$0.50
2,000 cu. yds. rock excav	3.00	3.00	2.00
26,000 cu. yds back fill	.50	.60.	.30
52,00 cu. yds. concrete	7.00	6.65	6.50
20,000 lin. ft. piles	.60	.60	.50
70,000 sheet piles and wales	100.00	80.00	60.00
6,000 lbs. pile shoes	.10	.07	.05
1,000 tons stone ballast	2.50	2.00	2.00
Totals	$465,600	$431,420	$393,800

Reading, Pa.—Bids will soon be called for by City Council for the construction of the Spring St. subway, to be entirely of concrete, and cost about $200,000.

San Juan, P. R.—The following are the bids opened on Aug. 7 by Maj. Chas. L. Potter, Corps Engrs., U. S. A., at Tompkinsville, S. I., N. Y., for dredging San Juan harbor, Porto Rico: (*a*) 1,880,000 cu. yds. soft dredging; (*b*) 65,700 cu. yds. coral rock; (*c*) totals: Utrecht contr. Co., Brooklyn, N. Y., *a* 11 cts., *b* 69 cts., *c* $252,133; Standard Dredging Co., Wilmington, Del., *a* 19 cts., *b* $6.80, *c* $803,960; Michael J. Dady, Brooklyn, N. Y., *a* 43 cts., *b* $9.85, *c* $1,455,545.

Ft. Moultrie, S. C.—Bids will be received until Sept. 14 by J. M. Fulton, Q. M., U. S. A., for dredging and fitting at this post.

Galveston, Tex.—Gen. H. M. Roberts, late of U. S. Engrs., is stated to have completed the report for the construction of the Galveston causeway, and the same has been presented by the County Comrs. to the three railroads having terminals here. The report recommends that a structure be built to cost $1,500,000, of which $710,000 will be used for the bridge, including the draw, and $440,000 for the causeway. The railroads will be asked to pay half the cost.

Peterboro, Ont.—Bids will be received until Oct. 10 by Alex. J. Grant, Supt. Engr., Trent Canal, Peterboro, for the works connected with the construction of Sec. 1, Ontario-Rice Lake Div. of the canal.

PROPOSALS OPEN.

For Proposals see Pages 66, 67, 68 and 70.

WATER.

Bids Close.		See Eng. Record.
Aug. 27.	C. i. pine, etc., Cincinnati, O.	Aug. 3
Aug. 27.	Pipe, Chicago, Ill.	Aug. 24
Aug. 28.	Mains, New York, N. Y.	Aug. 24
Aug. 28.	Mains, Brooklyn, N. Y.	Aug. 24
Aug. 29.	Electric machinery and sand washer pumps, Philadelphia, Pa. Adv. Aug. 10, 17.	Aug. 10
Aug. 29.	Mains, New York, N. Y.	Aug. 24
Aug. 30.	Tank and trestle, Ft. Dade, Fla. Adv. Aug. 10 to 24.	Aug. 10
Aug. 30.	Water wks., Bradshaw, Neb	Aug. 10
Aug. 30.	Mains, Norfolk, Neb.	Aug. 24
Aug. 30.	Mains, Columbus, O.	Aug. 24
Aug. 30.	Mains, Grand Forks, N. D	Aug. 24
Aug. 31.	Meters, Chicago, Ill	Aug. 17
Aug. 31.	Softening plant, Oklahoma City, Okla. Adv. Aug. 24.	Aug. 24
Aug. 31.	Irrigation ditch, Sanders, Mont	Aug. 24
Aug. 31.	Pipe, Grosse Pointe Farms, Mich	Aug. 24
Aug. —.	**Water wks., Rockingham, N C**	**June. 29**
Sep. 2.	Standpipe, etc., Carrington, N. D. Adv. Aug. 3 to 24.	Aug. 3
Sep. 3.	Pipe, Victoria, B. C.	Aug. 10
Sep. 3.	C. i. pipe, Kansas City, Mo	Aug. 10
Sep. 4.	**Hauling and laying pipe, New Orleans.** La. Adv. Jun. 29 to Aug. 24.	Jun. 29
Sep. 6.	Concrete conduit, Montreal, Que. Adv. Aug. 10, 17.	Aug. 10
Sep. 7.	Steel tank, etc., Pensacola, Fla.	Aug. 17
Sep. 7.	System, Pensacola, Fla	Aug. 17
Sep. 8.	Pump engine, boilers, etc., Louisville. Ky. Adv. Jul. 27 to Aug. 17	Jul. 27
Sep. 9.	Reservoir, etc., Orange, N. J.	Aug. 24
Sep. 9.	Water works improv., Stambaugh, Mich. Adv. Aug. 24.	Aug. 24
Sep. 10.	System at poor farm, Decorah, Ia	Aug. 24
Sep. 12.	Plant, Millen, Ga.	Aug. 24
Sep. 14.	Valves and gates, Manila, P. I. Adv. Jul. 27.	Jul. 27
Sep. 14.	Tank and tower, Norfolk, Va	Aug. 17

* *Items marked thus give the names of parties awarded contracts.*

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 26. Omaha, Neb. Adv. Aug. 3 to 24........Aug. 3
Aug. 27. Peru, Ind. ....Aug. 24
Aug. 27. Oakley, O. ....Aug. 24
Aug. 28. Louisville, Ky. Adv. Aug. 10, 17.....Aug. 10
Aug. 28. Brooklyn, N. Y. ....Aug. 17
Aug. 28. Indianapolis, Ind. ....Aug. 24
Aug. 29. Long Island City, N. Y...............Aug. 24
Aug. 30. Evansville, Ind. Adv. Aug. 3.........Jul. 27
Aug. 30. Ft. Dade, Fla. Adv. Aug. 10 to 24.....Aug. 10
Aug. 30. Richmond, Ind. ....Aug. 17
Aug. 30. Youngstown, O. ....Aug. 17
Aug. 30. Norfolk, Neb. ....Aug. 24
Aug. 31. Chicago, Ill. ....Aug. 17
Aug. 31. Canal Dover, O ....Aug. 17
Aug. 31. Elroy, Wis. ....Aug. 10
Aug. 31. Norwood, O. ....Aug. 24
Aug. —. Rockingham, N. C.....................Jun. 29
Sep. 1. Eatonton, Ga. ....Apr. 13
Sep. 1. Alton, Ill. ....Jun. 8
Sep. 2. Shelby, N. C. ....Aug. 3
Sep. 2. Olympia, Wash. Adv. Aug. 24.......Aug. 24
Sep. 2. Columbus, Ind. ....Aug. 24
Sep. 2. Riverside, N. J. Adv. Aug. 24......Aug. 24
Sep. 2. Grand Rapids, S. D....................Aug. 24
Sep. 3. New Philadelphia, O. ....Aug. 3
Sep. 3. Alexandria, La. Adv. Aug. 17, 24..Aug. 17
Sep. 3. Canton, O. Adv. Aug. 17, 24.........Aug. 17
Sep. 3. Kingston, N. Y. ....Aug. 24
Sep. 3. Webster, S. D. ....Aug. 24
Sep. 4. Beloit, Wis. ....Aug. 24
Sep. 5. Johnson City, Tenn. Adv. Aug. 24.....Aug. 24
Sep. 5. Sumter, S. C. ....Aug. 24
Sep. 5. Bozeman, Mont. ....Aug. 24
Sep. 9. Bryant, S. D. ....Aug. 17
Sep. 1. Chattanooga, Tenn. ....Aug. 24
Sep. 11. New Orleans, La......................Jul. 6
Adv. Jul. 6 to Aug. 24.
Sep. 13. Lake Mills, Wis. ....Aug. 24
Oct. —. Eaton, O. ....Aug. 3

BRIDGES.

Aug. 27. Newark, N. J.........................Aug. 17
Aug. 27. Springfield, Mass. ....Aug. 17
Aug. 28. Panama ....Aug. 17
Aug. 28. Indianapolis, Ind. ....Aug. 24
Aug. 29. Tonawanda, Pa. ....Aug. 24
Aug. 31. Greenfield, Mass. Adv. Aug. 24.......Aug. 24
Sep. 2. Tarboro, N. C. ....Aug. 3
Sep. 2. Jefferson, O. ....Aug. 17
Sep. 2. Trenton, O. ....Aug. 17
Sep. 2. St. Clairsville, O. ....Aug. 24
Sep. 2. Chandler, Okla. ....Aug. 24
Sep. 2. Danville, Ind. ....Aug. 24
Sep. 2. Sandpoint, Idaho. ....Aug. 24
Sep. 3. Catlettsburg, Ky. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 3. Ingot, Cal. ....Aug. 17
Sep. 3. Sedalia, Colo. ....Aug. 24
Sep. 3. Farmington, Cal. ....Aug. 24
Sep. 3. Albany, Mo. ....Aug. 24
Sep. 3. Santa Barbara, Cal. ....Aug. 24
Sep. 4. Columbus, O. ....Aug. 10
Sep. 4. Glasgow, Mont. ....Aug. 17
Sep. 4. Vicksburg, Miss. ....Aug. 24
Sep. 4. Rahway, N. J. ....Aug. 24
Sep. 4. Winnipeg, Man. ....Aug. 24
Sep. 5. Eaton, O. ....Aug. 24
Sep. 5. Long Island City, N. Y. ....Aug. 24
Sep. 9. Plaquemine, La. ....Aug. 10
Sep. 9. Wichita, Kan. ....Aug. 24
Sep. 9. Laurel Springs, N. J. ....Aug. 24
Sep. 10. Yosemite, Cal. ....Aug. 24
Sep. 14. Cleveland, O. ....Aug. 24
Sep. 16. Adin, Cal. ....Aug. 24
Sep. 30. Santiago, Chile ....Jul. 13
Oct. 19. Canton, China. Adv. Aug. 24..........Aug. 24

PAVING AND ROAD MAKING.

Aug. 27. Boston, Mass. ....Aug. 24
Aug. 27. Pensacola, Fla. ....Jul. 27
Adv. Jul. 27 to Aug. 17.
Aug. 28. Concord, N. H. ....Aug. 24
Aug. 28. Indianapolis, Ind. ....Aug. 24
Aug. 28. Baltimore, Md. ....Aug. 24
Aug. 28. Ellington, Conn. ....Aug. 24
Aug. 28. Riverton, N. J. ....Aug. 24
Aug. 29. Smethport, Pa. Adv. Aug. 10, 17....Aug. 10
Aug. 29. Kansas City, Mo. ....Aug. 24
Aug. 29. New York, N. Y. ....Aug. 24
Aug. 29. Norristown, Pa. Adv. Aug. 24........Aug. 24
Aug. 29. Cincinnati, O ....Aug. 24
Aug. 30. Marshfield, Mo. ....Aug. 3
Aug. 30. Richmond, Ind. ....Aug. 17
Aug. 30. Woodsfield, O. ....Aug. 17
Aug. 31. Wauseon, O ....Aug. 24
Aug. 31. Towanda, Pa ....Aug. 24
Aug. 31. Cincinnati, O ....Aug. 24
Aug. 31. Ridgway, Pa. ....Aug. 17
Aug. 31. Greencastle, Ind. ....Aug. 24
Aug. 31. Neenah, Wis. ....Aug. 24
Sep. 1. Yorkville, S. C. ....Aug. 24
Sep. 2. Elizabeth City, N. C..................Aug. 17
Sep. 2. Fond du Lac, Wis. ....Aug. 17
Sep. 2. Olympia, Wash. Adv. Aug. 24 ....Aug. 24
Sep. 2. Salem, Ind ....Aug. 24
Sep. 2. [illegible], Ind ....Aug. 24
Sep. 2. Cadiz, O ....Aug. 24
Sep. 2. Oakmont, Pa. ....Aug. 24
Sep. 2. Jamestown, N. Y ....Aug. 24
Sep. 3. Beardstown, Ill ....Aug. 3
Sep. 3. New Philadelphia, O. ....Aug. 3
Sep. 3. Dayton, O. ....Aug. 10
Sep. 3. St. Bernard, O ....Aug. 17
Sep. 3. Jacksboro, Tenn ....Aug. 17
Sep. 3. Lake Charles, La. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 3. Yorktown, Va ....Aug. 17
Sep. 3. Monticello, Ind. ....Aug. 17
Sep. 3. Albany, N. Y. ....Aug. 17
Adv. Aug. 17.
Sep. 3. Canton, O. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 3. Wilmington, Del. ....Aug. 17
Adv. Aug. 17.
Sep. 3. Idaho Springs, Colo. ....Aug. 24
Sep. 3. Cohoes, N. Y. ....Aug. 24
Sep. 3. Stockton, Md. ....Aug. 24
Sep. 3. Scranton, Pa. ....Aug. 24
Sep. 3. Washington, D. C. Adv. Aug. 24 ......Aug. 24
Sep. 3. Covington, Ind. ....Aug. 24
Sep. 4. Albany, N. Y. Adv. Aug. 17 ....Aug. 17

Sep. 4. Providence, R. I. ....Aug. 24
Sep. 4. Brooklyn, N. Y. ....Aug. 24
Sep. 4. Bloomington, Ind. ....Aug. 24
Sep. 4. Elmira, N. Y. Adv. Aug. 24..........Aug. 24
Sep. 4. Buffalo, N. Y. ....Aug. 24
Sep. 5. Bergholz, O. ....Aug. 24
Sep. 5. Albany, N. Y. Adv. Aug. 17...........Aug. 17
Sep. 5. El Reno, Okla. ....Aug. 24
Sep. 5. Johnson City, Tenn. Adv. Aug. 24.....Aug. 24
Sep. 6. Bluffton, Ind. ....Aug. 17
Sep. 6. Janesville, Wis. ....Aug. 24
Sep. 6. Decatur, Ind. ....Aug. 24
Sep. 10. Cleveland Heights, O. ....Aug. 24
Sep. 11. Cincinnati, O. ....Aug. 24
Sep. 11. Bridgeton, N. J. ....Aug. 24
Sep. 12. Silverton, O. ....Aug. 24
Sep. 12. Cincinnati, O. ....Aug. 24
Sep. 13. Madison, Wis. ....Aug. 17
Sep. 13. Des Moines, Ia. ....Aug. 24
Sep. 14. Ft. Moultrie, S. C. ....Aug. 24
Sep. 15. Struthers, O. ....Aug. 24
Sep. 16. Youngstown, O. ....Aug. 24
Sep. 16. Euclid, O. ....Aug. 24
Sep. 16. St. Paul, Minn. ....Aug. 24
Sep. 24. Lebanon, Ind. ....Aug. 24

POWER PLANTS, GAS AND ELECTRICITY.

Aug. 26. West Point, N. Y. Adv. Aug. 10 to 24.Aug. 10
Aug. 27. Arlington, O. ....Aug. 10
Aug. 27. Trenton, Ill. ....Aug. 17
Aug. 27. Arlington, O. ....Aug. 24
Aug. 27. Washington, D. C. ....Aug. 24
Aug. 28. Indianapolis, Ind. ....Aug. 17
Aug. 28. Baltimore, Md. ....Aug. 24
Aug. 29. San Francisco, Cal. ....Aug. 3
Aug. 29. Secaucus, N. J. ....Aug. 24
Aug. 29. Paulsboro, N. J. Adv. Aug. 24........Aug. 24
Aug. 30. Boston, Mass. ....Aug. 24
Aug. 30. Little Valley, N. Y. ....Aug. 24
Aug. 31. Lebanon, Pa. ....Jul. 20
Sep. 3. Winnipeg, Man. ....Jun. 15
Adv. Jun. 15 to Jul. 20.
Sep. 3. Washington, D. C. ....Aug. 17
Sep. 3. Portland, Me. ....Aug. 17
Sep. 3. L'Anse, Mich. ....Aug. 24
Sep. 4. Brooklyn, N. Y. ....Aug. 24
Sep. 5. Campbellford, Ont. ....Aug. 10
Sep. 12. Millen, Ga. ....Aug. 24
Sep. 16. Milton, O. ....Aug. 10
Sep. 17. Columbus, O. ....Aug. 24

BUILDINGS.

Aug. 26. Alter to Pub. Bldg., New York, N. Y.Aug. 17
Aug. 27. Post office, Trenton, N. J...........Jul. 27
Adv. Jul. 27, Aug. 3.
Aug. 27. Bus. bldgs., Grand Junction, Colo.....Aug. 10
Aug. 27. Remodeling court house, Murfreesboro, Tenn. ....Aug. 17
Aug. 27. Court house, Sudbury, Ont............Aug. 17
Aug. 27. School, Stambaugh, Mich. ....Aug. 24
Aug. 28. Courthouse, Anthony, Kan. ....Aug. 10
Aug. 28. Pub. bldg., Cleveland, O. ....Aug. 10
Aug. 28. Hotel, Ft. Smith, Ark. ....Aug. 10
Aug. 28. Improv. armory, Portland, Ore.......Aug. 10
Aug. 28. Bus. bldg., Cullman, Ala. ....Aug. 17
Aug. 28. Htg. prison, Indianapolis, Ind.......Aug. 17
Aug. 28. Pub. Bldg., New York, N. Y...........Aug. 17
Aug. 28. Pub. Bldg., Brooklyn, N. Y...........Aug. 17
Aug. 28. Bus. bldg., Goldsboro, N. C..........Aug. 24
Aug. 28. Htg. school, etc., Lancaster, Pa.....Aug. 24
Aug. 29. School, Wahpeton, N. D. ....Aug. 10
Aug. 29. Shelter houses, Brooklyn, N. Y......Aug. 17
Aug. 29. Pub. bldg., Peru, Ind................Aug. 10
Aug. 29. Pub. bldg., Long Island City, N. Y..Aug. 10
Aug. 29. Residence, Iowa City, Ia. ....Aug. 10
Aug. 29. School plans, New Castle, Pa. ....Aug. 17
Aug. 29. School, Akron, O. ....Aug. 24
Aug. 29. Pub. bldg., New York, N. Y...........Aug. 24
Aug. 29. Pub. bldg., Sherbrooke, Que..........Aug. 24
Aug. 30. Church, Delphos, O. ....Aug. 17
Aug. 30. School, Svea, Minn. ....Aug. 24
Aug. 30. School, Olean, N. Y..................Aug. 24
Aug. 31. School, Storrs, Conn. ....Aug. 3
Aug. 31. Jail, Williamsport, Ind. ....Aug. 3
Aug. 31. Court house, Liberal, Kan. ....Aug. 17
Aug. 31. Bus. bldg., Athens, O. ....Aug. 17
Aug. 31. School, New England, N. D............Aug. 24
Aug. 31. Theatre, Mansfield, O. ....Aug. 24
Aug. 31. Bus. bldg., Toronto, Ont. ....Aug. 24
Sep. 1. Bus. bldg., Walla Walla, Wash. .....Apr. 20
Sep. 1. Y. M. C. A. bldg., Tacoma, Wash.......Aug. 3
Sep. 2. Pub. bldg., New Castle, Ind. ....Aug. 17
Sep. 2. School, Columbus Grove, O.............Aug. 24
Sep. 2. School, Sioux City, Ia. ....Aug. 24
Sep. 2. Library, Ligonier, Ind. ....Aug. 24
Sep. 3. Post office bldg., Waterton, N. Y.....Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 3. Pub. bldg., Bloomfield, Ind...........Aug. 3
Sep. 3. Pub. bldg., Washington Barracks, D. C.Aug. 10
Sep. 3. Add. to jail, Buffalo, N. Y...........Aug. 10
Sep. 3. School, St. George, S. C. ....Aug. 17
Sep. 3. Add to school, Cleveland, O. ....Aug. 17
Sep. 3. School, Beloit, Wis. ....Aug. 24
Sep. 3. Htg. school, New York, N. Y...........Aug. 24
Sep. 4. Post office bldg., Quincy, Mass.......Jul. 27
Adv. Jul. 27, Aug. 3.
Sep. 4. School, Flandreau, S. D. ....Aug. 17
Sep. 4. School plans, Kane, Pa................Aug. 24
Sep. 4. Hospital, Brooklyn, N. Y..............Aug. 24
Sep. 4. Pub. bldg., Willard, N. Y.............Aug. 24
Adv. Aug. 24.
Sep. 4. Pub. bldg., New London, Conn..........Aug. 24
Sep. 4. Hospital, Binghamton, N. Y............Aug. 24
Sep. 5. Pub. bldg., Evansville, Ind...........Aug. 3
Sep. 5. Add to court house, Columbia, S. C..Aug. 17
Sep. 5. Pub. bldg., New Castle, Ind...........Aug. 24
Sep. 5. Pub. bldg., Geneva, N. Y..............Aug. 24
Sep. 6. Court house, Liberal, Kan.............Aug. 24
Sep. 7. Bldgs. at hospital, Elgin, Ill. ......Aug. 17
Sep. 9. School, Cleveland, O. ....Aug. 24
Sep. 9. School, Roulette, N. D ....Aug. 24
Sep. 9. Repairs to barracks, Kingston, Ont.....Aug. 24
Sep. 10. Bus. bldg., Elkins, W. Va............Aug. 17
Sep. 10. Plmbg. etc., post Bldg., Ft. Bliss, Tex.Aug. 17
Adv. Aug. 17 to 24.
Sep. 10. Light house, Philadelphia, Pa........Aug. 24
Adv. Aug. 24.
Sep. 10. Htg. court house, Forsyth, Ga........Aug. 24
Sep. 10. Htg. school, Kenmore, N. D...........Aug. 24
Sep. 11. Jail, Eureka, Cal. ....Aug. 3
Sep. 12. Boilers in post bldg., Jefferson Barracks, Mo. ....Aug. 24

Sep. 12. Post bldg., Ft. Sam Houston, Tex.....Aug. 24
Sep. 13. Church, Park Rapids, Minn............Aug. 24
Sep. 14. Pub. bldg., Washington, D. C.........Aug. 17
Sep. 14. Pub. bldg., Pensacola, Fla...........Aug. 17
Sep. 14. State school, Hudson, N. Y...........Aug. 24
Adv. Aug. 24.
Sep. 15. Church, Owensville, Ind. ....Aug. 24
Sep. 16. Marine Hospital, Buffalo, N. Y.......Aug. 3
Adv. Aug. 3, 10.
Sep. 16. Marine hospital, Pittsburg, Pa.......Aug. 10
Sep. 16. Indus. plant, Washington, D. C.......Aug. 24
Sep. 17. U. S. Mint bldg. repairs, San Francisco, Cal. ....Aug. 10
Sep. 17. Univ. bldg., Lawrence, Kan. ....Aug. 24
Sep. 19. Post office, Muscatine, Ia. ....Aug. 10
Sep. 23. Post office exten., Cedar Rapids, Ia...Aug. 10
Sep. 24. Post office bldg., Hamilton, O. .....Aug. 17
Adv. Aug. 17 to 24.
Sep. 26. Court house, Muscatine, Ia. ....Aug. 24
Sep. 30. Bus. bldg. plans, Harrisburg, Pa....Aug. 3
Sep. 30. Post office, Selma, Ala..............Aug. 24
Sep. —. Hotel, New Orleans, La. ....Jun. 29
Oct. 3. Court house plans, La Moure, N. D..Aug. 10
Oct. 15. Court house plans, De Pere, Wis. ....Aug. 17
Dec. —. Industrial plants, Ft. William, Ont...May 11
——— Bus. Bldg., Charles Town, W. Va....Jun. 15
Adv. Jun. 15, 22.
——— Court house plans, Pulaski, Tenn ....Jul. 27
——— Bus bldg., Markham, Tex...............Aug. 3
——— Indus. plant, Cobalt, Ont. ....Aug. 3
——— Indus. plant, Michigan City, Ind......Aug. 24

MISCELLANEOUS.

Aug. 26. Treat. iron for electric ducts, West Point, N. Y. Adv. Aug. 10, 24............Aug. 10
Aug. 26. Vacuum cleaning system, New York, N. Y. ....Aug. 17
Aug. 27. Track wk., Cincinnati, O. ....Aug. 3
Aug. 27. Broken stone, etc., New York, N. Y..Aug. 17
Aug. 27. Ex. to breakwater, Morrell Sta., P. E. I. ....Aug. 17
Aug. 27. Ditch, Crookston, Minn. ....Aug. 24
Aug. 27. Levee work, New Orleans, La..........Aug. 24
Aug. 27. Retaining wall, Louisville, Ky.......Aug. 24
Aug. 28. Dredging Block Island, R. I..........Aug. 3
Adv. Aug. 3 to 24.
Aug. 28. Jetty work, Wilmington, Del. ....Aug. 17
Adv. Aug. 17 to 24.
Aug. 28. Wall, Skaneateles, N. Y..............Aug. 24
Aug. 29. Pier wk., Stapleton, N. Y............Aug. 24
Aug. 30. Dredge, Philadelphia, Pa.............Aug. 3
Adv. Aug. 3 to 24.
Aug. 30. Rock excav., Portland, Me............Aug. 3
Adv. Aug. 3 to 24.
Aug. 30. Ice plant, Ft. Dade, Fla.............Aug. 10
Adv. Aug. 10.
Aug. 30. Flagstaff, Ft. Wood, N. Y. H., N. Y..Aug. 17
Adv. Aug. 17 to 24.
Aug. 30. Sea wall, Ft. St. Philip, La.........Aug. 17
Aug. 30. Locomotives, Panama. ....Aug. 24
Aug. 31. Jetty wk., Galveston, Tex............Aug. 3
Adv. Aug. 3 to 24.
Aug. 31. Ditch, Anderson, Ind. ....Aug. 24
Sep. 1. R. R. wk., Webb City, Mo..............Aug. 3
Sep. 4. Wharf plans, Gothenburg, Sweden....Apr.
Adv. Apr. 27 to May 18.
Sep. 2. Dredging, Tacoma, Wash. ....Aug. 17
Sep. 2. Repair dykes, etc., New York, N. Y..Aug. 17
Adv. Aug. 17 to 24.
Sep. 3. Pier wk., Two Rivers Harbors, Wis..Aug. 10
Adv. Aug. 10 to 24.
Sep. 3. Ditch, Ft. Snelling, Minn.............Aug. 10
Sep. 3. Walls, etc., Joliet, Ill..............Aug. 17
Sep. 3. Sanitary fixtures, etc., Panama........Aug. 24
Sep. 4. Dredging, Norfolk, Va.................Aug. 10
Adv. Aug. 10 to 24.
Sep. 4. Dredging, Providence, R. I............Aug. 10
Adv. Aug. 10 to 24.
Sep. 4. Garb. disp., Baltimore, Md............Aug. 17
Sep. 5. Pier, Buffalo, N. Y...................Aug. 24
Sep. 5. Dredging, Seattle, Wash. ....Aug. 17
Sep. 5. R. R. work, Pensacola, Fla............Aug. 17
Adv. Aug. 17 to 24.
Sep. 6. Dike, Boston, Mass. Adv. Aug. 24.....Aug. 24
Sep. 6. Furnishing rock, New Orleans, La......Aug. 24
Sep. 6. Furnishing rock, Vicksburg, Miss......Aug. 24
Sep. 7. Dredging, Stamford, Conn. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 7. Dredging, Washington, D. C............Aug. 17
Sep. 7. Drainage work, Little Rock, Ark.......Aug. 17
Adv. Aug. 17 to 24.
Sep. 9. Dredging, Honolulu, H. I. ....Aug. 3
Adv. Aug. 3 to 24.
Sep. 9. Emplacements, etc., for guns, West Point, N. Y. Adv. Aug. 24...............Aug. 24
Sep. 10. Ditch work, Sibley, Ia...............Jul. 27
Adv. Jul. 27 to Aug. 10.
Sep. 10. Exten. to b'kwater, Cleveland, O......Aug. 17
Sep. 10. Exten. to breakwater, Fairport Harbor, O. ....Aug. 17
Sep. 10. Dredging, New Orleans, La. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 10. Breakwater, Bar Harbor, Me. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 11. Dam, etc., Cincinnati, O. ....Aug. 17
Adv. Aug. 17 to 24.
Sep. 10. Lumber, Rock Island, Ill.............Aug. 24
Sep. 11. Levee wk., Bradley, Ark..............Aug. 17
Sep. 11. Ditch, Estherville, Ia. ....Aug. 24
Sep. 12. Ditch, Estherville, Ia. ....Aug. 24
Sep. 13. Garbage crematory, Ft. Benj. Harrison, Ind. Adv. Aug. 24.....................Aug. 24
Sep. 14. Dredging, Ft. Moultrie, S. C..........Aug. 24
Sep. 16. Earth filling, Plaquemine, La.........Aug. 24
Sep. 16. Breakwater, Stockton, Cal............Aug. 24
Sep. 17. Lumber, etc., New Orleans, La.........Aug. 24
Sep. 18. Dredging, Washington, D. C............Aug. 24
Adv. Aug. 24.
Sep. 18. Steam shovels, etc., Panama...........Aug. 24
Sep. 19. Dredging, etc., Gardiner, Me..........Aug. 24
Adv. Aug. 24.
Sep. 19. Removal of wreck, Boston, Mass.......Aug. 24
Adv. Aug. 24.
Sep. 30. Searchlight outfit, Washington Barracks, D. C ....Aug. 3
Oct. 5. Lock and dam, Franklin, Ark...........Aug. 10
Adv. Aug. 10 to 24.
Oct. 5. Lock and dam, Mobile, Ala.............Aug. 10
Adv. Aug. 10 to 24.
Oct. 10. Canal wk., Peterboro, Ont.............Aug. 24
——— Excav. and concrete wk., Ithaca, N. Y.Aug. 3
Adv. Aug. 3.
Fill, Rye, N. Y........................Aug. 17

CURRENT NEWS SUPPLEMENT

AUGUST 31, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

THE ASHOKAN DAM CONTRACT.

On Monday of this week the Board of Water Supply of New York awarded the contract for the Ashokan dams in the Catskills to MacArthur Brothers Co. & Winston & Co. for $12,669,775. This was not the lowest bid, as the John Peirce Co. submitted a tender of $10,315,350. In announcing the award Commissioner Chadwick made the following formal statement:

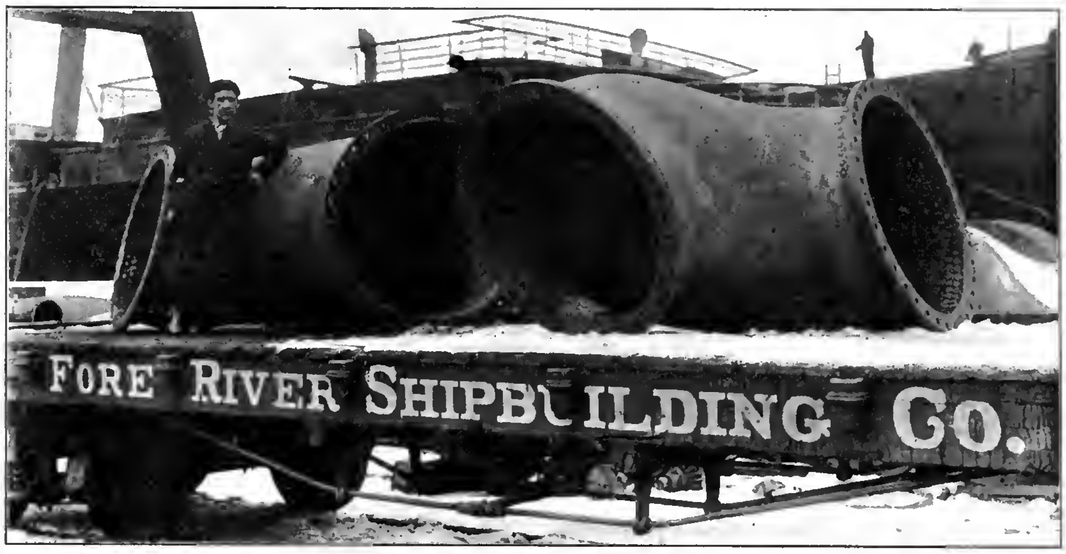
"The question regards the construction of a dam which shall hold water, which involves a special form of construction, requiring expert knowledge and experience, and the details of which must be rigidly insisted upon.

"The cost of the work, as separately and independently estimated by the chief engineer, two designing engineers and an assistant engineer, is shown to be over $2,000,000 more than the bid of the lowest bidder. These estimates of the engineering department are confirmed by the bids of four of the five bidders, each one of whom has had more or less experience in this particular kind of work. In an analysis of the bid of the lowest bidder his figures on masonry work, with which he is familiar, are approximately correct, according to the best evidence obtainable, but in the items of excavation and embankment his figures are over $2,000,000 less than the next lowest bidder.

"In regard to their bid, Mr. Peirce, of the John Peirce Company, the lowest bidder, states that in the matter of excavation and embankment for reservoir construction, his company has had no experience; that they were dependent upon others for their figures; that upon investigation he can procure no figures on these items to protect their proposal, and that upon rechecking his figures he finds that the estimate is too low to do satisfactory work for himself or the city. Therefore, the estimate of the engineering department and four bidders out of five is practically confirmed by the statement of Mr. Peirce himself, and there is no other conclusion to be reached, in the light of this evidence, than that the bid of the lowest bidder is much below the necessary cost, besides being concededly based upon lack of knowledge and experience as to excavation and embankment items.

"To best secure the efficient performance of this work it is necessary that the Board of Water Supply should take into consideration every phase of the question, the elements of which are financial standing, knowledge, experience and such a margin for profit as will secure willingness and ability to continue the work to its conclusion with essential speed, the absence of any one or more of these elements being vital. Therefore, in the case of the lowest bidder the absence of the elements of knowledge and experience in the matters of excavation and embankment for reservoir construction, and the evidence showing lack of margin for legitimate profit, is deemed sufficient, in the interests of the city, to recommend the rejection of that bid.

"Your committee, therefore, recommends, in view of the report of the chief engineer and the reasons set forth therein, and the answers to questions submitted to each one of the three consulting engineers, Messrs. Freeman, Burr and Stearns, which are herewith submitted, and which concur, supported by such additional thought and judgment as it itself has been able to bring to bear upon this subject, that contract No. 3, for the construction of the Ashokan dam, be awarded to MacArthur Brothers Company and Winston & Co., at their bid, which on the assumed basis of quantities amounts to $12,669,775, the committee having satisfied itself as to the financial standing, knowledge, experience and ability of said company to do the work."



HEAVY COPPER PIPES FOR STEAMSHIP "CREOLE."

HEAVY COPPER PIPES.

As an example of copper pipe work, the accompanying illustration is particularly interesting, for the pipes shown are of very unusual weight and sizes. The two copper pipes seen in the photograph are the main exhaust pipes of the Curtis turbine steamship "Creole" and were made at the copper shop of the Fore River Shipbuilding Co., at Quincy, Mass., the builders of the vessel. Each of these pipes weighs 2,500 lb. Each pipe is 42 in. in diameter, inside measurement, and 5/6 in. in thickness. Each pipe was made from sheet copper in four pieces, and the skill used in brazing these pieces together is shown in the smoothness and shapliness of the pipes, the workmanship on which will appeal to coppersmiths, who will appreciate that the pipe is nearly, if not quite, the largest size copper pipe made in this country for marine purposes. The Fore River company makes all kinds of copper work and steel piping of any shape or size up to 300 lb. pressure for power plants, distilleries, breweries, and the like, and with contracts ahead including the building of one of the two great 20,000-ton battleships for the U. S. Navy, to keep the works busy for three years, will extend this branch of its business and give employment to an additional number of coppersmiths.

THE DIRECT-ACTING SOLAR ENGINE.

A great many attempts have been made to utilize solar energy by directing the sun's rays on a boiler, furnishing steam for an ordinary engine. Capt. John Ericson was one of the famous inventors who was convinced that a practically useful apparatus for the purpose could be made. All of these suggestions have called for some combination of mirrors to concentrate the sun's rays, and all have proved impracticable commercially because of their enormous first cost per horse-power, the impossibility of building large units, the rapid deterioration of the parts, and the necessity of highly skilled attedance. The problem has been attacked by Mr. Frank Shuman, of 3,400 Disston street, Tacony, Philadelphia, from an entirely new quarter, with results which he considers extremely promising and are now receiving careful attention in many quarters. Mr. Schuman's success as an inventor of machinery for making wire-glass, mercerizing cotton and washing wool is well known and his Simplex concrete pile is extensively employed in engineering construction. He does not claim to have invented an apparatus that can be set up in a London cellar and furnish power to light the city, but asserts that he has devised a method of utilizing the heat of hot districts having abundant sunlight in such a way that power developed there may be botfled up in the shape of liquid air for use anywhere.

The novel apparatus he employs is merely a glorified hotbed, such as farmers use in forcing small fruits and vegetables. This he calls a hot box and one at his Tacony property measures about 18x60 ft. It gives temperatures as high as 240° F. under favorable conditions, while it is believed that 300° and over can be easily reached in the tropics. It consists of a flat box of the necessary size in which the steam pipes are laid, and above these pipes are two layers of window glass with an air space of about one inch between them. The rays of the sun pass, without obstruction through the glass to the blackened iron pipes, and are converted into ordinary heat, which is retained by the two layers of glass and the air between them. This heat is absorbed in the liquid contained in the pipes and generates pressure which drives the engine. The exhaust is condensed to the fluid state and returned to the boiler, thus constituting an endless cycle. In this latitude ether is used in the tubes. In the tropics ordinary water is intended to be used entirely.

The first cost of construction is no more than that of a good modern steam plant of the same power, according to Mr. Shuman's figures. It can be made of any size, being capable of indefinite expansion. The wear and tear is estimated at only about one-tenth of that of an ordinary steam-power plant. Any ordinary steam engineer can run it and the cost of attendance is believed to be only about one-tenth of that of a modern steam plant. The cost of the fuel, of course, is absolutely nothing.

For pumping water for irrigation purposes the solar engine is considered eminently fitted. It will pump as long as the sun shines, and whatever water it pumps is free, except the lubrication, the interest on the investment,

and the extremely slight attendance. One man on horseback could attend 50 small pumping stations, and this is considered the ideal use of the solar engine at the start. By means of artesian wells and solar engines, irrigation will cost very little indeed.

Mr. Shuman believes, however, that solar engines will ultimately furnish indirectly much of the mechanical power of the world. By means of great solar-power stations located in the tropics, he figures that enormous quantities of liquefied air can be produced at a price even below $1 per ton. This liquefied air can be used for running any continuous expansion motor, such as the steam engine, he states, and refers to recent experience in Great Britain and Boston in proof of this.

A triple effect from liquefied air can always be secured. The solar engine first manufactures liquefied air; this liquefied air is put into boilers furnished with a column-still attachment. The first run of this boiler would be nitrogen. This is diverted into gasometers after it has passed through the engine and given off its mechanical power, and after it has passed through brine tanks and given off its great cold to the artificial ice, and from this nitrogen calcium cyanamide, an artificial fertilizer, can be made.

The rapid development of liquefied air is a happy coincidence. The solar engine, without the liquefied air, can be used only for pumping water, owing to its intermittent power. The solar-power plant on exhibition at Tacony is the first one. There have been mistakes made in it which can be obviated in the second one. Whatever results it gives are believed to be only a small fraction of what it will give after these changes have been made. As the size of the solar-heat absorber is increased the power generated grows in greater proportion. It was never contemplated to use the solar engine in Philadelphia. The percentage of sunlight is too low, and the humidity too great. This season, particularly, has been an exceptionally bad one for any sun engine in this locality.

The home of the solar-engine, Mr. Shuman states, will be dry, intensely hot countries like Arizona and Egypt, and he estimates that from every eight square yards of exposed surface, one horsepower can be generated in these localities.

PROGRESS ON THE PANAMA CANAL.

The Isthmian Canal Commission has given out the following statement regarding the condition of construction work on the Panama Canal:

With the present organization and the progress which now is made, the canal can be completed more rapidly than by restraining expenditure within the appropriations, which were made at the last session of Congress to continue the work until 1908. The work on the locks and dams on each terminus has been opened and will be pushed vigorously during the year, while very little was expended at those places during the fiscal year which terminated June 30, 1907.

The time of completion of the canal appears to depend now upon work at Gatun, rather than the work of excavation, which has hitherto been generally taken as the determining feature. The progress in this direction has been faster than anticipated, and the appropriation made at the last session of Congress would not be sufficient to supply the necessary plant to begin laying the concrete in the locks and dams during the next fiscal year, although progress already made indicates that such a beginning is advisable.

In order to avoid reducing the force to keep within the expenditure already authorized for this fiscal year, the chairman of the commission has recommended to the Secretary of War that the work be allowed to proceed and that Congress be appealed to at its next session to make good any deficiency in the funds now available. If the funds requested are not provided, it will, of course, be necessary to reduce the rate of expenditure to keep within the appropriations on hand. About $8,000,000 in excess of the appropriations already made could be used to advantage in pushing forward the work during the present year.

RECLAMATION OF THE JERSEY MEADOWS

Dredging operations recently have been begun under the direction of the United States War Department, which, when completed, will afford a waterway through which vessels of deep draft can reach Newark, N. J., by way of the Kill von Kull, Newark Bay, and the Passaic River. The present channel, eleven miles long from the Kill von Kull to the Greenwood Lake bridge of the Erie R. R. in Newark, is to be increased in depth from 12 to 16 ft. at low tide and is to be given an average width of 300 ft. Approximately 4,000,000 cubic yards of excavation will be necessary. The spoil will be delivered by the dredges to scows, from which it will in turn be delivered to suction dredges and pumped in pipe lines onto the adjacent meadows in connection with their reclamation.

The channel work of the Government is supplemented by the city, which has entered into a $10,000 contract for dredging about the docks and wharves near the new channel. The original depth of water along these docks was 8 ft., but deposits discharged from the city sewers have reduced the depth to less than 6 ft. The original depth is to be restored by the city, but if advantage is to be taken by the dock owners of the full depth of the new channel, the docks will have to be reconstructed.

The project for the reclamation of about 4,000 acres of the Newark, Hackensack and Elizabeth meadows has been taken up by the United States Department of Agriculture, and a preliminary survey party is now in the field.

The work of the War Department is under the general direction of Col. Daniel W. Lockwood, Corps of Engineers, U. S. A. Mr. M. R. Sherrod, chief engineer of the engineering department of Newark, is directing the work of the city in connection with both the channel and reclamation projects, and Mr. Joseph O. Wright, of the drainage division of the Department of Agriculture, is in charge of the reclamation survey. The contractor for the channel dredging is the Midland Land & Improvement Co., and the P. Sanford Ross Co. is the contractor for the city's work.

THE DALLETT HOSE COUPLING.

The rapidly increasing use of compressed air in various industries has led to the design of various special fittings, particularly hose couplings, for use in connection with pneumatic tools. The accompanying illustration shows the general features of such a coupling which the Thomas H. Dallett Co., of Philadelphia, has placed on the market after four years of experimenting and testing. The illustration shows the two halves of the coupling, which are made of hard bronze, and also the gasket. The latter is of a rubber composition not affected by oil or gasoline, and is held in the female half of the coupling by the flange around the larger end fitting into a recess. When the coupling is connected, the tapering end of the gasket enters the conical opening in the male part, in which it fits loosely. When pressure comes on the coupling, this tapered end of the gasket is ex-

DALLETT HOSE COUPLING.

panded against the wall of the conical opening, and as soon as the pressure is relieved the gasket becomes loose again.

As will be noted, the male part of the coupling is provided with four locking-lugs, equally spaced around its circumference, and when the male and female parts are snapped together, these lugs insure their being held squarely, which obviates any tendency to leak.

To connect the coupling, simply press the parts together, give one-eighth of a turn and the locking-ring will spring into place. It is then a physical impossibility for it to be pulled apart or accidentally disconnected. When the connecton is to be broken, press back the locking-ring and give the coupling one-eighth turn. The locking-ring is provided with a milled ridge around its circumference which affords a good grip for pressing it back when disconnecting the coupling and so stiffens and strengthens it that it requires great abuse to bend it so as to impair the working of the coupling.

PROPOSED FINE FOR POLLUTION OF NEW YORK HARBOR.

A petition alleging that New York city owes the State over $44,000,000 in penalties for wholesale violations of the sewer laws of 1903, and asking that the Attorney General ascertain to what extent the city is liable, was presented to Governor Hughes of New York at Albany recently by Edward Hatch, Jr., chairman of the Special Committee on Pollution of the Merchants' Association. The petition is based on Section 75, Chapter 468, of the laws of 1903, which reads in part:

"No . . . municipality, shall . . . discharge or cause to be discharged into any of the waters of this State, unless the same shall have been permitted by the State Commissioner of Health, any sewage . . . or any substance, containing the same in quantities injurious to the public health, . . . unless express permission to do so shall have been first given in writing by the State Commissioner of Health, as provided in this article, except as hereinafter provided."

In Section 79-d the penalty for failure to obtain such permit to discharge sewage from any public sewer system of the State is $500, with a further penalty of $50 for each day the offense is maintained. The penalty for failure to make a report in the case of sewers existing at the time of the act is $50.

The petition makes the following charge:

"According to the information furnished by the authorities having charge of the sewer systems in the different boroughs there are some 624 sewers which have been 'constructed, modified or extended' since the passage of this act, and all, it so appears, in direct violation of the provisions of the Public Health law. This law is applicable to the city of Greater New York, if there is any validity in the law.

"According to one interpretation of the law, which does not seem to be an unreasonable one, the city of Greater New York would appear to be liable for penalties and fines for the violation of said law, to the amount of $44,186,735, divided among the boroughs as follows: Manhattan, $15,156,100; Brooklyn, $16,099,510; Queens, $4,546,850; Bronx, $7,771,875; Richmond, $612,400."

In speaking of the petition, Mr. Hatch said:

"The possible enormity of the fine may stagger the taxpayers of Greater New York, but there should be no question about the collection of the penalty. An offense against the health law by a corporation or municipality should be dealth with quite as severely as an offense by an individual, and with Governor Hughes' distinguished ability to apprehend the violators of the law, as he did in the insurance cases, the polluters of our rivers and harbor may find themselves confronted by a serious proposition. That there are methods for the disposal of sewage and wastes is well established, and many of the more advanced centers of population of the old world have abandoned the unsanitary practice of using the streams and lakes as common scavengers and adopted some method of purification treatment."

CHANGED METHODS OF MEETING EXPENSE OF NEW YORK STATE HIGHWAYS.

The members of the Boards of Supervisors in New York State have recently received a letter from State Engineer Skene explaining the new system of assessing the cost of State highway work. The most important part of the letter is as follows:

Heretofore the cost of improved highways has been divided as follows: State, 50 per cent.; county, 35 per cent. and town, 15 per cent. Under the new amendment the proportion to be borne by the county will be 2 per cent. of the cost of the improvement for each $1,000 of assessed valuation per mile of highways within the county, while the proportion to be borne by the town will be 1 per cent. of the cost of the improvement for each $1,000 of assessed valuation per mile of highway within the town.

The assessed valuation per mile is to be determined by dividing the total assessed valuation of the county or town, equalized for State purposes, by the total number of miles of highways in said county or town, respectively, exclusive of cities and incorporated villages. In no case, however, shall the county pay more than 35 per cent., or the town more than 15 per cent. of the cost of the improvement.

Assuming that the road to be improved will cost $40,000 and that the equalized assessed valuation of the county is $11,000,000 and the total miles of highways within the county is 1,000, the assessed valuation per mile is therefore $11,000, and 2 per cent. for each $1,000 of the $11,000 makes 22 per cent. Twenty-two per cent. of the $40,000 is $8,800 or the county's share.

Assuming that the assessed valuation of the town is $400,000 and the total number of miles in the town is 80, the assessed valuation per mile is therefore $5,000, and 1 per cent. for each $1,000 of the $5,000 makes 5 per cent. Five per cent. of the $40,000 is $2,000 or the town's share.

The State's share is the remainder, $29,200. Under the former law the State would have paid 50 per cent., or $20,000; the county, 35 per cent., or $14,000, and the town, 15 per cent., or $6,000.

PERSONAL NOTES.

Messrs. Burns & McDonnell, consulting engineers, Kansas City, Mo., have removed their offices to 821-23 Scarritt Building.

Messrs. Walter H. Graves, Fred S. Sawyer and George L. Sawyer have formed the Northwestern Engineering Co., with headquarters at Seattle, Wash.

William H. Denyse, formerly city engineer of Long Branch, N. J., and for many years in private practice there as a civil engineer, died, Aug. 21, aged 52 years.

Thomas Cornish, a mining engineer well known in the West, and formerly manager of W. S. Stratton's "Independence" mine, died suddenly in the Nevada Death Valley recently.

Mr. John W. Alvord, of Chicago, has been retained as consulting engineer to investigate and report on the desirability and cost of obtaining a supply of water from Lake Michigan for Grand Rapids, Mich.

Mr. R. V. Engstrom has resigned as superintendent for the Brayton Engineering Co., St. Paul, Minn., to become an instructor in the department of theoretical and applied mechanics at the University of Illinois.

Mr. P. P. Bird, formerly steam engineer of the South Chicago works of the Illinois Steel Co., has been appointed smoke inspector for the city of Chicago under the new ordinance which becomes effective Sept. 1.

Sir John Jackson, the well-known British contractor, has established a fund, yielding about $1,000 annually, at Edinburgh University. It is in honor of the late P. G. Tait, equally eminent as physicist and golfer, and will be used in physical research.

Mr. Ralph Mackenzie, of Negaunee, Mich., has been appointed chief engineer of the Government's coal min-

ing operations in the Philippine Islands. A considerable area is to be explored, and it is expected that several mines will be developed. The principal coaling station will be on Batan Island.

Dr. Marshman Edward Wadsworth, head of the School of Mines at the Pennsylvania State College, has resigned to become dean of the School of Mines of the Western University of Pennsylvania, and professor of geology and metallurgy. Dr. Wadsworth was State Geologist of Michigan from 1888 to 1893, and has been State Geologist of the Pennsylvania Board of Agriculture since 1902.

The Bureaus of Highways and of Street Cleaning of Philadelphia have been consolidated by Mayor Reyburn, and Mr. William R. Benson, assistant director of public works, has been appointed as chief of the new bureau. Mr. William R. Knight, Jr., has been appointed to succeed Mr. Benson as assistant director of public works.

Dr. Elwood Mead, formerly State Engineer of Wyoming, later professor of irrigation engineering at the Colorado Agricultural College, and afterwards chief of the Bureau of Irrigation of the Department of Agriculture, has accepted the position of chief of irrigation investigations for Australia from the British Government, at a salary of $15,000 per annum. He will leave for Australia in about a month.

Galen W. Pearsons, civil and mechanical engineer, Kansas City, Mo., died recently at his home in that city, aged 75 years. He was closely associated with the construction of the water-works of Bangor, Me.; Leavenworth, Kan.; Marshall, Mo.; Memphis, Tenn., and several other cities. In 1888 be was appointed assistant city engineer of Kansas City, and he was connected with the engineering department of that city thereafter up to the time of his death.

BUSINESS NOTES.

Mr.J. C. Van Doorn has been appointed northwestern sales agent of the Universal Portland Cement Co., with offices in the Security Bank Building, Minneapolis.

Mr. D. N. Carlin, manager of sales of the Thomas Carlin's Sons Co., Allegheny, Pa., has sailed for a trip through England and Germany.

The statement of earnings of the Chicago Pneumatic Tool Co. for the half year ending June 30, 1907. shows a total profit of $507,528.12, which, after deducting for depreciation and renewals of buildings and plant, and developing and perfecting new tools, leaves a net profit of $398,894.54. Out of this sum the sinking fund reserve and the reserve for bond interest have been set aside and two quarterly dividends paid, the remainder, $190,818.88, being carried to the surplus. The latter now amounts to $1,069,228.32.

TRADE PUBLICATIONS.

A small folder setting forth the merits of the Buckeye blue-printing machine, and giving a partial list of its users, is being sent out by the Buckeye Engine Co., Salem, O.

A handsome catalogue entitled "A Reading on the Rod," issued by W. & L. E. Gurley, Troy, N. Y., describes the manufacture and features of their many styles of leveling rods and flag poles. The illustrations are particularly fine and make the selection of a rod from the catalogue easy by being colored exactly the same as the rods themselves.

The American Engineering Co., engineers and contractors, Indianapolis, Ind., have issued two pamphlets containing reprints of articles written by the president of the company, Mr. Chas. N. Wilson. The first contains a careful study of the development and influence of electric roads, which appeared in a series of articles in The Tradesman, and the second a discussion entitled "Why Forty-Nine Projected Electric Roads Fail and the Fiftieth Succeeds," which was printed in the Interurban Railway Journal.

The Compressol system of foundations is described in a recent booklet by the Hennebique Construction Co., U. S. representatives of the system. The apparatus for doing the work is illustrated and explained, and the methods and advantages are fully set forth. Reproductions of photographs show foundations being constructed by this system abroad.

An explanation of a system of accounting by which the details of a foundry business can be analyzed carefully has been written by Mr. William Francis Russell and published by Gunn, Richards & Co. The foundry business rarely pays as much profit as many other industries requiring equal capital, and this pamphlet points out some of the reasons for such an unsatisfactory condition.

A catalogue from the Columbus Tent & Awning Co., Columbus, O., gives prices and dimensions of a great variety of tents for contractors, camping, meetings and other purposes. Wall tents, hip roof tents, compartment tents, shelters, and tents for the many purposes required by contractors are described and quotations attached for various weights of canvas.

"Some Information About the Reinforcing of Concrete" is the title of a small book issued by the Inland Steel Co., Chicago, which contains much interesting material for engineers, architects and contractors. There are discussions of high-carbon steel rods and bars, the materials from which they are made, and mechanical bond. Data for estimating the cost of concrete reinforcement, and tables of the sizes and weights of the rods and bars made by the company are given at the end of the book.

A new catalogue of the General Fireproofing Co., Youngstown, O., describes and illustrates in detail the pin-connected girder frame for reinforcing concrete, and contains half-tone cuts of work in which the company's system is used. The construction of the girder frame and of the materials used in it are described at considerable length, so as to make clear the points claimed for it. Detail drawings of typical centering for concrete building construction, and descriptions of other concrete reinforcement, such as lug bars, expanded metal, and steel studding, occupy the back part of the book.

The Corrugated Culvert Co., Guthrie, Okla., has sent out a catalogue describing corrugated metal culverts for railways and roads. Photographic illustrations show various sized culverts in place, the covering over the crown in some cases being quite thin, indicating a greater strength than is generally assumed for the older types of construction.

The latest catalogue from the Chicago Bridge & Iron Works, Chicago, is almost entirely devoted to a discussion of water towers for domestic supply and fire protection, and contains handly tables of capacities of tanks, standard dimensions of water towers, weights of pipe, properties of fire nozzles, and strengths of different types of riveted joints. The book is illustrated with interesting views of towers and tanks built by the company, the largest tower having a capacity of 1,200,000 gallons.

Extracts from reports of tests on the Forbes system of water purification are scattered through the pages of a small pamphlet which sets forth the advantages of using the system. Illustrations and prices of different types of sterilizers take up part of the book. The apparatus is made by the Forbes Co., Philadelphia.

A neat book of views showing buildings and other structures in which Red Ring brand cement has been or is now being used, has been sent out by the St. Louis Portland Cement Co. Specifications for granitoid walks by Mr. P. M. Bruner, a pioneer cement sidewalk builder, are given at the end of the book.

The New York Flexible Metallic Hose & Tubing Co., has issued an interesting descriptive pamphlet regarding the design of Nyflexmet metallic hose and tubing. The material consists of spirally twisted and interlocked strips of pliable steel or copper, having their edges formed into lips which are packed with asbestos or rubber. For special purposes such as resisting corrosion from moisture the hose is covered or lined with lead. Besides the ordinary uses of flexible tubing, varities of Nyflexmet hose are made for electric conduits, and air brake and car heating hose.

Wunner's "Bitumen-Emulsion," a German waterproofing compound used in making walls of cement, brick or stone impervious to water, is described in a pamphlet issued by Mr. Theodore F. Koch, Globe Building, St. Paul, Minn., selling agent for the United States. The compound is mixed with cement mortar or cement concrete, which can then be applied to the walls or masonry even with water oozing through. From three to six pounds of the compound are used to 200 pounds of cement and sand for making waterproof mortar, and from one and one-half to two pounds to every 100 pounds of cement in making concrete.

The claims of the American System of Reinforcing, Chicago, for concrete construction are briefly and clearly stated in a recent pamphlet. In addition to the data there are many views of concrete structures using the American system.

An interesting description of the electrical equipment of the Bath Portland Cement Co., Bath, Pa., has been issued by the Westinghouse Electric & Mfg. Co., who furnished the electrical apparatus. The individual drive system, using induction motors, is installed throughout.

Pneumatic hammers and riveters of a variety of forms are described in a pamphlet from the Dayton Pneumatic Tool Co., Dayton, O., and some suggestions added regarding their use and care. Pneumatic sand rammers for use in foundries and for tamping concrete or clay, pneumatic wood-boring drills, stay-bolt clippers, cylinder hoists, and compressors also receive attention. Tables of loss in transmitting air and flow through orifices are printed at the end of the book.

The Stewart Iron Works Co., Cincinnati, O., is getting out a new set of catalogues of iron fences, gates, fountains, stable fittings and iron reservoir vases, that describe fully these various products.

Kolesch & Co., 130 Fulton St., New York, manufacturers of engineers' and architects' supplies, have put on the market a circular slide rule for figuring the strength of gear teeth, according to the formula derived by Mr. Wilfred Lewis. All the variables are used on the rule, and the solution thus becomes a mechanical one.

Rockwell rod and bolt heating furnaces are described in circulars recently issued by the Rockwell Engineering Co., New York. These furnaces are operated with oil or gas fuel and their principal dimensions for all standard designs are listed.

A pamphlet describing the Agrippa chain pipe wrenches calls attention to the facts that they are of all wrought-steel construction, drop forged, with saw-tempered jaws, permanently fastened in a milled pocket in the handle, that the chain is of extra length, and swings from center so that it can be used on either side at will, and that all parts are interchangeable. The wrenches are made by the J. H. Williams Co., Brooklyn, N. Y.

Keystone plumbing pipe covering, a new covering for hot and cold water pipes, is described in a pamphlet recently issued by the H. W. Johns-Manville Co., New York. It is made in two forms; style A, which is lined with asbestos for covering hot-water service or heating pipes to prevent radiation, and style B, which is lined with waterproof paper, for covering cold-water pipes to prevent freezing in winter, or to prevent condensation and dripping of moisture from the cool pipes in summer time. The covering is supplied in 3 ft. lengths, canvassed and with lacing wire so that its application or removal is a simple matter.

A catalogue of standard gears has been issued by the Boston Gear Works, Norfolk Downs, Mass., which lists a great variety of gears, pinions and racks that may be ordered from stock, in steel, cast iron and brass. The extensive facilities of this company for molding or cutting gears to order on short notice are referred to, and detailed instructions are given for ordering standard or special gears and pinions with exactness on emergency orders. In addition to the above, an extensive line of small grooved pulleys, star escape wheels, brass ratchets and pawls, clutches and sprocket chains of all types are kept in stock and are listed.

Part 4 of the Trussed Concrete Steel Co.'s series of bulletins on reinforced concrete, treats of hotels, residences and apartment houses, and discusses the speed of erection, noiseless construction, sound-proof, dust-proof, fire-proof and sanitary qualities, and adaptability to architectural decoration claimed for reinforced concrete buildings. Among the buildings described are the Marlborough-Blenheim Hotel and the Traymore Hotel, Atlantic City, and the Hotel Pontchartrain, Detroit, in which the Kahn system of reinforced concrete is used.

A description of the La Chatelier pyrometer for determining temperatures up to 2,920 degrees Fahr., has been issued by Charles Engelhard, U. S. representative, 41 Cortlandt St., New York. The instrument is now employed in gas, chemical, pottery, steel, iron and other industries in which high temperatures are used. Numerous commendatory letters and interesting data on the melting points of metals and fusible alloys, temperatures of furnaces used in various industries, and tempering occupy a considerable portion of the book.

The National Interlocking Steel Sheeting Co., Chicago, has sent out a small folder dealing with the style P lock for interlocking standard channels without the use of bolts or rivets.

A late Tarvia bulletin from the Barrett Manufacturing Co. gives numerous photographs of macadam roads in Chicago and in cities in the East which have been tarviated. Some interesting views show two sections of the same road, a treated and an untreated section.

A spring lock joint for steel sheet piles is the subject of a booklet issued by the Ransome Concrete Machinery Co. The joint consists of two steel springs, riveted to the piles, which engage each other concentrically forming a tight and rigid connection. The applications of the joint to piles made of plain flat plates, and to reinforced, channel, segmental, corrugated and corner piles are shown. Temporary reinforcement for driving very thin piles or driving in hard ground, consisting of channels fastened to the pile by removable bolts, clamps and a driving shoe, is also shown.

Austin Pioneer dump wagons are fully described in a recent catalogue of the Austin Manufacturing Co., Chicago. The steel axle wagon has a capacity of 1½ cu. yds., the wood axle wagon, 2 cu. yds., and the municipal wagon, 2½ cu. yds. Special emphasis is laid on the hanging of the bottom boards.

The Ferro-Concrete Construction Co., Cincinnati, O., has issued Bulletin F-31, giving views of buildings, foundations retaining walls, tanks and chimneys constructed by them.

Thomas C. Farrell, Washington, N. J., manufacturer and patentee of combined box-cap and shoe-plank holders for molds for concrete construction, has sent out a comprehensive catalogue showing applications of the appliance to a great variety of work. The plank holders consist of metal pieces with vertical sides connected by a horizontal web in the form of an extended H. Two of these holders are used to a set, one on each face of the wall, and are connected by a bolt passing through

the wall. Ordinary plank are inserted into the holders, and do not require any carpenter work other than sawing to the proper length. One of the advantages claimed for the holders is that they save skilled labor, the carpenter and form-setting work being reduced to a minimum. Angle, T-shaped, Y-shaped and curved sections are made for 1, 1½ and 2 in. plank.

Bulletins recently issued by the General Electric Co., Schenectady, describe an improved line of circuit breakers for use with electric railway equipments up to 300 h.-p.; auxiliary contactor equipments for cylinder controllers for operating circuit-break contactors on large cars; standard isolated plant switchboards with fuses; Thomson inclined-coil portable indicating instruments, and the G. E. floor outlet boxes for interior conduit wiring systems in buildings.

Forged and rolled steel pipe flanges are listed in a large and well illustrated catalogue recently published by the American Spiral Pipe Works, Chicago, Ill. This company makes a specialty at its large new plant of pipe flanges for all types of pipe joints, including lap joints and welded flanges, and also of boiler and tank flanges and drop forgings of all classes. A feature of the catalogue is full-size illustrations of cross-sections through one side of every standard form of flange made.

An interesting treatise upon the gas engine is embodied in the catalogue recently prepared by the Weber Gas Engine Co., Kansas City, Mo. Much that is of interest to power users is presented, including a comparison of costs of fuels for steam, oil and gas engines and of current for electric motors for power development. The details of both the Weber multi-cylinder gas engine and the Weber suction gas producer are fully described, special effort having been made to call attention to the methods of construction used in the engines, and provisions made for facilitating their care and maintenance.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Alabama City, Ala.—A franchise is reported to have been granted R. A. Mitchell to furnish city with water for domestic purposes. It is proposed to construct plant at once, and Thornton Springs, near Gadsden, is to be used as a source of supply.

Little Rock, Ark.—The Home Water Co. is reported to have decided to expend about $400,000 in improvements, including the extension of water mains to Pulaski Heights.

Etna Mills, Col.—See "Power Plants, Gas and Electricity."

**San Diego, Cal.*—The Southern California Mountain Water Co., which furnishes the supply for San Diego and Coronado, is reported to have on Aug. 15 awarded contracts for improvement of the system to Robt. Sherer & Co., of Los Angeles, for about $150,000.

Monterey, Cal.—The Monterey County Water Co. is reported incorporated with a capital of $2,000,000, and principal office in San Francisco. Directors: Chas. E. Green, H. G. Platt, A. D. Shepard and others.

Los Angeles, Cal.—Bids will be received by the Bd. of Water Comrs. (Wm. Mulholland, Supt.), until Sept. 30 for 2 water tube boilers of 300 h.-p. ea. and one 7,000,000 gal. cross-compound pumping engine; also same time and place for 6,000 tons of standard hub and spigot c. i. water pipe, as advertised in The Engineering Record. F. J. Fischer, Chief Mechanical Engr.

Canon City, Colo.—Bids will be received until September 20 by the City Clk. for furnishing material and constructing an additional system of water works, consisting of a reservoir, located at and near Cottonwood Creek, and a pipe line connecting said reservoir with the present city water main. Probable cost of work, $400,000. A. H. Seely, Mayor.

New York, N. Y.—Bids will be received until Sept. 9 by the Bd. of Health (Thos. Darling, M. D., Pres.) for furnishing and delivering as required, lumber, timber, pipe, fittings, stop cocks, valves and miscellaneous plumbers' and steamfitters' supplies to the Hospitals of the Dept. of Health in the various Boroughs of the City of New York, during year 1907.

*The contract for the construction of main dams for Ashokan reservoir near Brown Station in the towns of Olive and Marbletown, Ulster County (bids opened Aug. 6 by the Bd. of Water Supply of N. Y. City) has been awarded to MacArthur Bros. Co. & Winston Co., of N. Y. City, for $12,669,775. For detailed list of bids received for this work see issue of The Engineering Record of Aug. 10.

Buffalo, N. Y.—Bids will be received until Sept. 10 by the Dept. Public Works (F. G. Ward, Comr.), for 2 vertical triplex boiler feed pumps and feed water heater for the Pumping Station Bureau Water.

Casselton, N. D.—We are informed that it is proposed to construct water works and a sewerage system. No definite action will be taken until a well has been sunk. Engineer, C. A. Hopeman, of Moorhead, Minn.

Mandan, N. D.—P. H. Michaels, of Mansfield, O., is reported interested in the construction of water works at Mandan.

Cincinnati, O.—Engineer Kisinger is reported to have completed specifications for water meters required for remainder of this year. The city is reported to have an appropriation of $13,000 for the purchase of meters.

Cleveland, O.—It is reported that work will soon begin on the construction of the west-side water works tunnel, to cost about $600,000. Chas. F. Schultz, Ch. Engr., Water Works Dept.

Bellevue, O.—Bids will be received until Sept. 5 by the Bd. Pub. Service (W. H. Erdick, Clk.), for constructing reinforced concrete walls around water works storage reservoirs. John C. Overmeyer, Engr., Fremont.

Leesburg, O.—It is stated that bids will be received by the Bd. of Pub. Affairs (W. H. Mason, Clk.) until September 5, for constructing portion of water works.

**Philadelphia, Pa.*—The Millard Constr. Co., of which Senator J. P. McNichol is one of the principal members, was awarded contract on Aug. 24 for the completion of the Torresdale filter plant, for $1,156,410.

**Springfield, Mass.*—The following are the bids opened by the Bd. of Water Comrs. on Aug. 21, for work included under Contract No. 1, Intake Dam and Tunnel, Little River Water Supply (Elbert E. Lochridge, Ch. Engr.: (*a*) Culgin-Pace Contr. Co., 1761 Carter Ave., New York, N. Y. (awarded contract); (*b*) Bruno & Pettitte, 23 Court St., Boston; (*c*) N. Y. Continental Jewell Filtration Co., New York, N. Y.; (*d*) Patk. McGovern, Boston; (*e*) Hugh Nawn Contr. Co., Boston; (*f*) T. A. Gillespie Co., New York, N. Y.; (*g*) H. E. Heningham, Thos. A. Clark and Ellis H. Baillie, New York, N. Y.; (*h*) Jules Brenchard Constr. Co., Yonkers, N. Y.; (*i*) MacArthur Bros. & Co., New York, N. Y.; (*j*) Daniel O'Connel & Sons, Holyoke; (*k*) Winston & Co., Katonah, N. Y.

	*a	b	c	d	e	f	g	h	i	j	k
Repairing and building road (lump sum)	$10,000.00	$20,000.00	$8,500.00	$19,500.00	$10,000.00	$10.000.00	$31,898.00	$4,000.00	$9,500.00	$10,500.00	$10,000.00
12,000 cu. yds. earth excavation at Peterson's	.75	.75	1.00	.65	1.00	1.50	1.00	1.50	1.00	1.00	1.50
2,500 cu. yds. earth excavation in gorge	.50	1.50	1.10	1.00	1.40	2.50	2.50	2.00	1.25	1.50	2.00
2,500 cu. yds. rock excavation	1.20	3.50	2.40	2.50	4.00	4.00	3.00	4.00	3.50	3.00	3.50
2,000 cu. yds. excavation below grade	7.50	4.00	2.70	5.00	5.00	5.00	3.00	6.00	5.00	8.00	6.00
Care of water during construction (lump sum)	15,000.00	10,000.00	7,500.00	18,000.00	5,000.00	7,500.00	12,100.00	12,000.00	25,000.00	20,000.00	10,000.00
9,500 cu. yds. cyclopean masonry in dam	8.00	7.00	7.70	6.00	6.25	7.00	5.00	9.00	8.25	6.50	8.00
300 cu. yds. concrete masonry	7.00	10.00	15.00	10.00	12.00	30.00	12.00	10.00	10.00	9.00	12.00
200 cu. yds. rubble masonry	4.50	4.50	4.50	4.00	6.00	5.00	4.00	4.00	5.00	5.00	5.00
4,530 lin. ft. tunnel	29.00	32.00	35.14	36.00	39.00	33.00	38.58	39.50	40.00	47.00	45.00
110 tons hauling pipes, gates, etc.	5.00	3.00	6.00	14.00	3.00	12.00	4.00	5.00	12.00	3.00	10.00
Placing and refilling about steel pipe (lump sum)	800.00	1,200.00	1,800.00	1,200.00	1,400.00	3,000.00	2,250.00	4,000.00	4,000.00	3,000.00	1,500.00
15,000 lbs. steel reinforcing	.06	.15	.055	.04	.06	.10	.05	.10	.09	.07	.08
Appurtenances (lump sum)	4,000.00	5,000.00	2,000.00	3,500.00	1,500.00	2,500.00	1,934.00	3,000.00	2,500.00	3,500.00	4,000.00
Total	$269,870	$283,640	$285,169	$294,770	$295,475	$296,060	$207,789	$338,285	$341,120	$355,990	$356,000

Tacony turbine pumps are described in a series of pamphlets published by the Tacony Iron Co., Philadelphia, Pa. This company is building four types, three of which embrace single and multi-stage turbine pumps, and the other special sewage pumps. The different standard designs enable a unit to be selected, which will operate most efficiently with the varying capacities and lifts that may be encountered. Special sump draining equipments are made, consisting of vertical shaft pumps for submergence in the pits, and driven by direct-connected motors outside.

What can happen when a steam main bursts or a fitting on the line breaks, or one boiler of a battery gives way, is vividly told in a pamphlet issued by the Lagonda Mfg. Co., Springfield, O., describing the Lagonda automatic boiler cut-off valve. The pamphlet also explains the dangers from ammonia explosions and the way in which the cut-off valve may be used to stop the flow. A number of tests are described to show the certainty with which this type of automatic valve operates in case of accident and the valve is illustrated in detail and its action explained.

Locke regulators are described in an attractive catalogue recently prepared by the Locke Regulator Co., Salem, Mass. The interesting history of the Locke regulator, now a well known feature of power plant equipment, is outlined, and the latest improvements described. The varying designs of regulators are explained, as are also the extensive variety of steam appliances manufactured, including pressure reducing valves, tank valves, pump governors, steam traps, automatic non-return stop valves and other special valve and control apparatus.

Feed water filtration is discussed in a pamphlet just published by James Beggs & Co., New York, descriptive of the Blackburn-Smith feed-water filter and grease extractor. This filter is designed for the removal of sediment, organic matter, grease, oil and other impurities from boiler feed water, or for general water filtration for industrial purposes. Its construction and mode of operation are explained and the advantages derived from its use referred to, including the utilization of condensation from heating systems and condensers with entire freedom from oil and grease.

Johnstown, Colo.—The citizens are reported to be considering the question of issuing $20,000 bonds for water works.

Unionville, Conn.—The Unionville Water Co. is reported to be considering the construction of a storage reservoir, or the securing of an additional water supply from Burlington.

**Vienna, Ga.*—A contract has been let to Walton & Wagner, of Atlanta, Ga., for the construction of water works, consisting of about 2¼ miles of 6 to 10 in. mains, pump, boiler and reservoir for $16,100. The contract for the tower and tank, artesian well and power house has not yet been let. Arthur Pew, Engr., Atlanta.

Pavo, Ga.—The citizens are reported to have voted to issue bonds for water works.

Atlanta, Ga.—The Council is reported to have on Aug. 19 rejected previous bids received for the purchase of pumps.

Shelley, Idaho.—Fred C. Michelson, City Clk., writes that the proposed water works will cost about $6,500.

Concordia, Kan.—Burns & McDonnell, Dwight Bldg., Kansas City, Mo., has been selected to prepare plans and specifications for remodeling the water works at Concordia.

Vernon Center, Minn.—The citizens are reoprted to have voted Aug. 21 to issue $8,000 bonds for the construction of water works. An engine, water tank and mains will be installed.

Brookfield, Mo.—The citizens are reported to have voted to issue $12,000 bonds for the construction of water works.

Hebron, Neb.—A. A. Aehl, City Clerk, writes that it is proposed to remove pumping station to better location, if water supply can be had. Will need new pump and engine if bonds carry.

Franklin, Neb.—J. A. Dickey, City Clk., writes that the citizens on August 26 voted to issue $17,000 bonds for the construction of water works.

Verona, N. J.—The Water Com. (Wm. A. Smith, Chmn.), is stated to have completed its report on the construction of water works, which it estimates at $55,639.

Cazenovia, N. Y.—It is stated that bids will be received until Sept. 4 by the Bd. Water Comrs. (Geo. W. Salisbury, Chmn.) for furnishing and laying 5,433 ft. 4-in. c. i. pipe, 10 hydrants, 2,700 lbs. lead, etc.

Ft. H. G. Wright, N. Y.—Bids will be received until Sept. 16 by Wm. E. Horton, Constr. Q. M., U. S. A., New London, Conn., for furnishing and installing about 1,550 ft. 4-in. pipe, as extension to water system at Ft. H. G. Wright, N. Y.

Bids will be received until Sept. 17 by Geo. R. Stearns, Dir. Dept. Pub. Wks., Philadelphia, Pa., for the 3d St. Pipe extension as per contract No. 131.

**Pawtucket, R. I.*—Wm. H. Barclay, Comr. of Pub. Wks., writes that the contract for constructing pumping station for water works (bids opened Aug. 15) has been awarded to Willmarth & Mackillop, of Pawtucket; cost reported to be about $42,120.

**Bonesteel, S. D.*—M. P. Dowling, Town Clk., writes that the contract for constructing water works (bids opened Aug. 20), has been awarded to C. E. Haakinson, of Sioux City, Ia., for $16,000.

Chattanooga, Tenn.—Mayor W. L. Frierson approved the ordinance authorizing the issue of $900,000 bonds for purchase or construction of municipal water works. The ordinance also provides for preliminary steps to be taken looking to an expert valuation of the present plant and the opening of negotiations with the City Water Co. for a purchase.

Lawrenceburg, Tenn.—See "Power Plants, Gas and Electricity."

Waco, Tex.—It is reported that the Water Comn. has purchased property in East Waco, and the tubular well system, which is used in connection with the artesian supply is to be enlarged.

Royse City, Tex.—The Council is reported to be considering the question of constructing water works.

Lind, Wash.—The citizens are reported to have voted to issue $23,000 bonds for the purchase of the water works. The system will probably be extended and improved.

Linden, Wis.—H. F. Treloor, Village Clk., writes that Geo. Harrop, of South Bend, Ind., is preparing plans for water works, to cost about $8,000.

Thermopolis, Wyo.—Fred. C. Hank, City Clk., writes that bids will probably be called for about Nov. 1 for water works, to cost about $50,000. Engineer, J. B. Chessington, of Thermopolis.

Hamilton, Ont.—At a meeting of Fire and Water Com. on Aug. 21 recommendation of sub-committee, with reference to purchase of electric pumps, was adopted, and Council will be asked to submit by-law to ratepayers sanctioning purchase of electric pumps of sufficient capacity to supply city with water.

Ottawa, Ont.—The City Engr. is reported to be preparing plans for a new reservoir to be located in the newly annexed portion of city, known as Bayswater; it will cost about $150,000.

**Items marked thus give the names of parties awarded contracts.*

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

***Camden, Ark.**—Louis Bauerlein, Secy. Comrs. Improv. Dist. No. 2, writes that the contract for constructing about 12,000 ft. sewers (bids opened Aug. 15) has been awarded to Pormey Paving & Constr. Co., Helena, Ark., for $6,260.

***Fayetteville, Ark.**—Bids were opened on Aug. 22 by the Bd. Improv.. Sewer Dist. No. 1 (I. G. Combs, Camn.) for furnishing material and constructing a system of sewers. (Burns & McDonnell, Engrs., 709 Dwight Bldg., Kansas City, Mo.), and the contract for same was awarded to Clinton W. Watson & Co., of St. Louis, Mo., at the following bid: Excav., under 4 ft., 15 cts. per cu yd.; excav., 4 to 6 ft., 22 cts.; excav., 6 to 8 ft., 28 cts.; excav., over 8 ft., 45 cts.; rock excav., $2.50; macadam, 14 cts. per lin. ft.; 8-in. vit. pipe, 22 cts.; 10-in., 29 cts.; 12-in.. 44 cts.; 15-in., 60 cts.; 18-in., 90 cts.; 8-in. c. i. pipe, $1.10; 10-in., $1.40; 12-in., $2; 16-in., $3; 6-in. on 8-in. Ys. ca. 65 cts.; 6-in on 10-in. Ys, $1; 6-in. on 12-in. Ys, $1.50; manholes, ea., $32; extra concrete, per cu. yd., $7; septic tank, ea., $3,000; filters, ea., $1,500; excav. tank and filters, 50 cts.; special bridges. $200; total cost $71,377. Totals of other bids received were: McIlroy, Reese & Co., Fayetteville, $83,750; Wm. F. Hall, Clinton, Mo., $74,469 and J. O. Severens, Guthrie, Okla., $71,377.

Fairfield, Cal.—The Town Clerk writes that bids will be received on Sept. 30 for the construction of sewerage system, to cost about $20,000.

Willows, Cal.—The City Trus. are reported to be considering the question of constructing a sewerage system.

Etna Mills, Cal.—See "Power Plants, Gas and Electricity."

***Lincoln, Cal.**—Daowing & Sons, of Palo Alto, are reported to have secured the contract for constructing sewer system for $17,342.

Alton, Ill.—An ordinance will probably be introduced at the October meeting of the Bd. of Local Improv., looking to the construction of a trunk sewer to cost about $140,000. Edmond Beall, Mayor; Geo. Gray, City Clk.

Springfield, Ill.—The City Council is reported to be considering the construction of a sewer to supply drainage for the southeastern portion of city. Frank Hamilton, City Engr.

Great Lakes, North Chicago, Ill.—The following are the bids opened at the office of the Bureau fo Navigation, Navy Dept., Washington, D. C., on Aug. 21, for laying sewers and drains at the naval training station. Great Lakes, North Chicago, Ill.. Carmine Roberts, Chicago, $63,252. H. C. Patterson, Muskegon, Mich., $66,500.

Bloomington, Ill.—Bids will be received on Sept. 5 for 1,990 ft. of 15 and 18-in. pipe sewers. Chas. F. Fauntz, City Engr.

Lafayette, Ind.—Bids will be received by the Bd. Pub. Wks. E. H. Andress, Jr., Clk.), until Sept. 4 for constructing a sewer in a portion of 20th St.

We are informed that the question of constructing the Congress St. sewer, has not yet been definitely decided upon. If constructed it will be of pipe, brick and concrete, 15 to 36-in. diam. and cost about $18,000.

Linton, Ind.—Bids will be received until September 16 by the Common Council for constructing a sanitary sewer system consisting of approximately 13 miles of sewer with a disposal plant. Approximate cost, $64,800. Frank Spelbring, City Clk.

Des Moines, Ia.—Steel & Shea are reported to have submitted lowest bid at $37.38 per lin. ft. for the long side of the street and $31.60 for the short side, for the sewer and water connections on Kingman Ave, from 26th to 35th Sts.

Independence, Io.—Bids will be received until Sept. 3 by the City Council for constructing about 4,200 lin. ft. 8 and 12-in. vitrified sewer pipe in portions of several streets. Rufus Brewer, City Clk.

Winfield, Kan.—The question of constructing lateral sewer system, is reported under consideration here.

Togus, Me.—Bids will be received at the office of the Treasurer, Eastern Branch, National Home for Disabled Volunteer Soldiers, Togus, until Sept. 10, for furnishing material, etc., for improving sewerage and drainage system, as advertised in The Engineering Record. Engineer, Geo. W. Fuller, 170 Bway., New York, N. Y.

***Norwood, Mass.**—Engineer Lewis D. Thorpe, Cornhill Bldg., Boston, writes that the lowest and successful bid opened on Aug. 23, for constructing sewers at Norwood was submitted by M. McDonough, of Swampscott, at the following bid: 8,500 cu. yds. earth excav., 8 ft. deep, 60 cts.; 200 cu. yds., 8 to 14 ft. deep, $1.25; 60 cu. yds., 14 to 20 ft. deep, $2; 20 cu. yds., 20 to 26 ft. deep, $3; 800 cu. yds. rock excav., 8 ft. deep, $4; 50 cu. yds., 8 to 14 ft. deep, $6; 10 cu. yds., 14 to 20 ft. deep, $8; 5 cu. yds, 20 to 26 ft. deep, $10; pipe laying, with cement joints: 1,050 ft., 24-in., 50 cts.; 200 ft. 20-in., 50 cts.; 5,100 ft. 15-in., 40 cts.; 275 ft. 12-in., 30 cts.; 1,800 ft. 12-in. 15-in. and 20-in. pipe laying, with sulphur joints, 50 cts.; 1,500 ft. 8-in. sub-drains, 40 cts., 1,000 ft. 6-in. sub-drains, 35 cts.; 3,900 ft. 16-in. c. i. pipe, 40 cts.; 100 cu. yds. concrete masonry, $5; 65 cu. yds. brick masonry, $10.00; 10 cu. yds. screened gravel, $2.50; 6,000 cu. yds. earth embkmt., 45 cts.; 200 lin. ft. spruce piles, 40 cts., and 4 M ft. spruce lumber, $40; total, $19,432. Totals of other bids: W. Shea, Quincy, $19,569; G. W. Bryne, Boston, $19,710; C. E. Trumble, Boston, $19,991; I. E. Palmer, Boston, $20,496; Chas. Gow Co., Boston, $20,529.

Springfield, Mass.—The City Council on Aug. 26 authorized the immediate construction of sewers in Long Hill, Carew and Armory Sts., at a cost of about $19,750.

***Detroit Mich.**—J. A. Mercier, Hammond Bldg., is reported to have secured the contract for 5 city sewers for $25,000.

St. Paul, Minn.—The Bd. of Pub. Wks. is reported to have received from the City Engr. preliminary estimate of the construction of the sewer system to connect the Warrendale system of sewage with that of South St., draining region about Lake Como, without the use of a sewage pumping plant; probable cost $26,000 to $35,000.

***Staples, Minn.**—O. F. Doyle, of St. Cloud, is reported to have secured the contract for constructing sewers (bids opened Aug. 15) for about $30,000. Engineer Oscar Claussen, of St. Paul.

New Ulm, Minn.—It is stated that bids will be received until September 3, by Ernst Wicherski, City Clerk, for constructing concrete sewer on Franklin St.

***Winnebago, Minn.**—The J. W. Turner Co. of Des Moines, Ia., is reported to have secured the contract for constructing sewers for $15,000.

Kansas City, Mo.—Bids will be received until Sept. 5 by E. A. Harper, City Engr., at the office of the Bd. Pub. Wks., for constructing sewers in District No. 299, 212 and 264, Divisions 2, 3 and 4 respectively.

Cape Girardeau, Mo.—Geo. E. Chappell, City Clk., writes that no bids were received on Aug. 19 for constructing proposed sewerage system in Dist. 1.

***Lewistown, Mont.**—Nelson J. Littlejohn is reported to have secured the contract for constructing a main sewer on 5th Ave. (bids opened Aug. 14) for $13,406.

Camden, N. J.—Bids will be received until Sept. 9 by the Bd. Freeholders (Geo. W. Whyte, Chmn.), for constructing a stone and brick culvert on Church Rd., Delaware Township.

***Westfield, N. J.**—L. Thompson, Town Clk., writes that the contract for constructing a trunk sewer from the sewage disposal works to a point near the Madison Hill Road, in Clark Township, a distance of about 2½ miles (bids opened Aug. 5) has been awarded to the New Jersey Contr. & Eng. Co., of Newark.

South Orange, N. J.—The Township of South Orange is about to construct its sewerage system to connect with the Joint Trunk Sewer, having purchased rights from the Township of Millburn and the Village of South Orange. The estimated cost of the sewers in South Orange Township is $150,000. Bids will be received until Sept. 17 for the construction of sewers in portions of the Maplewood and South Orange Heights Dists., as advertised in The Engineering Record. The construction in other districts will follow. The work will be put in under the supervision of Alex. Potter, Consulting Engr. of New York, N. Y. Edw. R. Arcularius, Township Clk.

Trenton, N. J.—Bids will be received until Sept. 3 by the Common Council for constructing sewers in portions of Whittaker Ave., Belvidere and Fowler Sts. Harry B. Salter, City Clk.

***Asbury Park, N. J.**—John L. Coffin, Supt. Dept. of Water and Sewers, writes that the contract for constructing sewers (bids opened Aug. 17) has been awarded to A. E. Marsden & Co., 21 West St., Utica, N. Y., as follows: Lake Ave. sewers, $6,750; ocean outlet, $4,900, and other sewers, $33,835; total contract, $45,488.

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrman, Pres.) until Sept. 5, for constructing a brick sewer in Van Cortlandt Park.

Olean, N. Y.—It is stated that bids will be received by the Common Council until September 6, for laying 10-in. vitr. pipe sewer in portion of N. 11th St. E. E. Allen, Supt. Streets.

Brooklyn, N. Y.—Bids will be received until Sept. 11 by Bird S. Coler, Boro. Pres., for furnishing material and constructing 12, 15. 18 and 24-in. pipe sewers and house connections in various streets including Ft. Hamilton Ave., 85th, 82d, Montgomery and 49th Sts.

Casselton, N. D.—See "Water."

***Toledo, O.**—It is stated that bids will be received by the Bd. of Pub. Service (Reynold Voit, Secy.), until September 3, for constructing sewers in portions of various streets. Frank I. Consaul, Ch. Engr.

Chagrin Falls, O.—The Walter P. Rice Eng. Co., of Cleveland, have completed and presented to the State Bd. of Health for approval, plans for a sewerage system and sewage purification plant for Chagrin Falls.

***Columbus, O.**—The following is the detail bid of the York Constr. Co., of Columbus, which recently secured the contract for constructing 20-in. sewage force main (bids opened July 10): 11,000 cu. yds. excav., 89 6/11 cts.; 170 sq. yds. repaving, brick, $1.75; 130 sq. yds. repaving, asphalt, $3; 100 lin. ft. curbing reset, 25 cts.; 100 cu. yds. brick masry., $10; 40 cu. yds. concrete, $9; 610 tons c. i. pipe, $41.25 5/61 cts.; 5 tons B. & S. specials, $90; 16 tons flange specials, $115; 9,000 lbs. misc. iron and steel, 6 cts.: total $39,915. Totals of other bids: W. C. Holliday, $39,024; S. T. Knight, Columbus, $53,735; and Baldwin Bros. & Graham, Cleveland, $54,885.

Cincinnati, O.—City Engr. Danenhower is reported to be preparing a survey for a system of storm water sewers south of Liberty St., and between Broadway and Central Ave.

***Port Clinton, O.**—Frank Richardson, of Port Clinton, is reported to have secured the contract for constructing sewers in Dist. 10 (bids opened Aug. 19) for $–,642.

Lakewood, O.—Bids will be received until Sept. 3 by B. M. Cook, Village Clk., for furnishing material and constructing a sewer of vitr. pipe in Park Row. Wm. H. Evers, Eng. Co. Engrs., 237 The Arcade, Cleveland.

Philadelphia, Pa.—Bids will be received by Geo. R. Stearns, Dir. Dept. Pub. Wks., until Sept. 11, for bridges, main sewers, branch sewers, inlets and Pine St. sewer, as advertised in the Engineering Record.

Bids will be received until Sept. 17 by Geo. R. Stearns, Dir. Dept. Pub. Wks. for sewer connecting Upper Roxborough, filters as per contract No. 132.

Rankin, Pa.—The Boro. Council is reported to have passed an ordinance providing for the issue of $50,000 bonds, for enlarging municipal building, erecting a garbage furnace and making street and sewer improvements.

***Mahanoy City, Pa.**—John Cunningham, of Mahanoy City, is reported to have secured contract to build a sewer on 2d St., for $7,000.

Lancaster, Pa.—The City Council has passed the ordinance, directing the Special Sewer Comn. to prepare plans for a system of sanitary sewers. I. Carpenter, City Engr.

***Baden, Pa.**—L. F. Northrup, Secy. Boro. Council, writes that the contract for constructing sewerage system (bids opened August 26) has been awarded to Thos. Sweeney Co., 4906 Cypress St., Pittsburg, for $10,545.

Madison, S. D.—Irwin D. Aldrich, of Spearfish, Secy. Regents of Educ., writes that no bids were received on Aug. 12 for constructing a sewerage system at the Madison Normal School, Madison.

Ennis, Tex.—Press reports state that the Ennis Sewerage Co. is about to begin the construction of a sewerage system.

Seattle, Wash.—It is stated that bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., until September 7, for the construction of the Green Lake Dist. of the North Trunk sewer.

Chippewa Falls, Wis.—It is stated that bids will be received until Sept. 3 by the Bd. Pub. Wks. (Geo. B. McCall, Chmn.) at the office of the City Clk., for constructing a sewer in a portion of Main St.

BRIDGES.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—See "Electric Railways."

Leadville, Colo.—G. Houston, Deputy State Engr., Denver, writes that bids will be received on Sept. 13 for an 80-ft. concrete bridge at Leadville.

Greeley, Colo.—G. Houston, Deputy State Engr., Denver, writes that bids will be received on Sept. 20 for constructing reinforced concrete bridge 135 ft. long at Greeley.

Palatka, Fla.—The Bd. of County Cmrs. at Putnam are stated to have under consideration the construction of a bridge over the St. Johns River from Hogeye Point to East Palatka; probable cost, $60,000.

Caldwell, Idaho.—The San Francisco, Idaho & Montana Ry. Co. is preparing preliminary plans for a 150-ft. crossing over Snake River at Homedale. Six 125-ft. spans will be used. Bids will probably be called for early in Sept. F. H. Richardson, Ch. Engr. and E. R. Place, Gen. Mgr.

***Chicago, Ill.**—The contract for constructing sub and superstructure of bridge over north branch of Chicago River at Kinzie St. (bids oened Aug. 20), has been awarded to the Great Lakes Dredging & Dock Co., Chamber of Commerce Bldg. for $14,140.

Anderson, Ind.—The Indiana Union Traction Co. (H. A. Nicholl, Gen. Mgr.) is reported to have ordered surveys for the construction of a steel bridge over White River west of Chesterfield.

Indianapolis, Ind.—The County Comrs. are stated to have ordered surveys and plans for the construction of 2 concrete arch bridges over Fall Creek—one at Delaware St. and another at Capital Ave.

Mt. Carmel, Ind.—The Big Four and Southern Ry. Co. (W. H. Wells, Engr. Const., Washington, D. C.) is stated to have ordered plans for the construction of a joint bridge over the Wabash River at Mt. Carmel.

South Bend, Ind.—The Comrs. of St. Joseph County at South Bend have decided to construct 4 reinforced-concrete culverts; spans 12 to 30 ft.

Crown Point, Ind.—It is stated that bids will be received until Sept. 3 by Chas. A. Johnson, Co. Aud., for constructing an iron bridge, with concrete and tubular abutments, steel backing, etc., over the Cady Marsh Ditch.

Des Moines, Ia.—The following are the bids opened on Aug. 20 by the Bd. of Pub. Wks. for constructing reinforced-concrete highway bridge across Des Moines River at its intersection with Locust St.; N. M. Stark & Co., $142,650; Cook Constr. Co., $128,963, Marsh Bridge Co., $124,800 (bidders all of Des Moines).

Baltimore, Md.—Bids will be received until Sept. 4 by the Bd. Award (J. Barry Mahool, Pres.) for structural steel in trusses, for Merryman's Lane Boule. Bridge over Stony Run. B. T. Fendall, City Engr.

***Millbury, Mass.**—Fred W. Moore, Chmn. Bridge Com., writes that the Berlin Constr. Co. of Berlin, Conn., has contract for constructing bridge over Blackstone River at S. Main St

Medford, Mass.—Bids will be received until Sept. 3 by Clifford M. Brewer, Mayor, for constructing a foot-bridge of reinforced concrete over the B. & M. R. R. tracks from Pembroke to Washington Sts.

Springfield, Mass.—Bids will be received by the City Treas., until Sept. 3 (extension of date), for the superstructure for a steel bridge over the Boston & Maine R. R. on line of Abbe Ave., with clear span of 178 ft. 6 in., 24 ft. roadway, and one 6 ft. sidewalk; also complete construction of concrete-steel structure over Mill River on line of Peconsic Ave., clear span 24 ft., length 100 ft., as advertised in The Engineering Record. Chas. M. Slocum, City Engr.

Duluth, Minn.—Estimates are stated to have been submitted to City Council as follows, by the City Engineer for the construction of a bridge across the Lester River, a two-span riveted girder bridge, $11,500; for a combination wood and steel span using the iron from the old Grand Ave. bridge, $6,000; for a concrete bridge, $16,800.

Vicksburg, Miss.—Bids will be received by H. J. Trowbridge, City Clk., until Sept. 16 for 2 reinforced-concrete bridges, each to require about 100 cu. yds. of concrete. Engineer, Walter G. Kirkpatrick, of Jackson.

Natchez, Miss.—It is stated that bids will be received by Jas. S. Fleming, Pres., until Sept. 3, for construction of 2 modern steel bridges, one over Second Creek at the Old Jersey Ford, and the other over Meabin's Creek at the Washington and Palestine Road.

Warrensburg, Mo.—It is stated that bids will be received by David Mohler, Co. Bridge and Road Comr., until Sept. 4, for constructing various steel bridges.

Dunbar, Neb.—Bids will be received until Sept. 13 by the Bd. Co. Comrs., at Nebraska City, for constructing a 50-ft. steel bridge, to have 14-ft. roadway, set on 30-in. steel tubes, 22-ft. long, with 12-ft. aproaches, about 7 miles north of Dunbar. Chas. H. Busch, Co. Clk.

Newark, N. J.—Bids will be received until Sept. 3 by the Co. Park Comn. (A. Church, Secy.), for constructing a concrete bridge at West Side Park.

Smith's Landing, N. J.—It is stated that bids will be received by the Bridge Comn. (Frank Enderlin, Chmn.)

* *Items marked thus give the names of parties awarded contracts.*

at the Co. Bd. of Chosen Freeholders, until Sept. 4, at the County Asylum, Smith's Landing, for constructing 2 highway bridges.

Carlsbad, N. M.—The Probate Clerk at Carlsbad writes that it is proposed to construct 2 bridges across Pecos Rives, 1 near Artesia and the other at Carlsbad; cost about $22,000.

Lorain, O.—It is stated that bids will be received by the Bd. of Co. Comrs. at Elyria (Chas. Chandler, Clk.), until Sept. 13, for constructing bridges, etc.

Newark, O.—It is stated that bids will be received by the Co. Comrs. until Sept. 3, for constructing 4 steel bridges. J. L. Gilpatrick is Co. Aud.; also until Sept. 23 for constructing a 105-ft. span riveted steel truss bridge.

Troy, O.—Bids will be received until Sept. 14 by the Bd. Co. Comrs., for $50,000 bonds to be issued for the purpose of providing means to pay for the material for and the construction of bridges in this county. E. E. Pearson, Co. Aud.

Tiffin, O.—Bids will be received by the Co. Comrs. until Sept. 20 for repair of Ferry St. bridge in City of Tiffin; estimated cost $7,500.

Youngstown, O.—See "Paving and Roadmaking."

Cleveland, O.—The following are the bids opened on Aug. 21 by the Bd. of Pub. Service for constructing superstructure of Kinsman Road viaduct over the Pennsylvania R. R. tracks: (*a*) 1,395 tons steel and iron in place, per ton; (*b*) totals: The Cowing Eng. Co., Cleveland, *a* $74, *b* $103,230; Van Dorn Iron Wks., Cleveland, *a* $77, *b* $107,415; King Bridge Co., Cleveland, *a* $77.80, *b* $108,531; the Strobel Steel Constr. Co., Chicago, Ill., *a* $82.30, *b* $114,808; Interstate Eng. Co., Bedford, *a* $82.80, *b* $115,506; Toledo-Massillon Bridge Co., Toledo, *a* $84, *b* $117,180; McClintic-Marshall Constr. Co., Pittsburg, Pa., *a* $89.80, *b* $125,271 W. J. Carter, City Engr.

Panama.—The following are the bids opened on Aug. 28 at the office of the Isthmian Canal Comn., at Washington, D. C., for furnishing a steel railroad bridge over Chagres River at Gamboa Canal Zone: Cowing Eng. Co., Citizens Bldg., Cleveland, O., $82,086; delivery at New York to begin Jan. 1, 1908, and end Apr. 1, 1908; R. C. Hoffman Co., Baltimore, Md., $77,287; delivery at New York to begin Jan. 1, 1908, and end Sept. 1, 1908; Inter State Eng. Co., Bedford, O., $85,847; delivery at New York to begin Jan. 1, 1908, and end Apr. 1, 1908; receivers for Milliken Bros., 11 Bway., New York, N. Y., $73,300; New York delivery to begin Jan. 1, 1908, and end Apr. 1, 1908; Penn Bridge Co., Beaver Falls, Pa.; delivery at New York, $59,600, and at New Orleans, La., $62,700, to begin Feb. 1 and end Apr. 1; U. S. Steel Products Equpt. Co., New York, N. Y. $62,000. New York delivery to begin Feb. 10, 1908, and end Apr. 10, 1908.

Philadelphia, Pa.—See "Sewage and Sewage Disposal."

**Pateros, Wash.*—The State Highway Bd. at Olympia on Aug. 16 is stated to have awarded the contract for constructing a bridge over Methow River to J. W. Quigg, at $13,754

Appleton, Wis.—Plans ar stated to have been completed by the Northwestern R. R. Co. for the construction of a bridge over Fox River, at a cost of $30,000. E. C. Carter, Ch. Engr., Chicago, Ill.

Ottawa, Ont.—It is stated that bids will be received by P. E. Ryan, Secy. Transcontinental Ry. Comn., until Sept. 5, for constructing superstructure and floor systems for bridges. The following points in District B, west of Quebec: Grand Bras d'Arms; Lachevrotiere River; Nigerette; Tawachiche River; Roberge Creek; River des Eaux Mortes. Viaduct of River du Milieu; 1st Brochet River; 2d Brochet River; 3d Brochet River; 4th Brochet River; 5th Creek a Beauce; Overhead Crossing, Quebec and Lake St. John Ry.; Little Bostonnais; Big Bostonnais; Croche River; River au Lait; and St. Maurice River.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Florence, Ala.—It is stated that bids will be received by J. B. White, City Clk., until Sept. 3, for laying cement sidewalks on Tennessee St., Royal Ave. and Huntsville Road.

Athens, Ala. Road improvement bonds amounting to $135,000 are reported sold.

Mobile, Ala.—The paving of Royal, St. Joseph, Government, Dauphin and Warren Sts. with wooden block is reported under consideration.

Tuscaloosa, Ala.—The following are the bids opened Aug. 9 by the Bd. of Aldermen and Mayor for about 12,000 yds. of sidewalk construction: John Bigler, Bessemer, 88½ cts.; Byron-Saunders Co., Montgomery, 89¼ cts.; Georgia Pavement & Constr. Co., $1.14; West Constr. Co., $1.08; H. Laferty Co., Birmingham, 95 cts.; Tuskaloosa Concrete Co., 98 cts.; G. C. Engsfeldt Co., Birmingham, 87½ cts.; Columbia Concrete Co., Columbus, Miss., 95 cts (price given per sq. yd.).

De Land, Fla.—Bids will be received until Sept. 9 by E. D. McLeod, City Clk., for constructing about 5,000 lin. ft. sidewalks

**Springfield, Ill.*—The Capitol City Concrete Co. has received the contract for paving of Walnut St. with asphalt at $1.90 per sq. yd. for paving and 55 cts per lin. ft. for combined curb and gutter (bids opened Aug. 26).

Champaign, Ill.—Bids will be received until Sept. 6 by the Bd. Local Improv. (G. C. Fairclo, Secy.), for grading, curbing, draining and paving with asphalt on Daniel St. Approximate quantities: Excav., 5,950 cu. yds; 8,320 sq. yds asphalt paving on concrete found.; 5,700 lin. ft. combined curb and gutter; 442 lin. ft. retaining and false curb; 40 gutter plates; 12 catch basins; 1,820 lin. ft. 8 in. v. c. pipe.

Downers Grove, Ill.—Bids will be received until Sept. 3 by the Bd. Local Improv. (J. W. Hughes, Chmn.) for constructing a macadam pavement in this village. H. G. Bunge, Attorney, 203 Security Bldg., Chicago.

Freeport, Ill.—Bids will be received until Sept. 5 for macadamizing 5th Ave., Home and American Sts., including sandstone curb and brick gutter, as advertised in The Engineering Record; estimated cost, $75,000. G. W. Graham, City Engr.

Rockville, Ind.—It is stated that bids will be received until Sept. 5 by H. A. Henderson, Co. Aud., for constructing gravel roads in Raccoon, Union and Washingtown Township; also until Sept. 20, for constructing a macadam road on the county line between Jackson and Howard Township.

Bloomfield, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Sept. 3 for the construction of a gravel and macadamized road in Richland Township, known as the Lucas Rd. Peter M. Cook, Co. Aud.

Washington, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 7 for the construction of 2 gravel roads, known as the Walker Rd. and the Barber Rd. Thos. Nugent, Co. Aud.

Columbus, Ind.—The County Surveyor is reported to have completed surveys for 3 gravel roads in Wayne Township, aggregating 5½ miles. Bids will soon be received, according to reports.

Indianapolis, Ind.—Bids will be received until Sept. 6 by the Bd. Street and Water Comrs. (Geo. T. Bouon, ing a portion of Meridian St. with creosoted wooden blocks, and paving with asphalt a portion of Arsenal Ave.

Peru, Ind.—Chas. Griswold, Co. Aud., writes that bids will be received on Sept. 14 for grading, draining and paving 23½ miles of gravel road in Richland Township; probable cost, $38,000 to $40,000.

Sullivan, Ind.—It is stated that bids will be received by the Bd. Co. Comrs. (L. O. Turnbull, Chmn.) until Sept. 3 for constructing 22,515 ft. gravel roads. E. E. Russell, Co. Aud.

Mt. Vernon, Ind.—It is stated that bids will be received until Sept. 5 by Silas G. Howard, Co. Aud., for constructing a road 2 miles long.

Lafayette, Ind.—Bids will be received until Sept. 4 by the Bd. Pub. Wks. (E. H. Andress, Jr., Clk.) for constructing a gravel roadway, with brick gutters and cement sidewalks, on a portion of 20th St.

South Bend, Ind.—Bids will be received Sept. 3 for 5,000 sq. yds. of Brick paving. A. J. Hammond, City Engr.

**Iowa City, Ia.*—O. J. Slater City Clk. writes that contracts for paving (bids opened Aug. 21) have been awarded as follows:

*To Wm. Horrabin, of Iowa City, for paving E. Burlington, Van Buren and Bowery Sts. as follows: 4,260 sq. yds. excav., 40 cts.; 11,028 sq. yds. Purington-Galesburg brick, $1.76; 7,075 lin. ft. concrete curb and gutter, 55 cts. and curb reset 40 cts.: total $25,065. Mike Ford of Cedar Rapids, bid for this work using Des Moines brick, $25,224.

*To Lehman & Bradley, Iowa City, for paving Johnson St., as follows: 1,780 cu. yds. excav., 30 cts.; 5,393 sq. yds. Oskaloosa brick, $1.62½; 3,647 lin. ft. concrete curb and gutter, 50 cts.; total $11,121. Totals of other bids for this work: Mike Ford, Cedar Rapids, $12,285 and Wm. Horrabin, of Iowa City, $11,347. Lehman & Bradley also secured contract for paving Brown St. with macadam at $2,324.

**Waterloo, Ia.*—W. A. Bryant & Sons Co. are reported to have secured the contract for paving with asphalt Iowa, Webster and Franklin Sts., at $1.87 per sq. yd.

**Mason City, Ia.*—The contract for paving 8th and E. 6th Sts. with brick is reported to have been awarded to Geo. Gatler at $2.20 per sq. yd.

**Cedar Rapids, Io.*—M. Ford, of Cedar Rapids, is reported to have received the contract for paving with brick portions of Washington and Beaver Aves. and 5th St., at $1.48 per sq. yd.

Paola, Kan.—It is stated that bids will be received until Sept. 3 by E. D. McLaughlin, City Clk., for grading and paving Gold, Walnut and Castle Sts.

Neodesha, Kan.—Bids will be received until Sept. 5 by J. J. Carroll, City Clk., for furnishing material and constructing brick paving and concrete curb for said city. Burns & McDonnell, Engrs, 709 Dwight Bldg., Kansas City, Mo.

Kansas City, Kan.—The Wyandotte County Comrs. are stated to have authorized the County Clerk to receive bids for paving Parallel Road and Kansas Ave.; also to resurface Shawnee Road. Cost of improvements is estimated at $30,000.

Lonaconing, Md.—Bids will be received until Sept. 6 by the Co. Road Dirs. (Clinton Uhl, Chmn.), at Cumberland, for grading and macadamizing about ¾ of a mile of the public highway between Lonaconing and Midland, known as the Midland Road.

Medford, Mass.—Bids will be received until September 3 by the Mtropolitan Park Comm., 14 Beacon St., Boston (Wm. B. De Lascasas, Chmn.), for grading surfacing and other work at Middlesex Fells Parkway Extension, Medford. The estimate of the work to be done is approximately as follows: 30,000 cu. yds. earth grading; 6,500 cu. yds. rock excav.; 3,225 lin. ft. pipe drain of the following sizes:10, 12, 15, 18 and 24-in; 2,000 lin. ft. 6-in. pipe underdrain; 45 concrete catchbasins and manholes; 250 sq. yds. cobble stone gutters; 325 lin. ft. straight edgestone; 450 lin. ft. curved edgestone; 4,500 cu. yds. loam surfacing; 4,000 cu. yds. loam to be furnished by contractor; 8,000 sq. yds. gravel roadway surfacing; 10,500 sq. yds. walk surfacing; 1 reinforced concrete culvert, 6-ft. x 4-ft. x 64-ft. 10-in. in length; 1 reinforced concrete culvert 4-ft. x 4ft. x 137ft. 9-in. in length.

Boston, Mass.—Bids will be received until September 3 by the Highway Comm. (W. E. McClinlock, Chmn.), 15 Ashburton Pl., Boston, for constructing State Highways in the following towns: Length given to be approximate only: Swansea, 5,800 ft.; Palmer, 9,100 ft.; Franklin, 3,500 ft.; Dracut, 3,200 ft.; Dover, 6,200 ft.

**Muskegon, Mich.*—Clifford S. Gamble, City Engr., writes that the Cleveland Trinidad Paving Co., of Cleveland, O., has secured the contract for paving Western Ave. with macadam, using stone curb, at $49,856. The work will comprise: 4,707 ft. sewer, 16 manholes, 66 inlets and relaying 55 yds. pavt.; bridge over Ryerson Creek; 2,400 cu. yds. sand fill.; 8,340 lin. ft. stone curb, 5x18 in.; and 19,024 sq. yds. pavt., complete, on 6-in. Portland foundation, 2½-in. surface.

Lansing, Mich.—City Engineer Collar is reported to have estimated the cost of paving Washington Ave. at $12,836.

St. Paul, Minn.—It is stated that bids will be received by the Bd. of Co. Comrs until Sept. 6 for the improvement of Larpenteur Ave. Edw. G. Krahmer is Co. Aud.

Minneapolis, Minn.—The construction of a boulevard around Lake Minnetonka is reported under consideration by the Park Bd.

Kansas City, Mo.—Bids will be received until Sept. 5 by E. A. Harper, City Engr., at the office of the Bd. Pub. Wks., for furnishing material and constructing asphalt pavement on Lydia Ave., asphalt oil macadam on 39th St. and W. Prospect Pl., and constructing vitrified brick pavement on 21st St.

**Kansas City, Mo.*—The contract for macadamizing 4½ miles of road from Blue Springs to Tarsney, is reported to have been let by the County Court to Davidson Bros. for $19,760.

Fulton, Mo.—The City Engineer writes that all bids opened on Aug. 20 for about 7,000 sq. yds. brick paving have been rejected as being too high. New bids will probably not be called for before spring.

Omaha, Neb.—Bids will be received until Sept. 3 by Dan B. Butler, City Clk., for paving portions of 6 streets with asphalt, stone, vitrified brick, vitrified brick block, artificial stone and macadam.

Jersey City, N. J.—Bids will be received until Sept. 3 by the Bd. Street and Water Comrs. (Geo. T. Bonton, Clk.) for improving the following streets. quantities being approximate only: Monticello Ave., 2,512 sq. yds. Belgian pavt., 2,062 sq. ft. flagging, etc.; Neptune Ave., 1408 sq. yds. Belgian pavt., etc.; Morgan St., 2,450 sq. yds. repaving, etc.

*The City Council is reported to have awarded the contract for improving a portion of W. 41st St. to the Uvalde Asphalt Co., 2 Greene St., at $11,967.

Orange, N. J.—Bids will be received until Sept. 9 by Edwd. Cheetham, Chmn. Com. on Streets, for macamadizing, curbing and flagging a portion of Tremont Ave.

Bayonne, N. J.—Bids will be received by the City Council (W. C. Hamilton, City Clk.) until Sept. 3, for paving Andrew and W. 43d Sts. with asphalt, about 5,130 sq. yds., and 2,800 ft. curb reset, as advertised in The Engineering Record. F. W. Dalrymple, City Engr.

**Wildwood, N. J.*—Evan G. Slaughter, Chmn. Street Com., writes that the contract for constructing 40,000 sq. yds. macadam streets, with cement gutter bids opened Aug. 13) has been awarded to Geo. W. Banks, of Wildwood.

Monroe, N. Y.—Bids will be received until Sept. 5 by the Bd. of Village Trus. for constructing about 11,000 sq. ft. cement sidewalk and about 1,400 lin. ft. curbing. Fred. J. Knight, Engr., Monroe; T. F. B. Carpenter, Village Clk.

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrman, Pres.) until Sept. 5, for furnishing and setting curbstones, providing the necessary drainage, paving with asphalt blocks the carriageway, and with rock asphalt mastic the sidewalks, and otherwise improving the semicircle at the entrance to Central Park at 66th St. and Central Park W.

Brooklyn, N. Y.—Bids will be received until September 11 by Bird S. Coler, Boro. Pres., for paving with asphalt and constructing sidewalks on several streets, including Christopher Ave., E. 32d to 93d, and 73d Sts., Kenilworth and Kossuth Places.

**Rochester, N. Y.*—The Bd. Contract & Supply is stated to have awarded contracts for paving as follows: Whitmore, Rauber & Vicinus, 279 South Ave., Atlantic Ave., $10,491; Culver Road grading $6,544 and to Julius Friedrich, 29 Frederick Park, for paving at $11,605.

Herkimer, N. Y.—The paving of N. Washington Green, Mary and Court St., is reported contemplated, at a cost of $30,103.

**Utica, N. Y.*—The Common Council is reported to have awarded contracts for paving as follows: Barber Asphalt Paving Co., 131 Broad St., Belmont Ave., $1,873; Salina St., $2,077, and Lansing St., $9,519.

*The bid of John R. Baxter, Jr., for paving a portion of Jay St. with Mack block is reported recommended for acceptance, at $9,351.

Cortland, N. Y.—The Bd. of Pub. Wks. is reported to have decided to pave Homer Ave.

Cleveland, O.—Bids will be received by the Bd. Co. Comrs. (Julius C. Dorn, Clk.), until Sept. 21 for furnishing material and repaving Wooster Pike, in Middleburg and Strongsville Townships, requiring 750 cu. yds., hank sand, 150,000 second quality 4-in. brick, 800 cu. yds. 2-in. crushed stone or slag, 325 bbls. Portland cement. A. B. Lea, Co. Surv.

**Columbus, O.*—The Bd. Pub. Service is reported to have on Aug. 22 awarded contracts for paving as follows: (*a*) Wheatland Ave, (*b*) Collins Ave, (*c*) Fairwood Ave., (*d*) Ogden Ave., (*e*) Hunter Ave., (*f*) 9th Ave., (*g*) Highland St., (*h*) 13th Ave.: N. B. Abbott, 85 N. High St., *b* $6,709, *c* $19,927, *e* $8,641, *f* $4677; *g* $8,024; Buckeye Engineering & Contr. Co., *b* $6,503; and D. E. Sullivan & Son, 1232 N. High St., *a* $13,554, *d* $10,536.

Bids for paving with asphalt Linwood Ave. is reported to have been opened by the Bd. Pub. Service as follows: Cleveland Trinidad Paving Co., Rose Bldg., Cleveland, $27,603; and A. G. Pugh, Dispatch Bldg., 4 bids, ranging from $26,113 to $26,571. Engineer's estimate on improvement is $25,352.

Cleveland, O.—Bids will be received until Sept. 20 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.) for paving Montgomery Pike, as per specification No. 668.

Portsmouth, O.—The Bd. of Pub. Service will receive bids until Sept. 4 for paving with vitr. brick on a Portland cement concrete foundation, Lincoln and Prospect Sts., to comprise: 6,939 sq. yds. paving; 1,880 lin. ft. curb; 440 lin. ft. sewer pipe, 24-in; 120 lin. ft. of 15-in., and 54 lin. ft. 12-in., with 5 manholes and 17 catch-basins. R. A. Bryan, Engr., Street Paving Dept.

Items marked thus give the names of parties awarded contracts.

Bellevue, O.—Contracts for paving with Metropolitan brick (bids opened Aug. 10) have been awarded as follows (Engineer, John C. Overmeyer, of Fremont):

To Lee & Griggs, of Clyde, for paving Euclid Ave. as follows: 2,070 cu. yds. excavation, 30 cts.; 2,370 lin. ft. straight curb, 37 cts.; 76 lin. ft. circular curb, 53 cts.; 84 lin. ft. headers, 35 cts.; 3,300 sq. yds. paving on 6 in. crushed stone on 2 in. sand fill., $1.33.

To the Modern Constr. Co. of Fremont, for paving Castalia St. as follows: 7,115 cu. yds. excav., 35 cts.; 6,882 lin. ft. straight curb, 42 cts.; 133 lin. ft. circular curb, 45 cts.; 198 lin. ft. header curb, 40 cts.; 11,959 sq. yds. paving on 8 in. foundation, sand cushion and sand fill., $1.39.

Sandusky, O.—W. S. Pace, of Mansfield, has secured contract to pave Monroe St. with Metropolitan block, about 30,000 sq. yds., and A. G. O'Donnell for paving Lawrence and Osburne Sts. with Metropolitan blk., 7,200 yds., on concrete foundation, stone curb and asphalt fill.

Marietta, O.—It is stated that bids will be received by the Co. Comrs. until Sept. 12, for grading, etc., portion of Marietta-Barlow Rd. J. M. Williams, Co. Aud.

Wilmington, O.—It is stated that bds will be received until Sept. 5 by the Co. Aud., for constructing a macadam pavement for Road Improvement No. 110.

Cincinnati, O.—Bids will be received until Sept. 20 by the Bd. Co. Comrs. (Fred. Druhs, Clk.) for improving Montgomery Pike, from south corporation line to north corporation line of Hamilton Co., Clumbia, Sycamore and Symes Townships, as per specification No. 668; also until Sept. 13 (readvertisement), for improving Reading Pike, Sycamore Township, as per specification No. 669.

It is stated that bids will be received by the Bd. Pub. Service (M. J. Keefe, Clk.) for constructing asphalt and macadam pavements on portions of 3 streets.

Toledo, O.—Bids for repaving portion of Norwood Ave. are reported to have been opened by the Bd. of Pub. Service as follows: Ohio Paving Co., vitrified brick with grout filler, $19,719; with asphalt filler, $21,564. James Sheehan, Big Four vitrified brick with grout filler, $20,876; asphalt filler, $22,072.70. Cleveland Trinidad Paving Co., asphalt over whole street, $23,585, with brick between the street car rails, $2,000 less. Henry P. Streicher, bitulithic, $28,879.

The following bids were reported opened for paving Phillips Ave.: (*a*) on concrete, (*b*) stone base: Garrigan Bros., *a* $42,549, *b* $36,137. Ohio Paving Co., *a* $51,117, *b* $44,265. John McMahon, *a* $41,972, *b* $35,560 and H. P. Streicher Co., *a* $37,642, *b* $31,551.

It is stated that bids will be received until Sept. 3 by the Bd. Co. Comrs. (J. W. Kerr, Chmn.) at the office of the Co. Aud., for grading, draining, bridging and macadamizing Otter Creek Rd.

Kent, O.—Bids will be received by T. A. McMahon, City Clk., until Sept. 7 for 9,247 sq. yds. block paving 4,041 lin. ft. straight curb, 297 lin. ft. circ. curb, rock excav, etc., as advertised in The Engineering Record.

Youngstown, O.—The Capitol Constr. Co. of Columbus, is reported to have secured the contract for reflooring the Lowellville Bridge for $5,687.

Rankin, Pa.—See "Sewerage and Sewage Disposal."

Pittston, Pa.—Edward Healey is reported to have secured the contract for paving S. Main St. with Mack brick for $6,59.

Huntingdon, Pa.—H. B. Ahrens & Sons, of Lewistown, are reported to have received the contract to build 2 miles of state road in Brandy Township, Huntingdon County; cost $17,000.

Ebensburg, Pa.—The Borough Council is reported to have passed an ordinance providing for the paving of Julian, Horner and Sample Sts.

Media, Pa.—The City Council is reported to have decided to pave with brick a portion of Front St.

Palestine, Tex.—S. Allen, City Secy., writes that the citizens on August 20 voted to issue $50,000 bonds for paving.

El Paso, Tex.—Bids will be received until Sept. 9 by the Comrs. Court, for furnishing material and constructing a macadam road along what is known as the county road. A. S. Eylar, Co. Judge.

Marshall, Tex.—H. S. Rice, City Secy., writes that all bids opened on Aug. 14 for constructing about 22 miles of sidewalks have been rejected. No date yet set for the receiving of new bids.

Ogden, Utah.—The City Council is reported to have awarded the contract for paving a portion of Wall St. to P. J. Moran, of Salt Lake City, for $19,452.

Tacoma, Wash.—W. H. Hicker is reported to have secured the contract for street grading in Badgerow addition, for $9,299.

Wheeling, W. Va.—The opening of the Tap Mill Road at the northern extremity of the city of Wheeling, is to be jointly undertaken by the County of Ohio, the city of Wheeling, the Wheeling Steel & Iron Wks., the Pan Handle Traction Co., and the Pennsylvania Ry. Co., operating the P. W. & Ky. Ry. They have each appropriated $8,000, making a total of $40,000, to do the work proposed. The work consists of excavating and removing large quantities of loose and solid rock which have slid down on the street and have been accumululating for several years; building concrete retaining and face walls, and about 5,000 sq. yds. of brick paving. The work is to be let by contract at once. Herman L. Arbenz is County Engr. Chas. Cooke, City Engr.

Ashland, Wis.—The Bd. Pub. Wks. is reported to have opened bids Aug. 22 as follows for paving with asphalt 7th St.: Barber Asphalt Paving Co., $39,218 and Andrews Constr. Co., $39,860.

Oshkosh, Wis.—The Barber Asphalt Paving Co. is reported to have submitted the only bid Aug. 17 for the paving with asphalt a portion of Church St., at $2.33 per sq. yd.

Milwaukee, Wis.—The construction of a boulevard from Juneau Park to the river is reported contemplated by the Metropolitan Park Commission.

Milwaukee, Wis.—The Barber Asphalt Paving Co. is reported to have secured the contract for paving with asphalt a portion of Broadway at $2.36 per sq. yd.

Janesville, Wis.—C. V. Kerch, City Engr., writes that with regard to bids to be received by the Street Assessment Com. (S. B. Heddles, Chmn.) until Sept. 6, for paving with brick, that the work consists of paving Lincoln School and City Hall Alleys and a portion of E. Milwaukee St., aggregating 4,182 sq. yds.

Ottawa, Ont.—The Barber Asphalt Co. is reported to have secured the contract for paving with asphalt a portion of Murray St. for $10,100.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—At a meeting of City Council on Aug. 19 a petition was presented by the Etowah Light & Power Co. asking for a franchise to enter this city for the purpose of selling light and power.

Redondo, Cal.—The War Dept. is reported to have granted to the Los Angeles Wave Power & Electric Co. (Fred. Starr, of Los Angeles, Pres.) all necessary rights and privileges for the establishment of a plant here.

Downieville, Cal.—Richd. Phelan is reported to be promoting the construction of a power plant at Denton on Feather River, and a new railroad through the Yuba Pass connecting Maryville and Oakland. A 10-ft. dam is to be constructed at the mouth of Gold Lake and the water piped down Gray Eagle Creek to the power plant. It is expected that 20,000 h.p. will be generated.

Pasadena, Cal.—The Electric Light & Supplies Com. of City Council is stated to have decided to enlarge the municipal electric lighting plant by the adding of 150 lamps, 50 to be arcs and 100 incandescents of 32 c.p. C. C. Glass, Mgr.

Etna Mills, Cal.—It is stated that the proposition is being agitated to bond the town for the purpose of buying the water works, installing a sewer system and acquiring a source of electricity for light and power purposes.

Washington, D. C.—Bids will be received until Sept. 3 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the navy yards and naval stations a quantity of supplies as follows: Norfolk, Va.: Sch. 226—Incandescent lamps; rubber-covered weatherproof, duplex telephone, and magnet wire, conduits, steel conduit iron poles, break-arms, electrical material, iron poles, etc. Charleston, S. C.: Sch. 230—Electrical supplies. Washington, D. C.: Sch. 226—Electrical instruments. Also until Sept 17: Mare Island, Cal.: Sch. 254—Incandescent lamps, carbons, dry battery cells, electrical supplies, etc. Sch. 256—Windlasses for arc lamp service. Puget Sound, Wash.: Sch. 252—Thermostat coils. Applications for proposals should designate the schedule desired by number. E. B. Rogers, Paymaster Genl., U. S. N.

Jacksonville, Fla.—Bids will be received until Oct. 4 by the Bd. of Trus. for the Water Works and Improvements Bonds, addressed to D. F. Dillon, Chmn., for furnishing, set up in running order on foundations furnished by the Bd., in the electric light station, one 1,500-kw. steam turbo-generator, a 50-kw. motor-driven exciter. Turbine to be run condensing steam pressure at boiler 150 lbs., no superheat, 27-in. of vacuum. Generator to be of the revolving-field type, 3-phase, 60-cycle, 2,300 volts. Bidders must furnish detail blueprints of the machinery they propose furnishing, with complete specifications and guarantee of efficiency. For further information apply to R. N. Ellis, Supt.

Chicago, Ill.—Bids will be received by Wm. Carroll, City Electrician, until Sept. 3, for furnishing the department of electricity with about 2,500 alternating current series arc lamps, 10 single-phase, 60-cycle, oil-insulated, self-cooled, step-down transformers, and 50 inductive regulators.

Clay City, Ind.—J. H. Bence, Town Clk., writes that the town would grant franchise for electric lighing plant to responsible parties.

Plymouth, Ind.—It is reported that improvements are contemplated at the Plymouth Electric Light Plant, at a cost of $10,000. Day service it is stated will be established if the city will extend its franchise and contract. C. D. Snoeberger, Pres.

Davenport, Ia.—It is reported that the Independence Power & Light Co. will erect a concrete power station, 54x168 ft.

Baltimore, Md.—The Bd. of Awards on Aug. 21 approved specifications for about $200,000 worth of municipal street lighting. Supt. of Lamps and Lighting McCuen, it is stated, will soon ask bids for the following work: Supplying incandescent burner and mantle equipment for street gas lights; equipment for naphtha and gasoline lamps; supplying illuminating gas for all street gas lamps.

Baltimore, Md.—Bids will be received until Sept. 4 at the Treas. Dept. (J. B. Reynolds, Acting Secy.), Washington, D. C., for manufacturing and placing in position in complete working order, in the new U. S. Custom House, Baltimore, Md., certain combination gas and electric light fixtures.

Marlboro, Mass.—The Marlboro Electric Co. (L. P. Howe, Mgr.), is reported to have been granted permission to issue $170,000 additional capital stock, and intends making improvements to its plant.

Biloxi, Miss.—The City Council is stated to have on Aug. 20 awarded to the Gulfport & Mississippi Traction Co. the contract to light city with electricity for a period of 10 yrs.

St. Louis, Mo.—It is stated that the Bd. of Pub. Improv. Aug. 23 approved plans for a municipal lighting and heating plant for the Quarantine Hospital, the building and machinery to cost about $10,000. A heating plant is also to be installed at the greenhouses in Forest Park.

Billings, Mont.—The Bd. of Directors of the Billings Heating Co. is stated to have awarded contract to construct plant to the Iowa Constr. Co., of Oskaloosa, Ia., at $67,400. Other bids received are reported to have been from the Electric & Steam Eng. Co., of St. Louis, Mo., at $69,472, and the Beeman Stocking Co., of Billings, at $69,039.

Tecumseh, Neb.—Contracts for constructing an electric light plant (bids opened Aug. 19) have been awarded as follows: To the Buckeye Engine Co., Salem, O., one 80-h.p. tandem c. p. engine, 225 r. p. m., and one 8-h.p. simple engine, 257 r. p. m.; to the Westinghouse Electric &Mfg. Co., Pittsburg, Pa., one engine type, 125-kw., 3-phase, 60-cycle alt.; one engine type, 50-kw., 3-phase, 60-cycle alt.; one switchboard complete, street lighting equipment and lighting transformers; to the English Iron Wks., Kansas City, Mo., one 150-h.p. boiler, Cookson heater, injector and Snow pump; Western Electric Co., Kansas City, Mo., all line material and poles. Total cost, $16,000. John Martz, Engr., Seward.

Newark, N. J.—The two lowest bids opened on Aug. 23 by the Special Com. on Lighting of Common Council for an electric light plant in the City Hall, are stated to have been submitted by E. M. Waldron & Co., at $28,904 and the Browe Co., at $29,981.

Morristown, N. J.—The Bd. of Directors of the Morris & Somerset Electric Co., at a meeting on Aug. 24, are reported to have instructed its Executive Committee to immediately let contracts for the construction of the company's electric lighting plant. The plant will cost about $200,000. Peter V. Stryker, Gen. Mgr.

Ellis Island, N. Y. H., N. Y.—Bids will be received by Robt. Watchorn, Comr. of Immigration, until Sept. 7, for furnishing materials and installing electric lighting in power house of Contagious Disease Hospital Group at Ellis Island Immigration Station.

Blackwell's Island, N. Y.—The following are the bids opened on Aug. 21 by Robt. W. Hebberd, Comr. Pub. Charities, N. Y. City, for furnishing materials and installing complete electric lighting and power system for all buildings and grounds under the jurisdiction of the Department of Public Charities, and comprising the New York City Home for the Aged and Infirm, Blackwell's Island, Boro. of Manhattan: (*a*) aggregate price for whole work, (*b*) aggregate price for the whole work by alternate installing underground conduit lines with service boxes, manholes, transformer vaults and the like complete as specified for all lines outside of buildings: Ideal Electric Cont. Co., 1123 Bway., N. Y. City, *a* $86,410, *b* $112,320; Thompson-Donney Co., 45 York St., Brooklyn, *a* $94,880, *b* $123,760; T. G. Blanchard, *a* $88,697, *b* $128,142.

Johnstown, N. Y.—I. M. Everest, of Albany, a representative of the McCaffery Water Motor & Power Co., of Troy, is stated to have secured water privileges along the Caroga and Peck Creeks from Caroga Lake to the Mohawk River and from Peck's Pond to its junction with Caroga Creek, and is seeking privileges in the vicinity of Johnstown, on the said creeks. It is stated that several large power stations will be established in this locality to distribute power in Montgomery, Fulton and Herkimer Counties.

Buffalo, N. Y.—Bids will be received until Sept. 6 by the Bd. of Superv. (Henry D. Feist, Clk.) for furnishing labor and material required in furnishing and installing lockers, gun cases, electric light fixtures, etc., in the armory of the 74th Regt., N. G., N. Y., Buffalo.

West Point, N. Y.—Bids will be received by Maj. J. M. Carson, Jr., Q. M., U. S. M. A., until Sept. 30, for furnishing and installing combination gas and electric light fixtures in old and new Cadet barracks, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received until Sept. 9 by C. B. J. Snyder, Supt. School Bldgs., New York City, for completing the abandoned contract for the electric equipment in School 109, Boro. Brooklyn.

Rochester, N. Y.—Bids will be received until September 30, by the Comrs. of Bldgs. of Monroe County (G. L. Meade, Chmn.), for furnishing and putting in place 150 h.p. 130 lbs. working pressure internal furnace boiler in the Monroe County Power House, at Rochester; also same date and place for furnishing and installing an electric lighting plant in the basement of the Court House at Rochester.

Hoosick Falls, N. Y.—Application has been made to the Public Service Comn. by the Schaghticoke Electric Co., of Hoosick Falls, for consent to increase its capital stock from $30,000 to $500,000, and also for consent to the issue of $1,750,000 of 5 per cent., 2 year, first mortgage bonds, to be used to develop water rights company has acquired along Hoosick River. If the application is granted, it is proposed to run high-tension transmission line to Schenectady to furnish additional power.

Philadelphia, N. Y.—A. F. Nims, of Philadelphia, is reported to have secured the contract for constructing concrete dam for the municipal electric light plant, for $4,561.

Hickory, N. C.—M. E. Thornton, of Hickory, writes that the contract for constructing a concrete rock reinforced dam with power house, across the Catawba River, at Hickory, and installing 3,000-h.p. turbine water-wheels and electrical apparatus and transmission lines for lighting and power purposes (bids opened Aug. 10) has been awarded to A. F. Hart & Co., of Hickory.

Fargo, N. D.—Geo. Hancock, is reported to have prepared plans for extending and rebuilding the power plant of the Union Light, Heat & Power Co. It is stated that the improvements will cost about $30,000.

Cincinnati, O.—The Little Miami Light, Heat & Power Co., which proposes to harness the Little Miami River, it is stated, has secured additional land along that river, and expects to start work in the fall. The total expenditure, including land and equipment, will be about $1,000,000. Engineers, John W. Hill & Sons, First Natl. Bank Bldg.

Pittsburg, Pa.—The Southside Electric Mfg. Co., is reported to have decided to apply for a charter. The stockholders plan to increase the capital and enlarge the plant for the purpose of furnishing light and heat to residents and stores and factories on the Southside; capital, $65,000. L. J. Regan, Pres., and Peter M. Lippert, Secy. and Treas.

Manayunk, Pa.—Wm. H. Dechant, of Reading, is reported to have secured a contract for building an electric power generator plant in Manayunk for supplying current to surrounding mills. The plant will be situated on Schuylkill River and will cost about $100,000.

. anama.—See "Miscellaneous."

Camp Hill, Pa.—The Camp Hill Fuel & Gas Co., of Camp Hill, is reported to have received a charter, with a capital of $5,000. Incorporators: Robt. Smith, T. K. Van Dyke and others.

** Items marked thus give the names of parties awarded contracts.*

Lancaster, Pa.—Bids will be received until Sept. 20 by Walter A. Miller, Clk., Thaddeus Stevens Industrial School Comn., at his office, Court House, for erecting a power plant and 2 cottages for above school; also the mechanical work at the power plant, also sewers and tunnels from buildings, and heating plant for all buildings; also, same time and place, for erecting a shop for the Stephens Orphans' Home.

Nashville, Tenn.—A building permit is reported to have been granted to the Nashville Gas Co. for the erection of a new brick boiler room, generator and engine room at its plant at 3d Ave.; cost about $10,000.

Lawrenceburg, Tenn.—Bids will be received by the Mayor and Bd. of Aldermen until September 13 for furnishing material and constructing complete a hydro-electric plant for water, lights and power comprising dam and penstocks, turbines, generator, arc lighting apparatus, pole lines, tower and tank, c. i., mains, hydrants, valves, etc., as advertised in The Engineering Record. Walter G. Kirkpatrick, of Jackson, Miss., Engr. R. B. Williams, Mayor.

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Constr. Q. M., U. S. A., until Sept. 12 for furnishing and installing acetylene gas fixtures in the Isolation Hospital, as advertised in The Engineering Record.

**Tacoma, Wash.*—The Council on Aug. 13 is stated to have decided to accept, conditionally on result of election to be held Sept. 10, the bid of Geo. Milton Savage Co., at $1,750,000, for installing on upper Nisqually River, a municipal hydraulic power plant of 10,000 h.p.

Madison, Wis.—It is reported that the Madison Gas & Electric Co. (John Corscot, Gen. Mgr.) intends expending $75,000 for new machinery and new buildings.

Burlington, Wis.—F. R. Crabtree, it is reported, has completed plans for a factory building, power house and warehouse to be erected by the Burlington Advancement Assoc. (Geo. Waller, Secy.).

Northfield, Wis.—It is stated that the Northfield Light, Heat & Power Co. is seeking a franchise.

Baldwin, Wis.—The Baldwin Electric Light & Fuel Co. is reported incorporated, with a capital of $15,000, by E. J. Cave, O. K. Hawley and Herman Heebink.

Eau Claire, Wis.—The Chippewa Valley Light & Power Co. is reported to have filed a mortgage for $1,000,000, and propose using some of the funds for improvements and extensions.

Muscoda, Wis.—An election is soon to be held, according to reports, to vote on the question of issuing $10,000 bonds for an electric light plant.

Winnipeg, Man.—Bids will be received by the Chmn. Bd. Control, until Oct. 1 (extension of date from Sept. 3), for the construction of general works, and for supply and erection of various portions of equipment for hydro-electric works and station at Point du Bois, for a transmission line between Point du Bois and Winnipeg, and for a receiving transformer station in Winnipeg, etc., as advertised in The Engineering Record.

Hamilton, Ont.—See "Water."

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—J. J. Fiske, Pres. and Gen. Mgr. Little Rock & Pine Bluff Traction Co., Rooms 9 and 10, 501½ Main St., writes that the company is ready to receive figures from railroad contractors upon grading in sections, bridging, track laying, over-head construction, and erection of power house, either in part or as a whole, etc.; also figures from manufacturers and supply houses for wire, steel bridge material, overhead construction material, power-house equipments, cars, etc. It is proposed to build approximately 50 miles of electric interurban street railroad between Little Rock and Pine Bluff, Ark.

Downieville, Cal.—See "Power Plants, Gas and Electricity."

San Jose, Cal.—It is stated that the Peninsular R. R. Co. contemplates building 30 miles of standard-gauge double track.

Westbrook, Conn.—Judge William S. Case, of the Superior Court, is stated to have passed an order declaring the building of the Shore Line Electric Ry. a matter of public convenience and necessity, and permitting the construction of a street railway in the towns of Westbrook, Old Saybrook and Essex.

Belleville, Ill.—The East St. Louis & Eastern Ry. Co. is reported organized. The purpose is to build a road between East St. Louis and Belleville. Incorporators: I. C. Haynes, T. W. Gregory, G. C. Pierce, F. H. Thomas and F. H. Kruger.

South Bend, Ind.—A franchise is reported to have been granted by the Comrs. of St. Joseph County to the Chicago, South Bend & Northern Indiana Traction Co. for an extension in Notre Dame Ave. to the College grounds.

Emmetsburg, Ia.—The Spirit Lake, Emmetsburg & Ft. Dodge Ry. Co. is stated to have filed articles of incorporation with the Secretary of State. Capital $20,000. The company organizes for the purpose of building an interurban railway from Ft. Dodge in a northwesterly direction through Emmetsburg to Spirit Lake, or to some point on the Okoboji Lakes, a distance of 100 miles.

Davenport, Ia.—Articles of incorporation of the Davenport & Manchester Interurban Ry. Co. are stated to have been filed with the Secretary of State. Capital $15,000. The purpose is the construction of an interurban electric railway between Davenport and Manchester. The line will be about 90 miles in length and will parallel the Milwaukee road. Geo. T. Baker, Pres.; F. W. Rank, Secy., and T. J. Halligan, Treas., all of Davenport.

Boston, Mass.—Bids for constructing entrances and exit at Summer St. for the Washington St. tunnel, will be received until Sept. [illegible] by B. [illegible] Beal, Secy. Boston Transit Comn.

Pittsfield, Mass.—A franchise is reported to have been granted by the Bd. of Aldermen [illegible] Berkshire St. Ry. Co. for an extension of [illegible] from East St. to a point beyond the Pleasure Park.

St. Louis, Mo.—The St. Louis, [illegible] & Grant Park Ry. Co., J. G. Hughes, Ch. Engr., [illegible] stated to have completed toward Grand Park about 2 miles of grading. The company will place contracts next month for about 6 miles of additional track, for which franchises have been granted.

Las Vegas, N. M.—The construction of an electric line between this city and Mora is reported contemplated. J. M. Cunningham, Jefferson Raynolds, H. W. Kelly, W. A. Buddecke, of the Las Vegas Ry. & Power Co., are said to be interested.

Grand Forks, N. D.—It is stated that Messrs. Lambrech and Murray, of Minneapolis, Minn., are planning to construct a third rail electric railway from Grand Forks to Carrigan.

Dayton, O.—It is reported that the Dayton Str. Ry. Co. is preparing to construct a railway line 12 miles in length, extending from Southeast Dayton to Dayton View and on out the Salem Pike to the Philadelphia Road in Harrison Township. The road is being promoted by Chas. Bosler, D. Dwyer and A. Emanuel.

Eugene, Ore.—It is reported that the Eugene & Eastern Ry. has just purchased from A. Welsh the franchises granted the Williamette Valley Co. for the construction of a street railway by the city of Eugene, the city of Springfield, and the rights of way between the two cities, and the right of way up the McKenzie River. The deed includes all the properties in connection with the railroads formerly transferred to A. Welsh by the Willamette Valley Co. J. O. Storey, Pres.; A. Welsh, Vice-Pres. and Gen. Mgr.; George Bracher, Treas.

Dauphin, Pa.—The charter for the Dauphin St. Ry. Co., which is to build the line between the Lucknow terminus of the traction company and Dauphin is reported signed by Governor Stuart. Capital, $75,000. A. G. Knisely, President.

Chester, Pa.—It is reported that the Chester Traction Co. is planning to reconstruct about 1 mile of track on Edgemont Ave.

**Johnstown, Pa.*—It is reported that the Southern Cambria St. Ry. Co. has awarded Howard C. Cook, of Johnstown, a contract for ties.

Carrizo Springs, Tex.—It is reported that D. J. Woodward, of San Antonio, is interested in a proposition to build an interurban from Cotulla to Carrizo Springs.

San Angelo, Tex.—J. H. Ransome, of Hereford, Tex., is stated to have been granted an electric street railway franchise by the City Council. Capital $200,000. J. A. Williams is the local representative of the company.

Ft. Worth, Tex.—The American Engineering Co. of Indianapolis, Ind., is stated to have closed a contract for constructing and equipping 60 miles of electric railway to connect Ft. Worth and Mineral Well.

Seattle, Wash.—The City Council is stated to have granted a franchise to the Loyal Ry. Co. to construct and operate a street railway in certain streets of the city.

Colfax, Wash.—It is stated that the survey for the Pullman, La Crosse & Columbia River Electric line, passing about 10 miles south of Colfax, through Union Flat, is about completed. J. O. Staats, of La Crosse, is in charge of the survey.

RAILROADS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—A corps of engineers is reported to be now en route to Pine Bluff to make a survey of thee Pine Bluff, North & South R. R. to be built from Pine Bluff north to some point on the Rock Island. The road will be operated and owned by Pine Bluff capital.

Ft. Smith, Ark.—The Kansas City Southern R. R. Co. (A. F. Rust, Resident Engr., Kansas City, Mo.) is reported to have decided to reconstruct its line in Ft. Smith and also build there large yards.

Pagosa Springs, Colo.—The Pagosa Springs & Del Norte R. R. Co. is reported incorporated, to construct a line from Juanita on the Denver & Rio Grande R. R. in Archuleta County to Del Norte, another branch of the same road in Rio Grande County.

Denver, Colo.—The Denver, Laramie & Pacific R. R. Co., which is reported to have been recently incorporated to build a new road between Denver and Seattle, Wash., is reported to be securing rights of way, etc. S. M. Nevius, the Chief Engineer, is reported to be now in Casper, Wyo.

Athens, Ga.—The citizens are reported to be considering the raising of stock for the Athens &Carolina R. R., to be constructed from Athens to Anderson, S. C. Mayor Dorsey, Prof. Branson and T. J. Scott, all of Athens, are reported on the committee from Athens.

Covington, Ind.—The Covington & Wabash Valley R. R. Co. is reported incorporated, with a capital of $50,000, to build a railroad from Covington to Silverwood, a distance of about 13 miles. Directors: Wm. G. Ruhl, 2728 Magnolia Ave., Chicago, Ill.; Chas. Walter Leinbach, Wm. E. Banebrake and Geo. P. Schwinn, all of Covington.

Sulphur, Ind. Ter.—The surveying of the Sulphur, Coalgate & Southeastern R. R., chartered to build from Sulphur eastward to Paris, Tex., is reported to be now in progress through the Chicasaw Nation. It is proposed to construct the line through Hickory, Pontotac and Coalgate. The Commercial Club of Hickory is reported to have closed a contract with company, guaranteeing right of way, terminals and $800 in cash. The citizens of Sulphur are reported to have given $1,500 toward the expenses of the survey.

Pella, Ia.—The Waterloo, Pella & Southwestern R. R. Co. is reported organized with principal office at Pella, and with B. F. Keables, Pres.; E. A. Harris, Gen. Mgr., and T. L. Blank, Secy., to construct a railroad 120 miles long and with 20 miles of sidings. The principal towns along the line will be Waterloo, Traer, Toledo, Tama, Sheridan, Grinnell, Sully, Pella, Howell, Durham, Attica, Columbia, Olmitz and Chariton.

Arkansas City, Kan.—It is reported that it is proposed to extend the Midland Valley R. R. (J. F. Holden, Gen. Mgr., Muskogee, Ind. Ter.) from Arkansas City to the northwest. The length of the road to be built will be about 190 miles, with terminals at Dodge City.

Billings, Mont.—It is reported that the North-Western R. R. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.), which is planning to extend its line to the coast, will enter Montana through the Yellowstone valley, and will pass through Billings. The road will be built northward from Belle Fourche, S. D., for 100 miles, and will then extend due west, up the Yellowstone valley to Billings, thence to Livingstone and Helena, and across Idaho and Washington by the most direct route possible to Seattle.

Cleveland, O.—It is reported that extensive improvements to the Conway yards on the Ft. Wayne R. R. are contemplated by the Pennsylvania R. R. Co. (Alex. Shand, Ch. Engr., Philadelphia, Pa.).

Swissvale, Pa.—The Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia) is reported to have decided to let contract for elimination of grade crossing at Braddock Ave., in Swissvale. The tracks will be elevated and a subway constructed; cost about $50,000.

Mitchell, S. D.—L. L. Ness, of Mitchell; O. E. Cassem, of Madison, Wis., and R. F. Schulz, of Brookings, are reported to be on the committee of business men which is investigating the question of constructing a railroad between Mitchell and Marshall, Minn.

Decatur, Tex.—M. J. Healy and Col. L. J. Polk are reported to be planning to build the East Line from McKinney, Tex., to Mexico, but for the present, it is said, they propose to make Decatur the western terminal.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—Arrangements are being made by the Claremont Hospital Assoc. (Dr. H. G. Thomas, Pres.), according to reports, to erect a hospital at a cost of $130,000.

Las Animas, Colo.—Bids will be received at the Bureau of Suplies and Accounts, Navy Dept., Washington, D. C., until Sept. 17, for the construction of quarters at the U. S. naval hospital, New Fort Lyon, Las Animas, Colo. Applications for proposals should refer to Schedule 225. E. B. Rogers, Paymaster Gen'l., U. S. N.

Silverton, Colo.—Plans and specifications for a City Hall to cost $35,000 have been submitted to the City Council.

**Greeley, Colo.*—M. J. Kinney, of Denver, is stated to have secured the contract to erect the court house, at $24,909. The J. D. Potter Plumbing Co., of Greeley, is stated to have submitted the lowest bid for plumbing and gas fitting and steam heating in said building.

**Middletown, Conn.*—The contract to erect an amusement hall at the Connecticut Hospital for the Insane at Middletown, it is stated, has been awarded to Chas. B. Andrus & Son, of Hartford, at $68,000. Bids opened Aug. 22.

**Great Lakes, North Chicago, Ill.*—We are informed that the Northern Constr. Co., of Milwaukee, Wis., has secured the contract for constructing 12 building at the the naval training station for $370,000 (bids opened Aug. 15 at the offic of the Bureau of Navigation, Washington, D. C.).

The following are the bids opened at the Bureau of Navigation, Navy Dept., Washington, D. C., on Aug. 26 for furnishing material and completing the construction of houses for officers' quarters for the naval training station: J. C. Ovell, Chicago, $58,000, and Jas. Conners, Racine, Wis., $54,264.

**Elgin, Ill.*—The trustees of the Northern Illinois Hospital for the Insane, it is reported, have awarded the contract for the rehabilitation of the heating plant to the L. S. Prentiss Company, of Chicago, for $27,000. Two new boilers, 4 automatic stokers and new piping and heating arrangements will be installed, forming a complete vacuum heating system.

Indianapolis, Ind.—The Mayor and Bd. of Public Safety, it is reported, are arranging for the construction of 4 police substations in this city. Estimated cost, $40,000 each.

Crown Point, Ind.—Bids will be received until Sept. 14 by the Bd. Co. Comrs. (Saml. A. Love, Chmn.) for erecting an addition to the court house. Chas. A. Johnson, Co. Aud.

Des Moines, Ia.—Bids will be received by the Bd. Pub. Wks (W. W. Wise, Chmn.), until Sept. 12 for erecting a 2-story brick fire station to be known as No. 5, to be located on Crocker St.; also plumbing and heating said building.

Nicholas, Ia.—Bids will be received until Sept. 9 by C. E. Duncan, Nicholas, for erecting a Town Hall. Henry W. Zeidler, Archt., 107 W. 2d St., Muscatine.

Baltimore, Md.—Bids will be received until Sept. 4 by the Bd. Awards (J. Barry Mahool, Pres.) for erecting a public comfort or public convenience station on Centre Market space at Lombard St.

Bids will be received by Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., until Oct. 7 for the construction and mechanical equipment (except plumbing) of an extension to U. S. postoffice, court house, etc., at Baltimore, as advertised in The Engineering Record.

Pittsfield, Mass.—The Common Council, Aug. 21, appropriated an additional $15,000 to erect the armory for Company F. This makes $65,000 available for the building, plans for which are being prepared by J. W. Howe, of Holyoke.

Greenfield, Mass.—Press reports state that bids will be received by the City Treas. until September 3 for $35,000 library bonds.

**Howell, Mich.*—The contract to erect the tuberculosis sanitarium here, bids for which were received Aug. 15, is reported awarded to Saur & Co., of Ann Arbor, at about $75,000.

**Hibbing, Minn.*—F. C. Norlander, of St. Paul, is reported to have secured the contract to erect the Carnegie Library at $20,948. Other bids received were: J. R. Quigley, of Duluth, $22,079, and J. W. Hilliard, of Duluth, $22,236.

Crookston, Minn.—It is reported that all bids received Aug. 5 for erecting the post office have been rejected.

Kansas City, Mo.—Separate bids will be received until Sept. 10 by the Bd. Pub. Wks. (Everett Elliott, Secy.) for erecting the following Fire Dept. Stations:

* ***Items marked thus give the names of parties awarded contracts.***

Station No. 11, Primrose Hill Addition, 612 Virginia St., A. Van Brunt & Bro., Archt., Rm. 120 Navajo Bldg.; Sta. No. 23, St. John and Elmwood Aves., C. Faris, Archt., Rm. 207 Empire Bldg.. Sta. No. 24, 2329 Spruce Ave., Sayler & Seddon, Archts., Rm. 504 Kemper Bldg.

Sikeston, Mo.—Matthew & Clark, of St. Louis, it is stated, have prepared plans for court house and jail to be erected at a cost of $30,000. E. J. Malone, Mayor.

**Lewistown, Mont.*—Wm. Oliver, of Spokane, Wash., is reported to have secured the contract to erect the court house, including plumbing, ventilating and heating, at $91,000.

Portsmouth, N. H.—Bids will be received at the Bureau of Yards and Docks (Wm. M. Smith, Acting Chief), Navy Dept., Washington, D. C., until Sept. 21, for constructing an extension of the power house building at the navy yard, Portsmouth, as per specification No. 1561.

Trenton, N. J.—The following are the bids opened on Aug. 27 at the office of the Superv. Archt., Treasury Dept., Washington, D. C., for the construction (including heating apparatus, electric wiring and conduits) of extension to the U. S. Post Office and Court House at Trenton: Conners Bros., Lowell, Mass., $133,400; Fissel & Wagner, New York, N. Y., $142,500; and Wm. Johnston, Trenton, $110,500.

Burlington, N. J.—The building of a city hall at a cost of about $25,000 is reported contemplated.

Whitesboro, N. Y.—It is stated that bids will be received until Sept 10 (readvertisement) by W. G. Frank, Archt., Clarendon Bldg., Utica, for erecting a fire department building.

Brooklyn, N. Y.—Plans have been filed for a 3-story brick hospital to be erected on Ocean Parkway and Ave. Z by the Dept. Charities, N. Y. City, at a cost of $225,000. Helmle & Huberty, Archts., 190 Montague St.

Napanoch, N. Y.—Bids will be received by Henry Melville, Pres. Bd. Mgrs. Elmira Reformatory, at Elmira, until Sept. 14 for furnishing and erecting all structural steel and iron work for power house and stack and conduits at Eastern New York Reformatory, Napanoch, as advertised in The Engineering Record.

**Oyster Bay, L. I. N. Y.*—The Town Bd., it is stated, has awarded the contract to remodel the town hall to W. S. Moore, at $12,478.

Utica, N. Y.—Bids will be received until Sept. 12 by Henry W. Roberts, Co. Treas., for $55,000 court house bonds.

Rome, N. Y.—Bids will be received until Sept. 12 at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for approaches at the U. S. Post Office, Rome.

Rochester, N. Y.—Bids will be received until Sept. 3 by the Bldg. Comn. (G. L. Meade, Chmn.), for furnishing and installing steam and hot water pipes in tunnels to be constructed at the County Building and for covering the same with asbestos fire felt.

Buffalo, N. Y.—See "Power Plants, Gas and Electricity."

Buffalo, N. Y.—Bids will be received until Sept. 3 by Henry P. Fink, Clk. Bd. Superv., for installing a system of ventilation at the 65th Regt. Armory. Esenwein & Johnson, Archts., Ellicott Sq.

**Lumberton, N. C.*—B. F. Smith, of Washington, D. C., is reported to have secured the contract to erect the court house for Robeson County, at $44,674.

Hillsboro, N. D.—Bids will be received until Sept. 7 by Fred L. Goodman, Chmn. Bldg. Com., for erecting an Armory. Haxby &Gillespie, Archts., Fargo.

Grand Forks, N. D.—The plans of W. J. Edwards, of Grand Forks, for the 2-story, 36x80-ft. fire station to be erected on S. 4th St. have been accepted.

Wyoming, O.—Garber & Woodward, Neave Bldg., Cincinnati, it is stated, have prepared plans for a $28,000 town hall.

Rankin, Pa.—See "Sewage and Sewage Disposal."

San Angelo, Tex.—See "Street Cleaning and Garbage Disposal."

Galveston, Tex.—It is reported that the Government will erect and equip a quarantine station at this port at once, on a site selected on Bird Isle Reef, in Galveston Harbor. The Secy. of the Treas. is stated to have appointed a committee to adopt plans. Three buildings are to be erected at a cost of $150,000 and equipped at an additional cost of $50,000.

El Paso, Tex.—It is stated that the Co. Comrs. have accepted plans for a court house. Estimated cost, $25,000.

Wenatchee, Wash.—The Council, it is reported, proposes to build a city hall at a cost of $25,000.

Tacoma Wash.—It is stated that the Council is considering the erection of a fire station to replace No. 3 at N. 13th and I Sts., the cost to be about $15,000.

Chippewa Falls, Wis.—Bids will be received until Sept. 4 by the State Bd. Control (Allan D. Conover, Pres.), Madison, for erecting 3 dormitory buildings at the Wisconsin Home for Feeble Minded. Ferry & Class, Archts., Milwaukee.

Eau Claire, Wis.—Bids will be received until Oct. 1st by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Court House and Post Office at Eau Claire.

**Sheboygan, Wis.*—Christian Ackerman, of Sheboygan, is reported to have secured the contract for the mason and carpenter work on the St. Nicholas Hospital, which is to be erected at a cost of $65,000. Geo. H. Helmle, Archt., Springfield, Ill.

**Superior, Wis.*—Chas. L. Flystad, Co. Clk., writes that the contract for erecting building of County Insane Ayslum (bids opened Aug. 21) has been awarded to Martin Haugner, Superior, at $99,000.

Green Bay, Wis.—Certain architects have been selected by the Bldg. Com. of the Bd. of Superv. to submit plans by Oct. 15 for a court house and jail.

Ottawa, Ont.—Prizes in the competition among Canadian archts. for the 4 best designs for the $3,000,000 department block and justice building are stated to have been awarded as follows: W. S. Maxwell, Montreal, Que., 1st prize; Darling & Pearson, Toronto, 2d; Gaxe & Archibald, Montreal, 3d; D. R. Brown and Hugh Ballance, Montreal, even for 4th.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The Co-Tenants Co. is reported formed by H. V. Blenkiron, W. L. Blenkiron and others for the purpose of erecting on Bway. and 6th St. an office building, probably 10 stories high.

San Francisco, Cal.—The following building permits have been asked: Mrs. B. Sheideman, to erect an 8-story brick office building at Stockton and Sutter Sts., to cost $160,000; the Empire Constr. Co., to erect a $50,000 building on Howard St., near 4th St.; Security Investment Co., a $61,500 building on Sacramento St.

Denver, Colo.—A building permit has been issued to Gougar & Todd, bicycle dealers at 1524 California St., for the erection of a 4-story building, the first floor of which is to be used for mercantile purposes and the other 3 floors for living apartments. The structure will be erected on California St., and will cost $42,000. W. H. King & Co. will have charge of the construction.

Pensacola, Fla.—A Knights of Pythias building to cost $35,000 is to be erected by the several Pythian lodges of the city.

Hartwell, Ga.—The Masons are said to be planning the erection of a $15,000 temple. Jule D. Matheson is a member of the committee having the matter in charge.

Decatur, Ill.—E. R. Wright, of Taylorville, Secy. Pythian Home Board, writes that all bids opened on Aug. 18 for erecting the Illinois Pythian Home at Decatur have been rejected, and new bids will be received about Oct. 1.

Kankakee, Ill.—Bids will be received until Sept. 17 by the Bldg. Com., Y. M. C. A. Bldg. (Watson Healy, Chmn.) for erecting a 3-story and basement stone building.

Chicago, Ill.—It is stated that plans are being prepared by Francis M. Barton, 169 Jackson Boule., for a theatre to be erected on Halsted St., to cost $210,000.

Plans have been completed for the Princess Theatre, which is to be erected at 255 Clark St. Mort H. Singer of the La Salle Theatre is reported interested. The building will contain 2 stories and a rathskeller. The cost is $150,000.

J. L. Kesner is to put up a 6-story hotel at State and 19th Sts. and Archer Ave. The cost will be $75,000. Jenney, Mundie & Jensen, 171 La Salle St., are the archts.

Hammond, Ind.—F. S. Betz Mfg. Co., it is reported, will erect an office building at a cost of $40,000.

Indianapolis, Ind.—Hiram Brown, Chmn. Bldg. Com., is reported to have announced that bids will be received until Oct. 1 for the construction of a Y. W. C. A. Bldg. on N. Pennsylvania St. Estimated cost, $100,000.

Gary, Ind.—Dr. L. H. Cook, of Bluffton, Ind., is reported to be planning the erection of 2 hotels here, to cost $50,000 each.

Dubuque, Ia.—It is stated that plans have been adopted for the Y. W. C. A. building to be erected on Locust and 6th Sts., and the Bldg. Com. has been authorized to award contracts. The building is to be 3 stories high.

**Syracuse, Kan.*—Chas. A. Fellows, of Topeka, it is stated, has the contract for a $50,000 business building, to be erected for the Santa Fe R. R.

Owensboro, Ky.—It is reported that A. L. Smith will erect a 3-story, 89x119-ft. building to be used as a department store by the Pierson Dry Goods Co.

New Orleans, La.—It is reported that the Alvita Springs Water Co. will build a $25,000 warehouse on the Frico Ry. tracks and Davis St.

Shreveport, La.—Bids will be received until Sept. 10 by F. G. Snyder, Pres. Shreveport Elks Bldg. Co., Ltd., for furnishing material and erecting the superstructure of the Elks' Club Blg. (foundation is already completed). Plans and specifications may be had upon a deposit of $5. A. J. Armstrong, Archt., Shreveport.

Portland, Me.—F. A. Thompson, 156 Free St., it is stated, is preparing plans for a 6-story business building to be erected at 16 Caseo St.

Baltimore, Md.—Henry J. Tinley has completed the drawings for the 4-story 27x85-ft. brick and stone warehouse to be erected for Boston Fear at 406 S. Charles St.

**Springfield, Mass.*—The contract for the plumbing of the Phelps Publishing Co.'s building, it is stated, has been awarded to Donahue Bros., 9 Pynchon St.

**Marquette, Mich.*—It is stated that the contract to erect the 3-story, brick, 100x60-ft. Y. M. C. A. bldg. has been awarded to Thos. M. Solar.

**St. Joseph, Mo.*—The Selden-Breck Constr. Co., of Memphis, Tenn., is reported to have secured the contract to erect the 9-story hotel for Isele Bros., to cost $425,000.

Paterson, N. J.—Floyd Y. Parsons, 359 E. 30th St., it is stated, has prepared plans for the building to be erected on Ellison St. for the Lodge of Elks, at a cost of $72,000.

**Princeton, N. J.*—The Cap and Gown Club of Princeton Univ., it is reported, has awarded a contract for the erection of a -3story $45,000 club house here, to Wm. R. Matthews, of Princeton. Raleigh C. Gildersleeve, of New York, N. Y., is the archt.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone store and tenement at Cherry and Montgomery Sts., for Osas Parnes, cost $40,000, Saml. Sass, Archt.; 6-story brick and stone warehouse at 356 W. 40th St., for E. J. Markey & Co., cost $30,000, J. Henry Eames, Archt.; 2-story brick and stone garage at 55 E. 108th St., for John Townsend, cost $20,000, Nathan Langer, Archt.

Henry Corn is stated to have leased the Hotel Normandie and will alter the same into a store and office building at a cost of about $150,000.

Brooklyn, N. Y.—Plans have been filed for a 3-story brick office building to be erected at Fulton St. and Flatbush Ave., at a cost of $30,000. The Jerome Realty Co., 319 6th Ave., owner; Henry C. Van Cleif, 220 Bway, N. Y. City, Archt.

Spencerport, N. Y.—The directors of the Bank of Spencerport, it is stated, propose erecting a 2-story brick bank building.

Charlotte, N. C.—It is reported that the Stone Wall Hotel Co. (E. J. Bugg, Secy.) has been incorporated with a capital stock of $125,000, for the purpose of building a hotel. Plans not yet completed.

Eugene, Ore.—Cherry Bros., it is stated, propose erecting a 3-story store and office building on 6th and 7th Sts., to cost $30,000.

Williamsport, Pa.—Geo. W. Dunlap is said to be arranging to build a $20,000 hotel at 4th and Poplar Sts.

**Providence, R. I.*—The contract for the erection of the brick, 150x250-ft. car shed which the Rhode Island Co. is to erect on Academy Ave., Mt. Pleasant, it is stated, has been awarded to the Humes Constr. Co., of Providence. Probable cost, $80,000.

Dell Rapids, S. D.—Plans are being prepared by the Eisentraut-Colby-Pottenger Co., of Sioux City, Ia., for a $20,000 hotel to be erected at Dell Rapids by the Dell Rapids Commercial Club. It wi.. be constructed of Dell Rapids stone, 3 stories high, with a full basement, and will be provided with steam heat and modern improvements.

**Knoxville, Tenn.*—The Geo. A. Fuller Co., of Chicago, Ill., has secured the contract to erect 10-story bank and office building here at $130,000. Richards, McCarthy & Bulford, of Columbus, O., archts.

Beaumont, Tex.—John H. Kirby, of Houston, is said to be seeking a site on Cypress St. on which he contemplates erecting a 2-story, 300x300-ft. corrugated iron bonded warehouse.

Laporte, Tex.—E. S. Roberts, of Houston, Tex., is said to be organizing a company for the purpose of erecting a $50,000 hotel at Laporte.

**Hoquiam, Wash.*—The contract for the construction of the brick hotel and store building on I and 8th Sts., it is reported, has been awarded to Granstrom & Festrog, of Hoquiam. Estimated cost, $75,000.

**Tacoma, Wash.*—The Hunt-Mottett Co. is reported to have awarded the contract to erect their building on Pacific Ave. and 21st St. to Jos. Wells. The total cost of the building, including plumbing, etc., is to be about $60,000.

A. P. Gillies, representing the Imperial Development Co., is stated to have secured a permit to erect a 24-story building on Pacific Ave. and C St., to cost about $6,000,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—A permit has been issued for a Sunday school building to be erected by the Southside Baptist Church, at 11th Ave. and 19th St. south, to cost $24,000.

San Francisco, Cal.—Henry H. Davis is reported to have had plans prepared by Arthur J. Laib for an apartment house to be erected on California and Pierce Sts. at a cost of $45,000.

The Keystone Real Estate Co. has applied for a permit to build a 6-story apartment house on Hyde and Washington Sts., to cost $250,000.

Wilmington, Del.—It is reported that the members of the Holy Trinity Lutheran Church at Concord Ave. and Madison St. will build an edifice to cost $12,000. Rev. J. H. Main, pastor.

The Abas Kodesch congregation, it is reported, will expend $35,000 building a synagogue. Lewis Topkis, Chmn. of the congregation.

**McLeansboro, Ill.*—The contract for building the new $15,000 M. E. Church in this city, it is reported, has been awarded to Edw. Snell, of Greyville, Ill.

Des Moines, Ia.—M. Rosenfield, it is reported, will build a residence this fall at 696 18th St to cost approximately $20,000. The home will be of brick and reinforced concrete. Plans are being drawn by Watrous & Sawyer.

New Orleans, La.—The Bldg. Com. of Touro Synagogue, it is stated, has accepted the plans of Emil Weil, 210 Carondelet St., for the brick and terra cotta synagogue to be erected on St. Charles Ave. and Berlin St., at a cost of $75,000.

Duluth, Minn.—A permit has been granted to Thos. Bates for a 4story brick apartment house to be erected on Second Ave. at a cost of $42,000; also to E. F. Goering for an apartment house to be erected on E. 1st St. and 9th Ave. E., to cost $12,000.

**St. Paul, Minn.*—A permit has been issued for a 1-story frame church to be erected on Iglehart St., near Dewey St., for the Olivet Congregational Church; cost, $25,000. Ingmann Bros., 1930 St. Anthony Ave., contractors.

Duluth, Minn.—A building permit, it is reported, has been granted to Thos. Bates for a brick apartment building to be erected on 2d St. and 2d Ave. east, to cost $42,000.

St. Louis, Mo.—It is stated that plans have been prepared for the Baden M. E. Church, to be erected at Hall's Ferry and Church Roads, of concrete, at a cost of $25,000. Rev. R. T. Smith, pastor.

The congregation of the Oak Hill Presbyterian Church (Rev. Walter F. McMillin, Pastor), it is stated contemplates erecting a brick edifice to cost $15,000.

Jackson, Mo.—The Methodist Episcopal Society South, it is stated, will erect a $50,000 church. Matthew & Clark, St. Louis, Mo., archs. Rev. M. T. Haw, pastor.

* *Items marked thus give the names of parties awarded contracts.*

Lincoln, Neb.—The contract to erect the Roman Catholic Church at 14th and K Sts. is reported awarded to Timothy G. Kelley, of Lincoln, at $20,725.

Zanesville, O.—The members of the Methodist Church Ave. and 184th St., for Wm. J. Casey, cost $175,000, are reported to be planning to erect a $50,000 edifice.

Philadelphia, Pa.—Pitcher & Tachau, of New York, N. Y., it is stated, have been commissioned to complete plans for the new edifice for the Mickve Israel Congregation, which now worships in the old synagogue in 7th St., above Arch. The new building will be at Broad and York Sts. The total cost of the structure will be about $150,000. . . . .

Erie, Pa.—Bids will be received until Sept. 11 by Louis Wagner, Chmn. Pennsylvania Soldiers' and Sailors' Home, at the Third Natl. Bank, Philadelphia, for erecting a dwelling for the commander of the Home. Jos. Frank, Archt., Rm. 30, Scott's Blk., Erie.

Seattle, Wash.—Graham & Myers, Lowman Bldg., are preparing plans for the enlargement of the Algonquin apartment house, on E. Union St. and 14th Ave. Probable cost, $160,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Huntsville, Ala.—The enlarging of the plant of the Rowe Knitting Co. is reported under consideration. W. I. Wellman, Gen. Mgr., Huntsville.

Birmingham, Ala.—The Hardie-Tynes Mfg. Co., it is reported, has placed a a mortgage of $100,000 with which to make improvements, including increasing its plants and enlarging its output.

Riverside, Cal.—See "Schools."

Colorado Springs, Colo.—The Continental Mfg. Co. is reported incorporated by Virgil C. Koons, Jas. C. Spicer and Anda A. Hilton with a capital of $100,000 and intends erecting a plant here to cost about $50,000 for the purpose of manufacturing mail devices patented by Virgil C. Koons, of Colorado Springs.

Rockford, Ill.—Redin Ekstrom & Co., it is reported, have secured a site on Railroad Ave. and Parmele St. on which it is proposed erecting a machine shop.

Chicago, Ill.—The plant, including the machinery of the American Corn Milling Co., 50th Pl. and the Chicago, Rock Island & Pacific R. R., is reported destroyed by fire Aug. 20.

The car factory and repair plant at 51st St. and St. Louis Ave. that was destroyed by fire July 30, it is reported, is to be rebuilt by the Chicago, New York and Boston Refrigerator Co.

Vincennes, Ind.—The stockholders of the Vincennes Pipe & Casting Co., it is stated, have decided to enlarge their plant.

Boston, Mass.—Jos. Gahm will, according to reports, erect a storage plant, costing $117,000 at Boston, plans for which have been prepared by Kirchhoff & Rose, of Milwaukee, Wis. It will be of brick and concrete, 105x155 ft. and 2 and 3 stories high. The cost, it is stated, does not include any machinery which will be installed in the building.

Concord, N. C.—Reports state that the Franklin Cotton Mills will build an additional mill, the equipment to be 12,000 spindles and accompanying machinery. This company is at present operating 7,000 spindles.

Duke, N. C.—Another cotton factory, it is reported, may be erected at Duke by the Erwin Cotton Mills, of Durham.

Dayton, O.—The American Rys. Co., of Philadelphia, Pa., has secured property in Dayton, and is about to build new car barns and repair shops for the People's Ry. Co. Dodge & Day, of Philadelphia, Pa., have been commissioned to prepare plans for the construction of the buildings.

Woonsocket, R. I.—The Lawton Spinning Co. is reported to be having plans prepared for a 4-story brick addition which it is proposed erecting to the plant in the Privilege Dist. Probable cost, $500,000.

Spartanburg, S. C.—Elisha Bomar, of Spartanburg, is reported organizing a company for the purpose of erecting a cotton yarn mill.

Seattle, Wash.—The Seattle Mattress & Upholstering Co., 913 First Ave. S., is said to be having plans prepared by Schack & Huntington, for 6 buildings to be erected on 6th Ave. S. and Holgate St. The plans include a warehouse and storeroom 58x180 ft., 4 stories high and having a foundation solid enough to support 2 additional stories should they be necessary. The walls of this building are to be constructed with reinforced concrete and the interior work is to be of mill construction. The plans provide for the erection of two other buildings, each 55x168 ft., to be used for factory purposes exclusively. In these will be located the work shops and the other machinery necessary in the business. They will be 4 stories high, of frame construction, built of milled timber throughout. There is also to be an engine room 32x100 ft.; also a dry kiln. The factory is to be fitted throughout with automatic sprinklers. The architects estimate the cost of the plant, exclusive of the machinery, at $69,000.

Youngstown, Wash.—Fire on Aug. 13, it is reported, destroyed the car shops, blacksmith shops and lumber yard of the Seattle Car Mfg. Co., at Youngstown. Loss stated to be $150,000.

Vancouver, B. C.—It is reported that plans are being prepared for a blast furnace for the manufacture of iron and steel to be erected near Kootenay Landing. The owners of the property are said to be Thos. Shaughnessy, Pres. of the Canadian Pacific Ry.; Chas. Hosmer, of Montreal, and other Eastern capitalists.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Montevallo, Ala.*—The contract to erect a dormitory at the Alabama Girls' Industrial School at Montevallo (bids opened Aug. 20) is reported to have been awarded to E. C. Seiz Co., of Atlanta, Ga., at about $80,000.

Marion, Ala.—It is stated that Warren & Welton are preparing plans for 3 buildings—Carnegie Library, president's home and infirmary—to be erected at the Judson Inst. here.

**East Lake, Ala.*—Jesse L. Burns, of Birmingham, is reported to have secured the contract to erect a building at the Alabama Boys' Industrial School here, at about $40,000.

Auburn, Ala.—Bids will be received until Sept. 17 by the Bldg. Com. (B. B. Comer, Chmn.), Alabama Polytechnic Inst. for erecting a 2-story brick building. Probable cost $25,000. Warren & Welton, Archts., 707 Title Guarantee Bldg., Birmingham.

Riverside, Cal.—Bids will be received by the Comr. Indian Affairs (C. F. Larrabee, Acting Comr. Washington, D. C.), until Sept. 26, for furnishing material and constructing 2 emloyes' cottages, a stable and addition to mess hall and laundry, all of brick, with plumbing and electric light; for a frame dormitory with plumbing, steam heat and acetylene gas piping, and for a combined cold storage and coal house of brick, with plumbing, electric light, boilers, ice and refrigerating machinery, etc., at the Indian School, Riverside. For further information apply to Harwood Hall, Supt., Riverside.

North Grosvenor Dale, Conn.—Bids will be received until Sept. 9 by McLean & Wright, Archts., 110 Tremont St., Boston, Mass., for erecting the Tourtellotte Memorial High School, at North Grosvenor Dale.

Normal, Ill.—Plans are being prepared by W. Carbys Zimmerman, 21 Van Buren St., Chicago, for a building at the State Normal school, Normal, that will be used for a school of domestic science. The structure will also contain an auditorium that will seat 1,000 persons. The appropriation for the structure amounts to $110,000.

**Elkhart, Ind.*—E. H. Machan, Secy. School Bd., writes that the contract for plumbing, electric wiring, steam heating and building power house for the new school at High and 3d Sts. has been awarded to Thos. Foy, of Kalamazoo, Mich., for $7,964.

Ottumwa, Ia.—The Sisters of the Humility of Mary are reported to have secured a site north of this city, on which it is proposed erecting an academy and boarding school to cost $70,000.

Anthon, Ia.—It is stated that bids will be received until Sept. 3 by H. B. Walling, Chmn. Bldg. Com., for erecting a parochial school.

Beloit, Kan.—Bids will be received until Sept. 3 by F. W. Knapp, Secy. State Bd. Control, Topeka, for erecting a porch and main building at the Girls' Industrial School, Beloit. John F. Stanton, State Archt., Topeka.

Chapman, Kan.—It is stated that bids will be received until Sept. 15 by E. S. McCormick, Co. Supt. Pub. Instruction, Abilene, for erecting a stone addition to the Co. High School. L. M. Wood, Archt., 627 Kansas Ave., Topeka.

Lawrence, Kan.—Bids are wanted by H. B. Peairs, Supt. Haskell Inst., for furnishing and delivering at the school, as required during the fiscal year ending June 30, 1908, about 83,750 ft. lumber, 30,000 shingles, 110 doors, windows and transoms, over 20 ft. steel ceiling, 2,800 ft. iron conduit, 4,100 ft. wire, c. i. stepping, 1,665 ft. pipe, 6 bath tubs, etc., 245 barrels cement, 100 yards stone, 36 tons of cement plaster, besides a quantity of lime, sand, pitch, etc.

Manhattan, Kan.—Bids will be received until Sept. 5 by the Regents of the State Agricultural College (E. R. Nichols, Pres.), at Manhattan, for furnishing material and erecting a veterinary building on the grounds of the college.

Tallulah, La.—The erection of a school to cost $35,000 is reported under consideration.

Fall River, Mass.—All bids received Aug. 14 for erecting a school on Maple St. are reported to have been rejected.

Greenfield, Mass.—It is stated that plans have been secured for a school to be erected on Conway and Allen Sts.

**Springfield, Mass.*—J. J. Cotter, it is stated, has been awarded the contract for the heating system in the Howard St. school addition at $1,873.

Grand Rapids, Mich.—The School Bd. is said to be preparing to improve the North division school, at an estimated cost of $56,000. Address Clk. of the Bd.

Calloway, Minn.—Wm. Elliott & Son, St. Paul, are reported to be preparing plans for a 6-story school to be erected here.

Rochester, Minn.—It is stated that plans have been completed and bids for the erection of a $100,000 addition to the Academy of Our Lady of Lourdes will be opened Sept. 9. The Academy is managed by the Sisters of St. Francis.

Vicksburg, Miss.—Bishop Theo. D. Bratton, of Jackson, writes that it is proposed to erect an Episcopal College at Vicksburg, to cost about $60,000. Plans have not yet been selected.

**Agricultural College, Miss.*—A. J. Moore, Secy. Executive Com., writes that the contract for erecting mess hall at Mississippi A. and M. College (bids opened Aug. 5) has been awarded to J. C. Hardy, of Agricultural College, Miss.

**Kansas City, Mo.*—The Forrester-Swanson Co. is reported to have secured the contract for erecting superstructure of high school, for about $243,000.

Whitehouse, N. J.—J. Frank Bartles, Clk. of the Bd. of Educ. of Bedminster Township, it is reported, will receive bids until Sept. 21 for $23,000 school bonds, the proceeds to be used to erect building at Peapack and Gladstone.

Trenton, N. J.—Bids will be received by Saml. H. Bullock, Chmn. Grounds and Bldgs. Com., Bd. Educ., until Sept. 5 for furnishing material and for the completion of the following work: The placing of new toilet rooms and making sewer connections in the following schools: Nixon No. 3, Franklin No. 4, Cooper No. 5, Parker No. 6, Livingston No. 8, U. S. Grant No. 9, Mott No. 12, Peabody No. 13, Lincoln No. 14, Girard No. 15, Monument No. 17, Columbus No. 18, William G. Cook No. 23, also the building of new additions to the Joseph Wood No. 1, Charles Skelton No. 2, including plumbing work and hot water heating. Wm. B. Thines, Archt., 104 N. Stockton St.

Buffalo, N. Y.—Bids will be received until September 11 by Francis G. Ward, Comr. Pub. Wks., for erecting a 20-room brick school on Bway. and Krupp Sts., Dist. 44. Bids on material and labor, also on each branch of the work, stated below, are to be submitted separately: Masonry, cut stone, plastering, etc.; iron work, etc.; fireproofing, etc.; carpentry, painting, electrical work, etc.; roofing, metal work, steel ceilings, etc.; heating, ventilating, etc.; plumbing, gas-fitting, etc.

Lockport, N. Y.—John C. Fogle is stated to have submitted the lowes bid on Aug. 19 for erecting High St. School, at $16,553.

**Albany, N. Y.*—Dr. A. S. Draper, State Comr. of Educ., is is reported has awarded the contract for the construction of the new State Normal College (bids for which were opened Aug. 15) to A. E. Stephens & Co., Binghamton, at $258,692.

Raleigh, N. C.—The Trus. of Wake Forest College, it is stated, are considering plans for a $30,000 dormitory to be erected at the College.

**Minot, N. D.*—D. A. Dinnie, of Minot, is reported to have secured the contract to erect a school on Valley St., at $11,271, and S. N. Swenson & Co., of Minot, the contract for heating and plumbing same, at $1,860.

Valley City, N. D.—It is stated that the Bd. of Educ. has adopted plans and directed the Clerk to receive bids until Sept. 17 for the superstructure of a school to replace structure destroyed by fire. Cost, exclusive of foundation, $25,000.

Fremont, O.—It is reported that the St. Joseph R. C. Society will expend $65,000 erecting a school.

**Newark, O.*—D. M. Keller, Clk. Bd. Educ., writes that the contract for installing ventilating and heating system in High School Annex (bids opened Aug. 19) has been awarded to Fitzpatrick & Hoepfner, Columbus, O., as follows: New building, $14,046, old building, $4,099.

Columbus, O.—Bids will be received until Sept. 17 by the Bd. Trus. Ohio Institution for the Education of the Deaf and Dumb (J. W. Jones, Secy., Columbus), for furnishing material and installing a hot water heating system in the buildings of said institution. Richards, McCarty & Bulford, Archts., Ruggery Bldg.

**Ashland, O.*—G. A. Ullman, Clk. Bd. Edu., writes that the contract for ventilating and heating, etc., Walnut St. school (bids opened August 16) has been awarded to Sam. Esswein Co., of Columbus, for $6,950.

Hamilton, O.—The Bd. of Educ. has decided to immediately construct a $50,000 school in the First Ward.

Beaver, Pa.—Bids will be received until Sept. 4 by Harry J. Boyde, Secy. School Bd., Snitzer Bldg., for erecting an 8-room brick school. C. C. & A. L. Thayer, Archts., New Castle.

Lancaster, Pa.—See "Power Plants, Gas and Electricity."

Midland, Pa.—Bids will be received until September 9 by the Independent School Bd. for erecting a 2-story school.

North Braddock, Pa.—Bids will be received until Sept. 11 by the School Bd. John F. Lowers, Secy. at the office of U. J. L. People's Archt., 611 Times Bldg., Pittsburg, for erecting a high school at Bell Ave. and Verona St., North Braddock.

**Spearfish, S. D.*—Irwin D. Aldrich, Cataract Hotel, Sioux Falls, writes that the contract for completing and equipping main building of Spearfish Normal School (bids opened Aug. 20) has been awarded to Stolte & Miencier, of Redfield.

Brookings, S. D.—Irwin D. Aldrich, Cataract Hotel, Sioux Falls, Secy. Regents of Educ., writes that bids will be received on Sept. 26 for erecting a law building at Vermillion, and a ladies' dormitory at Brookings, each to cost about $40,000.

Ipswich, S. D.—It is stated that bids will be received by S. H. Rossiter, Clk. School Bd., until Sept. 9, for erecting a brick addition to school. Jeffers & Henry, Archts., Aberdeen.

**Aberdeen, S. D.*—The contract for erecting school on grounds of Normal and Industrial School (bids opened Aug. 12) has been awarded to C. Lepper, of Aberdeen, for $46,787.

Avondale, Tenn.—The Co. Bd. Educ., it is reported, intends erecting a $15,000 school.

**Springfield, Tenn.*—The contract for the Springfield Training School, it is reported, has been let to McDonald & Roberts, of Nashville. The building is to be 3 stories and cost $14,000.

Stevensville, Tex.—The School Bd. is reported to be arranging to erect a 12-room school. Address Clk. of Bd.

Waco, Tex.—It is stated that the issue of $60,000 school bonds has been approved.

**Center, Tex.*—The Trus., it is stated, have awarded the contract to erect a school to S. T. Fleshman and E. H. Barron, at about $20,000.

**Pullman, Wash.*—It is stated that bids will be received by State Bd. of Control, Olympia, until September 16, for the construction of a library and assembly hall building and heating for same for the State College, at Pullman. Plans, etc., at office of John K. Dow, Arch., Spokane; and at office of E. A. Bryan, State College, Pullman.

STREET CLEANING AND GARBAGE DISPOSAL.

Rankin, Pa.—See "Sewerage and Sewage Disposal."

San Angelo, Tex.—The citizens are reported to have voted to issue $20,000 bonds for a fire station and a crematory.

** Items marked thus give the names of parties awarded contracts.*

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

San Diego, Cal.—The following are the bids opened at the office of the Bureau of Equipment, Washington, D. C., Aug. 20 for constructing a wharf, and a trestle and coal bunker on the wharf at the U. S. Naval Coal Depot, San Diego, Cal.: San Francisco Bridge Co., San Francisco, $281,943; Penn Bridge Co., Beaver Falls, Pa., $239,400; Cotton Bros. Co., Oakland, $264,000; Snare & Trieste Co., New York, N. Y., $269,260; and Pacific Constr. Co., San Francisco, $244,980.

New London, Conn.—The following are the bids opened on Aug. 19 by Maj. Harry Taylor, Corps Engrs. U. S. A., for dredging mouth of Connecticut River, about 60,000 cu. yds.: *a* Price per cu. yd., *b* totals: The W. H. Beard Dredging Co., *a* 24 cts., *b* $14,400; Morris & Cumings Dredging Co., *a* 36 cts., *b* $21,600; Maritime Dredging Co., *a* 23.3 cts., *b* $13,980; Hartford & New York Transportation Co. *a* 20 cts., *b* $12,000; Atlantic Dredging Co., *a* 32 cts., *b* $19,200; John P. Randerson, *a* 18 cts., *b* $10,800.

Ft. Du Pont, Delaware City, Del.—Bids will be received by Capt. J. L. Knowlton, Q. M., U. S. A., until Sept. 26 for reconstruction of freight wharf at Ft. Du Pont, as advertised in The Engineering Record.

**Washington, D. C.*—The Maryland Dredging & Contr. Co., of Baltimore, is reported to have secured contract for dredging channels of Potomac and Anacostia Rivers, near Washington, at 9½ cts. and 10 cts. per cu. yd. for soft mud and 20 cts. per cu. yd. for hard material; total cost about $170,040.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Sept. 3, to furnish at the navy yards, and naval stations a quantity of supplies as follows: Sch. 227—Sand, gravel, brick, yellow pine, steel beams. Sch. 235—Machinists' sets, drills. Sch. 236—Yellow pine. Sch. 237—Sheet brass, rolled and manganese bronze, ingot and sheet copper. Sch. 238—Bar and pig iron, galvanized sheet steel, sheet tin, slab zinc. Sch. 241—Brass tubing, valves, pipe fittings. Boston, Mass.—Sch. 229—Ringbolts, etc., spruce. Sch. 236—Ash, white cedar. Sch. 237—Rolled bronze, sheet phosphor-bronze, rod and sheet copper. Sch. 238—Sheet lead, bar iron and steel, roofing tin. Sch. 241—Iron and copper pipe, brass tubes, valves, pipe fittings. Sch. 242—Portland cement, etc. New York, N. Y., etc.—Sch. 230—Windlass, force pumps, bar steel, Sch. 231—Steel plate trolleys, triplex blocks, I beam tracks, etc. Newport R. I., etc.—Sch. 229—Galvanized steel, sheet brass. Sch. 236—Ash and oak. New Orleans, La.—Sch. 207—One punch and shear and two jib cranes. Washington, D. C.—Sch. 229—Nickel steel chain, wire rope, bronze rod, nickel. Sch. 236—Spruce. white cedar, white and yellow pine. League Island, Pa.—Sch. 236—Yellow pine. Sch. 237—Brass rod, rolled bronze, ingot, rod, and sheet copper. Sch. 238—Bar iron, bar plate and sheet steel, steel forgings, ingot and sheet tin, slab zinc, pig and sheet lead. Sch. 241—Galvanized iron, brass and copper pipe, valves, brass cocks, pipe fittings. Naval Academy, Annapolis, Md.—Sch. 232—Pine piles. Portsmouth, N. H.—Sch. 230—Gate and globe valves. Key West, Fla.—Sch. 206—1 universal wood worker. Also until Sept. 17: Mare Island, Cal.—Sch. 251—Portland Cement, doors, etc., Oregon pine, galvanized iron roofing etc., sewer pipe. Puget Sound, Wash.—Sch. 256—Galvanized sheet steel, iron pipe, plumbing fixtures, water heaters. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l, U. S. N.

Shawneetown, Ill.—Bids will be received until Sept. 3 by the Engr. Internal Improv. Comn. of Illinois, at the office of the Mayor, for reinforcing the Shawneetown levee.

**Booneville, Ind.*—The Comrs. of Warwick and Spencer counties are reported to have awarded contract to the R. A. Brown Constr. Co., of Washington, Ind., for the construction of the Barr Creek ditch in Jackson and Pigeon Creek Townships, for $26,000.

Mason City, Ia.—It is stated that bids will be received until Sept. 11 by A. S. Clark, Co. Aud., for constructing tile drains in Dists. No. 3 and 61.

Boone, Ia.—It is stated that bids will be received until Sept. 6 by E. F. Jones, Co. Aud., at Boone, for constructing a ditch in Boone-Story Drainage Dist. No. 1.

Sac City, Ia.—It is stated that bids will be received until Sept. 5 by J. J. Harter, Co. Aud., at Sac City, for constructing Joint Co. Drain No. 2 in Sac Co. and No. 51 in Calhoun Co.

Morgan City, La.—The citizens are reported to have voted August 20 a 1-mill tax for 7 years throughout St. Mary parish for completing channel to gulf by the Atchafalaya Ship Channel Co.

Baltimore, Md.—The City Board of Awards is reported to have approved specifications for constructing a wharf at Ft. McHenry and digging channel to it from main channel.

Salisbury, Mass.—Bids will be received until Sept. 19 by Maj. Edwd. Burr, Corps Engrs., U. S. A., Boston, for removing the wreck of the schooner Julia A. Decker, lying off Salisbury Beach at entrance of Newburyport Harbor, Mass.

Medford, Mass.—See "Paving and Roadmaking."

Detroit, Mich.—Bids will be received by Col. E. L. B. Davis, Corps. Engrs., U. S. A., until Oct. 7 for rock and earth excav., Sect. 2, Plan B, Detroit River, as advertised in The Engineering Record.

Bids will be received by Col. E. L. B. Davis, Corps Engr., U. S. A., until Oct. 8, for dredging Sect. 1, Plan B, Detroit River, as advertised in The Engineering Record.

**Fergus Falls, Minn.*—W. C. Lincoln, Co. Aud., writes that the contract for constructing ditches in Eastern and Effington (bids opened Aug. 9) has been awarded to Chas. Nord and Nils O. Edholm, of Deer Creek, for $7,990.

Ivanhoe, Minn.—Bids will be received by R. H. Sisson, Co. Aud., until Sept. 12, for constructing Ditch 15.

*R. H. Sisson, Co. Aud., writes that the contract for constructing ditches Nos. 12, 13 and 14 at Ivanhoe (bids opened Aug. 20.) has been awarded to Jerry Sherwood, of Litchfield, for $17,629.

Omaha, Neb.—Bids will be received until Sept. 3 by Maj. Thos. Cruse, Q. M., U. S. A., for installing an electric freight elevator in commissary storehouse at Quartermaster's Department.

Roswell, N. M.—Bids will be received by Arthur J. Stevens, Lock Box 45, Roswell, Secy. Com. of City Council, and Irrigation Companies interested, until Sept. 18 for about 8,000 ft. of concrete ditch within the city.

**Albany, N. Y.*—Arthur W. Luce, 100 Bway., N. Y. City, has secured contract for work on Contract 14, in connection with New York State Canal work bids opened July 31), at the following bid (Winslow M. Mead, Deputy Supt. State Bd. Pub. Wks.): Clearing, lump sum, $100; 3,000 cu. yds. grubbing, 34 cts.; 810,000 cu. yds. all excav., 73.5 cts.; 150 M ft. sheeting and bracing, $50; 174,000 cu. yds. forming embkmt., 1st class, 17 cts.; 31,000 cu. yds. forming embkmt., 2d class, 11 cts.; 1,300 cu. yds. lining, $1.70; 212 cu. yds. puddle, $1.70; 158 M ft. sawed lumber (yellow pine or Douglas fir), $55; 400 M ft. sawed lumber (hemlock), $40; 23 M ft. white oak lumber in miter sills and gates, $100; 75 M ft. sawed lumber (white oak), $80; 62 M ft. sawed lumber (creosoted yellow pine or Douglas fir), $100; 27,000 lin. ft. round timber in cribs, 15 cts.. 10,300 cu. yds. stone filling in cribs, $1.50; 70 foundation piles 10 ft. long, ea., $4.40; 70 foundation piles 12 ft. long, ea., $5; 1,500 foundation piles 14 ft. long, ea., $5.60; 3,401 foundation piles 16 ft. long, ea., $6; 84 foundation piles 20 ft. long, ea., $6.15; 40 mooring piles 20 ft. long, ea., $5.50; 200 M ft. wooden sheet piling, $50; 21,000 cu. yds. 1st-class concrete, $8; 210,000 cu. yds. 2d-class concrete, $7.50; 1,250 cu. yds. 3d-class concrete, $6.50; 55 cu. yds. reinforced concrete, $11.40; 3,300 cu. yds. wash wall, $2.50; 3,720 sq. yds. 2d-class stone paving, $1.50; 460 sq. yds. 3d-class stone paving, $1.50; 200 sq. yds. cobblestone paving, 75 cts.; 2,500 cu. yds. ballast, $1.50; 2,600 cu. yds. 1st-class riprap, $3; 15,400 cu. yds. 2d-class riprap, $3; 900 cu. yds 3d-class riprap, $2.85. 8,400 cu. yds. 4th-class riprap, $2.50; 200 cu. yds. 24-in. vitr. pipe, laid, $2; 2,427,000 lbs. structural steel, 4 cts.; 580,000 lbs. metal in uprights for dams, 6 cts.; 830,000 lbs. metal in gates for dams, 7.5 cts.; 810,000 lbs. metal in lock gates, 7 cts.; 330,000 lbs. metal in needle dams, 6 cts.; 128,000 lbs. metal in lock valves, 12 cts.; 280,000 lbs. metal in head gates, 10 cts.; 133,000 lbs. metal reinforcement, 4 cts.; 7,000 lbs. steel castings, 5 cts.; 163,000 lbs. iron castings plain, 3.5 cts.; 55,000 lbs. iron castings, machined, 6 cts.; 86,000 lbs. cast-iron shoes for uprights, 5 cts.; 1,000 lin. ft. wooden fence, 20 cts.; 870 fender fastenings, ea., $3; 2 24x36-in. sluice-gates with hoists and standards, ea., $200; 135,000 lbs. wrought-iron chain, 6 cts.;. 4,030 lin. ft. wrought-iron pipe railing, $1. deduct price to be paid to State for buildings removed by contractor, $100; total, $2,935,763.

*The Gilmour-Horton-Allen Co., of Sandy Hill, has secured the contract for work on Contract 35, New York State Canal (bids opened July 31), at the following detailed bid: (Winslow M. Mead, Deputy Supt. State Bd. of Pub. Wks.): 206,000 cu. yds. all excav., $1.1[illegible]; 100 M ft. sheeting and bracing, $45; 11,000 cu. yds. forming embkmt., 12.5 cts.; 320 cu. yds. lining, $1; 500 cu. yds. puddle, $2.20; 11 M ft. sawed lumber (yellow pine or Douglas fir), $52; 6 M ft. sawer lumber (spruce), $52; 5 M ft. white oak lumber in miter sills and gates, $95; 45 M ft. sawed lumber (white oak), $76; 12 M ft. sawed lumber (creosoted yellow pine or Douglas fir), $95; 51,000 cu. yds. 2d-class concrete, $7.20; 2,700 cu. yds. reinforced concrete, $9.20; 15 cu. yds. 1st-class masry., $25; 4 cu. yds. 1st-class masry. bridge coping, $32; 650 cu. yds. laying masry., $11; 3,400 lin. ft. pointing old masry., 5 cts.; 90 sq. yds. cobblestone paving, 90 cts.; 30 cu. yds. ballast, $1.25; 90 cu. yds. 4th-class riprap, $1.75. 6960 lbs. 4-in. w.-iron pipe and specials, 10 cts.; 880 lbs. 5-in. w.-iron pipe and specials, 10 cts.; 342,000 lbs. structural steel, 5 cts.; 390,000 lbs. metal in lock gates, 7 cts.; 73,000 lbs. metal in needle dams, 6 cts.; 33,000 lbs. metal in lock valves, 12 cts.; 334,000 lbs. metal reinforcement, 4 cts.; 51,400 lbs. iron castings, plain 3.5 cts.; 17,300 lbs. iron castings, machined, 6 cts.; 500 sq. yds. wood-block pavement, $2.50; 120 lin. ft. wooden fence, 20 cts.; 1,070 fender fastenings, ea., $3; 115 expansion bolts in place, ea., 40 cts.; 1,580 lin. ft. wrought-iron pipe railings, $1.40; 440 lin. ft. scroll railing, $1.90; 2 gate hoists, Class "A," ea., $600; 2 gate hoists, Class "B," ea., $500; 2 gate hoists, Class "C," ea., $700; 5 gate hoists, Class "D," ea., $600; 2 gate hoists, Class "E," ea., $800. removing old bridge superstructures, lump sum, $100; moving bridge and bulkhead gates, lump sum, $1,700; raising buildings, lump sum, $900; maintaining highway traffic, lump sum, $500; moving Weighlock House, lump sum, $1,000; deduct price to be paid to State for buildings, lump sum, $100; total, $739,261.

Saugerties, N. Y.—Bids will be received by Col. John G. D. Knight, Corps Engrs., U. S. A., New York City, until Sept. 30 for rock removal and dredging in Saugerties Harbor, N. Y., as advertised in The Engineering Record.

Philadelphia, N. Y.—See "Power Plants, Gas and Electricity."

New York, N. Y.—See "Water."

Oswego, N. Y.—The following are the bids opened on Aug. 17 by Col. H. M. Adams, Corps. Engrs., U. S. A., Buffalo, for constructing stone-concrete superstructure on outer breakwater at Oswego: (*a*) Barnett Contr. Co., Oswego; (*b*) Patk. Keohane, Fayetteville.

	a	*b*
1,175 lin. ft. removing old superstructure	$11.50	$10.00
20 M ft. timber above 1 ft. below water	20.00	50.00
5 M ft. timber below 1 ft. below water	25.00	150.00
24,750 tons rubble stone in place	2.60	2.25
21,500 cu. yds. rubble stone in place (alternative bids)	3.00	2.75
50,000 tons capping stone in place	6.00	4.95
750 cu. yds. concrete blocks	13.00	12.00
1,300 cu. yds. concrete in place	8.50	10.00
12 mooring posts	70.00	50.00
Totals	$400,027	$339,287

**Brunswick, Ga.*—Bids were opened on Aug. 22 by Lieut. Col. Dan. C. Kingman, Corps. Engrs., U. S. A., Savannah, for dredging Brunswick inner and outer harbor, and the bid of P. Sanford Ross, Inc., Jersey City, N. J., was recommended for acceptance for Lot No. 1, consisting of 520,000 cu. yds., at 14.8 cts. and the bid of the Coastwise Dredging Co., of Norfolk, Va., for Lot 2, about 230,000 cu. yds., 16½ cts., and Los. 3, 1,500,000 cu. yds., 23 cts.

Cando, N. D.—The Business men are reported to have decided to lay a drain tile from the main street to a coulee a half mile east.

Cincinnati, O.—Bids will be received by Maj. J. T. Warren, Corps. Engrs. U. S. A., Custom House, Cincinnati, until Sept. 30, for constructing dredge, as advertised in The Engineering Record.

Panama.—Bids will be received at the office of H. F. Hodges, Gen. Purchasing Officer Isthmian Canal Comn., Washington, D. C., until Sept. 25 for steam shovels, steam churn drills, air compressor plant, pumps, generator, induction motors, transformers, etc., as advertised in The Engineering Record.

Charleston, S. C.—The following are the bids opened on Aug. 20 by Capt. E. R. Stuart, Corps. Engrs., U. S. A., for dredging canal between Sewee Bay and McClellanville (price given per cu. yd.): Edw. M. Graves, 17 Commercial Bank Bldg., Cleveland, O., 20 cts.; Simons-Mayrant Co., Charleston, 27.7 cts.; Savannah Dredging Co., Savannah, Ga., 23⅝ cts.; Southern Dredging Co., Mobile, Ala., 37 cts.

Woonsocket, S. D.—It is stated that bids will be received by the Co. Comrs. until Sept. 4, for constructing drainage ditch No. 3. Lewis Strand is Co. Aud.

**Galveston, Tex.*—Capt. J. C. Oakes, Engr., is reported to have decided to recommend the acceptance of the bid of Chas. Clarke & Co., of Galveston, for the Brazos River jetty repair work. They bid $3.58 per ton, or a total of about $32,000.

Seattle, Wash.—Plans are reported to have been prepared for a new wharf to be built by the Standard Oil Co. on its property on the east waterway, Railroad Ave. and Whatcom St.

Wheeling, W. Va.—The lowest bid opened on Aug. 14 by Capt. F. C. Boggs, Corps Engrs., U. S. A., for furnishing and delivering iron and steel for bear-trap gates for Dam No. 18, Ohio River, was submitted by the Penn Bridge Co., of Beaver Falls, Pa., as follows: 158,000 lbs. structural steel, 3.94 cts.; 5,250 lbs. forgings, 8.2 cts.; 385 lbs. pins, etc., 8.2 cts.; 1,420 lbs. bolts, etc., 7.2 cts.; 4,840 lbs. steel castings 17.25 cts.; 1,000 lbs. iron castings, 6 cts.; 27 lbs. bronze cap screws, $1; total, $7,711. Totals of other bids: The Leetonia Boiler Co., Leetonia, O., $11,013; Lawrence D. Weaning, Cleveland O., $8,803; Pittsburgh Industrial Iron Wks., Pittsburg, Pa., $8,290; Excelsior Equipment Co., Pittsburg, Pa., $13,414; J. & J. B. Milbolland Co., Pittsburg, Pa., $9,866.

Racine, Wis.—The lowest bid opened on Aug. 2 by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, for building 196 ft. of crib breakwater at Racine harbor, was submitted by P. W. Galloway, of Racine, as follows: Framing 398 M ft. timber and plank furnished by U. S., per M ft., B M., $11; 30,000 lbs. drift bolts, 4 cts. per lb.; 3,000 lbs. screw bolts, 5 cts.; 2,500 lbs. spikes, 5 cts., and 10,000 tons stone, per ton of 2,000 lbs., $1.48; total, $20,653. Totals of other bids: Edw. Gillen Dock. Dredge & Constr. Co., Racine, $23,670; Wm. H. Gillen, Milwaukee, $23,148, and Burk, Smith & Nelson, Muskegon, Mich., $24,236.

Kenosha, Wis.—The lowest bid opened on Aug. 2 by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, for building 196 ft. of crib breakwater at Kenosha harbor, was submitted by P. W. Galloway, of Racine, at the following bid: Framing 425 M ft. timber and plank, furnished by U. S., per M ft., $11.50; 32,000 lbs. drift bolts, per lb., 4 cts.; 3,000 lbs. screw bolts, 5 cts.; 2,500 lbs. spikes, 5 cts.; 12,000 tons stone, per ton of 2,000 lbs., $1.55; total, $25,042. Totals of other bids: Edw. Gillen Dock, Dredge & Constr. Co., Racine, Wis., $27,370; Wm. H. Gillen, Milwaukee, $26,812; Burk, Smith & Nelson, Muskegon, Mich., $28,237.

**Mimico, Ont.*—H. F. McNaughton, of Toronto, Secy. Bd. Pub. Wks., writes that the contract for constructing concrete superstructure to wharf at Mimico Asylum (bids opened Aug. 20) has been awarded to Miller & Cumming, 50 Front St., Toronto.

Honolulu, H. I.—Bids will be received until October 15, by Capt. C. W. Otwell, Corps. Engrs., U. S. A., at Honolulu, for furnishing and delivering 14,000 bbls. Portland cement, 16,500 tons broken stone and 7,000 tons of sand.

PROPOSALS OPEN.

For Proposals see Pages 73, 74, 76, 77, 78, and 81.

WATER.

Bids Close.		See Eng. Record.
Sep. 3.	Pipe, Victoria, B. C.	Aug. 10
Sep. 3.	**C. i. pipe, Kansas City, Mo**	**Aug. 10**
Sep. 4.	**Hauling and laying pipe, New Orleans,** La. Adv. Jun. 20 to Aug. 31	Jun. 29
Sep. 4.	Pipe, Cazenovia, N. Y.	Aug. 31
Sep. 5.	Walls at reservoir, Bellevue, O.	Aug. 31
Sep. 5.	System, Leesburg, O.	Aug. 31
Sep. 6.	Concrete conduit, Montreal, Que. Adv. Aug. 10, 17.	Aug. 10
Sep. 7.	**Steel tank, etc., Pensacola, Fla.**	**Aug. 17**
Sep. 7.	System, Pensacola, Fla.	Aug. 17
Sep. 8.	**Pump engine, boilers, etc., Louisville.** Ky. Adv. Jul. 27 to Aug. 17	Jul. 27
Sep. 9.	Pipe, etc., New York, N. Y.	Aug. 31
Sep. 9.	Reservoir, etc., Orange, N. J.	Aug. 24
Sep. 9.	Water works improv., Stambaugh, Mich. Adv. Aug. 24, 31.	Aug. 24
Sep. 10.	System at poor farm, Decorah, Ia.	Aug. 24
Sep. 10.	Pump, etc., Buffalo, N. Y.	Aug. 31
Sep. 12.	Plant, Millen, Ga.	Aug. 24
Sep. 13.	Water works, Lawrenceburg, Tenn.	Aug. 31
	Adv.	Aug. 31
Sep. 14.	**Valves and gates, Manila, P. I.** Adv. Jul. 27.	**Jul. 27**
Sep. 14.	Tank and tower, Norfolk, Va.	Aug. 17
Sep. 16.	Pipe, Ft. H. G. Wright, N. Y.	Aug. 31
Sep. 17.	Pipe exten., Philadelphia, Pa.	Aug. 31
Sep. 20.	Water works, Canon City, Colo. Adv. Aug. 31.	Aug. 31
Sep. 30.	Boiler and pump engine, Los Angeles, Cal. Adv. Aug. 31	Aug. 31
Sep. 30.	Pipe, Los Angeles, Cal. Adv. Aug. 31	Aug. 31

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 2.	Riverside, N. J. Adv. Aug. 24, 31	Aug. 24
Sep. 3.	New Philadelphia, O.	Aug. 3
Sep. 3.	Alexandria, La. Adv. Aug. 17, 24	Aug. 17

**Items marked thus give the names of parties awarded contracts.*

Sep. 3.	Canton, O. Adv. Aug. 17 to 31	Aug. 17
Sep. 3.	Kingston, N. Y.	Aug. 24
Sep. 3.	Webster, S. D.	Aug. 24
Sep. 3.	Independence, Ia.	Aug. 31
Sep. 3.	Chippewa Falls, Wis.	Aug. 31
Sep. 3.	Lakewood, O.	Aug. 31
Sep. 3.	Green Bay, Wis.	Aug. 31
Sep. 3.	Omaha, Neb.	Aug. 31
Sep. 3.	Trenton, N. J.	Aug. 31
Sep. 3.	Toledo, O.	Aug. 31
Sep. 3.	New Ulm, Minn.	Aug. 31
Sep. 4.	Beloit, Wis.	Aug. 24
Sep. 4.	Lafayette, Ind.	Aug. 31
Sep. 5.	Johnson City, Tenn. Adv. Aug. 24, 31	Aug. 24
Sep. 5.	Sumter, S. C.	Aug. 24
Sep. 5.	Bozeman, Mont	Aug. 24
Sep. 5.	Bloomington, Ill.	Aug. 31
Sep. 5.	Kansas City, Mo.	Aug. 31
Sep. 5.	New York, N. Y.	Aug. 31
Sep. 6.	Olean, N. Y.	Aug. 31
Sep. 7.	Seattle, Wash.	Aug. 31
Sep. 9.	Bryant, S. D.	Aug. 17
Sep. 9.	Camden, N. J.	Aug. 31
Sep. 10.	Chattanooga, Tenn.	Aug. 24
Sep. 11.	Brooklyn, N. Y.	Aug. 31
Sep. 11.	New Orleans, La. Adv. Jul. 6 to Aug. 31.	Jul. 6
Sep. 11.	Philadelphia, Pa. Adv. Aug. 31	Aug. 31
Sep. 13.	Lake Mills, Wis.	Aug. 24
Sep. 16.	Linton, Ind.	Aug. 31
Sep. 17.	Philadelphia, Pa.	Aug. 31
Sep. 17.	South Orange, N. J.	Aug. 31
Sep. 19.	Togus, Me. Adv. Aug. 31	Aug. 31
Sep. 30.	Fairfield, Cal.	Aug. 31
Oct. —.	Eaton, O.	Aug. 3
Sep. 5.	Freeport, Ill. Adv. Aug. 31	Aug. 31
Sep. 5.	Monroe, N. Y.	Aug. 31
Sep. 6.	Bluffton, Ind.	Aug. 17
Sep. 6.	Janesville, Wis.	Aug. 31
Sep. 6.	Decatur, Ind.	Aug. 24
Sep. 6.	Indianapolis, Ind.	Aug. 31
Sep. 6.	Lonaconing, Md.	Aug. 31
Sep. 6.	Champaign, Ill.	Aug. 31
Sep. 6.	St. Paul, Minn.	Aug. 31
Sep. 7.	Kent, O. Adv. Aug. 31	Aug. 31
Sep. 7.	Washington, Ind.	Aug. 31
Sep. 9.	El Paso, Tex.	Aug. 31
Sep. 9.	De Land, Fla.	Aug. 31
Sep. 9.	Orange, N. J.	Aug. 31
Sep. 10.	Cleveland Heights, O.	Aug. 24
Sep. 11.	Brooklyn, N. Y.	Aug. 31
Sep. 11.	Cincinnati O.	Aug. 24
Sep. 11.	Bridgeton, N. J.	Aug. 24
Sep. 12.	Silverton, O.	Aug. 24
Sep. 12.	Cincinnati, O.	Aug. 24
Sep. 12.	Marietta, O.	Aug. 31
Sep. 13.	Cincinnati, O.	Aug. 31
Sep. 13.	Madison, Wis.	Aug. 17
Sep. 13.	Des Moines, Ia.	Aug. 24
Sep. 14.	Ft. Moultrie, S. C.	Aug. 24
Sep. 14.	Peru, Ind.	Aug. 31
Sep. 15.	Struthers, O.	Aug. 24
Sep. 16.	Youngstown, O.	Aug. 24
Sep. 16.	Euclid, O.	Aug. 24
Sep. 16.	St. Paul, Minn.	Aug. 24
Sep. 20.	Cincinnati, O.	Aug. 31
Sep. 20.	Rockville, Ind.	Aug. 31
Sep. 20.	Cleveland, O.	Aug. 31
Sep. 21.	Cleveland, O.	Aug. 31
Sep. 24.	Lebanon, Ind.	Aug. 24

BRIDGES.

Sep. 3.	Catlettsburg, Ky. Adv. Aug. 17 to 24.	Aug. 17
Sep. 3.	Ingot, Cal.	Aug. 17
Sep. 3.	Sedalia, Colo.	Aug. 24
Sep. 3.	Farmington, Cal.	Aug. 24
Sep. 3.	Albany, Mo.	Aug. 24
Sep. 3.	Santa Barbara, Cal.	Aug. 24
Sep. 3.	Natchez, Miss.	Aug. 31
Sep. 3.	Newark, O.	Aug. 31
Sep. 3.	Newark, N. J.	Aug. 31
Sep. 3.	Medford, Mass.	Aug. 31
Sep. 3.	Crown Point, Ind.	Aug. 31
Sep. 3.	Springfield, Mass. Adv. Aug. 31	Aug. 31
Sep. 4.	Columbus, O.	Aug. 10
Sep. 4.	Glasgow, Mont.	Aug. 17
Sep. 4.	Vicksburg, Miss.	Aug. 24
Sep. 4.	Rahway, N. J.	Aug. 24
Sep. 4.	Winnipeg, Man.	Aug. 24
Sep. 4.	Baltimore, Md.	Aug. 31
Sep. 4.	Smiths Landing, N. J.	Aug. 31
Sep. 4.	Warrensburg, Mo.	Aug. 31
Sep. 5.	Eaton, O.	Aug. 24
Sep. 5.	Long Island City, N. Y.	Aug. 24
Sep. 5.	Ottawa, Ont.	Aug. 31
Sep. 9.	Plaquemine, La.	Aug. 10
Sep. 9.	Wichita, Kan.	Aug. 24
Sep. 9.	Laurel Springs, N. J.	Aug. 24
Sep. 10.	Yosemite, Cal.	Aug. 24
Sep. 11.	Philadelphia, Pa. Adv. Aug. 31	Aug. 31
Sep. 13.	Dunbar, Pa.	Aug. 31
Sep. 13.	Leadville, Colo.	Aug. 31
Sep. 13.	Lorain, O.	Aug. 31
Sep. 14.	Cleveland, O.	Aug. 24
Sep. 16.	Adin, Cal.	Aug. 24
Sep. 16.	Vicksburg, Miss.	Aug. 31
Sep. 20.	Tiffin, O.	Aug. 31
Sep. 20.	Greeley, Colo.	Aug. 31
Sep. 23.	Newark, O.	Aug. 31
Sep. 30.	Santiago, Chile	Jul. 13
Sep. —.	Caldwell, Idaho.	Aug. 31
Oct. 19.	Canton, China. Adv. Aug. 24, 31	Aug. 24

PAVING AND ROAD MAKING.

Sep. 3.	Beardstown, Ill.	Aug. 3
Sep. 3.	New Philadelphia, O.	Aug. 3
Sep. 3.	Dayton, O.	Aug. 10
Sep. 3.	Medford, Mass	Aug. 31
Sep. 3.	St. Bernard, O.	Aug. 17
Sep. 3.	Jacksboro, Tenn.	Aug. 17
Sep. 3.	Lake Charles, La. Adv. Aug. 17 to 31.	Aug. 17
Sep. 3.	Yorktown, Va.	Aug. 17
Sep. 3.	Monticello, Ind.	Aug. 17
Sep. 3.	Boston, Mass	Aug. 31
Sep. 3.	Bloomfield, Ind.	Aug. 31
Sep. 3.	Albany, N. Y. Adv. Aug. 17 to 31.	Aug. 17
Sep. 3.	Canton, O. Adv. Aug. 17 to 24.	Aug. 17
Sep. 3.	Wilmington, Del. Adv. Aug. 17.	Aug. 17
Sep. 3.	Idaho Springs, Colo	Aug. 24
Sep. 3.	Cohoes, N. Y.	Aug. 24
Sep. 3.	Stockton, Md.	Aug. 24
Sep. 3.	Scranton, Pa	Aug. 24
Sep. 3.	Washington, D. C. Adv. Aug. 24	Aug. 24
Sep. 3.	Covington, Ind.	Aug. 24
Sep. 3.	Toledo, O	Aug. 31
Sep. 3.	Sullivan, Ind	Aug. 31
Sep. 3.	Downers Grove, Ill.	Aug. 31
Sep. 3.	Omaha, Neb.	Aug. 31
Sep. 3.	Paola, Kan	Aug. 31
Sep. 3.	Bayonne, N. J. Adv. Aug. 31	Aug. 31
Sep. 3.	Jersey City, N. J.	Aug. 31
Sep. 3.	Florence, Ala.	Aug. 31
Sep. 4.	Albany, N. Y. Adv. Aug. 17 to 31	Aug. 17
Sep. 4.	Providence, R. I.	Aug. 24
Sep. 4.	Brooklyn, N. Y.	Aug. 24
Sep. 4.	Bloomington, Ind	Aug. 24
Sep. 4.	Elmira, N. Y. Adv. Aug. 24, 31	Aug. 24
Sep. 4.	Buffalo, N. Y.	Aug. 24
Sep. 4.	Portsmouth, O.	Aug. 31
Sep. 4.	Lafayette, Ind.	Aug. 31
Sep. 5.	Bergholz, O.	Aug. 24
Sep. 5.	Albany, N. Y. Adv. Aug. 17	Aug. 17
Sep. 5.	El Reno, Okla	Aug. 24
Sep. 5.	Johnson City, Tenn. Adv. Aug. 24	Aug. 24
Sep. 5.	Rockville, Ind.	Aug. 31
Sep. 5.	New York, N. Y.	Aug. 31
Sep. 5.	Neodesha, Kan	Aug. 31
Sep. 5.	Mt. Vernon, Ind.	Aug. 31
Sep. 5.	Wilmington, O	Aug. 31
Sep. 5.	Kansas City, Mo.	Aug. 31

POWER PLANTS, GAS AND ELECTRICITY.

Sep. 3.	Winnipeg, Man. Adv. Jun. 15 to Jul. 20.	Jun. 15
Sep. 3.	Washington, D. C.	Aug. 17
Sep. 3.	Portland, Me.	Aug. 17
Sep. 3.	L'Anse, Mich.	Aug. 24
Sep. 3.	Chicago, Ill.	Aug. 31
Sep. 3.	Washington, D. C.	Aug. 31
Sep. 4.	Brooklyn, N. Y.	Aug. 24
Sep. 4.	Baltimore, Md.	Aug. 31
Sep. 5.	Campbellford, Ont.	Aug. 10
Sep. 6.	Buffalo, N. Y.	Aug. 31
Sep. 7.	Ellis Island, N. Y.	Aug. 31
Sep. 9.	New York, N. Y.	Aug. 31
Sep. 12.	Millen, Ga.	Aug. 24
Sep. 12.	Ft. Myer, Va. Adv. Aug. 31	Aug. 31
Sep. 13.	Lawrenceburg, Tenn. Adv. Aug. 31	Aug. 31
Sep. 16.	Milton, O.	Aug. 10
Sep. 17.	Columbus, O.	Aug. 24
Sep. 17.	Washington, D. C.	Aug. 31
Sep. 20.	Lancaster, Pa.	Aug. 31
Sep. 30.	Rochester, N. Y.	Aug. 31
Oct. 1.	Winnipeg, Man. Adv. Aug. 31	Aug. 31
Oct. 4.	Jacksonville, Fla.	Aug. 31

BUILDINGS.

Sep. 3.	Post office bldg., Waterton, N. Y. Adv. Jul. 27, Aug. 3.	Jul. 27
Sep. 3.	Pub. bldg., Bloomfield, Ind.	Aug. 3
Sep. 3.	Pub. bldg., Washington Barracks, D. C.	Aug. 10
Sep. 3.	Add. to jail, Buffalo, N. Y.	Aug. 10
Sep. 3.	School, St. George, S. C.	Aug. 17
Sep. 3.	Add to school, Cleveland, O.	Aug. 17
Sep. 3.	School, Beloit, Wis.	Aug. 24
Sep. 3.	Htg. school, New York, N. Y.	Aug. 24
Sep. 3.	School, Anthon, Ia.	Aug. 31
Sep. 3.	School, Beloit, Kan.	Aug. 31
Sep. 3.	Pub. bldg., Rochester, N. Y.	Aug. 31
Sep. 3.	Ventilating armory, Buffalo, N. Y.	Aug. 31
Sep. 4.	Post office bldg., Quincy, Mass. Adv. Jul. 27, Aug. 3.	Jul. 27
Sep. 4.	School, Flandreau, S. D.	Aug. 17
Sep. 4.	School plans, Kane, Pa.	Aug. 24
Sep. 4.	Hospital, Brooklyn, N. Y.	Aug. 24
Sep. 4.	Pub. bldg., Willard, N. Y. Adv. Aug. 24, 31.	Aug. 24
Sep. 4.	Pub. bldg., New London, Conn.	Aug. 24
Sep. 4.	Hospital, Binghamton, N. Y.	Aug. 24
Sep. 4.	School, Beaver, Pa.	Aug. 31
Sep. 4.	Pub. bldg., Chippewa Falls, Wis.	Aug. 31
Sep. 4.	Pub. bldg., Baltimore, Md.	Aug. 31
Sep. 5.	Pub. bldg., Evansville, Ind.	Aug. 3
Sep. 5.	Add to court house, Columbia, S. C.	Aug. 17
Sep. 5.	Pub. bldg., New Castle, Ind.	Aug. 24
Sep. 5.	Pub. bldg., Geneva, N. Y.	Aug. 24
Sep. 5.	School improv., Trenton, N. J.	Aug. 31
Sep. 5.	School, Manhattan, Kan.	Aug. 31
Sep. 6.	Court house, Liberal, Kan.	Aug. 24
Sep. 6.	Pub. bldg. improv., Buffalo, N. Y.	Aug. 31
Sep. 7.	Bldgs. at hospital, Elgin, Ill.	Aug. 17
Sep. 7.	Armory, Hillsboro, N. D.	Aug. 31
Sep. 9.	School, Cleveland, O.	Aug. 24
Sep. 9.	School, Roulette, N. D.	Aug. 24
Sep. 9.	Repairs to barracks, Kingston, Ont.	Aug. 24
Sep. 9.	School, Ipswich, S. D.	Aug. 31
Sep. 9.	School, North Grosvenor, Dale, Conn.	Aug. 31
Sep. 9.	Town hall, Nicholas, Ia.	Aug. 31
Sep. 9.	School, Rochester, Minn.	Aug. 31
Sep. 9.	School, Midland, Pa.	Aug. 31
Sep. 10.	Bus. bldg., Elkins, W. Va.	Aug. 17
Sep. 10.	Plmbg., etc., post Bldg., Ft. Bliss, Tex. Adv. Aug. 17 to 31.	Aug. 17
Sep. 10.	Light-house, Philadelphia, Pa. Adv. Aug. 24, 31.	Aug. 24
Sep. 10.	Htg. court house, Forsyth, Ga.	Aug. 24
Sep. 10.	Htg. school, Kenmore, N. D.	Aug. 24
Sep. 10.	Pub. bldg., Kansas City, Mo.	Aug. 31
Sep. 10.	Pub. bldg., Whitesboro, N. Y.	Aug. 31
Sep. 10.	Bus. bldg., Shreveport, La.	Aug. 31
Sep. 11.	Jail, Eureka, Cal	Aug. 3
Sep. 11.	Dwelling, Erie, Pa	Aug. 31
Sep. 11.	School, North Braddock, Pa.	Aug. 31
Sep. 11.	School, Buffalo, N. Y.	Aug. 31
Sep. 12.	Boilers in post bldg., Jefferson Barracks, Mo.	Aug. 24
Sep. 12.	Post bldg., Ft. Sam Houston, Tex.	Aug. 24
Sep. 12.	Approaches to P. O. bldg., Rome, N. Y.	Aug. 31
Sep. 12.	Pub. bldg., Des Moines, Ia.	Aug. 31
Sep. 13.	Church, Park Rapids, Minn.	Aug. 24
Sep. 14.	Pub. bldg., Washington, D. C.	Aug. 17
Sep. 14.	Pub. bldg., Pensacola, Fla.	Aug. 17
Sep. 14.	State school, Hudson, N. Y. Adv. Aug. 24, 31.	Aug. 24
Sep. 14.	Addition to court house, Crown Point, Ind.	Aug. 31
Sep. 14.	Reformatory, etc., Napanoch, N. Y. Adv. Aug. 31.	Aug. 31
Sep. 15.	School, Chapman, Kan.	Aug. 31
Sep. 15.	Church, Owensville, Ind.	Aug. 24
Sep. 16.	Marine Hospital, Buffalo, N. Y. Adv. Aug. 3, 10.	Aug. 3
Sep. 16.	Marine hospital, Pittsburg, Pa.	Aug. 10
Sep. 16.	Indus. plant, Washington, D. C.	Aug. 24
Sep. 16.	School, Pullman, Wash.	Aug. 31
Sep. 17.	U. S. Mint bldg. repairs, San Francisco, Cal.	Aug. 10
Sep. 17.	Univ. bldg., Lawrence, Kan.	Aug. 24
Sep. 17.	Htg. school, Columbus, O.	Aug. 31
Sep. 17.	Bus. bldgs., Kankakee, Ill.	Aug. 31
Sep. 17.	School, Valley City, N. D.	Aug. 31
Sep. 17.	Pub. bldg., Las Animas, Colo.	Aug. 31
Sep. 19.	Post office, Muscatine, Ia.	Aug. 10
Sep. 20.	School, Lancaster, Pa.	Aug. 31
Sep. 21.	Pub. bldg., Portsmouth, N. H.	Aug. 31
Sep. 23.	Post office exten., Cedar Rapids, Ia.	Aug. 10
Sep. 24.	Post office bldg., Hamilton, O. Adv. Aug. 17 to 24.	Aug. 17
Sep. 26.	Court house, Muscatine, Ia.	Aug. 24
Sep. 26.	School, Riverside, Cal.	Aug. 31
Sep. 26.	New Industrial plants, Riverside, Cal.	Aug. 31
Sep. 26.	School, Brookings, S. D.	Aug. 31
Sep. 30.	Bus. bldg. plans, Harrisburg, Pa.	Aug. 3
Sep. 30.	Post office, Selma, Ala.	Aug. 24
Sep. —.	Hotel, New Orleans, La.	Jun. 29
Oct. 1.	Bus. bldg., Decatur, Ill.	Aug. 31
Oct. 1.	Pub. bldg., Eau Claire, Wis.	Aug. 31
Oct. 1.	Y. M. C. A., Indianapolis, Ind.	Aug. 31
Oct. 3.	Court house plans, La Moure, N. D.	Aug. 10
Oct. 7.	U. S. Post Office improv., Baltimore, Md. Adv. Aug. 31.	Aug. 31
Oct. 15.	Court house plans, De Pere, Wis.	Aug. 17
Nov. 5.	Court house plans, Houston, Tex.	Aug. 31
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
———	School, bldg. material, Lawrence, Kan.	Aug. 31

MISCELLANEOUS.

Sep. 2.	Repair dykes, etc., New York, N. Y. Adv. Aug. 17 to 31.	Aug. 17
Sep. 3.	Pier wk., Two Rivers Harbors, Wis. Adv. Aug. 10 to 31.	Aug. 10
Sep. 3.	Ditch, Ft. Snelling, Minn.	Aug. 10
Sep. 3.	Walls, etc., Joliet, Ill.	Aug. 17
Sep. 3.	Sanitary fixtures, etc., Panama	Aug. 24
Sep. 3.	Park wk., Medford, Mass.	Aug. 31
Sep. 3.	Elevator, Omaha, Neb.	Aug. 31
Sep. 3.	Supplies, Washington, D. C.	Aug. 31
Sep. 3.	Levee work, Shawneetown, Ill.	Aug. 31
Sep. 4.	Dredging, Norfolk, Va. Adv. Aug. 10 to 31.	Aug. 10
Sep. 4.	Dredging, Providence, R. I. Adv. Aug. 10 to 31.	Aug. 10
Sep. 4.	Garb. disp., Baltimore, Md.	Aug. 17
Sep. 4.	Ditch, Woonsocket, S. D.	Aug. 31
Sep. 5.	Pier, Buffalo, N. Y.	Aug. 24
Sep. 5.	Dredging, Seattle, Wash.	Aug. 17
Sep. 5.	R. R. work, Pensacola, Fla. Adv. Aug. 17 to 24.	Aug. 17
Sep. 5.	El. ry. tunnel work, Boston, Mass.	Aug. 31
Sep. 6.	Dike, Boston, Mass. Adv. Aug. 24	Aug. 24
Sep. 6.	Furnishing rock, New Orleans, La.	Aug. 24
Sep. 6.	Furnishing rock, Vicksburg, Miss.	Aug. 24
Sep. 6.	Ditch, Boone, Ia.	Aug. 31
Sep. 6.	Ditch, Sac City, Ia.	Aug. 31
Sep. 7.	Dredging, Stamford, Conn. Adv. Aug. 17 to 31.	Aug. 17
Sep. 7.	Dredging, Washington, D. C.	Aug. 17
Sep. 7.	Drainage work, Little Rock, Ark. Adv. Aug. 17 to 31.	Aug. 17
Sep. 9.	Dredging, Honolulu, H. I. Adv. Aug. 3 to 24.	Aug. 3
Sep. 9.	Emplacements, etc., for guns, West Point, N. Y. Adv. Aug. 24, 31	Aug. 24
Sep. 9.	Supplies, New York, N. Y.	Aug. 31
Sep. 10.	Ditch work, Sibley, Ia. Adv. Jul. 27 to Aug. 10.	Jul. 27
Sep. 10.	Exten. to b'kwater, Cleveland, O.	Aug. 17
Sep. 10.	Exten. to breakwater, Fairport Harbor, O.	Aug. 17
Sep. 10.	Dredging, New Orleans, La. Adv. Aug. 17 to 31.	Aug. 17
Sep. 10.	Breakwater, Bar Harbor, Me. Adv. Aug. 17 to 31.	Aug. 17
Sep. 10.	Lumber, Rock Island, Ill.	Aug. 24
Sep. 11.	Dam, etc., Cincinnati, O. Adv. Aug. 17 to 31.	Aug. 17
Sep. 11.	Ditch, Mason City, Ia.	Aug. 31
Sep. 11.	Levee wk., Bradley, Ark.	Aug. 17
Sep. 11.	Ditch, Estherville, Ia.	Aug. 24
Sep. 12.	Ditch, Estherville, Ia.	Aug. 24
Sep. 12.	Ditch, Ivanhoe, Minn.	Aug. 31
Sep. 13.	Garbage crematory, Ft. Benj. Harrison, Ind. Adv. Aug. 24 to 31	Aug. 24
Sep. 14.	Dredging, Ft. Moultrie, S. C.	Aug. 24
Sep. 16.	Earth filling, Plaquemine, La.	Aug. 24
Sep. 16.	Breakwater, Stockton, Cal.	Aug. 24
Sep. 16.	Wharf, Seattle, Wash.	Aug. 31
Sep. 17.	Lumber, etc., New Orleans, La.	Aug. 24
Sep. 17.	Supplies, Washington, D. C.	Aug. 31
Sep. 18.	Dredging, Washington, D. C. Adv. Aug. 24, 31.	Aug. 24
Sep. 18.	Steam shovels, etc., Panama	Aug. 24
Sep. 18.	Concrete ditch, Roswell, N. M.	Aug. 31
Sep. 19.	Dredging, etc., Gardiner, Me. Adv. Aug. 24, 31.	Aug. 24
Sep. 19.	Removal of wreck, Boston, Mass. Adv. Aug. 24, 31.	Aug. 24
Sep. 19.	Removal of wreck, Salisbury, Mass.	Aug. 31
Sep. 24.	Dredging, Wheeling, W. Va.	Aug. 31
Sep. 25.	Steam shovels, etc., Panama. Adv. Aug. 31.	Aug. 31
Sep. 26.	Wharf, Ft. Du Pont, Del. Adv. Aug. 31	Aug. 31
Sep. 30.	Searchlight outfit, Washington Barracks, D. C.	Aug. 3
Sep. 30.	Dredge, Cincinnati, O. Adv. Aug. 31	Aug. 31
Sep. 30.	Dredging, Saugerties, N. Y. Adv. Aug. 31.	Aug. 31
Oct. 5.	Lock and dam, Franklin, Ark. Adv. Aug. 10 to 31.	Aug. 10
Oct. 5.	Lock and dam, Mobile, Ala. Adv. Aug. 10 to 31.	Aug. 10
Oct. 7.	Excav., Detroit, Mich. Adv. Aug. 31	Aug. 31
Oct. 8.	Dredging, Detroit, Mich. Adv. Aug. 31	Aug. 31
Oct. 10.	Canal wk., Peterboro, Ont.	Aug. 24
Oct. 15.	Cement, stone, etc., Honolulu, H. I.	Aug. 31

CURRENT NEWS SUPPLEMENT

SEPTEMBER 7, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

THE COLLAPSE OF THE QUEBEC BRIDGE.

At 5.30 p. m., August 29, the whole of the superstructure of the Quebec bridge so far erected collapsed without warning and 75 of the 86 men known to be on it were killed. The substructure remained entirely uninjured. The superstructure was entirely wrecked and incredibly distorted. It lies on shore between the piers and under water in the river. The completed south anchor and cantilever arms, one-fourth of the suspended center span, the center span traveler, part of the main traveler, one locomotive and two material cars went down. The 215-ft. south approach span is intact and erection had not been commenced on the north half of the superstructure.

The wrecked portion weighed about 17,000 tons. But little of that on the river side of the main pier can be recovered. Most of the anchor arm eyebars have little or no injuries except bending; many are still perfect. Most connections endured when their members were destroyed. Nearly all parts of the structure fell 150 feet or more, some of them fell 400 feet. Many of the heaviest members were completely shattered and deformed by the fall.

No conditions or appearances have so far been observed that may not be satisfactorily attributed to the collapse, that is, nothing is indicative of cause rather than effect, and nothing yet points to the manner of the failure. Except the anchor arm eyebars, most of the truss members visible have been destroyed. Every failure visible can well be attributed to the collapse and almost any one of them, if occurring before the general collapse, would have inevitably caused it.

All bracing was complete and all connections fully made in all parts of the structure up to the fourth panel of the suspended span, where only the two lower chord sections had been erected. These were still fully supported by the traveler tackles, although fitters had commenced to bolt up the field-rivet holes and other men were making them extra secure for the night. No hoisting of any description was being done.

The main traveler had been dismontled, and its forward overhangs and some of the many upper transverse girders removed, reducing its weight of 1,104 tons (including suspended falsework) to about 800 tons. It had been for over nine months securely anchored on the ninth panel of the cantilever arm and besides being much lighter and less top heavy than ever before was stiffer on account of the skeleton of the erection platform and some temporary wind bracing recently added. None of its connections had been disturbed except those of members completely removed.

The small overhead center span traveler and its equipment weighed approximately 400,000 lbs. and had been for about 32 hours completely and securely anchored on the third panel of the center span, within two moves of its final position.

The truss stresses were about the same as had long been sustained and were only about three fourths of the live and dead load working stresses which the bridge was proportioned to endure after erection. No erection operations were in progress. The anemometer on top of the main post, over 400 ft. above the water, automatically recorded in the office a 26-mile wind. It had previously recorded a maximum of about 56 miles in the severest storms when the main traveler was in the same position and only a slight vibration was observed. Erection work was habitually maintained up to a wind velocity of 40 miles.

The locomotive, weighing perhaps 40 tons, had just delivered an 8-ton load to the traveler's suspended platform, had returned on the other track with the duplicate load and was near the end of the cantilever arm, moving slowly.

Preliminary adjustments of the connections between center and cantilever spans had been satisfactorily and easily made several weeks previously, and the connections not again disturbed.

The tops of the center posts had moved, as planned, 14 ins. from their original positions to within ½ in. of plumb, and the trusses were in perfect alignment. All joints were perfectly closed. The last two lower-chord splices in the anchor arm were being riveted and 90 per cent. of all field rivets had been driven in the anchor arm. In the cantilever arm 50 per cent. of all field rivets had been driven. In connections where all field rivets had not yet been driven from 90 to 100 per cent. of all open holes were filled with the largest bolts that could be entered.

All conditions were normal or more favorable than usual when a loud noise and screams were heard and immediately men on shore saw the end of the cantilever descend unbroken almost to the water's edge, the main traveler fall north, and the 315-ft. center posts and the anchor arm collapse. Only one man, who was within 75 ft. of the anchor pier, succeeded in reaching the approach span. Witnesses estimate the time from the noise till all was over from 20 to 40 seconds. None of the witnesses was within several hundred feet and none of them, or of the survivors, has yet reported any details of the destruction, which was complete and almost instantaneous.

All of the erection foremen were on the bridge, and all perished. They were A. B. Yenser, general foreman; J. L. Worley, foreman of erection; A. H. Birks, resident engineer for Phoenix Bridge Co.; James W. Aderholdt, assistant foreman, and C. A. Meredith, riveting foreman. Of the remaining victims, 35 were Indians from Montreal, mostly expert riveters, 29 were Canadians and the rest were experienced bridge men from the United States. All of the survivors are injured but are expected to recover.

The tremendous distortion and tearing apart of the members of the superstructure subjected the workmanship, design and materials to tests of the utmost severity and in no case observed was there any indication of poor quality or defect. At the annual meeting of the Quebec Bridge Co., held Sept. 3, the chief engineer, Mr. Hoare, stated that two days before the disaster he was notified by an inspector of a deflection of some parts at one point in the lower chord of the west truss. The inspector who made this report assured a representative of The Engineering Record that he never saw anything at the bridge which indicated dangerous conditions and Mr. Hoare was unwilling to state at the bridge company's meeting that the collapse was due to the deflection mentioned. When the matter was reported to Mr. Theodore Cooper, the latter advised the builders to stop loading the bridge any more until an inspection could be made. His telegram to this effect was sent but a short time before the bridge fell. At a hearing before the coroner's jury on Sept. 4, Mr. Hoare testified that other deflections of a similar character had been noticed, but none of such amount, and they had all been remedied.

Work on the preliminary and final designs had been in continuous progress for ten years and the latter were in accordance with usual American long-span practice. Special tests had been made of some of the large members, an exhaustive investigation was made of the proportions and general dimensions of the trusses and great care was taken in detailing the members and connections. Equal care was taken to secure the best structural results, to conform to the best shop practice and to facilitate the simplicity and safety of erection. All details were rigidly examined by the consulting engineer and none were adopted until finally approved by him. Several alternative designs were made for some of them before entirely satisfactory ones were obtained. Maximum stresses were limited, as stated in The Engineering Record of Dec. 1, 1906, and the highest quality of materials and workmanship was required and secured.

Great pains were taken to analyze all erection operations in advance and the steps of the work were accurately worked out in conference between the designing and erection departments. All positions and stresses and the arrangement of plant, location of travelers, derricks, tackles, etc., were precisely fixed before the members were shipped from the shops. The sequence of assembling all members, the treatment of connections, provisions for changing stresses and displacements due to varying conditions of the partially erected structure were made, and elaborate diagrams were furnished to the field force showing sequence and methods of all operations. A large number of special appliances were made for handling the truss members and erecting apparatus. Besides this all of the erection foremen and principal assistants were provided with copies of a 79-page book containing additional sketches and explicit instructions detailing the precautions and operations necessary for different parts of the work, such as making connections, adjustments, field-riveting splices, moving traveler, shifting tackles, hoisting pieces, etc. In this way nothing was left to judgement or individual choice, all was worked out and checked up in advance and provision made for all conditions of the work.

Materials, workmanship and finished members were rigidly inspected at the shop and mills by the contractor's employees and by representatives of the chief engineer, the consulting engineer and the Canadian government. After the members were received at the site, they were assorted and stored and received a final rigid inspection by the foreman in charge, who examined them for possible injury in shipment, verified their condition, tested clearances, performed necessary fitting and field riveting, attached hoisting and handling devices, placed them in the proper position for hoisting and loaded them on service cars which delivered them to the erecting traveler. As the work advanced, it was constantly watched by the general inspectors, rivet inspectors, foremen and by the resident engineers representing the chief engineer, the consulting engineer and the contractor. Precise instrumental observations and regular reports were constantly made.

Just before the collapse, the levels and alignment of the masonry piers were taken and when these observations were repeated after the collapse they were identical, showing no displacement whatever. Accurate levels were always taken of the chord panel points after each movement of the traveler and the last one taken showed the height of the last completed panel of the suspended span to be within ¾ in. of the calculated position, which latter had been very recently verified by a final repetition of the computations lasting five weeks and involving several thousand results.

After one or two panels of the center span had been erected, the adjustment devices at the ends of the cantilever arms were operated slightly to correct an inequality of about ¼ in. in the tops of the last vertical posts. The toggles were adjusted to about mean position, securely shimmed solid and the jacks removed. The thrust from center span on the cantilever end lower chord was only about 300 tons, much less than the final stress provided for there.

During the progress of erection the tops of the main vertical posts, at first set about 15 in. out of plumb towards the shore, had approached the vertical as intended and had almost attained exact verticality. The main

diagonals from the tops of the center posts were calculated to experience a change of sign of stress and had about arrived at the neutral intermediate stage; their joints were closed but not yet field-riveted. Other joints in the trusses had been open on account of camber and changing lengths and stresses, and had all been satisfactorily closed and riveting on them was being completed. Eyebars showing over 1/64-in. error in length had been rejected, and a preliminary inspection showed approximate uniformity of tension and universal tightness of all eyebars in any one member. All compression joints were at all times scrupulously maintained fully secured with at least 90 per cent. of the holes filled with the largest bolts that would enter until the field rivets were driven. Most of the lower chord joints contained 1,000 or more 1-in. rivets. They were made with thick double web and single flange cover splice plates, and the most explicit instructions were given and enforced that the top flange cover plate should never be removed for any consideration whatever, and that if the removal of the lower flange cover plate was unavoidable the webs must first be secured by special angles. This requirement had been very rigidly maintained by the inspectors, and it was stated that the riveters seldom or never removed the lower flange cover plate and never removed more than five bolts at a time in any part of the splice. The rivet gangs had become well trained and the inspectors had few condemnations to make in their work. The accuracy of the shop work was demonstrated by the fact that one air reamer in operation half the time sufficed to fit the connections for nine gangs of riveters.

Frequent observations on the longitudinal alignment of the trusses showed them to be maintained with great accuracy; the last one showed a deviation of less than 1 in. transversely, an amount within the deflections caused by the varying position of the sun.

The main traveler was very securely anchored to the span one panel from the end of the cantilever arm, and its weight, not including its suspended falsework, had been reduced to about 400 tons by the removal of its equipment, the forward top and bottom cantilever trusses, the suspended working platform and some of the massive overhead transverse girders. Otherwise its tower and rear trusses were intact and none of their remaining connections had been disturbed. It was additionally strengthened by temporary wind bracing above the trusses and by the movable erecting platform stringers by which the successive stories were to be removed, so that it was more stable, much less topheavy and developed a far less moment than ever before. All calculations were made on the assumption that this 2,250,000-lb. traveler would erect the whole structure and would move out to the center of the suspended span, nearly 900 ft. from the pier, thus developing an enormous bending moment. These stresses in the anchor and cantilever arms were of the same character and within the maximum working limits of those allowed for dead and live loads in the finished structure. They had, however, never been nearly attained, but for commercial reasons it had been decided to erect the suspended span with a 400,000-lb. overhanging derrick traveler on the top chords, and at the time of the accident the main traveler was being taken down and carried across the river for use in erecting the north anchor and cantilever arms. Care was taken not to add new materials in the suspended span erection faster than corresponding weight was removed from the main traveler, so that the erection stresses were much less than the maximum provided for in the design. Three of the most competent and experienced erectors were constantly stationed on top of the traveler to shift the tackles and inspect them, and whenever any incipient failure or wear was noticed by them or by anyone else, the rope or appliance was immediately replaced by new from a large duplicate reserve stock.

Work had recently been somewhat delayed by a scarcity of workmen, and new men had been hired in the United States in accordance with a written agreement with a labor union which fixed their wages and paid their transportation to and from the bridge in case they worked through the season. Some of these men failed entirely to report at the bridge, and others, after working a short time, wished to quit and demanded their return fare. This was refused on account of their not having worked through to the end of the season, as agreed, and in consequence a strike was declared. The old employees did not wish to lose time in the short working season on this account and the strike was soon declared off, but bitter feelings were said to exist a few days before the disaster.

At 5:30 p. m. all the erectors and their foremen and the engineer were on the bridge making everything secure for quitting at 5:45. Three four-man gangs of riveters and one hoisting engine man were on the anchor arm, and six gangs of riveters were on the cantilever arm, the erecting gang was busy on the travelers and everything is believed to have been in normal condition. Mr. E. J. Wickzer, an experienced foreman who had been on this bridge three years in charge of the erection of falsework and travelers, was 1,200 ft. or more away in the axis of the bridge on the north side of the river, where he was erecting the steel and wooden falsework for the anchor arm. He was watching the foremen directing the fitting of the splices on the 34-ton lower chord pieces still suspended from the traveler, when he heard a very loud noise like the report of a cannon or explosion and saw the end of the cantilever and center span commence to descend, moving somewhat up and down stream as it did so. As it seemed to approach near the surface of the water the main traveler fell north, the main vertical posts collapsed and the entire structure instantly collapsed and disappeared, the whole taking but a few seconds. This account was corroborated by one of the workmen who was on the south shore about 500 ft. west of the bridge and had his attention attracted by a loud explosion. He looked up and saw what seemed to him to be a cloud of smoke and saw the cantilever arm descend and the traveler fall before the collapse of the main post. Other accounts were substantially the same, but it was impossible to secure any statement from the survivors on the structure, who are rumored to have said that rivet heads flew off before the disaster.

All of the cantilever arm and suspended span, except a small part of the first panel of the cantilever which remains on top of the main pier, has disappeared under water which rapidly deepens from nothing at low tide at the foot of the pier to 200 ft. or more at the end of the cantilever arm, making it impossible to determine the position or condition of the trusses. The 315-ft. main center posts are each broken in several places and have their feet on the ground on the south side of the main pier and their tops on the north side with the finials only projecting above the surface of the water. The anchor span, which of course was not self-supporting without the reactions from the cantilever span, and, owing to lack of compressive strength in its top chord, must have necessarily collapsed with the failure of the cantilever span, if not before, fell flat on the ground almost in its vertical plane, deviating laterally a surprisingly small amount. The bottom chords and some of the truss members projected in some places a few feet beyond the original planes of the trusses on both sides of the bridge, but the top chords in general moved a little east. There was no connection between the anchor arm and approach span except the four lines of track rails, three of which pulled off from the anchor arm and hung down vertically almost to the bottom of the pier, and the compressed air pipe which pulled free at one connection near a long transverse arm without displacing the latter. The approach span remained entirely unaffected by the collapse. The anchor pier bent, 95½ ft. high from top of masonry to roadway level, has two vertical posts which enclose the anchor eyebars and are 17 ft. wide at the base parallel to the bridge axis. These revolved to the north about their lower ends, to a position a little beyond the horizontal, and the trusses in collapsing moved still farther north until the panel points, up to eight (counting the from the shore end) at least, were 100 ft. or more beyond their original positions.

The top chords of the fallen trusses remain continuous to and across the main pier. All of the top chord connections are substantially complete, many of the caps remaining on the pins, and these and all other eyebars visible are in remarkably good condition, many of them entirely uninjured and evidently suitable to use again, including most of those which have been twisted and bent. Only one bar, that in the second panel from shore, of the west truss is broken through the body. It is reported that none of the pinholes have been found elongated and none of the pins injured, but very few of either are yet accessible. Especial notice was taken of the fact that in all cases where visible the heavy transverse plates riveted across the vertical posts to receive the eyebars on separate pins were found in perfect condition.

Most of the members of the top lateral system are in approximate position, and in general the connections at their ends and intersections appear to have endured well, but many of the struts are badly broken and distorted. Below them few members of the span could be readily examined except such of the compression posts and lower chords as projected beyond the edges of the pile. Most of the posts were completely destroyed, being bent and twisted in all shapes and often broken quite across. The lattice angles and their rivets failed in many places and allowed the webs to bend and buckle, and in three instances the shop rivets through the several thicknesses of heavy plates forming a single web were all sheared off for a length of 20 ft. or more, allowing the individual plates to separate. In another case one of the long posts was split 60 or 70 ft., resolving it into its component built channels, one of which was exposed to view.

Under each panel point of the anchor span a large pit several feet deep had been dug for the grillage foundations of the steel falsework bents. The timber had been recently removed for use on the north shore foundations, and when the lower chords fell they rested on the surface of the ground between the pits with their panel points approximately over the middles of the pits, thus forming girders spanning the excavations. The vertical posts of the trusses concentrated the weight at these points, and the enormous momentum of the thousands of tons of steel falling from 50 to 150 ft. drove them down to the bottom of the pits, breaking the bottom chords in many places at both the shop-riveted splices on pin centers and at the field-riveted splices a few feet on the river side of each panel point. At the eighth panel point of the west truss, the two inner webs were broken through at the splice and the two outer webs were not broken. In the same panel a piece of chord about 12 ft. long was broken entirely free at both ends. In the first panel of the east truss the lower chord was bent at right angles in two places, forming a horizontal connection between two vertical portions extending from the pier bent to the ground. The worst effects were observed in the ninth panels of both trusses; in the west truss the lower chord was bent in the shape of a letter S, and the east truss chord was about the same.

At the time of the disaster field riveters were at work on the last two lower chord splices. Afterwards both were found to have been fully secured with all splice plates and angles bolted or riveted and both were broken through the splice on the line of the finished ends, with many rivets and bolts sheared off. At joint 5-6 of the east truss, the fully riveted web plates for the center ribs were sheared through. The outside rib was fully riveted and the rivets were sheared in one end. The inside rib splice plates were bolted at both ends, one end remained secured and at the other end all the bolts were sheared off. At the 5 end, where the rivets and bolts were sheared, the flange angles of the outside web were broken off through the rivet holes 3 and 4 ft. from the splice. Both top and bottom cover plates were fully riveted and remained attached to 6 chord and had all rivets sheared in 5 chord.

The top strut of the anchor pier bent broke square in two at the center through the connection for the end lateral anchorage. The end floorbeam remained intact with its stringers all attached and bent down nearly vertical, the web of the beam being twisted and bent and the connections to the truss sheared off. The portal between the main pier vertical posts was broken through all members.

At the feet of the vertical posts in the anchor pier bent, the webs on the river side sheared off from the main part for a height of about 8 ft., crumpling up as the posts revolved down on top of the pier masonry. Otherwise the posts were practically uninjured and in each case pulled out eight of the twelve 1-in. anchor bolts 3 ft. long grouted into the masonry on the shore side. Two or three others in each case were pulled partly out and sheared off. The vertical anchor eyebars inside the post remained pin connected together at this point, and the lower sets, projecting about 6 ft. above the top of masonry were moved about 2 ft. north at the top, taking a smooth, regular curve, edgeways, and elongating in the body about 1 inch, as indicated by the displaced cement line. The masonry was uninjured.

The destruction and mutilation of members was most terrific on the main pier, across which fell the 3,000,000-lb. vertical bent with 4x10-ft. four-web vertical posts 315 ft. high on centers with stresses of over 10,000,000 lb. each. Each post was made in five sections and weighed 712,000 lb., exclusive of the top and bottom pin connection pieces. They were connected by two massive plate girders and three deep lattice girders, all double. The foot of the east truss post, with its shoe and the V-shaped special lower chord section connected to it, fell on the shore side of the pier and formed one leg of a letter N with the top of the other leg resting against and rising a few feet above the top of the pier, where it was broken through and separated 20 ft. or more from the remainder of the post which formed a letter V on the river side of the pier with the vertex under water and the finial, projecting 40 ft. above the pin center, emerging nearly horizontal and pointing northeast. A portion of the west truss main post extends horizontally across the pier obliquely, from about 1 to 4 ft. clear of the east side of the west pedestal and 12 or 15 ft. above the masonry. In the middle of this section two or three of the webs are broken through and at one end are rolled up close, the remaining one or two webs are continuous but very badly shattered and twisted. Beyond this place, on both sides of the pier, the lattice bars are destroyed and the post webs mashed up together and bent at right angles, connecting the horizontal part of the post with vertical parts on each side of the pier. The wide, thick web plates and 8-in. flange angles are shattered, twisted and broken and look like rags. Between the bolsters the twisted and torn steelwork is piled up in a jagged mass about 20 ft. high above the bolster tops. In the upper part of the wreckage lie the top chords, still connected, and displaced transversely about 8 ft. east of their original positions.

The top of west post P4 lies across the west end of the pier just east of the west pedestal, with its eyebar connections intact. Both end panel lower chord sections of the cantilever arm are reported to lie in longitudinal planes with their center points about on the middle of the pier. Both of the great bolsters are intact and not displaced. They are only slightly injured in a few places by bending the edges of the cap plates and outside angle flanges. All the bolts between their cap plates and the pedestals are sheared off. The masonry of the main pier is uninjured, except where the sharp corners are broken by impact.

Throughout the wreck the eyebars and all connections, except those of the lower chords which were subjected to

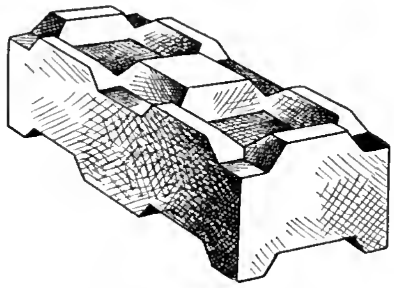
shearing conditions in the pits, endured remarkably well, but the latticing, even when made with well-riveted large angles, as in the main posts and chords, broke and sheared its rivets in many places, failing to develop the compressive strength of the webs and allowing them to buckle and twist between tieplates where, as a rule, they retained their original cross section. It was observed that in most cases where plates and angles were sheared it was through the rivet holes. In numberless cases very thick plates and angles were sheared, twisted, curled and bent at sharp angles, and their behavior and the texture of the fracture invariably indicated high-grade steel in which no sign of flaw or other defect was anywhere observed.

That anybody on the bridge should have escaped alive is miraculous, when it is considered that the least distance any part fell was over 150 ft. and that some of them fell over 400 ft., the bulk falling over 150 ft. Notwithstanding, eleven of the men who went down with the steelwork escaped alive and will probably recover from their injuries. Two brothers were riveting at the top of post P1, over 200 ft. above the rocky ground, one was inside the post and the other inside the transverse strut, both holding on rivets. The massive post was bent, crumpled and torn to pieces and the men escaped. Another riveter who was also holding on inside the lower chord near the main pier, more than 50 feet above the ground, went down in it and emerged alive. One man on top of the main traveler fell with it about 400 ft. into the water and was rescued, another on top of the small traveler fell about 250 ft. into the water and was also rescued.

The Canadian government has appointed a commission composed of Mr. H. Holgate and Mr. Kerry, of Montreal, and Professor Galbraith, of Toronto, to investigate the accident, and every effort is being made by the Quebec Bridge Co. and the Phœnix Bridge Co. to determine the cause of the disaster and fix the responsibility where it belongs, regardless of who may be at fault. No facts have been concealed and every facility was extended for the examination from which these notes have been prepared.

AN INTERLOCKING CEMENT BLOCK.

The accompanying illustration shows a new form of concrete building block recently put on the market in San Francisco. The shapes of the upper and under surfaces are the reverse of each other, and are arranged in such a manner that the blocks may be laid as headers or stretchers, with vertical joints having a horizontal distance apart equal to 1/4, 1/2, 3/4 or 1 times the length of



INTERLOCKING CONCRETE BLOCK.

the building block. This arrangement will make it possible to build concrete walls with any of the usual kinds of bond used for brickworks. The concrete block construction has the advantage that there is a bond in all of the horizontal joints, while in brickwork there is none. The blocks are supplied by the Interlocking Brick Co., 958 Market St., San Francisco.

PERSONAL NOTES.

Mr. F. C. Miller has resigned as resident engineer of the Sacramento division of the Southern Pacific Railway at Sacramento, Cal.

Mr. J. A. Purdam has been appointed superintendent of bridges, buildings and water supply in connection with the construction of the relocated line of the Panama R. R., with offices at Colon.

Willis G. Hale, a well-known architect of Philadelphia, died yesterday in a hospital there after a long illness, aged 55 years. He designed many of the handsome business buildings in Philadelphia.

Messrs. D. C. & Wm. B. Jackson, consulting engineers, have removed their Western office from Madison, Wis., to 508 Commercial National Bank Building, Chicago, and will open an Eastern office at Boston soon.

Mr. George Wildin, formerly assistant superintendent of motive power of the Lehigh Valley R. R., is now mechanical superintendent of the New York, New Haven & Hartford R. R., succeeding Mr. F. T. Hyndman.

Mr. H. W. Durham has resigned as resident engineer of the Isthmian Canal Commission at Panama to take charge of preliminary work on the Cape Cod Canal for the firm of Wm. Barclay Parsons, consulting engineers.

Henry Troth Townsend, president of the Logan Iron & Steel Co., Lewistown, Pa., for many years and a director of the Southwark Foundry & Machine Co., died recently at his home in Bryn Mawr, Pa. He was 56 years old.

Mr. John H. Griffith, Assoc. M. Am. Soc. C. E., formerly engineer of construction for the Metallurgical Company of America, New York City, has accepted an appointment as assistant professor of civil engineering at the University of Michigan.

The New York State Civil Service Commission will hold examinations Sept. 28 of candidates for the following positions: Bridge designer, $1,500 to $2,100 per year; bridge draftsman, $1,200 to $1,500 per year; architectural draftsman, $15 to $25 per week.

Mr. G. D. Fowle, signal engineer of the Pennsylvania R. R., has been appointed consulting signal engineer. Mr. A. H. Rudd, assistant signal engineer, succeeds Mr. Fowle as signal engineer, and Mr. C. C. Anthony, heretofore inspector of signals, has been appointed assistant signal engineer in place of Mr. Rudd.

The veterans of the Fifteenth and Fiftieth Brigades of New York Engineers, Army of the Potomac, met for their thirty-seventh annual reunion recently in New York City. Mr. Daniel M. Hulse, of Canadaigua, N. Y., was elected president of the organization for the succeeding year, and Canadaigua was chosen as the next meeting place.

Mr. Arthur E. Loder, formerly first assistant engineer of the Office of Public Roads of the Department of Agriculture, Washington, D. C., has been appointed chief engineer to the Los Angeles County Highway Commission, which is preparing plans for the construction of a system of permanent highways for Los Angeles County, to cost approximately three million dollars.

Congressman Theodore E. Burton, of Ohio, has resigned as chairman of the Rivers and Harbors Committee of the House of Representatives, his reason being that he requires more time for the consideration of general legislation than was available during his service as chairman of the committee. Mr. Burton will not, however, sever all connection with the problem of public waterway development. Recently he was appointed by the President to be chairman of the Inland Waterways Commission.

The appointment of Prof. E. R. Dewsnap as professor of railroad administration and management at the University of Illinois has been announced. Prof. Dewsnap, born in England of American parents, was educated at the University of Manchester, and at the Royal Technical College of Manchester. After graduating he spent considerable time studying the operation, construction and management of railroads in the United Kingdom, in France and in Germany, and was for a time an official on an English railway.

Col. Amos Stickney, Corps of Engineers, U. S. A., was retired from the army Aug. 27 with the grade of brigadier-general, having reached the age of 64 years, the limit of active service in the army. He was born in Missouri and was graduated from the Military Academy in 1864. He served as first lieutenant in the Corps of Engineers during the last two years of the Civil War and was honored successively during that time with the brevet titles of captain and major. From 1867 to 1881 he served in the Corps of Engineers as captain, being engaged mainly on river improvement work on the Des Moines and Mississippi rivers. In 1881 he was promoted to the rank of major and was transferred to river and harbor work in the South, on the Mississippi and other rivers. He was president of the Mississippi River Commission for nearly two years, and later was president of the Missouri River Commission. Since 1903 he has been stationed in New York City as chief engineer officer of the Atlantic division. He retired from that office and from his membership on the New York Harbor Line Board and the Lighthouse Board June 4, 1907, when he was granted leave of absence until the date of his retirement.

Rear-Admiral William A. Windsor, U. S. N., retired, died at his home in New York City, Aug. 29, aged 65 years. He studied engineering in the shops and drafting room of the Baltimore & Ohio R. R., and in 1862 was appointed a third assistant engineer in the navy. He was made a second assistant engineer in 1864, first assistant engineer in 1868, and chief engineer in 1889. Ten years later his rank was changed to commander. He was made a captain in 1901, and was placed on the retired list with the rank of rear-admiral in 1902. He was chief engineer and head of the department of steam engineering at the Brooklyn navy yard in 1898 and 1899.

Mr. W. J. Wilgus, vice-president of the New York Central & Hudson River R. R., under whose direction the electrification of the New York Central lines out of New York has been carried out, has been asked by Mayor Busse, of Chicago, to make a study of the problem of electrifying the trunk lines out of Chicago. The whole matter will be brought to the attention of the Council by Mayor Busse at once, as Mr. Wilgus, after Oct. 1, when his resignation from the Central Company takes effect, will be at liberty to entertain any proposition to act in a consulting capacity that may be made to him. Chicago's trunk system embraces twenty-three lines, all of which are now being elevated to avoid grade crossings.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Columbiana, Ala.—See "Power Plants, Gas and Electricity."

Phoenix, Ariz.—Robt. A. Craig, Supt., writes that about $150,000 will be expended in improving the plant of the Phoenix Water Co. purchased by the city, and that some time in September bids for improving the pipe system will be received. The pumping station is to be enlarged later. Howard S. Reed, C. E., Engr., Phoenix.

Russellville, Ark.—The following are reported to be the two lowest bids opened on Aug. 20 by the Bd. of Water Comrs. for constructing water works: Jas. G. Lyons, of Muskogee, Ind. Ter., $36,920, and the Southern Eng. & Constr. Co., Pine Bluff, $42,500.

Sunnyside, Cal.—W. L. Rice & Co., according to reports, are planning to install wells, pumps, tanks and mains in Sunnyside.

Delta, Colo.—Bids will be received until Sept. 10 for constructing a reservoir in Delta and Gunnison Counties to cost about $60,000.E. P. Martin, of Paonia, Colo., is the engineer; C. C. Hawkins may be able to give further information.

Canon City, Colo.—Bids will be received until Sept. 20 by the City Clk. for furnishing material and constructing an additional system of water works, consisting of a reservoir, located at and near Cottonwood Creek, and a pipe line connecting said reservoir with the present city water main, as advertised in The Engineering Record. A. H. Seely, Mayor.

Hudson, Colo.—It is reported that the Hudson Reservoir Co. is about to be formed here, by C. M. Ireland, J. N. and H. S. Bowles and others, to build an irrigation system to cost about $300,000. The company will acquire Bootleg reservoir and ditch, Jim Creek reservoir and others in Weld County.

Denver, Colo.—The Colorado Irrigation Lands Co. is reported incorporated by R. J. Bardwell, Albion K. Vickory and Willis F. Wolf, to do business all over the West; capital, $600,000.

Leadville, Colo.—The Colorado Fuel & Iron Co., it is reported, intends draining Turquoise Lake and constructing a new concrete dam to replace present dam at Sugar Loaf reservoir.

Wilmington, Del.—Bids are wanted for the new city filtration plant as advertised in The Engineering Record. Theo. A. Leisen, Ch. Engr.

Ft. Barrancas, Fla.—Bids will be received by Lieut. A. L. Rhoades, Q. M., U. S. A., until Sept. 26, for constructng a 200,000-gal reinforced-concrete reservoir, installing 1 steam pump and 1 steam air compressor, and extending water main at this post.

Athens, Ga.—The city is planning additions to the filter plant at the water works. Address J. W. Barnett, City Engr.

Pavo, Ga.—Jos. M. Brannon, Clk., writes that water works to cost $6,000 are to be constructed. Bonds for this improvement will be on the market about Oct. 15.

Atlanta, Ga.—It is reported that the Water Bd. and Special Council Com. has declared off all the bids received recently for the filter plant and the Gen. Mgr. of the Water Wks. has been directed to ask new bids.

Blue Ridge, Ga.—See "Power Plants, Gas and Electricity."

Dallas City, Ill.—See "Power Plants, Gas and Electricity."

Fairbury, Ill.—The City Council is reported to have decided to issue $3,000 bonds for water works.

Marion, Kan.—Fred. Lewis, Chm. Water Wks. Com., writes that Burns & McDonald, of Kansas City, Mo., are the engineers for the water works to be constructed with the $33,000 recently voted.

Baltimore, Md.—Water Engr. Quick is reported to be planning the laying of additional mains.

Baltimore, Md.—Press reports state that Building Inspector Preston estimates the cost for the repairs, new foundations, etc., for the Mt. Royal Pumping Station, which cares for the city's high-service supply at about $[illegible]5,000. This is independent of the cost for the new vertical pump which Water Engr. Quick will have placed in the pumping station in order to insure a good supply of water for this particular service, the estimated cost of which will be $150,000.

Saginaw, Mich.—The increasing of the water service by the installing of larger mains, is reported under consideration by the Water Bd.

Milan, Mich.—It is reported that an election will be held Sept. 10 to vote on the issuing of $30,000 bonds for water works.

Winona, Minn.—The city water is reported to have been condemned. Two plans are under consideration. One is to build an entirely new plant across the river in Wisconsin, and the other is to install a complete filtering plant.

Hastings, Minn.—The City Council is stated to have awarded the contract for drilling an artesian well for the new system of city water works to S. Swenson Artesian Well Co., of Minneapolis, at $3 per lin. ft., 10-in. pipe; $1.80 7⅝-in. casing, and below this well incased, $1.40; for testing, $1.25 an hour.

Hattiesburg, Miss.—Burke Jones, Supt. Water Wks., writes that about $20,000 worth of improvements are to be made to the water works. All the machinery has been purchased and the work is to be done by the city.

California, Mo.—Burns & McDonald, of Kansas City, Mo., are the engineers for the proposed water works which is to cost $60,000. Bonds are to be issued for this improvement. Edw. C. Nischwartz, Mayor.

Wonder, Nev.—The Wonder Water Co. is reported to have developed a supply of 125,000 gal. of water 7 miles distant, which it is proposed to pipe into town.

Highlands, N. J.—Bids will be received until Sept. 25 by the Mayor and Council for furnishing material and constructing a municipal water works. The work includes power house and foundation, stand pipe, pipe line, compound duplex steam pump, air compressor, driven wells and receiving tank, steam boiler and piping. Tunis H. Lane, Boro. Clk.; Runyon & Carey, 122 Market St., Newark, are the engineers.

Jersey City, N. J.—Bids will be received by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) until Sept. 9, for laying water pipe in Henderson St. Approximate estimates of quantities: 4,300 lin. ft. 24-in. pipe; 600 lin. ft. 6-in., 100 lin. ft. 8-in., 200 lin. ft. 12-in., vitr. pipe; 30 M ft. sheathing, 20 M ft. flooring, etc.

Washington, N. J.—The Washington Water Co., it is stated, intends making improvements to its plant at a cost of about $20,000 which will include the construction of a storage reservoir on the Isaac Case Farm above Roaring Rock and the laying of about 2 miles of new mains in the boro.

**Auburn, N. Y.*—The Water Comrs. are stated to have received bids as follows for water wheels at the lower pumping station: S. Morgan Smith Co., $4,400, and Trump Mfg. Co., $4,500 (awarded contract).

Rome, N. Y.—Bids will be received until Sept. 25 by Bd. of Water & Sewer Comrs. (Harvey S. Bedell, Chmn.) for constructing a dam on Fish Creek with accessories; also a tunnel about 5,500 ft. long, as advertised in The Engineering Record.

Oswego, N. Y.—It is reported that arrangements are being made to meet State Engr. Hill and go over preliminary plans for the new city water plant.

Fishkill, N. Y.—Brown & Freeman, of New York City, have been granted a franchise to lay pipes throughout the village to sell water to consumers. The source of supply will be Van Wyck Lake.

Shelby, N. C.—J. F. Tiddy, City Clk., writes that the water works and sewerage system are to be constructed at a cost of about $100,000, but bids for the construction will not be opened until after bonds have been sold. H. E. Knox, Jr., of Charlotte, is the engr.

Wilmington, N. C.—The city is said to be considering the purchase of the plant of the Clarendon Water Works Co.

Mandan, N. D.—The Commercial Club is said to be considering a proposition made to the city by P. H. Michaels, of Mansfield, O., to install water works.

Cincinnati, O.—Frank Borns is stated to have bid $2,532 for laying pipe in Grand, Warsaw and Rice Aves., Price Hill, and $1,983 for laying 3,515 ft. of 8-in. pipe at the river and main pumping stations.

Bids will be received by the Bd. Pub. Service (M. J. Keefe, Clk.) until Sept. 12, for furnishing material and laying c. i. water pipe, special castings and valves in portions of numerous streets.

New Carlisle, O.—J. E. Johnson, Village Clk., writes that it is not proposed to construct water works.

Cleveland, O.—Preliminary plans for the West Side water works tunnel are not yet completed. It may be 3 or 4 months before definite steps are taken. C. F. Schultz, Ch. Engr.

Bryan, O.—Bids will be received until Sept. 10 by the Bd. Trus. Pub. Affairs (R. L. Starr, Pres.), for furnishing and delivering f. o. b. cars Bryan, 6,600 ft. 4-in. c. i. water main pipe to operate under water pressure of 150 lbs. and 7 fire hydrants with steamer connections.

Ashland, O.—The following are reported to be the bids opened Aug. 26 by the Bd. Pub. Affairs on (*a*) pump engine and (*b*) 2 boilers for the water works plant: Snow Steam Pump Co., Buffalo, *a* $15,250; Columbus Equipment Co., *b* $5,590. Columbus Equipment Co., Rob Mumphard boiler, *b* $5,050; Springfield Boiler & Manufacturing Co., *b*, f. o. b. Ashland, $3,881; Canton Hughes Pump Co., *a* $7,975; Gem City Boiler Co., *b* $6,250; D. Connelly, *b* $6,100; Marine Engine & Machine Co., *a* $14,975; Platt Iron Works Co., *a* $10,225; Kingsford Fdry. & Machine Wks., *b* $3,290; D'Olier Engineering Co., *a* $14,950; Canton Hughes, *a* (2 bids) $6,725 and $6,170.

Guthrie, Okla.—W. W. Miller, City Engr., writes that the citizens have voted to issue $40,000 water bonds, $30,000 for storm sewers, $10,000 for sanitary sewers, and $10,000 for street improvements.

Pawnee, Okla.—M. H. Brejz, City Clk., writes that he will receive bids until Sept. 18 for $20,000 water works bonds. Improvements are contemplated to the water works system.

Lebanon, Pa.—It is stated that the enlarging of the water supply is being agitated.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Reedsville, Pa.—The Reedsville Water Co. is reported to be considering the construction of a reservoir.

**Belle Fourche, S. D.*—Contracts for work in connection with the irrigation project at Belle Fourche, it is stated, have been awarded as follows: For the construction of 2.8 miles of lateral, involving 30,700 cu. yds. of excav., Harry L. Shevling, Belle Fourche, $8,706; eight miles of lateral construction, involving 43,700 cu. yds. of excav., Primus & Wilson, of Orman, S. D., $4,975.

Newport, Tenn.—See "Power Plants, Gas and Electricity."

Brownsville, Tex.—See "Power Plants, Gas and Electricity."

Pierce, Tex.—It is stated that bids will be received by A. P. Borden, executor A. P. Pierce Estate, Pierce, until Sept. 10, for constructing pumping plant to consist of two 36-in. centrifugal pumps, direct connected to cross compound condensing Corliss engines of about 500 h. p. Water tube boilers will be used.

R[illegible] City, Tex.—A. F. Davis, City Secy., writes that bids will be called for in about 30 days for the construction of water works, to cost about $15,000.

Salem, Va.—See "Power Plants, Gas and Electricity."

Menasha, Wis.—See "Power Plants, Gas and Electricity."

Toppenish, Wash.—See "Power Plants, Gas and Electricity."

Winlock, Wash.—Secor Bros. & Mears, of Portland, Ore., it is stated, have made an offer to the city to install a complete water system of 2,000 ft. of 8-in. water main and 7 hydrants, at $1,800. Action has been postponed until plans and specifications are completed by the engineers.

London, Ont.—Two propositions are to be submitted to the people, one to provide $293,500 for extending the domestic water supply, and one for $182,000 to provide for a hydraulic power plant and reservoir.

Weyburn, Sask.—The citizens are reported to have voted to issue $50,000 bonds to install a water works system.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Oakland, Cal.—Bids will be received until Sept. 18 by the Bd. Pub. Wks. (Walter B. Fawcett, Secy.), for furnishing material and constructing a concrete and ironstone intercepting sewer in a portion of Wood St.

Pasadena, Cal.—City Engr. S. J. Van Ornum is said to be preparing an estimate of the cost for a main sewer to accommodate the recently annexed portion of the city. The building of the sewer is to be submitted to a vote of the people.

New Haven, Conn.—Bids will be received until Sept. 16 at the office of C. W. Kelly, City Engr., for constructing sewers in portions of several streets.

Joliet, Ill.—The Bd. Local Improv. Aug. 26 authorized the construction of the First Ward sewer trunk system. Probable cost, $31,000. H. A. Stevens, City Engr.

Elgin, Ill.—The building of storm and sanitary sewers in the west side district is reported under consideration.

Springfield, Ill.—Frank H. Hamilton, City Engr., writes that it is proposed to construct a brick sewer in the south part of the city at a cost of $50,000.

Chicago, Ill.—Bids will be received until Sept. 11 by John J. Hanberg, Comr. Pub. Wks., for constructing a 6½-ft. sewer in 35th St. extended and the Illinois Central right of way.

**Collinsville, Ill.*—We are informed that Johnson & Co., of Collinsville, have secured the contract for constructing sanitary septic sewer system in Dist. 1 (bids opened Aug. 20 by the Bd. of Local Improv.) at the following bid (Engineers, Burns & McDonnell, Scarritt Bldg., Kansas City, Mo.): Excav., 8 ft. deep, 35 cts. per cu. yd.; excav., 8 to 12 ft. deep, 75 cts.; excav., 12 to 16 ft. deep, $1.10; vitr. pipe, 8-in., 21½ cts. per lin. ft.; 10-in., 26¾ cts., 12-in., 32½ cts.; 6-in. on 8-in. Y connections, 35 cts.; 6-in. on 10-in. Y connections, 47 cts.; 6-in. on 12-in. Y connections, 57 cts.; 12-in. c. i. pipe, $1.90 per ft.; 10-ft. manholes, ea., $57; 15-ft. manholes, ea., $72.25; flushtanks, ea., $105.60; lamp holes, ea., $10; concrete, $9.75 per cu. yd.; total, $18,831. Time of completion, Jan. 1, 1908. Totals of other bids: John Hamm, Litchfield, Ill., $20,700; Staultz & Gass, Belleville, Ill., $18,875.

**Evansville, Ind.*—The contract to construct the Kentucky Ave. sewer (bids opened Aug. 30) has been awarded to the Hallerbach & May Contr. Co., of Evansville, for a concrete sewer at $168,926.

Huntington, Ind.—It is stated that bids will be received by the Common Council until Sept. 10, for constructing sewer in Market St. and Grayston Ave. J. B. Vernon, City Engr.

Richmond, Ind.—No bids were received Aug. 30 for sewer improvements. F. R. Charles, City Engr.

South Bend, Ind.—It is reported that the Bd. Pub. Wks. will soon ask bids for constructing a sewer in Cherry St. and in Notre Dame Ave.

Remsen, Io.—This city is reported to be planning the construction of a sewerage system.

Wapello, Ia.—It is reported that it is proposed to construct a sewer at a cost of $6,515. E. F. Christie, City Recorder.

Des Moines, Ia.—The lowest bid opened on Aug. 23 by the Bd. of Pub. Works for the construction of the Center Drive sewer system is reported to have been submitted by the Geo. M. King Constr. Co., at $1.37 per lin. ft.; total, $21,920. The L. L. and T. A. Hansman Co. bid for this sewer $1.45 per lin. ft.

Paducah, Ky.—Bids will be received until Oct. 1 by the Bd. Pub. Wks. for constructing about 14 miles of 6-in. vitrified pipe sewer laterals ranging in depth from 12 to 6 ft., as advertised in The Engineering Record.

**Louisville, Ky.*—The following are the bids opened Aug. 28 by the Comrs. of Sewers (J. B. F. Breed, Ch. Engr.) for constructing Happy Hollow Sewer: R. L. Clark & Co., 605 W. Market St., $25,641 (awarded contract); Paul & Kershner, Dayton, O., $31,489; F. W. Folz & Co., Cincinnati, O., $31,770; Kentucky Constr. Co., Louisville, $35,289; C. F. Fitch & Co., Louisville, $43,050. The detailed bid of the successful bidder, R. L. Clark & Co., was as follows: 3,551 lin. ft. earth excav. and cover embankments for main sewer, 61.5 cts.; 40 cu. yds. earth excav. and embankment for junction section, $10 (lump sum); 1,987 cu. yds. concrete masonry, class A, exclusive of cement and steel, $6; 25 cu. yds. concrete masonry, class B, of cement, $3.50; 172,419 lbs. reinforcing metal in place, 03.5 cts.; 25 cu. yds. excav. in trench below masonry, $1; 40 cu. yds. gravel refilling in trench below masonry, $1.25; culvert section, complete across 26th St. cement and steel, $225; 25 cu. yds. masonry, class A, junction section, $10; 2,317 bbls. Portland cement used in work, $2; 87 lin. ft. manholes complete exclusive of cement and steel, 90 cts.; connections with existing sewers, $50 (lump sum); cleaning of grounds and work on completion of contract, $50 (lump sum).

New Bedford, Mass.—City Engr. Williams has prepared plans and estimated for a sewerage system for the northerly portion of the city.

St. Paul, Minn.—The following are reported to be the bids opened on Aug. 22 by the Bd. of Pub. Wks. for sewer on Reaney St., to consist of 625 lin. ft. of sewer of concrete and steel, 350 ft. of 20-in. pipe, 327 ft. of 15-in. pipe, and 600 or more ft. of smaller pipe. John Lind, $7,300; Ryan & Johnson, $7,372; Jas. Forrestal, $7,422; Nicholas Feyen, $7,783, and O'Neil & Preston, $8,498.

Albert Lea, Minn.—The City Council has been petitioned to take steps immediately to construct the trunk sewer.

Winona, Minn.—See "Paving and Roadmaking."

Canton, Miss.—Bids will be received until Sept. 19 for furnishing material and constructing system of house sewers complete, approximately 7 miles of 18 to 6-in. pipe sewer. O. S. Miller, Mayor. Engineer, Walter G. Kirkpatrick, of Jackson.

Billings, Mont.—Bids will be received until Oct. 1 [illegible] Main St. sewer at a cost of about $85,000. Henry Gerharz, City Engr. J. D. Matheson, City Clk.

Aurora, Neb.—Bids will be received until Sept. 21 by Dennis Saylor, City Clk., for constructing a sewer system, as advertised in The Engineering Record.

Jersey City, N. J.—Bids will be received until Sept. 9 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.), for constructing sewers in Union St., Jackson, Claremont, Garfield and Carteret Aves. Approximate estimate of quantities: 1,757 lin. ft. 96-in. steel pipe; 21,000 lbs. steel I-beams; 36,500 lin. ft. piles driven; 67,600 ft. capping; 122,500 ft. flooring; 123 M ft. sheathing; 2,000 cu. yds. concrete, etc.

Brooklyn, N. Y.—Bids will be received until Sept. 18 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in Flatbush Ave. extension, westerly side, from Nassau St. to Fleet St., etc., Sect. Nos. 1 and 2.

Bids will be received by Bird S. Coler, Boro. Pres., until Sept. 18, for furnishing material and reconstructing sewer basins in Roebling St., at the north corner of S. 4th St., at the northerly and westerly corners of S. 3d, etc., in all about 32 sewer basins.

Shelby, N. C.—See "Water."

Hamilton, O.—The following are reported to be the bids recently received here for the construction of the Market St. storm sewer: Frank J. Davis, $17,552; W. H. Louthan, $16,992, and Thos. Bridge & Sons, $16,505.

Local press reports state that bids will be received on Sept. 21 by the Bd. of Pub. Service for constructing sewers and paving on S. D St.

Springfield, O.—It is stated that bds are wanted until Sept. 10 for $24,042 sewer bonds. S. M. Harris, City Aud.

**Canal Dover, O.*—The following are the bids received for constructing the sewer: Adam Schwab, New Philadelphia, O., $16,723 (awarded contract. Sheets and Lyon, Newcomerstown, O., $16,802, Parshall & Co., Akron, O., $20,608.

Dayton, O.—The Clerk, it is stated, has been authorized to receive bids for constructing a storm water sewer from the present terminus of the Chicago Ave. sewer.

Cleveland, O.—Bids will be received until Sept. 11 by the Bd. Pub. Service (A. R. Callow, Secy.), for constructing sewers in portions of Dawning and Columbia Aves., and culverts over branch of Doan Brook at Murray Hill Rd., S. E., and at E. 114th St., Caswell.

**Fostoria, O.*—Geo. M. Fink is reported to have secured the contract to construct a sewer from Main and Jones Sts. to the Bulk & Bottle Glass factory at $3,300.

St. Joseph, Mo.—The holding of an election next spring to vote on the question of issuing $250,000 bonds for sewer extensions is being agitated.

Delaware, O.—All bids opened Aug. 23 by the Bd. Trus. Girls' Industrial Home (T. F. Dye, Secy.) for constructing a sewage disposal plant at above home, to consist of about 5,040 ft. 3, 6, 8, 10 and 12-in. sewer pipe, 2,004 lbs. c. i. specials, 4,764 lbs. steel, 1,378 cu. yds. crushed stone, etc., have been rejected and new bids will be received on Sept. 27. E. G. Bradbury and G. P. Shute, Engrs., 85 N. High St., Columbus.

Guthrie, Okla.—See "Water."

El Reno, Okla.—D. Adams, City Clk., writes that the city is getting ready to sell bonds to the amount of $25,000 for pipe sewers. Engineer, R. N. Whittlesey, of El Reno.

York, Pa.—The issuing of $750,000 bonds for paving, sewer and park improvements is reported under consideration.

Allegheny, Pa.—The Common Council in special session Aug. 27 passed finally ordinances authorizing the employing of an architect to prepare plans and specifications for a sewer plant at the City Home.

Canton, Pa.—It is reported that the State Bd. of Health has refused to renew the permit to this boro. to discharge sewage into Mill Creek and that the building of a sewage disposal plant at a cost of about $30,000 is being agitated.

Groton, S. D.—Bids will be received by F. E. Bandimere, City Audr., it is stated, until Sept. 11, for constructing about 2,568 lin. ft. of sewers.

Salem, S. D.—The election which was to have been held Aug. 30 on the question of issuing $20,000 bonds to construct a sewerage system has been postponed until spring on account of unsatisfactory plans. F. H. Putnam, City Aud.

Portsmouth, Va.—On Oct. 1 the city expects to construct an outlet for the Fifth Ward sewerage system by day labor.

Salem, Va.—See "Power Plants, Gas and Electricity."

**Centralia, Wash.*—S. A. D. Eaton, City Engr., writes that the contract to construct a trunk sewer (bids opened Aug. 27) has been awarded to the Northern Bridge Co., of Tacoma, at $22,150.

* *Items marked thus give the names of parties awarded contracts.*

Baraboo, Wis.—The City Council has adopted a resolution authorizing the Sewer Com. to reject all bids recently received for constructing the 2d Ward sewer and authorizing the Com. to do the work itself, using concrete for the piping and letting cement work only to contractors.

BRIDGES.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—Bids will be received until Oct. 14 by the Bd. Pub. Wks. (Horace B. Ferris, Secy.) for constructing a reinforced concrete bridge across Los Angeles River at 7th St., as advertised in The Engineering Record.

Danbury, Conn.—The Bd. of Finance is reported to have appropriated $11,000 for the construction of a bridge over the Still River on White St.

Anacostia, D. C.—Bids will be received until Sept. 14 by the Comrs., D. C., Washington (H. L. West, Comr.), for filling the approaches to the Anacostia Bridge, D. C., amounting to about 90,000 cu. yds., as advertised in The Engineering Record.

Aurora, Ill.—The construction of a bridge over Main St. is reported contemplated, at a cost of $100,000. The Aurora, Elgin & Chicago Ry. Co. (Chas. Jones, Ch. Engr., Wheaton) is said to be interested.

Marion, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Sept. 10 for the construction of a steel bridge.

Council Bluffs, Ia.—The following bids are reported opened Aug. 19 for constructing two reinforced-concrete bridges over Indian Creek, one at Frank St. and another at 8th St.: E. A. Wickham Council Bluffs, $10,980 for one and $21,500 for both; Marsh Bridge Co., of Des Moines, $9,380 for one, or $11,300 for both; N. W. Stark & Co., of Des Moines, $5,050 for one, or $10,577 for both.

Williamsport, Md.—We are informed that bids have not yet been asked for proposed bridge to be constructed by the Washington & Berkeley Bridge Co. (V. Cushwa, Pres.) over Potomac River at Williamsport. Specifications are in course of preparation and borings for bed rock are being made. The work will be of reinforced concrete construction; probable cost, $80,000. Engineer, Mason D. Pratt, of Harrisburg, Pa.

*Springfield, Mass.—The following are the bids opened Sept. 3 by the Bd. Superv. for constructing the steel superstructure of Abbe Ave. bridge: Boston Bridge Wks., Boston, Mass., $14,999 (awarded contract); H. P. Converse & Co., Boston, Mass., $19,376; R. F. Hawkins, Springfield, Mass., $19,450; United Constr. Co., Albany, N. Y., $17,832; New Jersey & West Virginia Bridge Co., Manasquidoit, N. J., $15,630; Henry L. Norton, Boston, Mass., $15,499; Berlin Constr. Co., Berlin, Conn., $16,582; Canton Bridge Co., Albany, N. Y., $17,740; Penn Bridge Co., Philadelphia, Pa., $16,945.
Bids received at same time and place for constructing superstructure of Mill River Bridge are stated to have been as follows: Fred T. Ley & Co., Springfield, $18,150; Berlin Bridge Co., Berlin, Conn., $15,750.

Barnstable, Mass.—The following are reported to be the bids opened Aug. 26 by the Co. Comrs. at Barnstable for constructing a highway bridge over Bass River, between Yarmouth and Dennis: Berlin Constr. Co., $31,500; Baltimore Bridge Co., $31,200; John F. Gill Co., superstructure, $22,840; New Jersey, West Virginia Bridge Co., superstructure, $15,400. Canton Bridge Co., superstructure, $13,500.

Bay City, Mich.—Bids will be received until Sept. 23 by the Bay County Bridge Comn. (John H. Blomshield, Engr.), for dredging or otherwise constructing an embankment, containing about 50,000 cu. yds., forming the south approach to Belinda St. Bridge at Bay City, as advertised in The Engineering Record.

Newark, N. J.—The Joint Bridge Com. of Bd. of Freeholders of Essex and Hudson Counties is stated to have recommended that the Bridge St., Plank Road and Jackson Sts. bridges be repaired. The improvements will probably cost $300,000.
The 11th Ward Bridge Com. of Bd. of Freeholders is stated to have opened bids as follows on Aug. 27 for constructing a bridge over Morris Canal on Central Ave.: Hedden Iron Constr. Co., $55,000; Hay Foundry & Iron Wks., $49,985; and A. E. Sandford Co., $51,250.

Rensselaer, N. Y.—There is some talk of constructing a viaduct over the N. Y. Central & Hudson River R. R. Co. and the B. & A. tracks at 3d Ave.; if constructed it would cost about $180,000. John J. Sullivan, Pres. Chamber of Commerce, is reported interested.

*Lebanon, O.—Saml. D. Henkle, County Surveyor, writes that the following are the bids opened on August 24, for constructing high truss steel bridge with concrete floor, 2 spans, 135 ft. ea., and 16-ft. roadway, over Little Miami River: Cleveland Bridge Co., Cleveland, $9,670; Central Bridge Co., Indianapolis, Ind., $8,450; Champion Bridge Co., Wilmington, $8,460; Central Concrete & Constr. Co., Canton, $9,990; Riverside Bridge Co., Martins Ferry, $10,365; Oregonia Bridge Co., Lebanon, $7,950. (awarded contract).

Cincinnati, O.—Bids will be received until Sept. 20 (readvertisement) by the Bd. Pub. Service (M. J. Keefe, Clk.) for furnishing material and reconstructing and repairing the structural steel work of the Liberty St. viaduct.

*Toledo, O.—Garrigan Bros., Valentine Bldg., are stated to have secured the contract for paving with brick Phillips Ave. The bid on concrete base was $42,549, and broken stone, $36,137.

Guthrie, Okla.—The citizens are stated to have voted $7,000 bonds for constructing a steel and concrete bridge at 5th St.

Pendleton, Ore.—The construction of a steel bridge to replace the Lee St. structure is reported contemplated, at a cost of about $20,000.

Towanda, Pa.—The following bids are reported opened Aug. 15 by the County Comrs. for constructing the James St. Bridge over Susquehanna River between North Towanda and Wysox: Nelson Constr. Co., $96,578; A. Buchanan, $111,500; Penn Bridge Co., $94,095; New Jersey Bridge Co., $93,400; Owego Bridge Co., of Owego, N. Y., $96,400; E. Whalen, $92,000; Canton Bridge Co., $91,150; York Bridge Co., $95,300.

Woonsocket, R. I.—See "Paving and Roadmaking."

Gaffney, S. C.—Bids will be received by the Bd. Co. Comrs., until Sept. 10, for constructing a steel bridge over Broad River at Stacey's Ferry, to consist of 2 spans 165 ft. each, width 16 ft., steel piers 26 ft. high. E. F. Lipscom, Co. Superv.

Houston, Tex.—See "Paving and Roadmaking."

Galveston, Tex.—See "Miscellaneous."

Humble, Tex.—Bids will be received until Sept. 11 by John B. Ashe, Co. Aud., Houston, for constructing a steel bridge over the San Jacinto River at Humble.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Selma, Ala.—V. B. Atkins, Mayor, writes that bids will be called for in Oct. for paving streets with asphalt, brick or bitulithic. Julian Smith, City Engr.

*New Haven, Conn.—Contracts for paving (bids opened Aug. 19) are stated to have been awarded as follows: State St., with bitulithic, Warren Bros. Co., of Boston, Mass., $2.75 per yd.; Oak St., with Hassam pavement, to Connecticut Hassam Co., at $1.90 per yd. B. D. Pierce, of Bridgeport, secured the contract for paving Carlisle St. The proposed improvements will cost about $50,000.

Washington, D. C.—Bids will be received until Sept. 21 by the Comrs. D. C., for laying cement sidewalks in the District of Columbia, as advertised in The Engineering Record.

*Jacksonville, Fla.—Philip Prioleau, City Engr., writes that the contract to pave 6,060 sq. yds. on Adams St. (bids opened Aug. 26) has been awarded to Georgia Eng. Co., of Augusta, Ga., at $1.69 per sq. yd.

Danville, Ill.—Bids will be received until Sept. 26 by the Bd. Local Improv., for paving portions of Oakwood Ave., Green and Main Sts., and curbing and paving a portion of Van Buren St.

Logansport, Ind.—The Bd. of Pub. Wks., it is reported will receive bids until Sept. 17 for grading, graveling, curbing, etc., on portions of 7 streets.

South Bend, Ind.—It is reported that bids will be received by the Bd. Pub. Wks. until Sept. 10 for the paving, curbing and constructing cement sidewalks on St. Peters St.

*Valparaiso, Ind.—R. B. Ewing, City Clk., writes that the contract for paving 2 blocks with Metropolitan block (bids for which were received Aug. 23) has been awarded to H. C. Finley, of Hoopeston, Ill., at $1.64 per sq. yd.
Bids received at the same time for other paving, have been rejected and news bids are to be received Dec. 13. R. B. Ewing, City Clk.

Sioux City, Ia.—Bids will be received until Sept. 10 by the City Council at the office of the City Clk., for furnishing material and constructing sidewalks of cement, brick or stone on portions of numerous streets.

Des Moines, Ia.—Bids will be received by the Bd. of Pub. Wks., it is stated, until Sept. 16, for grading, etc., E. 18th and Brooks Sts. George D. Dobson, City Engr.

Lewiston, Me.—About 3,000 sq. yds. of granite block pavement is to be laid.

Baltimore, Md.—Bids will be received until Sept. 11 by the Bd. Award (J. Barry Mahool, Pres.), for grading, curbing and paving with macadam, a portion of Kate Ave.

Boston, Mass.—The following are the bids received Aug. 27 by the Massachusetts Highway Comn. at Boston for (*a*) road in Haverhill, (*b*) road in Barnstable: W. H. Gross & Co., *a* $15,458; F. E. Ellis, *a* $13,727; J. E. Watkins, *a* $12,010; R. F. Hudson, *a* $11,266, *b* $6,640; Ed. Adams, a $10,964; William Sears, b $6,329; C. H. Thomas, b $6,053.

South Haven, Mich.—The City Council is stated to have decided to pave Indiana Ave.

St. Joseph, Mich.—Bids will be received by Harry L. Murphy, City Clk., it is stated, until Sept. 18, for grading and paving portions of Main St. and Niles Ave.

*Mankato, Minn.—The contract for macadamizing and curbing a portion of 5th St. is reported to have been awarded to T. R. Coughlin Co., at $5,283.

Minneapolis, Minn.—J. A. Ridgeway, Secy. of Park Comrs., writes that the Boulevard to and around Lake Minnetonka is as yet only a possibility; no legislation has yet been passed authorizing its location or construction.

Winona, Minn.—Bids will be received by City Council until Sept. 16, for paving alley 23 with vitr. brick; also small piece storm water sewer and small piece sanitary sewer; also filling in a bridge on Wisconsin Road, about 50 ft. long.
*Contract was let on Aug. 26 to Abell & Braley Co., for macadamizing Lafayette Sq.

Marshfield, Mo.—W. P. McKnight, City Clk., writes that no contract was awarded Aug. 30 for 98,000 ft. of macadamized streets and that new bids will probably be asked.

Billings, Mont.—Bids will be received until Sept. 17 by J. D. Matheson, City Clk., for macadamizing about 8,500 sq. yds. and 3,000 lin. ft. concrete curb and gutter in Special Improv. Dist. No. 10; also until Oct. 1, for macadamizing and drainage of certain streets in Improv. Dist. No. 20, consisting of approximately 58,653 sq. yds. gravel macadam, 3,000 lin. ft. of sewer complete, 12 manholes complete, 15 catch basins and 17,400 lin. ft. of gutter complete; also, same date and place, for paving with shale brick certain portions of streets in Special Improv. Dist. No. 21, requiring about 6,305 sq. yds. of shale brick pavement, all 3 proposals advertised in The Engineering Record.

Butte, Mont.—The City Council is stated t have passed a resolution providing for the paving of Dakota St.

Hampstead, N. H.—Bids will be received until Sept. 17 by A. W. Dean, State Engr., at Concord, for grading and surfacing with trap rock, a portion of Main St.

*Westfield, N. J.—A. W. Vars, Town Surveyor, writes that the contract for macadamizing a portion of Euclid Ave. (bids opened Aug. 19) has been awarded to Wm. H. Weldon, of Rahway, for $2,739.

*Riverton, N. J.—E. A. Pancoast, Chmn. Highway Com., writes that the contract for 30,000 sq. yds. cement paving (bids opened Aug. 28) has been awarded to A. Bruce Wallace Co., 318-20 Drexel Bldg., Philadelphia, Pa., at 17½ cts. per sq. ft.

Jersey City, N. J.—Bids will be received until Sept. 9 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for repaving Bowers St., requiring about 5,430 sq. yds. asphalt, etc.; also Griffith St., requiring about 5,606 sq. yds. Belgian paving, etc.

*Camden, N. J.—The City Council is stated to have awarded the contract for paving with asphalt a portion of Haddon Ave. to the Filbert Constr. Co., at $1.91 per sq. yd.

Woodcliff Lake, N. J.—Bids will be received until Sept. 24 by the Mayor and Council of Woodcliff Boro., for macadamizing Mill Road and Pascack Road, Woodcliff Heights Road and Glen Road, a distance of 13,768 ft., as advertised in The Engineering Record.

Palisades Park, N. J.—It is stated that bids will be received by Boro. Council until Sept. 12, for grading and macadamizing portions of Edsall Boul. and Brinkerhoff Ave. E. R. Davis, Boro. Clk.; Lemuel Lozier, Boro. Engr., Bank Bldg., Hackensack, N. J.

Brooklyn, N. Y.—The following are the bids received Aug. 21 by Bird S. Coler, Boro. Pres., for regulating and repaving with asphalt on a concrete foundation the roadway of Bocrum St. from Bway. to Leonard St., Manhattan Ave. to Bushwick Ave., etc.: Crawford Co., 52 9th St., Brooklyn, $30,908; Uvalde Asphalt Paving Co., $31,142, and Barber Asphalt Paving Co., $31,380. The detailed bid of the lowest bidder (Crawford Co.), is as follows: 10,050 sq. yds. paving, $1.30; 20 sq. yds. old stone pavement to be relaid, 40 cts.; 1,900 cu. yds. concrete, $6.90; 5,420 lin. ft. new curb, 98 cts.; 600 lin. ft. old curb to be reset, 40 cts., and 30 noiseless covers and heads complete for sewer manholes, $18.
Bids will be received Sept. 18 by Bird S. Coler, Boro. President, for regulating, grading, paving and repaving with asphalt on a concrete foundation the roadway of Roebling St., from S. 4th St. to Union Ave. Engineers' estimate of the quantities is as follows: 18,620 sq. yds. asphalt pavement, 2,040 cu. yds. concrete, 5,600 lin. ft. of new curbstone, 600 lin. ft. of old curbstone to be reset, 1,470 cu. yds. of earth excav., 71,530 sq. ft. of cement sidewalk, 45 sewer catch basins (to be rebuilt), 35 noiseless covers and heads, complete, for sewer manholes. A former call for bids for this work to have been opened Sept. 4 was made but was withdrawn.
Bids will be received until Sept. 18 by Bird S. Coler, Boro. Pres., for repaving portions of Irving and Morgan Aves., Ten Eyck and Water Sts., and with granite pavement, Water St., and laying crosswalks at the intersections of several streets. Engineer's estimate: 23,190 sq. yds. asphalt pavement, 4,240 sq. yds. granite blk. pavement, 4,770 cu. yds. concrete, 11,070 lin. ft. new curb, etc.

New York, N. Y.—The following are the bids opened Aug. 29 by the Comrs. of Parks, New York City, for repaving where directed the cement walks of small parks, in all about 150,000 sq. ft.: Atlanta Contr. Co., $31,500; and Wm. H. Masterson, $23,400.
The following are the bids opened same time and place for paving and repaving with rock asphalt mastic where directed the walks of Central and other parks: (*a*) 1,200 cu. yds. concrete to be furnished and deposited; (*b*) 250,000 sq. ft. rock asphalt mastic to be furnished and laid; (*c*) total: Genasco Roofing Co., *a* $65, *b* 13½ cts., *c* $41,730; The Sicilian Asphalt Paving Co., *a* $6.50, *b* 13 cts.; *c* $40,300.
Bids were opened same time and place for furnishing and delivering 10,000 cu. yds. coarse North River Road gravel for drive in Central Park (*a*) price per cu. yd., (*b*) total: P. M. Dorgan, *a* $2.31, *b* $23,100; John B. Rosa Co., *a* $2.25, *b* $22,500.

Jamestown, N. Y.—All bids received Sept. 2 for 23,000 ft. of cement curb and gutter have been rejected. C. G. Jones, City Engr.

Oakley, O.—Bids will be received until Sept. 14 by David K. Mason, Village Clk., for furnishing material and constructing sewers in Dist. No. 2, including Linden Ave, Brotherton Rd. and other streets. Walter E. Sullivan, Village Engr.

Toledo, O.—It is stated that new bids will soon be received for paving Orange St

*Cincinnati, O.—Jas. Agness is reported to have secured the contract for paving a portion of Highland Ave., for $21,722.
The following bids are reported opened Aug. 29 by Bd. Pub. Service for grading, paving, etc., a portion of Beekman St., at an estimated cost of $24,354: Kirchner Constr. Co., $2.84 per sq. yd., and United States Wood Preserving Co., $2.85 per sq. yd.
Bids will be received by the Bd. Pub. Service (M. J. Keefe, Clk.) until Sept. 18, for furnishing material and paving with wood block a portion of Grant St.; also a portion of Burnett Ave. with brick.
It is stated that bids will be received by the Bd. of Pub. Service until Sept. 19, for grading, paving, etc., portions of several streets.

Hamilton, O.—See "Sewerage and Sewage Disposal."

Youngstown, O.—It is stated that bids are wanted until Sept. 17 for $13,200 bonds for paving Willis and Williamson Aves. Wm. J. Davies, City Aud.

Cincinnati, O.—It is stated that Chas. Underhill bid $5,620 for grading and constructing driveways at the new pumping station.

Columbus, O.—Bids will be received until Sept. 10 by the Bd. Pub. Service (Edwd. F. McGuire, Secy.) for furnishing material and paving portions of several streets.

*Dillonvale, O.—The City Clk. writes that Rosser & Maloney, of Bellaire, have secured the contract for paving with Metropolitan block, for $13,321 (bids opened Aug. 23).

*Dayton, O.—The I. E. Conley Co. is reported to have secured the contract for paving Williams St., at $25,310.

Guthrie, Okla.—See "water."

*Guthrie, Okla.—W. W. Miller, City Clk., writes that the contract to pave Cleveland Ave. (bids opened Aug.

* ***Items marked thus give the names of parties awarded contracts.***

20) has been awarded to Billings & Snyder, of Guthrie, at $1.70 per sq. yd., and 70 cts. for curb and gutter; total, $28,584. Two-course brick on sand filler is the material to be used.

Lancaster, Pa.—Bids will be received until Sept. 18 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 9,381 ft. road; also 10,847 ft. road, both in East Lampeter Township, Lancaster Co.

York, Pa.—Bids are wanted by the Engineer of the York St. Ry., at York, for furnishing within 1 month f. o. b. Hanover, Pa., of 25,000 paving brick.

**Oakmont, Pa.*—Douglass & McKnight, Engrs. Boro. of Oakmont, 1710 Union Bank Bldg., Pittsburg, writes that the contract to pave Oakmont Ave. (bids opened Sept. 2) has been awarded to the Sanders Paving & Constr. Co., Frick Bldg., Pittsburg, at the following bid: 5,000 cu. yds. grading, 48 cts.; 4,300 lin. ft. concrete curb and 2 ft. gutter, 83 cts.; 9,600 sq. yds. brick paving, 9-in. slag foundation, $1.38. H. S. Mitchell of Oakmont has secured the contract for 11,000 cu. yds. grading at 37 cts.

New York, N. Y.—The following are the bids opened Aug. 29 by the Park Comrs. for paving with sheet asphalt on a concrete foundation the carriageway, furnishing and setting curb, etc., on 5th Ave. between 59th and 60th Sts. and between 90th St. and the Plaza at 110th St.;: (*a*) The Asphalt Constr. Co., (*b*) the Barber Asphalt Paving Co., (*c*) Continental Asphalt Paving Co., (*d*) the Sicilian Asphalt Paving Co.:

	a	*b*	*c*	*d*
2,070 cu. yd. concrete in roadway foundation to be furnished and laid	$5.00	$5.65	$7.50	$6.25
51 manhole heads with noiseless covers furnished and set	30.00	19.00	20.00	20.00
26,700 sq. yds. asphalt roadway pavement, furnished and laid	1.46	1.68	2.90	1.58
5,400 lin. ft. new 5-in. bluestone curb, furnished and set on a concrete found.	1.45	1.64	1.25	1.40
4,060 lin. ft. present curb to be taken up, redressed and set on concrete found.	.80	.74	.75	1.00
6 receiving basins, complete	275.00	300.00	300.00	300.00
Totals	$68,036.00	$76,265.00	$112,320.00	$75,188.00

**Norristown, Pa.*—Foley & King, of Norristown, have secured the contract for 10,700 cu. yds grading (bids opened Aug. 24), at 29½ cts. per cu. yd. The Boulevard grading of 24,000 cu. yds. has been held over for the present. Frank L. Smith, Chmn. Park Comn.

**Pittsburg, Pa.*—The County Comrs. are stated to have awarded contracts for constructing roads as follows: Foley Bros., the road from Homestead to Duquesne through Mifflin Township, for $99,000; Booth & Flinn, 2 miles of road along Perrysville Plank Road, extending from Allegheny to West View, for $31,000.

York, Pa.—See "Sewerage and Sewage Disposal."

Woonsocket, R. I.—F. H. Mills, City Engr., is reported to have recommended that Court St. Bridge be paved with wood block, at a cost of about $6,000.

Houston, Tex.—The citizens are reported to have voted to issue $500,000 for the paving of roads and the erection of such small bridges as might be necessary. Address Geo. Horton, Co. Engr.

Texarkana, Tex.—It is stated that $250,000 will be expended in paving certain streets with brick on concrete foundation.

Manassas, Va.—See 'Power Plants, Gas and Electricity."

Centralia, Wash.—The Warren Constr. Co., of Portland, Ore., is reported to have submitted the only bid for paving with bitulithic Tower Ave., for $56,452.

**Chehalis, Wash.*—P. E. McHugh, of Tacoma, is stated to have secured the contract for paving with brick Market St., at $45,860.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Columbiana, Ala.—T. Gordon, of Columbiana, is said to be interested in the establishment of an electric light and water works plant in Columbiana, also an electric car system between Montevallo and Columbiana.

New Decatur, Ala.—The Decatur Light, Power & Fuel Co. (H. B. Johnson, Secy.) is it reported will expend $70,000 in improvements.

Hartselle, Ala.—It is reported that local electricians are figuring on the establishment of an electric light plant here.

Hot Springs, Ark.—The Consumers Electric Co. will purchase four 150-kw. a. c. 2,300-volt generators direct connected to producer gas engine. The cost of work contemplated will be about $135,000. Atwood Benton, of Hot Springs, is the Engr.

Vallejo, Cal.—The Snow Mountain Power Co., of Glenn and Mendocino Counties will, according to reports, furnish light and power to Vallejo and Oakland. Dr. G. F. Connors, of Calistoga, may be able to give further information.

**Hartford, Conn.*—The Westinghouse, Church & Kerr Co., of New York, N. Y., is reported to have secured the contract to erect a steel frame and brick addition to the boiler house extension of the power house on the west side of the Connecticut River at Dutch Point.

New London, Conn.—Bids will be received until Sept. 10 by Maj. Harry Taylor, Corps. Engrs., U. S. A., New London, for furnishing 40 or more 25 kw. electric generating sets, each consisting of a gasoline-driven multiple cylinder vertical engine directly connected to a direct current generator as advertised in The Engineering Record.

Dover, Del.—The Corporation Trust Co. of America is reported to have filed incorporation papers for the Van Buren Fuel & Light Co. with a capital of $25,000. Directors: Jas. S. Cummings, R. T. Graf and R. A. Wortman, all of Chicago, Ill.

Wilmington, Del.—The Oklahoma Fuel, Light & Power Co. is reported incorporated with a capital of $500,000 by Jas. S. Cummings, F. H. Lane, of Chicago, Ill., and others.

Washington, D. C.—Bids will be received until Sept. 10 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Boston, Mass.: Sch. 201—Motor. New York, N. Y.: Sch. 246—Generating sets. Sch. 259—Electric cable, etc. Sch. 264—Voltmeters and ammeters. Charleston, S. C.: Sch. 258—Electric cable and supplies, etc. Sch. 261—Voltmeters, etc. Norfolk, Va.: Sch. 259—Motor generator. St. Augustine, Fla.: Sch. 248—To construct an electric transmission power circuit and furnish electric power at the wireless telegraph station. Applications for proposals should designate the Schedule desired by number. E. B. Rogers, Paymaster Genl., U. S. N.

Americus, Ga.—The Americus Ry. & Light Co., recently organized with a capital of $250,000, is reported to have taken over the entire plant of the present light company and intends rebuilding same and equipping with new machinery.

Dotham, Ga.—A. J. Smith is reported to be organizing a company to develope electric power, and plans and estimates are being prepared.

Canton, Ga.—An election is to be held Sept. 21 to vote on the question of issuing $29,500 sewer water works and electric light bonds.

Blue Ridge, Ga.—The Council has decided to order an election for a $30,000 bond issue for water works and electric lights.

Chandlerville, Ill.—The County is stated to have granted a 20-year franchise to F. P. Sheaf and others for the installation of an electric light, heat and power plant system in the village.

Chicago, Ill.—Bids will received until Sept. 10 by Wm. Carroll, City Electrician, for furnishing about 5,000 gas mantle burners, and 450 dozen gas mantel frames; also furnishing about 150 combination c. i. and steel electric light arc lamp posts.

**Dallas City, Ill.*—J. H. Cole, of South Bend, Ind., is reported to have secured the contract to install a system of water works and construct an electric light plant.

Indianapolis, Ind.—The Sanborn-Marsh Electric Co., 115 N. Illinois St., is reported to have secured the contract to install the electric power and lighting plant in the Woman's Prison, at $6,279.

Auburn, Me.—The Barker Mill (E. W. Gross, Treas.), will construct a cement dam across the Little and Noscoggin Rivers at the Barker Mill this season.

Berlin, Md.—The citizens are reported to have voted in favor of the Mayor and City Council contracting for water and electric lights.

Baltimore, Md.—The installing of permanent arc lights on Baltimore St. instead of the incandescent lights is being considered. Bids for the incandescent lights were asked recently and the contract is being held pending the decision on arc lights.

Separate bids will be received until Sept. 11 by the Bd. of Awards, care of J. Sewell Thomas, City Register, for the special illumination of certain public buildings and streets within the city of Baltimore, and for permanent lighting City Hall dome. Robt. J. McCuen, Supt. Lamps and Lighting.

Oxford, Md.—The R. H. Pollard Co., of Baltimore, Md., is stated to have contracted with the Oxford Ice & Electric Light Co. to construct a plant for lighting purposes in Oxford, also a plant for the anufacture of ice.

Wyandotte, Mich.—Bids will be received until Sept. 17 by the Bd. Pub. Wks. (Jas. G. Pinson, Secy.), for the following electrical machinery. A 300 h.-p. water tube boiler; a 240 kw. generating unit complete; generator panel; feeder panel; series enclosed a. c. arc lamps system; as advertised in The Engineering Record.

Detroit, Mich.—Bids will be received by the Bd. of Water Comrs. (Benj. F. Guinney, Secy.) until Sept. 11, for the furnishing f. o. b. Detroit, 1 5-h.-p. 110-volt, 60-cycle, single-phase, alternating-current motor to run at 1,800 revolutions per minute, with pulley 5 in. in diam. 5½ in. face, with all details complete. Also furnishing one belted type of air-compressor with one 6-in. double acting cylinder, or two 6-in. x 6-in. single acting cylinders with all details complete, but without unloading device, for service at 60 lbs. air pressure, to run at a speed of 160 revolutions per minute, with pulley 30 in. diam. and 4-in. face.

**Dawson, Minn.*—Contracts are stated to have been awarded as follows for the electric light plant and water works (bids for which were received Aug. 20): The amount of the contracts will aggregate $25,000: Tank, pumps and pipe line to W. D. Lovell & Co., Minneapolis; building, to J. W. Carson, Dawson, gas producer engine (Muenzel, 80 h.-p.) to the Minneapolis Steel and Machinery Co., Minneapolis; dynamos, switchboard and electrical appliances to the Westinghouse Co.

Boston, Mass.—The following are stated to be the bids received Aug. 30 by the Schoolhouse Comn. at Boston for electric light system in extension to Mechanic Arts High School, Scotia St.: (*a*) old building; (*b*) new building: Lord Electric Co., *a* $3,250, *b* $20,000; Jas. Wilkinson & Co., *a* $9,626, *b* $27,952; Ed. C. Lewis, *a* $10,167, *b* $25,215.

St. Louis, Mo.—Pres. O'Reilly of the Bd. of Pub. Improvements has completed blueprints of the territory to be lighted under new contract. The location of every city light, arc or mantle, as well as the location of 4,000 new lights to be installed, is shown. There are now 18,000 mantle lamps and 1,100 arc lamps, costing the city approximately $504,000 and $107,800 per year, respectively. In addition there are 800 incandescent lamps used to light alleys. The new arc lamps will add about $50,000 and the new mantle lamps about $100,000 a year to the city's light bill, based on the present charge of $98 for arc and $28 for mantle lamps, making the total contract price approximately $860,000. The Bd. expects to have an ordinance ready to send to the Municipal Assembly soon.

Lovelocks, Nev.—J. W. Gemkroger, Secy. & Treas. of the Lovelock Light & Power Co., writes that the company has been incorporated with a capital of $25,000 and is doing its own construction work.

Trenton, N. J.—The Chamber of Commerce, it is stated, has taken up the old project to dam the Delaware River above the city for the purpose of supplying cheap light and power by electricity for the homes and business houses of the city.

Camden, N. J.—The Council has adopted a resolution looking toward the establishment of a municipal lighting plant.

Rutherford, N. J.—The Reading Ry. Co. is stated to have awarded to Augustus Wildman, of Harrisburg, the contract to construct a building for an electric light, heat and power plant for its freight-distributing yard at Rutherford. The power house will be 56x58 ft., built of brick on concrete foundation. The contract includes the building of a sewer to carry off the drainage, and the entire cost is to be about $12,000.

**Newark, N. J.*—E. M. Waldron & Co., of Newark, are stated to have secured the contract for the installing of the municipal lighting plant in the city hall (bids for which were received Aug. 23), at $28,904.

The Merchants Electric Light & Power Co. is reported incorporated with a capital of $250,000 for the purpose of engaging in the construction of electrical work for the purpose of supplying light, heat and power. Incorporators: Frank Lowrie, of New York, N. Y.; Richard S. Carrick, of Jersey City, and others.

Paulsboro, N. J.—Frank I. Moses, of Trenton, is stated to have submitted the lowest bid Aug. 30 for constructing the gas plant at $29,600.

New York, N. Y.—McKesson & Robbins, of New York, N. Y., have commissioned Dodge & Day, Engrs. & Contractors, of Philadelphia, Pa., to make additions to their present power plant. The additions will include a new engine, generator and necessary changes to piping, wiring, etc.

Conklingville, N. Y.—The Hudson River Electric Power Co., of Glens Falls, is reported to have applied to the Public Utilities Comn. at Albany for permission to issue $7,223,000 bonds, and propose building a dam on Sacandaga River at Conklingville and to erect a storage reservoir for electrical power purposes.

Auburn, N. Y.—See "Water."

**Columbus, O.*—The Allis-Chalmers Co., of Milwaukee, Wis., it is stated, has secured the contract for the exciter to be installed in the municipal electric light plant, at $2,035.

Toledo, O.—The Council Com. on Gas and Light, it is stated, has approved the ordinance granting to the Peoples Htg. & Lighting Co. the right to use the streets of the city.

Duquesne, Pa.—It is stated that the Duquesne Light Co. is arranging to issue $10,000,000 bonds for general improvements and equipment.

Allegheny, Pa.—A bill has been introduced in the Select Council for the issuing of $75,000 bonds to buy a turbo-generator outfit, condensing equipment and all necessary electrical apparatus for the extension of the arc lighting system at the municipal lighting plant on Bradock St.

Philadelphia, Pa.—It is stated that bids have been asked by Geo. R. Stearns, Dir. Dept. Pub. Wks., for additional pumps and dynamos for the Torresdale plant as follows: one 1,000,000 and one 2,500,000-gal. centrifugal pumps, estimated cost, $60,000; and 3 generators for electric lighting and driving the air blowers for the preliminary filters, estimated cost, $25,000.

Pawtucket, R. I.—The Bd. of Aldermen has granted a 5-year franchise to the Pawtucket Electric Co. (Orin Smith, Jr., Mgr.), to lay and maintain pipes for heating purposes.

Aiken, S. C.—A. Ludlow, Mgr. Carolina Light & Power Co., writes that no contracts will be let in connection with the developing of the power of Anderson Shoals for electrical purposes. All work will be done by day labor. Probable cost of work $40,000.

Yankton, S. D.—S. G. Donaldson, Pres. of the Yankton Light, Heat & Power Co., it is reported, wants catalogues on modern appliances.

Aberdeen, S. D.—It is reported that the Council has granted a 25-year franchise to C. F. Frechauf, of Creston, Ia.

Gleason, Tenn.—W. H. Williams, Gen. Mgr., of the Gleason Water & Light Co., writes that nothing will probably be done this year on the construction of the electric light plant.

Newport, Tenn.—Bids are wanted until Sept. 14 for $37,500 water works and $7,500 electric light bonds.

**Beaumont, Tex.*—The Beaumont Gas Co., it is stated, has awarded contract to J. C. Herrenkind to construct its new plant on Beaumont and Port Arthur public road, to replace the structure which was recently destroyed by fire. The building will be made of concrete building blocks and cost about $8,000.

**Brownsville, Tex.*—The City Council is stated to have accepted the bid of Henry G. Ulen, representing the American Light & Water Co., for the construction of a water works and electric light system (bids for which were received Aug. 24), at $65,940.

Terrell, Tex.—A. H. Wooley, City Secy., writes that no engineer has been employed as yet to prepare plans for the electric light plant which is to be constructed at a cost of $15,000.

Manassas, Va.—Bids will be received by O. E. Newman, Chmn. Improv. Com. of Council, until Sept. 28, for furnishing material and installing a water works and electric light plant, and macadamizing the streets in said town. Bids may be submitted as a whole or separately on the above work. Pressey & Weller, Engrs., 1416 F St., N. W., Washington, D. C.

**** Items marked thus give the names of parties awarded contracts.***

Salem, Va.—Bids will be received until Sept. 16 by W. R. Hester, of the Finance Com., for the purchase of $25,000 water, electric light, sewer and improvement bonds.

Oroville, Wash.—The Sillilkameen Power Co., of Oroville, it is reported, has been incorporated, with a capital of $1,200,000, by Monroe Hartman, Chas. A. Andrus and others.

Toppenish, Wash.—The Council is considering the granting of a franchise for both water and light to T. H. Noble, of North Yakima. R. D. Campbell, Town Clk.

Seattle, Wash.—The City Council has passed the ordinance granting to the Seattle-Tacoma Power Co. a steam-heating franchise in the territory bounded by Pike and Madison Sts. and Railroad and 5th Aves.

The Bd. of Pub. Wks. Aug. 24 approved the plans and specifications for the cluster lights that have been ordered installed by the City Council in the down town district. It is reported that bids for the installation, which is estimated to cost about $175,000, will be received by the Bd. of Pub. Wks. in about 3 weeks.

Dousman, Wis.—It is reported that A. J. Smith, Sentinel Bldg., Milwaukee, may be able to give information regarding the power plant to be constructed here.

Priarie Du Sac, Wis.—It is stated that the Legislature at Madison has granted articles of incorporation to a company which proposes constructing a dam across the Wisconsin River at Pounds Landing, about 1 mile north of this village. Magnus Swanson, of Madison; J. S. Tripp, of Prairie Du Sac, and M. A. De Vitt, of Chicago, Ill, are reported interested. The dam is to be constructed in connection with the power plant at Kilbourn, and is to furnish electric power for nearby cities and towns extending as far as Madison, Janesville and Beloit. It will furnish about 12,000 h.p., and will be of steel cement construction.

Revelstoke, B. C.—It is stated that bids will be received by A. Brown, Mayor, until Sept. 30, for furnishing materials and enlarge the civic hydro-electric plant, comprising 500 h.p. producer gas plant and engines, generators and exciters, transmission machinery, switchboards, wiring and the rearrangement of the present plant. H. Floyd, City Clk. Cecil Goddard, Consulting Engr., Winnipeg, Man.

Vancouver, B. C.—See "Miscellaneous."

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

La Junta, Colo.—The City Council is stated to have granted a right of way to C. S. Alnutt for an electric or gasoline motor railway parallel to the Santa Fe right of way through the main part of town. A right of way has been secured to Rocky Ford, 11 miles distant.

A company to be known as the Davenport & Dubuque Ry. will be organized shortly to carry on the construction of an electric railway from Davenport to Maquoketa and Dubuque, according to reports. T. M. Jennings, manager of the National Construc. Co., of St. Louis, is interested. Among other persons taking an active part in the enterprise are O. Sampson, Theo. Daudel, J. L. Kinley, of Andrew, Ia., and others.

Jacksonville, Fla.—George W. Clark is reported to have given bond to the Bd. of County Comrs. for $10,000 to guarantee the building of a railroad from the city limits to Panama Park within a year.

Brunswick, Ga.—The City & Suburban Ry. Co. is stated to have applied for a charter. The line is to be 4 miles long. Incorporators: F. D. M. Strachan, Frank D. Aken, and A. Fendig, of this city, and Geo. P. Walker, Harry D. Strachan, of Savannah, with Ernest L. Simpson and Lewis H. Spence, of New York.

Buckhead, Ga.—The Bd. of County Comrs. are reported to have granted the application of the Georgia Ry. & Electric Co. (Thos. K. Glenn, Mgr., Atlanta) to run a line to Buckhead. The new line will be about 5 miles in length, extending from Brookwood to Buckhead.

South Bend, Ind.—A franchise is stated to have been granted by the St. Joseph County Comrs. to the Chicago, South Bend & Northern Indiana Ry. Co. for the extension of its line in Notre Dame Ave. to the college grounds.

Booneville, Ind.—The Grand Central Traction Co. is reported to have announced that nearly all the deals for the right of way through this and other counties for an interurban line from Indianapolis to Evansville have been closed.

Mishawana, Ind.—The Chicago, South Bend & Indiana Ry. Co. is stated to have secured a site at Front and Main Sts. upon which to build a modern interurban station.

Bemidji, Minn.—It is reported that C. Gowran, of Grand Forks, G. Teitsworth, of Minneapolis, and A. A. Carter, of Bemidji, have made an application to the City Council for a franchise to construct, maintain and operate a complete electric street railway system within the limits of the city.

Salisbury, N. C.—The Bd. of Aldermen is stated to have granted a franchise to the Piedmont-Carolina Ry. Co. to build a belt-line railway from Newton Heights to Salisbury, and to a point near the new Fair Grounds.

The New South Investment Co. is stated to have been chartered to build and operate street railways, etc. Capital, $5,000,000. Cornelius O'Connor, of New York; Frederick H. Payne, of Williamsport, Pa.; Dix W. Noel, of New York, and L. L. Gaskill, of Salisbury, are reported interested.

Chattanooga, Tenn. The Chattanooga Rys. Co. is reported to have announced that the company contemplates spending about $450,000 for improvements, including extensions.

Palestine, Tex. The Corsicana Palestine Interurban Ry. Co. is reported to have announced they are ready to begin active work on the proposed line.

**Snohomish, Wash.* A contract is stated to have been let by the Snohomish Valley Ry. Co. (E. Colburn, Ch. Engr.), for the building of 55 miles of road from Snohomish to Renton to the Continental Engineering & Constr. Co., of New York, N. Y.

New Westminster, B. C.—It is stated that the British Columbia Electric Ry. Co. will place orders in the near future for material needed in the overhead work of the proposed line between Eburne and New Westminster.

RAILROADS.

Notes Arranged Alphabetically by States.

Denver, Colo.—A company is reported as being formed here to build a railroad from Denver to the Pacific Coast, with Seattle as the terminus; capital, $12,000,000. It will also link Denver with New Orleans and Galveston. Judge John D. Milliken, of McPherson, Kan., and Sidney J. Kent, of Lincoln, Neb., are reported interested, as is the Denver, Larimer & Northwestern R. R. Co.

**Kentwood, La.*—Geo. F. Conant, of Kentwood, Ch. Engr., writes that the Kentwood & Eastern Ry. Co. is extending its standard gauge tracks about 10 miles southeast from Bolivar, La. A. Philhrick is the contractor.

Francis, Mo.—The Chicago, Burlington & Quincy R. R. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.) is reported to be having a survey made for a line from Francis to Macon, by way of Clark.

Lincoln, Neb.—The building of a railway from the northern part of Nebraska to the Gulf of Mexico is reported contemplated. Ed. T. Roemer, C. E., of New York, N. Y., may be able to give further information.

Cleveland, O.—W. J. Springborn, Dir. of Pub. Service, and W. J. Carter, City Engr., are reported to have discussed the division of cost and plans for the proposed elimination of the Wheeling & Lake Erie R. R. grade crossing at Clark Ave. S. W., with A. B. Worthington, Vice-Pres., H. T. Douglas, Ch. Engr., and A. B. Coe, Div. Engr. It is hoped to have the details arranged for the beginning of work on this crossing this year. The work will cost over a million dollars.

Yanktown, S. D.—The City Council has granted a single track franchise along First and Bway. to the Yankton & Southern R. R.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—See "Miscellaneous."

San Francisco, Cal.—The Bldg. Com. of the Bd. of Superv., it is stated, has recommended a bond issue of $2,000,000 to build a 4-story class A building to replace the Larkin St. wing at the City Hall, and a bond issue of $750,000 to replace the Hall of Justice with a class A structure.

Greeley, Colo.—William Cowe, 510 Mack Bldg., Denver, is reported to have been selected to prepare plans for the city hall to be erected here.

**La Junta, Colo.*—Piper Bros., of Pueblo, it is stated, have secured the contract to erect a $15,000 hospital here.

Peoria, Ill.—Bids will be received until Oct. 17 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction of an extension, remodeling, etc., including mechanical equipment (except lift), to the U. S. Post Office and Custom House, at Peoria.

Decatur, Ill.—The following are the bids opened on Aug. 20 at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for the construction, complete, of U. S. post office at Decatur: V. Jobst & Sons, Peoria, $84,543; W. J. Turner Co., Chicago, $86,714; F. W. Menke Stone & Lime Co., Quincy, $94,542; W. J. McAlpine, Dixon, $88,346; Ed. Henry, Tipton, Ind., $96,000; C. W. Gindele Co., Chicago, $90,500; Northern Constr. Co., Milwaukee, Wis., $101,323; Moore & Danner, Kokomo, Ind., $104,925; General Constr. Co., Milwaukee, Wis., $96,935; and G. B. Strickler, Washington, D. C., $99,920.

**Indianapolis, Ind.*—E. E. Kottlowski & Co., 1113 Olive St., it is stated, have secured the contract for remodeling the buildings at the woman's prison, at $11,150, and Kirkhoff Bros. Co., 11 North New Jersey St., the contract for a heating system, at $11,726.

South Bend, Ind.—Plans are stated to have been completed for the Federal Bldg. to be erected here. According to reports bids will soon be received.

**Clinton, Ia.*—Contracts for erecting the $25,000 addition to the Agatha Hospital are stated to have been awarded as follows: General contract to Groff & Derr, of La Crosse, Wis.; steam heating and plumbing, to E. N. Woodbury, of Clinton; electric wiring, to Chas Hassler, of Clinton.

Des Moines, Ia.—Bids will be received until Oct. 21 by Jas. Knox Taylor, Superv. Arcnt., Treas. Dept., Washington, D. C., for the construction (complete) of the U. S. Post Office at Des Moines, as advertised in The Engineering Record.

**Anthony, Kan.*—R. P. Chevraux, Co. Clk., writes that the contract to erect a course house (bids opened Aug. 28), has been awarded to Mathein & Walter, of St. Joseph, Mo., at $56,369.

New Orlans, La.—Bids will be received until Oct. 5 at the Bureau Yards and Docks, Navy Dept. (Wm. M. Smith, Acting Ch.), Washington, D. C., for installing a hot water heating plant at the naval station, New Orleans, as per Specification No. 1562. Appropriation available, $20,000.

**Alexandria, La.*—The contract for erecting the public library for Alexandria is stated to have been awarded to Caldwell Bros., of Abbeville, at $12,510.

Portland, Me.—Bids will be received until Oct. 1 by the Bd. Co. Comrs. (Jas. H. McDonald, Chmn.) for plumbing the County Building. Apply to Geo. Burnham, Archt., 120 Exchange St., for plans and specifications before Sept. 11. A deposit of $5 is required.

Quincy, Mass.—The following are the bids received Sept. 4 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Custom House at Quincy: Richardson & Burgess, Washington, D. C., $70,237; A. E. Stannard, New York, N. Y., $78,000; W. H. Fissel & Co., New York, N. Y., $72,306; Horton & Heminway, Boston, $76,887; Woodbury & Leighton, Boston, $71,170; Conners Bros., Lowell, $69,850; McNiel Bros., Boston, $81,447.

**Flint, Mich.*—C. A. Lippincott, Pres. Bd. of Mgrs., writes that the contract to erect the Hurley Hospital was awarded on Aug. 22 to A. W. Lane, of Chicago, Ill., at $42,000, and the contract for heating, wiring and plumbing of same to Edwin Steiner Co., of Flint.

Mt. Clemens, Mich.—The Citizens are stated to have voted to issue $15,000 bonds for erecting an engine house.

**Marquette, Mich.*—The contract for erecting and heating administration building and Cottage "K" at the Upper Peninsular Hospital for Insane is stated to have been awarded to the Foster Constr. Co., of Milwaukee, at $74,402 and $4,578, respectively. Bids opened Aug. 20.

**Newberry, Mich.*—The following are reported to be the bids received Aug. 20 by the Bd. Trus. for erecting the administration building and cottage K at the Upper Peninsula Hospital for the Insane: General Construction Co., Milwaukee, Wis., $79,682; Paul Reisen & Son, Milwaukee, Wis., $77,946; Marshal N. Hunt, Sault Ste. Marie, $76,940; Lipsett & Sinclair, Marquette, $77,474; A. P. Wilson, Marquette, $78,730; Foster Constr. Co., Milwaukee, Wis., $74,402 (awarded contract); Northern Con. Co., Milwaukee, Wis., $81,000. The Foster Constr. Co. also secured the contract for installing the heating plants at $4,578.

**Ionia, Mich.*—The contract for erecting a county house (bids opened Aug. 14) has been awarded to Henry G. Wright & Co., of Ionia; probable cost, $35,000.

**Minneapolis, Minn.*—Silas H. Towler, 123 Nicollet Ave., Minneapolis, Pres. Minnesota Soldiers' Home, writes that the contract for the new boilers at the Soldiers' Home has been awarded to H. Kelly & Co., of Minneapolis, Minn.

**Fairmont, Minn.*—The contract for erecting the city hall is stated to have been awarded to O. C. Gould & Son, of Fairmont, at $11,968.

**Duluth, Minn.*—The contract for the erection of the County Asylum for Insane at this place, is stated to have been awarded to O. M. Haugner, of Superior, Wis., at $99,725.

Jackson, Miss.—The following are the bids opened on Aug. 22 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of an addition to, and the remodeling of, the U. S. Post Office and Court House at Jackson, Miss., including plumbing, gas piping, heating apparatus, electric wiring and conduits: H. A. Bishop, Chicago, Ill., $41,000; Sims Contr. Co., Jackson, $41,572; and Hiram Floyd Bldg. & Constr. Co., St. Louis, Mo., $45,394.

Kansas City, Mo.—Bids will be received until Sept. 13 by the Bd. Pub. Wks. (Everett Elliott, Secy.) for erecting a Fire Station No. 4 at Pennsylvania Ave., near 14th St. Root & Siemens, Archts., 701 Postal Bldg.

Cape May, N. J.—Bids will be received until Sept. 14 by Maj. C. A. F. Flagler, Corps Engrs., U. S. A., Wilmington, Del., for constructing a building at Cape May.

Binghamton, N. Y.—Bids willl be received until Sept. 11 by the State Comn. in Lunacy at the Capitol at Albany, for the construction, heating, plumbing, electric light wiring and fixtures and feeder cables of the dining room and kitchen addition to the Chronic Bldg. at the Binghamton State Hospital at Binghamton, as advertised in The Engineering Record.

Watertown, N. Y.—The following are the bids received Sept. 3 by the Superv. Archt., Washington, D. C., for the construction, complete, of the U. S. Post Office at Watertown: W. H. Fissel & Co., New York, N. Y., $81,900; Conners Bros., Lowell, Mass., $79,823; Richardson & Burgess Co., Washington, D. C., $81,175.

Brooklyn, N. Y.—The following are the bids opened on Aug. 28 at the office of the Fire Comr., N. Y. City, for a new building for engine and hook and ladder company on Rockaway Ave. and Ave. F, Brooklyn Boro.: P. J. Ryan, 314 W. 44th St., N. Y. City, $54,370; P. Guthy, 924 Bway., Brooklyn, $49,668; Geo. Hildebrand, 38 Park Row, N. Y. City, $51,400; Chas. H. Peckworth, 415 Hudson St., $51,725, and F. T. Nesbitt Co., 116 Nassau St., N. Y. City, $53,000.

Only one bid was received by the Park Comrs. of New York City on Aug. 29 for erecting a shelter house in Winthrop Park, Boro. Brooklyn; also same time and place, only one bid for erecting a shelter and tennis house in Prospect Park, Boro. of Brooklyn. The bidder in each case was Geo. F. Driscoll, at $31,500 and $65,973 respectively.

New York, N. Y.—The following are the bids opened on Aug. 28 at the office of the Fire Comr. N. Y. City, for furnishing material and erecting engine house on White Plains Ave. and 230 th St., Bronx Boro.: Thos. J. Waters, 103 E. 125th St., $38,400; A. Nugent's Son, 103 E. 125th St., $36,900; Calumet Constr. Co., 19 E. 59th St., $38,830; Kelly & Kelley, 45 E. 42d St., $38,488; A. L. Guidone, 1 Madison Ave., $40,000, and F. T. Nesbitt Co., 116 Nassau St., $37,900.

The bids opened by the Park Comrs. of New York City Aug. 29 for furnishing material and erecting addition "F" to the Metropolitan Museum of Art, in Central Park, 5th Ave., opposite 82d St., were as follows: (*a*) for the erection and completion in accordance with plans and specifications, (*b*) should pink Knoxville marble be substituted for Hauteville marble, deduct; Buckley Realty Constr. Co., *a* $435,000, *b* $1,500; Thos. Cockerill & Son, *a* $408,000, *b* $3,000; Thos. Dwyer, *a* $469,020, *b* $2,000; A. L. Guidona, *a* $434,300, *b* $2,000; Kelly & Kelley, Inc., *a* $411,133, *b* $1,500; John H. Parker Co., *a* $428,797, *b* $2,000; M. Reid & Co., Inc., *a* $404,585, *b* $1,500.

Buffalo, N. Y.—The following are reported to be the bids opened recently by the Bd. of Superv. for outside improvements at the new 65th Regt. armory: Henry P. Burgard Co., $31,500; Thomas Brown Contr. Co., $32,798; John P. Johnson, $32,900; Joseph F. Stabell, $33,045; Frederick J. Mumm, $35,900; Frederick W. Knickenberg, $36,000; Joseph J. Churchyard, $39,874; Mosier & Sommers, $42,000.

Rockaway Beach, L. I., N. Y.—The plans of McKim, Meade & White, 160 5th Ave., New York City, for the new Children's Hospital at Rockaway Beach have been submitted to the Association for Improving the Condition of the Poor, the organization which raised $250,000 toward the construction of this seaside institution for

** Items marked thus give the names of parties awarded contracts.*

tuberculous children. The plans show a series of 3-story pavilions, surrounded by broad verandas.

Raleigh, N. C.—The State Hospital Comn. on Aug. 20 is stated to have adopted a resolution for the erection of an additional building at the Central Hospital here for male patients. Bids for the erection are to be called for at once. W. A. Erwin, Durham; J. W. McNeill, of Cumberland, and J. H. Weddington, of Charlotte, Com. on Bldg.

**Bismarck, N. D.*—The contract for erecting addition to the court house is stated to have been awarded to W. W. Bowe for $10,278. F. G. Grambs secured the contract for plumbing and heating the same at $3,000. Bids opened Aug. 24 by I. W. Healy, County Aud.

**Dickinson, N. D.*—The contract for erecting the armory here is reported to have been awarded to the Northwestern Building Co., for $18,737.

Cincinnati, O.—Bids will be received until Sept. 18 by the Bd. Pub. Service (M. J. Keefe, Clk.) for furnishing material and erecting Public Comfort Stations under the 5th St. Market space, known as the Esplanade. Bids will be submitted as a whole or separately on excavation, carpentry, iron work, hollow tile work, tile work, reinforced concrete work, plumbing, electric work and ventilating system. Gustave W. Drach, Archt., Union Trust Bldg.

Danville, Pa.—Bids will be received until Sept. 24 by the Bldg. Com. at the office of Dr. H. B. Meredith, Supt. State Hospital for the Insane, at Danville, for erecting a female infirmary building; a building for acute insane male patients, and a building for the acute female insane patients, as advertised in The Engineering Record.

**Wilkesbarre, Pa.*—Geo. P. F. Eckhart, of Wilkesbarre, is reported to have secured the contract for the erection of a new building for the Mercy Hospital. Estimated cost, $65,000.

The Comrs. of Luzerne County are reported to have decided to erect an addition to the county jail. Architects, McCormack & French, Laning Bldg.

**Philadelphia, Pa.*—Horace Trumbauer, Archt., Land Title Bldg., is reported to have awarded to B. Ketcham & Sons, 1020 Brown St., the contract for erecting a 4-story dispensary building for the Polyclinic Hospital, on Lombard St., west of 18 St. The building will be 80 ft. square, and of brick and stone. The cost will be about $300,000.

Houston, Tex.—The Co. Comrs. have adopted a resolution authorizing the County Judge and County Engr. Geo. Horton to receive competitive plans until Nov. 5 for a court house of granite and brick, 4 stories high; probable cost, $500,000.

National Soldiers' Home, Va.—Bids will be received by B. A. Beeson, Treas. Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., until Sept. 26, for 3 barracks and mess hall, and addition to hospital.

Norfolk, Va.—Bids will be received until Sept. 17 by Col. F. L. Denny, Q. M., U. S. A., Washington, D. C., for constructing officers' quarters and a stable at Navy Yard, Norfolk, Va.

Ft. Myer, Va. Bids will be received until Sept. 16 by Capt. B. B. Hyer, Constr. Quartermaster, Ft. Myer, for an addition to the Cavalry Drill Hall, as advertised in The Engineering Record.

Seattle, Wash. The State Armory Comn. is reported to be ready for bids for erecting the armory on Western Ave. and Virginia St. Kerr & Rogers, Hancock Bldg., are the archts.

Milwaukee, Wis.—All bids opened on August 26 by the Bldg. Com., Auditorium Bd. (Alvin P. Kletzsch, Pres.), for furnishing material and erecting an auditorium at State and Cedar Sts., have been rejected as being too high. Plans will be modified and new bids received. The appropriation available is $450,000. Ferry & Clas, Archts., 419 Bway., Milwaukee.

Kincardie, Ont.—Bids will be received by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, until Sept. 18, for erecting a public building at Kincardie.

Toronto, Ont.—Bids will be received until Sept. 10 by H. F. McNaughton, Secy. Pub. Wks. Dept., Toronto, for erecting Registry offices in Port Arthur and Sault Ste. Marie.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Childersburg, Ala. See "New Industrial Plants."

Brewton, Ala.—The Masonic Fraternity of Brewton is reported to have purchased a site on Parker Ave. for the erection of a 3 story building, at a cost of $15,000.

Berkeley, Cal. Mrs. F. K. Shattuck, it is reported, has accepted plans for a $250,000 hotel to be erected in this city.

**Grand Junction, Colo.*—J. B. Boyer, Archt., Grand Junction, writes that the contract to erect an Elks Temple (bids for which were received Aug. 27), has been awarded to Boyer & Hawkins, of Grand Junction, at about $50,000.

Colorado Springs, Colo.—It is stated that the Modern Woodmen of America have under consideration he erection of a home in Colorado City, at a cost of about $[illegible].

**Elkhart, Ind.* The H. W. Gossard Co. is stated to have awarded a contract to P. T. Longacher for the construction of a factory building, estimated cost, $40,000.

Lafayette, Ind. The local Masonic Lodge is reported to be receiving bids for the remodeling and improvement of a building for a Masonic Temple at an estimated cost of $18,000.

Brazil, Ind.—Bids for the construction of the I. O. O. F. Temple are stated to have been opened as follows: Henry M. Dial, $24,800; Smith & Apple, $22,708; H. C. Wright, $21,700; Cutshall & Flagg, $19,582. The plans call for a 3-story brick building.

Creston, Ia.—The Creston Chautauqua Asso. is reported to have under consideration the construction of an auditorium in McKinley Park.

**St. Paul, Minn.*—Permits have been issued for a 2-story brick building for stores and hotel, to be erected on University Ave. and Snelling St.; cost, $35,000; Barrett & Zimmerman, owners; Ingmann Bros., 1930 St. Anthony St., Contractors. A 4-story brick warehouse and factory on Jackson and 9th Sts., to cost $35,000; Hart & Murphy, owners; St. Paul Bldg. Co., German Life Bldg., contractor. Two brick and cement buildings, one on John and 5th Sts. and the other on 5th and Olive St.; cost, $20,000; Newman & Hoy, Chamber of Commerce Bldg., contractors.

Duluth, Minn. The Apex Realty Co. will, it is stated, erect a 3-story brick store and lodging house on Superior St. and 7th Ave. w. It will be 25x130 ft. long and cost $16,800.

St. Louis, Mo.—The Wellston Turnwerein is stated to have purchased a site at Hodiamont and Garfield Aves., for the erection of a $50,000 gymnasium and auditorium.

Long Branch, N. J.—It is stated that the Long Branch Lodge, B. P. O. Elks, will soon receive bids for erecting a building at Broadway and Slocum Pl., at a cost of $18,000.

New York, N. Y.—Plans have been decided upon for a 7-story home for the Lotos Club to be erected at 110 W. 57th St. Probable cost, $500,000.

The building occupied by Herman Jacob & Sons, at 427 E. 102d St., is reported destroyed by fire.

Plans are stated to have been filed for the following buildings: 6-story brick and stone store and tenement at 58 Henry St., for James Shea, cost $30,000, Bernstein & Bernstein, Archts.; 6-story brick and stone loft building at 314 W. 14th St., for Daggett & Rumsdell, cost $35,000, Arno Kolbe & Gregory, Archts.; 6-story brick and stone loft building at 244 W. 42d St., for Robert Miller, cost $40,000, Hedman & Schoen, Archts.; 6-story brick and stone loft building at 605 W. 51st St., for John H. Maatz, cost $60,000, C. C. Nathan, Archt.; 3-story brick and stone garage at 118 E. 83d St., for Stuart Duncan, cost $20,000, C. L. Sefert, Archt.; 1-story brick repair shop at Mott Haven R. R. yard, 153d St., for N. Y. C. & H. R. R. Co., cost $20,000, D. R. Collins, Archt.

Cincinnati, O.—Plans are reported being prepared by Boll & Taylor, First National Bank Bldg., for the erection of buildings to replace structures recently destroyed at Hunter St. The buildings include a 4-story 44x109-ft. office and warehouse, a 4-story 67x140-ft. mill building, a 2-story 50x100-ft. storage building, a brick kiln with a capacity of 40,000 ft.; probable cost of improvements, $100,000.

**Springfield, O.*—John D. Reader, of Springfield, has secured the contract to erect the Pennsylvania R. R. depot here. Frank L. Packard, of Columbus, Archt.

Wilkinsburg, Pa.—It is stated that the Bank of Wilkinsburg will erect a building at Wood St. and Ross Ave. R. L. Finley, Pres.

**Philadelphia, Pa.*—Moore & Co., Inc., it is stated have secured a contract to erect on 5th and Locust Sts. a store, factory and warehouse building for the Locust Realty Co. The building will be wholly of reinforced concrete, 5 stories and a basement high, 116x189 ft., contain 2 tower fire-escapes and 1 brick inclosed stairway, in which will be situated an electric passenger elevator. There will also be a large electric freight elevator inclosed in brick walls in the center of the building.

F. Russell Stackert, 1421 Chestnut St., is reported to have been granted a permit to build a $40,000 parish hall for the Church of the Immaculate Conception, at 810-818 E. Chelten Ave. The building will cover an area measuring 70x118 ft., and will be 2 story.

Harrison C. Rea, 1815 Francis St., is reported to have been awarded the contract for erecting a $100,000 cigar manufacturing building for the Theobald & Oppenheimer Co. at 4th and Cambridge Sts. The building will cover an area measuring 168x122 ft. and will be 5 stories high. It will be of fireproof construction, with exterior walls of brick and stone. The interior will contain departments for manufacturing cigars, packing rooms, storage rooms and offices. Chas. Balderstone, Archt.

Cramp & Co., Commonwealth Bldg., are stated to have been granted a permit to erect a 3-story brick manufacturing building for the Henry H. Sheip Mfg. Co., at 6th St. and Columbia Ave. The building will measure 120x96 ft., and will be of brick and reinforced concrete construction. The cost will be $80,000. Ballinger & Perrot and Heacock & Hokanson drew the plans.

Minot, S. D.—It is stated that John Hollinger will erect a 3-story business building on Main St. at a cost of $18,000.

Peter Trystad, of Velva, is reported to have been awarded the contract for the erection of the $40,000 building for Guy Frank to be used as a postoffice.

Memphis, Tenn.—The erection of an auditorium here is reported contemplated. Geo. R. Dunn is said to be interested.

Tacoma, Wash.—The Northern Pacific Ry. (A. R. Cook, Div. Engr., Tacoma), is reported to have accepted plans for a $750,000 depot to be erected in Tacoma. The train shed will be 1,000 ft. in length, and the interior will be fitted with passenger and freight elevators.

Neenah, Wis.—The Equitable Fraternal Union, it is stated, has secured a site at Commercial St. and Doty Ave. on which it is proposed erecting a headquarters building to cost $80,000; the Wisconsin Telephone Co., it is stated, will erect an exchange building on the same streets for Neenah and Menasha, to cost $78,000.

Green Bay, Wis. The Hotel Beaumont at Green Bay is reported destroyed by fire.

Milwaukee, Wis.—The Northern Constr. Co., of Milwaukee, is reported to have secured the contract for erecting a 5-story building at Detroit and Milwaukee Sts., for Otto L. Kuehn, at a cost of $75,000.

Ottawa, Ont.—Plans are stated to have been approved by the Government for the hotel to be erected on Major's Hill in connection with the depot of the Grand Trunk Ry. Co. (Jos. Hobson, Ch. Engr., Montreal, Que.).

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Atlanta, Ga.—It is stated that J. T. Hall, Jr., has decided to erect a 3-story apartment house at W. Baker and Spring Sts., at a cost of about $18,000. Norman & Falkner, Archts.

Indianapolis, Ind.—It is reported that the Bd. Trus. of Broadway M. E. Church will receive bids until Oct. 1 for the construction of a stone veneer church on cor. Bway. and 25th St.; probable cost, $35,000.

Kansas City, Mo.—Wilder & Wight, Dwight Bldg., are stated to have prepared plans for an edifice to be erected at Bway. and Hunter Ave. for the Congregation of Our Lady of Perpetual Help, at a cost of $150,000.

Charles A. Smith, Dwight Bldg., is the archt. for the edifice to be erected at 812 Benton Boule. for the Grace Presbyterian Church, at a cost of $30,000.

New York, N. Y.—Plans have been filed for alterations to 2-story brick and stone chapel at 130 Stanton St. for New York Protestant Episcopal City Mission Society, cost $25,000, Hoppin & Koen, Archts.

Clifton, O. Jos. G. Steinkamp & Bro., Mercantile Bldg., are reported to have been selected to prepare plans for an apartment to be erected at Brooklyne and Ludlow Aves. for Fred Holz, at a cost of $35,000.

Cincinnati, O.—It is stated that Martin Fisher, 2156 Central Ave., has completed plans for a 4-story apartment house to be erected at Queen City and Harrison Ave. for Theo. Von Holle.

Philadelphia, Pa.—Chas. L. Hoffman, 914 Walnut St., is stated to have completed plans and specifications and will shortly invite estimates for the erection of a new edifice for the congregation of the Mt. Carmel Baptist Church. The building, which will be erected at 58th and Race Sts. at a cost of about $20,000.

Pittsburg, Pa.—It is stated that E. C. Brainerd will erect a dwelling at Tennyson and Parkman Aves., at a cost of $30,000.

Mitchell, S. D.—Bids will be received until Sept. 20 by S. C. Wherry, Archt., Mitchell, for the erection of a brick and stone church for the First Congregation Church at Kimball and 4th Sts., Mitchell. Bids will be received for building complete; for the foundation, including all doors and window frames in stone walls and joists and under floor complete; for the heating and plumbing compelte. Bidders for building complete must be able to separate bids to conform with the above.

San Antonio, Tex.—The members of the First Presbyterian Church, it is stated, have purchased site at D Ave. and 4th St. for the erection of a $75,000 edifice.

Milwaukee, Wis.—A permit is stated to have been issued to the St. Augustine Congregation for the erection of an edifice at Howell Ave. and Homer St. at a cost of $35,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—It is reported that $18,000 in bonds have been voted for the erection of a school. Address Clk. Bd. Educ.

Hesperus, Colo.—Bids will be received by Col. C. F. Larrabee, Acting Comr. of Indian Affairs, Washington, D. C., until Sept. 27, for furnishing material and constructing an office and a school building, both of brick, with plumbing, steam heat, and gas piping; a laundry and an addition to the boys' dormitory, both of brick, with plumbing and gas piping; for improvements to water system, moving hospital building, and resetting laundry machinery at Ft. Lewis School, Hesperus. For further information apply to John S. Spear, Supt., Ft. Lewis School, Hesperus.

Hartford, Conn.—A permit is stated to have been granted for two additions to the La Salette College on New Park Ave., to cost $40,000. Sinnot Bros. have the contract for the building. The present building, which is in the name of the missionaries of La Salette, will have a 4-story brick addition at each end, 35 x 72 ft., with stone foundations and slate roofs.

Washington, D. C.—Bids will be received until Sept. 14 by the Comrs. D. C. (Henry L. West, Chmn.) for erecting an addition to the Petworth School, at Brightwood Ave. and Philadelphia St., N. W. Plans and specifications may be had upon a deposit of $10.

**Moscow, Idaho.*—The contract to erect an administration building at the Univ. of Idaho (bids for which were received Aug. 20), has been awarded to A. S. Whiteway, of Boise, at $162,817.

**Duquoin, Ill.*—T. B. Eaton & Son are reported to have secured the contract to erect a school for colored children, to cost $12,000.

**Ft. Dodge, Ia.*—The following are the bids opened Aug. 21 by J. B. Butler, Pres. School Bd., for rebuilding the Ft. Dodge High School: J. R. Gier, of Conrad, $39,957; A. G. Bienz, of Ft. Dodge, $33,763; Mr. Zitteral, of Webster City, $39,270, and Gottlieb Proschhold, $38,285 (awarded contract).

Danville, Ky. The Bd. of Trus. of Central Univ., it is stated, has accepted plans for 2 buildings to be erected at a total cost of $100,000.

Iota, La.—The citizens are stated to have voted to erect a school.

Salem, Mass.—Bids will be received until Sept. 10 by the Com. on New High School Bldg. (Thos. G. Pinnock, Chmn.) for special apparatus for a forced hot water circulating system for new High School. John E. Spencer, Engr., 7 Front St.

**Pittsfield, Mass.* Foote & Jones, of Pittsfield, have secured the contract to erect an 8-room school, at $40,165.

Beaverton, Mich. The citizens are stated to have voted to issue $10,000 bonds for erecting a school.

Agricultural College, Mich.—Bids will be received until Sept. 18 by A. M. Brown, Secy. State Bd. Agriculture, Agricultural College, for erecting an agricultural building. E. A. Bowd, Archt., Lansing.

**Red Wing, Minn.* The Bd. of Control of the Training School at Red Wing is stated to have been awarded the contract for erecting the kitchen at the school to Johnson & Nelson, of Red Wing, for $13,665.

Hooksett, N. H.—Bids will be received until Sept. 15 for erecting an academy building at Hooksett. T. Edw. Sheehan, Archt., Boston, Mass. Probable cost, $150,000.

**Haddon Heights, N. J.*—Lynch Bros., of Philadelphia, Pa., are reported to have secured the contract to erect a 2-story brick school, at about $16,300.

* *Items marked thus give the names of parties awarded contracts.*

*Newark, N. J.—Contracts for erecting new wing to the Belmont Ave. School (bids opened Aug. 23) have been recommended by the Schoolhouse Com. Bd. Educ. awarded to the following: Walter E. Isetts, 16 N. 13th St., masonry, $51,605; W. G. Sharwell & Co., 320 N. 6th St., carpenter work, $15,688; Hay Foundry & Iron Co., New York, N. Y., iron work, $15,300; Ding & Luescher, roofing, $4,988; Storms & Co., 112 S. 14th St., heating, $7,009; Ralph B. Schmidt Co., 62 Ann St., plumbing, $3,567; Beaver Constr. Co., electrical work, $3,178; Browe Co., 16 Clinton St., air-moving machinery, $1,484; G. L. Kimmerle, painting, $880. Total, $103,699.

The lowest bids submitted, same time and place, for erecting an addition to the Bergen St. school are stated to have been as follows. Fredk. Fatzler & Co., mason work, $64,500; Storms & Co., steam fitting, $8,637; Beaver Constr. Co., electrical work, $820; Jachnig & Peoples, plumbing, $5,597; G. L. Kimmerle, painting, $1,043; C. C. Lieriau's Sons, iron work, $25,120; Lucas Peters carpenter work, $19,625; Browe Co., air-moving machinery, $1,183; Jos. Bleeker, roofing, $3,000. Total, $129,615. E. M. Waldron Co. is stated to have submitted a bid on the entire work, not including heating, at $116,929.

Bids for erecting an addition to Hawthorne Ave. School (Jeremiah O'Rourke & Sons, 756 Broad St., Archts.), it is reported, will be asked soon.

Montclair Heights, N. J.—Bids will be received until Sept. 17 (readvertisement), by the Bldg. Com. of the New Jersey State Normal School at Montclair Heights (Edw. Russ, Chmn.) at the office of the Comr. of Charities and Correction, State House, Trenton, for furnishing material and erecting a boiler house and the installation of a heating plant at the Norma [School Montclair Heights, as advertised in The Engineering Record.

Bayonne, N. J.—Bids will be received until Oct. 3 (readvertisement), by the Bd. of Educ. (R. T. Hewitt, Secy.) for furnishing material and constructing School No. 9 (except plumbing, gas fitting, heating and ventilating). A. C. Longyear, Archt., 126 Liberty St., New York, N. Y.

*Olean, N. Y.—M. M. Holmes, Clk. Bd. Educ., writes that the contract to erect a school in East Olean (bids received Aug. 30) has been awarded to L. E. Corsett, of Olean, at $25,362.

*Lockport, N. Y.—The contract for rebuilding the High St. School is reported to have been awarded to John C. Fogle at $16,553.

New York, N. Y.—The following are the bids opened Sept. 3 by C. B. J. Snyder, Supt. School Bldgs., for installing heating and ventilating apparatus in new Public School 66, Boro. of Manhattan: Frank Dobson Co., Inc., 319 E. 53d St., $26,915 (awarded contract); James Curran Mfg. Co., $37,722. E. Rutzler Co., $37,328; Blake & Williams, $37,994.

Brooklyn, N. Y.—Only one bid was received Sept. 3 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for completing abandoned contract for ventilating and heating school No. 109, Boro of Brooklyn, and it was rejected.

Roanoke Rapids, N. C.—Bids will be received until Sept. 16 by the Bd. Trus. Roanoke Rapids Graded School (W. C Edwards, Chmn.) for $10,000 bonds, issued for the purpose of erecting a school.

*Toledo, O.—Contracts for the construction of a school at the Miami County Children's Home (bids received Aug. 26) are stated to have been awarded by the Comrs. as follows: John Arnsman, 423 W. Central Ave., $25,439; Robt. Raitz & Co., plumbing, $1,675. Thos. Kewley, heating and ventilating, $5,800, and A. Bentley & Sons, electric wiring, $365.

Pittsburg, Pa.—Marshman Edw. Wadsworth, M. A., Ph. D., it is stated, has been appointed Dean of the School of Mines of the Western Univ. of Pa., and, it is reported, will have charge of the plans for the new building which is to be erected, the Legislature having appropriated $200,000 for the building and equipment.

Philadelphia, Pa.—Melody & Keating, 211 Diamond St., have been granted a permit to build a 3-story stone and brick parochial school building, 65x197 ft., at 56th St. and Chester Ave., to cost $62,000. Henry D. Dagit, 435 Chestnut St., is the archt.

Seymour and Paul A. Davis, 3d, 16 Chestnut St., are said to be completing plans and will shortly invite estimates for the erection of a 4-story laboratory building, to be erected for the Philadelphia College of Pharmacy, on 10th and Cherry Sts.

Monessen, Pa.—Press reports state that the Secy. of the School Bd., will receive bids until Sept. 10 for $40,000 school bond.

Latta, S. C.—Bids will be received until Sept. 23 by the School Bd. (A. S. Manning, Chmn.) for erecting a brick high school. Ernest V. Richards, Archt., Bennettsville.

Memphis, Tenn.—Local press reports state that the Bd. Educ. will receive bids until Sept. 16 for erecting a 12-room school on Carr and Raleigh Aves. Prob. cost, $40,000. Alsup & Woods, Archts., Memphis.

Denton, Tex.—One of the buildings of the North Texas State Normal School is reported destroyed by fire.

*Cheney, Wash.—The contract to erect the Normal Training School (bids for which were received Aug. 10) is stated to have been awarded to A. E. White, of Seattle, at about $80,000.

Galesville, Wis.—Parkinson & Dockindorf are reported to be preparing plans for a high school to be erected here, at a cost of $25,000.

Tomahawk, Wis. Bids will be received until Sept. 17 by Jas. Kelly, City Clk., for furnishing material and erecting a school. Probable cost, $40,000. Henry Wildhagen, Archt., Ashland.

Galt, Ont. Bids will be received until Sept. 17 by Frank Hogg, Chmn. Knox Church Bldg. Com., for erecting a Sunday school in connection with said church. Bids may be submitted as a whole or separately for the masonry, carpentry, slate and gravel roofing, plumbing, electric wiring, etc. Smith & Gemmell, Archts., 37 Bank of Commerce Bldg., Toronto.

STREET CLEANING AND GARBAGE DISPOSAL.

Rankin, Pa.—See "Sewerage and Sewage Disposal."

Evansville, Ind.—The Bd. of Pub. Wks. has decided to grant to the St. Louis Garbage Box Co. the right to erect a $40,000 night soil reducing plant on the city ground.

New York, N. Y. Bids will be received by W. Bensel, Comr. Street Cleaning, until Sept. 11, for furnishing and delivering 50 street-sweeping machines.

Ardmore, Pa. Robley A. Warner, C. E., of Ardmore, Box 708, Supt. of Health and Drainage of the Township of Lower Merion, has been directed by the Bd. of Comrs. of that Township to design a system or plant for the collection and disposal of garbage and ashes through the thickly settled districts and to make his detailed report at the Oct. meeting of the Comn.

Grafton, W. Va.—The city is reported to have entered into an agreement with Chas. Stolzenfels whereby a garbage crematory is to be constructed and the garbage burned for a period of 5 years.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Childersburg, Ala.—Bids will be received until Sept. 14 by D. L. Lewis, at Sycamore, for the Coosa River Spinning Co., for erecting a cotton mill and a warehouse near Childersburg. Knox, Dixon & Burr, Archts., Talladega.

Athens, Ga. The Son Mfg. Co. is erecting an extensive addition to its cotton mill and will be in the market for cotton machinery, shafting, etc.

Cordele, Ga.—The Reid Fertilizer Co., it is reported, has secured a site on which it is proposed erecting a plant to cost about $100,000.

*Rock Island, Ill.—The Rock Island Brewing Co., it is reported, has let the contract for erecting an addition to their building to Henry W. Hurst, of Rock Island. Estimated cost of improvements, $50,000.

*It is stated that the Truss Constr. Co. has secured the contract to erect a 3-story concrete and brick addition to the plant of Barber & Colman in South Rockford, to cost about $100,000.

Newport, Ky.—The Andrews Steel Co., it is reported, will make improvements and enlarge the plant.

Cave City, Ky.—The American Onyx & Marble Co., has been organized, with capital of $1,000,000, to acquire and work onyx deposits situated near Cave City, Ky. The deposits extend over an area of 1,800 acres, and the investigations to this time indicate the presence of most extensive deposits. It is proposed at this time to install boiler, engine, derrick, small tools, etc. Later a mill will be installed for sawing and polishing. Richard H. Phillips, Security Bldg., St. Louis, Mo., is Consulting Engr.

Baltimore, Md.—The Joseph Schlitz Brewing Co., according to reports, has had plans prepared by Kirchhoff & Rose, 201 Grand Ave., Milwaukee, Wis., for 3 storage plants which it will erect as follows: At Baltimore, Md., of brick and steel, 125x155 ft., 3 stories high, and cost approximately $40,000; at Youngstown, O., a $30,000, solid brick 90x155-ft. building; and at Richmond, Va., a $30,000 brick building, 2 stories high, 75x176 ft.

Flint, Mich.—The Michigan Motor Castings Co. is reported organized as a branch of the Detroit Stoker and Foundry Co. of Detroit, and will locate its plant in this city on Industrial Ave. and Dayton St. Plans are now being prepared for the plant. The main building will be of white sandstone brick, 75x300 ft.

*Camden, N. J.—Ballinger & Perrot, Archts., of Philadelphia, Pa., are reported to have awarded to the J. S. Rogers Co., of Stanwick, N. J., the contract for erecting a 1-story 92x174-ft. and a 6-story 80x172-ft. building for the Victor Talking Machine Co., at Front and Cooper Sts., Camden. Both buildings will have brick walls with stone trimmings. The column, floor and roof construction will be of reinforced concrete with slag roof covering. There will be a tower fire-escape in each building, and a passenger and freight elevator.

Albemarle, N. C.—A second cotton mill is to be erected according to reports, at Albemarle by the Eliot Mfg. Co., to cost $100,000, and electricity will be used, to be furnished by the Whitney Co. It is stated that the company will use $200,000 of its surplus for the new plant, and possibly a separate corporation will be formed to own and operate the mill.

Seattle, Wash.—The Northwestern Electric Co. of Seattle recently incorporated by E. C. Kilbourne, Pres., and F. A. Ernst, Secy., for the manufacture of heating and cooking appliances by electricity, will, it is stated, erect its factory in Seattle.

Corliss, Wis. The Wisconsin Engine Co., it is reported, will erect a pattern shop and a pattern storage shop at its plant at Corliss, after plans prepared by Kirchhoff & Rose, 201 Grand Ave., Milwaukee. Both buildings will be of concrete and brick and call for an expenditure of about $70,000. The pattern shop will be 40x160 ft. and the storage shop 220x140 ft.

Abbotsford, Wis.—Fredk. Weyerhaeuser, of St. Paul, Minn., is reported interested in the Atwood Lumber & Mfg. Co., which is being incorporated in Wisconsin for the purpose of erecting a saw mill near Abbotsford and also a paper mill in connection with same.

Vancouver, B. C.—J. T. Shadforth, one of the organizers of the North Pacific Iron & Steel Corporation, is reported to be in Vancouver preparing for the erection of a modern steel works.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received until Oct. 1 by Maj. H. Jervey, Corps. Engrs., U. S. A., Mobile, for construction of a wooden hull, stern-wheel, snag-boat, as advertised in The Engineering Record.

Oakland, Cal.—The Bd. of Pub. Wks. is reported to have recommended to City Council the immediate building of a concrete culvert across the channel between Lake Merritt and the estuary at 8th St., and a wall and levee along the western side of this channel, from 8th to 12th Sts. This is preparatory to the dredging of Lake Merritt, and the establishment of a city park south of the lake.

San Francisco, Cal.—Bids will be received until Sept. 26 by Lieut. Col. John Biddle, Corps Engrs., U. S. A., 1840 Polk St., San Francisco, for dredging in Petaluma Creek.

Berkeley, Cal.—Town Engr. McClure is reported to have completed specifications for the construction of a municipal wharf.

Washington, D. C. Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Sept. 10, for furnishing at the navy yards and naval stations the following supplies: Portsmouth, N. H.: Sch. 245 Steam windlass. Sch. 264—Ash, white pine, spruce, etc. League Island, Pa.: Sch. 262 Sand, gravel, oak. Sch. 263 Steel bolts and nuts, brass nuts, iron nuts, forges, screw and hydraulic jacks, drills, pipe dies, reamers, etc. Sch. 264 Sheet and strip brass, sheet copper, pig iron, etc. Washington, D. C.: Sch. 260 Shafting, etc., nickel steel forgings and tubes, iron and conveyor pipe, etc. Key West, Fla.: Sch. 243—Screw-cutting lathes, drill press, radial and sensitive drills, bolt cutter, pressure blower, blast forge, blacksmith's drill, plate bending rolls, patternmaker's lathe, etc. New Orleans La.: Sch. 247—Yellow pine and white oak boards. Washington, D. C.: Sch. 294 33,333 lbs. manganese bronze, 533,333 lbs. ingot copper, 50,000 lbs. slab zinc, and 50,000 lbs. pig tin. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l, U. S. N.

*Savannah, Ga.—The following are the bids opened on Aug. 23 by Lieut. Col. D. C. Kingman, Corps. Engrs., U. S. A., for dredging in Skidaway Narrows, Ga., 238,000 cu. yds. (price given per cu. yd.): Southern Dredging Co., Mobile, Ala., 25 cts.; Savannah Dredging Co., Savannah, 13¾ cts. (recommended for acceptance); H. B. Giffkin, Savannah, 14⅞ cts.

Great Lakes, North Chicago, Ill. Bids will be received at the Bureau of Navigation, Navy Dept. (W. H. Brownson, Chmn.), Washington, D. C., until Sept. 17 for furnishing material and grading at the naval training station, Great Lakes, North Chicago, Ill.

Indianapolis, Ind. The Park Bd. is reported to be asking bids for extensive repairs on the Riverside concrete dam. Estimated cost, $10,000. J. Clyde Power, Supt.

New Orleans, La.—Bids will be received at the office of the Mississippi River Comn., 4th Dist., 1539 Louisiana Ave., New Orleans, by Capt. J. F. McIndoe, Corps Engrs., U. S. A., until Sept. 20, for constructing the Burton to Louderhough levees, about 25,000 cu. yds., in the Lake Borgne Levee Dist.

Boston, Mass. Bids will be received until Sept. 30 by Maj. Edw. Burr, Corps. Engrs., U. S. A., Boston, for dredging in Mystic River, Mass., as advertised in The Engineering Record.

Boston, Mass.—The only bid received and opened on Aug. 20 by Maj. E. Burr, Corps. Engrs., U. S. A., for dredging Weymouth Back River, about 28,800 cu. yds., was submitted by Simon J. Donovan, of East Boston, at 33 cts. per cu. yd.

*Duluth, Minn.—The Great Lakes Dock & Dredge Co. is reported to have secured the contract to construct the rubble mound breakwater at the Superior entry.

Mankato, Minn.—It is stated that a tile drainage system consisting of 15-in. tiles and about 3 miles long, is to be constructed in Blue Earth County, and is to be known as Ditch Project No. 21. The County Engr. estimates the cost at $6,500.

*Minneapolis, Minn.—The Otis Elevator Co., of New York, N. Y., is reported to have secured the general contract for installing 5 freight elevators in the new Wisconsin Central freight depot. They will all be equipped with electric power and cost in all about $21,500.

Grand Rapids, Minn.—Geo. A. Ralph, State Drainage Engr., St. Paul, is reported to have announced that a drainage ditch will be constructed connecting Bowstring and Round lakes, Itasca County. Plans for the work have been prepared. Water from Bowstring flows into Hudson Bay, and Round Lake drains into the Mississippi River. The ditch will be 6 ft. deep and will permit navigation of canoes from Hudson Bay to the Gulf of Mexico.

Ashland, Neb.—E. Bignell, Geo. E. Ricker and Martin L. Shupe are reported appointed a committee of three to make a survey and outline a drainage district. The farmers propose organizing a company to construct the district, the cost of draining the bottom and dyking and rip-rapping along the Platte is estimated at $20,000.

*Asbury Park, N. J.—The Beach Comn. is reported to have on Aug. 28 awarded contract for new pavilion at 7th Ave. to Herbert Gardner, for $20,603.

Cold Spring, N. J.—Bids will be received until Oct. 2 by Maj. C. A. F. Flagler, Corps Engrs., U. S. A., Wilmington, Del., for construction of stone jetties, Cold Spring Inlet, N. J., as advertised in The Engineering Record.

Oyster Bay, L. I.—Bids will be received until Sept. 11 by W. Emlen Roosevelt, 32 Wall St., N. Y. City, for the construction of a stone breakwater into the waters of the Oyster Bay Harbor in the easterly side thereof in front of the premises of W. Emlen Roosevelt.

Skaneateles, N. Y.—State Supt. of Pub. Wks. Stevens received Aug. 28 at Albany two bids for constructing the wall for the Skaneateles feeder to the Erie Canal. As the bids were not complete, it is reported, they were not considered.

New York, N. Y.—Bids will be received by W. Bensel, Comr. Street Cleaning, until Sept. 11, for furnishing and delivering lumber.

Bids opened Sept. 2 by Col. John G. D. Knight, Corps Engrs., U. S. A., New York, for constructing and repairing dikes in Hudson River, were as follows: Bonker Contr. Co., 21 State St., New York, N. Y., 2,000 cu. yds. rubble stone, $1.54 per cu. yd.; 10,000 cu. yds. quarry spalls, $1.50 per cu. yd.; Wm. D. Fuller, New Baltimore, N. Y., $1.69 per cu. yd. on both items.

Reading, Pa. Bids will be received until Sept. 25 by the Bd of Pub. Wks. at the office of the City Clk. for constructing a subway and appurtenances under the P. & R. Ry. tracks at Spring St., as advertised in The Engineering Record.

York, Pa.—See "Sewerage and Sewage Disposal."

Philadelphia, Pa.—Bids will be received until Sept. 30 by Maj. J. C. Sanford, Corps Engrs., U. S. A., 815 Witherspoon Bldg., Philadelphia, Pa., for constructing steel hull 16-in. pump dredges for Savannah River, as advertised in The Engineering Record.

The following are the bids recently received by the Superv. Archt., at Washington, D. C., for installing 2 electric passenger elevators in the Custom House and Post Office at Philadelphia: Otis Elevator Co., $12,985, and Marine Engine & Machine Co., $11,660.

Panama.—Bids will be received until Sept. 28 by H. F. Hodges, Genl. Purchasing Officer, Isthmian Canal Comn.,

** Items marked thus give the names of parties awarded contracts.*

Washington, D. C., for furnishing steel barges as per circular No. 389.

The Davenport Locomotive Works, Davenport, Ia., submitted the lowest bid on Aug. 30 for 12 four-wheeled saddle tanked locomotives for construction work at Panama at $30,990 or $37,950 set up at Colon ready for operation.

Block Island, R. I.—The following are the bids for dredging entrance channel to Great Salt Pond, Block Island, R. I., opened on Aug. 28 by Lieut. Col. J. H. Willard, Corps of Engrs., U. S. A., at Newport, R. I. (price given per cu. yd.): Maritime Dredging Co., New York, N. Y., 37½ cts.; John A. Seeley, New York, N. Y., 39½ cts.; J. S. Packard Dredging Co., Providence, R. I., 28½ cts., and Chas. M. Cole, Fall River, Mass., 32 cts. (About 100,000 cu. yds. will be dredged.)

Sioux Falls, S. D.—Saml. H. Lea, State Engr., Pierre, S. D., writes that surveys are now being made under direction of State Engineer, for the Comrs. of Minnehaha County, to determine the feasibility of constructing drainage system.

Galveston, Tex.—John M. Murch, Co. Aud., writes that preliminary plans and estimates are now being completed by Gen. H. M. Roberts, late of the U. S. Engrs., and Mr. Thacher, of the Concrete Eng. Co., Park Row Bldg., New York, N. Y., for the proposed Galveston bridge and causeway; probable cost, $1,500,000.

Ellensburg, Wash.—The Co. Comrs. it is reported propose constructing a dam on the Yakima River, where the river turns west of this city. The cost to be about $2,000.

Superior, Wis.—The only bid received and opened on Aug. 17 by Maj. Graham D. Fitch, Corps. Engrs., U. S. A., Duluth, Minn., for building rubble mound breakwater at Superior entry, is stated to have been submitted by the Great Lakes Dredge & Dock Co. at $1.60 per ton for rock delivered in place, or $1.25 per ton for rock delivered in the dock.

Vancouver, B. C.—It is stated that bids will be received until Sept. 12, by F. Gourdeau, Deputy Minister of Marine and Fisheries, Ottawa, Ont., for furnishing and delivering at Vancouver, B. C., a double cylinder tandem hoisting engine, with 4 hoisting drums and 2 winch heads, an upright steel tubular steam boiler of 30 h.-p. capacity and a structural steel derrick, for the British Columbia buoy scow. Bidders must furnish plans of the boilers and engines offered. Bids for the engine, boiler, and derrick separately will be received, or for all together.

Breton Cove, N. S.—Bids will be received until Sept. 18 by Fred Gelinas, Secy. Dept. Public Works, Ottawa, Ont., it is stated, for the construction of an extension to the landing pier at Breton Cove, Victoria Co., N. S. E. G. Millidge, Resident Engr., Antigonish, N. S.

PROPOSALS OPEN.

For Proposals see pages 79, 80, 83, 84 and 86.

WATER.

Bids Close.		See Eng. Record.
Sep. 9.	Reservoir, etc., Orange, N. J.	Aug. 24
Sep. 9.	Water works improv., Stambaugh, Mich. Adv. Aug. 24, Sep. 7.	Aug. 24
Sep. 10.	System at poor farm, Decorah, Ia.	Aug. 24
Sep. 10.	Pump, etc., Buffalo, N. Y.	Aug. 31
Sep. 10.	Main, Bryan, O.	Sep. 7
Sep. 10.	Pumps, Pierce, Tex.	Sep. 7
Sep. 10.	Reservoir, Delta, Colo.	Sep. 7
Sep. 12.	Plant, Millen, Ga.	Aug. 24
Sep. 12.	Pipe, Cincinnati, O.	Sep. 7
Sep. 13.	Water works, Lawrenceburg, Tenn. Adv. Aug. 31.	Aug. 31
Sep. 14.	Valves and gates, Manila, P. I. Adv. Jul. 27.	Jul. 27
Sep. 14.	Tank and tower, Norfolk, Va.	Aug. 17
Sep. 16.	Pipe, Ft. H. G. Wright, N. Y.	Aug. 31
Sep. 17.	Pipe exten., Philadelphia, Pa.	Aug. 31
Sep. 20.	Water works, Canon City, Colo. Adv. Aug. 31.	Aug. 31
Sep. 20.	Reservoir, pipe line, etc., Canon City, Colo. Adv. Sep. 7.	Sep. 7
Sep. 25.	Dam, Rome, N. Y. Adv. Sep. 7.	Sep. 7
Sep. 25.	Water wks., Highlands, N. J.	Sep. 7
Sep. 28.	Water wks., Manassas, Va.	Sep. 7
Sep. 30.	Boiler and pump engine, Los Angeles, Cal. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 30.	Pipe, Los Angeles, Cal. Adv. Aug. 31.	Aug. 31
Sep. —.	Improv. Plant, Phoenix, Ariz.	Sep. 7

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 10.	Chattanooga, Tenn.	Aug. 24
Sep. 10.	Huntington, Ind.	Sep. 7
Sep. 11.	Brooklyn, N. Y.	Aug. 31
Sep. 11.	New Orleans, La. Adv. Jul. 6 to Sep. 7.	Jul. 6
Sep. 11.	Philadelphia, Pa. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 11.	Cleveland, O.	Sep. 7
Sep. 11.	Chicago, Ill.	Sep. 7
Sep. 11.	Groton, S. D.	Sep. 7
Sep. 11.	Lake Mills, Wis.	Aug. 24
Sep. 16.	Linton, Ind.	Aug. 31
Sep. 16.	Winona, Minn.	Sep. 7
Sep. 16.	New Haven, Conn.	Sep. 7
Sep. 17.	Philadelphia, Pa.	Aug. 31
Sep. 17.	South Orange, N. J. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 18.	Portland, Me.	Sep. 7
Sep. 18.	Brooklyn, N. Y.	Sep. 7
Sep. 18.	Oakland, Cal.	Sep. 7
Sep. 19.	Togus, Me. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 19.	Canton, Mass.	Sep. 7
Sep. 21.	Aurora, Neb. Adv. Sep. 7.	Sep. 7
Sep. 21.	Hamilton, O.	Sep. 7
Sep. 27.	Delaware, O.	Sep. 7
Sep. 30.	Fairfield, Cal.	Aug. 31
Oct. 1.	Billings, Mont.	Sep. 7
Oct. 1.	Paducah, Ky. Adv. Sep. 7.	Sep. 7
Oct. —.	Eaton, O.	Aug. 3

BRIDGES.

Sep. 10.	Yosemite, Cal.	Aug. 24
Sep. 10.	Marion, Ind.	Sep. 7
Sep. 10.	Gaffney, S. C.	Sep. 7
Sep. 11.	Philadelphia, Pa. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 11.	Humble, Tex.	Sep. 7
Sep. 13.	Dunbar, Pa.	Aug. 31
Sep. 13.	Leadville, Colo.	Aug. 31
Sep. 13.	Lorain, O.	Aug. 31
Sep. 14.	Cleveland, O.	Aug. 24
Sep. 14.	Anacostia, D. C. Adv. Sep. 7.	Sep. 7
Sep. 16.	Adin, Cal.	Aug. 24
Sep. 16.	Vicksburg, Miss.	Aug. 31
Sep. 20.	Cincinnati, O.	Sep. 7
Sep. 20.	Tiffin, O.	Aug. 31
Sep. 20.	Greeley, Colo.	Aug. 31
Sep. 23.	Newark, O.	Aug. 31
Sep. 23.	Bay City, Mich. Adv. Sep. 7.	Sep. 7
Sep. 30.	Santiago, Chile	Jul. 13
Sep. —.	Caldwell, Idaho.	Aug. 31
Oct. 14.	Los Angeles, Cal. Adv. Sep. 7.	Sep. 7
Oct. 19.	Canton, China. Adv. Aug. 24 to Sep. 7.	Aug. 24

PAVING AND ROAD MAKING.

Sep. 10.	Cleveland Heights, O.	Aug. 24
Sep. 10.	South Bend, Ind.	Sep. 7
Sep. 10.	Columbus, O.	Sep. 7
Sep. 10.	Sioux City, Ia.	Sep. 7
Sep. 11.	Brooklyn, N. Y.	Aug. 31
Sep. 11.	Cincinnati, O.	Aug. 24
Sep. 11.	Bridgeton, N. J.	Aug. 24
Sep. 11.	Baltimore, Md.	Sep. 7
Sep. 12.	Palisades Park, N. J.	Sep. 7
Sep. 12.	Silverton, O.	Aug. 24
Sep. 12.	Cincinnati, O.	Aug. 24
Sep. 12.	Marietta, O.	Aug. 31
Sep. 13.	Cincinnati, O.	Aug. 31
Sep. 13.	Madison, Wis.	Aug. 17
Sep. 13.	Des Moines, Ia.	Aug. 24
Sep. 14.	Ft. Moultrie, S. C.	Aug. 24
Sep. 14.	Peru, Ind.	Aug. 31
Sep. 14.	Oakley, O.	Sep. 7
Sep. 16.	Des Moines, Ia.	Sep. 7
Sep. 15.	Struthers, O.	Aug. 24
Sep. 16.	Youngstown, O.	Aug. 24
Sep. 16.	Euclid, O.	Aug. 24
Sep. 16.	St. Paul, Minn.	Aug. 24
Sep. 16.	Winona, Minn.	Sep. 7
Sep. 17.	Logansport, Ind.	Sep. 7
Sep. 17.	Hampstead, N. H.	Sep. 7
Sep. 17.	Billings, Mont. Adv. Sep. 7.	Sep. 7
Sep. 18.	Lancaster, Pa.	Sep. 7
Sep. 18.	Brooklyn, N. Y.	Sep. 7
Sep. 18.	Cincinnati, O.	Sep. 7
Sep. 18.	St. Joseph, Mich.	Sep. 7
Sep. 19.	Cincinnati, O.	Sep. 7
Sep. 20.	Cincinnati, O.	Aug. 31
Sep. 20.	Rockville, Ind.	Aug. 31
Sep. 20.	Cleveland, O.	Aug. 31
Sep. 21.	Cleveland, O.	Aug. 31
Sep. 21.	Hamilton, O.	Sep. 7
Sep. 21.	Washington, D. C. Adv. Sep. 7.	Sep. 7
Sep. 24.	Lebanon, Ind.	Aug. 24
Sep. 24.	Woodcliff Lake, N. J. Adv. Sep. 7.	Sep. 7
Sep. 26.	Danville, Ill.	Sep. 7
Sep. 28.	Manassas, Va.	Sep. 7
Oct. 1.	Billings, Mont. (2 props.) Adv. Sep. 7.	Sep. 7
Oct. —.	Selma, Ala.	Sep. 7
Dec. 13.	Valparaiso, Ind.	Sep. 7
———	York, Pa.	Sep. 7

POWER PLANTS, GAS AND ELECTRICITY.

Sep. 9.	New York, N. Y.	Aug. 31
Sep. 10.	Chicago, Ill.	Sep. 7
Sep. 10.	Washington, D. C.	Sep. 7
Sep. 11.	Detroit, Mich.	Sep. 7
Sep. 11.	Baltimore, Md.	Sep. 7
Sep. 12.	Millen, Ga.	Aug. 24
Sep. 12.	Ft. Myer, Va. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 12.	Vancouver, B. C.	Sep. 7
Sep. 13.	Lawrenceburg, Tenn. Adv. Aug. 31.	Aug. 31
Sep. 16.	Milton, O.	Aug. 10
Sep. 17.	Columbus, O.	Aug. 24
Sep. 17.	Washington, D. C.	Aug. 31
Sep. 17.	Wyandotte, Mich. Adv. Sep. 7.	Sep. 7
Sep. 20.	Lancaster, Pa.	Aug. 31
Sep. 28.	Manassas, Va.	Sep. 7
Sep. 30.	Revelstoke, B. C.	Sep. 7
Sep. 30.	Rochester, N. Y.	Aug. 31
Sep. 30.	New London, Conn. Adv. Sep. 7.	Sep. 7
Sep. 30.	West Point, N. Y. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 1.	Winnipeg, Man. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 4.	Jacksonville, Fla.	Aug. 31

BUILDINGS.

Sep. 10.	Bus. bldg., Elkins, W. Va.	Aug. 17
Sep. 10.	Plmbg., etc., post Bldg., Ft. Bliss, Tex. Adv. Aug. 17 to Sep. 7.	Aug. 17
Sep. 10.	Light-house, Philadelphia, Pa. Adv. Aug. 24, 31.	Aug. 24
Sep. 10.	Htg. court house, Forsyth, Ga.	Aug. 24
Sep. 10.	Htg. school, Kenmore, N. D.	Aug. 24
Sep. 10.	Pub. bldg., Kansas City, Mo.	Aug. 31
Sep. 10.	Pub. bldg., Whitesboro, N. Y.	Aug. 31
Sep. 10.	Bus. bldg., Shreveport, La.	Aug. 31
Sep. 10.	Pub. bldgs., Toronto, Ont.	Sep. 7
Sep. 10.	School, Salem, Mass.	Sep. 7
Sep. 11.	Jail, Eureka, Cal.	Aug. 3
Sep. 11.	Dwelling, Erie, Pa.	Aug. 31
Sep. 11.	School, North Braddock, Pa.	Aug. 31
Sep. 11.	School, Buffalo, N. Y.	Aug. 31
Sep. 11.	Pub. bldgs., Binghamton, N. Y. Adv. Sep. 7.	Sep. 7
Sep. 12.	Boilers in post bldg., Jefferson Barracks, Mo.	Aug. 24
Sep. 12.	Post bldg., Ft. Sam Houston, Tex.	Aug. 24
Sep. 12.	Approaches to P. O. bldg., Rome, N. Y.	Aug. 31
Sep. 12.	Pub. bldg., Des Moines, Ia.	Aug. 31
Sep. 13.	Church, Park Rapids, Minn.	Aug. 24
Sep. 13.	Pub. Bldg., Kansas City, Mo.	Sep. 7
Sep. 14.	Pub. bldg., Washington, D. C.	Aug. 17
Sep. 14.	Pub. bldg., Pensacola, Fla.	Aug. 17
Sep. 14.	State school, Hudson, N. Y. Adv. Aug. 24, 31.	Aug. 24
Sep. 14.	Addition to court house, Crown Point, Ind.	Aug. 31
Sep. 14.	Pub. bldgs., Cape May, N. J.	Sep. 7
Sep. 14.	Reformatory, etc., Napanoch, N. Y. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 14.	Indus. plant, Childersburg, Ala.	Sep. 7
Sep. 14.	School, Washington, D. C.	Sep. 7
Sep. 15.	School, Chapman, Kan.	Aug. 31
Sep. 15.	Church, Owensville, Ind.	Aug. 24
Sep. 15.	School, Hookset, N. H.	Sep. 7
Sep. 16.	Marine Hospital, Buffalo, N. Y. Adv. Aug. 3, 10.	Aug. 3
Sep. 16.	Marine hospital, Pittsburg, Pa.	Aug. 10
Sep. 16.	Indus. plant, Washington, D. C.	Aug. 24
Sep. 16.	School, Memphis, Tenn.	Sep. 7
Sep. 16.	School, Pullman, Wash.	Aug. 31
Sep. 16.	Pub. bldg., Ft. Myer, Va. Adv. Sep. 7.	Sep. 7
Sep. 16.	School, Roanoke Rapids, N. C.	Sep. 7
Sep. 17.	School, Galt, Ont.	Sep. 7
Sep. 17.	U. S. Mint bldg. repairs, San Francisco, Cal.	Aug. 10
Sep. 17.	Univ. bldg., Lawrence, Kan.	Aug. 24
Sep. 17.	Htg. school, Columbus, O.	Aug. 31
Sep. 17.	Bus. bldgs., Kankakee, Ill.	Aug. 31
Sep. 17.	School, Valley City, N. D.	Aug. 31
Sep. 17.	Pub. bldg., Las Animas, Colo.	Aug. 31
Sep. 17.	Pub. bldgs., Norfolk, Va.	Sep. 7
Sep. 17.	School, Tomahawk, Wis.	Sep. 7
Sep. 17.	School, Montclair Heights, N. J. Adv. Sep. 7.	Sep. 7
Sep. 18.	School, Agricultural College, Mich.	Sep. 7
Sep. 18.	Pub. Bldg., Kincardie, Ont.	Sep. 7
Sep. 18.	Pub. Bldg., Cincinnati, O.	Sep. 7
Sep. 19.	Post office, Muscatine, Ia.	Aug. 10
Sep. 20.	School, Lancaster, Pa.	Aug. 31
Sep. 20.	Church, Mitchell, S. D.	Sep. 7
Sep. 21.	Pub. bldg., Portsmouth, N. H.	Aug. 31
Sep. 23.	Post office exten., Cedar Rapids, Ia.	Aug. 10
Sep. 23.	School, Latta, S. C.	Sep. 7
Sep. 24.	Post office bldg., Hamilton, O. Adv. Aug. 17 to 24.	Aug. 17
Sep. 24.	Pub. bldg., Danville, Pa. Adv. Sep. 7.	Sep. 7
Sep. 26.	Court house, Muscatine, Ia.	Aug. 24
Sep. 26.	School, Riverside, Cal.	Aug. 31
Sep. 26.	New Industrial plants, Riverside, Cal.	Aug. 31
Sep. 26.	School, Brookings, S. D.	Aug. 31
Sep. 26.	Pub. bldg., National Soldiers' Home, Va.	Sep. 7
Sep. 27.	School, Hesperus, Colo.	Sep. 7
Sep. 30.	Bus. bldg. plans, Harrisburg, Pa.	Aug. 3
Sep. 30.	Post office, Selma, Ala.	Aug. 24
Sep. —.	Hotel, New Orleans, La.	Jun. 20
Oct. 1.	Bus. bldg., Decatur, Ill.	Aug. 31
Oct. 1.	Pub. bldg., Eau Claire, Wis.	Aug. 31
Oct. 1.	Y. M. C. A., Indianapolis, Ind.	Aug. 31
Oct. 1.	Plumbg. pub. bldg., Portland, Me.	Sep. 7
Oct. 1.	Church, Indianapolis, Ind.	Sep. 7
Oct. 3.	Court house plans, La Moure, N. D.	Aug. 10
Oct. 3.	School, Bayonne, N. J.	Sep. 7
Oct. 5.	Htg. Plant at Naval Station, New Orleans, La.	Sep. 7
Oct. 7.	U. S. Post Office improv., Baltimore, Md. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 15.	Court house plans, De Pere, Wis.	Aug. 17
Oct. 17.	Pub. bldg., Peoria, Ill.	Sep. 7
Oct. 21.	Post office, Des Moines, Ia. Adv. Sep. 7.	Sep. 7
Nov. 5.	Court house plans, Houston, Tex.	Aug. 31
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
———	School, bldg. material, Lawrence, Kan.	Aug. 31

MISCELLANEOUS.

Sep. 9.	Emplacements, etc., for guns, West Point, N. Y. Adv. Aug. 24 to Sep. 7.	Aug. 24
Sep. 10.	Ditch work, Sibley, Ia. Adv. Jul. 27 to Aug. 10.	Jul. 27
Sep. 10.	Exten. to b'kwater, Cleveland, O.	Aug. 17
Sep. 10.	Exten. to breakwater, Fairport Harbor, O.	Aug. 17
Sep. 10.	Dredging, New Orleans, La. Adv. Aug. 17 to Sep. 7.	Aug. 17
Sep. 10.	Breakwater, Bar Harbor, Me. Adv. Aug. 17 to Sep. 7.	Aug. 17
Sep. 10.	Lumber, Rock Island, Ill.	Aug. 24
Sep. 10.	Supplies, Washington, D. C.	Sep. 7
Sep. 11.	Breakwater, Oyster Bay, N. Y.	Sep. 7
Sep. 11.	Dam, etc., Cincinnati, O. Adv. Aug. 17 to Sep. 7.	Aug. 17
Sep. 11.	Ditch, Mason City, Ia.	Aug. 31
Sep. 11.	Levee wk., Bradley, Ark.	Aug. 17
Sep. 11.	Ditch, Estherville, Ia.	Aug. 24
Sep. 11.	Lumber, New York, N. Y.	Sep. 7
Sep. 11.	St. cleaning, New York, N. Y.	Sep. 7
Sep. 12.	Ditch, Estherville, Ia.	Aug. 24
Sep. 12.	Ditch, Ivanhoe, Minn.	Aug. 31
Sep. 12.	Engine, etc., Vancouver, B. C.	Sep. 7
Sep. 13.	Garbage crematory, Ft. Benj. Harrison, Ind. Adv. Aug. 24 to Sep. 7.	Aug. 24
Sep. 14.	Dredging, Ft. Moultrie, S. C.	Aug. 24
Sep. 16.	Earth filling, Plaquemine, La.	Aug. 24
Sep. 16.	Breakwater, Stockton, Cal.	Aug. 24
Sep. 16.	Wharf, Seattle, Wash.	Aug. 31
Sep. 17.	Lumber, etc., New Orleans, La.	Aug. 24
Sep. 17.	Supplies, Washington, D. C.	Aug. 31
Sep. 17.	Grading, Gt. Lakes, N. Chicago, Ill.	Sep. 7
Sep. 18.	Dredging, Washington, D. C. Adv. Aug. 24 to Sep. 7.	Aug. 24
Sep. 18.	Steam shovels, etc., Panama	Aug. 24
Sep. 18.	Concrete ditch, Roswell, N. M.	Aug. 31
Sep. 19.	Dredging, etc., Gardiner, Me. Adv. Aug. 24 to Sep. 7.	Aug. 24
Sep. 19.	Removal of wreck, Boston, Mass. Adv. Aug. 24 to Sep. 7.	Aug. 24
Sep. 19.	Removal of wreck, Salisbury, Mass.	Aug. 31
Sep. 20.	Levee, New Orleans, La.	Sep. 7
Sep. 24.	Dredging, Wheeling, W. Va.	Aug. 31
Sep. 25.	Steam shovels, etc., Panama. Adv. Aug. 31.	Aug. 31
Sep. 26.	Wharf, Ft. Du Pont, Del. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 26.	Dredging, San Francisco, Cal.	Sep. 7
Sep. 28.	Steel barges, Panama	Sep. 7
Sep. 30.	Searchlight outfit, Washington Barracks, D. C.	Aug. 3
Sep. 30.	Dredge, Cincinnati, O. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 30.	Dredging, Saugerties, N. Y. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 30.	Dredge, Philadelphia, Pa. Adv. Sep. 7.	Sep. 7
Sep. 30.	Dredging, Boston, Mass. Adv. Sep. 7.	Sep. 7
Oct. 1.	Snag boat, Mobile, Ala. Adv. Sep. 7.	Sep. 7
Oct. 3.	Jetty work, Cold Springs, N. J. Adv. Sep. 7.	Sep. 7
Oct. 5.	Lock and dam, Franklin, Ark. Adv. Aug. 10 to 31.	Aug. 10
Oct. 5.	Lock and dam, Mobile, Ala. Adv. Aug. 10 to 31, Sep. 7.	Aug. 10
Oct. 7.	Excav., Detroit, Mich. Adv. Aug. 31 to Sep. 7.	Aug. 31
Oct. 8.	Dredging, Detroit, Mich. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 10.	Canal wk., Peterboro, Ont.	Aug. 24
Oct. 15.	Cement, stone, etc., Honolulu, H. I. Adv. Aug. 31, Sep. 7.	Aug. 31
Sep. 25.	Subway, Reading, Pa. Adv. Sep. 7.	Sep. 7

CURRENT NEWS SUPPLEMENT

SEPTEMBER 14, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

PERSONAL NOTES.

Mr. E. H. Rondall has been elected city surveyor of Fredericksburg, Va.

Mr. J. A. Smith has been appointed general manager of the Panama R. R., succeeding Mr. W. G. Bierd.

Mr. Harry T. Poe, Jr., has resigned as assistant engineer with the American Pipe Mfg. Co., to become city engineer of Americus, Ga.

Charles R. Long, for many years president of the Louisville Water Co., Louisville, Ky., died at his home in that city, Sept. 4, aged 67 years.

Prof. D. W. Mead read a paper on hydraulic engineering at the University of Wisconsin, at the first regular fall meeting of Western Society of Engineers, in Chicago, Sept. 4.

Richard J. McGrann, a well-known railroad contractor, died recently at his home in Lancaster, Pa., aged 70 years. He was a cousin of Bernard J. McGrann, of Newark, N. J., also a railroad contractor, who died recently.

Lieut.-Col. Frederic V. Abbott, Corps of Engineers, U. S. A., assistant to the chief of engineers, has been ordered to the Philippine Islands for duty in connection with the construction of fortifications in Manila and Subig bays.

The tenth annual convention of the Central States Water-Works Association will be held in Wheeling, W. Va., Sept. 17, 18 and 19. The Windsor Hotel will be headquarters. Mr. Wm. Allen Veach, Newark, Ohio, is secretary of the association.

Messrs. Lockwood, Greene & Co., architects and engineers, Boston, Mass., were the engineers for the manufacturing buildings recently built for Messrs. Jas. Pyle & Sons, at Shadyside, N. J., and for the power plant for the same firm, described in The Engineering Record, Aug. 31. Mr. Chapman is engineer in charge of the power plant.

Messrs. J. G. Ellendt and O. L. Griffith have severed their connection with the Concrete Engineering & Supply Co., New York City, and together with Mr. C. E. Tirrell, have organized the J. G. Ellendt Co., with offices at 1 Madison Ave., New York. They will engage in consulting engineering and contracting on reinforced concrete work.

Mr. Horace Ropes, formerly connected with the Metropolitan Water Board of Boston and the New York City Board of Water Supply, has been engaged by the New York State Water Supply Commission to assist Mr. John R. Freeman, whose appointment as director of the engineering forces of Water Supply Commission was noted recently in these columns.

M. Jules Vacherot, whose work as chief landscape architect at the Paris Exposition of 1900 won for him the decoration of the Legion of Honor from France and decorations from several other European countries, arrived in New York recently. M. Vacherot, who is now in charge of all the gardens of Paris, recently became associated with a New York firm of landscape architects and engineers. He will spend two months of each year in New York.

Messrs. Willis G. Tucker, professor of chemistry and toxicology in the Albany Medical College; Olin H. Landreth, professor of engineering in Union College, and James H. Stoller, professor of biology in Union College, have established the Albany Sanitary Bureau, Albany, N. Y., for the purpose of conducting a practice in sanitary investigation, examinations, inspections and reports. Special consideration will be given such problems as public and private water supplies, stream pollution, sewerage conditions in municipalities and institutions, sanitary conditions in schools, churches, hotels and other public buildings, and the examinations of dairies and creameries. Prof. Landreth is secretary of the company.

Mr. Julian C. Smith, recently general superintendent of construction for Dodge & Day, engineers and constructors, of Philadelphia, has resigned his position with that firm and has acquired a controlling interest in the Atlantic Engineering & Construction Corporation, of Norfolk, Va. This company, the name of which will be changed to The Atlantic Co., Inc., will do a general engineering and contracting business throughout the southern seaboard States. The company now has on hand contracts for the grading for the large new terminal yards of the Tidewater Ry. Co., at Sewell's Point, Va., and for the construction and equipment of a hydro-electric power plant at Boonton, N. J.

A commission appointed by the Prussian Government is making a tour of this country studying heavy electric traction systems preparatory to taking up the electrification of Berlin steam suburban lines, including the Stadtbahn, a connecting line extending through the city, and the Ringbahn, a belt line around the city. The chairman of the commission is Herr Geheimer Baurat Wittfeld, of the Ministry of Railways, Highways and Bridges. Associated with Mr. Wittfeld and accompanying him on the trip are: Dr. Ing. Walter Reichel, of the Berlin Polytechnic University, and formerly chief engineer of the railway department of the Siemens & Halske Co.; Mr. Frederick Jordan, general manager of the Felten Guilleume-Lahmeyer works of Frankfurt; Mr. Emmerich Frischmuth, engineering director of the Siemens-Schuckert Works, of Berlin, and Mr. Phillip Pforr, manager and chief engineer of the railway department of the General Electric Co., of Berlin. The commission has visited the installations of the New York Central, New York, New Haven & Hartford, and Long Island railways; the Erie electrification at Rochester, the Boston subway and elevated systems; the works of the General Electric Co., at Schnectady, and plants at Niagara Falls, Pittsburg, Indianapolis and Fort Wayne, Chicago, Helena and Spokane are also included in the itinerary. The cost of the installation contemplated is estimated at about $20,000,000.

BUSINESS NOTES.

The Aberthaw Construction Co. have closed a contract for building a concrete-steel dam 40 ft. high and about 225 ft. long for The Barker Mills, Auburn, Me., under license from the Ambursen Hydraulic Construction Co., of Boston. Mr. I. W. Jones, of Milton, N. H., is the engineer for the company.

Judge Buffington, of the U. S. Circuit Court of Appeals, has rendered a decision in the suit of the Lidgerwood Mfg. Co., against the Lambert Hoisting Engine Co., holding that the latter has infringed the North patent for one-quarter and three-quarter speed cableways, owned by the Lidgerwood company.

The contracting office of the Virginia Bridge and Iron Co., heretofore located at Little Rock, Ark., has been transferred to New Orleans, La. The office will be in charge of Mr. F. E. Golian, who was connected with the engineering department of the company for some time, but has recently been with the Atlanta office.

The Bellevue Pipe & Foundry Co. during the past summer cooled their foundry by forcing air over pipes through which cold water was circulated. The molding room was kept at a good working temperature and not a single day was lost on account of the heat. The cooling equipment was installed by the American Blower Co., Detroit.

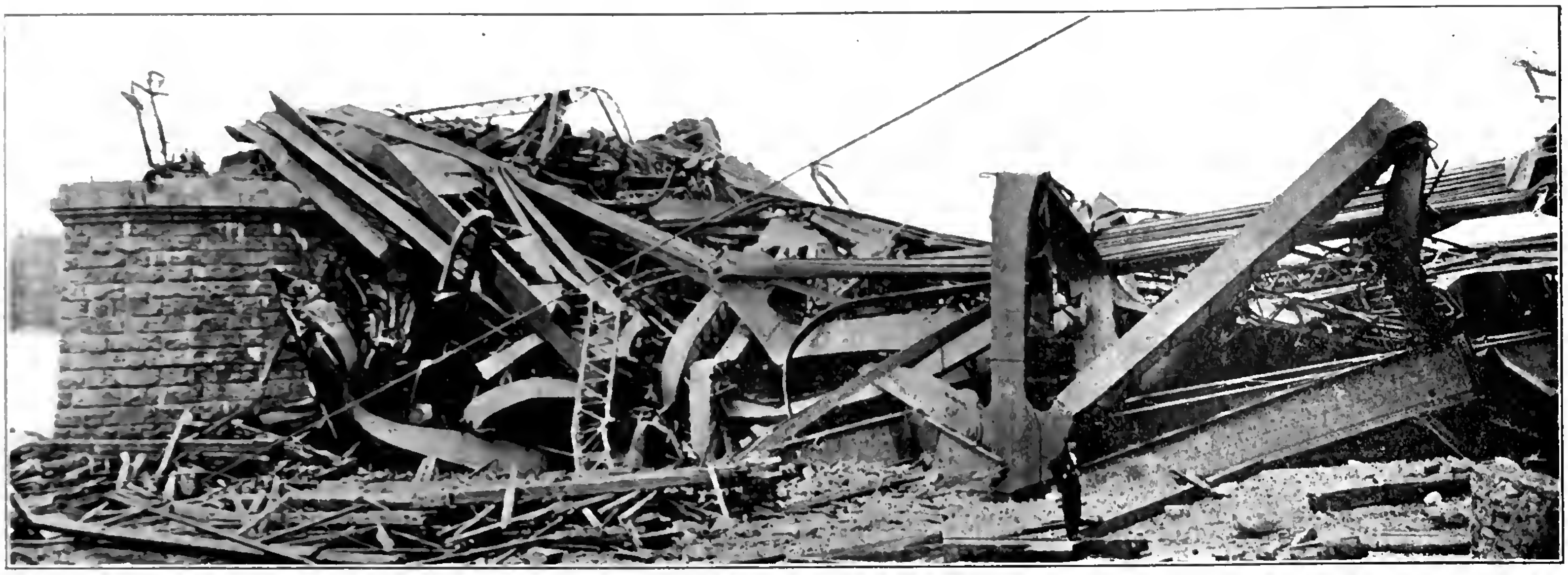
Dodge & Day, engineers and contractors, Philadelphia, have submitted a betterment report covering the entire factory of Fayette R. Plumb, Inc., of Frankford, Pa., and are now engaged in making extensive alterations to the forge shops. When this work is finished other departments will be taken up and ultimately the entire plant will be remodelled.

The Pacific Coast headquarters of the Standard Underground Cable Co., which have been at Oakland since the earthquake, are now permanently loacted at 511-514 Shreve Building, San Francisco, Cal., the office continuing in charge of Mr. A. B. Saurman as Pacific Coast manager. The new Oakland factory of the company is about four times the size of the one destroyed by fire after the earthquake, is fireproof and equipped with the latest machinery. A warehouse for the products of the company's eastern factories is maintained at Oakland.

On Aug. 22 the new Hunt St. factory of the D. T. Williams Valve Co., Cincinnati, was completely destroyed by fire, and all of the tools and machinery of the lubricating department, the only department which had been moved to the new building, were lost. The patterns, however, were still at the Broadway plant. A new lubricating department is now being installed on East 8th St., and castings and tools are being manufactured as quickly as possible, so that deliveries of lubricating devices can be made about Oct. 15. None of the other departments were injured.

A mechanical stoker of unusual design has recently been brought out by the Sarco Fuel Saving & Engineering Co. A reciprocating ram delivers a definite amount of coal in front of a pendulous shovel, the edge of which swings near the bottom of a pan. The shovel is drawn back mechanically against a strong helical spring until released, when it is pushed forward by the spring and shoves the coal forward on the grate. The force of this push is varied automatically at each swing of the shovel in order to distribute the fuel properly. One shovel will stoke a furnace width of about 3 ft. These stokers are now in use at several paper mills.

The July business of the Westinghouse Electric & Mfg. Co. was considerably above the average, the railway department alone showing orders of approximately $2,500,000. Among these was one from the Brooklyn Rapid Transit Co. for 400 electric railway motors, 200 of which, of 200 h.-p. each, are for the elevated railroad cars, while the balance of 60 h.-p. each, are for surface cars. The Westinghouse multiple unit control will be used with the elevated car equipment. Another large order, for the electrical apparatus for 24 substations, consisting of static and rotary transformers, and switch-boards, was received from the Schoepf interests, of Cincinnati, which operate extensive urban and interurban electric railways in Ohio and southern Indiana.



THE WRECKAGE AT THE MAIN PIER FROM THE WEST.

THE REMAINS OF THE SOUTH ANCHOR ARM.

[illegible] ARM WRECKAGE, QUEBEC BRIDGE, FROM THE NORTHWEST.

THE FALLEN ANCHOR BENT.

VIEW LOOKING NORTH.

THE WRECKAGE OF THE MAIN PIER FROM THE EAST.

THE FALLEN ANCHOR ARM, QUEBEC BRIDGE, SEEN FROM THE EAST.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Ft. Morgan, Ala.—Bids will be received by Capt. Louis F. Gabbard, Jr., Box 605, Mobile, Ala., until Sept. 25, for the construction at Ft. Morgan, Ala., of a 150,000-gal. tank and trestle and for pumping plant, ice machine and cold storage.

Van Buren, Ark.—J. E. Power and others, according to reports, have purchased the plant of the Van Buren Water Co. and will improve the same.

Oakland, Cal.—The Bd. Pub. Wks. is stated to have adopted a resolution to petition the City Council to unite with San Francisco in trying to secure a water supply for Oakland from the Sierra Nevada Mountains.

Los Angeles, Cal.—Bids will be received by the Bd. Pub. Wks. Oct. 7 (W. R. Ormsby, Acting Pur. Agt.) for cement-making machinery for the Los Angeles Aqueduct, as per specification No. 6.

Hotchkiss, Colo.—The Alta Vista Reservoir Co. (C. A. Fowler, Pres.) contemplates work costing about $25,000. The work will be done by day labor, the bulk of the work by hydraulic power. Length of dam 1,000 ft. outlet pipe, 15-in. cement. Capacity 45,000,000 ft. Fred. G. Hotchkiss, Engr., Hotchkiss.

Paonia, Colo.—The Mt. Lamborn Canal & Reservoir Co. contemplates building 7 miles of canal this fall and a reservoir and 6 miles of canal in 1908. Probable cost, $75,000. E. P. Martin, Paonia, Engr.; C. C. Hawkins, Secy.

Wilmington, Del.—Bids will be received Sept. 30 by the Water Dept. for the construction of covered slow sand filters, consisting of 6 beds and a covered filtered water reservoir with a capacity of 10,000,000 gals., together with appurtenances, as advertised in The Engineering Record. Theo. A. Leisen, Ch. Engr.

Ft. Du Pont, Del.—Bids will be received until Oct. 10 by Capt. J. L. Knowlton, Constr. Q. M., Ft. Du Pont, Delaware City, Del., for remodeling the sewer and water systems and constructing a 150,000-gal. tank at Ft. Du Pont, as advertised in The Engineering Record.

Columbus, Ga.—It is reported that an agreement has been reached between the Hudson Eng. & Contr. Co., of New York, N. Y., whereby the company agrees to supply the city with 5,000,000 gals. artesian water daily for a period of 20 years.

Jackson, Ga.—The Council is said to be considering the issuing of $10,000 bonds to extend the water system.

Catoosa Springs, Ga.—Bids will be received until Sept. 21 by Capt. E. D. Anderson, Q. M., U. S. A., Ft. Oglethorpe, for a deep well and water system at the Government target range, Catoosa Springs.

Atlanta Ga.—Bids will be received until Oct. 23 (readvertisement), by the Bd of Water Comrs. (Park Woodward, Gen. Mgr.), for furnishing and erecting complete a sectional washing pressure filter plant, to consist of 8 units, ea. unit 8 ft. in diam. and 20 ft. long, as advertised in The Engineering Record.

Lewiston, Idaho.—It is proposed to lay water mains under the supervision of W. A. Smith, Supt., at a cost of $57,300. An election is to be held Sept. 21 to vote on this question. John E. Nickerson, Compt.

Lindsay, Ind. Ter.—It is reported that $25,000 bonds have been voted for a water supply.

Tulsa, Ind. Ter.—The Council is reported to be contemplating the purchase of the plant of the water works company.

Indianola, Ia.—The citizens, it is stated, have voted in favor of the city purchasing the plant of the company operating in this city.

Des Moines, Ia.—The Des Moines Water Co. have been making surveys and collecting data for proposed improvements.

Covington, Ky.—The Com. on Water Wks. of the Bd. of Water Wks. Comrs. is said to be contemplating the purchase of the Kenton Water Co.'s mains in Madison Ave.

Bangor, Me.—The following are the detailed bids received Sept. 4 for constructing coagulating basin and head house (Geo. W. Fuller, Engr., 170 Bway., N. Y. City): (a) C. N. Taylor, $46,195, (b) Greer Filter Co., $47,786, (c) P. B. Elkins Co., $49,511: Earth excav., 6,200 cu. yd., *a* 50 cts., *b* 50 cts., *c* 55 cts.; rock excav., 20 cu. yd., *a* $3, *b* $4, *c* $5; earth embk. and fill., 4,700 cu. yd., *a* 40 cts., *b* 30 cts., *c* 30 cts.; top soil and seeding 15,000 sq. ft., *a* 4 cts., *b* 1 ct., *c* 6 cts.; road and walkways, 60 cu. yd., *a* $5, *b* 2.50, *c* $2.50; concrete, Class A, 170 cu. yd., *a* $9, *b* $15, *c* $13; concrete, Class B, 2,180 cu. yd., *a* $8, *b* $9.25, *c* $10. steel rods, 58,000 lbs., *a* 3.25 cts., *b* 4.9 cts., *c* 3.5 cts.; head house superstructure, lump sum, *a* $5,800, *b* $5,037, *c* $5,255; electric lighting and heating, lump sum, *a* $950, *b* $1,000, *c* $810; self-cleaning screens and appurtenances, lump sum, *a* $2,200, *b* $1,400, *c* $1,970; c. i. pipe, specials and valves, lump sum, *a* $4,750, *b* $5,540, *c* $5,440; sewers, lump sum, *a* $1,100, *b* $737, *c* $730; brick manholes, lump sum, *a* $400, *b* $275, *c* $65; manhole covers and drains for coag. basin, lump sum, *a* $300, *b* $200, *c* $400; coagulant devices, lump sum, *a* $2,500, *b* $1,800, *c* $1,587; plumbing and small piping, lump sum, *a* $1,100, *b* $1,350, *c* $1,235.

Berlin, Md.—See "Power Plants, Gas and Electricity."

**Grosse Pointe Farms, Mich.*—J. G. Armstrong, Clk., writes that the contract to lay 2¼ miles of water pipe (bids opened Aug. 31) has been awarded to Cornelius Cronin, of Grosse Pointe.

**Hibbing, Minn.*—The Village Council is stated to have accepted the bid of the Prescott Steam Pump Co., of Milwaukee, Wis., to furnish a steam pump at $7,500; two other bids were received, one from the Worthington Steam Pump Co., at $9,300, and the other from the Fairbanks Morse Co., at $6,791.

Kansas City, Mo.—D. E. Cornell, Mayor of the West Side, is said to be considering the calling of an election to vote on the issuing of bonds to construct a new water plant.

Ft. Keogh, Mont.—E. C. Bebb, a government irrigation expert, is reported to have examined the portion of the Ft. Keogh reservation which corners on the Tongue and Yellowstone Rivers, ascertaining the area that could be irrigated and the required elevation of the head gate of a ditch which would irrigate the flat. Between 7,000 and 10,000 acres were found to be within the domain of such a ditch and an elevation of 8 feet above the bank of the Yellowstone, at a point 5 miles west of the post, where the bluffs border the river, would be sufficient to give the necessary fall.

**Sanders, Mont.*—J. R. Thompson, Secy. Sanders Cooperative Ditch Co., writes that the contract to construct an irrigation ditch (bids for which were received Aug. 31) has been awarded to J. C. Lyndes, of Sanders, at from 15 to 35 cts. per cu. yd., as per classification; in all about $32,000.

Billings, Mont.—The purchasing of the plant of the Billings Water Co. by the city is being agitated.

**Bradshaw, Neb.*—C. B. Palmer, Jr., Village Clk., writes that the contract to construct water works (bids opened Aug. 30) has been awarded to the Drake-Williams Mount Co. and Crane Co., of Omaha, Neb.

Fremont, Neb.—See "Power Plants, Gas and Electricity."

Harrison, N. J.—Bids will be received until Oct. 1 by the Water Com. of Common Council for furnishing material and laying a water main in a portion of Franklin Ave. B. P. Walsh, Town Clk.

Belvidere, N. J.—Jos. M. Roseberry, Pres. of the Buckhorn Springs Water Co., writes that as soon as specifications are prepared bids for construction of water works will be asked. About $40,000 will be spent. S. W. Salmon, of Mount Olive, N. J., is the engineer.

Summit, N. J.—Bids will be received until Sept. 25 by the Pres. Bd. Trus., for drilling a deep well to the depth of about 1,600 ft. Jas. Johnstone, Village Clk.

**Gloucester, N. J.*—The contract to furnish a 3,000,000-gal. pump for the water works, it is reported, has been awarded to the D'Olier Eng. Co., of Philadelphia, Pa., at $3,495.

Camden, N. J.—In the report to the City Council by experts Wm. H. Boardman, J. M. Whitham and J. W. Ledoux on the increasing of the water supply, it is recommended that efficient strainers be used at the artesian wells at Delair that will increase the present output of 14,562,000 gals. to 17,000,000 daily, the metering of the entire city, and that the average daily use for each person be reduced to 125 gals. The erection of storage tanks on the hill at Bethel, near Delair, so that in the middle of the day there will be ample pressure throughout the city. These reservoirs, it is estimated, will cost $150,000. As to the future supply it is stated that the purchase of property adjoining the present plant will provide sufficient water to supply all demands of the city until 1920. This new plant, it is stated, will cost about $200,000 and will increase the output to 22,000,000 gals. daily.

A resolution has been passed by the City Council authorizing the city to borrow $3,500 to pay additional expenses of lowering the city water main in Cooper Creek at State St.

Santa Rosa, N. M.—W. S. Shields, of Chicago, Ill., is reported to have estimated the supply of water that can be taken from the canon 3 miles east of Santa Rosa at between 600,000 and 1,000,000 gals. daily. A well 600 ft. long reaching from one side of Los Tanos canon to the other is contemplated. The water is to be brought into the city gravitation. Local business men are said to be interested in the project, and it is stated that about $25,000 capital is to be subscribed.

New York, N. Y.—The following are the bids received Aug. 29 by the Park Comrs. of New York City, for furnishing, delivering and laying c. i. water pipe and appurtenances in the Harlem River Driveway between 155th and 177th Sts.: Atlanta Contr. Co., $23,810; Thos. Crimmins Contr. Co., $32,195; Wm. H. Masterson, $19,777; The Wilton Constr. Co., $23,125. The detailed bid of Wm. H. Masterson, the lowest bidder, on some of the items is as follows: 105 tons straight 6-in. c. i. pipe furnished, $38; 6½ tons 6-in. c. i. branches and special castings furnished, $100; 6,100 lin. ft. 6-in. c. i. pipe laid, $2; 750 lin. ft. 2-in. wrought iron pipe furnished and laid, $2; etc.

Albany, N. Y.—John R. Freeman, of Providence, R. I., is reported in charge of a force of engineers who are working in Sacandaga Valley to secure data concerning the State's water power resources in accordance with the Fuller Act. Mr. Freeman is to make a report to the Legislature by Feb. 1, 1908.

Niagara Falls, N. Y.—The construction of a new water system is being agitated. Three-fourths of the taxpayers are said to be in favor of Mayor A. C. Douglass' plan which involves an expenditure of about $525,000, and is to take water from the Canadian channel about half way between Navy and Buckhorn islands in the Niagara River.

**Cazenovia, N. Y.*—Gen. W. Salisbury, Pres. Water Bd., writes that no award was made Sept. 4 for furnishing and laying 5,433 ft. 4-in. c. i. pipe. The city will probably buy the material and let contract for labor.

Brooklyn, N. Y.—Bids were opened on Aug. 28 at the office of the Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing, delivering and laying water mains and removing existing water mains in Bedford, Clinton, Greenpoint, Harrison, Johnson, Manhattan, Meserole and Nassau Aves.; in Humboldt, Keap, Lorimer, Meserole, Oakland, Provost, Scholes, Waterbury and White Sts., and in Delmonico Pl., Boro. of Brooklyn, and the lowest bid received was submitted by J. H. Holmes, 87 Nassau St., N. Y. City, at a total of $317,817. The following is his detail bid of some of the principal items required: 3,560 tons straight pipe, $37.50; 360 tons specials, $75; 350 tons gate valve boxes, $54; 75 lin. ft. 30-in. pipe to lay, including excav., $3; 25 lin. ft. 24-in. pipe to lay, including excav., $2.50; 6,700 lin. ft. 20-in., $1; 40,200 lin. ft. 16-in., 90 cts.; 7,400 lin. ft. 12-in., 73 cts.; 5,600 lin. ft. 8-in., 72 cts.; 2,800 lin. ft. 6-in., 35 cts.; 350 sq. yds. Belgian block pavt., 30 cts.; 6,200 sq. yds. granite block pavt., 30 cts.; 6,500 sq. yds. granite block, concrete found., $1.60; 1,000 sq. yds. cobble pavt., 20 cts.; 7,500 sq. yds. asphalt, $1.90; 300 sq. yds. asphalt block, $1.90; 450 sq. yds. brick pavt., $1.60; 150 sq. yds. Medina sand stone, $1.20; 1,500 sq. ft. flag, 10 cts.; 500 sq. ft. cement sidewalk, 20 cts.; 50 cu. yds. brick masry., $15; 50 cu. yds. concrete, $10; 10 M ft. lumber, 1 ct.; 5,000 lbs. steel I-beams, 3 cts.; 1,000 cu. yd. extra excav., $1.50; 100 cu. yds. rock excav., $2.50; 2 16-in. connections 30-in. pipe, $450; 1 12-in. connection 30-in. pipe, $300; 1,000 ⅜-in. house connections, $1.50; 100 ½-in. house connections, $1.75; 100 ⅝-in. house connections, $2; 50 1-in. house connections, $3; 25 2-in. house connections, $7; 100 hydrants removed, $10; 50,000 lin. ft. 6-in. pipe removed, 1 ct. Totals of other bids: Shawmut Constr. Co., 301 S. 3d St., Brooklyn, $322,567, and Hanover Constr. Co., 21 Park Row, $336,365.

The Kings Dept. of Parks is reported to have awarded to Barton & McHarg, of New York City, N. Y., the contract to construct a water system to supply the club house and nursery for Forest Park. Probable cost, $15,000.

Ft. Caswell, N. C.—Bids will be received until Oct. 9 by L. Cravens, Quarter Master, Ft. Caswell, for building pump house, ice plant and cold storage here, as advertised in The Engineering Record.

Kings Mountain, N. C.—See "Power Plants, Gas and Electricity.

Charlotte, N. C.—Bids will be received until Sept. 19 by the Bd. of Water Comrs. (Patk. H. Williams, Supt.), for furnishing approximately 440 tons c. i. pipe and specials, 37 Matthews pattern fire hydrants, and valves of 6-in., 8-in., 12, 16 and 20-in. sizes; also same date and place separate bids for laying approximately 1,800 ft. of 20-in., 4,150 ft. 12-in. and 250 ft. 6-in. water mains together with necessary valves, hydrants and specials.

**Cincinnati, O.*—Frank Burns is stated to have secured the contract for laying 12-in. pipe in Grand, Warsaw and Price Aves., at $2,532, and for laying 8-in. filtered water pipe at California, at $1,983. The American Steel & Wire Co. is reported to have secured the contract to furnish 1,100 tons of sulphate of iron at $13,200.

The Selvage Constr. Co. is reported to have submitted the lowest bid for furnishing 28 fire hydrants.

**Sandusky, O.*—The contract to construct a mechanical filter plant (bids received June 29) was awarded recently to Thos. Sightbody, of Youngstown, at $75,000 complete, 6,000,000 gal. capacity. It is to be of concrete construction.

Mosquite, Ore.—Bids will be received until Oct. 26 by Saml. Hill, Chmn. Snake River Irrigation Dist., Mosquite, for $325,000 irrigation bonds.

**Halbur, Ia.*—Fred Franzwa, of Carroll, is stated to have secured the contract to construct water works at $3,865.

Seneca, S. C.—It is reported that bonds have been voted to establish a water plant.

Dickson, Tenn.—We are informed that the citizens have voted in favor of issuing $25,000 bonds for water works. Bids for construction not yet advertised.

Victoria, Tex.—The City Council has instructed the Com. to advertise for artesian water, the quantity to be not less than 700 gals. per minute, or 1,008,000 gals. per day.

Bronte, Tex.—The question of installing a water works system is reported contemplated. The forming of a company by local capitalists to bring water from Colorado River, a distance of 3 miles, is being considered.

Beaumont, Tex.—The Beaumont Water Wks. Co. is stated to have authorized an issue of $250,000 in bonds for improving the plant.

Fair Haven, Vt.—It is proposed to extend the water system by constructing 2 additional reservoirs and laying pipe, at a total cost of $15,000. Bids will be opened within a month. Washburn Fancher, of Fair Haven, is the Engr. in charge.; D. J. Durick, Village Pres.

Lind, Wash.—R. S. Hamilton, Town Clk., writes that no improvements are contemplated at the present time by the city to the water works recently purchased.

Tacoma, Wash.—An ordinance has been approved by the Mayor to lay 6-in. c. i. water pipe and 6-in. wooden water pipe in Local Improv. Dist. No. 517, including hydrants, gates, tees, etc.

*The report of the Special Water Com. recommending to the Council that the bid of the Los Angeles Well Drilling Co. for sinking an experimental well at South Tacoma at $7,500 be accepted, was adopted by Council.

**Seattle, Wash.*—The contract to lay water mains in 3d Ave. W., is stated to have been awarded to H. F. Johns at $11,875.

Union, W. Va.—Bids will be received until Oct. 5 by A. S. Johnston, Mayor, for $5,500 bonds, to be issued for the purpose of constructing a system of water works.

Kingwood, W. Va.—A local water company has been formed and, it is stated, has applied to the City Council for a franchise to establish a water works system.

Elkins, W. Va.—Water works bonds have been sold and bids for the construction will be received Sept. 20. Geo. Henry, City Clk.; Penniman & Fairley, Engrs., Baltimore, Md.

Parkersburg, W. Va.—G. L. McGibbons is reported to have been engaged by the Bd. of City Affairs to prepare plans for the construction of a water works system. J. V. Dunbar, City Engr.

Madison, Wis.—Bids will be received until Sept. 27 by the Bd. of Water Comrs. (John B. Heim, Supt.) for constructing a 1,000,000-gal concrete storage basin; also, same date and place, separate bids for drilling 1 and possibly 2 artesian wells, both proposals advertised in The Engineering Record.

**Fond du Lac, Wis.*—The City Council Aug. 26, it is stated, accepted the bid of S. H. Cole for laying a gravity intake water system in the northern extremity of

**Items marked thus give the names of parties awarded contracts.*

the city at Rees and Bannister Sts. The total cost of the work will be about $20,000, and includes 4,994 ft. of pipe.

Winnipeg, Man.—It is stated that the Winnipeg River is recommended as a source of water supply for Winnipeg in the report of the water supply experts placed before the Water Supply Comn. Sept. 6. The cost of constructing the system for a 12,000,000-gal. daily supply is estimated at $3,862,000 with wood stave pipe lines, and $6,050,000 with steel pipe lines. To bring in 48,000,000 gal. daily the cost is placed at $10,519,000 with stave pipe line and $17,084,000 with steel pipe lines.

Montreal, Que.—We are informed that the following are the detailed bids opened Sept. 6 by the Water Com. (Geo. Janin, Supt.) for constructing a reinforced concrete conduit, about 9 ft. in diam. and 27,300 ft. long: (*a*) Chief Engr.'s estimate, (*b*) Patk. McGovern, Boston, Mass.; (*c*) Louis P. Nott, Manchester, Eng.; (*d*) La Societe Canadienne d'Entreprise Generale, Montreal; (*e*) Treffle Bastien, Montreal. (Quantities given are approximate.) 27,100 lin. ft. of conduit complete, *a* $19, *b* $21.25, *c* $24, *d* $25, *e* $32.97; 44,000 cu. yds. rock excav., *a* $2.25, *b* $2, *c* $1.10, *d* $1.85, *e* $1.99; 10,000 cu. yds. loose rock and boulders, *a* $1.25, *b* 75 cts., *d* 24 cts., *e* $1; 2,400 lin. ft. piling and flooring, *a* $6, *b* $5.60, *c* $24.50, *d* $11, *e* $14.21; totals, *a* $640,800, *b* $684,815, *c* $757,600, *d* $787,700, *e* $1,025,151.

Welland, Ont.—The Railway & Municipal Bd. at Toronto has approved the application of the town of Welland for permission to issue $15,000 water works extension bonds.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Oakland, Cal.*—It is stated that the contract to construct a sewer in Channing St. has been awarded to the Standard Constr. Co., at $9,659.

Hartford, Conn.—The Bd. of Contract & Supply, it is stated, has authorized bids to be received for constructing sewers in New Britain Ave., Zion and Lincoln St. extension and Allen Pl. and across private property; bids to be opened Sept. 16.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Sept. 30 for constructing sewer in the District of Columbia, known as Valley of Soapstone Branch, as advertised in The Engineering Record.

Ft. Du Pont, Del.—See "Water."

Ft. Dade, Fla.—Bids will be received until Oct. 3 by the Constr. Q. M., U. S. A., for repair and extension to sewer outlet at this post.

Nampa, Idaho.—Bids will be received by the Sewer Comn. (Claude Duval, Clk.), it is stated, until Sept. 18, for constructing 9,535 ft. gravity sewer.

St. Charles, Ill.—Bids will be received until Sept. 18 by the Bd. Trus (C. W. Hart, Secy.) St. Charles School for Boys, at the office of T. D. Hurley, 1244 Unity Bldg., Chicago, for constructing a system of drains. W. Carbys Zimmerman, State Archt., 1101 Steinway Hall, Chicago.

Great Lakes, North Chicago, Ill.—Bids will be received at the Bureau of Navigation, Navy Dept. (Cameron McR. Winslow, Acting Ch.), Washington, D. C., until Sept. 27, for the laying of sewers and drains at the naval training station, Great Lakes, North Chicago, Ill.

Peoria, Ill.—Bids will be received until Sept. 18 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and constructing a sewer in a portion of S. Peoria St.

Chicago, Ill.—Rudolph Hering, of New York, N. Y., who has been engaged by the Drainage Bd. to investigate the sewage disposal problem, it is reported, has started the investigation.

Richmond, Ind.—It is stated that no bids were received Aug. 26 for constructing a sewer system in West Richmond south of Main St. and a sewer system on Northwest 2d St. The cost of these improvements is estimated at $105,000. Bids on the West Richmond sewer will probably not be asked again until late in the fall.

We are informed that bids will be received Sept. 25 (readvertisement), for constructing a sewer in W. 2d St. Fred. R. Charles, City Engr.

Ft. Wayne, Ind.—It is stated that the Bd. Pub. Wks. (H. W. Becker, Clk.) will receive bids until Sept. 19 for constructing 2 vitrified clay pipe sewers.

Brazil, Ind.—Plans and specifications have been ordered prepared, according to reports, for a sewerage system through the city, beginning at Hadleytown suburb.

Columbus, Ind.—Lawrence F. Orr, City Clk., writes that no contract was awarded Sept. 3 for constructing 9,838 ft. of main and lateral sewers. The matter may not be taken up for several months and may day over until spring.

Oelwein, Ia.—R. C. De La Hunt, of Cedar Rapids, it is stated, will install a sewage disposal plant.

Des Moines Ia.—It is stated that as soon as plans have been approved by the Council the Bd. of Pub. Wks. (W. W. Wise, Chmn.) will ask bids for the septic tank for the Center Drive sewer system.

**Muscatine, Ia.*—Hutchinson & Atwater, of Muscatine, are stated to have secured t.e contract to construct a sewer in Wayne St., at about $2,000.

**Hutchinson, Kan.*—Edw. Metz., City Clk., writes that the contract to construct sewers (bids opened Aug. 26), has been awarded to Davis & Henser, of Hutchinson, at 46.5 cts. for 10-in., and 35.5 cts. for 8-in. pipe.

**Alexandria, La.*—The contract to construct approximately 5 miles of sewers (bids opened Sept. 3) has been awarded to P. H. Porter, of Clinton, Ky.

Westfield, Mass.—Bids will be received until Sept. 18 by the Bd. of Selectmen at the office of the Town Clk., for constructing sewers, in all about 5,130 ft. pipe 8 to 24-in., with manholes and catch-basins, as advertised in The Engineering Record. Oren E. Parks, Town Engr.

Mankato, Mich.—The State Investment Bd. is stated to have given to Mankato $25,000 to be used in improvements to the park system and sewer system.

Gladstone, Mich.—See "Paving and Roadmaking."

Cadillac, Mich.—A. J. Teed, City Engr., writes that bids will be received Oct. 1 for constructing a sewage disposal plant to cost about $12,000.

**Marquette, Mich.*—Wm. Trebilcock is reported to have secured the contract to construct a sewer in Empire St., at $1,200.

Stillwater, Minn.—It is reported that the Council has directed plans and estimated to be prepared for the building of a sewer system.

pollution of the Atlantic Ocean. The cost of removing present system and construct plant will be about $5,000.

Merchantville, N. J.—The contractor to whom the contract for constructing the sewerage system was awarded has notified the Mayor that he has abandoned the contract. The work is said to be half completed. It is stated that the city will complete the work.

Summit, N. J.—Bids will be received until Sept. 17 by the Common Council, for constructing East Summit Lateral Sewers No. 3, consisting of about 4,200 ft. 8 and 10-in. pipe sewers; the Mountain Ave. Sewer, consisting of 460 ft. 8-in. pipe sewer. Edwd. J. Rowe, City Clk.

Asbury Park, N. J.—John L. Coffin, Supt. of Water and Sewers, it is reported, has asked the City Council to take immediate action to install some other system of sewerage than the present one in order to comply with the edict of the State Sewerage Comn. that towns along the coast must cease poluting the Atlantic Ocean by May 1, 1908. The new system will, it is estimated, cost between $25,000 and $30,000.

Brooklyn, N. Y.—The following are the bids opened on Aug. 28 by Bird S. Coler, Pres. Brooklyn Boro. For furnishing material and constructing sewer in Scott Ave., from Newtown Creek, north of Metropolitan Ave., to St. Nicholas Ave., etc.: (a) Jas. H. Holmes, Brooklyn; (b) Flick, Litchfield Const. Co., Brooklyn; (c) Rodgers and Haggerty, 1929 Amsterdam Ave., N. Y. City; (d) M. C. Madsen, Brooklyn; (e) Henry Newman, Brooklyn; (f) Jno. J. Creem, Brooklyn; (g) Borough Const. Co., Brooklyn; (h) Chas. Crawford, Brooklyn; (i) Jacks Asserson Const. Co., Brooklyn.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
2,946 lin. ft. 180-inch circular sewer..	$89.00	$64.92	$87.17	$90.00	$63.00	$65.00	$73.00	$90.84	$66.25
106 lin. ft. 180-inch horseshoe sewer.	95.00	140.00	99.73	100.00	85.00	81.00	135.00	78.15	73.50
174 lin. ft. drop section............	220.00	310.00	205.79	195.00	130.00	210.00	205.00	278.48	194.75
19 lin. ft. connecting section......	135.00	250.00	192.16	150.00	150.00	150.00	172.00	251.12	185.20
745 lin. ft. 48-inch sewer	16.00	15.00	11.72	15.00	10.00	10.00	22.00	12.85	8.50
470 lin. ft. 15-inch pipe sewer	3.00	3.50	3.49	3.10	5.50	4.00	3.25	3.38	4.65
5,600 lin. ft. 12-inch pipe sewer	2.75	2.60	3.00	2.50	4.75	3.50	3.06	3.38	4.40
1,000 lin. ft. 12-inch pipe sub-drain ...	.40	.50	.65	2.50	.01	.50	.06	.01	.65
1,100 lin. ft. 12-inch temporary drain pipe	1.50	2.30	2.47	2.50	.01	2.00	2.37	3.11	3.38
1 manhole, Class "A."........	260.00	310.00	260.00	230.00	250.00	900.00	455.00	203.04	250.00
6 manholes, Class "B."........	90.00	470.00	150.00	230.00	150.00	200.00	390.00	189.50	119.00
4 manholes, Class "C."........	80.00	440.00	100.00	160.00	150.00	100.00	306.00	116.10	92.00
3 manholes, Class "D."........	90.00	250.00	100.00	160.00	100.00	100.00	306.00	57.78	119.00
6 manholes, Class "E."........	80.00	60.00	75.00	160.00	75.00	75.00	66.00	32.13	47.00
1 manhole, Class "F."........	85.00	125.00	100.00	160.00	125.00	75.00	520.00	105.37	82.00
74 manholes on pipe sewers......	45.00	60.00	50.00	75.00	60.00	60.00	66.00	55.58	58.40
12 sewer basins, reconnected......	50.00	30.00	25.00	65.00	75.00	50.00	65.00	67.50	67.30
680M ft. sheeting and bracing.....	26.00	26.00	27.00	32.00	30.00	40.00	30.10	.01	38.30
100M ft. (B. M.) foundation plank.	10.00	28.00	27.00	32.00	30.00	16.00	28.50	.01	34.85
5 cu. yds., Class "A," concrete..	6.00	8.00	10.00	10.00	12.00	10.00	11.00	12.00	12.00
1,000 cu. yds., Class "B," concrete..	5.50	6.00	5.00	8.00	7.50	4.00	8.15	.01	7.00
TOTALS	$353,362	$332,639	$369,891	$387,232	$295,659	$312,311	$349,542	$369,923	$321,666

Aurora, Minn.—C. M. Dorway, Boro. Engr., is said to be preparing plans for constructing a sewerage system for Aurora. The constructing of 2 main sewers with laterals is contemplated.

**Fairmont, Minn.*—E. L. Lewis, City Clk., writes that the contract for constructing sewers in North Ave. was awarded on Aug. 26 to the J. W. Turner Improv. Co., at $1,645. The rest of the work, bids for which were received Aug. 26, will be let in the spring.

St. Louis, Mo.—It is reported that the Bd. Pub. Improv. has taken up the working out of plans for building a sewer through Forest Park Hill to a carry the Rives des Peres. It is stated that the cost of the improvement will be about $10,000,000.

**Lewistown, Mont.*—M. D. Kimball, City Clk., writes that the contract to construct 1½ miles of sewers (bids opened Aug. 14) has been awarded to N. J. Littlejohn, of Lewistown, at $13,870.

**Butte, Mont.*—P. Oren is reported to have secured the contract to construct a cement pipe storm drain at $4,940.

Omaha, Neb.—All bids received Aug. 26 for constructing storm water sewers have been rejected and new bids are to be received Sept. 20.

**Norfolk, Neb.*—The City Council is reported to have awarded the contract to construct sewer in Dist. No. 1 to John Elsinger, Jr., of West Point, at $6,671, and to O. W. Rish, of Norfolk, the contract to replace the mouth of the sewer at $2,904 (bids opened Aug. 30).

Newark, N. J.—The Comn. on the Passaic Valley Trunk Sewers is reported to have engaged Rudolph Hering, of New York, N. Y., as engineer to begin preliminary surveys, plans and specifications for this work.

Camden, N. J.—Bids will be received until Sept. 17 by Edwd. Francis, Chmn. Com. on Streets and Highways, for constructing sewers in Chelton Ave. and York St.

Summerville, N. Y.—It is stated that no bids were received recently for constructing the sewerage system.

Newark, N. Y.—Bids will be received by Charles McLouth, Pres. Bd. of Mgrs., New York State Custodial Asylum, Newark, it is stated, until Oct. 1, for construction of sewage disposal plant. Geo. L. Heins, State Archt., Albany.

Flushing, L. I., N. Y.—Bids will be received until Sept. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction, etc., of a sewage disposal plant for the buildings of the Parental School, Flushing, Boro. Queens.

Rochester, N. Y.—Bids will be received until Sept. 18 by the Bd. Contract and Supply (F. X. Pifer, Clk.) for the following in connection with the proposed sewerage system for portions of the 12th and 21st Wards: Constructing a separate system of sanitary sewers, and storm water sewers, including manholes, flush tanks and other appurtenances; constructing the substructure for the Brighton Sewage Pumping Station; furnishing 12-in. spiral riveted steel pipe and fittings for a sewage pressure main. Estimated cost of work, $122,000. E. A. Fisher, City Engr.

Steubenville, O.—It is stated that bids will be received by the Bd. of Pub. Service (T. W. Vance, Clk.), until Sept. 30, for constructing sewers, etc.

Lakewood, O.—Bids will be received until Sept. 20 by B. M. Cook, Village Clk., for furnishing material and constructing sewers in Irene St., Lake, Kyle and Hilliard Aves. Wm. H. Evers, Engr. Co., 237 The Arcade, Cleveland.

New York, N. Y.—The following are the bids received by the Park Comrs. of N. Y. City on Sept. 5 for constructing a brick sewer in Van Cortlandt Park, Boro. Bronx: (*a*) Jenks-Asserson Constr. Co., (*b*), P. F. Brennan, (*c*) Briggs & McLaughlin, (*d*) Thos. Crimmins Contr. Co., (*e*) Haggers Contr. Co., (*f*) Leahy Contr. & Constr. Co., (*g*) Jos. Moore, (*h*) Wakefield Constr. Co.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
25,000 cu. yds. earth excav...........	$0.81	$0.40	$1.00	$2.25	$1.70	$0.35	$1.00	$1.00
500 cu. yds. rock excav...............	5.00	4.00	1.00	5.00	3.60	1.50	4.00	1.00
2,102,000 bricks laid in cement mortar (per M).	20.12	25.00	20.00	20.00	21.60	29.00	23.00	20.00
4,690 cu. yds rubble masonry laid in cement mortar.	7.80	6.00	4.30	2.50	4.80	4.00	5.00	5.00
14,000 lin. ft. piling..................	.35	.40	.20	.33	.36	.45	.30	.25
21 M ft. timber for caps (per M).....	50.60	45.00	35.00	25.00	66.00	45.00	40.00	30.00
31,500 ft. timber for flooring (per M).	42.55	45.00	35.00	25.00	66.00	45.00	40.00	30.00
50 M ft. timber for sheething (left in place: per M).	43.70	30.00	35.00	15.00	66.00	45.00	30.00	30.00
500 cu. yds. concrete..................	8.50	8.00	6.00	6.00	7.00	6.00	7.00	6.00
8 brick manholes	50.00	75.00	70.00	50.00	80.00	90.00	70.00	50.00
400 cu. yds riprap (broken stone).....	3.17	3.50	1.50	2.00	1.20	2.50	3.00	2.00
Totals	$117,030	$108,152	$98,254	$123,397	$128,640	$104,850	$111,856	$101,765

Riverside, N. J.—The citizens are stated to have voted in favor of issuing $80,000 bonds to construct a sewer system.

Trenton, N. J.—Bids will be received until Sept. 17 by the Common Council, for constructing a sewer in a portion of Franklin St.

Plainfield, N. J.—It is reported that bids for $68,000 sewer bonds will be received until Oct. 7 by the Common Council.

Atlantic Highlands, N. J.—It is reported that the borough sewer system which extends a distance into Sandy Hook Bay, will have to be removed and a sewage disposal plant installed by May 1, 1908. This has been decided upon by the State Sewerage Comn. to avoid the

Akron, O.—It is stated that bids will be received until Sept. 28 by Wm. A. Durand, City Aud., for $18,900 sewer and paving bonds.

Cincinnati, O.—The City Engr., it is stated, has been directed by a resolution passed by the Council to prepare a general plan for sewering Fairmount and Lick Run and such other territory as may be necessary to make a complete system.

**Canal Dover, O.*—The detailed bid of Adam Schwab, of New Philadelphia, O., the successful bidder for constructing the sewerage system (bids opened Aug. 31), was as follows: 17,669 ft. 8-in. pipe, 57 cts.; 6,432 ft. 10-in., 70 cts.; 467 ft. 12-in., 90 cts.; lumber left in trench, $28 per M, etc.; total, $16,723. Average depth of sewers is 9 ft. 6 in., earthwork, gravel

**Items marked thus give the names of parties awarded contracts.*

and sand, all castings for flush tanks and manholes furnished by the city.

Erie, Pa.—Mayor Liebel has approved the estimates for sewers to be constructed in 5th, 24th, 21st, 23d, 25th, Wayne and Plum Sts.

Woonsocket, R. I.—Bids will be received until Sept. 19 by the Bd. of Sewer Comrs. for about 900 ft. of 8-in. sanitary sewer and about 600 cu. yds. rock excavation, as advertised in The Engineering Record.

Johnson City, Tenn.—The contract for constructing 4,200 ft. 8-in. vitrified sewer, Y's, etc., has been awarded to Hassom Paving Co., at $5,852 (bids opened Sept. 5). L. N. Wilson, Jr., City Engr.

Nashville, Tenn.—Curtis & Lewueur are stated to have submitted the lowest bid for constructing the city cemetery sewer and 4th Ave. S., at $6,696. Appropriation, $5,000.

Marlin, Tex.—The Houston & Texas Central R. R. Co. (L. A. Cottingham, Engr., M. of W., Houston) is reported to be having a survey made from Coleman to Live Oak St., with a view to constructing a cement sewer.

Palestine, Tex.—The Attorney General has approved an issue of $50,000 bonds for sewer purposes.

Seattle, Wash.—We are informed that a call will soon be made for bids for the construction of a main trunk sewer system, known as the "North Trunk Sewer," to be divided into 5 districts, and estimated to cost a total of about $3,000,000.

We are informed that an ordinance authorizing the work of constructing trunk sewer in Connecticut St. and other streets in connection therewith was passed by Council Sept. 4. Estimated cost, $83,000. Bids will be asked for the construction in a few weeks.

*H. F. Jahn & Co., 571 Colman Blk., has secured the contract for constructing sewers in 26th Ave., at $5,456.

*The detailed bid of the successful bidder, F. McLellan & Co., Burke Bldg., for constructing the sewer in 27th Ave. S. and other streets, was as follows (bids received Aug. 17, contract awarded Aug. 31): 307 lin. ft. 18-in. sewer pipe, $3; 347 lin. ft. 15-in. sewer pipe, $2.50; 20 4½-ft. manholes, $80; 200 lin. ft. tile drain, $1; 2 catch-basins, 1 inlet, $90; 727 lin. ft. 42x63-in. sewer pipe, $11; 1,764 lin. ft. 30x54-in., $9.50; 1,203 lin. ft. 30x45-in., $8.40; 529 lin. ft. 24x36-in., $7.30; 4,222 lin. ft. sub-drain, 80 cts.; 3 sand boxes, $100; total, $47,668.

McMechen, W. Va.—It is stated that at the election Sept. 4 the citizens decided in favor of issuing $25,000 bonds to lay sewers in certain streets.

**Elroy, Wis.*—The contract to construct 6,643 ft. of 6 to 18-in. pipe sewers (bids opened Aug. 31) has been awarded to Sweeney Bros., of Reedsburg, Wis. J. M. Dix, City Clk.

Ottawa, Ont.—The constructing of a system of relief sewers in the Upper Town, to cost about $28,000, is reported under consideration by the Civic Bd.

BRIDGES.

Notes Arranged Alphabetically by States.

**Oroville, Cal.*—The Bd. of Trustees have awarded the contract for the construction of the city's span of the Feather River Bridge to the Pacific Constr. Co., for $6,500.

Alamosa, Colo.—It is stated that bids will be received until Sept. 24 by T. W. Jaycox, State Engr., Denver, for the complete construction of wing walls for reinforced concrete bridge at Alamosa.

Rock Island, Ill.—All bids received for constructing the highway bridge over Sears Canal are stated to have been rejected. According to reports new bids will be received.

Ft. Wayne, Ind.—It is stated that bids will be received until Sept. 18 by Geo. W. Lindemuth, Co. Aud., for constructing an approach to River Bridge in Maumee Township, one grade in Lafayette Township, furnishing and laying a creosote block floor, and 7,500 ft. plank for Turner Bridge.

**Des Moines, Ia.*—The Marsh Bridge Co., Equitable Bldg., is reported to have secured the contract for constructing the Locust St. Bridge over Des Moines River, at $124,800.

Catlettsburg, Ky.—Bids received Sept. 3 by Maj. J. C. Warren, Corps. Engrs., U. S. A., Cincinnati, O., for constructing a service bridge at Lock No. 1, Big Sandy River, Catlettsburg, have been rejected. New bids are to be asked. The bids received Sept. 3 were as follows: Midland Bridge Co., Kansas City, Mo., $8,750, and McKay & Runyon, Catlettsburg, Ky., $8,739.

Springfield, Mass.—It is reported that all bids received Sept. 3 for constructing the superstructure of a bridge over Mill River at Pecousic Ave. have been rejected, and new bids will be received by the Bd. of Superv. about Sept. 17. Bidders will be permitted to submit their own blueprints with bids.

**Greenfield, Mass.*—The contract for constructing a highway bridge over Hinsdale Brook, Greenfield (bids received Aug. 31) has been awarded to Peter Barber, of Greenfield, at $997. The plans as drawn by the Clapp & Abercrombie Co. (W. A. Brown, Ch. Engr.), of Greenfield, call for about 82 cu. yds. concrete and 29 yds. reinforced concrete. The railing, instead of iron pipe, is to be of concrete in the form of posts and panels with vertical and horizontal reinforcement.

Fergus Falls, Minn.—Bids will be received until Oct. 3 by G. H. Gard, City Clk., for constructing a steel or concrete bridge over Red River of the North at Mill St.

* *Elizabeth, N. J.*—The Union County Bd. Freeholders is reported to have awarded the contract for constructing a bridge over Robinsons Branch of Rahway River to Arthur E. Smith of Plainfield for $10,445.

Long Island City, L. I., N. Y.—The following are the bids received Sept. 5 by J. W. Stevenson, Comr. of Bridges, N. Y. City, for constructing the steel and masonry approach in the Boro. of Queens, of the Blackwell's Island Bridge over the East River between the Boro. of Manhattan and Queens: R. E. Henningham, 1 Madison Ave., N. Y. City, $914,710; Williams Eng. & Constr. Co., 21 Park Row, N. Y. City, $800,345; Maryland Steel Co., 71 Bway., N. Y. City, $758,600; and Buckley Realty & Constr. Co., 59th St. and Madison Ave., N. Y. City, $797,804.

Rye, N. Y.—The village, through its Bd. of Trus., will construct 3 steel and concrete bridges. Plans and specifications and further information may be obtained from Chas. S. Towle, Village Engr., 5 E. 42d St., N. Y. City.

Raleigh, N. C.—A charter is stated to have been granted to the Yadkin Bridge Co. for the construction of a bridge over Yadkin River.

Dayton, O.—It is stated that City Engineer Klint is preparing plans for a bridge over Wolf Creek, at a cost of $5,000.

Cincinnati, O.—See "Railroads."

Cincinnati, O.—Revised estimates and plans for the Hopple St. crossing are stated to have been completed recently by I. B. Bouscaren, Superintendent of Track Elevation and Subways. This viaduct is to run from a point near Spring Grove Ave., over the B. & O. Railway and Mill Creek, to the C., H. & D. bridge on the other side of Mill Creek. The estimated cost is $350,539.

Engineer Bouscaren, of the Dept. of Track Elevation & Subways, is stated to have announced that he had completed plans for the Dodsworth Ave. viaduct over the B. & O. tracks from Knowlton's corner to a point opposite the warehouse of the Clifton Springs distillery. The bridge will be about 1,500 ft. long and its cost for steel or concrete will be about the same, $299,383.

H. T. W. Folz & Co., Dayton and Tillman Ave., are stated to have submitted the lowest bid, at $4,820, for constructing west abutment and approach to Liberty St. Viaduct.

Lancaster, Pa.—Bids will be received until Sept. 30 by the Bd. Co. Comrs., for constructing a stone twin-arch bridge or a reinforced concrete bridge across Hammer Creek on the line bewteen Warwick and Elizabeth Townsbips. M. G. Schaeffer, Co. Compt.

Woonsocket, R. I.—See "Paving and Roadmaking."

Cranston, R. I.—The Town Council is reported to be considering the erection of a steel bridge here.

Houston, Tex.—See "Paving and Roadmaking."

Austin, Tex.—An engineer is stated to have been engaged to estimate cost and report upon advisability of constructing new bridge across the Colorado River, to be built of either concrete or stone and cost about $500,000. The cost will be shared by city, Travis County and either the interurban or local electric railway company.

**Seattle, Wash.*—The contract for constructing the Green River Bridge near Auburn is stated to have been awarded by the County Comrs. to the International Constr. Co., for $7,241.

Fredericton, N. B.—It is stated that bids will be received by the Dept. Pub. Wks. (C. H. La Billois, Ch. Comr.), until Oct. 14, for constructing metal superstructure span of Cocagne Mouth Bridge, Kent Co.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Riverton, Ala.—Bids will be received until Oct. 12 by Maj. Wm. W. Harts, Corps. Engrs., U. S. A., Chattanooga, Tenn., for excavation, riprap, and paving at Colbert Shoals Canal, near Riverton, Ala., as advertised in The Engineering Record.

Windsor, Conn.—The Citizens are stated to have voted to expend $20,000 for road improvements.

Putnam, Conn.—It is stated that the Citizens voted to expend $20,000 for road improvements.

Canaan, Conn.—The appropriation of $20,000 for highway improvements is stated to have been voted upon favorably by the Citizens.

Portlnd, Conn.—It is reported that the Citizens voted to appropriate $20,000 for road improvements.

Aron, Conn.—The expenditure of $20,000 for road improvements in Aron is reported to have been voted upon favorably by the Citizens.

Deep River, Conn.—The citizens are stated to have appropriated $20,000 for the macadamizing of town roads.

Hamden, Conn.—Bids will be received until Sept. 17 by the Bd. Selectmen (Arthur E. Woodruff, Chmn.) for improving about 1,200 ft. road.

* *Stonington, Conn.*—Highway Comr. James H. Macdonald is stated to have awarded to the T. H. Gill Co., of Boston, Mass., the contract for the construction of the 2 sections of gravel road in Stonington, one of 9,500 ft. at 76 cts. and the other of 9,750 ft. at 79 cts. per ft. or a total of $14,922.50.

* *Ellington, Conn.*—The contract for constructing 5,612 ft. of gravel road in Ellington is stated to have been awarded to Frank Arrigoni & Bro., of Durham, for $4,714.

**Washington, D. C.*—The contract for grading Albemarle St. (bids opened Sept. 3) has been awarded to E. G. Gummel, of Washington, at 44 cts. per cu. yd.

Pensacola, Fla.—The following bids are reported opened Aug. 27 by L. Hilton Green, Chmn. Bd. Bond Trus., for 170,700 sq. yds. pavement: Southern Paving Co., of Nashville, bitulithic, $2.65; asphalt, $2.55; Graves-Matthews Paving & Constr. Co., of Birmingham, asphalt, $2.40; brick with sand foundation, $2.01; Southern Paving & Constr. Co., of West Virginia, brick with sand foundation, $2.21; with concrete, $2.61; price given per sq. yd.

**Freeport, Ill.*—The following are the detailed bids received Sept. 5 by G. W. Graham, City Engr., for macadamizing 5th Ave., Hosmer, American, Chestnut and other streets: (*a*) Wm. Ascher, Freeport, Ill., $70,967 (awarded contract); (*b*) M. Ford, Cedar Rapids, Ia., $72,222: 10,486 sq. yds. brick gutter, *a* $17,301.90, *b* $17,301.90; 44,790 sq. yds. macadam, *a* $19,259.70, *b* $20,603.40; 31,783 cu. yds. excavation, *a* $9,534.90, *b* $9,534.90; 31,460 lin. ft. Northern Ohio sandstone curbing, *a* $20,440, *b* $20,449; 25 intakes, *a* $750, *b* $700; 69 trees (removing), *a* $270, *b* $241; 7,840 sq. ft. cement sidewalk approaches, *a* $862, *b* $862. 1,000 ft. 24-in. sewer, *a* $2,250, *b* $2,250; 166 ft. 18-in. sewer, *a* $249, *b* $249; manhole, *a* $35, *b* $30.

Champaign, Ill.—The paving of N. Elm St. with brick is reported contemplated.

**Peoria, Ill.*—The Bd. Local Improv. is stated to have awarded contracts for paving portions of Jackson St. to John MacAllister and Crescent Contr. Co. at $9,227 anad $4,075, respectively.

Quincy, Ill.—Bids will be received until Sept. 18 by Bd. of Local Improv. for constructing brick pavement on 10th St., as advertised in The Engineering Record.

Hartford City, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 7, for the construction of 10,465 ft. and 15,185 ft. of macadam road in Harrison Township, known as roads No. 1 & 2; also 15,775 ft. macadamized road on the line between Harrison and Washington Townships. L. W. Dougherty, Co. Aud.

Shelbyville, Ind.—It is reported that the City Council will receive bids until Sept. 17 for the construction of a macadamized roadway on Center St. and cement sidewalks on 4 streets. H. J. Clark, City Clk.

Vincennes, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Sept. 28 for the construction of 10,283 ft. of gravel road; also the Fyffe gravel road, length, 5,736 ft.; also until Oct. 8, for the construction of 8,000 ft. gravel road; all in Vincennes Township. Jno. T. Scott, Co. Aud.

Ft. Wayne, Ind.—It is stated that bids will be received until Sept. 19 by the Bd. Pub. Wks. (H. W. Becker, Clk.), for paving sundry streets and constructing cement sidewalks.

Ft. Wayne, Ind.—See "Bridges."

Frankfort, Ind.—It is stated that bids will be received by the Bd. Co. Comrs. until Sept. 20 of Canton and Carrol Counties for constructing gravel road No. 19 about 18,408 ft. in length. Chas. F. Cromwell, Co. Aud., Clinton Co.

Decatur, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct 7 for the construction of a macadamized road in Root Township. C. D. Lewton, Co. Aud.

Sunman, Ind.—It is stated that bids will be received until Oct. 14 by the Town Council, for constructing cement sidewalks. E. R. Behlmer, Town Clk.

Des Moines, Ia.—Bids will be received until Sept. 16 by Bd. Pub. Wks. (W. W. Wise, Chmn.), for paving with vitrified brick 12th St. on 6-in. concrete foundation and asphalt filler, in all about 5,200 sq. yds.; also until Sept. 19 for paving with vitrified block on 6-in. concrete foundation and Portland cement filler, Park Land, in all about 4,317 sq. yds., and curbing Ingersol Ave., 10,192 lin. ft.; also until Sept. 21 for paving 6th St. and Arlington Ave. with repressed paving block on 6-in. Portland cement found. and asphalt filter, in all about 4,748 sq. yds.

Ottumwa, Ia.—No bids were received Sept. 2 for paving with brick. J. T. Brady, City Engr.

Ft. Williams, Me.—Bids will be received until Sept. 21 by Capt. F. J. Morrow, Q. M., U. S. A., Portland, for constructing concrete walks at Ft. Williams, as advertised in The Engineering Record.

**Baltimore, Md.*—Patrick Flanagan is reported to have been awarded the contract for macadamizing Chelsea Terrace. Bids opened by the Bd. of Awards, Aug. 28.

Boston, Mass.—Bids will be received until Sept. 17 by the Highway Comn. (W. E. McClintock, Chmn.), 15 Ashburton Pl., Boston, for constructing roads in the following towns and city: length given being approximately only: West Boylston, 6,800 ft.; Charlton, 2,500 ft.; Princeton, 3,000 ft.; Taunton, 3,500 ft.

North Adams, Mass.—The City Council is reported to have decided to issue $8,000 bonds for street improvements.

**Gladstone, Mich.*—Contracts for macadam pavements and installation of sewers are stated to have been awarded to the Northern Constr. & Engineering Co., of Escanaba, for $30,000.

Waseca, Minn.—John Madigan, City Clk., will receive bids until Sept. 17 for paving with brick block, about 17,207 sq. ft. on Elm and First Sts.

Eveleth, Minn.—It is reported that bids will be received until Sept. 17 for 20,000 ft. cement walks.

Sedalia, Mo.—The City Council is reported to have passed resolutions providing for the paving of 4th, 5th, 6th and 7th Sts.

Gloucester City, N. J.—The City Council is reported to have passed an ordinance providing for the issue of $75,000 bonds for street improvements.

Allenstown, N. H.—Bids will be received until Sept. 20 by A. W. Dean, State Engr., Concord, for constructing a trap rock road in Allenstown; probable cost, $4,000.

Trenton, N. J.—Bids will be received until Sept. 17 by the Common Council for paving a portion of Factory St. with sheet asphalt, and Stockton St., with sheet asphaltum; also repaving a portion of S. Clinton Ave. with sheet asphaltum. Harry B. Salter, City Clk.

Camden, N. J.—The City Council has passed an ordinance authorizing the issue of $150,000 street bonds and $15,000 park bonds.

An ordinance has passed third reading in the Council authorizing the paving with asphalt a portion of Berkley St., and with macadam a portion of 21st St.

Bids will be received until Sept. 17 by Edwd. Francis, Chmn. Com. on Streets and Highways, for paving Princess Ave. with Macadam, Jefferson and Delaware Aves. with Belgian block.

**Monroe, N. Y.*—T. F. B. Carpenter, Village Clk., writes that the contract to construct 11,000 sq. ft. of cement sidewalks has been awarded to the Jos. Sharpe Constr. Co., of Paterson, N. J.

New York, N. Y.—Bids will be received by Moses Herrman, Pres. Bd. Park Comrs., until Sept. 26, for furnish-

Items marked thus give the names of parties awarded contracts.

ing and delivering 3,000 cu. yds. fine bank gravel on Bridle Path, Ocean Parkway, bet. Prospect Park and Coney Island; also 4,000 cu. yds. (double screened) Hudson River road gravel to parks and parkways, Boro. Brooklyn.

Oyster Bay, L. I., N. Y.—The Nassau County Bd. Superv. is reported to have awarded the contract for grading West Shore Rd., Oyster Bay harbor, to Zebulon Wilson, of Oyster Bay, at $6,775.

Buffalo, N. Y.—Separate bids will be received until Sept. 20 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for paving and repaving portions of 5 streets.

Kings Mountain, N. C.—See "Power Plants, Gas and Electricity."

Durham, N. C.—Bids will be received until Oct. 1 by the Bd. of Co. Comrs., at Durham, for building about 11½ miles of macadam road. Approximate quantitites: 60,000 sq. yds. 6-in. macadam; 75,000 cu. yds. excav., together with the necessary pipe and reinforced concrete drains.

Ottawa, O.—It is stated that bids will be received until Sept. 21 by the Bd. Co. Comrs., for constructing 7 stone roads. J. T. Maidlow, Co. Surv. and Engr.

Silverton, O.—It is stated that bids will be received until Sept. 21 by A. A. Sprague, Clk. Bd. Pub. Service, for constructing cement sidewalks, grading, etc., on several streets; also same time and place for $7,600 street improvement bonds.

Lorain, O.—An ordinance is stated to have been passed authorizing the issue of $24,000 bonds for paving Vine St.

New Philadelphia, O.—The following are the bids received Sept. 3 for paving S. Bway.: E. A. Frishwater & Sons, Chester, W. Va., $16,113; J. Meinhart & Sons, Massillon, O., $16,454; Baldwin Bros & Graham Columbus, $17,420; Sheets & Lyons, Newcomerstown, O., $15,509; Vogt & Sons, Massillon, O., $15,512; Hensel & Springer, city, $14,988; Adam Schwab, city, $13,834.

Reading, O.—It is stated that Jos. R. Vedder, Village Clk., will receive bids until Sept. 19 for $8,200 Vine St. improvement bonds.

Akron, O.—See "Sewerage and Sewage Disposal."

Celina, O.—It is stated that bids will be received until Sept. 21 by T. A. Weis, Co. Aud., for $22,000 pike bonds.

Ashland, Ore.—All bids received Aug. 26 for macadamizing 16,800 sq. yds. have been rejected. The city will probably do the work or by private contract. M. F. Eggleston, City Recorder.

Scranton, Pa.—The Common Council is stated to have passed an ordinance providing for the grading, curbing and paving of a portion of Green Ridge St.

Uniontown, Pa.—Bids will be received until Sept. 18 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 7,070 ft. road, 16 ft. wide, in Dunbar Township; also 4,095 ft. road, 16 ft. wide, in Vanderbilt Borough, both in Fayette Co.

* *Erie, Pa.*—The contract for paving with asphalt a portion of French St. is reported to have been awarded to John McCormick & Son, 645 W. 10th St., at $1.64 per sq. yd.

Bids for paving a portion of German St. is reported to have opened as follows: Mayer Bros., 1213 State St., asphalt, $1.75, brick $1.90; J. McCormick & Son, asphalt, $1.80, brick $1.95 (price given per sq. yd).

* *Allentown, Pa.*—The City Council is reported to have awarded the contract for paving portions of 3d and Court Sts. to the Barber Asphalt Paving Co. at $2.09 and $2.07 per sq. yd., respectively.

Parnassus, Pa.—Bids will be received until Sept. 17 by F. R. Alter, Boro. Secy., for grading and paving a portion of 3d Ave. and McCutcheon St. F. R. Carson, Boro. Engr., 4th Ave., New Kensington.

Smethport, Pa.—The Reemard & Higgins Co. are stated to have bid $51,536 for 22,056 sq. yds. brick pavement on concrete base or $47,786 on stone base.

Philadelphia, Pa.—Bids will be received until Sept. 18 at the office of W. Hunter, Ch. Engr. Phila. & Reading Ry. Co., 520 Reading Terminal, for grading, draining and paving for temporary freight yard, at 19th and Indiana Sts., as per contract No. 27.

Reading, Pa.—The City Council is reported to have decided to expend $30,000 for improving 5th St.

*The contract for paving a portion of Chestnut St. with brick is reported to have been awarded to Fehr & O'Rourke at $3,757.

Lancaster, Pa.—J. E. Kendig, 301 E. Frederick St., is reported to have secured contracts for macadamizing portions of Franklin St. and Park Ave., at $4,046 and $2,380, respectively.

* *Providence, R. I.*—Contracts for constructing sections of state highways, covering a distance of nearly 30 miles, are stated to have been awarded by the State Bd. of Pub. Roads on Sept. 4, as follows: Coventry, 31,680 ft., John Bristow, $23,409; Gloucester, 10,560 ft., A. W. Steere, $7,814; Gloucester and Burrillville, 5,280 ft., A. W. W. Steere, $3,970; Jamestown, 5,280 ft., Alton Head, $4,784; Lincoln, 3,000 ft., T. J. Quinn, $2,528; Little Compton, 5,280 ft., Lane Constr. Co., $5,407: Narragansett, 7,920 ft., John Bristow, $10,397; Tiverton, 2,640 ft., L. H. Callan, $2,192; Warwick, 15,840 ft., Daniel A. Watson, $2 per cu. yd.

Woonsocket, R. I.—The Common Council is stated to have passed a resolution providing for an appropriation of $6,000 for paving with wood block Court St. Bridge.

**Johnson City, Tenn.*—The contract for paving on portions of Main, Market, Roan and other streets, in all about 48,000 sq. yds., bids for which were received Sept. 5, has been awarded to the Barber Asphalt Paving Co., at $2.14½ per sq. yd., for bituminous macadam on 6-in. slag foundation; total, $102,060. Bids were also received from the Southern Bitulithic Co., the Southern Paving & Constr. Co., and the Hassom Paving Co.

*S. H. Pouder has secured the contract for 22,000 sq. ft. concrete sidewalk and 4,600 lin. ft. concrete curbing, at a total of $5,397. L. N. Wilson, City Engr.

**Greeneville, Tenn.*—Killion, Turner & Co., of Jasper, are stated to have secured the contract for improving highways of Greene County, for $50,000.

Houston, Tex.—Bridge and paving work is contemplated here to the extent of $500,000. About 75 miles of rock, gravel and shell paving will be laid. John B. Ashe, Co. Aud.; Geo. A. Horton, Co. Engr.

Marshall, Tex.—John W. Maxcy, of Houston, has been engaged as consulting engineer for street paving and sidewalk construction. The cost of the work to be done will be about $200,000, which has been voted in bonds by the city.

Dallas, Tex.—Bids will be received until Sept. 20 by J. B. Winslett, City Secy., for paving Ross Ave. and Main St. with either bitulithic, sheet, natural rock or Indian Territory rock asphalt, vitrified brick, or other material, limestone curb, limestone gutter, combined concrete curb and gutter, brick gutters, etc.

**Seattle, Wash.*—We are informed that contracts for paving have been awarded as follows: To the Sparger Concrete Co., Lowman Bldg., for constructing concrete sidewalks on Olympia Way, for $3,864; A. L. Walters, concrete sidewalks on Kilbourne St., for $5,094; Kalberg & Co., grading, etc., on 13th Ave. S., at the following bid: Fixed estimate, $2,400; 97,000 cu. yds. earthwork, $43,650; 15 acres clearing and grubbing, $2,250; 182 M ft. B. M. curbs and gutters, $4,732; 7 catch-basins, 2 inlets, $560; 14 catch-basins, 1 inlet, $980; 1 single inlet, $12; 40 lin. ft. sewer pipe, 8-in., $56; 1,700 lin. ft. box drains, $850; total, $55,490; to H. F. Jahn & Co., regrading E. Denny Way, at $11,581; to H. F. Kahn & Co., concrete sidewalks on 3d Ave. W., at $11,857.

The following are the bids opened by the Bd. Pub. Wks. on Aug. 31 for planking Railroad Ave.: Sparger Concrete Co., 562 Lowman Bldg., $36,001; O. Lindland & Co., 3802 Densmore Ave., $34,872; Rydstrom & Goerig, 1802 16th Ave., $35,465. Hans Pederson, 501 Fairview Ave., $38,72●.

*We are informed that the contract to pave in the alley in Block 17, has been awarded to the Sparger Concrete Co., 562 Colman Blk., at $2,513, and the contract to pave alley in Block 22, to the Barber Asphalt Paving Co., 619 Bailey Bldg., at $2,636.

**Neenah, Wis.*—Geo. H. Stanchfield is stated to have secured the contract for macadamizing Wisconsin Ave., at $8,465.

Fond du Lac, Wis.—The Barber Asphalt Paving Co. is reported to have submitted the lowest bid for paving E. 1st, 2d, W. 2d, 3d and Sheboygan Sts., at $88,642.

Janesville, Wis.—No award was made Sept. 6 for paving Lincoln School, City Hall Alley and E. Milwaukee St. C. V. Kerch, City Engr.

Racine, Wis.—It is stated that the City Clk. will receive bids until Sept. 21 for improving sundry streets.

Milwaukee, Wis.—Local press reports state that bids will be received until Sept. 17 by the Bd. Pub. Wks. for paving with bitulithic 12th St. and Teutonia Ave., in all about 23,000 sq. yds.; probable cost, $50,000.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Citronelle, Ala.—The Citronelle Light & Power Co. is reported incorporated by J. A. Shannon, S. E. Shannon and H. H. Ore with a capital of $25,000. The incorporators have been granted the right to make and sell electric power and current and also to manufacture ice.

Radnor, Ala.—The Alberta Portland Cement Co. of Calgary has applied to the City Council for concessions for the development of electric power at Radnor.

Dothan, Ala.—A. J. Smith, who is interested in the building of an electric power plant at Dothan, writes that about $150,000 will be expended. No engineer has been selected as yet, and organization of a company is not yet complete. The plant is to be constructed about 17 miles from Dothan and run by water.

**San Francisco, Cal.*—The Bd. of Superv. on Aug. 26, it is stated, awarded the contract for furnishing light to the municipality to the San Francisco Gas & Electric Co. The appropriation is $275,000.

Stockton, Cal.—The Stockton Gas & Electric Co. is reported incorporated by A. H. Winn, Paul McDonald, and others.

Turlock, Cal.—The Turlock Electric & Water Co. recently incorporated by C. H. Weed, is about to commence work of constructing the electric light plant. Capital $50,000.

Montzuma, Colo.—It is reported that the Montezuma Power & Light Co. has been incorporated, with a capital of $50,000, by Geo. L. Nye, B. B. Morrison and R. W. Wagner.

Glenwood Springs, Colo.—The Central Colorado Power Co. is reported to be planning the construction of a tunnel 12 miles long, to be dug at the Shoshone plant at Glenwood Springs, to generate 10,000 h.p. It is reported that sites for additional power plants are being considered by the company, and it is said to be the intention to develop its plants sufficient during the next 2 years to be in a position to sell power to railroads for operating purposes.

**Norwich, Conn.*—The New England Eng. Co., 123 Court St., New Haven, is reported to have secured from the General Electric Co., of Schenectady, N. Y., the contract for the installing of a high-tension transmission line, 22,000 volts, from Scotland station on the Shetucket River to the present municipal plant at Norwich. The object of the line is said to be to supply power from the dynamos located at the dam now being constructed at Scotland Station to the municipal station at Norwich.

Washington, D. C.—See "Miscellaneous."

Jacksonville, Fla.—The following are the bids opened Sept. 4 by the Bond Trus. for furnishing 200 new street arc lights and other electrical appliances: The Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa., lights, etc., as per specifications, for $9,900; General Electric Co., of Schenectady, N. Y., $8,755.

Jacksonville, Ill.—Bids will be reveived until Sept. 17 for furnishing to the city the following: a 200-kw. generator and engine, 200 arc lamps, 4 transformers and arc regulators. Specifications are on file at the office of Chas. W. Brown, Engr. in Charge, Rm. 12, Scott Blk.

Seymour, Ind.—Bids will be received until about Nov. 1 for furnishing the city and inhabitants artificial gas for light and fuel; also electric light for street lighting, electric light for private parties and electric power for parties who desire it. For further information address Fred. Everback, City Clk.

Clay City, Ind.—A franchise and contract for lighting the city has been given to B. M. Guirl, of Clay City. J. H. Bence, City Clk.

Chickasha, Ind. Ter.—The City Council is reported to have granted a franchise to the Chickasha Water Power Co. for a period of 25 years. The franchise carries with it a contract with the city to furnish 50 street lights at the rate of $5.25 per lamp per month. A dam is to be constructed by the company across Washita River about 3 miles from the city and turbine wheels installed. About $50,000 is to be subscribed at first to start the work.

Leavenworth, Kan.—The Council Aug. 28 passed on its revised form the franchise for the Leavenworth Light & Heating Co.

Covington, Ky.—The agreement made with the Union Light, Heat & Power Co. by the Com. on Light of the City Council for a 5-year contract to furnish arc lights at $55 per lamp per year, it is reported has not been approved.

Ellsworth, Me.—It is reported that the Elssworth Power Supply Co. has been incorporated, with a capital of $450,000, for the purpose of generating electricity for manufacturing purposes. Henry M. Hall, of Ellsworth, is Pres. of the company.

The Monterey Hydro Electric Power Co. is reported organized at Ellsworth, for the purpose of owning, operating and dealing in water, lights and power for various purposes. Capital $5,000,000. Proosy Langely, Pres. N. T. Whiting, of Ellsworth, Treas.

Baltimore, Md.—Bids were opened by the Municipal Bd. of Awards Sept. 4 for the city's new street gas and naptha lamp contracts. The Consolidated Gas, Electric Light & Power Co. offered to supply the gas at $7.25 per lamp per annum, based on a consumption of 10,000 cu. ft. of gas per lamp ea. year, with a charge of 72½ cts. per 1,000 ft. for all excess consumption. The company also offered to supply gas for the lighting of the municipal buildings at 85 cts. per 1,000 cu. ft. The bidders for the contract for equipping, maintaining and lighting and extinguishing the gas lamps were as follows: Moses Newton, $8.97½ per lamp per annum if given the contract for 5 years, or 1 year contract, $10.31 per lamp per annum; 2 years, $10; 3 years, $9.24. The American Street Lighting Co. (bids being on 1 year, 2 years, 3 years or 5 years, respectively), $10.85 per lamp per annum, $10.85, $10.65 and $10.65. The Welsbach Co., $12, $11.75, $11.50, and $11. The American Street Lighting Co. and Moses Newton offered to take full charge of the lamps and furnish the gas at the following rates, 1, 2, 3 and 5 years, respectively: The American Co., $22.85 per lamp per annum, $22.85, $22.50, and $22.50. Moses Newton, $23.30, $23, $22.24, and $21.97½.

Berlin, Md.—The Mayor and City Council are in a position to grant a franchise and receive propositions to furnish water and electric lights for the town of Berlin. Bids will be received until Sept. 20, as advertised in The Engineering Record.

In connection with the franchise to be offered for sale by this city on Sept. 20, as advertised in The Engineering Record, the town is to have the option of purchasing the plant at the end of 5, 10, 15 or 20 years at a price that a committee may fix. An ice plant could be operated in connection with the power plant to good advantage. The population of the town is 1,500.

New Bedford, Mass.—Bids will be received until Sept. 16 by the Street Light Com. (Jos. Chaussn, Chmn.), for lighting the streets, for a period of 1 year, and not

Fall River, Mass.—The Aldermen are stated to have adopted the report of the Com. on Street Lights, recommending that the Mayor be authorized to enter into a contract with the Fall River Electric Light Co. for lighting the streets for a period of 5 years. The contract proposed provides for the new Magnetite lamp at 25 cts. per light per night.

Muskegon, Mich.—The Grand Rapids-Muskegon Power Co. (Geo. E. Erwin, Secy.), it is stated, intends building within the next few years 4 more power dams between the Rogers dam and Newaygo, making 6 dams in all, which will develop a total of 60,000 h.-p.

Escanaba, Mich.—F. E. Hatch, of Pellston, is reported interested in a company which proposes to harness Boney Falls on Escanaba River in Delta County. Mr. Hatch, it is stated, has applied to the Bd. of Pub. Wks. of Escanaba to furnish power for the operation of the municipal lighting plant.

Aurora, Minn.—The Council is reported to be considering the installing of an electric lighting system.

Oxford, Miss.—The power plant of the Univ. of Mississippi, which also supplied electricity to light the town, is reported to have been destroyed by fire Aug. 30. It is stated that it will be rebuilt at once. The city is stated to be contemplating the building of a municipal plant in connection with the water works.

Meadville, Mo.—There is reported to be a project on foot here for an electric light plant. Address J. H. Dunn, Meadville.

Jefferson City, Mo.—See "Public Buildings."

Springfield Mo.—The promoters to whom the city recently granted a franchise have decided to incorporate with a capital of $50,000. No name has yet been decided upon for the company, but A. J. Eisemayer is Acting Chmn.

St. Louis, Mo.—Bids will be received until Sept. 20 by the Bd. Pub. Improv. (Aud. J. O'Reilly, Pres.) for

**Items marked thus give the names of parties awarded contracts.*

furnishing and installing the following in Quarantine Hospital: 2 engines, 2 generators, switchboard, etc.; steam heating system, together with certain steam fixtures and appliances; boilers, boiler furnaces, smoke connections, chimney, etc.

Fremont, Neb.—It is stated that the plans for the municipal light and water station have been submitted to the City Council. The cost will be, according to reports, about $20,000.

Beatrice, Neb.—The City Light & Gas Co. is reported incorporated by R. C. Barney, Allen Brownhall and Mark A. Noble, and, it is stated, will make extensive improvements in the gas plant in this city which they have purchased.

Jersey City, N. J.—The Bath Electric Service Co. is reported incorporated with a capital of $100,000, to operate electric and gas plants. Office, 76 Montgomery St., Jersey City. Incorporators: Luther H. Leber, Arthur A. Lazier and others.

Morristown, N. J.—R. V. Stryker, Treas. and Gen. Mgr. Marris A. Somerset Electric Co., 131 South St., writes that all contracts have been let in connection with the improvements contemplated, at a cost of $200,000.

**Linwood, N. J.*—The Boro. Council is reported to have voted to install electric lights.

New York, N.Y.—Bids will be received until Sept. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in the following schools: Addition to and alterations in School 96, Boro. Manhattan; addition to School 140, Boro. Brooklyn; new School 89, Elmhurst, Boro. Queens; School 28, Richmond, Boro. Richmond.

Albany, N. Y.—See "Water."

Schaghticoke, N. Y.—The Schaghticoke Electric Co., which is now constructing an electric power plant on the Hoosick River in Schaghticoke has filed, according to reports, in the County Clerk's office, an amended certificate of incorporation extending the field of its operations to Schenectady and Montgomery Counties as well as Rensselaer, Saratoga and Albany Counties. Geo. E. Greene, Pres., and H. R. Leyden, Secy.

Seneca, N. C.—The Council is reported to be considering the establishing of an electric light plant.

Kings Mountain, N. C.—Bids will be received until Oct. 3 by F. L. Carpenter, Town Clk., for $50,000 water, light and street improvement bonds.

**Grand Forks, N. D.*—The contract for a 700-ft. tunnel for gas and other mains, it is stated, has been awarded by the Bd. of Regents of the North Dakota Univ. to Lykken, Robinson & Wardrope, of Leeds, at about $4,500.

Cleveland, O.—The Cleveland Electric Illuminating Co., it is reported, intends building a generating plant on the Lake Shore, and is considering the building of a tunnel into the lake to supply the plant with water. It is stated that plans for the plant are to be prepared by C. W. Schultz, Ch. Engr. of the Water Dept.

It is stated that 125 additional arc lights for street purposes will be attached to the street lighting service immediately. Chas. Kibble, Supt. of Lighting.

It is reported that the School Bd. will equip the Milford School with an electric plant.

Texhoma, Okla.—The Texhoma Electric Light, Water & Ice Co. is reported incorporated by W. A. Turner and others.

Hallett, Okla.—The Hallett Pipe Line Htg. & Lighting Co., of Fayetteville, Ark. (A. F. Wolf, Pres., Fayettebille, and Alva Duncan, of Parsons, Kan., Ch. Engr.), desires to purchase about 42,000 ft. of 4-in. casing for gas plant, 28,000 ft. of 2-in. pipe, and 3,000 ft. 6-in. pipe, with other supplies necessary to install a low-pressure gas plant.

Granite, Okla.—It is stated that Granite Electric Co. has been incorporated, with a capital of $10,00, by K. C. Knox, H. J. Hayes and others.

Dayton, Ore.—The City Council is reported to be investigating the securing of a water motor and dynamo with a view to establishing an electric light plant for Dayton.

Prineville, Ore.—It is reported that the Prineville Light & Power Co. will next year install a power plant on the Matoles to supply the whole county with electricity.

Waterford, Pa.—The Waterford Electric Light Co. is about to be incorporated by Bertram E. Waltz, Allyne C. Hovey and Chas. Himrod to supply light, heat and power in the boro. of Waterford.

Markes, Pa.—The Conooheagre Electric Light, Heat & Power Co. is reported incorporated, with a capital of $30,000, by E. B. Duel, Seth Lehmaster, of Markes, and others.

Reading, Pa.—The Bd. of Park Comrs. is reported to be contemplating the installing of electric cables in conduits in the City Park and to have lamps suspended from ornamental iron poles.

Charleston, S. C.—Bids will be received at the office of Ion Simons, City Electrician, until Nov. 15 for lighting the streets and public buildings of the city for a term of 1, 2 or 4 years from June 30, 1908, with electricity, gas or some other illuminating power equivalent thereto, or partly by one and partly by another.

Memphis, Tenn.—The constructing of a municipal lighting plant is reported under consideration.

Waco, Tex.—It is stated that Texas anad Eastern capitalists have subscribed toward the establishment of an electric power plant in Milam County, about 60 miles south of Waco. The City Council has granted a franchise to the company for poles, wires and all privileges needed in equipping an electric light service for this city. It is also proposed to supply light to Houston, aand power for an interurban electric railway which is to be operated all over central Texas. Jos. J. Henry is reported to be managing the enterprise.

Ferris, Tex.—It is reported that the Ferris Light & Power Co. has been incorporated, with a capital of $4,000, by W. W. Batchelor, C. A. Weatherford and others.

Calvert, Tex.—Jas. J. Henry, of Denver, it is stated, is promoting a project to build a power plant at this place to furnish electricity for light and power to surrounding towns.

Houston, Tex.—E. C. Lamb is reported to be organizing a company with a capital of $50,000 to build a plant for the manufacture of electric dry kilns.

Pittsford, Vt.—Surveyors are reported to be in the vicinity of Furnace Brook, Pittsford, for the Vermont Marble Co., which proposes to harness the power of this stream and build a power station on the site east of Pittsford Mills. The plan is to use steel tubing between the reservoir and the power house.

Montpelier, Vt.—The City Council, it is stated, has granted a franchise to F. M. V. Corry, E. H. Deavitt and E. M. Frost to erect poles and string wires in the streets of Montpelier for their power plant, which it is proposed erecting near Kinney's mills.

Spokane, Wash.—Reports state that the Big Bend Water Power Co. (E. P. Spaulding, Vice-Pres. and Gen. Mgr.) expects to start work soon at its power site, 28 miles down the Spokane River. The cost of the plant, including duplicate transmission lines to Spokane and to the Coeur d'Alenes, will be about $2,000,000. All lines will be put underground in the fire district. The dam to be constructed on the Spokane River will be 480 ft. in length and 100 ft. high, 130 ft. wide at the bottom and nearly 30 ft. wide at the top. The power house will be in the middle, and over the present channel of the river. It will be 184x66 ft., with walls 38 ft. high and 18 in. thick. The power house will be built entirely of steel and reinforced concrete, while the dam will contain 50,000 cu. yds. of masonry, which will cost, approximately, $400,000. On either side of the power house will be wasteways, one 152 ft. wire, the other 174 ft. wide. About 35,000 cu. yds. of rock will have to be moved in cutting a channel for the wasteways. Seven steel conduits, each 10 ft. in diameter will lead through the dam body-wall to 7 pairs of turbines, each of which will weigh 90 tons. Besides planning to dispose of light and power in Spokane and at the various mines of the Coeur d'Alene district, a 132-mile power line to Murray is being planned. R. C. Lowry, of Seattle, is Engr. for the company, and I. E. Ross, also of Seattle, is Electrical Engr. J. S. McKenna is local Consulting Engineer.

The officials of the Chicago, Milwaukee & St. Paul R. R. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) are reported to be contemplating the developing of electric power by harnessing the St. Joe River. It is reported that the electric energy will probably be used to substitute electricity for steam power to carry freight across the Bitter Root divide.

Seattle, Wash.—The Seattle-Tacoma Power Co., it is stated, has been given until 1913 to put wires under ground.

Elkins, W. Va.—The County Court (Lee Crouch, Clk.) will receive bids until Sept. 23 for the electric and gas fixtures for the court house now being erected.

Prairie du Sac, Wis.—A dam is to be constructed across Wisconsin River at Pound's Landing to cost about $1,500,000. Address Magnus Swenson, Madison.

**Superior, Wis.*—It is stated that the building of a municipal lighting plant has been abandoned for the present and a contract entered into with the Superior Water, Light & Power Co. for another year.

Antigo, Wis.—Henry Sherry, of Neenah, Wis., it is reported, proposes developing water power on Wolf River.

Muscoda, Wis.—L. M. Dixon, Village Clk., writes that a light plant and power was purchased by the city, and an election held Aug. 24 resulted in favor of issuing bonds for improvements. The dam was damaged by the flood and will be repaired; contract soon to be let.

Minnedosa, Man.—It is stated that water for the proposed power plant to be constructed here will be obtained from Clear Creek 30 miles north and a dam constructed there. Address E. O. Denison, Minnedosa, Man.

Kingston, Ont.—The Northumberland & Durham Power Co., of Durham, is reported to be considering the question of transmitting power to Kingston. The point of development will be Healy Falls.

Millbrook, Ont.—J. Davidson, of Millbrook, is stated to have purchased the electric lighting plant and has a contract to light the town.

Hamilton, Ont.—The Hydro Electric Power Comn., of Toronto, is reported to have sent out a surveying party to locate the transmission line from Hamilton, to Guelph, Berlin, St. Mary's and Stratford.

Ottawa, Ont.—The Municipal Electric Comn. has made a recommendation to the City Council that it be authorized to make the following offer to Gilmour & Hughson, the owners of the Chelsea Power, that one half of the bed of Gatineau River at the fall of Chelsea, with the right to take water enough from the river to develop 25,000 h.-p. be purchased by the city for the sum of 200,000 and that in addition the city agrees to build within 10 years a dam across the entire river capable of establishing an 80 ft. head at the water power.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Surveys are reported completed and rights of way acquired for the Napa, Lakeport & Richardson Bay R. R. Richard Hotaling, Pres.

Oakland, Cal.—A. W. Maltby, of Martinez, is reported to have secured a contract to construct an electric dailway from Airtisch to Oakland.

Denver, Col.—Surveys for the Interurban Constr. Co.'s electric line from Denver to Greeley will be started immediately, according to reports. Rights of way and franchise in Denver, Adams and Weld Counties have been secured by the company.

Sacramento, Cal.—It is reported announced that the Northern Electric Ry. Co. will construct an electric railway to Woodland via Colusa Willows, Arbuckle and Winters. The company secured permission from the War Dept. to build a bridge over Sacramento River at M. St. in connection with the Vallejo & Northern Ry. Co.

Quincy, Ill.—The City Council is reported to have adopted an ordinance granting a franchise to St. Louis, Terre Haute & Quincy Traction Co.

Boston, Mass.—The following are reported to be the bids received Sept. 5 by the Boston Transit Comn. at Boston, for entrances and exits at Summer St. for Washington St. Tunnel: Coughlan & Shields Co., $17,711.50, time 3 months; Chas. R. Gow Co., $14,518.50, Dec. 10, 1907; Patrick McGovern, $14,106, Nov. 15, 1907; John E. Palmer, $13,958, Dec. 1, 1907.

Athol, Mass.—It is stated that the Athol & Orange St. Ry. Co. (W. D. Smith, Gen. Mgr.), is planning to build a 154-ft. addition to its car house.

New Bedford, Mass.—The Union St. Ry. Co. (E. E. Potter, Gen. Mgr.), is reported to have announced the erection of an addition of 300 ft. x 350 ft. to its car sheds.

Lowell, Mass.—The Boston & Northern St. Ry. (David Bruce, of Lawrence, Div. Supt.), it is reported, is about to contract for the constructing of a single track electric railway from Lowell to Lawrence, via West Andover, a distance of about 9 miles.

Excelsior Springs, Mo.—The St. Joseph, Excelsior Springs & Lexington Ry. Co. is reported incorporated with a capital of $200,000. The company proposes to build and operate a standard guage electric railroad from Excelsior Springs to Hibbard, Mo., about 10 miles distant. A bridge will be built across the Missouri River at Lexington. G. P. Lingenfetter, of Denver; C. D. Wade, of Excelsior Springs; Chas. Dyer, of Denver; W. J. Bates, of Hibbard; A. M. Bates, S. S. McIntire, of Excelsior Springs, and D. C. Finley, of Kansas City, are said to be interested.

Bath, N. Y.—The Bath Electric Service is reported incorporated to construct an electric railway in Bath. Capital, $100,000. Luther H. Leber, Frederick M. Dayton, of Buffalo, and Arthur A. Lozier, are the incorporators.

Elmira, N. Y.—Summers, McDonald & Winters are stated to have secured the contract for grading electric railway from Hornell to Dansville.

Asheville, N. C.—It is stated that the Asheville Rapid Transit Co. will soon place contracts for constructing 2½ miles of track in Asheville.

Zanesville, O.—It is reported that steps are being taken by the Ohio Electric Ry. Co. for the extension of the line from Zanesville to Pittsburg.

Salem, Ore.—A. Welch, of Portland, is reported to have petitioned the City Council for a franchise over several streets of the city from the northern to the southern limits with outlet to the Willamette River for an entirely new electric railway system. The purpose is to construct the initial line to Albany, and extension is contemplated to Portland on the north and Eugene on the south. Lateral branches are planned for Turner and Mehama.

Marietta, Pa.—It is reported that the Conestoga Traction Co. (H. W. Crawford, Ch. Engr.), has decided to extend the Columbia & Donegal line from Marietta to Elizabethtown, running from Marietta to Maytown, Rowenna and Bainbridge by the way of Billmyer and on to Elizabethtown.

Kittanning, Pa.—It is reported that the Kittanning & Leechburg Rys. Co. (T. A. Moesta, Gen. Mgr.), expects to build a 90-ft. iron span bridge; also 3 miles of track.

Du Bois, Pa.—The United Traction St. R. R. Co. is reported organized with Austin Blakeslee, Pres., and M. I. McCreight, Secy. The electric railway system will be extended to Big Run.

Mercer, Pa.—It is stated that within a short time work on the construction of a new electric line between Mercer and Greenville will begin, according to present plans of the promoters, and a charter has been granted the Mercer Constr. Co. with a capital of $25,000. Incorporators: T. P. Filer, L. W. Orr and J. M. Campbell, of Mercer; Sylvester D. Downs, of Greenville, and W. Hilderbrand, of Pittsburg. It is also proposed to extend the line from Greenville to Sharpsville.

Philadelphia, Pa.—Articles of incorporation are stated to have been filed for the American Suspension Railway Co., of Philadelphia, the objects of which are to acquire improved railway traction or rapid transit lines. Incorporators: D. M. Prantz, W. H. Tigerman, Geo. W. Schriner, Frank O. Butler, and others, of Philadelphia. Capital, $5,000,000.

Harrisburg, Pa.—It is stated that M. S. Hershey contemplates constructing an electric railway to Ephrata.

Yankton, S. D.—The City Council is reported to have granted a franchise to Yankton & Southern R. R. Co. to construct a single track along 1st St. and Broadway.

Everett, Wash.—J. T. McChesney, of the Everett Improvement Co., and associates, it is stated, will soon begin construction of an electric line between Snohomish and Fall City, a distance of 35 miles. Surveys have been practically completed for the new line. The road will pass through Cherry Valley.

Wheeling, W. Va.—The Interurban Railway Co., of Wheeling, W. Va., is reported chartered to build an electric railway from Wheeling to Bethany. Capital, $10,000.

Morgantown, W. Va.—The Sahraton St. Ry. Co. (Geo. C. Sturgess, Pres.) is reported to have in contemplation the construction of an electric railway from Fairmont to Connellsville, Pa.

RAILROADS.

Notes Arranged Alphabetically by States.

Enterprise, Ala.—The building of a railroad between St. Andrews Bay via Shipley, Fla., to Enterprise and thence to Birmingham, is reported under consideration. G. W. Carlisle, of Enterprise, may be able to give further information.

Sulphur Springs, Colo.—A corps of engineers in charge of W. C. Hildebrand, Ch. Engr. of the Denver & Trans-

*Items marked thus give the names of parties awarded contracts.

continental Ry Co., is reported to be making a survey for the railroad which it is proposed constructing between Sulphur Springs and Minturn. The distance between the 2 points is stated to be about 32 miles.

Evanston, Ill.—It is stated that the officials of the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul railroads have decided to postpone indefinitely, probably until after the next presidential election, the work of elevating their tracks in Evanston.

Topeka, Kan.—A charter was granted the Independence North & South R. R., with a capital of $10,000. Incorporators: C. S. Leeds, Kansas City, Kan.; F. C. Daniels, Kansas City, Mo.; H. F. Guthrie and others, of Topeka. The road is intended to run from the east line of Wyandotte County southeast through Wyandotte, Douglas, Johnson, Allen, Bourbon, Wilsan, Neesho, Chautauqua, Montgomery and Labette Counties.

Cottonport, La.—There is reported to be a plan on foot by R. J. D'Arquin to run a railroad from here to Plaucheville.

Kansas City, Mo.—The Kansas City, Mexico & Orient Ry. Co., of Texas (C. H. Webster, Ch. Engr., Sweetwater, Tex.), it is reported, is about to issue $850,000 bonds with which it is proposed constructing the road across several gaps, aggregating about 200 miles.

Jamaica, L. I., N. Y.—The Pennsylvania R. R. (Alex. C. Shand, Ch. Engr., Philadelphia, Pa.), according to reports, will spend $3,000,00 for a brick, stone and concrete railroad station at Jamaica. The preliminary plans, with the network of tracks, subways and other facilities for traffic, are now in the hands of the railroad officials for consideration. There will be 18 tracks.

Columbus, O.—Representatives of the different steam and electric railroads involved in the expense of the abolishment of the grade crossings on the West and South sides have conferred with the director of public service and the city engineer and practically agreed on plans and specifications for the rock work as drawn by the City Engineer.

Cincinnati, O.—The Department of Track Elevation and Subways is stated to have plans for the elevating of tracks at Eastern Ave., to cost the city about $300,000; Hopple St. viaduct over the B. & O. tracks, $270,000; and crossing over the Norfolk & Western R. R. from the city limits to Duck Creek, $250,000.

Philadelphia, Pa.—The Philadelphia & Reading Ry. Co. is stated to have asked bids to be submitted to Wm. Hunter, Ch. Engr., Reading Terminal, Philadelphia, by Sept. 18, for grading, draining and paving a temporary freight yard at 17th and 19th Sts. and Indian Ave. The capacity is to be 2,000 cars, ten set of double tracks to be installed, the driveways between the tracks to be paved with Belgian block.

It is stated that bids for the first section of track elevation for the Philadelphia & Reading Ry. (Wm. Hunter, Ch. Engr., Philadelphia) will be asked within the next 5 weeks. The first section to be undertaken lies between Berks St. and the intersection of Broad and Cumberland Sts., a distance of about 9 squares. Contractors will be asked to bid for the construction of the retaining walls, bridges and trestles for the temporary tracks.

Panama.—It is reported that the charts received by the Isthmian Canal Comn. at Washington, D. C., for the relocation of the Panama Railroad indicate that it is proposed to practically construct a new railroad.

Wenatchee, Wash.—It is stated that the Priest Rapids Ry. Co. intends building a railroad from Wenatchee via Chelan and other towns in that section, to some point on the Northern Pacific R. R.

Cheney, Wash.—The North Coast Ry. Co. is said to be considering the building of its road through Cheney, provided a satisfactory offer is made to the company by the citizens.

Pasco, Wash.—The Northern & Southern Ry. Co., it is reported, contemplates the construction of a railroad between Waterville, Douglas County, to Pasco.

Belington, W. Va.—Ralph Overholt, of Pittsburg, Pa., and Benj. F. Overholt, of Scottdale, Pa., are reported interested in the Fairmont & Southern Ry. Co., which proposes constructing a railroad between Belington, W. Va., and Pittsburg, Pa., a distance of about 225 miles.

**Field, B. C.*—It is reported that the Grand Trunk Ry. Co. has entered into a contract with Macdonell & Gzowski, of Vancouver, to lower the grade of the main line near Field, which includes about 1½ miles of tunnels, on each side of the Kicking Horse Pass. The work will take about 2 years, and, it is stated, will cost about $1,000,000.

Hamilton, Ont.—It is stated that surveys are being made and it is hoped to begin construction in the spring on the Hamilton, Waterloo & Guelph Ry., which is to be constructed via Dundurn and Harvey Parks into the city.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Whipple Barracks, Ariz.—Bids will be received until Oct. 12 by Capt. Chas. C. Walcutt, Jr., Acting Quartermaster, Prescott, for construction plumbing, hot water heating and electric wiring hospital at Whipple Barracks, as advertised in The Engineering Record.

Takoma, Washington, D. C.—All bids received Aug. 23, by Maj. J. T. Crabbs, Quartermaster, Walter Reed Army General Hospital, for the general construction, including plumbing, gas piping, electric lighting of double set of hospital corps sergeants' quarters at above hospital, have been rejected, and new bids will be received Sept. 23.

Washington, D. C.—Plans are stated to have been approved for the erection of a building for the Bureau of American Republics to be erected at 17th and C Sts., N. W.

Coeur d'Alene, Idaho.—The citizens are stated to have voted to issue $40,000 bonds for the erection of a city hall.

Chicago, Ill.—The Lincoln Park Comrs. are stated to have decided to build a 2-story field house in the park in the block bounded by Orleans, Sedgwick, Hill and Elm Sts. The park is 218x349 ft. The field house will be 260x50 ft. It will contain an assembly hall, two gymnasiums, one for women and the other for men, and a branch of the Public Library. The building will cost, including equipment, $60,000.

Bids will be received until Sept. 18 at the office of Perkins & Hamilton, Archts., 1218 Hartford Bldg., for erecting and equipping an addition to the Public Comfort Station in Lincoln Park. Bids to be submitted separately on hot water, heating, plumbing and electric wiring. Perkins & Hamilton, Archts., 140 Dearborn St.

Chicago, Ill.—Bids will be received until Sept. 19 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and installing a heating system in the Bathhouse at W. 12th Pl. and Union St.

Washington, Ind.—It is stated that the Co. Comrs. will soon ask for bids for remodeling the court house, at an estimated cost of $17,000.

Evanston, Ind.—Harry Hake is reported to be preparing plans for a 2-story brick engine house to be erected at Clarion and Montgomery Aves., at a cost of $15,000.

Burlington, Ia.—H. I. Gaddard, Archt., is stated to have completed plans and will soon receive bids for erecting a 3-story brick building for the Burlington Hospital, to cost $50,000.

Des Moines, Ia.—The City Council is stated to have directed the Bd. Pub. Wks. to have plans prepared for the erection o. the city hall.

**Harper, Kan.*—Mathein & Walker, of St. Joseph, Mo., are reported to have secured the contract for erecting the court house at a cost of $57,932.

New Bedford, Mass.—It is reported that plans will be ready sometime in Oct. for remodelling the city hall into a library. Nat. C. Smith, archt, 97 William St.; Chas. S. Ashley, Mayor.

Lansing, Mich.—Bids will be received until Sept. 16 for alterations to be made to the city hall.

Natchez, Miss.—Bids will be received until Sept. 17 by the Bd. Trus. (M. M. Ullman, Secy.) Natchez Hospital, for installing heating plant in said hospital.

Mt. Vernon, Mo.—Bids will be received until Sept. 20 by the Bd. Mgrs. Mo. State Sanitorium (Dr. J. L. Eaton, Pres.), for erecting the Medical building at the above institution.

St. Louis, Mo.—See "Power Plants, Gas and Electricity."

**Jefferson City, Mo.*—The Warden and Bd. of Prison Inspectors of the Missouri State Penitentiary, we are informed, awarded the contracts as follows for the ventilating, heating, and lighting plant for the Penitentiary: Boiler house building, to John Short; steam boilers, to Heine Safety Boiler Co., St. Louis; steam engines, to St. Louis Iron & Machine Wks., St. Louis; dynamos, to Western Electric Co., Kansas City; motors, to Westinghouse Electric & Mfg. Co., St. Louis; conduit & cable work, F. E. Newberry & Co., St. Louis; pipe work, steam heating and ventilating, Peters-Eichler Heating Co.

Omaha, Neb.—Plans are stated to have been completed for the erection of the Clarkson Hospital, at an estimated cost of $75,000.

Paterson, N. J.—Bids will be received until Sept. 20 by Ralph Baer, Chmn. Com. on Indoor Relief for furnishing material and installing new steam heating apparatus in the City Almshouse, also a new boiler house for said almshouse. Wm. T. Fanning, Archt., 609 Colt Bldg.

West Haverstraw, N. Y.—Bids will be received until Sept. 30 by the Rt. Rev. H. C. Potter, Pres. of the Bd. of Mgrs., at West Haverstraw, for constructing, heating, plumbing and electric work of an open air pavilion at N. Y. State Hospital for Care of Crippled and Deformed Children at West Haverstraw. Only a bid for the entire work will be considered. G. L. Heins, State Archt., Albany, N. Y.

Ft. Slocum, N. Y.—Bids will be received until Oct. 7 by the Constructing Quarter Master at Ft. Slocum for construction, plumbing, steam heating and electric wiring of the following buildings: 2 double barracks, 1 recruit examination barrack, a quarter master's storehouse, a double set quarters for non-commissioned staff officers, a wagon shed, additions and alterations to mess hall kitchen and a band stand, as advertised in The Engineering Record.

Devils Lake, N. D.—The erection of an addition to Mercy Hospital is reported contemplated at a cost of about $30,000.

**Bakersville, N. C.*—Jos. Bowditch, Chmn. Bd. Co. Comrs., writes that the contract to erect the court house (bids opened Aug. 15) has been awarded to Fall City Constr. Co., Louisville, Ky., at $19,917.

Springfield, O.—Bids will be received until Oct. 16 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction, complete, of the extension to the U. S. Post Office at Springfield.

Hamilton, O.—J. F. Bender & Bros. are figuring on the general contract for the 2-story, 75x180 ft. Post Office, probable cost, $100,000, and desire sub-bids on granite work, steam heating and ventilating, plumbing, electric wiring, etc.

**Guthrie, Okla.*—The contract for repairing and improving the buildings and grounds of the Ft. Supply Military Reservation for the Insane of the Territory of Oklahoma, is reported to have been awarded to W. O. Campbell, of Oklahoma City, for $23,800.

Washington, Pa.—The East Washington Borough Council is reported to have decided to erect a borough hall, at a cost of $15,000.

Norristown, Pa.—Bids will be received until Sept. 19 by the Bldg. Com. Bd. Trus., State Hospital for Insane, for furnishing material and erecting 4 connecting corridors. Bids to be submitted on the following: Lumber; mill work; stretcher brick; cement; slag roofing; metal work; laying brick, etc. For further information address John L. West, Steward, State Hospital for Insane, Norristown.

Cresson, Pa.—The erection of an insane hospital for Cambria County near Cresson is reported contemplated, at a cost of $350,000.

Pittsburg, Pa.—Bids will be received until Sept. 27 at the office of F. P. Booth, Co. Compt., for erecting the Co. Soldiers' Memorial Building. Total cost, $1,250,000. Palmer & Hornbostel, Archts., New York, N. Y.

Houston, Tex.—Plans and specifications will be received until Nov. 5 by Geo. F. Horton, Co. Engr., Houston, for a $500,000 fireproof court house, as advertised in The Engineering Record.

Seattle, Wash.—Plans are stated to have been completed for 3 exposition buildings to be erected for the Alaska-Yukon Exposition. These buildings are the auditorium, the fine arts building and the machinery hall. All are to be modern in architecture and substantial in construction and used for a university after close of exposition.

**Madison, Wis.*—The State Bd. Control on Sept. 5 awarded the contract for erecting 3 dormitories at the State Home for Feeble Minded, to Otto Neitge, of Mankato, Minn., for $96,600.

Montreal, Que.—The following are reported to be the bids opened for erecting the Montreal Jail: J. B. Pauze & Co., $790,000; Martineau & Prenoveau, $799,395; the Laurin Constr. Co., $873,955, and C. E. Deakin, $893,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Brewton, Ala.—The Masonic Lodge is reported to have decided to erect a building, at a cost of $20,000.

** Prescott, Ariz.*—O. M. Stevenson, of San Bernardino, Cal., is reported to have secured the contract for erecting the Masonic Temple in Prescott, at $38,042.

**Ft. Smith, Ark.*—The following are the bids received Aug. 28 for erecting a 6-story reinforced concrete hotel: W. F. May & Co., Ft. Smith, $155,000; H. M. Fielding & Co., Guthrie, Okla., $203,000; T. W. Hackett, St. Louis, Mo., $199,895; Urban Constr. Co., Kansas City, Mo., $188,606; Hugh McLennan, Chicago, Ill., $188,000; Manhattan Constr. Co., New York, N. Y., $187,500 (awarded contract); Jefferson Constr. Co., New Orleans, La., $179,949; J. N. Ewen Constr. Co., Chicago, Ill., $217,000.

San Francisco, Cal.—The Cliff House is reported destroyed by fire. John Tait, Prop.

Oakland, Cal.—A permit is stated to have been issued to the Lyon Storage & Moving Co. for the erection of a 6-story concrete storage warehouse on 29th and Grove Sts., at a cost of $30,000.

Chicago, Ill.—It is reported that Mandel Bros. will build a storage house and stable for its West Side delivery at 1148 to 1152 W. Van Buren St. It will be 2 stories, 89x106 ft., and will be constructed of pressed brick and stone, cost, $30,000.

Thos. M. Seeds, Jr., is stated to have been granted a permit to build a 6-story brick addition, 42x62 feet, to the building of the Art Club, at Broad and Chancellor Sts.; cost, $80,000. Newman & Harris, Archts.

The southwest corner of Grand Boule. and 39th St., 100x150 ft., is to be improved with an apartment building and stores, according to reports, to cost $75,000. The work will be under the direction of the owner, W. R. Martin, 289 35th St.

It is stated that plans are being prepared for an 8-story mercantile building to be erected at 120 and 122 Franklin St. by Wm. W. P. Adams. The new structure will be 54x61 ft. It will be of mill construction, the front being of pressed brick and terra cotta. The structure will cost $75,000.

Des Moines, Ia.—It is stated that G. H. and E. G. Ragsdale will erect a 6-story building at 312 Court Ave. The structure will be 44x133 ft., and cost about $40,000.

W. O. Coffee is reported to have decided to erect a 3-story building at 10th and Walnut Sts., at a cost of about $30,000.

Topeka, Kan.—It is stated that the Topeka & Southwestern Ry. Co. (V. R. Parkhurst, Ch. Engr.) will erect a depot here, at a cost of $20,000.

Paducah, Ky.—The Red Men are stated to have directed plans to be prepared for a $50,000 business and society building to be erected here.

Louisville, Ky.—The Courier Journal Bldg. at 4th and Green Sts. is reported destroyed by fire.

New Orleans, La.—Diboll & Owen are stated to have prepared plans for a 6-story brick building at Gravier and Saratoga Sts., for the Colored Knights of Pythias, at a cost of about $100,000.

St. Paul, Minn.—A permit has been issued for a 2-story brick rooming house, to cost $12,500, to be erected on University Ave. and Simpson St. Lyman D. Baird, owner. Evensta & Hagabrom, builders.

A permit has been issued for the 1st Natl. Bank Bldg., to be erected at 4th and Minnesota Sts. by Geo. J. Grant, 61 E. 9th St., at a cost of $135,000, and for a 4-story brick warehouse to be erected on Cedar and 3d Sts., at a cost of $15,000. Wm. S. Streckland, owner; Lauer Bros., ft. of Chestnut St., and Butler Bros., Globe Bldg., builders.

York, Neb.—Tyler & Brandt, of Lincoln, are stated to have prepared plans for a 3-story building for the Benevolent and Protective Order of Elks, at a cost of $25,000.

Schenectady, N. Y.—The Overland R. R. Co. is reported incorporated with a capital of $30,000, for the purpose of erecting a hotel. Frank O'Brien, Pres.

Southampton, L. I., N. Y.—It is stated that G. Warrington Curtis will erect a stable here, at a cost of about $35,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 12-story brick and stone studios at 130 W. 57th St., for the 130 W. 57th St. Corp.,

*Items marked thus give the names of parties awarded contracts.

cost $500,000. Pollard & Steinam, Archts; 1-story brick stores at Simpson and Westchester Aves., for Jas. F. Meehan, Archt. and Proprietor, cost $20,000; alterations to 4-story brick and stone dwelling and loft at 16 W. 45th St., for Leah P. Norton, cost $22,000. Erwin Rossbach, Archt.

The Second National Bank is reported to have under consideration the erection of a bank building at 5th Ave. and 28th St.

*Dunkirk, N. Y.—The contract for erecting the plant for the Morley Milk Co. on Ruggles St., is reported to have been awarded by the Dunkirk Industrial Bldg. Co. to Peter Meisler & Son, of Dunkirk, for $40,000.

*Goldsboro, N. C.—Bids for erecting the Union Station at Goldsboro are reported to have been opened Aug. 28 by E. B. Pleasants, Ch. Engr. Atlantic Coast Line R. R. Co., as follows: Rhodes & Underwood, of Kingston, $57,370; Central Carolina Constr. Co., of Greensboro, $58,241; J. F. Ong, of Columbia, S. C., $56,820; D. J. Rose & Co., of Rocky Mount, $62,789; S. C. Williams, of Richmond, Va., $62,302; J. T. Wilson, of Richmond, $67,000; and King Lumber Co., of Charlottsville, $55,520 (awarded contract).

Charlotte, N. C.—The plans of Frank P. Milburn, of Washington, D. C., are reported to have been selected for the 4-story 60x140 ft. hotel to be erected on W. Trade St. by the Jackson Hotel Co., at a cost of $60,000.

Cincinnati, O.—Tietig & Lee, Commercial-Tribune Bldg., are reported to be preparing plans for a building to be erected at Commerce and Vine Sts., for the Wm. Glenny Glass Co., at a cost of about $25,000.

Columbus, O.—The Hotel Normandie is reported destroyed by fire. Mrs. Nicholas A. Court, Mgr.

*Cleveland, O.—The Bd. of Pub. Service awarded the contract for the excavation and foundations of the West Side market house to the C. H. Fath & Son Constr. Co. at $41,156.

Philadelphia, Pa.—Oscar Hammerstein is reported to have purchased a site at Broad and Poplar Sts. for the erection of an opera house.

Ballinger & Perrott are stated to have awarded a contract to Moore & Co. for a reinforced concrete factory building for the Locust Realty Co., 5th and Locust Sts. The plans provide for a 5-story 116x198 ft. structure; cost, $200,000.

Media, Pa.—The Concordville Hotel is reported destroyed by fire. Scott Kauffman, proprietor.

*Danville, Va.—The contract for erecting the Y. M. C. A. Bldg. is stated to have been awarded to Dietrick & Pearson, of Danville. The structure to cost about $20,000.

Tacoma, Wash.—G. W. Bullard, Archt., Provident Bldg., writes that they will not be ready for bids for erecting the Y. M. C. A. Bldg. until about Oct. 1, or later.

*Belington, W. Va.—The Enterprise Constr. Co., of Elkens, is reported to have secured the contract for erecting a Union Depot in Belington, at a cost of $20,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—It is reported that the Highland Ave. Baptist Society will erect an edifice, at a cost of $15,000.

*Monticello, Ark.—Wilson & Hendrix, of Pine Bluff, are stated to have secured the contract for erecting an edifice for the Congregation of Associate Reformed Presbyterian Church at Monticello, for $75,000.

New Haven, Conn.—Allen & Williams are reported to be preparing plans for a $75,000 edifice to be erected here. D. A. Blackeslee, Chmn. Bldg. Com.

Rockford, Ill.—Plans are being prepared, according to reports for the erection of an edifice for the Swedish Baptist Society, at an estimated cost of $20,000.

Chicago, Ill.—It is stated that Henry Veeder will build a handsome residence at Greenwood Ave. and 49th St. It will be two stories and cost $20,000.

H. H. Richards, it is stated, will construct a 3-story flat building at 4727 Michigan Boule. It will front 30x110 ft. and cost $30,000.

A. L. Stone has decided to erect an apartment house at 3316 to 3318 Wabash Ave., to cost $25,000, according to reports. It will be 3 stories, 40x57 ft.

Vincennes, Ind.—It is stated that bids will be received until Sept. 30 by W. C. Johnson, Chmn. Bldg. Com., for erecting a rubble stone edifice for the First Baptist Congregation. Campbell & Osterhage, Archts., Vincennes.

Ft. Wayne, Ind.—It is stated that the Trus. of the Simpson M. E. Church (Rev. L. N. Edwards, Pastor) will soon ask for bids for the erection of an edifice, estimated cost, $35,000.

Des Moines, Ia.—J. M. McNamara is stated to have purchased a site at 15th and High Sts. for the erection of an apartment house, to cost about $40,000.

*Ames, Ia.—John R. Gier, of Conrad, is reported to have secured the contract for erecting an edifice for the congregation of the Methodist Episcopal Church, at $34,594.

Wichita, Kan.—H. Conrow is reported to be preparing plans for an edifice for the College Hill Congregation, to cost $40,000. A. C. Kelly, Chmn. Bldg. Com.

Cambridge, Mass.—The Cantahigo Apartment House is reported destroyed by fire.

Duluth, Minn.—Henry Folz is stated to have secured a permit to erect an apartment at 2d and 3d Sts., at a cost of $15,000.

Kansas City, Mo.—It is stated that the Grace Presbyterian Society is arranging to erect a $30,000 edifice here. C. A. Smith, Archt.

Sedalia, Mo.—The congregation of St. Patrick's Church is stated to have decided to erect an edifice at 4th St. and Washington Ave., at a cost of $20,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone tenement at Delancey and Mott Sts., for Susswein & Hermann, cost $40,000, Jacob H. Amsler, Archt.; 6-story brick and stone tenement at 13th St. and Ave. C, for Jos. Wolkenberg, cost $75,000, Geo. F. Pelham, Archt.; 4-story brick and stone dwell. at 127 E. 64th St., for E. W. Turnbull, cost $30,000, Pickering & Walker, Archts.; 6-story brick and stone tenement at 116th St. and 1st Ave., for Lordi, Pernetti & De Respiris, cost $75,000, L. F. J. Weiher, Archt.; 6-story brick and stone tenement at 93d St. and West End Ave., for Allenal Constr. Co., cost $100,000, Rouse & Sloan, Archts.; 6-story brick and stone apartment house at St. Nicholas Neville & Bagge, Archts.

Plans have been filed for the erection of the following buildings: Three-story brick and stone tenements at 322 3d Ave., for Wm. Bradley, cost $120,000, Radcliffe & Kelley Archts.; 12-story brick and stone apartment house at 116th St. and Bway., for Paterno Bros., cost $225,000, Schwartz & Gross, Archts.; 5-story brick and stone tenement at 126th St. and 5th Ave., for I. Block, cost $35,000, Shampan & Shampan, Archts., alterations to 5-story brick and stone dwelling at 825 5th Ave., for Clifford V. Brokaw, cost $25,000, Little & O'Connor, Archts.

Plans have been filed for the erection of a 4-story extension to 4-story brick and stone dwelling at 41 E. 38th St., for Mrs. Chas. T. Cook, cost $25,000, Henry O. Chapman, Archt.

*Coxsackie, N. Y.—The Peter Keeler Constr. Co., of Albany, is reported to have secured the contract for erecting the Second Reformed Church on Washington Ave., at a cost of $20,000. Alex. Sellkirk, of Albany, Archt.

Guthrie, Okla.—It is stated that the First Methodist Society will erect an edifice, at a cost of $40,000.

Spokane, Wash.—O. M. Lilliquist is reported to be arranging to erect 2 flats at Lincoln St. and 10th Ave., at a cost of $30,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Montevallo, Ala.—Bids will be received until Oct. 18 by the Bldg. Co., for the plumbing, electric wiring and steam heating in the new addition to the dormitory at the Girls' Industrial School. Wm. Ernest Spink, Archt., 812 Title Guarantee Bldg., Birmingham.

San Diego, Cal.—It is stated that bids will be received until Oct. 14 by the Bd. Educ. (L. W. Belding, Secy.), for erecting a 16-room school of either reinforced concrete or of brick on University Ave. Bids to be submitted separately on ventilating and heating, plumbing and electrical work. Henry L. Gay, archt., 56 Keating Blk.

Los Angeles, Cal.—The School Board is stated to have decided to erect a building in the Garvanza Dist., at a cost of $30,000.

Washington, D. C.—Bids will be received by the Dept. of the Interior (G. M. Woodruff, Acting Secy.) until Sept. 17, 1907, for installing heating apparatus in the medical building of Howard University, cor. 5th and W Sts., N. W., Washington D. C. Plans and specifications may be seen, the building inspected, and all information obtained from Dr. Herbert S. Scurlock, 531 Florida Ave., N. W., or Dr. William C. McNeill at the building.

Iowa City, Ia.—Bids will be received until Sept. 16 by the Bldg. Com. Bd. Regents, State Univ., for erecting a fireproof addition to the Engineering Building. Proudfoot & Bird, Archts., 625 Flynn Block, Des Moines.

Newton, Ia.—Contracts for heating and plumbing the high school are reported to have been awarded to J. T. Carmody, of Cedar Rapids, at $19,710, and Johnson-Rowe-Daly Co., of Omaha, Neb., at $4,658, respectively.

*Negaunee, Mich.—L. E. Chausee, of Negaunee, is reported to have secured the contract for erecting the high school here, for $89,590.

*Republic, Mich.—The contract for erecting the high school (bids opened Aug. 26) is stated to have been awarded to A. P. Wilson, of Marquette, for about $50,000.

Saginaw, Mich.—C. L. Cowles, of Saginaw, is preparing plans for a $30,000 school to be erected for Saginaw.

*Duluth, Minn.—Dan Egan, of Ashland, is stated to have secured the contract for erecting the Sacred Heart School at $42,000.

Fairbrault, Minn.—It is stated that bids will be received until Sept. 17 by the State Bd. Control, St. Paul, for erecting a boys' dormitory building at the State School for the Blind, Fairbault. Clarence H. Johnston, archt., 712 Manhattan Bldg., St. Paul.

Moorhead, Minn.—Plans are stated to have been completed and bids will soon be received for erecting the Normal School here, at a cost of about $50,000.

*East Orange, N. J.—E. M. Waldron & Co., of Newark, is stated to have secured the contract for erecting the Lincoln Public School in the 4th Ward, for $82,262.

New York, N. Y.—Plans have been filed for the erection of a brick school at Hudson and Grove Sts. for City of New York, at a cost of $25,000, C. B. J. Snyder, Archt., 500 Park Ave.; also a 5-story brick and stone extension to 4-story brick school at 130th St. and Madison Ave., at a cost of $40,000, for congregation All Saints Roman Catholic Church, Neville & Bagge, Archts., 217 W. 125th St.

Bids will be received until Sept. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing ventilating and heating apparatus for New School 91, Boro. Manhattan; general construction, etc., of a grand stand to be placed on the Athletic Field at Munson and Orchard Sts., Astoria, Boro. of Queens; also until Sept. 23 (readvertisement) for completing the abandoned contract for the ventilating and heating apparatus for additions to and alterations in School 109, and in new School 151, both in Boro. Brooklyn.

Jamestown, N. Y.—School bonds amounting to $105,000 are reported sold.

Elizabeth City, N. C.—Bids will be received until Oct. 1 by the Bd. Educ. (J. B. Leigh, Chmn.) for $20,000 graded school bonds.

Sheraden, Pa.—Press reports state that bids will be received until Sept. 18 by the Directors of the School Dist., for $30,000 school bonds.

Harrisburg, Pa.—The following bids are reported opened Sept. 3 by the Building Com. of the School Bd. for erecting the Vernon St. School: W. S. Roebuck, $30,850; Augustus Wildman, $42,300; Eeard & Co., Reading, $43,666; W. O. Weaver & Son, $46,597; Stapf & Benfer, $46,889; Kuhn & Fetrow, $47,500; John Myers, $48,560; D. S. Sollenberger, $50,000; and P. W. Flinn, Altoona, $51,413.

Marion, Va.—The Directors of Judson College are stated to have secured plans for erecting college building, estimated to cost $30,000.

Delavan, Wis.—Bids will be received until Sept. 18 by the State Bd. Control (Allan D. Conover, Pres.), Madison, for erecting an industrial building, a stable and cow barn at the Wisconsin School for the Deaf, Delavan. Howland Russel, Archt., Milwaukee.

*Beloit, Wis.—E. C. Helm, Clk. School Bd., writes that the contract to erect a high school (bids opened Sept. 3) has been awarded to J. P. Culle Co., of Janesville, at $92,525, not including heating, plumbing or wiring.

St. Anne de Bellevue, Que.—The barns of the Agricultural College here are reported destroyed by fire. Wm. MacDonald is reported interested.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Ft. Morgan, Ala.—See "Water."

Birmingham, Ala.—Reports state that a certificate of incorporation has been filed by the Emery Steel Co., capital, $15,000. The company proposes to manufacture engines, machinery, castings, and erect power plants and all classes of work in connection with machinery. Incorporators: J. A. Emery, R. C. Foster and J. H. Pritchard. The principal place of business will be in Birmingham.

Denver, Colo.—The Diamond Match Co., whose main office is in Chicago, Ill., is reported to be contemplating the erection of a sawmill in Grand County and the establishment of a factory at some point along Moffat Road, near Denver.

Boulder, Colo.—The Crucible Steel Co., of Pittsburg, Pa., is stated to have bought an extensive tract of land near Boulder, and will erect a plant for refining tungsten, a rare mineral which is used in the manufacture of certain kinds of steel. Alex. Thomas, Secretary of the company, is reported to have announced that work on the plant would be begun at once.

Bainbridge, Ga.—It is reported that the Georgia, Florida & Alabama R. R. shops, burned here a few weeks ago, will be rebuilt. Work will begin for the erection of machine and repair shops at once, which will cost in the neighborhood of $250,000.

Chicago, Ill.—The Raymond Lead Co., it is reported, will construct a plant for the manufacture of lead on Lexington St. between Washtenaw Ave. and the Chicago & Northwestern and Panhandle railroads. The buildings include a power house and sheet lead mill, 125 x 175 ft.; storage building, 139 x 18 ft., and a structure for the office and lead presses, 113 x 224 ft. The buildings will be of a combination of fireproof steel construction and mill construction. The cost is estimated at $200,000. It is stated that construction will be commenced just as soon as the plans are completed and contracts let.

*Chicago, Ill.—It is reported that a contract has been awarded to the Vilter Mfg. Co. by the Illinois Steel Co. for a refrigerating plant for its South Chicago plant. The refrigerating machine will have a capacity equal to the melting of 1,100 tons of ice per day. This refrigeration will be used to dry the air for the blast furnaces. The equipment will include 4 cross compound condensing Corliss engines, each engine driving two double-acting ammonia compressors. The steam cylinders will be 24 in. and 46x36-in. stroke, and the ammonia compressors 18x36 in. There also will be furnished 100 coils of double pipe ammonia condensor and 80 coils of double pipe brine cooler and the necessary oil traps and other machinery. The plant will cost $115,000.

Marshalltown, Ia.—The Interstate Brewing Co. is reported to have authorized Bernard Barthel, of Chicago, Ill., to draw plans for a brewery to cost about $200,000.

*Lehigh, Ia.—It is stated that Johnson & Nelson, of Red Wing, Minn., have received the contract for the sewer pipe and tile factory.

Forest City, Ia.—J. H. Northup, of Fort Dodge, according to report, will put in a cement tile factory here.

Adel, Ia.—Straight Bros., it is stated, plan to establish a $125,000 tile factory here.

Detroit, Mich.—The American Electrical Heater Co., 121 State St., is stated to be having plans prepared for a $50,000 factory which they propose erecting at Cass Ave. and Vienna St.

High Bridge, N. J.—It is stated that bids are being received for a plant to be erected here for the Taylor Iron & Steel Co. The buildings included in the plant will be a 1-story brick fetling shop, 100x114 ft.; a 1-story brick machine shop, 168x72 ft., and a 1-story brick dry sand molding shop, 365x24 ft. The plans were drawn by Frank C. Roberts & Co.

Ft. Caswell, N. C.—See "Water."

Portsmouth, O.—The Norfolk & Western R. R. is reported to have purchased 75 acres of land adjoining its present shops at East Portsmouth, O., upon which it will erect new shop buildings, tripling the capacity of its shops at that point.

Cincinnati, O.—The increasing demand for Powell steam engineering specialties makes an enlargement of the plant of the Wm. Powell Co. a necessity. Plans are being prepared to erect buildings on ground 37x200 ft. recently acquired by them and to increase their power plant by 200 horse-power.

A plant, with equipment to cost about $75,000, is to be erected in Idlewild, according to reports, by the Ault & Wiborg Co., of New St., manufacturers of printing ink, who will use the suburban plant for the manufacture of varnishes. Plans have been completed by Harry Hake, who will supervise the erection of the structure. The

Items marked thus give the names of parties awarded contracts.

buildings are to be of brick, the largest building L-shaped, and the wings will be 32x88 ft. and 42x108 ft. In this structure will be located the offices, laboratory, tankroom and shipping department. The filler and thinning department will be 54x45 ft., the melting room 64x29 ft., and the stockroom 42x32 ft.

It is reported that the Buckeye Brewing Co. will make improvements on its grounds adjoining its plant, in McMicken Ave., to cost about $200,000, and are having plans prepared by the Cincinnati Brewery & Engineering Co. Work on some of the buildings will be started this fall. A 6-story, concrete and fireproof building, 77x100 ft., will give added floor space to the brew department and will also contain the racking and washrooms and a storage cellar. A 4-story fireproof building, 30x70 ft., is to be erected for the storage of hops, and a cooperage shop, 2 stories, 40x70 ft., is also being designed.

Sandusky, O.—The Fremont Mitten & Glove Co. is reported to have decided to build a $100,000 plant here to employ 200 people.

**Phillipsdale, R. I.*—The American Electrical Wks. at Phillipsdale is to be enlarged, the E. K. Watson Co. having received the contract for the erection of 3 buildings and a 175-foot chimney. The new buildings will include a wire mill 164x71 ft. and 2 stories in height, an annealing mill 90x84 ft. and 1 story in height, and a large boiler house 150x50 ft. In conjunction with this a great brick smokestack will be erected which will be 173 ft. in height with a flue of 7½ ft. The wire mill is to be of standard mill construction with a steel truss roof so as to have a clear span, and the building will contain many wire doors in order to furnish an abundance of light. All the modern appliances will go into the construction, including up-to-date sanitary accommodations. The bid boiler house will have a steel truss roof supported on steel posts with a 12-in. curtain wall. The roofing on all the buildings will be of tar and gravel.

Houston, Tex.—See "Power Plants, Gas and Electricity."

Hamilton, Ont.—The E. C. Atkins Co., of Indianapolis, Ind., it is stated, had definitely decided to establish its Canadian branch in Hamilton. It has purchased the old Hoefner works, east of Sherman Ave., below Barton St., and nearly 20 acres of ground. The building will be thoroughly fitted up to meet the requirements of the new concern, and new buildings will also be erected, the total expenditure amounting to probably $150,000.

Adam Beck, of London, Chmn. of the Hydro-Electric Power Comn., is reported to be contemplating the construction of a lumber and box factory here.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Berkeley, Cal.—The City Clk. is reported to be receiving bids for constructing a garbage disposal plant.

**Newport, Ky.*—The Council is reported to have awarded to the Sewell & Pardington Co. the contract to dispose of the city garbage from Sept., 1907, to March, 1908, at $166.66 per month.

Baltimore, Md.—The following are reported to be the bids received recently by the Bd. of Awards for the purchase of the reduction plant of the Baltimore Sanitary Contr. Co. and for the removal of the plant outside the city limits, and also for reducing the city garbage. The garbage is to be gathered by the city and collected at central points and to be taken in scows to the reduction plant to be reduced by the successful bidder. (The price given is per year from 1 to 10 years, respectively): The Southern Product Co., $71,000, $74,000, $77,000, $80,000, $83,000, $86,000, $89,000, $92,000, $95,000 and $98,000; David Peoples, of Philadelphia, Pa., $80,000, $83,000, $86,000, $89,000, $92,000, $95,000, $98,000, 101,000, $104,000 and $107,000. The Southern Product Co. bid $100,000 for the reduction plant and the David Peoples Co. $50,000.

Butte, Mont.—The Judiciary Com. has reported to Council recommending that the City Clk. be directed to invite estimates and suggestions from companies manufacturing and building garbage incinerating plants to take care of at least 100 tons of garbage per day.

Newark, N. J.—Bids will be received until Sept. 26 by the Bd. of Street and Water Comrs. (Morris R. Sherrerd, Ch. Engr.), for the collection, removal and disposal of ashes, rubbish material, paper and garbage for a period of 5 years, beginning Jan. 1, 1908, as advertised in The Engineering Record.

Cincinnati, O.—The Bd. Pub. Service is said to be receiving bids for the erection of dumping and incinerating stations at Plum and 2d Sts., which are to cost $75,000. Saml. Hannaford & Sons, Hulbert Blk., are the archts.

Columbus, O.—The Pub. Service Bd. is stated to have voted in favor of the reduction system for garbage disposal and for the location of the plant on the farm occupied by the sewage disposal plant south of Columbus. Engr. John H. Gregory filed with the Bd. of Pub. Service on July 12 specifications for a garbage reduction plant of 100 tons capacity for 24 hours at an estimated cost of $150,000; also a furnace for incinerating rubbish in addition to the garbage reduction.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Riverton, Ala.—See "Paving and Roadmaking."

**Little Rock, Ark.*—We are informed that the contract to construct improvements in Pulaski County Drainage Dist. No. 1 (bids for which were received Sept. 7) has been awarded to the Crescent Contr. Co., of Peoria, Ill., at $86,021. The Nick, Peay Constr. Co. also bid on this work, at $92,000. The work consists of 7 miles open ditch requiring 143,000 cu. yds. of earth excav. One reinforced concrete conduit, 84 in. diameter, 2,635 ft. long. Lund & Hill, Engrs., Little Rock.

Ft. Winfield Scott, Cal.—Bids will be received until Sept. 28 by Capt. B. F. Cheatham, Constr. Q. M., U. S. A., Ft. Mason, for furnishing material and constructing a torpedo wharf at Ft. Winfield Scott.

Washington, D. C.—Bids will be received until Oct. 10 by Maj. Spencer Cosby, Corps. Engrs., U. S. A., Washington, D. C., for dredging earth and rock and constructing jetties in James River, Va., as advertised in The Engineering Record.

Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Sept. 17, to furnish at the navy yards and naval stations the following supplies: New York, N. Y., etc.: Sch. 270—Electrical supplies, cut-outs, fuse wire, incandescent lamps, switches, Portland and linoleum cement, lavatory fittings, electric drills, bench grinders, grommets, drills, brass and copper wire; wood, machine, and lag screws; hydraulic jacks, cedar, cherry, oak, yellow, Oregon, and sugar pine; spruce spars, rod and sheet brass, rolled bronze, sheet copper, yellow sheathing metal, pig and hoop iron, bar steel, steel shafting, sheet tin, slab zinc, sheet lead, etc.; copper tubing, brass and iron pipe fittings, gate and water-closet valves, water-closets, etc. Sch. 278—Rolled bronze, bar iron, plain and galvanized sheet steel, tool steel. Sch. 280—Steel conduit, Portland cement, etc. League Island, Pa.: Sch. 272—Sheet copper. Puget Sound, Wash.: Sch. 282—Lavatories. Sch. 284—Brass, copper, phosphor-bronze, and steel wire. Sch. 286—Sheet copper, brass pipe, etc. Mare Island, Cal.: Sch. 283—Steam pump, iron, steel, zinc plates. Sch. 286—Ash, bar steel, pig iron. Norfolk, Va.: Sch. 271—Channels, eye-bars, hoist engines. Sch. 277—Steel bolts and nuts, engine lathe, pipe fittings, turn-buckles, anvils, etc., forges, twist drills, etc. Sch. 278—Rolled bronze, rod and sheet copper, bar iron, plain and galvanized sheet steel, sheet lead, roofing tin. Washington, D. C.: Sch. 271—Ties. Sch. 274—Machine steel, steel forgings. Sch. 277—Milling cutters. Naval Academy, Annapolis, Md.: Sch. 273—Core-making machine, sterilizer, band-saw machine, jig saw, lathe, air compressor, sand-papering machine. Portsmouth, N. H.: Sch. 277—Metallic bushed sheaves. Applications for proposals should designate the schedule desired by number. E. E. Rogers, Paymaster Gen'l., U. S. N.

It is reported that the installing of pneumatic tubes between the government printing office and the Capitol is under construction by the government.

Jacksonville, Fla.—Bids will be received until Oct. 10 by Maj. Lansing H. Beach, Corps. Engrs., U. S. A., Jacksonville, for dredging and rock removal in Withlacoochee River Entrance, Fla., as advertised in The Engineering Record.

Bids will be receved until Oct. 9 by Maj. Lansing H. Beach, Corps. Engrs., U. S. A., Jacksonville, for dredging at Forrester's Point, St. John's River, Fla., as advertised in The Engineering Record.

**Joliet, Ill.*—Geo. H. Munroe, Chmn. Bd. Comrs. of Spring Creek Drainage Dist., writes that the contract to excavate 90,000 cu. yds. in channels for drainage (bids opened Sept. 3) has been awarded to Robt. Shannon, Joliet, and the contract for the concrete walls in connection with same to Blair & Gallagher, of Columbia City, Ind.

Cerro Gordo, Ill.—Bids will be received until Sept. 27 by the Drainage Comrs. of Union Drainage Dist. No. 3 of the towns of Cerro Gordo and Willow Branch, in Pratt County (J. C. Locher, Clk.), for constructing 11 miles of open ditch involving the removal of 210,410 cu. yds. of earth. W. J. Day, Engr., Bement. For further information address the Clerk.

Indianapolis, Ind.—Bids will be received until Sept. 20 by the Bd. Park Comrs. (Chas. E. Coffin, Chmn.) for furnishing material and repairing the apron to the Riverside Park dam.

Goshen, Ind.—The Co. Comrs., it is reported, have ordered plans and specifications prepared for the construction of a ditch in Union, Jackson and Clinton Townships.

Des Moines, Ia.—Surveys have been made for a ditch in the 6th Ward. Probable cost, $2,000.

**Mason City, Ia.*—It is stated that the contract to construct Sect. No. 1 and 2 of ditch No. 5 has been awarded to .. D. Arnett, at $1,878, and Crapser & Inman, at $4,422, respectively.

Boone, Ia.—It is reported that bids will be received until Sept. 19 by E. F. Jones, Co. Aud., for constructing County Drain No. 1, to consist of 4,034 ft., 28-in., 2,437 ft. 22-in., 1,800 ft. 20-in., 800 ft. 18-in., 1,500 ft. 16-in., and 1,100 ft. 12-in. tile.

Dakotah, Ia.—It is reported that bids will be received until Sept. 20 by John Cunningham, Co. Aud., for constructing a ditch in Dist. No. 5.

Ft. St. Phillips, La.—The followng are reported to be the bids received Aug. 30, at New Orleans, for constructing a sea wall at this port: Wellington Steel Piling Co., of New York, $94,010. Cullen, Friested & Co., of Chicago (3 bids), $99,955, $102,320 and $104,900. Richard M. Murphy, of New Orleans, $96,807 (awarded contract). W. T. Carey & Bro., New Orleans (2 bids), $99,300 and $99,850. The work contemplated is the enlargement of a portion of the back or gulf levee, the construction of a new levee and the reinforcement of the levee with a row of interlocking sheet piles, with a reinforced concrete capping.

New Orleans, La.—At a meeting of the Orleans Levee Bd. on Aug. 23 three sets of resolutions were adopted, to the effect that the board advertise for bids and prepare plans to cover $800,000; that all retaining walls be paid for by the property owners, and that owners on sites from Desire to Mazant Sts. be given 12 months from date in which to complete their rental contracts.

*Contracts for levee work (bids for which were received Aug. 27), it is reported, have been awarded by the Orleans Levee Bd. as follows: To Adam Ruppel, Third District work at the following bid: 41½ cts. per cu. yd. of earth where the earth is taken near the site, and where the earth is secured elsewhere, 94½ cts.; creosoted revetment, $70 per 1,000 ft.; lumber, $60 per 1,000; piling in the revetment wall, per lin. ft., 70 cts.; reinforced concrete wall, $9 per cu. yd. The total cost is estimated at $89,000; also the Fourth Dist. contract at following bid: earth, 97½ cts.; concrete gravel, $2.57 per cu. yd.; reinforced concrete, $9; per 1,000 ft. of lumber, $60; piling, 70 cts. lin. ft. The total cost estimated at $91,000. For 6th and 7th Dists (banquetting of the levee) to the General Contr. Co., at 43 cts. per cu. yd.; total estimated cost, $11,000.

The Orleans Levee Bd., it is stated, has ordered $100,000 worth of work in 5th Dist., but bids have not yet been asked.

*The State Bd. of Engrs. is reported to have on Aug. 27 awarded contracts as follows: Raccourci, in Pointe Coupee Parish, an enlargement of 50,000 cu. yds. to R. T. Clarke Co., at 23½ cts. per cu. yd.. rattling Slough Levee, in Caddo Parish, on Red River, a new levee, containing 100,000 cu. yds., to M. Hunt, at 22.4 cts. per cu. yd.; Dortch Bend Levee, on Red River, in Bossier Parish, containing 250,000 cu. yd. to W. G. Burt, at 24.4 cts. per cu. yd.

The New Orleans Dry Dock & Shipbuilding Co. is said to be planning the construction of a dry dock to cost about $60,000.

Portland, Me.—The following are the bids opened on Aug. 30 at the office of Maj. Geo. A. Zinn, Corps Engrs., U. S. A., for rock excav. in Cape Porpoise Harbor, Me., about 5,226 cu. yds: (*a*) price per cu. yd., (*b*) totals: Eastern Dredging Co., Boston, Mass., *a* $9.60, *b* $50,170 (time of completion, 360 days); Simon J. Donovan, Ea. Boston, Mass., *a* $11.25, *b* $58,792 (2 years); John J. Fitzpatrick, Plattsburg, N. Y., *a* $13.62, *b* $71,178 (Sept. 1, 1909); Johnston & Virden, Lewes, Del., *a* $11.65, *b* $60,883 (8 months).

**Medford, Mass.*—The following are the toltals of bids received Sept. 3 by the Metropolitan Park Comn. at Boston (Geo. R. Rablin, Engr.), for grading, surfacing and other work at Middlesex Fells Parkway extension, at Medford: Thos. F. Welch, West Roxbury, $62,022; Falvey & Kelley, Dorchester, $57,995; Bruno & Petitti, Boston, $55,571; Hugh Nawn Contr. Co., Roxbury, $52,661; John F. Gill Co., Somerville, $53,437; Coleman Bros., Boston, $49,127; Rowe & Perini Constr. Co., Melrose, $44,230 (awarded contract).

Boston, Mass.—We are informed that the following are the bids received Sept. 6 by the Bd. of Harbor and Land Comrs. (F. W. Hodgdon, Ch. Engr., Boston) for building dike at Herring River, Wellfleet: Bruno & Petitti, Boston, $31,500; Wm. L. Miller, Boston, $21,000; Thomas & Connor, Middleboro, $18,500; and Chas. G. Craib, Winthrop, $25,500. The work includes 11,900 cu. yds. sand fill, and 2,400 cu. yds. marsh mud and sod facing; 800 lin. ft. timber sheeting; 910 lin. ft. concrete ton in connection with core wall; 18,500 sq. ft. area of roadway to be surfaced; fence 1,850 lin. ft. long to be built, etc.

Saginaw, Mich.—Bids will be received until Sept. 23 by the Bd. of Park & Cemetery Comrs. for excavating Rust Lake channel, connecting same with Saginaw River, Wright Bayou and river front, and filling the Rust Park property complete. The approximate quantity to be excavated is about 600,000 cu. yds. David C. Bell, Clk. of Bd.

Lansing, Mich.—Bids will be received for constructing a 20x30-in. drain 1,300 ft. long. H. A. Collar, City Engr.

Mankato, Minn.—See "Sewerage and Sewage Disposal."

Ft. Snelling, Minn.—D. W. Moore and Thos. Keough, both of St. Paul, it is reported, submitted the same bid on Sept. 5 to Maj. Amos W. Kimball, of St. Paul, for constructing ditches at Ft. Snelling at $2,893.

Charleston, Miss.—Bids will be received by E. Bacon, Secy. Co. Drainage Comrs., at Charleston, until Sept. 30, for constructing a main ditch in Ascalmore Drainage Dist., to be about 4 miles long, 4 ft. deep and 20 ft. wide. estimated cost, $14,000.

Cold Spring, N. J.—Plans and specifications are on file at the office of The Engineering Record, 239 W. 39th St., for the construction of stone jetties at Cold Spring Inlet, N. J., bids for which are to ~~be received~~ until Oct. 3 by Maj. C. A. F. Flagler, Corps Engrs., U. S. A., Wilmington, Del., as advertised in The Engineering Record.

Camden, N. J.—See "Paving and Roadmaking."

Two Bridges, N. J.—It is stated that the deepening of the channel of the Passaic River, 25 ft. wide and 3 ft. deep on the left side of the river at Two Bridges, is contemplated. H. Brownlee, at Singac, may be able to give further information.

Governor's Island, N. Y. H., N. Y.—The following are the bids opened on Aug. 26 by Col. W. L. Marshall, Corps. Engrs., U. S. A., N. Y. City, for furnishing material and building an embankment at Governor's Island: (*a*) 485,000 cu. yds. (inner section) sand, stone, brick, earth, or any material which will make firm, solid land, which is not liable to wash away, decay, or give out offensive odors; (*b*) 830,000 cu. yds. same material, outer section; (*c*) 1,315,000 cu. yds., both sections: Henry Steers, Inc., 17 Battery Pl., N. Y. City, *a* 17 cts., *b* 22.6 cts., *c* 20.5 cts.. Morris & Cumings Dredging Co., 17 State St., N. Y. City, *c* 26 cts.; U. S. Dredging & Contr. Co., Jersey City, N. J., *a* 35 cts., *b* 33 cts., *c* 27.3 cts.; Chas. A. Brown, 129 Broad St., N. Y. City, *a*, *b* and *c* 25 cts.

Stapleton, S. I., N. Y.—Chas. H. Peckworth, submitted the only bid on Aug. 29 to Comr. of Docks, N. Y. City, for furnishing material and building structures and appurtenances, etc., on the pier at Canal St., Stapleton, Boro. of Richmond, and it was rejected Sept. 3.

Ellis Island, N. Y. H., N. Y.—Bids will be received by Robt. Watchorn, Comr. of Immigration, Ellis Island, N. Y. H., until Sept. 19, for the installation of wharf drop and apron bridge at landing of ferry steamer "Ellis Island," Barge Office, New York City.

Albany, N. Y.—It is stated that in about one month bids for 2 contracts on the barge canal for the division between Rochester and Lockport will be asked by the State Engineer, John P. Kelly, of Rochester, Div. Engr.

New York, N. Y.—Bids will be received until Sept. 23 by Col. John G. D. Knight, Corps Engrs., U. S. A., New York, for furnishing rubble stone and quarry spalls for constructing and repairing dikes in Hudson River, N. Y., as advertised in The Engineering Record.

**Cincinnati, O.*—The National Concrete Co. is stated to have secured the contract to construct a retaining wall at the Beargrass Creek cut-off, at $5,610.

Panama.—Bids will be received until Oct. 5 at the office of H. F. Hodges, General Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing the following: Steel racks for steam shovels, asbestos cement, wire, machine bolts, hydraulic jacks, vacuum gauges, etc., as advertised in The Engineering Record.

*The Isthmian Canal Comn. at Washington, D. C., it is reported, has announced that the contract to furnish 500 dump cars for use on the Isthmus, has been awarded

**Items marked thus give the names of parties awarded contracts.*

to the W. J. Oliver Mfg. Co., of Knoxville, Tenn., at $562,500.

Providence, R. I.—Bids opened Sept. 4 by Lieut. Col. J. H. Willard, Corps. Engrs., U. S. A., Newport, for dredging in Providence Harbor (680,000 cu. yds.), were as follows (price given per cu. yd.): Maritime Dredging Co., New York City, 12.5 cts.; Atlantic Dredging Co., New York City, 08.7 cts.; Columbia Dredging Co., New York City, 07.94 cts.; John A. Seeley, New York City, .14 cts.; P. Sanford Ross, Jersey City, 08.9 cts.; J. S. Packard Dredging Co., Providence, R. I., 07.3 cts.

Norfolk, Va.—The following are the bids opened Sept. 4 by Maj. Jos. E. Kuhn, Corps. Engrs., U. S. A., for dredging harbor at Norfolk, in all about 426,800 cu. yds.: (*a*), Sect. "A"; (*b*), Sect. "B"; (*c*), Sect. "C"; (*d*), Sect. "D" (price given being per cu. yd.): River & Harbor Improv. Co., Philadelphia, Pa., *a*, 14 cts.; *b*, $1.50; *c*, 13.8 cts.; *d*, 25 cts.; L. M. Lewis, Norfolk, Va., *a*, 10.8 cts.; *b*, $4; *c*, 11.5 cts.; *d*, 16.5 cts.; Coastwise Dredging Co., Norfolk, Va., *a*, 10.7 cts.; *b*, $4; *c*, 10.3 cts.; *d*, 18 cts.; Norfolk Dredging Co., Norfolk, Va., *a*, 9.4 cts.; *b*, $1.75; *c*, 10.4 cts.; *d*, 21.5 cts.

Irvington, Va.—The Government, it is stated, will this fall commence dredging the mouth of Carters' Creek, near the mouth of the Rappahannock River, so as to widen and deepen the channel through the bar just outside the mouth. The depth is to be made 15 ft. at low water and the width will not exceed 200 ft., except at the angles. The cut will be 2,000 ft. long. The estimated amount of dredging is about 28,000 cu. ft., at a cost of about $7,000. Urbanna Creek, 8 miles above, will also be dredged this winter, the channel through the shoal within the creek to be the depth of 10 ft. at low water and a width of 150 ft. except near the steamboat wharf, where it will be widened out to a maximum width not to exceed 400 ft. to form a turning basin; the length of the channel to be about 2,000 ft. Estimated amount of dredging to be 20,000 cu. ft. at a cost of $4,000.

Milwaukee, Wis.—City Engr. Poetsch is said to be agitating the question of widening the channel of the Milwaukee River between the Grand Ave. and Michigan Ave. Bridges.

Two Rivers Harbor, Wis.—The following are the bids opened Sept. 3 by Maj. W. V. Judson, Corps. Engrs., U. S. A., Milwaukee, for removing old pier, building pile pier, dredging, etc., at Two Rivers Harbor, Wis.: (*a*) Greiling Bros., Green Bay, Wis.; (*b*) August Rieboldt & Jos. Wolter, Sturgeon Bay, Wis.: Remov. 600 lin. ft. old pier, *a* $21, *b* $12; 12,600 lin. ft. round piles, *a* 35 cts., *b* 28 cts.; making 200 M ft. B. M. sheet piles of plank, furnished by U. S., and driving same, per M ft. B. M., *a* $20, *b* $12; framing 160 M ft. B. M. timber, furnished by U. S., per M ft. B. M., *a* $20, *b* $12; 12,000 lbs. wrought iron or steel drift bolts, *a* 6 cts., *b* 5 cts.; 41,250 lbs. wrought iron or steel screw bolts and tie-rods, *a* 6 cts., *b* 6 cts.; 4,000 lbs. wrought iron and wire spikes, *a* 6 cts., *b* 5 cts.; 7,000 tons of stone, per ton of 2,000 lbs., *a* $1.90, *b* $1.20; dredging 150,000 cu. yds., *a* 16 cts., *b* 11.5 cts.; total, *a* $64,945, *b* $43,680.

**Ottawa, Ont.*—It is reported that a contract for construction work on the Trent Valley Canal (Rice Lake Div., Sect. 5) has been awarded to Brown & Aylmer, at about $550,000; bids received Aug. 7.

PROPOSALS OPEN.

For Proposals see pages 66, 67, 68 and 71.

WATER.

Bids Close. — See Eng. Record.

Sep. 17. Pipe exten., Philadelphia, Pa.........Aug. 31
Sep. 19. Water main, valves, etc., Charlotte, N. C.Sep. 14
Sep. 20. Water works, Canon City, Colo.......Aug. 31 Adv. Sep. 7, 14.
Sep. 20. Reservoir, pipe line, etc., Canon City, Colo. Adv. Sep. 7.........Sep. 7
Sep. 20. Berlin, Md. Adv. Sep. 14.........Sep. 14
Sep. 20. Water work, Elkins, W. Va.........Sep. 14
Sep. 21. Well, Catoosa Springs, Ga.........Sep. 14
Sep. 25. Well, Summit, N. J. ....Sep. 14
Sep. 25. Dam, Rome, N. Y.........Sep. 7 Adv. Sep. 7, 14.
Sep. 25. Water wks., Highlands, N. J.........Sep. 7
Sep. 25. Tank, etc., for pump. plant, Ft. Morgan, Ala. ....Sep. 14
Sep. 26. Reservoir, Ft. Barrancas, Fla. ....Sep. 7
Sep. 27. Storage basin, Madison, Wis.........Sep. 14 Adv. Sep. 14.
Sep. 27. Artesian well, Madison, Wis.........Sep. 14 Adv. Sep. 14.
Sep. 28. Water wks., Manassas, Va.........Sep. 7
Sep. 30. Boiler and pump engine, Los Angeles, Cal. Adv. Aug. 31, Sep. 7.........Aug. 31
Sep. 30. Pipe, Los Angeles, Cal. Adv. Aug. 31..Aug. 31
Sep. 30. Filters, Wilmington, Del.........Sep. 7 Adv. Sep. 7, 14.
Sep. —, Improv. Plant, Phoenix, Ariz.........Sep. 7
Oct. 1. Mains, Harrison, N. J.........Sep. 14
Oct. 9. Pump house, Ft. Caswell, N. C.......Sep. 14 Adv. Sep. 14.
Oct. 10. Water improv., Ft. Du Pont, Del......Sep. 14 Adv. Sep. 14.
Oct. 23. Filters, Atlanta, Ga. Adv. Sep. 14....Sep. 14
———. Extension to water system, Fairhaven, Vt. ....Sep. 14

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 17. Philadelphia, Pa. ....Aug. 31
Sep. 17. South Orange, N. J. ....Aug. 31 Adv. Aug. 31, Sept. 7, 14.
Sep. 17. Trenton, N. J. ....Sep. 14
Sep. 17. Summit, N. J. ....Sep. 14
Sep. 17. Camden, N. J.........Sep. 14
Sep. 18. Portland, Me. ....Sep. 7
Sep. 18. Brooklyn, N. Y.........Sep. 7
Sep. 18. Oakland, Cal. ....Sep. 7
Sep. 18. Rochester, N. Y. ....Sep. 14
Sep. 18. Peoria, Ill. ....Sep. 14
Sep. 18. St. Charles, Ill. ....Sep. 14
Sep. 18. Westfield, Mass. Adv. Sep. 14.........Sep. 14
Sep. 18. Nampa, Idaho ....Sep. 14
Sep. 19. Togus, Me. Adv. Aug. 31, Sep. 7....Aug. 31
Sep. 19. Canton, Miss. ....Sep. 7
Sep. 19. Ft. Wayne, Ind. ....Sep. 14
Sep. 19. Woonsocket, R. I. Adv. Sep. 14......Sep. 14
Sep. 20. Omaha, Neb. ....Sep. 14
Sep. 20. Lakewood, O. ....Sep. 14
Sep. 21. Aurora, Neb. Adv. Sep. 7.........Sep. 7
Sep. 21. Hamilton, O. ....Sep. 7
Sep. 23. Flushing, N. Y. ....Sep. 14
Sep. 25. Richmond, Ind. ....Sep. 14
Sep. 27. Delaware, O. ....Sep. 7
Sep. 27. Great Lakes, North Chicago, Ill....Sep. 14
Sep. 30. Fairfield, Cal. ....Aug. 31
Sep. 30. Washington, D. C. Adv. Sep. 14....Sep. 14
Sep. 30. Steubenville, O. ....Sep. 14
Oct. 1. Billings, Mont. ....Sep. 7
Oct. 1. Paducah, Ky. Adv. Sep. 7, 14.........Sep. 7
Oct. 1. Cadillac, Mich. ....Sep. 14
Oct. 1. Newark, N. Y. ....Sep. 14
Oct. 3. Ft. Dade, Fla. ....Sep. 14
Oct. 10. Ft. Du Pont, Del. Adv. Sep. 14....Sep. 14
Oct. —. Eaton, O. ....Aug. 3

BRIDGES.

Sep. 17. Springfield, Mass. ....Sep. 14
Sep. 17. Boston, Mass. ....Sep. 14
Sep. 18. Ft. Wayne, Ind. ....Sep. 14
Sep. 20. Cincinnati, O. ....Sep. 7
Sep. 20. Tiffin, O. ....Aug. 31
Sep. 20. Greeley, Colo. ....Aug. 31
Sep. 23. Newark, O. ....Aug. 31
Sep. 23. Bay City, Mich. Adv. Sep. 7, 14.....Sep. 7
Sep. 24. Alamosa, Colo. ....Sep. 14
Sep. 30. Santiago, Chile ....Jul. 13
Sep. 30. Lancaster, Pa. ....Sep. 14
Sep. —. Caldwell, Idaho.........Aug. 31
Oct. 3. Fergus Falls, Minn. ....Sep. 14
Oct. 14. Los Angeles, Cal.........Sep. 7 Adv. Sep. 7, 14.
Oct. 14. Fredericton, N. B. ....Sep. 14
Oct. 19. Canton, China. Adv. Aug. 24 to Sep. 7.Aug. 24

PAVING AND ROAD MAKING.

Sep. 17. Logansport, Ind. ....Sep. 7
Sep. 17. Hampstead, N. H. ....Sep. 7
Sep. 17. Billings, Mont. Adv. Sep. 7.........Sep. 7
Sep. 17. Boston, Mass. ....Sep. 14
Sep. 17. Milwaukee, Wis. ....Sep. 14
Sep. 17. Trenton, N. J. ....Sep. 14
Sep. 17. Eveleth, Minn. ....Sep. 14
Sep. 17. Parnassus, Pa. ....Sep. 14
Sep. 17. Waseca, Minn. ....Sep. 14
Sep. 17. Shelbyville, Ind. ....Sep. 14
Sep. 17. Camden, N. J. ....Sep. 14
Sep. 17. Hamden, Conn. ....Sep. 14
Sep. 17. Uniontown, Pa. ....Sep. 14
Sep. 18. Lancaster, Pa. ....Sep. 7
Sep. 18. Brooklyn, N. Y. ....Sep. 7
Sep. 18. Cincinnati, O. ....Sep. 7
Sep. 18. St. Joseph, Mich. ....Sep. 7
Sep. 18. Quincy, Ill. Adv. Sep. 14.........Sep. 14
Sep. 18. Philadelphia, Pa. ....Sep. 14
Sep. 19. Cincinnati, O. ....Sep. 7
Sep. 19. Des Moines, Ia. ....Sep. 14
Sep. 19. Ft. Wayne, Ind. ....Sep. 14
Sep. 20. Cincinnati, O. ....Aug. 31
Sep. 20. Rockville, Ind. ....Aug. 31
Sep. 20. Cleveland, O. ....Aug. 31
Sep. 20. Buffalo, N. Y. ....Sep. 14
Sep. 20. Frankfort, Ind. ....Sep. 14
Sep. 20. Dallas, Tex. ....Sep. 14
Sep. 20. Allenstown, N. H. ....Sep. 14
Sep. 21. Cleveland, O. ....Aug. 31
Sep. 21. Hamilton, O. ....Sep. 7
Sep. 21. Washington, D. C.........Sep. 7 Adv. Sep. 7.
Sep. 21. Des Moines, Ia. ....Sep. 14
Sep. 21. Ft. Williams, Me. Adv. Sep. 14.......Sep. 14
Sep. 21. Ottawa, O. ....Sep. 14
Sep. 21. Racine, Wis. ....Sep. 14
Sep. 21. Silverton, O. ....Sep. 14
Sep. 24. Lebanon, Ind. ....Aug. 24
Sep. 24. Woodcliff Lake, N. J.........Sep. 7 Adv. Sep. 7, 14.
Sep. 26. Danville, Ill. ....Sep. 7
Sep. 26. New York, N. Y. ....Sep. 14
Sep. 28. Manassas, Va. ....Sep. 7
Sep. 28. Vincennes, Ind. ....Sep. 14
Oct. 1. Billings, Mont. (2 props.) ....Sep. 7 Adv. Sep. 7, 14.
Oct. 1. Durham, N. C. ....Sep. 14
Oct. 7. Hartford City, Ind.........Sep. 14
Oct. 7. Decatur, Ind. ....Sep. 14
Oct. 8. Vincennes, Ind. ....Sep. 14
Oct. 12. Riverton, Ala. Adv. Sept. 14.........Sep. 14
Oct. 14. Sunman, Ind. ....Sep. 14
Oct. —. Selma, Ala. ....Sep. 7
Dec. 13. Valparaiso, Ind. ....Sep. 7
———. York, Pa. ....Sep. 7

POWER PLANTS, GAS AND ELECTRICITY.

Sep. 17. Columbus, O. ....Aug. 24
Sep. 17. Washington, D. C. ....Aug. 31
Sep. 17. Wyandotte, Mich. Adv. Sep. 7, 14....Sep. 7
Sep. 17. Jacksonville, Ill. ....Sep. 14
Sep. 20. Lancaster, Pa. ....Aug. 31
Sep. 20. St. Louis, Mo. ....Sep. 14
Sep. 20. Water works franchise, Berlin, Md....Sep. 14 Adv. Sep. 14.
Sep. 23. Elkins, W. Va. ....Sep. 14
Sep. 23. New York, N. Y.........Sep. 14
Sep. 28. Manassas, Va. ....Sep. 7
Sep. 30. Revelstoke, B. C.........Sep. 7
Sep. 30. Rochester, N. Y. ....Aug. 31
Sep. 30. New London, Conn. Adv. Sep. 7, 14...Sep. 7
Sep. 30. West Point, N. Y.........Aug. 31 Adv. Aug. 31, Sep. 7.
Oct. 1. Winnipeg, Man. Adv. Aug. 31, Sep. 7.Aug. 31
Oct. 4. Jacksonville, Fla. ....Aug. 31
Nov. 1. Seymour, Ind. ....Sep. 14
Nov. 15. Charleston, S. C. ....Sep. 14

BUILDINGS.

Sep. 17. School, Galt, Ont. ....Sep. 7
Sep. 17. U. S. Mint bldg. repairs, San Francisco, Cal. ....Aug. 10
Sep. 17. Univ. bldg., Lawrence, Kan. ....Aug. 24
Sep. 17. Htg. school, Columbus, O.........Aug. 31
Sep. 17. Bus. bldgs., Kankakee, Ill.........Aug. 31
Sep. 17. School, Valley City, N. D.........Aug. 31
Sep. 17. Pub. bldg., Las Animas, Colo.........Aug. 31
Sep. 17. Pub. bldgs., Norfolk, Va. ....Sep. 7
Sep. 17. School, Tomahawk, Wis. ....Sep. 7
Sep. 17. School, Montclair Heights, N. J......Sep. 7 Adv. Sep. 7, 14.
Sep. 17. Htg. hospital, Natchez, Miss.........Sep. 14
Sep. 17. Htg. school, Washington, D. C.........Sep. 14
Sep. 17. School, Faribault, Minn. ....Sep. 14
Sep. 18. School, Agricultural College, Mich...Sep. 7
Sep. 18. Pub. Bldg., Kincardie, Ont.........Sep. 7
Sep. 18. Pub. Bldg., Cincinnati, O.........Sep. 7
Sep. 18. School, Delavan, Wis. ....Sep. 14
Sep. 18. School, Sheraden, Pa. ....Sep. 14
Sep. 18. Add. to pub. bldg., Chicago, Ill.........Sep. 14
Sep. 19. Post office, Muscatine, Ia. ....Aug. 10
Sep. 19. Htg. pub. bath, Chicago, Ill.........Sep. 14
Sep. 19. Add. to hospital, Norristown, Pa.......Sep. 14
Sep. 20. School, Lancaster, Pa. ....Aug. 31
Sep. 20. Church, Mitchell, S. D.........Sep. 7
Sep. 20. Htg. hospital, St. Louis, Mo.........Sep. 14
Sep. 20. Htg. almshouse, Paterson, N. J.......Sep. 14
Sep. 20. Pub. bldg., Mt. Vernon, Mo.........Sep. 14
Sep. 21. Pub. bldg., Portsmouth, N. H.........Aug. 31
Sep. 23. Post office exten., Cedar Rapids, Ia...Aug. 10
Sep. 23. Htg. City Hall, Little Rock Ark. ......Sep. 14
Sep. 23. School, Latta, S. C. ....Sep. 7
Sep. 23. Pub. bldg., Takoma, Washington, D. C..Sep. 14
Sep. 24. Post office bldg., Hamilton, O. ....Aug. 17 Adv. Aug. 17 to 24.
Sep. 24. Pub. bldg., Danville, Pa.........Sep. 7 Adv. Sep. 7, 14.
Sep. 25. New indus. plants, Ft. Morgan, Ala..Sep. 14
Sep. 26. Court house, Muscatine, Ia. ....Aug. 24
Sep. 26. School, Riverside, Cal. ....Aug. 31
Sep. 26. New Industrial plants, Riverside, Cal..Aug. 31
Sep. 26. School, Brookings, S. D.........Aug. 31
Sep. 26. Pub. bldg., National Soldiers' Home, Va. ....Sep. 7
Sep. 27. Pub. bldg., Pittsburg, Pa.........Sep. 14
Sep. 27. School, Hesperus, Colo. ....Sep. 7
Sep. 30. Bus. bldg. plans, Harrisburg, Pa....Aug. 3
Sep. 30. Post office, Selma, Ala.........Aug. 24
Sep. 30. Church, Vincennes, Ind. ....Sep. 14
Sep. 30. Pub. bldg., West Haverstraw, N. Y....Sep. 14
Sep. —. Hotel, New Orleans, La. ....Jun. 29
Oct. 1. Bus. bldg., Decatur, Ill.........Aug. 31
Oct. 1. Pub. bldg., Eau Claire, Wis.........Aug. 31
Oct. 1. Y. M. C. A., Indianapolis, Ind.........Aug. 31
Oct. 1. Plumbg. pub. bldg., Portland, Me.....Sep. 7
Oct. 1. Church, Indianapolis, Ind. ....Sep. 7
Oct. 3. Court house plans, La Moure, N. D..Aug. 10
Oct. 3. School, Bayonne, N. J. ....Sep. 7
Oct. 5. Htg. Plant at Naval Station, New Orleans, La.........Sep. 7
Oct. 7. U. S. Post Office improv., Baltimore, Md.Aug. 31 Adv. Aug. 31, Sep. 7.
Oct. 7. Pub. bldg., Ft. Slocum, N. Y.........Sep. 14 Adv. Sep. 14.
Oct. 12. Hospital, Whipple Barracks, Ariz.....Sep. 14 Adv. Sep. 14.
Oct. 14. School, San Diego, Cal.........Sep. 14
Oct. 15. Court house plans, De Pere, Wis. ....Aug. 17
Oct. 16. Exten. post office, Springfield, O.......Sep. 14
Oct. 17. Pub. bldg., Peoria, Ill. ....Sep. 7
Oct. 18. School, Montevallo, Ala. ....Sep. 14
Oct. 21. Post office, Des Moines, Ia.........Sep. 7 Adv. Sep. 7, 14.
Nov. 5. Court house plans, Houston, Tex......Aug. 31 Adv. Sep. 14.
Dec. —. Industrial plants, Ft. William, Ont...May 11
———. School, bldg. material, Lawrence, Kan.Aug. 31
———. Post office, Hamilton, O. ....Sep. 14

MISCELLANEOUS.

Sep. 17. Lumber, etc., New Orleans, La.........Aug. 24
Sep. 17. Supplies, Washington, D. C.........Aug. 31
Sep. 17. Grading, Gt. Lakes, N. Chicago, Ill..Sep. 7
Sep. 17. Supplies, Washington, D. C. ....Sep. 14
Sep. 18. Dredging, Washington, D. C.........Aug. 24 Adv. Aug. 24 to Sep. 14.
Sep. 18. Steam shovels, etc., Panama.........Aug. 24
Sep. 18. Concrete ditch, Roswell, N. M.........Aug. 31
Sep. 19. Dredging, etc., Gardiner, Me.........Aug. 24 Adv. Aug. 24 to Sep. 14.
Sep. 19. Removal of wreck, Boston, Mass.......Aug. 24 Adv. Aug. 24 to Sep. 14.
Sep. 19. Removal of wreck, Salisbury, Mass.....Aug. 31
Sep. 19. Ditch, Boone, Ia. ....Sep. 14
Sep. 19. Wharf drop, etc., Ellis Island, N. Y...Sep. 14
Sep. 19. Levee, New Orleans, La. ....Sep. 7
Sep. 20. Ditch, Dakotah, Ia. ....Sep. 14
Sep. 20. Repairing dam, Indianapolis, Ind......Sep. 14
Sep. 23. Dikes, New York, N. Y. Adv. Sep. 14..Sep. 14
Sep. 23. Dredging, Saginaw, Mich. ....Sep. 14
Sep. 24. Dredging, Wheeling, W. Va.........Aug. 31
Sep. 25. Steam shovels, etc., Panama.........Aug. 31 Adv. Aug. 31.
Sep. 25. Subway, Reading, Pa.........Sep. 7 Adv. Sep. 7, 14.
Sep. 26. Wharf, Ft. Du Pont, Del.........Aug. 31 Adv. Aug. 31 to Sep. 14.
Sep. 26. Dredging, San Francisco, Cal. ....Sep. 7
Sep. 26. Garb. disposal, Newark, N. J.........Sep. 14 Adv. Sep. 14.
Sep. 27. Ditch, Cerro Gordo, Ill. ....Sep. 14
Sep. 28. Steel barges, Panama.........Sep. 7
Sep. 28. Wharf, Ft. Winfield Scott, Cal.......Sep. 14
Sep. 30. Searchlight outfit, Washington Barracks, D. C. ....Aug. 3
Sep. 30. Dredge, Cincinnati, O.........Aug. 31 Adv. Aug. 31 to Sep. 14.
Sep. 30. Dredging, Saugerties, N. Y.........Aug. 31 Adv. Aug. 31 to Sep. 14.
Sep. 30. Dredge, Philadelphia, Pa.........Sep. 7 Adv. Sep. 7, 14.
Sep. 30. Dredging, Boston, Mass.........Sep. 7 Adv. Sep. 7, 14.
Sep. 30. Ditch, Charleston, Miss. ....Sep. 14
Oct. 1. Snag boat, Mobile, Ala.........Sep. 7 Adv. Sep. 7, 14.
Oct. 3. Jetty work, Cold Springs, N. J........Sep. 7 Adv. Sep. 7, 14.
Oct. 5. Lock and dam, Franklin, Ark.........Aug. 10 Adv. Aug. 10 to 31.
Oct. 5. Lock and dam, Mobile, Ala.........Aug. 10 Adv. Aug. 10 to Sep. 14.
Oct. 5. Supplies, Panama. Adv. Sep. 14......Sep. 14
Oct. 7. Excav., Detroit, Mich. ....Aug. 31 Adv. Aug. 31 to Sep. 14.
Oct. 8. Dredging, Detroit, Mich. ....Aug. 31 Adv. Aug. 31 to Sep. 14.
Oct. 9. Dredging, Jacksonville, Fla.........Sep. 14 Adv. Sep. 14.
Oct. 10. Canal wk., Peterboro, Ont.........Aug. 24
Oct. 10. Rock removal, etc., Jacksonville, Fla...Sep. 14 Adv. Sep. 14.
Oct. 10. Jetty work, Washington, D. C.........Sep. 14 Adv. Sep. 14.
Oct. 12. Riprap, Riverton, Ala. Adv. Sep. 14...Sep. 14
Oct. 15. Cement, stone, etc., Honolulu, H. I....Aug. 31 Adv. Aug. 31 to Sep. 14.

CURRENT NEWS SUPPLEMENT

SEPTEMBER 21, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York. Annual Convention, Atlantic City, N. J., Oct. 14-18.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

SUGGESTED RULES FOR REINFORCED CONCRETE.

The Concrete Association of America recently submitted to the Building Code Revision Commission of New York City a proposed code of regulation. This was prepared by a special committee consisting of Messrs. H. C. Turner, E. O. Ellinger, F. G. Weber, A. Atkinson, W. N. Hazen, F. P. Kafka, R. L. Bertine and R. F. Tucker, and reads as follows:

1. Reinforced concrete construction shall be understood to mean an approved concrete mixture reinforced by steel of any shape, the two materials to be so combined that the concrete will take up the compression stresses and the steel the tension stresses and assist the concrete in shear and compression.

2. Reinforced concrete construction when designed in accordance with this code shall be approved for fireproof construction.

3. Before permission to erect any reinforced concrete structure shall be granted, complete drawings and specifications must be filed by the architect or engineer representing the owner with the Superintendent of Buildings, showing all construction details, including dimensions of concrete and the sizes and position of all reinforcing members.

4. The concrete shall be mixed in the proportions of not less than one part of cement by volume to seven parts of aggregates by volume, consisting of sand and broken stone or gravel. The proportions shall be such that the resistance of the concrete to crushing shall not be less than 2,000 lb. per square inch after hardening for 28 days. Tests to determine this value shall be made from time to time by a competent engineer under the direction of the Bureau of Buildings. The concrete used in reinforced concrete construction shall be what is usually known as a "wet" mixture.

5. All cement used in reinforced concrete construction shall be a Portland cement conforming to the standard specifications of the American Society for Testing Materials and shall be tested by an independent chemist not in the employ of the cement manufacturer. Records of these tests shall be kept on file in the contractor's office.

6. All sand used in reinforced concrete construction shall be clean and sharp, free from loam, dirt or other injurious material, and shall not be finer than the standard sample in the office of the Bureau of Buildings.

7. All stone used in reinforced concrete construction shall be clean, broken trap rock, or gravel, and shall not be of a size larger than can be easily worked or tamped around the reinforcing members. In case it should be desired to use any other material or kind of stone than specified above, samples of same shall first be submitted to and have the approval of the Superintendent of Buildings.

8. Steel for reinforced concrete construction shall have an elastic limit of at least 30,000 lb. per square inch, and an ultimate strength of at least 60,000 lb. per square inch, and shall be of uniform quality. Samples cut from any bar, shall be capable of bending cold 180 deg. around a bar of equal diameter without signs of fracture.

If twisted, corrugated, diamond or other mechanical bond bars are used, such bars may be stressed in tension to 16,000 lb. per square inch or to one-third of their elastic limit; in shear to 10,000 lb. per square inch, and in compression to twelve times the compression stress in concrete.

9. All steel reinforcement shall be completely incased in the concrete, and in beams, girders, columns and walls the steel shall not be nearer the surface than 1½ in. In floor and roof slabs the steel shall not be nearer the surface than ¾ in. for bars having a diameter of ½ in. or less. Where larger bars are used in floor or roof slabs, the steel shall not be nearer the surface than 1 in.

Where the number of bars used in a beam or girder cannot be placed in one plane they shall be placed in two or more planes.

In reinforced concrete footings the steel shall not be nearer the surface than 3 in.

10. Reinforced concrete shall be so designed that the stresses in the concrete and steel shall not exceed the following limits:

	Lb. per sq. in.
Extreme fibre stress on concrete in compression	600
Shearing stress in concrete	100
Concrete in direct compression	500
Tensile stress in steel	16,000
Shearing stress in steel	10,000

Compressive stress in steel 12 times the compressive stress in the concrete.

11. The adhesion of concrete to steel shall be assumed to be not greater than the shearing strength of the concrete.

12. The ratio of the moduli of elasticity of concrete and steel shall be taken as 1 to 12.

13. The following assumption shall guide in the determination of the bending moments due to the external forces. Beams and girders and floor slabs may be considered as continuous, where proper provision for continuity is made in the design. The bending moment for uniformly distributed loads being taken at not less than $WL/10$. In the case of square floor plates which are reinforced in both directions and supported on all sides the bending moment may be taken at $WL/20$.

In figuring T beams the width of the floor slab to be considered as part of the beam or girder shall be determined by the shearing resistance of the slab along the beam, but in no case shall the width of the floor slab so considered exceed the distance between beams and provided also that the beam or girder and slab shall be built at the same time as a unit.

14. The amount of resistance of reinforced concrete construction in transverse loads shall be determined by formula based on the following assumptions:

(a) The bond between the concrete and steel is sufficient to make the two materials act together as a homogeneous solid.

(b) The strain in any fibre is directly proportionate to the distance of that fibre from the neutral axis.

(c) The modulus of elasticity of the concrete remains constant within the limits of the working stresses fixed in these Regulations.

From these assumptions it follows that the stress in any fibre is directly proportionate to the distance of that fibre from the neutral axis.

The tensile strength of the concrete shall not be considered.

15. When the shearing stresses developed in any structural member of reinforced concrete construction shall exceed the safe working strength of the concrete, as fixed in these Regulations, a sufficient amount of steel shall be introduced in such positions that the deficiency in the resistance to shear shall be provided for.

16. When the safe limit of adhesion between the concrete and steel is exceeded, some provision must be made for transmitting stresses from the concrete to the steel.

17. Reinforced concrete may be used for columns and their strength determined as follows:

The concrete within the steel ties or hoops may be stressed in compression to 500 lb. per square inch. No allowance shall be made for the concrete outside of the hoops or ties and serving the purpose of fireproofing. Vertical steel bars may be placed in the concrete and if substantially tied together by steel bars at intervals of not more than the least side or diameter of the column may be stressed in compression to twelve times the compressive stress in the concrete. These rods shall be joined immediately above the floor line or at points of lateral support. They shall have full perfect bearings and be connected by tight fitting sleeves or the ends may be threaded and connected by standard sleeve nuts.

In concrete columns with vertical reinforcement the total cross section of vertical steel shall not be less than ½ of 1 per cent. of the cross section of the concrete within the hoops or ties, but in no case shall this amount be less than 1 square inch.

Concrete columns reinforced by spirally wound hoops of steel shall be designed in accordance with the following formula:

$P = [1.5\ fc + (3\ fs' \times As') \div r]\ Ac. + fs'\ As'.$

Where P = working load in pounds.

fc = 500 pounds.

fs' = 20,000 lb. for cold drawn wire.

fs = 6,000 lb. on vertical steel.

Ac = area concrete inside of hoops.

As = area of vertical steel.

As' = area of spirals per unit of column length.

r = radius of spirals in inches.

Minimum amount of spiral steel shall be such that $(fs' \times As') \div r$ shall not be less than 75 pounds.

For columns with length greater than 12 times the least diameter the value of fc to be used in the above formula shall be reduced.

The hoops shall not be spaced closer together than 1½ in., nor further apart than one-seventh of the diameter of the spiral. In no case shall the total cross section of vertical steel be less than 1 per cent. of the cross section of the concrete within the spiral.

Additional reinforcement or reduction in the compressive stress on the concrete shall be made for columns eccentrically loaded.

18. Spandrel walls supported entirely on reinforced concrete wall girders and extending from the floor line to the window sill shall have a minimum thickness of 8 in. and shall be reinforced with not less than ½ lb. of steel per square foot of wall.

Inclosure walls of skeleton buildings built in between columns and supported entirely on reinforced concrete girders shall have a minimum thickness of 8 in. for 40 ft. of the uppermost height thereof or the nearest tier of beams to that measurement. For each additional 30 ft. of height or to the nearest tier of beams to that measurement the thickness of the wall shall be increased 1 in. Basement walls shall be at least 2 in. thicker than the walls immediately above. All such inclosure walls shall be reinforced with not less than ¾ lb. of steel per square foot of wall. All window or door openings shall be reinforced with steel on the sides and at the top and bottom in addition to the steel specified above. Where walls are required to meet special conditions the thickness and the amount of reinforcement shall be determined by such conditions.

Parapet walls shall have a minimum thickness of 6 in. and shall be reinforced with not less than ½ lb. of steel per square foot of wall.

Inclosure walls for one-story storage or factory buildings shall have a minimum thickness of 4 in. and shall be reinforced with not less than ½ lb. of steel per square foot of wall.

19. Partitions required by the Code to be fireproof may be constructed of reinforced concrete and shall

have a minimum thickness of 3 in., and shall be reinforced with not less than ¼-in. rods on 12-in. centers, running both vertically and horizontally.

20. Reinforced concrete construction may be continued during freezing weather provided all frost is eliminated from the sand and broken stone by artificial heat and provided also that the work is protected from the weather by canvas or similar means and artificial heat supplied to prevent the concrete from freezing prior to taking its final set.

21. The contractor must be prepared to make load tests on any portion of reinforced concrete construction within reasonable time after erection. The tests must show that the construction will sustain a load of twice the live load for which the section was designed without any sign of failure.

THE CONCOURSE FLOOR OF THE HUDSON TERMINAL BUILDING, NEW YORK.

The concourse floor of the Hudson Company's Terminal Building in New York City is shown in the accompanying illustrations. It is of concrete steel construction, the reinforcing material being Ferroinclave sheets made by the Brown Hoisting Machinery Co., of Cleveland. In constructing this floor, the arch Ferroinclave sheets were laid on the bottom webs of the beams. The corrugations upon the upper side were then covered with a mixture of one part of Portland cement to 2½ parts of sand, and the concrete was placed on this. The minimum thickness of the floor at the crown was not less than 11 in., but, owing to the various depths of the beams, it was thicker than this in some places. The spacing of the beams varied considerably, and, in some cases, the beams were not parallel, but this was readily taken care of by beveling the ends of the Ferroinclave sheets. The under side of the Ferroinclave sheets was covered with concrete, so that they are entirely protected. The bottom flanges of the beams are covered with wire netting and then encased in concrete.

The great advantages claimed for this type of floor are that no centering is required, and thus no valuable space is taken up by it, and the work underneath or above the floor is not interfered with, and also that it is very quickly erected. The tie rods are above the tops of the Ferroinclave sheets, and thus encased in the concrete.

AN INVESTIGATION OF STEEL CONDUITS FOR WIRING.

The use of both rigid and flexible steel conduits for wiring installations has increased very rapidly in the last few years. The value of this form of raceway for electrical conductors has become well established and, while the manufacturing industries concerned with the production of conduit and its peculiar fittings have been developing the material, the experience of inspectors and users has elaborated a fairly satisfactory body of rules and a standard of workmanship. In the process of this development, although certain rules and practices have become well established, it is still true that there remain some points not yet definitely settled.

The Underwriters' Laboratories, 382 Ohio St., Chicago, is now inviting suggestions concerning these points from persons whose experience either as inspectors of electrical installations, as manufacturers of conduit and conduit fittings, or as contractors or users of these materials, qualifies them to give valuable information. It is hoped that from the results of experience thus obtained, some useful suggestions may be collected which will both record in what respects and in what measure present practice is satisfactory, and will also indicate in what particulars and by what means further improvements may be secured.

The Laboratories are sending out certain questions concerning conduit work and request detailed replies to the inquiries it contains. These replies will have value whether they furnish evidence that no considerable changes are needed or whether they point out defects either with or without suggestions for remedying them.

The questions are as follows

1. In what respects, if any, does the ordinary form of enamel on rigid conduit prove an unsatisfactory covering for the steel pipe?

2. Does galvanized rigid conduit possess advantages or disadvantages as compared with enameled conduit? If so, what and for what special uses?

The claim has been made that galvanized pipe in the presence of moisture, especially in concrete, suffers from "local action," a corrosion due to electrical action in the presence of the two metals and traces of acid. Well substantiated evidence of such effects is especially desired if the effect is known to have been observed.

Rule 25f of the National Board of Fire Underwriters reads: "Must have the metal of the conduit permanently and effectually grounded." It is essential that the metal of conduit systems be joined so as to afford electrical conductivity sufficient to allow the largest fuse or circuit breaker in the circuit to operate before a dangerous rise in temperature in the conduit system can occur. Conduits and gas pipes must be securely fastened in metal outlet boxes so as to secure good electrical connection. Where boxes used for centers of distribution do not afford good electrical connection, the conduits must be joined around them by suitable bond wires. Where sections of metal conduit are installed without being fastened to the metal structure of buildings or grounded metal piping, they must be bonded together and joined to a permanent and efficient ground connection.

3. Does the enamel ordinarily used on conduit and fittings (junction outlet and panel boxes) prevent or render difficult strict compliance with this rule of the National Electrical Code? If so, what commercially practicable means can be found for obtaining better conductivity?

At the meeting of the Underwriters' National Electrical Association in March, 1907, it was suggested that the following be added as a fine print note in Rules 24A, 25d, 25f, of the Code:

"It is recommended that galvanized cables, outlet boxes and fittings be used in order to secure a better electrical contact at all point throughout the cable system."

CONSTRUCTING FLOORS IN HUDSON COMPANY'S TERMINAL BUILDING.

It was also suggested that a note be added to Rule 49Ab to read:

"It is recommended that the protective coating (of switch and outlet boxes) be of metal such as tin or zinc."

These suggestions were referred to a special committee for consideration and report.

4. Definite information is desired as to the use of conduit in cement or concrete.

(a) Conditions liable to cause deterioration of conduit, either rigid or flexible in cement or concrete. See also Inquiry No. 2 above.

(b) Do flexible conduits or armored cables placed in wet concrete admit water to the interior while concrete is setting to a degree sufficient to cause trouble? If so, what precautions should be taken or what limitations should be placed to such use of flexible conduit or armored cables?

5. What injurious effects on exposed conduits are observed from the action of acid fumes and gases. In such cases what may be done to protect the conduits from rapid deterioration?

6. What added specifications for construction and installation of junction boxes should be made? See Code Rule 49A, which treats of Switch and Outlet Boxes, and Rules 25b and g.

What defects, if any, are found in present types of

(a) Ordinary conduit outlet boxes?

(b) Junction boxes?

(c) Grounding clamps?

(d) Fittings for use with flexible conduit and armored cables?

(e) Fittings for use with exposed rigid conduit such as "Condulets" and similar devices?

8. What other defects, not suggested above, have been noted in present forms of conduit or fittings? What means may be taken to correct such defects and what additions or revisions of the present Code rules on conduit are desirable?

The purpose of this inquiry is not to imply any doubt as to the large measure of fire protection afforded by steel conduits and their fittings, but rather to aid and encourage the development of these products which have already proved themselves of distinct benefit to the insurance interests.

COMMENTS OF WORKMEN REGARDING THE QUEBEC BRIDGE ACCIDENT.

On Sept. 13 two men at work on the traveler at the end of the Quebec Bridge at the time of its failure testified before the government investigating commission regarding their experience. One of them, Ingwall, stated that the traveler was hoisting a couple of timbers at the time of the accident. He was 10 ft. from the top of the traveler near the front, about 400 ft. above the water, and fell so fast that he hardly realized any details of what was happening. It seemed to him as if the bridge had just tipped. He never saw any defects in the structure, but had heard others talking about kinking in the bottom chord, and knew that some of the men had gone down to look at it the night before the accident.

Another survivor of the crew was D. B. Haley, president of the local bridge workers' union, who testified that he was on the extreme end of the traveler at the time of the accident. The cantilever arm seemed to fall first, and the other part afterward, a statement apparently inconsistent with the witnesses testimony that the first thing he knew after feeling himself falling was the sensation of being in the water. He testified that after working hours the day before the collapse he went down to see defects in the lower chord which had been reported among the men. Bends were to be seen at places in this chord in panels near the main pier, and the lattice bars were also buckled in places.

The brothers of Carl Swenson, one of the men killed in the accident, have given out for publication a letter in which the following statement was made by him: "I doubt very much whether the bridge will ever be finished, since the first and second panels of the bottom chord of the cantilever, Quebec side, are buckling." The authenticity of this letter is understood to be questioned by the bridge contractors.

The coroner's jury which heard the testimony concerning the death of one of the workmen, due to the accident, rendered a verdict on Sept. 12 that it was unable to ascertain the cause of the failure, but was of the opinion, according to the evidence adduced before it, that all desirable precautions had been taken.

Motor equipments for printing, electrotyping, stereotyping and binding machinery, are described in bulletin 229, recently issued by the Sprague Electric Co., of New York. The remarkable progress made in this direction is indicated by a list given of prominent printing, engraving and stereotyping plants equipped with Sprague motors.

PERSONAL NOTES.

Mr. J. F. Deimling has been appointed chief engineer of the Pere Marquette Railroad Co., succeeding Mr. E. K. Woodward, resigned.

Major E. Eveleth Winslow, Corps of Engineers, U. S. A., has been ordered to the office of the Chief of Engineers for temporary duty.

Prof. J. J. Flather, head of the mechanical engineering department of the University of Minnesota, has returned from a trip to Australia.

Mr. F. J. Seery, of Ithaca, N. Y., recently was appointed an assistant engineer in the office of the New York State Engineer and Surveyor.

Mr. Arthur Hay, civil engineer, Springfield, Ill., has been appointed engineer and general superintendent of the work of the Springfield Pleasure Driveway and Park Board.

Mr. William H. Newman, president of the New York Central & Hudson River R. R., returned to his office recently, after a vacation spent in France and Switzerland.

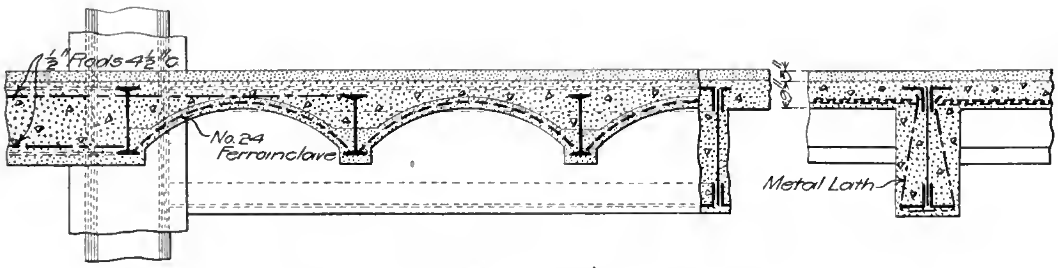
Dr. Rudolph Hering, consulting engineer, New York City, has been chosen by the Passaic Valley Sewage Commission to prepare plans for a trunk sewer to drain the Passaic Valley.

Winslow Allerdice, of New London, Conn., at one time an engineer in the United States Navy and later city engineer of Warren, Pa., died recently at his home in New London.

Prof. Robert Sibley, head of the engineering department of the University of Montana, has resigned to take charge of the installation and operation of a large hydraulic placer mining plant in Wyoming.

The United States Civil Service Commission will hold examinations in the large cities of the country, Oct. 23-24, of candidates for the position of architectural draftsman in the Immigration Service, Ellis Island, N. Y.

The New York State Civil Service Commission will hold examinations on October 12, of candidates for the position of assistant sanitary engineer, State Health Department. Full information with application forms may be obtained by addressing the Chief Examiner of the Commission at Albany.



FLOOR SYSTEM, HUDSON COMPANY'S TERMINAL BUILDING.

The Province of British Columbia, Canada, has appointed a commission consisting of the Minister of Public Works, and Prof. L. G. Carpenter, of the Colorado State College, to investigate irrigation conditions in the Province. The investigation is to be made with the preparation of a new Water Act especially in view.

Capt. James B. Cavanaugh, Corps of Engineers, U. S. A., in charge of defensive works and river and harbor improvements in Florida, has been ordered to transfer his duties to Capt. Horley B. Ferguson, on duty under direction of Capt. Cavanaugh, and proceed to the office of the Chief of Engineers. First Lieutenants William G. Caples, Warren Hannum and Theodore H. Dillon have been ordered to Mobile, Washington Barracks, and Havana, respectively.

Mr. S. A. Jordan has been appointed division engineer of the Philadelphia division of the Baltimore & Ohio R. R., succeeding Mr. A. A. Miller, resigned. Mr. E. V. Smith has been appointed division engineer of the Cleveland division to succeed Mr. Jordan. Mr. J. B. Myers has been appointed division engineer of maintenance of way of the Cumberland division to succeed Mr. J. R. Leighty, who has resigned to become engineer of the Southern division of the Missouri Pacific Ry. System. Mr. P. H. Petri has been appointed division engineer of the Shenandoah division to succeed Mr. Myers.

George W. Plympton, professor of physics at the Brooklyn Polytechnic Institute, and a well-known civil engineer, died September 11, at his summer home at Tyson, Vt., aged 80 years. He was born in Waltham, Mass., and received his education in the public schools of that city, and in the Rensselaer Polytechnic Institute, graduating from the latter in 1847. He taught mathematics at the Institute for a time. In 1851 he became professor of mathematics in the New York State Normal School, and nine years later accepted a similar position in the New Jersey State Normal School. In 1863 he became professor of physics at the Brooklyn Polytechnic Institute, a position which he held till his death. In 1905 he was made professor of civil engineering at the Brooklyn school, and in 1905 professor emeritus of civil engineering. From 1870 to 1886 he edited Van Nostrand's "Engineering Magazine." He was the director of the Cooper Union for many years.

Rear Admiral John Grimes Walker, U. S. N., retired, died, Sept. 16, at Cape Meddick, Me., aged 72 years. He began his naval career in 1850 when he was graduated from the Naval Academy at the head of his class. He served actively throughout the civil war and at its close he was made a commander and detailed to the Naval Academy. In 1881 he was appointed Chief of the Bureau of Navigation, an office which he held for eight years, being appointed rear-admiral at about the end of that period. In 1897 he was appointed chairman of the Isthmian Canal Commission by President McKinley. When a new commission was appointed in 1899, Admiral Walker was again made chairman. He was originally in favor of the Nicaragua route, but when the French company offered all its works, buildings and rights for $40,000,000, and the commission of 1899 was called on for a second report, Admiral Walker reported in favor of the Panama route. He was retired in 1897, having reached the age limit of 62 years.

BUSINESS NOTES.

The Forbes Co., Philadelphia, manufacturers of water sterilizers for public buildings, railroads, factories and the like, have opened a New York office at 120 Liberty St., in charge of Mr. Irving A. Chandler.

The Standard Roller Bearing Co., Philadelphia, has recently made large additions to its plant, the total floor space now being 500,000 sq. ft. Fifteen hundred men are employed. The business has grown to such proportions as to require the establishment of a publicity department. Mr. C. Dickens Sternfels, who has been with the Arthur Koppel Co., Pittsburg, in a similar capacity for three years, will conduct the new department.

The Columbian Rope Co., Auburn, N. H., has ordered a new electric generating and motor equipment from the Allis-Chalmers Co., Milwaukee. The generator is a 940-kw. 60-cycle three-phase machine, operating at 120 r. p. m. Two 30-kw. exciters are provided, one engine and the other motor-driven. The motors, all of the Allis-Chalmers standard type, with bearings having sealed end boxes designed to exclude dust and flying particles of metal, will be suspended from the ceiling. There are four 150 h.-p. motors for 600 r. p. m.; two 100 h.-p. for the same speed, and a 20 h.-p. motor for 900 r. p. m. Three 40-kw. transformers are used on the lighting system.

The American Steel & Wire Co., after having in operation a 12,500 h.-p. We-Fu-Go water softening and purifying system for six months at their Donora Works, have placed an order with Wm. B. Scaife & Sons Co., Pittsburg, Pa., for a 25,000 h.-p. We-Fu-Go system, consisting of eight large treating and settling tanks and eight mechanical gravity filters, for their Newburgh Steel Works at Cleveland. Other sales of We-Fu-Go systems are reported as follows: Rochester & Pittsburg Coal & Iron Co., Punxsutawney, Pa., 2,250 h.-p. (third order); Shenango Furnace Co., Sharpsville, Pa., 8,000 h.-p.; Armstrong Cork Co., Oakdale, Pa., 500 h.-p.; Fostoria Glass Co., Moundsville, W. Va., 350 h.-p.; The Allen & Wheeler Co., Troy, O., 200 h.-p.; Stone & Webster Engineering Corporation, Boston, Mass., 2,500 h.-p., for the Jacksonville Electric Co., Jacksonville, Fla.; the Paterson Parchment Paper Co., Passaic, N. J., 150,000 gal. per hour, continuous system.

The Parker Boiler Co., Philadelphia, has received an order from the J. B. Stetson Co., of the same city, for two 750-h.-p. boilers. This is the fourth order for Parker boilers for the Stetson plant, the total aggregating 7,000 h.-p.

J. H. Wagenhorst & Co., manufacturers of electric blue printing machines, Youngstown, O., report a prosperous season. Among the recent sales reported by them are the following: E. R. Thomas Detroit Co., Detroit, Mich.; J. Flood Walker, San Antonio, Tex.; Luzerne Engineering Co., Hazleton, Pa.; Surveyor General's Office, Cheyenne, Wyo.; J. E. Myers, Penn Station, Pa.; Harris Automatic Press Co., Niles, Ohio; American Thread Co., Holyoke, Mass.; Phoenix Mfg. Co., Eau Claire, Wis.

The Sandusky Portland Cement Co. reports the use of Medusa waterproof compound for the following work: Plant of the Grand Rapids Refrigerator Co., Grand Rapids, Mich.; reinforced concrete dam of the coal department of the D., L. & W. Ry., Scranton, Pa.; cold storage plant of A Booth & Co., Detroit, Mich.; A. T. & S. F. Ry., at Albuquerque, N. M., and Sommerville, Tex.; and the residence of Albert Kahn, of the Trussed Concrete Steel Co., Detroit.

Foundrymen have persisted of late in the policy of keeping out of the market, even the largest buying, from week to week for prompt delivery. This condition of affairs, together with the gratifying volume of this season's business to date and the fairly certain indications of its continuation for the remainder of the season, finally compelled the manufacturers of boilers and radiators to make an inquiry as to the conditions likely to prevail in the iron market. As a result of this examination, it is stated that there will be no lowering of prices of house-heating boilers or radiators during the balance of the season.

TRADE PUBLICATIONS.

The General Electric Co., Schenectady, has recently issued a series of bulletins descriptive of recent improvements in standard apparatus manufactured. One pamphlet describes improvements in knife-blade lever switches to enable them to withstand severe and continuous service and carry their rated current indefinitely without overheating, thus meeting the requirements of the fire underwriters. Another bulletin describes a new line of fuse boxes specially adapted for use in subway manholes, where severe conditions are met, but also useful on poles, in cellars and elsewhere; these are made in two general types, with outlets for cables at the side and bottom, respectively. Other bulletins refer to electrically operated ratchet-driven rheostat switches for remote control purposes in modern switch-board practice, and to the 1907 improvements in lightning arresters for medium and high voltage alternating current circuits, to electric flat-irons with their recent improvements and advantages, to the new Edison gem filament 50-watt lamp and to the new G. E. Tungsten lamp for street series lighting.

The Utility steam specialties are described in a number of publications recently issued by the Standard Steam Specialty Co., New York. These comprise folders describing the Utility pump governor, steam separator, exhaust head, feed water heater and exhaust muffler tank, which latter is a combined muffler tank, oil separator, return tank and pump gevornor. A comprehensive pamphlet gives detail drawings with the principal dimensions of all of this apparatus, and also sketches suggesting the proper methods of connection, and a complete price list.

The Buffalo Steam Pump Co., Buffalo, N. Y., has published a large catalogue of its extensive line of pumps of the power, steam, centrifugal and turbine types. In section one of the catalog, 75 pages are devoted to the steam and power pumps, which are built in all patterns for boiler feeding and general purposes, for high or low pressures, for handling chemicals and heavy liquids and for high duty service in water works plants. The second section is devoted to the centrifugal and turbine pumps, which are built in all forms, both simple and compound, and for power, steam or electrical drives, and considerable valuable information is appended concerning their operation.

An unusually attractive catalogue has recently been issued by the Burt Mfg. Co., Akron, Ohio, descriptive of the Burt oil filters, exhaust heads and ventilators, and the Cross, the American and the Warden oil filters. All are fully illustrated and described, as is also the Burt oil filtering and delivery system, which consists of oil filters and reservoirs for reclaiming oil wasted from bearings and redelivering it to the bearings through an overhead reservoir and gravity piping. A specialty is also made by this company of the manufacture of exhaust heads which are built in two types and in all sizes, and of a weather-proof ventilator hood for roofs or skylights. These are built with different forms of bases and are fitted with glass tops and easily operated shutters permitting them to be closed, if desired, in cold weather.

Storage batteries for stationary service are listed in a recent catalogue issued by the Westinghouse Machine Co., storage battery department. The Westinghouse battery is built in an extensive series of standard sizes, which range from the 2-plate element for closed circuit work, to the multi-plate cells for large installations. Battery regulators and boosters are illustrated and battery trucks for industrial railway service in shops and factories.

Their pneumatic tools are described in a comprehensive new catalogue from the Independent Pneumatic Tool Co., Chicago. The details of construction are shown, both of the piston air drills, reversible and non-reversible, and of the chipping, calking and riveting hammers, together with a variety of accessories, including pneumatic holders-on, boiler flue expanders, pneumatic rivet forges, and air hose and connections. Illustrated lists of parts are given, covering all of the standard drills, grinding machines, saws, hammers and holders-on. A feature of the catalogue is the number of illustrations of various tools in service at drilling, reaming, grinding, chipping, riveting and calking.

The Luitwieler system of pumps is explained in a catalogue recently issued by the Luitwieler Pumping Engine Co., Los Angeles, Cal., builders of a line of special machinery for deep well and high-duty pumping, for which remarkable claims for economy are made. The Luitwieler pump is illustrated and described and its special features described, and a number of successful installations are referred to. A specialty is made of small pumping units with gasoline engine drives for railroad water tank supply, and also of electrically driven pumping units.

The Goldschmidt Thermit Co., New York, has just issued two pamphlets relating to improved methods of calculating and making repair welds, and of making butt welds on wrought-iron and steel pipes and rods. The former relates particularly to welding locomotive frames, for which special molds are listed for all sizes of frame members, and also the amounts of Thermit, ignition powder and other materials for each size of mold. Valuable information is, however, appended for other classes of repair work, a method of universal molding by means of a yellow wax matrix having been perfected which obviates the services of a patternmaker and enables the amount of Thermit needed to be accurately determined. The welding of pipe and rods has been brought to a high degree of perfection, and full instructions are given for this class of work.

The twenty-fifth anniversary of the Ball Engine Co., Erie, Pa., is commemorated by an attractive little pamphlet giving a brief outline of the development of the Ball engine and the principal features of the present standards of construction of all its types.

Handling and storing coal and ore is interestingly treated in a recent catalogue of the Dodge Coal Storage Co., Philadelphia, Pa. Considerable space is devoted to descriptive matter on the well-known Dodge piling trimmer and reloader mechanisms, following which apparatus for coaling locomotives, circular storage cranes, revolving cranes, high-speed hoisting towers, bridge tramways, box car loading machines, car dumpers and automatic railways are discussed and representative installations illustrated. The book is particularly well illustrated and is a compendium of mechanical handling apparatus for coal and ore.

The Concrete-Steel Engineering Co., New York, has sent out a 96-page catalogue of half-tone views of reinforced-concrete bridges which it has put up in all parts of the country. All of them are built on the Melan, Thacher or von Emperger systems, the patents of which are controlled by the company. They vary in span from 10 to 132 ft., and some are finished with ornamented concrete, stone, or vitrified brick faces, and many of them have ornamental railings of plain or reinforced concrete.

"Prescott Pumping Machinery" is the title of an elaborate catalogue recently issued by the Fred M. Prescott Steam Pump Co., Milwaukee, Wis. It is a 145-page book, attractively designed typographically, listing the product of the Prescott works, and includes detail descriptions of the various classes of pumps built, and instructions in regard to setting them up and their operation. The book is divided into four sections as follows: Mine pumps, of which this company makes a specialty; condensing apparatus and power house equipment, boiler feed, fire and general service pumps, and the larger high duty pumping engines for water works and general pumping service. It is concluded with pump part lists and information of value concerning pumping and steam machinery.

The American Huhn Metallic Packing Co., New York, has issued a pamphlet concerning a gland packing for use with high-pressure steam. This consists of hollow rings of a special soft-metal alloy, designed to withstand extremely high temperatures, which are filled with a graphite preparation that works through small perforations in the inner periphery and lubricates the rod. It is said that no oil or grease lubrication is found necessary with this packing and that a set will, under ordinary conditions, wear a number of years without attention.

The Cutler-Hammer Mfg. Co., Milwaukee, Wis., makers of electric controlling devices, has issued a booklet descriptive of its line of electric crane controllers. In addition to descriptions of five types of crane and hoist controllers, connection and dimension diagrams and repair part charts are presented, together with prices, net weight and shipping weight of apparatus, etc. An improved form of contactor for handling heavy currents is also described.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—See "New Industrial Plants."

Montrose, Colo.—The Council, it is reported, has purchased a site on which it is proposed constructing a reservoir.

Canon City Colo.—Bids will be received until Oct. 7 (extension of date from Sept. 20) by the City Clk. for furnishing material and constructing an additional system of water works, consisting of a reservoir, located at and near Cottonwood Creek, and a pipe line connecting said reservoir with the present city water main, as advertised in The Engineering Record. A. H. Seely, Mayor.

Wallingford, Conn.—The Water Comrs. are stated to have had prepared a report on the increase of water by gravity supply at Pistapang Lake, and estimate the cost at about $38,000. J. H. Child is Engr. and Supt. of Water Wks.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Pensacola, Fla.—The following are the bids received Sept. 7 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for a water system and circulating mains at the Navy Yard, Pensacola: Newport Plumbing & Htg. Co., Inc., Newport News, Va., $35,678; Lewis & Kitchen, Chicago, Ill., $48,514; and McCay Eng. Co., Baltimore, Md., $39,440; also another bid on their own plans, at $37,940.

The following are the bids opened on Sept. 14 at the offices of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a 100,0000 gal. elevated steel tank and tower at the Navy Yard, Pensacola: Camden Iron Works, Camden, N. J., $21,000; Tippett & Wood, 162 Howard St., Phillipsburg, N. J., $10,120; R. D. Cole Mfg. Co., 57 E. Broad St., Newnan, Ga., $10,700; The Midland Bridge Co., 818 Wyandotte St., Kansas City, Mo., $10,900; Chicago Bridge & Iron Wks., 105th and Throop Sts., Chicago, Ill., $10,500; Pittsburgh Industrial Iron Wks., Westinghouse Bldg., Pittsburgh, Pa., $9,487, and R. B. Tufts, Prudential Bldg., Atlanta, Ga., $9,500.

Punta Gorda, Fla.—It is reported that a resolution has been recommended to the Council to have an 8-in. artesian well sunk.

Daytona, Fla.—A committee of three, consisting of Aldermen Hankins, Bingham and Rowe, have been appointed by the Council to confer with Supt. Gunn of the electric light company with reference to constructing a water works for the city.

Athens, Ga.—J. W. Barnett, City Engr., writes with regard to the filter plant improvement, that the city has a plant of Warren filters and expect to extend the plant and will be pleased to have propositions from all firms in position to supply and erect this filter.

Kewanee, Ill.—Bids will be received until Oct. 5 by J. C. Bannister, Chmn. Water Com., for certain machinery and equipment for pumping water from 2 deep wells in said city, to be delivered f. o. b. cars Kewanee. The material required is a structural steel tower of approximately 48 ft. long and 16 ft. wide at the base and 40 ft. long by 6 ft. wide at the top and 32 ft. high; a structural steel and iron walking beam with connecting rod and crank drive center trunnions and boxes, rod connections and brasses; 2 cast bronze deep well cylinders, 7 ft. stroke, 7½ or 7¾ in. internal diameter, complete with foot valves and 6 to 8 cup plungers; about 700 ft. pump rods suitable for above cylinders and about 300 ft. lift; about 700 ft. 8-in. galvanized pipe; a triplex geared power pump to be driven by belt suitable for 150 lbs. pressure and to deliver from 700 to 1,000 gals. per minute at 40 to 60 r. p. m.; an engine for fuel oil capable of developing 125 brake h.p. at normal speed on a guaranteed consumption of not more than 1 pound of oil per b. h. p. per hour, when operated at full load; an engine for illuminating or producer gas, having the same capacity as engine for fuel oil on a guarantee consumption of not more than a pound of anthracite buckwheat or pea coal per b. h. p. per hour when operated at full load; a 150 h.p. producer to be used in connection with engine; a horizontal steel tank, 8x30x36 ft., suitable for oil storage under pressure of 100 lbs.

Chicago, Ill.—Bids will be received until Sept. 25 by the Bd. Local Improv. (H. S. Dietrich, Pres.) for furnishing material and constructing water supply pipes in portions of 10 streets; also water service pipes in Cornelia Ave.

**Sibley, Ia.*—Drake, Williams, Mount & Co., of Omaha, Neb., are reported to have secured the contract for the erection of a solid steel tank, 22 ft. diam., 24 ft. high, for $2,600.

**Decorah, Ia.*—I. Linnevold, Co. Aud., writes that the contract for constructing a water system at the poor farm (bids opened Sept. 10) has been awarded to A. A. Chandlar & Son, of Decorah, for $1,250.

Primghar, Ia.—Bids will be received until Oct. 10 by W. H. Downing, Town Clk., for the construction of water works. M. Tschirgi & Son, Engrs., Bank & Insurance Bldg., Dubuque.

Concordia, Kan.—About $45,000 will be expended for remodeling the waterworks. Bonds for same have not yet been voted. Engineers, Burns & McDonnell, Scarritt Bldg., Kansas City, Mo.

Wichita, Kan.—The Council is said to be considering the buying or building of a water plant and is receiving offers from engineers to prepare plans.

Garnett, Kan.—It is stated that bids will be received by L. D. Pilkington, City Clk., until Oct. 1, for valves, pipe and connections for the water plant. Burns & McDonnell, Engrs., Kansas City, Mo.

**Louisville, Ky.*—John S. Morris, Auditor, writes that the contract for furnishing and installing pumping engines (bids opened Sept. 8) have been awarded as follows: Holly Mfg. Co., Buffalo, in the Crescent Hill Pumping Station, at $153,622, and Allis Chalmers Co., Milwaukee, Wis., River Pumping Station, $187,952. Capacity is to be 24,000,000 gals. per hour.

Newport, Ky.—The Water Comrs. are reported to have directed the Supt. to secure estimates of cost of erecting a water tower of 500,000 gal. capacity near the reservoir in the Highlands.

Greenville, Ky.—See "Power Plants, Gas and Electricity."

Amite City, La.—The Council is reported to be considering the question of putting in mains and procuring a water supply from the Gullett Gin Co.

New Orleans, La.—Bids were opened on Sept. 4 at the office of the Sewerage and Water Bd., for hauling and laying of approximately 250 miles of c. i. water pipe, from 4 to 30 in. diam. and aggregating about 26,000 tons. The work is divided into four contracts, namely: (*a*) Contract 15-W, (*b*) 16-W, (*c*) 17-W, (*d*) 18-W: Irwin Bros. *a* $225,789, *c* $251,595; M. O. Herron & Co., *a* $233,862, *c* $231,791, *d* $116,331; A. L. Patterson & Co., *b* $256,167; General Contr. Co., *c* $242,396, *d* $113,637; The Southern Contr. Co., *a* $218,495.

Provincetown, Mass.—Bids will be received until Sept. 25 by Walter Welch, Secy. Water Bd., Provincetown, for laying about 23,000 ft. 10-in. and 3,000 ft. 8-in. pipe in Provincetown and Truro. For further information address Edmund M. Blake, 8 Beacon St., Boston.

Berrien Springs, Mich.—See "Power Plants, Gas and Electricity."

Milan, Mich.—W. P. Gregory, Village Clk., writes that the citizens voted Sept. 10 to issue $30,000 bonds for water works and sewers.

**Stambaugh, Mich.*—The contracts to improve the water works (bids for which were received Sept. 9) we are informed, have been awarded to the Chicago Bridge & Iron Wks., of Chicago, Ill., for the tower and tank; and to the Freeman & Sons Mfg. Co., of Racine, for the power plant. Edmund T. Sykes, of Minneapolis, Minn., engr.

Detroit, Minn.—Bids will be received until Sept. 30 by the Water and Light Com. (Chas. G. Sturtevant, Clk.) for the erection of a 50-ft. steel water tower and tank of 100,000 gal. capacity, and the laying of 600 to 1,000 ft. of 8-in. water main, and installing one hydrant.

Mahnomen, Minn.—Bids will be received until Sept. 30 by A. O. Vachan, Recorder, for constructing a water tank and tower and complete water system for fire protection.

Jackson, Miss.—Press reports state that bids will be received by the Mayor and Bd. Aldermen until Sept. 25 (readvertisement) for $216,000 bonds for the purchase of the existing plant from the Light, Heat & Water Co. Ramsey Wharton, Mayor.

Columbia, Miss.—The question of issuing bonds to the amount of $50,000 for the construction of water works and a sewerage system is under consideration here.

Beaver City, Neb.—It is stated that bids will be received by W. L. Leonard, City Clk., until Sept. 30, for furnishing and laying water mains.

McCook, Neb.—The pumping plant of the McCook Water Works is reported to have been destroyed by fire.

Tupper Lake, N. Y.—The Tupper Water Co. is reported to be contemplating the constructing of a stand pipe of 600,000 gals. capacity.

Lidgerwood, N. D.—The Des Moines Bridge & Iron Wks., of Des Moines, Ia., is stated to have submitted Sept. 2 the only bid for a tower and tank for the water works system, at $4,050 for the entire work, including foundations, etc. The tank is to have a capacity of 75,000 gals., and the tower to be 75 ft. to balcony.

Minot, N. D.—City Engr. Severence is reported to be completing plans for water works.

**Middleton, O.*—It is reported that the following bids were received recently for c. i. pipe, etc.: Massillon Iron & Steel Co., Massillon, O., $36.20 a ton for 4-in. pipe, and $35.20 for 6 and 8-in.; 3 cts. a lb. for special castings (awarded contract); John Arpp, $37.70 for all sizes, and 3 cts. for special castings.

Bellaire, O.—An additional issue of bonds to the amount of $10,000 is reported to have been sold, to be used for purchasing pump and completing the filter system.

Ashland, O.—Bids will be received until Oct. 14 by the Bd. Pub. Affairs for furnishing and delivering f. o. b. cars, Ashland, about 350 tons standard weight, c. i. water pipe; digging trench and laying about 8,500 ft. water pipe; furnishing material and erecting building at pumping station: building foundations for new machinery; furnishing f. o. b. cars, Ashland, about 14,000 lbs. pig lead.

Cincinnati, O.—The Bd. of Pub. Service is reported to have on Sept. 13 rejected bids for water mains and will ask for new bids.

Park City (Knoxville), Tenn.—The City Council is reported to have granted a franchise to the Knoxville Water Co., of Knoxville, to extend its mains, place hydrants, etc., in Park City.

Sweetwater, Tenn.—The citizens are reported to have voted to issue $30,000 bonds for the construction of water works and $10,000 for street improvements.

Lufkin, Tex.—Judge J. T. Maroney is stated to have made an offer to the city to lease the water works system for a period of 10 years, paying $10,000 per annum, agreeing to give the city free use of the mains for fire purposes and to furnish an adequate supply of water the year round.

Orange, Tex.—The City Council is reported to have granted a 20-yr. contract to the Orange Ice, Light & Water Co., and the company is said to have decided to erect at once a standpipe 90 ft. high.

Fairland, Tex.—The question of constructing water works is reported to be under consideration here.

Brownwood, Tex.—The State Attorney General is reported to have approved the issue of $20,000 water bonds for Brownwood.

Pulaski, Va.—Engineer G. H. Derrick, of Pulaski, writes with regard to reservoir, etc., that nothing definite has yet been decided upon. It is proposed to construct reservoir or a small dam and several miles of pipe.

Norfolk, Va.—The following are the bids opened on Sept. 14 at the office of the Bureau of Yards and Docks,

*Items marked thus give the names of parties awarded contracts.

Navy Dept., Washington, D. C., for a 100,000 gal. elevated steel tank with suspended 15,000 gal. steel tank and tower, at the Navy Yard, Norfolk: Tippett & Woods, 162 Howard St., Phillipsburg, N. J., $9,450; R. D. Cole Mfg. Co., 57 E. Broad St., Newnan, Ga., $13,154; Pittsburg Industrial Iron Wks., Westinghouse Bldg., Pittsburg, Pa., $10,994; R. B. Tufts, Prudential Bldg., Atlanta, Ga., $9,500, (tower only;) Camden Iron Wks., Camden, N. J., $20,000; The Midland Bridge Co., 818 Wyandotte St., Kansas City, Mo., $12,500; Belmont Iron Wks Inc., 22nd and Washington Aves., Philadelphia, Pa., $13,677.

Ft. Ethan Allen, Vt.—Bids will be received until Sept. 28 by Lieut. M. G. Holliday, Q. M., U. S. A., for furnishing material and piping wells for air lift at this post.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

Wheeling, W. Va.—The improving of the water system is reported under consideration.

Pennsboro, W. Va.—It is reported that bids will be received until Sept. 30 for the purchase of $12,000 water works bonds. J. K. B. Wooddell, Mayor.

De Pere, Wis.—It is reported that $6,000 will be expended in extending the water mains.

**Linden, Wis.*—The City Clerk writes that the International Constr. Co., of South Bend, Ind., has escured the contract for constructing water works at Linden.

Winnipeg, Man.—At a meeting of the Fire, Water & Light Com. on Sept. 9 a recommendation was sent to Council calling for the purchase of 15 miles of water pipe.

London, Ont.—See "Power Plants, Gas and Electricity."

Weyburn, Sask.—Edgar A. Chappell, City. Secy.-Treas., writes that the proposed water works will cost between $75,000 and $100,000. No bids have yet been asked. Engineer, Wm. Rand, of Weyburn.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Bessemer, Ala.—The citizens are stated to have voted Sept. 9 to issue $35,000 bonds for storm sewers and $50,000 bonds for erecting a school.

Ensley, Ala.—W. A. Hendricks, advisory engr. of the Jefferson County Sanitary Comn., is stated to have decided upon the route for the extension of the sanitary sewers to the 5th Ward, for which the city recently voted $20,000 bonds. It is reported that bids for the construction will soon be asked.

Jasper, Ala.—P. Byrne, P. O. Box 111, Birmingham, is preparing plans for a sanitary sewerage system, and contract for same will be let about Oct. 3; probable cost, $15,000.

Willows, Cal.—There is reported to be a movement on foot here looking to the construction of sewers.

Santa Monica, Cal.—The City Council is said to be investigating the plan of the Bd. of Trade, for a sewage disposal system.

Denver, Colo.—The following are the bids opened on Sept. 11 by the Bd. of Pub. Works (J. B. Hunter, Ch. Engr.) for constructing sewers (bidders all of Denver):
*Sanitary sewer system in Sub-Dist. 8 of the East Side Sanitary Sewer Dist. 1: National Constr. Co., $111,363 (awarded contract). Denver & Pueblo Constr. Co., $124,440; Gaffy & Keefe Constr. Co., $144,816.
*Morgan's Capitol Hill special sanitary sewer system: Denver & Pueblo Constr. Co., $3,232 (awarded contract); Terrance Connoly, $3,421; National Constr. Co., $3,578.

East St. Louis, Ill.—Chas. S. Lambert, City Clk., writes that a sewerage system costing about $780,000 is to be constructed. W. I. Crocken, City Hall, is the engr. in charge. Silas Cook, Mayor.

Terre Haute, Ind.—The Council, it is stated, has passed an ordinance appropriating $33,050 to construct sewers in portions of numerous streets.

Indianapolis, Ind.—Plans are being prepared in the office of the City Engr. for a new sewer, to drain the section of the city between the Belt R. R. and Brookside Park, north and south, and west of the Laycock factory. It will be a continuation of the Brookside Ave. sewer, and will run in Brookside Ave. from Rural to 20th St., and in 20th from Rural E. to Olney St. It will be about 2,800 ft. in length and will vary in size from 15 to 20-in. Provision will be made for future branches, north and south, from the main trunk.

Cedar Rapids, Ia.—Bids will be received until Sept. 30 for constructing a 3-ring brick sewer on 21st and 12th Aves., W., 84 in. diam.; estimated at 2,550 lin. ft. of 7 in. 3-ring brick. T. R. Warriner, City Engr.

Clear Lake, Ia.—Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are preparing plans and specifications for sanitary sewers to include septic tanks.

Wellington, Kan.—The City Council has employed H. A. Rowland, of McPherson, Kan., to prepare plans for a system of sanitary sewers.

Louisville, Ky.—It is stated that instruction has been given to J. B. F. Breed, Ch. Engr., and Harrison P. Eddy, of Boston, Mass., Consulting Engr., of the Sewer Comn., to begin work on the plans and specifications for the southern outlet sewer, and at the same time to make preparations for the plans of the Bluegrass Creek interceptor. It is reported that it is expected that plans will be completed in a few weeks and bids for construction asked.

Salem, Mass.—Bids will be received until Oct. 2 by the Sewerage Comrs (Thos. G. Pinnock, Chmn.) for constructing Sec. 1, 2, 3 and 4 of South Salem trunk sewer with brick, or reinforced concrete masonry, requiring about 6,913 lin. ft. 34, 36, 38, 42 and 48-in. sewer.

Milan, Mich.—See "Water."

Ann Arbor, Mich.—It is reported that the Bd. Pub. Wks. has directed that estimates be prepared for sewers to be constructed in certain streets.

Houghton, Mich.—The City Council is reported to have granted the petition of the residents on Clark St. for a sewer to be constructed from the main sewer on Florence St.

Eveleth, Minn.—The City Council is reported to be considering the installation of a storm and sanitary sewer system, to cost about $21,000.

**Two Harbors, Minn.*—Thomas & McCoy, of Duluth, are reported to have secured the contract for constructing the North Two Harbors sewer, at $6,470, and the East Two Harbors sewer at $14,994.

Columbia, Miss.—See "Water."

Canton, Miss.—The Bd. of Aldermen has decided on the temporary postponement of the date for opening bids for constructing the sewer system, owing to delay in closing sale of bonds. Bids for this work were to have been opened on Sept. 19, and called for furnishing material and constructing system of house sewers complete, approximately 7 miles of 18 to 6-in. pipe sewer. O. S. Miller, Mayor. Engineer, Walter G. Kirkpatrick, of Jackson.

Carthage, Mo.—Bids will be received until Oct. 14 for furnishing material and constructing complete 3,258 ft. of 8-in. and 410 ft. 10-in. sewers, with manholes, flushtanks, etc., as advertised in The Engineering Record. Wm. Kohlman, City Engr.

Monett, Mo.—Bids will be received by D. S. Breese, City Clk., until Sept 24 for furnishing material and constructing a system of sewers. Burns & McDonnell, Engrs., 823 Scarritt Bldg., Kansas City.

Bozeman, Mont.—C. M. Thorpe, City Engr., writes that the lowest bid opened on Sept. 5 for constructing pipe sewers was submitted by E. T. Rich, of Bozeman, at the following bid: 250 ft. 6-in. vitr. sewer pipe, 78 cts.; 4,105 ft. 8-in., $1.02; 4,835 ft. 10-in. $1.05; 2,605 ft. 12-in., $1.14; 6,100 ft. 15-in., $1.22; 35 manholes, $78; 1 combined manhole and flush tank, $160; and concrete, $8 per cu. yd.; total, $19,861. C. Lundwall, of Bozeman bid for this work $20,465.

Humboldt, Neb.—M. N. Blair, of Falls City, Neb., is reported to have been engaged to make a preliminary survey and estimates of the cost of constructing a sanitary sewer system. An election is to be held on the question of its construction.

Omaha, Neb.—The City Council is reported to have on Sept. 9 approved the ordinance providing for a special election to vote on issuing $49,000 sewer bonds and $50,000 intersection paving bonds.
The lowest bid recently received for the North Omaha sewer outlet is stated to have been submitted by H. P. Jensen, of Omaha. Contract for same has not yet been let.

Stanwick, N. J.—The residents are reported to be planning the construction of sewers.

Ft. Lee, N. J.—The State Sewerage Comn. is reported to have approved the revised plans of Engineer Eckerson for the proposed sewerage system and bids will probably be called for at once.

Plainfield, N. J.—Bids will be received, it is stated, until Oct. 7, by Common Council for $68,000 of sewer improvement bonds.

**Kingston, N. Y.*—The contract for constructing a portion of an intercepting sewer in the City of Kingston, to consist of about 5,500 cu. yds. earth excav.; 350 cu. yds. rock excav.; 4,813 lin. ft. 24-in. vitr. pipe, 77 lin. ft. 24-in. c. i. pipe; 19 manholes, cutting through bulkhead at outfall, cleaning up, etc. (bids opened by the Bd. Water Supply at the office of Thos. Hassett, Secy., 299 Bway., New York, N. Y., on Sept. 3) has been awarded to the Haggerty Contr. Co., 215 W. 125th St., N. Y. City, for about $14,568.

Buffalo, N. Y.—The City Council is stated to have passed an ordinance providing for the construction of 36, 45, 42, 39 and 33-in. brick sewers on the east side of Fillmore St., bet. Delaware and Kensington Aves.

New York, N. Y.—Bids will be received until Sept. 26 by Louis F. Haffen, Pres. Bronx Boro., for constructing sewers and appurtenances in portions of Waterloo Pl., Lawrence, Valentine and Anthony Aves., W. 170th and E. 235th Sts.; constructing temporary sewers in White Plains Rd., and receiving basins in several streets. Engineer's estimate: 7,358 lin. ft. 12, 15 and 18-in. pipe sewer; 700 spurs for house connections, over and above the cost per lin. ft. of sewer; 78 manholes, complete; 6,265 cu. yds. rock to be excavated and removed; 10 M. ft. timber for foundations, furnished and laid, and sheeting furnished and left in place, etc.
Bids will be received by Louis F. Haffen, Pres. Boro. Bronx, until Oct. 1, for completing the abandoned contract for the construction of the storm relief tunnel sewer from the Webster Ave. sewer, near Wendover Ave., to the Harlem River, about 231 ft. north of High Bridge. Engineer's estimate: 5,170 cu. yds. Class A, 270 cu. yds. Class B, 25 cu. yds. Class C, and 13,670 cu. yds. Class D, concrete in place; 25,000 cu. yds. excav., all kinds; 303,010 lbs. steel bars, varying in size from ¼-in. to 1½-in.; 2,000 lbs. structural steel; 4,000 lbs. wrought iron; 22,000 lbs. c. i., including new manhole head covers, etc.; 8,050 ft. galvanized wire netting; 13,500 lbs. 24-in. c. i. pipe; 2,000 lin. ft. 12-in. and 1,500 lin. ft. 3-in. steam pipe; 11,000 lin. ft. piles; 260 M. ft. timber for foundations, sheeting, shoring and bracing, shafts Nos. 1 and 2 and shaft houses Nos. 1 and 2, etc.

Cohoes, N. Y.—It is reported that bids will be received by the Common Council until Oct. 1, for constructing sewer. Wm. J. Elliot, City Clk.

Brooklyn, N. Y.—Bids will be received by Bird S. Coler, Boro. Pres., until Sept. 25, for furnishing material and constructing relief sewers in Johnson St. from Hudson Ave. to Raymond St., etc. (Relief sewers, div. No. 2, sec. No. 2, Gold St. system); also in Dekalh Ave., from Raymond St. to S. Portland Ave., etc, div. 2, sec. 3, of above system.

Sea Cliff, L. I., N. Y.—The Village Improv. Assoc. is said to favor the establishment of a sewage disposal system.

Long Island City, L. I., N. Y.—Bids will be received until Sept. 30, by Jos. Bermel, Boro. Pres. for constructing sewers in portions of 10th, 17th and 19th Sts., Wilbur, 12th, Metropolitan and 7th Aves.: Engineer's estimate: 1,925 lin. ft. 2-ft. 6-in., and 460 lin. ft. 2-ft. 9-in reinforced concrete sewer; 6,665 lin. ft. 12, 15 and 18-in. vitrified salt glazed or cement concrete pipe sewer; 5,300 lin. ft. 6-in. vitrified salt glazed or cement concrete pipe for house connections; 60 manholes, complete; 28,500 ft. timber for foundation; 139 M. ft. timber for bracing and sheet piling, etc.

Kenmare, N. D.—The Village Trus. are reported to be considering the question of installing 14 blocks of sewers and installing a septic tank.

Youngstown, O.—Bids will be received by the Bd. Pub. Sewers (W. H. McMullin, Clk.) until Oct. 1 for furnishing material and constructing a sewer in a portion of Garfield St.

Chagrin Falls, O.—Bids will be received until Oct. 12 by H. D. Bishop, Clk. Council, for $60,500 bonds for the purpose of constructing a sewage disposal plant and to construct sewers.

Orrville, O.—L. E. Chapin, of Canton, is reported to have completed and presented to the State Bd. of Health plans for sewerage and sewage disposal for Orrville.

Cincinnati, O.—Estimates have been prepared for sewers as follows: On Glenway and Grand Aves., cost $19,566, and on Fisher, Collins and Herron Aves. and Powers St., an unnamed street south of Powers St. and Roll Ave., cost $46,484.

Girard, O.—Bids will be received Sept. 23 for furnishing and setting in place at the sewage disposal plant an automatic apparatus for handling the flow of sewage at the filter beds. Wm. Wilson, Engr., Youngstown.

**Leipsic, O.*—F. R. Stone, of Lima, is reported to have secured the contract for constructing the Hickey sewer, for $5,244.

Seattle, Wash.—We are informed that the following are the lowest bids received Sept. 7 by the Bd. Pub. Wks. for paving, sewers, etc.: Grading Westview Drive, et al., N. McKinnon, Seattle, Wash., $23,931; sewers on Franklin Ave., et al., T. I. Peterson, 324 24th Ave. S., $18,883; water mains on 28th Ave., H. J. Jahn & Co., 571 Colman Bldg., $3,571; water mains on 28th Ave. North, International Cont. Co., 737 New York Blk., $6,436. concrete walks on Sturgis Road, et al., Hans Pederson, 501 Fairview Ave., $5,848; grading 31st Ave., et al., J. Kalberg & Co., 515 Denny Way, $25,907; sewers on E. Cherry St., Nelson & Codson, Seattle, $1,313; sewers on Yakima Ave., et al., T. I. Peterson, 324 24th Ave., $6,787; grading alley between 24th Ave. and 25th Ave., H. J. Jahn & Co., 571 Colman Bldg., $1,01[illegible] concrete walks on 19th Ave., H. J. Jahn & Co., 571 Colman Bldg., $6,593; concrete walks on Grand Way, et al., T. I. Peterson, 324 24th Ave. S., $5,269.
No bids were received on Sept. 7 on the Green Lake Dist. of the North Trunk Sewer, which will cost about $3,000,000. It is reported that new bids will be received on Oct. 12. R. H. Thomson, City Engr.

Aberdeen, Wash.—It is reported that bids will be received by P. F. Clark, City Clk., until Sept. 25, for constructing about 5 miles of 8 to 24-in. vitr. clay pipe sewers, including manholes, flush tanks, etc. H. W. Troutman, City Engr.

Chippewa Falls, Wis.—It is stated that all bids opened Sept. 3 for constructing a sewer in a portion of Main St. have been rejected. The bids received were as follows: P. L. McQuillan, $18,945; A. Dahl, $19,500; Eau Claire Cornice and Htg. Co., $21,400.

Beloit, Wis.—The following are reported to be the bids received Sept. 4 for constructing sewers: Gallagher & McGavock, Beloit, 6-in. pipe, 30 cts.; 8-in., 79 cts.; manholes, $33, and flush tanks, $85; total, $7,848; and Andrew Thompson, Racine, 8-in. pipe, 85 cts.; manholes, $40; flush tanks, $80; total, $8,317.

Aylmer, Ont.—The question of constructing a sewerage system, at a cost of about $38,000, is reported under consideration.

BRIDGES.

Notes Arranged Alphabetically by States.

Madison, Ark.—The construction of a 4-span iron draw bridge at Madison is reported contemplated, at a cost of $28,000. F. W. De Rossitt is reported interested.

Napa Cal.—See "Railroads."

Iola, Colo.—Bids will be received until Sept. 27 by T. W. Jaycox, State Engr., Denver, for constructing a 200-ft. steel highway bridge across the Gunnison River at Iola.

**Danbury, Conn.*—The contract for constructing the bridge over Still River at White St. is stated to have been awarded to S. W. Bowles Co., of New York, N. Y., for $8,355.

Columbus, Ga.—The citizens are stated to have voted to issue $75,000 bonds for the construction of a bridge over the Chattahoochee River between Columbus and Girard.

South Bend, Ind.—The City Council is reported to have ordered the city engineer to prepare plans and specifications for the construction of a Melan Arch Bridge over the East Race on La Salle Ave.

Delphi, Ind.—It is reported that bids will be received until Oct. 8 at the office of Fred H. Engel, Co. Aud., for constructing a bridge and abutments or arch culvert, across Rock Creek, on the Michigan Rd., near Link Stevens, Washington Township.

Salem, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 7, for the construction of a steel bridge at Olk Pekin. S. G. Ellis, Co. Aud.

Crawfordsville, Ind.—It is reported that bids will be received by B. F. Carman, Co. Aud., until Oct. 5, for constructing 2 concrete arch bridges, one in Madison Township and the other in Ripley Township.

**Council Bluffs, Ia.*—W. H. Lopp, City Clk., writes that the N. M. Stark & Co., of Des Moines, has secured the contract to construct a reinforced-concrete bridge over Indian Creek (bids opened Aug. 19).

Atchison, Kan.—Bids will be received until Oct. 7 by the Bd. Co. Comrs. (J. C. Hotham, Chmn.) for rebuilding bridge No. 230, Mt. Pleasant Township.

**Wichita, Kan.*—The contract for constructing the reinforced concrete bridge over Arkansas River on Douglas Ave., (bids opened Sept. 9), is stated to have been awerded to the Canton Bridge Co., of Canton, O., at $97,000.

**Items marked thus give the names of parties awarded contracts.*

Plaquemine, La.—The Penn Bridge Co., Beaver Falls, Pa., is reported to have submitted the lowest bid Sept. 9, for rebuilding the steel bridge over Bayon Plaquemine, at $20,400.

Groton, Mass.—All bids opened on Sept. 10 by the Mass. Highway Comn., at Boston, for building concrete steel beam bridge in towns of Groton and Peperell, have been rejected. The following are the bids received: Fred E. Ellis, $16,890; J. F. Gill Co., $14,940; and Arthur J. Cavanaugh, $8,100.

Springfield, Mass.—Fred T. Ley & Co., of Springfield, are stated to have been awarded the contract for making the fill at the approaches to the Abbe Ave. Bridge at 75 cts. per cu. yd.

**St. Louis, Mo.*—The contracts for constructing the 9 piers of the McKinley Bridge are stated to have been awarded to the Missouri Valley Bridge & Iron Co., Koken Bldg., at $385,796.

Vicksburg, Miss.—We are informed that the time for receiving bids for constructing 4 reinforced concrete bridges has been extended from Sept. 16 to Oct. 7. W. G. Kirkpatrick, Engr., Jackson, Miss. Address H. J. Trowbridge, City Clk.

Trenton, N. J.—Bids will be received until Sept. 24 by the Bd. Chosen Freeholders, (Ammi R. Schanck, Dir.), for furnishing material and constructing the following bridges: Combination steel and concrete bridge over stream crossing Broad St., Boro Hopewell; extension and repairs to abutments and piers and erecting a steel superstructure with a reinforced concrete floor system and macadam roadway over Assinpink Creek, Whitehead's Mill, Hamilton and Lawrence Townships; combination steel and concrete bridge over stream crossing Lawrenceville and Princeton Rd, Lawrence Township. Frank J. Eppele, Co. Engr.

**Newark, N. J.*—The 11th Ward Bridge Com. of Bd. Freeholders is stated to have recommended awarding the contract for erection of Central Ave. Bridge over Morris Canal to the Hay Foundry & Iron Co., 114 E. 28th St., New York, N. Y., at $49,985. Bids opened Aug. 27.

New York, N. Y.—See "Power Plants, Gas and Electricity."

Trenton, N. C.—Bids will be received until Sept. 23 by J. K. Dixon, Clk. Bd. Co. Comrs., fo r$10,000 bridge bonds, to be issued for the purpose of constructing a bridge across Trent River.

Jefferson, O.—It is reported that bids will be received until Oct. 2 by the Bd. Co. Comrs. (A. D. Davis, Chmn.) for constructing a reinforced concrete bridge on the State road, Hartsgrove Township. J. S. Matson, Co. Surv.

St. Clairsville, O.—Bids will be received until Oct. 7 at the office of A. W. Beatty, Co. Aud., for furnishing material, constructing and repairing bridges and retaining walls in this county.

Cincinnati, O.—City Engineer Danenhower will submit to the Bd. of Pub. Service the plans and estimate of cost for two lift bridges over the canal—one to take the place of the Mohawk bridge at Central Ave. and Mohawk Pl., and the other at 14th St. Both bridges will be operated by hydraulic power, and cost $25,719 each.

Athens, O.—It is reported that bids will be received by the Co. Comrs. until Sept. 28, for the construction of bridge.

Bellefontaine, O.—It is reported that bids will be received by the Bd. of Co. Comrs. until Oct. 14, for constructing 67-ft. steel span bridge, on concrete abutments, with 40-ft. roadway. Chas. M. Richey, Co. Surv.

Xenia, O.—It is reported that bids will be received until Oct. 12 by the Bd. Co. Comrs., for constructing a low truss bridge, 80 ft. long, 14 ft. roadway, across Sugar Creek, Sugar Creek Township. Wm. Dodds, Co. Aud.

**Springfield, Ore.*—The contract for constructing the bridge over the Williamette River, near Springfield, for the Eugene & Eastern Ry. Co., is reported to have been awarded to L. N. Roney for about $30,000.

Philadelphia, Pa.—The following are reported to be the bids opened on Sept. 11 at the office of the Bureau of Surveys for the construction of bridges as follows: (a) Belmont and Girard Ave. Bridge, (b) bridge at Columbia Ave. and 31st St., (c) Boulevard Bridge over Newtown branch, (d) Boulevard Bridge over Tacony Creek: M. & J. B. McHugh, *a* $69,323; Mack Paving Co., *a* $82,614, *b* $51,292, *c* $44,136; Oswego Bridge Co., *a* $82,900, *b* $54,000; Filbert Paving Co., *a* $82,986, *b* $48,925, *c* $43,600; Richard Walsh, *a* $89,000, *b* $48,000, *c* $41,000; Armstrong & Latta, *a* $90,591; McGaw & Gray, *a* $95,000, *b* $47,700, *c* $45,600, *d* $130,500; Jas. McGraw & Co., *a* $99,900, *b* $58,400; F. J. Boas, *b* $54,498; John A. Kelly Co., *c* $43,500; Riley & Riddle, *c* $43,750, *d* $123,050; D. J. McNichol & Co., *c* $43,950; David Peoples, *c* $45,517, *d* $115,800.

Point Marion, Pa.—Press reports state that bids will be received about Sept. 28, by the Bd. Co. Comrs., at Uniontown, for erecting a 3 span bridge at Point Marion.

Pawtucket, R. I.—The rebuilding of the N. Main St. Bridge connecting Pawtucket and Central Falls is reported contemplated.

Houston, Tex.—The Comrs. of Harris County are stated to have awarded the contract for constructing a bridge over San Jacinto River, near Humble, to E. P. Nichols & Sons, at $6,900.

Milwaukee, Wis.—The construction of a viaduct over the railroad tracks at Highland Boule. is reported under consideration.

The issuing of $450,000 bonds for 3 $150,000 bascule bridges, replacing present swing bridges at Buffalo, Michigan and Oneida Sts., is reported under consideration.

PAVING AND ROAD MAKING.

Items Arranged Alphabetically by States.

**Birmingham, Ala.*—The Mayor and Bd. of Aldermen of the West End are stated to have awarded the contract for street improvements to E. W. Jordan, for $169,625, requiring 100,000 sq. yds. of paving, 30,000 yds. cement sidewalk, 80,000 lin. ft. of curb and guttering, and 40,000 cu. yds. of excavation.

Jasper, Ala.—P. Byrne, P. O. Box 111, Birmingham, is preparing plans for cement walks and other street improvements, which will be let as soon as plans are ready.

Selma, Ala.—The City Council is stated to have passed resolutions providing for the paving of Broad and Water Sts. with brick and asphalt. According to reports bids will soon be received.

Athens, Ala.—Bids will be received until Oct. 12 by C. D. Glaze, Pres. Road Comn., for constructing certain highways.

**Montgomery, Ala.*—Shafer & Chapman are stated to have secured the contract for paving portions of Park Pl. and Pleasant Ave. for $8,200.

Bristol, Conn.—The Bd. of Selectmen are stated to have opened bids as follows on Sept. 6 for grading and graveling 3,850 ft. of road on Farmington Ave.: Town of Bristol, $7,813; Roger Kennedy, of Middletown, $7,800; Pierson Engineering & Constr. Co., of Bristol, $7,730.

Bridgeport, Conn.—It is stated that the contract will soon be let for paving a portion of Fairfield Ave.

**New Britain, Conn.*—A 3,500-sq. yd. contract for bitulithic will be executed by Warren Bros. Co., of Boston, Mass.

**Springfield, Ill.*—John E. Bretz, of Springfield, has secured the contract for brick paving in Walnut St. from Jefferson St. to N. Grand Ave., at $1.58 per sq. yd. for paving and 55 cts. per lin. ft. for curb.

Chicago, Ill.—The Bd. Local Improvements is stated to have awarded contracts for improving portions of String and Ruble Sts. to the Barber Asphalt Paving Co., Stock Exchange Bldg., at $15,716, and R. F. Conway, 138 Washington St., at $15,168, respectively.

Springfield, Ill.—We are informed that the following are the bids received recently for paving N. Walnut St. Henry Welch, $1.50 per sq. yd.; for paving, curbing, 55 cts.; Capital City Concrete Constr. Co., $1.59 and 54 cts.; J. E. Bretz, $1.58 and 55 cts. Bidders of Springfield. Contract has not yet been awarded.

Vincennes, Ind.—The citizens of Johnson Township, Knox County, are stated to have voted in favor of the immediate construction of 28 miles of free gravel roads. Bids will be in order as rapidly as the surveys and plans can be prepared.

**Indianapolis, Ind.*—The Bd. of Pub. Wks. is stated to have awarded a contract for the resurfacing of N. Meridian St. with creosoted blocks to the Hoosier Constr. Co., Fitzgerald Bldg., at about $8.53 per sq. yd.

Salem, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 7, for the construction of gravel roads aggregating 30,898 ft. in length. S. G. Ellis, Co. Aud.

Green Castle, Ind.—It is reported that bids will be received until Sept. 28, by the Bd. Co. Comrs., for the improvements and construction of macadamized roads in the following Townships: 16,340 ft. in Russel; 5,151 ft., in Marion; 11,915.7 ft. in Monroe, and 1,301 ft. in Green Castle. C. C. Hurst, Co. Aud.

Logansport, Ind.—Bids will be received, it is reported, by the Bd. Co. Comrs., until Oct. 21, for the construction of a free gravel road on the line between Cass and Carroll Counties, known as the Rice Rd. George W. Cann, Co. Aud.

Crawfordsville, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 8 for the improvement and construction of a stone road in Brown Township, known as the Sutherlin Road. Length, 13,253 ft. Benj. F. Cormm Co., Aud.

Spencer, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct 2, for the construction of 6,176 ft. of gravel pike road in Jennings Township. George O. Mitten, Co. Aud.

Ft. Wayne, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Oct. 12, for the construction of 6 020 ft of macadamized road in Monroe Township. George W. Lindemuth, Co. Aud.

**Frankfort, Ind.*—A contract for 15,000 sq. yds. of bitulithic has been awarded to the Western Constr. Co., of Lafayette, Ind.

**Newcastle, Ind.*—The Western Constr. Co., of Lafayette, Ind., has received a contract for 15,227 sq. yds. of bitulithic.

Davenport, Ia.—The City Council is stated to have decided to pave a portion of 2d St.

**Waterloo, Ia.*—C. T. Wilson, City Engr., writes that W. A. Bryant & Sons Co., of Waterloo, have secured the contract for paving on the east and west sides, at a total cost of $105,515.

**Lake Charles, La.*—C. H. Burton, Asst. City Engr., writes that the contract to construct 10 miles of cement sidewalks (bids opened Sept. 3) has been awarded to the Wist Constr. Co., of Chattanooga, Tenn., at 14.5 cts. per sq. ft. for sidewalk; 43 cts. per lin. ft. curb, and 40 cts. per cu. yd. for excav. The total cost of the work will be about $70,000.

**Portland, Me.*—An additional contract for 1,782 sq. yds. of bitulithic has been awarded the Warren Bros. Co., of Boston, Mass.

**Baltimore, Md.*—The contract for paving with bitulithic 28th St. is reported to have been awarded to Wm. M. Elder, at $8,918.

Tacoma Park, Md.—Bids will be received until Sept. 30 at the office of the Town Clk., Takoma Park, Md., for constructing about 2,500 lin. ft. macadam roadway on Carroll Ave.; also furnishing about 650 cu. yds. crushed stone. Specifications furnished on application to Ben G. Davis, Town Clk., Takoma Park, D. C.

Suffield, Mass.—The citizens are stated to have decided to expend $20,000 for road improvements.

Boston, Mass.—Bids will be received until Sept. 24 by the Mass. Highway Comn. (W. E. McClintock, Chmn.), for constructing a section of State highway, about 4,700 ft. long in the town of Plymouth; also about 3,200 ft. in the town of Sterling.

**Kansas City, Mo.*—W. J. Stevenson is stated to have secured the contract for paving with brick a portion of 21st St., at $1.96 per sq. yd.

*The Park Bd. is stated to have awarded the contract for macadamizing Maple Ave., at $1.10 per sq. yd.

**St. Joseph, Mo.*—The Bd. of Pub. Wks. is stated to have awarded contracts for paving a portion of Mitchell Ave. to Rackliffe & Gibson, 619 Edward St., at $2.10 per sq. yd., and to G. O. Skilbred the paving of Delaware St. at $1.96 per sq. yd.

St. Louis, Mo.—Bids will be received until Oct. 8 by the Bd. Pub. Improv. (And J. O'Reilly, Pres.), for paving portions of numerous streets and alleys.

**Butte, Mont.*—B. M. Bardsen & Co. are stated to have secured the contract for paving Dakota St., at $5.80 per yd.

Omaha, Neb.—See "Sewerage and Sewage Disposal."

**Jersey City, N. J.*—The Boulevard Board is stated to have awarded contracts for resurfacing portions of boulevard as follows: The Bergen stretch, between Communipaw and Newark Aves., to Van Keuren & Son, Grand and Prior Sts., estimated cost, $18,030; also the portion between 1st St. and Central R. R. Bridge, Bayonne, estimated cost, $8,552; Palisade Contr. Co., 15 Exchange Pl., secured the contract for portion between Hudson and Bergenline Aves., North Bergen, estimated cost, $12,198.

Bids will be received until Sept. 23 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.), repaving Bowers Ave.; bids will be considered on asphalt or wooden block, requiring about 5,430 sq. yds. paving.

Harrison, N. J.—Bids will be received until Oct. 1 by the Common Council for paving a portion of Bergen St. with bitulithic; also Jersey St., with Mack repressed block. Bernard P. Walsh, Town Clk.

Somerville, N. J.—The paving of Main St. with brick and concrete at a cost of about $12,000, is reported contemplated.

Bridgeton, N. J.—All bids opened on Sept. 11 by Geo. Reeves, Chmn. Pub. Road Com., Bd. Chosen Freeholders, at Court House, Bridgeton, for improving a road in Landis Township, about 5¾ miles in length, have been rejected. The work comprises 16,420 cu. yds. earth excav., 9,232 cu. yds. compact gravel; arch bridge at Burn Mill stream; 10 ft. additional to present bridge at Blackwater stream; box culvert 2½ ft. x 30 ft. at station No. 215. Walter M. Sharp, Co. Engr., Bridgeton.

**Cohoes, N. Y.*—The contract for paving with granite blocks portions of Olmstead, Factory and Mohawk Sts. is reported to have been awarded to Mulderry Bros., of Albany, at $1.60 per sq. yd. Bids opened Sept. 3 by Common Council.

Watervliet, N. Y.—The Pub. Improvement Comn. is stated to have opened bids as follows for paving a portion of 3d Ave.: John H. Gleason & Co., of Troy, Shawmuth brick, at $2.58 per sq. yd., and Grattan Constr. Co., of Cohoes, Mack brick, at $2.60 per sq. yd.

Brooklyn, N. Y.—Bids will be received until Oct. 2 by Bird S. Coler, Boro. Pres., for furnishing material, regulating grading, curbing, laying sidewalks and paving on portions of several streets, including Caton Ave., E. 5th, 81st, 84th, and Lynch Sts., Prospect Pl., etc. Engineer's estimate: 17,215 lin. ft. new curb, set in concrete, 102,950 sq. ft. cement sidewalk, and 11,385 sq. yds. asphalt pavement, etc.

Bids will be received by the Park Comrs., New York City, (Moses Herrman, Pres), until Oct. 3, for repairing asphalt pavement on Glenmore Ave. and Eastern Parkway extension, also resurfacing walks in Prospect Park, Boro. Brooklyn, together with all work incidental thereto.

New York, N. Y.—Bids will be received until Sept. 26 by Louis F. Haffen, Pres. Bronx Boro., for paving with asphalt block, portions of Fairmount Pl., E. 137th, E. 176th, E. 186th Sts., Cypress and Honeywell Aves.; with asphalt, Concord Ave.; constructing sidewalks, etc.; on portions of Popham Ave., Macomb's Rd., E. 147th, E. 170th, E. 199th Sts., Summit and Kossuth Pl.; regulating, grading, placing steps, etc., on Randall Ave., Johnson and W. 168th Sts.: Engineer's estimate: 18,120 sq. yds. completed asphalt blk. pav., and keeping the same in repair for 5 years from date of acceptance; 1,240 sq. yds. completed asphalt pav., including binder course, and keeping the pavement in repair for 5 years from date of acceptance; 53,950 cu. yds. earth excav.; 48,800 cu. yds. rock excav.; 187,775 cu. yds. filling; 19,170 lin. ft. new curb., furnished and set; 70,000 sq. ft. new flagging, furnished and laid; 7,922 sq. ft. new bridgestone for cross-walks, furnished and laid; 1,250 sq. ft. cement flagging; 6,415 cu. yds. dry rubble masonry, in retaining walls, culverts and gutters; 1,250 sq. ft. steel woven wire fabric, etc.

New York, N. Y.—Bids will be received until Sept. 27 by Henry S. Thompson, Acting Boro. Pres. and Comr. Pub. Wks., Boro. Manhattan, for regulating paving and repaving portions of Edgecombe and Bradhurst Aves., Trinity, Manhattan and Clevland Pl., Ann, Gold, Greene, Pearl, Mercer, Water, Wooster, W. 36th, W. 37th, Church, Great Jones, Bond, Washington, W. 13th, E. 6th, E. 8th, W. 11th, W. 92d, E. 105th, Cannon, Attorney, Ridge, Pitt, Willett, Sheriff, Columbia, William, W. 137th, W. 156th, W. 157th, W. 158th, W. 159th, W. 160th, W. 201st, W. 202d and W. 134th Sts. Engineer's estimate: 30,490 sq. yds. wood blk. pavt.; 20,065 sq. yds. asphalt pavt., including binder course; 30,960 sq. yds. asphalt blk. pavt.; 38,140 sq. yds. granite blk. pavt., with paving cement joints; 77,931 sq. yds. old stone blocks, to be purchased by the contractor and removed by him; 21,325 cu. yds. concrete. 46,164 lin. ft. new bluestone curb, furnished and set; 9,789 lin. ft. old bluestone curb, redressed, rejointed and reset; 196 new sewer manhole heads and covers, furnished and set; 98 new water manhole heads and covers, furnished and set; 8,500 sq. ft. new granite bridgestone, furnished and laid.

Long Island City, L. I., N. Y.—Bids will be received until Sept. 30 by Jos. Bermel, Boro Pres., for regulating grading, curbing and laying sidewalks on Clark and William Sts., 12th and Jamaica Aves. Engineer's estimate: 24,384 cu. yds. earth excav.; 9,655 lin. ft. concrete curb; 44,910 sq. ft. new flagstones; 5,116 sq. ft. new Bluestone bridging, etc.

**Gastonia, N. C.*—The Atlantic Bitulithic Co., of Richmond, Va., has been awarded a 10,000-sq. yd. contract for bitulithic.

**Items marked thus give the names of parties awarded contracts.*

Charlotte, N. C.—A contract for 44,000 sq. yds. of bitulithic has been awarded the Atlantic Bitulithic Co., of Richmond, Va.

Durham, N. C.—Bids will be received until Oct. 1 by the Bd. of Co. Comrs., at Durham, for building about 11½ miles of macadam road. Approximate quantities: 60,000 sq. yds. 6-in. macadam; 75,000 cu. yds. excav., together with the necessary pipe and reinforced concrete drains, as advertised in The Engineering Record.

Cleveland, O.—Bids will be received until Oct. 5 by the Bd. Co. Comrs., (Julius C. Dorn, Clk.), for the completion of Miles Ave. improvement. A. B. Lee, Co. Engr.

**Portsmouth, O.*—The contract to pave Lincoln St. (bids opened Sept. 4) has been awarded to Kelley Bros., of Portmouth, at $11,765, and the contract to pave Prospect St. to Saml. Monroe & Son, of Portsmouth, at $2,160. R. A. Bryan, Engr., Street Paving Dept.

Toledo, O.—It is stated that the County Comrs. are asking for bids for the macadamizing of Sylvania Ave.; estimated cost, $6,627.

Napoleon, O.—It is reported that bids will be received by the Bd. Co. Comrs. (H. Rothes, Chmn.) until Sept. 27 for constructing roads.

University Heights, O.—Bids will be received until Sept. 25 by the Bd. Town Trus. (R. W. Hostetler, Chmn.) for grading and graveling portions of Bowman, Edward and Otterbein aves.

Malta, O.—Bids will be received by the City Clk. until Sept. 27 for paving and curbing a portion of Main St. Engineer, Paul R. Murray, of New Philadelphia, O.

Bergholz, O.—R. H. Lee, Engr., Carrollton, writes that the Trus. of Springfield Township (W. A. Taylor, Clk.) rejected all bids received Sept. 5 for constructing about 5 miles of macadam road in Springfield Township, and new bids will be received Sept. 25.

Greenville, O.—See "Miscellaneous."

Celina, O.—It is stated that bids will be received until Sept. 23 for $5,525 bonds for improving Market St. C. W. Rish, City Clk.

**Salem, Ore.*—The Warren Constr. Co., of Portland, Ore., will construct 9,277 sq. yds. of bitulithic.

**Portland, Ore.*—A contract for 16,997 sq. yds. of bitulithic has been awarded to the Warren Constr. Co., of Portland, Ore., and another of 25,814 sq. yds. to the Pacific Bridge Co.

Philadelphia, Pa.—Plans are stated to have been approved by the Comrs. of Fairmount Park for the driveway in Fairmount Park between Germantown Ave. and Cresheim Drive: estimated cost, $48,000.

Local press reports state that bids will be received until Sept. 24 by Geo. R. Stearns, Dir. Dept. Pub. Wks., for paving about 25 miles of new streets. Of the 25 miles to be paved about 16 miles will consist of asphalt, estimated to cost $500,000, while the rest of the work, estimated to cost $250,000, will be partly vitrified fireclay or shale bricks or blocks upon cement concrete foundations, or granite, Pennsylvania or Lambertville blocks upon like foundations.

**Claysville, Pa.*—The City Council is reported to have awarded the contract for paving Wayne St. to Hallam Constr. Co., of Washington, for $9,285.

Harrisburg, Pa.—Bids will be received until Oct. 3 by Jos. W. Hunter, State Highway Comr., for constructing 5,280 ft. in Londonderry Township, Dauphin Co.

Ft. Adams, R. I.—Bids will be received until Oct. 1 by Capt. Willis Metcalf, Constr. Q. M., U. S. A., 209 Thames St., Newport, R. I., for repairs of roads and construction of gutters, catch basins, curbs, cement walks and brick road crossings at Fort Adams, R. I.

Clinton, Tenn.—It is stated that bids will be received by J. K. P. Wallace, Chmn. Anderson County Pike Comn., until Oct. 5, for the purchase of $100,000 road bonds.

Sweetwater, Tenn.—See "Water."

Ft. Sam Houston, Tex.—Bids will be received until Oct. 1 by L. J. Fleming, Const. Q. M., U. S. A., for grading, construction of roads and walks, etc., around new hospital, Ft. Sam Houston.

Culpeper, Va.—The Comrs. of Culpeper County are reported to have voted to issue $100,000 bonds and are in the market for road machinery. Address J. C. Bell, of Culpeper.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

Chehalis, Wash.—It is stated that about $35,000 will be expended for macadamizing several streets in Chehalis.

Kenosha, Wis.—It is reported that bids will be received until Oct. 7 at the office of Jas. Gorman, City Clk., for grading and paving with brick Grand Ave., about 25,000 sq. yds.

Milwaukee, Wis.—The Barber Asphalt Paving Co. is stated to have secured the contract for resurfacing with asphalt portions of 3d and W. Water Sts., at $2.23½ per sq. yd., or a total of $15,247.

Milwaukee, Wis.—C. J. Poetsch, City Engr., writes that all bids opened on Sept. 17 for paving 12th St. and Teutonia Ave. have been rejected. It is reported that about 23,000 sq. yds. of pavement will be required.

**Toronto, Ont.*—The Warren Bituminous Paving Co., of Toronto, has been awarded a contract for 12,147 sq. yds. of bitulithic.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Magnolia, Ark.—The plant of the Magnolia Ice & Electric Light Co. is reported to have been destroyed by fire on Sept. 9.

Ashdown, Ark.—T. C. Ambrey, of Verda, La., is reported interested in the construction of a lighting and ice plant.

Oakland, Cal.—It is reported that the Great Western Power Co. (Edwin Hawley, Pres.) will establish on Oakland estuary an auxiliary electric generating plant. The adopted plans contemplate a building 250x100 ft. It is proposed to install turbine generators of 5,000 h.p. ea., besides the necessary steam generating plant. It is reported that contracts have been let for turbine generators, boilers and all necessary machinery.

San Francisco, Cal.—F. A. Healy has petitioned the Bd. of Supervisors for a franchise to lay pipes and install a hot water heating system throughout the city.

Fresno, Cal.—The Fresno Home Light & Power Co. is reported to have petitioned the City Trus. for a franchise.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Sept. 24, to furnish at the navy yards and naval stations the following supplies: Pensacola, Fla. Sch. 287—Portland and Rosendale lime cement, gravel, brick, metallic shingles, ridge coping, yellow pine, tin, etc., sewer and c. i. pipe and specials, centrifugal pumps, c. i. valves, manhole frames. Sch. 288—Twist drills, tool steel. Norfolk, Va., Sch. 268—Sensitive mill, vertical boring and turning mill. Sch. 304—Vises. Sch. 305—Yellow pine. Sch. 306—Sheet lead, galvanized steel plates, steel plates, billets, angles, channels and bars. Sch. 308—Terra-cotta pipe, iron pipe and fittings. Sch. 309—Gravel, steam dry rooms. Boston, Mass., Sch. 300—Induction motor. Charleston, S. C., Sch. 300—Motor drive. Sch. 302—Copper wire, electrical supplies. Sch. 306—Bar Iron, galvanized sheet steel. Sch. 308—Brass and iron pipe, pipe fittings, cocks, valves. Naval Academy, Annapolis, Md., Sch. 306—Bar iron, tool steel. Sch. 308—Brass flush pipes, soil pipe, iron pipe, pipe fittings, expansion joints. New York, N. Y., Sch. 268—Steam hammer, lift drop hammer, trimming press. Sch. 295—C. i. pipe, gate valves, etc. Sch. 296—Electrical conductor, leyden jars, dry cells, receiver sets, insulators. Sch. 297—Small tool machines, brass rod, rolled bronze, steel bar, pipe fittings. Sch. 299—Junction boxes, electrical conductor. Sch. 301—Brass tubes, valves, copper tubing. Sch. 302—Electrical conductor, brass and steel conduit, interior fittings. Sch. 306—Sheet brass and copper, tool steel. Newport, R. I., etc., Sch. 265—Constructing ferry slips. Sch. 269—Heating and ventilating. Sch. 299—Gyro testing, stands, wire rope, iron pipe and fittings. Sch. 306—Copper rod. New Orleans, La., Sch. 287—Yellow pine, cypress, etc. Portsmouth, N. H., Sch. 205—2 steel plate fans. League Island, Pa., Sch. 295—Bolts, etc., yellow pine, oak and yellow pine piles. Washington, D. C., etc., Sch. 267—Gun boring and turning lathe. Sch. 299—Brick, sand, Portland cement, broken stone, granite tailings, armature coils, electrical supplies, steel rivets, gear wheels and pinions, ash, steel shapes, plates and castings. Sch. 306—Sheet copper, machine and high-speed steel. Applications for proposals should designate the schedules desired by number. E. B. ROGERS, Paymaster General, U. S. N.

Walter C. Allen, Electrical Engr. of the District, submitted to the Comrs. on Sept. 13 the annual estimates for his department for the next fiscal year, asking $259,000 for lights, etc. an increase of $5,000; $124,350 for electric lighting, an increase of $17,850; $5,000 for 27 additional fire alarm boxes; $1,700 for repairing fire alarm boxes; $75,000 for replacing the present paper insulated underground fire alarm cables with rubber cables; $3,000 for cost of increasing the small tapper fire alarm circuits from 4 to 10; $13,000 for purchasing and erecting insulated wires and cables to replace present bare copper wires used in fire alarm circuits; $13,000 for the purchase of 65 additional fire alarm boxes, etc.

Pensacola, Fla.—See "Miscellaneous."

Punta Gorda, Fla.—The citizens have voted to issue bonds for an electric light plant.

Savannah, Ga.—Bids will be received until Oct. 15 by the Com. on Streets and Lanes (Harry Willink, Dir.) for the illumination by electric arc and incandescent lamps of the streets of this city, and for sale to the city of electric current, to be used for illumination, heat or power.

Americus, Ga.—See "Electric Railways."

Crawfordsville, Ind.—It is reported that the Co. Comrs. will receive bids until Oct. 5 for installing a lighting plant at the Co. Asylum. B. F. Cormm, Co. Aud.

Evansville, Ind.—The Co. Bd., it is reported has ordered estimates to be prepared for lighting the county infirmary with electricity.

Phillips, Ind. Ter.—The power plant of the Coalgate, Lehigh & Phillips Electric, Ice & Traction Co., located at Phillips, is reported to have been destroyed by fire on Sept. 7. H. C. Sprinkle, of Phillips, is president.

Dubuque, Ia.—The Peterson Heat, Light and Water Co., of Des Moines, is reported to be seeking a franchise here for a heat distributing system.

Davenport, Ia.—F. H. Griggs, of Davenport, is reported interested in the construction of a water power plant on Mississippi River above Davenport.

Prairie City, Ia.—The citizens are stated to have voted in favor of installing a system of lights.

Louisville, Ky.—Bids will be received until Sept. 27 by the Bd. Pub. Wks. (Roger G. McGrath, Secy.) for new power plant and steam heating apparatus in City Hall annex and old engine house, and remodeling apparatus in old City Hall.

Greenville, Ky.—The Greenville Light & Water Co. is reported organized, with a capital of $35,000, to furnish light and water. J. A. Gilman, Engr.

Berrien Springs, Mich.—The citizens are reported to have voted to issue $17,000 water and lighting bonds.

**Marshall, Minn.*—The contract for the construction of the municipal electric light plant has been awarded to J. G. Robertson & Co., of St. Paul. The equipment will consist of 2 200-kw. 3-phase 60-cycle 2,300-volt alternating-current generator, made by the Ft. Wayne Electric Works; a 325-h. p. Ideal and Lane & Bodley engines, and Brownell boilers of 400 h. p. E. Simmons is Supt.

Minneapolis, Minn.—Bids will be received until Sept. 24 by the Bd. Charities and Corrections (Rich'd Tattersfield, Secy.) for the installation of electric wiring for the city workhouse. L. A. Lamoreaux, Archt., 51 Lumber Exchange.

Oxford, Miss.—The Trus. of the University of Mississippi are reported to have decided to rebuild power house and electric light plant recently reported burned.

Meadville, Mo.—J. D. Dunn, of Meadville, writes that nothing definite has yet been done toward the construction of an electric light plant.

Campbell, Mo.—A. C. Morse, proprietor of the Campbell electric light plant, is contemplating installing a 150-kw. alternator, a 150-h. p. Corliss engine, a tubular boiler of 150 h. p. and a 10-ton ice plant, and is also contemplating extending the lines to Piggott, Ark., to furnish electricity for street and general lighting purposes.

Maryville, Mo.—The citizens are stated to have voted in favor of permitting the city to grant a 20-year franchise to the Maryville Electric Light & Power Co., also permitting the city to contract for street lighting for a period of 5 years.

Windsor, Mo.—It is reported that the plant and franchise of the Windsor Electric Light & Power Co. has been sold to Messrs. Garver and Roberts, of Neosho, Mo.

Linwood, N. J.—Jas. Farish, Boro. Clk., writes that an ordinance has been passed by the Council containing an agreement with the Pleasantville Electric Co. to light the Boro. for a period of 5 yrs. at $1,500 per yr. Contract has not yet been signed.

Atlantic City, N. J.—It is stated that the Council has granted the petition of the business men of Atlantic Ave. to light the streets with an incandescent lighting system from New Jersey to Florida Aves. The cost is estimated at $12,000.

New York, N. Y.—Bids will be received by Jas. W. Stevenson, Com. Bridges, until Sept. 26 for the construction and electrical equipment of subway station tracks and electrical equipment of elevated railway tracks of Williamsburg (new East River) Bridge, over East River, bet. Manhattan and Brooklyn Boroughs.

Bids will be received until Sept. 30 By C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment in addition to and alterations in School 59, Boro. Manhattan.

Long Acre Electric Light & Power Co. has obtained from John H. O'Brien, Comr. of Water Supply, Gas & Electricity, permission to lay its wires throughout Manhattan and Bronx Boroughs.

Syracuse, N. Y.—The Syracuse Lighting Comn., appointed by Mayor A. C. Fobes, to investigate the lighting situation as affecting the city and consumers of gas and electricity, advised against municipal ownership of a lighting plant at the present time, but recommends that steps be taken to secure authority for the erection of a plant for lighting streets, parks and public buildings, subject to approval of voters; the Commission also favors the construction of a municipal subway system. Prof. Delmar E. Hawkin, Secy. of Comn.

Flushing, L. I., N. Y.—See "Schools."

Troy, O.—It is reported that bids are wanted until Sept. 30 for $28,000 electric lighting bonds. Chas. F. Rannalls, City Aud.

Rawson, O.—It is reported that the question of municipal lighting is to be agitated.

Marshfield, Ore.—The Coos Bay Gas and Electric Co. is planning to increase the capacity of its plant and will soon instal four 100-hp. boilers, one 650-hp. simplex Corliss heavy duty engine, a 450-kw. 3-phase 60-cycle alternating-current dynamo and a direct-current generator of 250-kw. capacity. The company will also be in the market for 2 street cars and equipment, and a number of alternating-current meters and transformers. Seymour H. Bell, Mgr.

**Philadelphia, Pa.*—John R. Wiggins & Co., 721 Heed Bldg., Contractors, have been granted a permit to build for the Philadelphia Electric Co. a 2-story transforming station on Filbert St., west of 30th St. It will be 30x60 ft., of brick and stone, and cost $15,000. John T. Windrim, Archt., Commonwealth Bldg.

**Hammonton, Pa.*—The Town Council has made a 5-year cotnract with the Hammonton Electric Light Co. and the Hammonton & Egg Harbor City Gas Co. to light the streets of the town.

Womelsdorf, Pa.—W. W. Lengel, Boro Secy., writes that the citizens on Sept. 13 voted to issue bonds for the construction of a municipal electric light plant. Engineer, F. W. Darlington, 1140 Real Estate Trust Bldg., Philadelphia.

Pittsburg, Pa.—The Bureau of Building Inspection has granted to the Convent of Mercy a permit to erect a 2-story brick power house on 5th Ave., 14th Ward, to cost $25,000.

Panama.—Bids will be received at the office of H. F. Hodges, General Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Oct. 14, for automatic fire alarm telegraph systems, marine electric fixtures, batteries, dynamite and blasting material, wire, hoisting engines, shop machines, wrought iron pipe, etc., as advertised in The Engineering Record.

**Spartanburg, S. C.*—C. R. Willard & Co., of Spartanburg, is reported to have secured the contract for two dams for hydro-electric power development, one to be constructed at Ware Shoals, at a cost of about $75,000, the other at Brown's Mills, to cost about $50,000.

Bristol, Va.-Tenn.—Both the municipalities of Bristol are reported to have granted a franchise to an electric distributing company as a means of putting into effect the proposition of New York capitalists to spend $600,000 in developing the Holston River water power in order to supply Bristol with electricity for lighting and manufacturing purposes.

Amarillo, Tex.—The citizens, it is reported, will vote on the issuing of bonds for a municipal light and water plant.

Murray, Utah.—The Progress Co., of Murray, is reported to have filed a petition with the State Engineer for 60 ft. of water to be diverted from the big Cottonwood. It will be used to operate a turbine for the generation of 350 h.p. for the Murray electrical system.

Roanoke, Va.—The Rural Power Co. (P. B. Huff, Pres.), it is stated, will develop power plants in the county. Capital, $5,000.

Tacoma, Wash.—The City Council is reported to have on Sept. 4 rejected the bid of Geo. Milton Savage for the building of the upper Nisqually River power plant, at a cost of $1,750,000.

Antigo, Wis.—Thos. Orbison, of Appleton, is reported to be preparing plans for the development of the water power at Gardiner, on Wolf River. From 3,000 to 5,000 h.p. is available. Henry Sherry, of Neenah, is reported interested.

**Items marked thus give the names of parties awarded contracts.*

London, Ont.—O. Ellwood, Secy., writes that John M. Moore, C. E., of London, is the engr. in charge of the water system and power plant which it is proposed to install here at a cost of about $575,000. Date of opening bids for construction has not yet been decided upon.

Toronto, Ont.—A building permit has been granted for the erection of a brick boiler house, condenser house and smokestack to the Consumers' Gas Co.; cost of work, $60,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Decatur, Ala.—It is stated that the North Alabama Traction Co., John F. Knowlen, Ch. Engr., New Decatur, will build an extension to its lines in Decatur of about a half mile and work will commence soon. It is said that the company will spend $10,000 in Decatur on its lines within the next few months.

Wilmington, Cal.—Henry E. Huntington is stated to have been granted the right to occupy and cross certain streets in Wilmington, thus enabling the Pacific Electric Co. to build a double track along the shore of the west basin from Wilmington to a connection with the Interurban San Pedro line.

Vallejo, Cal.—The Vallejo & Northern Ry. Co., incorporated to build a road from Vallejo to Sacramento, is reported to have obtained its franchise from Vallejo.

Hanford, Cal.—F. S. Granger is stated to have applied to the Bd. of City Trustees for a street railway franchise.

San Diego, Cal.—The South Park & East Side R. R. Co. is stated to have filed petitions for the extension of its line on 4th St. through the northern and northeastern portion of this city. The franchise asked is for a line 6 miles long.

Concord, Cal.—It is stated that A. W. Maltby, of Concord, is working on a project to construct an electric railway from the terminus of the Key Route at Claremont through the Berkeley Hills to Lafayette, Walnut Creek, Concord, and Antioch.

Norwich, Conn.—The Norwich, Colchester & Hartford Traction Co. is reported organized, with Costello Lippitt as president; Lucian Brown, secretary, and Henry W. Tibbits, treasurer, all of Norwich. The company has a charter to construct a steel railway between Norwich and Hartford. Capital, $1,000,000. The length of the proposed line is 38 miles.

*Bristol, Conn.—The Bristol & Plainville Tramway Co. is stated to have awarded to W. W. Crothers a contract for the erection of an addition to its power plant in Highland Court. The extension will be 42x30 ft. and 2 stories high.

Americus, Ga.—The Secy. of State is said to have issued a charter to the American Ry. & Power Co., which will build 4 miles of street car line, put in a thoroughly up-to-date lighting plant and, in addition, will pump water for the city for the next 20 years. W. A. Dodson, A. and J. F. Lewis, of Valdosta, incorporators. Capital, $250,000.

Boise, Idaho.—The Boise & Interurban R. Co., it is reported, has decided to double track its line as far as the Pierce Park, nearly 4 miles, and the erection of a depot in Boise.

Danville, Ill.—The Secretary of State is stated to have issued a license to incorporate the Danville & Southern Ry. Co. Capital, $10,000. It is proposed to construct the main line from Danville to a point in the southwest corner of Georgetown Township, Vermillion County. Incorporators W. H. Carnahan, B. E. Bramble.

Quincy, Ill.—The St Louis, Terre Haute & Quincy Traction Co. is reported to have announced that it is their intention to construct from Terre Haute to St. Louis by connections at Marshall and building southwest from there, paralleling the Vandalia system to Pocahontas, and running directly west to Edwardsville. Connections and traffic arrangements are to be made for entrance into St Louis by the McKinley system and the new bridge. Leaving Quincy, branch lines will be built from Pittsfield to Hannibal, and from Hannibal to Louisiana. The total mileage in the proposition reaches 452 miles. The company is capitalized for $2,000,000, and the cost of construction and equipment will not exceed $1,500,000, it is said.

Evansville, Ind.—It is reported that Nathan P. Carter, of the Grand Central Traction Co., is seeking a franchise to enter Evansville with a line from Indianapolis to Evansville by way of Terre Haute.

Anderson, Ind.—It is stated that the Indiana Union Traction Co., H. A. Nicholl, Gen. Mgr., will expend $40,000 in the construction of a bridge over White River at Clusterton, making fills and taking a bad curve out of the line at that point.

Lewiston, Me.—John A. Jones, of Lewiston, has been engaged to make the survey for an electric railway to be constructed from Lewiston to Portland, a distance of about 33 miles. Preliminary surveys are to be commenced at once.

Belvidere, N. J.—It is stated that the Easton-Washington St Ry. Co. will ask the Common Council for a franchise to build its line through Belvidere, from the Oxford Township line to the Delaware River.

Morristown, N. J.—The Morris & Somerset Electric Co. is stated to have received permission to lay rails and street poles and string wires along the county roads through Morristown.

Warsaw, N. Y.—Surveyors for the Rochester, Scottsville & Caledonia Ry. Co. are stated to have completed the preliminary work to Letchworth Park at Portage. They have also completed a survey from Pavilion to Warsaw. It is understood that the line will begin at Rochester, running through private right of way to Scottsville, Caledonia, Le Roy and Pavilion, from which latter place branches will be run to Warsaw, Rock Glen and Perry and Letchworth Park at Glen Iris. Elliott Strathy, Ch. Engr.

*Dunkirk, N. Y.—It is reported that P. R. Colgan, of Dunkirk, and M. V. Ryan have been awarded the contract by the Western New York & Pennsylvania Traction Co. for the excavation for a line between Little Valley and Salamanca, a distance of 4 miles.

Hempstead, N. Y.—The Highway Comrs. of Hempstead are stated to have granted to the South Shore Traction Co. a franchise to build an electric railway from Central Ave. to the town line at Seaford.

Oswego, N. Y.—The Oswego Traction Co. is reported to have been granted a franchise to lay double tracks in E. 4th St.

Hornell, N. Y.—The Canandaigua Southern Electric R. R. Co. is stated to have announced that plans are now under consideration for extending the road from Atlanta to Wayland and thence by way of the Pittsburg & Shawmut line to Hornell, so that the cars will run direct from Canandaigua through to Hornell. In order to carry out this plan the Pittsburg & Shawmut road will be electrified from a point just outside of Wayland, to Hornell, and the cars of the Canandaigua Southern road will be run from Canandaigua through Naples, Cohocton, Atlanta and Wayland to Hornell.

New York, N. Y.—See "Power Plant Gas and Electricity."

Lancaster, O.—The Logan & Athens Constr. Co. is reported to have made application to the State Bd. of Pub. Wks. for a lease of the tow-path of the canal between Lancaster and Nelsonville, a distance of 33 miles, for the construction of an electric railway. The proposed road will connect Lancaster and Athens.

Salem, Ore.—The City Council is stated to have granted to A. Welch a franchise to construct a system of electric railways over certain streets of the city, traversing the city from north to south.

Lancaster, Pa.—It is reported announced that the Lancaster, Oxford & Southern Ry. Co. has decided to convert its line from steam to electricity. It is said that the change will be made when the power dam at McCall's Ferry is completed. W. M. Franklin, Pres.

Hanover, Pa.—The Hanover & McSherrystown St. Ry. Co., R. E. Manley, Gen. Mgr., is stated to have filed notice of the following extensions of route from North and Church Sts., McSherrystown, to Littlestown, via a bridge over Conewago Creek, and on Queen St., Littletown, to the northern and southern boundaries of the town.

RAILROADS.

Notes Arranged Alphabetically by States.

Locust Bayou, Ark.—The Ouachita Valley Ry. Co. is reported to have increased its capital from $25,000 to $100,000 to extend the road from Locust Bayou to a connection with the Little Rock & Southern R. R.

Napa, Cal.—Richard Hotaling, Pres. of the Napa, Lakeport & Richardson Bay R. R. Co., is reported to have disposed of the bonds for the new road to Eastern people, and it is said that within 3 months contracts will be let. The right of way has been acquired and all surveys finished. The marshes and creek near Santa Venetia and a tunnel 2,200 ft. long will be run through Schuetzen Park hill. A drawbridge will be used over Green Brae Creek and a trestle, over a mile in length, will extend from the Lyford property out into the bay.

Hahns Peak, Colo.—The Larimer & Routt County Ry. Co. is reported incorporated, with a capital of $1,000,000 to construct a railroad in both Larimer and Routt Counties, to extend from the terminal point of the Larimer and Hahn's Peak & Pacific Ry., which is on the state line between Colorado and Wyoming, into North Park, terminating near the mouth of Grizzly Creek. Directors, Isaac Van Horn, Holderness, N. H.; M. T. Dickinson, Brookline, Mass.; L. W. Thompson, Woburn, Mass.; George M. Colby, Lawrence, Mass., and others.

Atlanta, Ga.—The Southern Ry. Co. (W. H. Wells, Engr. Constr., Washington, D. C.) is reported to have submitted plans and specifications to contractors for bids for constructing the proposed additional terminal facilities at Atlanta. The plans include a 7-story freight and office building, 800x100 ft., of fireproof construction. Bids are to be submitted about Oct. 10.

Chicago, Ill.—Jacob R. Muhlick & Co., 100 E. Van Buren St., Chicago, have 100,000 cu. yds. of fine wheeler and grader work near Chicago Heights, Ill., on Chicago Southern Ry., to sublet. Will pay from 18 to 20 cts. per yd.

Buffalo, N. Y.—Engineers are reported to be making a survey in Schoharie County for the Buffalo, Rochester & Eastern R. R. (A. D. Robinson, Secy), which was recently incorporated, with a capital of $3,500,000, to build a 4-track line across the state between Troy and Buffalo.

Newburg, N. Y.—Mayor Robinson is reported to be in favor of the abolishment of the grade crossing of the West Shore R. R. ((J. H. Hustis, Gen. Supt., Syracuse) in the South end.

Hamilton, N. Y.—F. K. Baxter, of Utica, is making a preliminary survey for an extension of the Utica Southern R. R. between Hamilton and Norwich.

Asheville, N. C.—The Appalachian Const. Co., recently chartered here, will, it is reported, have charge of constructing the railroad from Rutherfordton, N. C., where connection will be made with the Seaboard Air Line to Knoxville, Tenn., where the proposed road will connect with the Louisville & Nashville R. R.

Uniontown, Pa.—The Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia, Pa.) is reported to have decided to expend $100,000 in Uninotown for a new yard and enlarged trackage facilities, and $117,000 in Dunbar for new trestles and yards to handle the traffic of the Dunbar Furnace Co.

Lynchburg, Va.—The Bd of Aldermen is stated to have concurred in the ordinance providing for a franchise for the Southern Ry. (W. H. Wells, Engr. of Constr., Washington, D. C.) for its cut-off through the west end of the city. The ordinance carries with it the right to establish a passenger station 2 miles from the present Union Station.

Walla Walla, Wash.—The Spokane & Inland Ry Co. (A. M. Lupfer, Ch. Engr., Spokane) is reported to have in contemplation the extension of its line to Walla Walla in the near future.

Acopulco, Mex.—The Mexican Dept. of Communications & Pub. Wks. has granted to the Mexican Pacific Co. a 99-year concession to construct and exploit a railroad from the city of Acapulco running southeast to northwest, touching at a point called Pie dela Cuesta and terminating on a given point on the River Coyuca, the surveys to be begun within 6 months. The headquarters of the company are to be in Acapulco.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

*Pine Bluff, Ark.—It is reported that A. Brewster, of Pine Bluff, has secured the contract to erect a 45-room hospital at 16th Ave. and State St., estimated to cost $15,000.

Napa, Cal.—The erection of a new city hall is reported under consideration.

*Inglewood, Cal.—The Consolidated Plumbing Co. is reported to have secured the contract for the plumbing and heating system to be installed in the Inglewood Sanitarium at $8,758.

Pueblo, Colo.—It is stated that plans and specifications for a cottage to be erected at the Insane Asylum at Pueblo have been submitted to the State Bd. of Charities for approval, and it is reported that bids for the construction will be received until Sept. 26. The cost of the building is to be about $50,000.

Norwich, Conn.—The following are reported to be the bids opened at Washington, D. C., Sept. 4, for making alterations and additions to the building for the marine corps at the Thames Naval Station: General Contr. Co., of New Orleans, $48,378; J. Franklin Edgecomb, of Groton, $44,281; Peck, McWilliams & Co., of Norwich, $37,750; F. M. Ladd Co., of New London, $36,326; Horace G. Watrous, of Groton, $44,156; H. R. Douglas, of New London, $44,723; Marquardt Bros., of Groton, $39,497; Henry H. Morgan, of New London, $29,593; A. N. Carpenter, of Norwich, $38,507.

Washington, D. C.—Bids will be received at the office of the building for the National Museum, Library of Congress, until Oct. 10 for furnishing, delivering and erecting in place complete the large metal, wood and plate glass windows, as advertised in The Engineering Record.

Bids were opened on Sept. 14 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for stable, laundry and conservatory for Naval Hospital reservation, Washington, and the following 3 contractors bid for all 3 buildings: Jos. S. Reynolds, 1816 1st St., N. W., $28,493; Brennan Constr. Co., 3056 K St., $28,464; and Columbia Eng. Co., 626 Colorado Bldg., $30,300. Piper & Kenyon, 729 15th St., N. W., bid for conservatory only $29,127, and Hitchings & Co., 1170 Bway., New York, N. Y., bid for greenhouse only, $2,162.

Pensacola, Fla.—See "Miscellaneous."

Hamilton, Ga.—The citizens have voted to issue $40,000 bonds to erect a courthouse, and it is reported that bids for the construction will be received by the Co. Comrs. about Oct. 2.

*Decatur, Ill.—The contract to erect the Post Office complete at Decatur, bids for which were received Aug. 20 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., has been awarded to V. Jobst, of Peoria, at about $82,593.

Chicago, Ill.—C. W. Zimmerman, State Architect, is stated to have prepared plans for the armory for the Seventh Regiment Illinois National Guard, to be erected at 33d St. and Wentworth Ave. The structure to be of concrete, steel and brick, 150x250 ft., and cost $300,000.

St. Charles, Ill.—Ernest Woodyatt, of Chicago, Ill., is reported to have been engaged to prepare plans for the Carnegie Library.

Muncie, Ind.—It is reported that the contract will soon be let for erecting city hall and municipal building, at an estimated cost of $100,000.

Terre Haute, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 30 for erecting a county jail, sheriff's residence and installing a heating plant. Jerome W. Denehie, Co. Aud.

Laporte, Ind.—It is reported that the erection of a jail has been estimated at $60,000.

Eufaula, Ind. Ter.—The Court House is reported destroyed by fire.

Ft. Dodge, Ia.—It is stated that a site has been donated in Ft. Dodge and $50,000 raised with which the Sisters of Mercy, of Dubuque, will erect a hospital here.

Des Moines, Ia.—Hallett & Rawson, 615 Walnut St., are reported to have submitted plans for the Coliseum, providing for a seating capacity of 10,000.

*Liberty, Kan.—J. M. Smith, Archt., Hutchinson, Kan., writes that the contract to erect the court house (bids for which were received Sept. 6) has been awarded to L. H. Sutton, of Liberal, at $15,500.

Louisville, Ky.—See "Power Plants, Gas and Electricity."

*Baltimore, Md.—E. A. Watters & Co. are stated to have secured the contract to erect the public comfort station at Lombard and Center Market Pl., at $12,835.

Bids will be received until Sept. 27 at the office of L. L. Williams, Custodian, U. S. Marine Hospital, for repairs and new covering for the roofs of the 3 ward buildings and connecting galleries of this station.

Fall River, Mass.—It is reported that the Mayor has directed the Bd. of Health to proceed with the erection of the contagious disease hospital, plans for which were drawn several months ago.

Detroit, Mich.—Stratton & Baldwin, Union Trust Bldg., are reported to have been engaged by Park Comr. Breitmeyer to prepare plans for the public bathhouse to be erected on Belle Isle, at a cost of about $35,000. Plans are expected to be ready in about 2 weeks, and bids for the construction will be asked at once.

Hibbings, Minn.—The Library Bd. is stated to have rejected as being too high all bids recently received for plumbing and heating in the Carnegie Library.

Faribault, Minn.—The German Evangelical Synod, at a recent meeting in St. Paul, it is stated, decided to erect the Lutheran Hospital in this city.

Maryville, Mo.—The citizens are stated to have voted to issue $35,000 bonds for erecting an infirmary at the County Farm.

*Items marked thus give the names of parties awarded contracts.

Jefferson Barracks, Mo.—Bids will be received until Oct. 1 by O. W. Bell, Q. M., U. S. A., for furnishing and installing 2 new boilers in general mess hall building at this post.

Fremont, Neb.—Bids will be received until Sept. 30 by E. N. Morse, Chmn. Bd. Pub. Wks., for furnishing material and constructing at the city water and light plant a building and foundations for machinery and boilers;; est. cost, $21,488; also erecting a chimney; est. cost, $5,500. Chas. A. Chapman, Engr., Marquette Bldg., Chicago, Ill.

**Somerville, N. J.*—The Bd. of Freeholders is stated to have awarded the contract for heating, lighting and plumbing the court house to Wm. H. Fissel & Co., of New York, N. Y., for $11,900.

Newark, N. J.—Bids will be received until Oct. 1 by the Bldg. Com. Bd. Chosen Freeholders (E. C. Eaton, Acting Chmn.), for installation of new boiler and alteration to the steam and hot water equipment at the Essex Co. Prison building, also plunmbing work at above building. Hurd & Sutton, Archts., Union Bldg.

**Trenton, N. J.*—Connors Bros., of Lowell, Mass., have secured contract for extension to U. S. Post Office (bids opened on Aug. 27 at the office of the Superv. Archt., at Washington, D. C.), for $133,400.

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrman, Pres.) until Sept. 26, for furnishing materials and erecting an addition to the Metropolitan Museum of Art, to be known as the library wing (addition G), located in Central Park, on the west side of 5th Ave. McKim, Mead & White, Archts., 150 5th Ave.
Plans have been filed for alterations and additions to be made to the St. Vincent's Hospital at 12th St. and 7th Ave., to cost $75,000.

Long Island City, L. I., N. Y.—Bids will be received until Sept. 30 by Jos. Bermel, Boro. Pres., for constructing a public comfort station.

Ft. Slocum, N. Y.—Bids will be received at the office of the Constructing Q. M. until Oct. 7 for the construction, etc., of addition to post hospital, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received by the Dept. Public Charities (Robt. W. Hebberd, Comr.), N. Y. City, until Sept. 30, for furnishing material, erecting Coney Island Hospital, Boro. Brooklyn. Security required, $120,000. Helmle & Huberty, Archts., 190 Montague St., Boro. Brooklyn.

Albion, N. Y.—Bids will be received by Jane L. Armstrong, Pres. Bd. Mgrs., Western House of Refuge for Women, at Albion, until Oct. 1, for construction, etc., of a cottage at Albion, as advertised in The Engineering Record.

Buffalo, N. Y.—The Council is reported to be considering the installing of a new hot water heating system in Engine House No. 3 and Hook and Ladder House No. 3, on Spring St.
The Buffalo Forge Co., Bway. and Tousey St., is stated to have submitted a bid to the Bd. of Superv. for a ventilating apparatus in the 65th Regt. Armory, at $10,970 (bids opened Sept. 10).
Bids were opened Sept. 10 by the Bd. of Superv. for erecting an addition to the county jail as follows: J. Geo. Schaaf, 547 E. Utica St., $34,500, and the Buffalo General Bldg. Co., Mosell and Urban Sts., $36,145. Bids on parts of the work were also received, the lowest for masonry being Metz Bros., 334 Landon St., $20,884; cut stone, A. P. Kehr, $8,285; masonry (county to furnish stone), J. J. Churchyard, 649 Clinton St., $11,373, and carpentry, $4,376.
The following are the bids opened on Sept. 16 at the office of the Superv. Archt., Washington D. C., for the construction (except elevators) of the U. S. Marine Hospital at Buffalo: Henry Shenk, Erie, Pa., $147,340; H. Probst, New York, N. Y., $149,700; Morris & Summers, Buffalo, $137,900, and Chas. McCaul, Philadelphia, Pa., $152,324.

Rochester, N. Y.—Bids will be received until Sept. 25 by the Bd. Contract and Supply, (F. X. Pifer, Clk.), for alterations and additions to the old N. Y. State Armory, Monroe and Clinton Ave. S., to convert same into a convention hall for this city. Appropriation, $40,000. J. Foster Warner, Archt., 1036 Granite Bldg.

Troy, N. Y.—Bids will be received until Sept. 26 by Hiram W. Gordinier, Compt., for $74,719 public building bonds; also $56,230 public improvement bonds.

Geneva, N. Y.—It is reported that all bids received Sept. 5 by L. P. Haviland, Chmn. Bldg. Comn., State Agricultural Experiment Station, Geneva, for erecting 3 staff residences and 2 cottages for the laborers at the said station have been rejected as being too high. Appropriation, $22,500.
The plans of A. C. Nash and Duncan Canvass, of New York, N. Y., are reported to have been accepted for the City Hall.

Lumberton, N. C.—Bids will be received until Oct. 7 by the Bd. Co. Comrs. (J. W. Carter, Chmn., Maxton) for $50,000 courthouse bonds.

**Grand Forks, N. D.*—Dinnie Bros., of Grand Forks, are reported to have secured the contract to erect the south side fire hall, at $11,115.

Dayton, O.—A site is stated to have been purchased on Sears St. for the erection of a station house to cost $200,000.

Ashland, O.—See "Water."

Massillon, O.—Bids will be received until Oct. 7 by Dr. Henry C. Eyman, Secy. Massillon State Hospital for furnishing and installing furnaces or mechanical stokers for 4 Heine boilers, 150 h. p. each, in batteries of two for above hospital.

Youngstown, O.—It is reported that bids will be received until Oct. 15 by the Co. Aud. for constructing a 4-story granite court-house, 237 x 136 ft. Estimated cost, $1,000,000. Owsley & Boucherle, archts., Wick Bank Bldg.

Harrisburg, Pa.—The Armory Bd. at Harrisburg is reported to have approved plans for armories to be erected, one in Pine Grove for Company F, 4th Regt., and one in Grove City for Company M, 16th Regt. An armory is to be erected in Reading for Companies A and I, 4th Regt., and an armory for 4 companies of the 12th Regt. is to be erected in Williamsport if the city will donate a site.
*The Bd. of Pub. Grounds & Bldgs., it is stated, has signed a contract with the York Eng. Co., of York, to extend the steam heating system of the Capitol Bldg. to the museum and conservatory.

Ft. Ethan Allen, Vt.—Bids will be received by Lieut M. G. Holliday, Q. M., U. S. A., until Sept. 28 for the construction, plumbing, wiring and fixtures for electric lighting, of 1 brick double set civilians' quarters at this post.

Richmond, Va.—It is reported that contracts will soon be awarded for the erection of a public bath at Broad and 18th Sts., at a cost of about $20,000.

Milwaukee, Wis.—Alvin P. Kletzsch, Pres. Auditorium Bd., writes that new bids will be received by the Bd. until Oct. 21, for erecting the auditorium, which is to cost about $475,000. Ferry & Clas., 419 Bway., are the archts.
*Theo. C. Froemming and Wm. Gutnecht are stated to have secured the contract for excavating, leveling and grading the site for the Auditorium, at $4,800, and J. E. Hathaway & Co., Canal St. and First Ave., the contract for the piling work, at 28 cts. per lin. ft. for 60-ft. piles, 25.5 cts. for 55 ft., 25 cts. for 50 ft. and 22 cts. for 45 ft.; total, $21,000.

Oconto, Wis.—The Oconto County Court House is reported partially destroyed by fire.

**Chippewa Falls, Wis.*—Otto Neitge, of Mankato, Minn., is stated to have secured the contract to erect 3 cottages at Wisconsin Home for Feeble Minded at Chippewa Falls, at $96,600. Ferry & Clas, of Milwaukee, are the archts.

Montreal, Que.—It is reported that bids will be received until Sept. 24, by Fred Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont., or C. Desjardins, Clk. of Works, post-office, Montreal, for constructing an addition to the post-office at Montreal.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—The Louisville & Nashville R. R. (J. E. Willoughby, Engr. of Constr., Knoxville, Tenn.), it is stated, is having plans prepared for a $150,000 passenger station which they propose erecting in Mobile.

**Portland, Ark.*—Pugh Blythe, of Monticello, is reported to have secured the contract to erect a $23,000 building here.

San Diego, Cal.—The erection of a $60,000 building for the Salvation Army is reported under consideration.

San Francisco, Cal.—The S. and H. Lachman estate is stated to have applied for a permit to erect a 2-story brick warehouse on Brannan and 4th Sts., at a cost of $174,000.

San Diego, Cal.—It is stated that A. G. Gassen will erect a business building at a cost of $60,000, to be occupied by the Chadbourne Furniture Co.

Napa, Cal.—See "Railroads."

**Los Angeles, Cal.*—B. V. Collins, of Los Angeles, has secured the contract to supply marble and tile for the Main St. Co.'s building on 6th and Main Sts., for $55,250. Parkinson & Bergstrom, Archts. The same contractor has been awarded contract for marble work for the Wright & Callender Bldg., at 4th and Hill Sts., for $18,600. J. C. Austin, Archt., Pacific Electric Bldg.
John P. Kremple, 415 Henne Bldg., is reported to have completed plans for a 3-story and basement brick store and rooming house to be erected on E. 7th and Wall Sts., for Adolph Nabel.

Denver, Colo.—Fallis & Stein, Colorado Bldg., are stated to have completed plans for an addition to the Oxford Hotel, to cost $30,000.
*A permit is stated to have been issued for a 63x83-ft. brick building at 16th and Wynkoop Sts. for the Union Pacific Ry. Co. R. L. Huntley, Ch. Engr., Omaha, Neb., to cost $23,000.

**Waterbury, Conn.*—The New York, New Haven & Hartford R. R. Co. (Edw. Gagel, Ch. Engr., New Haven) is reported to have awarded the contract for erecting the depot here to Horton & Hemingway, 633 Atlantic Ave., Boston. The structure is to cost $200,000.

Wilmington, Del.—It is stated that Harry Bothmann has under consideration the erection of a 6-story hotel in Wilmington, to cost about $250,000.
A company in which Dudley McAdow, of Stair & Haviland, of New York, N. Y., is interested, is reported to have secured a site on which it is proposed erecting a theatre to cost about $150,000.

Jacksonville, Fla.—The Florida Life Insurance Co., it reported, is planning to erect a 5-story business building to cost $100,000.

Atlanta, Ga—See "Railroads."

Macon, Ga.—A company is reported being formed for the purpose of erecting a 5-story office and bank building. W. C. Stevens is reported interested.

Boise, Idaho.—It is reported that Leo. J. Falk is Secy. of a company which intends erecting a $30,000 hotel and theatre here.

**Moline, Ill.*—The Leonard Martin Constr. Co. is reported to have secured the contract to erect a 6-story reinforced-concrete building for Deere & Co., to cost about $50,000.

Chicago, Ill.—The erection of a 14-story hotel at La Salle and Madison St. is reported contemplated, at a cost of about $300,000. Jas. W. Stevens is reported interested.
It is stated that the Saml. Cupples Woodenware Co. and the Saml. Cupples Envelope Co. will erect a 6-story 100x125-ft. building at Illinois and St. Clair Sts. S. N. Crowen, Archt., 85 Dearborn St.
An 8-story brick and terra-cotta fireproof building, 125x140 ft., is to be erected, according to reports, on Michigan Boule. and 13th St., to take the place of the present New Southern Hotel. The cost is to be about $200,000.

Terre Haute, Ind.—Arthur Foltz, of Indianapolis, it stated, has been engaged to prepare plans for the Y. W. C. A. Bldg.

Indianapolis, Ind.—It is reported that bids will be received by Hiram Brown, Chmn. Bldg. Com., until Oct. 10, for erecting the Y. M. C. A. building on N. Pennsylvania St. D. A. Bohlen & Son, Archts., Majestic Bldg.

Waterloo, Ia.—Woods Bros., it is stated, will erect a 7-story reinforced-concrete store building, 70x130 ft., and bids will be received about Jan. 1.

**Perry, Ia.*—John Oleson is reported to have secured the contract to erect a 2-story brick building for John Dignan, to cost about $15,000.

Davenport, Ia.—The Elks Bldg. Co. is stated to be having plans prepared by Hanssen & Harft, Schmidt Bldg., for a 2-story club building.

**Davenport, Ia.*—The Davenport Locomotive Wks. Co. it is stated, has awarded the contract to erect a brick addition, 100x200 ft., to its plant to the Tri-City Constr. Co., Masonic Temple, at about $25,000.

**Riverside, Md.*—The Baltimore & Ohio R. R. Co. is stated to have awarded the contract to erect the Y. M. C. A. Bldg. at Riverside to J. J. Walsh & Sons, of Baltimore, at about $33,000. The building is to be 2 stories, of brick with stone trimmings, 36x100 ft.

**Baltimore, Md.*—Thos. L. Jones & Sons, 410 W. Saratoga Ave., are reported to have the contract to erect a 4-story building at 109 N. Howard St. for F. H. Hack, to be of steel construction, 55x90 ft.

Fall River, Mass.—The Lodge of Elks, it is reported, has secured a site and will erect a $25,000 building. Jas. H. Hoar, Chmn., Bldg. Com.

Battle Creek, Mich.—The Elks are reported to be planning the erection of a temple, at a cost of about $50,000.

Iron River, Mich.—It is stated that Jos. Gibbs & Sons of Garden, have accepted plans for a store building to be erected in Iron River at a cost, including site, of about $30,000.

**Minneapolis, Minn.*—Pike & Cook, 416 S. 5th St., it is stated, have the contract to erect a 4-story fireproof building, 132x157 ft., for John W. Thomas & Co., at 8th and Nicollet Ave.

Winona, Minn.—The First Natl. Bank Directors, it is stated, have secured a site at 4th and Center Sts., on which it is proposed erecting a bank building to cost $75,000.

Duluth, Minn.—The erection of a 6-story office building for John Christie (bids for which were received Aug. 24) has been postponed indefinitely, probably until spring. E. K. Coe, Con. Engr., 1411 E. 3d St.; W. T. Bray, of Duluth, Archt.

Hattiesburg, Miss.—It is stated that about $25,000 has been raised with which it is proposed erecting a 4-story Y. M. C. A. Bldg.

Kansas City, Mo.—It is stated that plans are being prepared for an office building to be erected at 11th and Walnut Sts. for Ely Meyer and S. C. Simon.

Buffalo, N. Y.—The Delivery Co. (A. I. Loomis, Pres.), it is stated, has secured a site on Elm and Genessee Sts., on which it is proposed erecting a 2-story brick building, to cost about $30,000.
It is stated that the estate of John Greiner is contemplating the erection of a 3-story building, 250x50 ft., on Main and Chippewa Sts. Fred. Greiner, 338 Brisbam Bldg., may be able to give further information.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone stores and tenement at 278 Henry St., for Aronowitz, Segman & Bernadik, cost $48,000. Oscar Lowinson, Archt.; 7-story brick and stone stable at 3rd and Goerck Sts. for Jos. Goldfine, cost $63,000, Shampan & Shampan, Archts.; 2-story brick bakery at Duncomb Ave. and Elizabeth St., for estate of Louis Fleischmann, cost $50,000, Adolph Mertin, Archt.

Sloan, N. Y.—The Delaware, Lackawanna & Western R. R. (J. E. Snell, Supt. Bldgs. and Docks, Hoboken, N. J.), is reported to be considering the erection of a Y. M. C. A. Bldg. here, to cost about $20,000.

Kensal, N. D.—Nearly all the business section of Kensal, is reported to have been destroyed by fire Sept. 13.

**Ashtabula, O.*—C. F. Grain, of Ashtabula, is stated to have secured the contract to erect the club house for the Elks, the cost to be about $30,000.

Cincinnati, O.—Local press reports state that bids will be received by Harry Hake, Archts., Union Trust Bldg., until Sept. 24, for erecting a 15-story, 93x94-ft., fireproof, steel, granite and pressed brick office building at 7th and Vine Sts. Probable cost, $250,000.

Manayunk, Pa.—It is stated that a permit has been granted to Wm. Steele & Sons Co., of Philadelphia, to erect a 2-story factory at Walnut Lane and Station St., at a cost of $35,000.

**Lebanon, Pa.*—Jerry Greiner, General Contractor, is stated to have sub-let the contract for the heating in the Union House Hotel to Geo. W. Schreiber, of Lebanon. About 48 radiators will be required.

**Bristol, Pa.*—Ernest Lawrence, of Bristol, it is stated, has secured the contract to erect a 1-story building for the Trust & Savings Bank, at $11,386.

Wilkesbarre, Pa.—Chas. Knapp, of Baltimore, Md., and others are reported to have had plans prepared for a theatre which it is proposed erecting in Wilkesbarre, at a cost of about $200,000.

Pittsburg, Pa.—It is reported that thework of constructing the steel frame office building for the Henry W. Oliver estate, at Smithfield St. and Oliver Ave., is to be started soon. D. H. Burnham & Co., 9 Jackson Boule., Chicago, Ill., are taking bids on the structure, which is to be 25 stories high and cost $2,500,000.

Pittsburg, Pa.—A permit has been issued to Walter Werner to erect a 2-story brick storeroom and office building at Hoghland Ave. and Baum St., to cost $50,000; and J. A. Williams, a 6-story brick warehouse on Chatham St., to cost $40,000.

Nashville, Tenn.—H. H. Ewing & J. B. Fletcher, the Arcade, Nashville, it is stated, have prepared plans for the stone and brick warehouse to be erected on Harrison St. for the Wholesale Merchants Warehouse Co., at a cost of about $100,000.
Jos. Lightman is reported to be having plans prepared for three warehouses which he intends erecting at a total cost of about $80,000.

**Robstown, Neuces County, Tex.*—Howard J. Ross, of Washington, Ia., is stated to have secured the contract

**Items marked thus give the names of parties awarded contracts.*

to erect a $20,000 business building at Robstown for Geo. H Paul.

Beaumont, Tex.—The erection of a labor temple here to cost about $10,000, is reported under consideration. T. C Jennings may be able to give further information.

**Corsicana, Tex.*—W. H. Brilheart, of Abilene, is reported to have secured the contract to make improvements in the Odd Fellows Home for Widows and Orphans, to cost $24,500.

**Corpus Christi, Tex.*—Hoggson Bros., of New York, N. Y., it is stated, have secured the contract to erect a 4-story bank and office building for the City Natl. Bank of Corpus Christi, to cost about $50,000.

Lynchburg, Va.—See "Railroads."

Seattle, Wash.—C. Alfred Breitung, Walker Bldg., is reported to be preparing plans for a 2-story market building to be erected at Westlake Ave. and Stewart St. for a company, of which W. W. Sisco and J. R. Bold are directors. The cost of the building is to be about $50,000.

Milwaukee, Wis.—A committee, of which Pres. W. M. Post is a member, has been appointed to arrange for plans for the Y. M. C. A. Bldg. which is to be erected on the site south of the present building. The cost is to be about $250,000.

**Waukesha, Wis.*—The contract for the interior work of Resthaven, the sanitarium, club and hotel near Waukesha is stated to have been awarded Sept. 10 to the Foster Constr. Co.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—Jas. A. Lewis is stated to have awarded to the Jett Bros. Constr. Co., of Mobile, the contract to erect an apartment house, estimated to cost $300,000.

Sacramento, Cal.—C. T. Spading, it is reported, contemplates erecting an apartment house here to cost about $10,000.

Atlanta, Ga.—It is reported that the St. John's M. E. Church congregation is preparing to erect an edifice estimated to cost $25,000.

St. Charles, Ill.—Turnbull & Jones, of Elgin, it is stated, have been engaged by the Bldg. Com. of the Methodist Episcopal Church to prepare plans for an edifice.

Rockford, Ill.—It is stated that an edifice costing about $20,000, is to be erected in the Southeast end for the members of the Salem South Park Lutheran Church.

Elkhart, Ind.—See "New Industrial Plants."

Iowa City, Ia.—The lowest bid opened Aug. 29 by Bd. Regents State University of Iowa for erecting a residence for the president is stated to have been submitted by B. A. Wickham, of Iowa City, at $20,000.

**Lexington, Ky.*—Frank Corbin, of Lexington, is reported to have secured the contract to erect the Hill St. M. E. Church at $75,000.

**Haverhill, Mass.*—Jere Parker is reported to have secured the contract for erecting an edifice for the Adventist Christian Church, for about $10,000.

Duluth, Minn.—Geo. Munsey is reported to have filed plans for a 3-story brick and stone apartment house to be erected at 15th Ave. E. and Superior St., at a cost of $45,000.

Kansas City, Mo.—Plans have been filed for a frame dwelling to be erected at 3319 Garfield Ave., to cost $22,000. F. J. Kirker, owner; and for a stone dwelling to be erected at 36th and Harrison Sts., to cost $25,000. J. H. White, owner.

Farmington, Mo.—Chas. F. Mann, of St. Louis, is reported to be preparing plans for a $20,000 church, to be erected here.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 7-story brick and stone tenement at 183 Thompson St. for D. O. Mills; cost, $55,000; J. M. Robinson, Archt.; two 5-story brick tenements at 139th St. and Willis Ave. for John M. Link; cost, $60,000; Harry T. Howell, Archt.; 4-story brick tenement at Morris Park Ave and Hancock St. for Felix Farago; cost, $20,000; Goldner & Goldberg, Archts.

Charlotte, N. C.—It is reported that plans have been completed for an edifice to be erected for the Baptist Church at a cost of about $25,000.

Grand Forks, N. D.—It is stated that a Roman Catholic Church is to be erected here, replacing edifice destroyed by fire, cost to be about $100,000. Rev. E. J. Conaty,

Cincinnati, O.—Mrs. Louis Hummel, it is stated, will erect a residence on Harrison Ave., Westwood, to cost $15,000. Werner & Adkins, 77 Mitchell Bldg., are the archts.

Cleveland, O.—It is reported that plans have been prepared by A. F. Janowitz, 176 Euclid Ave., for an apartment house, to be erected at a cost of $28,000, for S. Newman.

It is stated that the members of the Euclid Ave Baptist Church are contemplating the erection of a new edifice to be 16 stories high, institutional in character, to contain gymnasium, lecture rooms, rooms for clubs and societies, etc. Rev. Charles A. Eaton, pastor.

Delphos, O.—It is stated that bids will be received by D. J. Breese, Chmn. Bldg. Comrs., of the Presbyterian congregation, box 155, until Oct. 1, for erecting a church according to plans by Archt. F. E. Walker, Toledo, O.

Pittsburg, Pa.—A permit has been issued for a brick edifice to be erected by the members of the Warren M. E. Church at Center Ave. and Soho St., to cost $33,000.

**Philadelphia, Pa.*—The contract for erecting an edifice for the congregation of St. Veronica's Catholic Church, at 6th and Venango Sts., is reported to have been awarded to John McShain. The building will be 1 story, 64x150 ft., and cost $80,500.

**Johnson City, Tenn.*—The North American Bldg. Co., of Chattanooga, is stated to have secured the contract for erecting the Methodist Episcopal Church South, at $24,000.

Jacksonville, Tex.—C. H. Page, Jr., of Austin, is reported to be the archt. for an edifice to be erected for the members of the Methodist Church, at a cost of about $20,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Osceola, Ark.—Bids will be received until Oct. 15 by L. A. Morris, Secy. Bd. School Dirs., for erecting a school; also, same time and place, for $25,000 school bonds. L. M. Weathers Co., Archts., Memphis, Tenn.

New Haven, Conn.—Mrs. Jas. B. Oliver, of Pittsburg, Pa., is reported to have given to the Sheffield Scientific School of Yale Univ. $150,000, with which it is proposed erecting a recitation or lecture hall as a memorial to Danl. Leet Oliver, Mrs. Oliver's son. Chas. Coolidge, of New York, N. Y., is the archt., and the building is to be of Indiana limestone, wholly fireproof.

**Stafford Springs, Conn.*—Lord & Burnham, of New York, N. Y., are reported to have secured the contract to erect the green houses at the Connecticut Agricultural College at a cost of $20,000.

**Ft. Wayne, Ind.*—The contract for preparing plans for the festival hall and armory at Concordia College is stated to have been awarded to J. F. Wing.

Lafayette, Ind.—The Bd. of Trus. of Purdue Univ., it stated, has approved the plans for the experiment station building which is to be erected at the Univ. with the $100,000 recently appropriated by the Legislature.

**Syracuse, Ind.*—The School Bd. is reported to have awarded to Everlee & Wallace, of Plymouth, Ind., the contract to erect the school and town hall at $27,500, and the contract for ventilating and heating same to the Bryce Htg. & Ventilating Co., of Toledo, O.

**Oelwein, Ia.*—The contract for the plumbing in the Central School is reported to have been awarded to the Scott Co., of Oelwein, at $2,513.

**Burlington, Io.*—The Stewart & Hayden Co., 310 N. Main St., is stated to have received the contract for the plumbing and heating of the Washington School.

**Ackley, Ia.*—Wm. Flesna, of Ackley, is stated to have secured the contract to erect a school, at $11,997.

**Chapman, Kan.*—E. S. McCormick, of Abilene, County Supt. of Pub. Instruction, writes that the contract for erecting addition to County High School at Chapman, (bids opened Sept. 15), has been awarded to Vick Bros. & Brooks, of Junction City, for $9,350.

**Cumberland, Md.*—The contract to erect a high school at Green and Lee Sts. is reported to have been awarded to Olin Gerlach, of Frostburg, at about $30,000.

Sutton, Mass.—Bids will be received until Sept. 26 by Jas. W. Stockwell, Chmn. Bldg. Com., and Cutting, Carleton & Cutting, Archts., Worcester, for erecting a 4-room school in Sutton Center.

New Bedford, Mass.—The City Council is reported to have decided to procure bids for erecting the high school, according to plans prepared by Samuel C. Hunt, 76 Pleasant St. C. S. Ashley, Mayor.

**Rochester, Minn.*—M. Heffron, of Rochester, is stated to have secured the contract to erect an addition to the Academy of Our Lady of Lourdes, which is to cost about $64,000.

Ravenna, N. Y.—It is stated that new bids are to be received for erecting the school for which there is an appropriation of $16,000. Bids for this building were received July 31, but were above the appropriation.

Flushing, L. I., N. Y.—Bids will be received until Sept. 30 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus for additions to School 41, Boro. Manhattan; also installing ventilating and heating and electric generating apparatus and electric elevator in the Parental School, Flushing, Boro. Queens.

Fargo, N. D.—Plans are stated to have been completed for a Normal School to be erected in Fargo.

**Crary, N. D.*—It is stated that E. C. Richmond, of Grand Forks, has secured the contract to erect a brick school at $10,645.

Esmond, N. D.—It is stated that bids will be received by W. Quennell, dist. clk., until Sept. 30, for erecting a brick school. Thori, Alban and Fisher, archts., 408 Chamber of Commerce Bldg., St. Paul, Minn.

Mt. Healthy, O.—Bids will be received until Oct. 10 (readvertisement) by Wm. Fischvogt, Clk. Bd. Educ., Special School Dist. No. 13, Springfield Township, Mt. Healthy, R. F. D. No. 4, for furnishing material and erecting a school on Vanzant Rd., near Hamilton Pike; also same time and place, for erecting a school in Stulls' subdivision; bids on labor and material must be submitted separately. Martin Fisher, Archt., 2156 Central Ave., Cincinnati.

Cincinnati, O.—Bids will be received until Sept. 30 by the Bldg. Com., (Dr. J. M. Withron, Chmn)., Bd. Educ., as a whole or separately, for the different branches of work necessary to complete the flush closet system in the Hyde Park School, corner Edwards and Observatory Aves.

Allegheny, Pa.—It is stated that plans have been authorized prepared for a school to be erected in the 10th Ward, at a cost of about $120,000.

Braddock, Pa.—It is stated that Archt. J. L. Peoples, Pittsburg, has completed plans and will receive bids until Sept. 25, for a 3-story school for the school commissioners, Braddock. Probable cost, $75,000.

South Sharon, Pa.—Bids will be received until Sept. 28 by A. R. Maxwell, Secy. Bd. Dirs. South Sharon School Dist., 519 Emerson Ave., for installing a ventilating and heating plant in the High School, to be erected here. W. G. Eckels, Archt., New Castle.

*The Bd. of Public Affairs is reported to have awarded contract for the new waterworks pumping engine to the Canton Hughes Pump Co. for $7,975, and for the two boilers to the D. Connelly Boiler Co., Cleveland, for

Bids will be received until Sept. 28 by A. R. Maxwell, Secy. School Bd., 519 Emerson Ave., for erecting the High School, Fruit and Haywood Sts. W. G. Eckles, Archt., New Castle.

Highmore, S. Dak.—It is stated that bids will be received by the Regents of Educ. at Brookings, until Sept. 26, for the erection of barn, granary and corn cribs on the State Experimental Farm, Highmore.

Teague, Tex.—The School Bd., it is staed, has accepted the plans of C. H. Page, Jr., of Austin, which have been submitted for a brick school, to be erected at a cost of $20,000.

Nixon, Tex.—The citizens are stated to have voted in favor of issuing $10,000 bonds to erect a brick school.

Kenosha, Wis.—The Bd. of Educ. is stated to be contemplating the erection of a grade school at a cost of $50,000.

**Superior, Wis.*—It is stated that the contract to erect a school has been awarded to Dan Egan, at about $50,000.

Milwaukee, Wis.—A permit has been granted to the St. Boniface congregation to erect a 2-story brick and stone school on 12th and Clarke Sts., to cost about $21,000.

Manitowoc, Wis.—Bids will be received until Sept. 25 by Herbert L. Markham, Clk. Joint School Dist. No. 1, for furnishing material and erecting a 6-room addition to the Luling School in the 6th Ward. C. H. Tegen, Archt.

Selkirk, Man.—It is reported that the School Bd. has decided to erect a school at a cost of $11,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Ashdown, Ark.—See "Power Plants, Gas and Electricity."

Los Angeles, Cal.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the necessary machinery for the equipment of a Portland cement plant of a daily capacity of 1,000 bbls. of manufactured cement, consisting of 3 rotary kilns, crushers, pulverizers, dryers, conveyors, elevators, car pulleys and shafting, silex mill linings and flint pebbles, etc., bids for which will be received at the office of the Bd. of Pub. Wks. until Oct. 7. Horace B. Ferris, Secy., W. R. Ormsby, Acting Purchasing Agent.

Pensacola, Fla.—See "Miscellaneous."

Streator, Ill.—A. Brandes, of Chicago, is reported to have decided to construct a cold storage and ice plant in Streator, to cost about $75,000.

Chicago, Ill.—The Johnson & Jennings Co. are reported to have secured a site on 37th and Morgan Sts., on which it is proposed erecting a factory and warehouse, to cost about $100,000.

Evansville, Ind.—It is stated that the Peerless Seat & Tank Co. has authorized Harris & Shopbell, 123 W. 4th St., to prepare plans for a 3-story, 50x100-ft. brick addition to the plant.

Elkhort, Ind.—The Sterling Hudson Whip Co., it is reported, has ordered plans prepared for a factory and a number of tenements to be erected in this city. The factory is to be 3 stories, 60x300 ft.

Des Moines, Ia.—J. C. Wisegates, of Streator, Ill., it is stated, is interested in a company which proposes erecting a glass factory here. Capital, $25,000.

Danbury, Ia.—Godfrey Durst is reported to be contemplating the installing of a concrete wheel house at his mill.

Sioux City, Ia.—It is reported that Frank Koucher, of St. Joseph, Mo., has the contract to erect an elevator and reinforced concrete warehouse for the Sioux City Seed & Nursery Co.

Wiley, Kan.—The Holly Sugar Co. is stated to have increased its capital stock from $1,500,000 to $5,500,000 for the purpose of erecting a sugar factory here.

**Baltimore, Md.*—The Engineering-Contracting Co., it is stated, has secured the contract to erect a storage and bottling plant for the Jos. Schlitz Brewing Co. on Eutaw St., to be 2 stories high, 124x140 ft., and cost $40,000.

**Pittsfield, Mass.*—The contract to erect the annealing building for the Stanley Electric Co., is reported to have been awarded to Beckwith & Pike, of Pittsfield. The building is to be of brick, steel construction, 2 stories high, 120x120 ft. and cost about $30,000.

Campbell, Mo.—See "Power Plants, Gas and Electricity."

Springfield, Mo.—The Pabst Brewing Co., of Milwaukee, Wis., it is stated, will erect a plant here, consisting of a cold storage plant, ice plant and offices and stables. W. C. Farmer is the company's local agent.

Hazen, Nev.—The Western Ore Purchasing Co., it is stated, intends rebuilding its plant in Hazen instead of Reno, where the plant was destroyed by fire.

**High Bridge, N. J.*—Doyle & Co., of Philadelphia, Pa., are reported to have been awarded the contract to erect a plant for the Taylor Iron & Steel Co. at High Bridge. The plant will consist of 3 brick and concrete buildings, a machine shop 126x112 ft., a fitting shop 115x100 ft., with a wing 28x100 ft. and a foundry 50x365 ft., with a wing 50x60 ft.

**Camden, N. J.*—We are informed that the General Fireproofing Co., of Youngstown, O., has been awarded the contract to furnish and erect pin-connected girder frames and cold twisted lug bars as reinforcement for the 2 new reinforced-concrete buildings for the Victor Talking Machine Co., at Camden, N. J. One structure is a 6-story factory building, 132x90 ft., and the other a power house, 1 story and basement, 173x70 ft. The contract includes the furnishing and the erecting in forms ready for concreting. The general contractor is J. S.

**Items marked thus give the names of parties awarded contracts.*

Rogers & Co., of Stanwick, N. J.; Ballinger & Perrott, of Philadelphia, Pa., are the archts.; and Jay H. Whitham, of Philadelphia, Pa., the engineer.

Buffalo, N. Y.—According to reports, the Marshall Milling Co., of Boston, Mass., has secured a site on Military Road on which it intends erecting a 3-story, 340x85-ft. flour and feed mill, to cost $50,000.

Martins Ferry, O.—The La Belle Box Co., in which H. P. McIlrath is reported interested, it is stated, intends erecting a box factory here.

Portland, Ore.—It is stated that plans have been prepared by MacNaughton, Raymond & Lawrence for a plant for the Columbia Steel Co. in West St. John. The plant is to consist of 5 buildings and is to cost about $75,000.

Philadelphia, Pa.—Harrison C. Rea, 1815 Francis St., is stated to have been granted a permit to erect a $100,000 factory for the Theobald & Oppenheimer Co., at 4th and Cambria Sts. The building is to be of brick and stone, 5 stories high, 168x112 ft. Chas. Balderston, 411 Walnut St., is the archt.

Superior, Wis.—The Soo Line (Thos. Green, Ch. Engr., Minneapolis, Minn.), it is stated, proposes erecting a grain elevator in this city to have several million bushels capacity.

Edmonton, Alta.—The Railway Paint Co., it is stated, is planning the erection of a paint factory here, to cost about $100,000.

**London, Ont.*—John Hayman is reported to have secured the contract to erect a $50,000 addition to the car shops.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Oakland, Cal.—The Garbage Com. of the Bd. of Health is stated to have recommended to City Council the purchase of an incinerator.

Hoboken, N. J.—The lowest bid opened on Sept. 11 by the Common Council for the removal of ashes and garbage is stated to have been submitted by Peter A. Poluso, for $9,500.

Orange, N. J.—The Orange and West Orange Boards of Health are reported to be considering plans for establishing a garbage crematory. Whether a municipal or a private plant will be built has not yet been decided upon.

**Cincinnati, O.*—The Bd. of Pub. Service is reported to have awarded to L. P. Hazen & Co., Reading Road and Elsmore Ave., the contract for the erection of the 2d St. Dumping Station, for $40,500, to be completed Jan. 15.

Memphis, Tenn.—The U. S. Constr. & Utilization Co., of Rochester, N. Y., is reported to have made an offer to the city to construct a crematory.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Bradley, Ark.—W. H. Baker, Secy. Long Prairie Levee Bd., writes that all bids opened on Sept. 11 for the construction and raising of levee from Buncom Springs to Louisiana and Arkansas line, about 450,000 yds., have been rejected. No date yet set for the receiving of new bids.

Ft. Logan H. Roots, Ark.—Bids will be received by the Quartermaster until Oct. 17 for constructing a 2-pipe concrete road culvert, as advertised in The Engineering Record.

Stamford, Conn.—The following are the bids received Sept. 7 by Maj. Harry Taylor, Corps Engrs., U. S. A., New London, for dredging in Stamford Harbor (estimated quantities, 187,500 cu. yds. dredging, 1,000 cu. yds. rock removal): Maritime Dredging Co., 23 cts. and $10, respectively; Atlantic Dredging Co., 27.7 cts. and $8.80, respectively.

Washington, D. C.—We are informed that the following was the only bid received Sept. 7 by the Bureau of Yards & Docks, Navy Dept., Washington, for dredging at the Navy Yard, Washington, as per specification 1556: John Miller, 702 11th St., N. W., 35 cts. per cu. yd. for dredged material removed and disposal of; $8 per hour for logging; work to be completed in 4 months.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received by Maj. M. Gray Zalinski, Q. M., U. S. A., until Oct. 19 for furnishing 12,000 trunk lockers as advertised in The Engineering Record.

Fairport, O.—The following are the bids opened on Sept. 10 by Lieut. Col. C. McD. Townsend, Corps Engrs., U. S. A., Cleveland, for extension of west breakwater at Fairport harbor, O.: (*a*) Great Lakes Dredge & Dock Co., Chicago, Ill.; (*b*) Sea Coast Constr. Co., New York, N. Y., (*c*) Hunkin Bros. Constr. Co., Cleveland; (*d*) Knobloch & Shelton, Erie, Pa.; (*e*) Graves & Stephens, Cleveland.

	a	*b*	*c*	*d*	*e*
Pier Head.					
140 M ft. hemlock timber	$50.00	$55.00	$53.75	$55.00	$60.00
1.2 M ft. white oak timber	85.00	70.00	60.00	75.00	100.00
12 M ft. hardwood timber	50.00	60.00	53.75	55.00	75.00
14,000 lbs. screw bolts and washers	.06	.08	.05	.065	.06
11,000 lbs. lag screws and washers	.10	.10	.05	.085	.06
7,000 lbs. tie rods and washers	.06	.05	.05	.075	.05
750 lbs. sleeve bolts and washers	.10	.10	.05	.105	.07
7,500 lbs. drift bolts	.05	.06	.05	.05	.05
1,200 lbs. corner straps	.10	.05	.05	.18	.10
200 lbs. spikes	.06	.04	.05	.05	.05
250 cu. yds. concrete blocks	15.00	14.00	20.00	15.00	12.00
600 cu. yds. concrete in mass	12.00	11.00	18.50	10.10	10.00
3,500 tons quarry run stone	1.80	1.50	2.05	2.50	1.80
500 lbs. 4-in. wrought iron pipe and mall fittings	.25	.04	.15	.15	.20
Rubble Mound Breakwater.					
65,000 tons quarry run stone	1 80	1.50	2.12	1.98	1.80
15,000 tons large placed stone	2.50	1.50	2.59	1,98	2.10
Total	$182,519	$147,037	$210,324	$188,535	$175,727

Washington Barracks, D. C.—Bids will be received until Sept. 30 by Maj. E. Eveleth Winslow, Corps. Engrs., U. S. A., Washington Barracks, for construction of an experimental field searchlight outfit.

Pensacola, Fla.—Lieut. Commander Carter, in charge of yards and docks at Pensacola, has sent recommendations to the Navy Dept. at Washington, D. C., for an expenditure of about $5,000,000 in improvements at the local yard, to include the construction of a stone graving dock, to cost $1,600,000; a breakwater, to cost about $1,000,000, a sea wall, $700,000; a coal plant, $250,000; dredging, $50,000; machinery for central power house, $35,000; machine shop for steam engineering, $115,000; plumbing shop for construction and repair, $70,000; sawmill for construction and repair, $50,000; rigging loft for construction and repair, $15,000; boat shop for construction and repair, $55,000; shop and office building for yards and docks, $100,000; timber storage shed, $10,000; shed for storage of combustible materials, $50,000; yard dispensary and operating room, $25,000; roads and walks, $35,000, and railroad track and equipment, $15,000.

Evanston, Ill.—The Drainage Bd., of Chicago, on Sept. 11, directed the engineering department to begin active work excavating the Evanston auxiliary channel, which is designed to drain the north shore suburbs.

Great Lakes, North Chicago, Ill.—The only bid received and opened at the Bureau of Navigation, Navy Dept., Washington, D. C., on Sept. 17, for furnishing material and grading at the naval training station, Great Lakes, North Chicago, was submitted by the Edwards Bros. Dredging Co., Sault Ste. Marie, Mich., at 81 cts. per cu. yd., same for all excavating or filing necessary. This bid is reported to have been rejected.

South Bend, Ind.—The Bd. Co. Comrs. will receive bids until Sept. 30 for the construction of reinforced concrete culverts. John W. Harbon, Co. Aud.

Crawfordsville, Ind.—The Comrs. of Montgomery Co. are said to have in contemplation the construction of the Pickering ditch, in Franklin Township.

Onawa, Ia.—Bids will be received until Oct. 1 by Bd. Superv. at Onawa for the excavation of the McCandlass Ditch, 280,681 cu. yds., as advertised in The Engineering Record. C. E. Blanchard, Co. Aud.

Sioux City, Ia.—The Otis Elevator Co., of New York, N. Y., submitted a bid recently to the Superv. Archt., Washington, D. C., for installing an elevator in the Post Office at Sioux City, at $5,200.

Rockwell City, Ia.—It is reported that bids will be received until Sept. 24 by B. E. Stonebarker, Co. Aud., for constructing an open ditch and tile drain in Dist. No. 2, requiring 800 ft. open drain and 5,560 ft. tile work.

Clinton, Ia.—The Meridocia Drainage and Levee Dist. is reported to have made arrangements to double the pumping capacity in the levee section of the district, at a cost of about $30,000.

Muscatine, Ia.—Bids will be received until Oct. 8 by A. S. Lawrence, Co. Aud., for the excavation of ditches in Drainage Dist. No. 3, in all about 62,870 cu. yds. of earth excav., and the furnishing in place outlet pipes masonry and gates at cross levee.

Louisville, Ky.—Bids will be received by Capt. H. Burgess, Corps. Engrs., U. S. A., until Oct. 21, for 2 steel barges; also same date for 2 dump scows, both proposals advertised in The Engineering Record.

New Orleans, La.—Bids for erecting a 75-ft. iron flagstaff at Ft. Jackson, La., will be received by Capt. Arthur Cranston, Q. M., U. S. A., New Orleans, until Oct. 7.

Local press reports stated that bids will be received at the office of the Bd. of State Engrs., Room 402, Cotton Exchange Bldg., New Orleans, until Sept. 24, for the construction of the following levee work: Contents approximate only: Arkansas Line to Ashtabula Plantation Levee, East Carroll Parish, 155,000 cu. yds.; Ashtabula Plantation to Pilcher's Landing Levee, East Carroll Parish, 145,000 cu. yds.; Lauderdale Levee, St. James Parish, 70,000 cu. yds.; St. Louis Levee, St. James Parish, 50,000 cu. yds.; Bohemia Levee, Plaquemines Parish, 42,000 cu. yds.; Point Pleasant Levee, Plaquemines Parish, 40,000 cu. yds. and 9,000 lin. ft. revetment; Nestor Canal Levee, Plaquemines Parish, Mississippi River, 15,000 cu. yds.; Dixie Levee, Caddo Parish, 42,000 cu. yds.; Wilson's to Smith's Levee, Rapides Parish, 60,000 cu. yds.

Osterville, Mass.—Frank W. Hodgdon, Ch. Engr., Harbor & Land Comrs., Boston, writes that the contract to widen west Bay cut at Osterville, town of Barnstable (bids received Sept. 6), has been awarded to J. H. Girrich, 247 Atlantic Ave., Boston, at $9,510.

**Medford, Mass.*—The detail bid of Rowe & Perini Constr. Co., of Melrose, the successful bidder for the grading, surfacing and other work at the Middlesex Fells Parkway extension at Medford (bids opened Sept. 3 by the Metropolitan Park Comn. at Boston) is as follows: 30,000 cu. yds. earth grading, 40 cts.; 3,500 cu. yds. rock excav., $1.30; 3,000 cu. yds. rock excav., $1.90; 1,250 lin. ft. 10-in. vit. pipe., 45 cts.; 1,000 lin. ft. 12-in. vit. pipe, 60 cts.. 400 lin. ft. 15-in. vit. pipe, $1.25; 175 lin. ft. 18-in. vit. pipe, $1.60; 400 lin. ft. 24-in. vit. pipe, $2; 2,000 lin. ft. 6-in. pipe underdrain, 30 cts.; 45 concrete catch basins and manholes, ea., $30; 250 sq. yds. cobble stone gutters, 75 cts.; 325 lin. ft. straight edgestone, $1; 450 lin. ft. curved edgestone, $1,50; 4,500 cu. yds. loam surfacing, 30 cts.; 4,000 cu. yds. loam, to be funrished, $1; 8,000 sq. yds. gravel roadway surfacing, 45 cts.; 10,500 sq. yds. broken stone, roadway surfacing, 30 cts.; 3,000 sq. yds. walk surfacing, 30 cts.; one reinforced con. culvert, 6x4x64 ft. 10 in., $900; one reinforced con. culvert, 4x4x137 ft. 9 in., $2,200; totals, $44,230.

**Marshall, Mich.*—John Broombaugh, of Elkhart, Ind., is reported to have secured the contract for building the Nottawa Drain, for $26,000.

Ortonville, Minn.—It is stated that bids will be received by A. L. Bolsta, Co. Aud., Sept. 24, for constructing ditch No. 7. Estimated cost $5,109.

Wheaton, Minn.—It is stated that bids will be received by N. F. Schroeder, Co. Aud., until Sept. 30, for constructing ditch No. 1. Estimated cost, $11,376.

**St. Paul, Minn.*—The State Drainage Bd. (Geo. Ralph, Engr.) is reported to have awarded contracts to Aspin Bros., at the following bid: At 14 cts. a cu. yd. for ditch 47, Marshall County, and 15½ cts. for ditches 48, 49

The Drainage Bd. has signed a petition to the district court of Aitkin County for authority to construct a ditch in that county to be known as ditch No. 58, and a petition to the court of Koochiching County for authority to construct ditches 59 and 60 in that county.

Geo. Ralph, Engr. for the Bd., it is stated, has been instructed to go to Le Sueur County to investigate a petition from residents of that part of the State for improvement of the water course of Straight River.

**Billings, Mont.*—Lyndes & Lockhard, of Forsyth, are stated to have secured the contract to construct the Sanders co-operative ditch, which is to be 16 miles in length.

Asbury Park, N. J.—Bids will be received until Oct. 9 by the Public Grounds Comn. (W. P. Sherman, Sec.), for the building of jetties to protect and build up the beach at Asbury Park.

Buffalo, N. Y.—The following are the bids received Sept. 5 for constructing a pile pier at Jersey St.: Geo. Parks & Sons, 217 15th St., $8,853 including stone filling, $7,353 if stone filling is omitted; A. F. Chapman & Co., 822 Prudential Bldg., $13,700 including stone filling.

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrman, Pres.) until Sept. 26 for furnishing and delivering 10,000 lin. ft. two-pipe iron fence (No. 1, 1907) for parks, Boro. of Bronx.

Brooklyn, N. Y.—Bids will be received by J. A. Bensal, Comr. of Docks, N. Y. City, until Sept. 27 for furnishing material and building extension to pier bet. 51st St. and 52d St., Boro. Brooklyn, as per contract No. 1,092.

Syracuse, N. Y.—The only bid received and opened recently by the Superv. Archt., Washington, D. C., for installing elevator in the U. S. Post Office at Syracuse, was submitted by the Otis Elevator Co., of New York, city, for $7,980.

Schenectady, N. Y.—The Bd. of Estimate and Apportionment, on Sept. 6, passed a resolution authorizing Corporation Counsel Yates to bring the matter of reconstructing the Villa Road culvert before the Pub. Service Comn. at Albany, the expense to be borne by the N. Y. Central R. R. Co.; probable cost $35,000 to $50,000.

Albany, N. Y.—Bids will be received by F. C. Stevens, Supt. State Bd. of Pub. Wks. until Oct. 17 for improving New York State Canal, Contract 20 Erie Canal. Sect. 2, by dredging channel in Mohawk River and other work between Rexford Flats and Cranes Village, as advertised in The Engineering Record. Length of contract, 18:5 miles.

Troy, N. Y.—See "Public Buildings."

Cleveland, O.—The following are the bids opened on Sept. 10 by Lieut. Col. C. McD. Townsend, Corps. Engrs. U. S. A., for extension of the east breakwater at Cleveland harbor—(a) 75,000 tons large placed stones, per ton; (b) 750,000 tons quarry run stone, per ton; (c) total: Graves & Stephens, Cleveland, O. (a) $1.75, (b) $1.29, (c) $1,098,750; Great Lakes Dredge & Dock Co., Chicago, Ill. (a) $1.53, (b) $1.80, (c) $1,464,750; Sea Coast Construction Co., New York, N. Y., (a) 94 cts., (b) 94 cts., (c) $775,500; The Hunkin Bros. Construction Co., Cleveland, O., (a) $2.50, (b) $1.99, (c) $1,680,000.

Ashtabula, O.—The Lake Shore Ry. Co. is reported to have decided to build a sea wall in connection with the new lake front improvements here. It will be 2,000 ft. long and 950 ft. from the east side of the new slip.

East Cleveland, O.—Bids will be received until Oct. 12 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.), Cleveland, for constructing a culvert on Pitney Rd., East Cleveland. A. B. Lea, Co. Surveyor.

Cincinnati, O.—We are informed that the following are the bids received Sept. 11 by Lieut. Col. Wm. T. Rossell, Corps. Engrs., U. S. A., Cincinnati, O., for work in Ohio River:

Dam in Ohio River at Marietta Island: Knonloch & Shelton, Erie, Pa., $53,205; and John C. Thomas, Bellaire, O., $84,020. The detailed bid of the lowest bidder, Kronlich & Shelton, is as follows: 10,000 cu. yds. excav., 95 cts.; 198 piles, $22; 15,000 lbs. iron tie rods, etc., 8 cts.: 1,200 cu. yds. earth filling, 30 cts.; 3,700 cu. yds. stone, $2.45; 4,000 cu. yds. stone, $1.95; 2,680 cu. yds. concrete, $7.77; 40 barrels extra cement, $2.50.

Dam in Ohio River at Brown's Island: Pennsylvania Contr. Co., Pittsburg, Pa.; 165 cu. yds. excav. ledge rock, $3; 5,400 cu. yds. excav. loose material, 70 cts.. 90 lin. ft. anchor bolt holes, 99 cts.; 110 piles, $16; 8,600 lbs. iron tie rods, etc., 8 cts.; 2,000 cu. yds. stone, $4; 2,100 cu. yds. stone, $4; earth filling (if required), 85 cts.; 2,625 cu. yds. concrete, $11.76; 40 bbls. extra cement, $2.25; total, $54,172.

Dike in Ohio River at Grand Chain, Ill.: Oscar F. Barrett, Cincinnati, O.: 500 cu. yds. stone, $3.80; 9,500 cu. yds. stone, $3; total, $30,250.

Akron, O.—E. McShaffrey & Son, General Contractors, 173 S. Forge St., would like to correspond with parties who would take a contract for sand hauling. There is about 12,000 cu. yds. of sand to be hauled about 1½ miles, either by traction engines or otherwise, and they would like to have the same done this fall or winter.

**Greenville, O.*—It is reported that bids will be received by E. Culbertson, Co. Aud., until Sept 26, for the purchase of $85,000 ditch and road improvement bonds.

Panama.—Bids will be received at the office of F. C. Nordsick, Asst. Purchasing Agt. Panama R. R. Co., 24 State St., New York, N. Y., until Sept. 24, for furnishing steel tie plates

*D. L. Gillespie & Co., of Pittsburg, Pa., is reported to have secured the contract from the U. S. government

**Items marked thus give the names of parties awarded contracts.*

to supply 10,000 m. ft. of dimension lumber for the Panama canal, at a cost of $225.775. The lumber is to be yellow pine and fir.

Panama—See "Power Plants, Gas and Electricity."

Wilkesbarre, Pa.—It is stated that bids will be received by Jas. M. Norris, Co. Controller, until Oct. 2 for building retaining and courtyard walls at new county court house. McCormick & French, Archts., Second National Bank Bldg.

Charleston, S. C.—Bids will be received by Capt. E. R. Stuart, Corps. Engrs. U. S. A., until Oct. 25 for constructing hydraulic dredge, as advertised in The Engineering Record.

Memphis, Tenn.—It is reported that bids will be received until Sept. 30, by E. Bacon, Secy., Drainage Comn. of Tallahatchie County, for construction of a main ditch in Ascalmore Drainage Dist. It will be about 4 miles long, 4 ft. deep and 20 ft. wide.

Galveston, Tex.—It is stated that the government intends constructing a dredge for Galveston, to cost about $400,000, to have a capacity of 25,000 yds. Capt. John C. Oakes, Trust Company Bldg., is in charge of work at Galveston.

The U. S. Engr. Dept. at Washington, D. C., has directed that bids received July 31 for cleaning Guadalupe River from its mouth to Victoria be rejected and has authorized Capt. John C. Oakes to construct a snag boat and do the work by government labor.

*The Bowers Southern Dredging Co., of Galveston, is reported to have recently secured the contract for dredging inland waterway between Aransas Pass and Pass Cavallo (bids for which were received July 31).

Alexandria, Va.—The Otis Elevator Co., of New York, N. Y., bid, Sept. 10 (bids received by the Superv. Archt., Washington, D. C.) for installing an electric passenger elevator in the U. S. Post Office and Custom House at Alexandria, $7,690.

Marinette, Wis.—Bids will be received until Sept. 30 by the Comrs. of the First Drainage Dist. of Marinette Co. at the office of Wm. C. Campbell, Secy. for constructing certain ditches and drains in said Dist., in all approximately 130,000 cu. yds.

Superior, Wis.—The Soo R. R. Co., (Thos. Greene, Ch. Engr., Minneapolis, Minn), is reported to have decided to build a dock on Howard's Pocket, 2,000 ft. long, with a shed 2 stories high; also a passenger dock on the McCord Mill site.

St. John, N. B.—At a meeting of the Bd. of Aldermen and Wm. Pugsley, Minister of Pub. Wks., Eugene Lafleur, Ch. Engr. of the Pub. Wks. Dept., submitted a report, in which he recommended the dredging of existing berth sites; removal of knoll at entrance to Sand Point slip to make easy ingress and egress for steamers; the clearing up of Sand Point channel, etc.

PROPOSALS OPEN.

For Proposals see pages 66, 68, 69 and 70.

WATER.

Bids Close. — See Eng. Record.

Sep. 25. Well, Summit, N. J. ......Sep. 14
Sep. 25. Dam, Rome, N. Y. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 25. Water wks., Highlands, N. J. ......Sep. 7
Sep. 25. Tank, etc., for pump. plant, Ft. Morgan, Ala. ......Sep. 14
Sep. 25. Pipe, Chicago, Ill. ......Sep. 21
Sep. 25. Pipe, Provincetown, Mass. ......Sep. 21
Sep. 20. Reservoir, Ft. Barrancas, Fla. ......Sep. 7
Sep. 27. Storage basin, Madison, Wis. ......Sep. 14
Adv. Sep. 14, 21.
Sep. 27. Artesian well, Madison, Wis. ......Sep. 14
Adv. Sep. 14, 21.
Sep. 28. Water wks., Manassas, Va. ......Sep. 7
Sep. 28. Piping wells, Ft. Ethan Allen, Vt. ......Sep. 21
Sep. 30. Boiler and pump engine, Los Angeles, Cal. Adv. Aug. 31, Sep. 7 ......Aug. 31
Sep. 30. Pipe, Los Angeles, Cal. Adv. Aug. 31 ......Aug. 31
Sep. 30. Filters, Wilmington, Del. ......Sep. 7
Adv. Sep. 7, 14.
Sep. 30. Tank, main, etc., Detroit, Minn. ......Sep. 21
Sep. 30. Tank, etc., Mahnomer, Minn. ......Sep. 21
Sep. 30. Mains, Beaver City, Neb. ......Sep. 21
Sep. —, Improv. Plant, Phoenix, Ariz. ......Sep. 7
Oct. 1. Mains, Harrison, N. J. ......Sep. 14
Oct. 1. Valves, etc., Garnett, Kan. ......Sep. 21
Oct. 5. Pump machinery, Kewanee, Ill. ......Sep. 21
Oct. 7. Reservoir, etc., Canon City, Colo. ......Sep. 21
Adv. Sept. 21.
Oct. 7. Machinery, Los Angeles, Cal. ......Sep. 14
Oct. 9. Pump house, Ft. Caswell, N. C. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 10. Water works, Pringhar, Ia. ......Sep. 21
Oct. 10. Water improv., Ft. Du Pont, Del. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 14. Pipe, etc., Ashland, O. ......Sep. 21
Oct. 23. Filters, Atlanta, Ga. Adv. Sep. 14, 21 ......Sep. 14
———. Extension to water system, Fairhaven, Vt. ......Sep. 14

SEWERAGE AND SEWAGE DISPOSAL.

Sep. 23. Flushing, N. Y. ......Sep. 14
Sep. 24. Monett, Mo. ......Sep. 21
Sep. 24. Clear Lake, Ia. ......Sep. 21
Sep. 25. Richmond, Ind. ......Sep. 14
Sep. 25. Brooklyn, N. Y. ......Sep. 21
Sep. 25. Aberdeen, Wash. ......Sep. 21
Sep. 26. New York, N. Y. ......Sep. 21
Sep. 27. Delaware, O. ......Sep. 7
Sep. 27. Great Lakes, North Chicago, Ill. ......Sep. 14
Sep. 30. Fairfield, Cal. ......Aug. 31
Sep. 30. Washington, D. C. Adv. Sep. 14, 21 ......Sep. 14
Sep. 30. Steubenville, O. ......Sep. 14
Sep. 30. Long Island City, L. I., N. Y. ......Sep. 21
Sep. 30. Cedar Rapids, Ia. ......Sep. 21
Oct. 1. Billings, Mont. ......Sep. 7
Oct. 1. Paducah, Ky. Adv. Sep. 7 to 21 ......Sep. 7
Oct. 1. Cadillac, Mich. ......Sep. 14
Oct. 1. Newark, N. Y. ......Sep. 14
Oct. 1. Youngstown, O. ......Sep. 21
Oct. 1. New York, N. Y. ......Sep. 21
Oct. 1. Cohoes, N. Y. ......Sep. 21
Oct. 2. Salem, Mass. ......Sep. 21
Oct. 3. Ft. Dade, Fla. ......Sep. 14
Oct. 3. Jasper, Ala. ......Sep. 21
Oct. 10. Ft. Du Pont, Del. Adv. Sep. 14, 21 ......Sep. 14
Oct. 12. Seattle, Wash. ......Sep. 21
Oct. 14. Carthage, Mo. Adv. Sep. 21 ......Sep. 21
Oct. —. Eaton, O. ......Aug. 3

BRIDGES.

Sep. 23. Trenton, N. C. ......Sep. 21
Sep. 24. Alamosa, Colo. ......Sep. 14
Sep. 24. Trenton, N. J. ......Sep. 21
Sep. 26. New York, N. Y. ......Sep. 21
Sep. 27. Iola, Colo. ......Sep. 21
Sep. 28. Athens, O. ......Sep. 21
Sep. 28. Point Marion, Pa. ......Sep. 21
Sep. 30. Santiago, Chile ......Jul. 13
Sep. 30. Lancaster, Pa. ......Sep. 14
Sep. —. Caldwell, Idaho. ......Aug. 31
Oct. 2. Jefferson, O. ......Sep. 21
Oct. 3. Fergus Falls, Minn. ......Sep. 14
Oct. 5. Crawfordsville, Ind. ......Sep. 21
Oct. 7. Vicksburg, Miss. ......Sep. 21
Oct. 7. Atchison, Kan. ......Sep. 21
Oct. 7. St. Clairsville, O. ......Sep. 21
Oct. 7. Salem, Ind. ......Sep. 21
Oct. 8. Delphi, Ind. ......Sep. 21
Oct. 12. Xenia, O. ......Sep. 21
Oct. 14. Los Angeles, Cal. ......Sep. 7
Adv. Sep. 7, 14.
Oct. 14. Fredericton, N. B. ......Sep. 14
Oct. 14. Bellefontaine, O. ......Sep. 21
Oct. 19. Canton, China. Adv. Aug. 24 to Sep. 7 ......Aug. 24

PAVING AND ROAD MAKING.

Sep. 24. Lebanon, Ind. ......Aug. 24
Sep. 24. Woodcliff Lake, N. J. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 24. Boston, Mass. ......Sep. 21
Sep. 24. Philadelphia, Pa. ......Sep. 21
Sep. 25. Bergholz, O. ......Sep. 21
Sep. 25. University Heights, O. ......Sep. 21
Sep. 26. Danville, Ill. ......Sep. 7
Sep. 26. New York, N. Y. ......Sep. 14
Sep. 26. New York, N. Y. ......Sep. 21
Sep. 27. Malta, O. ......Sep. 21
Sep. 27. New York, N. Y. ......Sep. 21
Sep. 27. Napoleon, O. ......Sep. 21
Sep. 28. Manassas, Va. ......Sep. 7
Sep. 28. Vincennes, Ind. ......Sep. 14
Sep. 28. Green Castle, Ind. ......Sep. 21
Sep. 30. Takoma Park, Md. ......Sep. 21
Sep. 30. Long Island City, N. Y. ......Sep. 21
Oct. 1. Billings, Mont. (2 props.) ......Sep. 7
Adv. Sep. 7 to 21.
Oct. 1. Durham, N. C. ......Sep. 14
Adv. Sep. 21.
Oct. 1. Ft. Sam Houston, Tex. ......Sep. 21
Oct. 1. Ft. Adams, R. I. ......Sep. 21
Oct. 1. Harrison, N. J. ......Sep. 21
Oct. 2. Spencer, Ind. ......Sep. 21
Oct. 2. Brooklyn, N. Y. ......Sep. 21
Oct. 3. Brooklyn, N. Y. ......Sep. 21
Oct. 3. Harrisburg, Pa. ......Sep. 21
Oct. 5. Cleveland, O. ......Sep. 21
Oct. 7. Hartford City, Ind. ......Sep. 14
Oct. 7. Decatur, Ind. ......Sep. 14
Oct. 7. Kenosha, Wis. ......Sep. 21
Oct. 7. Salem, Ind. ......Sep. 21
Oct. 8. Vincennes, Ind. ......Sep. 14
Oct. 8. Crawfordsville, Ind. ......Sep. 21
Oct. 8. St. Louis, Mo. ......Sep. 21
Oct. 12. Riverton, Ala. Adv. Sep. 14, 21 ......Sep. 14
Oct. 12. Athens, Ala. ......Sep. 21
Oct. 12. Ft. Wayne, Ind. ......Sep. 21
Oct. 14. Sunman, Ind. ......Sep. 14
Oct. 21. Logansport, Ind. ......Sep. 21
Oct. —. Selma, Ala. ......Sep. 7
Dec. 13. Valparaiso, Ind. ......Sep. 7
———. York, Pa. ......Sep. 7

POWER PLANTS, GAS AND ELECTRICITY.

Sep. 23. New York, N. Y. ......Sep. 14
Sep. 24. Washington, D. C. ......Sep. 21
Sep. 24. Minneapolis, Minn. ......Sep. 21
Sep. 26. New York, N. Y. ......Sep. 21
Sep. 27. Louisville, Ky. ......Sep. 21
Sep. 28. Manassas, Va. ......Sep. 7
Sep. 30. Revelstoke, B. C. ......Sep. 7
Sep. 30. Rochester, N. Y. ......Aug. 31
Sep. 30. New London, Conn. Adv. Sep. 7 to 21 ......Sep. 7
Sep. 30. West Point, N. Y. ......Aug. 31
Adv. Aug. 31, Sep. 7, 21.
Sep. 30. Flushing, N. Y. ......Sep. 21
Sep. 30. New York, N. Y. ......Sep. 21
Oct. 1. Winnipeg, Man. Adv. Aug. 31, Sep. 7 ......Aug. 31
Oct. 4. Jacksonville, Fla. ......Aug. 31
Oct. 5. Crawfordsville, Ind. ......Sep. 21
Oct. 14. Panama. Adv. Sep. 21 ......Sep. 21
Oct. 15. Savannah, Ga. ......Sep. 21
Nov. 1. Seymour, Ind. ......Sep. 14
Nov. 15. Charleston, S. C. ......Sep. 14

BUILDINGS.

Sep. 24. Post office bldg., Hamilton, O. ......Aug. 17
Adv. Aug. 17 to 24.
Sep. 24. Pub. bldg., Danville, Pa. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 24. Bus. bldg., Cincinnati, O. ......Sep. 21
Sep. 24. Post office bldg. addition, Montreal, Que. ......Sep. 21
Sep. 25. New indus. plants, Ft. Morgan, Ala. ......Sep. 14
Sep. 25. Alter. to pub. bldg., Rochester, N. Y. ......Sep. 21
Sep. 25. School, Manitowoc, Wis. ......Sep. 21
Sep. 25. School, Braddock, Pa. ......Sep. 21
Sep. 26. Court house, Muscatine, Ia. ......Aug. 24
Sep. 26. School, Riverside, Cal. ......Aug. 31
Sep. 26. New Industrial plants, Riverside, Cal. ......Aug. 31
Sep. 26. School, Brookings, S. D. ......Aug. 31
Sep. 26. Pub. bldg., National Soldiers' Home, Va. ......Sep. 7
Sep. 26. Add. to pub. bldg., New York, N. Y. ......Sep. 21
Sep. 26. School, Sutton, Mass. ......Sep. 21
Sep. 26. Pub. bldg., Highmore, S. D. ......Sep. 21
Sep. 26. Pub. bldg., Pueblo, Colo. ......Sep. 21
Sep. 27. Pub. bldg., Pittsburg, Pa. ......Sep. 14
Sep. 27. School, Hesperus, Colo. ......Sep. 7
Sep. 27. Hospital repair, Baltimore, Md. ......Sep. 21
Sep. 27. Htg. city hall, Louisville, Ky. ......Sep. 21
Sep. 28. Post bldgs., Ft. Ethan Allen, Vt. ......Sep. 21
Sep. 30. Bus. bldg. plans, Harrisburg, Pa. ......Aug. 3
Sep. 30. Post office, Selma, Ala. ......Aug. 24
Sep. 30. Church, Vincennes, Ind. ......Sep. 14
Sep. 30. Pub. bldg., West Haverstraw, N. Y. ......Sep. 14
Sep. 30. Pub. bldg., Fremont, Neb. ......Sep. 21
Sep. 30. Pub. bldg., Long Island City, L. I. ......Sep. 21
Sep. 30. School, Cincinnati, O. ......Sep. 21
Sep. 30. Hospital, Brooklyn, N. Y. ......Sep. 21
Sep. 30. School, Flushing, N. Y. ......Sep. 21
Sep. 30. School, Esmond, N. D. ......Sep. 21
Sep. —. Hotel, New Orleans, La. ......Jun. 29
Oct. 1. Bus. bldg., Decatur, Ill. ......Aug. 31
Oct. 1. Pub. bldg., Eau Claire, Wis. ......Aug. 31
Oct. 1. Y. M. C. A., Indianapolis, Ind. ......Aug. 31
Oct. 1. Plumbg. pub. bldg., Portland, Me. ......Sep. 7
Oct. 1. Church, Indianapolis, Ind. ......Sep. 7
Oct. 1. Pub. bldg., Jefferson Barracks, Mo. ......Sep. 21
Oct. 1. Pub. bldg., Albion, N. Y. Adv. Sep. 21 ......Sep. 21
Oct. 1. Boiler, etc., for prison, Newark, N. J. ......Sep. 21
Oct. 1. Church, Delphos, O. ......Sep. 21
Oct. 2. Pub. bldg., Hamilton, Ga. ......Sep. 21
Oct. 3. Court house plans, La Moure, N. D. ......Aug. 10
Oct. 3. School, Bayonne, N. J. ......Sep. 7
Oct. 5. Htg. Plant at Naval Station, New Orleans, La. ......Sep. 7
Oct. 7. U. S. Post Office improv., Baltimore, Md. ......Aug. 31
Adv. Aug. 31, Sep. 7.
Oct. 7. Pub. bldg., Ft. Slocum, N. Y. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 7. Post hospital addition, Ft. Slocum, N. Y. ......Sep. 21
Adv. Sep. 21.
Oct. 7. New ind. plant, Los Angeles, Cal. ......Sep. 21
Oct. 7. Stokers for hospital, Massillon, O. ......Sep. 21
Oct. 10. School, Mt. Healthy, O. ......Sep. 21
Oct. 10. Windows for Museum, Washington, D. C. Adv. Sep. 21 ......Sep. 21
Oct. 10. Bus. bldg., Indianapolis, Ind. ......Sep. 21
Oct. 12. Hospital, Whipple Barracks, Ariz. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 14. School, San Diego, Cal. ......Sep. 14
Oct. 15. Court house plans, De Pere, Wis. ......Aug. 17
Oct. 15. School, Osceola, Ark. ......Sep. 21
Oct. 15. Court house, Youngstown, O. ......Sep. 21
Oct. 16. Exten. post office, Springfield, O. ......Sep. 14
Oct. 16. Pub. bldg., Ashland, O. ......Sep. 21
Oct. 17. Pub. bldg., Peoria, Ill. ......Sep. 7
Oct. 18. School, Montevallo, Ala. ......Sep. 14
Oct. 21. Pub. bldg., Milwaukee, Wis. ......Sep. 21
Oct. 21. Post office, Des Moines, Ia. ......Sep. 7
Adv. Sep. 7, 14.
Oct. 30. Jail, etc., Terre Haute, Ind. ......Sep. 21
Nov. 5. Court house plans, Houston, Tex. ......Aug. 31
Adv. Sep. 14, 21.
Dec. —. Industrial plants, Ft. William, Ont. ......May 11
———. School, bldg. material, Lawrence, Kan. ......Aug. 31
———. Post office, Hamilton, O. ......Sep. 14

MISCELLANEOUS.

Sep. 24. Dredging, Wheeling, W. Va. ......Aug. 31
Sep. 24. Ditch, Rockwell City, Ia. ......Sep. 21
Sep. 24. Tie plates, Panama ......Sep. 21
Sep. 24. Ditch, Ortonville, Minn. ......Sep. 21
Sep. 25. Steam shovels, etc., Panama ......Aug. 31
Adv. Aug. 31.
Sep. 25. Subway, Reading, Pa. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 26. Wharf, Ft. Du Pont, Del. ......Aug. 31
Adv. Aug. 31 to Sep. 14.
Sep. 26. Dredging, San Francisco, Cal. ......Sep. 7
Sep. 26. Garb. disposal, Newark, N. J. ......Sep. 14
Adv. Sep. 14.
Sep. 26. Iron fence, New York, N. Y. ......Sep. 21
Sep. 26. El. ry. work, New York, N. Y. ......Sep. 21
Sep. 27. Ditch, Cerro Gordo, Ill. ......Sep. 14
Sep. 27. Pier extension, Brooklyn, N. Y. ......Sep. 21
Sep. 28. Steel barges, Panama ......Sep. 7
Sep. 28. Wharf, Ft. Winfield Scott, Cal. ......Sep. 14
Sep. 30. Searchlight outfit, Washington Barracks, D. C. ......Aug. 3
Sep. 30. Dredge, Cincinnati, O. ......Aug. 31
Adv. Aug. 31 to Sep. 21.
Sep. 30. Dredging, Saugerties, N. Y. ......Aug. 31
Adv. Aug. 31 to Sep. 21.
Sep. 30. Dredge, Philadelphia, Pa. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 30. Dredging, Boston, Mass. ......Sep. 7
Adv. Sep. 7 to 21.
Sep. 30. Ditch, Charleston, Miss. ......Sep. 14
Sep. 30. Culvert, South Bend, Ind. ......Sep. 21
Sep. 30. Ditch, Marinette, Wis. ......Sep. 21
Sep. 30. Ditch, Wheaton, Minn. ......Sep. 21
Sep. 30. Ditch work, Memphis, Tenn. ......Sep. 21
Sep. 30. Searchlight outfit, Washington Barracks, D. C. ......Sep. 21
Oct. 1. Snag boat, Mobile, Ala. ......Sep. 7
Adv. Sep. 7 to 21.
Oct. 1. Ditch, Onawa, Ia. Adv. Sep. 21 ......Sep. 21
Oct. 2. Walls, etc., for court house, Wilkes-barre, Pa. ......Sep. 21
Oct. 3. Jetty work, Cold Springs, N. J. ......Sep. 7
Adv. Sep. 7 to 21.
Oct. 5. Lock and dam, Franklin, Ark. ......Aug. 10
Adv. Aug. 10 to 31.
Oct. 5. Lock and dam, Mobile, Ala. ......Aug. 10
Adv. Aug. 10 to Sep. 21.
Oct. 5. Supplies, Panama. Adv. Sep. 14 ......Sep. 14
Oct. 7. Excav., Detroit, Mich. ......Aug. 31
Adv. Aug. 31 to Sep. 14.
Oct. 7. Flagstaff, New Orleans, La. ......Sep. 21
Oct. 8. Dredging, Detroit, Mich. ......Aug. 31
Adv. Aug. 31 to Sep. 14.
Oct. 8. Ditch, Muscatine, Ia. ......Sep. 21
Oct. 9. Dredging, Jacksonville, Fla. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 9. Jetty work, Asbury Park, N. J. ......Sep. 21
Oct. 10. Canal wk., Peterboro, Ont. ......Aug. 24
Oct. 10. Rock removal, etc., Jacksonville, Fla. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 10. Jetty work, Washington, D. C. ......Sep. 14
Adv. Sep. 14, 21.
Oct. 12. Riprap, Riverton, Ala. Adv. Sep. 14, 21 ......Sep. 14
Oct. 12. Culvert, East Cleveland, O. ......Sep. 21
Oct. 14. Supplies, Panama. Adv. Sep. 21 ......Sep. 21
Oct. 15. Cement, stone, etc., Honolulu, H. I. ......Aug. 31
Adv. Aug. 31 to Sep. 21.
Oct. 17. Culvert, Ft. Logan H. Roots, Ark. ......Sep. 21
Adv. Sep. 21.
Oct. 17. State canal wk., Albany, N. Y. ......Sep. 21
Adv. Sep. 21.
Oct. 19. Trunk lockers, Washington, D. C. ......Sep. 21
Adv. Sep. 21.
Oct. 21. Dump scows, Louisville, Ky. ......Sep. 21
Adv. Sep. 21.
Oct. 21. Barges, Louisville, Ky. Adv. Sep. 21 ......Sep. 21
Oct. 25. Dredge, Charleston, S. C. Adv. Sep. 21 ......Sep. 21
———. R. R. work, Chicago, Ill. ......Sep. 21

CURRENT NEWS SUPPLEMENT

SEPTEMBER 28, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y. Annual meeting, Detroit, Mich., Oct. 1-4, 1907.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York. Annual Convention, Atlantic City, N. J., Oct. 14-18.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O. Annual meeting, Atlantic City, Sept. 30-Oct. 4, 1907.

CENTRAL STATES WATER WORKS ASSOCIATION.

The city of Wheeling, W. Va., was the scene of the eleventh annual convention of the Central States Water Works Association, the first session being called to order on the morning of September 17 by Mr. George W. Lutz, Chairman of the Entertainment Committee. Mayor C. C. Schmidt extended to the convention a hearty greeting, and stated that Wheeling is now upon the eve of a bond issue and is undecided how to apply it in the improvement of its water works system, whether for a new reservoir, a sedimentation basin or a filtration plant. Greater pumping capacity is wanted, and the problem is whether to secure one unit of 20 million capacity or two units of 10 millions capacity. Wheeling, his Honor said, surely needs something, and needs it badly. President Thomas R. Cook, of Toledo, who responded, pointed out that the convention was not a junketing trip, but was called to discuss matters of vital concern to every municipality and private plant represented. He referred to the broadening and educational effect of such meetings of water works men to talk over their common difficulties, and to broaden their mental horizon. The man who always stays at home is apt to become narrow-minded.

Well Supplies.—Mr. John Langan, of Tipton, Ind., at the afternoon session read a paper on "Deep Well Water Supply." As the supply at Tipton is taken entirely from deep wells varying in depth from 60 to 440 ft., the paper was appreciated as coming from practical experience. In the discussion L. W. Latta, of Akron, stated that his company recently drilled 73 10-in. wells, in every case going through clay before striking water-bearing strata. While passing through the clay it was frequently necessary to pour water in the drill-hole to keep the drill running, but after passing through the clay and cleaning out, the water shot up within about 18 in. of the surface. Analysis by the State Board of Health shows the water is perfect for domestic use. Mr. Langan stated that when drilling some new 8-in. wells recently they did not encounter gravel before a depth of 130 ft., although in previous wells had done so at 60 to 70 ft. The first of these last wells was some 440 ft. deep, and the result was not wholly satisfactory, and another was dug by direction of the council. In drilling the first well the contractor, who was a new hand at it, did not keep a record of the character of the borings, and when drilling a second well was instructed to do this, and to report as soon as he struck gravel, with a sample of same. Learning that in the first well gravel had been encountered at 68 ft., Mr. Langan purchased some casing and had drillings made in the side of the first well, with the result that a vein of water was found that proved good and gave 300 gal. per minute. Two more wells drilled at a cost of \$2,000 have not been required, owing to the bountiful supply from the first well after the changes were made.

Mr. Langan stated that he had by repeated experimenting found that better results and more economy of water and steam can be maintained where the air lift is employed by using low air pressures. The higher the point at which the water can be taken the less weight of water to lift. Mr. Latta asked if Mr. Langan thought he could, by laying a pipe, say, 12 or 14 ft. from the surface of the well in which the water came within 8 ft. of the surface, reduce the head and get a greater flow at less cost of air lift. Mr. Langan replied that he had tried to do this, but had failed. Mr. Latta suggested that in the way he had indicated the supply might be allowed to flow into the clear water basin and pumped from there, inasmuch as Mr. Langan's main reservoir basin from which he pumped was 24 ft., and the height of water in wells from surface 8 ft., thus giving a margin of 16 ft. between bottom of the clear basin and surface of water in wells. It would be then cheaper to tap below the normal head than to put in air lift. Mr. Latta's experience is that it costs a great deal to pump by air-lift.

Mr. Herron, of Chillicothe, explained their system, which has a well of 25 ft. diameter, 24 ft. in depth, in the bottom of which are 11 driven wells, from 40 to 60 ft. in depth. The flow in these wells having decreased, they were enlarged. The air lift is used, the air being taken down in 2-in. galvanized pipe in the 8-in. casings. The 2-in. pipe run down within about 6 ft. of the bottom. After cleaning out the wells good results were had by using a small amount of air; the lowest pressure that could be used gave the best results; if a high pressure of air is turned on the air and water puff up.

Wood Pipe.—Mr. Latta told of an unfortunate experience had with the use of 48-in. stave pipe. He attempted to lay 2,400 ft. of such pipe; the original estimate called for 48-in. cast-iron pipe, but as the cost of these was over \$10 per lineal foot for the pipe alone, the wooden pipe was used instead. A price was made on this of \$1.20 per foot. The staves were 4 in. broad and 1⅞ in. thick. The pipe was to be banded with ⅝-in. round iron 16 in. center to center. After laying about 600 ft. of this, he was standing on the ditch one day after it had been filled, when he saw the ground sinking, and found that a portion of the pipe had collapsed. It was repaired, and ⅝-in. round iron rods used 8 in. center to center. In a few weeks later this also collapsed. It was replaced, using ⅝-in. round iron rods 4 in. center to center. That also showed signs of collapsing, and a 6-in. concrete arch was laid over the wooden stave pipe. Between 800 and 900 ft. of the wooden stave pipe was laid at an expense that was very onerous. He is now using 48x⅜-in. steel lockbar pipe, with flanged joints laid on a grillage of 2x6-in. oak, and has had no trouble whatever with it.

Mr. Langan asked if the speaker had ever considered what the result would have been if the pipe had been filled with water, and not covered over until it was so filled. Mr. Langan stated that in the beginning it was a grave question whether the water pipe would stand the pressure of the earth. As long as it was filled with water it held up, but collapsed as soon as the water was withdrawn.

Repairing Foot Valves.—A paper was next read by Mr. C. W. Wiles, of Delaware, O., on the repair of foot valves. The two Dean pumps of the Delaware Water Co., of 2,000,000 gal. capacity each, have separate 14-in. suction lines to the pump well, on which are flanged vertical foot valves, with a nest of gates. These foot valves had been in service about 18 years without being examined.

For a long time one of the pumps had not worked well; when run beyond a slow speed it pounded and labored. The engineer claimed that there must be a leak in the suction line, and much time was spent in looking for it. Recently trouble has been given by loss of water in the suction when the pump was not running, and this led Mr. Wiles to believe that the gates in the foot valve were not working well. This foot valve could not be examined in place, so a competent man was engaged with tools, to take it out.

The suction line enters the pump well about 10 ft. below the top, and with an elbow passes down some 14 ft. more; this foot valve is always under 4 to 12 ft. of water.

Heavy timbers were placed across the well, and from them a swing platform was dropped to the top of the first length of pipe, just below the elbow, from which a 12-ft. length of 14-in. pipe and the foot valve drop into the well. From this swing platform ropes and tackle were attached to the pipe, and after the bolts were removed it was raised and the foot valve rested on the platform, unbolted, and taken out of the well.

An examination showed that of the fourteen gates seven or eight were stuck and covered with mud, so that only about one-half were taking water, thus throttling the supply to the pump, and not seating, allowing the suction to drain when the pump was not in service.

The foot valve was thoroughly cleaned, the valves sandpapered so as to seat, and as all the springs were in good order, in a short time it was placed back, and the pump ran as good as new, taking and discharging easily at all speeds, and with no loss of water in the suction line when the pump was not working.

In view of the results of this examination it was thought best, while the tackle was in place, to examine the other foot valve, though the pump seemed to work fairly well. After disconnecting and hoisting out this second valve, it was found to have several gates out of order and the bottom plate on which the nest of valves rested was found to be broken entirely across one way and half across the other.

Six of the fourteen valves were stuck, and the only way the pump could take sufficient water was by the broken bottom plate opening up, allowing the water to pass through when the pump was working, and closing down when the pump was stopped. It was found that many bolts were badly worn by the movement of the broken plate. A new bottom, including gates and screen, was placed on the old top, and all replaced in the well.

Since cleaning and repairing these foot valves, the pumps have worked finely, running with less power and at a saving of steam.

Municipal Ownership.—A paper on "Municipal Ownership of Public Utilities," by John W. Hill, M. Am. Soc. C. E., of Cincinnati, O., was read in the absence of the author on the morning of Sept. 18. It was an argument for the private ownership of public utilities.

In discussing the paper, Mr. Alva L. Holmes, of Grand Rapids, Mich., said that if private companies had always operated their plants nearer to the general public in the past there would be less objection to them now. An ideal plan, the speaker thought, for the operation of public utilities would be to give the municipality a minority of the stock, put the management of such plants in the hands of private companies holding, say, 51 or 55 per cent. of the stock, the municipality to own the balance of the stock. Let the municipalities be represented on the board through their Board of Public Service. Thus the city would get good service and the product not be sold at less than cost. Neither private companies nor the municipalities can properly run water works or gas or electric light plants unless they realize from the product at least the cost of production and interest or investment, as well as a reasonable margin above. If they do not get cost the deficiency must be made up in a municipality in some other way, and in a privately owned plant out of the pockets of the stockholders.

Mr. Latta gave the case of a city that was using an old and cumbersome system of bookkeeping where the figures were kept in a separate book for each ward. As this system resulted in the information being almost valueless for operating purposes on account of the difficulty of getting at it readily, a card index system was suggested; but the officials replied that they could not introduce such an innovation, as the law required the method they employed. They could not think of going contrary to the laws, and introducing a little common sense.

Mr Jerry O'Shaughnessy, superintendent of the Columbus water works, objected strongly to some of the statements of the paper that seemed to reflect on Columbus, and also to the statement in regard to alleged platform utterances of Wm. Jennings Bryan. Later he introduced a resolution which, with slight amendment, was adopted, as follows:

Resolved, That it is the sense of this Convention that the Central States Water Works Association, drawing its membership from all classes, both of privately and publicly owned water works plants, cannot as a body endorse any theories as to municipal ownership of public utilities or otherwise; and that in the publication of any papers read before the Association, this Association disclaims any responsibility for the individual opinions expressed by the writers touching upon questions of public policy with which this Association as a scientific and technical body has no concern.

Quality of Water.—Dr. S. L. Jepson, of Wheeling, read a paper on the quality of water supplies.

In the discussion Mr. F. B. Leopold mentioned some unsuccessful well supplies. The water level in the Indianapolis wells receded year by year until cost of pumping to the surface was about 60 per cent. of entire cost of pumping according to their engineer's report. They finally had to abandon it. Gallipolis has a system of wells in the gravel of the river which are pointed to as an illustration of what can be done in this direction; but that is an exceptional case. Columbus, O., had an experience that was unsatisfactory. They laid about 2½ miles of perforated pipe in the gravel bed of their river, but eventually had to abandon it. A filtration plant has now been put in. At Williamsport, Pa., the Pennsylvania Water Co. put three filter cribs in the river. A year ago suit was entered against that company by the city of Williamsport, claiming that they were not furnishing as pure a character of water as their franchise called for, or as was available; and a decision was rendered against them and they were ordered by the court to install a filtration plant. Charleston, W. Va., had a similar experience, and they abandoned it and put in filtration.

With respect to filtration, the operating expenses deserve attention. One of the basic factors of cost in the mechanical filter is the coagulant. In practically all the earlier reports alum is placed as costing $25 to $30 a ton, but to-day alum can be purchased for $18 to $20 a ton, a difference of 25 per cent. Many plants installed in the last two or three years are using or contemplating using sulphate of iron as a coagulant, which results in a saving. The slow sand filter has its limitations in the character of water that it can handle successfully. Within its limitations the slow sand filter can undoubtedly produce satisfactory results from a sanitary standpoint, but even in those cases the physical appearance of the water leaves something to be desired. At Albany, N. Y., and Washington, D. C., the water is at times more or less turbid. At Albany they are now building preliminary filters to filter the water previous to its going into the slow sand plant, and to try and improve its character.

At Washington the old theory that the bacteria contained in the effluent were principally harmless bacteria from the under drains of the filter, has been disproved; because it has been found there that the filtered water contained the coli bacteria which must have gone through the filters. On the other hand, the mechanical filter will give nearly as good results bacterially as the slow sand filter. At Harrisburg last year the average was 99.24 reduction; and the average number of bacteria found in the filter water was 94. About two years ago the copper sulphate treatment was applied at Marietta, and during that time there was no trace of the coli bacteria found in the filtered water. Using the iron alone or alum alone there are times when the coli will go through the filter.

The new stockyards at Chicago are now building a filter plant to purify the waters of Bubbly Creek, which carries all the drainage from the slaughter houses. That water is almost pure sewage. It is black and in the summer time is covered with bubbles from fermentation. An experimental plant was put in there and operated for several months, demonstrating that the water can be purified. A 5,000,000-gal. filter plant is being built there now under guarantee to render that water in every way equal to the Chicago city water, and that is being done with the use of sulphate of iron combined with a small percentage of copper.

Mr Asa Williams, of Owensboro, Ky., referred to the installation at that city, which has been described in this journal on August 31. A test of the plant is reported elsewhere in this issue.

Mr Latta protested against attributing all typhoid fever cases to contaminated water supply. In his city recently the Board of Health notified him of 23 cases of typhoid fever, asking that something be done about improving the quality of the water forthwith. He traced these cases to their source and found three cases in one house, two of whom had just returned from a lake trip on the steamer "Northwest." The typhoid fever developed immediately after their return, and within a week the "Northwest" was held up at Buffalo six hours by the Health Officer, who fumigated it and had the plumbing overhauled. Two other cases were traced to the milk supply, the parties not having used city water for any purpose except sprinkling. It was found that the typhoid came from a little spring in which the milkman washed his hands and his cans on his farm. Out of the total number of cases complained of, only five by any possibility could have come from the city water.

Dr. Jepson stated that as a physician he had always maintained that too much importance has been attached to the water supply as the causation of typhoid fever.

Garbage Disposal. At the afternoon session President Cook read a paper on garbage disposal in Toledo by the reduction process, at the request of Secretary Veach, who believed it would be interesting, for although not directly along the line of the work of the Association, it would appeal to men who were largely connected with municipal affairs.

In the discussion, City Engr. Cook, of Wheeling, inquired what was done in Toledo with the tin cans, and was told that the cans were thrown out, but $6 a ton was obtained for them. The Department provides that no tin cans or anything similar are to go into the garbage, but as a matter of fact they do. After the tankage comes from the driers it is run over a picking table and the cans are taken out before the tankage goes into the digester, as there are pieces of glass, broken crockery and such matters that would hurt the commercial value of the product if not removed. From the dry tankage about 15 per cent. of grease is obtained, which is about 3 per cent of the entire garbage carted. This system will handle dead horses or dogs. A load of dogs is brought in every morning about 10 o'clock. The horses are skinned and then cut up in order to get them into the digester. The more animal fat the higher the percentage of ammonia in the tankage, which is sold on a unit basis.

A load of garbage weighing a little over 2 tons when turned into commercial products sells for $9 or $10, but it costs almost as much as it comes to. The entire process is handled by live steam, the most expensive way of doing anything by heat. The speaker thought that the process could be improved upon by using direct drier.

City Engr. Cook stated that the Wagner tank is made in Cincinnati and is used to a great extent by slaughter houses and places of that kind to reduce offal. The cost of reducing the garbage is slightly less than the money realized from by-products. The garbage business has been gone into pretty thoroughly in Wheeling. It was incinerated, and as the city had free gas, the burning did not cost anything. When the natural gas company got the franchise they agreed to furnish free fuel to the city crematory. The old Smith furnace was used, and the process was very unsanitary. The location of the crematory is in a conspicuous place in the city and is a disgrace to the municipality. The Health Officer and the City Engineer were sent on a trip to various cities to inspect the character of the garbage plants in use, and found that in no city, except possibly Pittsburg, where they have very cheap fuel, are they operating reduction plants at any profit which would attract a business man to undertake. The conclusion reached was that the best thing that Wheeling could do would be to go into the incinerating business.

President Cook stated that there was no complaint in Toledo of the operation of the plant, but when the apportionment was made of taxes for different purposes, the Health Department, as usual, got the small end of it. If the garbage can be gathered once in two days or oftener, when it reaches the plant it would not be objectionable, but when collected only one night a week, by the time it gets to the plant it is in a rotting and very objectionable condition.

Mr. J. D. Carmody, of Evansville, read a paper on "Sand Filtration by Nature's Method," written by Mr. Ferdinand Grote, of the Smith-Grote slow sand filtration system. It referred particularly to the Owensboro plant, already mentioned.

In the discussion Mr. Holmes mentioned an experience at South Haven on Lake Michigan, where, to avoid the cost of an intake in the lake, they forced out under the bed of the lake two 16-in. pipes with 15-ft. Cook strainers. It was built in the summer, and there were not many users that year. Two 16-in. pipes furnished a sufficient supply of water until the following spring, when more taps were taken on and it was found impossible to get water enough, and two more pipes were pushed out into the lake, leaving about 4 ft. of sand on top of the pipes. Before that season was ended it was necessary to put out two more, making six in all. They blundered through the next year, and the second year after that placed a 16-in. intake a half mile out in the lake, and have had no trouble since. Here the conditions were that the sand was so fine that the water could not get through fast enough. Unless a bed of gravel can be had through which the water will pass reasonably fast to the strainers of the wells, the supply will not be sufficient.

For the purpose of flushing the wells they had erected a stand pipe very near the plant, connected up with a by-pass, but it only gave temporary relief, the sand being too fine.

Mr. Grote said that Mr. Holmes was correct, that it would take the force of a current to make this kind of filtering used at Owensboro, a success, and where such conditions prevail good results are obtained, but in standing water where there is nothing to scour away the silt, the strainers will soon become clogged. The system is practicable, however, under Ohio river conditions.

Pipe Line Repairs.—Mr. Latta said that they had recently taken up a large number of 6, 8 and 10-in. mains, relaying them with mains from 16 to 24-in. The method originally in vogue was to excavate over the old pipe, take a pair of cutters, cut off as close to the hub as possible, and knock it out, losing from 6 to 8-in. of pipe in that way. This loss the speaker reduced by cutting out every second joint and leaving the intervening joints intact. In order to save waste of pipe the speaker conceived the idea of having a steel clamp made with feet all pointing one way; clamping this around the pipe, placing two 10-ton jacks on each side of the pipe with the foot of the jack against the hub of the pipe and with the head of the jack against the side of the clamp where it came around. This method was unsuccessful, as the pipe was smashed by the jacks.

Mr. Asa Williams, of Owensboro, stated that about five years ago he had occasion to take up 1,200 ft. of 8-in. pipe and relay with 10-in. Three tripods were equipped with chain blocks. The pipe was cut at one corner at the valve, the pipe being in the ditch, and the next corner at a fire hydrant T. The tripods were set about two lengths of pipe apart. The end of the pipe was pulled up, taking a strain with the other chain block, and when the end of the pipe got up to the top of the ditch a skid was placed across the top of the ditch to rest the pipe on. The tripod and chain blocks were then moved further down, and skids were eventually placed in this way across the ditch until the entire length of pipe rested on the skids. It was then rolled off the skids and the other pipe placed in position. Every third joint of the removed pipe was then melted out. A couple of 30-ft. telephone poles were placed on a wagon and two sections of pipe slung under the poles and the pipe hauled to the place where it was to be laid. It was easier to melt the joints on top of the ground than in the ditch. He has since taken up both 4 and 6-in. pipe, using the same method.

Mr. Holmes preferred to melt the joints out in the ditch, making the lengths as long as can be handled with teams, cutting the pipe far enough from the bell so as to put a sleeve on and handle it in that way. By using cutters on small pipe, say 4 and 6-in., it is possible to get them out of the way in a little while. Mr. Holmes had seen plumbers' blowing machines or torches used on pipe joints, but the process is slow.

Secretary Veach stated that about a year and a half ago he asked Mr. L. E. Chapin, of Canton, O., whether there was not some better method of unjointing pipe than by burning it out in the ditch; and was told that the Standard Oil people in Cleveland, O., had an arrangement in the way of a jack that one of their men had designed. It could be dropped down over the pipe, and had pawls in it that would prevent it from slipping. They could push out 6 or 8-in. pipe out of the bell in a few moments; a very practical and very successful device. They relaid more or less cast iron pipe every year, and they were very much pleased with it and used it entirely.

Mr. W. J. Scroggins, of Wheling, showed samples of the incrustation taken from the interior of the water pipe in that city. They were chunks of black substance, the color of tar and almost as hard as iron. It required from four to eight men to pull the cleaner through the pipes. The delegates subsequently inspected the process of clearing the water mains, which was going on at Wheeling in charge of Mr. D. H. Buell, of the National Water-Main Cleaning Co. Mr. Scroggins stated that 4 and 6-in. mains in Wheeling were so incrusted internally in some places that their diameter did not exceed 1¼-in., and in some places not 1-in., and when they try to flush such mains through the fire hydrants they could not throw a stream more than 7 or 8-in. beyond the nozzle. After cleaning the mains the same hydrant would throw a stream of full size half way across the street.

City Engineer Cook, of Wheeling, explained that the hard and metallic character of the deposit found in the Wheeling water pipes, and the carbuncles and tuberculation were undoubtedly due to the refuse from tin-plate mills, coal mines, etc., a condition that did not exist at many other points on the Ohio river, but has been increasing at Pittsburg and Wheeling for the last five years to an alarming degree since the tin-plate mills and other manufacturing plants have been discharging their residue into the Ohio river. In Pittsburg the process of cleaning the mains had developed the fact that it was impossible to get a broom-stick through many 4 and 6-in. mains. The method of cleaning is very simple. A swab is attached to the end of a wire, a piece of jute being used. A hole is cut in the pipe and the flow of water carries the swab along with the small wire attached. To this wire is attached a cable which pulls the cutter through, there being a windlass at the far end. It is astonishing to see the substances that are removed from the pipe. It is so offensive that many people standing watching the process remarked that they had never seen sewers cleaned that way before.

At the evening session illustrated addresses on meth-

ods of filtration were given in the handsome auditorium of the Carroll Club, by Messrs. F. B. Leopold and Morris Knowles, both of Pittsburg. Mr. Leopold's subject especially was the new Lorain plant, which he stated was probably more nearly adapted for a city the size of Wheeling than any other. The intake of the water from the lake to the sedimentation basin, its transfer to the mixing basin, the introduction of the coagulant, etc., were all shown by lantern slides. Various improvements made since 1897 at Lorain were explained, and figures were presented showing the falling off in typhoid fever after the installation of the filteration plant. Mr. Knowles described the Pittsburgh filters, which were the subject of a series of articles in this journal some time ago. The originally projected cost of the filteration system proper was $3,300,000. Adding the low lift pumping station and the filtered water reservoir, and the land, etc., will make another million. The original estimate will not be exceeded, and in fact some few hundred thousand dollars will be saved, which can be applied to future operating expenses.

Water Waste.—On Thursday morning a paper on "Meters" was read by Mr. A. L. Holmes, of Grand Rapids. The title is somewhat misleading, for it was partly an argument for the maintenance of a water plant in good order, by preventing slip in pumps, leakage in mains and waste in houses. When this is done it is possible to know the cost of water under efficient management, and then, by using meters, to charge each consumer a fair price for what he was using.

Mr. William Schofield, of Benwood, W. Va., agreed with a statement in the paper as to the fallacy of comparing water rates in vogue in different localities, explaining that in Benwood, adjoining Wheeling, they were compelled by ordinance to charge the Wheeling rates, although they were supplying filtered water to only 7,000 people for domestic service only; whereas the city of Wheeling supplies large manufacturing establishments and is pumping 17 or 18 million gallons per day. Mr. Fred. Bosch, of Whitewater, Wis., thought that the point made by Mr. Holmes in calling attention to the fact that water rates are seriously affected by pump slippage, was an important one. He gave an interesting account of his investigations along that line in detecting pump slippage, by means of which he reduced the amount very materially.

Mr. O'Shaughnessy, of Columbus, told of his success in reducing waste at that city, as a result of which, although some 1,500 taps had been added in seven years, something like five million gallons less water was now being pumped per 24 hours. He found that the meter was a powerful factor in reducing the waste of water. If a meter is installed on the premises, even if it does not work, so long as the customer is not aware of the fact, it is a guardian that tends to keep down the waste of water. Unless measures had been taken to reduce the wastage at Columbus, even 30 million gallons capacity would not be sufficient to take care of the demand. The speaker thought that the old style of brass ring packing inside of a horizontal pump was very poor, and permitted a large slip. He now uses square plaited hemp and square canvas packing in about the same proportions all the way through. If all hemp is employed or all canvas, the result is not so good. The city that persists in not using meters is certainly behind the times.

Mr. Schofield stated that he thought slip was a very important point as a result of recent experience. Finding that the pumps were running faster than usual, he set himself to learn the cause. He had attributed part of the increase to the increased use of water by water-motor washing machines. Not finding it there, he examined the sewers, still with no result, and then set the engineer to work on his pumps. The engineer reported no broken springs, valves all in good condition, and pump all right. He then tried to find leakage on the lines, but discovering nothing of moment, returned again to the pump, and after various tests found there was 40 per cent slippage. Repairs to the pump cut down 37 per cent. of the slip. Then the engineer examined his valves, and found them to be ⅛-in. too small, and the water was shooting out around the edge of the valves and going back. New valves were placed on the pump, but he still found considerable slip. The engineer went down to the sewer one day which empties into the river and from which the water is discharged from the condensers and from the filter plant. He thought there was too much water coming from the sewer, and an investigation showed some tubes shoved endwise in the surface condenser, from which the water was going.

In the business meeting it was voted to meet next year at Pittsburg, the date to be fixed later. The following officers were elected: President, John Langan, Tipton, Ind.; Vice-Presidents, William Schwertfeger, Wheeling, W. Va.; Elkanah Hulley, Marion, Ind.; Asa Williams, Owensboro, Ky.; L. M. Latta, Akron, O.; A. L. Holmes, Grand Rapids, Mich.; Fred Bosch, Whitewater, Wis.; J. Ahearne, Nashville, Tenn.; W. J. Scroggins, Wheeling, W. Va.; T. H. Venner, McKeesport, Pa.; Dabney H. Maury, Peoria, Ill.; Secretary, Wm. Allen Veach, Newark, O.; Treasurer, A. W. Inman, Massilon, O.; Executive Committee, A. H. McAlpine, Columbus, O.; Jerry O'Shaughnessy, Columbus, O.; C. W. Wiles, Delaware, O.; Finance Committee, Geo. F. Cooper, Xenia, O.; Wm. Schofield, Benwood, W. Va.; J. M. Wisler, Toledo, O.

CONCRETE COLUMN FORMULAS

The following letter from Mr. H. C. Turner, of the Turner Construction Co., New York, is self-explanatory: "Referring to your magazine of Sept. 21 and the article in the Current News Supplement entitled 'Suggested Rules for Reinforced Concrete,' there is an error in the formula given for the value of spiral-wound reinforced concrete columns. The last term in this equation, $fs' \times As'$, should be $fs \times As$; in other words, both of the prime marks should be omitted."

PERSONAL NOTES.

Mr. William H. McEniry has been elected city engineer of Bessemer, Ala.

William England Kern, first assistant surveyor in the Sixth District of Philadelphia, died Sept. 20. He was 40 years old.

Mr. J. C. Jeffery, assistant city engineer of Seattle, Wash., has resigned to enter a general contracting business with Mr. J. S. Holt, of Seattle.

Lieut.-Col. Walter L. Fisk, Corps of Engineers, U. S. A., has been ordered from San Francisco to the office of the Chief of Engineers for temporary duty.

Mr. W. G. Bierd, whose resignation as general manager of the Panama R. R. recently was noted in these columns, is to enter the service of the New York, New Haven & Hartford R. R., succeeding Mr. O. M. Shepard, general superintendent, who is to retire from railroad work Oct. 1.

Capt. Jas. P. Jervey, Corps of Engineers, U. S. A., commanding Company A, First Battalion of Engineers, has been ordered to the Engineer School at Washington Barracks as instructor.

Mr. Herbert W. Goddard, formerly connected with the Ransome & Smith Co., New York City, has become superinendent for the Concrete Steel & Tile Construction Co., Boston, Mass.

Prof. E. L. Clark, assistant professor of civil engineering at the Missouri School of Mines, Rolla, Mo., has resigned to accept a position in the United States engineering office at Seattle, Wash.

Frank L. Gilman, chief engineer of the Oregon water power division of the Portland Railway, Light & Power Co., Portland, Oregon, and city engineer of Portland in 1895-96, died at his home in that city, Sept. 11, aged 47 years.

Mr. Lucius T. Gibbs has been appointed electrical engineer of the Baltimore & Ohio R. R., succeeding Mr. W. D. Young, resigned. Mr. Gibbs is brother of Mr. George Gibbs, general superintendent of motive power of the Pennsylvania R. R.

Mr. Howard C. Ford has been appointed assistant professor of irrigation engineering and surveying at Iowa State College, Ames, Ia. Mr. Ford is a graduate of the University of Colorado and has been instructor in civil engineering in that institution for three years.

Mr. E. Darrow has resigned as chief engineer and general manager of the Toledo & Indiana Ry. Co. to become engineer for a syndicate with headquarters in New York City. He has been succeeded by Mr. H. C. Warren, formerly superintendent of the Toledo, Port Clinton & Lakeside Ry.

Prof. L. E. Young recently became director of the Missouri School of Mines and Metallurgy, at Rolla, Mo. He has had a wide experience in mining in Pennsylvania, Iowa, Michigan and Colorado. He was professor of mining engineering at the Colorado School of Mines at Golden, Colo., for several years, and before that he was assistant professor of mining engineering at the Iowa State College.

Mr. Charles N. Black, general manager and chief engineer of the Metropolitan Street Ry. Co. of Kansas City, Mo., has been appointed vice-president and general manager of the United Railroads of San Francisco, succeeding to the duties of the late Mr. Geo. F. Chapman. Mr. Black's connection with the Kansas City company dates from the time when as chief engineer for Ford, Bacon & Davis, of New York, the reconstruction of the system was entrusted to him. This work was finished in September, 1903, and Mr. Black was induced to continue with the company as its chief engineer. Two years later he was appointed manager.

Mr. W. L. Mattoon, formerly division engineer on the Zanesville and Western and Corning division of the Toledo & Ohio Central Ry., with headquarters in Columbus, Ohio, has become principal assistant engineer of the Hocking Valley and Zanesville & Western railways, with headquarters in the same city, succeeding Mr. Parker S. Cott, who resigned to accept a position with the Sunday Creek Coal Co. Mr. Mattoon is succeeded in his former position by Mr. D. C. Holtsbery, division engineer of the Eastern division of the Toledo & Ohio Central Ry., who in turn is succeeded by Mr. R. P. Black, in charge of construction work on the Indianapolis division.

Samuel Sloan, chairman of the board of directors of the Delaware, Lackawanna & Western R. R. and for 32 years president of the same road, died, Sept. 22, aged 90 years. He was one of the best-known railroad men in this country and since the beginning of his railroad career in 1855 as a director of the Hudson River R. R. he had been at various times president of seventeen railroads, among which are the Michigan Central, Pere Marquette, International & Great Northern, and the Fort Wayne & Jackson. He was, however, most closely connected with the Delaware, Lackawanna & Western, which under his management was developed from a short coal road into a great trunk line. He retired from the presidency of the Lackawanna in 1899.

Mr. Frederick L. Smith has opened an office at 5 Beekman St., New York, as an industrial engineer and specialist in structural steel and reinforced concrete. He will pay particular attention to the selection of industrial sites, the design of mills and power plants, the investigation and appraisal of factory properties and the design of structural work. For the past six years he has been in charge of the New York office of Mr. Joseph H. Wallace, the well-known industrial engineer of New York and London, during which time a number of important mills, shops and power plants were designed in the office, and plans were prepared for a large amount of structural work for architects and engineers who did not have a structural department.

BUSINESS NOTES.

Judge Hough of the U. S. District Court at Philadelphia appointed Messrs D. P. Allerton, Wm. H. Carpenter and S. P. Thomas on Sept. 25 receivers for the Scofield Co., of that city. This company has lately executed a number of large contracts in different parts of the country, including the dry-dock at the League Island Navy Yard and the large government pier at the Jamestown Exposition.

The Ohio Canal Traction Co., of Cleveland, O., was recently incorporated, with $75,000 capital, to place a number of 250-ton steel barges propelled by 40-h.-p. gasoline engines on the Ohio canals. The route at first will be from Cleveland to Akron, but it is expected that service will ultimately be extended to Massillon, New Philadelphia, Canal Dover, Uhrichsville, Dresden and Zanesville.

The Trussed Concrete Steel Co., of Detroit, has opened an office at 502 Atlas Bldg., San Francisco, in charge of Mr. Felix Kahn.

Among orders for foreign shipment recently received by the Buffalo Forge Co., of Buffalo, is one for a horizontal center crank compound automatic engine, 13x20x14, for direct connection to a General Electric Company's generator. The unit is for the electric illumination of the tower of Noshiro, on the northwest coast of Japan.

Wm. B. Scaife & Sons Co., Pittsburg, Pa., have been awarded the contract for furnishing the structural steel work and steel storage bins for the new plant of the Henry Cowell Lime & Cement Co., Concord, Cal. Eleven buildings will be required, involving about 2,500 tons of structural steel.

The Conley Frog & Switch Co., Memphis, Tenn., has completed its plant, consisting of a reinforced concrete building with electrically driven machinery. The company's shipping facilities are excellent, the plant being on the Illinois Central R. R. and the Union Belt Ry. A number of orders from railroads are now being executed. The capital of the company is $200,000, and the officers are: Mr. J. E. Conley, president; Mr. B. S. Randall, vice-president, and Mr. F. J. Callahan, secretary and treasurer.

Mr. Max F. Abbé, president of the Abbé Engineering Co., New York, has just returned from a five months' trip to Europe. He visited England, Belgium, France and Germany, and in several places made contracts for the manufacture of tube mills and linings under his various patents. In Germany he contracted with the Fried. Krupp Aktiengesellschaft Grusonwerk, at Magdeburg Buckau, for the building in the United States of their celebrated Excelsior mills, of which the Krupp people have sold 30,000 in various parts of the world. The Abbé Engineering Co. will be ready within a month to supply the trade with mills of this type.

The Cattaraugus Cutlery Co., Little Valley, N. Y., has recently purchased extensive new machinery equipment for an addition to its two present factories in Little Valley. The new machines comprise an engine, a generator and motors made by the Allis-Chalmers Co. The engine is an 18x42-in. horizontal heavy-duty Reliance Corliss engine, belted to a 150-kw. Allis-Chalmers alternator, wound for 60-cycle 3-phase current at 440 volts. The motor equipment includes three 40-h.-p. Allis-Chalmers standard induction motors designed for a speed of 850 r. p. m., a 30-h.-p. motor for the same speed, and three 5-h.-p. machines for 1,130 r. p. m. apiece.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Albany, Ala.—The question of establishing a water system on the grounds of the Alabama Poytechnic Institute is reported under consideration.

Slocomb, Ala.—J. A. Bateman, Mayor, writes that plans and specifications are on file at the office of the Morris Lumber Co., at Slocomb, for water works, and bids will be received at once for its construction; probable cost $15,000.

Tucson, Ariz.—Bids will be received at the office of Frank S. Treat, City Recorder, until Nov. 4 for furnishing material and constructing a system of water works, as advertised in The Engineering Record.

Camden, Ark.—E. H. Carson, Mayor, writes that this city proposes letting new franchise for water works for 25 years. Old franchise expires next year. Population of town is now 6,040.

Berkeley, Cal.—The Peoples' Water Co. is reported to have decided to install another large pumping plant at its station on University Ave. between Shattuck Ave. and Grove St.

Riverside, Cal.—The Santa Ana Riverside Water Development Co. is reported incorporated, with a capital of $300,000, by G. W. Sherwood, L. P. Drake, A. N. Saxton and others.

Craig, Colo.—Gen. Frank D. Baldwin, former Commander of the Dept. of Colorado, now on the retired list, is reported to be here investigating a proposition to build a canal to irrigate 100,000 acres of land. The proposed canal is to extend to the Craig placers.

Delta, Colo.—Engr. E. P. Martin, of Paonia, writes that bids are wanted for the building of a 32-in. siphon. It is proposed to build a large reservoir, but no bids have as yet been asked for this work.

Wallingford, Conn.—J. H. Child, Supt. and Engr., Wallingford waterworks, writes that several possible sources of increased water supply are to be considered. It is not probable that any construction work will be done before the spring of 1908.

Ashburn, Ga.—See "Power Plants, Gas and Electricity."

Millen, Ga.—See "Power Plants, Gas an dElectricity."

Atlanta Ga.—The Special Waterworks Com. (Councilman Longine, Chmn.) in its report to Council recommends that a new pump be bought for Hemphill station at once; that a pump be bought for the river station in the near future; that anew reservoir be completed as soon as possible; that the new filter plant, coagulating and clear water basin be pushed to completion as rapidly as possible; that a basin be constructed at the river station between the intake pipes and the pump, so as to assist in clearing the water before it reaches the reservoir, and that the new 36-in. main be laid as fast as possible and that more service pipes be put down throughout the city.

Shelley, Idaho.—Fred C. Mickelson, City Clk., writes that bids will be called for about Dec. 1 for the construction of water works to cost about $6,500. Engineer, N. N. Holm, of Shelley.

Harmon, Ill.—Benj. F. Swab, Village Clk., writes that an engineer will soon be selected to prepare plans for water works, to cost about $6,000. Have well completed, depth 532 ft.

Waterloo, Ia.—The citizens in mass meeting on Sept. 14 are reported to have decided to call an election to vote on the advisability of purchasing or constructing water works.

Frankfort, Kan.—J. M. Shumate, City Clk., writes that the citizens on Sept. 16 voted to issue $21,500 bonds for waterworks.

*New Orleans, La.—Local press reports state that the Sewerage and Water Bd. on Sept. 16 awarded contracts as follows for hauling and laying of approximately 250 miles of c. i. water pipe, from 4 to 30 in. diam. and aggregating about 26,000 tons: Contract 15-W to Irwin Bros., $225,789; contract 17-W to M. O. Herron & Co., $237,791; contract 16-W to A. L. Patterson & Co., $256,167, and contract 18-W to General Contr. Co., $113,637.

Patterson, La.—The Mayor writes that preliminary survey has been made for water works, but the proposition to construct same has not yet been submitted to the taxpayers.

Pollock, La.—The Town Council is reported to have decided to construct water works.

Berlin, Md.—See "Power Plants, Gas and Electricity."

Mattapoisett, Mass.—A committee is reported to have been formed to consider a public water supply. Selectman Lester W. Jenney may be able to give further information.

*Cokato, Minn.—W. D. Lovell, of Minneapolis, is reported to have secured the contract for constructing waterworks (bids opened Sept. 7), for $5,372.

Fairfax, Minn.—It is stated that bids will be received until Oct. 1 by the Village Council for constructing a steel watertower and tank. J. T. Johnson, Engr., Gibbon.

*Duluth, Minn.—L. M. Case, Mgr. Water & Light Comrs., writes that the contract for constructing and installing two electric booster pumps at 46th Ave., N., and Grand Ave. (bids opened Sept. 5) has been awarded to Fairbanks, Morse & Co., of Chicago, Ill., for $4,225.

Newton, Miss.—Bids will be received until Oct. 7 by the Mayor and Bd. Aldermen for furnishing material and constructing a complete water works system. Xavier A. Kramer, Engr., Magnolia.

Columbia, Miss.—W. L. Simmons, Town Clk., writes that F. Blanchard, of Columbia, has prepared preliminary plans for waterworks and sewerage system for Columbia, to cost about $50,000. Election will probably be held on Nov. 1.

Gulfport, Miss.—M. T. Sullivan, City Engr., writes that bonds have not yet sold for extensions to waterworks and sewerage system, and no contract for work yet let.

Fremont, Neb.—See "Power Plants, Gas and Electricity."

Hildreth, Neb.—The citizens are reported to have voted to issue $10,000 bonds for water works.

*Newport, N. H.—The contract for extending the water system to the village of Guild and for laying 2 miles of 8 and 6-in. c. i. pipe was on Sept. 14 let to Ablett & Bowes, of Cohoes, N. Y., at 20½ cts. per lin. ft.

*Orange, N. J.—Contracts for the final work of completing the water supply and distribution additions (bids opened by City Council on Sept. 9) are reported to have been awarded as follows: For concrete work on new reservoir and gatehouse, John W. Heller, of Brooklyn, N. Y., for $52,825; the Warren Foundry & Machine Co., of Phillipsburg, secured contract to furnish c. i. pipe for $57,385. R. H. Kernan, of South Orange secured contract to lay the pipe for $27,950.

Alamagordo, N. M.—See "Power Plants, Gas and Electricity."

Tupper Lake, N. Y.—D. C. Randall, Supt. Tupper Lake Water Co., writes that A. W. Cuddeback, of Paterson, N. J., is engineer for the proposed standpipe.

New York, N. Y.—The attention of intending bidders is now directed to the contracts to be advertised during the fall and winter by the Bd. of Water Supply, 299 Bway., New York, N. Y., to include main dam, Kensico reservoir; headworks of Catskill aqueduct, portions of the Esopus division of the Catskill aqueduct; portion of Wallkill division of Catskill aqueduct; Rondout siphon and Wallkill siphon, as advertised in The Engineering Record, in order that they may look over the ground before topographical features are obscured by snow. Further information can be obtained from A. D. Flinn, Dept. Engr. in charge of headquarters, Room 1515, 299 Bway., N. Y. City.

Lenoir, N. C.—The Mayor writes that bids will be received about Oct. 1 for improvements to water works, sewers and paving, to cost between $75,000 and $100,000.

Gastonia, N. C.—Bids are wanted, it is stated, until Oct. 1 for $30,000 street improvement bonds; $23,000 waterworks and sewer bonds; $15,000 school bonds. E. N. Lineberger, Treas.

Fargo, N. D.—It is stated that bids will be received until Oct. 9 by the Bd. Co. Comrs. for constructing a pneumatic water plant at the County Hospital. Arthur Lewis, Co. Aud.

Delta, O.—The Delta Electric Light Co. is reported to have petitioned City Council for a franchise for water works.

Swanton, O.—The City Council is reported to have passed an ordinance providing for the purchase of a site for water works. The citizens about a year ago voted to issue $20,000 bonds for the construction of same.

*Cincinnati, O.—The Bd. of Pub. Service on Sept. 18 awarded contracts for water meters, with ⅝-in. connections, to the America Valve & Meter Co. and Neptune Meter Co., New York, N. Y.; Pittsburg Meter Co., Thompson Meter Co., of Brooklyn, and Buffalo Meter Co.

Columbus, O.—The Bd. of Pub. Service is reported to have on Sept. 18 opened bids for laying 2 36-in. water mains to connect the new water softening and filtration plant with the city pumping station, as follows: W. C. Halliday, $162,590; Chas. C. Taylor & John M. Beckett, $162,683; Westwater & Casey, $163,907.

Ashtabula, O.—W. S. McKinnon, Pres. Ashtabula Water Co., writes that the company is not yet ready to let any contracts, nor has engineer been selected yet, but it is proposed to install a filtration plant.

Philadelphia, Pa.—A $2,000,000 filtration plant, with a daily capacity of 50,000,000 gal., to be erected on the site of the present Queen Lane pumping station and reservoirs, is reported to be under consideration by the Dept. of Pub. Wks. If the necessary funds are provided in the $10,000,000 loan the work of construction will be begun immediately.

*J. K. Dimmick & Co., 2040 Land Title Bldg., secured the contract for furnishing breeches, pipes and special castings for 1907 (bids opened Aug. 22 by the Dept. of Pub. Wks., Bureau of Filtration), at the following bid: Furnishing 20 to 48-in. c. i. H. & S. specials, per ton, $70; furnishing under 20-in. c. i. H. & S. specials, per ton, $60; furnishing 20 to 48-in. c. i. H. & S. breeches pipe, per ton, $100, and furnishing under 20-in. c. i. H. & S. breeches pipe, per ton, $90.

*Walter Wood, 400 Chestnut St., secured the contract for constructing the Roxborough pipe extension system, Item No. 1, bids opened Aug. 22 by the Dept. of Pub. Wks., Bureau of Filtration, at a total of $48,884, and M. & I. B. McHugh, 607 Witherspoon Bldg., secured contract for the Roxborough pipe extension system, Item No. 2, for $24,822.

*The Millard Constr. Co., 704-9 Penna. Bldg., secured the contract for the 3d St. pipe extension, Item No. 1 (bids opened Sept. 17 by the Dept. of Pub. Wks., Bureau of Filtration), at a total of $75,414, including pipe, valves, valve boxes, etc. It bid for 2,354 tons 48-in. c. i. pipe, per ton, $28.90; 18 tons less than 48-in. c. i. pipe, $30; 65 tons c. i. H. & S. specials, $63; 5,300 lbs. gray iron castings, 5 cts.; etc. (time of completion, 90 days). Totals of other bids: Walter Wood, 400 Chestnut St., $43,139; U. S. C. I. Pipe &Fdry. Co., Land Title Bldg., $78,586, and J. K. Dimmick & Co., 2024 Land Title Bldg., $73,335. The Millard Contr. Co. also secured contract for Item No. 2 of the 3d St. extension (bids opened same time), for $17,545.

*The detail bid of Millard Constr. Co., 704 Pennsylvania Bldg., the successful bidder for preliminary filters at the Torresdale Sta. (bids opened Aug. 22 by the Bd. of Pub. Wks. Bureau of Filtration) is as follows: 40,000 cu. yd. excav., all kinds, 69 cts.; 60,000 cu. yd. embkmt., 60 cts.; 720 roof drain inlets for filters, ea., 60 cts.; 8,500 cu. yd. fill filter roofs, 50 cts.; 5,000 sq. yd. sodding, 20 cts.; 5 acres seeding, $100; 500 lin. ft. T. C. pipe, 8 in. and under, $1; 6,500 cu. yd. puddle, $2.30; 26,000 cu. yd. concrete, $9.60; furnishing 1,100,000 lb. reinforcing steel, $1.75; placing, 1,800,000 lb. reinforcing steel, per lb., 1 ct.; 300 cu. yd. red brick masonry, $15; 1,800 sq. yd. granolithic pavent., $2.25; 500 cuts 16 to 30 c. i. pipe, per cut, $4; 150 tons c. i. H. & S. pipe, to furnish, $35.20; 150 tens, c. i. H. & S. pipe, to lay, $9.60; 340 tons c. i. flange pipe, to furnish, $88; 700 tons c. i. flange pipe, to lay, $25; 150 tons c. i. H. & S. specials and fittings, to furnish, $66; 150 tons c. i. H. & S. specals and fittings, to lay, $18; 450 tons c. i. flange specials and fittings, to furnish, $95; 475 tons c. i. flange specials and fittings, to lay, $30; 250,000 lb. screw lap-welded steel pipe, to furnish, 3.5 cts.; 350,000 lb. screw lap-welded steel pipe, to lay, .0075 cts.; constructing reinforced concrete tank, lump sum, $21,000; 820 sq. yd. treating exposed surfaces of tank with acid, 10 cts.; steam heating system, complete, lump sum, $11,500; steel riveted conduits, complete, lump sum, $83,000; 960 wash water manifolds, eac., $73.50; 60,000 lb. structural steel, to furnish, 4 cts.; 1,800,000 lb. structural steel, to place, 1.5 cts.; 3,500 lin. ft. pipe railings, 78 cts.; 275,000 lb. wash water troughs, 4.5 cts.; 3,100 sq. yd. vit. brick pavent., $1.90; 3,400 lin. ft. straight granite curb., $1.26; 300 lin. ft. curved granite curb., $1.65; 400 lin. ft. 3-ft. brick sewer, $5; 2 brick sewer manholes, complete, ea., $60; constructing hydraulic piping system, complete, lump sum, $27,500; 120 loss of head gauges, complete ,to furnish, ea., $49; 120 loss of head gauges, to place, ea., $12; constructing air blower equipment, lump sum, $14,000; constructing electrical equipment, lump sum, $14,500; 72,000 lb. w. i. and steel fixtures, to furnish, 6 cts.; 72,000 lb. w. i. and steel fixtures, to place, 5 cts.; 50,000 lb. c. i. fixtures, to furnish, 5 cts.; 50,000 lb. c. i. fixtures, to place, 3 cts.; 570 ventilator frames and covers, ea., $9.85; 840 ventilator frames and covers, ea., $5; 5,700 lin. ft. 20-in. galv. spiral riveted pipe, $2.94; constructing filter house, complete, and brick walls around filters, lump sum, $51,000; 5,100 cu. yd. filter sand, $2.10; 10,700 cu. yd. filter gravel, $2.25; 120 16-in. stop valves, to place, ea., $15; converting 20x24 sluice gate into hydraulic gate, 120 ea., $115. Total bid, including gates, valves, etc., $1,156,410. Totals of other bids: The Mack Paving Co., 2032 Land Title Bldg., $1,156,758; Reiter, Curtis & Hill, 315 Arcade Bldg., $1,419,015; David Peoples, 1000 Betz Bldg., $1,261,051; Bennis Constr. Co., 211 So. 9th St., $1,248,591.

Panama.—See "Miscellaneous."

Aberdeen, S. D.—The Water & Sewer Com. is reported to have recommended the building of a reservoir and standpipe, at a cost of $14,000.

Harlingen, Tex.—The Harlingen Land & Water Co. is reported incorporated: capital, $300,000; incorporators, Lon C. Hill, Paul Hill, J. D. Hill and others.

Seattle, Wash.—The City Council has passed an ordinance for laying salt water mains on 1st, 2d and 3d Aves. for fire protection; estimated cost, $100,000.

Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., until Oct. 5 for constructing water mains on N. and W. 80th St.; estimated cost, $17,100.

Waukesha, Wis.—President Ernst Merton, of the Water Comn., is stated to have presented a report to the City Council for the improvement of the waterworks and recommends the replacing of 11,973 ft. of the New England watermains in the business district and territory adjacent thereto, with standard cast iron mains, at an estimated cost of $20,678.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—It is stated that bids will be received until Oct. 5 by C. W. Heicks, City Clk., for constructing a sewerage system. Olmsted & Gillen, Engrs., 616 Grant Bldg., Los Angeles, Cal.

Santa Monica, Cal.—The Council is reported to have adopted plans for the disposal of the city's sewage through an outfall to be built into the ocean at Colorado Ave., on recommendation of its Sewer Com. To construct the proposed sewer system, which will include a pier at least 1,600 ft. in length to support the outfall, the people will be asked to vote bonds to the amount of $155,000.

Pasadena, Cal.—S. J. Van Orman, City Engr., writes that the proposed outfall sewer for the annexed portion of Pasadena will cost about $50,000. An election will be held on question before contract for the work is let.

Montrose, Colo.—We are informed that bids have not yet been asked for the new sewer system.

Bridgeport, Conn.—The Sewer Comn., which has charge of revising the city's sewer system, and will supervise the installation of a system of sewage at a cost of about $250,000, has selected Rudolph Hering, of New York, N. Y., as the supervising and consulting engineer.

Berwyn, Ill.—Bids will be received until Oct. 3 by the Bd. Local Improv. (R. F. Stevens, Secy) for constructing pipe sewers in East Ave., 12th and 16th Sts.; total esti-

Chicago, Ill.—See "Miscellaneous."

Linton, Ind.—All bids opened on Sept. 16 by Common Council for constructing a sanitary sewer system consisting of approximately 13 miles of sewer with a disposal plant, are stated to have been rejected and new bids will be received Oct. 7. Approximate cost, $64,800. Frank Spelbring, City Clk.

Aurora, Ind.—Bids will be received until Oct. 11 by the Common Council for constructing a sewer in Dist. No. 1, to be composed of 6 to 20-in. salt-glazed vitr. pipe, manholes, catch basins, etc.; est. cost, $12,500. Fred D. Johnston, City Clk.

Brazil, Ind.—Geo. A. Fletcher, City Engr., writes that survey will probably be made in October for the proposed sewerage system for the south side of city.

Indianapolis, Ind.—Chas. A. Brown, Asst. City Engr., 903 Majestic Bldg., writes that bids will be received on Oct. 7 by the Bd. of Pub. Wks. for the construction of the E. Michigan St. sewer, to cost about $146,000. It will be of concrete on brick and pipe, and the size will range from 12-in. to 7 ft. in diam.

Bartlesville, Ind. Ter.—Frank B. Hornett, City Recorder, writes that about $50,000 will be expended for sewers. Engineer, E. C. D'Varmeth, of Bartlesville. mated cost, $4,000.

Lemars, Ia.—Bids will be received until Oct. 1 by the City Council for constructing 1,572 ft. 8-in. vitr. pipe sewer, 1 flush tank and 6 manholes. D. N. Hoffmann, City Clk.

*Items marked thus give the names of parties awarded contracts.

Dayton, Ky.—City Engr. Lindsey is reported to have about completed his survey and estimates for a sewer system, to include 3 trunk sewers, at a cost of about $100,000.

New Orleans, La.—Local press reports state that Sewerage and Water Bd. on Sept. 16 rejected all bids opened on Sept. 11 for the construction of, approximately, 110 miles of sewers and appurtenances. The sewers will range in size from 8 to 27 in. and in depth from 5 to 17 ft. and will include, approximately, 1,230 manholes and 443 flush tanks. The work will be divided into four contracts. F. S. Shields, Secy. George G. Earl, Genl. Supt.

**Westfield, Mass.*—Oren E. Parks, Town Engr., writes that Danl. A. Dorey, of Natick, has secured the contract for building Sec. 14 of storm water sewers (bids opened Sept. 18) at the following bid: 2,000 lin. ft. earth excav., 24 in., $1.25; 600 lin. ft. 20 in., 70 cts.; 780 lin. ft. 18 in. $1; 360 lin. ft. 15 in., 50 cts.; 660 lin. ft. 12 in., 50 cts.; 70 lin ft. 10 in., 40 cts.; 660 lin. ft. 8 in., 30 cts., and 1,500 cu. yd. brick masonry, $1.60; and 30 cu. yd. concrete masonry, $8; total cost, $7,076. P. A. McIntyre, of Mattapan, bid for this work $7,930.

St. Paul, Minn.—Specifications are reported to have been completed for a sewer on Goff Ave. for a distance of 6 blocks, 310 ft. of which will be a tunnel in sand rock.

**St. Paul, Minn.*—Thornton Bros. are reported to have on Sept. 12 secured the contract for constructing sewers on Reaney and Beech Sts., for $6,786.

Cannon Falls, Minn.—It is reported that a sewer will be constructed on 4th and Colville Sts.

Gulfport, Miss.—See "Water."

Columbia, Miss.—See "Water."

Kansas City, Mo.—Geo. Hoffman, Pres. Bd. of Pub. Wks., is reported to have decided to recommend to Mayor Beardsley that an expert be hired to come here to lay out a new sewerage system.

The West Side Council, it is reported, let a contract to R. J. and W. M. Boyd, Heist Bldg., for the construction of a sewer 2 miles long in the western part of the city, for $68,102. The sewer starts at 16th St. and Tauromee Ave., 2 blocks southwest of Carnival Park, and runs north and east, entering Jersey Creek at 9th St.

Carterville, Mo.—The City Council is reported to be considering the question of constructing a sewerage system.

Sedalia, Mo.—The City Council has passed ordinances as follows: To create sewer districts in Dist. 22; establishing a sub-district in Dist. 37; establishing sewer Dist. 38 and establishing sewer Dist. 39.

Humboldt, Neb.—M. N. Bair, Archt., Falls City, who is preparing preliminary plans for sewerage system, estimates the cost at $7,000.

Lincoln, Neb.—This city will build a combined sewer about 4,200 ft. long, 30 and 24-in. vitr. pipe, to cost about $11,000.

**South Orange, N. J.*—Bids were opened on Sept. 17 by South Orange Township Com. for the construction of sewers as follows: (Engineer, Alex Potter, 143 Liberty St., New York, N. Y.):

*Maplewood Dist. Sewer: Jas. J. Fusco, Montclair, secured contract at following bid: 151 ft. 10-in. vit. pipe sewer, 6 ft. deep, 77 cts.; 1775 ft. 10-in., 6 to 8 ft. deep, 82 cts.; 911 ft. 10-in., 8 to 10 ft. deep, 87 cts.; 350 ft. 10-in., 10 to 12 ft. deep, $1; 225 ft. 10-in., 12 to 14 ft. deep, $1.27; 48 ft. 10-in. c. i. pipe sewer, $1.29; 1367 ft. 8-in. vit. pipe sewer, 6 ft. deep, 55 cts.; 8139 ft. 8-in., 6 to 8 ft. deep, 59 cts.; 2672 ft. 8-in., 8 to 10 ft. deep, 67 cts.; 1990 ft. 8-in., 10 to 12 ft. deep, 77 cts.; 675 ft. 8-in., 12 to 14 ft. deep, $1; 135 ft. 8-in., 14 to 18 ft. deep, $1.37; 100 ft. 8-in., 18 to 22 ft. deep, $2; 12 ft. 8-in. c. i. pipe sewer, $1.15; 63 manholes, 10 ft. deep or less, $52; 23 ft. of manholes over 10 ft. deep, per ft., $10; 40 ft. drop manholes, per ft., $12; 12 flush tanks, complete, ea., $125; 40 branches on 10-in. pipe, ea., $1; 300 branches on 8-in. pipe, ea., 77 cts.; 40 ft. of deep-cut connections, per ft., 57 cts.; 100 cu. yds. concrete, per cu. yd., $7; 500 lin. ft. of timber cradle, 50 cts.; 1000 ft. 4-in. vit. pipe sewer, 6 ft. deep, 42 cts.; 1200 ft. 4-in., 6 to 8 ft. deep, 47 cts.; 400 ft. 4-in., 8 to 10 ft. deep, 57 cts.; 500 ft. 6-in. vit. pipe under drain, $1. Total, $21,614.95. Totals of other bids: Chas. Ippolito, Orange, N. J., $21,881; Steele & Bave, Owego, N. Y., $22,334, and Eveline Bros., New Britain, Conn., $25,232.

*Total of bids for South Orange Heights Dist. sewer: Pasquale Cestone, Montclair, $17,496 (awarded contract); Jas. J. Fusco, Montclair, $18,002; John Driscoll, Orange, $18,576; Steele & Bave, Owego, N. Y., $18,764; Chas. Ippolito, Orange, $19,486; Eveline Bros., New Britain, Conn., $21,115; R. M. Rosser, Kingston, Pa., $22,215, and Jas. A. Christie, Newark, $25,796.

**Jersey City, N. J.*—Chas. O'Neill is reported to have secured the contract for a sewer in Stegman St. from Jackson Ave. to connect with the sewer in Van Cleef St.

Englewood, N. J.—Bids will be received until Oct. 5 by the Englewood Sewerage Co. (Oliver Drake Smith, Secy.) Park Pl. and Dean St., at Englewood, for constructing a pipe sewer approximately 6,590 ft. 12-in. pipe with manholes, as advertised in The Engineering Record.

Trenton, N. J.—Bids will be received until Oct. 1 by the Common Council for constructing a sewer in a portion of Barbara St.; also a drain in Paul Ave.

New Brighton, L. I., N. Y.—Bids will be received until Oct. 8 by Geo. Cromwell, Boro. Pres., for furnishing material and constructing temporary sewers in Innis St., Blackford and Sherman Aves., and Fingerboard Rd.; relaying and extending the Nicholas Ave. sewer. Engineer's estimate: 6,413 lin. ft. salt-glazd vitr. pipe sewer, 6 and 8-in. interior drain; 372 lin. ft. c. i. pipe, 12-in. interior diam.; 27 manholes, 9 flush tanks, with No. 5 Van Vranken siphon, etc.

Sea Cliff, L. I., N. Y.—G. Griffith Clapham, Village Clk., writes that the proposed sewage disposal system will cost about $50,000. Nothing definite has yet been done. Dr. H. G. Wahlig, Health Officer, is also reported interested.

Brooklyn, N. Y.—Bids were opened on Sept. 18 by Bird S. Coler, Pres. Brooklyn Boro., for sewer work in Brooklyn, as follows:

For constructing sewers in Flatbush Ave., westerly side, from Nassau St. to Fleet St., etc., Sec. 10. This work consists of 320 lin. ft. 48-in. and 1,570 lin. ft. 42-in. brick and concrete sewer, 500 lin. ft. 18-in., 750 lin. ft. 15-in. and 1,630 lin. ft. 12-in. pipe sewer, 900 lin. ft. 6-in. extra heavy c. i. standpipe, 60 6-in. extra heavy c. i. bends, 18 manholes, Class B; 30 manholes, Class C; 16 sewer basins and 60 m. ft. sheeting and bracing. (*a* percentage bid, *b* totals): Murphy Bros., *a* 137.9 per cent, *b* $64,672; John J. Creem, *a* 114⅞ per cent, *b* $53,873; Hammond & Sloane, Inc., *a* 136 per cent, *b* $63,781; Leo E. Kelly, *a* 118½ per cent, *b* $55,574; Jas. L. Carey & Co., *a* 108.18 per cent, *b* $50,734.

Sewers in Flatbush Ave. extension, westerly side, from Nassau St. to Fleet St., etc., Sec. No. 2. (*a* percentage bid, *b* totals): Hammond & Sloane, Inc., *a* 116 per cent, *b* $21,353; John J. Creem, *a* 112½ per cent, *b* $20,708; Jas. L. Carey & Co., *a* 108.18 per cent, *b* $19,915; Leo E. Kelly, *a* 122 per cent, *b* $22,451.

Gastonia, N. C.—See "Water."

Lenoir, N. C.—See "Water."

Grand Forks, N. D.—The City Council is reported to have adopted resolution accepting the plans of Engineer Gray, of Crookston, for a sewer system in Sewer Dist. No. 2.; estimated cost, $11,000.

University, N. D.—See "Schools."

Leipsic, O.—It is stated that bids will be received by H. G. Moenter, Village Clk., until Oct. 2 for constructing a sewer in Poplar St. Riggs & Sherman, Engrs., Toledo.

Hamilton, O.—See "Power Plants, Gas and Electricity."

Columbus, O.—It is stated that bids will be received until Oct. 4 by the Bd. Pub. Service (Edwd. F. McGuire, Secy.) for constructing the East Side sewage pumping station; probable cost, $50,000. Henry Maetzel, City Engr.

**Cincinnati, O.*—Thos. P. Strack, 518 Walnut St., is reported to have secured the contract for a sewer in the streets and right-of-way west of Enright Ave. and south of Warsaw and Glenway Aves., Price Hill, for $77,480.

City Engr. Danenhower is reported to have submitted a resolution to the Bd. of Pub. Service, asking for a sewer in Herschell and Red Bank Aves.; estimated cost, $26,776.

Steubenville, O.—Bids will be received at the office of the Bd. of Pub. Service (T. W.Vance, Clk.) until Oct. 14 for furnishing material and constructing brick and pipe sewers, as advertised in The Engineering Recodr.

Youngstown, O.—Bids will be received until Oct. 1 by the Bd. Pub. Service (W. H. McMillin, Clk.) for furnishing material and constructing a sewer in a portion of Garfield St.

Mingo Junction, O.—It is reported that bids will be received until Oct. 2 by Frank McAllister, City Clk., for constructing sewers in certain streets.

Batavia, O.—Bids are wanted, it is stated, until Oct. 7, for the purchase of $5,725 sewer bonds. G. H. Kain, Clk. Village.

Zanesville, O.—The Bd. of Pub. Service is reported to have approved the plans of H. I. Buell for the construction of the Southwestern sewer.

**Springfield, O.*—John Grady is reported to have secured the contract for constructing sewers in Walnut, Bane and Market Sts., for $6,520.

Norwalk, O.—The following are reported to be the bids opened by the Bd. of Pub. Service on Sept. 17 for laying storm and sanitary sewers from the intersection of St. Mary's St. to site of the proposed sewage disposal works, (*a*) concrete, (*b*) brick: Municipal Engineering Co., Akron, O., *a* $27,021; H. W. Matthews, Lorain, O., *a* $32,111; Cummerford & Quinn, Norwalk, *a* and *b* $24,890; Penney & Corron, Lorain, O., *a* $24,285, *b* $30,216.

**Philadelphia, Pa.*—Contracts for sewers (bids opened on Sept. 11 at the office of the Dept. of Pub. Wks., Bureau of Surveys) are reported to have been awarded as follows: To Lombards & Pascuzzi for extension of Thomas' run sewer, $23,127, and extension of sewer at Bingham St., $13,840; to David Peoples for extension of Wissahickon low-level intercepting sewer, $28,620, and extension of Jackson St. sewer, $36,121; to Edwin H. Vare, reconstruction of Market St. sewer, $3,925, and extension of Wissahickon high-level sewer, $47,840; to Patk. Durkin for sewer on 12th St. from Louden to Ruscomb Sts., $8,020; to Richard P. Bennis for sewer on 9th St. from Erie Ave. to Butler St., $24,405, and to the Millard Constr. Co. for reconstructing Pine St. sewer, for about $25,000. Awards were also made for branch sewer work aggregating upwards of $75,000.

*The following are the totals of bids opened on Sept. 17 by the Dept. of Pub. Wks., Bureau of Filtration, for constructing sewer connecting upper Roxborough filters: David Peoples, 1000 Betz Bldg., $23,472; Robt. P. Ryan, 2116 N. 30th St., $17,543; David McMahon, 600 E. Chelten Ave., $20,267; T. F. Reilly, Harrison Bldg., $12,074 (awarded contract); to be completed in 90 days; the Mack Paving Co., 2032 Land Title Bldg., $20,713.

Reading, Pa.—The City Council on Sept. 16 passed the ordinance providing for the issue of $40,000 bonds for building storm water sewers; also for the construction of house drain sewers, etc., in Dist. 12.

Braddock, Pa.—It is stated that bids will be received until Oct. 3 by C. A. Stewart, Boro. Engr., North Braddock, for constructing sewers in portions of several streets.

Carlisle, Pa.—The State Health Dept. is reported to have approved the double contract system of sewerage. According to the plans and estimates the system will cost $111,359, and this will include the district bounded by North, South, East and College Sts.

Allegheny, Pa.—The Council on Sept. 18 passed an ordinance providing for the issue of $10,000 bonds for the construction of a sewage disposal plant at the Allegheny City Home.

Chattanooga, Tenn.—Bids will be received by the Bd. of Pub. Wks. (H. F. Van Dusen Chmn.) until Oct. 15 for the construction of a brick main sewer and appurtenances on Chestnut St. as advertised in The Engineering Record.

Wichita Falls, Tex.—Edgar Rye, City Secy., writes that the citizens on Sept. 9 voted to issue $20,000 sewer bonds.

Whiterocks, Utah.—Bids will be received until Oct. 23 by F. E. Leupp, Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing a sewerage system and plumbing, Uintah and Ouray Agency. For further information apply to Capt. C. G. Hall, Acting Agt., Whiterocks.

Seattle, Wash.—Bids will be called for within a few weeks for the construction of the Lake Union Dist. of the north trunk sewer.

Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., on Oct. 5, for constructing sewers on Hiawatha Pl., at a cost of $7,100, and on N. 39th St.; est. cost, $33,500.

Bids will be received by C. B. Bagley, Secy. Bd. of Pub. Wks., on Oct. 5, for the following improvements: Grading and curbing Furman Ave. and constructing necessary bulkheads or retaining walls; estimated cost, $31,200; grading portion of Main St. and curbing same, building wood sidewalks and constructing a plank roadway, est. cost, $6,000; 6th Ave. N. E., grading and constructing concrete sidewalks, est. cost, $10,800; constructing concrete walks on Irving St. and curb and gutters, est. cost, $6,300, and paving Union St. with vitr. brick, together with granite curb, and addition to water-main and sewer systems, as may be necessary, est. cost, $23,300. New bids will also be received on Oct. 5 for paving 40th Ave.

A resolution will be introduced before City Council on Sept. 23, for the improvement of Railroad Ave., by constructing a concrete bulkhead or retaining wall, and grading; total estimated cost, about $1,000,000.

**Lake Mills, Wis.*—The contract for constructing 9,777 ft. pipe sewer (bids opened Sept. 13) has been awarded to F. E. Kaminski, of Berlin, for $10,542. Engineer, W. G. Kirchoffer, of Madison.

BRIDGES.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—See "Public Buildings."

**Sedalia, Colo.*—G. N. Houston, Deputy State Engr., Denver, writes that C. G. Sheely, of Denver, has secured the contract for constructing reinforced concrete bridge across Plum Creek, Sedalia (bids opened Sept. 3) for $3,605, to be completed Nov. 1, 1907.

Malta, Colo.—The lowest bid opened on Sept. 13 at the State Engrs. Office, Denver, for constructing the Lane County bridge, near Malta, was submitted by the National Constr. Co. of Denver, at $4,587.

**Anacostia, D. C.*—The contract for filling the approaches to the Anacostia bridge (bids opened by the Comrs. D. C., at Washington, D. C., on Sept. 14) has been awarded to the Warren Brenizer Co., of Washington, D. C. The bids called for an estimated filling in of 131,000 cu. yds.; total cost, $39,955.

Spring Valley, Ill.—Bids will be received until Oct. 1 by Anton Faletti, City Clk., for building an ice breaker and protection pier and driving pile booms on the east side of the Illinois River Bridge, and for completion of protection pier on west side of Illinois River.

Chicago, Ill.—Bids for constructing the 95th St. Bridge are reported to have been opened Sept. 14 by Mr. Hanberg, Comr. of Pub. Wks., as follows: M. P. Byrne Constr. Co., 88 Washington St., $23,390, and Warner Constr. Co., $17,396.

Belvidere, Ill.—All bids opened Sept. 11 for constructing a bridge over Kishwaukee River at Main St. are stated to have been rejected, being in excess of the $8,500 appropriation.

South Bend, Ind.—A. J. Hammond, City Engr., is reported to have estimated the cost of constructing a bridge over the East Race on E. La Salle Ave. as follows: Single span Melan Arch bridge, 80 ft. wide, $19,000; reinforced concrete beam bridge, 3 spans, with 2 piers, $12,775.

Tipton, Ind.—It is stated that bids will be received by the Co. Comrs. until Oct. 7 for construction of bridge over Turkey Creek. J. F. Barlow, Co. Aud.

Evansville, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Oct. 3 for constructing 3 reinforced concrete bridges. Harry Stinson, Co. Aud.

Hammond, Ind.—It is stated that bids will be received until Oct. 14 by the Bd. Co. Comrs. at Crown Point for constructing a swing bridge over Calumet River at Columbia Ave., Hammond. Chas. A. Johnson, Co. Aud., Crown Point.

Erie, Kan.—It is stated that bids will be received until Oct. 15 by the Bd. Co. Comrs., at the office of O. M. Johnson, Co. Clk., for constructing 3 steel or iron bridges across the Neosho River, as follows: One 200-ft. span, one 70-ft. span, two 30-ft. I-beam approaches, 20-ft. roadway, 1 mile east of Chanute; one 200-ft. span, one 75-ft. span, one 30-ft. I-beam approach, 14-ft. roadway, 2½ miles west of Erie; one 200-ft. span, one 50-ft. span, one 30-ft. I-beam approach, 14 ft. roadway, 1 mile south of St. Paul, all to have concrete abutments; also a 30-ft. I-beam bridge 7 miles southeast of Thayer.

Atchison, Kan.—It is stated that bids will be received until Oct. 7 by the Bd. of Co. Comrs. (J. C. Hotham, Chmn.) for rebuilding bridge No. 230, Mt. Pleasant Township.

Eureka, Kan.—It is stated that the Bd. Co. Comrs. will receive bids until Oct. 10 for constructing a steel bridge, 60-ft. span and one 24-ft. approach. W. H. Bonnett, Co. Clk.

Baltimore, Md.—Mr. Fendall, City Engr., is reported to be preparing plans for a bridge over Gwynns Falls at Edmondson Ave., estimated cost of proposed structure, $180,000.

Medford, Mass.—Bids will be received until Oct. 1 by Clifford M. Brewer, Mayor, for constructing a foot bridge of reinforced concrete, over the Boston & Maine R. R. tracks from Pembroke to Washington Sts. Fred. R. Charnock, City Engr.

Fitchburg, Mass.—The construction of a bridge at Water, Summer and 4th Sts. is reported contemplated, at a cost of $100,000.

**Groton, Mass.*—Wm. H. Ward, of Lowell, has secured the contract for constructing a concrete-steel beam bridge between Groton and Peperell (bids opened Sept. 17) for $15,414.

**Items marked thus give the names of parties awarded contracts.*

Muskegon, Mich.—The construction of a bridge over Mona Lake is reported contemplated, at a cost of $25,000.

St. Louis, Mo.—The United Free Bridge Com. is stated to have voted in favor of constructing the free bridge at Chouteau Ave.

**Russellville, Mo.*—The contract for constructing the bridge over the Moreau at Rock House ford near Russellville is reported to have been awarded to Canton Bridge Co., of Canton, O., for $6,660.

Glendive, Mont.—Bids will be received at the office of the U. S. Reclamation Service, Glendive, until Nov. 15 for the construction of 34 steel highway bridges in connection with the Lower Yellowstone project, N. D.-Mont., as advertised in The Engineering Record.

Oceanic, N. J.—Jas. M. Rawley is stated to have submitted a report to the Bd. of Freeholders of Monmouth County on the condition of the bridge over the Shrewsbury River at Oceanic. The estimated cost of a new substructure is $52,048.

New York, N. Y.—Bids will be received by Jas. W. Stevenson, Comr. Bridges, until Oct. 3 for the construction of the Madison Ave. Bridge over the Harlem River.

Cohoes, N. Y.—It is stated that at the conference between the Street Com. and the New York Central & Hudson River R. R. Co. (Geo. W. Kittredge, Ch. Engr., New York), held Sept. 16, it was decided by the committee to recommend to the Common Council the entering into a contract between the city of Cohoes and the New York Central R. R. for the widening of Columbia St. approaching the arch now there and the building of another arch 60 ft. wide; estimated cost will be $31,000.

Little Falls, N. Y.—See "Railroads."

**Cincinnati, O.*—Granger & Co., of Louisville, Ky., are stated to have submitted the lowest bid, Sept. 20, to Bd. Pub. Service for structural steel work of Liberty St. Viaduct, at $131,000.

Hamilton, O.—Separate bids will be received until Oct. 8 by the Bd. Co. Comrs., at the office of C. Pabst, Co. Aud., for the construction of a substructure and superstructure of a bridge over 2 Mile Creek on the 7 Mile Pike, north of the corporation line of the City of Hamilton; bids will also be received on concrete-steel construction.

Toledo, O.—It is reported that bids will be received by the Co. Comrs., at Toledo, until Oct. 14, for constructing 2 concrete masonry abutments for bridge across Ten Mile Creek at Ottawa Terrace, Washington Township.

Fremont, O.—Bids will be received, it is stated, until Oct. 7 by the Bd. Co. Comrs. for constructing substructure and steel and concrete superstructure over Big Mud Creek; also taking down steel bridge which is now across said creek; also taking out abutments under old bridge; also straightening said creek for a distance of 250 ft. and filling in of old channel at old bridge. S. M. Froznier, Co. Aud.

Dayton, O.—The City Council is stated to have passed an ordinance providing for the erection of a bridge over Wolf Creek at Edgewater Ave., from discarded spans of Stratford Ave. Bridge; estimated cost, $9,000.

Panama.—Bids will be received at the office of H. P. Hodges, Gen. Purchasing Officer Isthmian Canal Comn., Washington, D. C., until Oct. 24, for a steel railroad bridge, as advertised in The Engineering Record.

Jersey Shore, Pa.—It is stated that bids will be received until Oct. 8 by Saml. B. Rambo, Supt. Pub. Grounds and Bldgs., Harrisburg, for rebuilding the bridge over the east channel of the west branch of the Susquehanna River, near Jersey Shore.

**Philadelphia, Pa.*—Contracts for constructing bridges (bids opened Sept. 11 at the office of the Bureau of Surveys) are reported awarded as follows: Northeast Boule. bridge, over Tacony Creek and Ashdale St., to D. J. McNichol & Co., $94,949, to be completed in 12 mths; Belmont and Girard Ave. bridge, over Pennsylvania R. R., J. E. McHugh, $69,323, time, 7 mths; bridge at Columbia Ave. and 31st St., over connecting railway, McGaw & Gray, $47,703, time, 7 mths; Northeast Boule. bridge over Reading Ry., Richard Walsh, $41,000, time, 6 mths.

Johnstown, Pa.—The Common Council is stated to have passed a resolution authorizing the City Engineer to prepare estimates on the construction of a 225-ft. steel bridge over Stoney Creek at Haynes and Bedford Sts.

Chester, Pa.—The construction of a bridge over Chester Creek at 5th St. is reported contemplated.

Sheraden, Pa.—Plans are stated to have been prepared for a concrete structural steel bridge to be constructed over Panhandle tracks at the station, at a cost of about $[illegible]. Thos. Rodd, Ch. Engr., Union Station, Pittsburg.

Wallis, Tex.—The Comrs. Court at Richmond is reported to be considering the construction of a bridge over Brazos River at Wallis, probable cost, $42,000.

**Morgantown, W. Va.*—The County Court is reported to have awarded the Canton Bridge Co., of Canton, O., the contract for constructing an iron and steel bridge over Monongahela River, at a cost of $100,000.

**Milwaukee, Wis.*—The County Bd. on Sept. 17 is stated to have awarded the contract for constructing the Grand Ave. Viaduct to the Newton Engineering Co., 310 Mason St., for $372,000.

Sheboygan, Wis.—Plans are stated to have been prepared for the construction of a bridge over the River at Pennsylvania Ave.; probable cost, $65,00.0

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Los Angeles, Cal.*—The Bd. of Pub. Wks. is stated to have awarded on Sept. 13 contracts for paving as follows: Main St. to Western Paving Co., $20,324, and Flower St. to Barber Asphalt Paving Co., of Los Angeles, $75,335.

Sacramento, Cal.—See "Public Buildings."

San Diego, Cal.—The paving of a portion of 16th St. is reported contemplated.

Bloomfield, Conn.—The Citizens are stated to have voted to expend $[illegible] for road improvements.

Hartford, Conn.—Bids will be received by the Bd. of Contract and Supply until Oct. 7 for furnishing and laying the concrete base and sheet asphalt wearing surface of about 7,000 sq. yds. on Asylum St., as advertised in The Engineering Record.

Wilmington, Del.—Bids will be received until Oct. 15 by Francis A. Price, New Castle Co., State Highway Comr., Wilmington, for constructing a road in New Castle Hundred, leading from Wilmington to the town limits of New Castle, a distance of 2¾ miles.

Wilmington, Del.—The Street and Sewer Directors are stated to have decided to purchase a bitulithic mixing plant.

Ocala, Fla.—It is stated that bids will be received by the City Council (J. D. Robertson, Pres.) until Oct. 15, for laying 14,000 sq. yds. vitr. brick paving. W. C. Sistrunk, City Clk.

Palatka, Fla.—Press reports state that bids will be received until Oct. 8 by the Bd. Bond Trus. (E. S. Crill, Chmn.) for paving portions of Lemon and Water Sts., with vitrified brick, about 22,805 sq. ft. paving and 9,857 lin. ft. granite curbing, and 54 circular granite corner stones.

Nampa, Idaho.—Claude Duval, City Clk., writes that the citizens on Sept. 16 voted to issue $27,000 bonds for paving and bids for the work will be received about Oct. 22.

**Chicago, Ill.*—The South Park Comrs. have awarded to the Chicago Bitulithic Co. a contract for 72,623 sq. yds. of bitulithic on Michigan Ave. Boule., S. Park Ave. and 33rd St.

Chicago, Ill.—Bids will be received until Oct. 2 by the Bd. Local Improv. (N. S. Dietrich, Pres.) for paving portions of several streets with asphalt and granite blocks and repressed vitr. brick.

Goshen, Ind.—The paving of 5th and Crescent Sts. is reported contemplated, also the construction of cement sidewalks on several streets.

Brazil, Ind.—It is stated that plans are being prepared for the paving of Hendrix St. with macadam, and improving the road by paving with same material for about a mile beyond the city limits. The County Comrs. will let the contract.

La Grange, Ind.—Ordinances are stated to have been passed providing for street improvements at a cost of $15,000.

Peru, Ind.—Chas. Griswold, Co. Aud., writes that no bids were received on Sept. 14 for grading, draining, and paving 23½ miles of gravel road in Richland Township, and new bids will be received on Nov. 4.

Rockville, Ind.—It is reported that bids will be received until Oct. 8 by the Bd. Co. Comrs. for constructing a gravel road in Adams Township and a macadamized road in Florida Township. H. A. Henderson, Co. Aud.

Portland, Ind.—It is reported that bids will be received until Oct. 8 by the Bd. Co. Comrs. for 15 gravel roads in Bear Creek, Wayne, Noble, Jefferson, Pike and Greene Townships.

Bluffton, Ind.—It is reported that bids will be received until Oct. 9 by the Bd. Co. Comrs. for constructing two gravel roads in Jefferson and Lancaster Townships. C. D. Brineman, Co. Aud.

Martinsville, Ind.—It is reported that bids will be received until Oct. 8 by the Bd. Co. Comrs., for the construction of two gravel roads in Washington Township, one 2½ miles and one 1⅔ miles in length. B. E. Thornburg, Co. Aud.

Monticello, Ind.—It is stated that bids will be received until Oct. 8, (readvertisement) by J. L. Ackerman, Co. Aud., for grading, draining and paving several roads with stone.

**Frankfort, Ind.*—C. F. Cranwell, Co. Aud., writes that the contract for constructing gravel road, No. 10 (bids opened Sept. 20) has been awarded to Burt E. Dunn, of Frankfort, for $6,495.

Covington, Ind.—It is stated that bids will be received until Oct. 8 by Wm. B. Gray, Co. Aud., for improving 4 highways.

Gary, Ind.—Bids will be received until Oct. 5 by the Bd. of Town Trus., McCormick Bldg. (C. O. Holmes, Clk.), for grading and paving with vitr. brick or block, and constructing cement sidewalks on a portion of Madison St., also a portion of S. Bway.

Des Moines, Ia.—Only one bid was received Sept. 13 by the Bd. Pub. Wks. for paving with asphalt 1,084 sq. yds. on Library Ave., W. A. Bryant & Sons Co., of Waterloo, submitted the bid at $2.14 per yd.

Des Moines, Ia.—The paving of the following streets is reported to have been decided upon: Grand Ave., W. 30th St., with asphalt; creosote block, W. 6th, 7th and 16th Sts. New bids will be taken for paving W. 2d St. Bids for paving with brick, Park Lane, are reported to have been opened by the Bd. Pub. Wks. Sept. 19, as follows: J. W. Turner Improvement Co., of Des Moines, $2.19 per sq. yd. (recommended for award); Cook Constr. Co., $2.21 per sq. yd.; Jas. Horrabin, $2.23 per sq. yd., and F. W. Hunt, $1.14 per sq. yd.

Davenport, Ia.—Bids will be received until Oct. 1 by the Bd. Pub. Wks., for repaving 2d St., requiring 3,426 sq. yds. asphalt pavt. on a 5-in. Portland cement concrete foundation.

Topeka, Kan.—Street paving bonds amounting to $85,000 are reported sold.

Louisville, Ky.—It is stated that contracts will soon be let by Bd. Pub. Wks. for paving with asphalt a portion of Garvin Pl. and Broadway, estimated cost $23,000.

Louisville, Ky.—The American Standard Asphalt Co. is reported to have submitted the only bid Sept. 16 to Bd. of Pub. Wks. for repairing asphalt streets during fiscal year at $1.40 per sq. yd.

Provincetown, Mass.—Bids will be received until Oct. 1 by the Bd. Selectmen (Geo. Allen, Chmn.), for constructing a macadam road about 2,450 ft. in length.

Westfield, Mass.—Bids will be received until Oct. 2 by the Bd. of Selectmen (Chester H. Abbe, 1st Selectman), for laying about 1,200 sq. yds. of brick pavement on Arnold St. Oren E. Parks, Town Engr.

Boston, Mass.—Bids will be received until Oct. 1 by the Boston Transit Comn. (B. Leighton Beal, Secy.) for relaying about 2,000 sq. yds. granite block pavement on concrete base at various points over or near the Washington St. Tunnel.

Bids will be received until Oct. 1 by the State Highway Comn. (W. E. McClintock, Chmn.), Boston, for constructing highways in the following towns: Length given being approximate only: Wilmington, 3,100 ft.; Southboro and Plymouth, each 4,700 ft.

Grand Rapids, Mich.—All bids opened Sept. 12 by Bd. of Pub. Wks. for paving E. Bridge St. are reported rejected, being in excess of the estimate of $33,000. According to reports, new bids will be received.

**Duluth, Minn.*—The contract for paving 29th St. is reported to have been awarded to J. A. Johnson, 717 E. 2d St., for $9,854.

**St. Peter, Minn.*—John Keongh, of St. Peter, is stated to have secured the contract for grading and graveling about 2 miles of the Ft. Ridgely Road, for about $3,000.

Carterville, Mo.—The paving of Main St. with brick is reported contemplated.

**Sedalia, Mo.*—John Hyatt is reported to have secured the contract for paving portions of Kentucky and Massachusetts Ave. at $1.37½ and $1.65 per sq. yd. respectively.

Belleville, N. J.—Bids will be received until Oct. 1 by the Township Com. (Thos. J. Breen, Chmn.) Academy and Cortlandt Sts., for constructing sidewalks on a portion of W. Washington Ave. J. H. Francisco, Co. Surveyor.

Jersey City, N. J.—Bids will be received until Sept. 30 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for improving a portion of Ash St., requiring about 1,650 sq. yds. Belgian pavt., and 3,300 sq. ft. flagging.

Mt. Holly, N. J.—Press reports state that bids will be received until Sept. 30 by the Bd. Freeholders, for $55,000 road improvement bonds.

Haledon, N. J.—Bids will be received by the Township Com., until Oct. 2 for grading and macadamizing a portion of Morris Ave. Jas. T. Duggan, Township Clk.

West Orange, N. J.—The Town Council is reported to have passed an ordinance providing for the macadamizing of a portion of Watchung Ave.

**Newark, N. J.*—The contract for paving with brick a portion of Nassau St. is reported to have been awarded to Newark Paving Co., 133 1st St., at $8,742.

J. Roosevelt Shanley is reported to have secured the contract for paving with granite block a portion of Verona Ave., for $20,650.

*The bid of P. A. Matthews, of Caldwell, is reported to have been recommended for award for the widening of Bloomfield Ave., at 60 cts. per cu. yd. excavating and filling, 5-ft. brick sewer, $6 per lin. ft.; 24-in. tile, $1.50 per lin. ft.; cobble stone gutters, 80 cts. per sq. yd.

Trenton, N. J.—Bids for paving the following streets are reported opened Sept. 17 by Common Council: Eastern Paving & Constr. Co.: Clinton Ave., $2.33, $2.75 and $3; Stockton St., $2.15, $2.75 and $3; Factory St., $2.33, $2.75 and $3 per sq. yd., prices given on 5, 10 and 15 years' guarantee respectively.

**Bridgeton, N. J.*—John T. Dyer is stated to have secured the contract for street paving at $2.13 per sq. yd. for asphalt, probable cost of improvement $60,000.

Cohoes, N. Y.—See "Bridges."

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrmann, Pres.) until Oct. 3, for regulating, grading, laying walk pavement of portland cement and doing other work upon and adjacent to the site of the old engine house in City Hall Park, Boro. Manhattan.

**Schenectady, N. Y.*—The contract for paving Elmer St. with asphalt is reported to have been awarded to the Union Paving Co., at $2 per sq. yd.

West New Brighton, S. I., N. Y.—Bids will be received by Geo. Cromwell, Boro. Pres., St. George, New Brighton, until Oct. 8, for furnishing and delivering 1,400 tons of 1½-in. broken stone and screenings of trap rock or Staten Island syenite on parts of Bodine, Dongan and Taylor Sts., and Davis Ave., West New Brighton.

New Brighton, L. I., N. Y.—Bids will be received until Oct. 8 by Geo. Cromwell, Boro. Pres., for furnishing material and paving Wooley Ave. Engineer's estimate: 20,300 sq. yds. macadam pavt.; 5,750 sq. yds. vitr. brick pavt.; 10,100 lin. ft. cement curb; 4,800 sq. yds. cement sidewalk, etc.

**Brooklyn, N. Y.*—Cranford Co., 52 9th St., Brooklyn, has secured the contract for regulating and repaving with asphalt on a concrete foundation Skillman St. from Flushing Ave. to DeKalb Ave., at the following bid: 7,370 sq. yds. asphalt pave., $1.32; 10 sq. yds. old stone pave., relaid, 40 cts.; 1,300 cu. yds. concrete, $6.45; 3,685 lin. ft. new curb., 98 cts.; 1,840 lin. ft. old curb., reset, 40 cts.; 22 noiseless covers and heads, complete, for sewer manholes, ea., $18; total, $23,191. Totals of other bids: Uvalde Asphalt Paving Co., N. Y. City, $23,191; and Barber Asphalt Paving Co., $23,227.

Bids will be received by Bird S. Coler, Boro. Pres., until Oct. 9, for regulating and repaving with asphalt on a concrete foundation a portion of Bedford Ave., regulating grading, curbing, and laying sidewalks on Prospect Pl., Jewel St. and New York Ave.; constructing cement concrete sidewalks in various places and on various streets. The engineer's estimate: 15,490 sq. yds. asphalt pavt.; 15,490 sq. yds. present pvt., to be removed; 2,150 cu. yds. concrete; 13,640 lin. ft. new curbstone, to be set in concrete; 57,752 sq. ft. cement concrete sidewalk; 43,540 sq. ft. cement sidewalk, etc.

Bids were opened on Sept. 18 at the office of Bird S. Coler, Boro. Pres., for asphalt paving as follows:

Irving Ave.—Lowest bidder, Barber Asphalt Paving Co., 114 Liberty St., N. Y. City, as follows: 11,860 sq. yds. asphalt pave., $1.34; 100 sq. yds. old stone pave., relaid, 40 cts.; 1,940 cu. yds. concrete, $6.25; 3,130 lin. ft. new curb, 98 cts.; 2,500 lin. ft. old curb, reset, 40 cts.; 39 noiseless covers and heads, complete,

*Items marked thus give the names of parties awarded contracts.

for sewer manholes, ea., $18; total, $32,827. Totals of other bids: Uvalde Asphalt Co., 1 B'way, N. Y. City, $34,101; and Cranford Co., Brooklyn, $34,023.

Roebling St. from S. 4th St. to Union Ave.—Lowest bidder, Uvalde Co., N. Y. City, as follows: 18,620 sq. yds. asphalt pave., $1.10; 2,940 cu. yds. concrete, $6.30; 5,600 lin. ft. new curb., 95 cts.; 600 lin. ft. old curb., reset, 40 cts.; 1,470 cu. yds. earth excav., 70 cts.; 71,530 sq. ft. cement sidewalk, 22 cts.; 45 sewer catch basins (to be rebuilt), ea., $140; and 35 noiseless covers and heads, complete, for sewer manholes, ea., $18; total, $73,846. Totals of other bids: Barber Asphalt Co., N. Y. City, $75,087; and Cranford Co., Brooklyn, $76,441.

Ten Eyck St. from Union Ave. to Bushwick Ave.—Lowest bidder, Uvalde Asphalt Paving Co., N. Y. City.: 8,400 sq. yds. asphalt pave., $1.32; 30 sq. yds. old stone pave., relaid, 40 cts.; 1,420 cu. yd. concrete, $6.50; 3 840 lin. ft. new curb., 98 cts.; 1,200 lin. ft. old curb, reset, 40 cts.; and 24 noiseless covers and heads, complete, for sewer manholes, ea., $18; total, $25,005. Totals of other bids: Barber Asphalt Co., $25,154; and Cranford Co., $25,677.

Albany, N. Y.—The following contracts are reported awarded by Fred. Skene, State Engr. and Surveyor, bids for which have been opened Sept. 3, 4 and 5: Road 289, in Suffolk County., to E. M. & W. Ferguson, $16,896.—Road 279, Oswego County, to Stewart, Kerbaugh, Shanley Co., 527 5th Ave., New York, $25,423.—Road 245, Onondaga County, to Stewart, Kerbaugh, Shanley Co., $14,716.—Road 337, Madison County, to Stewart, Kerbaugh, Shanley Co., $12,525.—Road 278, Oswego County, to Stewart, Kerbaugh, Shanley Co., $23,-476.—Road 389, Oleans County, to Fred W. Knickenburg, Buffalo, $17,974.—Road 390, Orleans County, to Fred W. Knickenburg, Buffalo, $16,636.—Road 294, Monroe County, to the Monroe Roads Co., Rochester, $40,-475.—Road 236, Jefferson County, to Stewart, Kerbaugh, Shanley Co., $35,467.—Road 363, Putnam County, to Stewart, Kerbaugh, Shanley Co., $10,408.—Road 376, Fulton County, to Stewart, Kerbaugh Co., $23,432.—Road 381, Cortland County, to Stewart, Kerbaugh, Shanley Co., $25,916.—Road 306, Ulster County, to Stewart, Kerbaugh, Shanley Co., $51,927.—Road 304, Montgomery County, to Stewart, Kerbaugh, Shanley Co., $55,794.—Road 307, Ulster County, to Joseph Walker, $58,579.—Road 362, Fulton County, to Alonzo Schaupp, $15,345.—Road 303, Montgomery County, to Stewart, Kerbaugh, Shanley Co., $18,706.—Road 443, Saratoga County, to Stewart, Kerbaugh, Shanley Co., $55,195.—Road 442, Saratoga County, to Morris Kantrowitz, Albany, $37,611.—Road 524, Erie County, to Moshier & Summers, Buffalo, $64,586.—Road 450, Oswego County, to Stewart, Kerbaugh, Shanley Co., $13,787.—Road 525, Erie County, to Stewart, Kerbaugh, Shanley Co., $44,447.—Road 461, Herkimer County, to Newport Constr. Co., Newport, N. Y., $71,256.—Road 439, Rensselaer County, to Stewart, Kerbaugh, Shanley Co., $37,950.—Road 407, Schenectady County, to Molloy & Davis, Schenectady, $34,226.—Road 527, Erie County, to Stewart, Kerbaugh, Shanley Co., $72,915.—Road 521, St Lawrence County, to Stewart, Kerbaugh, Shanley Co., $59,660.—Road 423, Jefferson County, to Stewart, Kerbaugh, Shanley Co., $37,170.—Road 559, Erie County, to Casey & Murray, Rochester, $76,347.—Road 567, Dutchess County, to Lane Constr. Co., Syracuse, $40,027.—Road 622, Livingston County, to Stewart, Kerbaugh, Shanley Co., $46,197.—Road 597, Chenango County, to Newport Constr. Co., $33,127.—Road 560, Oneida County, to Casey & Murray, $23,407.—Road 596, Chenango County, to Stewart, Kerbaugh, Shanley Co., $33,217.—Road 656, Warren County, to Reardon & Byrnes, Glens Falls, $20,062.—Road 601, Cattaraugus County, to Gantz-Wilson Constr. Co., Buffalo, $35,963.—Road 615, Columbia County, Hinman & Sproul, Schenectady, $53,188.—Road 529, Erie County, to Stewart, Kerbaugh, Shanley Co., $45,597.—Road 545, Nassau County, to Jeremiah T. Finch, $33,670.—Road 570, Putnam County, to Stewart, Kerbaugh, Shanley Co., $51,925.—Road 533, Clinton County, to J. T. Finch, Glens Falls, $52,305.—Road 606, Tompkins County, to Stewart, Kerbaugh, Shanley Co., $21,512.—Road 617, Niagara County, to Stewart, Kerbaugh, Shanley Co., $32,330.—Road 528, Erie County, to Stewart, Kerbaugh, Shanley Co., $61,258.—Road 535, Cortland County, to Stewart, Kerbaugh, Shanley Co., $20,020.—Road 614, Cayuga County, to Stewart, Kerbaugh, Shanley Co., $54,662.—Road 530, Erie County, to Stewart, Kerbaugh, Shanley Co., $13,697.—Road 640, Schenectady County, to Malloy & Davis, $28,-718. Robertson & Gerhardt is stated to have secured the contract for constructing 5 miles of the Albany & Schenectady Road, at $50,790, and Stewart, Kerbaugh, Shanley Co. the contract for constructing second section of Middletown-Cuddebackville Road, for $51,072. Further reports state that roads which were not awarded will be readvertised, together with additional work.

All bids opened by Bd. of Contract and Supply for paving portion of Sheridan Ave. are reported rejected.

Lenoir, N. C.—See "Water."

Gastonia, N. C.—See "Water."

Hamilton, O.—A resolution is stated to have been passed instructing the City Engineer to prepare plans for paving a portion of 4th St. with sheet asphalt.

Findlay, O.—George St. will be paved next year with block on concrete base, at an estimated cost of $8,380. T. C. Snow, City Engr.

**Cadiz, O.*—J. S. Lacey, Co. Aud., writes that the contract fur macadamizing 4,400 ft. road (bids opened Sept. 2) has been awarded to Warnick & Timmons, of Cadiz, at $3.00 per sq. yd. for stone and 30 cts. per lin. ft. for grading.

Batavia, O.—Bids are wanted, it is stated, until Oct. 7, for $5,721 bonds, for constructing cement sidewalks. G. H. Hain, Village Clk.

**Cincinnati, O.*—The Kirchner Constr. Co., 8th and Plum Sts., is reported to have been awarded the contract (bids opened Sept. 11) for paving with asphalt a portion of Clinton St., at $27,198.

M. Sullivan & Sons are stated to have submitted the lowest bid for paving with brick, a portion of Tremont St., at $19,580.

The lowest bid received for a macadam roadway in Mt. Auburn is stated to have been submitted by C. S. Cregar at $1.45 per cu. yd.

O. R. Robinson is reported to have submitted the lowest bids for paving with brick a portion of Palm Ave., at $5,365.

The Bd. of Pub. Service is stated to have opened bids as follows on Sept. 19 for paving with wood block: Burnet Ave. (estimated cost, $80,569), A. J. Henkel & Bro., 621 Main St., lowest bidders, at $2.68 per sq. yd.; Ludlow Ave. (estimated cost ,$56,999), Russell & Jennison, $2.79 per sq. yd.; Bank St. (estimated cost, $28,168), M. T. Flynn, Chase Ave. and Dane St., $2.70 per sq. yd.

Mr. Danenhower, City Engr., is reported to have estimated the cost of paving and grading a portion of Wilder Ave. with brick and boulders at $18,271.

The Kirchner Constr. Co., 8th and Plum Sts., is stated to have submitted the lowest bid for paving Glenway Ave. with wood block, at $2.80 per sq. yd.

The United States Wood Preservation Co., 29 B'way, New York, N. Y., is reported to have submitted the lowest bid Aug. 29, for paving with creosoted wood block, on Beekman St., at $24,081.

*A. J. Henkel & Bro., 621 Main St., are stated to have secured the contract for paving with macadam Arlington St., for $8,629.

*The contract for improving a portion of Fairview Ave. is reported to have been awarded to Kirchner Constr. Co., 8th and Plum Sts., for $34,575.

*The County Comrs. are stated to have awarded the contract for improving Reading Pike in Sycamore Township, to J. M. Hassett & Co., for $83,582. Bids opened Sept. 13.

**Leipsic, O.*—Enck & Stone, of Leipsic, are stated to have received the contract for paving Easton St., at $15,679.

**Columbus, O.*—The Bd. Pub. Service on Sept. 18 is stated to have awarded the contract for paving with asphalt Linwood Ave., to A. G. Pugh, Dispatch Bldg., for $26,113.

**Canton, O.*—Contracts for block paving (bids opened Sept. 3) have been awarded as follows: (W. E. Sarver, City Engr.): To Wise, Wise, Smith & Shekels, Canton, for Lincoln Ave., 6,160 sq. yds., $8,482; Charles St., 6,610 sq. yds., $9,444; W. South St., 8,215 sq. yds., $7,612, and Fulton St., 4,850 sq. yds., $5,982. To Geo. Berger, of Massillon, for Harrisburg St. improvements, $6,133.

**Toledo, O.*—Henry Sheehan, 1208 Collingwood Ave., is reported to have secured the contract for paving with Logan block 1,135 ft. on Niagara St., for $6,511.

*The contract for paving with brick a portion of Madeline St. is reported to have been awarded to Wm. G. Ryan, 18 Everett St., Cleveland, for $3,781.

Barberton, O.—Paul & Henry, of Barberton, are stated to have submitted the lowest bids for paving the following streets: Lake Ave., $4,957; Bolivar Rd., $4,872; Cornell St., $32,767; Hunsberger St., $3,126, and High St., $18,-475.

Philadelphia, Pa.—Bids will be received until Oct. 3 by the Comrs. of Fairmount Park (Jesse T. Vogdes, Ch. Engr. & Supt.) for constructing a drive in Cresheim Valley.

Irwin, Pa.—It is stated that State Highway Comnr. Hunter, at Harrisburg, is asking for bids to construct the new State road from Irwin to the Allegheny County line near McKeesport. The project includes macadamizing the pike from Irwin to Circleville. From the latter point a 4-mile road will be built. The entire road will cost $45,-000. Westmoreland County and North Huntingdon Township will pay one-eighth of the cost and the State the balance.

Uniontown, Pa.—Bids will be received until Oct. 10 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 5,284 ft. road, along the Masontown and Uniontown Rd., German Township.

**Allegheny, Pa.*—Mayor Chas. F. Kirschler and Director of Pub. Wks. John Swan, on Sept. 11 are stated to have awarded contracts for public improvements as follows: Harry Graebing, grading, paving and curbing Nevada St., $2,500; Fraxier St., $4,200; Kennedy Ave., $8,000; Kenwood Ave., $6,000; Warner St. extension, $1,200. H. C. Howard, grading, paving and curbing Valley St., $25,000; sewer on Valley St., $6,000. Jas H. McQuaid, grading, paving and curbing Homer St., $21,000. A. V. Purnell, grading, paving and curbing Petrel St., $4,100; Tioga St., $4,100; Maryland Ave., $2,000. Fred Gwinner, grading, paving and curbing Woodland Ave., $23,000. Thomas Cronin Co., grading, paving and curbing Latrobe Alley, $2,000; Juno Alley, $2,000; Sawmill Alley, $16,000; Oak Alley, $2,100. Nelson & Daly, grading, paving and curbing Yetta Av $2,800.

Andersonville, Tenn.—Bids will be received, it is stated, until Oct. 5, by the Bd. Co. Comrs. (J. K. P. Wallace, Chmn.) for $100,000 county pike road bonds.

**Memphis, Tenn.*—M. Larkin is reported to have secured the contract for paving Florida Ave., for about $50,000.

**Salt Lake City, Utah.*—P. J. Moran is stated to have secured the contract for macadamizing portions of H. and 10th East St., at a cost of about $42,600.

Norfolk, Va.—The City Council is reported to have decided to expend $38,000 for street improvements.

Bellingham, Wash.—It is stated that City Engineer Gerhard estimates the cost of paving a portion of King St. at $10,835.

**Spokane, Wash.*—The Bd. of Pub. Wks. is stated to hvae awarded the contract for paving a portion of Monroe St. to the Barber Asphalt Paving Co., of Spokane, for $5,565.

*The Independent Asphalt Co. is reported to have secured the contract for paving a portion of Sprague Ave. for $56,495, and for maintennnce for 10 yrs. $5,650.

Seattle, Wash.—Plans are stated to have been approved for the paving with sandstone a portion of Yessler Way, at $97,000.

The Bd. of Pub. Wks. is stated to have approved plans and specifications for the following improvements: Stewart St., regrade and sandstone paving; Fremont Ave., sewer; 4th Ave., northeast, sewer; 15th Ave., et al., grading and sidewalks; Blewett St., et al., grading and sidewalks; W. 50th St., sewer; W. 51st St., sewer; E. Denny Way, grading and sidewalks; W. 60th St., grading and sidewalks; 22d Ave., grading and sidewalks; E. Spring St., grading and sidewalks; Norman St., grading and sidewalks.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

Aberdeen, Wash.—The City Council is stated to hve decided to regrade Broadway at a cost of $88,019; also to improve a portion of 2d St. at a cost of $7,375.

Ottawa, Ont.—Bids will be received until Oct. 16 by Jas. Davidson, Bd. Wks. Com., for an asphalt and bituminous paving plant, as advertised in The Engineering Record; also until Oct. 2 for paving with asphalt a portion of McLeod St. Newton J. Ker, City Engr.

**Toronto, Ont.*—The Bd. of Control on Sept. 18 is reported to have awarded contracts for paving as follows: Godson Constr. Co., Brock St. with asphalt, $4,482, Clinton St. with asphalt, $3,788; Barber Asphalt Paving Co., Elliott St. with asphalt, $4,044; Constr. & Paving Co., Manning Ave. with asphalt, $13,974; C. H. Rust, Castle Frank with asphalt, $5,700 and Hogarth St. with macadam, $15,395.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—Francis N. Lawton, Gen. Mgr., Supt. and Purchasing Agt. of the Huntsville Ry. Light & Power Co., is reported to have announced that plans have been drawn for the doubling of the capacity of the power house and for the extension of the street railway system.

Redlands, Cal.—The Edison Electric Co., of Los Angeles, is reported to be considering the construction of a new power house in the Santa Ana Canyon next year, to use the water of Bear Creek.

Stockton, Cal.—Press reports state that it will require an expenditure of about $250,000 to repair the damage to the power plant of the Standard Electric Co. at Electra.

Los Angeles, Cal.—The Tejunga Power & Water Co. is reported organized with a capital of $250,000 to conserve and develop the waters of Little Tejunga Canyon and distribute it for irrigation purposes in the San Fernando Valley. Bennett's spring is the source of supply, and it is estimated by the promoters that 400 inches of water can be developed. Cal F. Hunter, Johnston Jones, Dr. J. W. Trueworthy are reported interested.

Montezuma, Colo.—The Montezoma Mines Development Co. is stated to have secured water rights on Snake River and proposes in the spring to construct a power plant to furnish light and power for the mines of the district.

Las Animas, Colo.—Bids will bereceived at the Bureau Yards and Docks, Navy Dept. (Wm. M. Smith, Acting Ch.), Washington, D. C., until Nov. 9, for furnishing material, constructing and installing a stone building for central power plant, boilers, electric generators, switchboards, steam engines, steam-driven pumps, icemaking refrigerating and distilling machinery, hot water heating system, complete, extending to several buildings; air-lift pumping system, garbage crematory and building, installation of steam disenfector and all piping, valves, accessories and wiring; also coal dump and retaining wall, at the U. S. Naval Hospital, New Ft. Lyon, Colo., as per specification No. 1,536.

Laurel, Del.—The electric light plant of the Laurel-Seaford Electric Co. is reported to have been destroyed by fire on Sept. 21. Chas. C. Stephenson, Mgr., Laurel.

Washington, D. C.—See "Miscellaneous."

Auburn, Ga.—The business men, it is stated, intend petitioning Mayor and City Council to call an election to vote on issuing $55,000 bonds, of which $45,000 is to be used to erect and equip an electric light plant and a system of water works.

Millen, Ga.—The citizens are reported to have voted on Sept. 16 to issue $30,000 bonds for waterworks and an electric light plant.

Coeur D'Alene, Idaho.—The Idaho Water & Electric Power Co. is reported organized, with J. McClear, Pres.; P. J. Scallon, Vice-Pres., and Maude Thornton, secy. This company has been formed for the purpose of developing the water power along St. Joe River by the construction of many dams. The power generated will be utilized in assisting the heavy traffic across the mountains on the Chicago, Milwaukee & St. Paul R. R. It is promoted by the railroad company.

Albion, Ill.—The Albion Gas Light & Heating Co. is reported to have been incorporated, with a capital of $7,500 by W. H. Brosan, Harry Smith and others.

Cherry Valley, Ill.—W. H. Poulton and W. W. Mockey are reported to have purchased the Cherry Valley mills and elecric plant. The new owners intend to fix up the mills and install new machinery.

Berlin, Md.—Orlando Harrison, Mayor, writes that the City Council has decided to extend the time for granting of franchise for waterworks and electric light plant from Sept. 20 to Oct. 31, with the prospect of placing an ice plant in connection with same.

Salem, Mass.—See "Schools."

Forest, Miss.—It is reported that E. Cahn, of Meridian, Miss., Mgr. of the Forest Ginning & Mfg. Co., will install electric light plant.

Columbia, Miss.—The Bd. of Mayor and Town Council is reported to have contracted with Grayson & Elder, of Biloxi, to erect and maintain an electric light plant in the town, granting them a franchise of 25 years. They also promise to put in a 20-ton ice plant at the same time.

Helena, Mont.—The Capital City Power Co., of New Jersey, is reported incorporated with a capital of $2,000,000, by B. R. Higgins, S. Hartman and H. S. Leonard, of New Jersey, to develop and sell water power and electricity. A. P. Thatcher, of Helena, Mont., is named as state agent. This is the corporation which has been formed for the purpose of building the third dam across Missouri River, near Helena.

**Jefferson City, Mo.*—The Warden and Bd. of Prison Inspectors of the Missouri State Penitentiary have awarded contracts as follows for the ventilating, heating and lighting plant for the Penitentiary: Boiler house building, to John Short, Jefferson City, $5,950; steam boilers, to Heine Safety Boiler Co., St. Louis, $20,400; steam engines, to St. Louis Iron & Machine Wks., St. Louis, $21,200; dynamos, to Western Electric Co., Kansas City, $24,064; motors, to Westinghouse Electric & Mfg. Co., St. Louis, $12,350; conduit and cable work, F. E. Newberry & Co., St. Louis, $10,252,

**Items marked thus give the names of parties awarded contracts.*

and pipe work, steam heating and ventilating, Peters-Eichler Heating Co., $52,924.

St. James M.—The Executive Bd. of the Soldiers' Home (Capt. H. E. Warren, Pres.) is reported to be considering the erection of a power house to replace the one recently burned.

Fremont, Neb.—J. W. Andrews, City Engr., writes that bids will be received on Sept. 30 for the construction of building and smokestack for the municipal water and light station. Contracts for engines, boilers and dynamos have been let. Engineer, C. A. Chapman, Marquette Bldg., Chicago, Ill. E. N. Mors, Chmn. Bd. Pub. Wks.

Perth Amboy, N. J.—An explosion is reported to have on Sept. 23 wrecked the generating plant of the Perth Amboy gas works. A. F. Reitemeyer, of Elizabeth, Supt.

Atlantic City, N. J.—Chmn. Donnelly, of the Council's Lighting Bd., is reported to have approved plans for the system of illumination for Atlantic Ave. as prepared by Carrere & Hastings, of New York, N. Y. It is stated that the City Council will authorize a bond issue of $30,000 to provide for the installing of the system.

Alamogordo, N. M.—The Sacramento Power Co., of Alamogordo, is reported incorporated, with a capital of $1,000,000. The proposed improvement includes the construction of a storage dam for irrigation purposes. A. T. Payne, of Oklahoma City, Okla., is reported interested.

**New York, N. Y.*—Contracts for installing electric equipment in schools (bids opened Sept. 23 by C. B. J. Snyder, Supt. School Bldgs.) have been awarded as follows: School 98, Manhattan Boro., T. Fred Jackson, Inc., 592 Columbus Ave., for $10,573; School 140, Brooklyn Boro., to Peet & Powers, 225 4th Ave., New York City, $4,560, and School 89, Queen's Boro., to L. F. Benn, for $11,240.

Brooklyn, N. Y.—The following are the bids opened on Sept. 14 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for 15 motor generator sets and accessories for the New York Navy Yard: Westinghouse Electric & Mfg. Co., 1507 Continental Trust Bldg., Baltimore, Md., $62,095; Western Electric Co., 463 West St., New York, N. Y., $84,480; and General Electric Co., Schenectady, N. Y. (2 bids), $61,-510 and $52,560.

**Columbus, O.*—Geo. Stockton, Supt. Columbus State Hospital, writes that contracts were let on Sept. 17 for addition to power plant: New engine to the Ironton Engine Co., of Ironton, $2,498, and dynamo and switch board to F. Bissell Co., of Toledo, for $3,550.

Hamilton, O.—It is stated that bids will be received until Oct. 12 by Thad. Straub, City Aud., for $20,000 electric light bonds; also $20,000 storm sewer bonds.

Lebanon, Pa.—It is reported that the Cornwall Ore Bank Co. is about to construct a power plant at Lebanon, and intends to transmit high-tension electric energy to Cornwall for the purpose of furnishing power for crushing iron ore, etc. Quincy Bent is Mgr. of Penna. Steel Co. at Lebanon, Pa.

Allegheny, Pa.—The Council on Sept. 18 passed the ordinance providing for the issue of $75,000 bonds for the purchase of a turbo-generator outfit for the municipal lighting plant.

Scranton, Pa.—The Scranton Electric Co. (A. J. Duffy, Electrician) is reported to have decided to extensively improve its plant.

Royer, Pa.—Engineer Frank W. Moore, Box 557, Indiana, Pa., writes that the proposed electric plant to furnish light and power to Williamsburg, Martinsburg and Royer will cost about $45,000. Bids will probably not be called for until 1908.

Seneca, S. C.—The City Clk. writes that bonds have been issued for the construction of an electric light plant.

Fredericksburg, Va.—The City Council is reported to have appropriated $4,000 for the work of adding to the city electric light plant an incandescent system for lighting stores and dwellings.

Boydton, Va.—R. W. Lassiter, of Oxford, N. C., is reported to be here negotiating with owners of lands on the Roanoke River, with a view of securing the water rights on the river for the purpose of establishing an electric plant at Eagle Point Falls.

Spokane, Wash.—It is reported that the Power Development Co., which is a subsidiary corporation of the Spokane & Inland R. R. Co. and one of the corporations belonging to the Inland Empire system, will have a surplus of 10,000 to 15,000 h. p. from the new power station at Nine Mile Bridge as soon as the plant at that place is completed, after supplying electric power to the railway lines of the system. It is proposed to utilize this surplus power by supplying light and power to the citizens of Spokane under the franchise purchased by Jay P. Graves and associates from Frank P. Hogan.

Elkins, W. Va.—The Elkins Power Co. is reported incorporated with a capital of $75,000, by Stephen B. Elkins, J. T. Davis and others.

Platteville, Wis.—The Platteville Gas Co. is reported incorporated, with a capital of $50,000. P. R. Crahden is reported interested.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—The Huntsville Ry., Light & Power Co. (R. N. McLure, Ch. Engr.) states that plans have been drawn for the doubling of the capacity of the power-house and for the extension of the street railway system. The Merrimack end of the line will be extended half a mile to Sanaqua Wells, while the Dalls end will be looped around to the Meridianville pike and back into the city by way of the Southern Depot.

Redding, Cal.—It is reported that the Northern Electric Co. plans to extend its line to Red Bluff, also to Redding and probably Kennett. C. S. Compton, Ch. Engr.

Sand Point, Idaho.—It is stated that an ordinance will soon be placed before the Council asking for a franchise granting right to Chas. R. Foss, John C. Cleary and Peter Johnson to build, maintain and operate a steam or electric railway on the streets of Sand Point.

Caldwell, Idaho.—The Boise & Interurban Ry. Co. (F. H. Knox, Ch. Engr.) is stated to have decided to build a street railway line in Caldwell and to extend its present line from the city to the Canyon County fair grounds, which are located about a mile distant.

Crawfordsville, Ind.—The Indianapolis & Eastern Ry. Co. (C. C. Reynolds Gen. Mgr.) is reported to have announced that the contract for the construction of a branch line from Crawfordsville to Danville, Ill., will be let this year, work to begin early in the spring.

Indianapolis, Ind.—The City Park Bd. is reported to have granted to the Grand Central Traction Co. a right of way across the western side of Garfield Park for an electric railway.

Paducah, Ky.—The Southern Constr. Co. is stated to have awarded a contract to the American Engineering Co., of Indianapolis, Ind., to survey a route for the interurban railway projected from Hickman to Paducah. Two routes have already been surveyed and right-of-way has been secured.

Boston, Mass.—Bids will be received until Oct. 3 by the Boston Transit Comn. (B. Leighton Beal, Secy.) for constructing part of new westerly wall roof and invert for enlargement of subway, Haymarket Sq.

Brockton, Mass.—It is stated that the Old Colony St. Ry. Co. is planning to lay stretch of new tracks nearly a third of a mile long on Belmont St. About $15,000 will be expended in this work.

Norwich, N. Y.—The Chenango Valley Co., which proposes to build an electric railway from Binghamton to Norwich and up the Canaswacta and Otselic valleys to South Otselic, Hamilton and the Utica Southern, which is planning to build from Utica to Norwich, have been granted franchises through the Norwich.

Grand Forks, N. D.—It is reported that Robt. Thompson, of Holmes, will take up the project of buidling an electric railway from Grand Forks to Carington.

Cleveland, O.—The Co. Comrs. are reported to have granted the Cleveland, Brooklyn & Elyria Ry. Co. a franchise to build and operate an electric railway through the county along Wooster Pike.

Neopolis, O.—The Co. Comrs. are stated to have granted a franchise to the Toledo & Delphos Electric Ry. Co. to use the streets of the village of Neopolis and to cross the county roads where necessary.

Ashtabula, O.—It is reported that plans have been formulated for a road from Painesville eastward through Lineville to Jefferson, where it will connect with the Pennsylvania & Ohio R. R.

Toledo, O.—A franchise is stated to have been granted the Toledo & Defiance R. R. Co. by the County Comrs., permitting the company to operate an interurban electric railway on private right-of-way through the county.

The County Comnrs. are stated to have granted to the Toledo & Delphos Electric Ry. Co. a franchise to use the streets in Peapolis. The corporation is constructing an electric line from Toledo to Delphos, paralleling the Wabash Ry.

Portland, Ore.—The Oregon Electric Co. (H. T. Corbett, Vice. Pres.) is stated to have decided to construct a branch line from Portland to Hillsboro, a distance of about 7 miles.

Scranton, Pa.—Franchises are reported to have been granted the Clark Summit & Winola St. Ry. Co. by the Townships of Abington, Newton, Falls and Overfield. The new street railway will connect with the Dalton St. Ry. and will, with the latter system, embrace a direct route to Lake Winola.

Freeland, Pa.—The Town Council is stated to have passed the Lehigh Traction franchise ordinance, giving that company the right to extend its lines to Front St. and further north, if desired. A. Markle, Gen. Mgr., Hazleton.

Northampton Heights, Pa.—The Easton & South Bethlehem Electric Ry. Co. is stated to have decided to build a 4,300-ft. extension in Northampton Heights.

Ft. Worth, Tex.—It is stated that the Northern Texas Traction Co. will double the capacity of its powerhouse, expending about $150,000. H. M. Flanders, Ch. Engr., Handley.

Brantford, Ont.—It is stated that the Grand Valley Radial Co. (T. Andrews, Ch. Engr., Brantford), will shortly award contracts for the construction of the line between Brantford and Port Dover, via Waterford and Simcoe, a distance of 34 miles.

Chatham, Ont.—The Chatham, Wallaceburg & Lake Erie Ry. Co., having completed its road to Lake Erie, is reported to be planning to extend to Wallaceburg. Robt. E. Kizer, Genl. Mgr.

Kingston, Ont.—The contract for the construction of the powerhouse of the Sydney & Glace Bay, Ry., at Dominion No. 4, is stated to have been let to Rhodes, Curry & Co., of Amherst. The plant and machinery will cost $25,000.

RAILROADS.

Notes Arranged Alphabetically by States.

Lafayette, La.—The Eunice, Lafayette & Abbeville R. R. Co. is reported incorporated at Lafayette to build a railroad from Eunice in a southeasterly direction to Lafayette and from Lafayette to Abbeville and from there to any deep-water point on the Gulf coast. Capital, $1,000,000. Directors, Gus. Fusilier, Julius J. Stagg, Jas. J. Lewis and others.

Buffalo, N. Y.—The contract between the city and the Grand Trunk R. R. Co. for eliminating the grade crossing at Niagara St. and International Bridge is reported to have been approved.

Little Falls, N. Y.—The New York Central & Hudson River R. R. Co. (W. G. Wilgus, of N. Y. City, Vice-Pres. Constr. Dept.) is reported to be considering the abolition of grade crossings through this city, the work to include raising the tracks and roadbed, construct 5 steel viaducts and erect new depot and freighthouse. Tentative plans and blue prints are reported to be on file at the office of City Engr. Dempster.

**Brockwayville, Pa.*—Frank Shumaker, of Bellefonte, is reported to have secured the contract for constructing double track line for the Buffalo, Rochester & Pittsburg R. R. Co. from Brockwayville to Carmen, a distance of about 9 miles. The work also includes the construction of a tunnel 1,200 ft. long and the straightening of many long curves. About $500,000 will be expended.

**Providence, R. I.*—The New York, New Haven & Hartford R. R. Co. is reported to have awarded contracts as follows for work in connection with a tunnel: For 15 piers bet. the passenger station and Canal St., to C. D. Blakely & Son, of New Haven, Conn. These piers will carry the viaduct connecting the tracks at the east end of the station and the Canal St. abutment. The contract for two abutments and iron rails for the enlarged highway bridge over Waterman Ave. in East Providence was awarded to O'Connor & Andrews, of East Hartford, Conn.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—See "Miscellaneous."

Bakersfield, Cal.—Train & Williams, of Los Angeles, are stated to have submitted to the Bd. of Superv. plans, which have been accepted for a Hall of Records to be erected of reinforced concrete at a cost of about $40,000. Bids for the construction will probably be asked about Oct. 1.

San Francisco, Cal.—The following are the bids opened on Sept. 17 at the office of the Superv. Archt., Washington, D. C., for repairs to stonework, miscellaneous repairs, alterations and painting at the U. S. Mint Building, San Francisco: Raymond Granite Co., $49,500; Buck & Campbell $55,095; Kern Bros., $53,200, and New Era Development Co., $37,987.

The Superv. Finance Com., it is stated, has recommended an appropriation of $25,000 for the erection of a firehouse on Bush St.

Sacramento, Cal.—The citizens of Sacramento City and County, on Sept. 10 decided to issue bonds to the amount of $1,485,000 for the erection of a new court house and jail, for building new bridges and repair of old ones, and the building and maintenance of permanent good roads throughout the county.

Berkeley, Cal.—It is reported that a new hospital will be erected in the Claremont Dist. at a cost of $100,000. Dr. Geo. Reinhardt is reported interested.

Las Animas, Colo.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 15 to construct bakery and laundry buildings at the naval hospital, New Fort Lyon, Las Animas. Applications for proposals should refer to Sch. 313. E. B. Rogers, Paymaster General, U. S. N.

Denver, Colo.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until October 18 for the extension, etc., to the U. S. Post Office and Courthouse at Denver.

**Greeley, Colo.*—Contracts for erecting the Public Library, it is stated, have been awarded as follows (bidders all of Greeley): Barber & Gordon, building, $14,127; J. D. Potter, steam heat, and Wm. Ecker the plumbing. The total cost is $16,368.

Washington, D. C.—It is reported that the revised plans for the building for the International Bureau of American Republics have been approved by Secy. of State Root and John Barrett, Dir. of the Bureau. Albert Kelsey and Paul P. Cret, of Philadelphia, Pa., are the achts. The building is to be 2 story, constructed throughout of steel and concrete and to cost about $1,000,000.

Pensacola, Fla.—The following are the bids opened on Sept. 14 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing locomotive shed and paint shop complete at the Navy Yard, Pensacola: Lewis & Kitchen, 1200 Michigan Ave., Chicago, Ill., $39,468; Geo. Ittner, Prudential Bldg., Atlanta, Ga., $34,797; Grant Wilkins, 23½ Whitehall St., Atlanta, Ga., $30,550; C. M. Leach, Navy Yard, Boston, Mass., $41,357. H. A. Bishop, 218 La Salle St., Chicago, Ill., $29,600; and Penn Bridge Co., Bond Bldg., Washington, D. C., $30,-700.

Atlanta, Ga.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Oct. 30 for the construction, including plumbing, of the superstructure of the U. S. Post Office and Courthouse at Atlanta.

The joint Com. from the General Council of the City of Atlanta and the Bd. of Co. Comrs. have recommended to the Mayor and General Council of the city and the Bd. of Co. Comrs., that a joint courthouse and city hall be erected upon land now owned by Fulton County and located on Pryor and Hunter Sts; total cost of buildings, outside of the furnishings, to be about $800,000.

Ft. McPherson, Ga.—Bids will be received by Lieut. W. E. Holliday, Constr. Q. M., U. S. A., Ft. McPherson, until Oct. 17 for the construction, plumbing and electric wiring of one brick stable for 76 animals, and for the construction of one frame wagon shed, at this post.

Thomaston, Ga.—The Comrs. of Upson County (H. M. Sandwich, Clk.) propose within the next 60 days awarding the contract to erect a courthouse, and would like to receive plans at once for a building to cost about $50,000.

**Clayton, Ga.*—The ordinary of Rabun County, it is stated, has closed a contract with the Falls City Constr. Co., of Louisville, Ky., to build a new courthouse to cost about $25,000.

**Crown Point, Ind.*—Chas. A. Johnson, Co. Aud., writes that the contract for erecting addition to courthouse (bids opened Sept. 14) has been awarded to W. J. Turnes Co., 167 Dearborn St., Chicago, Ill. Probable cost, $78,860.

Brazil, Ind.—The erection of a new courthouse is reported under consideration.

**New Castle, Ind.*—The State Bd. of Trus., it is reported, has awarded the contract to erect 2 cottages at the State Epileptic Village to Bendseldt & Son, of Richmond, at about $27,000.

*The Bd. of Trus. of the State Epileptic Village is reported to have awarded contract to Powell & Dorsette, of Anderson, for the installation of a heating plant for the numerous cottages.

Marion, Ind.—It is stated that bids will be received until Oct. 3 by J. W. Sanderson, Treas. N. H. D. V. S., for constructing officers' quarters.

**Items marked thus give the names of parties awarded contracts.*

Sheldon, Ia.—Bids will be received until Oct. 16 by Henry Shipley, Pres. Pub. Library Bd., for furnishing material and erecting a library.

Boone, Ia.—Liebbe, Nourse & Rasmussen, of Des Moines, are said to be preparing plans for an armory to be erected for the Boone Iowa Natl. Guard Co., the cost to be about $10,000.

Marshalltown, Ia.—The Co. Bd. of Insanity Comrs., it is reported, has recommended to the Bd. of Superv. the building of a county hospital for the insane at the county farm to care for the incurable insane.

**Glenwood, Ia.*—It is stated that the contract to install plumbing and heating in the custodial building at Glenwood has been awarded to Johneson-Roe-Daly Co., of Omaha, Neb., at about $10,000.

**Des Moines, Ia.*—Benson & Marxer Co., 425 Grand Ave., are reported to have secured the contract to erect No. 5 fire station, at W. 17th and Crocker Sts., at $13,025, and the Globe Plumbing and Heating Co., 518 E. Walnut St., the contract for the plumbing and heating of same, at $1,700. Bids for this work were received Sept. 12.

New Orleans, La.—The plans and specifications of Crosby & Henkel, 706 Morris Bldg., for thenew $200,000 Delgado Memorial, an addition to the Charity Hospital to be erected on Tulane Ave., have been accepted by the Bd. of Administrators of the hospital and bids for the construction of the building will be received until Oct. 15. The building will be 6 stories high, and accommodate about 170 patients. The exterior of the building will be of pressed brick and terra cotta, and will be fireproof. Concrete and steel will figure largely in its construction. Address bids to Edwin Marks, Secy. and Treas. Bd. of Administrators Charity Hospital.

Indian Head, Md.—Bids will be received at the Bureau of Su lies and Accounts, Navy Dept., Washington, D. C., until Oct. 1 to construct at the naval proving ground, Indian Head, Md., a storehouse, and to furnish and erect therein a traveling crane and hoist. Applications for proposals should refer to Sch. 310. E. B. Rogers, Paymaster General, U. S. N.

Grand Rapids, Mich.—The erection of a St. Mary's Hospital at a cost of about $65,000 is reported contemplated. Mrs. M. J. Lewis is Secy. Com. having the matter in charge.

Springfield, Mo.—Reed & Heckenlively, Baldwin Theatre Bldg., are reported to be preparing plans for a 3-story addition to the Burge Deaconess Hospital on N. Jefferson St., to cost $25,000.

Kansas City, Mo.—Edwards & Sunderland, Sheidley Bldg., are reported to have prepared plans for alterations and additions to the city market house; cost about $20,000.

Missoula, Mont.—It is stated that bids will be received until Oct. 7 by the Bd. Co. Comrs. (D. J. Andrews, Chmn.) for $175,000 county building bonds. W. H. Smith, Co. Clk.

East Orange, N. J.—It is reported that the Bd. of Directors has decided to reject all bids received in June for erecting the 2 branch libraries, as they were too high. The plans are to be altered, so as to reduce the cost.

Canandaigua, N. Y.—J. Foster Warner, of Rochester, it is stated, is changing the original plans for the remodeling of the courthouse. It is now proposed to erect a third story and to fireproof the building throughout.

Ilion, N. Y.—Bids will be received until Oct. 2 by A. B. Russell, Secy. Bd. Dirs., Ilion, for erecting a hospital. F. H. Gouge, Archt., 70 Genesee St., Utica.

Brooklyn, N. Y.—The Bd. of Trus. of the Brooklyn Pub. Library, it is stated, are considering the plans of Raymond F. Almirall, 51 Chambers St., Boro. Manhattan, for the Central Library Bldg., to be erected at Park Plaza, Flatbush Ave. and Eastern Parkway.

New York, N. Y.—See "Miscellaneous."

Buffalo, N. Y.—Bids will be received until Oct. 8 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for installing a hot water heating system at Engine House No. 3 and Truck House No. 3; also at Engine House No. 9 and Truck House No. 1.

Geneva, N. Y.—A. P. Rose, Mayor, writes that Arthur C. Nash, of N. Y. City, has been selected to prepare plans for a city hall, to cost between $100,00 and $125,000. Nothing will probably be done before the spring, as the question has not yet been voted upon.

New York, N. Y.—Plans have been filed for alterations to 4-story brick and stone courthouse at Center and White Sts. for City of New York; cost, $25,000. John H. Duncan, Archt., 208 5th Ave.

Bids will be received at the office of Mayor Geo. B. McClellan, Chmn. Armory Bd., New York City, until Oct. 7, for furnishing material and excavating the plot for proposed armory building for the 2d Battery, N. G., N. Y., at Franklin Ave. and E. 166th St., Boro. Bronx; also furnishing material and erecting above armory (exclusive of excavating), C. C. Haight, Archt., 452 5th Ave., Boro. Manhattan; also same time and place for furnishing material and changing the system of steam heating in the Drill Hall of the 13th Armory, Boro. Brooklyn. Walter E. Parfitt, Archt., 26 Court St., Boro. Brooklyn.

A committee of Chinese merchants, it is reported, propose erecting a hospital in Chinatown, to cost about $25,000. Lee Yu and Ching Fong Wing are reported interested.

Maxton, N. C.—Bids will be received until Oct. 7 by the Bd. Co. Comrs. (J. W. Carter, Chmn.) for $50,000 courthouse bonds.

Ft. Lincoln, N. D.—Bids will be received by Bowers Davis, Constr. Q. M., U. S. A., until Nov. 8, for the construction of an ice house, commissary root cellar, and addition to Q. M. stables at this post, as advertised in The Engineering Record.

La Moure, N. D.—Plans and specifications will be received by the Bd. Co. Comrs. until Oct. 9 (extension of date) for a courthouse to cost between $60,000 and $100,000. E. W. Field, Co. Aud.

Cincinnati, O.—The Council is reported to have passed an ordinance appropriating $20,000 for the erection of engine house at Borden and Elmore Aves.

*William Attlesey, it is reported, has been awarded the contract for building the public comfort station at Fountain Sq., at $19,721.

Cleveland, O.—It is reported that bids will be received until Oct. 4 by the Bd. Pub. Service (W. J. Springborn, Pres.) for erecting the main zoological building in Brookville Park; probable cost, $40,000.

It is stated that the plans for the superstructure of the West Side Market are being altered so as to keep the cost within the appropriation.

Carrolltown, Pa.—The citizens are reported to have voted in favor of issuing $25,000 bonds to erect a fire-house.

Harrisburg, Pa.—The State Bd. of Charities is stated to have approved plans for 3 jails to be erected, one each at Easton, Franklin and Allentown, and also plans for an addition to the dining room and an infirmary at the State Hospital for Chronic Insane at Wernersville.

Philadelphia, Pa.—The erecting of a new 3-story 40x40-ft. wing at the West Philadelphia General Homeopathic Hospital is reported under consideration.

Plans are reported filed for a 6-story brick stone and terra cotta hospital, to be erected at North College Ave. and 22d St., for the Women's Medical College of Pennsylvania.

Bids will be received by Lieut. Col. F. G. Hodgson, Constr. Q. M., U. S. A., until Oct. 7 for additions and alterations to certain buildings at the Philadelphia depot of the Q. M. Dept.

Pittsburg, Pa.—The following are the bids opened on Sept. 16 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for construction (except elevators) of the U. S. Marine Hospital at Pittsburg: Wm. Miller & Son, Pittsburg, $140,000; Chas. McCaul, Philadelphia, $134,141; Noel Constr. Co., Baltimore, Md., $126,710; Cramp & Co., Philadelphia, $124,800; Wm. Kerr's Sons, Pittsburg, $139,600; A. & S. Wilson, Pittsburg, $145,694; Henry Shenk, Erie, $123,000; and Nichols Bldg. Co., Pittsburg, $177,324.

The Allegheny Co. Comrs., it is stated, have sold $300,000 of the $1,000,000 bond issue with which it is proposed erecting a soldiers' memorial building, bids for the construction of which are being received.

Polk, Pa.—Bids will be received until Oct. 16 by John Alwiley, Secy. State Inst. for Feeble Minded, of Western Pennsylvania, at Polk, for erection complete of the following buildings: Custodian group, industrial school building, cow barn, machinery barn, the placing of 16 stone porches to present cottages, fireproofing and tile flooring for connecting corridors of present buildings. All to be erected on the institution's premises. Proposals will be received for the total of the 6 various constructions and for each of the 6 various constructions separately. Plans and specifications can be seen at the offices of the architect, F. J. Osterling, Commonwealth Bldg., Fourth Ave., Pittsburg.

Ebensburg, Pa.—The Co. Comrs. are stated to have voted in favor of erecting an addition to the county jail at Ebensburg, to cost about $50,000.

San Juan, P. R.—Competitive plans will be received until Feb. 1 by L. H. Grahame, Comr. of the Interior, for the Capitol, of Porto Rico. The cost of the building is not to exceed $300,000. Applications from architects are to be received by the Comr. before Nov. 1, 1907.

Aberdeen, S. D.—The Masons are said to be planning the erection of a $50,000 hospital here.

Richmond, Tex.—Plans and specifications are wanted for a fireproof 3-story courthouse, with basement, and containing 23 rooms; cost not to exceed $70,000. For further information, address D. R. Pearson, Richmond.

Liberty, Tex.—Bids, including plans and specifications, will be received until Oct. 3 by I. B. Simmons, Co. Judge, for erecting 1 story to the Liberty Co. Jail for new cells and other repairs.

Seattle, Wash.—The state and forestry buildings to be erected by the state commission for the 1909 fair, will cost about $7- 000 and $90,000 respectively. Saunders & Lawton, Alaska Bldg., and Bebb & Mendell, Denny Bldg., are the archts. respectively.

La Crosse, Wis.—The Directors of the La Crosse Pub. Library, it is stated, have approved plans for an addition which it is proposed erecting to the Washburn Memorial Library at a cost of about $25,000.

Toronto, Ont.—The Bd. of Directors of the Home for Incurables, it is reported, has approved the proposition of the Bd. of Control to spend $50,000 in building a wing to the institution, for city patients. Dr. Sheard and Ambrose Kent will arrange the details.

The Bd. of Management of the Pub. Library, it is stated, has decided to ask the Chief Librarian to report on suitable plans for a branch library to be erected on Queen and Lisgar Sts., at a cost of about $25,000.

Hamilton, Ont.—The Bd. of Hospital Governors, it is stated, has decided upon the site on Victoria Ave. for the Home for the Advanced Cases of Consumption, and directed the archt. to complete plans as soon as possible so that work may be commenced at once.

**Montreal, Que.*—J. B. Pauze & Co., of Montreal, according to reports, have secured the contract to erect the jail, at $-90,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—Clyde & Paul Stevenson are reported to be planning the erection of a 3-story brick and stone store and apartment house at 5th and Chestnut Sts., to cost $25,000.

Montrose, Ala.—The Montrose Hotel Co. is reported incorporated, with a capital of $100,000, and will erect a resort hotel at Montrose, on the eastern shore of Mobile Bay.

**Selma, Ala.*—Thos. Purvis, of Selma, is stated to have secured the contract to erect a clubhouse for the Harmony Club at a cost of about $25,000.

Coronado, Cal.—Edw. Quayle is reported to have prepared plans for a building on 10th St. and Orange Ave. for the Coronado Bank, to cost about $20,000.

Sacramento, Cal.—It is reported that an additional story will be added to the Oschner Building at 719½ K. St., and that an addition of 25 ft. will be made at the side; the improvements will cost about $50,000.

**Los Angeles, Cal.*—It is stated that J. W. Morrison has secured the contract to erect a 2-story brick ware house, 100x203 ft., at Banning and Alameda Sts., to cost $20,000. Morgan & Wall, 232 N. Main St., are the archts.

San Francisco, Cal.—J. A. and C. F. Crocker, it is stated, have applied for a permit to erect a 5-story brick loft building at 1st and Mission Sts., to cost $190,000, and also to reconstruct the building on Fremont and Mission Sts., to cost $60,000.

Denver, Colo.—The Walter S. Chessman Realty Co. is reported to be completing arrangements for the erection of a $125,000 building on California and 16th Sts.

**Tampa, Fla.*—It is reported that Geo. MacFarland, of Tampa, has the contract for the erection of an office building, estimated to cost $20,000.

Chicago, Ill.—Washington Porter, according to reports, is to erect upon 286 Fifth Ave. a 10-story steel and concrete building, which will be occupied by Squiers, Aldrich & Co.

Armour & Co., it is reported, propose erecting a 6-story office building in the stockyards this winter, to cost about $400,000.

Peoria, Ill.—H. E. Hewitt, 24 Arcade Bldg., is said to be preparing plans for a Y. W. C. A. building to cost $30,000.

Indianapolis, Ind.—The Boyd Automobile Co. (C. R. Newly, Gen. Mgr.) is reported to have ordered plans for the erection of a garage, salesroom and storehouse for automobiles on Massachusetts Ave.

Sioux City, Ia.—The Sioux City Auditorium Co. (J. L. Kennedy, Pres.) is stated to have secured a site on 7th and Douglass Sts., on which to erect the auditorium at a cost of about $25,000.

**Des Moines, Ia.*—Jos. Schneible is reported to have secured the contract for the construction of the Des Moines Brewing Company's plant; estimated cost $150,000.

Oskaloosa, Ia.—The round house of the Chicago, Burlington & Quincy R. R. (W. L. Breckinridge, Engr., Chicago, Ill.) is reported to have been destroyed by fire on Sept. 13.

Wichita, Kan.—It is reported that the Atchison, Topeka & Santa Fe Ry. Co. (C. A. Morse, Ch. Engr., Topeka), propose erecting a depot in Wichita, to cost about $200,000.

Owensboro, Ky.—The Scarborough-Davis Co., of Evansville, Ind., it is stated, submitted the lowest bid for erecting a building here for A. L. Smith, at $25,916.

Louisville, Ky.—The Red Men at a meeting in Norfolk, Va., on Sept. 11, it is stated, decided to erect a building in Louisville, to cost about $1,000,000.

**Somerset, Ky.*—The Directors of the Farmers' National Bank, according to reports, awarded the contract to Geo. T. Hood & Co. for the erection of a modern bank building. Estimated cost, $125,000.

Shreveport, La.—Capt. W. H. Williams and J. H. Jordon are reported to have been appointed members of a committee by the Caddo-Bossier Branch of the Southern Cotton Assoc., to investigate the matter of erecting an immense warehouse in Shreveport.

Covington, La.—Bids will be received until Oct. 12 by the Covington Bank and Trust Co. for erecting a 2-story brick building. Drago & Smith, Archts., Cosmopolitan Bank Bldg.

Baltimore, Md.—Thos. L. Jones & Sons, 410 W. Saratoga St., are reported to have applied for a permit to erect for Fred. H. Hack at 109 N. Howard St., 2 4-story brick warehouses to cost $35,000.

South Haven, Mich.—Arrangements are being made, according to reports, to rebuild the Avery Beach Hotel (Geo. B. Kelly, Pres.), recently destroyed by fire. Estimated cost, $800,000.

Duluth, Minn.—It is reported that Waterworth & Fee will erect a $42,000 business building on 2d St.

Duluth, Minn.—Clinton Markell is reported to have secured a permit to rebuild the Freimuth Blk., at a cost of $65,000.

**St. Paul, Minn.*—Geo. J. Grant, 61 E. 9th St., is reported to have secured the contract for a 2-story building, 92x112 ft., on 5th and Washington Sts., for the St. Paul Fire & Marine Insurance Co., to cost about $200,000. Architect, Louis Lockwood, National G. A. Bank Bldg.

Minneapolis, Minn.—Bertrand & Chamberlain, Bank of Commerce Bldg., it is stated, have completed plans for a 4-story reinforced concrete and brick building, which is to be erected for the Augsburg Publishing Co. at 4th St. and 5th Ave., S., at a cost of about $65,000.

Hattiesburg, Miss.—The railroads entering this city are said to be considering the erection of a union station, to cost about $200,000. F. T. Myers, Div. Engr., Mississippi Central Ry., may be able to give further information.

**St. Louis, Mo.*—The Southern Illinois Constr. Co., East St. Louis, Ill., is reported to have secured the contract to erect for Louis Freidman, at 10 N. 20th St., the 5-story mercantile building, to cost about $40,000.

St. Louis, Mo.—The Holbrook-Blackweilder Co. is reported to be contemplating the erection of a mercantile building at 10th and Olive Sts., to cost about $400,000.

Missoula, Mont.—The Elks are reported to be contemplating the erection of a building to cost about $30,000.

Lincoln, Neb.—The Star Van & Storage Co. will erect a 3-story fireproof addition to storage house, 50x72 ft., to have brick walls and reinforced concrete floors and columns; cost $15,000.

West New York, N. J.—H. & W. Neumann, of Jersey City, it is reported, have completed plans for a 3-story brick store and apartment house, which is to be erected in West New York at Bergenline Ave. and 12th St., for Dr. L. H. Shenier, at a cost of about $18,000.

**Items marked thus give the names of parties awarded contracts.*

**Bristol, N. J.*—Ernest Lawrence is stated to have secured from the Bristol Trust Co. the contract to erect a bank building, at $12,067.

Newark, N. J.—Edwin A. Kirch & Co. are reported to have purchased the building at 77 Market St. and propose making improvements, including the erection of of an addition at a cost of about $30,000.

Mt. Vernon, N. Y.—The Masons, it is reported, intend erecting a temple here. Sigmund A. Guttenberg, 37 Prospect Ave., is stated to have been engaged to prepare plans for the building, which is to cost about $20,000.

Brooklyn, N. Y.—It is stated that plans for a 4-story treatre to be erected on Fulton St. and Nostrand Ave. have been filed. Cost, $175,000. Wm. H. McElfatrick, 1402 Bway., Boro. Manhattan, is the archt.

Permit has been issued for the erection of five 6-story stores and tenements on S. 1st St. for P. Leizerkowitz, of 935 Myrtle Ave. Architect, Saml. Sass, 23 Park Row, New York City; cost $260,000.

Little Falls, N. Y.—See "Railroads."

**Syracuse, N. Y.*—The Lodge of Elks, according to reports, has awarded the contract to erect a clubhouse on Clinton St. to Edw. McLaughlin, of Syracuse, at about $100,000.

Red Springs, N. C.—The Red Springs Foundry Warehouse Co. (W. J. Johnson, Secy.), is reported incorporated with a capital of $25,000 for the purpose of building a warehouse.

Grand Forks, N. D.—Plans are reported to have been completed for a combined office and cold storage building for the Pabst Brewing Co., to be erected on N. 4th St., on the Northern Pacific property.

Oklahoma City, Okla.—J. H. Everest, L. L. Land and Geo. Cook are reported to be planning the erection of a $100,000 steel fireproof department store and office building.

**Toledo, O.*—The contract for the new building for the People's Savings, Building & Loan Co., is stated to have been awarded to the H. J. Speiker Co. Approximate cost, $125,000; and the contract to erect a 2-story brick and concrete building on Superior St. for Ralph King to Jos. Pheils, at about $50,000.

**Logan, O.*—It is reported that the Hocking Valley Ry. Co. has awarded the contract for the heating plant at its new repair shops at Logan, to the B. F. Sturdevant Co., of Boston, Mass., and the piping and plumbing in connection with the plant to the S. A. Esswein Htg. & Plumbing Co., of Columbus, O. The contract will amount to about $20,000.

Cincinnati, O.—P. Sullivan, it is reported, has secured a site on Central and Carlisle Aves., on which he intends erecting a hotel costing about $200,000.

A. Janzen & Co., wholesale grocers, it is stated, propose erecting at 2d and Walnut Sts., a 6-story, 100x124 ft., concrete, iron and steel warehouse, to cost about $80,000, plans for which have been prepared.

**Oxford, O.*—Vanaudall & Free, of Oxford, according to reports, have secured the contract to erect the Phi Delta Theta Chapter House, at about $18,000.

**Harrisburg, Pa.*—It is stated that the contract to erect an annex to the Market House has been awarded by the Chestnut St. Market Co. to J. N. Bastress & Co., of Harrisburg, at$24,400.

Philadelphia, Pa.—Thos. K. Patton is reported to have bequeathed to the Masonic Grand Lodge of Pennsylvania $1,000,000 as a fund for the establishment and maintenance of an institution for the support and education of male orphans of Masons.

Nashville, Tenn.—J. E. R. Carpenter is reported to be completing plans for the erection of a new club house for the Watauga Club on 6th Ave., N., to cost about $100,000.

**Fort Worth, Tex.*—The contract to build the new Katy depot is reported to have been awarded to J. A. Stewart & Co., Lincoln Trust Bldg., St. Louis, Mo. The structure will be 300x45 ft., 2 stories high and cost $50,000.

Hillsboro, Tex.—The Directors of the Y. M. C. A. are reported to have decided to expend about $20,000 for the erection of a building.

San Angelo, Tex.—Dr. T. W. Conerly, according to reports, intends erecting a 2-story business building on Chadbourne St., to cost $20,000.

**Danville, Va.*—C. C. Kent, Jr., Gen. Secy. Y. M. C. A., writes that the contract for erecting a Y. M. C. A. bldg. (bids opened Aug. 15) has been awarded to Deitrick & Pearson, of Danville, for $28,577.

**Roanoke, Va.*—C. W. Hancock & Sons, of Lynchburg, Va., it is stated, have secured the contract for the erection of a business block and office building 6 stories high. Estimated cost, $120,000.

Seattle, Wash.—It is stated that a 3-story clubhouse is to be erected for St. Aloysius parish, to cost about $20,000.

A permit has been issued for the construction of a 10-story steel frame reinforced concrete building at 1900-1910 3d Ave., for the Washington Securities Co.; estimated cost, $300,000.

It is stated that a building permit has been granted to the Seattle Athletic Club to make alterations. A new foundation is to be put in. The cost is approximately $42,000.

Tacoma, Wash.—E. W. Houghton, 414 Collins Bldg., Seattle, it is reported, has completed plans for the 24-story commercial building which is to be erected by the Imperial Development Co. of Tacoma at a cost of about $6,000,000. J. C. Donnelly and Edmund Croft, of Tacoma, and A. P. Gillies, of Seattle, are among the incorporators. It is to be a combined hotel, office and warehouse, 200x415 ft. and is to contain 20 elevators.

Spokane, Wash.—Kemp & Hebert are having plans prepared for a 4-story department store building, 115x142 ft., to cost $125,000. Alfred Jones, Archt., Ferowell Bldg.

The Polson Implement Co., of this city, is having plans prepared for a 5-story mill construction warehouse, 75x80 ft. Archt., L. L. Rand, The Rookery.

The Idaho, Washington & Northern R. R., the Spokane International and the Cœur d'Alene branch of the Northern Pacific R. R., it is reported, contemplate constructing a union station here. E. J. Roberts, Supt. Spokane International Ry., Spokane, may be able to give further information.

New Martinsville, W. Va.—The Masons, it is stated, have accepted plans for a lodge building, estimated to cost $45,000.

**Elkins, W. Va.*—C. W. Dowling, of Williamstown, is stated to have secured the contract to erect the State Home at Elkins for the Odd Fellows, at about $70,000.

Milwaukee, Wis.—The Gridley Dairy Co., it is stated, intends erecting on 8th and Sycamore Sts. a 4-story brick and concrete building, 50x150 ft., to cost about $100,000.

Racine, Wis.—The Elks, it is stated, contemplate erecting a clubhouse, to cost $40,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—A. S. Ritter Brown, of Omaha, Neb., is reported to have decided to erect a residence for his wife on Cherry Creek Boule., between Lafayette and Humboldt Sts., Denver, to cost about $70,000.

**Washington, D. C.*—A permit has been issued for a 3-story brick apartment house to be erected at 676 4th St. N. E., at a cost of $30,000. Thos. W. Smith, Archt.; J. Parsons, Pennsylvania Ave. and 13½ St. N. W., builder.

The following are the bids opened on Sept. 21 for the erection of the Northminster Presbyterian Church, (A. M. Poynton and W. L. Webster, Associate Archts.): W. A. Kimmel, $31,427 (awarded cotnract); Arthur Cowsill, $32,697; Jos. H. Gibbons, $34,000; A. Getz & Son, $34,497, and W. E. Morrey, $37,689.

Thornton, Ind.—Mrs. Susan Lafollete is reported to have ordered plans for the erection of a 12-room residence ,to cost $12,000.

Washington, Ind.—The Trustees of the Baptist Church are reported to have decided to erect a new edifice; estimated cost $20,000. Architect, Elmer E. Dunlap, Columbus, Ind.

Hutchinson, Kan.—The First Methodist Society is reported to be preparing to erect a church; estimated cost $40,000.

Lenox, Mass.—Wm. D. Sloane, of New York, N. Y., has set aside 250 acres of his estate here and will erect a residence for his daughter, to cost $200,000.

Grand Rapids, Mich.—The Wealthy Ave. Baptist congregation is reported to have decided to build a church at this place. F. Holmes, Treas.

Duluth, Minn.—Clinton Markell is reported to have been granted a permit to erect a residence at 1st St. and 22d Ave., E., to cost about $13,000.

Hattiesburg, Miss.—The First Baptist congregation is reported to be preparing to erect a church at a cost of $50,000. Address, Pastor.

Kansas City, Mo.—Howe & Hoit, Bayard Bldg., are reported to be preparing working plans for the edifice to be erected for St. George Episcopal Church at 33d St. and the Pasco, at a cost of $25,000.

Brooklyn, N. Y.—Plans have been filed by Hyman Epstein, 618 Marcy Ave., for the erection on Jefferson and Howard Aves., 14 4-story brick tenements; total cost, $378,000. Architect, Saml. Sass, 23 Park Row, New York City.

Youngstown, O.—The Primitive Methodists are reported to be preparing to erect a $25,000 church. Architect, Harry Wirsing. Rev. Robt. Wilson, Pastor.

**Toledo, O.*—Pfaender Bros. are reported to have secured the contract to erect the Epworth M. E. Church at about $50,000.

Columbus, O.—Dawson & Holbrook are reported to have completed plans for the erection of a 4-story apartment house, to be erected by A. G. Field.

Sewickley, Pa.—Rutan & Russell, of Pittsburg, it is stated, have completed plans for a 3-story 88x72 ft. residence to be erected in Sewickley for Geo. H. Clapp, Pres. Pittsburg Testing Laboratory. Probable cost, $50,000.

**Swarthmore, Pa.*—Bowers & Logan are reported to have secured the contract to erect a 3-story residence for Prof. A. H. Tomlinson, which is to cost about $18,000.

**Philadelphia, Pa.*—Burd P. Evans & Co., 706 N. 9th St., are reported tohave been awarded the contract to erect a church and parsonage at 16th and Wingohocking Sts. for the Mt. Hermon Reformed Church, to cost $30,000.

Norman W. Cramp has been granted a permit for a $20,000 3-story stone residence, which he will erect on Seminole Ave., west of Willow Grove Ave., Chestnut Hill. Archts., Savery, Scheetz & Savery, Stephen Girard Bldg.

Houston, Tex.—Bids will be received at the office of Sanguinet & Staats, Archts., 1st Natl. Bank Bldg., until Oct. 1, for the erection of a synagogue for the Congregation of Adath Yeshurun.

Norfolk, Va.—A. H. Martin, it is reported, will erect a 3-story apartment house on Berkley Ave. and Clifton St., Berkley Ward, at a cost of $50,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—The Bldg. Com. of the Univ. of Alabama, it is stated, has adopted plans of Robt. Lockwood, Montgomery, for the 3 buildings to be erected at the Univ.—a central heating and electrical building, a laboratory for the biological and chemical departments, and an engineering building.

**Decatur, Ala.*—Ben M. Nelson is reported to have secured the contract for building 3 brick ward schools in New Decatur for a total of $25,000.

**Auburn, Ala.*—B. B. Comer, of Montgomery, Chmn. Bldg. Com., Alabama Polytechnic Inst., writes that the contract for erecting 2-story brick building for Alabama Polytechnic Inst. at Auburn (bids opened Sept. 17) has been awarded to Jas. A. Cullars, of Auburn; probable cost, $25,000.

Prof. N. C. Curtis, of the Alabama Polytechnic Inst., it is stated, has been directed to prepare plans for a library building, to cost $30,000, and for an agricultural building, to cost about $60,000.

Mobile, Ala.—Bids will be received until Oct. 1 at the office of Rudolph Benz & Sons, Archts., Masonic Temple, for furnishing material and erecting the extension of the east wing of the Medical Dept of the University of Alabama.

South Pasadena, Cal.—It is reported that $25,000 bonds have been voted to erect a school.

**Colorado Springs, Colo.*—Honeyman & Auld, 12 Carpenters' Alley, it is stated have been awarded the contract to erect a hall for women at Colorado College to cost about $30,000.

Marianna, Fla.—Bids will be received until Oct. 3 by J. C. Folson, Chmn. Bldg. Com., for erecting a school.

Starke, Fla.—The Com. on Educ. of the Bd. of Trade is stated to have submitted a report to the Bd. of Trade, which has been accepted, recommending the purchase at once of a site and the erection of a school building, to cost, including equipment, about $30,000.

Fitzgerald, Ga.—The City Council is reported to be considering the holding of an election to vote on the issuing of $40,000 bonds for school purposes.

Anderson, Ind.—J. B. Pearcy, Supt. of Schools, writes that architects will be selected in a few days for the proposed high school to be erected on Lincoln and 14th Sts. Bids will not probably be called for in December.

**Lafayette, Ind.*—The contract to put in cement work and foundation for the experiment station at Purdue University, is reported to have been awarded to W. F. Stillwell, of Lafayette. The contract for the construction of the building will probably be let this fall; estimated cost $100,000.

**Iowa City, Ia.*—Rawson & Son, of Iowa City, have secured the contract for enlarging the Engineering Building at the State University (bids opened Sept. 16), for $50,625.

Topeka, Kan.—It is stated that bids will be received by the State Bd. Control until Oct. 5 for furnishing material and erecting a laundry building; also for the raising of the hospital building at the Boys' Industrial School at Topeka. John F. Stanton, State Archt., Topeka.

**Lawrence, Kan.*—Edw. E. Brown, Secy. & Purchasing Agent, University of Lawrence, writes that the contract for erecting building on campus at University of Lawrence (bids opened Sept. 17) has been awarded to Manhattan Constr. Co., of Manhattan, for $85,167, including plumbing, ventilating and heating and electric wiring.

**Siddell, La.*—C. D. Stewart, of Baton Rouge, it is reported, has secured the contract to erect a 2-story brick school, estimated to cost $20,000.

Portland, Me.—It is reported that Chickering & O'Connell, of Boston, Mass., have completed plans for a convent, to be erected in connection with the St. Joseph Academy. Estimated cost, $150,000.

**Westford, Mass.*—The contract for ercting a 4-room school is reported to have been awarded to P. H. Harrington, of Graniteville, at $12,1...

Pittsfield, Mass.—Both boards of the City Government adopted in concurrence Sept. 23 the order appropriating $6,000 for the new Henry L. Dawes School off Elm St.

Greenfield, Mass.—Bids will be received until Oct. 2 by Sam'l. D. Conant, Chmn. Special Com., Bank Row, for erecting a 4-room brick school, including plumbing, ventilating and heating. Manvis R. Drew, Archt., Pond's Blk.

Salem, Mass.—Bids will be received until Oct. 3 by the Com. on New High School Bldg. (Thos. G. Pinnock, Chmn.) for erecting a High School; also installing a ventilating and heating system and electrical power plant for said school. Kilham & Hopkins, Archts., 9 Park St., Boston; Geo. Huey, Consulting Engr., 7 Water St., Boston.

**Faribault, Minn.*—M. C. Cutter, of St. Paul, Acting Secy. State Bd. of Control, writes that the contract for erecting dormitory at State School for Blind (bids opened Sept. 17) has been awarded to John P. O'Neil, of Faribault, for $22,984.

Magnolia, Miss.—Bids will be received until Oct. 15 by A. L. Lazar, Town Clk., for $25,000 school bonds.

Missoula, Mont.—M. R. Hardenburgh, Secy. High School Bd., writes that A. J. Gibson, of Missoula, is preparing plans for high school, to cost bet. $50,000 and $60,000.

Manchester, N. H.—It is reported that the State of New Hampshire proposes erecting at the State Industrial School at Manchester, a 4-story brick and stone dormitory 32x117 ft., to cost about $24,000.

**East Orange, N. J.*—The following are reported to be the bids opened on Sept. 9 for installing heating plant in the new Lincoln School: Storms & Co., Newark, $12,884, (awarded contract); J. H. Merritt Co., New York, N. Y., $13,563; Otis Eng. Co., New York, N. Y., $12,973, and Louis W. Butterfield, Orange, $13,580.

Montclair Heights, N. J.—The bids received Sept. 17 at Trenton for the erection of a boiler house nad the installation of a heating plant at the State Normal School at Montclair Heights are reported to have been as follows: Entire work, Storms & Co., of Newark, $42,624; Earl & Cook, of Newark, $42,600; Fredk. Kilgus, of Newark, $42,600. Heating plant only—E. Rutzler Co., New York, N. Y., $37,500; Baker & Smith, of New York, N. Y., $38,133; Geo. J. Tobin, of, Plainfield, $39,157.

Paterson, N. J.—The Prospect Park Bd. of Educ. is said to be considering the erection of a school, to cost about $25,000.

Metuchen, N. J.—Bids will be received until Oct. 17 by the Bd. Educ. (R. Bruce Crowell, Clk.) for erecting an 11-room brick school. Walker & Morris, Archts., 36 E. 22d St.

New Brunswick, N. J.—The Trus. of Rutgers College, it is stated, are considering plans for an engineering building, which it is proposed erecting at a cost of about $50,000.

Dunkirk, N. Y.—The Bd. of Educ. is stated to have approved the plans prepared by H. P. Beebe, of Fredonia, for a school estimated to cost $13,000.

*Items marked thus give the names of parties awarded contracts.

New York, N. Y.—Plans have been filed for a 4-story brick and stone law building for Columbia College; cost $400,000. McKim, Mead & White, Archts., 160 5th Ave.

Bay Shore, L. I., N. Y.—The citizens, it is stated, have voted in favor of issuing $25,000 bonds to erect a 2-story addition to the school.

**New York, N. Y.*—Bids were opened on Sept. 23 by C. B. J. Snyder, Supt. School Bldg., for completing and finishing the ventilating and heating apparatus for additions to and alterations in (*a*) School 109, Brooklyn Boro. (*b*) School 151, Brooklyn Boro, and (*c*) installing ventilating and heating in School 91, Manhattan Boro: The W. R. Bracken Co., *a* $18,500; Wm. J. Olvany, *a* $20,658, *b* $5,784, *c* $58,755; Blake & Williams, 210 W. 20th St., N. Y. City, *a* $20,517, *c* $50,983 (awarded contract); Frank Dobson Co., Inc., *a* $21,250, *b* $9,992, *c* $52,612; Hopkins-Jordan Co., *a* $19,500, *b* $6,400; Gillis & Geoghegan, 537 W. Bway., N. Y. City, *a* $20,490, *b* $5,675 (awarded contract); E. Rutzler Co., *c* $51,134; A. G. Suter & Co., *c* $51,825; Jas. Curran Mfg. Co., *c* $53,783.

Gastonia, N. C.—See "Water."

**Kenmare, N. D.*—Frost & Hosmer, Archts., Minot, write that the contract for plumbing and heating the high school (bids opened Sept. 10) has been awarded to the Kenmare Htg. & Plumbing Co., of Kenmare, for $6,439.

University, N. D.—Bids will be received until Oct. 1 by J. W. Wilkerson, Secy. Bd. Trus. Univ. of North Dakota, for installing the sewerage, plumbing and heating systems for the School of Mines.

**Valley City, N. D.*—W. T. Craswell, Clk. Bd. of Educ., writes that the contract for constructing superstructure of school to replace one recently destroyed (bids opened Sept. 17) has been awarded to Wm. Reid, of Valley City, for $14,937.

Cincinnati, O.—Bids will be received until Oct. 14 by the Bd. Educ. (S. B. Marvin, Pres.) for $250,000 bonds, issued for the purpose of obtaining and improving public school property.

**Harrisburg, Pa.*—W. S. Roebuck is reported to have secured the contract to erect the Vernon School (bids for which were received Sept. 3), at $39,850.

Hays, Pa.—The citizens are stated to have approved the issue of $10,000 bonds to erect a school.

Pittsburg, Pa.—It is stated that plans have been completed for a 12-room brick and stone school, to be erected for the Roman Catholic Church of St. Mary of the Mount, at Mt. Washington. It is to cost about $65,000. It is stated that an addition of 18 rooms is to be added to the Belmar sub-district school at a cost of about $100,000.

Indiana, Pa.—Plans and specifications will be received until Oct. 15 by the School Bd. (Oliver Fry, Secy.) for a 2-story school to contain 16 school rooms, an assembly hall, library and teachers' room. Cost of building completed, including heating, plumbing and electric wiring, not to exceed $65,000.

Allegheny, Pa.—C. M. Bartherger, Westinghouse Bldg., Pittsburg, is stated to be the archt. engaged to prepare plans for the school in the 10th Ward, which is to cost about $120,000.

Milton, Pa.—It is reported that the building of a high school is under consideration.

New Castle, Pa.—The plans of W. G. Eckles, Mill and Washington Sts., which have been accepted for the high school, provide for a 3-story structure.

Latta, S. C.—A. S. Manning, Chmn. Bd. School Trus., writes that all bids opened on Sept. 24 for the erection of a high school have been rejected, and new bids will be received after specifications are slightly altered.

Woodruff, S. C.—Bids will be received until Nov. 4 by the Bd. Trus. School Dist. No. 33 (E. F. Pearson, Chmn.) for $15,000 bonds, issued for the purpose of erecting and equipping a school. Simpson & Bomar, Attys., Spartanburg, S. C.

Woonsocket, S. D.—It is stated that a site has been secured and on which it is proposed erecting a Roman Catholic College, to cost about $100,000.

Nashville, Tenn.—A permit has been asked for the Marcus M. Ross School, to be erected on Grove St., of brick, and cost about $17,000.

Laredo, Tex.—The citizens are reported to have voted to issue $40,000 bonds for the erection of a school house.

Norfolk, Va.—The School Bd., according to reports, has decided to ask the City Council to appropriate $20,000 to erect an 8-room annex to the Berkeley School.

Seattle, Wash.—The Bd. of Regents, it is stated, has approved the plans of Howard & Galloway for the engineering, chemistry and auditorium buildings which are to be erected on the campus, and has authorized the archts. to receive bids for the construction of said buildings.

Edgerton, Wis.—It is stated that plans have been submitted for a high school which is to be erected in this city, at a cost of $40,000, to be presented to the city by Miss Florence Child.

Milwaukee, Wis.—The Bd. of Regents, it is stated, has decided upon a site on Eldred St., on which it is proposed erecting the $225,000 normal school. The archt. has been directed to complete the plans as soon as possible so as to let the contract for the construction immediately.

**Rapid River, Wis.*—The contract to erect the high school is reported to have been awarded to T. M. Solar, of Antigo, at $20,855, exclusive of heating and plumbing. Other bids received are stated to have been as follows: A. P. Wilson, Marquette, $22,968; John A. Lindsay, Escanaba, $24,050; O. G. Brubaker, Sault Ste. Marie, $24,100, and Lipsett & Sinclair, of Marquette, $29,833.

Dundas, Ont.—The issuing of $25,000 bonds to erect a school is reported under consideration.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

San Diego, Cal.—Plans are reported to have been completed for a laundry building to be erected by Nelson Snyder, of the Electric Laundry Co., on I and 15th Sts. It will be 100x140 ft., 1 story high and of pressed brick and will be equipped with improved models of machinery which, together with the structure, will cost about $50,000.

Pueblo, Colo.—Geo. Roe, of Pueblo, is reported to be preparing plans for improvements and additions to Walter Brewery, which will cost about $25,000.

Manchester, Ga.—Fuller E. Callaway, C. V. Truitt and Roy Dallas, all of La Grange, are reported interested in the construction of a cotton mill at Manchester, to cost about $500,000.

Chicago, Ill.—Oscar Heineman, mfr. of silks, located in the Occidental Bldg., is reported to have purchased a site on Armitage, Fairfield and Wastenaw Aves., and will erect a 3-story building to be used for spinning and weaving silks; the new plant will cost $135,000. Architect, Paul Gerhardt, Schiller Bldg.

Plans are being prepared for a plant to be built for Stein, Hirsch & Co. on south branch of river, north of Archer Ave. It will comprise 6 buildings ranging in height from 1 to 4 stories. The exterior will be constructed of brick on concrete foundations; cost estimated at $200,000. Nimmons & Fellows, 204 Dearborn Bldg., Archts.

Logansport, Ind.—The Directors of the Logansport Industrial Assoc. are reported to have secured a site upon which to erect a radiator factory.

Elkhart, Ind.—The Sheemaker Automobile Co., of Freeport, Ill., is reported to have decided to establish and equip with new machinery an automobile factory on N. Main and Simonton Sts. Dr. C. M. Eisenbeiss is reported interested.

Sioux City, Ia.—The Inter State Brewing Co. will construct a new brewery, to cost about $150,000. Ground is now being graded and construction work will begin about Oct. 1st. Frank Kruger, Pres.; H. A. Knepper, Secy.

Berlin, Md.—See "Power Plants, Gas and Electricity."

Columbia, Miss.—See "Power Plants, Gas and Electricity."

Weston, Mo.—County Surveyor Virgil H. Elliston is reported to have completed surveys for the plant of the Missouri Portland Cement Co. of Kansas City. This company purposes establishing a cement plant about 4 miles north of Weston on the lines of the Rock Island and Burlington Railroads, with a daily capacity of 1,000 bbls. T. J. Benkendorf, 919 Ridenbaugh St., Kansas City, Pres.; H. W. McNutt, of St. Joseph, Sec. and Treas. Freeborn Eng. & Constr. Co., of Kansas City, Mo., Consulting Engrs.

Niagara Falls, N. Y.—The Niagara Pulp Board Co. is reported to have applied to the Bd. of Pub. Wks. for a permit to erect a plant on 3d St., to cost about $57,000. Col. Chas. B. Gaskill is reported interested.

Cuyahoga Falls, O.—The plant of the Hollow Stay Bolt Co. is reported to have been burned on Sept. 13 and will be rebuilt at once.

Hillsboro, Tex.—It is reported that the sum of $75,000 is to be expended at once by the directors of the Hillsboro Cotton Mill Co. in enlarging the main building and making needed improvements.

Roanoke, Va.—The Roanoke Enameling & Stamping Co. will soon let contracts for erecting its plant.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Las Animas, Colo.—See "Power Plants, Gas and Electricity."

**Oak Park, Ill.*—The contract for building garbage crematory in Oak Park is reported to have been awarded by the Village Trus. to Lewis & Kitchen, of Chicago. The structure is to be chiefly of fire brick and will be built on North Boule., near Euclid Ave.

Cambridge, Mass.—Geo. E. Clukas, Supt. of Streets, writes that all bids opened on Sept. 4 for the construction of garbage incinerator have been rejected and new bids will be received on Oct. 7.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Col. E. L. Russell, Vice-Pres. of the Mobile & Ohio R. R. Co., is reported to have announced that improvements are contemplated by his company on the river front north of St. Anthony St., and include the building of a bulkhead, 1,000 ft. long, with docks upon which will be laid tracks sufficient to hold 100 freight cars. The work will be stated as soon as preliminary plans are completed, and the total cost will be about $200,000.

Bids will be received at the office of Maj. H. Jervey, Corps. Engrs., U. S. A., until Nov. 25 for building locks and dams Nos. 14 and 15, Black Warrior River, Ala., and lock tenders' houses, as advertised in The Engineering Record.

Wilmington, Del.—Bids will be received by Maj. C. A. F. Flagler, Corps. Engrs., U. S. A., until Oct. 21 for dredging new entrance to Broadkill River, Del., as advertised in The Engineering Record.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 1 to furnish at the navy yards and naval stations the following supplies: Portsmouth, N. H.: Sch. 291—Profiling machine. Sch. 320—Beach, oak. Boston, Mass.: Sch. 318—Damp proof wire, interior fittings, switches, steel enameled conduit fittings. Sch. 319—Copper rivets, etc., copper wire brass hinges. Sch. 320—Maple, mahogany lignumvitæ. Sch. 321—Sheet brass and copper rolled bronze. Sch. 323—Copper pipe, brass and iron pipe fittings. New York, N. Y., etc.: Sch. 291—Engine lathes, boring mill, horing and drilling and milling machines, Universal shaper. Sch. 314—Incandescent lamps arc, electric wire, dry batteries, electrical supplies. Sch. 316—Brass and iron pipe. Sch. 320—Spruce, cypress, white and yellow pine. Sch. 321—Bar and pig iron, galvanized sheet steel, sheet zinc. Sch. 323—Brass and copper pipe, hose pipes, valves, brass and iron pipe fittings. Puget Sound, Wash.: Sch. 329—Fir, lumber. Sch. 333—Galvanized iron plates, Scotch pig iron, galvanized sheet steel. Mare Island, Cal.: Sch. 329—Galvanized sheet steel. Sch. 330—Power press. Sch. 333—Galvanized corrugated iron, mild and tool steel. Washington, D. C.: Sch. 315—Recoil cylinders, nickel steel, steel forgings, steel drill rod, machine steel. Sch. 321—Steel drill rod, spring steel. Naval Academy, Annapolis, Md.: Sch. 317—Tram cars, track, etc. Norfolk, Va.: Sch. 290—Nut facing machine. Sch. 318—Bells and buzzers, plugs, signal and deck lanterns, etc., glass tube fuses, switch handles, link fuses. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

Savannah, Ga.—The Cranger-Lewis Lumber Co. proposes constructing slip, wharf and terminals at this port, at cost of about $25,000.

Centerville Station, Ill.—It is stated that bids will be received by the Centerville Station Bd. until Oct. 5 for constructing ditch to drain Pittsburg Lake.

Chicago, Ill.—Bids will be received until Oct. 3 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and constructing a chimney for the boilers at the 95th St. sewage pumping station, 95th St. and Erie Ave.

**Great Lakes, North Chicago, Ill.*—The Bureau of Navigation, Navy Dept., Washington, D. C., is reported to have awarded contract for furnishing material and grading at the naval training station, Great Lakes, North Chicago, to the Edwards Bros. Dredging Co., Sault Ste. Marie, Mich., at 81 cts. per cu. yd., same for all excavating or filling necessary.

Indianapolis, Ind.—It is reported that bids will be received until Oct. 5 by the Bd. Co. Comrs. for constructing culverts as follows: West Newton Rd., Decatur Township; Auugsta Rd., Pike Township; on road in n. w. quarter Sec. 18, Wayne Township; on south line of Sec. 21, Decatur Township, and over Big Run, east line of Sec. 10, Lawrence Township. C. J. Clark, Co. Aud.

**Portland, Ind.*—Philip Bergman, Drainage Comr., is reported to have awarded to John Boyd a contract for the construction of the Goshen ditch for $3,895.

Crawfordsville, Ind.—The Comrs. of Montgomery Co. will soon ask for bids for the construction of a large ditch known as the Joseph H. Gray ditch.

New Orleans, La.—Local press reports state that the following bids were opened on Sept. 10 at the office of Capt. J. F. McIndoe, Corps Engrs., U. S. A., Custom House, New Orleans, for dredging in Southwest Pass, Mississippi River: The Bowers Southern Dredging Co. (R. F. Clark, Pres., Galveston, Tex.), $475,000, work to be completed in 200 days; the North American Dredging Co., New Orleans, $557,320, 16 mos.; John Anderson, Gulfport, Miss., $679,208, 14 mos.; and the Atlantic, Gulf and Pacific Co., of New York, N. Y., $543,360, 20 mos.

Bids will be received until Oct. 22 by Jas. S. Brady, Chmn. Executive Com., joint organization of the Atchafalaya Basin and Lafourche Levee Dists., for the construction of the Cancienne Canal in the Parish of Assumption, to be about 8,500 ft. long and requiring about 250,000 cu. yds. excav.

At a meeting of the New Orleans Levee Bd., on Sept. 19, it was decided to procure bids for building levees in the 3d dist., one from Louisa to Desire St., at a cost of about $40,000, and the other from Mazant to Poland St., to cost about $75,000. The Engineer also recommended that arrangements be made for filling all low places along the commercial front at a cost of about $25,000.

*A. B. Calbriac is reported to have, on Sept. 10, secured the contract for constructing the new Couret Pl. levee, for about $25,000.

*W. B. Borne is reported to have secured the contract for enlarging and revetting the levee in the 5th Dist. Algiers (bids opened by the Levee Board on Sept. 11), at $61.75 per M. ft., for creosoted lumber, and 43 cts. per cu. yd. for earthwork in place, and $45.50 per M. ft. for cypress lumber.

All bids opened on Sept. 6 by Capt. G. M. Hoffman, Corps Engrs., U. S. A., for furnishing 9,000 tons of rock for New Orleans harbor have been recommended for rejection.

Bids will be received by Col. E. H. Ruffner, Corps Engrs., U. S. A., New Orleans, until Nov. 20 for a wooden hull, combined hydraulic dredge and snagboat, as advertised in The Engineering Record.

Indiana Head, Md.—See "Public Buildings."

**Saginaw, Mich.*—David C. Bell, City Clk., writes that the contract for excavating Rust Lake channel, connecting same with Saginaw River, Wright Bayou and river front, and filling the Rust Park property complete; approximate quantity to be excavated is about 600,000 cu. yd. (Bids opened Sept. 23 by the Bd. of Park & Cemetery Comrs.) has been awarded to H. W. Hubbell & Co., of Saginaw, for $96,525.

Tacoma, Wash.—The following are the bids opened on Sept. 2 by Maj. H. M. Chittenden, Corps Engrs., U. S. A., 602 Burke Bldg., Seattle, for dredging and bulkheading at Tacoma Harbor: (*a*) North American Dredging Co., San Francisco, Cal.; (*b*) Puget Sound Bridge & Dredging Co., Seattle. (*c*) Richmond Dredging Co., San Francisco, Cal.; (*d*) International Contract Co., Seattle; (*e*) Pacific Coast Dredging & Reclamation Co., San Francisco, Cal.; (*f*) A. W. Tweeden & Co., Tacoma.

	a	*b*	*c*	*d*	*e*	*f*
2,400,000 cu. yds. dredging	$.11988	$.099	$.1247	$.129	$.1475	$.08
170,000 lin. ft. piling	.185	.1716	.20	.19	.17	.14
610 M. ft. timber	25.00	31.20	24.00	35.00	24.45	19.00
8,000 cords brush	3.25	2.95	3.40	3.00	3.00	2.40
28,000 cu. yds. stone	2.25	2.15	2.40	2.00	2.55	1.98

*Items marked thus give the names of parties awarded contracts.

**Thief River Falls Minn.*—Arpin Bros., of Thief River Falls, are reported to have secured a contract for building drainage ditches 47 in Marshall County and 48, 49 and 50 in Kittson County, for about $30,000.

**Vicksburg, Miss.*—The contract for furnishing about 15,000 tons rock along Mississippi River (bids opened Sept. 6 by Capt. G. M. Hoffman, Corps. Engrs., U. S. A., New Orleans, La.) has been recommended for award to Guy Dickinson, of Little Rock, Ark., at $1 per ton on cars at Little Rock.

Jefferson City, Mo.—The Bd. to Survey the St. Francois River basin, under provisions of an enactment of recent session of General Assembly, which appropriated $10,000 for the work, has been appointed, including D. B. Panky, of Kennett; A. H. Carter, of Dexter, and W. H. Meredith, of Poplar Bluff.

Roswell, N. M.—Arthur J. Stevens, Lock Box 45, Secy. Com. of City Council, writes that the contract for 8,000 ft. concrete ditch in Roswell (bids opened Sept. 18) was not awarded because of no reasonable bids, and the work will be done by the committee.

**Astoria, L. I., N. Y.*—The following are the bids opened on Sept. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for the general construction, etc., of a grand stand, to be placed on Athletic field at Munson and Orchard Sts. and the East River, Astoria, Boro. of Queens. Wm. Werner, $32,090; J. & L. Moreland Co., $32,382, and Laurence J. Rice, 5 E. 42d St., New York City $31,475 (awarded contract.)

New York, N. Y.—Bids will be received by the Park Bd. (Moses Herrmann, Pres.) until Oct. 3 for furnishing material and constructing a stone wall, surmounted by an iron fence, in the Botanical Garden, in Bronx Park, City of New York.

Bids will be received by John W. Brannan, Pres. Bd. Trus. Bellevue and Allied Hospitals, until Oct. 7, for material and constructing a tunnel connecting Training School for Women Nurses with Pavilions A and B of New Bellevue Hospital, situated under 26th St. E. of 1st Ave., Boro. Manhattan.

Toledo, O.—It is stated that bids will be received by the Co. Aud. until Oct. 7 for constructing riprap stone wall.

Lima, O.—The Ohio Oil Co. (Standard) is reported to be considering the construction of a pumping station north of the village of Moranville, to cost about $100,000.

Panama.—Bids will be received at the office of H. F. Hodges, Gen. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Oct. 21 for pumps, monitor nozzle, truck wheels and rockers for engines, shower heads, stopcocks, lead pipe, soil pipe and fittings, etc., as advertised in The Engineering Record.

Providence, R. I. The Common Council on Sept. 16 adopted a resolution to construct a tunnel from N. Main to Thayer St. under College Hill and to south of the north line to Waterman St.

**Richmond, Va.* The contract for the erection of the Smyth Brothers-McCleary-McClellan Stock Yards is reported to have been awarded on Sept. 17 to J. T. Wilson, of Richmond. The main building will be 640x280 ft. and is to be completed by Feb. 1. Contract price, $75,000.

Seattle, Wash.—Maj. H. M. Chittenden, Corps. Engrs., U. S. A., writes that the Puget Sound Bridge & Dredging Co., of Seattle, bid on Sept. 5 for dredging Snohomish Slough, about 250,000 cu. yds., 18.7 cts. per cu. yd.

Lion's Head, Ont.—Bids will be received until Oct. 18 by Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, for constructing an extension to the wharf at Lion's Head. J. G. Sing, Resident Engr., Confederation Life Bldg., Toronto.

PROPOSALS OPEN.

For Proposals see pages 66, 67 and 68.

WATER.

Bids Close.		See Eng. Record.
Oct. 1.	Mains, Harrison, N. J.	Sep. 14
Oct. 1.	Valves, etc., Garnett, Kan.	Sep. 21
Oct. 1.	Tower and tank, Fairfax, Minn.	Sep. 28
Oct. 1.	Improv., Lenoir, N. C.	Sep. 28
Oct. 5.	Main, Seattle, Wash.	Sep. 28
Oct. 5.	Pump machinery, Kewanee, Ill.	Sep. 21
Oct. 7.	Reservoir, etc., Canon City, Colo. Adv. Sept. 21.	Sep. 21
Oct. 7.	Machinery, Los Angeles, Cal.	Sep. 14
Oct. 7.	System, Newton, Miss.	Sep. 28
Oct. 9.	Pump house, Ft. Caswell, N. C. Adv. Sep. 14 to 28.	Sep. 14
Oct. 9.	Plant, Fargo, N. D.	Sep. 28
Oct. 10.	Water works, Pringhar, Ia.	Sep. 21
Oct. 10.	Water improv., Ft. Du Pont, Del. Adv. Sep. 14 to 28.	Sep. 14
Oct. 14.	Pipe, etc., Ashland, O.	Sep. 21
Oct. 23.	Filters, Atlanta, Ga. Adv. Sep. 14 to 28.	Sep. 14
Nov. 4.	Water wks., Tucson, Ariz. Adv. Sep. 28.	Sep. 28
Dec. 1.	Water wks., Shelley, Idaho.	Sep. 28
———	Extension to water system, Fairhaven, Vt.	Sep. 14
———	Attention to Contractors, New York, N. Y. Adv. Sep. 28.	Sep. 28
———	Water wks., Slocomb, Ala.	Sep. 28

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Oct. 1.	Billings, Mont.	Sep. 7
Oct. 1.	Paducah, Ky. Adv. Sep. 7 to 21.	Sep. 7
Oct. 1.	Cadillac, Mich.	Sep. 14
Oct. 1.	Newark, N. Y.	Sep. 14
Oct. 1.	Youngstown, O.	Sep. 21
Oct. 1.	New York, N. Y.	Sep. 21
Oct. 1.	Cohoes, N. Y.	Sep. 21
Oct. 1.	University, N. D.	Sep. 28
Oct. 1.	Trenton, N. J.	Sep. 28
Oct. 1.	Lenoir, N. C.	Sep. 28
Oct. 1.	Lemars, Ia.	Sep. 28
Oct. 2.	Salem, Mass.	Sep. 21
Oct. 2.	Leipsic, O.	Sep. 28
Oct. 2.	Mingo Junction, O.	Sep. 28
Oct. 3.	Ft. Dade, Fla.	Sep. 14
Oct. 3.	Jasper, Ala.	Sep. 21
Oct. 3.	Braddock, Pa.	Sep. 28
Oct. 3.	Berwyn, Ill.	Sep. 28
Oct. 3.	Chicago, Ill.	Sep. 28
Oct. 4.	Columbus, O.	Sep. 28
Oct. 5.	Bisbee, Ariz.	Sep. 28
Oct. 5.	Seattle, Wash.	Sep. 28
Oct. 5.	Englewood, N. J. Adv. Sep. 28.	Sep. 28
Oct. 7.	Indianapolis, Ind.	Sep. 28
Oct. 8.	New Brighton, S. I., N. Y.	Sep. —
Oct. 10.	Ft. Du Pont, Del. Adv. Sep. 14 to 28.	Sep. 14
Oct. 11.	Aurora, Ind.	Sep. 28
Oct. 12.	Seattle, Wash.	Sep. 21
Oct. 14.	Carthage, Mo. Adv. Sep. 21 to, 28.	Sep. 21
Oct. 14.	Stubenville, O. Adv. Sept. 28.	Sep. 28
Oct. 15.	Chattanooga, Tenn. Adv. Sep. 28.	Sep. 28
Oct. 23.	Whiterocks, Utah.	Sep. 28
Oct. —.	Eaton, O.	Aug. 3

BRIDGES.

Bids Close.		See Eng. Record.
Oct. 1.	Spring Valley, Ill.	Sep. 28
Oct. 2.	Jefferson, O.	Sep. 21
Oct. 3.	Fergus Falls, Minn.	Sep. 14
Oct. 3.	New York, N. Y.	Sep. 28
Oct. 3.	Evansville, Ind.	Sep. 28
Oct. 5.	Crawfordsville, Ind.	Sep. 21
Oct. 7.	Vicksburg, Miss.	Sep. 21
Oct. 7.	Atchison, Kan.	Sep. 21
Oct. 7.	St. Clairsville, O.	Sep. 21
Oct. 7.	Salem, Ind.	Sep. 21
Oct. 7.	Fremont, O.	Sep. 28
Oct. 7.	Eureka, Kan.	Sep. 28
Oct. 7.	Tipton, Ind.	Sep. 28
Oct. 7.	Atchison, Kan.	Sep. 28
Oct. 8.	Delphi, Ind.	Sep. 21
Oct. 8.	Hamilton, O.	Sep. 28
Oct. 8.	Jersey Shore, Pa.	Sep. 28
Oct. 12.	Xenia, O.	Sep. 21
Oct. 14.	Los Angeles, Cal. Adv. Sep. 7, 14.	Sep. 7
Oct. 14.	Fredericton, N. B.	Sep. 14
Oct. 14.	Bellefontaine, O.	Sep. 21
Oct. 14.	Hammond, Ind.	Sep. 28
Oct. 14.	Toledo, O.	Sep. 28
Oct. 15.	Erie, Kan.	Sep. 28
Oct. 19.	Canton, China. Adv. Aug. 24 to Sep. 7.	Aug. 24
Oct. 24.	Panama. Adv. Sep. 28.	Sep. 28
Nov. 15.	Glendive, Mont. Adv. Sep. 28.	Sep. 28

PAVING AND ROAD MAKING.

Bids Close.		See Eng. Record.
Oct. 1.	Billings, Mont. (2 props.) Adv. Sep. 7 to 21.	Sep. 7
Oct. 1.	Durham, N. C. Adv. Sep. 21, 28.	Sep. 14
Oct. 1.	Ft. Sam Houston, Tex.	Sep. 21
Oct. 1.	Ft. Adams, R. I.	Sep. 21
Oct. 1.	Harrison, N. J.	Sep. 21
Oct. 1.	Provincetown, Mass.	Sep. 28
Oct. 1.	Lenoir, N. C.	Sep. 28
Oct. 1.	Davenport, Ia.	Sep. 28
Oct. 1.	Belleville, N. J.	Sep. 28
Oct. 1.	Boston, Mass.	Sep. 28
Oct. 2.	Spencer, Ind.	Sep. 21
Oct. 2.	Brooklyn, N. Y.	Sep. 21
Oct. 2.	Chicago, Ill.	Sep. 28
Oct. 2.	Haledon, N. J.	Sep. 28
Oct. 2.	Westfield, Mass.	Sep. 28
Oct. 2.	Ottawa, Ont.	Sep. 28
Oct. 3.	Brooklyn, N. Y.	Sep. 21
Oct. 3.	Harrisburg, Pa.	Sep. 21
Oct. 3.	Philadelphia, Pa.	Sep. 28
Oct. 5.	Cleveland, O.	Sep. 21
Oct. 5.	Seattle, Wash.	Sep. 28
Oct. 5.	Gary, Ind.	Sep. 28
Oct. 7.	Hartford City, Ind.	Sep. 14
Oct. 7.	Decatur, Ind.	Sep. 14
Oct. 7.	Kenosha, Wis.	Sep. 21
Oct. 7.	Salem, Ind.	Sep. 21
Oct. 7.	Hartford, Conn. Adv. Sep. 28.	Sep. 28
Oct. 8.	Vincennes, Ind.	Sep. 14
Oct. 8.	Crawfordsville, Ind.	Sep. 21
Oct. 8.	St. Louis, Mo.	Sep. 21
Oct. 8.	Monticello, Ind.	Sep. 28
Oct. 8.	Covington, Ind.	Sep. 28
Oct. 8.	W. New Brighton, N. Y.	Sep. 28
Oct. 8.	Portland, Ind.	Sep. 28
Oct. 8.	Rockville, Ind.	Sep. 28
Oct. 8.	Martinsville, Ind.	Sep. 28
Oct. 8.	Palatka, Fla.	Sep. 28
Oct. 8.	New Brighton, S. I., N. Y.	Sep. 28
Oct. 9.	Bluffton, Ind.	Sep. 28
Oct. 9.	Brooklyn, N. Y.	Sep. 28
Oct. 10.	Uniontown, Pa.	Sep. 28
Oct. 12.	Riverton, Ala. Adv. Sep. 14, 21.	Sep. 14
Oct. 12.	Athens, Ala.	Sep. 21
Oct. 12.	Ft. Wayne, Ind.	Sep. 21
Oct. 14.	Sunman, Ind.	Sep. 14
Oct. 15.	Ocala, Fla.	Sep. 28
Oct. 15.	Wilmington, Del.	Sep. 28
Oct. 16.	Asphalt plant, Ottawa, Ont. Adv. Sept. 28.	Sep. 28
Oct. 21.	Logansport, Ind.	Sep. 21
Oct. 22.	Nampa, Idaho	Sep. 28
Oct. —.	Selma, Ala.	Sep. 7
Nov. 4.	Peru, Ind.	Sep. 28
Dec. 13.	Valparaiso, Ind.	Sep. 7
———	York, Pa.	Sep. 7

POWER PLANTS, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Sep. 30.	New London, Conn. Adv. Sep. 7 to 28.	Sep. 7
Sep. 30.	West Point, N. Y. Adv. Aug. 31, Sep. 7, 21, 28.	Aug. 31
Sep. 30.	Flushing, N. Y.	Sep. 21
Sep. 30.	New York, N. Y.	Sep. 21
Sep. 30.	Fremont, Neb.	Sep. 28
Oct. 1.	Winnipeg, Man. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 1.	Washington, D. C.	Sep. 28
Oct. 3.	Salem, Mass.	Sep. 28
Oct. 4.	Jacksonville, Fla.	Aug. 31
Oct. 5.	Crawfordsville, Ind.	Sep. 21
Oct. 14.	Panama. Adv. Sep. 21	Sep. 21
Oct. 15.	Savannah, Ga.	Sep. 21
Nov. 1.	Seymour, Ind.	Sep. 14
Nov. 9.	Las Animas, Colo.	Sep. 28
Nov. 15.	Charleston, S. C.	Sep. 14

BUILDINGS.

Bids Close.		See Eng. Record.
Sep. 30.	Pub. bldg., Long Island City, L. I.	Sep. 21
Sep. 30.	Hospital, Brooklyn, N. Y.	Sep. 21
Sep. 30.	School, Flushing, N. Y.	Sep. 21
Oct. 1.	Bus. bldg., Decatur, Ill.	Aug. 31
Oct. 1.	Pub. bldg., Eau Claire, Wis.	Aug. 31
Oct. 1.	Y. M. C. A., Indianapolis, Ind.	Aug. 31
Oct. 1.	Plumbg. pub. bldg., Portland, Me.	Sep. 7
Oct. 1.	Church, Indianapolis, Ind.	Sep. 7
Oct. 1.	Pub. bldg., Jefferson Barracks, Mo.	Sep. 21
Oct. 1.	Pub. bldg., Albion, N. Y. Sep. 21, 28.	Sep. 21
Oct. 1.	Boiler, etc., for prison, Newark, N. J.	Sep. 21
Oct. 1.	Church, Delphos, O.	Sep. 21
Oct. 1.	Pub. bldg., Indian Head, Md.	Sep. 28
Oct. 1.	Htg. school, University, N. D.	Sep. 28
Oct. 1.	School, Mobile, Ala.	Sep. 28
Oct. 1.	Church, Houston, Tex.	Sep. 28
Oct. 2.	Pub. bldg., Hamilton, Ga.	Sep. 21
Oct. 2.	School, Greenfield, Mass.	Sep. 28
Oct. 2.	Hospital, Ilion, N. Y.	Sep. 28
Oct. 3.	Court house plans, La Moure, N. D.	Aug. 10
Oct. 3.	School, Bayonne, N. J.	Sep. 7
Oct. 3.	School, Salem, Mass.	Sep. 28
Oct. 3.	Add. to jail, Liberty, Tex.	Sep. 28
Oct. 3.	School, Marianna, Fla.	Sep. 28
Oct. 3.	Post bldgs., Marion, Ind.	Sep. 28
Oct. 4.	Zoological bldg., Cleveland, O.	Sep. 28
Oct. 5.	Htg. Plant at Naval Station, New Orleans, La.	Sep. 7
Oct. 5.	School, Topeka, Kan.	Sep. 28
Oct. 7.	U. S. Post Office improv., Baltimore, Md. Adv. Aug. 31, Sep. 7.	Aug. 31
Oct. 7.	Pub. bldg., Ft. Slocum, N. Y. Adv. Sep. 21 to 28.	Sep. 14
Oct. 7.	Post hospital addition, Ft. Slocum, N. Y. Adv. Sep. 21, 28.	Sep. 21
Oct. 7.	New ind. plant, Los Angeles, Cal.	Sep. 21
Oct. 7.	Stokers for hospital, Massillon, O.	Sep. 21
Oct. 7.	Add. to pub. bldg., Philadelphia, Pa.	Sep. 28
Oct. 7.	Pub. bldg., New York, N. Y.	Sep. 28
Oct. 7.	Armory, New York, N. Y.	Sep. 28
Oct. 8.	Htg. pub. bldg., Buffalo, N. Y.	Sep. 28
Oct. 9.	Court house plans, La Moure, N. D.	Sep. 28
Oct. 10.	School, Mt. Healthy, O.	Sep. 21
Oct. 10.	Windows for Museum, Washington, D. C. Adv. Sep. 21, 28.	Sep. 21
Oct. 10.	Bus. bldg., Indianapolis, Ind.	Sep. 21
Oct. 12.	Hospital, Whipple Barracks, Ariz. Adv. Sep. 14 to 28.	Sep. 14
Oct. 12.	Bus. bldg., Covington, La.	Sep. 28
Oct. 14.	School, San Diego, Cal.	Sep. 14
Oct. 15.	School plans, Indiana, Pa.	Sep. 28
Oct. 15.	Court house plans, De Pere, Wis.	Aug. 17
Oct. 15.	School, Osceola, Ark.	Sep. 21
Oct. 15.	Court house, Youngstown, O.	Sep. 21
Oct. 15.	Post bldgs., Las Animas, Colo.	Sep. 28
Oct. 16.	Exten. post office, Springfield, O.	Sep. 14
Oct. 16.	Pub. bldg., Ashland, O.	Sep. 21
Oct. 16.	Library, Sheldon, Ia.	Sep. 28
Oct. 16.	Pub. bldgs., Polk, Pa.	Sep. 28
Oct. 17.	Pub. bldg., Peoria, Ill.	Sep. 7
Oct. 17.	Post bldg., Ft. McPherson, Ga.	Sep. 28
Oct. 17.	School, Metuchen, N. J.	Sep. 28
Oct. 18.	School, Montevallo, Ala.	Sep. 14
Oct. 18.	Exten. to post office, Denver, Colo.	Sep. 28
Oct. 21.	Pub. bldg., Milwaukee, Wis.	Sep. 21
Oct. 21.	Post office, Des Moines, Ia. Adv. Sep. 7, 14.	Sep. 7
Oct. 21.	Hospital, New Orleans, La.	Sep. 28
Oct. 30.	Jail, etc., Terre Haute, Ind.	Sep. 21
Oct. 30.	Post office, Atlanta, Ga.	Sep. 28
Nov. 4.	School, Woodruff, S. C.	Sep. 28
Nov. 5.	Court house plans, Houston, Tex. Adv. Sep. 14 to 28.	Aug. 31
Nov. 8.	Post bldgs., Ft. Lincoln, N. D. Adv. Sep. 28.	Sep. 28
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
Dec. —.	School, Anderson, Ind.	Sep. 28
Feb. 1.	Plans for Capitol, San Juan, P. R.	Sep. 28
———	School. bldg. material, Lawrence, Kan.	Aug. 31
———	Post office, Hamilton, O.	Sep. 14
———	Court house plans, Thomaston, Ga.	Sep. 28
———	Court house plans, Richmond, Tex.	Sep. 28

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Oct. 1.	Snag boat, Mobile, Ala. Adv. Sep. 7 to 28.	Sep. 7
Oct. 1.	Ditch, Onawa, Ia. Adv. Sep. 21, 28.	Sep. 21
Oct. 1.	Traveling crane, Indian Head, Md.	Sep. 28
Oct. 1.	Supplies, Washington, D. C.	Sep. 28
Oct. 2.	Walls, etc., for court house, Wilkes-barre, Pa.	Sep. 21
Oct. 3.	Jetty work, Cold Springs, N. J. Adv. Sep. 7 to 28.	Sep. 7
Oct. 3.	Wall, New York, N. Y.	Sep. 28
Oct. 3.	El. ry. wk., Boston, Mass.	Sep. 28
Oct. 3.	Chimney, Chicago, Ill.	Sep. 28
Oct. 5.	Lock and dam, Franklin, Ark. Adv. Aug. 10 to 31.	Aug. 10
Oct. 5.	Lock and dam, Mobile, Ala. Adv. Aug. 10 to Sep. 28.	Aug. 10
Oct. 5.	Supplies, Panama. Adv. Sep. 14	Sep. 14
Oct. 5.	Culvert, Indianapolis, Ind.	Sep. 28
Oct. 5.	Ditch, Centerville Station, Ill.	Sep. 28
Oct. 7.	Excav., Detroit, Mich. Adv. Aug. 31 to Sep. 14.	Aug. 31
Oct. 7.	Flagstaff, New Orleans, La.	Sep. 21
Oct. 7.	Tunnel, New York, N. Y.	Sep. 28
Oct. 7.	Garbage crematory, Cambridge, Mass.	Sep. 28
Oct. 7.	Riprap wall, Toledo, O.	Sep. 28
Oct. 8.	Dredging, Detroit, Mich. Adv. Aug. 31 to Sep. 14.	Aug. 31
Oct. 8.	Ditch, Muscatine, Ia.	Sep. 21
Oct. 9.	Dredging, Jacksonville, Fla. Adv. Sep. 14 to 28.	Sep. 14
Oct. 9.	Jetty work, Asbury Park, N. J.	Sep. 21
Oct. 10.	Canal wk., Peterboro, Ont.	Aug. 24
Oct. 10.	Rock removal, etc., Jacksonville, Fla. Adv. Sep. 14 to 28.	Sep. 14
Oct. 10.	Jetty work, Washington, D. C. Adv. Sep. 14 to 28.	Sep. 14
Oct. 12.	Riprap, Riverton, Ala. Adv. Sep. 14 to 28.	Sep. 14
Oct. 12.	Culvert, East Cleveland, O.	Sep. 21
Oct. 14.	Supplies, Panama. Adv. Sep. 21	Sep. 21
Oct. 15.	Cement, stone, etc., Honolulu, H. I. Adv. Aug. 31 to Sep. 21.	Aug. 31
Oct. 17.	Culvert, Ft. Logan H. Roots, Ark. Adv. Sep. 21 to Sep. 28.	Sep. 21
Oct. 17.	State canal wk., Albany, N. Y. Adv. Sep. 21, 28.	Sep. 21
Oct. 18.	Exten. to wharf, Lions Head, Ont.	Sep. 28
Oct. 19.	Trunk lockers, Washington, D. C. Adv. Sep. 21, 28.	Sep. 21
Oct. 21.	Dump scows, Louisville, Ky. Adv. Sep. 21, 28.	Sep. 21
Oct. 21.	Barges, Louisville, Ky. Adv. Sep. 21, 28.	Sep. 21
Oct. 21.	Dredging, Wilmington, Del. Adv. Sep. 28.	Sep. 28
Oct. 21.	Pumps, monitor, nozzle, etc., Panama. Adv. Sep. 28.	Sep. 28
Oct. 22.	Canal, New Orleans, La.	Sep. 28
Oct. 25.	Dredge, Charleston, S. C. Adv. Sep. 21, 28.	Sep. 21
Nov. 9.	Crematory, Las Animas, Colo.	Sep. 28
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28.	Sep. 28
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28.	Sep. 28

Items marked thus give the names of parties awarded contracts.

CURRENT NEWS SUPPLEMENT

OCTOBER 5, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York. Annual Convention, Atlantic City, N. J., Oct. 14-18.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

PERSONAL NOTES.

The statue shown in the accompanying illustration, printed here through the courtesy of the New York "Tribune," was erected to the memory of Major-General George Sears Greene by the State of New York. It stands on Culp's Hill at Gettysburg and marks the place where the thin line of troops of his brigade repulsed four attacks by three brigades of Lee's army on the evening of the second day of the great battle. It was this three hours of struggle in the evening of July 2 that saved the day for the Union army and prevented the capture of its ammunition train. The great soldier whose military genius is commemorated by the statue was over sixty years of age at the time. He had served in the regular army until 1836 and had there achieved high distinction as a civil engineer. When the civil war broke out he was chief engineer of the Croton water-works, but in spite of his age he enlisted in the volunteer army and served with great distinction. When hostilities ceased he again took up active professional work and for many years was engaged in consulting practice. He was president of the American Society of Civil Engineers for two years and was one of its most active members for a long period. Even after he had passed his ninetieth birthday he attended many of the regular meetings. An account of his career was published in this journal on Feb. 4, 1899. The statue was the work of R. H. Perry, and stands on a granite base 5 ft. square and 8 ft. high. On one side of the base is a large bronze plate bearing an inscription to General Greene and a statement of the part he played at Culp's Hill. The brigade under his command was made up of New York regiments exclusively, and it was largely on this account that Gov. Hughes took an important part in the ceremonies attending the dedication of the monument.

Mr. Gerard U. Matthes has resigned from the U. S. Reclamation Service to join the staff of Mr. Robert McF. Doble, consulting engineer of the Central Colorado Power Co., Colorado Springs, Colo.

Mr. F. J. Boland, city engineer of Hanford, Cal., has been appointed chief engineer of an electric railway line that is to be built in the vicinity of Hanford.

Mr. Oscar Edwards, city engineer of Roseburg, Wash., and county surveyor of Douglas County, in the same state, has been appointed city engineer of St. John, Wash.

Capt. George P. Howell and First Lieutenant John J. Kingman and Henry H. Roberts, Corps of Engineers, U. S. A., have been ordered to report for duty in the Philippines.

The State Railroad Commission of New Jersey recently appointed Mr. P. Boller, of East Orange, N. J., as civil engineer of the commission, and retained the firm of Boller & Hodge as consulting engineers.

The following city officials of Baltimore, Md., were recently reappointed: Benjamin T. Fendall, city engineer; Alfred M. Quick, water engineer and president of the Water Board; Oscar F. Lackey, harbor engineer and president of the Harbor Board.

Gen. James H. Lane, professor emeritus of civil engineering at the Alabama Polytechnic Institute, died at Auburn, Ala., recently. He was well known in the South as an educator, having been associated with various Southern colleges since the civil war, in which he served in the confederate army.

STATUE OF GENERAL GEORGE SEARS GREENE AT CULP'S HILL, GETTYSBURG.

Mr. Samuel Whinery, consulting engineer, New York City, has been engaged by the finance commission of Boston, Mass., to investigate the problem of street paving in that city.

Civil Engineer U. S. G. White, U. S. N., has been detached from the Naval Academy, Annapolis, Md., and transferred to the Bureau of Yards and Docks, Navy Department, Washington, D. C.

Mr. J. V. Nimmo has resigned as chief engineer of the New Canadian Co., Ltd., and the Atlantic, Quebec & Western Ry., and his duties have been taken up temporarily by Mr. W. Lyon Browne.

Mr. Robley A. Warner, superintendent of Health and Drainage of Lower Merion Township, Montgomery County, Pa., has been directed by the Board of Commissioners of that township to investigate the problem of garbage and ashes collecton in the township and report at the October meeting with such recommendations as he may deem advisable.

George Lewis Heins, State Architect of New York, died at his home at Lake Mohegan, Sept. 25, aged 47 years. Mr. Heine was one of the best-known architects in the United States. He was appointed State Architect by Theodore Roosevelt in 1899, and designed all the

State buildings erected since that time. Several years ago he made an extensive study of cathedrals in foreign countries, and was one of the leading authorities on church architecture in the world, the firm of Heins & La Farge having designed the Cathedral of St. John the Divine and other important church buildings. He also designed the buildings in the New York Zoological Gardens and was consulting architect for the Rapid Transit Commission.

Mr. A. A. Knudson, of New York, N. Y., has been appointed as expert in connection with the litigation between the Toronto Street Railway Co. and the Toronto Gas Co. Associated with Mr. Knudson are Mr. W. E. Foss, electrical engineer, of Boston, Mass., and Mr. C. I. Anderson, consulting engineer, of Franklin, Ohio.

Maj.-Gen. Sir John Charles Ardagh, ex-director of military intelligence of the British War Office, died Oct. [illegible] at Carnarvon, Wales. He entered the Royal Engineers as a lieutenant in 1850, much of his service was in the engineering department. He was at one time commandant of the School of Military Engineering. He was a delegate to the peace conference at The Hague in 1890, and was appointed a member of the Permanent Court of Arbitration, which was formed at The Hague as a result of the conference of 1899.

BUSINESS NOTES.

Owing to the rapid growth of its business The Pittsburg Automatic Vise & Tool Co., Pittsburg, has found it necessary to subdivide its sales department, and Mr. E. W. Buechling, who has had extensive selling experience in addition to a thorough practical training in the machine shop, has been appointed to the new position of assistant manager of sales.

The Standard Roller Bearing Co., Philadelphia, has increased its capital from $3,500,000 to $5,000,000. The plant and equipment for the manufacture of roller bearings for shafting hangers are being largely increased, and a new department is being established for producing roller bearings for trolley cars.

The Hilles & Jones Co., Wilmington, Del., has taken steps toward the electrification of its entire works, in anticipation of the equipment with electric motors of the new machine shops recently completed. The following Allis-Chalmers type N direct current shunt wound motors will be installed: One 140 h.-p. motor for 300 r. p. m., three 30 h.-p. motors for 575 r. p. m., two 15 h.-p. motors for 425 r. p. m., three 10 h.-p. motors for 475 r. p. m., and one 10 h.-p. motor for 475-900 r. p. m.

The B. F. Sturtevant Co., through Mr. F. R. Chinnock of the electrical department of the New York office, reports the folowing sales of electric generating sets: Benj. Hutchings, Flatbush, Brooklyn, N. Y., one 9x8 vertical engine, 22½-kw. generator; David Rodgers Co., Paterson, N. J., one 13x12 horizontal engine, 50-kw. generator; International Paper Co., New York City, one 5x5 vertical engine, 6-kw. generator; Chas. E. Ring & Co., Brooklyn, N. Y., one 9x9 vertical engine, 30-kw. generator; Peter Hauck Brewing Co., Harrison, N. J., one 13x13 horizontal engine, 50-kw. generator; Chas. Hakemeyer Co., Paterson, N. J., one 17½-kw. generator, Bedford Reformatory for Women, Bedford, N. Y., one 13x13 horizontal engine, 50-kw. generator; Department of Docks & Ferries, New York City, ferry boat "New York," two 9x8 vertical engines, 30-kw. generators, ferry boat "Richmond," two 9x8 vertical engines, 30-kw. generators; ferry boat "Castleton," two 9x8 vertical engines, 30-kw. generators; ferry boat "Queens," two 9x8 vertical engines, 30-kw. generators; ferry boat "Middletown," two 9x8 vertical engines, 30-kw. generators; ferry boat "Gowanus," two 9x8 vertical engines, 30-kw. generators; ferry boat "Bay Ridge," two 9x8 vertical engines, 30-kw. generators; J. G. White & Co., New York City, two 3½x3 vertical engines, 3-kw. generators; American Sapphire Co., Colorado, one 7x7 vertical engine, 15-kw. generator; Chrome Steel Co., Chrome, N. J.; one 3½x3 vertical engine, 3-kw. generator, American Can Co., Lubeck, Me., one 13x13 horizontal engine, 50-kw. generator, one 10 h.-p. motor, one 15 h.-p. motor; Wm. Sheehan & Co., New York City, one 11x10 horizontal engine; H. Wales Lines Co., Meriden, Conn., one 11x10 horizontal engine, 30-kw. generator, one 7x7 vertical engine, 15-kw. generator, Peter Hauck Brewing Co., Newark, N. J., one 11x10 horizontal engine, 40-kw. generator; Jas. Shewan & Sons, New York City, four 7x7 vertical engines, 25-kw. generators, Vulcan Detinning Co., Sewaren, N. J., one 7x7 vertical engine; Tintern Manor Water Co., Redbank, N. J., one [illegible]x4½ vertical engine, 5-kw. generator, one 6x6 vertical engine, 7-kw. generator; Hudson Companies, York Street Operations, Jersey City, N. J., three 10 and 18x[illegible] vertical cross compound engines with 100-kw. generators, one 8 and 14x8 vertical engine, 50-kw. generator, two 8 and 14x8 vertical engines, 50-kw. generators, two 12x10 vertical engines, 50-kw. generators.

The Ransome Concrete Co., of California, announces the removal of its main office from 8th and Harrison sts. to the Crocker Building, San Francisco.

CONTRACTING NEWS
OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—Bids will be received by Robt. Craig, Supt. Water Wks., until Nov. 15, for water pipe, as advertised in The Engineering Record.

Santa Ana, Cal.—The Santa Ana Valley Irrig. Co. and the Anaheim Union Water Co. are reported to be considering the construction of a submerged dam in Santa Ana River.

Paonia, Colo.—E. P. Martin, of Paonia, Ch. Engr. Mt. Lamborn Canal & Reservoir Co., writes that the proposed work contemplated by this company will cost about $75,000. Bids will be received on Oct. 6 by C. C. Hawkins, Secy.

Grand Junction, Colo.—J. F. O'Malley, City Engr., writes that the City Council has passed on first reading an ordinace calling for an election on Nov. 2 to vote on issuing $400,000 bonds for the construction of a mountain water system to supply the city. John M. Conley, City Clk. J. R. Wentworth, Mayor.

**Idaho Springs, Colo.*—The city is reporte dto have contracted with Noxon & Wilkie for the construction of a reservoir on Chicago Creek, to cost about $20,000.

Wilmington, Del.—All bids which were received Sept. 30 by the Water Dept. for the construction of covered slow sand filters, consisting of 6 beds and a covered filtered water reservoir, with a capacity of 10,000,000 gals., together with appurtenances, have been returned to the bidders unopened, and it has been decided to indefinitely postpone the project. Theo. A. Leisen, Ch. Engr.

Canton, Ga.—See "Power Plants, Gas and Electricity."

Albany, Ga.—See "Sewerage and Sewage Disposal."

Dublin, Ga.—See "Power Plants, Gas and Electricity."

Washington, Ga.—The question of constructing a filter at the water works is reported under consideration.

Lewiston, Idaho.—The Citizens are reported to have voted on Sept. 21, to issue $57,300 bonds, to be used to extend and improve water system, preliminary to paving a large part of city.

Mt. Carroll, Ill.—It is reported that bids will be received until Oct. 15 by C. N. Freezer, Clk., for furnishing a water pump of about 1,500,000 gals. every 24 hours.

Wolcottville, Ind.—The citizens are reported to have voted to construct water works at a cost of $10,000.

Warsaw, Ind.—C. A. Riydon, Mayor, writes that Sol. C. Dickey, of Winona Lake, Ind., will construct a filtration plant here.

Lansing, Mich.—It is reported that C. D. Dodge, Supt. Water and Light Comn., has been authorized to purchase 100 water meters.

Coledonia, Minn.—See "Power Plants, Gas and Electricity."

Stillwater, Minn.—See "Sewerage and Sewage Disposal."

Bemidji, Minn.—Bids will be received by Thos. Malloy, City Clk., until 8 p. m., Oct. 7, for 100 water meters.

Jackson, Miss.—Bonds to the amount of $216,000 are reported sold, to be used for purchasing the present water system.

Beaver City, Neb.—Bids will be received by W. L. Leonard, City Clk., until Oct. 22 for the construction of a system of air pressure water works, as advertised in The Engineering Record.

Brooklyn, N. Y.—The Bd. of Aldermen on Oct. 1 authorized the issue of $3,000,000 corporate stock for the improvement of the water supply of Brooklyn.

Buffalo, N. Y.—Bids will be received until Oct. 10 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for four 600-h.-p. boilers for the pumping station, Bureau Water.

Bids are wanted until Oct. 15 for the sale and removal of 2 pumping engines, known as Engines Nos. 3 and 5, at the pumping station, Bureau Water. Henry L. Lyon, Deputy Water Comr.

**Rochester, N. Y.*—Whitmore, Rauber & Vicinus, 279 South Ave., is reported to have submitted the lowest bid on Sept. 18, to lay one mile of 12-in. Holley water mains for $7,433.

New York, N. Y.—Bids will be received by Louis F. Haffen, Boro. Pres., until Oct. 10, for furnishing 40 h. p. boilers and pumps with necessary fittings, and operating same to remove water from Inwood Ave. cut of Webster Ave. storm relief tunnel sewer, and at shaft No. 2 continually 24 hours per day, and at the westerly end of the High Bridge cut for 8 hours per day.

Rome, N. Y.—Roy Armstrong, City Clk., writes that all bids opened on Sept. 25 by the Bd. of Water and Sewer Comrs., for the construction of a dam on Fish Creek, with all its accessories, also a tunnel about 5,500 ft. long, have been rejected and new bids will be received early in the winter months. The following are the bids received: (Engineers, Knight & Hopkins, of Rome): G. H. Eldridge, Ossinning, $160,723; N. Y. Continental Jewell Filtration Co., N. Y. City, $166,851; A. C. Martin & Co., Seneca Falls, $107,250; F. D. Grannis, Ossinning, $147,409, and D. W. Rosser, Kingston, Pa., $129,431.

Sandusky, O.—The City Council, on Sept. 17, adopted the report of the Mayor's Comn. on Water Works, and ordered that the first and most essential work be taken up at once.

**Cleveland, O.*—The Bd. of Pub. Service is reported to have, on Sept. 20, awarded contract for 400 1-in. water meters to Henry R. Worthington, of New York, N. Y.

Hudson, O.—See "Power Plants, Gas and Electricity."

Pawhuska, Okla.—R. G. Hall, Mayor, writes that bids will be received until 2 p. m., Oct. 7, for furnishing material and constructing water works and sewers.

Somerset, Pa.—It is reported that at a recent mass meeting held here, it was voted to employ an engineer to prepare estimates for securing water from Laurel Hill mountain by gravity.

Philadelphia, Pa.—Bids will be received by Geo. R. Stearns, Dis. Supt. Pub. Wks., until Oct. 22, for electric improvement for Torresdale filters; pumping engines for Lardner's Point pumping station; centrifugal pumping engine for Torresdale pumping station and magnesia covering and painting at Lardner's Point pumping station, as advertised in The Engineering Record.

Newport, Tenn.—See "Power Plants, Gas and Electricity."

Bay City, Tex.—J. Sutherland, Mayor, writes that bids will be received about Oct. 20 for the construction of waterworks, to cost about $18,000. Engineer, M. Chapman, of Bay City.

**Auburn, Wash.*—W. F. McMahon, of Auburn, is reported to have secured the contract for constructing waterworks, for $13,090.

Seattle, Wash.—Local press reports state that the Fire and Water Com. of Council has decided to report favorably to Council the resolution for the installation of the salt water main system.

Tenino, Wash.—The City Council is reported to have granted S. W. Fenton, Mgr. of the Hercules Sandstone Co., a franchise for a new system of waterworks.

De Forest, Wis.—The citizens are reported to have voted to establish waterworks.

**Fernie, B. C.*—Robt. Potter, City Eng., writes that Harry Oldland, of Fernie, has secured the contract for constructing a covered concrete septic tank, 100 ft. long x 30 ft. wide (bids opened Aug. 26). He bid for 460 cu. yds. concrete $11 per cu. yd., and 1,000 cu. yds. excav. at 45 cts.; total cost, $5,510. Other bids for this work were: Campbell & Gray, Fernie, $6,375; M. Kerr & Co., Fernie, $6,960, and Hugh McDonald, Victoria, $8,950.

Winnipeg, Man.—Bids will be received by the Chairman Board of Control, until Nov. 15, for supply of approximately 15 miles of assorted water pipe, delivery of same to commence about May 15, 1908 or as soon as navigation opens, as advertised in The Engineering Record. H. N. Ruttan, City Engr.

Toronto, Ont.—The City Engineer and the Medical Officer of Health are about to ascertain probable cost of a filtration plant for the city water supply.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arronged Alphabetically by States.

Ensley, Ala.—All bids opened on Sept. 27 by City Council for completion of the 66-in. storm sewer on Ave. D, are reported to have been rejected, and the city has decided to complete the work. The lowest bid received was that of J. R. Payne, for $21,000.

**Paragould, Ark.*—The W. K. Palmer Co., of Kansas City, Mo., is reported to have secured the contract for constructing sewer system for about $10,000.

Washington, D. C.—The lowest bid opened on Sept. 30 by the Comrs. D. C. for constructing sewers was submitted by the Warren F. Brenizer Co. at the following bid: 4,500 cu. yd. sewer excav., 73 cts.; 250 cu. yd. rock excav., $3; 2,000 lin. ft. 18-in. sewer, $1.14; 3,900 lin. ft. 15-in. sewer, 99 cts., and 40 cu. yd. brick masonry, $17; total cost, $10,856. Totals of other bids: E. G. Gummel, $10,861; I. H. Fisher, $12,260. R. T. Beall Constr. Co., $12,810, and Jas. H. Coyle, $15,290.

Canton, Ga.—See "Power Plants, Gas and Electricity."

Albany, Ga.—C. W. Rawson, Mayor, writes that the citizens on Sept. 23 voted to issue $75,000 bonds to complete surface drainage and extend sewers and water mains. Engineer, R. J. Edgerly, of Albany.

Wallace, Idaho.—Henry M. Lancaster, City Engr., writes that about $20,000 will be expended for new sewers.

Great Lakes, North Chicago, Ill.—The following are the bids opened at the office of the Bureau of Navigation Navy Dept., Washington, D. C., on Sept. 27, for laying sewers and drains at the naval training station, Great Lakes, North Chicago, Ill.: H. C. Patterson, Waukegan, $58,415; H. D. Hallett, Aurora, $55,390; Nash Bros., Chicago, $59,999; Carmine Roberts, Chicago, $55,131, and F. H. Idelhart, Morgan Park, $59,000.

Chicago, Ill.—Bids will be received until Oct. 8 by the Bd. Local Improv. (H. S. Dietrich, Pres.) for constructing brick and pipe sewers in portions of several streets; also drains in portions of 12 streets.

Normal City, Ind.—It is reported that bids will be received until Oct. 8 by Jas. G. Mendenshall, Clk., for constructing sewers in certain streets.

Riverside, Ind. The Town Bd. is reported to have adopted specifications for the contruction of the Jersey St. sewer.

**Cedar Rapids, Ia.*—T. R. Warriner, City Engr., writes that the contract for constructing 3-ring brick sewer on 21st and 12th Aves. (bids opened Sept. 30) has been awarded to M. Ford, of Cedar Rapids, for $29,207.

Wapello, Ia. E. T. Christie City Recorder, writes that bids will be received on Oct. 10 for the construction of a system of pipe sewers, to cost about $6,000. Engineer, W. S. Kremer, of Wapello. J. S. McChesney, Mayor.

Wichita, Kan.—The City Council is reported to have decided to construct sanitary sewer in Dist. No. 9.

**Togus, Me.* A. L. Smith, Treas. Eastern Branch, National Home, D. V. S., at Togus, writes that the contract for furnishing materials, labor, etc., for the improvement of the sewerage and drainage system at Togus (bids opened Sept. 19) has been awarded to J. B.

* *Items marked thus give the names of parties awarded contracts.*

Greer, of Pittsburg, Pa.; cost about $45,000. Engineer, Geo. W. Fuller, 170 Bway., New York, N. Y.

Detroit, Mich.—Comr. Haarer, of the Bd. of Pub. Wks., is reported to have, on Sept. 19, rejected all bids received for constructing Sect. 4 and 5 of the Schroeder Ave. sewer and Sect. 6 of the Lothrop Ave. sewer, all being considered too high. Jas. Hanley, 40 Fort St. W., submitted the lowest bids on all three contracts, at $17,761; $26,293 and $10,757 respectively.

St. Paul, Minn.—Bids will be received until Oct. 21 by H. J. Spencer, City Clk., for furnishing material and constructing about 1,500 lin. ft. sewer, together with manholes, catch-basins, etc.

Cloquet, Minn.—Bids will be received until Oct. 19 by Jos. Loisel, City Clk., for constructing a sanitary sewer in Arch St. and Ave. C.

Black River Falls, Minn.—It is stated that bids will be received until Oct. 8 at the office of the City Clk. for furnishing material and constructing a sewer in Main St.

Stillwater, Minn.—Pillsbury & Claussen, of St. Paul, are reported to have completed plans and specifications for waterworks and sewer system for the new prison at Stillwater.

Cannons Falls, Minn.—Geo. E. Wilson, City Clk., writes that the proposed sewer on 4th and Colville Sts. will cost about $1,700, but will not be constructed until 1908.

**Monett, Mo.*—J. J. Dunnigan, of Shenandoah, Ia., has secured the contract for constructing a sanitary sewer system (bids opened Sept. 24), at the following bid (Engineers, Burns & McDonnell, Kansas City, Mo.): Excav. under 8 ft., 90 cts. per cu yd.; excav. 8 to 12 ft. deep, $1. excav. 12 to 16 ft., $1.15; 8-in. pipe, 24 cts. per lin. ft.; 10-in. pipe, 30 cts.; 12-in pipe, 42 cts.; 15-in pipe, 62 cts.; 6 to 8 in. y's, 75 cts.; 6 to 10 in. y's, $1; 6 to 12 in. y's, $1.50; manholes, ea., $30; flushtanks, ea., $65; lamp holes, ea., $10; rock excav., $3 per cu yd.; lumber, per M ft., $30; public sewer and septic tank, $6,437; total cost, $51,998. Totals of other bids: E. J. Overly & Co., Joplin, $61,718; McIlroy & Reese, Fayetteville, Ark., $52,490, and Wm. F. Hall, Clinton, $52,575.

Overbrook, N. J.—Bids will be received until Oct. 10 at the office of G. F. Drum, Co. Engr., Court House, Newark, for furnishing and delivering f. o. b. cars at Overbrook, on the Caldwell branch of the Erie R. R., 8,000 ft. tile drainage pipe of various sizes.

Oneida, N. Y.—Bids will be received, it is stated, until Oct. 15 by the Bd. Pub. Wks. for constructing a sewer in Williams, Elm and Lake Sts.

**Dunkirk, N. Y.*—The Council is reported to have awarded contract for a sanitary sewer on Central Ave. from city line to the Nickel Plate tracks, to Lawrence Schultz, of Fredonia, for $11,641.

Rochester, N. Y.—The lowest bids recently received by the Bd. of Contract and Supply for the new sewer system for the 21st ward are reported to have been submitted as follows: Sewer work, H. N. Cowles, $85,430; for the plumbing station connected with the system, Houston Barnard, $6,332, and for steel riveted pipe, through which sewage will be pumped, Frank R. Stockley, at $3,543; aggregate of the three low bids for the entire work is $97,305.

**Long Island City, L. I., N. Y.*—Contracts for constructing pipe sewers in portions of Wilbur Ave. (bids for which were received Sept. 30 by Jos. Bermel, Boro. Pres.) have been awarded, according to reports, to H. J. Mullen, at $7,978 and for constructing reinforced concrete and pipe sewers in portions of Metropolitan Ave. to Jos. A. Boyce, at $29,434.

New York, N. Y.—The following are the bids opened on Oct. 1 by Louis F. Haffen, Pres. Bronx Boro., for completing construction of storm relief tunnel sewer from the Webster Ave. sewer near Wendover Ave., in the Mill Brook water shed (Sewerage Dist. No. 33), to the Harlem River, about 231 ft. north of High Bridge, 24th Ward, Boro. of Bronx: (*a*) Williams Eng. & Contr. Co., 21 Park Row; (*b*) John J. Hart Co., 173th St. and Bway.; (*c*) Phoenix Constr. & Supply Co., 41 Park Row; (*d*) Wakefield Constr. Co., Williamsbridge.

	a	*b*	*c*	*d*
25,000 cu. yds. excav., all kinds	$5.75	$6.25	$12.00	$10.00
5,170 cu. yds. Class A concrete	9.00	9.25	13.25	15.00
270 cu. yds. Class B concrete	7.00	11.00	13.25	8.00
25 cu. yds. Class C concrete	20.00	20.00	16.50	20.00
13,670 cu. yds. Class D concrete	10.00	12.00	11.50	17.00
50 lbs. ¼-in. steel bars	.07	.04	.02½	.04
110 lbs. ⅜-in. steel bars	.07	.04	.02½	.04
13,500 lbs. ½-in. steel bars	.07	.04	.02½	.04
33,200 lbs. ⅝-in. steel bars	.06	.04	.02½	.04
6,310 lbs. ¾-in. steel bars	.06	.03½	.02½	.04
1,910 lbs. ⅞-in. steel bars	.06	.03½	.02½	.04
222,500 lbs. 1-in. steel bars	.05	.03½	.02½	.04
100 lbs. 1⅛-in. steel bars	.05	.03½	.02½	.04
54,700 lbs. 1¼-in. steel bars	.05	.03½	.02½	.04
2,715 lbs. 1⅜-in. steel bars	.04	.03½	.02½	.04
97,925 lbs. 1½-in. steel bars	.04	.03½	.02½	.04
Shaft No. 1 and appurtenances, except. excav. and timber	4,000.00	1,570.00	2,500.00	10,000.00
Shaft No. 2 and appurtenances, except 24-in. pipe and concrete excav., timber	7,000.00	4,100.00	3,000.00	2,000.00
Shaft House No. 1 and appurtenances, complete	2,500.00	1,400.00	1,750.00	1,000.00
Shaft House No. 2 and appurtenances, complete	2,500.00	1,400.00	1,750.00	1,000.00
190 net tons structural steel	90.00	125.00	75.00	75.00
4,000 lbs. wrought iron	.07	.05	.03	.02
22,000 lbs. cast iron, including new manhole heads, covers, etc.	.04	.06	.04	.02
8,050 sq. ft. galvanized wire netting	.07	.06	.05	.30
990 sq. yds. waterproofing	2.00	1.25	1.80	1.00
4 gates and appurtenances in Webster Ave. gate chamber	300.00	300.00	400.00	50.00
13,500 lbs. 24-in. cast iron pipe	.03½	.03	.03	.02
500 cu. yds. broken stone for foundation	1.90	2.25	2.00	2.00
400 cu. yds. dry rubble masonry	4.00	3.10	2.00	3.00
675 cu. yds. rubble masonry in mortar	7.00	6.50	6.00	5.00
3 cu. yds. granite masonry	31.00	100.00	50.00	20.00
1,500 lin. ft. 3-in. drain pipe	.25	.30	.15	.10
2,000 lin. ft. 12-in. drain pipe, including broken stone cradle in rock	1.00	.50	1.00	1.00
11,000 lin. ft .piles, below cut-off, including w. i. and steel, etc., as required	.50	.60	.30	.30
260 M ft. timber for found., etc.	70.00	80.00	50.00	30.00
4,500 cu. yds. embkt., including riprap, etc.	1.00	1.50	1.00	1.00
40 lin. ft. brick sewer, 6 ft. 1½ in. x 6 ft. 6 in.	20.00	22.00	25.00	10.00
40 lin. ft. brick sewer, 3 ft.	10.00	17.00	20.00	10.00
40 lin. ft. brick sewer, 2 ft. 6 in.	7.00	11.00	15.00	10.00
2 brick manholes, to be rebuilt	75.00	50.00	50.00	75.00
Totals	$428,751	$468,960	$600,487	$637,301

Flushing, L. I., N. Y.—The following are the bids opened on Sept. 23 by C. B. J. Snyder, Supt. School Bldgs., New York City, for general construction, etc., of a sewage disposal plant for the buildings of the Parental School, on road bet. Flushing and Jamaica, Boro of Queens: Jas. MacArthur, $36,000; McHarg-Barton Co., $36,900; New York Sewage Disposal Co., $30,111; Henry J. Mullen, $31,000, and Peace Bros., $34,175.

Brooklyn, N. Y.—Bids were opened on Sept. 25 by Bird S. Coler, Boro. Pres., for furnishing material and constructing relief sewers in Dekalb Ave. from Raymond St. to South Portland Ave., etc. (Relief sewers, div. 2, sect. 3, Gold St. system). The bids were submitted on the percentage basis as follows: Fleck-Litchfield Constr. Co., 345 5th Ave., 105.53 per cent; Rodgers & Haggerty, 1929 Amsterdam Ave., 109.68 per cent; Borough Constr. Co., Brooklyn, 140.78 per cent. This work consists of 2,490 lin. ft. 138-in. circular sewer, 400 lin. ft. 24-in. pipe sewer, 350 lin. ft. 18-in. pipe sewer, 570 lin. ft. 15-in. pipe sewer, 2,440 lin. 12-in. pipe sewer, 40 lin. ft. 24-in. temporary pipe drain, 2,490 lin. ft. 12-in. pipe subdrain, 2 manholes, Class "A," 1 manhole, special Class "A," 1 manhole, Class "C," 34 manholes on pipe sewer, 18 sewer basins, reconected, 500 M. ft. sheeting and bracing, 100 M. ft. foundation planking, 500 cu. yds. Class "B" concrete, and the total cost is estimated at $203,132.

Bids were opened on Sept. 25 at the office of Bird S. Coler, Boro. Pres., for furnishing material and constructing relief sewers in Johnson St. from Hudson Ave. to Raymond St., etc. (relief sewers, div. No. 2, sect. No. 2, Gold St. system). These bids were also submitted on a per centage basis as follows Hammond & Sloane, Inc., 60 Wall St., N. Y. City, 114.4 per cent; Fleck, Litchfield Constr. Co., 345 5th Ave., N. Y. City, 82.8 per cent; John J. Creem, Brooklyn, 119.99 per cent; Borough Constr. Co., Brooklyn, 100.7 per cent; Jas. Kelly, Brooklyn, 126 per cent; Rodgers & Haggerty, 1929 Amsterdam Ave., N. Y. City, 107.57 per cent. This sewer will comprise 2,285 lin. ft. 144-in. circular sewer, 17 lin. ft. 48-in. egg-shaped sewer, 17 lin. ft. 15-in. pipe sewer, 90 lin ft. 12-in. pipe sewer, 2,285 lin ft. 12-in pipe sub-drain, 5 manholes, 22 sewer basins, reconnected, 400 M. ft. sheeting and bracing, 75 M. ft. foundation plank, and 400 cu. yd. class "B" concrete; total estimated cost, $152,905.

New Brighton, S. I., N. Y.—Bids will be received by Geo. Cromwell, Boro. Pres., until Oct. 8, for furnishing material and constructing a temporary combined sewer and appurtenances in Richmond Terrace,, Sewer Dist. No. 19A, 3d Ward. Engineer's estimate: 2,782 lin. ft. reinforced concrete sewer; 5,157 lin. ft. 10, 12, 15, 18 and 20-in. interior diam. salt-glazed vitr. pipe sewer, etc.

Springfield, O.—City Engr. W. H. Sieverling is reported to have completed plans for the N. Limestone St. sewer, which he estimates at $6,914, and the W. Main St. sewer, estimated at $22,227.

Ironton, O.—Geo. H. Davis, Clk. Bd. of Pub. Service, writes that the citizens on Sept. 25 voted to issue $45,000 bonds for sewers.

Akron, O.—Bids will be received until Oct. 8 by the Bd. Pub. Service for constructing a surface water sewer in portions of High and Long Sts.

Chagrin Falls, O.—Bids will be received by H. D. Bishop, Village Clk., until Oct. 14, for the construction of sewage at filter beds, was submitted by the Pacific timaed cost $60,000. Engineers, the Walter P. Rice Eng. Co., of Cleveland.

Girard, O.—The only bid received and opened on Sept. 23 for an automatic apparatus for handling flow of sewage at filter beds, was submitted by the Pacific Flush Tank Co., of Chicago, Ill., for $1,200. The only bid opened same time for 5,570 lin. ft. 18-in. sewer was submitted by S. N. De Groodt, of Youngstown, for $21,906. Engineer, Wm. Wilson, of Youngstown.

Oberlin, O.—Bids are wanted, it is stated, until Oct. 12, for $10,000 bonds for constructing sewer beds. C. H. Snyder, City Clk.

Greenwich, O.—Bids are wanted, it is stated, until Oct. 14, for $8,000 sewer and $4,700 paving bonds. J. F. White, Village Clk.

Pawhuska, Okla—See "Water."

McKeesport, Pa.—Bids will be received, it is stated until Oct. 10 by C. E. Soles, City Compt., for constructing a 15-in. terra-cotta sewer in Sheridan St. and Cavin Alley.

Kingston (Wilkesbarre), Pa.—The Borough Council is reported to have decided to construct sewers on Elm, Ridge, Pringle and Walnut Sts.

Chambersburg, Pa.—The Boro. Council is reported to have voted to esatblish a complete sewer system, with storm sewers and underdrains for surface water. The system will extend over 20 miles of streets, draining 1,708 acres, and will cost $150,000.

**Mont Alto, Pa.*—State Health Comr. Dixon, at Harrisburg, is reported to have awarded contract for system of sewers to be constructed at the Pennsylvania South Mountain Sanitorium, near Mont Alto, to C. F. Hessenberger, of Harrisburg, for $11,006.

Harrisburg, Pa.—Plans will probably be prepared this winter for improvements to sewer system and sewage disposal plant. M. B. Cowden, City Engr.

Newport, Tenn.—See "Power Plants, Gas and Electricity."

Sherman, Tex.—The City Council is reported to have decided to extend the sewer system to Austin College and out on Lamar St.

Spokane, Wash.—The lowest bid opened on Sept. 19 by the Bd. of Pub. Wks. for a sewer in alley bet. Northern Pacific line and 2d Ave. was submitted by John Fife, for $8,944. Jas. C. Broad, 106 Post St., submitted lowest bid for sewer in McClelland St. and 8th Ave., for $9,365.

BRIDGES.

Notes Arranged Alphabetically by States.

Atlanta, Ga.—The steel bridge over the railroad tracks at Jones Ave. is reported wrecked.

Hailey, Idaho.—Bids will be received until Oct. 24 by the Bd. Co. Comrs. (W. F. Horne, Clk.) for constructing 3 bridges as follows: One across Big Lost River; one across Spring Hollow, near American Falls, and one across James Creek, in James Lane on Lost River.

Lafayette, Ind.—The County Council is stated to have appropriated $48,000 toward the construction of a bridge over Wabash River near Granville.

Martinsville, Ind.—It is reported that bids will be received until Oct. 8 by the Co. Comrs. for repairing bridge 1 mile north of Morgantown over Indian Creek; constructing 20-ft. concrete arch in Harrison Township and a 35-ft. concrete arch 1 mile north of Brooklyn. E. Thornburgh, Co. Aud.

Richmond, Ind.—It is reported that bids will be received until Oct. 9 by the Co. Comrs. for constructing approaches to several county bridges.

**Springfiedl, Moss.*—Chas. M. Slocum, City Engr., writes that the contract for constructing concrete steel bridge over Mill River at Pecousic Ave. (bids opened Sept. 17) has been awarded to Culgin-Pace Contr. Co., 1763 Carter Ave., New York, N. Y., for $9,600. Other bids received for this work were: Berlin Constr. Co., Berlin, Conn., $8,215; D. W. Mellen Co., Springfield, $10,589; Hancom Constr. Co., Boston, $13,900, and Fred T. Ley Co., Inc., Springfield, $13,300.

Menominee, Mich.—The City Council is reported to have passed a bill providing for the appropriation of $9,000 for a steel bridge to be constructed at the Paper Mills.

New York, N. Y.—The Bd. of Estimate and Apportionment on Sept. 27 approved the plans for the foundations of the viaduct approach to the Blackwells Island Bridge over the Pennsylvania, New York and Long Island R. R. Co.'s tracks at the entrance to Sunnyside yard, Long Island City.

**Long Island City, L. I., N. Y.*—The contract for constructing steel and masonry approach in Boro. of Queens for Blackwell's Island Bridge over East River (bids opened Sept. 5 by J. H. Stevenson, Comr. of Bridges, N. Y. City) has been awarded to the Maryand Steel Co., 71 Bway., N. Y. City., for $758,600.

Hamilton, O.—It is reported that bids will be received until Oct. 22 by the Co. Comrs. at Hamilton, for furnishing material and making channel cut, pipe culvert, and bulk heads and new concrete substructure and superstructure of bridge on the Cincinnati & Dayton Pike at the Compton Farm in Lemon Township. Christ. Pabst, Co. Aud.

Cincinnati, O.—Bids will be received until Oct. 22 by W. C. Culkins, City Aud., for $257,000 bonds, the proceeds to be used to purchase a site necessary and construct the Gilbert Ave. Viaduct.

**Neopolis, O.*—The Toledo-Massillon Bridge Co. of Toledo, is stated to have been awarded a contract to buidl a steel bridge for the Toledo, Wabash & St. Louis Ry. Co. at the crossing of Blue Creek, near Neopolis.

**Tiffin, O.*—R. R. Bour, Co. Aud., writes that the contract for repair of Perry St. Bridge (bids opened Sept. 20) has been awarded to the Modern Constr. Co., of Fremont, for $7,397.

Johnstown, Pa.—The issuing of $30,000 bridge bonds is reported contemplated.

Wilkesbarre, Pa.—Bids will be received until Oct. 8 by the Bd. Comrs., Pub. Grounds and Bldgs. (Saml. B. Rambo, Supt.), Harrisburg, for rebuilding the substructure and superstructure of the bridge across Nescopec Creek, Sugar Loaf Township, Luzerne Co.

Richmond, Tex.—See "Public Buildings."

Raymond, Wash.—It is stated that bids are being received for constructing 2 railway bridges in Raymond, one over the south fork and a second over the north fork of Willapa River, at a probable cost of $40,000.

**Items marked thus give the names of parties awarded contracts.*

Winlock, Wash.—It is stated that bids will be received until Oct. 9 by the Co. Comrs. at Chehalis for construction of a bridge over the Olequa Creek, about 3 miles south of Winlock. Bridge is to have 80 ft. span, 14 ft. roadway in the clear, to be built on the principle of the Howe truss, with 4 panels of 20 ft. J. E. Stearns, Co. Aud.

Stevenson, Wash.—Bids will be received until Oct. 15 by the State Highway Bd. (Jos. M. Snow, Secy.), Olympia, for constructing a 185-ft. span steel bridge across the Washougal River, in Skamania Co., on State Road No. 8. Bowerman & McCloy, Consulting Engrs., 649 New York Blk., Seattle.

**Racine, Wis.*—The Bd. of Pub. Wks. is stated to have awarded on Sept. 20 contracts for constructing the Lafayette Ave. Bridge to Peter Galloway, 1700 W. 6th St., for substructure at $8,175, and the Milwaukee Bridge Co., 1400 34th St., Milwaukee, for superstructure, at $5,000.

Fork River, Man.—It is stated that bids will be received by D. F. Wilson, Secy.-Treas., until Oct. 10 for a Howe truss bridge with two 80-ft. spans across the Mossy River, also for 2 Howe truss bridges with 60-ft. spans across the Fork River. The bridges may be either of wood or steel.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Selma, Ala.—V. B. Atkins, Mayor, writes that the proposed paving, bids for which will be received in Oct., will cost about $100,000. Asphalt, brick or bitulithic will be used. Julian Smith, City Engr.

Ft. Logan H. Roots, Ark.—Bids will be received by the Constructing Q. M., U. S. A., until Oct. 31, for constructing extension to sidewalks at this post, as advertised in The Engineering Record.

Los Angeles, Cal.—The construction of a 25-mile boulevard from the City Hall to the lighthouse on Point Firmin, near San Pedro, is reported contemplated by the County Highway Comn. According to reports, right of way for the entire distance has been secured.

Alameda, Cal.—See "Power Plants, Gas and Electricity."

San Francisco, Cal.—The Supervisors Finance Com. is stated to have recommended expending $142,000 for paving Harrison 4th, and Howard Sts., and San Bruno and Railroad Aves.

The Bd. of Supervisors is stated to have authorized the following appropriations: $50,000 for repairing asphalt and bituminous pavements and $25,000 for repairing Fillmore St.

Oakland, Cal.—The City Council is stated to have adopted resolutions providing for the following improvements: Grading, curbing and macadamizing portions of Arlington Ave., 40th, Herzog and Willow Sts., and sidewalks on North St.

Ft. Collins, Colo.—Bids will be received, it is stated, until Oct. 14 by T. W. Jaycox, State Engr., Denver, for the repair and improvement of 3½ miles wagon road between Ft. Collins and Loveland.

Creede, Colo.—Bids will be received, it is stated, until Oct. 14 by T. W. Jaycox, State Engr., Denver, for the construction and repairs of a flume and wagon road on Willow Creek at Creede.

Bristol, Conn.—The Bd. of Selectmen is stated to have opened bids Sept. 18 as follows for constructing the state highway in Bristol: Olin T. Benedict, Pittsfield, Mass., $7,738; Frank R. Arrigona, Durham, $7,431; Town of Bristol, $7,350; Roger Kennedy, Middletown, $7,340; Frank J. Emmett, Bristol, $7,257, and the Pierson Engineering & Constr. Co. of Bristol, $6,850.

**Washington, D. C.*—The contract for laying cement sidewalks in Dis't Columbia (bids opened Sept. 21) has been awarded to Colburn Bros., Colorado Bldg., Washington, for $74,800. C. B. Hunt is Engr. of Highways.

St. Augustine, Fla.—The City Council is stated to have passed the ordinance providing for the paving with brick San Marco Ave. According to reports, bids will soon be received.

Dublin, Ga.—See "Power Plants, Gas and Electricity."

Nampa, Idaho.—Bids will be received until Oct. 19 by Claude Duval, City Clk., for furnishing material and laying bitulithic pavements on portions of several street in Dist. No. 6, including Front, First, D, E, F and other streets.

Lewiston, Idaho.—See "Water."

Jacksonville, Ill.—We are informed that bids will be received on Oct. 14 for 38,461 sq. yds. brick paving, and [illegible] ft. combined curb and gutter.

Chicago, Ill.—Bids will be received until Oct. 10 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and paving with brick a portion of W. Ravenswood Park.

Bids will be received until Oct. 14 by the Bd. Local Imprvts. (H. S. Dietrich, Pres.) for constructing cement sidewalks on portions of numerous streets.

**Vincennes, Ind.*—J. T. Scott, Co. Aud., writes that the contract for constructing 10,281 ft. gravel road (bids opened Sept. 28) has been awarded to Bole & O'Donnell, of Vincennes, for $22,430.

**Des Moines, Ia.*—The J. W. Turner Improvement Co. of Des Moines, is stated to have secured the contract for paving with brick Park Lane at $2.19 per sq. yd.

**Argentine, Kan.*—The Kansas Bitulithic Co. is stated to have secured the contract for paving 2 miles of streets in Argentine for $60,800.60.

Covington, Ky.—The Bd. of Aldermen is stated to have passed the ordinance providing for the paving with brick a portion of Pike St.

Baltimore, Md.—Bids will be received until Oct. 9 by the Bd. Awards (J. Barry Mahool, Pres.) for grading, curbing and paving with macadam, portions of Yale and Walrad Aves.

Denton, Md.—Bids will be received until Oct. 15 by the Bd. Co. Comrs. (Isaac L. Dukes, Clk.), for grading and macadamizing about 1¼ miles of the Bloomery Rd.

Sterling, Mass.—The following are the bids opened Sept. 24 by Mass. Highway Comn. at Boston, for constructing a section of State highway in Sterling: R. F. Hudson, Melrose, $5,297; M. L. Camarco, $4,755; Chas. E. Horne, $4,562, and Worcester Broken Stone Co., Worcester, $4,362.

Boston, Mass.—Bids will be received until Oct. 8 by the State Highway Comn. (W. E. McClintock, Chmn.), Boston, for constructing a section of State highway, about 21,000 ft. long in the town of Belchertown; also 2,800 ft. in the city of Gloucester.

Port Huron, Mich.—The Bd. of Estimates is stated to have voted to expend $4,500 for constructing sidewalks throughout Port Huron.

Iron River, Mich.—Surveys are stated to have been completed and according to reports work will soon be started on the construction of a highway connecting Crystal Falls and Iron River, a distance of 15 miles, at a cost of about $80,000. A rock crusher, steam road roller and other necessary machinery has been purchased.

Menominee, Mich.—The City Council is stated to have passed a bill providing for an appropriation of $3,783 for paving with macadam a portion of State St.

St. Paul, Minn.—Keough Bros. are reported to have submitted the lowest bid for grading a portion of Valley St., at $4,500.

Kansas City, Mo.—Bids will be received until Oct. 10 by the Bd. Pub. Wks. for paving with asphalt, portions of 6 streets; also artificial stone sidewalks on portions of 9 streets. E. A. Harper, City Engr.

St. Louis, Mo.—The City Council is reported to have passed a bill authorizing the paving with brick the Old Manchester Road from Kings Highway to January Ave.

Trenton, N. J.—Plans and specifications for the macadamizing of Brunswick Pike from Clarksville to the Middlesex County line are reported to have been prepared by Frank J. Eppele, County Engr.

The Street Com. of City Council is stated to have rejected all bids opened Sept. 17 for paving portions of S. Clinton Ave., Factory and S. Stockton Sts., being above estimated cost. According to reports, new bids will be received.

Somerville, N. J.—J. B. Farley, Asst. Secy. Bd. of Comrs., writes that it is proposed to pave Main St. with vitr. brick, 50 ft. wide and ½ mile long at a cost of $15,000. Bids will not be called for until after Jan. 1. Engineer, Joshua Doughty, Jr., of Somerville.

Brooklyn, N. Y.—Bids will be received by Bird S. Coler, Boro. Pres., until Oct. 16 for regulating and repaving with asphalt and granite block on a portion of Atlantic Ave.; with asphalt on portions of Central Pl., Olive Pl., St. Andrews Pl. and Washington Ave., and with asphalt block on a portion of 48th St.; also constructing cement sidewalks on various streets in the Boro. Engineer's estimate, 9,600 sq. yd. asphalt, 1,540 sq. yd. granite block, 2,400 sq. yd. asphalt block, 58,930 sq. ft. cement sidewalks, 8,175 lin. ft. new curb, 1,520 cu. yd. concrete, etc.

**Albany, N. Y.*—The Bd. of Contract and Supply is stated to have awarded the contract for improving a portion of Bradford St. to Mulderry Bros., 115 1st St., at $8,449.

*Hastings Paving Co. is reported to have secured the contract for furnishing asphalt blocks for repair of S. Pearl St., at $69 per M.

**Long Island City, L. I., N. Y.*—Contracts have been awarded, according to reports, by Jos. Bermel, Boro. Pres., for paving as follows (bids for which were received Sept. 30): For regulating, grading and repairing with macadam about 12,000 sq. yd. on Greenpoint Ave. from Long Island City to Town of Newtown, to Jos. A. Foyce, at $17,940; for regulating, grading and laying sidewalks on portion of Jamaica Ave., 1st Ward, 19,740 sq. ft. new flagstone, to Henry J. Mullen, at $19,884, and on Clark St., 1st Ward, 6,150 sq. ft. new flagging, to Dennis McCarthy, at $5,292.

Buffalo, N. Y.—Separate bids will be received until Oct. 11 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for paving portions of 5 streets.

New York, N. Y.—Bids were opened on Sept. 26 by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc., as follows: Macombs Road from Featherbed Lane to Aqueduct Ave.—The lowest bidder was F. Del Balso, at the following bid: 10,200 cu. yd. earth excav., 40 cts.; 19,750 cu. yd. rock excav., $1.60; 8,300 cu. yd. fill., 20 cts.; 2,780 lin ft. new curb., 75 cts.; 10,370 sq. ft. flag., 25 cts.; 2,680 sq. ft. bridgestone, 50 cts., and 170 cu. yd. dry rubble masny., $1; total cost, $43,527. Totals of other bids: T. Crimmins Contr. Co., $45,103; D. W. Moran, $47,508, G. I. Bailey, $50,330; P. J. Kane, $44,581, and H. Lowdon, $44,606.10.

The following are the totals of lowest bid in each case for regulating, etc., certain strees in Bronx Boro (bids opened Sept. 26): Randall Ave. from Leggett Ave. to Bronx Park, C. J. Quinn, $26,786; W. 168th St. from Shakespeare Ave. to Boscobel Ave., McHarg, Barton Co., $8,847; Kossuth Pl. from Mosholu Parkway to De Kalb Ave., T. E. Vermilye, $5,626; Popham Ave. from W. 176th St. to Montgomery Ave., L. C. Rose, $7,957; E. 170th St. from Aqueduct Ave. to Wythe Pl., J. B. Malatesta, $34,076; E. 147th St. from So. Boule. to St. Mary's Park, T. E. Vermilye, $8,596; Johnson Ave. bet. Kappock St. and Spuyten Duyvil, P. J. Dougherty, $28,460; E. 199th St. from Bainbridge Ave. to Jerome Ave., F. Del Balso, $10,354.

Bids were opened on Sept. 26 by Louis F. Haffen, Pres. Bronx Boro., for asphalt block pavement as follows:

Cypress Ave. from E. 138th St. to E. 143d St. Hastings Pavt. Co., lowest bidder: 6,460 sq. yd. asphalt block pavt., $1.72; 990 cu. yd. concrete, $5; 800 lin. ft. new curb., 93 cts., and 1,980 lin. ft. old curb., 33 cts.; total, $17,498. Totals of other bids: Barber Asphalt Paving Co., $18,615; Continental Asphalt Paving Co., $17,833.

E. 186th St. from 3d to Park Aves.—Lowest bidder, Barber Asphalt Pavt. Co.: 1,400 sq. yd. asphalt block pavt., $1.85; 240 cu. yd. concrete, $5.50; 550 lin. ft. new curb., 96 cts.; 530 lin. ft. old curb., 34 cts.; total, $4,618.

The Hastings Pavt. Co. submitted lowest bids on Sept. 26 for paving with asphalt block on E. 176th St. from Park to 3d Aves., at $6,591; E. 137th St. from So. Boule. to Willow Ave., $4,555, and Honeywell Ave. from Tremont Ave. to E. 182d St., at $17,181.

**Bergholz, O.*—W. A. Taylor, Clk. Bd. Trus. of Springfield Township, writes that the contract for constructing about 5 miles of macadam road in Springfield Township (bids opened Sept. 25), has been awarded to M. J. McGinty, of Minerva, for $25,000.

**Barberton, O.*—Paul & Henry, of Barberton, are stated to have secured the contract for paving the following streets: Lake Ave. at $4,957; Bolivar Rd., $4,872; Cornell St., $32,767; Hunsberger St., $3,126 and High St., $18,475.

Greenwich, O.—See "Sewerage and Sewage Disposal."

Akron, O.—Davidson & Wildes, of Akron, are stated to have secured the contract for paving with Metropolitan block portions of Franklin Ave., Erie and Portage Sts., at $14,480.

John Payne, City Engr., is reported to have estimated the cost of paving Mill St. with brick at $21,235, and Medina block at $32,067.

**Van Buren, O.*—The Trus. of Van Buren Township are stated to have awarded the contract for constructing the Kreitzer Rd. in Berkeley Height to Geo. Hively, at 23½ cts. per cu. yd. for about 13,350 cu. yds.

**Zanesville, O.*—The contract for paving Wayne Ave. is reported to have been awarded to Adams Bros., of Zanesville, for $8,084.

**Cincinnati, O.*—The County Comrs. are stated to have awarded the contract for improving Montgomery Pike (bids opened Sept. 20) to M. Sullivan & Son for $107,875. Other bids received were as follows: John Snyder, $108,125; L. Drach Constr. Co., $110,920; S. E. Maxfield, $112,527; W. H. Settle, $113,470; M. H. Link, $113,568; Jones, Hammel & Brown, $115,907, and A. J. Henkel & Bro., $116,130.

Youngstown, O.—Bids will be received until Oct. 28 by Wm. I. Davies, City Aud., for $26,000 Federal St. widening bonds, $15,000 bonds to construct a city barn; $1,470 Summit Ave. sewer bonds; $1,485 Darrow St. grading bonds; $2,530 Iona St. paving bonds, and $4,635 sidewalk bonds.

Enid, Okla.—Bids will be received until Oct. 11 by the Mayor and Council at the office of E. R. Lee, City Clk., for grading, curbing and paving with asphalt Grand and Walnut Aves., about 11,500 sq. yds. C. H. Saxton, City Engr.

Guthrie, Okla.—It is proposed to pave about 25 blocks of Noble Ave. from Drexel Boule. to the east side of 15th St. W. W. Miller, City Engr.

**El Reno, Okla.*—P. F. Connelly, of Sioux Falls, S. D., is stated to have secured a $100,000 contract for paving streets throughout El Reno.

Glenburn, Pa.—Bids will be received, it is stated until Oct. 10 by the State Highway Dept., Harrisburg, for the construction of 10,100 ft. of road in Glenburn Borough in Lackawanna County.

Sharon, Pa.—It is stated that bids will be received until Oct. 8 by Oscar J. Denny, Boro. Secy., for grading and improving Biwabik and Euclid Aves.

Chester, Pa.—The Borough Council is stated to have passed an ordinance providing for the paving of Parker, 10th, 11th, Crosby and Upland Sts., Concord Ave. and numerous other highways.

Lancaster, Pa.—J. U. Fritchey & Son, of Montello, are reported to have secured the contract for paving a portion of Duke St. with brick at $2.10 per sq. yd.

Sheraden, Pa.—Bids will be received until Oct. 15 by C. E. Owens, Boro. Engr., 425 4th Ave., Pittsburg, for grading, curbing and paving Berwyn Ave., Boro. of Sheraden.

McKeesport, Pa.—It is stated that bids will be received until Oct. 8 by C. E. Soles, City Compt., for grading, curbing and paving with vitrified brick 3 streets.

Dallas, Tex.—All bids opened Sept. 20 for paving Ross Ave. and Main St. are reported rejected, as they were considered too high.

According to reports, a municipal paving plant may be installed.

Palestine, Tex.—John R. Hearne, Mayor, writes that bids will probably be called for in 90 days for the proposed paving for which the citizens recently voted to issue $50,000 bonds.

**Tacoma, Wash.*—P. J. Concannon is reported to have secured the contract for constructing sidewalks in a portion of Tacoma at $12,500.

Olympia, Wash.—Bids will be received, it is stated, until Oct. 15 by Jos. M. Snow, State Highway Bd., Olympia, for grading and macadamizing State Aid Road No. 2.

Seattle, Wash.—The lowest bidders for street improvements are stated to have been as follows: Ritchie & Riley, paving Jefferson St., $7,202; Coast Concrete Co., for sidewalks on E. Union St., $7,218; T. Ryan, for grading 33d Ave. at $7,466, and Holt & Jeffery for grading Lakeview Ave. at $23,616.

Bellingham, Wash.—Bids will be received until Oct. 15 by the State Highway Bd., at Olympia, for grading and macadamizing State Aid Road, No. 3, near Bellingham.

Spokane, Wash.—The Bd. of Pub. Wks. on Sept. 19, is stated to have opened bids as follows for grading, parking and curbing (*a*) State St., (*b*) Providence Ave., (*c*) Mission Ave., (*d*) Kiernan Ave., (*e*) 8th Ave., (*f*) Columbus St: Mitchell Bros. *a* $2,200, *b* $3,995, *c* $5,355, *d* $3,890, *e* $10,480, *f* $3,599; H. L. Lilienthal, *a* $2,650, *c* $5,040 and sidewalks $3,482, *d* $4,290, *e* $11,478; Julia V. Costello, *c* $5,375, *e* $11,425; Copson & Carson, sidewalks on *b* $1,733 and on *d* $1,996; Root & Biegle, sidewalks on *c* $3,495 and on *f* $2,020; Handley & Payne, sidewalks on *c* $3,633 and on *f* $2,000; J. H. McAllister, 111 Mill St., sidewalks on *e* $2,524.

*H. L. Lilienthal is reported to have secured the contract for grading, parking and curbing Summit Boule. and Mission Ave., for $21,316.

The Bd. of Pub. Wks. is stated to have opened bids on Sept. 19 for paving *a* Lincoln St., *b* Post St. and *c* Wall St. as follows: Barber Asphalt Paving Co., *a* $5,730, *b* $5,549, *c* $5,030; Independent Asphalt Co., *a* $5,950, *b* $5,925, *c* $5,250.

Ottawa, Ont.—Plans and specifications are on file at the office of The Engineering Record, 239 W. 39th St., N. Y. City, and bids will be received until Oct. 16 by Jas. Davidson, Chmn. Bd. Wks. Com., for an asphalt and

**Items marked thus give the names of parties awarded contracts.*

bituminous paving plant, as advertised in the Engineering Record.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Alameda, Cal.—The citizens on Sept. 21 voted to issue $305,000 bonds for park and playground, Webster St. roadway, Bay Farm Road, fire apparatus, new school, a new building for the electric light plant, etc.

Oroville, Cal.—The Oroville Light & Power Co. is reported to be preparing to begin work on a power plant in Humbug Valley. Wm. Durbow, Mgr., Oroville.

San Jose, Cal.—There is reported to be a movement on foot here looking to the construction of a municipal electric light plant.

Napa, Cal.—The Napa Valley Electric Co. is reported incorporated, to generate, buy, sell and furnish electric current for lighting, heat and power; acquire, own and operate electric light, heat and power plants and systems; to generate, buy, sell and furnish gas for illuminating, heat and power, etc.; capital, $200,000. Directors, Attorney Percy S. King, Derrel L. Beard and Henry Brown, of Napa, and Dr. G. S. Connor and H. J. Lewelling, of St. Helena.

Oakland, Cal.—The plant of the Oakland Gas, Heat & Light Co., on 1st and Grove Sts., is reported to have been damaged by fire on Sept. 17.

Placerville, Cal.—The City Trus. are reported to be considering the question of constructing a municipal electric light plant.

Plateau, Cal.—The Northern California Power Co. (E. V. D. Johnson, Mgr., Redding) is reported to have in contemplation the construction of a power plant on South Battle Creek.

Montezuma, Colo.—L. D. Bailor, of Lead, Secy. Montezuma Gold Mining Co., writes that the company will not be ready to commence work on its proposed power plant until the spring.

Washington, D. C.—See "Public Buildings."

Washington, D. C.—See "Miscellaneous."

Dublin, Ga.—An election will probably soon be held to vote on issuing about $60,000 bonds for improving light and water plant, install fire alarm system and pave Jackson and Jefferson Sts.

Canton, Ga.—The citizens are reported to have voted to issue bonds for establishing water works, a sewerage system and electric light plant.

Kokomo, Ind.—Bids will be received until Nov. 8 by Bd. Pub. Wks. (J. A. Burkhalter, Chmn.) for furnishing electric lights for the streets, alleys and public places and buildings in the city. W. T. Meck, City Clk.

Columbus, Ind.—The Columbus Gas Light & Coke Co. is reoprted reorganized and is said to be asking Council for a long-term franchise. The company contemplates the erection and equipment of a new gas plant.

Ida Grove, Ia.—It is reported that the Ida Grove Electric Co. contemplates remodeling and extending its plant.

Mt. Pleasant, Ia.—Jackson & Ruggles, of Centerville, Ia., are reported to be considering the installation of an electric light plant at Mt. Pleasant.

**Davenport, Ia.*—The Independent Light & Power Co. is reported to have awarded to the McCarthy Improv. Co. the contract for laying 20 miles of gas mains.

Ft. Leavenworth, Kan.—Bids will be received by Capt. J. E. Normoyle, Q. M., U. S. A., until Oct. 12, for furnishing and installing electric fixtures in 8 double sets non-commissioned staff officers' quarters, 1 double stable guard building and 2 quartermasters' stables, and electric wiring in 2 quartermasters' stables, this post.

White Castle, La.—Alphonse Kahn is reported to have presented a proposition to this city to furnish electric lights.

**Wyandotte, Mich.*—Arbuckle, Ryan & Co., Toledo, O., are reported to have secured contract for engine and the Westinghous Electric & Mfg. Co., of Pittsburg, Pa., the contract for other necessary equipment for extension to electric light plant, for $13,566.

Albion, Mich.—Paul Ray, Vice-Pres. and Gen. Mgr. Albion Gas Light Co., writes that it is proposed to install a 100,000 cu. ft., 2-lift gas holder steel tank and new condensing apparatus.

Painesdale, Mich.—W. O. Rankin, of Painesdale, is reported interested in the construction of a power plant about 5 miles from Painesdale.

Bay City, Mich.—The City Council is reported to have decided to consider the question of constructing a municipal electric light plant.

Negaunee, Mich.—Electric light bonds to the amount of $10,000 are reported offered for sale.

Manchester, Mich.—It is reported that estimates are being made for a municipal light and power plant.

Caledonia, Minn.—The citizens, it is reported, will soon be asked to vote on issuing $6,000 bonds for improving light and water plant.

Northome, Minn.—E. E. Bigham, of Minneapolis, is reported to have secured a franchise for an electric light plant.

University, Miss.—D. S. Ross, of University, Secy. University of Mississippi, writes that bids will probably be received in the spring for rebuilding power plant recently burned; cost will be between $10,000 and $15,000.

Exeter, Neb.—C. C. Smith is reported to have secured a franchise for electric lighting.

Portsmouth, N. H.—The following are the bids opened on Sept. 21 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for extension of Central Power House, Navy Yard, Portsmouth: The Whiton & Haynes Co., 35 Federal St., Boston, Mass., $42,982; C. M. Leach, Care Navy Yard, Portsmouth, $41,363; Conners Bros. Co., 157 Plain St., Lowell, Mass., $44,000, and Jas. E. Leamy & Co., 28 Larned Bldg., Syracuse, N. Y., $41,937.

Elmer, N. J.—The Elmer Gas Co. is reported incorporated, to construct a gas plant. Rufus W. Smith, Pres.; E. C. Harris, Secy.

Woodbury, N. J.—A resolution has been introduced in City Council, providing for the issue of $25,000 bonds for the construction of municipal electric light plant.

Jersey City, N. J.—Bids will be received until Oct. 7 by John J. Heavey, Chmn. Com. on Municipal Lighting, for furnishing about 475 gas lamps, lighting and extinguishing same for the fiscal year ending Nov. 30, 1908; also about 305 oil lamps for same period.

New York, N. Y.—The following are the bids opened on Sept. 6 by Jas. W. Stevenson, Comr. of Bridges, for the construction and electrical equipment of subway station tracks, and the electrical equipment of the elevated railway tracks of Williamsburg New East River bridge, over East River: Snare & Triest Co., 143 Liberty St., $390,600; T. E. Gore and Daniel Mechan, 220 Bway., $348,000, and T. W. Carlin Constr. Co., $395,000.

New York, N. Y.—See "Water."

Bismarck, N. D.—Bids will be received, it is stated, until Oct. 10 by the Bd. Co. Comrs. for wiring the county courthouse. I. W. Healy, Co. Aud.

Rawson, O.—F. P. Folk, City Clk., writes that the Council has taken no definite action, but will probably construct electric plant. For further information address E. W. Burket, Mayor.

Hudson, O.—A citizen of Hudson has decided to construct and present to this town an electric light plant and waterworks, to cost about $100,000. Dr. W. I. Chamberlain and G. Mead will be trustees for the donor, and Mayor E. L. Filius will represent the town.

Philadelphia, Pa.—See "Water."

Providence, R. I.—The Narragansett Electric Lighting Co. (Marsden J. Perry, Gen. Mgr., Providence) is reported to have decided to build a tunnel under Providence River for its electric cables; the estimated cost of the improvement is $40,000.

**Lawrenceburg, Tenn.*—We are informed, with regard to bids opened on Sept. 13 by the Mayor and Bd. of Aldermen, for hydro-electric plant, that the contract for cyclopean concrete dam has been awarded to W. J. Neely, Columbia, Tenn., and for tunnel to Howard Neely, Chattanooga, Tenn. The turbines and dynamo will be purchased by the Engineer, W. G. Kirkpatrick, of Jackson, Miss.

Newport, Tenn.—C. H. Holland, Mayor, writes that the citizens on Sept. 21 voted to issue $50,000 bonds to be used for the construction of water works, a sewerage system and electric light plant. John M. Jones is Recorder.

Bristol, Va.-Tenn.—John H. Gose, City Clk., writes that J. D. Mitchell, Harry Roberts and Theo. Swann, all of Bristol, Va.-Tenn., have secured franchise for electric power plant for Bristol.

Waynesboro, Va.—The electric light and pumping station, combined with Rife's machine shops, are reported to have been destroyed by fire on Sept 25. W. A. Rife, of Waynesboro, is owner and Mgr.

Toppenish, Wash.—R. D. Campbell, Town Clk., writes that E. F. Bohannon has secured a franchise for an electric light plant.

Tacoma, Wash.—L. H. Pearson, Clk. Comr. of Pub. Wks., writes with regard to the proposed municipal power plant, that the proposition is at present in the hands of a committee of City Council, with a view to purchasing the water rights and site on the Upper Nisqually.

Renton, Wash.—The City Council is stated to have appointed a committee to investigate and report on the question of constructing a municipal electric light plant.

Tomahawk, Wis.—The Tomahawk Power Co. is reported incorporated with a capital of $25,000 by R. A. Curtis. A. H. Reid and others.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Geneva, Ala.—Richard Tullis, of Montgomery, is stated to have announced that he would soon begin the construction of an electric railway from Geneva to Dothan, Ala., to cost $500,000. It is his intention when this work is completed to extend the line to Union Springs, Troy, Eufaula, Clayton and Montgomery.

Los Angeles, Cal.—It is stated that since the Los Angeles-Pacific Co. was granted a permit to construct its subway from Temple St. to Sunset Boule., the company has changed its plans and now proposes to build a large subway. The old ordinance provided for a subway 26 ft. high and 22 ft. wide. Recently the City Council passed an ordinance providing for a subway 24 ft. high and 28 ft. wide. The Hill St. tunnel is to be large, and it is desired to make both bores correspond. It is the intention of the company to begin work on the subway at once.

Santa Cruz, Cal.—The City Council is stated to have granted a franchise to the Ocean Shore R. R. Co. for entrance into Santa Cruz, together with terminus and depot site in this city.

Ventura, Cal.—F. M. Packard and J. P. Jones, of Los Angeles, are stated to have applied for a franchise for an electric railway from Ventura to Nordhoff.

Hanford, Cal.—F. S. Granger is stated to have secured a franchise for a street railway over certain streets in Hanford.

Trinidad, Colo.—I is reported that extensive improvements on the street car system are now being contemplated by the Trinidad Electric Ry. Co. and within a year the company proposes to connect Cokedale, Sagundo, Hastings and interlying coal camps with Trinidad. One of the branches will extend west and the other north.

Farmer City, Ill.—The City Council is reported to have granted a franchise to Corn Belt Interurban Ry. Co. for right-of-way along east side limits of the city.

Canton, Ill.—It is stated that the Illinois Central Ry. Co. contemplates constructing a power station for a 12-mile line.

Carthage, Ill.—A petition is reported to have been filed by the Mississippi Valley Electric Ry. Co. with the State Bd. of Railroad and Warehouse Comnrs. asking for permission to cross at grade the Wabash R. R. at Carthage and the Toledo, Peoria & Western R. R. at Elvaston. The railroad in question is to be constructed from Carthage west to Keokuk, Ia., and from Hamilton, opposite from Keokuk, Ia., through Nauvoo to Ft. Madison, crossing the Santa Fe bridge at Ft. Madison and the Keokuk & Hamilton bridge at Keokuk. R. R. Smith, Assist. Engr., 1034 Rookery Bldg., Chicago.

Alton, Ill.—W. Rudsill, of Bunker Hill, is stated to have applied to the Village Bd. of East Alton for a franchise for a street railway through that place. He states the projected line will run from Bunker Hill through Bethalto Oil City and East Alton to Alton, a distance of 20 miles.

Crawfordsville, Ind.—The Comrs. of Montgomery County are stated to have granted a franchise to the Chicago & Western Indiana Traction Co., known as the "Educational Route," to construct and operate an electric railway through the county.

**Princeton, Ind.*—The Evansville & Southern Indiana Traction Co., (R. H. Cole, Ch. Engr.), is stated to have let a contract to Jones Bros., of Columbus, O., for the construction of its extension between Princeton and Paloka, a distance of 4½ miles. The contract to construct the five bridges on the extension was awarded to the Lafayette Engineering Co., of Lafayette.

Atlantic, Ia.—The Atlantic Northern & Southern Ry. Co. is stated to have announced that they have completed arrangements for the right of way for the entire distance between Atlantic and Kimbalton. The work of grading has been started. The line will be in all about 20 miles in length.

Clinton, Ia.—The Wenatchee Valley & Northern Ry. Co. is stated to have filed articles of incorporation with the Secy. of State; capital, $100,000. L. Lamb, Pres.; Petrel Davis, Treas.; J. E. Lamb, Secy., all of Clinton.

Rosedale (Kansas City), Kan.—The Strang Olathe-Kansas City Electric Ry. Co. is reported to have applied to the City Council of Rosedale for a franchise for the use of the streets.

Northampton Mass.—Eugene D. Parks, of Russell, and others are reported to have announced that plans are being considered for the construction of a street railway from Northampton, Easthampton and Westhampton. The line, it is proposed, will extend from Easthampton to Loudville, West Farms and Florence, with a branch line to Westhampton.

Bemidji, Minn.—The City Council is reported to have passed the ordinance granting a franchise to Carl C. Gowran, A. A. Carter and Geo. W. Teitsworth for constructing and maintaining a street railway in Bemidji.

Brooklyn, N. Y.—The Public Service Comn. on Oct. 2 passed a resolution providing for the construction of the 4th Ave. subway in accordance with plans of the Bd. of Rapid Transit R. R. Comrs. of N. Y. City, and bids for same will be called for at once; probable cost of construction, $23,000,000. The route of the line is from the Manhattan terminal of the Manhattan Bridge, over the bridge and under the extension of Flatbush Ave. to Flatbush and Atlantic Aves., thence under 4th Ave. to 40th St. This is the part that will be contracted for almost immediately, the line to be 4 tracked. Eventually 2 tracks will be extended from 40th St. to Ft. Hamilton, and the other 2 tracks will be carried from 40th St. to Coney Island.

Buffalo, N. Y.—The Public Service Comn. is stated to have granted an order of approval to the Crosstown St. Ry. Co., of Buffalo, to construct an extension of its electric street railroad in Cheektowaga, in and through Delavan Ave., from the city line of Buffalo to the Pine Hill Road.

Tottenville, S. I., N. Y.—The construction of an electric traction system on Staten Island is reported projected by New York capitalists, who plan to build and operate a line in a section which is now served by stages. The line will be known as the Richmond & Tottenville Ry. Co., to connect Richmond, Rossville, Kreischersville and Tottenville. The road will be standard gauge and about 10 miles long. The estimated cost of construction and equipment is about $400,000. Thos B. McGovern, Broad Exchange Bldg., and Cornelius G. Kolff, 50 Bway., New York City, are reported interested.

Dayton, O.—The Dayton St. Ry. Co. is stated to have been granted a franchise from southwest Dayton to Dayton View and northwest Dayton, and the announcement has been made that the construction work will be begun at once.

Defiance, O.—The Ohio Electric Ry. Co. is stated to have made the Co. Comrs. a proposition to build a joint bridge across the Auglaize River at this point, the structure to be 80 ft. wide and 4 spans long and built of concrete.

Albany, Ore.—A. Welch is reported to have been granted a franchise for a street railway in Albany.

Eugene, Ore.—The Eugene & Eastern Electric Ry. Co. (J. O. Storey, Pres.) is stated to have begun surveys for the electric railway to be constructed between Eugene and Portland.

Wellsville, Pa.—A charter is stated to have been granted to the Dillsburg & Wellsville R. R. Co. to build a line from a connection with the Dillsburg & Mechanicsburg line at Dillsburg via the Stony Run, Beaver Creek & Doe Run R. R. to Wellsville. The line will be 7½ miles long and the capital is $75,000. Directors, Augustus C. Hetrich, of Wellsville; Robert J. Beet, Jos. Milligan, West De Brougher and others.

Chambersburg, Pa.—Governor Stuart is reported to have approved the application of the Chambersburg, Greencastle & Waynesboro St. Ry. Co. for an extension of its system from Greencastle to Chambersburg. Practically all the rights of way have been secured. Construction work will likely be commenced at the Greencastle terminus, and connection may be made with the Chambersburg & Gettysburg system at Chambersburg. The line will pass through Kauffman's, Rhodes' Grove, Marion and Guilford Springs.

Lancaster, Pa.—The Conestoga Traction Co. is stated to have purchased a site for a new carbarn and power plant. It is expected that work on the new plant will be started soon.

McSherrystown, Pa.—The Hanover & McSherrystown St. Ry. Co. is stated to have secured a franchise from City Council for extension through McSherrystown, and proposes extending the line to Littlestown, a distance of about 5 miles.

**Items marked thus give the names of parties awarded contracts.*

Windber, Pa.—It is stated that the Berwind-White Coal Mining Co. is considering the construction of an electric railway to connect central Windber with the various mines of the company in that section.

Pittsburg, Pa.—The City Council is reported to have passed an ordinance granting a franchise to the Dravosburg Heights St. Ry. Co.

Providence, R. I.—See "Miscellaneous."

Chattanooga, Tenn.—It is stated that the Tennessee Constr. Co. is to build the Georgia-Tennessee Interurban Electric Ry., which is being promoted by S. W. Divine. It is understood that this concern is to build a line from Chattanooga to Chickamaug Park and that another concern will build the line from that point to Spring Place, Ga. The Tennessee Constr. Co. has capital of $25,000. Samuel B. Smith, Pres., and W. M. Elliott, Secy. and Treas.

Houston, Tex.—The Galveston-Houston Electric Co. is reported organized by the Stone & Webster interests, of Boston, to embrace in its holdings three companies, the Houston Electric Co., which is the terminal company in Houston, owning the Houston St. Ry. system; the Galveston Electric Co., which is a terminal company, owning the Galveston St. Ry. system, and the third is the Galveston-Houston Electric Ry. Co., which is a concern organized for the purpose of constructing an interurban line between Houston and Galveston, a distance of 52 miles. Surveys have been made and considerable preliminary work has been done toward the construction of the interurban. The line will run on a private right of way, and actual construction will be begun as soon as various further preliminaries have been arranged.

Bellingham, Wash.—Albert A. Hang is reported to have announced that he will construct an electric railway connecting the Mt. Baker mining dist. with Bellingham.

Tacoma, Wash.—The Pacific Traction Co. is stated to have filed a mortgage of $2,000,00 to provide funds for the construction of the Tacoma system. The next line to be built will be to Point Defiance.

Elkins, W. Va.—S. B. Elkins, Richard O. Kerns and Henry Gasaway Davis, of New York, N. Y., are stated to have secured a charter for an electric railway through the counties of Taylor, Balbour and Randolph in West Virginia, to be connected with the Morgantown, Fairmont & Mannington Line, which is to be extended to Wheeling, and then run direct to Pittsburg. It is said that the road will cost close to $1,000,000. The name of the new company is the Elkins Light & Power Co.

Chihuahua, Mex.—It is reported announced that more than $1,000,000 will be spent in constructing the new electric street railway system in Chihuahua and in building suburban lines to Santa Eulalia and to the new smelter of the American Smelting & Refining Co., 16 miles distant. The rails and other material for the new system have arrived. Enrique Creel is said to be interested and A. C. Nash is Gen. Mgr.

Mexico City, Mex.—The Electric Tramways, Ltd., of this city, is stated to have obtained concessions from the Federal Government to build important extensions and to double track some of its existing lines.

Vera Cruz, Mex.—Announcement is stated to have been made by the Vera Cruz Electric Light, Power & Traction Co. that it has completed arrangements to provide that city with electric traction in addition to the power and lighting service which it is now supplying. The power plant at Vera Cruz is being greatly enlarged and work of rebuilding the track will soon be started.

Linares, Mex.—The street railway system of the city of Linares, State of Nuevo, Leon, is reported to have been purchased by Jose Bonilla. He states that he will greatly improve the lines and will build extensions to two smaller towns in that immediate section.

Saltillo, Mex.—It is stated that a number of capitalists have organized a syndicate, headed by Guillermo Velasco and Rodolfo Garza, of Saltillo, to construct an electric street railway system in Saltillo.

RAILROADS.

Notes Arranged Alphabetically by States.

Denver, Colo.—Local press reports state that the Denver, Laramie & Northwestern R. R. Co., is reported organized to build a railroad from Denver to Lander, Wyo. Col. W. E. Skinner, of the Denver Union Stockyards Co., is said to have purchased for the syndicate promoting the road, the Higby tract on W. 48th Ave. and Bwdy. as a site for its terminal road.

Lewiston, Idaho.—Articles of incorporation of the Bitter Root R. R. Co., an auxiliary of the Oregon & Navigation Ry. Co., were renewed on Sept. 14 by the filing of new articles in the office of the Clk. of Multnomah County. Capital, $200,000. It proposes building a railroad from Lewiston, Idaho, into Montana. The line will ultimately be built, it is said, and become a part of the Oregon Ry. & Navigation system, connecting with the Lewiston extension.

Muskogee, Ind. Ter.—The final survey for the Shawnee Central R. R. Co. is reported to have been completed. The road is to run from Muskogee to Childress, Tex., 300 miles, with an 80-mile branch line between Shawnee and Tulsa. Dr. W. S. Woods, of Kansas City, Mo., Pres. of the National Bank of Commerce, is the chief promoter.

A company is reported organized at Guthrie, Okla., to build a railroad 55 miles long, for the purpose of connecting Muskogee to a point on the Ft. Smith & Western R. R. and also connecting that section with deep water navigation on Arkansas River, estimated cost of line is $1,500,000. Incorporators: C. R. D. Dean, J. M. Aydelotte and C. H. Gilman, of Shawnee, Okla., and Ira L. Reeves and S. M. Rutherford, of Muskogee.

Danville, Ky.—J. F. Allen, Pres. of the railroad which is to be constructed from Danville to Scottsville, is reported to have floated bonds to the amount of $2,000,000. Right of way has been secured from Scottsville to McKinney, and the survey will be completed into Danville ... Contractor W. J. Oliver, of Chattanooga, Tenn., ... expected to be here to make an estimate on cost of construction.

... *Ky.*—A railroad to connect Corbin, Ky., on the ... Louisville & Nashville R. R., with Clarksville, ... reported projected. The road is to be known as the ... ville & Norththeastern R. R., and will be constructed by way of Monticello, Ky., Burnside, Albany, Ky., ... Boiling Springs, Lafayette and Springfield, Tenn. The first portion of the line to be constructed will be from Corbin to Monticello, about 55 miles. Saml. Woodward, of Cincinnati, is president of the company.

Buffalo, N. Y.—Press reports state that surveyors are at work in Wayne County on the route of a steam road to be constructed from Troy to Buffalo, known as the Buffalo, Rochester & Eastern R. R. The road will run through Butler, Rose, 5 miles north of Clyde; South Sodus, North Walworth and Pittsfield. A syndicate of capitalists interested in the Boston & Maine R. R., and the New York, New Haven & Hartford R. R. are reported interested in this new road.

Utica, N. Y.—The New York Central & Hudson R. R. Co. (Geo. W. Kittredge, Ch. Engr., N. Y. City) is reported to have completed and presented to Mayor Sherman, plans for an elevated crossing at Genesee St.; two plans were presented, one of which would cost $524,000 and which provides for a clearance above the freight tracks of 22 ft.; and the other plan, to cost about $780,000, provides for a clearance of 22 ft. above all the tracks. The former is said to be considered the most desirable.

Edinburg, N. D.—The Northern Dakota Ry. Co. is reported organized, with Thos. Campbell, Pres.; Elis Thorwaldson, Vice-Pres., and Dan Bull, Secy., to construct a railway from Edinburg north a distance of 21 miles to the plant of the Pembina Portland cement mines.

Sandusky, O.—At a recent meeting of City Council the report of City Engineer Schultz on the grade crossing subways was submitted. His estimates varied from $118,000 to $150,000 per subway for 4 subways.

Toledo, O.—City Engr. Frank I. Consaul is reported to have prepared an estimate of cost of the separation of grades at the junction of Bway. and the Wabash R. R. The elevation of the Wabash R. R. tracks and the lowering of the street to conform, will cost, approximately, $133,637. Of this the Wabash R. R. Co. (A. O. Cunningham, Ch. Engr., St. Louis, Mo.) must pay $66,818, and the Toledo Ry. & Light Co. and the City, each $33,409. The Wabash tracks will be raised 4½ ft. and Bway. will be lowered 12 ft.

Cleveland, Okla. Ter.—The Wichita, Cleveland & Gulf Ry. Co. is reported incorporated with a capital of $50,000,000 and headquarters at Cleveland, Okla., to build a railroad from Wichita, via Cleveland, to Port Arthur, Tex., passing through Sedgwick, Butler, Cowley and Chautauqua Counties, in Kans.; the Osage reservation and Pawnee County, in Okla.; the Creek, Cherokee and Choctaw nations in Ind. Ter., and the states of Arkansas, Texas and Louisiana; estimated length of proposed line is 634 miles. Incorporators are David Ratjer, J. F. Hethering, J. C. Byers, and others, all of Cleveland.

**Philadelphia, Pa.*—The contract for the first construction work in connection with the elevation of its tracks between Market St. terminal and Wayne Junction, is reported to have been awarded on Sept. 24 by the Reading Ry. to Riley & Riddle. It provides for laying out of a temporary freight yard of 200 cars capacity on 17th and 19th Sts. and Indiana Ave., along the line of the Philadelphia, Germantown and Norristown branch of the railway.

Specifications are reported as being printed by the Philadelphia & Reading Ry. (Wm. Hunter, Engr., Phila.) for the celvation of tracks between a point south of Berks and Broad Sts. The railway will invite bids within a few days. The tracks in this section will be raised by a solid embankment with masonry retaining walls. Engineers of the railway are also drafting plans for a temporary locomotive storage yard at Wayne Junction, for which bids will be asked in a short time. A storage yard for passenger equipment will be laid out at Huntingdon St., near Broad St., on the property formerly occupied as a freight delivery yard.

**Swissvale, Pa.*—A contract is reported to have been awarded by the Pennsylvania R. R. Co. to the Green & Read Constr. Co. for the undergrade crossing at Braddock Ave., Swissvale station, to be completed about July, 1908; the work is estimated to cost about $100,000.

Anderson, S. C.—The contract for the survey for the Georgia-Carolina R. R. to connect Athens, Ga., and Anderson, is reported to have been let at Royston, Ga., on Sept. 19, to Decamps & Cunningham, of Anderson, and the Richardson Weq Eng. Co., of Atlanta, Ga. These two firms will work jointly. The survey work will commence within 30 days.

Menasha, Wis.—The Ontonagon Northern R. R. Co. is reported incorporated, and is to be the Michigan end of the Wisconsin & Northern R. R. and is to extend from Oskosh to Ontonagon, Lake Superior. The projector of the line is said to be the Menasha Woodenware Co.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Selma, Ala.—The following are the bids received Sept. 30 by the Superv. Archt. at Washington, D. C., for the construction, including heating apparatus, plumbing, gas piping, electric conduits and wiring, of the U. S. Post Office at Selma: Algernon Blair, Montgomery, Ala., $139,800; King Lumber Co., Charlotteville, Va., $119,300, and H. A. Bishop, Chicago, Ill., $138,250.

Hot Springs, Ark.—Bids will be received about Oct. 19 by Capt. P. L. Boyer, Q. M., U. S. A., for furnishing material and constructing on the Government reservation here, a 1-story, 33x56 ft., stable and carriage house, including excavations, if any, necessary for same; foundation, stone and cement; superstructure, brick; roof, slate; bids will also be received for plumbing of same.

Oakland, Cal.—The Fabiola Hospital Assoc., it is reported, has asked bids for erecting a 3-story addition to the hospital, to cost $50,000.

San Francisco, Cal.—The Southern Pacific R. R. Co. (W. Hood, Ch. Engr., San Francisco), it is stated has applied for a permit to erect a 3-story steel and concrete hospital on Hayes and Baker Sts.

The Fire Comr. has asked the Bd. Pub. Wks. to have plans prepared and ask bids for erecting the fire department building on Bush St., to cost $25,000.

Santa Rosa, Cal.—It is stated that a city hall and fire department building is to be erected at a cost of $50,000, exclusive of site.

Denver, Colo.—The lowest bids received recently for erecting a public bath at 20th and Curtis Sts., it is stated, were as follows: General work, W. E. Towers, Continental Bldg., $48,877; plumbing Irving Plumbing & Htg. Co., 1709 California St., $11,497; ventilating and heating, T. F. Dolan Htg. & Plumbing Co., 1422 Glenarm St., $7,400.

**Atlanta, Ga.*—J. R. Gray, Pres. Auditorium-Armory Bd., writes that the contract for erecting auditorium-armory has been awarded to Gude & Walker, of Atlanta, for about $200,000.

Arco, Idaho.—It is stated that the Bd. Co. Comrs., at Harley, will receive bids until Oct. 14 for erecting a jail at Arco.

Chicago, Ill.—Bids will be received until Oct. 12 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a fire engine house at 710 52d Ave., bids to be submitted on the following: Masonry, carpentry, iron work, plumbing, etc.

Watertown, Ill.—It is reported that bids are wanted until Oct. 8 for erecting a building for the Western Illinois Hospital for the Insane. W. Carbys Zimmerman, State Archt., 1001 Steinway Hall, Chicago.

East St. Louis, Ill.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C. until Oct. 28, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Post Office and Court House at East St. Louis.

Auburn, Ind.—It is stated that the State Bd. of Charities have plans for a poor asylum, to be erected in DeKalb County.

Muscatine, Ia.—The following are the bids opened on Sept. 19 at the office of the Supervising Archt., Treas. Dept., Washington, D. C., for the construction complete of the U. S. Post Office at Muscatine: General Constr. Co., Milwaukee, Wis., $57,640; W. J. McAlpine, Dixon, Ill., $55,400; G. B. Strickler, Cedar Rapids, Ia., $58,890; Northern Constr. Co., Milwaukee, Wis., $59,500; C. W. Gindele Co. Chicago, Ill., $58,250, and J. W. Wiese, S. Omaha, Neb., $58,200.

A. S. Lawrence, Co. Aud., writes that the contract for erecting courthouse (bids opened Sept. 26) has been awarded to W. J. McAlpine, of Dixon, Ill., for $108,500.

Mason City, Ia.—The Mason City Hospital Co., it is stated, has accepted plans and specifications for its hospital, which is to cost about $25,000. Dr. I. I. Nichol, Secy.

Waterloo, Ia.—The Franciscan Sisters, of St. Louis, Mo., it is reported, propose erecting a hospital here at a cost of about $70,000.

Cedar Rapids, Ia.—The following are the bids opened on Sept. 23 at the office of the Superv. Archt., Treas Dept., Washington, D. C., for the construction (except elevator) of an extension, remodeling, etc., to U. S. Post Office and Court House at Cedar Rapids: G. B. Strickler, Cedar Rapids, $129,782; Northern Constr. Co., Milwaukee, Wis., $138,000; General Constr. Co., Milwaukee, Wis., $121,277; W. J. McAlpine, Dixon, Ill., $117,000, and Bartlett & Kling Cedar Rapids, $138,537.

National Military Home, Kan.—Bids will be received until Oct. 22 by Maj. W. M. Martin, Treas., N. H. D. V. S., for constructing the following buildings: Combination barrack building, with mess hall and kitchen; addition to quartermaster's storehouse; quarters for chaplain; addition to mess hall; dormitory for civilian employes. Separate bids to be submitted for heating, plumbing and electrical work.

Louisville, Ky.—Bids will be received until Oct. 10 by the Bd. Safety (W. W. Davies, Chmn.) for erecting a police station at 18th and Garland Aves. Fred Erhart, Archt., 409 Norton Bldg.

Portland, Me.—Bids will be received by Capt. F. I. Morrow, Q. M., U. S. A., 478½ Congress St., Portland, until Nov. 5 for the construction, etc., of a double barrack at Ft. Williams, and a single barrack at Ft. McKinley, as advertised in The Engineering Record.

Ft. Washington, Md.—Bids will be received by the Constructing Q. M., U. S. A., Ft. Washington, until Nov. 4 for the construction, plumbing, heating, electric wiring and installing electric light fixtures for one double barrack building for coast artillery at Ft. Washington, as advertised in The Engineering Record.

Baltimore, Md.—The erection of a central police station, at a cost of about $100,000, is reported under consideration.

**Quincy, Mass.*—Conners Bros., of Lowell, Mass., have secured the contract for erecting complete U. S. Post Office (bids opened Sept. 4 at the office of the Superv. Archt., Treas. Dept., Washington, D. C.), for $69,835.

**Charlestown, Mass.*—The Mass. State Armory Comn., at Boston, it is stated, awarded the contract to erect an armory in Charlestown on Bunker Hill St., (bids for which were opened Sept. 23), to Whiton-Haynes Co., 35 Federal St., Boston, at $121,000.

**Worcester, Mass.*—The contract to erect an addition to the heating plant at the City Home is reported awarded to John J. Power, at $3,600.

Flint, Mich.—Bids will be received at the office of the Superv. Archt., Washington, D. C., until Nov. 5, for the construction complete of U. S. Post Office at Flint, as advertised in The Engineering Record.

Lansing, Mich.—We are informed that all bids opened on Sept. 16 for alterations to City Hall have been rejected as being too high, and work will be done by day work, under direction of the Supt. of Pub. Wks.

St. Paul, Minn.—The Fire Bd., it is reported, has rejected all bids recently received for erecting No. 18 engine house, on University Ave. and St. Albans St., as they exceeded the appropriation, which is $25,000.

Minneapolis, Minn.—The State Bd. of Equalization, it is reported, is in favor of issuing $45,000 for the rebuilding of cells, installing new plumbing system and otherwise improving the sanitary condition of the county jail. $15,000 has been granted to rebuild the elevators in the courthouse.

Independence, Mo.—The Co. Court is reported to have adopted plans for the 2 buildings to be erected at the county farm, as prepared by Smith & Rea, Dwight Bldg., Kansas City. The main building is to be 3 stories, 309x232 ft., and the other 2 stories, 50x110 ft., constructed of

*Items marked thus give the names of parties awarded contracts.

native limestone, and it is stated that bids for the construction will be received about Oct. 22. Estimated cost, $250,000.

*St. Joseph, Mo.—George & Burnet are reported to have secured the contract to erect an addition to the Ensworth Medical College and Hospital, at about $30,000.

Fayette, Mo.—The citizens, it is reported, have authorized the erection of a building at the County Infirmary to cost $10,000.

St. Louis, Mo.—The City Officials are said to be contemplating the erection of a new public market at a cost of about $500,000.

Bids will be received until Oct. 18 by the Bd. Pub. Improv. (A. J. O'Reilly, Pres.) for furnishing material and rebuilding the east wing of the main building of the City Poorhouse, known as Bldg. No. 1; probable cost, $25,000.

*Helena, Mont.—It is stated that the contract to erect the House of the Good Shepherd near Kenwood has been awarded to Lease & Richards, of Great Falls, at $75,545, including laundry building. Contracts are yet to be let for the plumbing and lighting of said building, which will cost an additional $15,000.

*Omaha, Neb.—McGowan & Jacobberger are reported to have secured the contract to erect the Clarkson Hospital. The total cost of the building is to be about $100,000.

*Binghamton, N. Y.—T. E. McGarr, of Albany, N. Y., State Comr. in Lunacy, writes that the contract for constructing diningroom and kitchen addition to Chronic Bldg., to include construction, heating, plumbing, electric light wiring and fixtures and feeder cables, at Binghamton State Hospital, Binghamton, has been awarded to R. T. Ford & Co., of Rochester, for $49,900.

Ft. Totten, Willet's Point, N. Y.—Bids will be received at the office of the Constr. Q. M., U. S. A., until Oct. 18, for alterations and repairs to Barracks 107, 108 and 110 at this post, as advertised in The Engineering Record.

Plattsburgh Barracks, N. Y.—Bids will be received at the office of the Constr., Q. M., U. S. A., until Oct. 28, for constructing, plumbing, and electric wiring, a quartermaster's stable, and constructing a wagon shed at this post, as advertised in The Engineering Record.

Castleton, S. I., N. Y.—Bids will be received by Dept. Pub. Charities (Robt. W. Hebberd, Comr.), New York City, until Oct. 14, for labor and materials required for the excavation, masonry, steel and iron roofing and metal work, carpentry, glazing, painting, hardware, electric work and all other work (except plumbing, heating, elevator work, electric wiring and fitting up of the diet kitchens, drug rooms and utility rooms), for the construction and completion of 6 ward buildings of the Sea View Hospital, on Manor Rd., Township of Castleton, Boro. of Richmond. Raymond F. Almirall, Archt., 51 Chambers St., New York City.

*Brooklyn, N. Y.—The following are the bids opened on Sept. 30 by the Dept. of Pub. Charities (Robt. W. Hebberd, Comr.) for furnishing material and erecting Coney Island Hospital, Boro. of Brooklyn: Clarke & Stowe, 221 Greenpoint Ave., Brooklyn, $347,300. L. A. Burke Sons Co., 25 W. 42d St., N. Y. City., $350,713; P. J. Carlin Constr. Co., 1 Madison Ave., N. Y. City, $339,711; R. B. Ferguson, 252 Lee Ave., Brooklyn, $342,800; Peter Cleary, 235 Bainbridge St., Brooklyn, $349,900; D. J. Ryan, 723 3d Ave., Brooklyn, $343,800; F. T. Nesbitt Co., 116 Nassau St., N. Y. City, $338,500, and R. E. Heningham, 1 Madison Ave., N. Y. City, $328,475 (awarded contract).

*Buffao, N. Y.—The Bd. of Superv., it is stated, has warded the contract to erect an addition to the jail (bids for which were received Sept. 10) to Geo. Schaaf, 14 Builders' Exchange, at $34,500.

New York, N. Y.—The following are the bids opened on Sept. 26 by the Park Board, for furnishing material and erecting an addition to Metropolitan Museum of Art, to be known as Library Wing (addition G): Buckley Realty Constr. Co., 624 Madison Ave., $90,000; Luke A. Burke & Sons Co., Inc., 25 W. 42d St., $90,713; Calumet Constr. Co., 15 E. 59th St., $91,721; Thos. Cockerell & Son, 147 Columbus Ave., $98,900; Guidowe & Galardi Co., 1 Madison Ave., $103,100; Rich. E. Heningham, 1 Madison Ave., $94,127; Geo. Hildebrand, 38 Park Row, $101,900; Kelly & Kelley, Inc., 45 E. 42d St., $93,735; John H. Parker Co., 225 4th Ave., $98,978; M. Reid & Co., Inc., 114 W. 39th St., $98,880; Thompson & Kelsey, $96,874; Thos. J. Waters, $95,000, and Wm. Werner, 892½ Forest Ave., $99,527.

Governor's Island, N. Y. H., N. Y.—Bids will be received until Oct. 15 by the Constr. Q. M., U. S. A., Governor's Island, N. Y. H., for furnishing material for the construction, plumbing, heating, wiring and lighting fixtures of a post exchange and gymnasium at Ft. Jay, Governor's Island.

Poughkeepsie, N. Y.—Bids will be received until Oct. 9 by State Comn. in Lunacy, at Albany (T. E. McGarr, Secy.), for 2 new boilers at central group, Hudson River State Hospital, Poughkeepsie.

Long Island City, L. I., N. Y.—Bids will be received until Oct. 17 by Jos. Bermel, Boro. Pres., for rebuilding the interior of the county courthouse.

Rochester, N. Y.—The following are reported to be the bids received Sept. 25 by the Bd. Contract & Supply for remodeling the armory into a convention hall: F. J. Sauer, $19,600; Fred Gleason, $21,594; R. T. Ford & Co., $23,200; Anthony Link, $21,844; F. H. Rapp & Co., $21,000.

*The contract to erect above building is reported awarded to Frank J. Sauer, 31 S. Water St.

Glen Cove, L. I., N. Y.—It is reported that the Town Bd., Oct. 19, will open bids for erecting the brick and terra cotta town hall, which is to cost about $15,000.

Ft. Lincoln, N. D.—Bids will be received by Bowers Davis, Constr. Q. M., U. S. A., until Oct. 8 (not Nov. 8 as previously stated) for the construction of an ice house, commissary root cellar, and addition to Q. M. stables at this post, as advertised in The Engineering Record.

Columbus Barracks, O.—Bids will be received until Oct. 30 by Capt. H. E. Chamberlain, Constr. Q. M., U. S. A., for construction of 3 double sets lieutenants' quarters (including plumbing, heating, electric wiring and fixtures), 1 quartermaster's storehouse and 1 wagon shed at this post.

Cincinnati, O.—Harry Hake, Union Trust Bldg., Cincinnati, it is stated, has been directed to prepare plans for a firehouse, to be erected in Cumminsville, at a cost of about $20,000.

Youngstown, O.—See "Paving and Roadmaking."

Wapakoneta, O.—The Auglaize County Infirmary, it is reported, has been destroyed by fire.

Cleveland, O.—Bids will be received at the office of the Superv. Archt., Washington, D. C., until Oct. 31, for mechanical equipment (except elevators); also interior partitions and mason work, of U. S. Post Office, at Cleveland, both proposals advertised in The Engineering Record.

*Painesville, O.—The Trus. of the Painesville Hospital Assoc., it is reported, have awarded to Chas. Bauck Co., of Cleveland, the contract to erect an addition to the hospital.

Hamilton, O.—The following are the bids opened on Sept. 24 at the office of the Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of U. S. Post Office building at Hamilton: John Grants' Sons Cleveland, $126,800, and Barnes Bros., Marion, Ind., $108,000.

Butler, Pa.—It is stated that the Co. Comrs. have decided to issue $125,000 bonds to repair the courthouse.

Hazleton, Pa.—Cope & Stewardson, of Philadelphia, it is stated, have completed plans, and bids are now being received, for an addition to be erected to the State Hospital at Hazelton, which is to consist of a main building, 3 stories high and 2 wings each 2 stories high, to be of brick and stone and cost about $60,000.

Harrisburg, Pa.—Bids will be received until Oct. 16 by the Bd. Trus. of the Pennsylvania State Lunatic Hospital at the office of H. L. Orth, M. D., Supt., Harrisburg, for erecting a building for the care and treatment of convalescent inmates, and a building for care and treatment of the recent and acute patients. J. A. Dempwolf, Dempwolf, Archt., York.

Pittsburg, Pa.—Mayor Guthrie has signed the ordinance authorizing a bond issue of $150,000 and a special appropriation of $25,000 to provide money to replace buildings destroyed by fire at Marshalsea.

The building of a new market house, at a cost of about $500,000, is reported under consideration.

*Philadelphia, Pa.—The contract to erect the superstructure of the Harbor of Refuge Lighthouse, Delaware Bay, (bids for which were received in Philadelphia, Pa., on Sept. 10), is stated to have been awarded to Danl. L. Toomey, of Brooklyn, N. Y., at $14,800.

Newberry, S. C.—It is stated that a Special Com. has been appointed by the Chamber of Commerce to form a company with a capital of $15,000 for the purpose of erecting a hospital here.

Richmond, Tex.—Bids will be received until Oct. 14 by the Comrs. Court, for $75,000 courthouse, $30,000 Bragos River Bridge, and $5,000 Bernard Bridge bonds. For further information address D. R. Pearson, Richmond.

Roanoke, Va.—Bids will be received until Oct. 25 by W. E. Thomas, City Clk., for building an extension to the City Market House, and rearranging and remodeling the present building. H. H. Huggins, Archt., Roanoke.

*Olympia, Wash.—The State Bd. of Control at Olympia, it is stated, has awarded contracts as follows for work at the penitentiary: Two 150- h. p. boilers. Babcock & Wilcox Co., N. Y. City, $4,963; balance draft system for heating, Engineering Corporation, Seattle, $1,800; steel material for new buildings, G. H. Sutherland, Walla Walla, $2,840.

Seattle, Wash.—It is reported that a $50,000 building is to be erected at the Alaska-Yukon-Pacific Exposition for the State of Oregon.

Chippewa Falls, Wis.—Bids will be received until Nov. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Chippewa Falls.

Eau Claire, Wis.—The following are the bids received Oct. 1 by the Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Eau Claire: P. M. Hennesey, St. Paul, Minn., $120,662; I. W. Miller, St. Paul, Minn., $116,927; Newman & Hay, St. Paul, Minn., $147,253; Genl. Constr. Co., Milwaukee, $133,054; Northern Constr. Co., Milwaukee, $134,000; Wm. Lister, Chippewa Falls, $163,907; Chippewa Falls Constr. Co., Chippewa Falls, $162,092; C. W. Gindele Co., Chicago, Ill., $125,150; Cauntzen Bros., Fergus Falls, Minn., $125,895, and Paul Riemers Sons, Milwaukee, $124,197.

Edmonton, Alta.—Wm. Fingland, of Winnipeg, Man., it is stated, is preparing plans for Parliament Buildings to be erected here, and it is expected that the contract for the construction will be let this fall.

Oaxaca, Mex.—Dr. M. Damourett, of Oaxaca, is said to be planning the erection of a tuberculosis sanitarium here to cost about $500,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

*Florence, Ala.—The Bd. Dir. of Farmers' Union Warehouse Co. is stated to have awarded the contract for erecting the warehouse in East Florence to Abbott & Eberhard, of Sheffield. The structure to be of brick, 80x120 ft.

Phoenix, Ariz.—Trost & Trost, of El Paso, Tex., it is reported, are preparing plans for a building for the Republican Club.

Trost & Trost, of El Paso, it is stated, have submitted plans for the Y. M. C. A. Bldg. to be erected on Monroe St. and 1st Ave., at a cost of about $60,000.

*Los Angeles, Cal.—The Pozzo Constr. Co., 501 Macy St., is reported to have secured the contract to erect a 2-story store and lodge building at N. Main and Macy Sts. for Mrs. Marie Hammel, to cost $18,000.

Contracts for work in connection with the Y. M. C. A. Bldg., which is being erected at 715 S. Hope St., it is stated, have been awarded as follows: To the Natl. Lumber Co., outside iwndows and door frames; B. V. Collins, marble and tile work; Bailey Ornamental Iron Co., Los Angeles, ornamental iron. A. B. Benton, 114 N. Spring St., is the archt.

Long Beach, Cal.—The Home Bond & Bldg. Assoc., in which M. Pike is reported interested, it is stated, has had plans prepared by L. J. Marshall for a theatre, which it is proposed erecting at 3d St. and Locust Ave.

Berkeley, Cal.—It is reported that Mrs. Lelita Acheson and her son, Wm. Acheson, are planning the erection of a business building on the site of their residence on University Ave., to cost about $75,000.

*San Francisco, Cal.—Mrs. Emma Rose, it is stated has applied for a permit to erect an 8-story store and office building at Sutter St. and Clara Lane. Reid Bros. Geary and Stockton Sts., are the archts., Thompson-Starett Co., 2053 Sutter St., are the builders.

Edw. Barron, it is stated, has applied for a permit to erect on William and Geary Sts., a $24,000 building.

The erection of a 6-story hotel at N. Ellis and Powell Sts. is reported contemplated by the Robert P. Kearney estate.

Geo. Alex A. Wright, Fredk. W. d'Evelyn and Chas. B. Russell are reported to have been chosen by Mrs. Mary A. Lapidge as Trus. of the Victoria Memorial Hospital, which is to be erected in the Mission Dist.

*Los Angeles, Cal.—The F. O. Engstrum Co., E. 5th and Colyton Sts., it is stated, has been awarded the contract to construct a reinforced concrete ice storage building on Alameda and Industrial Sts., for the Union Ice Co. It will cost $28,000 and was designed by H. Alban Reeves.

Sausalito, Cal.—Eugene Korn and others, it is stated, are considering the forming of a company with a capital of $150,000, and erecting a 4-story hotel here.

Denver, Colo.—Chas. Boettcher is reported interested in the erection of a $400,000 7-story reinforced cement fireproof business building at 16th and Market Sts.

*Contracts for erecting the Casino in Lakeview Park, which is to cost about $100,000, are reported awarded as follows: Concrete and brick work to D. S. Stahling; lumber and carpentry work to the Frank Kirchner Lumber Co., 7th and Lawrence Sts., and plumbing, sewerage and sanitary work to the J. E. Kiefer Co., 1410 Lawrence St.

I. A. Ferguson is reported to be planning the erection of a 4-story office building at 1715 Champa St., to cost $125,000.

Coal Creek, Colo.—It is stated that the Odd Fellows intend erecting a 2-story stone and concrete building at a cost of $20,000 to replace the hall which was destroyed by fire.

Pueblo, Colo.—Dr. J. D. Moore and others, it is stated, intend erecting a natatorium to cost $20,000.

Jacksonville, Fla.—W. P. Richardson, 128 E. Bay St., is stated to have applied for a permit to erect for the Atlantic & East Coast Terminal Co. 3 warehouses and office buildings at Bay, Forsyth, Jefferson and Davis Sts. They are to be of brick, part 1 story and part 2 stories in height.

Tampa, Fla.—It is stated that a $60,000 Y. M. C. A. Bldg. is to be erected at Truggs St. and Florida Ave.

Athens, Ga.—The Athens Hotel Co. is reported to have decided to erect a fireproof hotel on Washington St., to cost about $150,000.

Savannah, Ga.—It is proposed to remodel Pulaski Hotel, at a cost of about $25,000.

Boise, Idaho.—J. A. Pinney is said to be having plans prepared for a theatre, which he intends erecting on 8th and Jefferson Sts.

Decatur, Ill.—E. R. Wright, of Taylorville, Secy. Pythian Home Board, writes that bids for erecting the home in Decatur, for which there is an appropriation of $125,000, will be opened Oct. 12. Deal & Ginzel, of Lincoln, are the archts.

De Kalb, Ill.—It is stated that the erection of a $40,000 Y. M. C. A. Bldg. is under consideration.

Springfield, Ill.—Plans are reported to have been approved for the Masonic clubhouse, to be erected at S. 6th St. and Capitol Ave., at a cost of $50,000.

*East Chicago, Ind.—The contract for erecting the I. O. O. F. Hall is stated to have been awarded to W. W. Parker, of Hammond, Ind., for about $12,000.

Wabash, Ind.—It is stated that the Wabash Athletic Asso. will erect a $15,000 gymnasium.

Waterloo, Ia.—The carbarns of the Waterloo, Cedar Falls & Northern Ry. Co. are reported destroyed by fire.

Wichita, Kan.—The Wichita Wholesale Grocery Co., according to reports has accepted plans for a 4-story warehouse and business building.

*New Orleans, La.—Geo. J. Glover, Hennen Bldg., is reported to have secured the contract for the foundations of the Monteleone Hotel, a 12-story building, to be erected on Royal St. Contract price reported to be $35,000.

Toledano & Wogan, 830 Canal St., it is stated, have completed plans for the superstructure of the above hotel and bids for the construction will soon be asked.

Springfield, Mass.—G. Wood Taylor, 425 Main St., it is stated, has prepared plans for a club house to be erected by the Nayasset Club on W. State St., to cost $119,000. W. H. Nevins and E. A. Carter are members of the Bldg. Com.

*Grand Rapids, Mich.—Chas. Hoertz & Son, 18 Porter Blk., are reported to have secured the contract to erect an addition to the Hotel Pantlind, at about $20,000.

Breckenridge, Minn.—The citizens are reported to be agitating the erection of a Y. M. C. A. Bldg. at a cost of $15,000.

*Chillicothe, Mo.—Jas. E. Meek, of Chillicothe, is reported to have secured the contract for the brick work on the factory building to be erected here for the Browning Rake & Storck Co., which is moving from Browning to Chillicothe. The cost of the building is to be about $20,000.

Kansas City, Mo.—Jarvis Hunt, Dwight Bldg., is reported to have submitted plans, which have been accepted, for a 20-story steel fireproof, marble and terra cotta office building, which the Great Western Life Insurance Co.

Items marked thus give the names of parties awarded contracts.

(O. L. Van Landingham, Pres.) R. A. Long Bldg., contemplates erecting at 60th St. and Grand Ave., at a cost of about $1,500,000. It is expected that contracts will be let within 30 days.

J. O. Hogg, N. Y. Life Bldg., is reported to be the archt. for a music hall which is to be erected at Oak and 13th Sts., at a cost of $350,000.

Kansas City, Mo.—G. H. Clark, owner of the Orpheum Theatre, it is reported, is planning the erection of a $200,000 theatre.

Newark, N. J.—Hyman Rosensohn, 188 Market St., is said to be preparing plans for 6 4-story brick store and apartment houses, to be erected at Belmont and Avon Aves., for Ginsbry & Elin. The total cost is to be about $125,000.

Hoboken, N. J.—Edw. M. Patterson, 76 Montgomery St., Jersey City, is stated to have completed plans for the 2 flats and store buildings which are to be erected at 15th St. and Willow Ave., at a total cost of $50,000. Bridget Bigley, 14th St. and Willow Ave. is the owner.

Atlantic City, N. J.—H. A. Stout, Bartlett Bldg., is stated to have prepared plans for an 8-story, 200x93 ft., brick and terra cotta hotel, to be erected on the Board Walk.

Buffalo, N. Y.—Plans have been filed for a brick addition to the malthouse of the Riverside Malting Co., at 2212 Niagara St., to cost $30,000.

Auburn, N. Y.—It is stated that bids will be received until Nov. 21 by the Bd. Trus., Masonic Temple Assoc., for erecting a temple. G. Edwd. Cooper, Archt., Utica.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone store and tenement at 78 Bayard St. for A. Sbabero; cost, $45,000; Peter M. Coco, Archt.; 6-story brick and stone stores and tenments at Broome and Lewis Sts. for Saml. Golding; cost, $25,000; Saml. Sass, Archt.; 6-story brick and stone stores and tenement at Pike and Henry Sts. for Julius Tishman; cost, $80,000; E. A. Meyers, Archts.; 12-story brick and stone store and loft building at 48 West 21st St. for Tischel Realty Co.; cost, $250,000; Schwartz & Gross, Archts.; 5-story brick and stone store and loft building at 49 W. 45th St. for Jos. Keen; cost, $25,000; Alfred E. Barlow, Archt.; 6-story brick and stone stores and tenement at 474 3d Ave. for Kramer & Rockmore; cost, $90,000; Geo. F. Pelham, Archt.; 10-story brick and stone store and apartment house at Bway. and 112th St. for A. C. and H. M. Hall Realty Co.; cost $750,000; Neville & Bagge, Archt.; 2-story brick and stone stable at 144th St. and Lenox Ave. for Jos. A. Pucci; cost, $50,000; Neville & Bagge, Archt.; alterations to 5-story brick and stone Masonic Fraternity; cost, $800,000; Trustees Masonic Hall and Asylum Fund; H. P. Knowles, Archt.

Harry P. Knowles, 1 Madison Ave., architect for the Masonic fraternity of the State, has filed plans with Building Supt. Murphy for an 18-story extension to the Masonic Hall, at 23d St. and Sixth Ave.; cost $800,000.

*The Geo. A. Fuller Constr. Co., Flat Iron Bldg., 23d St. and Bway., it is stated, has secured the contract to erect the 2d Nat. Bank Bldg., at 5th Ave. and 28th St.

*The contract to erect the building for the Lotus Club in W. 57th St. is reported to have been awarded to Marc Eidlitz & Sons, 489 5th Ave. Probable cost, $400,000.

Valley City, N. D.—Hancock Bros., of Fargo, it is reported, have prepared plans for the 2-story brick Masonic Temple to be erected here, at a cost of about $15,000.

Cleveland, O.—The Doan Coines Realty Co., is reported incorporated with a capital of $150,000 for the purpose of erecting an 8-story business building.

Cincinnati, O.—The Cincinnati Church Co., Spring Grove Ave., it is stated, intends erecting a 1 and 2-story concrete, 60x240 ft., addition to cost $25,000.

The Reliance Eng. Co. is reported to have been commissioned by the B. H. Kroger Grocery & Baking Co. to prepare plans for a $25,000 stable, to be erected adjoining the bakery and warehouse on Reading Road.

Connellsville, Pa.—It is stated that plans are being completed for a 5-story building, to be erected at Pittsburg and Main Sts., for the Second National Bank.

Swissvale, Pa.—The Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia, Pa.), it is stated, will soon let the contract to erect a new station here.

York, Pa.—The York Trust Co., according to reports, has accepted plans prepared by J. A. Dempwolf, of York, for a 9-story business and office building.

**Philadelphia, Pa.*—The William Steele & Sons Co., 1600 Arch St., has been granted a permit to erect a $240,000 bread-baking plant for the Freihofer Vienna Baking Co., on Indiana Ave. to Clearfield St., and from 19th to 20th Sts. The plant will include a 2-story and basement brick and concrete warehouse, 93x288 ft.; a 1 story brick boiler and engine house, 102x69 ft.; a 1 story brick bakery building, 136x296 ft., and a stone cold storage plant, 55x155 ft., underground.

*F. T. Maguire is reported to have been awarded the contract to erect a parish house for the Church of the Immaculate Conception at 819 E. Chelton Ave., Germantown. The building will be 70x118 ft. and 2 stories, of Roman brick and granite, with terra cotta trimmings. The cost will be about $55,000. F. Russell Stackert, 1421 Chestnut St., Archt.

The Hennebique Constr. Co. is stated to have been granted a permit to install reinforced concrete footings, columns, floors, beams and girders in the building of the Horn & Hardardt Baking Co., now in process of construction at 202 S. 10th St. The cost will be $40,000. F. Russell Stackert, 1421 Chestnut St., Archt.

Lancaster, Pa.—See "Electric Railways."

Providence, R. I.—It is stated that the Maiden Lane Realty Co. has been organized with B. P. Cheney, of Boston, Mass., Jas. Hanley, of Providence, and others, to erect a 20-story Silversmiths' Bldg., at 18 Johnson St.

Nashville, Tenn.—The warehouses of Boyd Douglas & Co., grain dealers on 2d Ave., N., it is stated, have been destroyed by fire.

Memphis, Tenn.—Walter Harrison, of Birmingham, Ala., it is stated, is preparing plans for the Union Terminal Station, which is to be erected in Memphis by the Memphis R. R. Terminal Co.

Houston, Tex.—Bids are wanted until Oct. 8 for erecting a 3-story brick building for G. A. Sternenberg, at Milam St. and Walker Ave. O. H. P. Rudesill & Son, Archts., 1012½ Texas Ave.

Port Arthur, Tex.—It is reported that the members of the German Club propose erecting a $25,000 club house at Atlanta and Mobile Aves.

Denison, Tex.—H. Brooks & H. Tone, Jr., are reported to have secured a building on Main St. and have engaged C. W. and G. L. Rapp, of Chicago, Ill., to prepare plans for alterations to convert the building into a theatre, which are to cost about $30,000.

**Norfolk, Va.*—The contract to erect the Naval Y. M. C. A. Bldg. in Norfolk, it is stated, has been awarded to John Henry Miller, of Baltimore, Md. There is about $225,000 available for the building.

Richmond, Va.—Plans have been approved for the freight and office building which the Seaboard Air Line Ry. (W. L. Seddon, Ch. Engr., Portsmouth), will erect on the east side of 15th St., between Franklin and Broad Sts. The structure will cost $45,000. It will be used for storage and station purposes, the offices being on the second story.

**Spokane, Wash.*—John Huetter, 429 Sharp Ave., is reported to have secured the contract to erect a branch exchange at Sinto Ave. and Jefferson St., for the Pacific States Telephone Co., at a cost of $20,000.

Seattle, Wash.—The Trustee Security Co., it is stated, intends erecting a building to be known as Central Blk., and to cost $1,500,000.

The Metropolitan Building Co. is reported incorporated, to erect 2 office buildings on Union St. and 5th Ave., at a cost of about $500,000. Jas. A. Moore, C. F. White and others are reported interested.

The New Washington Improvement Co. is reported to have in contemplation the erection of a wing to the New Washington Hotel, at a cost of $100,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

**Los Angeles, Cal.*—Contracts for work on the Scientist Church, to be erected on W. Adams St., it is stated, have been awarded by A. F. Rosenheim, Archt., H. W. Hellman Bldg., as follows: Blumve & Jay Co., plumbing, sewering and gas fitting $3,450; F. E. Newberry Co., electrical work, $2,338; Atlantic Terra Cotta Co., terra cotta work, $32,100, and the enameled and facing brick to the Hydraulic Pressed Brick Co., of St. Louis, at $12,000.

Trinidad, Colo.—S. L. Anderson, it is stated, has been granted a permit to erect at Colorado and Arizona Aves. a $25,000 apartment house.

Macon, Ga.—It is reported that the Tabernacle Church has been organized, with M. K. Layton, Chmn. and E. H. Middlebrooks, Secy., and intends erecting an edifice costing about $15,000.

Chicago, Ill.—Sigmund Hecht, according to reports, will erect a 33story apartment house on Wrightwood Ave. and Hampden Court, to cost $40,000.

El Dorado, Kan.—It is reported that the Methodist Congregation has accepted plans prepared by W. G. Charles, of Wichita, for a new edifice.

Covington, Ky.—It is stated that the members of the St. Augustine Church, of Central Covington, propose erecting an edifice costing about $60,000.

Holyoke, Mass.—A. W. Holton is stated to have completed plans for a 3-story, 50x38 ft., addition, which it is proposed erecting to the Sarah Gilette Home for the Aged People, and it is reported that the Bldg. Com. will soon ask for bids for the construction of same.

**Frazee, Minn.*—Herman Jeuh, of Minneapolis, it is stated, has secured the contract to erect a R. C. Church here at $17,675.

Park Rapids, Minn.—Bids will be received, it is stated, until Oct. 14 (readvertisement) by Rev. P. O'Meara, Pastor St. Peter's R. C. Church, for erecting a brick edifice. A. J. Blix, Archt., St. Cloud.

Hattiesburg, Miss.—It is stated that plans are being prepared for an edifice for the First Presbyterian Church, which is to cost about $50,000.

Newark, N. J.—Hymen Rosensohn, 188 Market St., is stated to be preparing plans for a 4-story brick apartment house, to be erected at a cost of $25,000, at 78 Monmouth St., by Marks Brooks.

Paterson, N. J.—Chas. E. Sleight, Romaine Bldg., is reported to have prepared plans for an apartment house which is to be erected at Clark and Ward Sts. by the Paterson Realty Co. at a cost of about $200,000.

Jersey City, N. J.—John A. Resch, 170 Lexington Ave., is reported to have been engaged by Saml. Gorlin, 152 Bayview Ave., to prepare plans for 4 brick apartment houses to be erected on Van Horn St., at a total cost of $80,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 5-story brick and stone tenement at 334 3d Ave. for Wm. Bradley; cost, $25,000; Radcliffe & Kelly, Archts.; 6-story brick and stone tenement at 1st Ave. and 114th St. for B. Pernetti; cost, $75,000; L. T. J. Weiher, Archt.; 6-story brick and stone apartment at Bway. and 122d St. for Times Realty Co.; cost, $175,000; Neville & Bagge, Archts.; 4-story brick and stone residence at Northern Ave. and 181st St. for Dr. Chas. V. Paterno; cost, $120,000; John C. Watson, Archt.; 3 3-story brick tenements at College Av.e and 165th St. for Jos. Reiss; cost, $54,000; Goldner & Goldberg, Archts.

Buffalo, N. Y.—The erection of a $25,000 edifice, it is reported, is contemplated by the members of the Grace Universalist Church.

Rockaway Beach, L. I., N. Y.—The members of the Congregational Church, according to reports, are contemplating the erection of a new edifice, to cost about $50,000.

**Pittsburg, Pa.*—Hays & Dodds, of Allegheny, it is stated, have secured the contract to erect a $20,000 brick residence at Wilkins and Murray Aves., Squirrel Hill, for Jos. A. Kelley.

**Wilkinsburg, Pa.*—Jack Allhouse, it is reported, has secured the contract to erect a $25,000 brick and stone edifice for the Warren M. E. Church on Center Ave., Wilkinsburg.

Sewickley, Pa.—Nirdlinger & Simpson, Diamond Bank Bldg., Pittsburg, are said to be preparing plans for a $30,000 cement and brick residence, to be erected at Beaver and Grove Sts., for Wm. McBride.

Philadelphia, Pa.—It is stated that plans are being prepared by W. L. Blithe, Rothschild Bldg., and will be ready in about a month for bids for erecting the new edifice for the Fletcher Memorial Presbyterian Church, on 58th and Master Sts.

**Norristown, Pa.*—Geo. W. Rogers is reported to have secured the contract to erect a 3-story residence for Frank B. Wonsetler at Norristown, to cost $15,000.

Providence, R. I.—It is reported that the members of St. Anne's R. C. Church are contemplating the erection of a $25,000 edifice.

Dallas, Tex.—It is stated that a committee has been appointed by the Oak Lawn Methodist Church to secure plans for a new edifice which it is proposed erecting at a cost of about $25,000.

Spokane, Wash.—The members of the First Presbyterian Church, according to reports, are considering the erection of a new edifice to cost about $75,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Jasper, Ala.—The erection of a high school at a cost of about $25,000 is reported under consideration.

Alameda, Cal.—See "Power Plants, Gas and Electricity."

San Diego, Cal.—The Bd. of Educ. is reported to have accepted the plans of Harrison Albright, of Los Angeles, for a reinforced concrete 20-room school, to be erected at 12th, 13th, E and F Sts., at a cost of about $100,000, including equipment.

**Redondo, Cal.*—L. J. Notman is reported to have secured the contract to erect the grammar school, at $11,000.

South Pasadena, Cal.—A. Hinckley, City Clk., writes that the citizens on Sept. 13 voted to issue $25,000 bonds for erecting schools. For further information address Clk. County Board of Supervisors.

Willimantic, Conn.—Jos. Jackson, of New York, N. Y., is reported to have submitted plans for a 2-story 10-room brick school to be erected for St. Joseph Parish. Rev. J. J. Fleming, pastor.

Buhl, Idaho.—It is reported that W. R. Parson & Son Co., of Duluth, Minn., has been engaged to prepare plans for a school to be erected here at a cost of $25,000.

Greencastle, Ind.—The Library Com. of De Pauw Univ., it is stated, has directed O. D. Bohlen, Majestic Bldg., Indianapolis, to complete plans for the library, which, it has been decided, is to be constructed of stone and reinforced concrete. Bids for the construction will be asked, according to reports, in about 5 weeks; probable cost, $50,000. C. W. Coffin, Secy., De Pauw Univ.

Wichita, Kan.—The Roman Catholics, it is reported, contemplate erecting a Cathedral School to cost about $130,000.

Washington, Kan.—The Secy. Bd. of Educ. writes that bids will be received on Oct. 20 for the erection of a high school, to cost bet. $12,000 and $15,000.

Covington, La.—Bids will be received until Oct. 12 by C. Z. Williams, for the entire construction of a public school. And. J. Bryan, Archt., 708 Hennen Bldg., New Orleans.

**Salem, Mass.*—T. G. Pinnoch writes that the contract for installing a hot water circulating system in the high school (bids for which were received Sept. 10), has been awarded to Evans Almirall Co., of New York, N. Y.

**Fall River, Mass.*—Patk. Corrigan, 4 Morgan St. is reported to have secured the contract to erect the Westall School, a red brick structure, including ventilating, heating, lighting, etc., at $66,500. Other bids were: Jas. A. Donnelly, $69,792; Fall River Granite & Constr. Co., $73,995.

Northampton, Mass.—It is reported that a new library is to be erected at Smith College at a cost of about $60,000.

**St. Clair Heights, Mich.*—J. Merrill, Principal of School, writes that John Cutler, of Detroit, has the general contract and Ernst. Bros., of Detroit, the contract for the heating and plumbing in the 4-room addition to the school.

Lansing, Mich.—The State Bd. of Agriculture is stated to have rejected all bids recently received for erecting the agricultural building at the Michigan Agricultural College, as they exceeded the appropriation, which is $125,000.

**Ishpeming, Mich.*—Chas. Burt, Chmn. Bldg. Com., Bd. Educ., School Dist. No. 1, writes that C. L. Anderson, of Ishpeming, has secured the contract for ventilating and heating the high school (bids opened Sept. 23) for $14,022.

Bids for plumbing, sewerage and gas fittings for the above high school have been rejected and new bids will be received in about 2 weeks.

Opechee, Mich.—It is stated that the plans and specifications for the $10,000 school are about completed and bids for the construction will soon be asked.

Moorhead, Minn.—It is stated that all bids recently received by the State Bd. of Control at St. Paul, for erecting the Normal School here, exceeded the appropriation, which is $50,000. The plans are to be modified so as to reduce the cost.

Eveleth, Minn.—It is stated that plans and specifications for a school to be erected on the north side have been completed, and bids for the construction will soon be asked.

**Minneapolis, Minn.*—It is stated that the contract for installing a ventilating and heating system in the West High School has been awarded to Archambeau Htg. & Plumbing Co., 219 S. 3d St., at $21,640.

**Kansas City, Mo.*—Flanagan Bros. are reported to have secured the contract for erecting annex to Central High School to cost about $50,000. Architect, C. A. Smith, Dwight Bldg.

**Items marked thus give the names of parties awarded contracts.*

Helena, Mont.—A. O. Von Herbulls, of Washington, D. C., it is stated, has submitted to Bishop John P. Carroll, of Helena, plans for the high school which is to be erected for the Roman Catholic Church. The building is to be 2-story, 140x156 ft., constructed of granite and yellow brick.

Trenton, Neb.—The contract to erect the high school, it is stated, has been awarded to E. Rokahr, of Lincoln, at $12,304.

Merno, Neb.—Bohrer Bros., of Fall City, according to reports, have secured the contract to erect a school at $11,400.

Woodridge (Rutherford), N. J.—Bids will be received until Oct. 14 by Chas. J. Funz, Dist. Clk., Woodridge St. and Union Ave., for erecting an addition to the present schoolhouse. Wm. M. Meeker, Archt., Passaic.

Plainfield, N. J.—The erection of 2 wings to the high school at a cost of $40,000, is reported under consideration. The erection of a primary school on Darrow Ave. at a cost of about $90,000, is also reported under consideration.

Princeton, N. J.—It is stated that plans have been completed for the physical laboratory, which is to be erected at the Univ. at a cost of about $600,000. Work is to commence at once. Plans have also be completed for the geological and biological laboratory, which is to be erected at a cost of $600,000, but work on this will not commence for several months.

Roselle Park, N. J.—The citizens, on Sept. 24, it is stated, authorized the issue of $68,000 bonds to erect a high school.

Syracuse, N. Y.—The Consolidated Eng. & Constr. Co., 1 Madison Ave., New York City, has secured the contract for erecting a gymnasium for the Syracuse University. It will be of steel frame construction, 3 stories high, and dome, trimmed with ornamental terra cotta, pressed brick and granite, and provided with all the latest apparatus, swimming pools, etc.; cost about $300,000.

West Raleigh, N. C.—The Trus. of the North Carolina A. & M. College are reported to have decided to erect a Y. M. C. A. building to be 2 stories high, 70x80 ft.; cost about $20,000. Geo. T. Winston, Pres.

Cincinnati, O.—Wm. Grantman, Clk. Bd. of Educ., writes that bids will be received about Nov. 11 for the construction of a school at Westwood, to cost about $150,000. Architects, Garber & Woodward, of Cincinnati.

Springfield, O.—The Bd. of Educ., it is stated, is contemplating the erection of a high school.

Red Lion, Pa.—It is stated that the School Bd. is considering a site, on which it is proposed erecting a 12-room school.

South Sharon, Pa.—A. R. Maxwell, Secy. School Bd., writes that the contract to erect the high school (bids for which were received Sept. 28) has been awarded to A. Wishart & Sons, of Sharon, at $59,434, and the contract for the ventilating and heating plant for same school (bids received same time) to the American Htg. & Ventilating Co., of Pittsburg, at $11,335.

Warren, R. I.—The taxpayers, it is stated, have authorized the erection of a school in the Parker Mill Dist., at a cost, including equipment, of about $12,000.

Exeter, R. I.—The State Bd. of Educ., it is reported, has decided upon a site in Exeter, on which it is proposed erecting the State Inst. for Feeble Minded.

Memphis, Tenn.—Alsup & Wood, Randolph Bldg., are stated to have revised the plans for Carr Ave. School, and A. B. Hill, Secy. Bd. Educ., is reported to have been authorized to receive bids for the construction; also bids for erecting a 12-room school on Mhoon Ave. and Poplar Boule. Each building is to cost about $50,000, exclusive of heating and furniture.

Uvalde, Tex.—It is reported that the contract to erect the brick public school, not including heating, has been awarded to Birkner Bros., of Lockhart, at about $30,000.

Woodstock, Va.—W. R. Parson & Son Co., of Duluth, Minn., it is stated, has been engaged to prepare plans for a combined high and grade school building.

Norfolk, Va.—J. W. Jones, of Norfolk, is reported to have been awarded the contract for erecting a $17,000 annex to the Ward school.

Ellensburg, Wash.—The State Bd. of Control at Olympia, it is reported, has awarded contracts as follows for work at Ellensburg Normal School: Buildings, Lance & Peters, Seattle, $53,700; plumbing, Wm. B. Coffee Plumbing Co., of Tacoma, $4,199; heating, Seattle Htg. & Plumbing Co., Seattle, $13,520.

Madison, Wis.—Bids will probably be received in Nov. by the Bd. of Trus. of the University of Wisconsin (H. E. McCaffrey, Secy.), for the erection of the women's gymnasium, to cost about $150,000. Architect, Arthur Peabody, of Madison.

Edgerton, Wis.—Leenhouts & Guthrie, of Milwaukee, it is stated, have completed plans for the Child Memorial High School, a 2-story brick structure, which is to cost about $40,000.

East Milwaukee, Wis.—Fred Graf, 307 Grand Ave., Milwaukee, according to reports, has completed plans for a 2-story school to be erected in East Milwaukee at a cost of $10,000.

Manitowoc, Wis.—The School Bd. of Dist. No. 7, according to reports, has awarded contracts as follows for erecting the school on Marshall and 18th Sts.: Frank Wolfe, of Two Rivers, mason work, $4,997; Albert Tomcheck, of Manitowoc, carpenter work, which included tin and iron work and the painting, $4,800; J. H. Phalen, of Manitowoc, $1,497 for the plumbing.

Galesville, Wis.—It is stated that bids will be received until Oct. 23 by the Bd. Educ. (E. F. Clark, Clk.) for erecting a solid brick and stone high school. Parkinson & Dockendorff, Archts., La Crosse.

Superior, Wis.—Van Ryn & DeGelleke, of Milwaukee, it is stated, have completed plans for the normal school to be erected in Superior, at a cost of about $45,000, and as soon as plans have been approved by the Bd. of Regents at Madison bids for the construction will be asked by the Bd.

Oakville, Ont.—Bids will be received until Oct. 15 by the Bd. Educ. for erecting a high school. Address C. A. Bradbury, Oakville. R. B. McGiffin, Archt., 59 Yonge St., Toronto, Ont.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Tehachapi, Cal.—The Golden State Portland Cement Co. is reported incorporated for the purpose of erecting a cement plant here, having a capacity of 2,000 bbls. of cement per day; capital, $2,000,000. Geo. W. Parsons, of Los Angeles, is Treas. of the company and a member of the Bd. of Directors.

Sioux City, Ia.—The Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), it is reported, will construct a roundhouse, machine shops, an iron house, storage quarters, etc., in Floyd Valley; probable cost of work, $2,000,000.

Spencer, Mass.—Jos. F. Wicks, of Worcester, is said to be planning the erection of a brick mill on the site of the Red Mill, Valley St., the cost to be about $50,000.

New Bedford, Mass.—Abbott P. Smith is reported to have had plans prepared by C. R. Makepeace & Co., of Providence, R. I., for a new cotton mill, 4 stories high, 480x130 ft. Equipment, 70,000 spindles. The mill will be located on Hastings wharf.

Port Huron, Mich.—The Grand Trunk Ry. (J. L. Hodgson, Master Car Builder, Port Huron) is stated to have authorized the erection of 2 shop buildings at the north end of the city.

St. Paul, Minn.—J. W. Stevens, New York Life Bldg., is reported to be preparing plans for a factory to be erected in the Midway dist. for the manufacture of woollen suitings, the cost to be $75,000.

Gastonia, N. C.—The Dunn Mfg. Co. is reported incorporated, with C. E. Armstrong, C. N. Dunn and others, for the purpose of constructing a spindle plant and installing about 4,000 spindles; capital, $200,000.

Clinton, N. C.—W. D. McNeill, of Fayetteville is reported interested in a company which is to be formed for the purpose of constructing a cotton yarn mill of 5,000 spindles; capital, $125,000.

Belmont, N. C.—The Monarch Mfg .Co., it is stated, is about to be formed with A. C. Lineberger, Pres., and S. P. Stowe, Secy. and Treas., and will build a cotton mill of 10,000 spindles; capital, $200,000.

Mansfield, O.—Bids will be received until Oct. 16 by the Bd. Mgrs. Ohio State Reformatory, for furnishing material and constructing an ice-making and refrigerating plant of from 10 to 12 tons capacity. For further information address Jacob Reinhardt, Steward, Mansfield.

Bangor, Pa.—The York-Bangor Slate Co. is reported formed for the purpose of constructing a plant near Bangor, to cost $200,000. It is stated that the quarries will be operated by eelctricity. M. G. Collings ,of York, is Pres., and Cotton Amy, Mgr.

Philadelphia, Pa.—It is stated that a permit has been granted to McLaughlin Bros. to erect on Indiana Ave. and 20th St. a 4-story brick and stone 33x80-ft. manufacturing building for the Decker Electric Mfg. Co., to cost $25,000.

Pittsburg, Pa.—The Jones & Laughlin Steel Co. is reported to have been granted a permit to construct 2 open hearth furnaces below S. 27th St., to cost $12,500.

Memphis, Tenn.—Walter Webb and H. H. Maury, 90 Front St., it is reported, have secured the Merchants' Grain Elevator and Warehouse, at Tennessee and Trezevant Sts., and is having plans prepared for the thorough renovating of the building purchased and for new warehouses which are to be erected.

Spokane, Wash.—The Kootenai Northwest Lumber Co., in which G. J. Simpson, of the grocery firm of Simpson & Carter, is reported interested, is said to be planning the erection of a mill, location not yet decided upon. It is stated that the headquarters of the company will be in Spokane.

Yardley, Wash.—E. H. Stanton Co. is reported to have had plans prepared for an abbatoir and packing establishment, to be erected in Yardley, at a cost of $150,000.

Marinette, Wis.—The Goodman Lumber Co. is reported organized by Robt. F. Goodman and Chas. Goodman, of Marinette, and others for the purpose of erecting and equipping a sawmill in Northern Wisconsin for the manufacture of hardwood.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Pasadena, Cal.—Chas. L. Hill, of Los Angeles, is reported to have petitioned counsel for permission to establish a plant here for the disposal of garbage, refuse, dead animals, etc.

Baltimore, Md.—Local press reports state that all bids received Sept. 4 by the Bd. Awards (J. Barry Mahool, Pres.) for the removal and final disposition of garbage, dead animals and market refuse of this city from Jan. 1, 1908, until Jan. 1, 1918, have been rejected, and new bids will be received. J. L. Wickes, Comr. St. Cleaning.

Detroit, Mich.—The Bd. of Health is reported to have recommended to the City Council the establishment of a municipal plant for the incineration of refuse and rubbish.

Hoboken, N. J.—Peter A. Poluso is reported to have secured the contract for removal of ashes and garbage in Hoboken for the ensuing year for $9,500.

Newark, N. J.—We are informed that all bids opened at the office of the Bd. of Street and Water Comrs. (Morris R. Sherrerd, Ch. Engr.) on Sept. 26 for the collection, removal and disposal of ashes, rubbish material, paper and garbage in the City of Newark for a period of 5 years, beginning Jan. 1, 1908, have been rejected, the lowest bidder omitting to state in his bid the kind of reduction, cremation or incineration plant to be used. New bids will be received on Oct. 10, as advertised in The Engineering Record. The following are the totals of the bids received (*a* year 1908, *b* year 1909, *c* year 1910, *d* year 1911, *e* year 1912): Jacob & Benj. Meyer Contr. Co., Frelinghuysen Ave., Newark, *a* $152,500, *b* $155,500, *c* $159,500, *d* $166,500, *e* $169,000; Van Keuren & Son, Harrison, *a* and *b* $158,000, *c* and *d* $162,900, *e* $169,000; Henry Scheider, 786 Clinton Ave., Newark, *a* $129,500, *b* $134,500, *c* $139,500, *d* $144,500, *e* $149,500.

Harrisburg, Pa.—The Sanitary Com. of Councils on Sept. 26 recommended that Council award the 10-year contract for collection and disposal of garbage, dead animals, etc., to the Pennsylvania Ammonia & Fertilizer Co., owned by Carlisle & Martin, of Harrisburg, for $26,000 per year.

Altoona, Pa.—The Board of Health is reported to be considering the question of procuring bids for collecting and disposing of garbage for a period of from 1 to 10 years.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Alameda, Cal.—See "Power Plants, Gas and Electricity."

Denver, Colo.—The Continental Tunnel Co. is reported formed, with a capital of $5,000,000, to construct a tunnel about 6 miles in length under James Peak, which will also make a short cut for the Moffat R. R. between Denver and Salt Lake City. Herbert George, Simon Guggenheimer and Chas. Kountze, all of Denver, are reported to be among the stockholders.

Stockton, Cal.—R. C. Tumelty, City Engr., writes that plans have been adopted for constructing bulkhead on north side of Stockton channel, but no bids have yet been called for. A. C. Russel, City Clk.

Washington, D. C.—Bids were opened on Sept. 18 by Maj. Spencer Cosby, Corps Engrs., U. S. A., for dredging, and the Miner Eng. Co., of Norfolk, Va., secured the contract at the following bid: 100,000 cu. yds. soft mud and sand in Occoquan Creek, 16 cts.; 20,000 cu. yds. mud and sand in Urbana Creek, 22 cts., 28,000 cu. yds. sand in Carters Creek, 27 cts., and 10,000 cu. yds sand in Mattaponi Creek, 35 cts.; total cost, $31,460. The River & Harbor Improv. Co., of Philadelphia, Pa., bid for this work $33,864.

Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 8, to furnish at the navy yards, and naval stations the following supplies: New York, N. Y., etc.: Sch. 311 and 344—Wireless telegraph apparatus. Sch. 345—Gravel or trap rock, sand, piles. Sch. 347—Switches. Sch. 351—Sheet copper. Sch. 352—Yellow and white pine, mahogany, walnut and ash. Boston, Mass.: Sch. 352—Yellow pine decking. Sch. 353—Tool steel. League Island, Pa.: Sch. 312—Planer and matcher, molding and scrool machines, sandpapering machine, smoothing planer, scroll saw. Sch. 345—Soil pipe, plumbing supplies. Sch. 349—Electric and air drills, steel squares, etc., air hammers, tools. Sch. 350—High-speed steel. Naval Academy, Annapolis, Md.: Sch. 347—Material for two steel towers. Sch. 348—Electrical supplies, sheet copper, bar iron, tool steel. Washington, D. C.: Sch. 349—Twist drills, iron pipe, brass and iron unions, iron pipe fittings, valves. Sch. 350—Cold drawn steel. Norfolk, Va.: Sch. 346—Double braided wire, cabinet and panel board, electric chandeliers, etc., globes and reflectors, electric fittings. Sch. 349—Tools, pneumatic drills, vises. Pensacola, Fla.: Sch. 334—Motors, waterproof cable, mild steel, steel and iron pipe, valves, iron and steel pipe fittings. Sch. 335—Copper pipe. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Gen'l., U. S. N.

Honolulu, H. I.—Capt. C. W. Otwell, Corps Engrs., U. S. A., writes that the following are the bids opened on Sept. 9 for dredging in Hololulu harbor about 400,000 cu. yd., including all necessary bulkheading (price given per cu yd.): Hawaiian Dredging Co., Ltd., Honolulu, 97 cts. (recommended for award); North American Dredging Co., San Francisco, Cal., $1.27; San Francisco Bridge Co., San Francisco, Cal., $1.18, and Cotton Bros. & Co., Oakland, Cal., $1.44.

Evanston, Ill.—Geo. M. Wisner, of Chicago, Ch. Engr. Sanitary Dist., writes that the proposed work in connection with Evanston channel will cost about $4,000,000, but no contracts will be let until next year.

Chicago, Ill.—Bids will be received at the office of the U. S. Reclamation Service, 876 Federal Bldg., Chicago, until Oct. 21 for furnishing 12,000 bbls. of Portland cement, f. o. b. cars at works of bidder.

Indianapolis, Ind.—B. Hendricks, Secy. Bd. Park Comrs., writes that the contract for furnishing material and repairing apron to Riverside Park dam (bids opened Sept. 20) has been awarded to the Modern Constr. Co., of Indianapolis, for $7,800.

Estherville, Ia.—Bids will be received, it is stated, until Oct. 15 by Roy J. Ridley, Co. Aud., for constructing tile ditches Nos. 24 and 31.

Rockwell City, Ia.—Bids will be received, it is stated, by the Auditor of Calhoun County, at Rockwell City, until Oct. 12 for constructing 3,700 ft. tile drain for Sac and Calhoun counties.

Boone, Ia.—It is stated that bids will be received until Oct. 11 by E. F. Jones, Co. Aud., for constructing county drains Nos. 31, 32 and 34.

Sac City, Ia.—It is stated that bids will be received until Oct. 11 by J. J. Harter, Co. Aud., for constructing 9,000 ft. tile drain in Cedar Township.

Clarion, Ia.—Bids will be received until Oct. 7 by the Bd. Co. Superv. for $18,000 Dist. No. 19, and $4,671 Dist. No. 24 drainage bonds. E. M. Callender, Co. Aud.

Sibley, Ia.—V. A. Burley, Co. Aud., writes that the contract for the construction of an open ditch, requiring about 103,000 cu. yds. excav. (bids opened Sept. 10), has been awarded to the Standard Drainage Co., of Windom, Minn., at 10⅝ cts. per cu. yd.

Louisville, Ky.—Bids will be received by Capt. H. Burgess, Corps Engrs., U. S. A., until Nov. 4 for a steel hull for snagboat, as advertised in The Engineering Record.

New Orleans, La.—The Harvey Canal Land & Improvement Co. is reported to have purchased the Harang or Aymar Canal, and will begin work at once deepening and widening this waterway in order to furnish a short route from New Orleans to the Bayou Lafourche Country. The company will also construct short canal 2 miles long to connect with Lake Salvador. H. P. Dart, Pres.; Horace H. Harvey, Secy.

Portland, Me.—Bids were opened on Sept. 19 by Maj. Geo. A. Zinn, Corps Engrs., U. S. A., as follows for building training walls and dredging in Kennebec River, Me.:

Training walls—Philip H. Doyen, of Portland, Me., $1.09 per ton for stone; training walls, $12.50 per cu.

*Items marked thus give the names of parties awarded contracts.

yd. for masonry beacons, Rowe Bros. Co., Richmond, Me., 88 cts. and $6.50, respectively.

Dredging: Simon J. Donovan, Boston, Mass., 49½ cts. per cu. yd.; Eastern Dredging Co., Boston, Mass., 35½ cts. per cu. yd. for group 1, 41½ cts. for groups 2 and 3, 50 cts. for group 4 and 44½ cts. for group 5.

Roseau, Minn.—It is stated that bids will be received until Oct. 10 by S. G. Iverson, Secy. State Drainage Comn., St. Paul, for constructing State Ditch No. 51. Geo. A. Ralph, State Drainage Engr., Old Capitol Bldg.

Minneapolis, Minn.—See "Public Buildings."

Newark, N. J.—The Franklin Mineral Co., Prudential Bldg., Newark, will lease on royalty for long or short terms as desired, of limestone quarries, as advertised in The Engineering Record.

Atlantic City, N. J.—The City Council is reported to have on Sept. 23 decided to build about 2,000 ft. of new boardwalk 300 ft. seaward of the present promenade along the inlet front and will receive bids for its construction on Oct. 28.

Brooklyn, N. Y.—Bids will be received until Oct. 17 by the Park Bd. (Saml. Parsons, Jr., Pres.) New York City, for repairs and alterations to the various ornamental stone entrances to Prospect Park; also repairs and alterations to and painting of fences around parks, Boros. Brooklyn and Queens.

Bids will be received by the Park Bd. (Saml. Parsons, Pres.), New York City, until Oct. 17, for furnishing material and constructing a rustic masonry boundary wall around Sunset Park, Boro. Brooklyn.

Albany, N. Y.—State Engr. Skene is reported to have submitted to the State Canal Bd. a proposal for the improvement of the present line of the Erie Canal in Niagara County near Eagle Harbor; the proposed contract will involve the excav. of about 6 miles, at an estimated cost of $725,000.

Cincinnati, O.—The Council has passed the ordinance submitted by the Bd. of Pub. Service authorizing that Board to expend $10,000 in building a retaining wall in McMicken Ave., north of Bader St., and for restoring McMicken Ave., damaged by recent landslide.

Akron, O.—The City Council has passed an ordinance to issue $8,400 bonds for the construction of the retaining wall at Hickory St.

Panama.—Bids will be received at the office of H. F. Hodges, General Purchasing Officer, Isthmian Canal Comn., at Washington, D. C., until Oct. 28, for block and phosphorous tin, malleable castings for dump carts, grease cups, wire screenings, wire and manila rope, etc., as advertised in The Engineering Record.

The following are the bids opened on Sept. 25 at the office of the Isthmian Canal Comn., Washington, D. C., for steam shovels, Type E, having a capacity of dipper of 5 cu. yd. ea.: Bucyrus Co., So. Milwaukee, Wis., $163,560 (to be delivered at Colon in 167 days); Marion Steam Shovel Co., Marion, O., $158,160 (Colon, 150 days); Vulcan Iron Wks., Toledo, O., $196,454 (Colon, 240 days).

Reading, Pa.—We are informed that bids which were to have been received at the office of Caleb Weidner, City Clk., until Sept. 25, for the construction of subway and appurtenances under the P. & R. Railway tracks at Spring St., were not opened but returned to contractors. New bids will be called for later. Elmer H. Beard, City Engr.

Providence, R. I.—We are informed that a resolution has passed City Council, providing for getting the right, in connection with the Rhode Island Co., of the Legislature to build a tunnel for trolley cars from North Main St. to Thayer St. If the right is obtained the tunnel will probably be built by the R. R. Co. Otis F. Clapp is City Engr.

Bids will be received by Col. J. H. Willard, Corps Engrs., U. S. A., Newport, until Oct. 30, for dredging in Providence harbor, as advertised in The Engineering Record.

Latchford, Ont.—It is stated that bids will be received until Oct. 10 by Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, for constructing a dam across the Montreal River. J. G. Sing, Resident Engr., Confederation Life Bldg., Toronto.

Southampton, Ont.—Bids will be received until Oct. 25 by Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont., for extension to wharf at Southampton Harbor of Refuge. J. G. Sing, Engr. in Charge, Confederation Life Bldg., Toronto.

PROPOSALS OPEN.

For Proposals see pages 82, 84, 85 and 86.

WATER.

Bids Close.		See Eng. Record.
Oct. 9.	Pump house, Ft. Caswell, N. C. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 9.	Plant, Fargo, N. D.	Sep. 28
Oct. 10.	Water works, Pringhar, Ia.	Sep. 21
Oct. 10.	Water improv., Ft. Du Pont, Del. Adv. Sep. 14 to 28	Sep. 14
Oct. 10.	Pumps, etc., New York, N. Y.	Oct. 5
Oct. 10.	Boilers, Buffalo, N. Y.	Oct. 5
Oct. 14.	Pipe, etc., Ashland, O.	Sep. 21
Oct. 15.	Pump, Mt. Carroll, Ill.	Oct. 5
Oct. 20.	Water wks., Bay City, Tex.	Oct. 5
Oct. 22.	Pumping engines, boilers, etc., Philadelphia, Pa. Adv. Oct. 5	Oct. 5
Oct. 22.	Water wks., Beaver City, Neb. Adv. Oct. 5.	Oct. 5
Oct. 23.	Filters, Atlanta, Ga. Adv. Sep. 14 to Oct. 5.	Sep. 14
Nov. 4.	Water wks., Tucson, Ariz. Adv. Sep. 28.	Sep. 28
Nov. 15.	Pipe, Phoenix, Ariz. Adv. Oct. 5	Oct. 5
Nov. 15.	Pipe, Winnipeg, Man. Adv. Oct. 5	Oct. 5
Dec. 1.	Water wks., Shelley, Idaho.	Sep. 28
——	Attention to Contractors, New York, N. Y. Adv. Sep. 28, Oct. 5	Sep. 28

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 8.	New Brighton, S. I., N. Y.	Sep. 28
Oct. 8.	Chicago, Ill.	Oct. 5
Oct. 8.	New Brighton, S. I., N. Y.	Oct. 5
Oct. 8.	Akron, O.	Oct. 5
Oct. 8.	Black River Falls, Minn.	Oct. 5
Oct. 8.	Normal City, Ind.	Oct. 5
Oct. 10.	Ft. Du Pont, Del. Adv. Sep. 14 to 28	Sep. 14
Oct. 10.	Wapella, Ia.	Oct. 5
Oct. 10.	McKeesport, Pa.	Oct. 5
Oct. 10.	Overbrook, N. J.	Oct. 5
Oct. 11.	Aurora, Ind.	Sep. 28
Oct. 12.	Seattle, Wash.	Sep. 21
Oct. 14.	Carthage, Mo. Adv. Sep. 21 to 28	Sep. 21
Oct. 14.	Stubenville, O. Adv. Sept. 28, Oct. 5	Sep. 28
Oct. 14.	Chagrin Falls, O.	Oct. 5
Oct. 15.	Chattanooga, Tenn. Adv. Sep. 28, Oct. 5.	Sep. 28
Oct. 15.	Oneida, N. Y.	Oct. 5
Oct. 19.	Cloquet, Minn.	Oct. 5
Oct. 21.	St. Paul, Minn.	Oct. 5
Oct. 23.	Whiterocks, Utah.	Sep. 28
Oct. —.	Eaton, O.	Aug. 3

BRIDGES.

Oct. 8.	Delphi, Ind.	Sep. 21
Oct. 8.	Hamilton, O.	Sep. 28
Oct. 8.	Jersey Shore, Pa.	Sep. 28
Oct. 8.	Wilkesbarre, Pa.	Oct. 5
Oct. 8.	Martinsville, Ind.	Oct. 5
Oct. 9.	Richmond, Ind.	Oct. 5
Oct. 9.	Winlock, Wash.	Oct. 5
Oct. 10.	Fork River, Man.	Oct. 5
Oct. 12.	Xenia, O.	Sep. 21
Oct. 14.	Los Angeles, Cal. Adv. Sep. 7, 14.	Sep. 7
Oct. 14.	Fredericton, N. B.	Sep. 14
Oct. 14.	Bellefontaine, O.	Sep. 21
Oct. 14.	Hammond, Ind.	Sep. 28
Oct. 14.	Toledo, O.	Sep. 28
Oct. 15.	Erie, Kan.	Sep. 28
Oct. 15.	Stevenson, Wash.	Oct. 5
Oct. 19.	Canton, China. Adv. Aug. 24 to Sep. 7	Aug. 24
Oct. 22.	Hamilton, O.	Oct. 5
Oct. 24.	Panama. Adv. Sep. 28.	Sep. 28
Oct. 24.	Hailey, Idaho.	Oct. 5
Nov. 15.	Glendive, Mont. Adv. Sep. 28, Oct. 5	Sep. 28

PAVING AND ROAD MAKING.

Oct. 8.	Vincennes, Ind.	Sep. 14
Oct. 8.	Crawfordsville, Ind.	Sep. 21
Oct. 8.	St. Louis, Mo.	Sep. 21
Oct. 8.	Monticello, Ind.	Sep. 28
Oct. 8.	Covington, Ind.	Sep. 28
Oct. 8.	W. New Brighton, N. Y.	Sep. 28
Oct. 8.	Portland, Ind.	Sep. 28
Oct. 8.	Rockville, Ind.	Sep. 28
Oct. 8.	Martinsville, Ind.	Sep. 28
Oct. 8.	Boston, Mass.	Oct. 5
Oct. 8.	Palatka, Fla.	Sep. 28
Oct. 8.	New Brighton, S. I., N. Y.	Sep. 28
Oct. 8.	Sharon, Pa.	Oct. 5
Oct. 8.	McKeesport, Pa.	Oct. 5
Oct. 9.	Bluffton, Ind.	Sep. 28
Oct. 9.	Brooklyn, N. Y.	Sep. 28
Oct. 9.	Baltimore, Md.	Oct. 5
Oct. 10.	Uniontown, Pa.	Sep. 28
Oct. 10.	Chicago, Ill.	Oct. 5
Oct. 10.	Kansas City, Mo.	Oct. 5
Oct. 10.	Glenburn, Pa.	Oct. 5
Oct. 11.	Enid, Okla.	Oct. 5
Oct. 11.	Buffalo, N. Y.	Oct. 5
Oct. 12.	Riverton, Ala. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 12.	Athens, Ala.	Sep. 21
Oct. 12.	Ft. Wayne, Ind.	Sep. 21
Oct. 14.	Sunman, Ind.	Sep. 14
Oct. 14.	Jacksonville, Ill.	Oct. 5
Oct. 14.	Ft. Collins, Colo.	Oct. 5
Oct. 14.	Creede, Colo.	Oct. 5
Oct. 14.	Chicago, Ill.	Oct. 5
Oct. 15.	Ocala, Fla.	Sep. 28
Oct. 15.	Wilmington, Del.	Sep. 28
Oct. 15.	Bellingham, O.	Oct. 5
Oct. 15.	Sheraden, Pa.	Oct. 5
Oct. 15.	Denton, Md.	Oct. 5
Oct. 15.	Olympia, Wash.	Oct. 5
Oct. 16.	Asphalt plant, Ottawa, Ont. Adv. Sept. 28, Oct. 5.	Sep. 28
Oct. 16.	Brooklyn, N. Y.	Oct. 5
Oct. 19.	Nampa, Idaho.	Oct. 5
Oct. 21.	Logansport, Ind.	Sep. 21
Oct. 22.	Nampa, Idaho	Sep. 28
Oct. 31.	Ft. Logan H. Rools, Ark. Adv. Oct. 5.	Oct. 5
Oct. —.	Selma, Ala.	Sep. 7
Nov. 4.	Peru, Ind.	Sep. 28
Dec. 13.	Valparaiso, Ind.	Sep. 7
——	York, Pa.	Sep. 7

POWER PLANTS, GAS AND ELECTRICITY.

Oct. 10.	Bismarck, N. D.	Oct. 5
Oct. 10.	New York, N. Y.	Oct. 5
Oct. 12.	Ft. Leavenworth, Kan.	Oct. 5
Oct. 14.	Panama. Adv. Sep. 21	Sep. 21
Oct. 15.	Savannah, Ga.	Sep. 21
Oct. 22.	Philadelphia, Pa. Adv. Oct. 5	Oct. 5
Nov. 1.	Seymour, Ind.	Sep. 14
Nov. 8.	Kokomo, Ind.	Oct. 5
Nov. 9.	Las Animas, Colo.	Sep. 28
Nov. 15.	Charleston, S. C.	Sep. 14

BUILDINGS.

Oct. 7.	Pub. bldg., Ft. Slocum, N. Y. Adv. Sept. 14 to Oct. 5.	Sep. 14
Oct. 7.	Post hospital addition, Ft. Slocum, N. Y. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 7.	Pub. bldg., New York, N. Y.	Sep. 28
Oct. 7.	Armory, New York, N. Y.	Sep. 28
Oct. 8.	Htg. pub. bldg., Buffalo, N. Y.	Sep. 28
Oct. 8.	Post bldgs., Ft. Lincoln, N. D. Adv. Sep. 28, Oct. 5.	Sep. 28
Oct. 8.	Hospital, Watertown, Ill.	Oct. 5
Oct. 8.	Bus. bldg., Houston, Tex.	Oct. 5
Oct. 9.	Boilers in pub. bldg., Poughkeepsie, N. Y.	Oct. 5
Oct. 9.	Court house plans, La Moure, N. D.	Sep. 28
Oct. 10.	School, Mt. Healthy, O.	Sep. 21
Oct. 10.	Windows for Museum, Washington, D. C. Adv. Sep. 21, 28.	Sep. 21
Oct. 10.	Bus. bldg., Indianapolis, Ind.	Sep. 21
Oct. 10.	Pub. bldg., Louisville, Ky.	Oct. 5
Oct. 12.	Pub. bldg., Chicago, Ill.	Oct. 5
Oct. 12.	Hospital, Whipple Barracks, Ariz. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 12.	Bus. bldg., Covington, La.	Sep. 28
Oct. 12.	School, Covington, La.	Oct. 5
Oct. 12.	Bus. bldg., Decatur, Ill.	Oct. 5
Oct. 14.	School, San Diego, Cal.	Sep. 14
Oct. 14.	Hospital, Castleton, S. I., N. Y.	Oct. 5
Oct. 14.	Jail, Arco, Idaho	Oct. 5
Oct. 14.	School, Woodridge, N. J.	Oct. 5
Oct. 14.	Church, Park Rapids, Minn.	Oct. 5
Oct. 15.	School plans, Indiana, Pa.	Sep. 28
Oct. 15.	Court house plans, De Pere, Wis.	Aug. 17
Oct. 15.	School, Osceola, Ark.	Sep. 21
Oct. 15.	Court house, Youngstown, O.	Sep. 21
Oct. 15.	Post bldgs., Las Animas, Colo.	Sep. 28
Oct. 15.	School, Oakville, Ont.	Oct. 5
Oct. 15.	Post bldgs., Governor's Island, N. Y.	Oct. 5
Oct. 16.	Exten. post office, Springfield, O.	Sep. 14
Oct. 16.	Pub. bldg., Ashland, O.	Sep. 21
Oct. 16.	Library, Sheldon, Ia.	Sep. 28
Oct. 16.	Pub. bldgs., Polk, Pa.	Sep. 28
Oct. 16.	Hospital, Harrisburg, Pa.	Oct. 5
Oct. 16.	New industrial plant, Mansfield, O.	Oct. 5
Oct. 17.	Pub. bldg., Peoria, Ill.	Sep. 7
Oct. 17.	Post bldg., Ft. McPherson, Ga.	Sep. 28
Oct. 17.	School, Metuchen, N. J.	Sep. 28
Oct. 17.	Pub. bldg., Long Island City, L. I., N. Y.	Oct. 5
Oct. 18.	School, Montevallo, Ala.	Sep. 14
Oct. 18.	Exten. to post office, Denver, Colo.	Sep. 28
Oct. 18.	Barracks, Ft. Totten, N. Y. Adv. Oct. 5	Oct. 5
Oct. 18.	Pub. bldg., St. Louis, Mo.	Oct. 5
Oct. 19.	Pub. bldg., Glen Cove, L. I., N. Y.	Oct. 5
Oct. 19.	Post bldgs., Hot Springs, Ark.	Oct. 5
Oct. 20.	School, Washington, Kan.	Oct. 5
Oct. 21.	Pub. bldg., Milwaukee, Wis.	Sep. 21
Oct. 21.	Post office, Des Moines, Ia. Adv. Sep. 7, 14.	Sep. 7
Oct. 21.	Hospital, New Orleans, La.	Oct. 5
Oct. 22.	Pub. bldg., Independence, Mo.	Oct. 5
Oct. 22.	Pub. bldg., National Military Home, Kan.	Oct. 5
Oct. 23.	School, Galesville, Wis.	Oct. 5
Oct. 24.	Roofing National Museum, Washington, D. C. Adv. Oct. 5	Oct. 5
Oct. 24.	Shafts and bases, etc., Nat'l Museum, Washington, D. C. Adv. Oct. 5	Oct. 5
Oct. 25.	Ex. to pub. bldg., Roanoke, Va.	Oct. 5
Oct. 28.	Post office, East St. Louis, Ill.	Oct. 5
Oct. 28.	Post bldgs., Plattsburgh Barracks, N. Y. Adv. Oct. 5	Oct. 5
Oct. 30.	Jail, etc., Terre Haute, Ind.	Sep. 21
Oct. 30.	Post office, Atlanta, Ga.	Sep. 28
Oct. 30.	Post bldgs., Columbus Barracks, O.	Oct. 5
Oct. 31.	Interior partitions in P. O. Bldg., Cleveland, O. Adv. Oct. 5	Oct. 5
Oct. 31.	Mechanical equipment in P. O. Bldg., Cleveland, O. Adv. Oct. 5	Oct. 5
Nov. 4.	School, Woodruff, S. C.	Sep. 28
Nov. 4.	Barrack bldgs., Ft. Washington, Md. Adv. Oct. 5.	Oct. 5
Nov. 5.	Court house plans, Houston, Tex. Adv. Sep. 14 to Oct. 5.	Aug. 31
Nov. 5.	Barrack bldg., Portland, Me. Adv. Oct. 5.	Oct. 5
Nov. 5.	Post Office, Flint, Mich. Adv. Oct. 5	Oct. 5
Nov. 11.	School, Cincinnati, O.	Oct. 5
Nov. 15.	Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 21.	Bus. bldg., Auburn, N. Y.	Oct. 5
Nov. —.	University gymnasium, Madison, Wis.	Oct. 5
Dec. —.	Industrial plants, Ft. William, Ont.	May 1
Dec. —.	School, Anderson, Ind.	Sep. 28
Feb. 1.	Plans for Capitol, San Juan, P. R.	Sep. 28

MISCELLANEOUS.

Oct. 7.	Tunnel, New York, N. Y.	Sep. 28
Oct. 8.	Dredging, Detroit, Mich. Adv. Aug. 31, Sep. 14 to Oct. 5.	Aug. 31
Oct. 8.	Ditch, Muscatine, Ia.	Sep. 21
Oct. 8.	Supplies, Washington, D. C.	Oct. 5
Oct. 9.	Dredging, Jacksonville, Fla. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 9.	Jetty work, Asbury Park, N. J.	Sep. 21
Oct. 9.	Boilers, pub. bldgs., Poughkeepsie, N. Y.	Oct. 5
Oct. 10.	Canal wk., Peterboro, Ont.	Aug. 24
Oct. 10.	Rock removal, etc., Jacksonville, Fla. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 10.	Jetty work, Washington, D. C. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 10.	Garbage, Newark, N. J. Adv. Oct. 5	Oct. 5
Oct. 10.	Dam, Latchford, Ont.	Oct. 5
Oct. 11.	Drain, Sac City, Ia.	Oct. 5
Oct. 11.	Ditch, Boone, Ia.	Oct. 5
Oct. 12.	Riprap, Riverton, Ala. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 12.	Culvert, East Cleveland, O.	Sep. 21
Oct. 12.	Ditch, Rockwell City, Ia.	Oct. 5
Oct. 14.	Supplies, Panama. Adv. Sep. 21	Sep. 21
Oct. 15.	Ditch, Estherville, Ia.	Oct. 5
Oct. 15.	Cement, stone, etc., Honolulu, H. I. Adv. Aug. 31 to Sep. 21.	Aug. 31
Oct. 16.	Ditch, Roseau, Minn.	Oct. 5
Oct. 17.	Culvert, Ft. Logan H. Roots, Ark. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 17.	State canal wk., Albany, N. Y. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 17.	Repairs to fence, etc., Brooklyn, N. Y.	Oct. 5
Oct. 17.	Wall, Brooklyn, N. Y.	Oct. 5
Oct. 18.	Exten. to wharf, Lions Head, Ont.	Sep. 28
Oct. 19.	Trunk lockers, Washington, D. C. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 21.	Dump scows, Louisville, Ky. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 21.	Barges, Louisville, Ky. Adv. Sep. 21, 28.	Sep. 21
Oct. 21.	Dredging, Wilmington, Del. Adv. Sep. 28, Oct. 5.	Sep. 28
Oct. 21.	Pumps, monitor, nozzle, etc., Panama. Adv. Sep. 28.	Sep. 28
Oct. 21.	Cement, Chicago, Ill.	Oct. 5
Oct. 22.	Canal, New Orleans, La.	Sep. 28
Oct. 25.	Dredge, Charleston, S. C. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 25.	Exten. to wharf, Southampton, Ont.	Oct. 5
Oct. 28.	Tin, rope, etc., Panama. Adv. Oct. 5	Oct. 5
Oct. 28.	Boardwalk, Atlantic City, N. J.	Oct. 5
Oct. 30.	Dredging, Providence, R. I. Adv. Oct. 5.	Oct. 5
Nov. 4.	Steel hull for snag boat, Louisville, Ky. Adv. Oct. 5.	Oct. 5
Nov. 9.	Crematory, Las Animas, Colo.	Sep. 28
Nov. 15.	Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28, Oct. 5	Sep. 28
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28, Oct. 5.	Sep. 28
— —	Lease of limestone quarries, Newark, N. J. Adv. Oct. 5	Oct. 5

CURRENT NEWS SUPPLEMENT

OCTOBER 12, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H. Annual convention, Milwaukee, Wis., Oct. 15-17, 1907.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York. Annual Convention, Atlantic City, N. J., Oct. 14-18.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

A NEW HYDRAULIC DREDGE.

The dredge shown in the accompanying illustration is a powerful machine built to the order of the Commissioners of Lincoln Park, Chicago, for filling to the north of the present park. The plan is to reclaim from Lake Michigan an area approximately 1,500 ft. wide by about a mile long by enclosing it with a stone revetment and filling in behind it with material taken from the bed of the lake. For much of the distance the breakwater lies in 18 ft. of water, and the total volume of fill is about 4,000,000 cu. yds. The breakwater is now partly completed and is made of stone from the spoil-banks of the Chicago drainage canal.

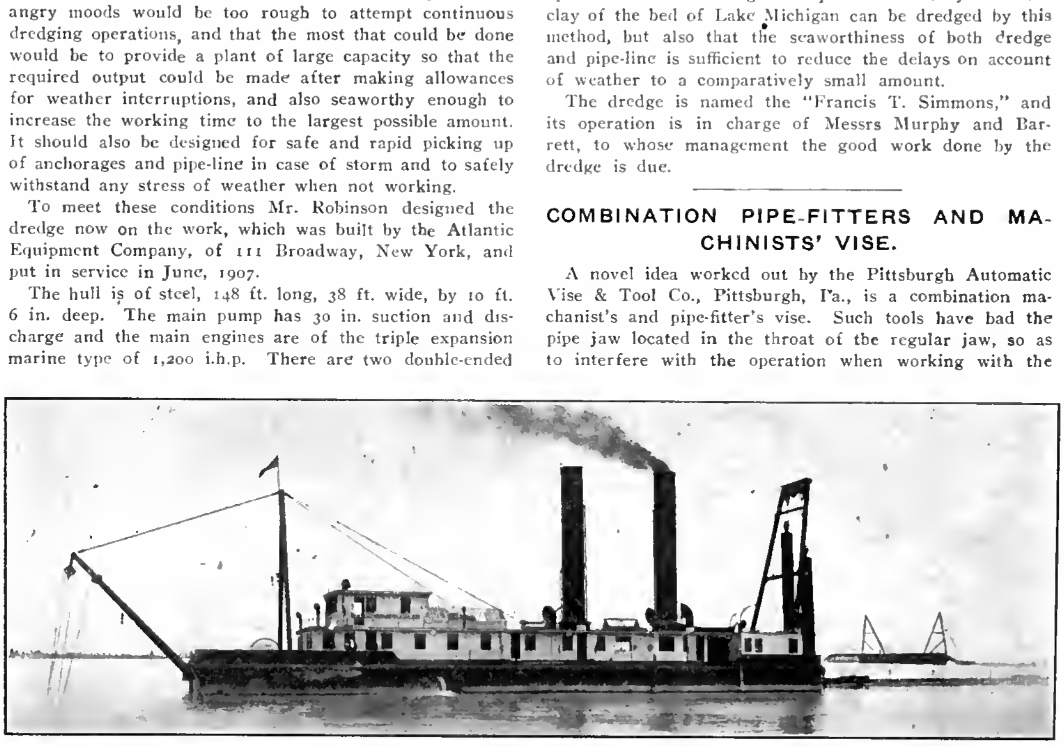
The conditions surrounding the dredging and filling of this work were difficult and peculiar. Not only was the locality in deep water and exposed to the storms of Lake Michigan, which often rise with suddenness and severity, but the soil to be dredged consisted of the tough blue clay which underlies the Chicago area, compacted by the storms of the lake and mixed with more or less gravel and stones. The ordinary hydraulic dredge as used on the lakes would be unsuitable, first because of unseaworthiness, and second because it could only deal effectively with soft material. The usual floating pipe-line connected by rubber sleeves and mounted on a number of small scows or floats would be put out of business with every wind storm or irretrievably wrecked.

The superior economy of the hydraulic process of dredging and filling if it could be successfully applied led Mr. Francis T. Simmons, president, and Mr. R. H. Warder, secretary, to pursue the subject further to see if these difficulties could be overcome, and they therefore commissioned Mr. A. W. Robinson, M. Am. Soc. C. E., to examine and report on the ground and if possible to design a dredge that could cope with the difficult conditions presented. Mr. Robinson had previously designed and built several large hydraulic dredges, notably the "Tarte," which is employed in dredging clay from the bed of Lake St. Peter in the River St. Lawrence, and is provided with a special pipe-line for withstanding heavy storms. This dredge is of great power and holds the world's record for output, having dredged 750,000 cu. yd. in a calendar month and delivered 2,000 ft. The original pipe-line of this dredge is still in use after having withstood the storms of 5 years.

It was, of course, realized that Lake Michigan in its angry moods would be too rough to attempt continuous dredging operations, and that the most that could be done would be to provide a plant of large capacity so that the required output could be made after making allowances for weather interruptions, and also seaworthy enough to increase the working time to the largest possible amount. It should also be designed for safe and rapid picking up of anchorages and pipe-line in case of storm and to safely withstand any stress of weather when not working.

To meet these conditions Mr. Robinson designed the dredge now on the work, which was built by the Atlantic Equipment Company, of 111 Broadway, New York, and put in service in June, 1907.

The hull is of steel, 148 ft. long, 38 ft. wide, by 10 ft. 6 in. deep. The main pump has 30 in. suction and discharge and the main engines are of the triple expansion marine type of 1,200 i.h.p. There are two double-ended marine boilers 11 ft. 6 in. x 18 ft. long, with eight corrugated furnaces. The installation of engine room auxiliaries such as condensing apparatus, pumps, electric light is most complete and well arranged.



THE HYDRAULIC DREDGE OF THE LINCOLN PARK COMMISSION.

On the upper deck is a pilot-house with large plate-glass windows, where are arranged all the levers which control the operation of the dredge. Here are also pressure and vacuum gauges for all purposes, indicating exactly the work that is being done.

The suction-pipe is carried by a very strong steel frame and is fitted with a powerful cutter for digging the clay. This cutter is an improved development of a number of earlier machines and has demonstrated its efficiency by being able to handle the heaviest clay up to the full capacity of the pump. It is 9 ft. in diameter, and weighs about 9 tons, being formed of eight steel blades of peculiar curvature cast in one piece, and having renewable hard steel cutting edges attached. The mechanism for driving and feeding this cutter is of the most powerful description. The secret of success of this dredge is that the excavation of the stiff clay is done by an efficient cutting tool that will not clog and provided with a powerful feed, the main pump being only employed for transportation of the spoil. A capacity rate of 3,000 cu. yd. per hour has frequently been reached in clay, the entire under side of the discharge appearing as continuous slices of blue clay, some of the pieces being 4 or 5 ft. long.

One of the most serious problems to be dealt with was that of the floating pipe-line. This is the most seaworthy pipe-line on the lakes, and is formed of semi-submerged steel pontoons about 100 ft. long, connected by ball-and-socket joints having spring connections of great strength. Long lengths of pontoon were necessary to give steadiness in waves and a yielding connection was essential to relieve the joints of the great stresses due to surging. The springs are of locomotive draw-bar size and are arranged similarly to railway car draft-rigging. There are also tension and compression springs to control the side deflection of the joint. In wave-action this pipe-line is very satisfactory. A special flange connection is provided at the dredge so that the pipe-line can be instantaneously disconnected from the dredge at any time, simply by pulling out a toggle-lever. On several occasions when it became too rough for the dredge to work, owing to the difficulty of discharging over the breakwater, the pipe-line was disconnected and towed to harbor by a tug through a rough sea which broke over both tug and pipes continuously, with no harm whatever to the pipe-line. These occasions, however, are relatively rare, and the operation of the dredge has proved not only that the clay of the bed of Lake Michigan can be dredged by this method, but also that the seaworthiness of both dredge and pipe-line is sufficient to reduce the delays on account of weather to a comparatively small amount.

The dredge is named the "Francis T. Simmons," and its operation is in charge of Messrs Murphy and Barrett, to whose management the good work done by the dredge is due.

COMBINATION PIPE-FITTERS AND MACHINISTS' VISE.

A novel idea worked out by the Pittsburgh Automatic Vise & Tool Co., Pittsburgh, Pa., is a combination machanist's and pipe-fitter's vise. Such tools have bad the pipe jaw located in the throat of the regular jaw, so as to interfere with the operation when working with the machinist jaw, as the pipe jaws protruded considerably into the throat of the vise, and limited the capacity of the pipe held. The inventors have endeavored to eliminate such objections by utilizing the rear of the draw bar instead of the throat of the vise. To the end of the bar is fitted a glove-like casting. To this casting are attached the pipe jaws, which are made of tool steel and placed close together.

A small lug is screwed in the rear of the vise directly under the slide bar. This is slotted so as to permit the reception of one link of a chain. The castings being placed in position on the rear of the vise, and one end of the chain made firm to the lug by a small pin, the pipe is placed in the jaws and the chain thrown around it, a link being dropped into the lug on the top of the casting. Then with both ends of the chain held firm, a half turn of the main screw of the vise throws the draw bar backwards, drawing the chain tightly around the pipe and securely locking it against rotation or movement. The swivel in the base of the vise is also locked automatically when the pipe is locked. If the work is desired to be held on the outside of the bench, the screw is loosened and the vise swiveled around, thus locking both the work and the vise.

Water purification for all purposes is treated at length in a catalogue of Wm. B. Scaife & Sons Co., Pittsburg. The impurities in water and their removal by chemical and mechanical means are discussed in the beginning of the book, and the chemistry of water softening and the results of treatment are presented. We-Fu-Go systems of the intermittent, syphon, and continuous types, and Scaife systems are then taken up and explained with the use of diagrams. The company's mechanical gravity filters, and the strainers used in them also receive attention. The second half of the book discusses boiler scale and corrosion, boiler compounds, feed water heaters, and the use of purifying and softening systems by railroads, breweries, ice factories, tanneries, laundries, cloth and paper mills, and for domestic use.

A REVERSIBLE HOIST FOR GASOLINE ENGINES OR ELECTRIC MOTORS.

A reversible hoist, specially adapted for use in connection with a gasoline engine or an electric motor, has recently been placed on the market by the Parker Hoist & Machine Works, of Chicago. One of these hoists belted to a gasoline engine is shown in an accompanying illustration. A 9x21-in. drum and a winch head, mounted on the same shaft, are provided for general hoisting purposes, while a 24-in. sheave wheel on this shaft provides for derrick and barrow-hoist operation. The drum is arranged with a friction clutch so it can be thrown out of service when the winch head or the sheave wheel is being used for hoisting, thus precluding any necessity for the removal of the cable or rope on the drum. In addition to this arrangement, a foot brake is provided which enables the operator to hold the load at any point.

The engine or motor used to operate the hoist is belted to a pulley on the driving shaft of the latter. Power is transmitted from this shaft to the shaft on which the sheave wheel, drum and winch head are mounted, by a grooved friction drive wheel on both shafts. The hoist is reversed by throwing the friction wheel on the drive shaft out of mesh with the one on the shaft carrying the drum, and by replacing this drive wheel by a second friction-drive wheel mounted on an auxiliary shaft, which is geared to the main shaft in such a manner that a reverse motion is obtained. The hoist is thus reversed by the movement of one lever at one end of the truck on which it is mounted. The foot brake and the other levers controlling the operation of the hoist are all placed adjacent to this reversing lever, so the operator has complete control of the machine from one position.

The hoist weighs 1,250 lb., complete, when mounted on a truck, and requires a 4x4-ft. floor space. It is particularly well adapted to operating hod and barrow hoists used in building construction. It has also been utilized, however, in a wide range of service where a light portable and reversible hoist, specially suited for operation by a gasoline engine or an electric motor is desired.

THE DEVELOPMENT OF THE PETROLITHIC PAVEMENT.

The first petrolithic pavements were constructed six years ago, at which time the use of oil for street improvement was in its infancy. A great amount of experimental work was done at that time and has continued up to the present, with the result that a marked improvement has been accomplished. The first petrolithic pavements were constructed with only one and one-half to two gallons of any kind of crude oil it was most convenient to secure, averaging from 30 to 40 per cent. asphaltum. This oil was cultivated to a depth of about 2 to 3 in., then slightly tamped with a rolling tamper. These streets, which are now four to six years old, are stated to be in fair condition to-day, although they have not received a dollar in repairs. Within a year or so, a minimum expenditure for a surface coat of oil will practically make them as good as when first constructed, their originator asserts, as their tamped base remains intact.

The Petrolithic Pavement Co., of Los Angeles, is now using 1½ gallons of oil containing 70 per cent. or more of asphalt. This heavy oil is thoroughly mixed with the soil to a depth of 4 in., until every particle of the soil is coated with the oil. The rolling tamper is then applied, which begins tamping from the bottom up until it is tamped solid to the surface. Two gallons of oil have been used thus far. Two inches of hard gravel is then spread for the wearing surface, on which 1½ gallons of heavy asphaltic oil is applied, and tamping is continued until the whole mass is like the hardest hardpan.

The result is claimed to be a 6-in. pavement unyielding under traffic, thoroughly durable and dustless, and noiseless, which does not require sprinkling or constant repairs. It is stated that it does not work up into chuck holes as does macadam, and can be constructed for less than half the cost of the latter.

The specifications adopted by the city of Los Angeles, Cal., for such pavements are as follows:

Grading.—Grading shall include all filling, the removal of all earth, stone, or all other material of whatever nature it may be, that may be encountered in preparing the street, and shall also include all trimming and shaping required to bring the surface of the street to grade and cross-section. Where mud or other soft material is encountered it shall be taken out and the space filled with good earth or gravel. The contractor, however, will not be required in such cases, to excavate the mud or other soft material to a greater depth than 2 ft. below grade. All filling shall be done with good sound earth. The embankments shall be carried up of full width, in horizontal layers not exceeding 1 ft. each in thickness, and the teams shall be made to travel as evenly as possible over the whole surface of each layer, both going and coming. The [illegible] is especially prohibited. No material of a spongy nature shall be used for filling. The space upon which fills are to be made shall first be cleared of all [illegible] timber.

The [illegible] grade and cross-section, after being thoroughly [illegible], [illegible] of the natural material of the street in that portion of the street which is to be oiled, shall be 2 in. below the finished surface of the street and at all points shall be parallel thereto.

The roadbed surface shall be rolled with a roller weighing not less than 250 pounds to the inch width of tire, until it is unyielding. Depressions made by the rolling shall be leveled up with good earth and again rolled. Such portions of the street as cannot be reached by the roller, and all places excavated below grade and refilled, and all pipe trenches and other places that cannot be properly compacted by the roller, shall be tamped solid, and in case of wet weather or soft or muddy ground, making by a screen of four meshes to the inch, up to the limit specified above, and shall contribute at least sixty (60) per cent. of the total volume of the gravel. Decomposed granite will not be accepted as gravel.

At all stages of the work sufficient water shall be applied to secure the best results in the tamping, the amount of water to be used to be governed by the character of the soil, the intention being to make the soil just damp enough to pack solid.

Any portion of the street that cannot be reached by the roller shall be tamped solid by hand, under the direction of the Board of Public Works.

The contractor will be held responsible for all damage to curbs, gutters or cross-walks that may be caused by him in the performance of the work.

Should an excess of oil remain upon the surface after rolling has been completed, sufficient clean, sharp, coarse sand shall be spread over the surface to absorb the same, and the surface shall then be again rolled until solid.

Oil.—(a) The oil used shall be a natural oil treated to remove water or sediment, or one from which the volatile material has been removed by distillation. It must not have been injured by over-heating.

(b) All oil must be delivered at the point required for sprinkling at a temperature of not less than 150 deg. Fahrenheit.

(c) In determining the quantity of oil delivered the correction for expansion by heat shall be as follows: From the measured volume of oil received at any temperature above 60 deg. Fahrenheit, an amount equivalent to four-tenths of one per cent. of every 10 deg. Fahrenheit shall be subtracted as the correction for expansion by heat. For the purpose of measuring oil a temperature of 60 deg. Fahrenheit shall be deemed normal temperature.

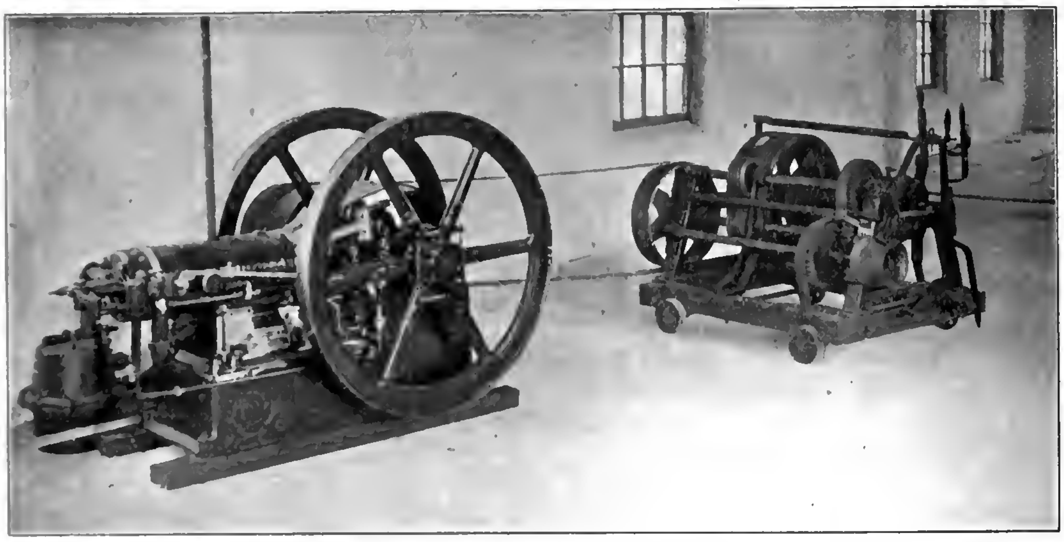
(d) The oil shall not contain more than 8 per cent. of matter volatile when said oil is heated slowly to 220 deg. Fahrenheit and maintained at that temperature during 15 minutes.

(e) After being freed from water and sediment, the oil shall contain not less than 70 per cent. of asphalt, having at a temperature of 77 deg. Fahrenheit, a penetration of 80 deg., District of Columbia standard. The percentage of asphalt shall be determined by heating a weighed amount of said oil in an evaporating oven to a temperature of 400 deg. Fahrenheit until it has reached the proper consistency, when the weight of the residue shall be determined and the per cent. calculated.

(f) Deduction will be made for water and sediment in exact proportion to the percentage of water and sediment found therein, and the oil shall not contain over 2 per cent. of such water and sediment.

(g) All tank wagons used for the delivery of this oil must be first submitted to the Department of Oil Inspection, which will gauge and stamp into the steel heads of said tanks the capacity in gallons of said tanks, and no figure of capacity will be accepted other than the official rating given by the Department of Oil Inspection.

Roller.—The tamping roller to be used in the execution of the work herein specified shall consist of a roller the outer surface of which shall be studded with teeth not less than 7 in. long, and having a surface area of not less than 4 sq. in. each, the roller itself to be of such a weight that the load upon each tooth shall not be less than 300 lb.



REVERSIBLE HOIST FOR USE WITH GASOLINE ENGINES OR ELECTRIC MOTORS.

BUSINESS NOTES.

Mr. Louis A. Pradt, formerly assistant attorney-general in charge of the defense of claims against the United States, has removed his offices in Washington, D. C., to 500 Hibbs Bldg.

The Edison Portland Cement Co. has opened a permanent office in the Post Office Square Bldg., Boston, in charge of Mr. J. L. Bernard, to take care of the New England trade.

The Ridgway (Pa.) Dynamo & Engine Co. has reopened its Chicago sales office at 824 Marquette Bldg. Mr. F. S. Hickok, who has had extensive experience in the electrical and power plant fields, is in charge as manager.

The Capital City Construction Co. has been incorporated at Indianapolis, Ind., to construct bridges, residences, business blocks and other structures and carry on a general contracting business. The directors are Messrs. Jas. O. Barrett, T. T. Burris and F. W. Eppert.

The Northern Engineering Works, Detroit, Mich., will add a new power station to their plant. The boiler and coal storage building, which will be erected at once, will be 30x60 ft. in plan, one story high, of fireproof construction throughout. Wickes boilers, Murphy stokers, and Webster heaters will be used. The plans were made by Smith, Hinchman & Grylls, engineers and architects, Detroit.

The Graphic Arts Co., of Buffalo, N. Y., recently purchased an Allis-Chalmers 45-kw. type "K" generator and seven 5-h.p. type "K" direct-current shunt motors built by the same company for operation at a speed of 1,050 r.p.m., and two 3-h.-p. type "K" motors for operation at 1,025 r.p.m. Five of the 5-h.-p. motors are for belting to presses and will be arranged to secure a speed range from 1,200 to 1,500 impressions per hour. One 5-h.-p. motor will be belted to a paper cutter, another to a roughing machine, while a 3-h.-p. machine will be mounted on the bronzing machine.

PERSONAL NOTES.

Mr. Homer Washburn Glidden, architect, formerly of Chicago, has established an office at 430 South Broadway, Los Angeles, Cal.

Walter D. Pease, water commissioner of Cheyenne, Wyoming, and formerly city engineer of that city, died recently, aged 73 years.

Mr. William Lamson, Brooklyn, N. Y., has been appointed an assistant engineer on the staff of the New York City Board of Water Supply.

The Engineers' Club of Philadelphia has voted to move into larger quarters next spring, and a committee has been appointed to investigate available locations.

Mr. T. Rumney, mechanical superintendent of the Erie R. R., has been promoted to be general mechanical superintendent, with headquarters in New York City.

Mr. Julian C. Smallwood has been appointed professor in charge of the department of mechanical engineering at George Washington University, Washington, D. C.

Mr. H. Montgomery has been appointed superintendent of motive power and equipment of the Bangor & Aroostook R. R., with headquarters at Milo Junction, Me.

Mr. W. J. Young has resigned as chief engineer of the Lehigh & New England R. R. to become chief engineer of a manufacturing concern at Martin's Creek, Va.

Capt. Alfred B. Putnam, Corps of Engineers, U. S. A., on duty with the First Battalion of Engineers in the Philippine Islands, has been ordered to Chattanooga, Tenn.

The British Local Government Board, under a grant [illegible]

drewes to undertake a bacteriological investigation of air in sewers and drains.

G. Norman Weaver, a civil engineer, of Newport, R. I., died at his home in that city, Oct. 4. He was a nephew of the late George H. Norman, who established the Norman Medal of the American Society of Civil Engineers.

The offices of Mr. R. D. Smith, assistant general superintendent of motive power and rolling stock of the New York Central & Hudson River R. R., have been moved from New York City to Albany, N. Y., where they will be located hereafter.

Mr. T. H. Brown has been appointed assistant division engineer of the Pittsburg division of the Baltimore & Ohio R. R. Co., succeeding Mr. L. E. Haislip, who has been transferred to the Wheeling division to succeed Mr. J. J. Smiley, resigned.

The United States Civil Service Commission will hold an examination Nov. 13, in the large cities of the country, of candidates for the positions of assistant technical editor in the Geological Survey, and constructing engineer in the Forest Service.

Messrs. Arthur B. White and William F. Bixby have organized the firm of Bixby & White, civil and hydraulic engineers, with offices in the San Fernando Building, Los Angeles, Cal. They will make a specialty of structural steel and reinforced concrete construction, irrigation, and sewerage systems.

Mr. John Severin Branne, formerly secretary and chief designing engineer of the James E. Brooks Co., consulting engineers, 45 Broadway, New York City, has resigned and has opened an office at 1 Madison Ave., New York, as a consulting engineer, making a specialty of bridges, buildings and general structural work.

The Mary Kingsley medal, instituted by the Liverpool School of Tropical Medicine to commemorate Miss Mary Kingsley, the African traveler, who died in 1900, has been presented to Col. W. C. Gorgas, U. S. A., member of the Isthmian Canal Commission and formerly chief sanitary officer of Havana, for distinction in special research into tropical medicine.

Mr. Elwood Mead, chief of irrigation and drainage investigations, Office of Experiment Stations, United States Department of Agriculture, whose resignation was noted in these columns Aug. 31, sailed from Vancouver, Oct. 11, for Melbourne, Australia, where he is to be chairman of the Commission on Rivers and Water Supply of the State of Victoria.

Maj. Francis R. Shunk and Capt. Edward H. Schulz, Corps of Engineers, U. S. A., have been designated as chief engineer officers of the departments of Dakota and Missouri, respectively, relieving Lieut.-Col. William H. Bixby, who has served temporarily as chief engineer officer of those departments in conjunction with his duties as chief engineer officer of the Department of the Lakes.

The following promotions and appointments have been made at Lehigh University for the coming year: Professor J. F. Klein, dean of the faculty and superintendent of heat and light; P. B. de Schweinitz, professor machine design in the department of mechanical engineering; Robert C. H. Heck, professor of experimental engineering in the department of mechanical engineering; Frank P. McKibben, professor of civil engineering, in charge of the department; Winter L. Wilson, professor of railroad engineering in the department of civil engineering.

The Nominating Committee of the American Society of Civil Engineers has issued the following list of nominees for the offices to be filled at the annual election in January: President, Charles Macdonald, New York City; vice-presidents, Geo. F. Swain, Boston, Mass., and Mordecai T. Endicott, Washington, D. C.; treasurer, Joseph M. Knap, New York City; directors, Chas. L. Harrison, New York City; Geo. W. Kittredge, New York City; Dexter Brackett, Boston, Mass.; Gardner S. Williams, Ann Arbor, Mich.; Horace Andrews, Albany, N. Y.; Chas. S. Churchill, Roanoke, Va.

Readers of The Engineering Record are cautioned that a man who some time ago defrauded mechanical and electrical engineers in this country has recommenced operations. He is a very plausible Englishman, about 30 years of age, 5 ft. 7 or 8 in. in height, of slight build; he has a light complexion and crooked teeth, and generally represents himself as the son of some large manufacturer or other important man in England, over here on business. He is very well posted as to the names of products and manufacturers on both sides of the Atlantic, is very plausible, and, as a rule, after gaining the confidence of the men upon whom he calls, tells a story about having been robbed and asks for a loan to tide him over until he can get money from his father, to whom he has cabled.

Mr. William H. Arnold, formerly chief engineer of the Bush Terminal Co., New York City, and Mr. Harold S. Andrew, formerly of the Engineer Department of the United States Army, have formed a partnership, with offices at 52 Broadway, New York, under the firm name of Arnold & Andrew, as consulting engineers. The design of dredging machinery and docks and the investigation of drainage problems will be taken up as specialties. Mr. Arnold has for several years made a specialty of dredging apparatus and is the patentee of a pneumatically operated clam-shell bucket for dredging hard material. Mr. Andrew has been closely identified with the improvement of New York and New Jersey rivers and harbors and recently made a hydrographic survey of the new Ambrose channel, New York harbor.

The following candidates for membership in the American Society of Civil Engineers were elected Oct. 2: As members—C. C. Anthony, inspector of signals, Pennsylvania R. R., Philadelphia, Pa.; R. E. Barkenhus. Civ. Engr., U. S. N., Newport, R. I.; B. J. Dalton, Prof. Civ. Eng., Univ. of Kans., Lawrence, Kans.; W. T. Dougan, Eng. M. of W., New York City Ry. Co., New York City; H. J. Gault, Constr. Engr., U. S. Reclamation Service, Selden Station, N. Mex.; George Higgins, Lecturer in Civ. Eng., Melbourne Univ., Melbourne, Victoria, Australia; H. F. Jonas, Prin. Asst. to Bridge Engr., Sunset Lines in Texas and Louisiana, Houston, Tex.; Willard Kent, Narragansett Pier, R. I.; W. E. Knobloch, Supt. in Fourth Mississippi River Dist., U. S. Engrs., New Orleans, La.; A. T. Kroeber, Asst. Engr. to Hering & Fuller, New York City; S. A. Mitchell, Cons. Engr., Ft. Smith, Ark. Chf. Engr., Kansas City Water-Works, Kansas City, Mo.; Eugene Mowlds, Engr. in Chg. of Drawing Room, Edge Moor Plant, Am. Bridge Co., Edge Moor, Del.; J. P. Newell, Cons. Civ. Engr., Portland, Ore.; W. C. Phelps, Prin. Asst. Engr., Interborough Metropolitan Co., New York City; H. L. Potter, U. S. Engr. Office, New York City; H. A. Schulze, Archt., San Francisco, Cal.; James Shand, with S. Pearson & Son, as Agt. in charge of Port Works of Coatzacoalcos, Mex.; E. P. Shuman, Dist. Engr., Second Eng. Dist., Philippine Islands, Vigan, P. I.; J. B. Snow, Asst. Eng., Pennsylvania, New York & Long Island R. R., East River Tunnels, New York City; E. B. Temple, Asst. Chf. Engr., Pennsylvania R. R. Co., Philadelphia, Pa.; J. H. Terry, Secy. and Treas. Latla & Terry Constr. Co., Philadelphia, Pa.; W. C. Weeks, Supt. of Constr., Washington Water Power Co. of Spokane, Wash.; B. E. Winslow, Cons. Architectural Engr., San Francisco, Cal. As associate members—A. B. Alderson, in private practice, also Town Engr., West Hartford, Conn.; Kay Alexander, Res. Engr., Northern Pacific Ry., St. Regis, Mont.; P. S. Baker, Computer, Philadelphia & Reading Ry., Philadelphia, Pa.; John Berger, Asst. Engr., New York Central & Hudson River R. R., New York City; C. E. Pengler, Chf. Asst., Eng. Dept., Realty Syndicate, Oakland, Cal.; E. E. Bratton, First Asst. Engr. and Chf. Draftsman, Bureau of Filtration, Philadelphia, Pa.; H. F. Cameron, Engr. and Asst. Supt., J. G. White & Co., Inc., on Improvements of Port of Cebu, Cebu, Philippine Islands; G. P. Carver, Cons. Engr., Boston, Mass.; I. M. Chace, Office Engr., Cananea, Yaqui River & Pacific R. R. Co. and Gila Valley, Globe & Northern Ry. Co., Tucson, Ariz.; E. M. Chadbourne, Vice-Pres. and Gen. Mgr., Clinton Fireproofing Co. of California, San Francisco, Cal.; R. L. Chamberlaine, Asst. Engr. and Chf. Draftsman, United Railways & Electric Co. of Baltimore, Baltimore, Md.; Paul Chipman, with Canadian White Co., Montreal, Canada; E. W. Cunningham, Structural Engr., Vorce Eng. Co., Cleveland, Ohio; G. J. Davis, Asst. Prof. of Hydr. Eng., Univ. of Wisconsin, Madison, Wis.; H. W. Dennis, Designer and Computer with Wm. A. Brackenridge, Cons. Engr., Niagara Falls, N. Y.; G. V. Dieden, Res. Engr., Tidewater Ry. Co. and Deepwater Ry. Co., Leesville, Va.; T. B. Downer, Asst. Engr., Los Angeles Aqueduct, Mojave, Cal.; C. C. Fisher, Asst. Engr., U. S. Reclamation Service, Meridian, Idaho; G. M. Forrest, Chf. Asst. to Chf. Engr., Building Bureau of Board of Education, New York City; E. J. Fucik, Engr. for Geo. W. Jackson, Inc., Chicago, Ill.; J. H. Gandolfo, Asst. Constr. Engr., with John Van Vleck, New York City; L. L. Gay, Asst. Engr., U. S. Reclamation Service, Boise, Idaho; August Gundersen, Asst. Engr., Butler Bros.-Hoff Co. of New York; H. M. Harps, Prin. Asst. Eng., with Herbert C. Keith, Cons. Eng., New York City; A. C. Harrington, with Buffalo, Lockport & Rochester Ry. Co., Albion, N. Y.; J. B. Harris, Reinforced Concrete Engr., Los Angeles, Cal.; N. F. Hopkins, Harrok, Hopkins & Taylor, Civ. and Min. Engrs., Pittsburg, Pa.; H. W. Horne, Asst. Engr., Board of Water Supply, New York City; H. F. Howe, Div. Engr., Cebu Div., Philippine Ry. Co., Cebu, P. I.; Hyotaro Inagaki, Res. Engr., Imperial Government Taiwan Rys., Taipeh, Formosa, Japan; W. E. Ingram, Prin. Asst. Structural Engr., The Arnold Co., Chicago, Ill.; E. S. Johnson, Office Engr., Key West Extension, Florida East Coast Ry., Miami, Fla.; L. A. Keith, Chf. Engr., Board of Public Service, Mansfield, Ohio; J. C. Lathrop, Chf. Draftsman, United Railroads of San Francisco, San Francisco, Cal.; C. M. Leonard, Pres. and Gen. Mgr., Leonard-Martin Constr. Co., Engrs. and Gen. Contrs., Chicago, Ill.; J. D. Lombardo, Asst. Engr., Mexican Light & Power Co., Necaxa, Pueblo, Mexico; C. M. Meyers, Asst. Engr., Rapid Transit Subway Constr. Co., New York City; H. S. Morse, Asst. Eng., U. S. Reclamation Service, Glendive, Mont.; C. A. Pohl, Asst. Engr., New York State Barge Canal, Lyons, N. Y.; S. G. Porter, Chf. Engr., Arkansas Valley Sugar Beet & Irrigated Land Co., Holly, Colo.; C. H. Preston, with New York, New Haven & Hartford R. R., Waterbury, Conn.; C. L. Richardson, Richardson-Wey Eng. Co., Atlanta, Ga.; Shigeki Sekiha, Draftsman, Penn Bridge Co., Beaver Falls, Pa.; J. C. Smith, Gen. Supt. of Constr., Dodge & Day, Philadelphia, Pa.; G. R. Soloman, Soloman-Norcross Co., Engrs., Atlanta, Ga.; H. H. Starr, Asst. Engr., Erecting Dept., Am. Bridge Co. of New York; W. L. Stevenson, Prin. Asst. in charge of parkway construction, 4th Survey Dist., Dept. of Public Works, Philadelphia, Pa.; J. W. Sussex, Wenatchee, Wash.; E. A. Yates, Asst. Engr., East River Tunnels, Pennsylvania R. R., New York City. As associate—G. N. Cole, Eastern Factor and Agt. for Cross Horizontal Folding and other warehouse doors, New York City.

TRADE PUBLICATIONS.

Record of Construction No. 62 of the Baldwin Locomotive Works, Philadelphia, is a good discussion of balanced compound locomotives. The first Baldwin locomotive of this type was built in 1902, and since then over 350 have been ordered. The balanced compound principle is discussed and the main dimensions of a number of typical locomotives of this construction presented.

Catalogue 70, just issued by the Watson-Stillman Co., New York, is devoted to forcing presses for shop purposes, of which a large variety are shown. Nearly half of this catalogue, which contains 130 pages describes new designs of hydraulic tools for forcing and pressing and is probably the most extensive and complete list of shop tools for making force fits, driving broaching tools and similar purposes that has been published.

The Kennedy Valve Mfg. Co. has issued a 132-page book filled with valuable information on valves and their use. It is arranged in six sections, the first discussing the different types and details of gate valves, the second devoted to bronze gate valves, the third to iron-body, bronze-mounted, and all-iron gate valves and indicator devices for automatic sprinkler systems; the fourth to renewable-disk globe, angle, radiator and corner valves, swinging check valves, back water and sewer gas valves, and Siamese connections; and the fifth to hydrants, floor stands, extension valve boxes and flanges. The sixth section embraces a series of tables regarding diameters, drilling and bolting of flanges, and data that will be useful to engineers.

The Power Specialty Co., New York, announce the appearance of the fourth edition of its pamphlet on Superheated Steam, which has been revised by Mr. E. H. Foster, the inventor of the Foster superheater. This edition contains profuse illustrations of superheaters manufactured by the company as applied to the various types of boilers in use in this country, and also of the direct fired type, ranging from large illustrations of 3,000 h.-p. units to small portable superheaters, which may be used for experimental purposes. The pamphlet also contains a few pages devoted to superheated steam specialties, such as piston rod packing, Harter flexible joints, corrugated bronze gaskets, and the Willits double acting non-return valve, all of which articles are sold by the company as especially adapted to plants using superheated steam. At the back of the book are steam tables running to high pressures and temperatures, also tables of velocities of steam in various sizes of pipe at different degrees of superheat, and curves for readily selecting the proper size of steam pipe for any set of conditions, which will be found useful to the designing engineer.

The Chicago Pneumatic Tool Co. is mailing two new catalogues, one of which, No. 23, is a book of more than 100 pages and is devoted exclusively to Franklin air compressors. It contains much descriptive matter and information relating to air compressors in general and to the Franklin designs in particular. The other, No. 24, is also a book of more than 100 pages and covers the company's line of pneumatic tools and appliances, including "Boyer" and "Keller" hammers, "Little Giant" drills, sand rammers and hoists.

Thomson polyphase induction wattmeters, for measuring energy in any two-phase, three-phase or monocyclic circuit, are described in bulletin No. 4,527 issued by the General Electric Company. These instruments are made in three types; one for house service with metal cover, and two for switchboard use, one having a metal cover and the other a glass cover. Each consists of two single-phase motor elements, each acting upon its own disk with both disks mounted upon a single shaft actuating the register. The meters may be applied to a circuit carrying a mixed load of lamps, motors, or other devices, and will record accurately irrespective of load conditions.

The latest catalogue of the Parker Hoist & Machine Co., 981 Francisco Ave., Chicago, is devoted to full descriptions of the materials and sizes of their hoisting engines, jib cranes, guy and stiff leg derricks, winches and derrick fittings, wire rope, wheelbarrows, platform and belt elevators, and other contractors' equipment.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—The date of opening of bids for water works improvements has been extended from Nov. 15 to Dec. 1, as advertised in The Engineering Record. Robt. Craig, Supt. Water Wks.

Florence Ariz.—See "Power Plants, Gas and Electricity."

Phoenix, Ariz.—See "Miscellaneous."

Oakland, Cal.—Plans and specifications are reported to have been completed for the salt water fire fighting plant. The plans provide for a pumping plant, a building in which the pumps, motors and engines will be located and distributing mains over the area to be covered by auxiliary system. Estimated cost of the pumping plant and building, $50,000. Cost of the distribution system will depend upon the amount of territory covered by mains.

**Los Angeles, Cal.*—The contract for the construction of a controlling tower in Little Bear valley for the Arrowhead Reservoir & Power Co., is reported to have been let to Arthur S. Bent, of Los Angeles. It will be 184 ft. high from tunnel floor grade, will be erected at front of present portal of outlet tunnel No. 1; will be 13 ft. in diameter at top, and built of reinforced concrete; cost, about $8,000.

Naturita, Colo.—The Empire Irrigation Co. is reported organized to take over the rights, title, interest, franchises, lands and all other assets of the Naturita Canal and Reservoir Co., the Naturita Cattle & Land Co., the Shenandoah Irrigation Co. and the Naturita Valley Co., all in Colorado. It is stated that about $500,000 will be expended in improvements. A. D. Struthers, Pres., Carmon Layton, Secy., both of Des Moines, Ia.

Las Animas, Colo.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Nov. 5 for installing a water system at the naval hospital, New Ft. Lyon, Las Animas, Colo. Applications for proposals should refer to Sch. 385. E. B. Rogers, Paymaster Genl., U. S. N.

Atlanta, Ga.—At a meeting of the Water Board on Sept. 30 it was decided to lay water main from river to present reservoir at once; also procure bids for pump for Hemphill station; it was also decided to authorize the engineer at Hemphill station to prepare plans for new intake from river to pump well.

Albany, Ga.—R. J. Edgerly, City Engr., writes that bids will probably be received in December or January for sewers to cost about $37,500; water improvements to cost $8,000, and paving to cost $16,000. W. C. Rawson, Mayor.

*Irwin Bros., New Orleans, were the successful bidders on Contract "15 W," at a total of $225,789, including valves, hydrants, plugs, etc., and the unit prices on some of the items in this contract are as follows: Loading and unloading pipe and piling, 5,400 tons, per ton, 50 cts., hauling pipe, 420,000 tons, 2 cts. per 100 ft.; 24-in. water pipe, 500 lin. ft., 1.50 per lin. ft.; 20-in., 500 lin. ft., 1.20; 16-in., 500 lin. ft., 80 cts., 12-in., 17,100 lin. ft., 60 cts.; 10-in., 100 lin. ft., 45 cts.; 8-in., 500 lin. ft., 38 cts.; 6-in., 167,200 lin. ft., 35 cts.; 4-in., 152,800 lin. ft., 30 cts.; set 420 hydrants and furnish concrete base and porous fill to same, $6 ea.; c. i. manholes, covers and frames, 20,000 lbs., 6 cts.; lumber under pipe or under valve chambers, 30 M ft., $15; blocks and wedges, 55 M ft., $30; extra excav., 600 cu. yds., $1.50 brick masry., 50 cu. yds., $7; extra concrete masry., 50 cu. yds., $12; 4-in. vitr. clay drain tile, 100 lin. ft., 50 cts.; asphalt, 7,700 sq. yds., $4; Belgian block, 700 sq. yds., $3; vitrified brick, 100 sq. yd., $3; square block, 7,800 sq. yds., 70 cts.; cobble stone, 11,600 sq. yds., 60 cts.; gravel, 11,700 sq. yds., 60 cts.; shell, 6,300 sq. yds., 50 cts.; plank, 14,600 lin. ft., 40 cts.; bitulithic pavt., 100 sq. yds., $4; Schillinger, 4,000 sq. yds., $1.20; flagging, $1,400 sq. yds., 90 cts.; brick, 4,900 sq. yds., 80 cts.; old curb removed and reset, 300 lin. ft., 40 cts.

* A. L. Patterson & Co., of Macon, Ga., was successful bidder for Contract "16 W," at a total of $256,167, including valves, hydrants, etc. Some of the unit prices on this bid are as follows: For loading, unloading and piling pipe, per ton of 2,000 lbs., 8,900 tons, $1; hauling pipe, 520,000 ton per hun. ft., 3 cts.; 30-in. water pipe, 6,300 lin. ft., $2.68; 24-in., 4,700 lin. ft., $1.30; 20-in., 13,900 lin. ft., $1.20; 16-in., 700 lin. ft., 85 cts.; 12-in., 43,300 lin. ft., 70 cts.; 10-in, 100 lin. ft., 60 cts.; 8-in., 500 lin. ft., 50 cts.; 6-in., 152,500 lin. ft., 34 cts.; 4-in., 111,000 lin. ft. 30 cts.; laying 30-in. and 12-in. flexible pipe, 600 lin. ft., $16; set 500 hydrants and furnish concrete base and porous fill, $5; c. i. valve boxes, manhole covers and frames, 45,000 lbs., 5 cts.; all lumber in place, 40 M ft., $30; blocks and wedges, 55 M ft., $30; round piling in place, 200 lin. ft., $1.20; creosoted piling in place, 200 lin. ft., $1.80; extra excav., 1,000 cu. yds., $1.50; brick masry., 100 cu. yds., $20; extra concrete masry., 50 cu. yds., $15; 4-in. vitr. clay drain tile, 100 lin. ft., 80 cts.; asphalt, 5,000 sq. yds., $2.80; Belgian block, 300 sq. yds., $1.40; vitr. brick, 2,600 sq. yds., $1.10; square block, 2,500 sq. yds., 30 cts.; cobble stone, 15,500 sq. yds., 26 cts.; gravel, 10,300 sq. yds., 20 cts.; shell, 5,300 sq. yds., 10 cts.; plank, 1,000 lin. ft., 10 cts.; bitulithic pavt., 100 sq. yds., $4; Schillinger, 1,600 sq. yds., 75 cts.; flag, 700 sq. yds., 20 cts.; brick, 8,000 sq. yds., 30 cts.; old curb removed and reset, 300 lin. ft., 30 cts.

*M. O'Herron & Co., of New Orleans, was the successful bidder for Contract "17 W," at a total of $237,791, including valves, hydrants, etc. Some of the unit prices in this bid are as follows: For loading, unloading and piling pipe, per ton 2,000 lbs., 8,000 tons, 75 cts.; hauling 470,000 tons, 1½ cts. per per 100 ft.; 24-in. water pipe, 500 lin. ft., $2; 20-in., 3,200 lin. ft., $1.10; 16-in., 12,900 lin. ft., 80 cts.; 12-in., 37,200 lin. ft., 60 cts., 10-in., 100 lin. ft., 50 cts.; 8-in., 500 lin. ft., 45 cts.; 6-in., 207,000 lin. ft., 34 cts.; 4-in., 148,000 lin. ft., 29 cts.; setting 560 hydrants and furnishing concrete base and porous filling, $6; c. i. valve boxes, manhole covers and frames, 58,000 lbs., 5 cts.; lumber under pipe or valve chambers, 50 M ft., $13 per M ft.; blocks and wedges, 70 M ft., $30; round piling, 200 lin. ft., $1; creosoted piling, 200 lin. ft., $1; extra excav., 1,000 cu. yds., $2; brick masry., 50 cu. yds., $10; extra concrete masry., 50 cu yds., $10; 4-in. vitr. cay drain tile, 100 lin. ft., 60 cts.; asphalt, 2,500 sq. yds., $4.50; Belgian block, 100 sq. yds., $3; vitr. brick, 2,400 sq. yds., $3; square block, 100 sq. yds., $1; cobble stone, 8,400 sq. yds., 50 cts.; gravel, 4,300 sq. yds., 50 cts., shell, 3,400 sq. yds., 50 cts.; plank, 1,000 lin. ft., 20 cts.; bitulithic pavt., 100 sq. yds., $4; Schillinger, 1,100 sq. yds., $1.50; flag, 500 sq. yds., 50 cts.; brick, 3,000 sq. yds., 50 cts.; old curb removed and reset, 300 lin. ft., 50 cts.

*The General Contr. Co., of New Orleans, was successful bidder for Contract "18 W," at a total of $113,637, including valves, hydrants, etc. Some of the unit prices in this bid are as follows: Loading, unloading and piling pipe, 4,400 tons, 50 cts.; hauling pipe, 240,000 tons, 1 ct. per 100 ft.; 24-in. water pipe, 500 lin. ft., $1.50; 20-in., 500 lin. ft., $1.10; 16-in., 1,200 lin. ft., 80 cts.; 12-in., 30,800 lin. ft., 60 cts.; 10-in., 100 lin. ft., 50 cts.; 8-in., 800 lin. ft., 40 cts.; 6-in., 102,200 lin. ft., 35 cts.; 4-in., 80,700 lin. ft., 30 cts.; set 170 hydrants and furnish concrete base and porous fill, ea., $5; c. i. valve boxes, manhole covers and frames, 23,000 lbs., 5 cts.; lumber in place under pipe or valve chambers, 20 M ft., $30; blocks and wedges, 36 M ft., $30; round piling, 200 lin. ft., $2; creosoted piling, 200 lin. ft., $3. extra excav., 400 cu. yds., 85 cts.; brick masry., 20 cu. yds., $15; extra concrete masry, 20 cu. yds., $13; 4-in. vitr. clay drain tile, 100 lin. ft., 50 cts.; asphalt, 500 sq. yds., $4; Belgian block, 100 sq. yds., $4; vitr. brick, 100 sq. yds., $3; square block, 3,000 sq. yds., 75 cts.; cobble stone, 6,700 sq. yds., 75 cts.; gravel, 500 sq. yds., 60 cts.; shell, 600 sq. yds., 50 cts.; plank, 3,000 lin. ft., 30 cts.; bitulithic pavt., 100 sq. yds., $5; Schillinger, 300 sq. yds., $1.80; flag, 100 sq. yds, 75 cts.; brick, 1,000 sq. yds., 75 cts.; old curb removed and reset, 200 lin. ft., 25 cfs.

**Columbus, O.*—The following are the bids opened on Sept. 18 by the Bd. of Pub. Service for Contract 17, c. i. force mains, for water supply improvement: (*a*) Engineer's estimate; (*b*) W. C. Halliday; (*c*) Chas. V. Taylor and John M. Beckett; (*d*) Westwater & Casey (awarded contract); (bidders all of Columbus).

	(*a*)	(*b*)	(*c*)	*(*d*)
1,600 cu. yds. Excav., Class A	$ 3.25	$ 4.56	$ 6.50	$ 7.20
16,500 cu. yds. Excav., Class B	0.50	0.65	0.52	0.42
12,200 cu. yds. Embkmt.	0.59	0.80	0.60	0.54
40 cu. yds. Broken stone or gravel backing	1.25	1.50	1.25	1.00
50 cu. yds. Stone paving	3.00	4.00	3.75	4.00
2,200 cu. yds. Macadam	3.00	1.85	1.58	1.50
3,600 lin. ft. Post and rail fence	0.30	0.25	0.25	0.25
45 cu. yds. Brick masonry	12.00	10.00	9.00	10.00
450 cu. yds. Concrete	8.00	10.00	9.00	10.00
2,420 tons C. i. pipe	44.00	42.00	43.25	43.43
130 tons Bell and spigot special castings	95.00	100.00	95.00	97.00
4 tons Flange special castings	115.00	100.00	95.00	100.00
2 tons Remov. old c. i. pipe and special castings	15.00	10.00	9.00	20.00
7 tons Relaying old c. i. pipe and spec. castings	10.00	22.00	18.00	15.00
Remov. and relay. 20-in. Venturi meter, (lump sum)	100.00	115.00	110.00	125.00
2 Remov. and relay. 24-in. Venturi meter, each	100.00	150.00	140.00	150.00
3 set Brass pipe and fit. for Venturi meters, each	30.00	30.00	22.00	20.00
1,460 lin. ft. Remov. 1½-in. lead lined iron pipe	0.05	0.04	0.04	0.10
1,300 lin. ft. Relay. 1½-in. lead lined iron pipe	0.10	0.08	0.07	0.10
100 lin. ft Furn. and lay. 1½-in. lead lined iron pipe	0.75	0.55	0.40	1.00
Valves, valve boxes, hydrants and connections (lump sum)	7,181.00	7,232.85	8,042.00	9,122.00
Ejector (lump sum)	150.00	310.00	196.00	200.00
7,500 lbs. Twisted steel rods	0.03	0.05	0,035	0.04
2,500 lbs. Manhole steps and tie rods	0.06	0.05	0.04	0.04
11,000 lbs Iron castings	0.05	0.05	0.04	0.04
Totals	$160,034	$162,590	$162,683	$163,907

Coeur D'Alene, Idaho.—Dr. C. L. Crait, Geo. Mason and others are reported interested in the construction of a gravity system of waterworks, to cost about $150,000.

Spring Valley, Ill—It is reported that bids are wanted until Oct. 15 for the extension of water mains in certain streets Anton Faletti, City Clk.

Carlyle Ill.—See "Power Plants, Gas and Electricity."

Indiana Harbor, Ind.—The East Chicago & Indiana Harbor Water Works Co. is reported incorporated to construct water works to supply this city and the immediate towns and villages with water. H. S. Oakley, C. W. Sherman, C. B. Woods and Harry H. Phillips are directors

Adel, Ia—Bids will be received by the Town Council until Oct 21, at the office of V. T. Sweeley, Town Clk., for constructing a 4 in. c. i. water pipe in a portion of Rapids St

Marion, Kan—Bids will be received until Oct. 22 by Thos. W. Bown, City Clk., for constructing waterworks. Separate bids to be submitted on the following: Furnishing c. i. pipe and special castings, furnishing hydrants and valves, furnishing and installing machinery, laying pipe, constructing well, power house, tower foundations, etc. Burns & McDonnell, Engrs., 821 3 Scarritt Bldg., Kansas City, Mo

**New Orleans La.* The City Council on Oct 1 approved the following contracts for waterworks construction recently awarded by the Sewerage and Water Bd. (bids for which were opened on Sept 4):

Wyandotte, Mich.—R. Winthrop Pratt, of Columbus, O., is stated to have presented to the Bd. of Pub. Wks. his report on the construction of filtration plant for Wyandotte.

Owosso, Mich.—Bids will be received until Oct. 23 by the Bd. Pub. Wks. for furnishing and installing complete 2 Scotch marine boilers at the water works, as advertised in The Engineering Record.

Bay City, Mich.—The City Council is reported to have decided to expend about $19,000 for laying new mains to connect the east and west side water systems.

**Mahnomen, Minn.*—A. O. Vachon, Recorder, writes that W. D. Lovell, 1415 8th St., S. E., Minneapolis, has secured the contract for constructing water tank, tower and complete water system for fire protection (bids opened Sept. 30) for $4,300.

**Detroit, Minn.*—Chas. G. Sturtevant, Clk. Water and Light Com., writes that the contract for the erection of a 50-ft. steel water tower and tank of 100,000 gal. capacity, and laying 600 to 1,000 ft. of 8-in. water main, and installing one hydrant (bids opened Sept. 30), have been awarded to the Chicago Bridge & Iron Works, of Chicago, Ill.

Cloquet, Minn.—It is reported that Thos. F. McGilvrey, City Engr. of Duluth, estimates the cost of water works for Cloquet at $43,950.

Meridian, Miss.—The citizens have voted to issue $50,000 bonds for the extension of the water mains and other improvements to the waterworks. W. F. Wilcox, Supt.

Brookhaven, Miss.—Bids will be received, it is stated, by R. D. Lanier, Mayor, and Bd. Aldermen, until Oct. 15, for $15,000 water works extension bonds. C. H. Hamilton, City Clk.

Wahoo, Neb.—See "Power Plants, Gas and Electricity."

**Exeter, Neb.*—The National Constr. Co., of South Bend, Ind., is reported to have secured the contract for constructing an air pressure system of water works for $14,800.

Franklin, Neb.—Jay A. Dickey, City Clk., writes that bids will be received on Oct. 21 for water works, to cost between $15,000 and $17,000.

Wahoo, Neb.—The Mayor writes that it is proposed to construct water works; probable cost, $60,000.

Collingswood, N. J.—See "Power Plants, Gas and Electricity."

Camden, N. J.—Bids will be received by the Water Com. of City Council (Jos. Potter, Chmn.) until Dec. 17 for improving present artesian water supply system, and adding to the present supply of 17,000,000 gal. at least 5,000 gals. daily, as advertised in The Engineering Record.

**Highlands, N. J.*—The following are the bids opened on Sept. 25 by the Mayor and City Council for the construction of water works (Engineers, Runyon & Cary, 122 Market St., Newark): R. B. Carter Co., New York, N. Y., $33,113. and Wharton Co., Philadelphia, Pa., $34,500; Harrison Construction Co., Newark, $29,989; H. A. Miller, Wilmington, Del., $28,944; Atlantic Constr. & Sup. Co., Atlantic City, $31,343; McCay Eng'g Co., Baltimore, Md., $27,777 (awarded contract).

Rome, N. Y.—The following contracts are expected to be advertised during the early winter months by the Water and Sewers Comrs., and intending bidders are asked to look over ground before topographical features and physical conditions are obscured by snow: Intake dam on Fish Creek; tunnel; aqueduct, and reservoir, as advertised in The Engineering Record. Further information can be obtained from Knight & Hopkins, Engrs., of Rome.

Brooklyn, N. Y.—The Bd. of Estimate, N. Y. City, on Oct. 4 appropriated $100,000 to provide for the construction and extension of high pressure water service for fire protection at Coney Island.

Salisbury, N. C.—The City Clerk writes that the citizens on Oct. 1 voted to issue $300,000 bonds. It is stated that it is proposed to use the proceeds of the issue for street, water and sewer improvements during the next 3 years.

Ironton, O.—Bids will be received, it is stated, until Oct. 15 by the Bd. Pub. Service for furnishing material and excavating, concrete work and piling for the foundation of valve well at city water works, for clear water system.

Prague, Okla.—The question of issuing $30,000 bonds for water works is reported under consideration.

**Philadelphio, Pa.*—We are informed that Dravo, Doyle & Co., 719 Arcade Bldg., has secured the contract for 2 turbine-driven sand washer pumps for the Torresdale filter plant, Contract 119, for $6,480 (bids opened Aug. 29 by the Dept. of Pub. Wks).

Panama.—See "Power Plants, Gas and Electricity."

Greensburg, Pa.—The Jamison Coal & Coke Co. is reported to have decided to construct a reservoir northeast of George Station, to supply water to its five plants.

Wickford, R. I.—The Wickford Fire Engine Corporation (Chas. Stafford, Secy.) on Oct. 1 voted to issue $30,000 bonds for the purpose of installing waterworks for the town of North Kingston .

Hurley, S. D. The question of constructing water works is reported as being considered here.

Brownsville, Tex Bids will be received, it is stated, until Oct. 30, by Frank W. Kibbie, City Attorney, for $43,000 water and $10,000 electric light bonds.

Norfolk Va. The Common Council on Oct. 1 passed an ordinance appropriating $50,000 for the purchase of 2,000 water meters .

Wenatchee, Wash. The Com. on Fire, Light and Water is reported to have been instructed to have plans prepared for new water works.

**Items marked thus give the names of parties awarded contracts.*

Spokane, Wash.—Fred. Wendt is reported to have petitioned the County Comrs. for a franchise for a water system for Irvington Heights.

The Adrian Irrigation Co. (Walter Thos. Mills, Pres.), with offices in the Columbia Bldg., is reported to have engineers in the field making permanent location for its canal, following which work on construction will be started. It is proposed to irrigate about 3,000 acres. The water supply is derived from five lakes, which will be connected by ditches, making dams in three places to raise and hold the flood waters of Crab Creek.

Tacoma Wash.—Frank L. Davis, City Engr., is reported to have recommended to City Council the laying of an 18-in. water main from South Tacoma pumping station to supply water in the west end of the city. Estimated cost $40,000.

West Bend, Wis.—The City Clerk writes that bonds have been sold for the construction of water works.

West Bend, Wis.—The citzens are reported to have voted to issue $25,000 bonds for water works.

Two Rivers, Wis.—It is stated that bids will be received until Oct. 16 by the Water and Light Comrs. (J. G. Weilep, Secy.) for laying 1,070 ft. 4-in. water pipe.

Thermopolis, Wyo.—The citizens have voted to issue $50,000 bonds for waterworks.

Sudbury, Ont.—See "Power Plants, Gas and Electricity."

Clinton, Ont.—The citizens are reported to have voted Sept. 30 to issue $53,000 bonds to establish a system of waterworks for fire protection.

**Montreal, Que.*—Geo. Janin, Supt. Water Works, writes that the contract for constructing reinforced concrete conduit about 9 ft. diam. and 27,300 ft. long has been awarded to Patk. McGovern, 6 Beacon St., Boston, Mass., for about $684,815.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Jasper, Ala.—Bids will be received by the Mayor and Council until Oct. 21 for constructing sanitary sewers. P. Byrne, Engr., Birmingham.

**Ensley, Ala.*—C. M. Burkhalter & Co. are reported to have on Oct. 3 secured the contract for building storm sewers, for $5,500.

Ventura, Cal.—The citizens are reported to have voted to issue $150,000 bonds for the construction of two storm sewers, 3 steel and concrete bridges, improvement to parks, paving, a fire house, and other improvements.

Santa Monica, Cal.—The citizens on Sept. 28 voted to issue $150,000 bonds for the establishment of a septic tank, outfall sewer; also a pleasure wharf on Colorado Ave. T. H. James, City Engr.; J. C. Heminway, City Clk

**San Francisco, Cal.*—J. A. Dowling & Co. are reported to have secured the contract for constructing sewers on Drumm and Commercial Sts., for $15,879, and Williams & Belser, for sewers in Stuart, Beale and Tremont Sts., for $5,318.

Torrington, Conn.—Bids will be received by the Bd. of Warden and Burgesses of Torrington until Oct. 21 for the construction of sanitary sewers, including 7,771 lin. ft. 12, 10 and 8-in. tile pipe and 37 manholes, as advertised in The Engineering Record.

Albany, Ga.—See "Water."

Elgin, Ill.—The question of constructing a complete system of combination sewers in the 5th Ward, is reported under consideration here.

Champaign, Ill.—The Bd. of Pub. Wks. is reported to be considering the construction of a sewerage system.

Marshall, Ill.—C. A. Purdunn, of the Bd. of Local Improv., writes that Robt. W. Paige, of Terre Haute, Ind., is preparing plans and specifications for the construction of a sewerage system.

Quincy, Ill.—See "Paving and Roadmaking."

**Linton, Ind.*—Frank Spelbring, City Clk., writes that Fred C. Morgan and T. E. Slinkard, of Linton, have secured the contract for constructing a sewerage system (bids opened Oct. 7); cost reported to be about $64,000.

Elkhart, Ind.—It is reported that plans have been ordered prepared for sewers in W. Franklin and Hudson Sts. L. E. Arnold, Chmn. Bd. Pub. Wks.

Bids will be received, it is stated, until Oct. 15 by the Bd. Pub. Wks. for constructing a sewer in E. Jackson St. A. M. Smith, City Engr.

Adel, Ia.—Bids will be received until Oct. 21 by the Town Council at the office of V. G. Sweeley, Town Clk., for constructing 8 and 10-in. vitrified clay pipe sewers in Walnut, Main and Rapids Sts., in all about 4,460 lin. ft.

**Clinton, Ky.*—P. H. Porter, of Clinton, has secured the contract for constructing a system of sewers in Clinton.

Covington, La.—The Town Council is reported to have appointed a committee, consisting of J. S. Jones, Maurice Plaunche and Preston Burns, to investigate and report on the question of constructing a sewerage system.

Agawam, Mass.—The Selectmen are reported to have voted to extend the sewer system along the Agawan side of Mittineague along Bridge and Maple Sts. and Highland Ave.

Salem, Mass.—The following are the bids opened on Oct. 2 by the Sewerage Comrs. for constructing (*a*) Sect. 1, (*b*) Sect. 2, (*c*) Sect. 3 and (*d*) Sect. 4 of the So. Salem trunk sewer, to be of brick or reinforced masonry, requiring in all about 6,913 lin. ft. 34, 36, 38, 42 and 48 in. sewer—(1) brick, (2) concrete: Bruno & Petitti, (*a*1) $29,277, (*a*2) $28,207, (*b*1) $25,850, (*b*2) $24,935, (*c*1) $22,930, (*c*2) $23,105, (*d*1) $20,100, (*d*2) $19,225; Falvey & Kelley, (*a*1) $29,104, (*a*2) $28,207, (*b*1) $22,938, (*b*2) $21,114, (*c*1) $18,277, (*c*2) $16,489, (*d*1) $18,678, (*d*2) $17,265. Thos. F. Welch, Boston, (*a*1) $25,896, (*a*2) $21,318, (*b*1) $19,351, (*b*2) $15,232, (*c*1) $22,154, (*c*2) $17,222, (*d*1) $14,842, (*d*2) $11,792; Coughlan & Shields Co., (*b*1) $24,756, (*b*2) $22,460, (*c*1) $22,183, (*c*2) $20,620; C. E. Trumbull Co., (*b*1) $24,633, (*b*2) $21,448, (*c*1) $22,281, (*c*2) $19,553.

Tecumseh, Mich.—Bids will be received until Oct. 29 by the Bd. of Village Trus. (W. L. Jones, Clk.) for furnishing material and constructing a sanitary sewer system, consisting of 1,020 ft. 15-in., 500 ft. 12-in., 11,348 ft. 10-in., 28,227 ft. 8-in. and 14,674 ft. 6-in. pipe sewer, with manholes, flush tanks, masonry and Y branches. Engineers, the Riggs & Sherman Co., of Toledo, O.

**Detroit, Mich.*—W. W. Magee, Secy. Bd. Pub. Wks., writes that Jas. Hanley, 40 Fort St., has secured the contract, for the Shroeder Ave. sewer, sects. 4 and 5 at $17,093 and $25,021 respectively, and Langley & Jeynes, for the Lothrop Ave. sewer for $10,074.

Virginia, Minn.—Bids will be received until Oct. 22 by Albert E. Bickford, City Clk., for constructing sewers in Sewer Dist. No. 3 G.

**St. Paul, Minn.*—O'Neil & Preston are reported to have secured the contract on Oct. 3 for building a sewer on Goff Ave., for $5,357.

Hattiesburg, Miss.—It is stated that bids will be received until Oct. 15 at office of City Clk., for constructing sanitary sewers and appurtenances, requiring about 2,640 lin. ft. 15-in., 6,150 lin. ft. 10-in. and 6,708 lin. ft 8-in. sewer, 43 manholes and 7 flush tanks. J. H. Putnam, City Engr.

**Bozeman, Mont.*—E. T. Rich is reported to have secured the contract for constructing sewers on Sept. 24, for $25,000.

Plainfield, N. J.—The City Council is reported to have decided to complete the installation of the sewage connection through the entire south side of city, recently abandoned by contractor; it will cost about $40,000.

Trenton, N. J.—Bids will be received until Oct. 15 by the Common Council for constructing sewers in portions of Logan and Stuyvesant Aves. Harry B. Salter, City Clk.

Riverside, N. J.—Bids will be received until Oct. 31 by Henry Taubel, Chmn. Township Com., at Kiessling's Hall, Riverside, for $80,000 bonds, to be issued for the purpose of constructing a sewerage system.

Summit, N. J.—Bids will be received until Oct. 15 by the Common Council for constructing the Edgewood sewers, consisting of about 5,300 ft. 12, 10 and 8-in. vitr. pipe.

Buffalo, N. Y.—Separate bids will be received until Oct. 22 by the Dept. Pub. Wks. (F. G. Ward, Comr.), for furnishing material and constructing sewers in portions of the following streets: 20 and 18-in. tile sewer in Eller Ave.; 15 and 10-in. tile sewer in Southside Parkway and a 12 and 10-in. tile sewer in Bloomfield Ave.; 45, 42, 39, 36 and 33-in. brick sewer in Fillmore Ave.

Saratoga Springs, N. Y.—Bids will be received, it is stated, until Oct. 16 by the Sewer, Water and Street Comn., for constructing 8-in. terra-cotta sewers in portions of Church, Granite, Alger and Clinton Sts.; also a 6-in. terra-cotta sewer in a portion of Henry St.

Salisbury, N. C.—See "Water."

Steubenville, O.—Bids will be received, it is stated, by T. W. Vance, Clk. Bd. Pub. Service, until Oct. 21, for constructing an 18-in. pipe sewer in a portion of Wells St.

Ironton, O.—The citizens are reported to have voted to issue $75,000 sewer and flood defense bonds.

Cincinnati, O.—Bids will be received until Oct. 15 by the Bd. Pub. Service (M. J. Keefe, Clk.), for the repair of the McLean Ave. brick sewer, 12 ft. diam. Engineer's estimate, $12,000.

Delaware, O.—The lowest bid opened on Sept. 27 by the Bd. of Trus. of the Girls Industrial Home for a sewage disposal plant, was submitted by the Pitt Constr. Co., of Pittsburg, Pa., for $12,786. Engineers, E. G. Bradbury and Geo. P. Shute, of Columbus.

Orrville, O.—The State Bd. of Health has approved plans for sewerage and a sewage disposal plant for Orrville. Engineer, L. E. Chapin, of Canton.

Scranton, Pa.—Bids will be received until Oct. 18 by C. R. Acker, Dir. Dept. Pub. Wks., for constructing a lateral sewer in Division St.

Archbald, Pa.—The Boro. Council is reported to have decided to construct sewers on Main and Monroe Sts., which is said to be preliminary to constructing sewers in the entire borough.

RockHill, S. C.—The question of constructing a sewage system is reported under consideration here; probable cost, $117,000.

Aberdeen, S. D.—F. W. Raymond, City Aud., will receive bids until Oct. 28 for the construction of sewers.

Salt Lake City, Utah.—Bids will be received, it is stated, by the Bd. Pub. Wks. (F. J. Leonard, Chmn.) until Oct. 18, for furnishing and installing pump and motor, constructing pump house and outlet pipe for intercepting sewer. Louis C. Kelsey, City Engr.

Spokane, Wash.—Bids will be received until Oct. 22 by the Bd. Pub. Wks. (J. T. O'Brien, Secy.) for the construction of sub-trunk sewers in the 1st Ward, Dists. Nos. 6 and 7; also a main trunk sewer, 1st Ward, Dist. No. 4.

Kent, Wash.—C. C. Cornelius, Town Clk., writes that contract was not let on Sept. 28 for constructing main trunk sewer; only two bids were received.

Seattle, Wash.—Local press reports state that about $275,000 will be expended by the city within the next year or so, to relieve the tide flat sewer situation, the work to include the construction of the Lander St. and the Connecticut St. trunk sewers.

Fond du Lac, Wis.—Bids will be received until Oct. 18 at the office of J. F. Hohensee, City Clk., for constructing sanitary sewers in portions of First, Tenth and Merrill Sts.

Ladysmith, Wis.—Bids will be received until Oct. 15 by the Bd. Pub. Wks. (Tom Baker, Chmn.) for constructing a sewer in Miner Ave.

BRIDGES.

Notes Arranged Alphabetically by States.

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Chicago, Ill.—Bids will be received until Oct. 26 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and constructing the sub-structure for bascule bridge over the north branch of the Chicago River, near Kinzie St., with all necessary abutments and approaches; also superstructure of said bridge, including all machinery necessary thereto.

Granville, Ind.—John P. Foresman, Aud. of Lafayette, writes that it is proposed to erect a bridge over Wabash River near Grenville next spring, to cost about $50,000.

Des Moines, Ia.—It is stated that plans are being prepared for the erection of a viaduct at S. 7th St.

Des Moines, Ia.—The City Council is reported to have decided to remove present Locust St. steel bridge to North St.

Williamsport, Md.—Bids will be received by the Williamsport & Berkeley Bridge Co. (Edw. W. Byron, Secy.) until Oct. 30 for a reinforced concrete arch bridge, 15 spans, total length 1,570 ft., over Potomac River, as advertised in The Engineering Record. Mason D. Pratt, Consulting Engr., Harrisburg, Pa.

Thief River Falls, Minn.—It is stated that contract will soon be let for constructing a steel bridge over Red Lake River, at a cost of $14,000.

Meridian, Miss.—At a joint conference held Sept. 30 between the officials of the city, the steam railroads and the street railway a committee of engineers was requested to report in 15 days on the location and estimated cost of an overhead bridge. J. T. Rivers, Mayor.

Kansas City, Mo.—The construction of a viaduct to connect the West Side Dist. with the Union Station is reported contemplated.

**New York, N. Y.*—The following are the bids opened on Oct. 3 by Jas. W. Stevenson, Comr. of Bridges, for constructing the Madison Ave. Bridge over Harlem River: Bernard Rolf, 39 Cortlandt St., $1,333,333; John C. Rodgers, 1929 Amsterdam Ave., $1,155,987 (awarded contract); Phoenix Constr. & Supply Co., 41 Park Row, $1,189,626; Maryland Steel Co., 71 Bway., $1,324,567; Williams Engr. & Contr. Co., 21 Park Row, $1,197,000.

New York, N. Y.—See "Electric Railways."

New York, N. Y.—See "Power Plants, Gas and Electricity."

Hempstead, L. I., N. Y.—Bids will be received by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York City, until Oct. 18, for furnishing, delivering and constructing piers for 2 bridges over the Wantagh stream, and to do certain grading of Seaman's Road, in the town of Hempstead.

**Oberlin, O.*—Burge & Miller are reported to have secured the contract for constructing stone abutments for the Vine St. Bridge, at $2,153.

Ashland, O.—It is reported that bids will be received until Nov. 4 by the Bd. Co. Comrs., for furnishing material and constructing the McClintock Bridge in Clear Creek Township, to consist of one 45-ft. steel superstructure and stone abutments. E. B. Westover, Co. Aud.

Clinton, O.—It is stated that bids will be received until Oct. 23 by the Bd. Co. Comrs. at Akron, for furnishing material and constructing a bridge across the Tuscarawas River on the Haulk Rd. in Franklin Township, about a mile north of Clinton. Mark D. Buckmann, Co. Aud.

Troy, O.—See "Paving and Roadmaking."

Cincinnati, O.—The Com. on Streets is stated to have recommended the construction of a bridge over the canal, replacing the Mohawk Bridge at Central Ave.; estimated cost of proposed structure, $25,720.

Dayton, O.—It is stated that bids will be received by T. P. Kaufman, Co. Aud., until Oct. 17 for $20,000 bridge bonds.

Bids will be received until Nov. 2 by Edwd. Philips, City Aud., for $9,000 bonds to be issued for the purpose of providing money to construct a bridge across Wolf Creek and for purchasing and condemning the necessary land therefor.

Portland, Ore.—The City Council is reported to have authorized the Executive Bd. to receive bids for constructing a steel bridge over Sullivan's Gulch at Union Ave. and E. Everett St.; estimated cost, $66,000.

Williamsport, Pa.—Bids will be received until Oct. 15 by the Bd. Co. Comrs. (Nate Brion, Chmn.) for constructing a stone arch bridge across Hamilton's Run, Cummings Township.

Chester, Pa.—Local press reports state that bids will be received until Oct. 17 by the Bd. Co. Comrs., at Media, for constructing a reinforced concrete bridge on Ardmore Ave., over Cobbs Creek, Haverford Township.

Philadelphia, Pa.—Bids will be received by Geo. R. Stearns, Dir. Dept. Pub. Wks., until Oct. 21 for bridges on Sch. A, as advertised in The Engineering Record. This work consists of the following: At 12th St. under Connecting Ry 4 track half through solid floor plate girder railroad bridge, 69 ft. 6 in. long, 52 ft. wide, containing 14,000 cu. yd. of grading; appropriation, $70,000; also at Wyoming Ave. over Frankford Creek, highway bridges, two separate concrete arch bridges, 571 ft. apart, ea. with a span of 90 ft. and width of 74 ft.; appropriation, $140,000. Geo. S. Webster, Ch. Engr., Bureau of Surveys.

Lancaster, Pa.—The County Comrs. are reported to have opened bids Sept. 30 for the erection of a stone or concrete bridge to be built over Hammer Creek between Elizabeth and Warwick Townships: Ferro Concrete Co., $3,495; J. P. Brenneman, concrete, $6,050; P. B. Bucher, stone, $3,340; Chas. T. Eastburn, stone, $5,150.

Woonsocket, R. I.—See "Paving and Roadmaking."

Johns Island, S. C.—Bids will be received until Oct. 20 by T. F. H. Peck, Chmn. Township Bd., for con-

**Items marked thus give the names of parties awarded contracts.*

structing a bridge connecting Johns Island with Wadmalaw, also 2 concrete bulkheads.

Belton, Tex.—The Bell County Comrs. are reported to be considering erection of steel wagon bridge, costing $[illegible], over the Leon River between Belton and Temple, Tex.

Crosby, Tex.—Bids will be received until Oct. 16 by John R. Ash, Co. Aud., Houston, for constructing a bridge across San Jacinto River near Crosby.

Tarrant, Tex.—It is reported that bids will be received until Oct. 15 by C. J. Kenna, Co. Aud., Ft. Worth, for constructing a 40-ft. steel bridge, with 12-ft. steel piers, resting on concrete bases, 12 ft. roadway, across Bear Creek, about 4 miles north of Tarrant.

Spokane, Wash.—The City Council on Oct. 2 selected Prof. W. H. Burr, of New York, N. Y., to visit Spokane and report on respective methods of a steel or concrete bridge on Monroe St.; also to prepare plans for the bridge.

River Falls, Wis.—Bids will be received until Oct. 21 by Allen P. Weld, City Clk., for constructing a steel arch bridge, with sidewalk and cement floor, with covering of vitrified brick at the Cedar St. crossing, Kinnickinnic River.

Superior, Wis.—Plans for an extension of the Belknap St. Viaduct are reported to have been prepared. The plan is to extend the viaduct to the east over the Northern Pacific R. R. and Lake Superior & Transfer Ry. tracks. The entire extension will be about 742 ft. long, while the present viaduct is 776 ft. in length. The cost of the proposed improvement will be about $60,000.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Stockton, Cal.—The City Council is reported to have passed a resolution providing for the paving of Poplar St.

San Francisco, Cal.—We are informed that Flinn & Treacy, of San Francisco, submitted the following bid on Sept. 19 to the Bd. of State. Harbor Comrs.: For 22,000 sq. ft. new paving with basalt blocks, excav. 6 in. and filling 5 in. deep with clean sand, 28⅞ cts., and 3,000 sq. ft. repaved with old blocks, including preparing roadbed, as above, 10 cts.; total cost, $6,652.

Naturita, Colo.—It is stated that bids will be received until Oct. 21 by T. W. Jaycox, State Engr., Denver for constructing about 2 miles of wagon road between Naturita and Paradox, Montrose County.

**Bristol, Conn.*—The Pierson Engineering and Constr. Co. is reported to have secured the contract for improving Farmington Ave. for $6,850.

**Hartford, Conn.*—F. L. Ford, City Engr., writes that the contract for paving with asphalt Asylum St. (bids opened Oct. 7) has been awarded to the Southern New England Paving Co., 26 State St., Hartford, Conn. Total bid, $15,960.

**Wilmington, Del.*—The Street and Sewer Directors are reported to have decided to purchase a municipal paving plant from the Warren Bros. Co., of New York, N. Y., at a cost of $12,250, with $900 additional for 2 storage tanks.

Washington, D. C.—The Comrs. of Dist. of Columbia are stated to have decided to resurface the driveway on west side of 14th St. between Thomas Circle and Rhode Island Ave.

Atlanta, Ga.—The construction of a driveway from Piedmont Park to Grant Park is reported under consideration.

Albany, Ga.—See "Water."

**Boise, Idaho.*—The contract for 25,000 lin. ft. of cement curb and same length of 6-ft. cement sidewalk has been awarded to Ward & Ballinger, of Boise, at 45 cts. and 75 cts. per lin. ft., respectively.

Quincy, Ill.—Bids will be received until Oct. 17 for 10-in. pipe sewer on 10th St. and paving 10th St. for 2 blocks with a single course brick and sand stone curb. F. L. Hancock, City Engr.

**Hartford City, Ind.*—L. W. Dougherty, Co. Aud., writes that Marion Creek, of Priam, secured contract for constructing macadam road in Harrison Township, for $22,367, and Chas. Clamme, of Hartford City, for a road in another portion of Harrison Township, for $6,883.

Lafayette, Ind.—It is stated that bids will soon be received for paving Owen St.

Resolutions are reported to have been adopted providing for the paving of Hollaway and Hickory Sts.

**Vincennes, Ind.*—Patrick Lenahan, of Vincennes, is reported to have secured the contract for improving 5,736 ft. of Fyffe Gravel Road, for $8,122. Bids opened Sept. 29.

Des Moines, Ia.—The City Council is stated to have decided to pave with brick portions of Postal Ave., W. 19th, 20th, 28th, 29th, W. 9th and Walnut Sts.

Galena, Kan.—The City Council is reported to have passed an ordinance providing for the paving of a portion of Wall St.

**Emporia, Kan.*—The contract for paving 14,284 sq. ft. of Commercial St. is stated to have been awarded to Ft. Scott Stone & Constr. Co., of Ft. Scott, at $1.65 per ft.

**Boston, Mass.*—We are informed that Jones & Meehan, 1 Beacon St., have secured the contract for paving and regulating Northern Ave. and Sleeper St. (bids opened Sept. 30 by Wm. Jackson, City Engr.), at the following bid: 800 lin. ft. edgestone, $1.0[illegible]; 6,500 sq. yds. granite block, $2.[illegible]; [illegible] sq. yds. brick sidewalk, $1; 50 sq. yds. flag, $[illegible]; total, $[illegible],800. Totals of other bids received: Daniel F. Lynch, $11,939; Daniel J. Kiley, $[illegible]; D. F. [illegible] & Co., $[illegible]; McCourt & Doherty, $16,172; W. H. Grose & Co., $16,524; R. Eagar, Jr., $[illegible]; J. McShane, $17,[illegible]; Jas. Doherty, $17,298, and Peter W. H[illegible], $[illegible].

So. St. Paul, Minn.—The paving of Concord St. is reported contemplated, at a cost of $[illegible].

St. Cloud, Minn.—The City Council is stated to have decided to expend $18,[illegible] for street improvements.

Bemidji, Minn.—It is stated that bids will be received until Oct. 15 by the Bd. Co. Comrs. for constructing 2 county roads. John Willmann, Co. Aud.

Carterville, Mo.—Bids will be received until Oct. 17 by H. E. Moody, City Clk., for constructing 39,000 sq. ft. cement sidewalks on 5 streets. Est. cost, $5,300. F. A. Funk, City Engr.

Kansas City, Mo.—See "Miscellaneous."

Concord, N. H.—Bids will be received by the Comrs. of Cabarrus County until Oct. 24 for grading and macadamizing about 10 miles of public road from Concord to Kannapolis, also 1 mile on the Concord and Charlotte Road, as advertised in The Engineering Record. Engineer, Quint E. Smith, of Concord.

Gloucester, N. J.—The Mayor is stated to have approved the ordinance providing for an appropriation of $75,000 for street improvements.

Belleville, N. J.—Bids will be received until Oct. 15 by Thos. H. Breen, chmn. Township Com., for furnishing material and constructing sidewalks on portions of Heckel and Anderson Sts. J. H. Francisco, Surveyor, 175 Broad St., Newark.

New York, N. Y.—Bids will be received until Oct. 21 by Henry S. Thompson, Acting Boro. Pres. and Comr. Pub. Wks., for regulating and repaving with wood blk. portions of Trinity Pl., Church and Vesey Sts.; with asphalt, 6th, 8th and W. 11th Sts., and with asphalt blk., Cannon, Attorney, Ridge, Pitt, Willett, Sheriff and Columbia Sts. Engineer's estimate: 17,110 sq. yds. wood blk. pavt.; 13,700 sq. yds. asphalt pavt., including binder course; 7,170 sq. yds. asphalt blk. pavt.; 36,510 sq. yds. old stone blocks, to be purchased and removed by the contractor; 6,710 cu. yds. concrete, including mortar bed; 20,095 lin. ft. new bluestone curbstone, to be furnished and set, etc.

Bids will be received by the Park Bd. (Saml. Parsons, Jr., Pres.) until Oct. 24, for furnishing and delivering 1,000 cu. yds. broken stone of trap rock, and screenings of trap rock (No. 4, 1907), for parks, Boro. Bronx.

Ithaca, N. Y.—Bailey, Johnson & Saunders, 121 S. Tioga St., Ithaca, have the following work to sublet, for which they will furnish plant: 8,000 cu. yds. local stone (bottom course), half mile haul; 4,000 cu. yds. limestone (top course), 1½ miles haul; stone on cars, $1.15; 10,000 cu. yds. excav., guard rail paving, etc.

Mineola, L. I., N. Y.—It is stated that the Bd. Supervisors of Nassau County is about to issue $250,000 bonds for road improvements.

Hempstead, L. I., N. Y.—A resolution is stated to have been passed by the Bd. of Estimate and Apportionment of New York City approving the proposed agreement to be entered into by the Comr. of Water, Gas & Electricity and the Town Bd. and Comrs. of Highways of Hempstead, for an easement of right of way over the banks of the Brooklyn waterworks reservoir for the construction of Eagle Ave.

**Buffalo, N. Y.*—F. V. Bardol, D. S. Morgan Bldg., is reported to have secured the contract for paving with brick a portion of Pink St., $4,750.

Brooklyn, N. Y.—Bids will be received until Oct. 23 by Bird S. Coler, Boro. Pres., for regulating and repaving portions of Park Pl., Bradford, George, Saskman and Schaeffer sts. Engineer's estimate: 28,000 sq. yds. asphalt pavt.; 3,210 cu. yds. concrete; 6,340 lin. ft. new curb, etc.

**New York, N. Y.*—The Comr. of Docks has awarded to M. J. Fitzgerald the contract for furnishing materials and curbing, flagging and laying granite pavement, with crosswalks, within the area of the marginal street on the Chelsea section, bet. W. 15th and W. 19th Sts., North River, Boro. of Manhattan, for $50,500.

Rochester, N. Y.—The construction of a municipal asphalt plant is reported under consideration.

**Schenectady, N. Y.*—The contracts for paving with asphalt Earle Ave. and Union St. is reported to have been awarded to F. R. Crane, at $2 per sq. yd.

Durham, N. C.—We are informed that all bids opened by the Comrs. of Durham County, N. C., Oct. 1, for building about 11½ miles of macadam road, to consist of about 60,000 sq. yds. 6-in. macadam and 75,000 cu. yds. excav., with necessary pipe and reinforced concrete drains, have been rejected, being too high, and new bids will be received. A. D. Markham, Chmn.; Engineer, Gilbert C. White, of Durham.

Salisbury, N. C.—See "Water."

Dayton, O.—Bids will be received until Nov. 2 by Edwd. Philipps, City Aud., for $33,600 paving bonds.

Cleveland, O.—Bids will be received until Nov. 6 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for the completion of the Miles Ave. improvement. A. B. Lea, Co. Engr.

Troy, O.—Bids will be received until Nov. 12 by E. E. Pearson, Co. Aud., for furnishing material and building about 2,800 lin. ft. macadam road known as the Horse Shoe Bend Improv., near W. Milton, also the substructure for bridge and reinforced concrete culvert. Approximate quantities: [illegible],000 cu. yds. earth excav.; 28,000 cu. yds. rock excav.; 2,070 cu. yds. masonry; 160 cu. yds. reinforced concrete; 3,373 sq. yds. macadam, and 360 lin. ft. piling. H. J. Walker, Co. Engr.

**Marion, O.*—The contract for constructing the White Oaks Road is reported to have been awarded by the County Surveyor to Brady & O'Connell for $3,800.

Lorain, O.—Bids are wanted, it is stated, until Oct. 19 for $44,000 Reid St., $8,500 Washington St., $68,000 Oakwood St., $13,500 Bank St. and $16,000 2d Ave. paving bonds. Custer Snyder, City Aud.

**Silverton, O.*—A. A. Sprague, Clk. Bd. Pub. Service, writes that the contract for constructing cement sidewalks, grading, etc. (bids opened Sept. 21), has been awarded to I. E. Witman, of Columbus, for $10,598.

Woodsfield, O.—It is stated that the Village Council will receive bids until Oct. 19 for grading and macadamizing W. Court St.

Richwood, O.—It is stated that bids will be received until Oct. 26 by Ray L. Jordan, Village Clk., for improving Franklin St., by paving with brick, constructing curb, gutters and retaining walls.

Harrisburg, Pa.—The Boro. Council is reported to have passed resolutions providing for the paving of portions of 15th, Hummel and State Sts.

Local press reports state that bids will be received until Oct. 17 by the Highway Dept., for paving Moltke Alley, Hummel and Parker Sts.

Somerset, Pa.—The County Comrs. are stated to have decided to macadamize portions of the Somerset and Bedford Pike and Frieden's Station Road, at a cost of $18,237.

Scranton, Pa.—Bids will be received until Oct. 15 by C. R. Acker, Dir. Dept. Pub. Wks., for laying flagstone sidewalks on portions of several streets.

**Woonsocket, R. I.*—The United States Wood Preserving Co., of New York, N. Y., is reported to have secured the contract for paving with wood block Court St. Bridge, at $5,800.

Beaumont, Tex.—Bids will be received until Oct. 21 by Jas. A. Harrison, Co. Judge, for $300,000 road bonds.

Seattle, Wash.—The following are the bids opened on Sept. 28 by the Bd. of Pub. Wks. for paving Yesler Way from Bway. to 32d Ave.: (*a*) Sparger Concrete Co., 568 Colman Bldg.; (*b*) H. F. Jahn & Co., 581 Colman Bldg.:

	a	*b*
Fixed estimate	$2,500.00	$2,500.00
Clearing and grubbing (lump sum)	4,000.00	6,000.00
150 lin. ft. 8-in. pipe sewer	2.00	1.60
7,400 cu. yds. sub-grade	.75	.75
7 catch-basins, 1 inlet, ea	70.00	85.00
8 catch-basins, no inlet, ea	55.00	70.00
1,358 lin. ft. curb, curved granite	2.25	2.25
12,643 lin. ft. curb, concrete	.45	.50
391 sq. yds. concrete walks	1.30	1.60
10,176.8 sq. yds. asphalt	2.35	2.25
11,081 sq. yds. sandstone	4.65	4.50
2,354 sq. yds. brick gutters	3.30	3.20
1,120 lin. ft. wood stop	.50	.45
21 catch-basins to move, ea	30.00	35.00
18 inlets to move, ea	5.00	4.00
66 adj. catch-basins, manholes	4.00	4.00
102 sq. yds. brick alley crossings	3.30	3.20
700 cu. yds. concrete bulkhead	8.50	9.50
256 lin. ft. railing	.15	.50
132 lin. ft. 8-in. c. i. pipe	2.75	2.20
36 lin. ft. 6-in. c. i. pipe	2.25	1.70
200 lin. ft. 1-ft. galv. pipe	.35	.40

**Seattle, Wash.*—Fritch & Co., Inc., are stated to have secured the contract for constructing about 12 miles of sidewalks 6 ft. in width in the Jas. A. Moore's University Park Addition for $40,000.

Huntington, W. Va.—It is stated that bids will be received until Nov. 1 by K. L. Hamilton, City Clk., for $50,000 street improvement bonds.

Menasha, Wis.—The paving of portions of Broad St. with macadam is reported contemplated.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Hartsells, Ala.—The Hartsells Electric Light & Power Co. is reported incorporated to construct an electric light plant. J. C. Rogers, of Hartsells, is reported interested.

Florence, Ariz.—The Florence Water, Light, Ice & Power Co. is reported formed by Dr. G. M. Brockway, P. A. Chambers and others, to construct water works, an electric light and gas plant and an ice plant in Florence.

Chico, Cal.—L. D. Macy, a hotel proprietor, of Chico, is reported to have decided to petition Council for a franchise for an electric light plant.

Redlands, Cal.—The Edison Electric Co. is reported to be planning the construction of a power plant to utilize the water of Bear Creek.

Badito, Colo.—It is reported that the Southern Colorado Power Co. has been incorporated to construct a reservoir and water power plant at Badito, on Huerfano River. It is expected that the power plant will generate 10,000 h.p. for use of all the towns and mines in the vicinity of Badito. It is probable that the company will furnish electric power to operate the mines of the Colorado Fuel & Iron Co. near Walsenburg and Trinidad.

Washington, D. C.—See "Miscellaneous."

Carlyle, Ill.—It is reported that the electric light plant and water works will be improved and extended.

Blackshear, Ga.—The question of constructing an electric light plant is reported under consideration.

Indiana Harbor, Ind.—The Indiana Harbor & East Chicago Electric Co. is reported incorporated, to construct, equip and operate an electric plant to supply the city of East Chicago and other cities, towns and villages in said territory, with light, heat and power. H. H. Philips, R. M. Cole, H. S. Oakley and C. B. Woods are the directors.

Bicknell, Ind.—It is reported that the Town Council will receive bids for the construction and equipment of a combined water and electric light plant.

Mishawaka, Ind.—The Mishawaka Textile Co. is reported to have purchased the north race of the local water-power, and will install new machinery for the generation of electricity for power purposes.

Clay City, Ind.—The Clay City City Lighting Co. is reported to be in the market for material, equipment and expert labor for the construction of an electric light plant. J. M. Long and H. R. Vandevier, Directors.

Newton, Ia.—It is reported that it is proposed to purchase engine, boiler and switchboard for the municipal electric light plant.

Marion, Kan.—See "Water."

Paducah, Ky.—See "Public Buildings."

Baltimore, Md.—Bids will be received until Oct. 16 by the Bd. Awards (J. Barry Mahool, Pres.) for installing a 60-h. p. shunt field control direct-current 440-volt motor at the New Eastern Female High School.

Orange, Mass.—The Rodney Hunt Machine Co. is reported to be considering the question of purchasing the water power at Eagleville and developing same for electrical purposes.

Bay City, Mich.—Albert Boston, Deputy Recorder, writes that specifications have been prepared, and bids will probably soon be called for by the City Comptroller, for dismantling the east side electric light plant and re-establishing same on west side of river. Wm. H. Fitzhugh, Supt.

*Items marked thus give the names of parties awarded contracts.

Escanaba, Mich.—The Escanaba Electric Power & Pulp Co. is reported incorporated with a capital of $500,000 and has been granted the right by the city of Escanaba to furnish city plant with power for lighting streets and commercial light and power for 10 years. O. L. Huie, Marinette, Wis., Pres.; J. M. Malloy, Watertown, Wis., Vice-Pres., and P. L. Utley, Watertown, Wis., Secy. and Treas.

**Red Wing, Minn.*—The State Bd. of Control is reported to have awarded contract for installing an addition to the power plant at the Red Wing Training School to the Northern Eng. Co., of Minneapolis, for $2,198. The contract for rewiring the buildings was awarded to Hartig & Hellier, of Minneapolis, for $4,000.

Laurel, Miss.—The Gulf State Investment Co. is reported to have secured a 25-year franchise to construct and operate an electric light and power plant.

Stevensville, Mont.—H. C. Hodge, of Tacoma, Wash., is reported interested in the construction of an electric light plant to light Stevensville and Victor. He expects to develop the water power in the Big Creek canyon west of Victor.

Wahoo, Neb.—A committee is reported appointed with Mayor E. Lenrud as chairman, to report on question of constructing an electric light plant and water works.

Central City, Neb.—Mr. Martin, of Fremont, is reported to have petitioned for a franchise for an electric light plant.

Collingswood, N. J.—The Collingswood Mutual Water Improv. Co., of Philadelphia, Pa., is reported to have petitioned Borough Council for a franchise to light borough and supply water.

New York, N. Y.—See "Schools."

New York, N. Y.—Bids will be received until Oct. 24 by Jas. W. Stevenson, Comr. Bridges, for the electrical equipment of the University Heights Bridge.

Bids will be received until Oct. 21 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in additions to and alterations in School 59; also in connection with alterations in School 171, both in Boro. Manhattan.

Webster, N. Y.—The Sodus Gas & Electric Light Co. of Sodus, is reported to have secured a franchise in Webster to distribute electricity and gas.

Long Island City, L. I., N. Y.—The Bd. of Estimate on Oct. 4 granted a franchise to the Queens Lighting Co. to construct and operate pipes under and along the streets in the Boro. of Queens for the purpose of supplying gas to the public and private consumers.

Clifton Forge, N. Y.—Ford S. Burgett is reported interested in the formation of a company to develop the power on the outlet, and furnish electricity for lighting, etc.

East Worcester, N. Y.—The Great Bear Light & Power Co., of East Worcester, is reported incorporated to operate in the counties of Otsego and Schoharie. Capital, $20,000. Directors, Jas. E. Dante, A. D. Hallenbeck and Lucy Dante, of East Worcester.

Warrensville, O.—Bids will be received until Oct. 18 by the Bd. Pub. Service (A. R. Callow, Secy.), Cleveland, for installing complete electric wiring and conduits in the new quadrangle building of the Cleveland Farm Colony at Warrensville.

Toledo, O.—The City Council is reported to have granted Homer T. Yaryan, representing the People's Heat & Power Co., a franchise. According to agreement of the company, made in the ordinance, $200,000 will be expended in Toledo west of the river and $100,000 east of the river, in 2 years.

An application for a 25-year franchise in Toledo is reported to have been made to City Council by the Citizens' Light, & Htg. Co. This company is a new one formed by C. S. Ashley and others and contemplates a general business in light, heat and power in Toledo.

Baker City, Ore.—The Baker Light & Power Co. (A. Welch, Mgr., Baker City), is reported to be planning extensive improvements to its Rock Creek plant.

Womelsdorf, Pa.—W. W. Lengel, Boro. Secy., writes that bids will be received on Oct. 15 for the construction of a municipal electric light plant, to cost about $15,000. Engineer, F. W. Darlington, 1140 Real Estate Trust Bldg., Philadelphia.

Riegelsville, Pa.—John S. Riegel, of Riegelsville, is reported to have under consideration the construction of a water power plant on the Delaware at Narrows lock, to furnish power for his paper mill at Milford.

Panama.—Bids will be received until Nov. 4 at the office of H. F. Hodges, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for electric fixtures, water meters, punching and shearing machines, pipe cutters, etc., as per circular No. 396.

Mt. Carmel, Pa.—The business men are reported to have organized a company, to be known as the Citizens Co., to construct and operate an electric light plant.

Philadelphia, Pa.—The United Gas Improvement Co. is reported to have decided to expend $1,000,000 for improvements to its plant here within the next year. Property has been purchased in West Philadelphia upon which will be erected a 3,000,000-ft. gas holder, and a similar holder will be erected in Frankford.

*We are informed that Dravo, Doyle & Co., 719 Arcade Bldg., has secured the contract for installing 3 turbine-driven generators, including condenser, air pump, piping and switchboard complete at Torresdale pumping station, Contract 110, for $25,150 (bids opened Aug. 29 by the Dept. of Pub. Wks., Bureau of Filtration).

Aberdeen, S. D.—Press reports state that C. F. Freehauf, of Cresco, Ia., has declined to accept franchise recently granted him for an electric light and power plant, and the city is reported to be ready to receive other propositions.

Salt Lake City, Utah.—See "Sewers."

Provo, Utah.—Architect W. H. Lepper is reported to be preparing plans for electric plant for the Telluride Power Co., of Provo, to be constructed near Grace, which when fully developed will have a capacity of 40,000 h. p. At present the design is for a plant of half that capacity, with two 10,000 h. p. generators. The power will be supplied by water from the Bear River. The water will flow through an 8 ft. pipe of iron 1⅛ in. thick.

Boydton, Va.—R. W. Lassiter is reported to have in contemplation the development of water power on Eagle Point fall, on Roanoke River, and the establishment of an electric light plant.

Deer Park, Wash.—The Co. Comrs., at Spokane, are reported to have granted A. M. Wood and R. H. Long a franchise for an electric lighting system in Deer Park.

Princeton, W. Va.—The Princeton Power Co. is reported incorporated with a capital of $25,000, to establish an electric power plant. E. S. J. Evans, Gen. Mgr.

Strathcona, Alta.—It is reported that bids will soon be asked for a gas plant to be constructed here by the International Light & Htg. Co., of Cleveland, O.

Sudbury, Ont.—The Ontario Ry. and Municipal Bd. is reported to have authorized the issue of $10,000 bonds for the extension of the water works and electric lighting system.

Mexico City, Mex.—The Mexican Light & Power Co. is reported to have decided to construct a hydraulic plant on Nexaca River, near Huachinango, to cost about $5,000,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Troy, Ala.—It is reported that Fox Henderson, L. M. Bashinsky and W. Chancy are promoting a scheme to build an electric railway from Troy to Orion, a distance of about 13 miles.

Pasadena, Cal.—The City Council is stated to have awarded a franchise to the Pacific Electric Ry. Co., Geo. E. Pillsbury, Ch. Engr., Los Angeles, to lay a double-track system in the business section of the city.

Chico, Cal.—It is understood that a project is on foot to electrify the Butte County R. R. from Chico to Paradise. D. H. Brammer, of Paradise, is reported interested.

Napa, Cal.—The Napa & Lakeport Ry. Co. is stated to have filed articles of incorporation with the County Clerk. The road is to be constructed from Napa to Lakeport, a distance of 90 miles, with a branch line from Monticello, 14 miles. Capital, $2,000,000. Incorporators: E. C. Amedee, of San Francisco, and A. J. Brown and W. F. Ansell.

Ventura, Cal.—F. M. Packard and J. P. Jones, of Los Angeles, are stated to have applied to the Bd. of Superv. for a franchise for an electric railway from Ventura to Nordhoff.

Elmhurst, Cal.—Application is stated to have been made to the Bd. of Supervisors at Oakland for a franchise to operate an electric railway through Elmhurst by Ira A. Miller.

Trinidad, Colo.—The Stonewall Valley Electric R. R. Co. is reported incorporated with a capital of $100,000. Incorporators: P. M. Johnson, St. Elmo, Ill.; Frank P. Read, James McKeough and J. C. Huddelson, Trinidad. The company intends extending the Trinidad Street Railway next spring from Cokedale through the Stonewall Valley into the Stonewall Mountains.

Macon, Ga.—The Macon Ry. & Light Co. is stated to have presented a petition to the County Comrs. asking the right of way along the Columbus Road to Brown Pl.

South Bend, Ind.—Arrangements are stated to have been completed by the promoters of the Ft. Wayne & South Bend Ry. by which work on the electric line will be started in the near future. Perry A. Randall, of Ft. Wayne, is reported interested.

Evansville, Ind.—The Evansville, Petersburg & Vincennes Ry. Co. is stated to have filed articles of incorporation with the Secretary of State, for constructing, equipping and operating an electric railroad from Evansville through Vanderburg, Warrick, Gibson and Pike counties to Petersburg. Capital, $10,000. Directors, F. W. Cook, L. J. Herman, H. E. Meyer and T. M. Honeywell.

Decatur, Ind.—The Ft. Wayne & Springfield Traction Co. is stated to have decided to ask for bids for the construction of 12 miles of road, including 3 bridges, from Decatur to Berne. J. J. Fledderjohann, Pres.

**Boston, Mass.*—The contract for constructing westerly wall roof and invert enlargement of subway, Haymarket Sq. (bids opened Oct. 3, by the Boston Transit Comn.), has been awarded to Coughlan & Shiels Co., 104 Hanover St., for $33,840.

Malden, Mass.—The Boston Elevated St. Ry. Co., of Boston, is reported to be considering the construction of an elevated railway from Charlestown to Malden.

Pittsfield, Mass.—The Pittsfield Electric St. Ry. Co. is stated to have presented the Railroad Comrs. with a petition for a certificate that public convenience and necessity require the building of an extension of its line from West Pittsfield through Hancock to Lebanon, N. Y (P. C. Dolan, Mgr.)

Traverse City, Mich.—Articles of association of the Grand Traverse Ry. Co. are stated to have been filed. Capital stock $450,000. The company will build an electric railway from Traverse City to Elk Rapids and Charlevoix. Articles of association of the Traverse City St. Ry. Co., which will operate the railway in the city, were also filed. Capital $255,000.

Minneapolis, Minn.—The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Co. is reported organized for the purpose of constructing and operating an electric railway in Minnesota and Iowa. Capital $25,000,000. Eben Winthrop Freeman, of Portland, Me., is Pres., and M. H. Boutelle, of Minneapolis, Minn., Secy.

New York, N. Y.—Bids will be received by Jas. W. Stevenson, Comr. Bridges, New York City, until Oct. 24, for the construction of train spacing signals for the elevated railway tracks of the Brooklyn Bridge.

Albany, N. Y.—The United Traction Co., E. S. Fassett, Gen. Mgr., is reported to have awarded to M. F. Dollard the contract for excavating, filling and forming the 33-ft. strip owned by the company on the south side of the continuation of Western Ave., preparatory to laying tracks.

Wooster, O.—It is reported that all of the right of way has been secured for the Wooster & Mansfield Electric Ry. Co., which is to connect Wooster with Mansfield, and that the road will be built. The road as projected touches Jefferson, Reedsburg, New Pittsburg, Hayesville and West Mansfield, places that have neither railway nor traction outlets. David Collier, of Plimpton, O., is Vice-Pres.

Mangum, Okla. The Southwestern Interurban Ry. Co., has been chartered to build a line of interurban railway from Mangum to Hollis, by way of Francis, a distance of 37 miles; also to Granite and Cordell, 40 miles, with a branch line from Granite to Hobart, 15 miles; from Mangum to Altus, 27 miles; the total mileage of all lines being 119. Capital $1,000,000. Directors, W. T. Funderburk, D. J. Doyle, E. E. Pinkerton, and others, all of Mangum.

Oklahoma, Okla.—A charter is stated to have been issued to the Oklahoma Central Interurban Ry., Telephone, Telegraph, Light & Power Co., which proposes to build interurban electric lines, connecting practically all of the towns and cities of any importance in the two territories. Capital $5,000,000. Its main line is to run from South McAlester northwest to Cheyenne, passing through Holdenville, Wewoka, Shawnee, Oklahoma City, El Reno, Geary and Weatherford. The distance is 500 miles and the estimated cost of construction $17,000 per mile. Branches are also to run from McAlester north to Checotah and Muskogee; south from McAlester to Atoka and Durant; north from Holdenville to Okemah and Okmulgee; south from Wewoka to Ada; north from Shawnee to Chandler and Stillwater; south from Shawnee to Pauls Valley, Davis and Ardmore; north from Oklahoma City to Guthrie and Perry; south from Oklahoma City to Norman and Purcell; north from El Reno to Kingfisher and Enid; south from El Reno to Chickasha, and west to Anadarko and Lawton; south from Weatherford to Cordell, Hobart and Mangum, and north to Sayre and Elk City, 528 miles in all. Incorporators, R. N. Wade, H. H. Codington, of Weatherford; Leon Brown, of St. Louis, Mo.; G. M. Watson, of Nevada, Mo.; Louis Landmann, of Jefferson City, Mo.; C. S. Freeman, of Denver, Colo.; B. F. Sharp, of Memphis, Tenn., and others.

Amended articles of incorporation are stated to have been filed with Territorial Secretary for the Oklahoma City Street Ry. Co., providing for interurban extensions north to Guthrie, south to Norman, and west via Spencer or Choctaw City to Yukon, a total distance of 125 miles. Capital $3,000,000. Incorporators, John W. Shartel, Anton Classen, Geo. H. Brauer and others.

Butler, Pa.—An application will be made by John Daly, W. J. Hogan, W. Criswell, W. G. Stern and E. W. Dewey for the charter for the Butler & Chicora Str. Ry. Co. It is proposed to construct a line from Butler to Carns City, East Brady and Kaylor.

Philadelphia, Pa.—The Philadelphia Subway Terminal Ry. Co. is reported to have secured a charter to construct a subway for railroad purposes in Broad St. from the north side of Filbert St. to a point near North Philadelphia Station, where it will connect with the Pennsylvania's Germantown and Chestnut Hill branch. The estimated cost is from $10,000,000 to $15,000,000. The length of subway is 4 miles.

Chambersburg, Pa.—Ordinances are stated to have been passed by the Town Councils of Chambersburg and Greencastle, granting franchises to the Chambersburg, Greencastle & Waynesboro St. Ry. Co. (J. M. Wolff, Genl. Mgr., Waynesboro) for the proposed extension from Newcastle to Chambersburg and over certain streets in Chambersburg.

Bradford, Pa.—John Looker is reported to be the head of a petition being circulated and already freely signed, the object of which is to collect about $10,000 as a bonus to be offered the Western New York & Pennsylvania Traction Co. for the construction of a line between Bradford and Eldredge.

Bentleyville, Pa.—Application is stated to have been made to Gov. Stuart for a charter for the Finleyville Southern St. Ry., which desires to build a 14-mile line from Finleyville to Bentleyville via Hackett and other towns. Several bridges will be built along the line. Incorporators, M. J. Hayden, T. M. Hayden, J. E. Hayden, H. B. Hayden and S. C. Wilson.

Gettysburg, Pa.—It is stated that surveyors are again in the field in the interests of the Gettysburg-Mt. Holly Springs Ry. project. This line was originally surveyed a few years ago, but construction work was not started. It will connect at Mt. Holly with the Carlisle & Mt. Holly Ry. Co., thus providing electric railway service between Gettysburg and Harrisburg, a distance of about 50 miles.

Sunbury, Pa.—The Town Council is stated to have granted a franchise to the Sunbury & Selinsgrove Electric Ry. Co. which will enable that company to operate on Front St. and Market Sq.

Seattle, Wash.—The City Council is reported to have passed an ordinance granting franchises to the Loyal Ry. Co. to lay, maintain and operate tracks and equipment for street railway lines in Seattle.

Vancouver, Wash.—The Washington Ry. & Power Co. is reported to have been reorganized. E. M. Rands, Pres.; H. C. Phillips, Treas., and M. M. Conner, Secy. It is the purpose of the company to continue the work of the old company. The company estimates that it will cost about $75,000 to finish the city system and the first 4 miles extension.

Grafton, W. Va.—It is stated that the Grafton Traction Co., which is building a street railway over the principal streets of Grafton proper, will extend its lines to both West Grafton and South Grafton.

Oshkosh, Wis.—The Common Council is stated to have passed an ordinance permitting the Winnebago Traction Co. to place a double track on High St.

Sarnia, Ont.—The Town Council has passed a by-law authorizing the Sarnia St. Ry. Co. to construct a street railway from Wellington St. to the C. M. Railway depot, a distance of about a mile and a half. The company will also lay double tracks on Front St. and along Wellington to Vidal. The company will be on the market for rails, cedar ties, poles, wire, bonds and electric equipment for the overhead work.

**Items marked thus give the names of parties awarded contracts.*

Hamilton, Ont.—The City Council is stated to have passed the by-laws granting the Hamilton, Waterloo & Guelph Ry. a franchise for a railway to Guelph and Galt.

Calgary, Alta.—Bids will be received by S. J. Clarke, Chmn. Pub. Wks. Com., Calgary, until Nov. 1 for the following: (a) For the construction of about 12 miles of street car track and overhead trolley work in the city; (b) building a steel bridge with concrete abutments over the Elbow River; (c) for 6 semi-convertible cars with electrical equipment, etc. Separate bids to be submitted on each of the above. R. E. Speakman, City Engr.

RAILROADS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The St. Louis, Iron Mountain & Southern R. R. Co. (A. De Bernardi, Gen. Supt., Little Rock), is reported to have decided to expend about $75,000 in trackage and yard improvements in and near Little Rock.

Denver, Colo.—See "Miscellaneous."

**St. Cloud, Minn.*—The contract for building 2 miles of track at the Great Northern R. R. car shops is reported to have been let to Guthrie & Co., of St. Paul, for $14,200.

Mt. Vernon, N. Y.—The Mt. Vernon & Eastern R. R. Co. is reported organized to operate a standard gauge railroad from Mt. Vernon to Lewisboro, 35 miles in length; capital, $1,000,000. Directors: Oakleigh Thorne and Wm. H. Cheesebrough, of N. Y. City; Marsden J. Perry, of Providence, R. I.; Geo. H. Hansel, of Cranford, N. J., and others.

Alva, Okla.—The Alva & Southern R. R. Co. is reported incorporated, with headquarters at Alva and St. Louis, Mo., to build a railroad 250 miles south from Kiowa, Kan., through the counties of Woods, Dewey, Custer, Roger Mills and Greer, in Okla., to the Red River. Capital, $5,000,000. Incorporators: L. T. McKnight, Pres.; G. E. Autrey, Secy., and Wm. Haviland, Asst. Secy., all of Alva, and G. E. Autrey, Treas., of Granton, O.

Pittsburg, Pa.—Press reports state that H. C. Frick and other local capitalists, including the Mellons, will build a subway, elevated and surface road to connect Pittsburg with Wilkinsburg, East Pittsburg, Braddock and McKeesport.

Bamberg, S. C.—The Bamberg, Ehrhardt & Walterboro R. R. Co. is reported formed, to construct railroad between points named with terminus at Bamberg. Later it will be extended to Denmark.

Summersville, W. Va.—The Gauley & Birch River R. R. Co. is reported incorporated, with a capital of $300,000, to construct a coal and timber road from the mouth of Muddlety Creek in Nicholas County by way of Hooverville to a point near the mouth of Big Birch River in Braxton County. Principal business office of the company is at Summersville.

Walkersville, W. Va.—The Walkersville & Ireland R. R. Co. is reported incorporated, with a capital of $25,000, to construct a railroad from Walkersville to Marlinton. Incorporators: W. E. Mick, Walkersville; R. H. Swisher and W. H. Bailey, of Grafton, and others. Capital, $25,000. Principal office of company is to be Grafton.

Superior, Wis.—The State R. R. Rate Comn. is reported to have issued a certificate of public convenience and necessity to the Soo Line (Thos. Greene, Ch. Engr., Minneapolis, Minn.), to build its Minnesota extension from the Wisconsin-Minnesota state line through Douglas County to South Superior to connect with the proposed line over the Wisconsin & Northern Minnesota R. R.

A certificate is also reported to have been granted to the Northern Wisconsin ..& Minnesota R. R. to build through Superior to the Duluth-Superior bridge at the northerly end of Connors Point, thence across the State line.

**Wellington, N. Z.*—The following are the bids opened at the office of the High Comr. for New Zealand, Westminster Chambers, 13, Victoria St., London, S. W., on July 1, for the construction of a railway tunnel, single track, about 5 miles 25 chains, 12 ft. in length, 17 ft. high, segmental arch on top, 15 ft. wide, curved walls on side, at Arthur's Pass, through the dividing range bet. Canterbury and Westland, on the route of the New Zealand Midland Ry.: John McLean & Son, Wellington, N. Z., £599,794 (awarded contract); Jere. Drummey, Arrowtown, N. Z., £628,732; Kirkwood, Kerr & Co., London, England, £688,215. P. S. Hay, of Wellington, N. Z., is Engr. in Chief.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Bessemer, Ala.—It is reported that plans are being prepared for a hospital, which Dr. Crowe and associates, owners of the mines at Abernant, Yolande and Connelsville, intend erecting.

**Ft. Smith, Ark.*—The contract to erect the Sebastian County Hospital, it is reported, has been awarded to R. L. Payne, 2403 Tilles St., at about $[illegible].

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Sacramento, Cal.—R. A. Herold, Brythe Bldg., is preparing plans for a new county court house and jail, to cost about $660,000.

Redondo, Cal.—The plans of Marsh & Rusell, of Los Angeles, for a city hall, to cost about $30,000, it is reported, have been accepted.

**Pueblo, Colo.*—The contract to erect a brick and masonry addition to the State Insane Asylum is reported awarded to Frank Taylor, of Pueblo, and the contract for the plumbing system to the Burke Htg. & Plumbing Co., of Pueblo. The total cost of the building is to be about $50,000.

Washington, D. C.—The following are the totals bids opened at the office of the Supt. U. S. Capitol Bldg. and Grounds, Washington, Sept. 21, for furnishing and erecting fans, electric motors and heaters required for the ventilation of the office building, House of Representatives: B. F. Sturtevant Co., Washington, $18,824, and American Blower Co., New York, N. Y., $19,300.

Bids will be received at the office of the Building for National Museum, Library of Congress, Washington, D. C. (Bernard R. Green, Supt. of Construction) until Oct. 24 for furnishing, delivering and setting in place complete the cut buff Bedford limestone and marble column shafts and marble bases required for the screens in the rotunda of the new building for National Museum, as advertised in The Engineering Record.

Bids will be received at the office of Bernard R. Green, Supt. of Construction, Office of National Museum, Library of Congress, until Oct. 24, for furnishing and constructing roof covering for National Museum, as advertised in The Engineering Record.

Albany, Ga.—The citizens are stated to have voted to issue bonds for the erection of a city hall.

Brunswick, Ga.—Court house and jail bonds, amounting to $75,000 are reported sold.

Atlanta, Ga.—The Co. Comrs. have ordered the erection of a new almshouse on Powers Ferry Road, to cost $50,000.

Cœur d'Alene, Idaho.—The plans of Geo. Williams, of Cœur d'Alene, for the city hall have been accepted by the City Council. The plans provide for a 3-story pressed brick structure, costing about $40,000.

Chicago, Ill.—Bids will be received until Oct. 16 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a police station at Lawndale Ave. and 27th St. Bids to be submitted on the following: Masonry; cut stone; carpentry; sheet metal, etc.; plumbing, etc.; electrical work; steam fitting.

**Peoria, Ill.*—V. Jobst & Sons, 223 S. Adams St., it is reported, have secured the contract for building 2 cottages at the Quincy Soldiers' Home, at $103,000.

Watertown, Ill.—The date of opening of bids for erecting a building for the Western Illinois Hospital for the Insane has been extended from Oct. 8 to Oct. 14. W. Carbys Zimmerman, State Archt., 1001 Steinway Hall, Chicago. Dr. Taylor, Supt., Watertown.

Indianapolis, Ind.—Vonnegut & Bohn, Indiana Trust Bldg., are reported to have been engaged to prepare plans for the M. E. Hospital, which it is estimated will cost in the neighborhood of $150,000.

Bloomfield, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Nov. 5 for the construction of a new jail cell-house. P. M. Cook, Co. Aud.

Des Moines, Ia.—The State Bd. of Agriculture is stated to be contemplating the erection of an administration building on the State Fair Grounds, to cost about $25,000.

Paducah, Ky.—Bids will be received, it is stated until Oct. 18, by the Bd. Co. Comrs., at Paducah, to install steam heating and electric light systems in the county court-house and jail.

**Louisville, Ky.*—We are informed that F. A. Clegg & Co., 237 3d St., has secured the contract for electric light and steam heating plant for the city hall and engine house (bids opened Sept. 27) for $26,500.

New Orleans, La.—Bids will be opened Oct. 21 by the Bd. of Administration of the Charity Hospital (Dr. E. S. Lewis, Vice-Pres.) for the erection and entire completion of a 6-story fireproof hospital known as the Delgado Memorial. Crosby & Henkel, 706 Morris Bldg., are the archts.

It is stated that the contract to erect an annex to the city hall has again been annulled. Alterations are to be made in the plans and the Compt. will again ask bids.

Baltimore, Md.—Bids will be received until Oct. 16 by the Bd. Awards (J. Barry Mahool, Pres.) for erecting Truck House No. 4 at No. 929 McCulloh St.

The following are the bids opened on Oct. 7 at the office of the Superv. Archt. for the construction and mechanical equipment (except plumbing), of an extension to the U. S. Post Office, Court House, etc., at Baltimore, Md.: Henry Smith & Son, Baltimore, $154,400; M. C. Davis, $152,875; Noel Constr. Co., $147,900, and Chas. McCane Co., Philadelphia, Pa., $134,561.

**Pittsfield, Mass.*—Geo. E. Lester, of Pittsfield, it is stated, has the contract to erect an addition to the House of Mercy Hospital, at a cost of $15,000.

Fall River, Mass.—The Bd. of Health, according to reports, has approved the plans of Louis G. Destremps & Son, 56 N. Main St., for the contagious disease hospital.

Springfield, Mass.—Andrew Carnegie has given $50,000 to the city to erect a branch library. A site at Indian Orchard has been secured.

Worcester, Mass.—Fuller & Delano, of Worcester, are reported to be preparing plans for a $50,000 addition to the armory.

Saginaw, Mich.—Wellington R. Burt and Thos. E. Dorr, it is reported, have offered the city $75,000 with which to erect an auditorium, on condition that the city raise $25,000 additional.

Lapeer, Mich.—Bids will be received until Oct. 24 by the Bd. Control, Michigan Home for the Feeble Minded and Epileptic, for erecting a new dormitory building, a new bakery and for additions and alterations to the farm house. Bids to be submitted separately on plumbing. Clark & Munger, Archts., Bay City.

Maryville, Mo.—It is reported that the County Comrs. will erect a $35,000 infirmary and let contracts for construction in December.

Paris, Mo.—John T. Grigsby, County Surveyor, writes that the citizens on Sept. 28 voted to issue $25,000 bonds for the erection of an infirmary.

Monroe City, Mo.—J. N. Magruder, Co. Clk., writes that the citizens on Sept. 28 voted to issue $25,000 bonds for erecting a county almshouse. No architect yet selected.

St. Louis, Mo.—It is reported that plans are being prepared for an armory for the First Regiment, to cost about $40,000.

Kansas City, Mo.—Bids will be received until Oct. 31 by Saml. A. Boyer, Co. Clk., at the Court House, Kansas City, for erecting buildings for the new country Home for the Aged and Infirm. Probable cost, $250,000. Smith & Rea, Archt., 722 Dwight Bldg.

**Omaha, Neb.*—It is reported that Wm. P. Deverall, 429 Ramage Bldg., has secured the contract to erect a laundry at the Home of the Good Shepherd, to be 3 stories high, and cost, completely equipped, $60,000.

**Newark, N. J.*—The Pub. Bldg. Com. of the Bd. of Freeholders, it is stated, has recommended the awarding of the contracts for a new boiler and alterations to the steam and hot water equipment at the county jail to Sorms & Co., 112 S. 14th St., at $6,347; and for plumbing work to Ralph B. Schmidt, 62 Ann St., at $9,996. Bids for this work were received Oct. 1.

Bids will be received by the State Military Bd. at the office of R. Heber Breintnall, Adj. Gen., State House, Trenton, until Oct. 21, for furnishing material and erection of an armory for the first troop at Newark.

Plainfield, N. J.—Evarts Tracy is stated to have submitted to the Police Bd. plans for a 2-story headquarters buidling, to be erected at an estimated cost of $70,000.

Ft. Wood, N. Y. Harbor.—Bids will be received until Oct. 18 by G. C. Burnell, Constr. Q. M., U. S. A., Ft. Wood, for furnishing and installing storm sash for new barrack and wireless telegraph station at this post.

Albion, N. Y.—A. E. Curtin, Supt. Western House of Refuge for Women, writes that all bids opened on Oct. 1 for the erection of a cottage were too high, and contract was not let.

Brooklyn, N. Y.—Bids will be received until Oct. 17 (readvertisement) by Comrs. of Parks (Moses Herrman, Pres.) New York City, for furnishing material and erecting a shelter house in New Lots Park, Fulton Park and Winthrop Park and a shelter and tennis house in Prospect Park, all in Boro. of Brooklyn.

Ellis Island, N. Y. H., N. Y.—Bids will be received at office of Robt. Watchorn, Comr. Immigration, Ellis Island, N. Y. H., until Oct. 15 for furnishing material and installing window sash doors and heating apparatus in the covered way, at the U. S. Immigrant Sta., Ellis Island.

Winston-Salem, N. C.—Bids will be received until Oct. 25 by the Bd. Co. Comrs. (M. D. Bailey, Chmn.) for erecting a jail. Frank P. Milburn & Co., Archts., Washington, D. C.

Akron, O.—Bids will be received until Oct. 18 by the Bd. Trus. Co. Children's Home, (A. M. Armstrong, Pres.), for erecting a brick building. W. P. Ginther, Archt., 37 Arcade Bldg.

Mangum, Okla.—It is stated that bids are wanted until Nov. 1 for erecting a county jail. Probable cost, $25,000. Floyd McJ. Neil, Co. Clk.

Wilkesbarre, Pa.—McCormick & French, Laning Bldg., it is stated, have completed plans for improvements to be made to the county jail, at a cost of $100,000.

Grove City, Pa.—It is stated that bids will be received until Oct. 16 by the Armory Bd. (Benj. W. Deeming, Secy.), at the office of the Adjutant General, at Harrisburg, for erecting an armory at Grove City. A. P. Mount, Archt., Corry.

Warren, Pa.—Bids will be received until Oct. 22 by the Bldg. Com., Bd. Trus., State Hospital for the Insane (S. R. Waters, Sec'y.), for erecting 3 hospital buildings and a dwelling on the hospital grounds. E. A. Phillips, Archt., Warren.

Pine Grove, Pa.—Bids will be received by the Armory Bd. (Benj. W. Deeming, Secy.), at the office of the Adjutant General at Harrisburg, until Oct. 16, for constructing an armory at Pine Grove. McCormick & French, Archts., Wilkesbarre.

Pittsburg, Pa.—The following are reported to be the bids received Sept. 27 by the Co. Compt. for erecting the Allegheny County Soldiers' Memorial Home in the Oakland Dist. (*a*) sandstone, (*b*) limestone, (*c*) granite, (*d*) Pennsylvania blue stone: P. W. Finn, *a* $954,234, *b* $897,634, *c* $1,114,004, *d* $1,112,004; Henry Shenk Co., *a* $1,038,873, *b* $1,009,962, *c* $1,191,750, *d* $1,268,537; Wm. Miller & Sons Co., *a* $997,800, *b* $984,800, *c* $1,184,800, *d* $1,256,800; A. & S. Wilson Co., *a* $898,700, *b* $886,568, *c* $1,034,600, *d* $1,142,600; C. H. Kerr Co., *a* $1,254,047, *b* $1,188,187, *c* $1,398,817, *d* $1,496,047; J. E. & A. L. Pennock, *a* $1,087,000, *b* $1,079,000, *c* $1,279,000; John Pierce Co., *b* $959,000, *c* $1,159,000; J. C. Robinson & Son, *a* $924,333, *b* $899,333, *c* $1,062,333; Ambrose B. Stannard, *a* $1,097,000, *b* $1,069,000, *c* $1,220,000 *d* $1,320,000; John Gill & Sons, *a* $998,000, *b* $983,000, *c* $1,175,000, *d* $1,240,000.

It is stated that John T. Comes, Archt., 929 5th Ave., will receive bids until Oct. 17 for erecting a 2-sotry stable for the Mercy Hospital. Probable cost, $10,000.

Local press reports state that all bids received Sept. 16 by the Superv. Archt. at Washington, D. C., for erecting a marine hospital at Pittsburg exceeded the appropriation available, and new plans will be prepared so as to bring the cost within the appropriation, and bids will probably again be asked this fall.

Pottstown, Pa.—Bids will be received until Oct. 16 at the office of the Adjutant Genl. of Pennsylvania at Harrisburg for alterations and additions to the armory of Co. A, 6th Regt. Infantry, N. G. Pa., at Pottstown. Jos. M. Huston, Archt., Witherspoon Bldg., Philadelphia.

Greensburg, Pa.—The Co. Comrs., it is stated, have decided to erect a heating plant for the court house on the site of the power house at the county jail.

Rankin, Pa.—An architect has been engaged to prepare plans and supervise the erection of addition to municipal building.

Philadelphia, Pa.—Cope & Stewardson, 320 Walnut St., are preparing plans for a library and museum. Not yet ready for estimates.

Chattanooga, Tenn.—The Bd. of Pub. Safety, it is reported, has approved the plans of Bearden & Foreman, Chamberlain Bldg., for Fire Hall No. 6, which is to be erected at Prospect and 6th Sts.

Ft. Bliss, Tex.—Bids will be received by the Constr. Q. M., U. S. A., until Nov. 4 for alterations in two lavatory buildings at this post, as advertised in The Engineering Record.

Galveston, Tex.—The Trus of the St. Mary's Infirmary, it is reported, propose erecting a 4-story addition, to cost about $60,000.

**Items marked thus give the names of parties awarded contracts.*

Richmond, Va.—It is reported that an armory costing about $80,000 is to be erected on 6th and Marshall Sts. for the Richmond Light Infantry Blues.

Ft. Monroe, Va. Bids will be received until Oct. 18 by Capt. Ernest K. Tilton, Constr. Q. M., U. S. A., Ft. Monroe, for installing heating plant in Quarters 45 at this post.

Seattle, Wash.—The Children's Orthopedic Hospital Assoc. is reported to have engaged Howard & Galloway, of Seattle, to prepare plans for the 3-story fireproof hospital. which the assoc. proposes erecting, at a cost of about $50,000.

Milwaukee, Wis.—Preliminary plans are being prepared for an addition to the public museum.

Chippewa Falls, Wis.—The Progressive League, of this city, is reported to have approved the plans prepared by Claude & Starke, of Madison for the sanitarium which it is proposed erecting here, at a cost of about $250,000.

Kincardine, Ont.—Bids will be received until Oct. 22 by Fred Gelinas, Secy. Bd. Pub. Wks., Ottawa, for erecting a public building at Kincardine.

**Montreal, Que.*—Peter Lyall & Sons, of Montreal, are erported to have securede the contract to erect an addition to the post office.

**Lachute, Que.*—The Dept. Pub. Wks. at Ottawa, Ont., is stated to have awarded the contract to erect the Dominion Bldg. at Lachute to O. B. Lafleur & Sons, of Lachute, at $15,000.

Regina, Sask.—It is stated that competitive plans are to be submitted Nov. 30 for the parliament buildings.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Andalusia, Ala.—J. A. Prestwood is reported to have had plans prepared for a $20,000 building to be erected on the court square.

**Gadsden, Ala.*—The contract to erect the Ewing Bldg. on Chestnut St. is reported to have been awarded to Otto Fischer of Gadsden at about $20,000.

Globe, Ariz.—It is reported that the Lodge of Elks is contemplating the erection of a $50,000 building.

Poplar Bluff, Ark.—It is stated that the St. Louis, Iron Mountain & Southern R. R. (E. W. Wiggin, Engr. Bridges & Bldgs., St. Louis, Mo.) is having plans prepared for a passenger station here, to be erected at a cost of $20,000.

Little Rock, Ark.—It is reported that the St. Louis-Southwestern R. R. (M. L. Lynch, Ch. Engr., Tyler, Tex.) intends expending $150,000 erecting a freight and passenger station here.

**Redlands, Cal.*—The Bldg. Com. of the Odd Fellows is stated to have let contracts for the addition to the building on West State St. as follows: Taylor Bros., brick work; Union Iron Wks., iron work, and C. H. Hoyt, carpentering; all of the contracts aggregating $20,000.

**San Diego, Cal.*—Weymouth Cowell, of Los Angeles. is reported to have secured the contract to erect a hotel estimated to cost $40,000.

San Francisco, Cal.—The German American League of San Francisco, it is reported, is contemplating the erection of a building for club purposes, at a cost of about $1,000,000.

Mrs. A. Pease has been granted a permit to erect a 6-story brick rooming house on O'Farrell and Jones Sts., to cost $80,000.

Permits have been asked for the following buildings: Claus Spreckels, to erect a 6-story class C office building at Market and Fremont Sts., to cost $120,000. the Regents of the University of California, to erect a 4-story class C warehouse on First and Mission Sts., to cost $140,000; and Henry T. Scott, to repair his 5-story brick structure at Mission and Fremont Sts., at a cost of $125,000.

Mrs. Emma Rose is reported to have applied for a permit to erect an 8-story class A building at Sutter St. and Clara Lane, to cost $400,000.

Fredk. Noonan, Sutter & Hyde Sts., is said to be preparing plans for a 3-story and basement reinforced and brick store, factory and office building, to be erected at Market adn Kearny Sts. for Henry Kahn; cost, $30,000.

A Borel & Co. are reported to have adopted plans for a bank building to be erected on Montgomery St. at a cost of $70,000.

Denver, Colo.—It is stated that Herbert George intends erecting on Champa and 18th Sts. a 3-story building to cost $50,000.

Tampa, Fla.—It is stated that bids are wanted until Oct. 15 for erecting a 2½-story, 30x100 ft., buff brick and concrete, stone trimmings, L-shaped hotel, with wings, for Josiah Richardson; probable cost $20,000. Bonfrey & Elliott, Archts., Curry Bldg.

Architects Bonfoey & Elliott, of Tampa, write that bids will be received on Oct. 15 for the erection of a building for the Centre Asturiano Club, cost about $50,000.

Macon, Ga.—It is reported that the directors of the Citizens National Bank have secured a site and intend erecting a $25,000 building.

West Point, Ga.—The officials of the West Point Route are stated to have purchased the Hotel Langley and propose converting it into a passenger station at a cost of about $25,000.

Brunswick, Ga.—The Elks Bldg. Co. is reported incorporated and will erect a club house and lodge building to cost about $30,000.

Terre Haute, Ind.—M. C. Miller, of Buffalo, N. Y., it is reported, has submitted to the Lodge of Elks, No. 86, plans for the Temple which is to be erected. The estimated cost of the building, exclusive of plumbing and heating, is $70,000.

**Des Moines, Ia.* W. F. Mitchell & Co., 116 8th St., it is stated, have secured the contract to erect a 3-story brick, 133x100-ft. store and apartment house for the Ewing estate at 9th and Locust Sts., at about $5,000.

It is stated that F. M. Hubbell will erect a 5-story brick building at 715 Walnut St. for Chapman Bros.

Sioux City, Ia.—The directors of the First National Bank, according to reports, have directed plans to be prepared for a 6-story bank and office building.

Neodesha, Kan.—J. L. P. Arnold, according to reports, is arranging to erect a $20,000 opera house.

Alexandria, La.—It is stated that the Elks propose erecting a $50,000 building.

**Adams, Mass.*—L. A. Weston, of Adams, is reported to have secured the contract to install the Bundy steam trap system in the main gingham mill of the Renfrew Co., the cost to be about $7,000, also the contract to install the plumbing and heating systems in the addition to Eagle mill, North Adams.

Magnolia, Mass.—The Magnolia Hotel is reported to have been destroyed by fire.

**Detroit, Mich.*—Albert A. Albrecht, 1212 Penobscot Bldg., is reported to have secured the contract to erect three laboratory buildings, each 3 stories high, of brick and limestone at the plant of Parke, Davis & Co., to cost about $120,000.

Virginia, Minn.—The Lodge of Elks, No. 1003, it is reported, will erect a 3-story lodge building.

Minneapolis Minn.—Chas. H. Miles, of Hibbing, it is reported, contemplates erecting in Minneapolis a vaudeville theatre to cost about $100,000.

Lauderdale, Miss.—It is reported that plans have been adopted for a cotton warehouse to be erected at a cost of $50,000 by the farmers' union of Lauderdale County.

Kansas City, Mo.—The Missouri Realty & Rental Co., according to reports, has secured a site at 15th St. and Lydia Ave. on which it is proposed erecting a skating rink at a cost of about $50,000.

Omaha, Neb.—O. W. Butts, 801 Jones St., is said to be contemplating the erection in the spring, at 8th and Jones Sts., of a fruit and cold storage warehouse 6 stories high.

The Woodmen of the World, it is reported, contemplate erecting a building costing about $300,000.

Trenton, N. J.—The Junior Order of United American Mechanics Bldg. Assoc. (Wm. H. Miers, Trenton, Secy.) is said to be planning the forming of a stock company, with a capital of $200,000, for the purpose of erecting an 8-story building in Trenton.

New York, N. Y.—Plans have been filed for the erection of a 16-story brick and stone hotel at 33d St. and Broadway as an addition to Hotel Martinique. W. R. H. Martin, owner; cost, $800,000. H. J. Hardenbergh, 1 W. 34th St., Archt.

Clinton & Russell, 32 Nassau St., are reported to have prepared plans for an addition to be erected to Hotel Astor, Bway., 44th and 45th Sts. ,to cost about $3,500,000.

**Haines Falls, N. Y.*—J. E. & A. L. Pennock, Land Title Bldg., Philadelphia, Pa., are reported to have secured the contract to erect a hotel in Twilight Park, Haines Falls, to be 3 stories high and have 2 wings.

Long Island City, L. I., N. Y.—Thompson & Frohling, of New York City, N. Y., it is stated have prepared plans for the 6-story 175x149-ft. Belmont tunnel terminal building which is to be erected at Van Alst Ave., Hunters Point Ave. and 4th St., Long Island City. The entire building, including floors, is to be of reinforced concrete, the facings to be of gray limestone and red brick. Plans are also reported as being prepared by Thompson & Froehling for the Jackson Ave. station to be constructed in connection with the Belmont tunnel.

Fargo, N. D.—Hancock Bros., of Fargo, according to reports, have prepared plans for a 4-story brick building to be erected at Bway. and 4th Ave. for the Fargo Mercantile Co.

Cincinnati, O.—The Cincinnati Bar Assoc., it is reported, is considering the erection of a club house at a cost of $30,000.

Tietig & Lee, Commercial Tribune Bldg., are reported to have completed plans and bids for the construction are now being received for a 9-story 50x75 ft. warehouse, which is to be erected on College St. for the Robt. Mitchell Furniture Co. at a cost of about $50,000.

Wapakoneta, O.—The Co. Comrs. are reported to have decided to issue $50,000 bonds to build an infirmary to replace the building destroyed by fire recently. This with insurance will make $65,000 available.

Marietta, O.—A. L. Graecy, W. J. Speer and W. A. Campbell are said to be organizing a company with a capital of $60,000 for the purpose of erecting a business building.

Toledo, O.—It is stated that bids are wanted until Oct. 15 for erecting a 4-story building, for the Y. W. C. A.; probable cost $125,000. H. W. Wachter, Archt., The Nashy.

**Glenwood, Pa.*—The Jones & Laughlin Steel Co., of Pittsburg, it is reported, has let a contract to A. Richmond & Son, of Pittsburg, for erecting a 3-story brick and stone office building at Glenwood, to cost $30,000.

Philadelphia, Pa.—John N. Gill & Co., Heed Bldg., are reported to have secured the contract to erect on Broad St., for Hildebrand Bros., a storage warehouse 6 stories high to cost $45,000.

Batesburg, S. C.—Wilson, Sompayrac & Urquhart, of Columbia, are preparing plans for a bank building to cost about $10,000, to be erected at Batesburg; bids for erection will be received about Oct. 30. W. W. Watson, cashier.

**Dell Rapids, S. D.*—It is reported that the contract to erect a hotel for the Dells Hotel Co. has been awarded to Smith & Small, of Sioux City, at about $11,732.

Watertown, S. D.—The Watertown House Furnishing Co. is reported incorporated, with L. J. Shaw, Pres., and will erect a 3-story warehouse and business building.

Elizabethton, Tenn.—Judge W. P. Dundan, of Elizabethton, is reported to be planning the erection of a hotel to cost about $25,000.

Tyler, Tex.—The Tyler Opera House Co. is reported incorporated for the purpose of erecting a $50,000 opera house.

Denison, Tex.—The Odd Fellows are reported to be planning the erection of a 2-story building, to cost about $12,000.

Laguna, Tex.—The Laguna Vista Club is reported organized for the purpose of erecting a sanitarium here at a cost of about $100,000.

Temple, Tex.—It is stated that plans are now being prepared for a reinforced concrete passenger station to be erected here by the Gulf, Colorado & Santa Fe R. R. (F. G. Pettibone, Gen. Mgr., Galveston), and for which an appropriation of $40,000 has been made.

Corpus Christi, Tex.—J. H. Ennis, of Batson, according to reports, has purchased the Seaside Hotel and intends erecting a 100-room hotel on the site.

Abilene, Tex.—It is reported that J. M. Radford has awarded a contract to G. W. Brillheart, of Abilene, for the erection of a 3-story and basement office building, to cost $50,000.

San Angelo, Tex.—J. S. Shupert is reported to be having plans prepared for a $20,000 office building for R. S. Scott.

Seattle, Wash.—Plans, it is stated, are to be prepared at once for the first 2 buildings which are to be erected by the Metropolitan Bldg. Co., in which Jas. A. Moore is interested. The buildings are to be of steel fireproof construction and to be erected on Union St., at a total cost of $500,000. A heating and lighting plant is to be constructed on the grounds for the use of the buildings.

Jas. E. Blackwell, Mutual Life Bldg., according to reports, has completed plans for a 3-story, brick, 60x108-ft. building to be erected at 2d Ave. and Pike St. for John H. McGraw, at a cost of $28,000.

The Salvation Army is reported to be contemplating the erection of a 5-story building on the site of the present headquarters building at 5th Ave., S., and Washington St. to cost $150,000.

The Masonic Order is reported to have purchased a site at Seneca St. and Harvard Ave. on which it is proposes erecting a $250,000 Masonic Temple.

Tacoma, Wash.—It is stated that the Milton Land Co. has applied for a permit to erect a 4-story brick store and hotel building at Commerce and C Sts., of brick and concrete, and cost $40,000. Fredk. Heath, Fidelity Bldg., is the archt. Bids for the construction of the building are to be asked at once.

Spokane, Wash.—J. E. Kennedy has been granted a permit to erect a 5-story brick building on Wilson Ave. and Huron St., to cost $45,000.

Welch, W. Va.—I. J. Rodes, of Welch, writes that it is proposed to construct an ice and cold storage plant at Welch, for J. M. Coach & Co., at a cost of $35,000. Architect not yet selected, nor contracts yet let for buildings. Machinery has been purchased.

Milwaukee, Wis.—It is stated that plans have been prepared by H. J. Esser, 82 Wisconsin St., for a $25,000 building to be erected at Hilbert and Steward Sts. for the Bay View Tannery Co.

Toronto, Ont.—Plans have been filed for a union station to be erected in Toronto for the Grand Trunk Ry. (E. H. Fitzhugh, 3 Vice-Pres., Montreal, Que.)

**Calgary, Alta.*—The J. McDiarmid Co., of Winnipeg, is renorted to have secured the contract for the central part of the Canadian Pacific R. R. depot in Calgary. The building is to cost approximately $250,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—R. W. Massey is reported to have secured a permit to erect a $160,000 6-story apartment house at Highland Ave. and 20th St. S.

Hot Springs, Ark.—The congregation of the Christian Church, it is stated, is planning the erection of a $30,000 edifice. Rev. T. N. Kincaid, pastor.

Los Angeles, Cal.—Arthur B. Benton, 114 N. Spring St., according to reports, has prepared plans for an edifice, parish house and rectory to be erected for the Congregational Church of the Messiah, of which Rev. Stanley Fisher is pastor. The cost of the buildings is to be about $100,000.

Denver, Colo.—Marean & Norton, Dodge Bldg., it is reported, are preparing plans for a residence to be erected at 8th and Logan Aves. for Mrs. Walter S. Cheesman at a cost of about $100,000.

Richd. T. Dorgan is reported to be planning the erection of a residence on Race St., to cost $15,000.

**Danbury, Conn.*—Geo. Mertz Bros., of Port Chester, N. Y., according to reports, have secured the contract to erect an edifice for the First Congregational Church, which is to cost about $77,900. Howells & Stokes, of New York, N. Y., are the archts.

Cairo, Ill.—It is stated that bids will be received by C. B. S. Pennebaker, Chmn. Bldg. Com., until Oct. 16 for erecting a brick annex, 36x72 ft., to the Cairo Baptist Church. John S. Jenkins, Archt., Cairo.

Springfield, Ill.—First M. E. Church is reported to have been destroyed by fire.

Chicago, Ill.—Lloyd G. Kirkland, according to reports, will construct a 3-story 25x90 ft. brick and stone apartment house on Walton Pl., near the Lake Shore Drive; cost, $30,000; and Albert R. Boydell, a 3-story apartment house at Monroe ave. and 53d St., 58x140 ft; cost, $50,000.

The Home for the Aged, according to reports, is to be enlarged by a 5-story addition, at a cost of $40,000.

Evanston, Ill.—The Trus. of the Weadon M. E. Church (Rev. Frank W. Merrell, pastor) are reported to have approved plans for a brick and stone edifice to cost $25,000.

Des Plaines, Ill.—The Sisters of the Holy Family, according to reports, are preparing to erect an addition to the convent, estimated to cost $80,000.

Hammond, Ind.—It is reported that the members of the Christian Church are planning the erection of a $30,000 edifice. Rev. J. S. Sharp, pastor.

**Items marked thus give the names of parties awarded contracts.*

**Sulphur, Ind. Ter.*—It is reported that the contract to erect an edifice costing about $12,000 for the First Methodist Church has been awarded to Geo. Frier and W. L. Scott, of Sulphur.

**Stuart, Ia.*—H. Tappendorf, of Rock Island, Ill., is reported to have secured the contract to erect a brick church here, at about $44,000, exclusive of heating, plumbing and electric wiring.

Des Moines, Ia.—W. G. Birdsell, of Perry, is reported to have secured the contract to erect an edifice for the members of the Norwegian Lutheran Church at a cost of about $11,250.

Louisville Ky.—J. Ross Todd is reported to have purchased a site near Cherokee Park and intends erecting a residence, to cost about $50,000.

Baton Rouge, La.—The members of the First Baptist Church, it is stated, are planning the erection of a new edifice. Probable cost, $25,000. Rev. W. P. Hall, Pastor.

Emmitsburg, Md.—Baldwin & Pennington, of Baltimore, it is stated, have completed plans for a church to be erected at Mt. St. Mary's College at a cost of about $100,000. The foundation for the building is completed, and contract for the cut stone work is reported awarded to D. M. Andrews Co., of Baltimore.

Baltimore, Md.—Otis J. Tall is said to be planning the erection of a residence to cost $15,000.

Duluth, Minn.—Luther Mendanhall, it is reported, will erect a $25,000 residence, in the near future, on Woodlawn Ave. and Lewis St.

Brooklyn, N. Y.—Plans have been prepared and the congregation of Beth Elohim is said to be in favor of beginning work at once on the construction of the synagogue, which is to cost $100,000.

Buffalo, N. Y.—Marcus Barmon is reported to be treas. of an assoc. which contemplates erecting a semi-orthodox Jewish temple in the Richmond Ave. dist., to cost about $40,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 6-story brick and stone tenement at 22d St. and 3d Ave. for Saml. D. Davis; cost $50,000; Bernstein & Bernstein, Archts.; 12-story brick and stone apartment house at 7th Ave. and 58th St. for Alwyn Court, Inc.; cost, $900,000; Harde & Short, Archts.; 2 6-story brick and stone tenements at Morningside Ave. and 118th St. for West Side Constr. Co.; cost $250,000; Neville & Bagge, Archt.; 6-story brick and stone apartment house at 138th St. and Riverside Drive for Hensle Constr. Co.; cost $225,000. L. A. Goldstone, Archt., and a 1-story brick church at Tiffany and Fox Sts. (Rev. W. F. Dougherty, Pastor); cost, $30,000; M. J. Garvin, Archt., 3307 3d Ave.

Carey, O.—It is reported that the congregation of Our Lady of Consolation will soon let contracts for erecting a $75,000 church.

Cleveland, O.—It is reported that plans have been filed for a $45,000 edifice to be erected for the Calvary Evangelical Church at Woodhill Road and Wamelink Ave.

The Anshe Chesed congregation is stated to have decided to erect a new synagogue on Euclid Ave. and E. 82d St., to cost $200,000.

Greensburg, Pa.—J. R. Niseman, it is reported, will erect a $20,000 residence on N. Maple St.

**Pittsburg, Pa.*—Golden & Crick, 512 5th Ave., are reported to have secured the contract to erect a brick and stone edifice for the St. Elizabeth Slavonic R. C. congregation, to cost $18,150.

Chas. J. Reiger, 307 4th Ave., is reported to be preparing plans for a brick residence to be erected for Mrs. Dr. N. Shilito, at a cost of $20,000.

Kittanning, Pa.—Chas. W. Bier, of Pittsburg, is reported to have been engaged to prepare plans for a brick and stone edifice for the M. E. Church, to cost $50,000.

Wilkesbarre, Pa.—Thos. Podmore, Bennett Bldg., is reported to have been engaged to prepare plans for an $18,000 residence for Mrs. Geo. Weaver.

**Lebanon, Pa.*—Harry F. Gilley of Lebanon, is reported to have secured the contract to erect a $15,000 edifice for the St. Paul Reformed Church.

Meadville, Pa.—It is reported that the members of St. Paul's Reformed Church have decided to erect a $15,000 edifice. Rev. Dr. B. B. Werer, pastor.

**Bennettsville, S. C.*—The contract to erect a $20,000 edifice for the Presbyterian Church is reported to have been awarded to G. A. Brown, of Bennettsville, at about $20,000.

Chattanooga Tenn—Thos. L. Montague, according to reports, intends erecting a $60,000 residence.

Nashville, Tenn.—A Bldg. Com. is reported appointed by the members of the First Presbyterian Church to secure plans for a $50,000 edifice.

Waco, Tex.—The members of the R. C. Church of the Assumption are reported to be preparing to expend $15,000 in improvements. Rev. P. J. Clancy, pastor.

**Corsicana Tex*—Hardin Bros., of Farmersville, are reported to have secured the contract to erect an edifice for the members of the First Christian Church at $16,500.

Aberdeen, Wash.—The erection of a brick and stone edifice, costing aobut $30,000, is reported contemplated by the members of the Methodist Church.

Tocoma, Wash.—E. R Wheeler, Vice-Pres. of the Far West Lumber Co., is reported to have had plans prepared for a $30,000 residence, to be erected at N. 9th St. and Yakima Ave.

Milwaukee, Wis.—It is stated that a permit has been granted for a church and school, to be erected at a cost of $35,000, on Fratney St., for St. Mary of Czestochowa congregation. O. C. Uehling, 120 Wisconsin St. is the archt.; Frank Niezorawski, 870 Franklin St., is the mason contractor.

H. J. Ester, 82 Wisconsin St., is reported to be preparing plans for a residence to be erected on Hilbert St., at a cost of $25,000.

Toronto, Ont.—It is reported that the members of St. John Church contemplate erecting a new edifice at a cost of about $30,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Girard, Ala.—School bonds amounting to $10,000 are reported sold.

San Francisco, Cal.—The California Academy of Science, it is stated, has decided to erect a $300,000 building on the site of the building destroyed by fire at the time of the earthquake.

Denver, Colo.—Plans have been filed for an administration building to be erected for the Roman Catholic Theological Seminary, which it is proposed erecting at Louisiana, Cook and Madison Sts. John J. Huddart, 42 Bank Bldg., is the archt., and the building is to cost about $75,000. Rev. Thos. F. Lovan, Pres. of the Seminary.

**Athens, Ga.*—E. B. Fitts & Co., it is reported, have transferred to McKenzie & Deleon, of Atlanta, the contract to erect the agricultural hall at the Univ. of Georgia. The building is to be 300 ft. long, of gray brick, with terra cotta trimmings.

It is stated that plans are being prepared for a barn to be erected at the Univ. to accommodate 30 cows.

Pana, Ill.—It is stated that bids will be received until Oct. 15 by the Bd. Educ. (F. A. Cutler, Secy.), for $50,000 bonds.

Normal, Ill.—It is stated that bids will be received until Oct. 19 by Chas. L. Chapen, Chmn. Bldg. Com., for an auditorium and manual arts building, for the State Normal University. Probable cost, $110,000.

Chicago, Ill.—The Bd. of Educ., according to reports, contemplates erecting during the coming year the following buildings at a total cost of $2,872,000: Irving Park High School, 41st Court and Grace St., $500,000; Washburne School, 14th and Jefferson Sts., 17-room addition, $175,000; Brentano School, Fairfield and Diversey Aves., 12-room addition, $140,000; Jackson School, Damon and Aberdeen Sts., 20-room addition, with assembly hall and gymnasium, $190,000; Bowen High School, 80th St. and Marquette Ave., $500,000; Dante School, Desplaines and Ewing Sts., 15-room addition, with assembly hall, $215,000; Jefferson School, Elburn Ave. and Laflin St., 9-room addition, $170,000; Howe School, Laurel Ave. and Superior St., 12-room addition, with assembly hall, $140,000; Tilton School, 42d and Park Aves., new 20-room building, $210,000; Farragut School, 23d St. and Spalding Ave., 16-room addition, with assembly hall, $150,000; Andersenville School, Ashland Ave. and Foster St., new 26-room building to replace branch of Goudy School, $210,000; Nobel School, 41st Ave. and Hirsch St., new 22-room building, $222,000.

Ardmore, Ind. Ter.—Hargrove College, a school for whites and negroes, it is reported, has been destroyed by fire.

Tulsa, Ind. Ter.—The Henry Kelsey College, which is to be removed here from Muskegon, it is stated, intends erecting here in all 12 buildings, three of which will be erected this year, namely, an administration building and 2 dormitories, which will cost about $100,000.

Salina, Kan.—Rev. John Maher, pastor of the Sacred Heart R. C. Church, is reported to have announced that a parochial school is to be erected, at a cost of $25,000.

**Argentine (Kansas City), Kan.*—J. B. Smith, Clk. School Bd., writes that W. A. Drollinger, of Argentine, has secured the contract for erecting high school (bids opened Sept. 30), for about $23,000.

Baltimore, Md.—The Second Branch of the City Council is stated to have passed an ordinance appropriating $50,000 for the purchase of a site and the erection of a school on old Pimlico road to replace school No. 59.

**Holyoke, Mass.*—The Bd. Pub. Wks. is stated to have awarded the contract to install a ventilating and heating system in the Sargeant School to P. J. Donnelly, at $4,250.

*It is stated that the contract to install the plumbing in the Sargeant School has been awarded to Sparrow & McTigue, at $1,229.

New Bedford Mass.—Louis E. Destremps, of Fall River, is preparing plans for a parochial school for the parish of Our Lady of Perpetual Help. It will be 2 stories high, of brick and contain 6 rooms; probable cost, $30,000.

New Bedford, Mass.—Bids will be received until Oct. 22 at the office of W. H. B. Remington, Clk. Com. on City Property, Rm. I, Library Bldg., for furnishing material and erecting a high school, boiler house and other work in connection with the same on County St. near Court St. Saml. C. Hunt, Arch., Rm. 30, Odd Fellows' Bldg.

Lansing, Mich.—The State Bd. of Agriculture and the Governor are reported to have decided to abandon for the present the erection of an agricultural building at the Michigan Agricultural College, as the bids recently received for the erection of this building exceeded the amount available.

**Saginaw, W. S., Mich.*—The contract for South Side School has been awarded as follows: Wilson Kerns, mason work, and to Spence Bros. for carpenter work.

**Ann Arbor Mich.*—The contract to erect the Alumni Memorial Building at the Univ. of Michigan., it is reported, has been awarded to Koch Bros., of Ann Arbor, at $107,000. Donaldson & Meier, Penobscot Bldg., are the archts.

Minneapolis, Minn.—Bids will be received, it is stated, until Oct. 24, by Dan'l. C. Brown, City Compt., for $591,000 school and park bonds.

Ely, Minn.—The citizens of Dist. 12, it is stated, have voted in favor of the erection of a school, at a cost of $30,000.

**Eveleth, Minn.*—L. A. Roberts, of Duluth, is stated to have secured the contract to erect a 6-room grade school in the north part of the city, at $23,525.

Leadwood, Mo.—The Secy. Board of Educ. writes that bids will be received on Oct. 21 for the erection of a school to cost about $28,000. Architects, Reister & Rubach, of Belleville, Ill.

**Helena, Mont.*—The contract to erect the manual training school and central heating plant, it is reported, has been awarded to Frank Jacoby & Son, at $23,807. E. W. Fiske bid $25,800, and Howard Pew $26,608.

Newark, N. J.—Bids will be received until Oct. 17 by the Bd. Educ. (R. D. Argue, Secy.) for furnishing material and erecting the following schools: Lincoln School and addition to Hawthorne Ave. School—J. O'Rourke & Sons, Archts., 756 Broad St.; Runyon & Carey, Engrs., 122 Market St. Bergen St. School addition—Alfred Peter, Archt., 238 Washington St.; Percy B. Taylor, Engr., 800 Broad St. Bids to be submitted on the following: Masonry and fireproofing, iron work, carpentry, plumbing, roofing, electrical work, heating, etc. Probable cost, $80,000, $90,000 and $100,000, respectively.

**Elizabeth, N. J.*—Fred. Kilgus, of Newark, is reported to have secured the contract to construct a boiler house and install the ventilating and heating system in the Normal School, at $42,203.

**Bayonne, N. J.*—The contract to erect School No. 9 is reported to have been awarded to W. H. & F. W. Crane, of New York, N. Y., at $111,649. Other bids received are stated to have been as follows: M. T. Connolly, $135,000; Jas. MacArthur, $116,000; Walter Isetts, $112,000; E. M. Waldron, $115,265; Richd. E. Cunningham, $120,000; Cramp & Co., $116,525. Calumet Constr. Co., $114,468; John J. O'Leary Co., $118,500.

New Brunswick, N. J.—The Bd. of Trus. of Rutgers College, according to reports, had accepted plans of D. D. Williamson, of New Brunswick, and Hill & Stout, of N. Y. City, for the engineering building which is to be erected, at a cost of $60,000.

Springville N. Y.—E. E. Joralemon, of Niagara Falls, is reported to have been engaged to prepare plans for the high school which is to be erected, at a cost of about $75,000.

New York, N. Y.—Plans have been filed for the erection of a 4-story brick school at 189th St. and Lorillard Pl. for City of New York; cost, $320,000. C. B. J. Snyder, Archt., 500 Park Ave.

Bids will be received by C. B. J. Snyder, Supt. School Bldgs., New York City, until Oct. 21 for installing, ventilating and heating apparatus for additions to Schools 41 and 59; also erecting outside iron stairs at Schools 8, 28, 67, 80 and 127, all in Boro. Manhattan; installing ventilating and heating apparatus of addition and alterations to Schools 80 and 129, Boro. Brooklyn.

Bids will be received same time and place as above for installing, ventilating and heating and electric generating apparatus and electric elevator in the Parental School, Flushing, Boro. Queens.

Stamford, N. Y.—It is stated that bids will be received until Nov. 1 by E. W. Van Slyke, Archt., Binghamton, for erecting a 2-story, 62x86 ft., cement, press brick and limestone school.

**Buffalo, N. Y.*—Contracts are reported awarded as follows for erecting a 20-room brick school in Dist. No. 44 (bids for which were received Sept. 11): Masonry, etc., Buffalo General Building Co., $29,403; iron work, etc., C. F. Ernest's Sons, $9,368; fireproofing, etc., Buffalo General Building Co., $7,349; carpentry, etc., Adolph F. Bournique, $12,993, and roofing, etc., Philip Christian, Jr., $4,231.

Bids on ventilating and heating, etc., and for plumbing, gas fitting, etc., in this school, bids for which were received at the same time, were rejected, and new bids are to be asked. The lowest bid received at this time is reported to have been from Timothy McEvoy & Son on both heating and plumbing, etc., at $[illegible] and $6,748, respectively.

State College, Pa.—F. J. Osterling, of Pittsburg, it is stated, has prepared plans for the engineering building which Chas. M. Schwab contemplates erecting here, at a cost of about $1,500,000. The plans provide for 2 wings, one extending from the present engineering building west along College Ave., a distance of about 600 ft., and the other north from the present building, a distance of about 500 ft. The material used is to be Hummelstown brownstone.

Ford City, Pa.—W. G. Eckles, of New Castle, is stated to have been engaged to prepare plans for a school to be erected in Ford City, at a cost of about $70,000.

**Philadelphia, Pa.*—Herbert E. Havens is reported to have secured the contract to erect a 4-story brick and stone addition to the Philadelphia College of Pharmacy at Cherry and 10th Sts., to cost $30,000.

**McKees Rocks, Pa.*—A. W. Hoover Co. is reported to have secured the contract to erect a 2-story 4-room addition to the schoolhouse in Stowe Township, just outside of McKees Rocks, which is to cost $20,000. Robinson & Winkler, of Pittsburg, are the Archts.

Allegheny, Pa.—We are informed that the plans for the 10th Ward School, for which C. M. Bartberger & Son, Westinghouse Bldg., Pittsburg, are preparing plans, will cost about $175,000.

**Brookings, S. D.*—The contract to erect the girls' dormitory at the State College, it is stated, has been awarded to Nelson & Co., of Mankato. The cost of the building is to be aobut $40,000. Bids for this work were received Sept. 26.

Mitchell, S. D.—The citizens are reoprted to be planning the erection of a high school, at a cost of $100,000.

**Vermillion, S. D.*—Erick Nylen, of Vermillion, is reported to have secured the contract to erect the law building at the Univ. of South Dakota, at $42,700.

Dalhart, Tex.—The Attorney General is reported to have approved the issue of $25,000 Dalhart Independent School Dist. bonds.

Bartlett, Tex.—It is stated that bids will be received until Oct. 15 by the School Bd. (J. W. Morris, Secy.), for erecting a school; probable cost, $18,500.

Dayton, Va.—It is reported that the School Bd. has directed plans and specifications prepared for a $30,000 school.

Richmond, Va.—C. P. Walford, Clk. and Supervisor, writes that C. K. Bryant, of Richmond, is preparing plans for a school to cost about $300,000.

Tacoma, Wash.—It is sated that plans are being prepared for a men's dormitory which is to be erected at Whitworth College, at a cost of about $30,000.

**Items marked thus give the names of parties awarded contracts.*

Seattle, Wash.—Bids will be received until Nov. 12 by the Univ. Regents, Rm. 21, Post Intelligence Bldg., Seattle ((Wm. Markham, Secy.), for furnishing material and erecting complete 3 buildings, known as the engineering building, chemistry building and auditorium building, for the State Univ. of Washington, according to plans prepared by Howard & Galloway, Administration Bldg., Alaska-Yukon-Pacific Exposition, Seattle, from whom a set of plans and specifications (one set only), may be procured on a deposit of $25, which deposit will be refunded upon the return of plans. Bids will be received on each building separately or on the 3 as a whole.

Oshkosh, Wis.—The plans of Van Ryn & De Gelleke, of Milwaukee, are reported accepted for the gymnasium to be erected at the Normal School, at a cost of $40,000. It is reported that bids for the construction will probably be asked during the coming winter.

Auckland, New Zealand.—Horace Trumbauer, of Philadelphia, Pa., it is stated, won in the architectural competition for designing a memorial building to the late John Seddon. The building is to be a technical school and is to cost about $1,000,000.

Selkirk, Man.—Bids will be received until Oct. 15 by H. W. Newton, Secy.-Treas. School Bd., for $11,000 school bonds.

**Ottawa, Ont.*—Maurice J. Whelan, of Ottawa, is reported to have secured from the Dept. Pub. Wks. at Ottawa the contract to erect a standardization building at the Ottawa Observatory, at $14,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Florence, Ariz.—See "Power Plants, Gas and Electricity."

Elm City, Ga.—It is reported that the Elm City Cotton Mills will increase its capital from $250,000 to $350,000 for the purpose of enlarging the mill.

Sioux City, Ia.—Bids will be received until Oct. 15 by the Interstate Brewing Co. (Fred Knepper, Secy.), 817 4th St., for erecting a brick and steel brewery.

Gardner, Mass.—Nichols & Stone, chair manufacturers, whose entire plant was destroyed by fire Sept. 9, are stated to have announced that they have decided to rebuild and continue their business.

Salem, Mass.—The Philadelphia & Reading Coal & Iron Co., which is a Reading Ry. property, it is stated, has purchased 44 acres of land abutting on Salem Bay at Salem, Mass., which has a frontage of over 2,000 ft. on the bay, and it is reported that the company will erect a coal shipping depot, which will cost about $500,000. The plans as outlined call for modern docks and wharves that may be commenced this fall. At first it is proposed to erect a plant with about 75,000 tons capacity, to which extensions can be made at any time.

Pittsfield, Mass.—The Eaton-Hurlbut Paper Co. is said to be planning the erection in the spring of new factory building.

Dassel, Minn.—The Dassel Roller Mill Co. is reported incorporated with a capital of $20,000 and will erect at once a 3-story flour mill equipped with the best machinery. Arne Arneson, of Cyrus, Minn., is to be the manager.

**Hamilton, O.*—The Hamilton Coke Co. is reported to have let the contract for the erection of several large coke ovens to Coke & Gas Constr. Co., of Camden, N. J. Estimated cost, $350 000.

Cincinnati, O.—The Cincinnati Iron & Steel Co. (Edw. H. Bush, Pres.) will, it is stated, erect a rolling mill having a capacity of 3,000 tons per month, and to cost $500,000.

Altoona, Pa.—Plans are reported to have been prepared and bids are being received by Victor Beutner, Westinghouse Bldg., Pittsburg, for a cement plant, to be built at Altoona, by the Altoona Portland Cement Co., to cost about $800,000; it will have a daily capacity of 2,000 bbl. About 2,500 h. p. in gas engines will be employed to furnish the power. Plant will be completed and ready for operation about June 1.

Aliquippa, Pa.—According to press reports, B. F. Jones, Jr., Pres. Jones & Laughlin Steel Co., Ltd., of Pittsburg, has issued a statement that his company has decided to construct a steel rail mill at Aliquippa.

Since the giving out of the above report B. F. Jones, Sr., of the Jones & Laughlin Steel Co., Ltd., of Pittsburg, is said to have subsequently denied a part of the said statement.

**Allentown, Pa.*—We are informed that the Fuller Eng. Co., Allentown Natl. Bank Bldg., Allentown, has secured contract to build a cement mill, with a daily capacity of 4,000 bbl., for the Allentown Portland Cement Co. Work will commence upon this plant at once, and it is expected that the plant will be in operation by July 1. Among other contracts which the Fuller Engng. Co. has are the plant for the Blue Seal Portland Cement Co., to be built at Courtney, Mo., and the plant for the Matcham Portland Cement Co., to be built at Evansville, Pa.

Woonsocket, R. I.—The Perseverance Worsted Co., it is stated, will erect a 3-story brick weaving mill of 120 looms capacity.

St. Joe, Wash.—C. B. Pride, of Appleton, Wis., is reported to be preparing plans for a paper and pulp mill, to cost $1,500,000, to be erected in St. Joe for the Wood Pulp & Paper Co., of Seattle, Wash.

Guernsey, Wyo.—The Consolidated Mining Co., in which W. C. Young and W. M. Kerin, of Denver, Colo., and F. O. Olson, of Pittsburg, Pa., are interested, it is reported, will expend about $700,000 in the erection of a steel mill in Guernsey.

New Brunswick, N. B.—Johnson & Johnson, according to reports, have decided to erect an addition to their cotton mill on George St., to cost $35,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Monica, Cal.—The citizens are reported to have voted Sept. 28 to issue $10,000 bonds for an additional garbage incinerator.

Baltimore, Md.—Bids will be received until Oct. 16 (readvertisement) by the Bd. Awards (J. Barry Mahool, Pres.) for the removal and final disposition of garbage, dead animals and market refuse of this city from Jan. 1, 1908, until Jan. 1, 1918. J. L. Wickes, Comr. St. Cleaning.

Altoona, Pa.—Saml. B. Trees, Secy. Bd. of Health, writes that bids will probably be received about Nov. 15 for the collection and disposal of garbage. Frank Engstrom is City Engr.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—The Arizona Placer Co. (U. G. Douglass, Mgr.) will during the fall construct a reinforced concrete dam in the Bradshaw Mountains and 4 miles of 84-in. perimter metal flume, together with 1 to 4 miles of riveted pipe line branching from 24 to 8 in. diameter, supplying 6 placer giants. Engineer, O. A. Turney, of Phoenix.

Franklin, Ark.—Capt. G. M. Hoffman, Corps Engrs., U. S. A., Vicksburg, Miss., writes that the Midland Bridge Co., of Kansas City, Mo., bid on Oct. 5 for constructing Lock and Dam No. 8 in Ouachita River at Franklin Shoals, Ark., a total of $488,713.

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Santa Monica, Cal.—See "Sewerage and Sewage Disposal."

Oroville, Cal.—Emery Oliver, Div. Engr.of the Western Pacific, who has been at work with Engineer Jasper on plans for a levee for the City of Oroville, or a modification of the plans adopted some time ago, is stated to have reported upon a system of works that will cost about $50,000 and take only about 6 weeks to construct.

Oakland, Cal.—It is reported that it has been decided to recommend to City Council that a bond issue be submitted to the voters for municipal wharves in East and West Oakland; the estimated cost of the proposed wharves and warehouses is about $1,207,600.

Berkeley, Cal.—Bids will be received until Oct. 26 by J. V. Mendenhall, Clk. Bd. Town Trus., for constructing a wharf and approach thereto in San Francisco Bay.

Denver, Colo.—At a meeting of the Continental Tunnel Co., at the offices of Bartels & Blood, in the Continental Bldg., on Oct. 3, it was decided to issue $5,000,000 bonds to be used to construct tunnel through James Peak. Engineers are reported to be making a survey and topographical map of James Peak. When completed and used by the Moffat R. R., the time will be cut between Denver and Salt Lake City by 12 hours. Col. D. C. Dodge, Chmn. Executive Com.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 15 to furnish at the navy yards and naval stations the following supplies: Boston, Mass.: Sch. 338——Milling machines, bolt-threading and nut-tapping machine, engine lathes, upright drills, sensitive drills, buffing and strapping machine, hydrostatic press, sawing, slotting and metal-planing machines, boring and turning mill, etc. Sch. 361—Steel nuts, nickel steel. Sch. 365—Rolled bronze. Portsmouth, N. H.: Sch. 340—Steam gypsy, steering engine. Sch. 341—Scroll and re-saw, scroll sawing machine, planer and jointer. New York, N. Y., etc.: Sch. 339—Screw, punching and shearing machines. Sch. 342—Structural steel. Sch. 357—Transformers. Sch. 361—Expanded metal, steel forging. Sch. 364—Steel springs. Sch. 366—Brass pipe and fittings, valves. League Island, Pa.: Sch. 362—Ash, cedar, mahogany, white oak, etc. Sch. 368—Steel bolts and nuts, drills and drilling machines, pneumatic drills and hammers, oil filters and pumps. Sch. 369—Rolled bronze, bar iron and steel, cold-rolled steel, etc. Sch. 372—Brass and lead pipe, valves, etc.; brass and iron pipe fittings. Naval Academy, Annapolis, Md.: Sch. 343—Screw-cutting lathe. Sch. 367—Portland cement, paving blocks, granite curb, gravel, brick. Washington, D. C.: Sch. 338—Planing and milling machines. Sch. 360—Chain drive nickel steel chain, wire rope, machine steel, nickel steel, forgings and castings, brass tubes, black and galvanized iron pipe. Norfolk, Va., etc.: Sch. 338—Steam hammer. Sch. 339—Cutting-off and grinding machine. Sch. 340—Steam gypsy, steering engine, steam windlass. Sch. 362—Ash. Sch. 364—Brass bolts, etc.; pneumatic drill and hammer, valve reseating machine, etc. Sch. 365—Sheet brass and copper, rolled bronze, steel. Sch. 366—Brass tubing, pipe fittings. Pensacola, Fla.: Sch. 337—Wood planing and mortising machines, wood turning lathe, mortising and relishing machine, grooving head. Sch. 341—Drilling outfit, drill press, screw-cutting lathes, bolt-threading machine. Charleston, S. C.: Sch. 361—Motors, conduit and elbows, snaking wires, electrical supplies. Also until Oct. 29: Mare Island, Cal.: Sch. 375—Electrical fittings. Sch. 376—Cable chain. Sch. 377—Drill chucks and drills. Also until Oct. 22, Mare Island, Cal. Sch. 336—Rotary blower. Also until Oct. 29: Puget Sound, Wash.: Sch. 377—Fir, sheet brass, galvanized steel tubing, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Genl., U. S. N.

**Savannah, Ga.*—Bids were opened on Sept. 30 by Maj. I. C. Sanford, Corps Engr., U. S. A., at Philadelphia, Pa., for constructing a steel-hull, 16-in. pump dredge for Savannah River, to be delivered at Savannah, Ga., and the bid of the Ellicott Machine Co., of Baltimore, Md., at $117,700, to be delivered in 7½ months, has been recommended for acceptance.

**Cerro Gordo, Ill.*—Bids were opened on Sept. 27 by the Drainage Comrs. of Union Drainage Dist. No. 3, of the towns of Cerro Gordo and Willow Branch, in Pratt County (J. C. Locher, Clk.), for constructing 11 miles of open ditch involving the removal of 210,410 cu. yds. of earth, and the same was awarded to Morgan & Co., of Bellefontaine, O., at 7.92 cts. per cu. yd. W. J. Day, Engr., Bement.

**Onawa, Ia.*—C. E. Blanchard, Co. Aud., writes that the contract for excavating McCandlass ditch, about 280,681 cu. yd. (bids opened Oct. 1) has been awarded to Callanan Bros. & Katz, Bee Bldg., Omaha, Neb., at 8.69 cts. per cu. yd.

Des Moines, Ia.—The Bd. of Aldermen is reported to have authorized the Bd. of Pub. Wks. to enter into a contract immediately for a section of improvement of Des Moines River, to extend from S. 5th St. bridge to the Great Western R. R. tracks, across the Des Moines River. This section will eliminate the forks of the two rivers and prevent the flooding of the extreme lower sections of city. Probable cost of work, $100,000.

Topeka, Kan.—The City Engr. is reported to have submitted to City Council plans and specifications for a drainage ditch from Topeka Cemetery grounds to the Shunganunga, down 11th St., which he estimates at $16,054.

**New Orleans, La.*—The Orleans Levee Bd. is reported to have on Sept. 30 awarded to A. Ruppel the contract for two additional stretches of levee to be built in the 3d Dist., one from Louisa to Desire, and the other from Mazant to Poland St.; total cost is estimated at $115,000. He bid for earth taken near levee 41½ cts. per cu. yd., and with earth taken from away 94½ cts. on both contracts, and $70 per M ft. for creosoted piling for levee and revetment.

Chalmette, La.—Bids will be received by Col. E. H. Ruffner, Corps Engrs., U. S. A., New Orleans, until Nov. 14 for the compeltion of a monument to memory of American soldiers, as advertised in The Engineering Record.

Bar Harbor, Me.—The following are the bids opened on Sept. 10 at the office of Maj. Geo. E. Zinn, Corps Engrs., U. S. A., Portland, for the construction of breakwater at Bar Harbor (price given per ton): Philip H. Doyen, of South Portland, Me., $1.27; E. S. Belden & Sons, Hartford, Conn., $1.13, and Sylvester I. Hill, Chebeague, Me., $1.23½.

Manchester, Mass.—Bids will be received until Oct. 18 by the Massachusetts Harbor & Land Comrs. at Boston (Frank W. Hodgdon, Ch. Engr.) for dredging channel in Manchester Harbor, in the town of Manchester. The work includes the dredging of about 14,500 cu. yds., situ measurement, of material to make about 2,000 ft. of main channel in the harbor 6 ft. deep at mean low water and 75 ft. wide on the bottom.

Boston, Mass.—The only bid received and opened on Sept. 30 by Maj. Edw. Burr, Corps Engrs., U. S. A., 25 Pemberton Sq., Boston, for dredging in Mystic River, about 13,000 cu. yds., was submitted by the Bay State Dredging Co., of Boston, at 49½ cts. per cu. yd.

Detroit, Mich.—Bids will be received by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., until Nov. 20, for rock and earth excav. at Sect. 3, Plan B, Detroit River, as advertised in The Engineering Record.

Pontiac, Mich.—Bids will be received until oct. 21 by the Bd. Pub. Wks. (H. G. Mormon, Supt.) for 1 continental boiler of 200 h.p. with Morrison suspension furnaces; steam pressure 160 lbs., as advertised in The Engineering Record.

**Minneapolis, Minn.*—The Otis Elevator Co., of New York, N. Y., is reported to have secured the contract to install new hydraulic passengers in the Metropolitan Life Insurance building; cost, $42,000.

Ivanhoe, Minn.—Bids are wanted, it is stated, until Oct. 25 (readvertisement), for constructing Ditch No. 15. R. H. Sisson, Co. Aud.

Minneapolis, Minn.—See "Schools."

Natchez, Miss.—The U. S. War Dept. at Washington, D. C., is reported to have approved plans for an expenditure of $100,000 for the protection of Natchez harbor. Preliminary surveys of the river bank, and sounding of the river along the front have been made.

Clayton, Mo.—Press reports state that bond has been filed and approved in the County Court for the construction of a drainage ditch through the Florissant Valley, beginning at Natural Bridge road and extending for 13 miles, to the channel of Cold Water Creek, half a mile from Missouri River, near Florissant. Henry Chomeau, Herman Tegetoff and John H. C. Ruegg have been appointed viewers to make a report early in November. County Surveyor Wm. Elbring will estimate the cost of the enterprise.

Kansas City, Mo.—The Park Board on Sept. 30 approved the plans of Geo. E. Kessler, Landscape Archt., for the improvement of Brush Creek and Mill Creek Valleys. The plans provide for straightening Brush Creek in places so that the kinks will be taken out and channel kept within city limits. This will enable city to control stream for drainage purposes. On each side of creek from Wornall Road to Prospect Ave. roadways are to be built. The land to be condemned will not be less than 300 ft. wide at any place along the parkway.

St. Louis, Mo.—A bond is reported to have been filed and approved in the St. Louis County Court on Sept. 23 for the construction of a drainage ditch through the Florissant Valley from Bridgeton to the Missouri River, and Henry Choumeau, John H. C. Ruegg and Herman Tegethoff were appointed as viewers of the district. County Surveyor Wm. Elbring was instructed to make a survey and an estimate of cost of ditch. The drainage canal is to be 15 miles in length, beginning at Natural Bridge Road, near Bridgeton, and extending in a northeasterly direction to the New Jamestown Road, half a mile from the Missouri River, near Florissant. The report of the surveyor and viewers is to be made to the court on Nov. 4.

Atlantic City, N. J.—Bids will be received by the Streets, Walks and Drives Com. (Wm. Riddle, Chmn.) until Oct. 28 for the construction of a boardwalk along Ocean front between Pacific and Connecticut Aves., about 2,920 ft. in length, and to be constructed with a wood floor, or reinforced concrete joists, supported by reinforced concrete girders and columns, as advertised in The Engineering Record. J. W. Hackney, City Engr.

**New York, N. Y.*—We are informed that the Maryland Steel Co., 71 Bway., has secured the contract for furnishing material and building freight sheds on piers Nos. 60, 61 and 62, and on the adjacent bulkhead platforms or lateral extensions bet. W. 19th and W. 22d St., North River, in the Chelsea section (bids opened Aug. 21 by the Dept. of Docks and Ferries) for $1,543,960.

The following are the bids opened on Oct. 3 by the Park Board (Moses Hermann, Pres.) for furnishing material and constructing a stone wall surmounted by an iron fence in the Botanical Garden, Bronx Park: Joseph di Benedetto, $24,463; Matteo Capobianco, $21,800; Cooper & Evans Co., $18,400; Thos. Crimmins Contr. Co., $26,500; W. H. Danby, $20,000; Guidone & Galardi Co., $17,000; Hahn & O'Reilly, $23,900; Wm. Horne Co., $18,600; Kelly & Kelley, Inc., $18,297; J. M. Knopp, $22,-

**Items marked thus give the names of parties awarded contracts.*

528. John B. Malatesta, $17,000; McHarg Barton Co., $1?,170; Louis Pepe & Co., $30,005; Thompson and Kelsey, $1?,773, and Florindo Tolosi, $25,600.

Saugerties, N. Y.—The following are the bids opened on Sept. 30 by Col. John G. D. Knight, Corps Engrs., U. S. A., N. Y. City, for 640 cu. yds. rock removal and 6,800 cu. yds. covering over rock (price given per cu. yd. prism meas.): P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J., $2.12, and R. G. Packard Co., 130 Pearl St., N. Y. City, $2.

New York, N. Y.—The following are the bids opened on Sept. 23 by Col. John G. D. Knight, Corps Engrs., U. S. A., New York, for furnishing (*a*) rubble stone, 2,000 cu. yds, and (*b*) quarry spalls, 10,000 cu. yds., for constructing and repairing dikes in Hudson River, N. Y.: Bouker Contr. Co., 21-24 State St., *a* $1.54, *b* $1.55; Thos. R. McCann, 840 Washington Ave., Brooklyn, *a* $1.50, *b* $1.55.

Ft. Schuyler, N. Y.—Bids will be received until Nov. 1 by Lieut. Chas. L. Fischer, Q. M., U. S. A., for repairing the quartermaster's wharf.

**Fairport, O.*—Lieut. Col. Mc. D. Townsend, Corps Engrs., U. S. A., Cleveland, writes that the contract for extending west breakwater at Fairport harbor (bids opened Sept. 10) has been awarded to Sea Coast Constr. Co. 225 5th Ave., New York, N. Y., for $147,037.

Toledo, O.—The Otis Elevator Co., of New York, N. Y., bid for installing passenger elevator in post office at Toledo $7,870.

Ironton, O.—See "Sewage and Sewage Disposal."

Bowling Green, O.—The County Engineers of the four Counties of Putnam, Wood, Henry and Hancock, are reported to have prepared specifications for the dredge work on Ditch 12 of the Jackson cut-off; the work will cost about $180,000.

Springfield, O.—It is stated that bids are wanted until Oct. 22 for $17,500 Buck Creek improvement bonds. Frank A. Crothers, City Clk.

Panama.—See "Power Plants, Gas and Electricity."

Ft. Greble, R. I.—Bids will be received until Oct. 19 by Capt. Willis C. Metcalf, Q. M., U. S. A., 209 Thames St., Newport, for repairs to quartermaster's wharf and ferry slip at Ft. Greble.

Port Royal, S. C.—Bids will be received until Oct. 16 by Capt. Chas. C. Clark, Acting Ch. Q. M., U. S. A., Atlanta, Ga., for one 30-h. p. boiler f. o. b. cars Port Royal, S. C.

Dallas, Tex.—Bids will be received by Capt. W. P. Wooten, Corps Engrs. U. S. A., until Nov. 18 for building locks and dams 2 and 4 on Trinity River, as advertised in The Engineering Record.

**Bremerton, Wash.*—J. Ryan, of Seattle, is reported to have secured the contract for the construction of an extension to the seawall at eastern end of Navy Yard, for about $30,000.

**Puyallup, Wash.*—A. W. Tweeden & Co., of Tacoma, are reported to have secured the contract for dredging and bulkheading Puyallup River, for about $450,000.

Marinette, Wis.—Bids will be received until Oct. 19 (readvertisement) by the Comrs. of the First Drainage Dist. of Marinette Co. at the office of Wm. C. Campbell, Secy., for constructing 12 ditches in said dist., from ¼ to 4 miles in length, with a total length of 11 miles, requiring 7,600 lin. ft. and 49,270 lin. ft. ditch, with a width of 6 ft. and 4 ft., respectively, at the bottom; about 145,000 cu. yd. excav. A. L. Hillis, City Engr.

St. Alphonse, Que.—Bids will be received until Oct. 26 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing an extension to the wharf at St. Alphonse. J. C. Tache, Resident Engr., Chicoutimi.

Wellington, N. Z.—See "Railroads."

PROPOSALS OPEN.

For Proposals see pages 66, 67 and 68.

WATER.

Bids Close.		See Eng. Record.
Oct. 15.	Pump, Mt. Carroll, Ill.	Oct. 5
Oct. 15.	Found. of well, Ironton, O.	Oct. 12
Oct. 15.	Mains, Spring Valley, Ill.	Oct. 12
Oct. 16.	Pipe, Two Rivers, Wis.	Oct. 12
Oct. 20.	Water wks., Bay City, Tex.	Oct. 5
Oct. 21.	Water works, Franklin, Neb.	Oct. 12
Oct. 21.	Pipe, Adel, Ia.	Oct. 12
Oct. 22.	Pumping engines, boilers, etc., Philadelphia, Pa. Adv. Oct. 5, 12	Oct. 5
Oct. 22.	Water wks., Beaver City, Neb. Adv. Oct 5, 12.	Oct. 5
Oct. 22.	Water works, Marion, Kan.	Oct. 12
Oct. 23.	Filters, Atlanta, Ga. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 23.	Boilers, Owosso, Mich. Adv. Oct. 12	Oct. 12
Nov. 4.	Water wks., Tucson, Ariz. Adv. Sep. 28.	Sep. 28
Nov. 4.	Meters, Panama	Oct. 12
Nov. 5.	System, Las Animas, Colo.	Oct. 12
Nov. 15.	Pipe, Winnipeg, Man. Adv. Oct. 5, 12	Oct. 5
Dec. 1.	Water wks., Shelley, Idaho.	Sep. 28
Dec. 1.	Pipe, etc., Phoenix, Ariz. Adv. Oct. 5 and 12.	Oct. 12
Dec. 17.	Water supply improv., etc., Camden, N. J. Adv. Oct. 12	Oct. 12
———	Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Oct. 12	Sep. 28
———	Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12	Oct. 12

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 14.	Stubenville, O. Adv. Sep. 28, Oct. 12	Sep. 28
Oct. 15.	Chattanooga, Tenn. Adv. Sep. 28, Oct. 5.	Sep. 28
Oct. 15.	Oneida, N. Y.	Oct. 5
Oct. 15.	Elkhart, Ind.	Oct. 12
Oct. 15.	Trenton, N. J.	Oct. 12
Oct. 15.	Cincinnati, O.	Oct. 12
Oct. 15.	Summit, N. J.	Oct. 12
Oct. 15.	Ladysmith, Wis.	Oct. 12
Oct. 16.	Saratoga Springs, N. Y.	Oct. 12
Oct. 15.	Hattiesburg, Miss.	Oct. 12
Oct. 16.	Salt Lake City, Utah	Oct. 12
Oct. 17.	Quincy, Ill.	Oct. 12
Oct. 18.	Scranton, Pa.	Oct. 12
Oct. 18.	Fond du Lac, Wis.	Oct. 12
Oct. 19.	Cloquet, Minn.	Oct. 5
Oct. 21.	St. Paul, Minn.	Oct. 5
Oct. 21.	Torrington, Conn. Adv. Oct. 12	Oct. 12
Oct. 21.	Steubenville, O.	Oct. 12
Oct. 21.	Jasper, Ala.	Oct. 12
Oct. 21.	Adel, Ia.	Oct. 12
Oct. 22.	Spokane, Wash.	Oct. 12
Oct. 22.	Buffalo, N. Y.	Oct. 12
Oct. 22.	Virginia, Minn.	Oct. 12
Oct. 23.	**Whiterocks, Utah.**	**Sep. 28**
Oct. 28.	Aberdeen, S. D.	Oct. 12
Oct. 29.	Tecumseh, Mich.	Oct. 12
Oct. 31.	Riverside, N. J.	Oct. 12
Oct. —.	**Eaton, O.**	**Aug. 3**

BRIDGES.

Oct. 15.	Erie, Kan.	Sep. 28
Oct. 15.	Stevenson, Wash.	Oct. 5
Oct. 15.	Tarrant, Tex.	Oct. 12
Oct. 15.	Williamsport, Pa.	Oct. 12
Oct. 16.	Crosby, Tex.	Oct. 12
Oct. 17.	Chester, Pa.	Oct. 12
Oct. 18.	Hempstead, N. Y.	Oct. 12
Oct. 19.	**Canton, China. Adv. Aug. 24 to Sep. 7**	**Aug. 24**
Oct. 20.	Johns Island, S. C.	Oct. 12
Oct. 21.	River Falls, Wis.	Oct. 12
Oct. 22.	Hamilton, O.	Oct. 5
Oct. 23.	Philadelphia, Pa. Adv. Oct. 12	Oct. 12
Oct. 23.	Clinton, O.	Oct. 12
Oct. 24.	Panama. Adv. Sep. 28	Sep. 28
Oct. 24.	Hailey, Idaho	Oct. 5
Oct. 24.	New York, N. Y.	Oct. 12
Oct. 26.	Chicago, Ill.	Oct. 12
Oct. 30.	Williamsport, Md. Adv. Oct. 12	Oct. 12
Nov. 4.	Ashland, O.	Oct. 12
Nov. 12.	Troy, O.	Oct. 12
Nov. 15.	Glendive, Mont. Adv. Sep. 28 to Oct. 12	Sep. 28

PAVING AND ROAD MAKING.

Oct. 15.	Ocala, Fla.	Sep. 28
Oct. 15.	Wilmington, Del.	Sep. 28
Oct. 15.	Bellingham, O.	Oct. 5
Oct. 15.	Sheraden, Pa.	Oct. 5
Oct. 15.	Denton, Md.	Oct. 5
Oct. 15.	Olympia, Wash.	Oct. 5
Oct. 15.	Bemidji, Minn.	Oct. 12
Oct. 15.	Scranton, Pa.	Oct. 12
Oct. 15.	Belleville, N. J.	Oct. 12
Oct. 16.	Asphalt plant, Ottawa, Ont. Adv. Sep. 28 to Oct. 12.	Sep. 28
Oct. 16.	Brooklyn, N. Y.	Oct. 5
Oct. 17.	Cartersville, Mo.	Oct. 12
Oct. 17.	Quincy, Ill.	Oct. 12
Oct. 17.	Harrisburg, Pa.	Oct. 12
Oct. 19.	Nampa, Idaho.	Oct. 5
Oct. 19.	Woodsfield, O.	Oct. 12
Oct. 21.	**Logansport, Ind.**	**Sep. 21**
Oct. 21.	Naturita, Colo.	Oct. 12
Oct. 21.	New York, N. Y.	Oct. 12
Oct. 22.	**Nampa, Idaho**	**Sep. 28**
Oct. 23.	Brooklyn, N. Y.	Oct. 12
Oct. 23.	Concord, N. H. Adv. Oct. 12	Oct. 12
Oct. 24.	New York, N. Y.	Oct. 12
Oct. 26.	Richwood, O.	Oct. 12
Oct. 31.	Ft. Logan H. Roots, Ark. Adv. Oct. 5, 12.	Oct. 5
Oct. —.	Selma, Ala.	Sep. 7
Nov. 1.	El. ry., Calgarry, Alta.	Oct. 12
Nov. 4.	Peru, Ind.	Sep. 28
Nov. 6.	Cleveland, O.	Oct. 12
Nov. 12.	Troy, O.	Oct. 12
Nov. 15.	Garb. disp., Altoona, Pa.	Oct. 12
Dec. 13.	**Valparaiso, Ind.**	**Sep. 7**
———	**York, Pa.**	**Sep. 7**
———	Ithaca, N. Y.	Oct. 12

POWER PLANTS, GAS AND ELECTRICITY.

Oct. 15.	**Savannah, Ga.**	**Sep. 21**
Oct. 15.	Womelsdorf, Pa.	Oct. 12
Oct. 16.	Baltimore, Md.	Oct. 12
Oct. 18.	Paducah, Ky.	Oct. 12
Oct. 18.	Salt Lake City, Utah.	Oct. 12
Oct. 18.	Warrensville, O.	Oct. 12
Oct. 22.	Philadelphia, Pa. Adv. Oct. 5	Oct. 5
Oct. 21.	New York, N. Y.	Oct. 12
Oct. 22.	Marion, Kan.	Oct. 12
Oct. 24.	New York, N. Y.	Oct. 12
Nov. 1.	**Seymour, Ind.**	**Sep. 14**
Nov. 4.	Panama	Oct. 12
Nov. 8.	Kokomo, Ind.	Oct. 5
Nov. 9.	Las Animas, Colo.	Sep. 28
Nov. 15.	**Charleston, S. C.**	**Sep. 14**

BUILDINGS.

Oct. 14.	Hospital, Castleton, S. I., N. Y.	Oct. 5
Oct. 15.	School plans, Indiana, Pa.	Sep. 28
Oct. 15.	**Court house plans, De Pere, Wis.**	**Aug. 17**
Oct. 15.	School, Osceola, Ark.	Sep. 21
Oct. 15.	Court house, Youngstown, O.	Sep. 21
Oct. 15.	Post bldgs., Las Animas, Colo.	Sep. 28
Oct. 15.	School, Oakville, Ont.	Oct. 5
Oct. 15.	Post bldgs., Governor's Island, N. Y.	Oct. 5
Oct. 15.	Club house, Tampa, Fla.	Oct. 12
Oct. 15.	Bus. bldg., Toledo, O.	Oct. 12
Oct. 15.	Pub. bldg., Ellis Island N. Y. H., N. Y.	Oct. 12
Oct. 15.	Bus. bldg., Tampa, Fla.	Oct. 12
Oct. 15.	School, Bartlett, Tex.	Oct. 12
Oct. 15.	Industrial plant, Sioux City, Ia.	Oct. 12
Oct. 16.	**Exten. post office, Springfield, O.**	**Sep. 14**
Oct. 16.	Pub. bldg., Ashland, O.	Sep. 21
Oct. 16.	Library, Sheldon, Ia.	Sep. 28
Oct. 16.	Pub. bldgs., Polk, Pa.	Sep. 28
Oct. 16.	Hospital, Harrisburg, Pa.	Oct. 5
Oct. 16.	New industrial plant, Mansfield, O.	Oct. 5
Oct. 16.	Pub. bldg., Baltimore, Md.	Oct. 12
Oct. 16.	Alterations to armory, Pottstown, Pa.	Oct. 12
Oct. 16.	Church, Cairo, Ill.	Oct. 12
Oct. 16.	Armory, Grove City, Pa.	Oct. 12
Oct. 16.	Pub. bldg., Chicago, Ill.	Oct. 12
Oct. 16.	Armory, Grove City, PPa.	Oct. 12
Oct. 17.	**Pub. bldg., Peoria, Ill.**	**Sep. 7**
Oct. 17.	Post bldg., Ft. McPherson, Ga.	Sep. 28
Oct. 17.	School, Metuchen, N. J.	Sep. 28
Oct. 17.	Pub. bldg., Long Island City, L. I., N. Y.	Oct. 5
Oct. 17.	Shelter House, Brooklyn, N. Y.	Oct. 12
Oct. 17.	School, Newark, N. J.	Oct. 12
Oct. 17.	Pub. bldg., Pittsburg, Pa.	Oct. 12
Oct. 18.	School, Montevallo, Ala.	Sep. 14
Oct. 18.	Exten. to post office, Denver, Colo.	Sep. 28
Oct. 18.	Barracks, Ft. Totten, N. Y. Adv. Oct. 5, 12.	Oct. 5
Oct. 18.	Pub. bldg., St. Louis, Mo.	Oct. 5
Oct. 18.	Storm sash for pub. bldg., Ft. Wood, N. Y. H.	Oct. 12
Oct. 18.	Htg. jail, Paducah, Ky.	Oct. 12
Oct. 18.	Htg. Post bldg., Ft. Monroe, Va.	Oct. 12
Oct. 18.	Pub. bldg., Akron, O.	Oct. 12
Oct. 19.	Pub. bldg., Glen Cove, L. I., N. Y.	Oct. 5
Oct. 19.	Post bldgs., Hot Springs, Ark.	Oct. 5
Oct. 19.	Schools, Normal, Ill.	Oct. 12
Oct. 20.	School, Washington, Kan.	Oct. 5
Oct. 21.	Pub. bldg., Milwaukee, Wis.	Sep. 21
Oct. 21.	**Post office, Des Moines, Ia. Adv. Sep. 7, 14.**	**Sep. 7**
Oct. 21.	Hospital, New Orleans, La.	Oct. 5
Oct. 21.	School, Leadwood, Mo.	Oct. 12
Oct. 21.	Armory, Newark, N. J.	Oct. 12
Oct. 21.	School, New York, N. Y.	Oct. 12
Oct. 22.	Pub. bldg., National Military Home, Kan.	Oct. 5
Oct. 22.	Hospital, Warren, Pa.	Oct. 12
Oct. 22.	Pub. bldg., Kincardine, Ont.	Oct. 12
Oct. 22.	School, New Bedford, Mass.	Oct. 12
Oct. 23.	School, Galesville, Wis.	Oct. 5
Oct. 24.	Roofing National Museum, Washington, D. C. Adv. Oct. 5, 12.	
Oct. 24.	Shafts and bases, etc., Nat'l Museum, Washington, D. C. Adv. Oct. 5, 12	Oct 5
Oct. 24.	Pub. bldg., Lapeer, Mich.	Oct. 12
Oct. 25.	Ex. to pub. bldg., Roanoke, Va.	Oct. 5
Oct. 25.	Jail, Winston Salem, N. C.	Oct. 12
Oct. 28.	Post office, East St. Louis, Ill.	Oct. 5
Oct. 28.	Post bldgs., Plattsburgh Barracks, N. Y. Adv. Oct. 5, 12	Oct. 5
Oct. 30.	**Jail, etc., Terre Haute, Ind.**	**Sep. 21**
Oct. 30.	**Post office, Atlanta, Ga.**	**Sep. 28**
Oct. 30.	Post bldgs., Columbus Barracks, O.	Oct. 5
Oct. 30.	Bus. bldg., Batesburg, S. C.	Oct. 12
Oct. 31.	Interior partitions in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12	Oct. 5
Oct. 31.	Mechanical equipment in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12	Oct. 5
Oct. 31.	Pub bldg., Kansas City, Mo.	Oct 12
Nov. 1.	Jail, Mangum, Okla.	Oct. 12
Nov. 1.	School, Stamford, N. Y.	Oct. 12
Nov. 4.	Post bldg., Ft. Bliss, Tex. Adv. Oct. 12	Oct. 12
Nov. 4.	**School, Woodruff, S. C.**	**Sep. 28**
Nov. 5.	**Court house plans, Houston, Tex.** Adv. Sep. 14 to Oct. 12.	**Aug. 31**
Nov. 5.	Barrack bldg., Portland, Me. Adv. Oct. 5, 12.	Oct. 5
Nov. 5.	Post Office, Flint, Mich. Adv. Oct. 5, 12.	Oct. 5
Nov. 5.	Barracks, New Orleans, La.	Oct. 12
Nov. 11.	School, Cincinnati, O.	Oct. 5
Nov. 12.	School, Seattle, Wash.	Oct. 12
Nov. 15.	*Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 21.	Bus. bldg., Auburn, N. Y.	Oct. 5
Nov. —.	University gymnasium, Madison, Wis.	Oct. 5
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
Dec. —.	**School, Anderson, Ind.**	**Sep. 28**
Feb. 1.	**Plans for Capitol, San Juan, P. R.**	**Sep. 28**

MISCELLANEOUS.

Oct. 15.	Ditch, Estherville, Ia.	Oct. 5
Oct. 15.	**Cement, stone, etc., Honolulu, H. I. Adv. Aug. 31 to Sep. 21.**	**Aug. 31**
Oct. 15.	Supplies, Washington, D. C.	Oct. 12
Oct. 16.	Ditch, Roseau, Minn.	Oct. 5
Oct. 16.	Garb. disp., Baltimore, Md.	Oct. 12
Oct. 16.	Boiler, Port Royal, S. C.	Oct. 12
Oct. 17.	**Culvert, Ft. Logan H. Roots, Ark.** Adv. Sep. 21 to Oct. 12.	**Sep. 21**
Oct. 17.	**State canal wk., Albany, N. Y.** Adv. Sep. 21 to Oct. 12.	**Sep. 21**
Oct. 17.	Repairs to fence, etc., Brooklyn, N. Y.	Oct. 5
Oct. 17.	Wall, Brooklyn, N. Y.	Oct. 5
Oct. 18.	Exten. to wharf, Lions Head, Ont.	Sep. 28
Oct. 18.	Dredging, Manchester, Mass.	Oct. 12
Oct. 19.	Trunk lockers, Washington, D. C. Adv. Sep. 21 to Oct. 12.	Sep. 21
Oct. 19.	Ditch, Marinette, Wis.	Oct. 12
Oct. 19.	Repairs to Wharf, Ft. Greble, R. I.	Oct. 12
Oct. 21.	Dump scows, Louisville, Ky. Adv. Sep. 21 to Oct. 12.	Sep. 21
Oct. 21.	Barges, Louisville, Ky. Adv. Sep. 21 to Oct. 12.	Sep. 21
Oct. 21.	Dredging, Wilmington, Del. Adv. Sep. 28 to Oct. 12.	Sep. 28
Oct. 21.	Pumps, monitor, nozzle, etc., Panama. Adv. Sep. 28.	Sep. 28
Oct. 21.	Cement, Chicago, Ill.	Oct. 5
Oct. 21.	Boilers, Pontiac, Mich. Adv. Oct. 12.	Oct. 12
Oct. 22.	Canal, New Orleans, La.	Sep. 28
Oct. 22.	Supplies, Washington, D. C.	Oct. 12
Oct. 24.	El. ry. wk., New York, N. Y.	Oct. 12
Oct. 25.	Dredge, Charleston, S. C. Adv. Sep. 21 to Oct. 5.	Sep. 21
Oct. 25.	Exten. to wharf, Southampton, Ont.	Oct. 5
Oct. 25.	Ditch, Ivanhoe, Minn.	Oct. 12
Oct. 26.	Wharf, Berkeley, Cal.	Oct. 12
Oct. 26.	Wharf, St. Alphonse, Que.	Oct. 12
Oct. 28.	Tin, rope, etc., Panama. Adv. Oct. 5	Oct. 5
Oct. 28.	Boardwalk, Atlantic City, N. J.	Oct. 5
Oct. 28.	Board walk, Atlantic City, N. J. Adv. Oct. 12.	Oct. 12
Oct. 29.	Supplies, Washington, D. C.	Oct. 12
Oct. 30.	Dredging, Providence, R. I. Adv. Oct. 5, 12.	Oct. 5
Nov. 1.	El. ry., Calgary, Alta.	Oct. 12
Nov. 1.	Repairs to wharf, Ft. Schuyler, N. Y.	Oct. 12
Nov. 4.	Steel hull for snag boat, Louisville, Ky. Adv. Oct. 5, 12.	Oct. 5
Nov. 4.	Punching machines, Panama	Oct. 12
Nov. 9.	Crematory, Las Animas, Colo.	Sep. 28
Nov. 14.	Monument, Chalmette, La. Adv. Oct. 12.	Oct. 12
Nov. 15.	Garb. disp., Altoona, Pa.	Oct. 12
Nov. 15.	Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 18.	Locks and dams, Dallas, Tex. Adv. Oct. 12	Oct. 12
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 12	Sep. 28
Nov. 20.	Rock and earth excavation, Detroit, Mich. Adv. Oct. 12	Oct. 12
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28 to Oct. 12.	Sep. 28
———	Lease of limestone quarries, Newark, N. J. Adv. Oct. 5	Oct. 5

*Items marked thus give the names of parties awarded contract.

CURRENT NEWS SUPPLEMENT

OCTOBER 19, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

THE KEY WEST EXTENSION OF THE FLORIDA EAST COAST RY.

The projected extension of the Florida East Coast Ry., from Miami to Key West, often referred to as a railway over the ocean, has advanced to such a stage that trains are to be run over it by next January as far as Knight's Key—two-thirds of the distance from Miami to Key West. The portion to be completed by that date includes several of the most interesting engineering features of the road, namely, the fill across the Everglades, the drawbridges at Jewfish Creek and at Indian Key Channel, the marl fills across the long openings between Upper Matecumbe and Lower Matecumbe and between Lower Matecumbe and Long Key, with several stretches of trestle across channels which will ultimately be filled with rock, the Long Key Viaduct—a reinforced concrete structure two miles long, carrying the train 30 ft. above the water—besides many miles of excellent embankment.

The road leaves Miami and runs through Biscayne Pine Land, crossing a few small glades, until it comes to Homestead, the most southern station on the ridge that defines the main land of Florida. To this point the road has been in operation for several years. Upon leaving Homestead, which is an agricultural center of growing importance, the road soon enters the glades, great prairies of meadow land, flooded with fresh water much of the year and interspersed with "hammocks," or higher spots, covered with woody growth. The hammocks break the monotony of the meadows, and render the landscape charming.

This part of the road was constructed on a fill thrown up by two dredges, one working on each side of the embankment, and digging its way from Homestead toward the bay. The dredges floated in the ditches they dug. In many places the hard rock underlying the marl was so close to the surface as to make the floating of the dredges over it difficult. Especially shallow draft dredges were built for this work.

The glades in this part of Florida dip gently toward the south and the water covering them becomes deeper as the road approaches the coast. The inlets and bayous also become more numerous, affording sufficient change to stimulate the fancy of the traveler, until the road makes a turn to the eastward and enters a key which crosses over from the main land to Key Largo, the largest and highest of the Florida Keys.

Immediately before entering Key Largo, the train crosses the drawbridge at Jewfish Creek, one of the long tidal streams in which yachting parties in Florida waters take such delight. To go through Jewfish Creek or Steamboat Creek on a boat carrying a searchlight at night is a treat nobody having experienced it will ever forget.

Key Largo commences immediately across the bridge, but it contains a lake of considerable size, not known to exist until actual construction on the railroad was commenced. The road crosses the lake on an embankment which gave much trouble in the construction. The material available for construction here proved to be the fiber of mangrove roots, deposited many feet deep. It made a levee upon which a crossing was finally effected, and a dressing of rock superimposed, both to form a roadbed and to prevent the bank itself from burning up.

Key Largo is an island of some importance, as it produces a quantity of fruit. It contains several settlements on its outer coast, both North and South of where the road enters, which is near to the middle of the Key. After reaching the high ground of the Key the road turns to the southwest, and from this place on follows the keys, with water of the Bay of Florida or the Atlantic ocean almost always in sight. The grade is carried high enough to be above hurricane tides, which requires a fill at most parts of the line, though there are a few slight cuts here and there, and one or two deeper cuts where rock is quarried for ballasting the road. The rock is coral, and beautiful specimens may be gathered in the quarries. On the ocean side of the keys there is usually found a sand beach, with a sand ridge thrown up by past storms, in which cocoanut trees have been planted and found a permanent lodging. These trees can be seen a long way out at sea, and are the only part of the Florida Keys that usually comes in sight of the traveler bound from New York to southern ports by water. An exception to this in future will be trains upon the embankments, which will appear to passengers on ships at sea to be running on the water at the horizon. The Long Key Viaduct, rising 30 ft. above water level, will also be seen a considerable distance at sea, with its chain of 180 arches.

The temporary terminus of the road for this winter's travel will be the Knight's Key Dock, to which ships drawing 19 ft. of water may approach. It was built for the purpose of receiving masonry supplies for the viaduct work, and has been discharging this function for some time. It will be this winter the most southern railway terminus in the United States. At the present writing, the Long Key Viaduct is the southern terminus of the road for construction trains, though comparatively little remains to be done between that structure and Knight's Key.

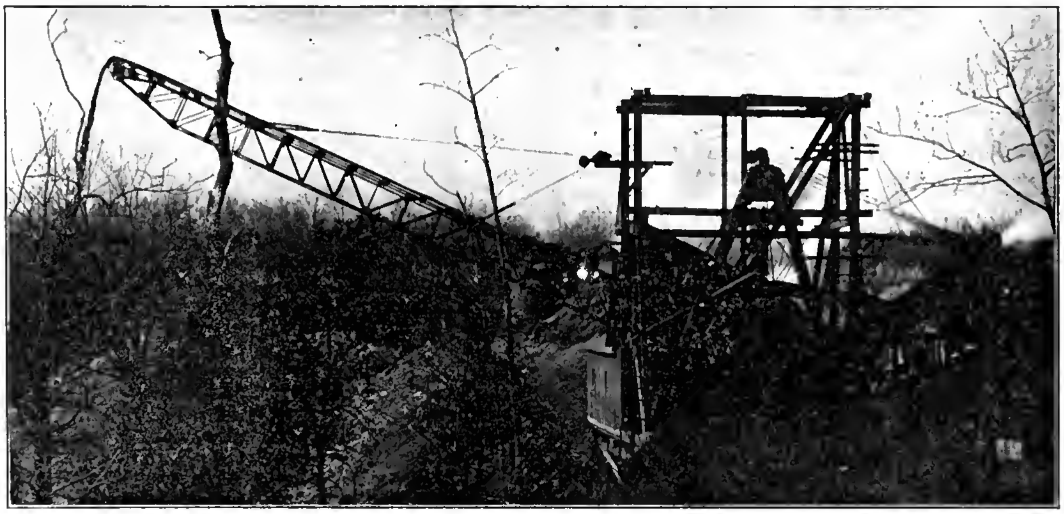
AN EXCAVATOR FOR HEAVY STRIPPING.

The accompanying illustration shows a specially designed stripping excavator built by The Bellefontaine Foundry & Machine Co., of Bellefontaine, Ohio, for G. W. Prutsman, Danville, Ill., who has a contract with the Consumers Coal Co., of that place, to strip 35 acres of coal lands. The proposition is to remove from 38 to 40 ft. of overburden, of which 16 to 24 ft. is shale and the balance gravel and clay at a single cut, placing all the material to one side, leaving a bottom width of 36 ft. of clean coal ready for removal.

The car deck is 30 ft. wide by 56 ft. long, mounted on four special trucks moving on two tracks, the tracks composed of the usual short heavy sections of rails laid loose on the ties and tramed with bridle bars. The forward trucks are at the immediate front end, while the rear ones are set under some 8 ft. from the rear. To allow for inequality of the coal surface on which the tracks are laid, each truck has one swivel axle so that the load, while equal on each wheel, is carried on three points. The truck bodies are built solid of heavy beams, and the wheels are 39 in. in diameter and weigh 900 lbs. each, having double flanges 2¼ in. thick, amply strong to crowd the rails of the two tracks into proper relation to each other. When making short curves one or two of the rails are laid directly on the ties and the other on steel plates on the ties. Unusually large bolster plates bear into bolster plate sockets in the trucks, there being no attachments of any kind otherwise, so that the trucks can be swiveled short enough to turn the entire machine at right angles in less than twice its length if desired. To give the entire car body a three-point suspension on the four trucks the rear portion of the car is carried on a 5-in. swivel pin in the center of a large bolster, which in turn rests on the two rear trucks.

The makers' standard double engines mounted in a single bed are used on all movements. The hoist engines are 10x12-in., driving the drums through heavy steel gears with a 5.75:1 ratio. The backing drum is used for hoisting or changing the elevation or angle of the elevating conveyor and not in any way in connection with the handling of the bucket. The usual steam clutches with outside bands wood lined, are used. The swinging rig is an 8x8-in. throttle reversing engine, while an engine of the same size and style built in a cast steel bed is used on the boom as a thrusting engine. The conveyor feeder and conveyor are driven by an 8x10-in. single cylinder engine. Steam at 125 lbs. pressure is provided for all engines from an open bottom locomotive type boiler 60 in. in diameter by 21 ft. long, containing 88 3-in. tubes and rated at 100 h.-p.

The boom is 35 ft. from center to center, of solid steel beam and wood combination. The dipper handle is of the same style of construction 24 ft. long. The 2-yd. dipper is built entirely of wrought and forged material



AN EXCAVATOR FOR HEAVY STRIPPING.

and is fitted with four heavy teeth. It is handled by 1½ in. chain.

The swinging circle is 12 ft. in diameter made of solid plate and beam construction and is handled by double 1-in. cables to the swinging rig. The deck casting on which circle rests is the makers' safety type.

After excavating the material with the dipper, it is cast into a large steel hopper at one side and near the front end of the machine. From the bottom of this hopper it is carried in a uniform rate and depth by an all-steel cross feeder about 12 ft. center to center to a small hopper at the lower end of the elevating belt proper. This is a 40-in. belt running on a steel arm 105 ft. center to center, which is supported on a tower 488 ft. high above the deck. This tower is located cross-wise on the car body and just back of the A frame. The dumping clearance at the outer end of the conveyor is nearly 60 ft. above the track.

In the ordinary operation of the machine with the 24-ft. handle, all very large or heavy pieces, stumps and logs are easily cast into the space from which the coal has been removed, direct from the hopper. Two jacks, one on either side directly under the elevator tower and directly attached to the car body without an overhanging arm and resting on the track just back of the front trucks, prevent oscillation of the elevator or car to any extent when the machine is in operation.

The machine is easily moved in either direction by steel rope tackles hooked directly into the back of the dipper. Special forged track grabs which seize the rails just back of the forward trucks serve as hitches or anchors. Changing the forward and rear blocks from truck to track or vice versa reverses the direction of the car when pulling at the dipper.

THE HART SECTIONAL COOLING TOWER AND SPRAY PREVENTER.

The principal difficulties experienced with open, natural-draft cooling towers have been the limited exposure of the water to the air currents, due to the spray in the outer portion of the tower blanketing the inner portions of the tower, and the loss of water in spray blown by the wind beyond the tower. These have both been eliminated, it is claimed, in the tower recently designed by B. Franklin Hart, Jr., & Co., New York. A new form of sectional cooling spray is used, having serrated edges, causing the water to fall from stage to stage in finely-divided streams, and yet permitting the general distribution of air currents throughout all portions of the tower between the trays. The trays are long, shallow troughs, a few inches in width, built in any length and located in the tower in stages with small spaces between edges. The entire construction is adapted to installation in old towers, which have proved of insufficient capacity or where tower construction is not permissible and it is necessary to install the system in ill-adapted spaces.

The spraying preventer construction involves the use of galvanized iron baffle plates or enclosures, hung outside the tower at each stage and on such sides as to catch the spray carried outside by strong prevailing winds. The baffles are hung some distance out from the tower so as not to interfere with the wind currents of ordinary intensity and are inclined inward toward the bottom, which is flanged into a gutter to collect the water and deliver it back to the tower again. These baffles are hung alongside the upper portions of the stages, there being a fine mesh screen enclosure around each group of trays lower down.

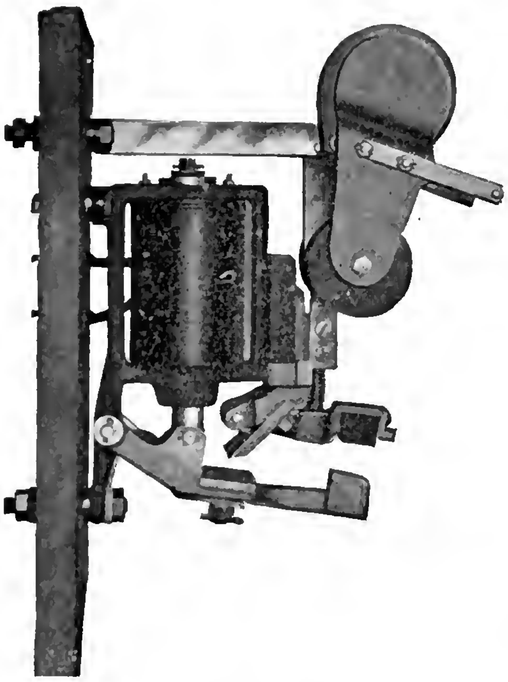
A NEW CONTACTOR.

The Cutler-Hammer Mfg. Co., of Milwaukee, makers of electric controlling devices, has recently placed on the market an improved type of contactor for handling main-line currents where the nature of the service is severe. In such cases controllers employing sliding contacts cannot always be relied upon to handle the main-line current, and it is customary to employ a controlling panel consisting of a number of contactors, this panel in return being controlled by a master controller designed to regulate the secondary current which energizes the solenoids of the contactors.

The contactor is a compact piece of apparatus provided with powerful blow-out magnet. The main line circuit is closed by the solenoid raising a pivoted arm carrying a thick copper plate, to a point where contact is made with a pair of stationary, laminated copper brushes. Arcing on this contact is prevented by providing an auxiliary copper and carbon contact in the field of a powerful blow-out magnet, which extinguishes the arc incident to the breaking of the circuit. This auxiliary contact closes before the main contact is made and opens after the main contact is broken, thus effectually preventing any sparking on the main contact.

Another improvement is the pivoting of the blow-out shields, permitting these to be raised, as shown in illustration, so as to expose the auxiliary carbon and copper contact. In earlier types of contactors these shields were rigidly fastened in their normal position, completely covering the copper and carbon contacts, and rendering access to these difficult.

The present construction makes renewal of either contact, or of the coiled spring (visible just above the carbon contact) a matter of a few moments only. At a recent test at one of the largest Pittsburg steel mills a 220-volt circuit was opened and closed by a contactor of this type 88,000 times, before renewal of the copper and carbon contacts became necessary, and on a test to determine time required for repairs, the old contacts were removed and new ones inserted in less than two minutes.



A NEW CONTACTOR.

PERSONAL NOTES.

Alexander M. Fox, the oldest director of the Pennsylvania R. R., died recently at his home in Philadelphia.

Mr. Franklin B. Ware, of New York City, has been appointed State Architect of New York, succeeding the late George L. Heins.

Mr. John J. Rooney, Jr., has been appointed an assistant engineer in the City Viaduct Department of Cincinnati, O., succeeding Mr. Thomas Chuck, resigned.

Jonathan Wainwright, president of the Drake & Stratton Co., contractors, Philadelphia, Pa., died at his summer home at Ogdensburg, N. Y.., Oct. 11, aged 56 years.

The office of Mr. E. P. Dawley engineer of construction of the New York New Haven & Hartford R. R., has been removed from New Haven to Providence, R. I.

Major William L. Sibert, corps of engineers, U. S. A., member of the Isthmian Canal Commission, was in Pittsburg recently on business connected with the canal project.

Messrs. Harold Wallem and C. F. Schrotte, of the engineering department of the Siemens-Schuckert Works, of Berlin, are on a tour of this country, studying high-tension electrical developments.

Mr. H. H. McGee has been appointed engineer in charge of new construction and maintenance of bridges, buildings and structures of the Ulster & Delaware R. R., with headquarters at Rondout, N. Y.

Robert H. Fleming, general manager of the Southern Contracting Co., a civil engineer closely associated with the construction of several railroads during the last decade, died at his home in Ludlow, Ky., Oct. 8, aged 65 years.

Mr. O. M. Shepard, formerly general superintendent of the New York, New Haven & Hartford R. R., who retired from that position Oct. 1, has been appointed general assistant to Mr. John F. Stevens, operating vice-president of the company.

Mr. D. C. Newman Collins, consulting engineer and industrial architect, 29 Broadway, New York City, has recently issued a paper discussing the details of various classes of structures and the materials and methods employed in their construction.

Mr. F. G. Hoffman, city engineer of Marion, Ill., and Mr. R. E. Townsend, formerly of the engineering corps of the Mexican Central Ry. Co., have entered into partnership, to do a general engineering and contracting business, with offices at Marion.

Mr. Edmund Van Hoesen, formerly deputy state engineer and surveyor of New York, and recently employed by the New York State Public Service Commission as an expert on railway accidents, has resigned the latter position to become chief engineer of the Tonopah & Goldfield R. R.

The consolidation of the bureaus of water and filtration of Philadelphia, that has long been pending, was authorized by the Council Oct. 10. Mr. F. C. Dunlap, formerly at the head of the Bureau of Filtration, is to be chief of the consolidated bureaus, which will be known as the Bureau of Water.

Mr. Clarence W. Hubbell, civil engineer to the Board of Water Commissioners of Detroit, Mich., has been engaged to manage the water-works of Manila, P. I. Mr. George H. Fenkell, civil engineer to the Commissioners of Water-Works, Erie, Pa., has been appointed to succeed Mr. Hubbell at Detroit.

Prof. C. B. Stewart, of the University of Wisconsin, calls attention to the fact that by an oversight on the part of this journal the excellent article on his experiments with submerged tubes, printed in The Engineering Record of Sept. 28, was not stated to be an abstract of a forthcoming bulletin to be issued by the university.

Mr. W. E. Leland, mechanical engineer, Merchants' Exchange, San Francisco, Cal., has completed plans for the power plants and heating, ventilating and water supply systems for the Alaska Building, San Francisco, and the Oakland Bank of Savings Building. He is preparing plans for the ventilating system of the Oakland Theatre Building.

Mr. Walter B Snow has opened an office at 170 Summer St., Boston, to undertake any kind of publicity work for manufacturers of machinery and allied products. His regular service will cover the conduct, on a salary basis, of the publicity departments of a limited number of non-competitive clients. Special service will be rendered to others in the form of general advertising, catalogue making, technical writing and investigation. Mr. Snow acquired an intimate acquaintance with engineering in general and publicity in particular during nearly twenty-five years connection with the B. F. Sturtevant Co.

The Association of Iron and Steel Electrical Engineers has been organized to further the application of electrical machinery to the iron and steel industry. At the first meeting, held last week in the rooms of the Engineers' Society of Western Pnnsylvania, Pittsburg, Pa., the following officers were elected: James Farrington, electrical superintendent of the La Belle Iron Works, president; J. C. Reed, electrical engineer Pennsylvania Steel Co., first vice-president; G. W. Sturgess, electrical superintendent Lackawanna Steel Co., second vice-president; G H Winslow, electrical engineer National Tube Co., secretary, and E. W. Yearsly, electrical engineer Midvale Steel Co., treasurer.

BUSINESS NOTES.

The Northern Engineering Works, Detroit, has furnished two 12-ton overhead traveling cranes to the Bingham Junction, Utah, plant of the United States Smelting Co. The same company has supplied the Oriental Metal Bed Co., Hoboken, N. J., with a Newton cupola.

The Fort Pitt Bridge Works, of Pittsburg, has opened an office in the Fisher Building, Chicago, in charge of Mr. A. R. Young, C. E.

The Ambursen Hydraulic Construction Co., of Boston, Mass., has commenced work on a dam 27 ft. in maximum height and 350 ft. long across the Sebasticook River at Winslow, Me. The owners are the Fort Halifax Power Co., Waterville, Me.

A large order for vises has just been placed with the Pittsburg Automatic Vise & Tool Co. by the Washington Terminal R. R. for its new shops in Washington. The vises are of the double and single swivel types.

Keuffel & Esser Co. have moved from their temporary quarters in San Francisco to their new building at 48-50 Second St. The blue printing plant in the new establishment has been given special attention so that work can be turned out rapidly.

The Pilling Air Engine Co., of Detroit, Mich., manufacturers of pneumatic hoists, locomotive turntable motors and compressed air hoisting machinery will change its name to the Detroit Hoist & Machine Co., a new corporation with capital stock fully paid of $50,000. The Pilling corporation will be retained with a nominal capital to protect the name and good will. Both companies will be controlled by the same management. A new plant has just been installed and is now in operation. Other improvements will be added in the near future, provision having been made by the purchase of three acres of ground on the Grand Trunk R. R. at Milwaukee Junction, in Detroit.

The Seaboard Portland Cement Co., which will build a plant at Alsen, N. Y. (clay and limestone proposition), has placed an order with the Lehigh Car. Wheel & Axle Works, Catasauqua, Pa., covering its entire pulverizing requirements, comprising forty-five 42-in. Fuller-Lehigh Pulverizer Mills, capable of pulverizing the coal, raw material and clinker for the 6,000 barrel plant.

The Jones & Laughlin Steel Co. is a recent purchaser of two Allis-Chalmers 1,000-kw. 6,600-volt generators wound for 25-cycle 3-phase, and designed to operate at 94 r. p. m. These units, together with a 600-kw. direct-

current generator 2,400-volt and operating at 110 r. p. m., will be installed in the new Aliquippa Works on the Ohio River several miles outside of Pittsburg. A new 500-kw. motor generator set, comprising a synchronous motor rated at 6,600 volts, wound for 3-phase, 25 cycles, and a 250-volt direct-current generator is also being added to the structural shop.

The General Fireproofing Co. has secured control of the sale of universal corner bead in the United States through a contract just effected with the manufacturers, the Rogers-Shear Co., Warren, Pa. Universal corner bead is used as reinforcement for plastered corners, and as it may be made to bend uniformly, it is also used as a finish around windows, on arches and ovals, doing away with the necessity of combustible wood trim. It also results in a saving of the plasterers' time as it gives straight and true lines. The material was used in the new Plaza Hotel, New York.

The Sandusky Portland Cement Co., of Sandusky, O., manufacturers of Medusa water-proof compound, report that this material was used in the following work: Concrete foundations and cement plaster coat on the light well in the new concrete office structure known as the Pacific Building, San Francisco; in the new plant for the District of Columbia Paper Mfg.. Co., Washington, D. C.; by the Aberthaw Construction Co., in concrete tanks and water filter for the Woronoco Paper Co., near Boston, Mass.; for stopping leaks in the Illinois Tunnel Company's concrete subway work, Chicago, Ill., and by James Stewart & Co., contractors, in the linoleum plant being constructed by them at Lancaster, Pa.

Some months ago the Cutler-Hammer Mfg. Co. announced the purchase of The Wirt Electric Co., of Philadelphia. The former company has now consolidated the Wirt business with that of its New York plant at Park Ave. and 130th St., where the manufacture of Wirt apparatus will be continued. Information concerning Wirt apparatus may be obtained from any of the Cutler-Hammer offices.

TRADE PUBLICATIONS.

A recent pamphlet of the Atlas Construction Co., St. Louis, Mo., describes the Atlas reinforced concrete chimney on the Wiederholt system. It makes use of a hollow tile construction, a double shell of hollow tile being erected in sectional form which serves as a mold and obviates the necessity of wooden forms. Illustrations are presented of a number of chimneys that have been erected in different parts of the country.

The results of tests of the spreading power of carbonizing coating, made by the Goheen Manufacturing Co., Canton, O., and of red lead and graphite are printed in a folder by the Goheen Company. The tests were made under the direction of Prof. Wm. T. Magruder, of Ohio State University, at the Columbus shops of the Pennsylvania lines, on rusty sheets, some freshly sandblasted, and some cleaned with wire brushes, and on new sheets coated with mill-oxide. The results show a decided advantage for carbonizing coating.

The American Steel & Wire Co. has published a handbook and catalogue of concrete reinforcement, consisting of 118 pages, 5½x9 in., bound in cloth. It contains chapters on the economic use and properties of reinforced concrete, cost and strength of concrete, reinforcing steel, protection of steel and iron from corrosion, fire protection, modulus of elasticity, the bonding of courses, freezing, cements, and finishing and facing concrete surfaces. Almost all of the reading matter is taken from the works of Buel and Hill, Taylor and Thompson, and Webb. Special attention is called to the merits of triangular mesh wire reinforcement, made by the company. Twenty-three pages are given to diagrams and tables of the weights, areas and sizes of triangular and square mesh wire reinforcement, safe bending moments, weights and thicknesses of slabs, and areas and weights of steel and iron wire. The bending moment diagrams and tables are based on Professor Talbot's tests and formulas. Suggested methods of using reinforcement, and views of buildings for which the American Steel & Wire Co. furnished the reinforcing steel take up 25 pages at the end of the book.

The latest edition of the book on Municipal Filtration published by the Pittsburg Filter Mfg. Co., Pittsburg, has 109 pages devoted to explanatory matter on the mechanical filtration of water and descriptions of the apparatus and plants built by the company. The successive steps of coagulation, sedimentation and filtration are taken up, and the conditions which cause variations in these steps of the purification process are discussed. The design of the apparatus for successfully carrying on the three stages of treatment are next taken up, and besides showing the company's designs by photographs and drawings, illustrations and descriptions of actual plants using the equipment are added. Of these plants the one at Harrisburg, Pa., with a capacity of 10,000,000 gal. per day, is treated most fully. Extracts from reports showing results of mechanical filtration occupy the last few pages of the book. The book will prove interesting and helpful to those who are selecting a filtration system.

The seventh edition of the Review of Technical Paints for Metal has lately been issued by the National Paint Works, Williamsport, Pa. The book is by Mr. Frank P. Cheesman, and contains a great quantity of valuable matter for paint users, much of the material being taken from papers and reports to the American Society for Testing Materials, the Master Car and Locomotive Painters' Association, the Association of Railway Superintendents of Bridges and Buildings, and similar organizations. The requirements of paints for metals, covering capacity and the factors affecting it, and the relation of covering capacity to durability, are taken up in the opening pages. Then follow discussions of the causes of paint decay, pigments and vehicles, Linseed Oil Versus Paint as Priming Coats for Metal, the latter a paper by Mr. Cheesman before the 1907 meeting of the American Society for Testing Materials, and experiences with coatings for concrete and cement. The next division of the book contains a great fund of experience with paints for bridges, cars, and steel cage buildings, together with short descriptions of the principal paints made by the company. Under the description of each paint, the experiences with it on all classes of work, are noted, thus aiding materially in the selection of a paint for any particular condition. Nearly 50 per cent. of the company's output is composed of paints made up from the purchasers' specifications, the company making a specialty of such work.

The Patton Clay Mfg. Co., Patton, Pa., has issued an attractive catalogue of its products in vitrified sewer pipe, specials and fittings, wall coping, flue linings, building blocks, hollow tile floor arches and beam covering, and paving and building brick. Comprehensive tables are given of the weights and dimensions of all sizes of standard, double strength and special socket sewer pipe, feet of pipe to a car load, cubic yards of excavation per lineal foot of trench, carrying capacity of sewers, number of brick for different shapes and sizes of sewers, and there are miscellaneous tables and practical notes on laying sewer pipe. An interesting table gives the net prices of sewer pipe and fittings, based on given list prices, the discounts varying by 1 per cent. from 45 to 90 per cent.

A handsome catalogue has been published by the Marion Steam Shovel Co., Marion, Ohio, describing the uses of its six standard shovels, a railroad ditcher and some specially constructed machines. The shovels are described in detail, and there is a table in which the dimensions and weights of all the models are arranged in parallel columns, for easy comparison in selecting the shovel best adapted to given conditions. The standard models have working weights of 23, 38, 58, 70, 85, and 105 tons, the dippers being ¾, 1¼, 2, 2½, 4 and 5 yd. respectively. The railroad ditcher has a ½-yd. dipper, weighs 20 tons, and works on a train of flat cars, moving the entire length of the train and loading the car next to the one on which it rests. One advantage of this machine is that a train can be run into a narrow cut and loaded without the use of additional track. The greater part of the book is devoted to half-tone pictures of Marion shovels and unloaders, operating under a great variety of conditions. Among the interesting illustrations are those of shovels working in tunnels, a 105-ton shovel with a 40-ft. boom, a shovel burning oil and another using compressed air. The Marion unloader is made in three styles, with center, right hand, and left hand plows, each style being made in four sizes.

A useful list of specifications for vitrified conduits, with information regarding their shipment, has been prepared by the Rochester Sewer Pipe Co., Rochester, N. Y. Some months ago the manufacture of these ducts was briefly explained in this journal, and the care taken in inspecting and loading them was mentioned.

The Chain Belt Co., Milwaukee, Wis., has recently issued a new 288-page cloth-bound edition of its general catalogue, of elevating, conveying and power transmitting machinery. The first part is devoted to illustrations of various styles of conveyors and typical installations made by this company in various parts of the country. Following this, is a large amount of information concerning the installation of conveying machinery, in which is included the approximate horse-powers required to operate chain belts of different types. The next section is devoted to supplies for conveying machinery, the greater part listing the various styles and sizes of sprocket chains, special attachment links and sprocket wheels for use with them, with an extensive list of bucket elevator supplies of all kinds. In addition an extensive list of hangers, couplings, pulleys, gearing and other mill supplies is given. Among the special machinery manufactured by this company there are listed the Clark automatic power grain shovels, chain-driven foundry tumbling mills and revolving screens.

Electric heating and cooking devices for marine uses are described in a new bulletin from the General Electric Co., Schenectady, N. Y. As practically all steam vessels have electrical generating plants, there are a number of heating devices which may become very convenient on shipboard, including electric air heaters and radiators, water heaters, flat-irons, surgeons' instruments, heating pads, and a variety of electric cooking utensils, examples of all of which are illustrated.

A valuable catalogue of hydraulic machines has recently been issued by the Watson-Stillman Co., New York. It is a 140-page book devoted particularly to pumps and accessories intended for the very high pressures, for hydraulic presses, etc., including all types from the single-plunger, hand-operated machines to steam-driven pumps of the multi-cylinder type, for pressures up to 10,000 lb. per square inch. The extensive list of accessories includes hand and accumulator stop actions, accumulator pump release actions, balanced-spindle by-pass valves and air pressure boosters. A feature of the book is the illustrations and lists of parts, including leather packing, for all of the standard pumps built. Some of the highly developed hydraulic machinery built by this company, for use in the North River tunnels, is also illustrated.

A new edition of its blow-off valve booklet has recently been issued by the Lunkenheimer Co., Cincinnati, Ohio, in which the straight-away, "Duro," angle and locomotive type valves are described. Complete lists of dimensions and prices of these valves and parts are given and approved methods of connecting them to the boilers suggested. An improvement recently made in the Duro valve, by which a rod may be easily entered into the horizontal boiler connection for breaking up scale and sediment, is described.

A new type of vertical oil engines built by the De La Vergne Machine Co., New York, is described in a folder recently issued. This engine differs from the well-known Hornsby-Akroyd horizontal oil engine in that it is of the two-cycle type and is especially designed for use with cheap fuels, such as kerosene or fuel oil, and not for gas or gasoline. The engine is especially adapted for high speed operation for direct connection to electrical generating or other high speed machinery, and is also made in a marine type for use in launches. It is at present built in only the 7½ and 15 h.-p. sizes. Many advantages of reliability, economy and small space occupied are claimed for the new engine.

The Murphy automatic smokeless furnace is described at length in a handsome catalogue recently issued by the Murphy Iron Works, Detroit, Mich. Improvements in its details are well illustrated and good methods of setting the furnace for automatic stoking suggested. The booklet has a large number of good engravings illustrating the parts of the stoker mechanism and showing representative installations of the furnace. Among the recent notable installations are those in four of the power stations of the New Orleans Railway & Light Co., in the new Brunot Island power house of the Pittsburg Ry. Co., and in the power plants of the Kalamazoo Paper Co., and the West Virginia Pulp & Paper Co.

The York Mfg. Co., York, Pa., has issued a series of new bulletins covering its line of vertical single-acting and horizontal double-acting refrigerating and ice-making machinery. In bulletins No. 10 and 15 are presented complete descriptions of the vertical and horizontal machines respectively, illustrating them in various sections and elevation and explaining in detail their various features. In each of the other bulletins, Nos. 11 to 20 inclusive, one of the various standard sizes of ammonia compressors is illustrated in detail, those illustrated ranging from 10 to 175 tons of refrigeration for the vertical single-acting machines and a 30-ton unit of the horizontal type. In addition to the above, bulletin No. 22 discusses the principal features of the new ammonia absorption type of refrigerating machinery, the manufacture of which has recently been undertaken by this company in addition to its ammonia compression type.

Economical machinery for the coal mine is the subject of an attractive 24-page pamphlet from the Ingersoll-Rand Co., explaining various classes of labor-saving machinery manufactured by this company. Ten different lines of apparatus are described, the new Ingersoll pick machine, the radial axe, the diamondless core drills, the electric-air rock drills, pneumatic drills and hammers, the return air pumping system, the pneumatic displacement pumps and air compressors of all types and capacities.

Recent bulletins issued by the Sprague Electric Co., New York, describe motor equipments that have been devised for single and double magazine Mergenthaler linotype machines, and electric dynamometers for testing gasoline engines. The latter is an electrical dynamometer equipment, especially mounted for convenience of connecting to internal combustion engines of the automobile type for testing purposes, and is being extensively used in the automobile manufacturing industry. A bulletin has also been published describing the motor-driven machine tool equipment of the new shops of the F. Wesel Mfg. Co., in Brooklyn, N. Y. This installation is a model one for the economies in space that have been effected by carefully designed motor applications to machines and for its well arranged wiring system.

Sullivan mining hoists are described in bulletin 56 issued by the Sullivan Machinery Co., Chicago. The details of their construction and the methods of their operation are explained, and there are illustrations of a large number of hoisting engines at mines in the Lake Superior iron district and elsewhere.

Westinghouse incandescent lamps are listed in a pamphlet recently issued by the Westinghouse Lamp Co., which includes a pamphlet statement of the vari-

ous types and sizes of incandescent lamps made for all currents and purposes, the principal types being illustrated.

The Bristol electric pyrometer is described in considerable detail in catalog 70, recently issued by Wm. H. Bristol, New York. These pyrometers are manufactured in both the indicating and recording types and in switchboard or portable models, and have been adapted to a large number of temperature scales for a great variety of manufacturing processes. Many applications of the instrument are suggested, and full-size charts are illustrated to show records taken in blast furnaces and in metal melting.

The Curtis steam turbine generator is described in a valuable pamphlet recently issued by the General Electric Co., Schenectady, N. Y. It will be found of special interest on account of the valuable information presented relative to superheating, vacuum and economy, and to the details of construction and operation of the Curtis apparatus. Of particular interest are the portions referring to the details of the new Curtis hydraulic governor, the low-pressure turbine sets recently installed and their economy curves, and the illustrations of the methods of cutting and riveting buckets. Detail tests are given of 9,000, 5,000, 2,250 and 1,000 kw. turbine generator units, which show some remarkably high efficiencies.

Suction gas producers are discussed at length in a pamphlet recently issued by the Wile Power Gas Co., Rochester, N. Y., with special reference to the company's system of pressure gas without using a holder. The various characteristics of the Wile system are well illustrated, including the automatic water regulators, the operating valves, etc., by means of which a uniform quality of gas is secured with quick responses to changes in the load. The producers are built in two types, one comprising units from 35 to 150 h. p. in capacity, and the other units up to 500 h. p., and specifications for producer apparatus and equipments are suggested.

Equipment for the power plant is the subject of a comprehensive pamphlet recently issued by the Schutte & Koerting Co., Philadelphia, Pa., which describes an extensive variety of injectors, condensors, valves and other steam specialties. The eductor condenser is described at length and representative installations illustrated, and also Koerting spray nozzles used in power plants for the recooling of condenser circulation water; several illustrations are presented of these cooling spray jets in operation at power plants. The remainder of the catalog is devoted to automatic stop and check valves of a noiseless pattern, stop, check and emergency valves, free exhaust valves, balance trip valves and combined trip and throttle valves.

Recent publications of the Fort Wayne Electric Works include bulletins describing the type L small direct-current motors and type MPL belted generators for lighting and power purposes. The details of construction of this apparatus are shown and applications of the small motors for belted and individual drives are illustrated. The generators are made in an extensive range of sizes up to 400 kw., and embody many improvements in constructional detail over former types. In addition to the above, a revised instruction book has been issued for the type K single-phase integrating induction watt meters, built by this company.

Two pamphlets recently issued by the B. F. Sturtevant Co., Hyde Park, Mass., outline the improvements that have recently been made in the Sturtevant direct-current electric motors. One bulletin is devoted to the bipolar and four-pole types of motors which are built in sizes from ¼ to 2 h. p. for the bipolar motors, and from 2 to 80 h. p. in the four-pole type, while the other bulletin is devoted to the eight pole type of motor for slow speed service, which is built in a variety of forms and in powers from 6 to 75 h. p. A feature of the new designs are special forms of motor construction for direct mounting upon the sides of blower casings for direct connected fan drives.

Bulletin [illegible] recently issued by the Ridgway Dynamo & Engine Co., Ridgway, Pa., is an attractive portfolio of illustrations of engines and generators the company has installed in power plants in all parts of the country. [illegible] engines and generators are shown in numerous [illegible] under many conditions of operation.

[illegible] economizers at the Manhattan power station of the Interborough Rapid Transit Co. form the subject of a pamphlet recently issued by the Green Fuel Economizer Co., Matteawan, N. Y., and containing a reprint of a paper read by Mr. R. D. Tomlinson, before the New York Railway Club.

[illegible] locomotive cranes with Brown patent grab buckets [illegible] coal, limestone, clay, etc., are [illegible] circular L recently issued by the Brown Hoisting Machinery Co., Cleveland, Ohio. The construction of the locomotive cranes is shown in detail and their [illegible] and adaptability for a great variety of [illegible] explained, as are also [illegible] of the Brown [illegible] grab buckets. Locomotive [illegible] fitted with [illegible] grab buckets, are [illegible] service, and a [illegible] presented

Extra heavy valves are listed in a pamphlet recently issued by Jenkins Bros., New York, in which special reference is made to high-grade valves suitable for the extra heavy pressures which are now generally carried in power plants. The valves shown have both brass and iron bodies and are made in the globe, angle and check patterns suitable for working pressures up to 300 lb.

The 1907 edition of the Buffalo Forge Company's general catalog describes forges, blacksmiths' tools, power blowers and exhausters, heating and ventilating apparatus, pumps and ventilators. The list of forges includes all types from small hand blowers to the improved down draught forges and heating furnaces for shop installations, with the complete equipment of accessories necessary for such plants. Other smithshop tools described are blacksmiths' drills, the Buffalo armor-plate, punches and shears, upsetters and tire benders. A complete list of blowers and exhausters for ventilating purposes, exhaust heads, roof ventilators, pumps, steam engines and heating apparatus is given, and there is data relative to the operation of this apparatus, which will be of interest to the designing engineer.

Portable industrial railways are discussed in an attractive catalog recently issued by the Arthur Koppel Co., Pittsburg, Pa., which illustrates the Koppel system of light, portable track sections with rolled-steel ties and easily connected angle joints, which greatly facilitate the laying of tracks. The various details of the track construction are illustrated, together with the different forms of dump and platform cars which are built for industrial service. A number of interesting illustrations of Koppel trackage and cars in industrial service are shown, including that in use in the Pennsylvania R. R. Terminal construction work.

The Dixon Engineering & Construction Co., Toledo, O., has sent out a binding cover containing a number of folders relating to the Dixon system of garbage disposal. Some of the plants built by the company are briefly described, and letters and newspaper clippings commenting on their operation are added.

Goff, Horner & Co., Ltd., Pittsburg, are distributing a small folder on the Cummings System of steel reinforcement for concrete structures. Sketches aid the text in describing Cummings' loop truss girder, the patent chair lock. Cummings' hooped columns and anchor rods. The claims of the system are discussed and its applications pointed out

Wyckoff wood pipe forms the text of an 80-page catalogue of the Wyckoff Supply Co., Elmira, N. Y. The introduction gives interestingly some of the history of wood pipe. After describing machine-made pipe, the durability, ability to stand high pressure, resistance to electrolysis, effect of frost, and the carrying capacity are discussed. Under the latter heading is a table showing the velocities and discharge under low heads of wooden, cast iron and riveted steel pipe. Then follow chapters on the coating, manufacture and the method of winding Wyckoff machine-made pipe. Interesting tables are given of the spacing and weight of metal for bands, weight of steel per linear foot, weight of pipe per lineal foot, dimensions, data on hauling and cost of laying wooden pipe. Some space is given to a description of Wyckoff's water-proof patent steam pipe covering. The appendix contains miscellaneous engineering data and tables relating to hydraulic work, the last table giving discharge and friction loss at different heads for pipes from 4 to 48 in.

The Hathorn helve hammer is illustrated in a brochure recently published by the Parker Hoist & Machine Co., Chicago. This hammer, which is built in four sizes, namely, 25 lb., 40 lb., 60 lb. and 80 lb., is fully described and illustrated, and lists of all extra parts which are kept in stock are included.

Triumph Originality is discussed in a recent well-prepared catalogue devoted to the detailed construction of the ammonia compressors built by the Triumph Ice Machine Co., Cincinnati, Ohio. The requirements of the modern ammonia compressor and the recent improvements that have been made in the Triumph apparatus to meet with these requirements are referred to. The steel fittings, ammonia condensers, oil interceptors, liquid receivers and other details of an ice-making or refrigerating plant, manufactured by this company, are illustrated, together with the equipment and auxiliary apparatus necessary in can ice plants, ice water systems, etc. A well-planned machinery arrangement for an ice water plant is also suggested, which embraces a very compact layout of apparatus.

The General Electric Co. has recently issued bulletins devoted to the subjects of the horizontal shaft type of Curtis steam turbines, the Wright demand indicators and mercury arc rectifiers, the latter apparatus being well illustrated and described. The horizontal shaft turbines are built in capacities up to 300 kw., both direct current or alternating, as desired, and can be arranged to operate either non-condensing or condensing. The generators have commutating poles and special commutator construction, particularly adapting them to continuous operation, with little attention, and the attendant advantages of small floor space, low height, light weight and absence of reciprocating parts are dwelt upon, as well as also their suitability for many peculiar conditions of operation.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Jackson, Ala.—See "Power Plants, Gas and Electricity."

Sulphur Springs, Ark.—See "Power Plants, Gas and Electricity."

Redlands, Cal.—The stockholders of the Domestic Water Co. are reported to have decided to issue $50,000 additional bonds for improving the system.

Oakland, Cal.—The Bd. of Pub. Wks. is reported to have on Oct. 9 adopted the plans for a salt water system, furnishing auxiliary fire protection to the city, to cost about $130,000.

Yuba City, Cal.—Chas. Andross, proprietor of the water works, is reported to be considering the erection of a steel tower and tank.

Oceanside, Cal.—It is stated that bids will be received until Nov. 5, by the Bd. of Trustees for one horizontal return tubular boiler 48 in. in diam. and 16 ft. long, and one cross-compound, high-duty pumping engine of 1,000 gals. capacity. H. D. Brodie, City Clk.

Los Angeles, Cal.—We are informed that all bids opened by the Bd. of Water Comrs. on Sept. 30 for a 7,000,000-gal. cross compound pumping engine for the Buenea Vista pumping station have been rejected.

*Bids were opened on Sept. 30 by the Bd. of Water Comrs. (Wm. Mulholland, Supt.) for 2 water tube boilers of 300-h. p. ca. for the Buena Vista pumping station, and Chas. C. Moore & Co. secured the contract for a total of $9,540 for Sterling boiler, manufactured by Babcock & Wilcox Co., to have 3,034 sq. ft. of heat surface.

Fruit, Colo.—Bids are wanted until Nov. 1 for $25,000 bonds, to be issued for the purpose of completing waterworks for fire and domestic purposes. I. H. Whittemore, Town Clk.

Ft. Du Pont, Delaware City, Del.—The following are the bids opened on Oct. 10 by Capt. J. L. Knowlton, Constr. Q. M., for (*a*) 150,000-gal. steel tank, according to government specifications, (*b*) 150,000-gal. steel tank, contractor's specifications; (*c*) 150,000-gal. steel tank, government specifications, but without heater, valve chamber, mains or piping, etc.; (*d*) additions to pump house, pipe work and overflow reservoir; (*e*) air compressor and changes in apparatus in pump house; (*f*) 2 sewage ejectors and ejector chamber; (*g*) remodeling sewer system, and (*h*) cast and wrought iron pipe, for changes in water and sewer systems: Pittsburg Industrial Iron Works, Pittsburg, Pa., *a* $12,990, *c* $9,985; Harry A. Miller, Wilmington, Del., *d* $2,610, *e* $4,580, *h* $1,900; M. B. Bunyea, Chester, Pa., *f* $4,600, *g* $7,300; H. C. Clark, Delaware City, Del., *d* $2,560, *e* $4,617, *h* $1,980, and Chicago Bridge & Iron Works, Chicago, Ill., *a* $18,000, *b* $14,500.

Madison, Ga.—See "Power Plants, Gas and Electricity."

Atlanta, Ga.—The City Council on Oct. 9 decided to have bids called for on a 20,000,000 and 25,000,000 gal. centrifugal pump for Hemphill Ave. pumping station, clear water basin and the completion of the 36-in. pipe from the river to he reservoir.

Covington, Ga.—The citizens are reported to have voted on Oct. 9 to issue $60,000 bonds for the construction of water works and a sewerage system.

**Boise, Idaho.*—Paul S. A. Bickel, of Milner, Idaho, Ch. Engr. Twin Falls Northside Land & Water Co., writes that Donald Grant, of Faribault, Minn., has secured contract for work contemplated by this city; cost, about $500,000.

Coeur D'Alene, Idaho.—C. W. Craik, G. W. Mason and P. J. Scallon are reported to have petitioned for a franchise for water works.

Virden, Ill.—Richd. H. Phillips, 503 Security Bldg., St. Louis, Mo., is preparing plans for water works for Virden, to cost about $60,000. Bids for construction will probably be called for in Nov.

Springfield, Ill.—City Engr. Hamilton and his assistants are reported to be sounding the Sangamon River preparatory to the construction of a new dam for the improvement of the water supply.

East Moline, Ill.—It is reported that the city will this fall build standpipe reservoir and pumping staion as the first step to the construction of municipal water works. Theo. E. Cavely, City Clk.

**Duquoin, Ill.*—The City Council is reported to have awarded contract for the construction of the combined water and sewerage system here to Wm. Tunny, of Joliet, for $18,000.

Anna, Ill.—The Anna Water Works Co. is reported incorporated, with a capital of $14,000, to construct and operate water works. Incorporators, H. P. Tuthill, J. N. Dickinson and others.

Churdan, Ia.—The citizens are reported to have voted to issue $10,000 bonds for water works.

**Pittsfield, Mass.*—L. Cummings, Clk. Bd. of Pub. Wks., writes that the contract for an intake on Sackett Brook and excavating basin (bids opened Oct. 9) has been awarded to Daniel O'Connell's Sons, of Holyoke; estimated cost, about $13,500.

**Fairfax, Minn.*—The Minneapolis Steel & Machinery Co., of Minneapolis, has secured the contract for furnishing steel tower 90 ft. and a 100,000-gal. steel tank for $3,000, and Engineer J. F. Johnson, of Gibbon, secured contract for constructing same at $2,375 (bids opened Oct. 1).

Sauk Rapids, Minn.—Oscar Claussen, of St. Paul, is reported to have been selected to prepare plans for water works, to cost $25,000.

Items marked thus give the names of parties awarded contracts.

Newton, Miss.—P. H. Porter, of Clinton, Ky., has secured the contract for constructing water works for Newton (bids opened Oct. 7) for about $45,000. Engineer, Xavier A. Kramer, of Magnolia.

Nutley, N. J.—The Town Council on Oct. 9 passed on final reading an ordinance providing for the issue of $25,000 water and road improvement bonds.

Ft. Terry, N. Y.—Bids will be received until Nov. 11 by Capt. Wm. E. Horton, Q. M., U. S. A., New London, Conn, for furnishing material and sinking a 6-in. tubular well at Ft. Terry.

Clinton, N. Y.—The citizens are reported to have voted to issue $53,000 bonds for constructing water works.

**Rochester, N. Y.*—The Bd. of Contract and Supply on Oct. 7 awarded contract for sewers, walks and grading and waterpipe in Driving Park Ave. to H. N. Cowles, 47 Tacoma St., for $19,933.

Brooklyn, N. Y.—The Mayor on Oct. 8 approved the ordinance providing for an issue of $3,000,000 bonds to improve the water supply system of Brooklyn Boro.

Wilmington, N. C.—A representative of the city is now negotiating with the Clarendon Water Co. for the purchase of its plant. If not satisfactory, the city will install municipal water works. J. J. Fowler is City Treas.

**Ironton, O.*—A. Q. Thatcher, of Toledo, has secured contract for water works improvements, for $41,800.

**Ashland, O.*—Chas. L. Fortney, Asst. Supt. Water Wks, writes that the Massillon Iron & Steel Co., of Massillon, has secured the contract for 350 tons of water pipe, at $32.25 per ton for 4 in. and $31.25 for 6, 8, 10 and 12 in., all f. o. b. cars Ashland.

Chilocco, Okla.—Bids will be received until Nov. 7 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and improving the water system at he Chilocco School. For further information apply to S. M. McCowan, Supt. School, Chilocco.

Enid, Okla.—See "Sewerage and Sewage Disposal."

Charleston, S. C.—The City Council on Oct. 8 adopted the majority report of the Water Supply & Advisory Com. (John F. Rafferty, Chmn.); also accepted the statement of cost as submitted by Engineer J. L. Ludlow, of Winston-Salem, N. C., and approved the amended franchise of the Charleston Light & Water Co.

Gregory, S. D.—The citizens are reported to have voted to issue $12,000 bonds for water works

Nashville, Tenn.—The citizens are reported to have voted on Oct. 10 to issue $200,000 bonds for extension of water works.

Palestine, Tex.—Thos. Cronin is reported to have purchased the water works and will make improvements to same.

Blackstone, Va.—Bids are wanted by the Water Com. H. H. Seay, Chmn.) for laying and constructing concrete reservoir, to hold 250,000 gals. water; also laying 1½ miles water pipes.

Manassas, Va.—See "Power Plants, Gas and Electricity."

Seattle, Wash.—The following are the bids opened on Oct. 5 by the Bd. of Pub. Wks. for water mains on N. and W. 80th Sts.: Geo. A. Webster Co., $21,828; Smith & Hall, Downs Blk., $21,401, and International Concrete Co., New York Blk., $15,753.

Raymond, Wash.—City Engr. John D. Henry is reported to be preparing plans for water works.

De Pere, Wis.—Bids will be received until Oct. 25 by the Bd. Water Comrs. for furnishing material and constructing a water works extension, requiring about 4,540 ft. 10, 8 and 6 in. c. i. pipe, 7,500 lb. special castings, 8 hydrants. M. J. Maes, City Clk.

De Forest, Wis.—Fred. Moeller, Village Clk., writes that the National Constr. Co., of South Bend, Ind., is preparing plans for water works, to cost about $10,000.

Kelowna, B. C.—See "Power Plants, Gas and Electricity."

**Haileybury, Ont.*—The Common Council is reported to have on Oct. 2 awarded to J. H. McKnight Co., Ltd., the contract for water works, for $44,000.

Vanda, Sask.—The question of issuing $15,000 bonds for water works is reported under consideration.

Weyburn, Sask.—Edgar A. Chappell, City Secy.-Treas., writes that the Municipal Council is pushing preliminary work looking to the letting of contract for a reservoir, pumping station and stand pipe at a point about 3½ miles from town, in connection with contemplated water works. It is proposed to bring the water from there by gravity.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Monica, Cal.—It is reported that bids will be received by J. C. Heminway, City Clk., until Oct. 21 for the purchase of $160,000 bonds for sewers, a wharf and garbage crematory.

San Francisco, Cal.—The sum of $100,000 to continue the repair of the city's sewers and $97,200 for street repaving, asked for by President Casey of the Works Board was appropriated by the Bd. of Superv. on Oct. 7.

Corona, Cal.—See "Public Buildings."

Ft. Du Pont, Delaware City, Del.—See "Water."

**Washington, D. C.*—The contract for constructing sewers in the valley of Soap Stone Branch, bet. 30th and 36th Sts., and in Albemarle St. (bids opened Sept. 30), is reported to have been awarded to the Warren F. Brenizer Co., of Washington, for $10,856.

Pensacola, Fla.—See "Public Buildings."

Madison, Ga.—See "Power Plants, Gas and Electricity."

Covington, Ga.—See "Water."

Quincy, Ill.—The City Council is reported to be considering the construction of the north end sanitary sewer, to cost $30,000.

Belleville, Ill.—It is proposed to extend the High, Jackson, Church and Race Sts. sewers to the city limit; estimated cost, $20,000. Fred Durtschmann, Jr., City Engr.

Duquoin, Ill.—See "Water."

Terre Haute, Ind.—Bids will be received until Oct. 25 by the Bd. Pub. Wks. (Herbert Briggs, Sec.), for constructing sewers at 13th, 9th and Poplar Sts. and Maple Ave., as advertised in The Engineering Record.

North Manchester, Ind.—A. G. Ebbinghaus, Town Clk., writes that bids will be received on Oct. 24 for the construction of a combination sanitary and drainage system, to cost about $10,000. Engineer, W. Fowler, of Wabash.

**Ft. Wayne, Ind.*—The Bd. of Pub. Wks. is reported to have awarded contract for construcion of 2 sewers, one in Spring St. and one in Barthold St., to Anton Reig, 100 Putnam St., at 85 cts. and 89 cts. per lin. ft.

Indianapolis, Ind.—The City Engineer is reported to be preparing plans for branches of the sewer in North Indianapolis. The main trunk line is in 26th St., and a branch will be constructed which will drain district lying bet. Northwestern and Senate Aves. and 26th and 30th Sts. It will be about 2 miles in length and will vary in size from a 10-in. pipe to a 3-ft. circular brick passageway; this branch is estimated at from $25,000 to $30,000.

Des Moines, Ia.—Bids will be received until Nov. 4 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing a brick culvert on 27th St., in the vicinity of Clark St.

Cedar Rapids, Io.—Bids will be received until Oct. 24 by the Pub. Improv. Com. (W. C. Byers, Chmn.), for constructing 6 and 8 in. vitrified pipe sanitary sewers in portions of several alleys.

**Salem, Mass.*—The Sewerage Com. has awarded to Thos. Walsh, of Roxbury, contracts to build Sections 1, 2 and 4 of the South Salem Sewer, and to Falvey & Kelley, of Cambridge, Sec. 3 (bids opened Oct. 2).

**Milford, Mass.*—Bruno, Salamone & Pettitti, of Boston, are reported to have secured the contract to build the low level section of sewer on Central St., for $16,155.

Adrian, Mich.—John Mawdsley, City Clk., writes that the citizens on Oct. 8 voted to issue $15,000 bonds to complete the sewerage system. Engineers, Riggs & Sherman, of Toledo, O.

Tecumseh, Mich.—Bids will be received until Oct. 29 by the Bd. of Village Trus. (W. L. Jones, Clk.) for furnishing material and constructing a sanitary sewer system, as advertised in The Engineering Record. Engineers, the Riggs & Sherman Co., of Toledo, O.

Cadillac, Mich.—Bids will be received by the Bd. of Pub. Wks. (Geo. Johnston, Clk.) until Dec. 2 for building sewage purification works and pumping station, as advertised in The Engineering Record.

Sturgis, Mich.—A. L. Hubbard, City Clk., writes that Geo. Pierson, of Kalamazoo, is engineer for the proposed sewers and sewage disposal plant. An election will probably be held to vote on question this fall.

St. Paul, Minn.—The Bd. of Pub. Wks. is reported to have on Oct. 7 rejected bids for the construction of a sewer on Case St., all being considered too high. Engineer's estimate, $10,140. Several blocks of the sewer call for reinforced concrete.

*The contract for constructing a sewer on a portion of Sturgis St. is reported to have been awarded on Oct. 10 to Ryan & Johnson, at $4,790.

Canton, Miss.—Bonds to the amount of $50,000 are reported sold, to be used for the construction of 7 miles of 18 to 6 in. pipe sewers. O. S. Miller, Mayor. Engr., Walter G. Kirkpatrick, of Jackson.

Kansas City, Mo.—Bids will be received until Oct. 24 by E. A. Harper, City Engr., for constructing sewers in Dists. No. 262 and 240, Div. No. 3, and Dist. No. 238, Div. No. 1.

Lincoln, Neb.—We are informed that the Sanitary Comn. is at work on a concrete storm sewer 850 ft. long and 10x20 ft. in cross section, across the Antelope, at 20th and Vine Sts. Wm. Grant is City Engr.

Madison N. J.—The citizens voted Oct. 14 in favor of constructing a sewerage system; probable cost $125,000.

**Rochester, N. Y.*—The Bd. of Contract and Supply on Oct. 9 awarded contract for construction of a system of sanitary and storm water sewers in the 12th and 21st Wards to H. N. Cowles, 47 Tacoma St., for $85,430.

Rochester, N. Y.—See "Water."

White Plains, N. Y.—Bids will be received by the Bronx Valley Sewer Comn. (Frank N. Glover, Secy., 2 Grand St.) until Nov. 7 for the construction of about 12 miles of circular sewer from 3 1-3 to 6 ft. in diam., and about 3 miles of circular lined tunnel, mostly 6½ ft. and 8½ ft. diam., as advertised in The Engineering Record. The material for construction to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

Auburn, N. Y.—Bids will be received by E. C. Aiken, Mayor, until Dec. 3 for the construction of sewers, to consist of approximately 36,150 ft. 8, 10, 12, 15, 18 and 20 in. pipe sewers, and the construction of disposal works, as advertised in The Engineering Record. J. Walter Ackerman, City Engr.

Troy, N. Y.—Bids will be received until Oct. 29 by the Bd. of Contract & Supply (Jas. Riley, Clk.), for furnishing material and constructing a salt glazed vitrified drain pipe sewer in a portion of Tibbits Ave.

University, N. D.—See "Schools."

Portsmouth, O.—It is stated that bids will be received until Oct. 23, by the Bd. of Pub. Service (Chas. F. Schirrmann, Clk.), for the construction of a storm sewer on 10th St., requiring 575 ft. 18 D. S. vitr. pipe sewer; 20 lin. ft. 15 D. S. vitr. pipe street corner connections; 345 cu. yds. excav.; 4 manholes and casting, complete.

Toledo, O.—It is stated that bids will be received until Oct. 24 by the Bd. of Pub. Service for constructing sewers in various streets. Frank S. Consaul, Ch. Engr., Bd. Pub. Service.

Lakewood, O.—Bids will he received, it is stated, until Oct. 25 by B. M. Cook, Town Clk., for $31,255 street and sewer improvement bonds.

Springfield, O.—Local press reports state that bids will probably soon be asked for the construction of the high level intercepter from Main and Water Sts. to Main and Factory Sts. The city's share of the cost will be $68,600, and the property owners $24,042.

Massillon, O.—It is stated that bids are wanted until Oct. 31 for $11,500 storm water sewer bonds. J. H. Dougals, Secy. Sinking Fund Trus.

**Canton, O.*—W. E. Sarver, City Engr., writes that the contract for constructing the Navarre St. storm sewer (bids opened Sept. 3), has been awarded to Wise, Will, Smith & Shekels, of Canton, for $9,459.

**Cincinnati, O.*—Thos. P. Strack, 518 Walnut St., on Oct. 12 secured contract for improving and repairing McLean Ave. brick sewer, 12 ft. diam., for $12,300.

New Philadelphia, O.—Plans have been submitted to the State Bd. of Health at Columbus for a sewage purification plant for New Philadelphia.

Cleveland, O.—Bids will be received by the Bd. Pub. Wks. (A. R. Callow, Secy.), until Oct. 24 for constructing sewers in Barkwell Ave. and W. 65th St.

**Columbus, O.*—We are informed that D. W. McGrath, of Columbus, has secured the contract for the east side sewage pumping station (bids opened Oct. 4 by the Bd. of Pub. Service) at a total of $18,372. Some of the unit prices in this bid are as follows: 120 cu. yds. excav., class A, $2.00; 1,100 cu. yds. excav., class B, 75 cts.; 620 cu. yds. borrow, 50 cts.; 530 cu. yds. rolled embkt., 50 cts.; 300 cu. yds. loam, 50 cts.; 170 lin. ft. straight stone curb, 75 cts.; 85 lin. ft. curved stone curb, $1.30; 50 lin. ft. resetting stone curb, 20 cts.; 300 sq. yds. granolithic pavnt., $2; 30 sq. yds. repaving with vitr. brick, $2; 415 cu. yds. concrete, $11; 53 lin. ft. 3-duct vitri. conduit, 85 cts.; 160 lin. ft. 6-in. vitr. sewer pipe, 40 cts.; 70 lin. ft. 8-in. vitr. sewer pipe, 50 cts.; 13 tons c. i. pipe, $45; 2 tons Bell & Spigot special castings, $80; 6 tons flange special castings, $100; 58 lin. ft. 2-in. water supply main, 40 cts.; 58 lin. ft. 2-in. high pressure natural gas main, 30 cts.; 6,500 lbs. twisted steel rods, 5½ cts.; 3,700 lbs. wrought steel floor plates, 4 cts.; 7,600 lbs. miscellaneous steel work, 6½ cts.; 2,000 lb. water level indicators, 6 cts., etc. Totals of other bids: Bert Walter, Columbus, $19,149, and E. K. Hibbs, Columbus, $21,058. John H. Gregory is Engr. in charge of water and sewerage works.

**Billings, Mont.*—The following are the bids opened on Oct. 1 by the City Council for constructing Main St. sewer: (*a*) Piper Const. Co., Billings; (*b*) P. Wesch & Co., Billings; (*c*) E. H. Gagnon & Co., Billings; (*d*) J. K. Kennedy & Co., Fargo, N. D.; (*e*) Nick Hughes, Butte (awarded contract), and (*f*) R. M. Bardsen, Butte.

	a	*b*	*c*	*d*	**e*	*f*
1,558.0 12-in. sewer; vit. pipe	$3.00	$2.80	$2.10	$2.00	$2.00	$2.73
1,488.76 15-in. sewer. vit. pipe	3.50	3.05	2.51	2.50	2.25	3.43
1,519.85 18-in. sewer; vit. pipe	4.00	3.50	3.15	3.00	2.65	4.27
1,712.23 21-in. sewer; vit. pipe	4.32	3.95	3.85	3.50	3.10	5.31
3,448.75 concrete culvert, 5x9 ft.	29.00	18.10	29.43	19.00	19.00	17.40
19 manholes, brick	250.00	85.00	120.00	90.00	75.00	75.00
9 manholes, concrete	200.00	110.00	135.00	97.00	65.00	72.00
1 bulkhead, concrete	1,000.00	350.00	1,000.00	850.00	200.00	100.00
1 bulkhead, concrete	1,000.00	500.00	750.00	850.00	300.00	125.00
Totals	$131,925	$86,863	$125,130	$87,200	$83,837	$87,248

Enid, Okla.—The citizens are reported to have voted to issue $78,500 bonds for storm sewer, $10,000 for septic tank, and $15,000 for water extensions.

Ardmore, Pa.—Bids will be received until Oct. 31 by R. A. Warner, Supt. of Health and Drainage, Ardmore, Box 708, for constructing 1,575 ft. 8-in. terra cotta sewer on Lehigh Ave. as advertised in The Engineering Record.

St. Clair, Pa.—H. W. Brown, Town Clk., writes that it is proposed to construct 18, 24 and 30 in. pipe sewers on 1st and 3d Sts., to cost $8,000. Eng., W. H. Wright, St. Clair.

Beeville, Tex.—It is stated that a 24-in. sewer is to be constructed on Washington St., the citizens to pay half the cost, and the County Comrs. the other half.

Seattle, Wash.—The following are the bids opened on Oct. 5 by the Bd. Pub. Wks. for sewers in Hiawatha Pl.: Smith & Hall, Downs' Blk., $7,756, and Dicken & Rightmire, $7,334.

BRIDGES.

Notes Arranged Alphabetically by States.

Willows, Cal.—The Simpson Bridge, crossing Stony Creek between Orland and Newvills, is reported destroyed by fire. The structure is about 900 ft. in length.

Redding, Cal.—It is stated that bids will be received until Nov. 8, by the Bd. of Superv. (S. N. Witherow,

**Items marked thus give the names of parties awarded contracts.*

Clk.), for the construction of a bridge across the Sacramento River, about one mile above Castle Crag.

Greeley, Colo.—The County Comrs. are stated to have recommended awarding the contract for constructing a reinforced concrete bridge at Oak St. in Greeley to C. G. Sheehy, of Denver, at $5,950.

Willimantic, Conn.—The City Council is stated to have decided to expend $12,000 for the enlarging of the S. Main St. stone arch. bridge.

Palatka, Fla.—The Co. Comrs. on Oct. 10 are stated to have awarded the contract for constructing the bridge over St. John's River from Hogeye Point to East Palatka to the Converse Bridge Co., of Chattanooga, Tenn., for $54,000.

Vincennes Ind.—J. S. Spiker, Co. Engr., writes that bids will be received on Nov. 5 by the Comrs. of Knox Co. for 20 new bridges and repairing 4 bridges. John T. Scott. Co. Aud.

Sulphur Springs, Ind. Ter.—Bids will be received at the office of the Supt. Platt Natl. Park, Sulphur Springs, until Oct. 28 for constructing complete a suspension foot bridge at Bromide Springs in the park.

St. Joseph, Mich.—An ordinance is stated to have been passed providing for an issue of $20,000 bonds for constructing the Wayne St. Viaduct.

Menominee, Mich.—C. C. Hansen, County Clk., writes that the proposed steel bridge to be constructed at the paper mills to replace old structure will cost $18,000, of which the city of Menominee will pay $9,000, and the balance will be paid for by the city of Marinete, Wis. Address F. S. Norcross, City Clk., of Menominee, Mich.

Minneapolis, Minn.—Plans are stated to have been prepared for the steel arch bridge to be erected at the Soldiers' Home and Minnehaha Park at a cost of about $45,000.

Greenwood, Miss.—The Bd. of Supervisors of Leflore County are stated to have authorized the issue of $60,000 bonds for erecting bridges and $40,000 for constructing public roads.

Kansas City, Mo.—See "Railroads."

Glendive, Mont.—Specifications are on file at the office of The Engineering Record, 239 W. 39th St., New York, N. Y., and bids will be received at the office of the U. S. Reclamation Service, Glendive, until Nov. 15 for the construction of 34 steel highway bridges in connection with the Lower Yellowstone project, N. D.-Mont.

Lincoln, Neb.—We are informed that Wm. Grant, City Engr., is preparing plans for a reinforced concrete viaduct to be constructed across the Burlington, Missouri Pacific & Northwestern tracks on N. 10th St., to cost about $120,000.

Mt. Holly, N. J.—Bids will be received by the Boards of Chosen Freeholders of the Counties of Mercer and Burlington at the Court House, Mt. Holly, until Oct. 28 for the following: Furnishing materials and constructing concrete abutments, wingwalls, pier and steel superstructure for a bridge over Crosswicks Creek on line of new road, leading from North Crosswicks, in the county of Mercer, to Crosswicks, in the county of Burlington; also a separate bid will be received to include grading; a separate bid will also be received for grading only for above bridge. Joel Horner, Dir. Bd. Chosen Freeholders, of Burlington Co., at Mt. Holly.

Newark, N. J.—A bridge is to be constructed over the Hackensack River for the New York & Greenwood Lake R. R. and the Newark branch of the Erie R. R., and contracts are stated to have been awarded to McMullen & McDermott for the sub-structure, and the American Bridge Co., 42 Bway., New York, N. Y., for the superstructure, to be completed June 1, 1908. The bridge will carry two tracks, have a total length of 688 ft., consisting of 6 approach spans and one draw span 265 ft. long, having two openings of 100 ftt. each in the clear. It will involve the construction of 4 miles of new double track railroad, partly on the old Greenwood Lake right of way and partly on the new right of way over Hackensack Meadows to Harrison.

Carlsbad, N. M.—It is stated that bids will be received until about Oct. 26 by the Bd. Co. Comrs. for $22,000 bridge bonds.

New York, N. Y.—See "Miscellaneous.

Brighton, N. Y.—The citizens are reported considering construction a bridge over the New York Central tracks at Clover St., at a cost of about $20,000.

Syracuse, N. Y.—John M. Shultz is reported to have secured the contract for constructing the bridge over Oswego Canal at N. Salina St., for about $66,000.

Toledo, O.—The Toledo-Massillon Bridge Co. is reported to have secured the contract for constructing a bridge over the Maumee River at Damascus Landing near Napoleon for $65,000.

Portland, Ore.—It is stated that bids will be received by A. L. Barlus, City Audr., until Nov. 15, for the construction of a steel bridge on Union Ave. Douglas W. Taylor, City Engr.

Stroudsburg, Pa.—The Stroudsburg & Water Gap Electric Street Ry. Co. (A. A. Holbrook, Gen. Mgr.) is stated to have awarded the contract for constructing a railway bridge over McMichaels Creek at S. 7th St. to Fine & Harris, of Philadelphia, for $16,000.

Pittsburg, Pa.—It is stated that the Pittsburg & Lake Erie R. R. Co. contemplate constructing a 9-track bridge, 125 ft. wide, over Main St. in the West End. J. A. Atwood, Ch. Engr.

Jersey Shore, Pa.—The contract for constructing a bridge over east channel of west branch of Susquehanna River near Jersey Shore is reported to have been awarded to the York Bridge Co., of York, for $51,945. Bids opened Oct. 8 by Saml .B. Rambo, Supt. Pub. Bldgs. and Grounds, Harrisburg.

Mauch Chunk, Pa.—Bids will be received until Nov. 7 by the Bd. Co. Comrs. (D. O. Straup, Chmn. for constructing a new span in place of the eastern span on the ... Mauch Chunk Bridge over the Lehigh River at Mauch Chunk.

Coatesville, Pa.—The Bridge Jury is stated to have recommended the construction of a bridge over the Philadelphia & Reading Ry. and Brandywine Creek, on Main St., Coatesville, at a cost of $500,000.

Chamberlain, S. D.—It is staten that the Chicago, Milwaukee & St. Paul R. R. Co. has decided to construct a steel railroad bridge over Missouri River at Chamberlain. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Richmond, Tex.—It is stated that a steel bridge will be constructed over Bernard River, between Ft. Bend and Wharton Counties, at a cost of about $10,000.

Walla Walla, Wash.—Specifications are on file at the office of The Engineering Record, 239 W. 39th St., New York, N. Y., for a steel bridge, with concrete floor, to be constructed across Mill Creek, on 4th St., bet. Rose and Sumach Sts., bids for which will be received by J. B. Wilson, City Engr., until Oct. 28. The bids must include all labor and material required for removal of present stone walls and for material and construction of the bridge, excav., drainage, etc.

Menomonie, Wis.—The Common Council is stated to have passed a resolution directing the Special Bridge Com., City Attorney and City Engineer to make a survey, with a view of procuring right-of-way, over Red Cedar River below the dam for the construction of a bridge.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—See "Sewerage and Sewage Disposal.

Alameda, Cal.—F. E. Browning, City Clk., writes that the citizens at a recent election voted to improve two approaches to the city, one to cost $37,000 and the other $13,000. Address A. V. Frodder, St. Supt.

Corona, Cal.—See "Public Buildings."

Redding, Cal.—It is stated that bids will be received until Nov. 7, by the Bd. of Superv. (S. M. Witherow, Clk.), for clearing and constructing a wagon road, a distance of about 2.04 miles.

San Francisco, Cal.—Flynn & Treacy, 302 Montgomery St., are stated to have secured the contract for paving a portion of East St., for $14,906.

Connecticut.—The citizens of Seymour, Avon, Ansonia, Canton, East Lyme, Old Lyme, Madison and Wallingford, West Hartford, Groton, East Granby and Berlin are stated to have voted to expend $20,000 each for highway improvements.

Jacksonville, Fla.—Mr. Barnard, County Engr., is reported to have been instructed to prepare plans and survey the road connecting Jacksonville and Atlantic-Pablo Beach.

Pensacola, Fla.—Bids will be received by the Bd. of Bond Trus. (L. Hilton Green, Chmn.) until Nov. 15 for paving about 170,700 sq. yds. clay or shale blocks, sheet asphalt, bitulithic, wood block or macadam pavement and 115,950 lin. ft. concrete curb, as advertised in The Engineering Record. Engineer, T. Chalkley Hatton, of Wilmington, Del.

Atlanta, Ga.—The County Comrs. are stated to have decided to pave Peachtree St. with bitulithic, at a cost of $30,000.

Chicago, Ill.—Bids will be received, it is stated, until Oct.. 22 by the West Park Comrs., Union Park, for macadamizing a portion of Washington Boule.

Rockville, Ind—It is stated that bids will be received until Nov. 7 by H. A. Henderson. Aud. Parke Co., at Rockville, for grading, draining, dredging and macadamizing the county line between Parke and Fountain counties.

Greencastle, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Nov. 2 for the construction of 16,340 ft. gravel road in Russell Township; also 10,566 ft. macadamized road in Monroe Township. C. C. Hurst, Co. Aud.

Ft. Wayne, Ind.—Geo. W. Lindemuth, Co. Aud., writes that the contract for constructing 6,020 ft. macadam road in Monroe Township (bids opened Oct. 12), has been awarded to Wm. Busching, of Ft. Wayne, for $4,349.

The Bd. Co. Comrs., it is reported, will receive bids until Nov. 2 for the construction of 9,563 ft. macadamized road in Madison Township. Geo. D. Lindemuth, Co. Aud.

Logansport, Ind.—It is reported that the Bd. Pub. Wks. (Chas. Ringleben, Chmn.) will receive bids until Oct. 22 for paving Huber St.

The Bd. Co. Comrs., it is reported, will receive bids until Nov. 4 for the construction of two gravel roads in Bethlehem Township, 1¾ and 2¼ miles in length, respectively, also 2 gravel roads, one in Jackson Township and the other in Clinton Township. George W. Cann, Co. Aud.

Vincennes, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Nov. 5 for the construction of 10,268 ft. gravel roads in Vincennes Township and 104,602 ft. in Decker Township. John T. Scott, Co. Aud.

Decatur, Ind—It is reported that the Bd. Co. Comrs. will receive bids until Nov. 4 for the construction of 2 macadamized roads, one in Kirklin Township and the other in Root Township. C. D. Lewton, Co. Aud.

New Albany, Ind.—The Bd. of Pub. Wks. is stated to have adopted a resolution providing for the improvement of W. Main St.

Indianapolis, Ind.—The Bd. of Pub. Wks., it is stated, will soon receive bids for improving Central and Brightwood Aves., Stilwell, Maryland, Houston and Dye Sts.

Crawfordsville, Ind.—It is stated that bids are being received for paving and constructing cement walks in Binford and Pine Sts.

Des Moines, Ia.—Bids will be received until Oct. 30 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for paving portions of W. 28th, W. 3d and W. 4th Sts. with vitrified paving blocks; also until Oct 31 for paving with asphalt W. Walnut St., about 3,288 sq. yd.

W. A. Bryant Asphalt Co. is reported to have submitted the lowest bid for paving a portion of W. 41st St. with asphalt, at $2.15 per sq. yd., or a total of about $10,000.

New Orleans, La.—Wm. Hardee, City Engr., is reported to have estimated the cost of paving portions of Howard Ave. and Lopez St., at $11,800.

Baltimore, Md.—The paving of a portion of Lakewood Ave. is reported contemplated.

Minneapolis, Minn.—The Park Bd. is stated to have decided to co-operate with the St. Paul Park Comn. in establishing a parkway or boulevard along the east bank of the river from Franklin to Marshall Aves.

St. Cloud, Minn.—B. Vorsberg, City Clk., writes that the proposed paving for which $20,000 will be expended will be done by days' work.

St. Louis, Mo.—The Bd. of Pub. Improvements on Oct. 11 is stated to have awarded contracts for paving, as follows: G. Eyermann & Bro., 1216 S. Grand Ave.—Virginia Ave., $5,441, and a portion of Broadway, $18,890. J. E. Perkinson—Carter Ave., $37,986; Bremen Ave., $21,696. Jas. T. McMahon— Angelica St., $6,215. Fruin & Colnon, Laclede Bldg.—Euclid Ave., $3,628; Michigan Ave., $87,330; Ivory Ave., $23,462. Skrainka Constr. Co., 319 N. 4th St.—Hamilton Ave., $5,774. Schneider Granite Co.—Portions of Broadway, $82,563.

St. Louis, Mo.—Bids will be received until Oct. 29 by the Bd. Pub. Improv. (A. J. O'Reilly, Pres.) for paving portions of Pine and 3d Sts. with wood blocks, and Loughborough, Idaho and Columbia Ave. with vitrified brick; constructing granitoid sidewalks on portions of 24 streets.

Kansas City, Mo.—Bids will be received until Oct. 24 by E. A. Harper, City Engr., for furnishing material and paving with asphalt portions of Grand, Anderson and Walrond Aves., constructing brick or block pavement on several alleys, constructing artificial stone sidewalks on numerous streets.

Springfield, Mo.—J. C. Likes is stated to have secured the contract for paving Boonville St. with brick, at $1.77 per sq. yd.

Red Bank, N. J.—Bids will be received until Nov. by A. C. Harrison, Clk. Bd. Comrs., for paving a portion of Front and Broad Sts. All information regarding work and materials will be furnished by Geo. D. Cooper, C. E., Red Bank.

Nutley, N. J.—See "Water."

Paulsboro, N. J.—Chas. M. Titus, of Paulsboro, is stated to have secured the contract for paving streets throughout the city for $15,000.

Jersey City, N. J.—Bids will be received until Oct. 21 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for improving Ege Ave., requiring about 2,815 sq. yds. Belgian pavt., 6,900 sq. ft. cement walks etc.

Rochester, N. Y.—See "Water"

Buffalo, N. Y.—Separate bids will be received until Oct. 22 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for paving portions of 5 streets.

New York, N. Y.—Bids will be received by Louis F. Haffen, Pres. Boro. Bronx, until Oct. 29 for regulating, grading, building approaches and placing fences in Johnson Ave. and in Spuyten Duyvil Rd. Engineer's estimate: 9,000 cu. yds. earth excav., 7,500 cu. yds. rock excav., 25,000 cu. yds. filling, 4,650 cu. yds. dry rubble masonry in retaining walls, culverts and gutter, etc.

Brooklyn, N. Y.—Bids will be received until Oct. 30 by Bird S. Coler, Boro. Pres., for regulating, grading and paving with asphalt on a concrete foundation of Mansfield Pl., Christopher Ave., E. 29th, E. 32d, 93d, 73d and Roebling Sts. Engineer's estimate: 32,165 sq. yds. asphalt pavt., 4,480 cu. yds. concrete, 4,970 cu. yds. earth excav., 8,457 lin. ft. curb, 82,840 sq. ft. cement sidewalk, etc.

New York, N. Y.—The New York Central Co. have filed plans for a private driveway for its general offices and post office section of the new Grand Central terminal now building on Lexington Ave., 44th to 45th Sts. It is to face on Depew Pl., and it will be 220 ft. wide and 58 ft. deep. It will be built of steel and stone and cost $30,000.

New Brighton, S. I., N. Y.—The following are the bids opened on Oct. 8 at the office of Geo. Cromwell, Boro. Pres., for furnishing material and regulating, grading and paving with macadam Wooley Ave. from Indiana Ave. to Watchogue Road: (*a*) Jacob E. Conklin, 299 Bway., N. Y. City, $49,561 (awarded contract); (*b*) Quinroy Constr. Co., Port Richmond, $51,270; (*c*) Jos. Johnson's Sons, West New Brighton, $54,103.

	*a	b	c
2,000 cu. yds. excav.	$0.60	$0.70	$0.70
10 cu. yds. reinforced concrete	10.00	18.00	20.00
500 lin. ft. 4-in. under drain	.25	.50	.40
60 lin. ft. 12-in. culvert pipe	1.00	1.00	1.00
20,300 sq. yds. macadam	1.00	1.39	1.35
5,750 sq. yds. vitr. brick with sand cushion, including 4½-in. concrete foundation, 1-3-6	3.00	2.45	2.75
60 cu. yds. concrete, Class B	7.00	6.00	6.00
50 cu. yds. concrete, Class A	7.00	7.50	8.00
10,100 lin. ft. cement curb	.80	.45	.65
460 lin. ft. 16-in. bluestone curb	1.25	1.10	1.00
100 lin. ft. old curb reset	.25	.40	.25
4,800 sq. ft. cement sidewalk	.22	.26	.25
2 vault covers and frames	10.00	1.00	8.00

Ithaca, N. Y.—Bailey, Johnson & Saunders, 121 S. Tioga St., Ithaca, will sublet and furnish plant for macadam road work, as advertised in The Engineering Record.

Concord, N. C.—Bids will be received by the Comrs. of Cabarrus County until Oct. 24 for grading and macadamizing about 10 miles of public road from Concord to Kannapolis, also 1 mile on the Concord and Charlotte Road, as advertised in The Engineering Record. Engineer, Quint E. Smith, of Concord.

Lakewood, O.—See "Sewerage and Sewage Disposal."

Kent O.—It is stated that bids are wanted until Oct. 21 for $15,000 street improvement bonds. T. A. McMahon, Village Clk.

Shiloh, O.—It is stated that bids are wanted until Oct. 25 for $5,400 bonds for paving Main St. P. T. Barnes, Village Clk.

*Items morked thus give the names of porties awarded contracts.

*Zanesville, O.—P. J. Kirwin, Secy. Bd. Pub .Service, writes that Petit & Abele, of Zanesville, on Oct. 14 secured the contract for paving State St., about 9,000 sq. yds.

Cincinnati, O.—It is stated that bids will be received until Nov. 1 by Bd. Co. Comrs. (Fred Dreihs, Clk.) for improving Hamilton Pike, from the north corporation line of Mt. Healthy to the Butler County line, Springfield Twp.

Cleveland, O.—Bids will be received until Oct. 24 by the Bd. Pub. Service (A. R. Callow, Secy.) for grading and otherwise improving a portion of West Boulevard.

Oklahoma City, Okla.—The City Council is stated to have passed a resolution providing for the paving of 6th St.

Scranton, Pa.—Bids will be received until Oct. 22 by C. R. Acker, Dir. Pub. Wks., for paving Dix Court, Irving Ave. and Alder St.

Philadelphia, Pa.—Local press reports states that the Dept. of Pub. Wks. on Oct. 10 awarded contracts as follows: Filbert Paving & Constr. Co., asphalt paving, at from $1.72 to $2.07 per sq. yd., or a total of $500,000; Barber Asphalt Paving Co., Land Title Bldg., paving with asphalt, Orkney St. and Park Ave., at $2.05 per sq. yd.; Cunningham-Murray, 15th and Chestnut Sts., and the Mack Paving Co., contract for paving with brick 10 miles of streets, the former bid $1.95 per sq. yd. and the latter $1.92 to $2.06 per sq. yd., and D. J. McNichol, 704 Betz Bldg., the contract for repairs to streets occupied by railways, for $50,000. There are about 15 miles of asphalt paving to be laid.

Salt Lake City, Utah.—Bids will be received at the office of the Bd. of Pub. Wks. (F. J. Leonard, Chmn.) until Dec. 6 for grading, curbing and paving First South St., to include 60,000 cu. yds. grading, 17,000 lin. ft. curb and 41,000 sq. yds. asphalt, as advertised in The Engineering Record. Louis C. Kelsey, City Engr.

Manassas, Va.—See "Power Plants, Gas and Electricity."

Toppenish, Wash.—See "Public Buildings."

*Bellingham, Wash.—Chas. Lind, of Bellingham, is reported to have secured the contract for graveling a portion of Ellis St., for $3,840.

Seattle, Wash.—Bids were opened on Oct. 5 by be Bd. of Pub. Wks. for the following street improvements:

Improving Westlake Ave., Denny Way to Mercer St.: H. W. Hawley, 2602 Western Ave., $11,407. Holt & Jeffery, 313 3d Ave., N., $10,352; Rydstrome & Goerig, 1802 16th Ave., $11,280, and L. H. Goerig, 312 25th Ave., $10,984.

Concrete walks, (*a*) Irving Pl., (*b*) 6th Ave., N. W.: E. H. Rawle & Co., 400 Arcade Annex, *a* $5,976; Smith & Hall, Downs' Block, *a* $6,163, *b* $10,806; Andrew Peterson, 410 Washington Bldg., *b* $11,212.

Grading Fuhrman Ave.: S. Normile, 608 Kinnear Pl., $54,161, and International Contract Co., 738 New York Blk., $41,465.

Paving Union St.: H. F. John & Co., 571 Colman Blk., $25,405; Sparger Concrete Co., 562 Colman Blk., $25,451; Barber Asphalt Paving Co., 619 Bailey Bldg., $24,964, and Stirrat & Goetz, Pioneer Blk., $24,643.

The City Engineer is stated to have prepared plans for a municipal asphalt plant, to cost about $60,000.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Jackson, Ala.—The Jackson Light & Power Co. is reported formed, with a capital of $20,000, to construct an electric railway to Grove Hill, a distance of 16 miles, construct electric lighting system, and water works. It is proposed to construct a dam across a creek near Jackson. Incorporators: C. H. Warren, C. E. Mathis, W. F. Monk and others.

Citronelle, Ala.—The Citronelle Light & Power Co. (S. E. Shannon, Secy., Hattiesburg, Miss.) is reported to be having plans prepared by E. N. Cunningham, of New Orleans, La., for a light and power plant.

Sulphur Springs, Ark.—Smith & Powers, of Sulphur Springs, are preparing plans for electric light plant and water works combined, to cost about $25,000.

Earl, Ark.—The Earl Light & Power Co. is reported organized, with a capital of $10,000. Directors, L. J. Machen, W. E. Duffus, C. C. Bird and others.

Eureka Springs, Ark.—A company, of which Geo. Sengal is Pres. and Treas., and L. P. Tilles, of Ft. Smith, Secy., is reported to have purchased the plant and property of the Citizens' Electric Light Co. and will make extensive improvements.

Alameda, Cal.—F. E. Browning, City Clk., writes that it is proposed to erect a fireproof building for the municipal electric light plant and install some new machinery.

Pasadena, Cal.—Heman Dyer, City Clk., writes that there is talk of calling an election to vote on issuing bonds for an addition to the electric light plant. Chas. C. Glass is Mgr. municipal electric light plant.

Fresno, Cal.—It is stated that bids will be received at the office of the Treas. Dept., Washington, D. C., until Oct. 30, for furnishing light fixtures for public buildings at Fresno, under the control of Treas. Dept.

Santa Rosa, Cal.—The Snow Mountain Water & Power Co. is reported to have petitioned the Bd. of Superv. for 25 additional lines through Sonoma County, to be feeders from the main wires. Among the places to be touched by these wires will be Sebastopol, by way of Forestville; Trenton, Fulton, tne Todd district, Guerneville and all the country adjacent thereto; Sonoma, Windsor, Occidental, Molino, Duncan's Mills, Bodega Corners, Bloomfield, Valley Ford, Two Rocks, Penngrove, Danman's Station, Tomales, Marin County and other places.

Julesburg, Colo.—The Julesburg Heating Co., it is stated, has been granted a franchise to establish a municipal heating plant.

Eaton, Colo.—W. A. and Roscoe Farr and others are reported to have incorporated the Eaton Electrical Co., with a capital of $25,000, for the purpose of furnishing heat, light and power to Eaton.

New London, Conn.—The following are the bids opened on Sept. 30 by Maj. Harry Taylor, Corps Engrs., U. S. A., for furnishing 65 or more 25 k. w. electric generating sets (price given per set): The Otto Gas Engine Wks., Philadelphia, Pa., $3,400; Aug. Mietz, New York, N. Y., $3,600; N. Y. Safety Steam Power Co., New York, N. Y., $3,618.50; General Electric Co., Schenectady, N. Y., $3,085, and same company, $2,700 (alternative proposal).

*Essex, Conn.—The Essex Light & Power Co. is reported to have secured the contract to light the streets from the Essex steamboat dock to Ivoryton, for 3 years, with 47 lights, at $1,259 per year.

Washington, D. C.—The following are the totals of bids opened on Sept. 25 at the office of the Supt. U. S. Capitol Bldg. and Grounds for temporary electric lighting fixtures for the Office Building, House of Representatives, Washington: Cassidy & Son Mfg. Co., 133-135 W. 23d St., New York, N. Y., $12,877 (time of completion, Nov. 20, 1907). Horn & Brannen Mfg. Co., 427 No. Broad St., Philadelphia, Pa., $16,443 (Jan. 1, 1908); L. Plaut & Co., 432 East 23d St., New York, N. Y., $17,981 (Nov. 25, 1907); Mitchell Vance Co., 503-511 W. 24th St., New York, N. Y., $18,602 (Nov. 25, 1907); C. A. Muddiman & Co., 616 12th St., N. W., Washington, D. C., $19,432 (Nov. 23, 1907); Lawrence Gas Fixture Mfg. Co., Philadelphia, $20,500 (Nov. 25, 1907), and J. B. McCoy & Son, 114-120 W. 30th St., New York, N. Y., $25,149 (Nov. 25, 1907).

The plans of Secy. Wilson, of the Dept. of Agriculture, for an underground conduit between the Bureau of Engraving and Printing Bldg. and the new buildings of the Dept. of Agriculture, in order to furnish power for the electric illumination and heating of the latter buildings, is reported to have been approved by the District Comrs.

Madison, Ga.—The citizens are reported to have voted Oct. 7 to issue $50,000 bonds for water works, sewers and for improving the electric light plant.

Chicago, Ill.—The Chicago Heat, Power & Refrigeration Co. is reported incorporated, with a capital of $10,000, to distribute steam heat, electricity, and refrigerating fluid to office buildings, factories, and residences through a vast system of underground conduits radiating from a central plant to be built probably on the south branch of the river. Incorporators: Fred W. Blocki, Wm. F. Brennan, Jere. P. Bartholow and others.

Evansville, Ind.—It is reported that bids will be received until Oct. 28 by the Bd. Co. Comrs. for wiring the new County Infirmary building. Harry Stinson, Co. Aud.

Centerville, Ind.—The City Council, according to reports, contemplates establishing a lighting plant.

Farmersburg, Ind.—The Farr Electric Co. is reported incorporated, with a capital of $20,000, to construct and equip a new plant to generate electricity for light, heat and power purposes. Directors, W. F. Baldridge, E. W. Jennings and others.

Ft. Des Moines, Ia.—Bids will be received until Nov. 1 by Capt. John J. Boniface, Const. Y. M., U. S. A., for furnishing and installing electric light fixures, watt meters board and making service connections in the veterinary stable at Ft. Des Moines.

Conowingo, Md.—Jas. H. Harlow, Pres. Conowingo Bridge Co., is reported interested in the construction of a dam at Conowingo, near Havre de Grace, to develop about 100,000 h.p.

Baltimore, Md.—Bids will be received until Oct. 23 by the Bd. Awards, care J. Sewell Thomas, City Register, for furnishing, installing, equipping, maintaining and operating gasoline or naphtha street or outdoor lamps, with the use of incandescent mantle fixtures.

Bay City, Mich.—Bids will be received until Oct. 30 by the City Comptroller, for furnishing a steam turbine, generator, exciter, switchboard, boilers, Scotch type, and lamps, to re-establish the city's electric plant, as advertised in The Engineering Record.

Berrien Springs, Mich.—Contracts will probably soon be let for an electric light plant, consisting of 25 street lights, 5 miles of wire, etc. A. B. Ayers, Pres. Bd. Trus.; A. J. Hammond, Consulting Engr., South Bend, Ind.

Painesdale, Mich.—Engineer W. A. Rankin, of Painesdale, writes that no contracts will be let until spring for the proposed power plant to be constructed about 5 miles from Painesdale.

*Minneapolis, Minn.—Richd. Tattersfield, Secy. Bd. of Charities & Correction, writes that the contract for installing electric wiring for city workhouse (bids opened Sept. 21) has been awarded to the Northern Eng. Co., of Minneapolis.

The Com. on Gas on Oct. 9 recommended that bids be invited for gas, electric and incandescent street lighting and also for supplying the city with 7,000 or more lamp heads with the incandescent attachments.

Plattsmouth, Neb.—Earl G. Westcott is reported to have been granted a franchise for an electric light plant.

*The Omaha Electric Light & Power Co.. of Omaha, is reported to have secured the contract for lighting the city of Plattsmouth.

St. Paul, Neb.—The question of issuing $10,000 bonds for a nelectric light plant is reported under consideration.

*Paulsboro, N. J.—Frank D. Moses, of Trenton, is reported to have secured the contract for building municipal gas plant, for $28,000.

Clifton Springs, N. Y.—F. S. Burgett, of Clifton Springs, writes, with regard to the development of water power and for the lighting of the streets of this and nearby villages, that bids for teh work will be received nearby villages, that bids for the work will be received be presented to the Village Bd. for consideration.

Brooklyn, N. Y.—Bids will be received by C. B. J. Snyder, the Supt. School Bldgs, New York City, until Oct. 28 for installing electric equipment in new School 5, Boro. Brooklyn.

Wolcott, N. Y.—O. M. Curtis, proprietor of the Wolcott electric light plant, is reported to be considering the construction of a dam across Wolcott Creek.

Long Island City, L. I., N. Y.—The Bd. of Estimate of New York City on Oct. 11 revoked the franchise recently granted to the Queens Lighting Co. for supplying gas to the Boro. of Queens.

Ellis Island, N. Y. H., N. Y.—Bids will be received by Robt. Watchorn, Comr. Immigration, Ellis Island, N. Y. H., until Oct. 28, for furnishing material and installing electric conduits and wiring in new dormitories, 1st and 2d cabin rooms and balcony, 3d floor main building at the U. S. Immigration Station, Ellis Island, N. Y. H.

Cincinnati, O.—Bids will be received until Nov. 14 by the Bd. Trus. Memorial Assn. of Hamilton Co. (Elias R. Montfort, Pres.), at the office of Saml. Hannaford & Sons, archts., for furnishing material and installing light fixtures for the Soldiers' and Sailors' Memorial Bldg., at Grant and Elm Sts.

Eugene, Ore.—The Pacific Light & Power Co., of Junction City, is reported to be considering the construction of a power plant at Triangle Lake, about 30 miles west of Eugene, and will extend the wires to Eugene, Corvallis and Junction City.

Pierre, S. D.—See "Schools."

Aberdeen, S. D.—The Wagner, Lake Andes & Armour Traction Co. is reported to have petitioned the City Council for a franchise for an electric light and power plant; cost of proposed plant will be about $150,000 and will be capable of furnishing an all-night service to business houses and residences.

Beaumont, Tex.—It is reported that the directors of the Beaumont Ice, Light & Refrigerator Co. have decided to increase the capital stock for the purpose of enlarging its plant.

Manassos, Va.—We are informeed that all bids opened by O. E. Newman, Chmn. Improv. Com. of Council, on Sept. 28 for furnishing material and installing a water work and electric light plant and macadamizing the streets in said town have been rejected, on account of town being unable to sell bonds. A new election will be held, and after bonds are sold new bids will be received. Pressey & Weller, Engrs., 1416 F St., N. W., Washington, D. C.

Waterloo, Wis.—The citizens are reported to have decided to issue $10,000 bonds for the purchase of the present electric light plant, and for its further construction.

Ashland, Wis.—The City Council on Oct. 11 voted to accept the proposition of the Chippewa Valley Constr. Co. to transmit power from Copper Falls, the city to lease the power plant for 3 years, with the option of purchase at that time. A. E. Appleyard, of Boston, Mass., is president of the company, and promises to bring 6,000 h. p. from Copper Falls, 18 miles south of Ashland, by next June.

Eau Claire, Wis.—The Northwestern Lumber Co. is reported to have decided to build a high dam on Eau Claire River for developing power for manufacturing purposes.

Olds, Alta.—The Bd. of Trade is reported interested in the development of power at Little Red Deer, a distance of 13 miles from city. Address S. Craig, of Olds.

Kelowna, B. C.—The citizens are reported to have voted to issue $40,000 bonds for improvements to water work and electric light plant.

Portage la Prairie, Man.—The directors of the Central Electric Light Co. are reported to have decided to expend $35,000 in enlarging its power plant.

Carnduff, Sask.—The Minneapolis Street & Town Lighting Co., of Minneapolis, Minn., is reported to have petitioned for a franchise to light town by electricity.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Jackson, Ala.—See "Power Plants, Gas and Electricity."

Decatur, Ala.—It is stated that the North Alabama Traction Co. will spend $10,000 or more on the extension and improvement of its street car system in Decatur. On some of the streets they are putting down a heavier rail. The company is also building an extension of a ½ mile to its line.

San Francisco, Cal.—Plans are stated to have been completed by the Southern Pacific Co for an extension to its local system, consisting of an electric train line to Hayward. The local line will be extended from Melrose north along a private right-of-way paralleling the foothill boulevard as far as Hayward. The line will be double-tracked.

Sacramento, Cal.—The Northern Electric Ry. Co., with a capital of $25,000,000, is stated to have filed articles of incorporation. The new organization has been formed to acquire the Northern Electric Co., the line of which runs from Chico to Sacramento, and the Shasta Southern, which runs between Chico and Hamilton, besides constructing new roads to the northern part of the State. It is proposed to build a road from Chico to Redding, a distance of 76 miles; from Sacramento to Folsom, 20 miles; from Sacramento Hamilton via Woodland, with a branch to Colusa, 103 miles. from Sacramento to Yuba City, 28 miles. Directors, Alan W. Maginnis, Curtis Hillyer, Francis C. Van Deinse, and others.

San Diego, Cal.—The City Council is reported to have adopted an ordinance granting a franchise to the Point Lorna Electric Ry. Co. to construct and operate lines on certain streets in San Diego.

Fitzgerald, Ga.—C. A. Holtzendorf and associates are stated to have been granted a franchise to equip and operate an electric street railway on certain streets of Fitzgerald

Lyons, Ill.—The Western Illinois Electric Traction Co.. is reported incorporated to build an electric railway from Lyons through the counties of Cook, Dupage and Kane to Aurora Capital, $100,000. Incorporators: M. M. Miller, E. J. Schmidt, L. Grollman, L. Michael, Wm. M. Klein.

Bunker Hill, Ill.—J. T. W. Rudisill is reported to have announced that the Wood River, East Alton & Bunker Hill Traction Co., East St. Louis, Ill., proposes to build an electric railway from Wood River through East Alton, Bethalto, Moro and Bunker Hill, 20 miles. Surveys are partly secured. Contracts will be let when right-of-way is secured. The Rude Engineering Co., First Natl. Bank Bldg., East St. Louis, is in charge of the engineering work.

*Items marked thus give the names of parties awarded contracts.

Indianapolis, Ind.—The Grand Central Traction Co., which is preparing to construct an electric line from Indianapolis to Evansville, is reported to have applied to the Bd of Pub. Wks. for two franchises. The first for a private right of way to enter the city from the southeast along the J. M. & I. tracks to Iowa St. The other to enter the city over the local tracks to the traction terminal station in the same manner other traction lines are now operating in the city.

Lafayette, Ind.—The Commissioners are stated to have granted a franchise to the Chicago & Western Indiana Traction Co. to construct and operate an inerurban railroad through Fairfield, Wea and Randolph Townships, in Tippecanoe County

Owingsville, Ky.—The Kaufman-Shaw Constr. Co., of Dayton, O., is stated to have in contemplation the construction of an electric railway from Salt Lick by way of Owingsville and Sharpsburg to Carlisle, Ky., 34 miles.

Alexandria, La.—The Kent Co., Ltd., is stated to have filed its charter with a capital of $100,000. The company proposes to operate electric and other street railways. A. Albert, Pres.; Benj. Weil, Secy.

Negaunee, Mich.—The Lake Superior & Ishpeming Ry. Co. will extend its tracks across the city on the north side, a distince of 2 miles, and to include 1 mile of trestle. The depot will be moved from present site on South side to the North side of city, a distance of 1½ miles. Bids for this work will be received by R. Young, ch. engr., Marquette, Mich.

Joplin, Mo.—It is reported that the Joplin & Pittsburg St. Ry. Co. will soon award contracts for machinery in connection with its proposed electric railway between Joplin and Pittsburg, Mo., a distance of about 24 miles. It is planned to erect a car barn at Joplin and two substations.

Mt. Vernon, N. Y.—The Mt. Vernon & Eastern R. R. Co. is reported formed to construct a standard gage steam or electric railroad from Mt. Vernon to Lewisboro, 35 miles long. Capital, $1,000,000. The Directors: Oakleigh Thorne, Chas. E. Mitchell, of New York; Marsden J. Perry, of Providence, R. I.; Geo. H. Hamsel, of Cranford, N. J., and others.

Cincinnati, O.—The survey of the proposed route of the Cincinnati. Reading & Middletown St. Ry. Co., which will operate 35 miles of traction line from Middletown and Franklin to Bond Hill and Norwood, is stated to have been completed. It is estimated that the road can be built at an expenditure of $25,000 per mile, or a total of $875,000.. Directors: Guy W. Mallon and Jos. Meyer, Cincinnati; Frank Koehler, Reading; R. M. Billingslea, Bethany, and others

Oklahoma City, Okla.—The Oklahoma City Electric Terminal Co. is reported to have been granted a charter. Capital, $2,500,000. Guy V. McClure, Chas. Combs, Warren E. Moore, J. J. Johnson and Fred. S. Combs are reported interested. According to the present plans two divisions of the system will give twelve miles' service. The proposed route begins at a point two miles east of the city and entering the city near the junction of the railroad tracks of the Frisco and Choctaw division of the Missouri, Kansas & Texas, and passing through to the west side will stop near where Main St. crosses the North Canadian River. The other line will start at a point near the south line of Capitol Hill and will pass through to the northwest portion of the city.

Memphis, Tenn.—The County Court is stated to have granted to the Clarksdale, Covington & Collierville Interurban Co. a franchise over roads, pikes and private property of Shelby County.

Ft. Worth, Tex.—Suderman & Dolson, of Houston, is stated to have secured the contract for the grading of the Fort. Worth, Weatherford & Mineral Waters Interurban Line. The cost will be about $1,750,000.

Salt Lake City, Utah.—The City Council is stated to have granted a franchise to the Utah Light & R. R. Co. for additional trackage from the intersection of Twelfth West St. to Fourth North St., giving a double track or single track from that point to Jordan River.

Wellsburg, W. Va.—The Bethany Trolley Syndicate, of Wellsburg, is reported chartered, with a capital of $10,000. Incorporators: J. L. D. Queen, R. M. Addleman, H. O. Moon and others, all of Wheeling. The purpose of the concern is to construct an electric railway from Wellsburg to Bethany and to maintain a power and water works plant.

Racine, Wis.—The Milwaukee Electric Railway & Light Co. is stated to have applied for a franchise to build a car line on 2d St., east of Main St., so that the plant of the Racine Gas Light Co. can be reached with freight.

RAILROADS.

Notes Arranged Alphabetically by States.

Kansas City, Kan.—The Gulf Short Line Ry. Co. is reported incorporated, with a capital of $36,000,000, to build a railroad from Kansas City, Kan., to Port Lavaca, Tex., estimated length, 1,500 miles, including branches. The road is to run through Wyandotte, Johnson, Miami, Douglass, Franklin, Osage, Coffey, Lyon, Chase, Marion, McPherson, Reno, Sedgwick, Cowley, Harvey, Butler, Greenwood Elk and Chautauqua Counties in Kansas; Osage, Kay, Noble, Logan, Payne, Lincoln, Oklahoma, Tulsa, Okfusee, Okmulgee, Huges, Pittsburg, Coal, Atoka, Bryan, Choctaw and Pushmataha Counties in Okla., and through the State of Texas Incorporators: J. P. Byrne and Louis E. Potts, of Oklahoma City, Okla.; Fred A. Jeran, La Junta, Col.; Charles F. Bridge and Jos. Ragsdale, Topeka, Kan. Offices to be at Kansas City, Kan., and Oklahoma City, Okla.

Kansas City, Mo.—The Special Com. appointed by City Council on the union depot ordinance is reported to have recommended the adoption of the ordinance which embraces the following conditions: A franchise for 6 tracks on the Belt line, 4 tracks on the North Side from the eastern city limits to Bway., and a right-of-way along the West Bluffs to 25th and Belt line to be granted the Kansas City Terminal Ry. for a period of 200 years; the said company to build and maintain a union station to cost not less than $2,000,000 within 3 years from date of granting franchise; and is required in addition to build and maintain 10 subways and 33 viaducts across the Belt line, and build and maintain freight depots at Sheffield, 15th and Askew Sts., and north of Grand Ave. near Heim's brewery; to dedicate to city, ground for a park fronting proposed new union station bet. Main St. and Bway. and 23d and 24th Sts., and 50-ft. strips of ground for roadways at certain points to connect streets vacated across the tracks. The city guarantees not to extend or open any new streets or roadways across grades and tracks specified. It also grants the Terminal Co. right to change grade of any present tracks not to exceed 3 feet.

Wilkesborre, Pa.—The Special Committe of Engineers representing the four railroads interested, at a meeting at New York, N. Y., on Oct. 4, is reported to have approved plans for the elimination of grade crossings in Wilkesbarre. E. B. Morgan, Chmn. Grade Crossing Comn.

**Coatesville, Pa.*—Willauer & Co., of Pottstown, are reported to have secured a contract from the Philadelphia & Reading Ry. Co. for the grading and masonry work for the change in alignment of about ½ mile on its Wilmington & Northern Division at Coatesville and G. F. Shoemaker & Co. for the bridge to be 4 spans and 250 ft. long.
Bldg., is the archt.

Abilene, Tex.—Edw. S. Hughes and Henry Sayles, of Abilene, are reported interested in the construction of a railroad from Temple via Gatesville, Hamilton and Comanche to Abilene, a distance of about 150 miles.

Surveys are being made for a railroad from Abilene, Tex., south to Ballinger, a distance of about 40 miles. Connection will be made with the Texas & Pacific R. R. and the Colorado Southern R. R. at Abilene, and with the Santa Fe at Ballinger. J. W. McDaniels, of Abilene, is Ch. Engr.

Roscoe, Tex.—The Roscoe, Snyder & Pacific Ry., chartered to construct a railroad from Roscoe (a station on Texas & Pacific Ry.) to Snyder, 50 miles, has its entire line graded and 5 miles of track laid. Work, which has been suspended, is to be resumed and the road completed. Martin Duval, Ch. Engr., Roscoe, Tex. Edw. S. Hughes, Abilene, Tex., is interested in the new organization.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Selma, Ala.*—The contract to erect the Carnegie Library, it is reported, has been awarded to Ernest Laramar, of Selma, at about $18,000.

Barber, Cal.—A. J. Bryan is stated to have prepared plans for the hospital which is to be erected near Barber by the Sisters of the Roman Catholic Church at a cost of about $30,000.

San Francisco, Cal.—The erection of a pest house on the Bay View site, it is stated, has been recommended by the Bd. of Superv. to the Bd. Pub. Wks. Probable cost, $20,000.

Corona, Cal.—The Bd. of Trade and City Trustees, it is reported, have decided to issue $78,000 bonds of which $50,000 is for street improvements, $20,000 for a city hall, $5,000 for an outfall sewer and $3,000 for a steam roller for street work.

San Francisco, Cal.—Rankin, Kellog & Crane, of Philadelphia, Pa., are reported to be preparing plans for a group of reinforced concrete buildings to be erected in San Francisco for the Transport Service of the Army Dept. The buildings to be erected are six 3-story storehouses, 60x200 ft. ea., a 3-story and basement office building, 50x150 ft.; a number of houses for officers, and a system of docks. The cost will be $1,250,000.

Berkeley, Cal.—J. V. Mendenhall, City Clk., writes that final plans have not yet been adopted for the erection of a town hall.

Los Angeles, Cal.—A. H. Puttcamp, Severance Bldg., is reported to have been engaged to prepare plans for a 3-story brick and concrete hospital, to be erected for the West End Hospital Assoc., at 1437 W. 25th St., at a cost of about $18,000.

San Jose, Cal.—The Bd. of Police & Fire Comrs., it is stated, has approved the plans of Wolfe & McKenzie, 63 W. Santa Clara St., for the Market St. fire house, which is to be 2 stories high, of reinforced concrete, 80x60 ft., and to cost about $27,000, also plans for the Third St. fire house, which were prepared by Wm.*Binder. Auzerais Bldg., and provide for a 2-story building of reinforced concrete and steel frame, 45x40 ft., and cost about $16,000. Bids for the construction, it is stated, will be asked soon.

The Bd. of Police & Fire Comrs., it is stated, is to ask competitive plans on 2 other fire houses which it is proposed erecting.

**Takoma (Washington), D. C.*—The contract for erecting double set hospital corps sergeants' quarters (bids opened Sept. 23) by Maj. J. T. Crabbs, Q. M., U. S. A., has been awarded to S. H. Maddox & Co., Washington, for construction plumbing and gasfitting at $12,343, and to Elmer E. Lowell, Portland, Me., for electric wiring and fixtures for $564.

Pensacola, Fla.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Nov. 11 for plumbing and sewerage at Santa Rosa Quarantine Station, Pensacola.

**Quincy, Ill.*—V. Jobst & Sons, of Peoria, according to reports, have secured the contract to erect 2 cottages at the Soldiers' & Sailors' Home, at $103,600.

**West Liberty Ia.*—W. J. McAlpine, of Dixon, Ill., is reported to have secured the contract to erect a court house estimated to cost $25,000.

Leesville La.—Bids will be received until Nov. 4 by the Police Jury (C. K. Oakes, Clk.), for erecting a county building. Bids to be stated separately on construction, electric wiring, heating and plumbing. C. H. Page, Jr., & Bro., archts., Austin, Tex.

New Orleans, La.—It is reported that City Engr. Hardee has completed alterations to the plans for the City Hall annex, and bids for the construction will soon be asked by the City Compt.

Bids will be received at the Bureau of Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., until Nov. 2 for constructing a dispensary building and accessories for the naval station, New Orleans; appropriation, $8,500.

Bids will be received until Nov. 5 by Col. F. L. Denny, Q. M., U. S. Marine Corps, Washington, D. C., for the construction at Naval Station, New Orleans, La., of Marine barracks and officers' quarters. De Buys, Churchill & La Bouisse, Archts., 817 Hibernia Bank Bldg., New Orleans.

The following are the bids opened on Oct. 5, at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a central heating plant at the Naval Station, New Orleans, La. (Specification No. 1562): (*a*) For work complete in accordance with plans and specification. (*b*) For work complete omitting steam-driven pump with accessories. (*c*) For the complete work in accordance with specification, with modification. Jos. A. Hurley, 392 Selby Ave., St. Paul, *a*, $23,656. C. C. Hartwell Co., Ltd., 213 Barine St., New Orleans, La, *a*, $24,764; *b*, $24,155; *c*, (two bids), $20,847 and $19,900 (conditional). C. L. de Muralt, 114 Liberty St., New York, N. Y. (three bids), $19,770, $18,920 and $18,955. A. M. Lockett Co., Ltd., 533 Barone St., New Orleans, La., *a*, $17,700; *b*, $17,200.

**Baltimore, Md.*—Chas. L. Stockhausen, Gay and Water Sts., is stated to have secured the contract to erect at Monument St. and Bway., the Saml. Leon Frank Memorial Hospital, which is to consist of a 4-story administration building, a ward building, a laundry building and a boler house, to be of granite, brick and terra cotta, and to cost, complete, about $150,000. Louis Levi, American

Boston, Mass.—Bids will be received until Oct. 28 by the Park Comrs. (Chas. E. Stratton, Chmn.), for erecting a brick sanitary and locker building on Franklin Field.

Rochester, Minn.—It is stated that bids will be received until Oct. 26 by the State Bd. Control, St. Paul, for the erection, electric work, plumbing and heating of Ward C at State Hospital, Rochester. Clarence H. Johnston, archt., 712 Manhattan Bldg., St. Paul.

St. Peter, Minn.—It is stated that bids will be received until Oct. 26 by the State Bd. Control, St. Paul, for the erection, plumbing and heating of a tuberculosis hospital at the State Hospital, St. Peter. Clarence H. Johnston, archt., 712 Manhattan Bldg., St. Paul.

**St. Paul, Minn.*—Fred H. Bartels, 647 Blair St., has secured the contract to erect 2-story brick building for a laundry at the German Catholic Orphan Asylum, for $13,500.

Springfield, Mo.—The City Council is stated to have appointed a committee to select a site on which it is proposed erecting a municipal building.

Kansas City, Mo.—Bids will be received until Oct. 26 by the Bd. Pub. Wks. (Everett Elliott, Secy.) for work at the General Hospital, 24th and ocust Sts., to include floors, mill work, concrete floors, excavation and brick work. Root & Siemens, Archts., 701 Postal Bldg.

**Ft. Omaha, Neb.*—Contracts for erecting buildings at this post have been awarded, according to reports, as follows: J. H. Wiese, of South Omaha, balloon house at $35,753; Koenig, Collins & Co., of Omaha, hydrogen gas house, $7,500; Peter Soderberg, Omaha, wireless telegraph station, $2,750.

Wildwood, N. J.—Calvin W. Rogers, of Philadelphia, Pa., it is reported, submitted the lowest bid on Oct. 10 for erecting the Town Hall, at $29,950. Appropriation, $20,000.

Newark, N. J.—The Pub. Bldg. Com. of the Bd. of Freeholders, it is stated, has approved the general suggestions of Percy B. Taylor, 122 Market St., for the alterations to be made to the heating plant in the Overbrook Hospital buildings and has decided to construct a system of tunnels as recommended by the Engr., connecting the hospital buildings for the purpose of conveying heat to the structures from the central plant. The alterations will add $40,000 to the cost of the hospital.

**Castleton, S. I., N. Y.*—The following are the bids opened on Oct 14 by Robt. W. Hebberd, Comr. Charities, N. Y. City, for furnishing material and excavation, masonry, steel and iron, roofing and metal work, carpentry, glazing, painting, hardware, electric work and all other work (except plumbing, heating, elevator work, electric wiring and fitting up of the diet kitchens, drug rooms and utility rooms), for the construction and completion of six ward buildings of the Sea View Hospital on Manor Rd., Township of Castleton, Boro. of Richmond (bidders all of Manhattan Boro): Thos. Cockerill & Son, 147 Columbus Ave., $1,064,000; O'Connell & Hannan, 103 E. 125th St., $984,000; Dan. J. Ryan, 723 3d Ave. $932,000; L. A. Burke Sons Co., 25 W. 42d St., $873,000 (awarded contract); P. J. Carlin Constr. Co., 1 Madison Ave., $892,425, and Thos. E. Leahy Bldg. Co., 1 E. 42d St., $964,743.

Albany, N. Y.—It is reported that an appropriation of $35,000 has been made to make improvements to the ventilating system in the assembly chamber at the Capitol.

Brooklyn, N. Y.—Bids will be received by the Dept. Pub. Charities (Robt. W. Hebberd, Chmn.), Boro Manhattan, until Oct. 24 for furnishing material required for the complete remodeling of the present annex building, situated on the grounds of the Kings Co. Hospital, Clarkson St., near Albany Ave., Boro. Brooklyn; or for the complete remodeling of the present annex building, and for the erection and entire completion of 2 additions to said building.

New York, N. Y.—The following are the bids opened on Oct. 7 by the Armory Board at the office of the Mayor, for (*a*) furnishing material and building an armory for the Second Battery, N. G., N. Y. (exclusive of excavating), at Franklin Ave. and E. 166th St., Boro of Bronx; (*b*) excavating site for same: Guidone & Garlardi, 1 Madison Ave., *a* $398,500, *b* $37,000; Thos. Cockerill & Son., 147 Columbus Ave., *a* $442,500; W. Werner, 892½ Forest Ave., *a* $448,400; Fleischman Realty & Constr. Co., 170 Bwdy., *a* $444,000; Geo. Hildebrand, 38 Park Row, *a* $473,000; L. A. Burke Sons Co., 25 W. 42d St., *a* $460,000; R. E. Heningham, 1 Madison Ave., $414,892, *b* $30,670; P. Gallagher, 1189 Bway., *a* $427,542; Kelly & Kelley, 45 E. 42d St., *a* $465,147, *b* $59,656; John H. Parker Co., 225 4th Ave., *a* $407,985, *b* $61,143; Hearn Constr. Co., *a* $540,000, *b* $30,000; Cunningham & Kearns, 432 E. 91st St., *b* $24,450; Patrick Reddy, *b* $28,000; Thos. Crimmins Contr. Co., 444 E. 69th St., *b* $29,305; P. D. Kane, 933 E. 150th St., *b* $24,926; Frank Del Balso, 1471 Ave. A., *b* $28,150; Chas. Schneider, 167th St. and Findlay Ave., *b* $23,750; Holland Bros., 177th St. and Trinity Ave., *b* $20,000; P. Gallagher, 1180 Bway., *b* $57,900; C. W. Collins, Fordham Road and Morris Ave., *b* $32,400.

**Items marked thus give the names of parties awarded contracts.*

Bids will be received by J. A. Bensel, Comr. Docks, until Oct. 31, for furnishing material and building a new ferry house for the Staten Island ferry, at the Manhattan terminal, foot of Whitehall St., Boro. Manhattan, as per Contract No. 1099.

Plans have been filed for the 4-story granite 51x219-ft. police station and prison which is to be erected at 156 Greenwich St. by the City of New York, at a cost of $230,000. Stockton B. Colt, 287 4th Ave., and Thornton Clarke, Assoc. Achts.

The Armory Com. of the Armory Bd., on Oct. 9 is stated to have accepted the plans of Walker & Morris, 24 E. 23d St., for the 22d Regt. armory.

Raleigh, N. C.—Bids will be received until Oct. 25 by W. A. Erwin, Chmn. Bldg. Com., West Durham, for erecting a 4-story brick addition to the State Hospital for the Insane at Raleigh; bids to be submitted separately on plumbing and heating. Barrett & Thompson, Archts. and Engrs., Raleigh.

Norwood, O.—It is stated that a site has been selected and a market house is to be erected. $35,000 is reported appropriated for the purchase of a site and the erection of the building.

Cincinnati, O.—Harry Hake, Union Trust Bldg., is reported to be preparing plans for a $40,000 firehouse, to be erected at Pearl and Martin Sts.

Des Jardins & Sheblessey, 4th Natl. Bank Bldg., are reported to be preparing plans for a $25,000 addition which it is proposed erecting to the Cincinnati Sanitarium on College Hill.

**Clevelond, O.*—Henahan & King, Rose Bldg., are reported to have secured the contract for the foundation for the contagious disease hospital in connection with the city hospital.

Hubbell & Benes, Citizens' Bldg., are reported to have completed plans for the superstructure of the West Side Market, and bids for the construction will probably soon be asked by W. J. Springborn, Pres. Bd. Pub. Service. The building is to be of brick, with stone trimming.

Chauncey, O.—It is stated that bids will be received until Oct. 26 by Ray C. Gardner, Village Clk., for erecting a prison.

Youngstown, O.—Court house bonds, amounting to $960,000, are reported sold.

**Danville, Pa.*—The following are reported to be the bids received Sept. 24 by the Bldg. Com. at the office of Dr. H. B. Meredith, Supt., State Hospital for the Insane, at Danville, for the erection of a women's infirmary, a building for acute insane men patients and a building for acute insane women patients: Lawrence Bros., Kane, $246,248; L. H. Focht & Son, Reading, $197,300. Geo. W. Beard & Son., Reading, $198,800; W. O. Weaver & Son, Harrisburg, $208,947; Steinbach-Billmeyer & Co., Lewistown, $217,100; Metzger & Wells, Philadelphia, $188,700; Mosier & Summers, Buffalo, N. Y., $202,300; Bennett & Woodnut, Williamsport, $207,291; Lynch Bros., Philadelphia, $186,197 (awarded contract), and Geo. H. Meyerholtz, Philadelphia, $249,817.

Philadelphia, Pa.—The following are reported to be the bids received Oct. 7 for alterations and additions to the Arsenal Bldgs. at Philadelphia: Lynch Bros., $64,933; Edwd. Fay & Son, $67,300; R. C. Ballinger & Co., $72,704; Wm. R. Dougherty, $81,960, and Cramp & Co., $83,850.

It is reported that only one bid was received by the Director of Pub. Wks. on Oct. 10 for completing the northwest corner of the City Hall, it being submitted by Edw. Fay & Son, at $109,000.

Pittsburg, Pa.—The lowest bid received Oct. 9 by Mayor Guthrie for erecting an engine house in the 23d Ward is reported to have been submitted by John Siebert Sons' Co., at $38,615. Appropriation, $20,000.

We are informed that new bids will be received about Nov. 1 at the office of F. P. Booth, Co. Compt., for erecting the Allegheny County Soldiers' Memorial Building; cost, about $850,000. J. G. Chalfant is County Engr.

Cranston, R. I.—The enlarging of the town hall is reported under consideration.

Memphis, Tenn.—The Bd. of Trus. of the Methodist Church (John Sherd, Chmn.) is reported to be planning the erection of a hospital to cost $200,000.

**Dallas, Tex.*—The bid of L. R. Wright, 297 Main St., for erecting the city jail, at $20,972, is reported to have been recommended for award.

Tyler, Tex.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Nov. 25, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring of an extension, etc., to the U. S. Post Office and Court House at Tyler.

Portsmouth, Va.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Nov. 22 for the construction, including plumbing, gas piping, heating, etc., of U. S. post office at Portsmouth, as advertised in The Engineering Record.

Toppenish, Wash.—Bids will be received until Nov. 4 by R. D. Campbel, Town Clk., for $4,000 town hall bonds and $2,000 street improvement bonds as advertised in The Engineering Record.

Bremerton, Wash.—Secy. of the Navy Victor H. Metcalf, at Washington, D. C., is stated to have approved the plans for the construction of a permanent hospital at the Puget Sound Navy Yard, Washington, at a cost of $150,000, also plans for extensive improvements to the steam engineering department of the yard. Gen. Elliott, head of the U. S. Marine Corps, is stated to have approved plans for a new marine barracks, also at Puget Sound Navy Yard, to cost about $150,000.

Tacoma, Wash.—The plans of I. Jay Knapp, National Bank of Commerce Bldg., are reported to have been accepted for the conservatory which is to be erected in Wright Park at a cost of $10,000.

Everett, Wash.—The Co. Comrs. are reported to have adopted plans for the court house annex which is to be erected next spring.

Winnebago, Wis.—W. A. Gordon, Supt. Northern Hospital for Insane, writes there is no truth in the report that this institution is to build an addition.

Balsam Lake, Wis.—Bids will be received until Nov. 1 by Harry D. Baker, Chmn. Com. on County Property, at St. Croix Falls, for erecting 1 story to the present jail at Balsam Lake, including fireproof floor and partitions, cells on both first and second story, heating, plumbing, piping and fixtures for acetylene gas lighting Fremont D. Orff, archt., 615 Lumber Exchange, Minneapolis, Minn.

Whitehall, Wis.—Parkinson & Deckendorf, of La Crosse, it is stated, are preparing plans for a 3-story brick city building, to be erected here, at a cost of $16,000, to be used as an engine house, library and city hall.

Milwaukee, Wis.—The Juvenile Court Comn., according to reports, has petitioned the County Comrs. to appropriate $125,000 to erect 2 buildings, 1 for a detention home for children, juvenile school delinquents, and the other a parental school. C. D. Crane, 91 Wisconsin St., is reported to have been directed to prepare plans for the buildings.

The plans of H. Messmer & Son, 473 E. Water St., for the north side natatorium were accepted by the Council Com. on Pub Bldgs and Grounds on Oct. 10. The building will be erected at Richards and Center Sts. and will cost about $45,000.

Torreon, Mex.—It is stated that plans have been accepted and work is to commence at once on the erection of a municipal hospital. Probable cost, $75,000.

Chihuahua, Mex.—It is reported that plans have been approved for a 2-story Federal Bldg. to be erected in this city at a cost of $500,000 and to be known as Palacio Federal.

Port Arthur, Ont.—Bids will be received until Oct. 24 by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, for alterations and additions to the post office at Port Arthur.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Dothan, Ala.—Ausfeld & Blount, 105 Bibb St. Montgomery, are reported to be preparing plans for a bank, 1-story fireproof, of Georgia marble, to be erected for the First Natl. Bank at a cost of $65,000.

Sulphur Springs, Ark.—It is reported that the Kansas City Southern Ry. (A. F. Rust, Res. Engr., Kansas City, Mo.) will erect a $100,000 hotel here.

San Francisco, Cal.—Wright, Rushford & Cahill, 571 California St., are reported to have prepared plans for a store and apartment house which is to be erected at Bush St. and Grant Ave. by Geo. Terbush, at a cost of $52,000.

R. S. Browne has applied for a permit to erect a 6-story hotel on O'Farrell St. near Taylor St., to cost $66,000, and the Moffatt Estate Co. to erect a $75,000 building at Ellis and Larkin Sts.

A permit has been issued to the Mergenthaler Linotype Co. to erect a 3-story brick building on Sacramento and Montgomery Sts., to cost $65,000.

San Pedro, Cal.—Hudson & Munsell, Stimson Bldg., Los Angeles, it is reported, are preparing plans for a 3-story brick building to be erected for the Oorder of Elks.

Los Angeles, Cal.—F. G. and P. F. Schumacher and Philip Wilson, it is reported, propose erecting a theatre on Main St., to cost about $250,000.

Harrison Albright, Laughlin Bldg., is reported to be preparing plans for the 10-story, 150x126-ft. reinforced concrete building to be erected for the Consolidated Realty Co. at 6th and Hill Sts., and as soon as plans are completed bids will be asked. The contract for excavating the site is reported to have been awarded to Carl Leonardt, H. W. Hellman Bldg.

San Jose, Cal.—The Arcade store and the entire block on which it was situated, it is reported, was destroyed by fire on Oct. 11.

Oakland, Cal.—T. Daniel Frawley is reported planning the erection of a theatre having a seating capacity of 2,000.

Alameda, Cal.—It is stated that plans are being prepared for a 3-story hotel to be erected near the city hall by a company in which S. E. Biddle, Jr., and A. E. Kelly are interested. The capital of the company is $100,000.

San Diego, Cal.—Harrison Albright, of Los Angeles, according to reports, has completed plans for a reinforced concrete store and office building to be erected for Henry Timken & Sons at 6th and E Sts., to be 8 stories high, 125x100 ft., and to cost $250,000.

S. G. Kennedy, of San Diego, it is stated, has completed plans for a 2-story brick laundry, 100x100 ft., to be erected on I and 14th Sts. for Nelson Snyder. A power plant is to be installed.

It is reported that plans have been completed for a 6-story business building which is to be erected for H. Perry on 14th St.

Pueblo, Colo.—It is reported that the Directors of the Y. M. C. A. are planning the erection of a $100,000 building.

Denver, Colo.—The Colorado Orphans' & Old Folks' Home Assoc. is reported to be planning the erection of a $30,000 building on 9th St.

F. E. Edbrooke, 510 Opera House Blk., is reported to have been engaged by the Directors of the Colorado Natl. Bank to prepare plans for a 16-story office building.

Tampa, Fla.—Architects Bonfrey & Elliott, of Tampa, write that bids will be received on Nov. 15 for the erection of a Y. M. C. A. building to cost about $60,000.

Quincy, Fla.—W. B. Camp, of Jacksonville, is reported to be preparing plans for a hotel to be erected here at a cost of $40,000.

**Grangeville, Idaho.*—The contract for erecting the Emperial Hotel is reported awarded to A. J. Thurner & Co., of Grangeville, at $45,455.

**Decatur, Ill.*—Contracts were awarded as follows, according to reports, for erecting the Pythian Home for the Aged in Decatur, bids for which were received Oct. 12: General contract to Graff & Doerr Constr. Co., of La Crosse, Wis., $107,295; electric work to Decatur Electrical Supply Co., Decatur, $1,598; gas, sewerage and water plumbing to Field & Schoeb, Decatur, $3,332; heating plant to John & Koehnly, of Lincoln, Ill., $15,778.

Chicago, Ill.—John T. Collins is reported to be having plans prepared for alterations to be made in building at Clark St. and Archer Ave., to cost about $30,000.

H. H. Frazee is stated to be interested in a theatre to be erected at 76 Dearborn St., at a cost of $150,000.

It is stated that the Halsted St. Amusement Co. has leased a site on W. 12th and Halsted Sts. and intends erecting a theatre, to cost $20,000.

Murphy Bros., according to reports, propose erecting a 10-story building at Randolph and Dearborn Sts.

The North Shore Fireproof Storage Co. is said to be having plans prepared for a 4-story addition to its warehouse, 50x70, at 2077 Evanston Ave. It will cost $25,000.

The Chicago, Milwaukee & St. Paul R. R. (D. J. Whittemore, Ch. Engr.), it is reported, is about to construct a 6-story, 53x116-ft. addition to its office building on Southport Ave. It will be of fireproof construction and cost $125,000.

The Otto Schmidt Wine Co., it is stated, will erect a 3-story store and flat building at Indiana Ave. and 23d St., of pressed brick, to cost $75,000.

Reports state that the members of the University Club of Chicago will erect a clubhouse at Michigan Ave. and Monroe St., according to plans prepared by Holabird & Roche, 1618 Monadnock Bldg., to cost about $1,000,000.

Levy Mayer is reported to have purchased the Stratford Hotel and intends erecting on the site an 18-story hotel and theatre.

Jacob L. Kesner, it is stated, will erect on 5th Ave. and Harrison St. an 8-story brick mercantile building.

Huehl & Schmid, 163 Randolph St., are reported to have prepared plans for a 5-story warehouse to be erected at Peoria and Washington Sts. for J. W. Allen & Co. at a cost of $80,000.

Peter Pritikin, it is reported, intends erecting a theatre, store and office building on Halsted St., to be 3 stories high, 150x100 ft., and cost $75,000.

Dr. F. Ziegfeld, Pres. of the Chicago Musical College, it is stated, has secured a site at 246 Michigan Boule. on which it is proposed erecting a theatre to cost about $500,000.

Bedford, Ind.—A 2-story Masonic temple of brick and stone is to be erected here, at a cost of $20,000. Architects, J. T. Johnson & Co., State Life Bldg., Indianapolis.

Evansville, Ind.—It is reported that F. J. Schlotter, 113½ U 4th St., has been engaged to prepare plans for a 3-story store and office building on Main St. for Jacob Haas.

Indianapolis, Ind.—C. E. Fest and A. C. Newby, it is reported, are planning to erect a 7-story office building on Circle and Market Sts.

Sioux City, Ia.—Jas. F. Toy, Pres. of the First Natl. Bank, is reported to have announced that plans are being prepared for a 6 or 7-story store and office building which is to be erected at 4th and Nebraska Sts.

**Waterloo, Ia.*—Chapman & Schifferdaker are reported to have secured the contract for the concrete foundation which is to be put in for the 3-story Dunkelberg Blk. which is to be erected at W. 5th and Jefferson Sts. at a total cost of $30,000.

**Wichita, Kan.*—The Kansas City, Mexico & Orient R. R. is reported to have awarded to the Westinghouse, Church, Kerr & Co., of New York, N. Y., the contract to erect the shops at Wichita. The cost is reported to be $100,000.

De Quincy La.—The Kansas City Southern Ry. (R. H. Gaines, Asst. Engr., Mansfield, La.), it is reported, will erect a hotel and eating house to cost $100,000.

**Mandeville, La.*—The contract to erect a concrete building at Carroll and Claiborne Sts., is reported to have been awarded to Thos. Engelbach, of New Orleans.

Cambridge, Mass.—The Salvation Army is said to be planning the erection of a $20,000 building.

**Saginaw, Mich.*—The contract for a new building for Valley Telephone Co. is reported to have been awarded to Spindler & Kerns. Architect, C. L. Cowles, 114 N. Washington Ave.

**Minneapolis, Minn.*—The Minneapolis Steel & Machinery Co., it is reported, has the contract to furnish the steel work and Ben Aronson to do the mason work for the improvements at the North Star Malting Co.'s building at 18th Ave., N. E., and 2d St. The warehouse will be 42x66 ft., and brick storehouse 18x44 ft. There will also be some steel tanks. Total cost, $65,000.

*The John Wunder Co., Lumber Exchange, is reported to have secured the contract to erect the 5-story 100x155 ft. brick and terra cotta warehouse for Forman, Ford & Co. on 2d St. and 1st Ave., to cost $75,000.

Downs & Eads, N. Y. Life Bldg., it is stated, are preparing plans for a 5-story, 66x110 ft. fraternity building, to be erected on 10th St. and 2d Ave.. S., at a cost of $60,000. Jas. MacMullan, Secy., Fraternity Hall Assoc.

Hattiesburg, Miss.—It is stated that the New Orleans & Northeastern R. R. (J. C. Haugh, Res. Engr., New Orleans, La.), intends erecting a depot in Hattiesburg to cost $125,000.

Kansas City, Mo.—The members of the Missouri Republican Club are said to be considering the erection of a club-house to cost $25,000.

Kansas City, Mo.—See "Railroads."

Helena, Mont.—The Odd Fellows, it is reported, have decided to erect a Home here at a cost of about $25,000.

Hastings, Neb.—A. L. Clarke, Pres. of the First Natl. Bank, is reported interested in the erection of a hotel to contain about 200 rooms, at a cost of about $150,000.

Omaha, Neb.—The Western Newspaper Union (Geo. A. Joslyn, Pres.) is reported to be preparing to erect an 8-story building at Howard and 9th Sts., estimated to cost $200,000.

The Plattsdeutscher Verein is said to be having plans prepared for a 3-story club house to be erected on S. 13th St., to cost $35,000.

Fairbanks, Morse & Co., according to reports, have awarded the contract to erect a 6-story warehouse, 66x132 ft., at 9th and Harney Sts., to E. P. Gould & Sons, at about $75,000.

Atlantic City, N. J.—The Hotel Men's Assoc., according to reports, have ordered plans prepared for a $2,000,000 convention hall to be built at the sea end of the Ocean Pier.

Newark, N. J.—It is stated that Thos. Cressey, 800 Broad St., is preparing plans for a 6-story building to

*Items marked thus give the names of parties awarded contracts.

be erected at 76 Market St. for Amos H. Van Horn. It will be of steel frame construction, of stone and brick exterior.

Jos. Okin is reported to have had plans prepared by Hyman Rosensohn, 188 Market St., for a 6-story brick and limestone store and office building to be erected at Bank and Washington Sts., at a cast of about $100,000. It is stated that bids for the construction will be received by the archt.

New York, N. Y.—Plans have been filed for the erection of a 12-story brick and stone mercantile building at 8 E. 12th St. for Masters Builders Realty Co.; cost, $100,000. Samuel Sass, Archt.

Utica, N. Y.—It is reported that the erection of a Masonic Temple to cost $20,000 is under consideration.

Fayetteville, N. C.—It is stated taht bids will be received until Oct. 22 by J. G. Hollingsworth, owner, for erecting a brick, stone, granite, iron and steel opera and market house. Wheeler, Runge & Dickey, archts., Charlotte.

**Minot, N. D.*—H. A. Hurd, of Minot, is reported to have secured the contract to erect the John Hollinger block at $14,000.

**Homer, O.*—The contract to erect a signal tower and freight station for the Baltimore & Ohio R. R. in Homer is reported to have been awarded to the Pittsburg Constr. Co., of Pittsburg, Pa., at about $50,000.

Bowling Green, O.—The members of the Y. M. C. A. are reported to be contemplating the erection of a new brick and stone building to cost about $40,000, including site.

Cincinnati, O.—M. E. Braun, of Baymiller St., is reported interested in the project to erect a garage and stable in Calhoun to cost about $100,000.

Boll & Taylor, First Natl. Bank Bldg., It is stated, have been engaged to prepare plans for a building to be erected for H. W. Weisbrodt & Co., at a cost of $35,000.

**Cleveland, O.*—It is stated that the contract for the reinforced concrete work on the Cleveland Telephone Exchange which the Chesapeake & Potomac Telephone Co. is erecting on Wisconsin St. has been awarded to H. G. & L. J. Dill, of Washington, D. C.

Shawnee, Okla.—J. B. Forney, of Shreveport, La., is reported to be arranging to erect a hotel in Shawnee to cost $250,000.

**Philadelphia, Pa.*—John N. Gill & Co., 1745 N. Marshall St., are reported to have secured the contract to erect for Hildebrand Bros. a 6-story storage warehouse at 2511 N. Broad St., to cost $45,000.

Chattanooga, Tenn.—The Bldg. Com. of the Y. M. C. A. has accepted the plans of R. H. Hunt, 8th and Broad Sts., for the brick and terra cotta building to be erected on Georgia Ave., to cost $100,000.

Dallas, Tex.—The Mystic Shriners, it is reported, propose erecting a lodge building to cost $150,000.

**Roanoke, Va.*—H. G. & L. J. Dill, of Washington, D. C., it is reported, have secured the contract to erect the Strickland Office Bldg., which is to be 7 stories, steel frame, 60x100 ft., and cost about $75,000.

Tacoma, Wash.—Plans are about completed and it is reported that bids will soon be asked by the Fraternal Order of Eagles to erect a $35,000 building at 1305 S. E. St.

Wheeling, W. Va.—John C. Lynch, Gen. Secy. Y. M. C. A., writes that Gresey & Faris, Schmulbach Bldg., are preparing plans for a Y. M. C. A. building to cost about $100,000. Contracts will probably be let in the spring.

**Milwaukee, Wis.*—Jas. Corse, of Racine, is reported to have secured the contract to erect a sub-station in Milwaukee for the Chicago & Milwaukee Electric Ry. Co., to cost $25,000.

A. F. Gallum & Sons are reported to have taken out a permit to erect an $80,000 tannery building on N. Water St., to be 4 stories high, built of steel and iron.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Eufaula, Ala.—Bruce & Everett, of Atlanta, Ga., are reported to be prepearing plans for rebuilding the Baptist Church, recently destroyed by fire. Probable cost, $15,000.

Globe, Ariz.—The members of the Methodist Church are said to be preparing to erect a $25,000 edifice.

Pine Bluff, Ark.—It is reported that A. Brewster, J. McCain and W. Z. Tankersley, as a committee, have invited plans to be submitted by Oct. 25 for a church to cost about $30,000.

Los Angeles, Cal.—T. L. Bacon, it is stated, will erect a 5-story and basement apartment house at Olive and 9th Sts., according to plans prepared by A. L. Haley, Henne Bldg. Cost, $65,000.

Riverside, Cal.—It is stated that the members of the First Baptist Church propose erecting an edifice costing about $20,000.

Denver, Colo.—The Pennsylvania Apartment Co. is reported incorporated by Wm. B. Milliken, L. E. Hill and F. W. Billings for the purpose of erecting an apartment house at 14th and Pennsylvania Aves. at a cost of $100,000.

It is stated that City Clerk Sommers has had plans prepared for a 3-story apartment house which he intends erecting at Ogden and 16th Sts. at a cost of $45,000.

It is reported that $100,000 has been raised toward the $500,000 needed to erect the St. John's Cathedral, and it is stated that work is to begin at once. Chas. A. Johnson, a vestryman, may be able to give further information.

Cordele, Ga.—The members of the Methodist Church, according to reports, propose erecting a $40,000 edifice.

Chicago, Ill.—Hugo Freels is reported to be planning the erection of a 3-story apartment house at North and Francisco Aves., to cost $50,000.

Peoria, Ill.—It is reported that the members of St. Stephens R. C. Church are contemplating the erection of a $30,000 edifice. Rev. Sydney Jeffords, pastor.

**Sioux City, Ia.*—The contract to erect the M. E. Church at Morning Side is reported to have been awarded to Kuhne & Co., of Ranton, Ill., at about $32,000.

**Springfield, Mass.*—A 3½-story concrete building, 130x68 ft., will be erected for the Brightside Home for Aged Men. D. J. Landers, of Holyoke, has secured contract for mason work, and Frank P. Morey, of Springfield, for carpenter work. Architect, J. W. Donohue, Walker Bldg., Springfield.

Springfield, Mass.—John W. Donohue, 476 Main St., is reported to be preparing plans for an Italian church, to cost about $35,000. Rev. A. Dalla Pocta, Rector.

Detroit, Mich.—Cram, Goodyear & Ferguson, of Boston, Mass., it is reported, have been engaged to prepare plans for the St. Paul Episcopal Cathedral.

**Aurora, Mo.*—The contract to erect the Christian Church, it is reported, has been awarded to G. E. Maxwell Lumber Co., at $19,000.

Holdrege, Neb.—Fiske & Bieman, of Lincoln, Neb., are reported to have completed plans for a $25,000 edifice to be erected by the members of the First Baptist Church.

Hoboken, N. J.—E. M. Patterson, 76 Montgomery St., Jersey City, is stated to have completed plans for a 5-story flat house to be erected on Syms St., West Hoboken, for Wm. Dalton and G. Laura, 3920 Boule., Hoboken. Cost, $25,000.

New York, N. Y.—Plans are stated to have been filed for the erection of the following buildings: Three 6-story brick and stone tenements at Bway. and 130th St. for Fleischmann Realty & Constr. Co.; cost, $125,000; M. Zipkes, Archt.; 6-story brick and stone tenement at St. Pauls Pl. and Crotona Pl. for L. Weiner; cost, $45,000; J. C. Watson, Archt.; 5-story brick tenement at 153d S. and Courtlandt Ave. for David H. Sarfaty; cost, $25,000; Moore & Landseidel, Archts.; 5-story brick tenement at 178th and Bryant Sts. for Bonagur Constr. Co., cost, $30,000; V. Bonagur, Archt.; 5-story brick and stone tenement at Hughes Ave. and 182d St. for Marie Krabo; cost, $26,000. Chas. Schaefer, Archt.; 2 5-story brick tenements at Walton and Burnside Aves. for Moses Muller; cost, $80,000; Goldner & Goldberg, Archts.

**Lima, O.*—J. G. Bullinger, of Portland, Ind., it is stated, has secured the contract for erecting the First Baptist Church, estimated to cost $30,000.

Toledo, O.—Plans and specifications are being prepared for an additional 6-story apartment building and central heating station for the Scottwood Apartment group, now under construction by the Columbia Constr. Co. (Frank H. Rile, Engr. and Archt., Hickox Bldg., Cleveland); estimated cost of buildings, $300,000. Estimates will be received on plumbing, heating, electric work, elevators, lighting fixtures, etc., at the Toledo office of the Columbia Constr. Co., by E. F. Pickett, Res. Engr. and Archt.

Cleveland, O.—It is stated that plans are being prepared for an edifice to be erected of stone for the Windermere Methodist Church in East Cleveland, the cost to be about $75,000.

The Anshe Chesed Hebrew Congregation, it is reported, has secured a site on Euclid Ave., on which it is proposed erecting a synagogue, to cost $200,000.

Scranton, Pa.—It is stated that C. S. Woolworth has accepted plans for a $50,000 residence to be erected on Vine and Olive Sts.

Memphis, Tenn.—It is stated that a refuge home is to be erected at a cost of about $25,000, and for which plans are now being prepared by Alsup & Woods, Randolph Bldg.

Salt Lake City, Utah.—Wm. Carroll is reported to have completed plans for an apartment house to be erected at a cost of $65,000 for W. W. Hall.

Milwaukee, Wis.—A permit is reported issued for the erection of the Kingsley Methodist Church at 33d and Walnut Sts., to cost $25,000.

Montreal, Que.—The Roman Catholic Church in the Parish of Cote St. Paul, is reported destroyed by fire Oct. 12.

SCHOOLS.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—The Greater University Bldg. Com. of the Bd. of Trus. on Oct. 12 accepted plans for 3 buildings, which are the power plant and engineering building, geological and diological academic buildings. It is reported that bids for construction will be asked at once. Plans were also authorized prepared for chemical laboratory and making all necessary improvements on the present building.

Auburn, Ala.—It is stated that plans have been accepted by the Bldg. Com. for the 2-story Carnegie Library, which is to be erected at the Alabama Polytechnic Inst. at a cost of $30,000.

Ozark, Ark.—The Bldg. Com. of the Methodist Church (A. H. Treedway, Clk.), it is reported, is planning the erection of a $15,000 school.

Hoxie, Ark.—It is reported that a $15,000 school is to be erected here, and plans are being prepared by Mann & Downey, of Little Rock.

Pasadena, Cal.—It is stated that the high school is to be enlarged and 2 additional schools erected at a total cost of $150,000. A. L. Hamilton, Supt.

San Francisco, Cal.—It is stated that the Bd. of Wks. will probably soon ask bids for erecting the S. End School at Beacon and Girard Sts., for which there is an appropriation of $81,000.

The Bd. Educ. has approved plans for a school in Sunnyside Dist., on San Jose Ave., to cost $51,000.

Preliminary plans for the Jean Parker and Sheridian Schools have been submitted to the Bd. Educ.

Hartford, Conn.—The Supt. of Schools writes that W. D. Johnson, of Hartford, is preparing plans for an addition to the Arsenal School.

New London, Conn.—Jas. Sweeney, 80 State St., is stated to have been engaged to prepare plans for the heating plant to be installed in Harbor School.

New Britain, Conn.—The School Com., it is stated, is considering the erection of a 4-room addition to the Monroe St. School, estimated to cost $20,000.

Bristol, Conn.—The erection of an addition to the high school, to cost about $30,000, is reported under consideration.

New Haven, Conn.—Bids will be received until Nov. 1 by the Bd. Educ. (Geo. T. Hewlett, Secy.) for erecting a public assembly hall building at Winchester Ave. and Ivy St. Foote & Townsend, Archts., 902 Chapel St. Also erecting a school on Greene St. near Wooster Pl. Brown & Van Beren, Archts., 865 Chapel St. Bids may be submitted as a whole or separately on the following work for the above buildings: Carpentry, masonry, plumbing, gas fitting, ventilating and heating.

Quincy, Fla.—W. B. Camp, of Jacksonville, is stated to be preparing plans for a school to be erected here at a cost of $25,000.

Salem, Ind.—It is stated that bids will be received until Oct. 28 by the School Bd. (Chas. Schrewsbury, Chmn.), for erecting a joint-graded high school; also installing ventilating and heating system in said school.

**Lafayette, Ind.*—The Bldg. Com. of the Trus. of Purdue Univ., it is reported, has awarded the contract to erect the experimental station at the Univ. to W. P. Jungclas, of Indianapolis, at $89,899. A separate contract will be let for the heating plant.

Ardmore, Ind. Ter.—It is reported that steps are being taken to replace the Hargrove College, which was recently destroyed by fire, with a $50,000 building.

**Essex, Ia.*—Thos. Schneider is reported to have secured the contract to erect a school here, at $25,000.

**Clearfield, Ia.*—Guthrie & Holst, of Albia, are reported to have secured the contract to erect a school at $15,695.

Millersburg, Ky.—The Millersburg Female Academy, it is reported, was destroyed by fire Oct. 9.

Greenwood, La.—Bids will be received until Oct. 25 by S. A. Alexander, Greenwood, for erecting a 2-story brick school, contractor to furnish all material except brick.

Williamstown, Mass.—The Bd. Trus. of Williams Collegee, it is staed, has decided to erect this spring the dormitory on Main St.

Detroit, Mich.—Bids will be received until Oct. 22 by the Bd. Educ. (Wm. J. Lee, Secy.), for furnishing material and erecting a 15-room school at Alger and Cameron Aves. Bids must be submitted separately on the following: Masonry, carpentry, ventilating, heating, etc. Probable cost, $60,000.

Agricultural College, Mich.—A. M. Brown, Secy. Trus. Michigan Agricultural College, writes that bids will probably be called for in February for the erection of a new argricultural building.

Mt. Pleasant, Mich.—Both houses of the Legislature are reported to have passed the appropriation of $204,000 for school purposes in Mt. Pleasant, of which $57,000 is to be used to erect a gymnasium and to make other permanent improvements..

Mankato, Minn.—It is stated that bids will be received by the State Bd. Control, St. Paul, until Oct. 26 for the erection, plumbing, heating and electric work for a building at the State Normal School, Mankato. Clarence H. Johnson, archt., 712 Manhattan Bldg., St. Paul.

Faribault, Minn.—It is stated that bids will be received until Oct. 26 by the State Bd. Control, St. Paul, for the erection, electric work, heating and plumbing in custodian building, kitchen and farm cottage dining-room at the State School for Feeble Minded, Faribault. Clarence H. Johnston, archt., 712 Manhattan Bldg., St. Paul.

Pipestone, Minn.—Bids will be received by C. F. Larrabee, Acting Comnr. Indian Affairs, Washington, D. C., until Nov. 12 for furnishing materials and constructing a stone warehouse, with gasoline gas piping; a stone hospital, with plumbing, steam heat and gasoline gas piping and tank and tower, at Indian School, Pipestone. For further information apply to Willard S. Campbell, Supt. Indian School, Pipestone.

Springfield, Mo.—The School Bd. is reported to have passed a resolution authorizing the issue of $200,000 bonds for the building of a school.

Liberty, Mo.—E. J. Eckel, of St. Joseph, is preparing plans for a library for William Jewell College, and bids will probably be called for in the spring.

St. Louis, Mo.—Architects have been commissioned to submit plans for the trades school which has been endowed to the extent of $1,000,000 by David Ranken, Jr. It will be known as the David Ranken, Jr., School of Mechanical Trades and will be erected at Newstead, Cook and Finney Aves.

Omaha, Neb.—The Co. Comrs. are said to be considering the appropriating of $25,000 to erect a detention school.

Jersey City, N. J.—The Bd. of Educ. is reported to have adopted plans for the annex to be erected to School No. 14, as prepared by John T. Rowland, Jr., 15 Exchange Pl. Bids for the construction, it is stated, will be received Nov. 14.

Bids will be received until Oct. 28 by the Bd. Educ., Township of North Bergen, at the Town Hall, Hudson Co. Boule. and Main St., North Bergen (Geo. P. Christman, Dist. Clk.), for $17,500 school bonds.

Bordentown, N. J.—Bids will be received until Oct. 22 by the Com. on the Manual Training and Industrial School for Colored Youth (W. D. Forbes, Chmn.) for furnishing material and erecting a laundry at the above school.

West New Brighton, S. I., N. Y.—Bids will be received until Oct. 28 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing, ventilating and heating apparatus for addition to the alterations in School 19, West New Brighton, Boro. Richmond.

Syracuse, N. Y.—All bids received Oct. 7 for erecting the Salina St. School, it is stated, were too high, and new bids will be asked

**University, N. D.*—Bids were opened on Oct. 1 by the Bd. Trus. Univ. of North Dakota (J. W. Wilkerson, Secy.) for installing the sewerage, plumbing and heating systems for the School of Mines, and the same was awarded to Spriggs Bros., of Grand Forks, for $2,309.

Cincinnati, O.—Bids will be received at the office of the Clerk Bd. of Educ., until Nov. 11, for the erection of a

Items marked thus give the names of parties awarded contracts.

17-room school on Montana and Harrison Aves., as advertised in The Engineering Record. Architects, Garber & Woodward, 508 Neave Bldg. Dr. J. M. Withrow, Chmn. Bldg. Com.

Lawton, Okla.—W. H. Pennington is reported to have secured the contract to erect an 8-room school for which $25,000 bonds were recently voted.

Allegheny, Pa.—Bids will probably be received the latter part of November for the erection of the 10th Ward School, which will cost about $200,000. Architects, C. M. Barthberger & Son, Westinghouse Bldg., Pittsburg.

Philadelphia, Pa.—Rowland W. Boyle, 1626 Chestnut St., is stated to have prepared plans for a 2-story and basement school to be erected for the parish of Our Lady of Lourdes at 63d St. and Lancaster Ave.
*Wm. R. Dougherty, 160 4Sansom St., is reported to have secured the contract to erect the 3-story 40x60-ft. dormitory on Spruce St. for the Univ. of Pennsylvania, the cost to be $40,500.

**Latta, S. C.*—A. S. Manning, Chmn. Bd. School Trus., writes that the contract for erecting the proposed high school has been awarded to John E. Deibler, of Chesterfield, S. C.

North, S. C.—It is stated that bids will be received until Oct. 22 by J. L. Reeves, Clk. Bd. Trus. School Dist. No. 34, for erecting a school. C. Gadsen Sayre, archt., People's Bank Bldg., Anderson.

Pierre, S. D.—Bids will be received by C. F. Larrabee, Acting Comnr. Indian Affairs, Washington, D. C., until Nov. 4 for furnishing material and consrtucting a brick office, with plumbing, steam heat and electric light; a brick warehouse, with electric light, and brick addition to the workshop, with plumbing and electric light; also an electric light plant at Indian School, Pierre. For further information apply to J. C. Levengood, Supt. School, Pierre, S. D.

Memphis, Tenn.—The following are reported to be the bids received Oct. 7 by the Bd. of Educ. for erecting a school on Carr Ave. and one on Mhoon Ave. Bids are on both buildings as a total: Selden-Breck Constr. Co., $131,688; C. J. Wagner & Co., $129,590; A. W. Geettingly, $129,494; McKnight & Barker, $125,472.

Corsiconna, Tex.—The Attorney General has approved the issue of $15,000 bonds for erecting a school.
**Tomahawk, Wis.*—F. Tomlinson, of Ashland, is reported to have secured the contract for erecting a public school estimated to cost $35,000.

Toronto, Ont.—Bids will be received until Oct. 24 by H. F. McNaughten, Secy. Pub. Wks. Dept., for the heating, plumbing, ventilation and electric wiring required for the new normal schools at Peterborough, Stratford, Hamilton and North Bay. Probable cost, $50,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

San Diego, Cal.—It is reported that bids are to be asked at once for erecting a flouring mill at California and Ash Sts. for the Globe Grain and Milling Co., to have a capacity of 250 bbl. per day.
B. Rabimovita, iron manufacturer of Marietta, O., is said to be negotiating for a site in San Diego, to which he intends removing his steel plant at Marietta, O.

Long Beach, Cal.—Plans of the buildings which will comprise the plant of the Craig Shipbuilding Co., it is reported, to be erected at Long Beach have been received by Jos. E. Pugh, the local repressentative, and bids for their erection and also for the bulkheading, it is stated, will be called for at once. The various buildings to be erected are punch shop, 46x147 ft.; foundry, first section, 90x100 ft.; machinee shop, 90x128 ft.; powerhouse, 50x150 ft.; boiler house, 25x50 ft.; mold loft, 40x150 ft.; forge shop, 45x35 ft.; joiner shop, 40x50 ft.; bending floor, 35x35 ft., and office, 30x50 ft. All of these, save the last, will be of heavy mill construction, limited to one story, by reason of the weight of the machinery. The cribbing and bulkheading in front of the plant will be 600 ft. long, the cribbing to extend back 20 ft. The plans were prepared by Ch. Engr. Baker, of Craig Co.

Chicago, Ill.—The Scully Steel Co. is reported to have acquired a lease on a tract of 365,000 sq. ft., between 22d St. and the river, Morgan St. and the canal, and it is said, will build thereon an extensive modern plant.

Summit, Ill.—The Corn Products Co. (E. T. Bedford, Pres.), according to reports, intends constructing a plant, at a cost of $5,000,000, at 63d St., Summit. It is stated the buildings include 33 structures, the smallest of which will be 1½ stories, 60x140 ft. There will be 2 refining buildings, each 14 stories, 150x200 ft.; the wet starch building, 8 stories, 135x250, and another, 150x150; 3 buildings devoted partly to manufacturing and warehousing, each 150x400, and three other warehouses, 2 and 3 stories high, 100x300. Ten or 12 structures, each 4 stories, 100x150, with the exception of one which will be 300 ft. long, will be used for the various manufacturing processes. Grain storage tanks, with a capacity of 1,000,000 bushels, and a storage building, with a capacity of 10,000 tons of gluten feed, will be built. In addition to this there will be a power plant, with a total capacity of 12,000 h. p., and generators with a capacity of about 8,000 kw. The grinding capacity will be 50,000 bushels a day, the finished product output being 100,000 bushels a day. There will be 20 miles of railroad tracks on the property.

Kenner, La.—The Kenner Ice & Cold Storage Co. (Rube Van Dervort, Secy.), it is reported, intends erecting an ice plant of 20 tons capacity.

Pittsfield, Mass.—The Eaton Hurlbut Paper Co. write that it will let contract at once for the erection of a factory building, 50x50 ft., to cost $7,000.

Haverhill, Mass.—The Haverhill Building Assoc. is reported to have accepted plans and specifications for factory No. 2, to be erected on Walnut St. Estimated cost, $115,000. C. Willis Damon, Haverhill, Mass., Archt.

Newark, N. J.—It is reported that the J. .H. Ladew Co., of Glen Cove, L. I., N. Y., and Chattanooga, Tenn., have secured 20 acres of the Newark meadow land on the Passaic River, and propose constructing a plant having a capacity of 3,000 finished hides per day. It is stated that plans are being prepared for the buildings which are to be of brick and concrete fireproof construction and the largest, a tannery, will be 900 ft. long and contain 500 vats.

Carthage, N. Y.—The St. Regis Paper Co. of Deferiet, is reported to have purchased the plant of the Carthage Lumber Co. and will remodel the mill and install 15 barking machines for peeling pulp wood. It is also reported that they will increase the power of the mill, build a new conveyor to elevate their logs from the river and construct additional storage tracks for cars.

York, Pa.—The York Felt & Paper Co. (C. F. Black, Gen. Mgr.), is reported to be preparing to rebuild the mills recently destroyed by fire
It is stated that the York Mfg Co intends erecting a 2-story 150x230 ft brick addition to its plant in the West End, to be used as a foundry.

Philadelphia, Pa.—Sauer & Hahn are reported to have been commissioned to prepare plans for a cotton spinning and hosiery mill to be erected at a cost of $100,000 by the Standard Hosiery Co., at 1320 N. Lawrence St. The plant will include a 5-story spinning mill, measuring 50x150 ft.; an engine and boiler house, 36x96 ft.; a picker house, 36x44 ft.; a dye and bleach house, 18x98 ft., and a reinforced concrete reservoir. The buildings will be of reinforced concrete and slow-burning construction, with walls of brick. The work will also include the erection of a 5-story addition to the present hosiery mill, measuring 18x98 ft. Estimates for the work will shortly be invited.

South Pittsburg, Tenn.—W. H. Wilson is reported interested in a company which has been organized to erect a plant for the manufacture of concrete blocks, brick moldings, ornamental and monolithic work and to do all kinds of concrete construction.

Toronto, Ont.—McKenzie & Mann are reported to have made an offer to the city for a portion of Ashbridge Marsh on which it is proposed erecting a steel plant giving employment to 15,000 men.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Monica, Cal.—See "Sewerage and Sewage Disposal."

**Ft. Benj. Harrison, Ind.*—Lewis & Kitchen, 901 Bway., Kansas City, Mo., are reported to have secured the contract for constructing garbage crematory at this post, for $4,200.

**Newark, N. J.*—L. J. Buckley & Co., of Glen Ridge, are reported to have secured the contract for the collection, removal and disposal of ashes, rubbish material, paper and garbage in the City of Newark for a period of 5 years, beginning Jan. 1, 1908 (bids opened Oct. 10 by the Bd. of Street and Water Comrs.), at the following bid for each year's work. Year 1908, $128,900; 1909, $133,700; 1910, $138,900; 1911, $143,875; 1912, $148,275. Other bidders and their totals were: J. & B. Meyer Contr. Co., $740,250; Van Keuren & Sons, $795,000; Geo. B. Aschenbach, $737,500, and Henry Scheider, $765,500.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Riverton, Ala.—The only bid received and opened on Oct. 12 by Maj. Wm. W. Harts, Corps Engrs., U. S. A., at Chattanooga, Tenn., for work on Colbert Shoals Canal, near Riverton, was submited by W A. Shippey, of Memphis, Tenn., and the North Alabama Constr. Co., of Florence, Ala., at the following bid: 350,000 cu. yd. excav., 26.24 cts.; 230,000 cu. yd. riprap (medium), $1.10; 2,800 cu. yd. riprap (large), $6.50, and 3,000 sq. yd. paving, $4.50.

Pine Bluff, Ark.—Bids will be received by Capt. Wm. D. Connor, Corps Engs., U. S. A., Reigler Bldg., Little Rock, until Nov. 16, for 248,000 cu. yds. levee work opposite site Pine Bluff on Arkansas River, as advertised in The Engineering Record.

Santa Monica, Cal.—See "Sewerage and Sewage Disposal."

San Francisco, Cal.—The following are the bids opened on Sept. 26 by Lieut. Col. John Biddle, Corps. Engrs., U. S. A., for dredging in Petaluma Creek: (*a*) Sect. 1, about 117,000 cu. yd.; (*b*) Sect. 2, about 29,000 cu. yd.: Edw. F. Haas, Merchants' Exchange Bldg., (*a*) 14 1-3 cts.; North American Dredging Co., Merchants Exchange Bldg., (*a*) 16.9 cts., (*b*) 20 cts.; Bay & River Dredging Co., 601 Mission St., (*a*) 8.4 cts., (*b*) 14.8 cts.

Long Beach, Cal.—See "New Industrial Plants."

Wilmington, Del.—Geo. H. McGovern, Asst. Secy. Bd. of Trade, writes that the question of improving the river front is in contemplation. Work not yet decided upon. T. H. Melvin, Pres. Street and Sewer Dept.

Toccoa, Ga.—Bids are wanted, it is stated, until Oct. 24 for constructing reinforced concrete walls and walks and grading and terracing plats. B. P. Brown, Jr., Ordinary.

New Boston, Ill.—Bids will be received until Nov. 7 by the Comrs. Bay Island Drainage and Levee Dist (R. H. Roberts, Chmn.) for constructing 50,000 cu. yd. ditch and 724,700 cu. yd. levee embankment in Sections 1 to 5, inclusive, and 138,300 cu. yd. main ditch, Sec. 6, and 165,000 cu. yd. Eliza Creek ditch, Sec. 7. Harman Engr. Co., Engrs. Peoria, Ill.

Goshen, Ind.—The Comrs. of Elkhart County are reported to be preparing to let contracts for constructing 12 ditches, including the Bechtel ditch, in Locke Township, 2 miles long, and the Null ditch, in same township, 2½ miles long.

Boone, Ia.—It is stated that bids will be received until Oct. 25, by E. F. Jones, Co. Aud., for the construction of County Drain No. 38. Sec. 1 to consist of 725 ft. 14-in. tile; Sec. 2, 1,000 ft. 12-in. tile; Sec. 3, 1,200 ft. 10-in tile.

**Sac City, Ia.*—J. J. Harter, Co. Aud., writes that the contract for constructing 9,000 ft. tile drain (bids opened Oct. 11) has been awarded to Anton Orn, of Sac City, for $6,400.

**New Orleans, La.*—The Orleans Levee Bd. is reported to have on Oct. 10 awarded contracts for levee work between upper end of Deka Levee and Delacroix Levee, about 23,000 cu. yd., to Bender & Cotton, at 23 cents per cu. yd., and for new levee on upper end of Beeker Levee to M. Frey, at 29.45 cts. per cu. yd.

Detroit, Mich.—The following are the bids opened on Oct. 7 by Col. E. L. B. Davis, Corps Engrs., U. S. A., for dredging at Section 1, Plan B, Detroit River: (*a*) 247,000 cu. yds. full rate; (*b*) 186,000 cu. yds. half rate; (*c*) total: Great Lakes Dredge & Dock Co.; Chicago, Ill., *a* $1.98, *b* 99 cts., *c* $673,200; Hickler Bros., Sault Ste. Marie, *a* $2.20, *b* $1.10, *c* $748,000. Grant Smith & Co. & Locker, Thorice, *a* $2.40, *b* $1.20, *c* $816,000; M. Sullivan, Buffalo, N. Y., *a* $2.70, *b* $1.35, *c* $918,000; Lake Erie Dredging Co., Buffalo, N. Y., *a* $3.30, *b* $1.65, *c* $1,122,000.

Grand Rapids, Mich.—City Engr. L. W. Anderson is reported to have completed an approximate estimate of cost of building concrete dock wall along west side of Grand River, from 4th to 11th St. It will be about 2,437 ft. in length and cost about $54,550.

Ortonville, Minn.—It is stated that bids will be received until Oct. 24 by A. L. Bolsta, Co. Aud., for constructing Ditch No. 7.

Clayton, Mo.—Wm. Elbring, County Surveyor Clayton, writes that the proposed drainage ditch through Florissant Valley, if constructed, will cost about $40,000.

**Overbrook, N. J.*—G. F. Drum, Co. Engr., writes that the contract for furnishing 8,000 ft. tile drainage pipes (bids opened Oct. 10) has been awarded to the Richmond Clay Products Co., Tribune Bldg., New York, N. Y., for $1,539.

Jersey City, N. J.—The following are reported to be the bids opened by the Bd. of Educ. on Oct. 10 for (*a*) building stone wall and approaches on street sides of grounds of high school; (*b*) erecting retaining wall on east side of grounds: Jos. Cutley, (*a*) $43,045, (*b*) $21,150; Jas. Whelan, Hoboken, (*a*) $48,600; M. T. Connolly Constr. Co., (*a*) $46,600, (*b*) $2,400.

Cold Spring, N. J.—The following are the bids opened on Oct. 3 by Maj. C. A. F. Flagler, Corps Engrs., U. S. A., Wilmington, Del., for construction of stone jetties in Cold Spring Inlet, N. J.: (*a*) 285,000 tons, (*b*) 2,000 lin. ft. piling, brush and stone jetty, (*c*) constructing pile, brush and stone wings, 1,050 ft.: Bennis Constr. Co., Philadelphia, Pa., *a* $2.37, *b* and *c* $35; Seacoast Constr. Co., New York, N. Y., *a* $2, *b* $16, *c* $12; Christie & Lowe, Chicago, Ill., *a* $2.60, *b* and *c* $50.

Ft. Totten, N. Y.—Bids will be received until Nov. 11 by the Disbursing Officer, Torpedo Depot, Ft. Totten, for steel submarine torpedo cases, as advertised in The Engineering Record.

New York, N. Y.—Governor Hughes has signed the bill designating a site on Riverside Drive for a water gate to be erected as a memorial to Robert Fulton. It will probably be located at W. 115th St. and cost about $1,500,000. W. H. Fletcher, 3 Park Row, is Secy. Robt. Fulton Memorial Assoc.
Bids will be received until Oct. 29 by Louis

Detroit, Mich.—Bids were opened on Oct. 7 by Col. E. L. B. Davis, Corps Engrs., U. S. A., for rock and earth excav., Sect. 2, Plan B, Detroit River, and the followings bids were received for the combined Sub-aqueous and Coffer-dam Method; also for Sub-aqueous Method only: (*a*) Grant Smith & Co., & Locker, Thorice, Mich.; (*b*) E. E. Oliver & Bro., Knoxville, Tenn.; (*c*)) Great Lakes Dredge & Dock Co., Chicago, Ill.; (*d*) S. O Dixon, Milwaukee, Wis.

COMBINED SUB-AQUEOUS AND COFFERDAM METHOD.

Sub-aqueous Method—	*a*	*b*	*c*
76,000 cu. yds. rock excav., full rate	$3.40	$3.50	$3.90
56,000 cu. yds. rock excav., half rate	1.70	1.75	1.95
280,000 cu. yds. earth excav., full rate	.60	1.00	.60
12,000 cu. yds. earth excav., half rate	.30	.50	.30
Coffer Dam Method—			
704,000 cu. yds. rock excav., full rate	1.24	1.24¾	1.50
44,000 cu. yds. rock excav., half rate	.62	.62⅜	.75
180,000 cu. yds. earth excav	.60	.50	.60
Coffer dam construction, lump sum	25,000.00	25,000.00	25,000.00
Coffer dam removal, lump sum	15,000.00	15,000.00	15,000.00
Pier removal	5,000.00	5,000.00	5,000.00
Totals	$1,578,440	$1,690,685	$1,819,200
Sub-aqueous Method Only—	*a*	*d*	*c*
736,000 cu. yds. rock excav., full rate	$2.60	$3.20	$3.30
144,000 cu. yds. rock excav., half rate	1.30	1.60	1.65
460,000 cu. yds. earth excav., full rate	.60	.47	.60
12,000 cu. yds. earth excav., half rate	.30	.23½	.30
Pier removal, lump sum	5,000.00	5,000.00	5,000.00
Totals	$2,385,400	$2,809,620	$2,951,000

**Items marked thus give the names of parties awarded contracts.*

F. Haffen, Pres. Boro. Bronx, for constructing anchorages for the concrete retaining walls and building drain at the Morris Heights approach to the N. Y. C. & H. R. R. bridge. Engineer's estimate: 500 cu. yds. excav., 500 cu. yds. filling and back filing, 4,000 lin. ft. bearing piles, 7 cu. yds. Classs "A" and 70 cu. yds. Class "B" concrete, 6,200 lin. ft. steel wire cable, 3/8-in. dia., 110 lin. ft. 16-in. and 18 lin ft. 8-in. c. i. pipe, 2,000 ft. lumber.

**Brooklyn, N. Y.*—The contract for furnishing material and building extension to pier bet. 51st and 52d Sts., Boro. of Brooklyn (bids opened Sept. 27 by J. A. Bensel, Comr. of Docks, N. C. City) has been awarded to the N. Y. State Constr. Co., 80 Broad St., for $17,303.

The Bd. of Estimate and Apportionment on Oct. 4 passed a resolution authorizing the issue of corporate stock in the sum of $10,000,000 for the acquirement and development of property along South Brooklyn waterfront, from 28th to 36th St., and from 58th to 61st St.; it is estimated that $6,000,000 will be required to pay for the purchase of property and the remainder to be used in building the docks which Comr. Bensel of the Dept. of Docks and Ferries has planned along the entire waterfront.

Panama.—Bids will be received until **Nov. 8 by the** Isthmian Canal Comn. at the office of H. D. Hodges, Genl. Purchasing Officer, Washington, D. C., for Portland cement, boiler, feed pumps, wire rope, rivets, etc., as per circular No. 307.

**Panama.*—The Isthmian Canal Comn. at Washington, D. C., is reported to have awarded to the Newport News Shipbuilding & Dry Dock Co., of Newport News, Va., the contract for furnishing 6 steel dredges for canal work for $120,000.

Philadelphia, Pa.—Bids will be received by Maj. J. C. Sanford, Corps Engrs., U. S. A., until Nov. 15, for dredging in Delaware River, in Sects. 4 and 5, as advertised in The Engineering Record.

Providence, R. I.—The New York, New Haven & Hartford, R. R. Co. (Edw. Gagel, Ch. Engr., New Haven, Conn.) is reported to be considering the construction of wharves and buildings on India St. and the extension of the harbor line to the south, and the relocation of the channel bet. Fox Point and the India Point Ry bridge, to cost in all about $1,000,000.

Charleston, S. C.—Plans are reported to have been completed by the Bureau of Yards & Docks at Washington, D. C., for constructing a pile and timber wharf at the entrance of the dry dock at the Charleston navy yard; probable cost, $75,000.

Bids will be received until Oct. 25 by Capt. E. R. Stuart, Corps Engrs., U. S. A., Charleston, for constructing hydraulic dredge, as advertised in The Engineering Record.

San Angelo, Tex.—The Atchison, Topeka & Santa Fe R. R. Co. (C. A. Morse, Ch. Engr., Topeka, Kan.) is reported to have decided to construct a 20-ft. dam across the North Concho River near San Angelo.

Two Harbors, Wis.—It is stated that an election will soon be held to vote on issuing $20,000 bonds for improving the inner harbor.

Ft. D. A. Russell, Wyo.—Bids will be received until Nov. 4 by Capt. V. K. Hart, 15th Inf., U. S. A., Cheyenne, for furnishing material and constructing a steel fence for enclosing quartermaster's carrols at Ft. D. A. Russell.

Portuguese Cove, N. S.—It is stated that bids will be received until Oct. 25 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for the construction of a breakwater at Portuguese Cove.

Laprairie, Que.—Bids will be received until Nov. 4 by the Dept. Pub. Wks. (Fred Gelinas, Secy.), Ottawa, Ont., for constructing 2 ice piers in the river St. Jacques, at Laprairie. J. L. Milliard, Resident Engr., Merchants' Bank Bldg., Montreal, Que.

St. Simeon, Que.—Bids will be received until Nov. 4 by the Dept. Pub. Wks. (Fred Gelinas, Secy.), Ottawa, Ont., for constructing a head block to the wharf at St. Simeon. A. R. Decary, Resident Engr., Post Office, Quebec, Que.

**Ottawa, Ont.*—The Dept. of Pub. Wks. at Ottawa is reported to have awarded contracts as follows: Ferry wharf at Dalhousie, N. B., at $10,000, to J. & A. Culligan, of Kacquet River; breakwater at Trancook Island, Lunenburg, N. S., to A. W. Girroir & Sweet, of Antigonish, at $20,000: wharf at Agnes, Beauce County, Que., to A. L. Lapointe, of Agnes, at $4,000, and wharf at Sand Point, Renfrew County, to J. J. Fallon, of Cornwall, at $6,000.

Colborne, Ont.—Bids will be received until Oct. 24 by Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, for constructing a wharf and stone approach at Colborne. T. G. Senz, Res. Engr., Confederation Life Bldg., Toronto.

PROPOSALS OPEN.

For Proposals see pages 74, 76, 78 and 79.

WATER.

Bids Close.		See Eng. Record.
Oct. 22.	Pumping engines, boilers, etc., Philadelphia, Pa. Adv. Oct. 5 to 19	Oct. 5
Oct. 22	Water wks., Beaver City, Neb. Adv. Oct 5, 12.	Oct. 5
Oct. 22.	Water works, Marion, Kan	Oct. 12
Oct. 23.	Filters, Atlanta, Ga. Adv. Sep. 14 to Oct. 5.	Sep. 14
Oct. 23.	Boilers, Owosso, Mich. Adv. Oct. 12	Oct. 12
Oct. 23.	Water wks. exten., De Pere, Wis	Oct. 19
Nov. 4.	Water wks., Tucson, Ariz. Adv. Sep. 28.	Sep. 28
Nov. 4	Meters, Panama	Oct. 12
Nov. 5.	System, Las Animas Colo	Oct. 12
Nov. 5.	Boiler, etc., Oceanside, Cal	Oct. 19
Nov. 7.	Improv. water system, Chilocco, Okla	Oct. 19
Nov. 11.	Well, Ft. Terry, N. Y	Oct. 19
Nov. 15.	Pipe, Winnipeg, Man Adv. Oct. 5 to 19	Oct. 5
Dec. 1.	Water wks., Shelley, Idaho	Sep. 28
Dec. 1.	Pipe, etc., Phoenix, Ariz. Adv. Oct. 5 to 19.	Oct. 12
Dec. 17.	Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19	Oct. 12
——	Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Oct. 19	Sep. 28
——	Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12, 19	Oct. 12
——.	Reservoir, etc., Blackstone, Va	Oct. 19

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 21.	Torrington, Conn. Adv. Oct. 12, 19	Oct. 12
Oct. 22.	Spokane, Wash	Oct. 12
Oct. 22.	Buffalo, N. Y	Oct. 12
Oct. 22.	Virginia, Minn	Oct. 12
Oct. 23.	Whiterocks, Utah	Sep. 28
Oct. 23.	Portsmouth, O.	Oct. 19
Oct. 24.	Cleveland, O.	Oct. 19
Oct. 24.	Toledo, O.	Oct. 19
Oct. 24.	Cedar Rapids, Ia	Oct. 19
Oct. 24.	Kansas City, Mo	Oct. 19
Oct. 24.	North Manchester, Ind	Oct. 19
Oct. 25.	Terre Haute, Ind. Adv. Oct. 19	Oct. 19
Oct. 28.	Aberdeen, S. D	Oct. 12
Oct. 29.	Tecumseh, Mich. Adv. Oct. 19	Oct. 12
Oct. 29.	Troy, N. Y	Oct. 19
Oct. 31.	Riverside, N. J	Oct. 12
Oct. 31.	Ardmore, Pa. Adv. Oct. 19.	Oct. 19
Oct. —.	**Eaton, O.**	**Aug. 3**
Nov. 4.	Des Moines, Ia	Oct. 19
Nov. 7.	White Plains, N. Y Adv. Oct. 19	Oct. 19
Nov. 11.	Pensacola, Fla	Oct. 19
Dec. 2.	Cadillac, Mich. Adv. Oct. 19	Oct. 19
Dec. 3.	Auburn, N. Y. Adv. Oct. 19	Oct. 19

BRIDGES.

Oct. 22.	Hamilton, O.	Oct. 5
Oct. 23.	Philadelphia, Pa. Adv. Oct. 12, 19	Oct. 12
Oct. 23.	Clinton, O.	Oct. 12
Oct. 24.	Panama. Adv. Sep. 28	Sep. 28
Oct. 24.	Hailey, Idaho	Oct. 5
Oct. 24.	New York, N. Y	Oct. 12
Oct. 26.	Chicago, Ill	Oct. 12
Oct. 26.	Carlsbad, N. M	Oct. 19
Oct. 28.	Sulphur Springs, Ind. Ter	Oct. 19
Oct. 28.	Walla Walla, Wash	Oct. 19
Oct. 28.	Mt. Holly, N. J	Oct. 19
Oct. 29.	New York, N. Y	Oct. 19
Oct. 30.	Williamsport, Md. Adv. Oct. 12, 19	Oct. 12
Nov. 4.	Ashland, O	Oct. 12
Nov. 5.	Vincennes, Ind	Oct. 19
Nov. 7.	Mauch Chunk, Pa	Oct. 19
Nov. 8.	Redding, Cal.	Oct. 19
Nov. 12.	Troy, O.	Oct. 12
Nov. 15.	Glendive, Mont. Adv. Sep. 28 to Oct. 12	Sep. 28
Nov. 15.	Portland, Ore.	Oct. 19

PAVING AND ROAD MAKING.

Oct. 21.	New York, N. Y	Oct. 12
Oct. 22.	Nampa, Idaho	Sep. 28
Oct. 22.	Buffalo, N. Y	Oct. 19
Oct. 22.	Logansport, Ind	Oct. 19
Oct. 22.	Scranton, Pa	Oct. 19
Oct. 22.	Chicago, Ill	Oct. 19
Oct. 23.	Brooklyn, N. Y	Oct. 12
Oct. 24.	Concord, N. C. Adv. Oct. 12, 19	Oct. 12
Oct. 24.	New York, N. Y	Oct. 12
Oct. 24.	Kansas City, Mo	Oct. 19
Oct. 24.	Cleveland, O.	Oct. 19
Oct. 26.	Richwood, O	Oct. 12
Oct. 29.	St. Louis, Mo	Oct. 19
Oct. 29.	New York, N. Y	Oct. 19
Oct. 30.	Des Moines, Ia	Oct. 19
Oct. 30.	Brooklyn, N. Y	Oct. 19
Oct. 31.	Ft. Logan H. Roots, Ark. Adv. Oct. 5 to 19.	Oct. 5
Oct. 31.	Des Moines, Ia	Oct. 19
Oct. —.	Selma, Ala.	Sep. 7
Nov. 1.	El. ry., Calgarry, Alta	Oct. 12
Nov. 1.	Cincinnati, O.	Oct. 19
Nov. 2.	Greencastle, Ind	Oct. 19
Nov. 2.	Ft. Wayne, Ind	Oct. 19
Nov. 4.	Peru, Ind.	Sep. 28
Nov. 4.	Decatur, Ind	Oct. 19
Nov. 4.	Logansport, Ind	Oct. 19
Nov. 4.	Red Bank, N. J	Oct. 19
Nov. 5.	Vincennes, Ind	Oct. 19
Nov. 6.	Cleveland, O	Oct. 12
Nov. 7.	Rockville, Ind	Oct. 19
Nov. 7.	Redding, Cal.	Oct. 19
Nov. 12.	Troy, O.	Oct. 12
Nov. 15.	Garb. disp., Altoona, Pa	Oct. 12
Nov. 15.	Pensacola, Fla. Adv. Oct. 19	Oct. 19
Dec. 6.	Salt Lake City, Utah Adv. Oct. 19.	Oct. 19
Dec. 13.	Valparaiso, Ind.	Sep. 7
——	York, Pa.	Sep. 7
——	Ithaca, N. Y. Adv. Oct. 19	Oct. 12

POWER PLANTS, GAS AND ELECTRICITY.

Oct. 21.	New York, N. Y	Oct. 12
Oct. 22.	Marion, Kan	Oct. 12
Oct. 23	Baltimore, Md.	Oct. 19
Oct. 24.	New York, N. Y	Oct. 12
Oct. 28.	Evansville, Ind	Oct. 19
Oct. 28.	Brooklyn, N. Y	Oct. 19
Oct. 28.	Ellis Island, N. Y	Oct. 19
Oct. 30.	Bay City, Mich. Adv. Oct. 19	Oct. 19
Oct. 30.	Fresno, Cal.	Oct. 19
Nov. 1.	Seymour, Ind.	Sep. 14
Nov. 1.	Ft. Des Moines, Ia	Oct. 19
Nov. 1.	Clifton Forge, N. Y	Oct. 19
Nov. 4.	Panama	Oct. 12
Nov. 4.	Pierre, S. D	Oct. 19
Nov. 4.	Berrien Springs, Mich	Oct. 19
Nov. 8.	Kokomo, Ind.	Oct. 5
Nov. 9.	Las Animas, Colo.	Sep. 28
Nov. 14.	Cincinnati, O.	Oct. 19
Nov. 15.	Charleston, S. C.	Sep. 14

BUILDINGS.

Oct. 21.	School, New York, N. Y	Oct. 12
Oct. 22.	Pub. bldg., National Military Home, Kan.	Oct. 5
Oct. 22.	Hospital, Warren, Pa	Oct. 12
Oct. 22.	Pub. bldg., Kincardine, Ont	Oct. 12
Oct. 22.	School, New Bedford, Mass	Oct. 12
Oct. 22.	School, Bordentown, N. J	Oct. 19
Oct. 22.	School, North, S. C	Oct. 19
Oct. 22.	Bus bldg., Fayetteville, N. C	Oct. 19
Oct. 22.	School, Detroit, Mich	Oct. 19
Oct. 23.	School, Galesville, Wis.	Oct. 5
Oct. 24.	Roofing National Museum, Washington, D. C. Adv. Oct. 5 to 19	Oct. 5
Oct. 24.	Shafts and bases, etc., Nat'l Museum, Washington, D. C. Adv. Oct. 5 to 19	Oct. 5
Oct. 24.	Pub. bldg., Lapeer, Mich	Oct. 12
Oct. 24.	Pub bldg., Brooklyn, N. Y	Oct. 19
Oct. 24.	Schools, Toronto, Ont	Oct. 19
Oct. 24.	Addition to Post Office, Port Arthur, Ont.	Oct. 19
Oct. 25.	Ex. to pub. bldg., Roanoke, Va	Oct. 5
Oct. 25.	Jail, Winston Salem, N. C	Oct. 12
Oct. 25.	Schools, Greenwood, La	Oct. 19
Oct. 25.	Add to hospital, Raleigh, N. C	Oct. 19
Oct. 25.	Church plans, Pine Bluff, Ark	Oct. 19
Oct. 26.	Hospital work, Kansas City, Mo	Oct. 19
Oct. 26.	School, Mankato, Minn	Oct. 19
Oct. 26.	Hospital, Rochester, Minn	Oct. 19
Oct. 26.	Hospital, St. Peter, Minn	Oct. 19
Oct. 26.	School, Faribault, Minn	Oct. 19
Oct. 26.	Prison, Chauncey, O	Oct. 19
Oct. 28.	Post office, East St. Louis, Ill	Oct. 5
Oct. 28.	Post bldgs., Plattsburgh Barracks, N. Y. Adv. Oct. 5 to 19	Oct. 5
Oct. 28.	Schools, Salem, Ind	Oct. 19
Oct. 28.	School, West New Brighton, N. Y	Oct. 19
Oct. 28.	Pub. Bldg., Boston, Mass	Oct. 19
Oct. 29.	School, New York, N. Y	Oct. 19
Oct. 30.	Jail, etc., Terre Haute, Ind	Sep. 21
Oct. 30.	Post office, Atlanta, Ga.	Sep. 28
Oct. 30.	Post bldgs., Columbus Barracks, O	Oct. 5
Oct. 30.	Bus. bldg., Batesburg, S. C	Oct. 12
Oct. 31.	Interior partitions in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12	Oct. 5
Oct. 31.	Mechanical equipment in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12	Oct. 5
Oct. 31	Pub bldg., Kansas City, Mo	Oct 12
Oct. 31.	Pub bldg., New York, N. Y	Oct. 19
Nov. 1.	Jail, Mangum, Okla	Oct. 12
Nov. 1.	School, Stamford, N. Y	Oct. 12
Nov. 1.	School, New Haven, Conn	Oct. 19
Nov. 1.	County Memorial Bldg., Pittsburg, Pa	Oct. 19
Nov. 1.	Add to jail, Balsam Lake, Wis	Oct. 19
Nov. 2.	Pub. Bldg., New Orleans, La	Oct. 19
Nov. 4.	Post bldg., Ft. Bliss, Tex Adv. Oct. 12, 19.	Oct. 12
Nov. 4.	School, Woodruff, S. C	Sep. 28
Nov. 4.	School, Pierre, S. D	Oct. 19
Nov. 4.	Pub. bldg., Leesville, La	Oct. 19
Nov. 5.	Court house plans, Houston, Tex. Adv. Sep. 14 to Oct. 19.	Aug. 31
Nov. 5.	Barrack bldg., Portland, Me. Adv. Oct. 5 to 19.	Oct. 5
Nov. 5.	Post Office, Flint, Mich Adv. Oct. 5, 12.	Oct. 5
Nov. 5.	Barracks, New Orleans, La.	Oct. 12
Nov. 5.	Barracks, etc., New Orleans, La	Oct. 19
Nov. 11.	Plumbing, pub. bldg., Pensacola, Fla	Oct. 19
Nov. 11.	School, Cincinnati, O. Adv. Oct. 19	Oct. 19
Nov. 12.	School, Seattle, Wash.	Oct. 12
Nov. 12.	Schools, Pipestone, Minn	Oct. 19
Nov. 14.	School, Jersey City, N. J	Oct. 19
Nov. 15.	Pub. bldg., Chippewa Falls, Wis	Oct. 5
Nov. 15.	Y. M. C. A. bldg., Tampa, Fla	Oct. 19
Nov. 21.	Bus. bldg., Auburn, N. Y	Oct. 5
Nov. 22.	Post office, Portsmouth, Va Adv. Oct. 19.	Oct. 19
Nov. 25.	Exten. to post office, Tyler, Tex	Oct. 19
Nov. —.	University gymnasium, Madison, Wis	Oct. 5
Nov. —.	School, Allegheny, Pa	Oct. 19
Dec. —.	**Industrial plants, Ft. William, Ont**	**May 11**
Dec. —.	School, Anderson, Ind.	Sep. 28
Feb. 1.	Plans for Capitol, San Juan, P. R	Sep. 28
Feb. —.	College, Agricultural College, Mich	Oct. 19

MISCELLANEOUS.

Oct. 21.	Dredging, Wilmington, Del. Adv. Sep. 28 to Oct. 19.	Sep. 28
Oct. 21.	Boilers, Pontiac, Mich. Adv. Oct. 12, 19.	Oct. 12
Oct. 22.	Canal, New Orleans, La	Sep. 28
Oct. 22.	Supplies, Washington, D. C	Oct. 12
Oct. 24.	El. ry. wk., New York, N. Y	Oct. 12
Oct. 24.	Walls, etc., Toccoa, Ga	Oct. 19
Oct. 24.	Ditch, Ortonville, Minn	Oct. 19
Oct. 24.	Wharf, Colborne, Ont	Oct. 19
Oct. 25.	Dredge, Charleston, S. C Adv. Sep. 21 to Oct. 5 and Oct. 19.	Sep. 21
Oct. 25.	Exten. to wharf, Southampton, Ont	Oct. 5
Oct. 25.	Ditch, Ivanhoe, Minn	Oct. 12
Oct. 25.	Drain, Boone, Ia.	Oct. 19
Oct. 25.	Breakwater, Portuguese Cave, N. S	Oct. 19
Oct. 26.	Wharf, Berkeley, Cal	Oct. 12
Oct. 26.	Wharf, St. Alphonse, Que	Oct. 12
Oct. 28.	Tin, rope, etc., Panama. Adv. Oct. 5	Oct. 5
Oct. 28.	Boardwalk, Atlantic City, N. J	Oct. 5
Oct. 28.	Board walk, Atlantic City, N. J. Adv. Oct 12.	Oct. 12
Oct. 29.	Supplies, Washington, D. C	Oct. 12
Oct. 29.	Wall, New York, N. Y	Oct. 19
Oct. 30.	Dredging, Providence, R. I. Adv. Oct. 5 to 19.	Oct. 5
Nov. 1.	El. ry., Calgary, Alta	Oct. 12
Nov. 1.	Repairs to wharf, Ft. Schuyler, N. Y.	Oct. 12
Nov. 4.	Steel hull for snag boat, Louisville, Ky. Adv. Oct. 5 to 19.	Oct. 5
Nov. 4.	Punching machines, Panama	Oct. 12
Nov. 4.	Steel fence, Ft. D. A. Russell, Wyo	Oct. 19
Nov. 4.	Ice, Piers, La Prairia, Que	Oct. 19
Nov. 4.	Wharf, St. Simeon, Que	Oct 19
Nov. 7.	Levee work, New Boston, Ill	Oct. 19
Nov. 8.	Cement, etc., Panama	Oct. 19
Nov. 9.	Crematory, Las Animas, Colo	Sep. 28
Nov. 11.	Torpedo Cases, Ft. Totten, N. Y. Adv. Oct. 19.	Oct. 19
Nov. 14.	Monument, Chalmette, La. Adv. Oct. 12, 19.	Oct. 12
Nov. 15.	Garb. disp., Altoona, Pa	Oct. 12
Nov. 15.	Pub. bldg., Chippewa Falls, Wis	Oct. 5
Nov. 15.	Dredging, Philadelphia, Pa. Adv. Oct. 19.	Oct. 19
Nov. 16.	Levee work, Pine Bluff, Ark Adv. Oct. 19.	Oct. 19
Nov. 18.	Locks and dams, Dallas, Tex. Adv. Oct. 12, 19.	Oct. 12
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 19	Sep. 28
Nov. 20.	Rock and earth excavation, Detroit, Mich. Adv. Oct. 12, 19	Oct. 12
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28 to Oct. 19.	Sep. 28
——	Lease of limestone quarries, Newark, N. J. Adv. Oct. 5	Oct. 5

*Items marked thus give the names of parties awarded contracts.

CURRENT NEWS SUPPLEMENT

OCTOBER 26, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting, November 6, 1907. Paper on Water Purification at St. Louis, Mo.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York. Next meeting, November 12, 1907. Paper on Gearless Traction Eelctric Elevators.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Patterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

THE BUSINESS SITUATION.

The financial colic that afflicted New York this week is something that need cause little apprehension regarding the general business condition of the country. It was a symptom of mild distress attending the casting out from New York banking circles of a few individuals whose use of the funds of depositors has long been regarded with distrust by conservative financiers. The institutions they managed naturally failed to retain the confidence of many of their depositors, and in the sudden unexpected local demand for cash originating with these depositors, it was necessary to sell at any price large amounts of high-grade stocks and other securities. This forced sale coupled with attacks by bear traders produced a condition approaching a panic on Wall Street, but it was a strictly local upheaval that has had little effect on the country at large, except to produce a more careful consideration of credits. The situation was not without its humorous side, moreover, as when an officer of a trust company which was forced to suspend on account of its poor management attributed the suspension to "one man, who, in the last six months, in public and private speeches, has been gradually undermining the credit system of the country." The fact that the New York Trust Companies' Association did not help this institution, although perfectly able to do so had it seen fit, is all the commentary the above-quoted statement deserves.

This New York incident and a purely local disturbance in Pittsburg are merely examples of the results that sometimes follow the giving of too liberal credits by financial institutions. It would probably be a good thing for most of us to experience a little more difficulty in getting accommodation from banks for new ventures. It is a good many years since we had any experience with hard times, and while an early recurrence of them, of which there is slight probability, would be deplorable, a little stiffening of conditions now would be helpful in checking new ventures which will tie up large amounts of capital without much chance of appreciable returns for some years. While there seems to be absolutely no indication of trouble ahead for any legitimate business asking and giving only regular credits, it is a good time to be careful to avoid embarking on anything speculative or involving a heavy line of credits. The great commercial body of the country is a sensitive organism when in its healthiest condition, and if its life's blood, credits, suffers from anaemia, the results may become quite distressing without being serious. It must be most unsatisfactory for holders of shares of the best railroads to consider their depreciation of twenty to forty per cent. within ten months, yet the inherent value of the securities is just the same that it was in 1906. Their extraordinary low rate this week was due to the fact that they were the things on which money could be raised most quickly by people needing it in a hurry, and so they were thrown on a market not ready to absorb them in such quantities except at prices below their actual value.

THE ALLIS-CHALMERS REPORT.

The annual report of the Allis-Chalmers Co. for the year ending June 30, and a supplementary report by President Whiteside for the quarter ending Sept. 30, were made public on Oct. 24, and show some highly significant facts, which are doubtless gratifying to the stockholders. There has been a considerable change in the composition of the Board of Directors and four leading officials of the United States Steel Corporation have been elected to it, Judge Elbert H. Gary, Edmund C. Converse, Charles MacVeagh, the Steel Corporation's general solicitor, and Alexander F. Banks, president of its Joliet Eastern R. R. The finance and executive committees have been abolished, and the management of the company is practically in the hands of Judge Gary and President Whiteside. The changes in the directorate mean a great addition to the financial resources behind the company.

During the fiscal year, the results were not so satisfactory as expected on account of strikes, the failure of contractors to complete buildings and furnish machinery on time, and the large expense attendent upon the organization of the new plant and the development of new lines of manufacture. Beginning with the last quarter of the year, most of the adverse conditions had been overcome and the company entered upon the present period of steadily increasing net earnings, which is reflected in the following statement drawn from President Whiteside's supplementary report, dated Oct. 21:

	Gross Profit	Expenses	Net profit
April	$228,660	$191,261	$ 37,399
May	268,893	199,475	69,418
June	282,724	189,183	93,541
July	270,451	189,449	81,002
August	289,745	188,045	101,700
September	292,640	186,432	106,280

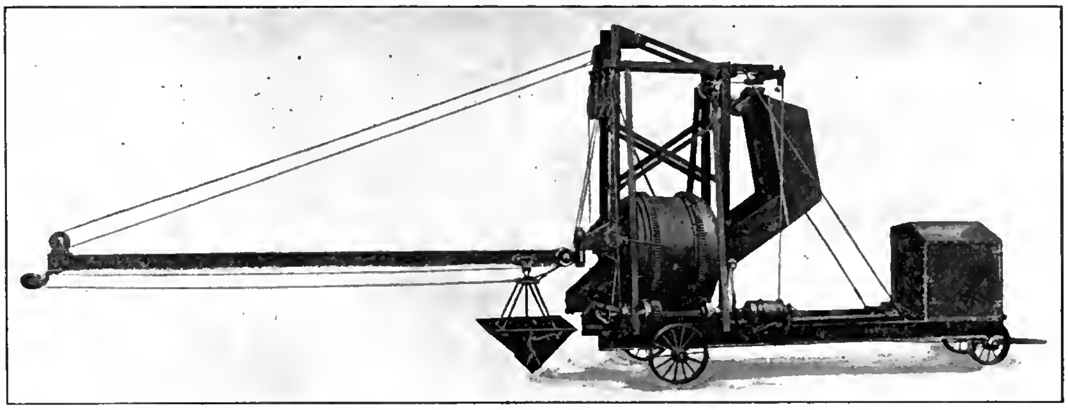
In this table the figures for expenses embrace general and selling expenses, interest on bonds, and the like. These figures are a better indication of the company's condition than those given in the annual report for the year ending June 30, since it was not until April that the company began to receive benefits from the newly-developed lines of machinery built at its enlarged West Allis plant.

A SPECIAL CONCRETE MIXER FOR STREET USE.

The accompanying illustration shows the general features of a concrete mixer designed to meet the special requirements of street work, although it is equally suited for the conditions that exist during the construction of many large retaining walls, bridge abutments and dams. The machinery is carried on a frame of 10-in. channels, supported on trucks provided with a traction drive for moving the mixer along the street when it is used in laying concrete foundations for pavements or in building subways or conduits.

The automatic loading bucket has a partition and the materials can be shoveled into it from both sides of the machine. In the illustration the bucket is shown pulled up to discharge its contents into the mixer. The latter has a capacity of 22 to 25 cu. ft. to the hatch and is of the standard Koehring type.

The mixing drum discharges the concrete into a special bucket which travels on an I-beam track, at any point of which it can be stopped and discharged. The standard length of this track is 24 ft., although a longer or shorter length can be furnished if desired. The track is connected to the frame by a universal joint, which allows it to be swung from one side of the street to the other side and to be raised at an angle of 45 deg. with the horizontal. When the machine is used in street work, the bucket will partially spread the concrete.



A SPECIAL CONCRETE MIXER FOR STREET USE.

The machine does away with all wheeling, which is expensive on account of the labor employed. It is furnished with gasoline, steam or electric motor power equipment by the builders, the Koehring Machine Co., Milwaukee, Wis.

THE HENNEPIN CANAL.

The formal opening this week of the Hennepin or Illinois and Mississippi Canal is an interesting event in transportation affairs in the upper Mississippi Valley. As long ago as 1864 the Iowa Legislature sent a memorial to Congress requesting the construction of a canal from Hennepin to Rock Island. The first survey was made in 1866 and several more were subsequently made before Congress made its first appropriation, in 1890, for the work.

The canal begins at the great bend of the Illinois River, 1¾ miles above the town of Hennepin, Ill., proceeds thence 62 miles via Bureau Creek valley and over the summit to Rock River at the mouth of the Green River, near Colona, Ill., thence by slack water down Rock River 8½ miles, thence by canal around the lower rapids of Rock River 4½ miles to the Mississippi River, making a total distance from the Illinois to the Mississippi River of 75 miles, and 193¼ miles from Chicago to the Mississippi River.

The canal is 80 ft. wide at the water surface, 7 ft. deep, with lock chambers 2,170 ft. in length and 35 ft. in width, capable of passing barges of 600 tons burden.

The summit level is about 11 miles in length, and the distance from its eastern end to the Illinois River

is 18.4 miles, with a difference of level of 196.4 ft., which is overcome by 21 locks. The distance from the western end of the summit level to the Mississippi River is 45.0 miles and the difference in level is 100 ft., overcome by 11 locks. The summit level is fed by a navigable feeder which is of the same size as the main canal and 29 miles long, beginning at Sterling, Ill., where water for the feeder is obtained by damming Rock River.

A lock is located at the head of the feeder as a guard lock and also to enable boats to pass from the feeder into the river and back at different stages of the water in the river. The dam located here also creates slack water in Rock River, enabling boats to navigate it as far as Dixon, Ill., giving to that place as well as to Sterling water connections with the canal.

Work was begun on the canal in July 1892, on the Mississippi River near the mouth of Rock River and the 4½ miles of canal around the lower rapids of Rock River, with slack water in the river above, were completed and formally opened to navigation on April 17, 1895, and since that time have been largely used by coal boats from the mines on Rock River.

RECENT INSTALLATIONS OF LARGE GAS ENGINES.

Power users in practically all lines of business have shown very active interest in recent gas engine installations, the natural result of the unprecedented scale upon which the U. S. Steel Corporation has entered upon the use of gas power. The saving in fuel effected by use of the gas engine as a prime mover has long been fully realized by power users of this country, yet little progress has been made except in the natural gas district, chiefly because of a widespread doubt as to the reliability of engines of this type. The performance of the engines already installed by leading gas engine manufacturers has, therefore, been watched very closely and the record of some recent installations will undoubtedly prove of interest to all power users.

The first Allis-Chalmers gas engine to be put in constant service was a tandem engine of 1,000 h.p. maximum capacity direct connected to an Allis-Chalmers direct-current generator of 500 kw. rated capacity. This unit is installed at the Milwaukee works of the Illinois Steel Co. Although it was the first gas engine built by this company, it started successfully on its first trial, and after a few days devoted to the tests and adjustments natural in a first installation, the engine was put in continuous day and night operation where it has remained ever since, only shutting down with the mill on Sunday.

As would be expected of an engine installed at a rolling mill, the load varies greatly in character and is subject to wide fluctuations. Mill motors in all classes of service and incandescent lights are carried from the same generator, but the regulation is so close that there is practically no change in voltage with changes in load, even such as would be shown by flicker of the lights.

Another unit of 600 h.p., direct connected to a 350-kw. Allis-Chalmers direct-current generator, has been for some time in service at the works of the Trenton Iron Co., Trenton, N. J. This engine is supplied with gas from producers furnished by the R. D. Wood Co. The unit differs slightly in type from the one just described, and was the first of its size and type to be started by Allis-Chalmers Co. This unit has been in continuous service ever since first started, on load ranging from full rated capacity to 50 per cent. overload.

A 2,000-h.p. Allis-Chalmers engine direct-connected to a 1,000-kw. generator has been for some time in operation on blast furnace gas at the plant of the National Tube Co. at McKeesport, Pa. This engine is a twin-tandem or a four-cylinder engine with cylinders of the same size as those installed by the Milwaukee works of the Illinois Steel Co. It was but natural, therefore, that this engine should be put into regular service immediately on starting up and give the same satisfactory results as were obtained by the Milwaukee plant. This engine is the first of several units which Allis-Chalmers Co. are installing at the same plant. Power is used for mill motors and lights and, as is customary in the steel business, all these engines are operated on 24-hr. service.

Two units, duplicates of the unit at McKeesport, are just going into service at the power house of the Milwaukee Northern Railway Co. at Port Washington, Wis. This is an interurban line, with Milwaukee as its southern terminal, operated exclusively by gas power. The generators are 1,000-kw. Allis-Chalmers three-phase 25-cycle alternators, direct connected to Allis-Chalmers gas engines, the gas being supplied by producers.

A duplicate of the Trenton engine, using natural gas, has also been recently put in service at the Kokomo plant of the Pittsburg Plate Glass Co. This is the first of a number of units which Allis-Chalmers Co. is building for that service.

Two units of 4,000 h.p. each, consisting of Allis-Chalmers gas engines direct connected to 2,000-kw. Allis-Chalmers alternators, will very shortly be put in operation at the South Works of the Illinois Steel Co., South Chicago, Ill. These engines operate with blast furnace gas, and as the design in all respects duplicates that of the engines already in service, there is every reason to believe that they will start up with the same characteristic absence of difficulty.

Another 4,00,-h.p. unit is now in the course of erection at one of the Carnegie plants in the Pittsburg district, this unit being the first of seven 4,000-h.p. units which are being installed at the rate of one every thirty days in the same power house.

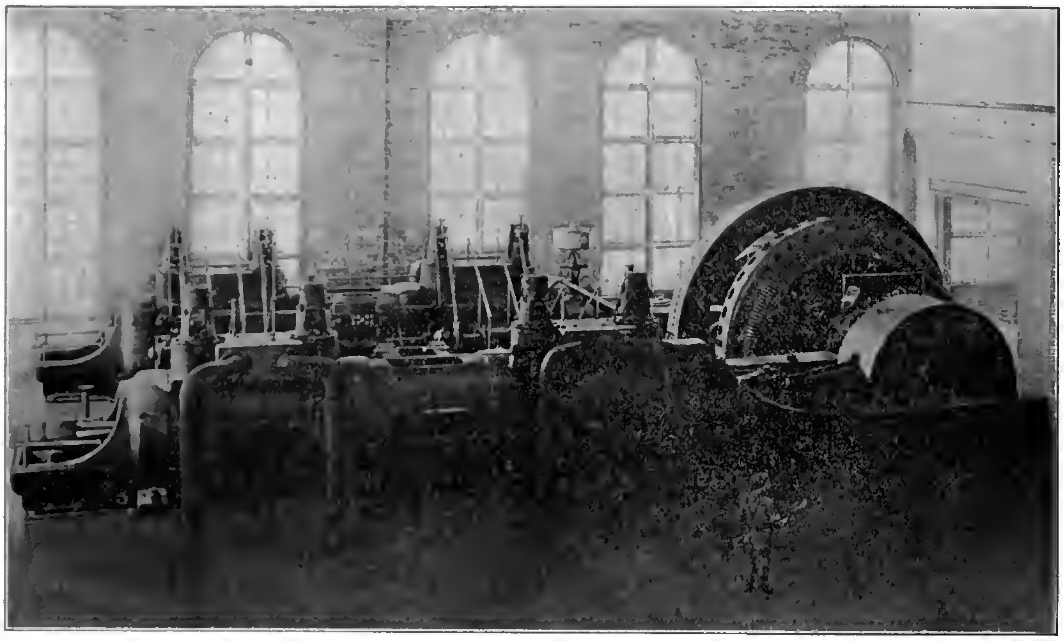
The performance of those first engines is being given especially close attention by the officials of the Indiana Steel Co., at whose new mills at Gary gas power is to be used exclusively. The entire electric power equipment of this plant is being supplied by the Allis-Chalmers Co. The portion now under contract consists of 17 Allis-Chalmers gas engines rated at 4,000 h.p. each. Fifteen of these are direct connected to Allis-Chalmers 25-cycle three-phase alternators, which will operate in parallel and supply current to more distant portions of the mill; two are direct-current generators supplying current for portions of the plant immediately adjacent to the power house.

The Allis-Chalmers Co. is also building eight blowing engines with the same size gas cylinders as electrical units for the same plant, making 25 engines, or a total of 100,000 h.p. which the company is supplying for this power house alone. It will require approximately 1,000 carloads to complete the shipment of these engines.

The electrical power house, in which will be installed the seventeen electrical units, is 1,000 ft. long and 105 ft. wide. Switchboards are arranged in the gallery at such height that all of the units and the signals of the engine attendants may be readily observed by the operators at the switchboard. It will be one of the largest power houses in the world, and the electrical generating station at this plant alone will be double the size of any previous gas engine installation either at home or abroad. The power house containing the Allis-Chalmers blowing engine units is of the same width as the electrical house and 600 ft. long. These figures give some idea of the magnitude of this gas engine installation and of the confidence which the designers of this great plant repose in the Allis-Chalmers gas engine as a prime mover. The realization of this is, in large measure, responsible for the great interest in gas engines now shown by power users in other lines of industry.

With gases being wasted which were suitable for use in gas engines, it was but natural that the iron and steel industries should be the first to adopt the use of gas engines on a large scale. The saving in the first cost of fuel, however, is to a certain extent offset by the interest charges on the cleaning apparatus which is necessary in order to remove from blast furnace gas the abrasive dust with which it is charged; this extensive cleaning apparatus, however, is not necessary where producer gas is used.

A great many power installations have been delayed in order to allow time for the first large gas engines to be put into service and to demonstrate whether they would justify the expectations of their builders and designers. Since these Allis-Chalmers engines have started up there has been a considerable increase in inquiries and a number of contracts of this nature have been entered into within the past few months. It is manifest that the gas engine using producer gas is now to take its place permanently as a prime mover in situations where the cost of fuel makes economy in this direction especially desirable.



FOUR-CYCLE DOUBLE-ACTING GAS ENGINE OF MILWAUKEE NORTHERN RAILWAY.

The Northern Engineering Works, Detroit, Mich., has furnished three electric cranes to the North Shore Electric Co., two at Waukegan, and one at Blue Island, Ill.

CONCRETE-METAL BRIDGE PIER.

Mr. Samuel H. Lea, State Engineer of South Dakota, has recently received a patent for a concrete-steel bridge pier consisting of an annular framework of steel bars, forming a structure of any desired shape in plan, and having an inner and an outer surface with an annular space between them as shown. One or both surfaces of the metal framework is covered with wire lath or other suitable material, so as to form a diaphragm over the surface covered. The annular space within the framework is filled with concrete, the outer and inner coating over the metal diaphragm and framework being of rich cement mortar. The sides of the structure are held the proper distance apart by braces, spaced at suitable distances. The lower part of the framework is securely fastened to a shoe, having a cutting edge on the bottom.

This form of construction is intended for a bridge pier, abutment, bulkhead or other similar purpose. It may also be used as an open caisson or as a pneumatic caisson; in the latter case an air-tight cover is placed at the top or at any height between the top and bottom, and provided with the necessary valves and air locks. When used as an open caisson the structure is sunk at the required place and the material within the open interior space may be removed by whatever means may be most convenient.

This form of construction is claimed by the inventor to possess strength, durability and portability as compared with forms in general use. The steel framework affords the necessary tensile strength and rigidity; it is thoroughly protected from rust by the enveloping cement and concrete, which is practically indestructible and affords weight and solidity. The structure can either be previously made as a whole and then put in place at once, or it can be made in sections and put together as it settles in place. The structure may be settled in place by its own weight or, if this is not sufficient, additional weight to the required amount may be applied. When the structure rests securely on the bottom the lower interior portion is filled with concrete out to the cutting edge of the shoe to afford a firm bearing. If no bed rock or other firm foundation is found, piles can be driven inside the structure to afford a good foundation, there being sufficient clear space for this. After the foundation has been properly arranged the entire space inside the hollow pier may be filled with lean concrete or with stone or gravel, or with ordinary earth, as may be preferred.

The advantage of cheapness should not be overlooked in this form of construction. The bulk of the work on the ground may be done with common labor; concrete work not requiring technical skill in mixing and placing when this is done under intelligent supervision. The cost of a structure of this kind should usually be far less than that of an ordinary form of construction.

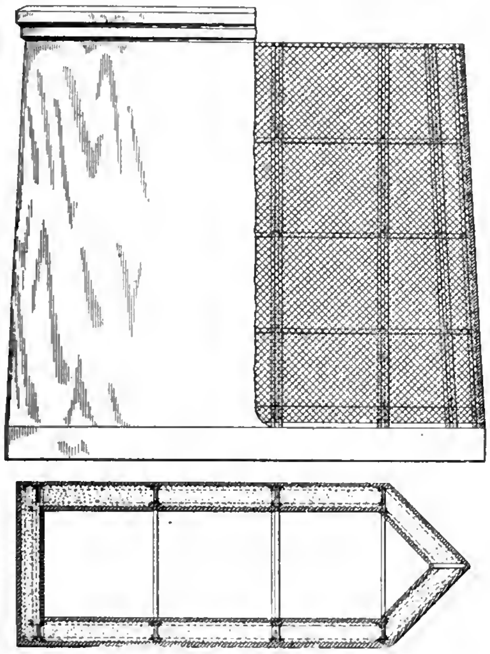
A NEW BALANCED VALVE.

The balanced valve, shown in the accompanying illustrations, was designed and patented by Mr. J. Peterson, Assoc. M. Am. Soc. C. E., 299 Broadway, New York, and six of them, 12 and 48-in. in size, are now in use in Gate House 2 of the new Croton dam. The valve consists of a casing adapted to be submerged in a reservoir or well and provided with ports at all times open to the inflow of water. This casing has valve seats above and below the ports and is surmounted by a bonnet. Within the casing is a plug designed to bear

against the valve seats and operated by a stem, extending through the stuffing box at the top of the bonnet.

In its closed position, the conical peripheral edges of the plug bear snugly against the valve seats. When the valve is opened by operating the stem, the plug is lifted upward from its position and the water flows into the pipe through the ports; as the pressure is all around the plug, it is thus balanced and the gate may be operated with little exertion and with facility.

This gate can be attached in a vertical as well as horizontal position, at the end of intake pipes, in place of a sluice gate. It can also be used in place of ordinary disk



REINFORCED CONCRETE BRIDGE PIER.

gates on a pipe line, in fire hydrants and similar situations.

The advantages claimed for this gate by the designer are simplicity of construction, ease of operation under any head, the only thing to overcome in operating the valve being the weight of the plug and the friction of the stem in the stuffing box, and the speed of operation for it requires only one-third the time to open or close it, that is, with an ordinary sluice gate or disk valve.

THE WESTINGHOUSE RECEIVERSHIP.

On account of the sudden unexpected hardening of the money market in New York this week, at a time when some large financial changes had to be made by several of the Westinghouse companies, it was concluded better for all concerned to place them in the hands of receivers. The following statement by Mr. George Westinghouse explains the situation:

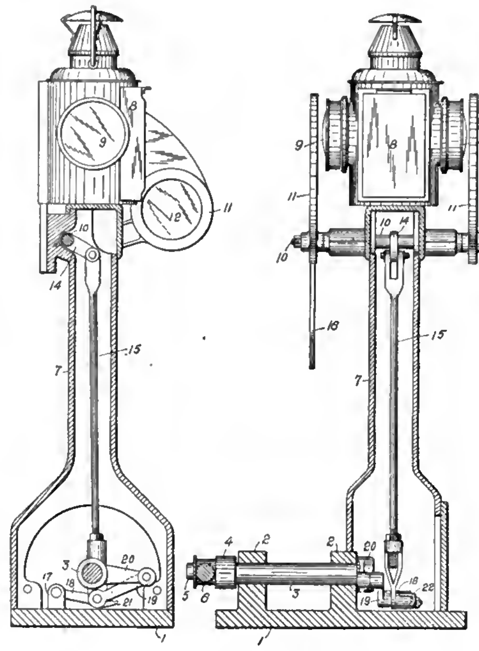
"When the Pittsburg Clearing House Committee, after a full investigation and conference with me, concluded that, although the Westinghouse Electric and Manufacturing Company, and the Westinghouse Machine Company were solvent, receiverships were advisable as the best means of protecting the interests of all concerned, it was clearly our duty to follow their friendly advice. The necessity for the receiverships is due solely to the acute financial stringency, and consequent inability to renew our maturing paper.

"Both the electric and machine companies are solvent, and are doing the largest and most satisfactory business in their history, and each company is earning liberal dividends on its stock, and has quick assets subsequently equal to its liabilities. I most confidently believe that every creditor of each company will be paid in full, and that, with wise management, under the direction of the receivers appointed by the court, the properties will soon be restored to the stockholders."

A NEW TYPE OF DWARF SEMAPHORE SWITCH STANDS

The switch stand here shown is of the dwarf semaphore type designed to be used in yards, as distant or caution signal and at all facing point switches where dwarf stands are now used. The same principle, however, incorporated in higher stands at main line sidings may be employed with equal facility and a corresponding increase in the reliability of the signal.

The object of this device is to insure the movement of the signal to danger on or before the departure of the split rail from the stock rail. Heretofore, in dwarf semaphore stands, the motions of the split rail and the spectacle casting have been relatively synchronous, that is the spectacle partook of the motion of the split rail throughout its entire throw. For example, suppose the switch to be open and the signal at danger. The brakeman throws the switch and instantly upon lifting the ground lever the semaphore blade starts toward the clear, and when the split rail is within, say, ½ in. from the stock rail the semaphore blade has traveled down through 50° towards its clear position of 60° from the horizontal, Should there be any obstruction such as a nut, gravel or sand between the split rail and stock rail to prevent any further travel of the former, the split rail and the semaphore will remain in this relative position, i.e., the switch sufficiently open to derail a train, with the semaphore blade at an angle of 50° downward from the horizontal.



A NEW SWITCH STAND.

The design of this stand prevents such a contingency by a mechanism which throws the signal to danger before any motion of the split rail takes place, and brings the signal to the clear after the split rail is in contact with the stock rail. This result is accomplished by a mechanical motion which destroys the synchronosity of the movements of the two parts in the following manner:

The motion consists of a toggle comprising a pair of links the one, 18, being pivoted to a fixed bearing, 17, cast in the bedplate of the stand, and the other, 19, being pivoted to a crank, 20, of the shaft, 3, which is integral with the ground lever, 4. The up-and-down rod, 15, connects the toggle with the spectacle casting through a rock shaft, 10, upon which the spectacle is mounted. Starting to follow the motion from the clear position, the working is as follows: The arrangement of pivotal centers is such that, as the crank, 20, rises it lifts the toggle-joint until the latter reaches the level of the crank-axis. In this position an extension, 21, of the link, 18, comes in contact with a pin, 22, on the link, 19, preventing any further upward motion of the toggle-joint. At this stage of the motion the toggle-joint has traveled a sufficient distance to throw the semaphore to danger. Up to this point, due to the angularity of the connecting rod, the split rail has not moved, and the desired result is accomplished, i.e., the signal is at complete danger before any motion of the switch. The remainder of the motion the links, 19 and 20, which are now superimposed, complete the half circle as a unit with no further motion of the signal and while the switch is being fully thrown.

The closing of the switch is merely a reversal of this motion. The links 19 and 20 travel as a unit until the position is reached at which place the switch is closed, when the pin, 22, engages the extension, 21, of the link, 19, and starts the downward motion of the toggle-joint.

This type of stand has been approved by the general managers of the Harriman lines and will be extensively used in the future. Several successful experiments and tests have been made in the Oakland yards of the Southern Pacific and plans are now being made for the manufacture of a large number of stands. The stand was invented by Mr. J. D. Isaacs, consulting engineer for the Harriman lines; Mr. W. W. Slater, signal engineer for the same interests, and Mr. M. R. Daniels, of the firm of Daniels & Dillman, consulting engineers, Monadnock Bldg., San Francisco. The preceding notes concerning the apparatus have been furnished by Mr. Daniels.

PERSONAL NOTES.

Mr. Howard Egleston has been appointed resident engineer on construction on the Canea, Yaqui Valley & Pacific Ry.

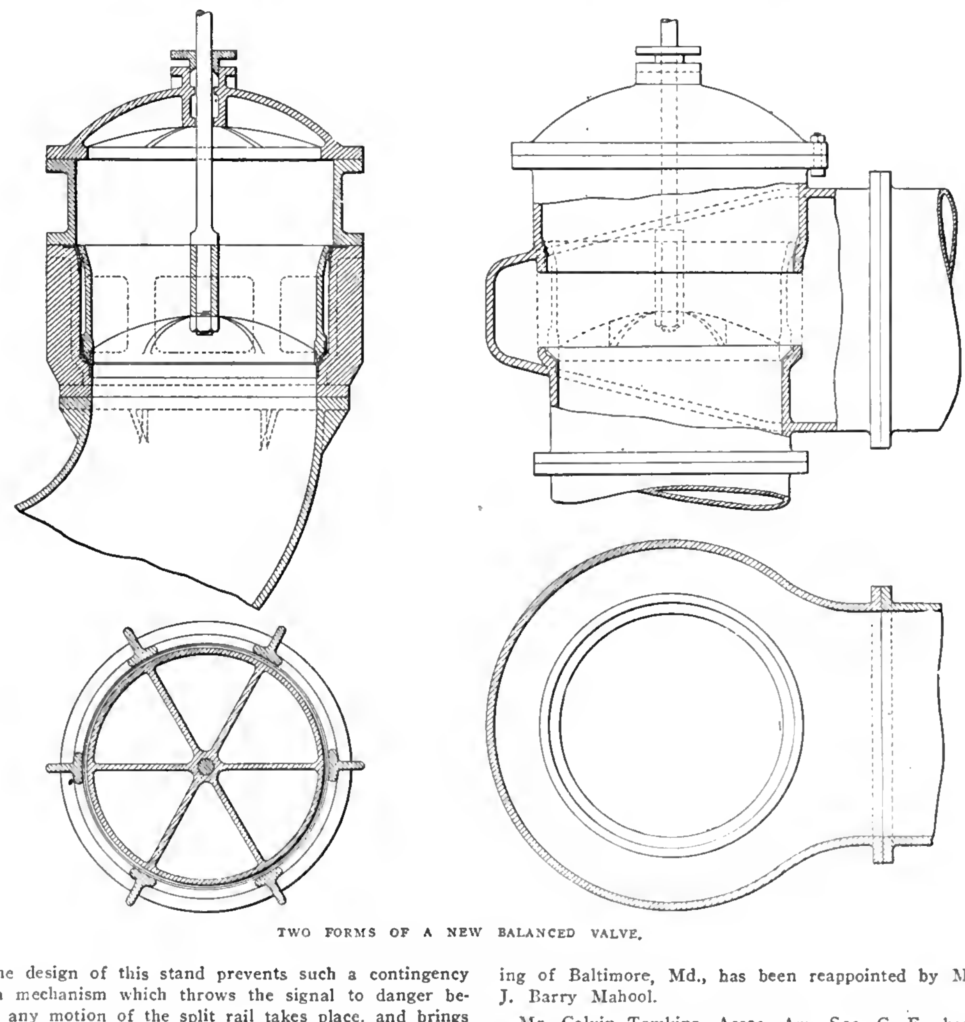
Col. Joseph L. Wickes, commissioner of street cleaning of Baltimore, Md., has been reappointed by Mayor J. Barry Mahool.

Mr. Calvin Tomkins, Assoc. Am. Soc. C. E., has declined a nomination as sheriff on the ticket of the Citizens' Union of New York City.

Mr. E. E. Stone, assistant chief engineer of the Boston & Albany R. R., has been appointed engineer of maintenance of way of the same line.

Mr. Edmund W. Kent, superintendent of the water department of Woonsocket, R. I., is to become general manager of the Newport Water Co., Newport, R. I.

Messrs. C. J. Aschauer and W. H. Lienesch have



TWO FORMS OF A NEW BALANCED VALVE.

formed a partnership as architectural engineers, under the firm name of Aschauer & Lienesch, with offices at Decatur, Ill.

Mr. Bion J. Arnold, of The Arnold Co., Chicago, has been appointed consulting engineer for the subway systems of New York City by the Public Service Commission of New York.

Mr. J. M. Floesch, chief engineer of the Buffalo, Rochester & Pittsburg Ry., has resigned to become associated with a contracting firm engaged in building the Grand Trunk Pacific Ry.

Senor Narcisco Puig, government engineer of roads, canals and ports of Spain, and Senor Jose Nicholan, also an engineer in the service of Spain, are studying irrigation works in Colorado.

Mr. W. M. Foust has been appointed water commissioner of Cheyenne, Wyo., to fill the vacancy caused by the death of W. D. Pease, and Mr. Z. E. Sevison has been appointed assistant city engineer.

Mr. R. K. Rochester, principal assistant engineer of the Vandalia R. R. Co., has transferred his headquarters from Indianapolis to St. Louis. Mr. H. L. Simpson has been appointed assistant engineer at Indianapolis.

Mr. Philip L. Farley, formerly assistant superintendent of the Bergen Point Chemical Works, Bayonne, N. J., has opened an office in Long Island City, N. Y., as a civil engineer and specialist in municipal improvements.

Mr. F. D. Smith has resigned as superintendent of construction for the Stevens-Hewitt Engineering Co., New York City, and has opened an office at 123 Liberty St., New York, where he will engage in the business of electrical contracting.

Thomas Hilton Williams, Sr., president of the A. A. Griffin Iron Co., and the E. A. Williams & Son Brass Foundry, Jersey City, N. J., died recently, aged 59 years. He was a member of the American Society of Mechanical Engineers.

Messrs. Percy H. Thomas and N. J. Neall have entered into partnership, under the firm name of Thomas & Neall, for the practice of electrical engineering. Offices will be maintained at 52 William St., New York, and 12 Pearl St., Boston.

Mr. C. K. Koppes has resigned as assistant engineer of the Chicago, Milwaukee & St. Paul Ry., with headquarters at Milwaukee, Wis., to become resident engineer of the Cleveland Short Line Ry., with headquarters at Cleveland, Ohio.

Mr. Archibald Buchanan, Jr., superintendent of motive power of the Central Vermont Ry., has resigned to become chief of the bureau of inspection of the Public Service Commission of New York State. Mr. Buchanan's headquarters will be at Albany.

Capt. Horton W. Stickle, Corps of Engineers, U.S.A., on duty at the Military Academy, West Point, as assistant to the officer in charge of construction, has been ordered to Culebra, Canal Zone, for duty in connection with the construction of the Gatun locks.

The Supreme Court of New York recently granted an order permitting the American Society of Mechanical Engineers and the Mechanical Engineers' Library Association, a subsidiary corporation, to consolidate into one corporation under the name of the former organization.

George Frederick Bodley, one of the most eminent architects of Great Britain, died recently. He is best known for his ecclesiastical buildings. He was associated with Mr. Henry Vaughn, of Boston, in the preparation of plans for the new Cathedral of St. Peter and St. Paul in Washington, D. C.

The New York State Civil Service Commission will hold an examination Nov. 16, of candidates for the position of assistant civil engineer in the service of the Public Service Commission. The last day for filing applications is Nov. 9. For further information address Mr. Charles S. Fowler, chief examiner, Albany, N. Y.

Mr. H. J. Slifer, formerly general superintendent of the Chicago, Rock Island & Pacific Ry., has been appointed assistant to the president of the Panama R. R. He will assume the duties of Mr. W. G. Bierd, who recently resigned as general manager to become general superintendent of the New York, New Haven & Hartford R. R.

Messrs. John R. Freeman, consulting engineer to the New York City Board of Water Supply, and Charles L. Harrison, principal assistant engineer of the Pennsylvania, New York & Long Island R. R. Co., have been selected to represent the Denver Union Water Co. on the board of appraisal that is to determine the value of the company's plant.

Director Fred. H. Sykes of the Extension Teaching Department of Columbia University states that during the coming winter there will be twenty evening courses of twenty-five weeks, specially adapted to the needs of technical and professional men interested in applied mechanics, architecture, electricity, fine arts, industrial chemistry, mathematics, surveying and structures.

Mr. J. P. Snow, bridge engineer of the Boston & Maine R. R., in an address before a recent meeting of the American Association of Railway Bridge Builders, at Milwaukee, Wis., urged the enactment of a Federal law compelling the use of brine receptacles on refrigerator cars as a protection to bridges. The following officers were elected at the same meeting: President, R. H. Reid, Cleveland; vice president, John P. Canty, Fitchburg, Mass.; secretary, S. F. Patterson, Concord, Mass.; treasurer, C. P. Austin, Medford, Mass.

Charles Ezra Hequembourg, consulting civil engineer, died Oct. 17, at his home in Dunkirk, N. Y. He began his professional career in 1865 as engineer in charge of field work for the Tennessee & Cumberland Oil & Mining Co. From 1866 to 1872 he engaged in the contracting business and built, among other works, the water-works of Dunkirk, N. Y. Shortly after this he was contracting engineer for an important part of the water-works of Chicago. Subsequently he became engineer for several gas companies and for several years after 1888 he was consulting engineer for the Chicago gas trust and its successors. In 1893 he established a consulting practice. He was a member of the American Society of Civil Engineers.

Mr. Dai H. Lewis, 760 Main St., Buffalo, N. Y., has been elected to manage the 1908 convention of the National Association of Cement Users, which will be held Jan. 20-25, 1908, in the old 65th Regiment Armory, Broadway and Potter Sts., Buffalo, N. Y. The convention headquarters will be at the Iroquois Hotel. Application blanks for exhibit space can be secured by addressing Mr. Lewis. The assignments of space to those making application before 12 o'clock noon Nov. 16, 1907, will be made in the order in which the applications are drawn one by one, after having been thoroughly mixed. Applications for space received after 12 o'clock noon, Nov. 16, 1907, will be filled as received. The exhibit sections are in general 10 x 12½ ft., and the charge per single section is in most cases twenty dollars.

The Siegfried Advertising Agency, devoted especially to real estate, financial and marine advertising, has been established by Henry K. Hannah and Frederick H. Siegfried, who also control the Realty News Bureau, the offices of both being located at 277 Broadway, New York. The new agency already represents fifteen or more well-known realty and financial companies, capitalized at upward of $75,000,000, and will be managed by Mr. Siegfried, a former Boston Herald man, who was several years in charge of the business end of The Engineering Record and has more recently devoted himself to the interests of several large New York realty concerns. Mr. Siegfried is the elder son of the late A. H. Siegfried, general manager of the Curtis Publishing Co., and one of the most widely known general advertising men in America ten years ago.

BUSINESS NOTES.

The Ambursen Hydraulic Construction Co., of Boston, Mass., has been employed to design and supervise the construction of a concrete-steel dam 22 ft. high and 750 ft. long, across the Rappahannock River, near Fredericksburg, Va., for the Fredericksburg Power Co. Work will be commenced immediately.

The new addition to the machine shop of the Duquesne plant of the Carnegie Steel Co. has been equipped with Pittsburgh high speed vises made by the Pittsburgh Automatic Vise & Tool Co.

The Canadian Rand Co., Limited, of Montreal, have opened up a show room at 11 St. Nicholas St., where they display a complete line of air compressors, rock drills and Imperial pneumatic tools. A small stock of repair parts will also be carried in stock for the convenience of local customers. This is the only place in Montreal where such a stock is displayed.

Since April 1 of this year the Traylor Engineering Co. has occupied commodious offices on the top floor of the new United States Express Bldg., 54-56 Trinity Pl., New York. About 150 people, one-third of whom are engineers, are now constantly employed in the office. The plant at Allentown, Pa., where the company's mining, crushing and cement machinery is made, now covers over 6½ acres. The entire plot of ground at the plant contains 19 acres.

The J. R. Alsing Co., founded in 1869, has changed its name to the J. R. Alsing Engineering Co., under the laws of the State of New York and increased its capital stock from $20,000 to $100,000. The officers will be the same as in the old company. The increase in business compelled the change.

It has been officially confirmed that Mr. Wm. Frank Hall, who represented the Bradley Pulverizer Co., manufacturers of the Griffin mill during the last seven years, has resigned and accepted a position with the Lehigh Car, Wheel & Axle Works to further the sale of their Fuller-Lehigh pulverizer mill. An office has been opened in New York in the Trinity Bldg., where Mr. Hall will make his headquarters. The Lehigh Car, Wheel & Axle Works has also opened an office in Kansas City, Mo., in the Scarritt Bldg.

The Southwestern Bridge Co., of Joplin, Mo., has opened contracting offices as follows: Dallas, Tex., 806 Wilson Bldg., Mr. J. I. Boggs, contracting engineer; Oklahoma City, Okla., 317 Culbertson Bldg., Mr. R. X. Basford, contracting engineer; Denver, Colo., 726 Symes Bldg., Mr. George A. Sears, contracting engineer.

The Cuba Railway Co., with headquarters in New York City, recently purchased a No. 4 K Gates crushing plant from the Allis-Chalmers Co. for use at Camequey, Cuba. It is expected that this plant will be used successively on the several divisions of the road, situated, in each instance, between the quarry and the right of way, parallel to which boilers, bins and crushers are arranged so that the product may be readily dumped into cars for distribution along the line.

TRADE PUBLICATIONS.

Catalogue 69A of the Jeffrey Mfg. Co., Columbus, Ohio, is devoted to Jeffrey screens, which are built for the purpose of treating all classes of materials, including coal, trap rock, chemicals, clay, coke, plaster, marble, slate, ores, quartz, sand and other materials. Illustrations are presented of the various types of screens, from those of the cylindrical revolving type to the shaking and vibrating screens of the various types. Interesting detailed plans are presented of vibrating screen plants, and considerable information of interest is added concerning the screening of materials.

The Manufacture of Modern Welded Pipe is the subject of a most attractive pamphlet devoted to the important subject of pipemaking, which has recently been issued by the National Tube Company, Pittsburg, Pa. The pamphlet presents a series of illustrations, which show the progressive operations from the iron ore to the finished product in the process of making modern welded pipe, beginning with interesting illustrations of ore mining in the Mesaba range, steamer landings at the Lake Superior ore docks, ore piles and blast furnaces in the Pittsburg district and the subsequent handling of the pig-iron. The old process of refining by puddling is graphically compared with the modern process, ultilizing the Bessemer converter, following which are illustrated serially the successive operations in the manufacture of pipe, both the butt welded and lap welded. The important after details of sizing, straightening and testing are also illustrated and data presented in regard to the relative corrosion of wrought iron and steel pipes under the severe conditions of mine water acidity.

The 1907 catalog of the Hayden-Derby Mfg. Co., manufacturers of the Metropolitan injectors, H. D. ejectors and jet apparatus, has recently been issued, presenting a complete list of this apparatus with the most recent improvements. Suggestions are made as to the types of injectors to be selected for various conditions of operation, and also as to piping and operating them. Considerable additional data is presented in regard to jet apparatus, and also reference is made to the new Hancock swing check valve, which has recently been brought out by this company, in response to a demand for a high-grade check valve for inector delivery pipes. This valve has been especially designed to obviate the difficulties which have long been experienced with check valves used for this purpose, and it is claimed that owing to its design, it will remain tight, without regrinding or repairs of any kind.

The Twinvolute turbine pumps recently placed on the market by the Watson-Stillman Co., New York, are fully described in catalog No. 72, just issued by this company. The details of this pump for both the single and 2-stage types are illustrated, and units of both types are shown connected to electric motors of various types for direct driving, in which form the company is prepared to furnish them. Tables of capacities are presented for these pumps, and also much additional information in regard to the operation of hydraulic machinery is included.

Among the many artistic catalogues received from engineering and contracting supply houses few have approached the latest catalogue of The Hayward Co., 99 Cedar St., New York. The book resembles more an album of fine photographic views than the accustomed trade publication. The size of the pages is 9½ x 11¾ in., and each one is lined with a border and ornamented with a sketch of dredging and spoil or coal-handling plants in operation. The illustrations of the company's buckets, dredges and plants are all half tone engravings printed in black, while the text and ornamentation are printed in brown. The first 31 of the 151 pages are devoted to illustrations, dimensions and specifications of Hayward orange-peel, clam-shell, scraper clam-shell, bottom dump, turnover and scoop buckets. The remainder of the book is devoted to pictures of Hayward equipment in actual operation, each view with its descriptive text occupying a separate page. The buckets are shown operating in conjunction with the derricks, hoists, cableways and engines of about twenty different manufacturers, and in dredging channels, ditches and sand for commercial purposes and handling coal and all kinds of spoil, from sand to rock. The illustrations and data on the performances of many of the plants will probably give valuable suggestions to contractors.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Ft. Morgan, Ala.—Bids will be received until Nov. 14 by Capt. L. F. Garrard, Constr. Q. M., Ft. Morgan, for constructing building for pump house, installing 2 horizontal tubular boilers of 50 h.p., 2 compound duplex pumps, ice plant and cold storage at this post as advertised in The Engineering Record.

Fordyce, Ark.—It is reported that the property owners are about to petition Council to construct water works.

Selma, Cal.—There is reported to be a movement on foot here looking to the calling of an election to vote on issuing bonds for a municipal water supply.

**Greeley, Colo.*—Jos. A. Osner, 357 Bway., Denver, is reported to have secured the contract for constructing the dam at the Black Hollow reservoir, west of Pierce. The concrete work is to be finished by Dec. 1, and the entire dam must be completed a month later. The reservoir is to hold 230,000,000 cu. ft. of water.

Madison, Ga.—See "Power Plants, Gas and Electricity."

Atlanta, Ga.—Bids will be received by the Bd. of Water Comrs. and Special Com. until Nov. 12 for 13,000 ft. of 36-in. water pipe, to be of c. i., steel-riveted, reinforced concrete, wood pipe or any other pipe capable of standing a pressure of 200 lbs. to the square inch; also on Nov. 25 for furnishing and erecting complete within building and on foundation furnished by city, and making necessary connections to 36-in. suction and 30-in. discharge mains of water works and 10-in. steam main at pumping station No. 2, a 20,000,000 and a 25,000,000 gal. centrifugal pump, to be operated by electric motor ,compound triple expansion condensing engine or steam turbine, and for direct pumpage against a head of 120 lbs. domestic and 160 lbs. fire pressure; also for furnishing and erecting one vertical triple expansion high duty pumping engine of self-contained type ,to have a capacity of 20,000,000 U. S. gals. water in 24 hours. All three proposals advertised in The Engineering Record.

Ashburn, Ga.—See "Power Plants, Gas and Electricity."

Harmon, Ill.—Benj. F. Swab, Village Clk., writes that bids will probably be received in the early spring for the construction of water works to cost about $6,000.

Winnetka, Ill.—The question of installing a gravity filter system at the water works is reported under consideration.

Pauls Valley, Ind. Ter.—C. P. Bruce, Mayor, writes that it is proposed to construct water works at a cost of$40,000. Engineer not yet selected. L. T. Jones, City Clk.

Bellevue, Ky.—The City Council is reported to have passed a resolution looking to the calling of an election to vote on issuing $57,000 bonds for water works.

Kenner, La.—The Kenner Ice & Cold Storage Co. is reported organized with a capital of $25,000 for the purpose of constructing water works and establishing a cold storage plant.

Sauk Rapids, Minn.—Bonds to the amount of $25,000 are reported sold to be used for the construction of water works. Engineer, Oscar Claussen, of St. Paul.

Duluth, Minn.—See "Power Plants, Gas and Electricity."

Brookhaven, Miss.—Water extension bonds to the amount of $15,000 were sold on Oct. 15.

Hildreth, Neb.—It is stated that bids will be received Nov. 25 for $10,000 water works bonds. A. L. Beck, Village Clk.

Velva, N. D.—It is stated that bids will be received until Nov. 12 by S. M. Jones, City Aud., for constructing water works, including a concrete reservoir, gravity pipe line, and gasoline engine power.

Ellendale, N. D.—Bids are wanted until Nov. 4 for sinking an artesian well. Edw. N. Leiby, Mayor.

Hobart, Okla.—Bids will be received until Nov. 9 by A. W. Kerr, City Clk., for furnishing material and constructing an extension to the water mains consisting of approximately 18,000 ft. 4-in., and 5,500 ft. 6-in. c. i. pipe, 38 fire hydrants, four 6-in. valves and 11 4-in. valves, as advertised in The Engineering Record. O. E. Noble, City Engr.

Guthrie, Okla.—W. W. Miller, City Engr., writes that this city proposes installing a filter plant to cost about $20,000.

Alva, Okla.—The Mayor writes that the citizens on Oct. 17 voted to issue $40,000 bonds for constructing water works and sewers. Engineer, Wm. Haviland, of Alva.

Aylmer, Ont.—Bids will be received until Oct. 29 by Junius Bradley, Town Clk., for furnishing and completing a conduit line, 20,400 ft. long. Bids will also be received for sectional part of 5,100 ft. A separate bid will also be received on labor only.

Philadelphia, Pa.—Bids will be received until Nov. 4 by Geo. R. Stearns, Dir. Dept. Pub. Wks., Bureau of Water, for the following as advertised in The Engineering Record: Specification 89: Corrugated iron roof covering for ventilators of boiler house, Spring Garden Pumping Station Specification 90, a 6,000,000-gal. pumping engine for Belmont High Service Pumping Station; Specification 93, furnishing pipe fittings and materials for high pressure fire mains system; Specification 94, excavating water pipe trenches for high pressure fire main system; Specification 95, excavating water pipe trenches and laying c. i. water pipe and all appurtenances for high pressure fire main system.

The following are reported to be the bids opened on Oct. 22 by the Dept. of Pub. Wks., Bureau of Filtration:

Two pumping engines for Lardner's Point pumping station: Bethlehem Steel Co., $244,800; Holly Mfg. Co., $268,769; Southwark Co., $272,900; Allis-Chalmers Co., Milwaukee, $284,000, and R. D. Woods Co., $294,000.

Centrifugal pump of 40,000,000 gal. capacity at Torresdale pumping station: R. D. Wood & Co., $24,500; Allis-Chalmers Co., $18,7000. Pump driven by a horizontal steam turbine, Dravo, Doyle & Co., Pittsburg, $15,476.

The lowest bid for 3 boilers at Torresdale pumping station is reported to have been submitted by the D'Olier Co. at $32,250.

Seneca, S. C.—We are informed that the citizens have voted to construct water works, but matter is at standstill at present time. Dr. W. F. Austin, Chmn. Com.

Dallas, Tex.—D. F. Sullivan, Water & Sewer Comr., writes that the city will probably soon be in the market for one high service pump of 10,000,000-gal. capacity. Plans are not yet ready for the geenral improvements. J. W. Bassett, Ch. Engr., Water Wks.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Bisbee, Ariz.*—Chick & White, of Berkeley, Cal., are reported to have secured the contract for a system of sewers (bids opened Oct. 5) for $77,722.

San Jose, Cal.—It is stated that bids will be received until Nov. 4 for the construction of 9,932 ft. concrete sewer, 24x36 in., and average cut 13½ ft. Roy E. Walter, City Clk. Chas. H. Pieper, City Engr.

Forsyth, Ga.—The citizens are reported to have voted Oct. 15 to issue $13,000 bonds for a sewerage system.

Madison, Ga.—See "Power Plants, Gas and Electricity."

Springfield, Ill.—It is proposed to construct 2,200 lin. ft. of 18-in. pipe sewer in Osburn Ave. from Dorlan Ave. to N. Grand Ave.; estimated cost $2,928.

Rockford, Ill.—It is stated that Mark Jardine, Pres. Bd. Local Improv., will receive bids until Oct. 30 for constructing sewers in portions of several streets.

Harvard, Ill.—J. H. Vichers, Mayor, writes that W. S. Shields, of Chicago, is preparing plans for a sewerage system and disposal plant to cost about $52,000.

Indianapolis, Ind.—Asst. City Eng. Chas. Brown is reported to be preparing plans for a sewer in Fulton St. bt. Ohio and St. Clair Sts., to cost about $10,000.

Des Moines, Ia.—Bids will be received until Oct. 29 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing a septic tank in the vicinity of Center Boule. and John Lynd Rd.

Ottumwa, Ia.—J. T. Brady, City Engr., writes that bids for laying 6,000 lin. ft. clay pipe sewers in sundry streets will be received until Nov. 4. The sizes are 10 in. to 20 in., mostly 15, 18 and 20 in. The city has not yet purchased pipe. Bids will also be received at same date for 160 ft. of 5-ft. double-ring brick sewer.

New Orleans, La.—At a recent meeting of the Sewerage and Water Board, Geo. G. Earl, Supt., is reported to have suggested the construction of sewers by forces now employed by the Board.

Boston, Mass.—Bids will be received until Nov. 15 by the Metropolitan Water & Sewerage Bd., 1 Ashburton Pl., Boston (Wm. M. Brown, Ch. Engr.) for constructing in rock and earth trench and tunnel Section 81 and parts of Section 83 and 85 of the extension of the high level sewer South Metropolitan System in Brookline and Brighton, as advertised in The Engineering Record.

**Salem, Mass.*—Wm. H. Rollins, Clk. Bd. of Sewer Comrs., writes that Thos. Walsh, of Roxbury, secured contracts for Sections 1, 2 and 4 of the South Salem sewer, at $21,318, $15,232 and $11,722 respectively, and Falvey & Kelley, of Cambridge, Section 3, at $16,439 (bids opened Oct. 2). All sections to be constructed of concrete.

**Two Harbor, Minn.*—Haugsten & Johnson, of Two Harbors, are reported to have secured the contract for constructing sewers in 8th and 10th Aves., for $4,710.

**Stillwater, Minn.*—W. C. Fraser, of Rochester, is reported to have secured the contract for constructing a sewerage system for the prison at Stillwater, for $14,000.

Hattiesburg, Miss.—J. H. Putnam, City Engr., writes that all bids opened on Oct. 15 at office of City Clk., for constructing sanitary sewers and appurtenances, requiring about 2,640 lin. ft. 15-in., 6,150 lin. ft. 10-in. and 6,708 lin. ft. 8-in. sewer, 3 manholes and 7 flush tanks, have been rejected and new bids will be received on Nov. 7 for a larger contract. Two bids were received for this work from C. M. Burkhalter, of Birmingham, Ala., fo about $29,000, and P. H. Porter, Clinton, Ky., $46,000.

**Omaha, Neb.*—Jens Jensen is reported to have secured the contract for constructing Izard St. sewer, for $123,000.

Trenton, N. J.—Bids will be received by the Common Council until Nov. 5 for constructing sewers in Liberty St., Hamilton and Fairmount Aves. Hary B. Salter, City Clk.

Riverside, N. J.—Bids will be received bp Irven Kollo, Township Clk., until Nov. 1, for the construction of a sewerage system to consist of about 10 miles of 8 to 24-in. pipe sewers, pump house, engines, pump, pump well and disposal works, as advertised in The Engineering Record. Engineer, Wm. H. Boardman, 426 Walnut St., Philadelphia, Pa.

**Englewood, N. J.*—Chas. Brocker, of Englewood, is reported to have secured the contract for constructing about 6,500 ft. 12-in. pipe sewers, with manholes, etc., for the Englewood Sewerage Co. (bids opened Oct. 5).

**Summit, N. J.*—J. Edw. Rowe, City Clk., writes that bids were opened on Oct. 15 by the Common Council for constructing the Edgewood sewers, consisting of about 5,300 ft. 12, 10 and 8 in. vitr. pipe, and the contract was awarded to Chas. Ippolitto, of Orange, for about $15,000.

Perth Amboy, N. J.—Forrest L. Smith, City Engr., 102 Smith St., writes that the proposed sewerage system will cost about $48,000. Wm. Fullerton, Street Comr.

Batavia, N. Y.—J. H. Wood, Clk. Sewer Comn., writes that an ordinance is now being prepared and will be submitted to the votors, providing for the issue of $342,000 bonds for a sewerage system. Engineer, Alex. Potter, 136 Liberty St. New York City.

Chagrin Falls, O.—Bids will be received by H. D. Bishop, Village Clk., until Nov. 9 (readvertisement) for the construction of a sewerage system and a sewage purification plant, estimated cost $56,000. Engineers, the Walter P. Rice Eng. Co., 629 Soc. for Sav. Bldg., Cleveland.

Columbus, O.—Bids will be received until Oct. 30 by the Bd. Pub. Service (Edwd. F. McGuire, Secy.) for constructing 2 sewers, one in the alley west of Oakley Ave., and the other in the alley west of Dakota Ave.

Kent, O.—Plans for a sewerage system, a sewage purification plant for Kent, have been submitted to the State Bd. of Health, at Columbus.

Youngstown, O.—Bids will be received until Nov. 7 by the Bd. Pub. Service (W. H. McMillin, Clk.) for furnishing material and constructing sewers in portions of Truesdale, Perry and E. Federal Sts.

Hobart, Okla.—Bids will be received by A. W. Kerr, City Clk., until Nov. 9, for furnishing material and constructing a complete storm water sewer system, to consist of 48 to 30-in. concrete and brick sewers. 21 and 18-in. concrete brick or pipe sewers, and 15, 12 and 10-in. pipe sewers, with 16 manholes and 34 catch basins, as advertised in The Engineering Record. O. E. Noble, City Engr.

Johnson City, Tenn.—Bids will be received until Oct. 31 by the Bd. of Mayor and Aldermen for $16,000 sewer bonds.

Seattle, Wash.—The only bid received and opened on Oct. 12 by the Bd. of Pub. Wks. for constructing trunk sewer in the Green Lake District, was submitted by the Jas. Black Masonry & Constr. Co., of Seattle, as follows: Fixed estimate, $1,500; 795 lin. ft. 36-in. concrete sewer, $6; 3,721 lin. ft. 42-in., $7.50; 548 lin. ft. 48-in., $12; 5,023 lin. ft. 54-in., $16; 336 lin. ft. 72-in., $20; 1,104 lin. ft. 84-in., $33; 2,050 lin. ft. 90-in., $30; 2,132 lin. ft., 96-in., $34; 3,482 lin. ft. 90-in. concrete sewer with brick invert, $33; 183 lin. ft. 126-in., $64, and 6,948 lin. ft. 138-in., $85; 3,581 lin. ft. 72-in brick tunnel, $27; 75 manholes, ea. $100; 400 lin. ft. manholes, extra depth, $10; 1 junction chamber No. 1, $3,500; 1 No. 2, $8,930; 1 No. 3, $8,989; 1 stormwater overflow, $18,426; 1 sand catcher, $8,600; 1 siphon, $5,835; 500 side connections, ea. 50 cts.; 100 cu. yds. concrete in tunnel, $10; 200 cu. yds. extra concrete, $14; 10,000 lin. ft. sub-drain, 50 cts.; 20,000 lbs. extra steel, 5 cents; total bid, $993,036.

We are informed that bids on Lake Union Dist. sewer will be called for in about 2 months, to be followed with 3 other districts; estimated cost of entire improvement $3,000,000.

Bids will be received by the Bd. of Pub. Wks. on Nov. 2 for constructing sewers and water mains on 11th Ave., W., and other streets, at an estimated cost of $4,200.

*Dicken & Rightmire, of Ballard, have secured the contract for constructing sewers in Dearborn St. and in Hiawatha Pl. for $8,512.

**Spokane, Wash.*—John Fife is reported to have secured the contract for constructing a sewer in the alley between the Northern Pacific and Second Ave., from Cedar to Wall Sts., for $8,944.

Marinette, Wis.—Bids will be received until Nov. 2 by the Bd. Pub. Wks. (Jacob Wittiz, Chmn.) at the office of the City Clk., for constructing a sewer in Josephine St.; also in the Alley between Sherman and Thomas Sts.

BRIDGES.

Notes Arranged Alphabetically by States.

Newark Ark.—It is stated that $15,000 has been appropriated for the construction of a steel bridge over the Salado Creek.

Orofino, Idaho.—The Farmer's Bridge & Warehouse Co. is reported to have secured a franchise to construct a bridge over Clearwater River at Orofino. Incorporators: W. A. Cury, P. H. Blake and Jas. Holt.

Jasper, Ind.—It is reported that bids will be received until Nov. 4 by the Bd. Co. Comrs. for constructing a 120-ft. steel bridge, to have 14-ft. roadway, acrsos Patoka River, on the Jasper and Huntingburg Rd., what is now called the Brierfield Bridge; also a steel bridge on Ireland and Sulphur Springs Rd. M. A. Sweenley, Co. Aud.

Richmond, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Nov. 9 for the construction of 8 bridges, 2 in Center Township, 2 in Wayne Township and 1 each in Franklin, Hanson, Dalton and Jefferson Towships.

Lafayette, Ind.—It is reported that bids will soon be asked for the construction of a bridge over the Wabash River in Tippecanoe County.

Winnipeg, Man.—Bids will be received until Nov. 1 by the Chairman Bd. of Control, at the office of M. Peterson, Secy., Winnipeg, for a second-hand single-track through truss steel railway bridge, 155 ft. to 165 ft. single span, crossing Pinawa Channel, in connection with Point de Bois hydro-electric development, as advertised in The Engineering Record.

Carman, Man.—It is stated that bids will be received until noon, Nov. 8, by the Bd. of Pub. Wks. (A. Malcomson, Secy.-Treas.) for the construction of a 90-ft. Pratt truss steel bridge with 18-ft roadway, concrete abutments, across Boyne River, near Carman.

Greenville, Miss.—It is stated that bids will be received until Nov. 4 by T. H. Hood, Clk. Bd. of Superv., for construction of a Ben bridge across Six Mile Bayou, in Washington County.

**Vicksburg, Miss.*—W. T. Young Bridge Co., of Nashville, Tenn., is reported to have secured the contract for constructing concrete-steel bridges on Cemetery Road and Cherry St. fo $4,850; also for 2 steel bridges over Staats Bayou and Simrall Canal, at $1,472 each.

**Items marked thus give the names of parties awarded contracts.*

Belvidere, N. J.—Scott Clark, Chmn. Street and Alley Com., writes that the date of opening of bids for constructing new bridge across Kishwaukee River has been extended from Oct. 25 to Nov. 2.

Trenton, N. J.—It is stated that the Delaware & Raritan Canal Co. contemplates expending $10,000 for the erection of 3 bridges over the canal in Trenton; wooden structures at Labor St. and Greenwood Ave. and and iron one at Perry St. crossing.

Brighton, N. Y.—The citizens are reported to have voted to construct an overhead bridge at Clover St., at a cost of $20,000.

**Hamilton, O.*—The County Comrs. on Oct. 8 are stated to have awarded the contract for constructing a steel bridge over Two Mile Creek to Central Slate Bridge Co. of Illinois, at $5,292.

West Bethlehem, Pa.—Bids will be received by the Comrs. of Lehigh and Northampton Counties at Easton, on Nov. 29, for the construction of a reinforced concrete bridge over Broad St., West Bethlehem. It will be 60 ft. wide with 5 spans, 2 of 75 ft., 2 of 90 ft., and 1 of 100 ft. L. A. Francesco, Co. Engr., Easton.

**McKees Rocks, Pa.*—The Pittsburg & Lake Erie R. R. Co. is reported to have awarded the contract for constructing a 2-track bridge over Chartiers Creek at McKees Rocks to the American Bridge Co., Pittsburg, at a cost of about $30,000.

Indiana, Pa.—It is stated that bids will be received until Nov. 1 by the Co. Comrs. at Indiana, for the construction of 2 steel highway bridges, having a clear span of 30 ft., with 34 ft. between backwalls.

Webster, Pa.—Bids will be received until Nov. 8 by the Comp. of Westmoreland Co. and the Co. Comrs. of Washington Co., at Greensburg, Westmoreland Co., for constructing a joint bridge over the Monongahela River, between Webster, Westmoreland Co., and Donora, Washington Co.; superstructure to have 5 truss spans, 2 viaduct approaches; total length of steel work, about 1,550 ft.; roadway, 25 ft.; one sidewalk, 6 ft., and 2 electric car tracks; substructure to have 2 river piers of stone, with concrete foundation; 4 concrete piers, 14 concrete pedestals and 2 concrete abutments. A. H. Nelson, Engr., Hartje Bldg., Pittsburg.

Wharton, Tex.—Bids will be received until Nov. 11 by C. S. Gordon, Co. Judge, Wharton, for the erection of a steel highway bridge over San Bernard River, 325 ft. wide, jointly with Fort Ben County, as advertised in The Engineering Record. H. Pennington, Rms. 52 and 53, Theatre Bldg., Houston, is the engr.

**Houston, Tex.*—Bids for constructing a wooden bridge with steel swing over the San Jacinto River on the Houston Crosby County Road are reported opened Oct. 16 as follows: A. N. Fitzgerald, $10,176 (awarded contract); Southwestern Bridge Co., $10,625; Ottumwa Bridge Co., $10,900; Austin Bros., $11,600, and Missouri Valley Bridge & Iron Co., $10,684.

Sundance, Wyo.—It is stated that bids will be received until Nov. 5 by the Co. Comrs. for the construction of 2 steel bridges across Belle Fourche River, 1 at Hulett and 1 at Moorcroft. L. Nauch, Co. Clk.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Gadsden, Ala.*—The City Council is reported to have awarded the contract for 20,000 sq. yds. of cement sidewalk and 30,000 lin. ft. combined curbing and guttering to Leslie M. Lockwood, of Bessemer.

Mesa, Ariz.—It is proposed to procure bids for concrete curb and gutter to cost about $2,000. O. A. Turney, of Phoenix, is City Engr.

**Sacramento, Cal.*—M. Hughes is stated to have secured the contract for macadamizing a portion of 35th Ave. for $3,873.

Wilmington, Del.—Bids for constructing a macadam road about 2⅔ miles long, extending from Eden Park to city limits of New Castle, are reported as follows: Theo. Horsch, $25,500; T. W. Boremann, of Lansdowne, Pa., $27,122, and B. F. Wickersham, of Kennett Sq., Pa., $24,968.

Pensacola, Fla.—We are informed that the Board of Bond Trus. has postponed the receiving of bids for approximately 170,700 sq. yds. of clay or shale blocks, sheet asphalt bitulithic, wood block or macadam pavement, and 115,950 lin. ft. of concrete curb, which were to have been opened on Nov. 15 until a later date, not yet decided upon. L. Hilton Green, Chmn. Bd.; T. Chalkley Hatton, Consulting Engr., Wilmington, Del.

Elgin, Ill.—Plans are reported completed for the paving with brick 3,600 sq. yds. on N. Liberty St., at a cost of $6,000.

The Bd. of Local Improv. has decided to resurface Knoxville Ave. from Hamilton St. to Illinois Ave. with brick at a cost of $11,000.

Kokomo, Ind.—Bids will be received, it is reported, untiy Nov. 6 by the Bd. Co. Comrs. for constructing 12 gravel roads in this county, in all about 40 miles. Wm. L. Benson, Co. Aud.

Greenfield, Ind.—It is stated that bids are being received by O. O. Berer, City Clerk, for paving S. State St.

Danville, Ind.—The Comrs. of Hendricks County are stated to have granted a petition for the construction of a gravel road in Franklin Township.

Columbus, Ind.—The Bd. Co. Comrs, it is reported will receive bids until Nov. 4 for the construction of 4,761 ft. of gravel road in Columbus Township. John M. Davis, Co. Aud.

Salem, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Nov. 4, for the construction of the following gravel roads: Salem and Martinsville road, 10,046 ft.; Borden and Martinsburg road, 9,738 ft.; Martinsburg and Greenville road, 10,363 ft.; Martinsburg and Palmyra road, 9,000 ft; Old Grade road, 18,639 ft.; Livonia and Mt Pleasant road, 24,845 ft.; Millsport gravel road, 24,220 ft. S. G. Ellis, Co. Aud.

Crawfordsville, Ind.—It is stated that bids will be received by the City Council until Oct. 30 for grading and paving alley east of Marshall St and alley west of Grant Ave., and for improvement of Plumb St. by construction of cement sidewalks. Henry B. Hulett, City Clk.

Jasper, Ind.—It is reported that bids will be received until Nov. 4 by the Bd. Co. Comrs. for constructing an extension and improving the Holland and Huntingsburg Rd. No. 2, Paloka Township, in all about 4,225 ft.

Davenport, Ia.—Bids will be received, it is reported, by the Bd. Pub. Wks. until Nov. 15th, for paving several streets. Thos. Murray, City Engr.

New Orleans, La.—The Budget and Assessment Com. is reported to have authorized the City Comptroller to receive bids for paving with brick portions of Howard and Lopez Sts.

Baltimore, Md.—Bids will be received until Oct. 30 by the Bd. Awards (J. Barry Mahool, Pres.) to grade, curb, gutter and pave with vitrified brick, bitulithic, asphalt block or sheet asphalt, a portion of 28th St.

Denton, Md.—Bids will be received until Nov. 12 by the Bd. Co. Comrs. (S. D. Lukes, Clk.) for grading and macadamizing about 1 mile of the Denton Three Bridges Rd.

Boston, Mass.—Bids will be received until Oct. 29 by Wm. Jackson, City Engr., Boston, for paving and regulating Sumner and Bremen Sts., East Boston.

**St. Paul, Minn.*—Keogh Bros. are stated to have secured the contract for grading in the Midway Dist. at $7,900.

Brookhaven, Miss.—Local press reports state that bids will be received on Nov. 18 by the City Clerk for laying about 5 miles of concrete sidewalks.

**Carterville, Mo.*—H. E. Moody, City Clk., writes that the contract for constructing 30,000 sq ft. cement sidewalks (bids opened Oct. 17) has been awarded to Gray, Bauer & Co., Carterville.

Ventnor City, N. J.—Bids will be received until Oct. 30 by the Common Council for constructing about 2,500 ft. boardwalks. E. D. Rightmire, City Engr., Bartlett Bldg., Atlantic City.

Oyster Bay, L. I., N. Y.—According to reports bids will soon be received for improving 1,750 ft. of the Central Park Road. Appropriation available, $5,500.

New York, N. Y.—The City Comptroller has been authorized to issue $100,000 bonds for repairing, maintaining and repaving streets in Boro. of Manhattan.

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 10 by J. W. Stevenson, Comr. of Bridges, N. Y. City, for the construction of a bridge floor at the Washington Ave. Bridge, in Brooklyn Boro.: Cooper & Evans Co., 220 B'way, N. Y. City, $5,222 (awarded contract); Wm. H. Luth Co., $6,421; Eagle Iron Wks, $6,754, and F. W. Carlin Const. Co., $7,480.

Brooklyn, N. Y.—Bids will be received by Bird S. Coler, Boro. Pres., until Nov. 6, for repaving with asphalt, Brooklyn, Throop and Knickerbocker Aves., Himrod, Monitor and S. 5th Sts., repaving with wood block, Kossuth Pl., Morgan and Irving Aves., Skillman and Ten Eyck Sts., repaving with asphalt block 44th St.; laying sidewalks on Hart and Starr Sts. Engineer's estimate: 22,750 sq. yds. asphalt pavt.; 2,310 sq. yds. asphalt blk. pavt.; 32,420 sq. yds. wood blk. pavt.; 8,570 cu. yds. concrete; 27,045 lin. ft. new curb., to be set in concrete; 11,365 lin. ft. old curb., to be reset in concrete; 28,760 sq. ft. cement sidewalk; 178 noiseless covers and heads, complete, for sewer manholes.

Brooklyn, N. Y.—Bids will be received until Nov. 6 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in 49th, 83d, 53d, Provost and Dean Sts. Engineer's estimate: 2,504 lin. ft. 12-in., 175 lin. ft. 15-in., 135 lin. ft. 18-in. and 260 lin. ft. 24-in. pipe sewer, 28 manholes, 3.3 M ft sheeting and bracing and foundation planking, etc.; also a sewer basin at corner of Jewell St. and Meserole Ave.

Lakewood, O.—It is stated that bids will be received until Nov. 4 by B. M. Cook, Village Clk., for paving Newman Ave.

Monclova, O.—It is stated that bids will be received until Nov. 2 by Don C. Whitehead, Clk., Monclova Township, for draining, grading and macadamizing half a mile of country road.

Cincinnati, O.—Bids will be received until Nov. 15 by the Bd. Co. Comrs. (Fred Dreihs, Clk.), for improving Hog Back Rd. (Observatory Ave. extension), Columbia Tonwship, as per specifications, No. 600.

Cincinnati, O.—Bids will be received until Oct. 31 by the Bd. Pub. Service (M. J. Keefe, Clk.) for furnishing material and repairing asphalt streets, avenues, alleys, etc.

Youngstown, O.—Bids will be received until Nov. 7 by the Bd. Pub. Service (W. H. McMillin, Clk.,) for furnishing material and paving Wick and Summit Aves.

**Sharonsville, O.*—J. M. Hasset is reported to have secured the contract for repairing Sharonville Pike from Sharonville to Carthage Road, a distance of 7 miles, for $85,000.

Akron, O.—John Payne, City Engr., is reported to have estimated the cost of paving 1,800 ft. of North Hill at $28,000.

Richwood, O.—It is stated that bids will be opened Nov. 9 for $8,000 bonds for improving Franklin Ave. R. L. Jordan, Village Clk.

Hobart, Okla.—Bids will be received at the office of A. W. Kerr, City Clk., until Nov. 9 for 41,700 sq. yds. brick, bitulithic, or asphalt, 8,600 lin. ft. curb, and 4,000 lin. ft. headers, as advertised in The Engineering Record.

**Scranton, Pa.*—M. O'Herton is reported to have secured the contract for paving 6th and Webster Aves., at $18,430 and $17,606, respectively.

Pittsburg, Pa.—The Select Council is stated to have approved the ordinance authorizing the widening of Cecil Pl. to a 50-ft. street.

Johnson City, Tenn.—Bids will be received by the Bd. of Mayor and Aldermen until Oct. 31 for $34,000 street improvement bonds.

Dallas, Tex.—It is stated that bids are being received for paving with brick or block Main St.

Ottawa, Ont.—The bid of the Iroquois Iron Wks, of Buffalo, N. Y., for the construction of an asphalt and bituminous paving plant is reported recommended for acceptance at $15,350.

Tacoma, Wash.—Bids will probably be called for in Nov. for sandstone paving L. I. Dist. 332, at a cost of $65,000, and for sandstone and asphalt on L. I. Dist. 339, to cost about $146,000.

Ft. Wright, Wash.—Bids will be received until Nov. 6 for installing concrete curbing for roads at this post by Lieut. B. T. Scher, 3d Inf., Constr. Q. M., U. S. A.

**Montesano, Wash.*—A. H. Moulton is reported to have received the contract for constructing the South Side County Road, at $12,000.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Chico, Cal.—It is stated that bids will be received until Nov. 12 by L. D. McMacy, of Chico, for constructing an electric light and heating plant.

Needles, Cal.—Carl F. Schrader is reported to have petitioned the Bd. of Superv. at San Bernardino for a franchise for a gas and electric light system at Needles. He will procure electricity from the Victor & Virgin mining Co. and will install a gas plant.

Placerville, Cal.—The City Clerk writes that the city is seeking information with regard to the construction of an electric light plant. The question must first be submitted to a vote of the people.

Azusa, Cal.—A. Ganslein, representing the Interstate Gas Co. of Los Angeles, is reported to be circulating a petition for the location of a gas plant between Azusa and Glendora, to light both places.

Glendale, Cal.—The Southern California Gas Circuit Co., 501 Chamber of Commerce Bldg., Los Angeles, is reported to have purhcased a site at Glendale for a gas plant.

**Los Angeles, Cal.*—The City Council is reported to have awarded contract for electric generator and transformers for Cottonwood Creek Hydro Electric plant to Westinghouse Electric & Mfg. Co. for $18,039.

Key West Barracks, Fla.—Bids will be received until Nov. 9 by the quartermaster at this post for furnishing a steam boiler, 125 h.-p., with all accessories complete. Bids will state price f. o. b., both Key West, Fla., and Mallory Steamship Line, New York City.

Madison, Ga.—Moses Cohen, City Clk., writes with regard to the construction of water works, sewerage system and electric light plant for which the citizens were recently reported to have voted to issue $85,000 bonds, that contracts have been awarded, and the work has been under way for about 3 months.

Macon, Ga.—The State R. R. Comn. is reported to have, on Oct. 17, approved the proposed issue of $100,000 common and $50,000 preferred stock which the Bibb Power Co., of Macon, proposes to issue. This company has just been organized, and proposes to develop certain water powers in Bibb County and to supply light and power to the citizens of Macon. It is also expected that the company will supply power to the new interurban electric railways soon to be built.

Albany, Ga.—It is reported that the Albany Power Co. will receive bids for the construction of a dam to develop power and a power house to be equipped with electrical machinery for generating and transmitting electricity at Porter Shoals, on Flint River, near Albany. Alex. W. Smith and E. M. Y. Underwood are reported to be among the incorporators.

Ashburn, Ga.—The citizens are reported to have voted to issue $45,000 bonds for constructing water works and an electric light plant.

Chicago, Ill.—Local press reports state that all bids opened on Oct. 15 by City Electrician Carroll for 2,500 lamps and their equipment have been rejected and new bids will be received. Four bids were received, all bidders submitting the same price, a total of $84,395.

Oregon, Ill.—Paul F. Schuster is reported to have received a franchise for a gas plant.

Paducah, Ky.—See "Public Buildings."

Minneapolis, Minn.—Bids will be received at the office of L. A. Lydiard, City Clk., until Nov. 8, for lighting the streets and avenues of this city with gas and with electricity for the year 1908; also supplying gas for the street lamps of said city for the year 1908; bids will also be received for furnishing about 7,000 incandescent gas street lamps.

Columbus, O.—Bids will be received until Oct. 30 by the Bd. Pub. Service (E. F. McGuire, Secy.,) for furnishing material and doing the following work at the municipal electric light plant, Dublin Ave.; boiler blow-off tunnel, foundation for additional boilers, continuation of ash pit tunnel, retaining wall and driveway.

Cleveland, O.—The Lighting Com. of the Bd. of Pub. Service on Oct. 16 voted to recommend the granting of a franchise to the Cuyahoga Light Co. It will furnish electric lighting in the downtown district.

Cuyahoga Falls, O.—C. M. Walsh, of Cuyahoga Falls, has petitioned Village Council for a franchise to furnish the village with light, heat and power, and for a 10-year privilege of using the streets and alleys of the town with poles and wires.

**Elyria, O.*—The Elyria Milling & Power Co. (G. N. Arnold, Pres.,) is reported to have secured the contract for lighting the city for 10 years at $64 per yr. for each arc light. The new company is to use water power in generating electricity.

Panama.—See "Miscellaneous."

Providence, R. I.—The Special Com. of City Hospital has recommended that the Narragansett Electric Lighting Co. be permitted to install a system of underground wires, conduits and appurtenances on Eaton St.

Union, S. C.—J. A. Brown, of Union, is reported to have petitioned Town Council for a franchise for an electric light and power plant.

**Items marked thus give the names of parties awarded contracts.*

*Armour, S. D.—The City Council is reported to have entered into a contract with the Wagner, Lake Shore & Armour Traction Co., which is installing an electric light plant and power house in this city, to install four 1,200-c.p. arc light at $6 per month.

McKenzie, Tenn.—Edw. Moseley, Cashier First State Bank, is reported interested in the construction of an electric light plant and and ice plant.

Beaumont, Tex.—See "Power Plants, Gas and Electricity."

Waynesboro, Va.—We are informed that the electric power plant here, recently damaged by fire, has been sold to Gardner & Quarly, of Basic City, Va., who are arranging to put in a new plant.

*Green Bay, Wis.—The City Council on Oct. 19 adopted resolutions awarding contract to Green Bay Gas and Electric Co. to furnish light at $70 per lamp per year.

Seattle, Wash.—Bids will be received by the Bd. of Pub. Wks. on Nov. 2 for grading, curbing and constructing concrete sidewalks on 9th Ave. W. and other streets, at an estimated cost of $11,700; on Lane St., cost $9,500, and Meridian Ave., $72,000.

Onoloska, Wis.—The La Crosse Water Power Co., of La Crosse, is reported to have petitioned for a franchise through Onalaska.

Eau Claire, Wis.—The Vice-Pres. of the Northwestern Lumber Co., of Eau Claire, writes that the company has no definite plans as yet for building their high dam on Eau Claire River. It has been buying flowage rights and will probably build a dam within a year or two.

*Revelstoke, B. C.—The Canadian General Electric Co., of Montreal, Que., is reported to have secured the contract for constructing an addition to the municipal electric lignt plant for $25,762.

Hamilton, Ont.—According to local press reports Chief Engineer Sothman, of the Hydro-Electric Power Com., on Oct. 15, submitted to the Bd. of Works estimates and plans for the installation of a municipal lighting plant. The total capital cost of a complete arc lighting system of 500 magnetite lamps, including underground system of 4-duct conduit and wooden poles, in the underground district, is estimated at $175,580, which, less $57,148, estimated as cost of installing conduit system, would make expenditure for installing lighting system alone, $118,432. The underground system is for King, York and James Sts., and east of James St. and west of King St.; he estimates that a 2-duct system could be installed for $165,780, but would not answer if required for anything but arc lighting. He estimates it would cost $49.70 per lamp per year under 2-duct system and $51.03 under 4-duct conduit system.

Kenora, Ont.—The ratepayers are reported to have passed a by-law providing for a bond issue of $75,000 for completing power development and water works.

Humbolt, Sask.—Telfer Bros., of Humbolt, are reported interested in the construction of an electric light plant.

Montreal, Que.—Local press reports state that the Fire and Light Com. of City Council will on Dec. 1 receive bids for illuminating and heating gas; also separate bids for electric lighting and heating.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Hollywood, Cal.—The Los Angeles Pacific Co. (C. H. Ellison, Ch. Engr., Los Angeles) is stated to have made application to the City Trustees for a franchise commencing at end of Franklin Ave., Hollywood, running west on Franklin to Cahuenga north on Cahuenga to Highland Aves. and city limts.

Oakland, Cal.—A petition for a franchise for an electric railway from the city limits to North Piedmont Heights is reported filed with the Bd. of Supervisors by the Oakland Traction Co.

San Francisco, Cal.—The Bd. of Supervisors is stated to have passed the franchise of the Parkside Traction Co. for the construction of a railway on 20th Ave.

Long Beach, Cal.—It is stated that the Pacific Electric Ry. Co. has asked the City Trustees for permission to build an electric railway on 7th St. This is a much needed line and will extend from the foot of 7th St., in the inner harbor section, to the city limits on the east, and will probably follow the same street in the county to California St., with a branch line to tap Signal Hill.

Augusta, Ga.—Bids are wanted until Nov. 1 for rails, switches, ties, trolley wire and poles for 1,600 ft. spur track. For further information address the Commanding Officer, Augusta Arsenal, Augusta.

J. C. Sheppard, of Edgefield, A. E. Padgett and Wm. P. Calhoun are reported interested in the construction of an electric railway from Edgefield to Augusta.

Muskogee, Ind. Ter.—The Falls Constr. Co. is reported to have filed articles of incorporation with a capital of $2,500,000 for the construction of an electric railway to connect Muskogee and Ft. Smith, for the Muskogee Navigation Co. Incorporators: S. M. Rutherford, E. A. Hill, J. M. Brogan and Ira L. Reeves, all of Muskogee.

Waterloo, Ia.—The Waterloo, Cedar Falls & Northern Ry. Co. (C. D. Cass, Gen. Mgr.) is reported to have announced that about 2 miles of track will be laid in Waterloo during the present year.

New Orleans, La.—Bids will be received until Dec. 11, by Chas. R. Kennedy, Compt., for a 39-year franchise, beginning June 30, 1912, to construct, maintain and operate an electric street railway through several streets, including St. Bernard Ave. and Broad St.

Boston, Mass.—Bids will be received until Oct. 31 by the Boston Transit Comn. (B. Leighton Beal, Secy.), 15 Beacon St., for constructing open incline north of the Boston City Hospital Relief Station, near Canal St., for the Washington St. Tunnel.

*Springfield, Mass.—The Selectmen are reported to have granted the petition of the Berkshire Street Ry. Co. to locate poles for the high-tension line on the west side of the town. The contract for the work has been awarded to Fred T. Ley & Co., of Springfield. The total cost is estimated at $65,000.

Grand Rapids, Mich.—The Grand Rapids Electric Ry. Co. (Geo. W. Doane, Ch. Engr., Gadwin) is reported to have announced that contracts will be let within the next 30 days for two electric railway lines, one from Bay City, Mich., to Grand Haven, and the other from Grand Rapids, Mich., to Montpelier, Ohio.

Crookston, Minn.—The City Council is stated to have granted a street railway franchise to W. A. Marin.

Tottenville, S. I., N. Y.—Maps and plans are reported filed for the construction of an electric railway from Tottenville and Richmond, S. I., which is to be constructed by the Tottenville & Richmond Electric R. R. Co. The line will be 10 miles long with a single track and numerous switches; estimated cost, $400,000.

Lindenhurst, L. I., N. Y.—The Town Board and Bd. of Highway Comrs. are stated to have granted the South Shore Traction Co. a street railway franchise.

RAILROADS.

Notes Arranged Alphabetically by States.

Denver, Colo.—H. A. Sumner, of Denver, Ch. Engr. Continental Tunnel Ry. Co., writes that the proposed tunnel through James Peak will be 6.04 miles in length, with an elevation of 9,190 ft. east portal and 9,106 ft. west portal above sea level. A bond issue of $5,000,000 has been authorized. Thos. F. Walsh, Pres. W. O. Temple, Secy., and D. C. Dodge, Chmn. Executive Com., all of Denver.

Coffeyville, Kan.—The citizens are reported to have voted Oct. 17 to issue $30,000 bonds, to aid the Coffeyville & Memphis R. R. Co. in the construction of its line from Coffeyville southeast to Centralia and Vinita, Ind. Ter.

Garden City, Kan.—The Kansas & Texas Ry. Co. is reported formed to build 700 miles of railroad south from Garden City, Kan, via Guymon, Okla., to Amarillo, Tex., thence southeast to Houston, Tex.; estimated cost is $5,000,000. John H. Barnard, of Boston, Mass., is the principal incorporator.

Garden, Mich.—The Van's Harbor Lumber Co. is reported to have decided to construct a railroad from Garden to a connection with the Soo Line at Russell's Spur, a distance of 35 miles.

Bloomfield, N. J.—The Delaware, Lackawanna & Western R. R. Co. (L. Bush, Ch. Engr., Hoboken), is reported to be considering the abolition of the crossings at Glenwood Ave. and Washington St., and the erection of a new station, and the opening of a new street as an approach to the station.

Benson Mines, N. Y.—The Little River R. R. Co. is reported formed to build and operate a standard gauge steam road, 8 miles in length, from Benson Mines south to the settlement known as McConnell, in the town of Fine. Capital, $80,000.

Schenectady, N. Y.—Press reports state that the New York Central & Hudson River R. R. Co. (W. J. Wilgus, vice-pres. Construction Dept., New York City) has asked for bids for replacing the Delaware & Hudson tracks at Schenectady in order to obtain a better grade to be run under the West Shore tracks.

Pond Creek, Okla.—The St. Louis, Bartlesville & Pacific Ry. Co. is reported to be preparing to extend its line from Pond Creek westward through Garfield County into Woods County to connect with the Kansas City, Mexico & Orient Ry. The extension will be 40 miles in length.

Beaver, Okla.—The Beaver Valley & Northwestern Ry. Co., with a capital of $4,000,000, is reported incorporated, and with headquarters at Beaver. The line will run from Oklahoma City northwest through Okla. and across Southwest Kan. to La Junta, Colo., 400 miles. Incorporators: J. H. Webb, Ray Barnes, A. F. Rock and others, all of Beaver.

Wilkesbarre, Pa.—We are informed that plans for the partial elevation of tracks have been submitted by the Board of Engineers, but they are not satisfactory with respect to Market and Northampton Sts., and the board will be asked to change the plans in respect to the aforesaid streets. If successful, negotiations in respect to cost can be carried on in the near future. The actual construction work ought to begin next spring. Edwin B. Morgan is chmn. of the Grade Crossing Com. of City Councils.

Waskom, Tex.—Bids are wanted until Oct. 31 for grading the first 7 miles of the Shreveport & Gulf R. R. (E. H. Ludlow, Ch. Engr., Waskom.)

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Luverne, Ala.—Bids will be received until Nov. 6 by the Comrs. Court, for erecting a fireproof jail. E. J. Ostling, archt., Montgomery. F. M. T. Tankersley, Co. Judge Probate.

San Francisco, Cal.—It is reported that plans are being prepared for the 4-story reinforced concrete hospital which is to be erected here by the Southern Pacific R. R. (E. E. Calvin, Gen. Mgr., San Francisco), at a cost of about $300,000.

Springfield, Ga.—The Grand Jury is reported to have recommended the erection of a new court house at a cost of $30,000.

*Hamilton, Ga.—The contract to erect the court house is reported awarded to the Mutual Constr. Co., of Louisville, Ky., at $34,061.

Cairo, Ga.—The Chairman County Comrs. writes that bids will be received about Feb. 1 for the erection of a court house, to cost $40,000 also for the erection of a jail, to cost $13,000. Architect, Alex. Blair, of Macon.

Nashville, Ill.—The building of a hospital at a cost of $10,000 is reported under construction.

*Galena, Ill.—The Warren Constr. Co., of Chicago, according to reports, has secured the contract to erect a sanitarium for the insane in Galena, estimated to cost $82,593.

Chicago, Ill.—Bids will be received until Nov. 6 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for painting at the U. S. Post Office, Court House, etc., at Chicago, as advertised in The Engineering Record.

It is reported that the Trus of the Univ. Hospital are planning the erection of an addition estimated to cost $75,000.

Peoria, Ill.—Bids will be received until Oct. 31 at the Ill. General Hospital for the Insane (Geo. A. Zeller, Supt.) for erecting 2 hospital buildings. W. Carby Zimmerman, State Archt., 1101 Steinway Hall, Chicago.

Marion, Ind.—Bids will be received until Nov. 29 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Marion, as advertised in The Engineering Record.

*Humboldt, Ia.—It is stated that the contract to erect the Carnegie Library has been awarded to Mayer Bros., of Humboldt, at $10,330.

*Paducah, Ky.—H. Smedley, Co. Clk., writes that the contract for installing steam heat and electric light system in court house and jail (bids opened Oct. 18) has been awarded to Katteyohn & Dolbey, of Paducah, for $2,494.

*Louisville, Ky.—Geo. Seadler, 341 W. Jefferson St., is reported to have secured the contract to erect the 2-story building for the police station at 18th St. and Garland Ave., and F. A. Clegg & Co., 237 3d St., the contract for heating and plumbing for said building. The total cost is to be about $10,415.

New Orleans, La.—Local press reports state that bids will be received Nov. 11 (readvertisement) by the Finance Com. for erecting the City Hall annex.

*Baltimore, Md.—The contract to erect a building for Truck Company No. 4, on McCulloh St., is reported awarded to Jas. F. Farley, at $24,563.

*Hibbing, Minn.—Schirmer Bros., of Hibbing, it is reported, have secured the contract for the plumbing in the public library at $1,610.

Minneapolis, Minn.—The City Council, it is reported, has appropriated $45,000 to complete the armory, and it is stated that the contract will be let at once by the Armory Bd.

*Fairmount, Minn.—Carl A. Wilson, of Kansas City, Mo., is reported to have secured the contract to erect a 2-story Carnegie library of brick and stone at Fairmount Ave. and 18th St., to cost $40,000.

*Minneapolis, Minn.—J. L. Robinson, it is stated, secured the general contract to erect the superstructure for the Christian Memorial Hospital, at 2341 6th St. S. The foundation is completed. It will be 99x111, 2-story, of pressed brick and cut stone and reinforced concrete construction. E. H. Hewitt, 15 N. 4th St., archt. Cost, $45,000.

Hattiesburg, Miss.—W. S. Hull, of Jackson, it is stated, has been engaged by the Bd. of Superv. to prepare plans for a 3-story brick and stone jail, absolutely fireproof, to cost about $40,000.

Forest, Miss.—W. S. Hull, of Jackson, is reported to have completed plans for a $40,000 jail.

Williamsburg, Miss.—Bonds to the amount of $20,000 are reported sold, to be used for the erection of a courthouse for Covington County.

Jefferson Barracks, Mo.—Bids will be received by O. W. Bell, Q. M., U. S. A., until Nov. 19 for construction of 2 barrack buildings, including heating, plumbing, electric wiring and disinfecting plant at this post.

St. Louis, Mo.—The lowest bid received Oct. 17 by the Bd. Pub. Improv. for fireproofing the east wing of the poor house is reported to have been submitted by the Cooney Constr. Co. at $24,800.

Nevada, Mo.—Bids will be received until Dec. 3 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Nevada.

Atlantic City, N. J.—The City Council has authorized an issue of $70,000 bonds for the purpose of erecting a municipal hospital for contagious diseases.

Bids will be received by the Streets, Walks and Drives Com. of City Council (Wm. Riddle, Chmn.) until Nov. 11, for constructing a rest pavilion and comfort station on the outside line of the boardwalk and New York Ave., to be of reinforced concrete, as advertised in The Engineering Record. Architect, H. A. Stout, Bartlett Bldg., Atlantic City.

*Ilion, N. Y.—A. B. Russell, Secy. Ilion Emergency Hospital, writes that contracts for erecting hospital (bids opened Oct. 2) have been awarded as follows: Masonry and carpentry, Scott & Gleason, Norwich; heating, Thos. Breen Co., Utica; plumbing, Pelton Bros., Herkimer, N. Y., and wiring, Utica Electric Co., Utica.

*Glen Cove, L. I., N. Y.—The contract to erect the town hall and courthouse for Glen Cove is reported awarded to Wm. E. Burnett, of New York, N. Y., at $15,808.

Long Island City, L. I., N. Y.—The only bid received Oct. 14 by Jos. Bermel, Boro. Pres., for the reconstruction of the interior of the burned Queens County Court House is reported to have been submitted by C. B. Willi at $294,000. The appropriation is $200,000, and it is stated that new plans will have to be prepared.

New York, N. Y.—According to press reports all the bids received Sept. 26 by the Park Bd. for erecting a wing at the Metropolitan Museum of Art (Addition G) have been rejected as being too high.

Bids will be received by Francis J. Lantry, Fire Comr., until Oct. 31, for furnishing materials required for additions and alterations to the steam heating plant at quarters of engine 31, Boro. Manhattan.

Cincinnati, O.—Harry Hake, Union Trust Bldg., it is stated, has completed plans for the fire house to be erected at Clarion and Montgomery Aves., Evaston, at a cost of $18,000. It is reported that bids will soon be asked by the Bd. Pub. Safety for the contruction of this building.

Bainbridge, O.—It is reported that the Council is arranging to erect a $12,000 town hall.

**Items marked thus give the names of parties awarded contracts.*

**Hamilton, O.*—Barnes Bros., of Marion, Ind., have secured contract for constructing U. S. Post Office complete at Hamilton, including plumbing, gas piping, heating, electric conduits and wiring (bids opened Sept 24 by the Superv. Archt., Treas. Dept., Washington, D. C.), for about $88,400.

Ft. Stevens, Ore.—Bids will be received by the Constructing Q. M., U. S. A., at Ft. Stevens, until Nov. 8, for the construction, plumbing, heating and electric wiring and fixtures of one artillery barrack building for 109 men, at this post.

Richmond, Va.—Bids will be received until Nov. 4 by Capt. Wm. M. Myers, Comdg. Richmond Howitzers, P. O. Box 54, for furnishing material and remodeling and building extension to the Howitzers' Armory Bldg., on N. 7th St. C. K. Howell, Archt., Richmond.

Strathroy, Ont.—Bids will be received until Nov. 5 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for erecting an armory at Strathroy.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—A company is reported formed, with L. L. Harzberg, pres., and O. R. Hood, vice-pres., for the purpose of erecting an opera house in Gadsden, to cost about $40,000.

Monrovia, Cal.—Parkinson & Bergstrom, of Los Angeles, are reported to be preparing plans for a $300,000 bank building.

Los Angeles, Cal.—A permit is reported issued for the Masonic Temple, to be erected at 1301 S. Figueroa St., 3 stories high and cost $107,701. Hudson & Munsell, Stimson Bldg., are the archts., and F. O. Enstrum Co., Byrne Bldg., are the contractors.

San Jose, Cal.—The directors of the First National Bank, it is reported, have directed plans to be prepared for an 8-story building.

**Tampa, Fla.*—Bonfoey & Elliott, archts., Tampa, write that the contract for erecting a building for Centre Asturiano Club (bids opened Oct. 15) has been awarded to C. F. Aulick, of Tampa, for $49,837.

Columbus, Ga.—The State Mutual Life Insurance Co., of Rome, it is stated, is contemplating the erection of a 7-story building in Columbus.

**Albany, Ga.*—C. D. Smith, of Albany, it is reported has secured the contract to erect a 3d story to the brick hotel and business building owned by Cruger & Pace.

Athens, Ga.—The Athens Hotel Co. is reported incorporated with Billups Phinizy as pres. and A. E. Griffith as secy for the purpose of erecting a hotel at Clayton and Washington Sts., to cost about $150,000.

**Athens, Ga.*—The Athens Hotel Co. is reported to have awarded to Miles & Bradt, of Atlanta, the contract for erecting its proposed fireproof hotel, to cost about $150,000.

Chicago, Ill.—The members of the First Presbyterian Church at Lake View (Rev. Frank M. Carson, pastor), it is reported, are planning the erection of a parish house to cost about $20,000.

The Chicago Assoc. of Commerce, it is reported, intends erecting a building on Jackson Boule., to be known as the Hall of Commerce, and to cost $500,000. David R. Forgan and Walter H. Wilson are members of the Bldg. Com.

It is stated that the Warehousing Co. will erect a brick and stone warehouse at 291 W. 23d St., to cost $50,000.

Carl Buhl, it is stated, intends erecting at State St. and Harmon Pl. an 11-story building costing about $300,000.

It is stated that a 5-story warehouse, costing about $90,000, is to be erected by J. W. Allen & Co., at Peoria St. and Washington Boule.

Carmi, Ill.—The Louisville & Nashville R. R. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) is stated to have secured a site on which it is proposed erecting a steel, stone and cement depot at Carmi.

La Grange, Ill.—J. C. Llewellyn, 1518 First Natl. Bank Bldg., Chicago, is preparing plans for the erection of a bank and office building for the La Grange Trust & Savings Bank, to cost about $50,000, and bids for the construction will be received about Nov. 10.

Peoria, Ill.—The Larkin Soap Co. (W. E. Parsons, Mgr., Peoria) is reported to be plannnig the erection of an 8-story brick and steel warehouse, to be erected as an addition to the present building at Liberty and Water Sts. The cost of the building complete will be about $250,000.

Council Bluffs, Ia.—The Y. M. C. A., it is reported, has secured a site on which it is proposed erecting a building estimated to cost $40,000.

Des Moines, Ia.—It is reported that the Ragsdale Co. will erect a 5-story building.

Sioux City, Ia.—Shenkberg Co., wholesale grocers, it is reported intend erecting an 8-story addition to its building.

Lake Charles, La. I. C. Carter is stated to have submitted plans for a 2-story brick Masonic Temple, which have been accepted, and it is stated that the Bldg. Com. has been authorized to ask bids for the construction.

Baltimore, Md.—The Westinghouse Electric & Mfg. Co., according to reports, is contemplating the erection of a 6-story brick building in Baltimore, to cost $40,000.

Boston, Mass.—The Christian Scientists, it is stated, are planning the erection of a publishing house near the church in Back Bay to cost about $200,000. A. V. Stewart, of the Bd. of Trus., may be able to give further information.

**Baldwinsville, Mass.*—We are informed that Smith, Day & Co. will rebuild its plant recently burned, 3-story building, 128x41½ ft., and R. W. Hamilton, of Baldwinsville, has contract for mason work, and Jos. Garnean contract for carpenter work.

Grand Rapids, Mich.—Mose Salomy, it is stated, will erect at S. Division and Prescott Sts. a 4-story brick 67x120-ft. building, to cost $30,000.

**Mankato, Minn.*—J. B. Nelson & Co., of Mankato, it is reported, have secured the contract to remodel the building of the National Citizens' Bank, at S. Front and Hickory Sts., to cost $10,500.

Minneapolis, Minn.—It is stated that a rescue home is to be erected by the Salvation Army, at a probable cost of $35,000.

**Jackson, Miss.*—J. F. Barnes & Co., of Jackson, it is reported have secured the contract to erect the main building for the Old Ladies Home, to cost $18,000.

**Hattiesburg, Miss.*—The directors of the Komp Machine Wks., according to reports, have awarded to T. P. Crymes the contract to erect a building 3 stories, 90x90 ft., of brick construction, to cost $19,000.

Jackson, Miss.—D. G. Patton & Co., of Memphis, Tenn., are reported to have decided to erect a 4-story warehouse in Jackson.

**Kansas City, Mo.*—The Urban Constr. Co., Broad and College Sts., it is stated, has the contract to erect a 3-story oil house mill, cooper shop, boiler house, etc., for the American Linseed Oil Co., at a cost of $30,000.

Lincoln, Neb.—Judge T. C. Munger, it is stated, will erect a 2-story brick fireproof business block, costing about $20,000.

Omaha, Neb.—The National Printing Co., according to reports, will erect a 5-story building at 12th and Harney Sts.

Manchester, N. H.—The Manchester Real Estate & Improvment Co. is reported organized with a capital of $250,000 to construct a theatre, apartment and office building in Lowell St. It will be 4 stories high, 100 x 150 ft., of reinforced concrete with a concrete block front, to be absolutely fireproof. Dr. A. Gall Straw, pres.; Dr. Geo. A. Campbell, Treas.

Atlantic City, N. J.—Sam'l S. Phoebus, it is stated, has announced that he intends erecting a hotel on the ocean front.

Bloomfield, N. J.—See "Railroads."

Clovis, N. M.—The Atchison, Topeka & Santa Fe R. R. (C. A. ..orse, Ch. Engr., Topeka, Kan.) will erect an amusement hall at Clovis to cost $30,000.

Schenectady, N. Y.—Benj. Riley, late prop. of the Arrowhead Hotel in Saratoga Lake, it is stated, is planning the erection of a hotel in Schenectady to cost about $250,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 14-story brick and stone office and store building at B'way and 23d St. for H. C. & M. L. Eno, cost $2,000,000; Maynicke & Franke, archts.; 5-story brick and stone bank and office building at 250 5th Ave. for Second National Bank; cost, $140,000; McKim, Mead & White, archts.

Long Island City, L. I., N. Y.—Mrs. Russell Sage, it is stated, has increased her gift from $50,000 to $85,000 for the L. I. R. R. Y. M. C. A. Bldg., and it is reported to be the purpose of the Asso. to erect an entirely new building instead of remodeling the old structure.

Batavia, N. Y.—The Bell Telephone Co., it is reported, will erect a building on Jackson St., to cost $50,000.

**Taylorsville, N. C.*—John W. Campbell is reported to have secured the contract to erect the Taylorsville cotton mills, boiler and engine house, at a cost of $100,000.

Rocky Mount, N. C.—Lictner & Wilkins, of Wilmington, N. C., have completed plans for a 3-story brick hotel, to cost about $65,000.

La Moure, N. D.—Hancock Bros., of Fargo, according to reports, have prepared plans for a 2-story building, 50x100 ft., to be erected by A. B. Hutchinson, at a cost of $12,000.

Dayton, O.—According to reports, the Knights of Pythias are considering the erection of a lodge building, to cost about $70,000.

Cincinnati, O.—Jos. G. Steineamp & Bro., Mercantile Library Bldg., are reported to have prepared plans for the store and apartment house which is to be erected for F. & W. Siefke Co., undertakers, at 8th and Linn Sts., at a cost of $30,000.

Edw. H. Dornette, Pickering Bldg., it is stated, has been engaged to prepare plans for a garage and stable, to be erected at Howell and Clifton Aves. by M. E. Brown and others, at a cost of $50,000.

Springfield, O.—The Detroit, Toledo & Ironton R. R. Co. (Geo. K. Lowell, Gen. Mgr., Detroit, Mich.), it is reported intends erecting a new depot on N. Limestone St.

Columbus, O.—It is stated that bids will be received until Nov. 1 for a 2-story reinforced concrete stable and garage. Frank L. Packard, Archt., New Haydn Bldg.

Lawton, Okla.—The directors of the First Natl. Bank, it is reported, have decided to erect a 3-story banking office building at 3d St. and C Ave.

El Reno, Okla.—J. J. Greer, of Kansas City, Kan., according to reports, will erect a hotel here costing approximately $250,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—J. D. Block is reported to be having plans prepared by J. W. Dutton for a $15,000 residence.

Los Angeles, Cal.—Morgan & Wells, 232 N. Main St., are reported to be preparing plans for a $20,000 residence for L. A. Thompson.

San Diego, Cal.—Wm. Clayton is reported to be having plans prepared for a 2-story residence, to cost $15,000.

Los Angeles, Cal.—It is stated that plans have been prepared for a new edifice which is to be erected for the members of the German Evangelical Trinity Lutheran Church, at 18th and Cherry Sts., at a cost of approximately $40,000.

San Diego, Cal.—It is stated that plans are about completed for a residence to be erected at a cost of $15,000 at 6th and Laurel Sts. for Wm. Clayton.

Chicago, Ill.—Ignatz Schwinon, it is stated, will erect a 3-story 159x167 apartment house of brick and stone at Humboldt, Boule and Shakespeare Aves., at a cost of $80,000.

Alexandria, La.—The Jewish citizens, it is reported, have decided to erect a temple at a cost of $30,000.

Walbrook P. O., Baltimore, Md.—B. W. & E. Minor, it is stated, intend erecting a 4-stroy apartment house at Garrison and Windsor Aves., Walbrook, at a cost of $40,000.

Fairhaven, Mass.—Louis E. Destremps, of New Bedford, is preparing plans for a parochial school and chapel combined at Oxford Village, Fairhaven, to cost about $20,000. Rev. M. Bernard, Pastor, Fairhaven.

Duluth, Minn.—The Frank L. Young Co., Palladio Bldg., according to reports, has nrepared plans for an edifice which the members of the Endion Methodist Episcopal Church contemplate erecting, at a cost of $35,000.

Omaha, Neb.—It is reported that a $25,000 residence is to be erected at 38th St. and Dewey Ave by P. H. Updike.

Falls City, Neb.—Bids will be received, it is stated, until Dec. 31 by the Committee of the Roman Catholic congregation for basement and foundation for a new edifice. Rev. Father Bex, Pastor.

South Orange, N. J.—Robt. S. Stephenson and Herbert Wheeler, assoc. archts., 233 5th Ave., N. Y. City, N. Y., are stated to have prepared plans for a residence which is to be erected at Charlton and Irvin Aves. for John J. Gould, at a cost of $35,000.

Newark, N. J.—C. W. Peck, 81 N. 6th St., it is reported, is preparing plans for a $20,000 residence, to be erected on Sanford Ave.

Defiance, O.—The members of the First Presbyterian Church, it is reported, are planning the erection of an edifice costing about $25,000.

East Cleveland, O.—Geo. H. Steffens, of Cleveland, O., it is reported, has prepared plans for a $20,000 edifice to be erected by the members of the Lake View Congregational Church.

Philadelphia, Pa.—Archbishop Ryan is reported to have purchased a site at 28th and Diamond Sts., on which it is proposed erecting a church, rectory, convent and school.

**Beaver Falls, Pa.*—L. C. Kirker & Sons, 4th Ave. and 9th St., it is reported, have secured the contract to erect an edifice for the Christian Church at $20,000. Rev. John Darby, Pastor.

**Bala, Pa.*—H. Elwood Bradford is reported to have secured the contract to erect a 3-story granite dwelling at City and Bryn Mawr Aves. at a cost of $15,000.

Memphis, Tenn.—The congregation of the Idlewild Presbyterian Church is reported to have accepted plans for an edifice to cost $35,000. Judge J. P. Young, Chmn. Bldg. Com.

Seattle, Wash.—Plans have been filed by S. L. Dowell for the construction of a 5-story brick apartment house, at 3236 and 3238 Eastlake Ave., to cost $18,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—G. H. Jones, Bursar of the University of Alabama, writes that Frank Lockwood, of Montgomery, is preparing plans for an engineering building, to cost $125,000, and a museum building, to cost $85,000. Bids will probably be called for within a month.

**Montgomery, Ala.*—Contracts for work at the Alabama Girls' Industrial School are reported awarded as follows: Heating, Barbour Plumbing & Htg. Co., Birmingham, at $14,463, and electric wiring, at $659; plumbing, Alabama Supply Co., of Birmingham, at $4,900.

Dermott, Ark.—Bids will be received until Oct. 30 by Dr. E. E. Barlow, Dermott, for erecting a school. Bids to be submitted separately on plumbing, heating and wiring. Chas. L. Thompson, Archt., Little Rock.

Phoenix, Ariz.—Bids will be received, it is stated, by C. W. Goodman, Supt. Indian School, until Oct. 29 for 6,350 ft. lumber, 30,000 shingles, 10,000 lath, 33 doors and windows, 50,000 brick, 100 bbls. of lime, 3,000 lbs. of iron, 200 posts, 1,500 electric lamps, besides a large quantity valves, pipe, sinks, lavatories, closets, boilers, tools and equipments.

New Britain, Conn.—At the city meeting held Oct. 21 it was voted to permit the School Com. to erect an addition to Monroe St. School, at a cost of about $15,000.

Washington, D. C.—Bids will be received until Nov. 2 by the Coms. D. C. for constructing an addition to the McKinley Manual Training School as advertised in The Engineering Record.

Ashburn, Ga.—The citizens are reported to have voted to issue $10,000 bonds for erecting an addition to a school.

Chicago, Ill.—Bids will be received until Nov. 1 at the office of the Business Manager, Bd. Educ., Dearborn and Madison Sts., for cupola, brass furnaces and core oven at the Lyman Trumbull Manual Training High School.

De Kalb, Ill.—D. E. Moon, Secy. Bd. Educ., writes that bids will be received on Oct. 28 for erecting a school, to cost about $40,000. Architect, J. C. Llewellyn, 194 Dearborn St., Chicago. A. W. Fisk, Chmn. Bldg. and Grounds Com.

Dixon, Ill.—The high school is reported destroyed by fire.

Iowa City, Ia.—It is stated that bids will soon be asked by the Bd. of Trus of the State Univ. of Iowa for erecting a law building at the Univ., 3 story and basement and to be of Bedford stone.

**Items marked thus give the names of parties awarded contracts.*

**Norwoy, Ia.*—C. W. Ennis, of Toledo, is reported to have secured the contract to erect an $11,000 school.

Franklin, La.—It is stated that bids will be received by Wilson McKerrall, Chmn. Bldg. Com., until Oct. 29 for erecting a 3-story brick school; also separate bids for plumbing, electric wiring and heating. C. H. Page, Jr., & Bro., Archts, Austin, Tex.

Mansfield, Lo.—Bids will be received until Nov. 9 by the Bldg. Com. (A. F. Jackson, Secy.) for erecting a high school.

Pittsfield, Moss.—Harding & Seaver, 7 North St., it is stated, have submitted plans for the school to be erected on Fenn St.

Medford, Mass.—Chas. B. Dunham, 6 Beacon St., Boston, is preparing plans for a grammar school. R. B. Lawrence, Chmn. School Com.

Boston, Mass.—Bids will be received until Oct. 31 by the Schoolhouse Comrs. (R. Clipston Sturgis, Chmn.), 120 Boylston St., for building an extension to Francis Parkman School, Walk Hill St.; also installing plumbing system in said extension. Chas. B. Perkins, Archt., 15 Ashburton Pl.

St. Poul, Minn.—O. Savard, Secy. Bd. Educ., writes that the Board is now looking for a site for the Central High School.

Magnolia, Miss.—School bonds amounting to $25,000 are reported sold.

St. Louis, Mo.—Bids will probably be received at the end of October for the erection of a parochial school for St. Agatha's Parish, to cost about $50,000. Address Jos. Stander & Son, Archts, 210 Temple Bldg., St. Louis.

**Leadwoou, Mo.*—Thos. R. Tolleson, Secy. Bd. Educ., writes that the contract for erecting a school (bids opened Oct. 21) has been awarded to McCarthy Constr. Co., of Farmington.

Greenville, N. C.—Bids will be received until Nov. 4 by the Bd. Aldermen for $75,000 school improvement bonds. F. M. Wooten, Mayor.

Fremont, Neb.—The Normal School is reported to have been destroyed by fire on Oct. 14.

**Hooksett, N. H.*—The contract for building the Academy for the Sisters of Mercy has been awarded to the J. H. Mendell Co., of Manchester, N. H., for $145,000. Contract for heating and plumbing not yet let. T. Edward Sheehan, archt., Tremont Bldg., Boston, Mass.

**Newark, N. J.*—The Com. on Schoolhouses of the Bd. of Educ., it is stated awarded contracts as follows for erecting the new Lincoln School and for additions to the Bergen St. School and the Hawthorne Ave. School (bids received Oct. 17): Lincoln School—Mason and carpenter work, Walter Isetts, 16 N. 13th St., $46,465; iron work, Hedden Iron Const. Co., 22 Clinton St., $2,950; painting, Olaf Scharin, $945; roofing, Essex Cornice and Skylight Co., $4,142; plumbing, Sam'l F. Wilson, 474 Clinton St., $3,458; electrical work, The Browe Co., 16 Clinton St., $1,743; heating, Storms & Co., 112 S. 14th St., $8,498; motor work, General Electrical Co., $490.

Bergen St. School—Mason work, T. J. Mackinson & Co., 223 S. 7th St., $43,490; iron work, O. C. Lienau & Son, $11,858; carpenter, Geo. Landgraf & Son, 154 Chadwick Ave., $17,997; painting, Olaf Scharin, $1,097; roofing, Baier & Conrad, $2,660; plumbing, Jaehnig & Peoples, 221 13th Ave., $4,963; electrical work and bell system, Beaver Const. Co., $1,172; heating, Storms & Co., $8,742; air moving apparatus, The Browe Co., $1,175.

Hawthorne Ave. School—Mason work, Jos. Oschwald, 238 Washington St., $44,131; iron work, Goeller Iron Wks, Newark, $10,790; carpenter work, Geo. Landgraf & Son, $17,035; painting, Chas. Stopper, $825; roofing, Jos. Bleeker, $2,140; plumbing, Sam'l F. Wilson, 474 Clinton St., $3,627; electrical work, The Browe Co., $1,883; heating, Elias Berla, 76 Mulberry St., $11,260; motor and wiring, Beaver Const. Co., $567.

Swedesboro, N. J.—The following are reported to be the bids recently received for erecting a school: Lynch Bros., Philadelphia, Pa., $33,773; J. S. Rogers, $33,968; Venner Wood, $34,905; J. Steelman, $34,944; John Hamlin, $36,200; John B. Guest, $36,995, and Metzger & Wells, $38,456.

Dover, N. J.—It is stated that bids for erecting the high school recently received exceeded the appropriation, which is $35,000, and a special election is to be held Oct. 29 to vote on an additional $30,000 appropriation.

**Princeton, N. J.*—The Geo. A. Fuller Co., of New York, N. Y., is stated to have secured the contract to erect the laboratory of physics at Princeton Univ., which is to cost $351,987. The structure is a gift from Stephen S. Palmer.

New York, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., until Nov. 4 for installing ventilating and heating appaartus of additions to and alterations in School 29, Boro. Manhattan.

Buffalo, N. Y.—Bids will be received until Nov. 1 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for erecting a 20-room brick school in Dist. No. 44, Broadway and Krupp St. Separate bids to be submitted on the following: Heating, ventilating, etc.; plumbing, gas fitting, etc.; also, same time and place, for erecting an 18-room brick school in Dist. No. 58, Rother near Walden Aves. Separate bids to be submitted on the following: Masonry, cut stone, iron work, fireproofing, carpentry, electrical work, etc.; roofing, metal work, steel ceilings, etc.; heating, ventilating, etc.; plumbing, gas fitting, etc.

Hamilton, O.—Bids will be received, it is stated, by John A. Kelles, Clk. Bd. Educ., until Nov. 1 for $23,000 school bonds.

**Memphis, Tenn.*—The Secy. Bd. of Edu. writes that McKnight & Barker, Memphis Trust Bldg., have secured the contracts for erecting two schools, one on Carr Ave., the other on Mhoon Ave. (bids opened Oct. 7) for about $125,000. Architects, Alsup & Woods, Randolph Bldg.

Morristown, Tenn.—Crapsey & Lamm, of Cincinnati, O., are reported to be preparing plans for a T-shaped administration building, which is to be erected at the Normal and Industrial College, of pressed brick, and cost about $40,000.

Dallas, Tex.—T. G. Terry, Secy. Bd. of Educ., writes that W. F. Nicol, N. Texas Bldg., is preparing plans for a school, to cost about $30,000.

Pullman, Wash.—The State Bd. of Control at Olympia, it is stated, has awarded the contract to erect a library and assembly hall at the State College, Pullman, as follows: General construction to Hastie & Dougan, of Seattle, $117,560, and heating to G. H. Sutherland Co. of Walla Walla, at $6,000.

Fairbanks, Wosh.—It is reported that the Council has decided to erect a school at a cost of $15,000.

Superior, Wis.—Bids will be received until Nov. 15 by the Bd. of Regents at Madison (Wm. Kittle, Secy.) for furnishing material and erecting the addition to the Normal School at Superior, for which there is an appropriation of $45,000. Separate bids are to be submitted for ventilating and steam heating, plumbing, sewerage work, etc.

**Tomahawk, Wis.*—Jas. Kelly, City Clk., writes that F. Tomlinson, of Ashland, has secured contract for general construction of proposed school (bids opened Oct. 18) for $42,960.

Benton, Wis.—M. E. Cottman, Clk. School Bd., writes that it is proposed to erect a high school, to cost about $20,000. Architect, H. Kleinhammer, of Platteville.

Milwaukee, Wis.—Bids will be received until Oct. 31 by Bd. School Directors (Frank M. Harbach, Secy.), Milwaukee, for furnishing material and raising old building and erecting a new school building on Forest Home and 11th Ave., in the 11th Ward. Separate bids to be submitted on general construction, plumbing, sewerage and gas fitting; ventilating and heating; heat regulating apparatus; electrical work.

Toronto, Ont.—The time for receiving bids for the heating, plumbing, ventilation and electric wiring required for the new normal schools at Peterborough, Stratford, Hamilton and North Bay has been extended from Oct. 24 to Nov. 4. Address H. F. McNaughten, Secy. Pub. Wks., Toronto. Probable cost, $50,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Ft. Morgan, Ala.—See "Water."

San Francisco, Cal.—C. M. Schwab, it is reported, intends modernizing the shipbuilding and structural plant of the Union Iron Works, at a cost of about $1,000,000.

**San Bernardino, Col.*—It is reported that the contract for the foundations of the new machine shops for the Santa Fe R. R. has been awarded to Carl Leonardt, of Los Angeles. They are to be 100 x 500 ft., and when completed including equipment will cost about $250,000. Carl Leonardt is also reported to have the contract for the erection of the roundhouse which is to cost $150,000.

Los Angeles, Cal.—F. W. Braun, 409 E. 3d St., is reported to be planning the erection of a plant on 3d St. for the manufacture of mining machinery. It is reported to be the purpose of the company to erect a 4-story and basement 90x100 ft. storage building, a 3-story warehouse, 150x116 ft., and a manufacturing building in the rear of the warehouse. An iron and brass factory and a sheet metal and wood working department is also to be included in the plant. The total cost of the building, equipment and site, it is stated, will be about $1,000,000.

Washington, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Deept. (R. C. Hollyday, Ch.), Washington, D. C., until Nov. 16, as per Specification No. 1,566, for furnishing and installing laundry equipment at the Naval Hospital Medical School, Washington, to include the following: Two all-metal washers, inside cylinder 32-in. x 54 in.; one 26-in. extractor, with attached countershaft; one 100-in. steam-heated mangle; one 36-in. reverse body ironer, electric heated; one 20-gal. starch cooker; one 3-compartment cabinet dry room, 4 trucks; 3 7-lb. electric-heated irons; one 60-gal. soap tank; one electric motor of not less than 10 h. p; also all the necessary shafting, hangers, pulleys and belting to operate the same, and shafting and hangers to operate two additional washers and one additional extractor of sizes and types called for above, and the necessary pipe, valves and fittings and wiring that are neecssary to install the machinery.

Albany, Ga.—The Business League, it is reported, has announced that $175,000 of the $250,000 needed for the erection of a yarn mill in Albany by 1908 has been secured. Many prominent business men of Albany are interested.

Chicago, Ill.—The Great Western Smelting & Refining Co., according to reports, is about to award contracts for the construction of a new plant at Iowa St. and 41st Ave. The plant will comprise a main building 130x408 ft., foundy 60x60 ft., smelter 50x400 ft., and a refining plant 40x360 ft. H. W. Tomlinson, 17 Van Buren St., is the archt.

Indianapolis, Ind.—It is reported that plans have been filed for a 3-story reinforced concrete building which is to be erected for the Sanitary Can Co., at St. East St., at a cost of about $40,000.

Carthage, Ky.—It is stated that plans are being prepared for an addition which it is proposed erecting to the plant of the Block-Poliak Co., at a cost of $500,000.

Duluth, Minn.—The United States Steel Corporation is reported to be considering plans for a steel plant which it is proposed erecting in Duluth.

McKenzie, Tenn.—See "Power Plants, Gas and Electricity."

Hubbard City, Tex.—Bids are wanted, it is stated, for complete equipment and installation of 25-ton ice-making and 50-ton refrigerating machinery for plants of Union Central Light & Ice Co. Address J. P. Hornaday, Financial Agt., 27 William St., New York, N. Y.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Waterbury, Conn.—The Bd. of Health has recommended the immediate construction of a garbage disposal plant.

Terre Haute, Ind.—We are informed that the Bd. of Pub. Wks. (Patk. B. Walsh, Pres.) has decided to erect a garbage crematory and is in the market for propositions from builders of crematories.

Baltimoe, Md.—Local press reports state that the following are the bids opened on Oct. 18 by the Bd. of Awards for the disposal of city garbage: The American Reduction Co., of Pittsburg, Pa., offered to dispose of garbage by Pittsburg system during next 10 years, beginning Jan. 1, 1908—the time when contract with Baltimore Sanitary Co. expires—for $49,500 a year. For reduction plant of Baltimore Sanitary Co., which city bought for $135,703, it offers $10,000, making net cost for 10 years $495,000. The Southern Product Co., of Baltimore, bid to dispose of garbage during year from Jan. 1, 1908, to Jan. 1, 1909, for $57,000 per year, the price to be increased $2,000 yearly for 9 ensuing years, or a total of $660,000. The company offered $100,000 for reduction plant, which makes net cost for 10 years $560,000. An additional proposal by the same copmany is that if, at the expiration of 10 years, it is again awarded contract it will pay city $150,000 for reduction plant. If contract is not renewed at that time, according to additional proposal, the firm will turn plant over to city free of charge. This company proposes using the Arnold-Egerton system, which is at present used here. The Baltimore Product Co., of Baltimore, bid to dospose of the garbage during the year from Jan. 1, 1908, to Jan. 1, 1909, $58,000 per yr., the price to increase $2,900 yearly for remaining 9 years, the cost for the year bet. Jan. 1, 1917, and Jan. 1, 1918, being $84,100; total amount of this company's bid for $710,500, which, minus the $50,000 it offers for reduction plant, makes a net cost of $660,000. The company proposes to use the Arnold-Egerton system. J. L. Wicks, Comr. of Street Cleaning.

Montclair, N. J.—A committee has been appointed consisting of M. N. Baker, of Montclair; Dr. A. C. Benedict, of South Orange; Dr. Minor Maghee, of West Orange, and Dr. Poor, of Orange, to consider plans for the disposal of garbage of Montclair, Orange, South Orange, Glen Ridge and Bloomfield.

New York, N. Y.—The Bd. of Aldermen has passed an ordinance providing for an appropriation of $222,000 for dumping scows for the Street Cleaning Dept.

Cincinnati, O.—Bids will be received until Oct. 31 by the Bd. Pub. Service (M. J. Keefe, Clk.) for the equipment of a dumping station on 2d near Vine St., to consist of the following: Destruction furnace and boiler, heating system and power piping, air lifts, compressor and receiver; refuse and ash conveyor and engine and shafting; hydraulic elevators. Sam'l Hannaford & Sons, Archts., Hulbert Blk.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received until Nov. 21 by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, for dredging at the mouth of Wolf and Jordan Rivers, Miss., as advertised in The Engineering Record.

Denver, Colo.—See "Miscellaneous."

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Oct. 29 to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y.: Sch. 413—26,840 lbs. mild steel bar; 25,000 lbs. galvanized sheet steel; brass and c. i. valves. Sch. 416—Garbage crematory complete; ice-making plant. Washington, D. C.: Sch. 409—40,000 asphalt paving blocks. Sch. 412—3,125 lbs. oil hardening steel. Boston, Mass.: Sch. 410—21,000 lbs. crucible steel wire. Sch. 414—valve reseating machine. Norfolk, Va.: Sch. 413—10 M. ft. cherry; 15,400 lbs. brazier's copper. Sch. 414—Pneumatic drill and hammer, 2 valve reseating machines. Bids will also be received until Nov. 5, same time and place, as follows; League Island, Pa.: Sch. 406—Instantaneous change engine lathes; motor driver, engine lathe; boring and turning mill; automatic screw-cutting machine. Charleston, S. C.: Sch. 407—Automatic plug machine. Portsmouth, Va.: Sch. 408—Two high speed engine lathes. Mare Island, Cal.: Sch. 388—30 M. ft. white ash, 25 M. ft. cedar, 60 M. ft sugar pine, about 190 M ft. red wood, 100 tons pig lead, 1,800 lbs. shet lead. Sch. 389—150 tons pig iron. Sch. 391—97,500 lbs. bar iron, 5,000 lbs. machinery steel; 71,500 lbs. galvanized sheet steel. Sch. 395—4,000 lbs. Portland cement; galvanized iron or steel pipe. Application for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

Ft. Des Moines, Ia.—Bids will be received until Nov. 7 by Capt. John J. Boniface, Constr. Q. M., U. S. A., for constructing corral fences and erecting picket lines at this post.

Prophetstown, Ill.—Bids will be received until Nov. 11 by the Comrs. of the Big Slough Special Drainage Dist., counties of Henry and Whiteside at the office of F. W. Sears, Engr., Prophetstown, for the enlargement of the main ditch of said drainage district, requiring the removal of about 353,000 cu. yds. material.

Wilmington, Del.—The following are the bids opened on Oct. 21 by Maj. C. A. F. Flagler, Corps. Engrs., U. S. A., for dredging entrance to Broadkill River (price given per cu. yd.): River & Harbor Improv. Co., Philadelphia, Pa., 19.2 cts.; Pennsylvania Dredging Co., Camden, N. J., 23⅜ cts.

Springfield, Ill.—The State Senate has passed a bill which, if the House concurs in same, will be presented to the voters of the entire State of Illinois on Nov. 5, authorizing the issue of $20,000,000 State bonds at 4 per cent. for the building of a deep waterway from the terminus of the Chicago drainage channel near Joliet to Utica.

**East St. Louis, Ill.*—R. A. Brown, of Vincennes, Ind., has secured the contract for dredging about 16 miles of drainage canal east and south of East St. Louis, in the American Bottoms, lying between the bluffs on the east and the Mississippi River on the west, at 16½ cts. per cu. yd. The engineer's estimate calls for the removal of about 1,000,000 cu. yds. of dirt, about half of which will be used for levee purposes. W. J. Crocker, City Engr.

Tipton, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until November 2 for the construction of 9,800 ft. of tile ditch ranging from 8 to 16 in. P. O. Duncan, Co. Engr.

**Items marked thus give the names of parties awarded contracts.*

St. Paul, Minn.—The following are reported to be the bids opened on Oct. 10 by the State Drainage Board for improving channel of Roseau River in Roseau and Kittson counties, which will require the removal of about 510,089 cu. yds. (price given per cu. yd): Miller Dredging Co., 11.40 cts.; France Dredging & Constr. Co., 12.4 cts.; Standard Drainage Co., 10.5 cts. Ambrose G. Wahl, St. Cloud, 11.95 cts.; G. A. McWilliam, Walnut, Ill., 10.95 cts.; Phelan & Shirley ,Omaha, Neb., 11.0 cts.; R. A. Eley, Marshalltown, Ia., 10.85 cts., and Jerry Sherwood and Chas. Sutcliff, of Litchfield, total cost, about $54.000 (awarded contract).

Atlantic City, N. J.—The Atlantic City Monorail & Amusement Co., recently incorporated with a capital of $250.000, is reported to have decided to construct a new ocean pier in front of Hotel Windsor, to cost about $250,000. Geo. Cochran, Pres.; Robt. J. W. Koons, Secy., both of Philadelphia, Pa.

Albany, N. Y.—We are informed that no bids were received on Oct. 17 by F. C. Stevens, Supt. State Bd. of Pub. Wks., for Contract No. 20, Erie Canal, Sect. 2, which calls for dredging a channel in Mohawk River and performing work incidental thereto bet. Rexford Flats and Cranes Village. Length of contract, 18.5 miles. Sheets 1 to 41, inclusive. New bids will be called for.

Brooklyn, N. Y.—Bids will be received until Nov. 6 by Bird S. Coler, Boro. Pres., for furnishing material and dredging Newtown Creek Canal, at and in the canal and basin included within the boundaries of Johnson, Montrose, Morgan and Varick Aves. and also in the Stagg St. basin. Engineer's estimate of materials to be dredged is 14,500 cu. yds., scow meas.

Rye, N. Y.—Bids will be received, it is stated, until Nov. 6 by Geo. L. Henderson, Village Clk., for constructing a dock or bulkhead at Milton, Rye, N. Y. Chas. S. Towle, Village Engr., 5 E. 42d St. New York.

Syracuse, N. Y.—Local press reports state that F. C. Stevens, of Albany, State Supt. of Pub. Wks., has asked the State Engineer to make an examination and devise plans for the entire rebuilding of a portion of the canal in Syracuse. The N. Y. Central & Hudson River R. R. Co. (W. J. Wilgus, Vice-Pres. Constr. Dept., N. Y. City) is reported to be planning construction of a steel aqueduct at the tunnel east of the city.

Hallville, Ont.—Bids will be received until Nov. 2 by Hugh Martin, Clk. Mountain Township, Hallville, for $9,381 bonds to provide for the construction of the Silver Creek and Castore River drainage work.

Reading, Pa.—The following are reported to be totals of bids opened on Oct. 17 by the Bd. of Pub. Wks. for constructing Spring St. subway: Hawman Bros., Reading, $110,480; David Peoples, Philadelphia, $110,945; Jacob Mayer, Reading, $122,284; Jos. P. O'Reilly, Reading, $122,434; L. H. Focht & Son, Reading, $122,982; Abrens & Co., Reading, $131,174; Eastburn & Chiles, Philadelphia, $142,310, and Mack Paving Co., Philadelphia, $178,830.

National Soldiers' Home, Va.—Bids will be received by John T. Hume, Treas. Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., until Nov. 1 for dredging channel extension, Jones' Creek, about 4,800 cu. yds.

PROPOSALS OPEN.

For Proposals see pages 60, 61, 62, 63 and 64

WATER.

Bids Close. — See Eng. Record.
Oct. 29. Conduit, Aylmer, Ont. … Oct. 26
Nov. 4. Water wks., Tucson, Ariz. … Sep. 28
Adv. Sep. 28.
Nov. 4. Meters, Panama … Oct. 12
Nov. 4. Well, Ellendale, N. D. … Oct. 26
Nov. 4. Engine, etc., Philadelphia, Pa. … Oct. 26
Adv. Oct. 26.
Nov. 5. System, Las Animas, Colo … Oct. 12
Nov. 5. Boiler, etc., Oceanside, Cal … Oct. 19
Nov. 7. Improv. water system, Chilocco, Okla. … Oct. 19
Nov. 9. Water extension, Hobart, Okla. … Oct. 26
Adv. Oct. 26.
Nov. 11. Well, Ft. Terry, N. Y … Oct. 19
Nov. 12. Pipe, Atlanta, Ga. Adv. Oct. 26 … Oct. 26
Nov. 12. System, Velva, N. D. … Oct. 26
Nov. 14. Pump house, Ft. Morgan, Ala … Oct. 26
Adv. Oct 26.
Nov. 15. Pipe, Winnipeg, Man. Adv. Oct. 5 to 19. Oct. 5
Nov. 25. Pumps Atlanta, Ga. Adv. Oct. 26 … Oct. 26
Nov. 25. Pumping engine, Atlanta, Ga … Oct. 26
Adv. Oct. 26.
Dec. 1. Water wks., Shelley, Idaho. … Sep. 28
Dec. 1. Pipe, etc., Phoenix, Ariz. … Oct. 12
Adv. Oct. 5 to 26.
Dec. 17. Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19 … Oct. 12
——— Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Oct. 26 … Sep. 28
——— Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to 26 … Oct. 12
———. Reservoir, etc., Blackstone, Va … Oct. 19

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 29. Des Moines, Ia … Oct. 26
Oct. 29. Tecumseh, Mich. Adv. Oct. 19 … Oct. 12
Oct. 29. Troy, N. Y … Oct. 19
Oct 30. Columbus, O. … Oct. 26
Oct. 30. Rockford, Ill. … Oct. 26
Oct. 31. Riverside, N. J … Oct. 12
Oct. 31. Ardmore, Pa. … Oct. 19
Adv. Oct. 19.
Oct. —. Eaton, O. … Aug. 3
Nov. 1. Riverside, N. J. Adv. Oct. 26 … Oct. 26
Nov. 2. Seattle, Wash … Oct. 26
Nov. 2. Marinette, Wis. … Oct. 26
Nov. 4. Des Moines, Ia … Oct. 19
Nov. 4. Ottumwa, Ia … Oct. 26
Nov. 4. San Jose, Cal. … Oct. 26
Nov. 5. Girard, O. … Oct. 26
Nov. 5. Trenton, N. J … Oct. 26
Nov. 6. Brooklyn, N. Y … Oct. 26
Nov. 7. White Plains, N. Y. Adv. Oct. 19, 26. Oct. 19
Nov. 7. Hattiesburg, Miss. … Oct. 26
Nov. 7. Youngstown, O. … Oct. 20
Nov. 9. Chagrin Falls, O. … Oct. 26
Nov. 9. Hobart, Okla. Adv. Oct. 26 … Oct. 26
Nov. 11. Pensacola, Fla … Oct. 19
Nov. 15. Boston, Mass. Adv. Oct. 26 … Oct. 26
Dec. 2. Cadillac Mich. Adv. Oct. 19, 26 … Oct. 19
Dec. 3. Auburn, N. Y. Adv. Oct. 19, 26 … Oct. 19
Jan. 15. Manila, P. I. Adv. Oct. 26 … Oct. 26

BRIDGES.

Oct. 29. New York, N. Y … Oct. 19
Oct. 30. Williamsport, Md. Adv. Oct. 12, 19 … Oct. 12
Nov. 1. Winnipeg, Man. Adv. Oct. 26 … Oct. 26
Nov. 1. Indiana, Pa. … Oct. 26
Nov. 2. Belvedere, N. J … Oct. 26
Nov. 4. Ashland, O. … Oct. 12
Nov. 4. Jasper, Ind. … Oct. 26
Nov. 4. Greenville, Miss. … Oct. 26
Nov. 5. Vincennes, Ind … Oct. 19
Nov. 5. Sundance, Wyo. … Oct. 26
Nov. 7. Mauch Chunk, Pa … Oct. 19
Nov. 8. Redding, Cal. … Oct. 19
Nov. 8. Webster, Pa. … Oct. 26
Nov. 8. Carman, Man. … Oct. 26
Nov. 9. Richmond, Ind. … Oct. 26
Nov. 11. Wharton, Tex. Adv. Oct. 26 … Oct. 26
Nov. 12. Troy, O. … Oct. 12
Nov. 15. Glendive, Mont. Adv. Sep. 28 to Oct. 12. Sep. 28
Nov. 15. Portland, Ore. … Oct. 19
Nov. 29. West Bethlehem, Pa. … Oct. 26
Dec. 31. Canton, China. Adv. Oct 26 … Oct 26

PAVING AND ROAD MAKING.

Oct. 29. St. Louis, Mo … Oct. 19
Oct. 29. New York, N. Y … Oct. 19
Oct. 29. Boston, Mass. … Oct. 26
Oct. 30. Des Moines, Ia … Oct. 19
Oct. 30. Brooklyn, N. Y … Oct. 19
Oct. 30. Baltimore, Md. … Oct. 26
Oct. 30. Ventnor City, N. J. … Oct. 26
Oct. 30. Crawfordsville, Ind. … Oct. 26
Oct. 31. Ft. Logan H. Roots, Ark … Oct. 5
Adv. Oct. 5 to 26.
Oct. 31. Des Moines, Ia … Oct. 19
Oct. 31. Cincinnati, O. … Oct. 26
Oct. —. Selma, Ala. … Sep. 7
Nov. 1. El. ry., Calgarry, Alta … Oct. 12
Nov. 1. Cincinnati, O. … Oct. 19
Nov. 2. Greencastle, Ind … Oct. 19
Nov. 2. Ft. Wayne, Ind … Oct. 19
Nov. 2. Seattle, Wash … Oct. 26
Nov. 2. Monclova, O. … Oct. 26
Nov. 4. Peru, Ind. … Sep. 28
Nov. 4. Decatur, Ind … Oct. 19
Nov. 4. Logansport, Ind … Oct. 19
Nov. 4. Red Bank, N. J … Oct. 19
Nov. 4. Jasper, Ind. … Oct. 26
Nov. 4. Salem, Ind. … Oct. 26
Nov. 4. Columbus, Ind. … Oct. 26
Nov. 4. Lakewood, O. … Oct. 26
Nov. 5. Vincennes, Ind … Oct. 19
Nov. 6. Cleveland, O … Oct. 12
Nov. 6. Brooklyn, N. Y … Oct. 26
Nov. 6. Kokomo, Ind. … Oct. 26
Nov. 6. Ft. Wright, Wash. … Oct. 26
Nov. 7. Rockville, Ind … Oct. 19
Nov. 7. Redding, Cal. … Oct. 19
Nov. 7. Youngstown, O. … Oct. 26
Nov. 9. Hobart, Okla. Adv. Oct. 26 … Oct. 26
Nov. 12. Troy, O. … Oct. 12
Nov. 12. Denton, Md … Oct. 20
Nov. 15. Pensacola, Fla. Adv. Oct. 19, 26 … Oct. 19
Nov. 15. Davenport, Ia. … Oct. 26
Nov. 15. Cincinnati, O … Oct. 26
Nov. 18. Brookhaven, Miss. … Oct. 26
Nov. 21. Greenville, Tenn. Adv. Oct. 26 … Oct. 26
Nov. —. Tacoma, Wash. … Oct. 26
Dec. 6. Salt Lake City, Utah … Oct. 19
Adv. Oct. 19, 26.
Dec. 13. Valparaiso, Ind. … Sep. 7
——— York, Pa. … Sep. 7
——— Ithaca, N. Y. Adv. Oct. 19 … Oct. 12

POWER PLANTS, GAS AND ELECTRICITY.

Oct. 28. Brooklyn, N. Y … Oct. 19
Oct. 28. Ellis Island, N. Y … Oct. 19
Oct. 30. Bay City, Mich. Adv. Oct. 19, 26 … Oct. 19
Oct. 30. Fresno, Cal. … Oct. 19
Oct. 30. Columbus, O. … Oct. 26
Nov. 1. Seymour, Ind. … Sep. 14
Nov. 1. Ft. Des Moines, Ia … Oct. 19
Nov. 1. Clifton Forge, N. Y … Oct. 19
Nov. 1. Exeter, Neb. … Oct. 26
Nov. 4. Panama … Oct. 12
Nov. 4. Pierre, S. D … Oct. 19
Nov. 4. Berrien Springs, Mich … Oct. 19
Nov. 8. Kokomo, Ind. … Oct. 5
Nov. 8. Minneapolis, Minn. … Oct. 26
Nov. 9. Las Animas, Colo. … Sep. 28
Nov. 9. Key West Barracks, Fla. … Oct. 26
Nov. 12. Panama … Oct. 26
Nov. 12. Chico, Cal. … Oct. 26
Nov. 14. Cincinnati, O. … Oct. 19
Nov. 15. Charleston, S. C … Sep. 14

BUILDINGS.

Oct. 28. Post bldgs., Plattsburgh Barracks, N. Y. Adv. Oct. 5 to 26 … Oct. 5
Oct. 28. School, West New Brighton, N. Y … Oct. 19
Oct. 29. School, New York, N. Y … Oct. 19
Oct. 29. School, Phœnix, Ariz. … Oct. 26
Oct. 29. School, Franklin, La. … Oct. 26
Oct. 30. Jail, etc., Terre Haute, Ind … Sep. 21
Oct. 30. Post office, Atlanta, Ga. … Sep. 28
Oct. 30. Post bldgs., Columbus Barracks, O … Oct. 5
Oct. 30. Bus. bldg., Batesburg, S. C … Oct. 12
Oct. 30. School, Demott, Ark. … Oct. 26
Oct. 31. Interior partitions in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12 … Oct. 5
Oct. 31. Mechanical equipment in P. O. Bldg., Cleveland, O. Adv. Oct. 5, 12 … Oct. 5
Oct. 31. Pub bldg., Kansas City, Mo … Oct 12
Oct. 31. Pub bldg., New York, N. Y … Oct. 19
Oct. 31. Hospital, Peoria, Ill. … Oct. 26
Oct. 31. Alter. to htg. plant of pub. bldg., New York, N. Y. … Oct. 26
Oct. 31. School, Boston, Mass. … Oct. 26
Oct. 31. School, Milwaukee, Wis. … Oct. 26
Nov. 1. Jail, Mangum, Okla … Oct. 12
Nov. 1. School, Stamford, N. Y … Oct. 12
Nov. 1. School, New Haven, Conn … Oct. 19
Nov. 1. County Memorial Bldg., Pittsburg, Pa. … Oct. 19
Nov. 1. Add to jail, Balsam Lake, Wis … Oct. 19
Nov. 1. School, Chicago, Ill. … Oct. 26
Nov. 1. Bus. bldg., Columbus, O. … Oct. 26
Nov. 1. School, Buffalo, N. Y. … Oct. 26
Nov. 2. Pub. Bldg., New Orleans, La … Oct. 19
Nov. 2. School, Washington, D. C. … Oct. 26
Adv. Oct. 26.
Nov. 4. Post bldg., Ft. Bliss, Tex … Oct. 12
Adv. Oct. 12 to 26.
Nov. 4. School, Woodruff, S. C … Sep. 28
Nov. 4. School, Pierre, S. D … Oct. 19
Nov. 4. Pub. bldg., Leesville, La … Oct. 19
Nov. 4. Htg. schools, Toronto, Ont … Oct. 26
Nov. 4. Pub. bldg. improv., Richmond, Va … Oct. 26
Nov. 5. Court house plans, Houston, Tex … Aug. 31
Adv. Sep. 14 to Oct. 26.
Nov. 5. Barrack bldg., Portland, Me … Oct. 5
Adv. Oct. 5 to 26.
Nov. 5. Post Office, Flint, Mich … Oct. 5
Adv. Oct. 5, 12.
Nov. 5. Barracks, New Orleans, La. … Oct. 12
Nov. 5. Barracks, etc., New Orleans, La … Oct. 19
Nov. 6. Jail, Luverne, Ala … Oct. 26
Nov. 6. Painting pub. bldg., Chicago, Ill … Oct. 26
Adv. Oct. 26.
Nov. 7. Pub. bldg., National Soldiers, Home, Va. … Oct. 26
Nov. 8. Barracks, Ft. Stevens, Ore. … Oct. 26
Nov. 9. School, Mansfield, La … Oct. 26
Nov. 10. Bus. bldg., La Grange, Ill … Oct. 26
Nov. 11. Rest pavilion, etc., Atlantic City, N. J. … Oct. 26
Adv. Oct. 26
Nov. 11. Plumbing, pub. bldg., Pensacola, Fla … Oct. 19
Nov. 11. School, Cincinnati, O. Adv. Oct. 19, 26. Oct. 19
Nov. 11. Pub. bldg., New Orleans, La … Oct. 26
Nov. 12. School, Seattle, Wash. … Oct. 12
Nov. 12. Schools, Pipestone, Minn … Oct. 19
Nov. 14. School, Jersey City, N. J … Oct. 19
Nov. 14. New industrial plants, Ft. Morgan, Ala. Oct. 26
Adv. Oct. 26.
Nov. 15. Pub. bldg., Chippewa Falls, Wis … Oct. 5
Nov. 15. Y. M. C. A. bldg., Tampa, Fla … Oct. 19
Nov. 15. School, Superior, Wis. … Oct. 26
Nov. 16. New indus. plant, Washington, D. C … Oct. 26
Nov. 19. Post bldgs., Jefferson Barracks, Mo … Oct. 26
Nov. 21. Bus. bldg., Auburn, N. Y … Oct. 5
Nov. 21. Pub. bldgs., Greenville, Tenn … Oct. 26
Adv. Oct. 26.
Nov. 22. Post office, Portsmouth, Va … Oct. 19
Adv. Oct. 19, 26.
Nov. 25. Exten. to post office, Tyler, Tex … Oct. 19
Nov. 29. Post Office, Marion, Ind. Adv. Oct. 26. Oct. 26
Nov. —. University gymnasium, Madison, Wis … Oct. 5
Nov. —. School, Allegheny, Pa … Oct. 19
Dec. 3. Post Office, Nevada, Mo … Oct. 26
Dec. 31. Church, Falls City, Neb. … Oct. 26
Dec. —. Industrial plants, Ft. William, Ont … May 11
Dec. —. School, Anderson, Ind. … Sep. 28
Feb. 1. Plans for Capitol, San Juan, P. R … Sep. 28
Feb. 1. Court house and jail, Cairo, Ga … Oct. 26
Feb. —. College, Agricultural College, Mich … Oct. 19
——— Industrial plant, Hubbard City, Tex … Oct. 26

MISCELLANEOUS.

Oct. 29. Supplies, Washington, D. C … Oct. 12
Oct. 29. Wall, New York, N. Y … Oct. 19
Oct. 29. Supplies, Washington, D. C. … Oct. 26
Oct. 30. Dredging, Providence, R. I … Oct. 5
Adv. Oct. 5 to 26.
Oct. 31. El. ry. wk., Boston, Mass. … Oct. 26
Oct. 31. R. R. wk., Waskom, Tex. … Oct 26
Oct. 31. Garb. Disposal, Cincinnati, O. … Oct. 26
Nov. 1. El. ry., Calgary, Alta … Oct. 12
Nov. 1. Repairs to wharf, Ft. Schuyler, N. Y. Oct. 12
Nov. 1. Dredging, National Soldiers' Home, Va. Oct. 26
Nov. 1. El. ry. wk., Augusta, Ga. … Oct. 26
Nov. 2. Ditch, Tipton, Ind. … Oct. 26
Nov. 4. Steel hull for snag boat, Louisville, Ky. Oct. 5
Adv. Oct. 5 to 26.
Nov. 4. Punching machines, Panama … Oct. 12
Nov. 4. Steel fence, Ft. D. A. Russell, Wyo … Oct. 19
Nov. 4. Ice, Piers, La Prairia, Que … Oct. 19
Nov. 4. Wharf, St. Simeon, Que … Oct 19
Nov. 5. Supplies, Washington, D. C … Oct. 26
Nov. 6. Dock, Rye, N. Y. … Oct. 26
Nov. 6. Dredging, Brooklyn, N. Y … Oct. 26
Nov. 7. Levee work, New Boston, Ill … Oct. 19
Nov. 7. Fence, Ft. Des Moines, Ia. … Oct. 26
Nov. 8. Cement, etc., Panama … Oct. 19
Nov. 9. Crematory, Las Animas, Colo … Sep. 28
Nov. 11. Torpedo Cases, Ft. Totten, N. Y … Oct. 19
Adv. Oct. 19, 26.
Nov. 11. Ditch, Prophetstown, Ill. … Oct. 26
Nov. 14. Monument, Chalmette, La … Oct. 12
Adv. Oct. 12 to 26.
Nov. 15. Garb. disp., Altoona, Pa … Oct. 12
Nov. 15. Pub. bldg., Chippewa Falls, Wis … Oct. 5
Nov. 15. Dredging, Philadelphia, Pa … Oct. 19
Adv. Oct. 19 to 26.
Nov. 16. Levee work, Pine Bluff, Ark … Oct. 19
Adv. Oct. 19, 26.
Nov. 18. Locks and dams, Dallas, Tex … Oct. 12
Adv. Oct. 12 to 26.
Nov. 18. Hoisting engines, etc., Portland, Ore. Oct. 26
Adv. Oct. 26.
Nov. 20. Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 19 … Sep. 28
Nov. 20. Rock and earth excavation, Detroit, Mich. Adv. Oct. 12, 19 … Oct. 12
Nov. 20. Breakwaters, Ludington, Mich. … Oct. 26
Adv. Oct. 26.
Nov. 20. Dredging, Muskegon, Mich. … Oct. 26
Adv. Oct. 26.
Nov. 21. Dredging, Galveston, Tex … Oct. 26
Adv. Oct. 26.
Nov. 21. Dredging Mobile, Ala. Adv. Oct. 26 … Oct. 26
Nov. 21. Wharf, Ft. Sumter, S. C … Oct. 26
Nov. 22. Dredging, Newport, R. I. … Oct. 26
Adv. Oct. 26.
Nov. 25. Locks, etc., Mobile, Ala … Sep. 28
Adv. Sep. 28 to Oct. 26.
Nov. 25. Dredging, Mattituck, N. Y. … Oct. 26
Adv. Oct. 26.
Dec. 11. El. ry franchise, New Orleans, La … Oct. 26
——— Lease of limestone quarries, Newark, N. J. Adv. Oct. 5 … Oct. 5

CURRENT NEWS SUPPLEMENT

NOVEMBER 2, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting November 6, 1907. Paper on Water Purification at St. Louis, Mo.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York. Annual meeting, New York, Dec. 3-6, 1907. Next meeting November 12, 1907. Paper on Gearless Traction Electric Elevators.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O

THE STURTEVANT STEAM TURBINE.

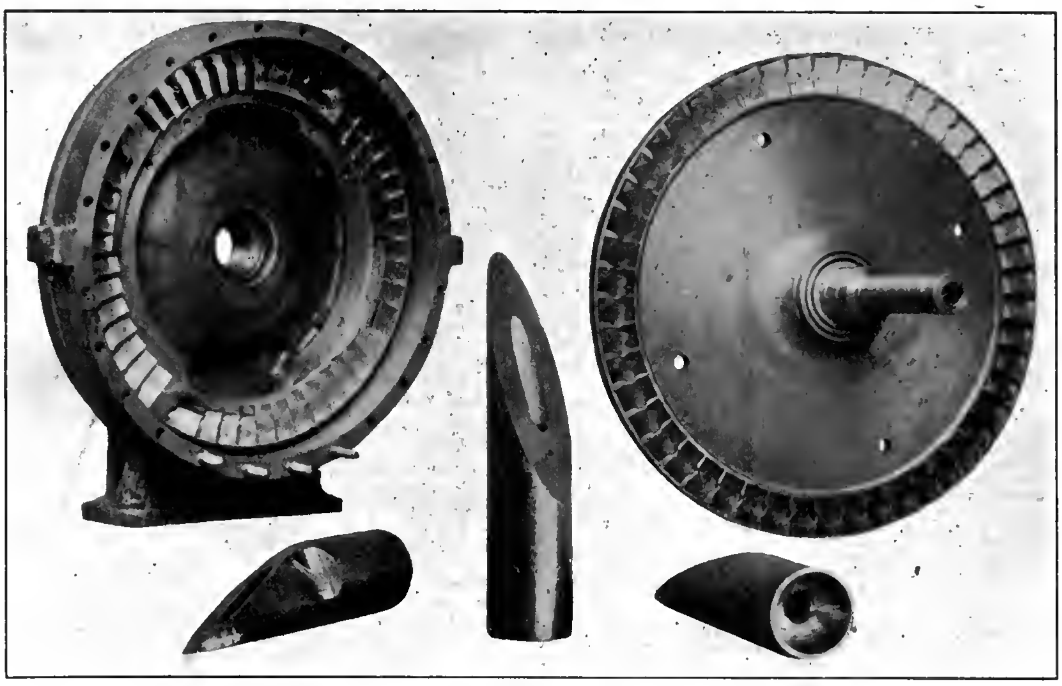
Several years ago it became apparent to the B. F. Sturtevant Co. that the steam turbine would be particularly adapted to driving direct-connected blowers and small generators. The experimental work was conducted by Mr. William E. Snow, of the engineering staff, and the turbine, which is a modification of the Riedler-Stumpf type, is now built under his patents. The steam enters at the sides of the bucket wheel through nozzles of Tobin bronze and acts upon buckets cut in the wheel. Similar buckets in the steel stationary guide plates form closed spaces in which the steam reacts, and as the steam is returned again and again to the moving buckets, each time at reduced velocity, more and more of its energy is absorbed. After the whirling motion has taken place in four of these stationary buckets the steam escapes from the open ended guide plates into the interior of the turbine case.

The bucket wheel or rotor is made of a single forging with the buckets worked out of the solid metal on a special automatic bucket-cutting machine. This process is stated to insure a wheel of great strength, and as it runs between the two guide plates there is no tendency to end thrust. A clearance of 1/16 in. all round the revolving wheel greatly reduces the liability of contact from lack of alignment, due to heating or wear of the bearings. Should contact occur, however, the makers believe it would be much less harmful with this design than it would be if the wheel carried on its periphery a large number of inserted blades. The bucket wheel is also made in another type; these buckets are milled into the edge of the disc and the steam acts tangentially. Either side or tangential bucket may be used with either single or multi-stage type turbines.

The Sturtevant turbine is made of the single-stage type in capacities ranging from 10 to 200 h.-p., and adjustment of the nozzles and buckets permits a wide range of power and speed for a turbine of given outside dimensions. Sizes above 200 h.p. are usually made from two to four bucket wheels. The areas of the nozzles and buckets increase successively on these wheels to take care of the larger volume of the expanded steam.

The speed of the Sturtevant turbine is controlled by a throttling governor which is direct-connected to avoid the use of belts or gears. The governor consists of but four parts and one spring. Located upon the end of the outboard bearing, it is enclosed in a dust-proof case and is direct-connected to the regulating valve which is placed upon the inlet beneath the governor.

GOVERNOR OF TURBINE.



THE STATOR, ROTOR AND NOZZLES OF THE STURTEVANT TURBINE.

The pressure upon the main bearings, which are the only surfaces in contact, is but 14 lb. per square inch, and the makers therefore claim that the wear is not appreciable. The bearings are of the self-aligning ring-oiling type with solid linings of phosphor bronze. When in continuous operation the only attention required is a weekly filling of the oil wells of these bearings.

The casing is made in halves so that the upper part can be removed easily for inspection of the bucket wheels; an annular passage supplies steam to the nozzles and each nozzle can be shut off separately by means of a small valve. The deep base is utilized for carrying the steam and the exhaust, which are connected directly to the base, thereby doing away with all overhead piping. The steam passages in the base are also arranged to form a separator, thereby insuring dry steam, so essential to efficiency and long life of the nozzles.

Among the advantages claimed for this turbine may be mentioned low speed. The repeated use of steam in the buckets of the same wheel gives the turbine a speed ranging from 1600 to 3000 r.p.m. This speed permits direct-connection and avoids the use of belts, gears, or other speed-reducing devices.

For installations in which the turbine is to be run non-condensing, no stuffing boxes are used on the shaft, steam tightness being secured by a short labyrinth or water packing. Since there is no contact between the rotary and the stationary rings of this packing, no adjustments are necessary and the packing will have a long life.

BUSINESS NOTES.

The Wiederholdt Construction Co., American Trust Bldg., Chicago, has acquired from the Atlas Construction Co., of St. Louis, all of the patent rights of the Wiederholdt system of reinforced concrete.

The Second Annual National Exhibition of Cement Products will be held in the Coliseum, Chicago, Dec. 17-21, 1907, under the auspices of the Cement Products Exhibition Co. Application for the first allotment of space will close on Nov. 9. Diagrams of exhibition spaces, application blanks and all details can be had by addressing the manager, Mr. L. L. Fest, New Southern Hotel, Chicago.

A riveting machine of unusual size and reach has been ordered from John F. Allen, 370 Gerard Ave., New York, by the Hawley Down Draft Co., Chicago. It will reach 84 in. into a stack 8 in. in diameter and drive 1-in. hot rivets or ½-in. cold rivets.

Building blocks of an unusual character are used in central New York with marked success. The Rochester Sewer Pipe Co., 545 Oak St., Rochester, manufactures a large amount of high-grade vitrified conduit, and as the company refuses to sell for electric purposes any conduit which does not conform fully with specifications, the slightly imperfect product of the kilns is now marketed as building blocks. Being cheap, non-absorbtive, fireproof and strong, they have come into considerable favor, and it seems likely that in a short time the demand for them will have increased materially.

The Northern Engineering Works, Detroit, Mich., has furnished three 10-ton electric traveling cranes, each of about 56-ft. span, and a No. 72 Newton cupola for the new foundry of R. Hoe & Co., printing press manufacturers, of New York. Three Northern cranes of 40-ft. span, one of 15-ton and two of 10-ton capacity, have also been furnished to the Clyde Iron Works, Duluth. The latter equipment will be operated by alternating current.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Ft. Morgan, Ala.—Bids will be received by Capt. L. F. Garrard, Constr. Q. M., until Nov. 28 for the construction of a 150,000-gal. steel tank on a 75-ft. trestle, as advertised in The Engineering Record.

**Los Angeles, Cal.*—We are informed that the Risdon Iron Wks. have secured the contract for a pumping engine for Buena Vista pumping station (bids opened Oct. 14) for $25,980.

Orland, Cal.—The Secretary of the Interior at Washington, D. C., is reported to have given his formal approval to the Orland Irrigation Project, as outlined by government engineers; appropriation available for this work is $650,000.

Pueblo, Colo.—F. L. Tebow, of Denver, is reported to have filed with the County Clerk at Pueblo preliminary maps and statement of a reservoir to be constructed on Turkey Creek, in the northwestern part of the country; it will have an estimated capacity of 306,800,000 cu. ft. of water.

Atlanta, Ga.—The following are reported to be totals of bids opened on Oct. 23 by the Bd. of Water Comrs. for furnishing and erecting complete a sectional washing pressure filter plant to consist of 8 units, each unit 8 ft. diam. and 20 ft. long. Said filter plant to have a minimum guaranteed daily delivering capacity of 4,000,000 gal. when one unit is out of service during washing period: New York Continental Jewell Filtration Co., New York, N. Y. (2 bids), $30,000 and $22,000; Roberts Filter Mfg. Co., Philadelphia, Pa., $21,600, and Philadelphia Water Purification Co., Phila., Pa. (2 bids), $26,125 and $25,125.

Lewiston, Idaho.—Bids will be received until Nov. 11 by the Common Council for furnishing f. o. b. Lewiston the following: 9,400 ft. 12-in., 5,400 ft. 8-in., 4,000 ft. 6-in. and 14,000 ft. 4-in. c. i. or steel pipe; all pipe to be kalamain, or kalamain and asphalted, or asphalted only, warranted to withstand a pressure of 300 lbs. to the square inch; 14,000 lbs. 4 to 12 in. c. i. fittings; 12,000 lbs. pig lead; 6 12-in., 17 8-in., 27 6-in. and 48 4-in. valves; 20 6-in. and 20 4-in. frostproof fire hydrants. John E. Nickerson, City Clk.

**West Chicago, Ill.*—The City Clerk writes that the citizens on Oct. 19 voted for water works, and contract for constructing same has been awarded to Duboldt Bros., of West Chicago.

Wichita, Kan.—The City Council on Oct. 21 selected I. Phillips to prepare plans for a new system of water works or make an estimate of the present work of the plant of the Wichita Water Co.

Wahoo, Neb.—See "Power Plants, Gas and Electricity."

Kimball, Neb.—It is reported that steps are being taken to construct water works at a cost of $17,000.

Trenton, Neb.—It is stated that the Village Trus. will receive bids until Nov. 11 for furnishing material and erecting a steel stand pipe 16 ft. diam. and 40 ft. high. Address W. H. Thornhill, Village Clk.

**Beaver City, Neb.*—W. L. Leonard, City Clk., writes that the National Constr. Co., of South Bend, Ind., has secured the contract for constructing water works (bids opened Oct. 22) for $21,600. The Des Moines Bridge & Iron Co., of Des Moines, Ia., bid for this work $22,890.

Campton Village, N. H.—The Campton Village Water Co. (Moody Dole, Pres.) is building a concrete dam and excavating a reservoir on Cove Mountain brook in the town of Thornton for a village water system. The pipe line will be laid early next season. Arthur W. Dudley, of Manchester N. H., is the engineer.

Jersey City, N. J.—C. H. Van Keuren, Ch. Engr. Street and Water Bd., in a communication to the Street and Water Bd., suggests that a supplemental contract be entered into with the Jersey City Water Supply Co. for laying additional mains under Hackensack and Passaic rivers, and if this cannot be done that the city perform the work itself. The cost of two additional 36-in. pipe lines, laid upon pile foundation under Hackensack River, he estimates, would cost $65,000. Two additional c. i. mains laid under Passaic River, where it will be unnecessary to drive pile foundation, would cost $27,500, make a total for the entire work of $92,500.

Roswell, N. M.—There is reported to be a petition in circulation here looking to the calling of an election to vote on issuing $165,000 bonds for water works and a sewerage system.

Mattituck, N. Y.—Bids will be received until Nov. 25 by Col. John G. D. Knight, Corps Engrs., U. S. A., New York City, for dredging in Mattituck Harbor as advertised in The Engineering Record.

Buffalo, N. Y.—The following are the bids opened on Oct. [illegible] by the Bd. of Pub. Wks. for 4 600-h. p. boilers, to be placed in boiler house at north end of pumping station: Heine Safety Boiler Co., $40,350, and Parker Boiler Co., $27,628.

Bainbridge, N. Y.—E. F. Musson, of Norwich, is preparing [illegible] for a reservoir and filtration plant for Bainbridge. [illegible] not be called for until the Spring.

Seneca Falls, N. Y.—This village is reported to have been granted [illegible] by the State Bd. of Water Supply [illegible] municipal water works on condition [illegible] by appropriation from the taxpayers [illegible] pay for the construction and also [illegible] and indirect, which may result from [illegible] of plans.

Batavia, N. Y.—[illegible] Water Comn. (J. H. Burkhart, Chmn.) [illegible] considering the selection of Dorman Springs, [illegible] miles south of Batavia, as a source of water supply for Batavia

New York, N. Y.—Bids will be received by John H. O'Brien, Comnr. Water Supply, Gas and Electricity, until Nov. 13 for furnishing, delivering and erecting a system of water curtains, with all piping, valves, manifolds, sprinkler heads, brackets, supports and all other appurtenances in the high-pressure pumping stations located at Oliver and South Sts. and Gansevoort and West Sts., Boro. Manhattan.

New Brighton, S. I., N. Y.—The Bd. of Aldermen, of N. Y. City on Oct. 29 voted to purchase the plant of the Staten Island Water Supply Co. for $1,100,000.

Wilmington, N. C.—This city has purchased the plant of the Claredon Water Co. for $155,000. It is stated that it will be enlarged and extended.

**Lumberton, N. C.*—The contract for the water and sewer extension is reported to have been awarded to F. M. Farrell, of Merry Oaks, N. C., for $18,570.

Smithfield, N. C.—See "Power Plants, Gas and Electricity."

Velva, N. D.—We are informed that the bids to be received by the City Clerk until Nov. 12 for the construction of complete water works will consist of an 85,000-gal. concrete reservoir sewer tile gravity pipe line, c. i. pressure distribution pipe line, frame pumping station combined gasoline engine and pump and 2 intake wells. Engineer, Oscar Claussen, German-American Bank Bldg., St. Paul, Minn.

Bowbells, N. D.—The citizens are reported to have voted to issue $12,000 bonds for the construction of water works and a system of fire protection.

Delta, O.—C. S. Longnecker, Mgr. Delta Electric Light Co., writes that this company will, if it secures franchise, construct water works at a cost of $25,000. The citizens will soon vote on the question of granting a franchise or constructing municipal plant.

**Lawton, Okla.*—The American Light & Water Co., of Kansas City, Mo., and the McQuatters Plumbing & Machine Co., of Hillsboro, Tex., are reported to have secured contracts from City Council for the construction of a dam and reservoir in the Wichita Mountains on Medicine Creek, and laying water mains from Lawton to the dam site; it is stated that the city will expend about $275,000 and will procure a permanent and adequate water supply.

Mangum, Okla.—The citizens are reported to have voted to issue bonds for water works extensions.

Portland, Ore.—Bids will be received by Lieut. Col. S. W. Roessler, Corps. Engrs., U. S. A., until Nov. 18 for furnishing and delivering 4 hoisting engines, 3 locomotives and 2 boilers, as advertised in The Engineering Record.

Huntington, Ore.—It is reported that bids will be received about Nov. 10 by the City Clk. for boring a well 1,000 ft. deep and cased with 6-in. iron casing.

**Philadelphia, Pa.*—The Dept. of Pub. Wks. on Oct. 28 awarded contracts as follows (bids opened Oct. 22): To the D'Olier Eng. Co., for boilers at the filter plant, amounting to $32,350; the Allis-Chalmers Co., of Milwaukee, Wis., for a centrifugal pump at $18,700, and for magnesia covering to the H. W. Johns-Mezille Co. at $8,000.

Harrisburg, Pa.—See "Power Plants, Gas and Electricity."

**Belle Fourche, S. D.*—The Secy. of the Interior at Washington, D. C., has executed a contract with Devore Bros. & Farlow, of Vale, S. D., for the construction and completion of a portion of the South Canal, Belle Fourche irrigation project, for $103,500.

Childdress, Tex.—The City Council is reported to be considering the question of calling an election to vote on issuing $15,000 bonds for fire protection in the business portion of the city.

Beaumont, Tex.—Hollis P. Porter, of Beaumont, Engr. of the Neches Canal Co., writes that the proposed work contemplated by this company will cost about $125,000. Will purchase all piping. W. M. Carroll, Pres.

Crockett, Tex.—The citizens are reported to have voted Oct. 15 to issue $25,000 bonds for the construction of water works.

Denison, Tex.—W. W. Berry, Supt. Water Co., writes that about $30,000 will be expended in improvements, to include filter plant, pumps, boiler, etc., but no bids will be asked for same.

Norfolk, Va.—The Common Council on Oct. 18 concurred with the Bd. of Aldermen in appropriating $50,000 for the purchase of 2,100 meters, to be placed in the residences where the largest waste of the city water is found, and it is stated that the Mayor will approve the same.

Seattle, Wash.—The lowest bid opened on Oct. 12 by the Bd. of Pub. Wks. for constructing pipe line on Harvard Ave., North, was submitted by the Independent Asphalt Paving Co., Pioneer Bldg., at the following bid: 20 cu. yds. solid rock excav., trenching, hauling and back fill. (including clearing and grubbing) $1; 4,320 cu. yds. other materials excav., trenching, hauling and back fill., per cu. yd. (including clearing and grubbing), $1; 32.5 M. ft. lumber in staves, in 42-in. pipe, $50; 114,000 steel in bands, 7 cts.; 20 lin. ft. 6-in. c. i. waste pipe, $1.50; 1,000 lbs. c. i. fittings, 10 cts.; 510 lin. ft. 42-in. riveted steel pipe, 5-16-in. thickness, $11; 780 lin. ft. 42-in. steel pipe, 3/8-in. thickness, $13.50; totals, $31,000. Totals of other bids: International Contract Co., New York Blk., $31,817, and Sanfield & Gifford, 764 Belmont Pl., $33,298.

Tacoma, Wash.—This city has in contemplation the erection of a 500,000-gal. stand pipe of steel or reinforced concrete, to be about 60 ft. high. C. C. Raleigh, Asst. City Engr.

Prosser, Wash.—The citizens are reported to have voted, Oct. 12, to issue $10,000 bonds to sink a well for domestic water supply.

Spokane, Wash.—Prof. Wm. H. Burr, of New York, N. Y., on Oct. 20 filed with Mayor Moore a report on the question of a water supply for city, recommending that the underground flow of water in the Spokane Valley be utilized.

Deer Park, Wash.—T. A. Beard is reported to have petitioned the County Comrs. at Spokane for a franchise for water works.

Union, W. Va.—A. S. Johnston, Mayor, writes that bonds to the amount of $5,500 have been sold for water works.

St. Croix Falls, Wis.—Otto W. Comer, Village Clk., writes that all bids opened on Oct. 26 for water works extension have been rejected; probable cost of work, $5,000. Ben. Clayton, of St. Croix Falls, is reported interested.

**De Pere, Wis.*—M. J. Maes, City Clk., writes that contracts for furnishing material for water works extension has been awarded to W. O. Bahr, of Manitowoc, to the Ludlow Valve Co., of Chicago, Ill., and to the Sheffield Cast Iron Pipe & Fdy. Co., of Chicago., Ill., total cost of work, $5,843.

**Madison, Wis.*—Geo. Nelson, of Madison, is reported to have secured the contract on Oct. 9 for constructing a reservoir for about $11,550.

Sheboygan, Wis.—Bids will be received until Nov. 15 by Theo. Dieckmann, Mayor, and John M. Steimle, City Clk., for $360,000 bonds, issued for the purpose of purchasing the plant of the City Water Co. and for making extensions to said plant.

Neenah, Wis.—It is stated that bids will be received Nov. 5 for $20,000 water works bonds. J. L. Keating, City Clk.

Ft. Mackenzie, Wyo.—Bids will be received until Nov. 14 by Capt. Wm. D. Davis, Q. M., U. S. A., for constructing an 8-in. c. i. water main from U. S. reservoir to Ft. Mackenzie, together with connection to post distributing system

Thermopolis, Wyo.—J. B. Chessington, City Engr., writes that the citizens have voted to raise $50,000 bonds for the construction of water works and the city will receive bids until Nov. 18 for the purchase of the bonds. F. C. Hank, Town Clerk.

Kelowna, B. C.—See "Power Plants, Gas and Electricity."

London, Ont.—An election will probably be held in January to vote on issuing bonds for extension of the water works. John M. Moore is engr. and supt.

Vonda, Sask.—The Town Clerk writes that the proposed water works will cost $12,000 to $15,000, and bonds will be voted for on Nov. 2.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Ventura, Cal.—The City Clerk writes that bids will probably be called for in Dec. for the proposed sewer work, steel bridges, parks, paving, fire house, etc., for which the citizens on Sept. 24 voted to issue $150,000 bonds. Engineer, J. B. Wand, of Ventura.

San Francisco, Cal.—At a meeting of the City Superv. on Oct. 14, upon recommendation of the Finance Com., the following amounts were set aside: $233,700 to repair and clean out sewers and repair street pavements; $21,350 for repairing municipal buildings other than City Hall; $32,052 to pay for sewer construction in 7th St. from Howard to Market and in Market from 7th to Jones, and $12,177 for resurfacing with bitumen portions of Market St. from 2d to 12th Sts.

**Torrington, Conn.*—W. A. Williston, Boro. Engr., writes that the following are the bids opened on Oct. 21 for the construction of sanitary sewers: (*a*) 45 ft. 12-in. tile pipe; (*b*) 1,145 ft. 10-in. tile pipe; (*c*) 6,581 ft. 8-in. tile pipe; (*d*) 37 manholes, ea. (*e*) rock excav. per cu. yd.; (*f*) totals: Robbiatti Ambrose, Torrington, *a* 78 cts., *b* $1.35, *c* $1,25, *d* 60 cts.; *e* $6, *f* $8,955 (awarded contract); Eveline Bros., *a* 86 cts., *b* $1, *c* $1,25 *d* $52, *e* $7, *f* $8,784; Pierson Eng. & Const. Co., *a* $1.10, *b* $1. *c* $2, *d* $60, *e* $6. *f* $10,694; Gill & Co., *a* $1.18, *b* $1.18, *c* $1.18, *d* $55, *e* $5, *f* $11,204; Little & Long, *a* $1.42½, *b* $1.55, *c* $2.55, *d* $75; *e* $6, *f* $14,042.

Chicago, Ill.—The Drainage Bd. on Oct. 21 purchased property for right-of-way of proposed Evanston auxiliary channel, which is to divert sewage of North Shore suburbs from Lake Michigan into north branch of Chicago River.

South Bend, Ind.—A. J. Hammond, City Engr., is preparing plans for about 5 or 6 miles of pipe sewers.

**Adel, Ia.*—V. T. Sweeley, Town Clk., writes that the contract for constructing sewers in Walnut, Main and Rapids Sts. (bids opened Oct. 21) has been awarded to G. M. King Constr. Co., of Des Moines, for $3,211.

Des Moines, Ia.—Bids will be received until Nov. 9 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing a reinforced concrete culvert at 13th and North Sts.

**Virginia, Minn.*—Chas. C. Butler, of Virginia, is reported to have secured the contract for constructing sewers in Dist. 3 G (bids opened Oct. 22) for $3,079.

**St. Joseph, Mo.*—The Bd. of Pub. Wks. is reported to have awarded to G. O. Stulbred the contract for extending the Sycamore St. sewer for $7,306.

East Rutherford, N. J.—Geo. A. Duncan, Boro. Clk., writes that the citizens on Oct. 28 voted to construct a system of sewers. Engineers, Wise & Watson, of Rutherford.

Roswell, N. M.—See "Water."

Long Island City, L. I., N. Y.—Bids will be received until Nov. 11 by Jos. Bermel, Boro. Pres., for furnishing material and constructing a sewer in a portion of 3d Ave.; also a catch basin on the cor. Sanford St. and Hamilton Ave.

Sea Cliff, L. I., N. Y.—G. Griffith Clapham, Village Clk., writes that it has been decided not to push the sewer question until the spring, but in the meantime the matter will be under consideration.

Lumberton, N. C.—See "Water."

Smithfield, N. C.—See "Power Plants, Gas and Electricity."

Velva, N. D.—See "Water."

Alliance, O.—John L. McConnell, Mayor, has approved the ordinance providing for the construction of

**Items marked thus give the names of parties awarded contracts.*

a sewer outlet for the sewage disposal plant, at a cost of $5,700. Chas. O. Silver, Clk. Bd. Pub. Service.

Dayton, O.—The following are reported to be the bids opened on Oct. 11 by the Bd. of Pub. Service: On sanitary sewers in Sewer Dist. No. 4, bounded by Wayne Ave. and Wyoming St. and the old corporation line, Shafor & Dill, $13,260; John T. Reese, $13,372.

**Cincinnati, O.*—M. J. Connelly Const. Co. has secured the contract for constructing sewers on Edwards Road and in the ravine north of Bodman Ave. for $10,623, and W. S. Hollander for sewers in Cutter St. and in property of W. Goodman, for $3,186 (bids opened by Bd. Public Service Oct. 17).

Springfield, O.—Bids will be received by the Bd. of Pub. Wks. (F. A. Crothers, clk.) until Nov. 20 for furnishing material and constructing a portion of the high level intercepting sewer to include 9,816 lin. ft. vitr. pipe, plain or reinforced concrete sewer, 9,376 lin. ft. 6 in. pipe house connections, Y branches. manholes, 17,875 cu. yds. rock excav., 115 cu. yds. Class A concrete, etc. W. H. Sieverling, City Eng.

Akron, O.—Bids will be received until Nov. 6 by the Bd. Pub. Service (Chas. H. Watters, secy.) for constructing sewers in portions of 6 streets.

Salem, O.—L. E. Chapin, of Canton, is preparing plans for sewage disposal plant, to cost about $40,000. Contracts will not be let until about April.

Canton, O.—Bids will be received by the Bd. of Pub. Service until Nov. 25 for 5,000 ft. pipe sewer, 15 to 24 in.; 37 catch basins and 20 manholes. B. F. Faust, Clk. of Bd.

Put In Bay, O.—Carl Oelschlager, Village Clk., writes that it is proposed to construct a sewerage system. Engineer, C. E. De Witt, of Port Clinton.

**Steubenville, O.*—T. W. Vance, Clk. Bd. Pub. Service, writes that the contract for 3,079 ft. of 24, 30 and 36-in. brick sewer (bids opened Oct. 14) has been awarded to Jas. Ferry & Sons, of Crafton, Pa.

Girard, O.—E. L. Hauser, City Clk., writes that bids will be received on Nov. 5 for constructing a portion of the main sewer, to consist of 5,600 lin. ft. 18-in. pipe sewer, average cut about 15 ft. Engineer Wm. Wilson, of Niles.

Lancaster, Pa.—Bids will be received by the Special Sewerage Comn. (Chas. G. Baker, Clk.) until Nov. 11 for building about 2,200 ft. of 108-in. reinforced concrete sewer and appurtenances, as advertised in The Engineering Record. This is to complete work recently abandoned by contractor.

Weatherly, Pa.—It is reported that a petition is now being circulated, looking to the construction of a sewerage system.

**Chattanooga, Tenn.*—Bids were opened on Oct. 15 by the Bd. of Pub. Wks. for the construction of a brick main sewer and appurtenances on Chestnut St. from Tennessee River to the center of 9th St., to consist of about 3,899 ft. of egg-shaped sewer, 36x54 in. to 50x75 in., and 175 ft. 6-in. circular sewer, and Guild & Co., of Chattanooga, secured the contcart for storm sewer, without diverter, for about $61,214.

St. Albans, Vt.—Surveys are in progress for the reconstruction of sewer system, the plans to be completed in time to submit matter of construction to the citizens at the election in Mar. They will include a trunk sewer, taking sewage from present outlet in brook and carrying it through a system of septic tanks and filter beds before discharging the effluent. N. N. Atwood, Mayor. A. W. Dudley, Manchester, N. H., Engr.

**Spokane, Wash.*—Contracts for sewers (bids opened by the Bd. of Pub. Wks. on Oct. 22) have been awarded as follows: To Jas. C. Broad, 106 Post St., for the 1st Ward sub-trunk sewer, Dist. No. 7, at $96,234; to Allen F. Gill, for main trunk sewer, 1st Ward, Dist. 4, for $18,475, and to John Fife, for building sub-trunk sewer, 1st Ward, Dist. 6, for $20,944.

Seattle, Wash.—See "Paving and Roadmaking."

North Milwaukee, Wis.—Bids will be received until Nov. 11 by E. H. Klamp, Village Clk., for constructing a concrete septic tank, 42 ft. diam. by 16 ft. deep. W. G. Kirchoffer, Engr., Madison.

Toronto, Ont.—A report on the question of the trunk sewer was presented to the Bd. of Control on Oct. 22 by City Engr. Rust. He is said to have recommended the construction of high and low level intercepting sewers, and the clarification of the sewage by means of septic tanks and contact beds. To carry out scheme would involve purchase of about 125 acres of land in neighborhood of Ashbridge's Bay. An expenditure of $3,400,000 is involved in the proposal. As designed, the amount of land provided is sufficient for a population of 600,000, but at the present time it will only be necessary to provide works for a population of 350,000. At a meeting of the Bd. of Control on Oct. 23 the following resolution passed two readings, to submit to ratepayers at next municipal election the question of constructing a trunk sewer and sewage disposal works, in acordance with report of City Engr.

Manila, P. I.—Plans and specifications are on file at the office of The Engineering Record, 239 W. 39th St., New York, N. Y., for furnishing and installing electrically driven pumps and motors for the new sewer system for the city of Manila, bids for which will be received at the office of the Municipal Board (John M. Tutler, Secy.) until Jan. 15, as advertised in The Engineering Record. There will be one main station and 5 substations, each equipped with 2 pumps and corresponding motors, or a total of 12 pumps and motors. J. F. Case, Chief Engr.

BRIDGES.

Notes Arranged Alphabetically by States.

Tucson, Ariz.—The Bd. of Supervisors is stated to be considering plans for a bridge to be constructed over the Rillito, at a cost of about $5,000.

**Napa, Cal.*—The Bd. of Supervisors is stated to have opened bids Oct. 16 for constructing a stone masonry arch bridge over Milliken Creek at crossing of Little Trancas in Road Dist. No. 4: Jas. B. Newman, $9,693; C. H. Gildersleeve, $7,796, and H. W. Wing, $6,680 (awarded contract).

**San Diego, Cal.*—The Bd. of Superv. is stated to have awarded the contract for constructing the Lakeside Bridge to Mercereau Bridge & Const. Co., of Los Angeles, at $11,840.

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Muncie, Ind.—Bids will be received, it is stated, by the Bd. Co. Comrs. until Nov. 6 for constructing 2 bridges, one across Mississineva River and the other across White River. Jos. E. Davis, Co. Aud.

Marion, Ind.—Bids will be received, it is stated, until Nov. 5 by the Bd. Co. Comrs. for constructing 4 concrete bridges. Harry Goldthwaite, Co. Aud.

Baltimore, Md.—Plans are stated to have been submitted to Municipal Art Comn. by Mr. Fendall, City Engr., and Danl. B. Banks for the Edmondson Ave. Bridge; estimated cost of structure, $180,000.

Thief River Falls, Minn.—Bids will be received until Nov. 6 by Lars Backie, City Clk. for building an iron bridge across Red Lake River.

Joplin, Mo.—The construction of a viaduct at 3d St. is reported contemplated at a cost of $91,000. The structure to be of steel with cement approaches.

Cleveland, O.—The Erie R. R. bridge No. 5, over Cuyahoga River, near Broadway, S. E., is reported destroyed.

Cincinnati, O.—The construction of a bridge over the canal at 14th St. is reported contemplated at a cost of $22,000.

Portland, Ore.—It is stated that the Executive Bd. has authorized the Auditor to receive bids for constructing a bridge over Sullivan's Gulch at E. 28th St.

Bids will be received, it is stated, until Nov. 29 by A. L. Barbour, City Aud., for constructing a reinforced concrete bridge across Sullivan's Gulch, at E. 28th St. Douglas W. Taylor, City Engr.

Panama.—The following are the bids opened on Oct. 24 at the office of the Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for the construction of a single-track railroad bridge, compelte, consisting of one 108-ft. through plate girder span and two 103-ft. 6-in. through plate girder spans: The Strobel Steel Co., Monodnock Blk., Chicago, Ill., $21,400 (delivery in New York, Feb. 15, 1907); U. S. Steel Export Co., New York, N. Y., $15,609 (Feb. 15); R. C. Hofman Co., Baltimore, Md., $19,240 (Feb. 15), and Penn Bridge Co., Beaver Falls, Pa., $19,420 (May 1).

Pittsburg, Pa.—The construction of a bridge connecting Meadow and Bond Sts. is reported contemplated, also a bridge over Beechwood Boule. at Murray Ave., probable cost, $80,000 and $60,000, respectively.

Mill Run, Pa.—Bids will be received until Nov. 15 by the Co. Comrs. (M. E. Townsend, Chmn.), at Uniontown, for constructing the stone abutments and wing walls for a bridge over Mill Run in Springfield Township, Mill Run; also same time and place for constructing the superstructure of said bridge, to be of steel, 35 ft. long.

Georgetown, S. C.—Bids will be received until Nov. 20 by J. B. Johnson, Co. Superv., Georgetown, for constructing a steel drawbridge across Mingo Creek.

Memphis, Tenn.—Bids will be received at the office of F. M. Guthrie, 70 Madison St., until Nov. 6 for putting in a new foundation under the N. 2d St. steel bridge across Wolf River, to consist of two sets of piers, about 65 ft. long and 15 ft. in diam.

Ogden, Utah.—Press reports state that Salt Lake & Ogden Ry. Co. (E. A. Vail, Ch. Engr., Salt Lake City) will soon comence the construction of a viaduct on 24th St.

Olympia, Wash.—The State Bd. of Highway Comrs. are stated to have awarded the contract for constructing the Washongal River Bridge, on State Road No. 8, to the Northwestern Bridge Co., of Tacoma, for $6,975. The structure will be of steel, with 180-ft. span.

Centralia, Wash.—Bids will be received until Nov. 9 by the State Highway Comn. (Jos. M. Snow, Secy.), Olympia, for grading and bridging State Aid Road No. 5, otherwise known as Harrison Ave., near the city of Centralia.

Spokane, Wash.—Plans have been prepared by Allen R. Scott, County Engr., for the Le Pray Bridge, which is to be built at the site of the old structure, 26 miles below Spokane, crossing the river between Spokane and Stevens Counties. The structure will consist of 3 Howe Truss Spans, each 120 ft. long. The 2 piers in the river will be of tubular steel, filled with concrete, and the supports at either end of the bridge will be short towers of timber. The floor will be on the lower chord and will be about 23 feet above high water. According to reports bids will be received by Chas. Howard, Clk. Bd. County Comrs.

Prof. W. H. Burr, of New York, N. Y., in his report to Mayor C. Herbert Moore on bridge at Monroe St., recommends that a new structure be built to take the place of present bridge, using such parts of it as may be available in other locations where traffic is lighter, or disposing of it in some other manner. If steel bridge is constructed he estimates cost at $250,000; a concrete bridge he estimates would cost about $325,000. He also considers feasible the scheme of constructing a bridge from the intersection of Front and Lincoln Sts., and gave as his opinion that it could be constructed at a cost of approximately 60 per cent. less than the amount necessary to apply in the construction of a bridge at Monroe St.

Bids will be received until Dec. 16 by Robt. Fairley, City Compt., for $400,000 bonds, issued for the construction and repair of bridges across the Spokane River.

The City Council on Oct. 22 authorized the City Engr. to prepare plans for a steel girder bridge across the river at E. Olive Ave., to cost about $40,000.

Eau Claire, Wis.—See "Miscellaneous."

Canton, China.—Bids will be received by the Canton River Bridge Co., Ltd. (Lau Chin Ting, Chmn.) until Dec. 31 (change of date from Oct. 19) for the construction of a steel cantilever and girder bridge, 1,102 ft. in length, in the Front Reach, Canton, on site about 740 ft. to west of Dutchfolly-fort, as advertised in The Engineering Record.

Markham, Ont.—See "Power Plants, Gas and Electricity."

Monteal, Que.—Press reports states that Thomas Malcolm is interested in the construction of a bridge over Restigouche River from Campbellton, N. B., to the Quebec side in Bonaventure County. The bridge will be 3,330 ft. long, containing 16 piers and will connect Atlantic, Quebec & Western Ry. and Intercolonial Ry.; probable cost, $600,000.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Hot Springs, Ark.—Bids will be received until Nov. 20 by F. V. P. Ellsworth, City Engr., for street paving in Improvement Dist. No. 21 and 26, approximately 10,000 sq. yds., with either asphalt, bitulithic or vitrified paving block on 6-in. concrete base; also approximately 5,000 sq. yds. with vitrified brick between the tracks of the Street R. R.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Wethersfield, Conn.—Bids will be received until Nov. 6 by the Bd. of Selectmen (Alfred W. Hanmer, 1st Selectman) for constructing a section of road in this town.

Wilmington, Del.—It is stated that bids will be received until Nov. 5 by Francis A. Price, Co. State Highway Comn., 1009½ arket St., for constructing a macadam road.

Palatka, Fla.—Bids will be received, it is stated, until Dec. 3, for 22,805 sq. yds. vitrified brick and 9,857 lin. ft. of granite or concrete paving. J. E. Craig, City Engr.

**East St. Louis, Ill.*—Walter Coonan has secured the contract for paving Illinois Ave. from State St. to 13th St. (bids opened Oct. 21), at the following bid: 390 ft. 20-in. pipe, laid, $1.60; 915 ft. 15-in. pipe, laid, $1.25; and 1,180 ft. 12-in. pipe, laid, $1; 5 c. i. manhole caps, ea., $14; 6 stone inlets with iron covers, ea., $14; 45 cu. yds. brick masonry in manholes and catch-basins, $9; 68c cu. yds. excav. placed in fill, 30 cts.; 1,100 cu. yds. excav. removed, 50 cts.; 2,500 ft. sandstone curb, 60 cts., and 8,100 sq. yds. banner brick, $1.65; total, $19.126. Totals of other bids on this class of brick: W. H. Hill Constr. Co., $19,611, and J. & P. Keeley, $19,955. Walter Coonan also secured contract for paving 11th St. from St. Louis Ave. to Illinois Ave. (bids opened Oct. 21) with Banner brick for $5,103.

Chicago, Ill.—Bids will be received until Nov. 7 by the Bd. Local Improv. (H. S. Dietrichs, Pres.) for paving with granite blocks 38th Pl.

Peoria, Ill.—Odrinances have been prepared providing for the paving of Water St. from Main to Chestnut St. with brick on Portland cement concrete base at a cost of $12,950, and for paving S. Adams St. from Oregon St. to city limits with brick, on gravel base, at a cost of $10,000.

Monticello, Ind.—It is stated that bids will be received until Dec. 3 by J. L. Ackerman, Co. Aud., for constructing a gravel road in Prairie Township and a macadam road in Jefferson Township; also until Nov. 26 for $59,700 macadam road bonds.

Noblesville, Ind.—It is stated that the Comnrs. of Hamilton County will soon ask for bids for the construction of 1½ miles of crushed stone road; estimated cost, $17,000.

Cedar Rapids, Ia.—Bids will be received until Nov. 14 by the Pub. Improv. Com. (W. C. Byers, Chmn.) for paving portions of 15th and 19th Sts. with repressed vitrified brick block.

Davenport, Ia.—Bids, it is stated, will be received until Nov. 5, by the Bd. Pub. Wks. for paving various streets and alleys. Thomas Murray, City Engr.

**Chillicothe, Mo.*—Jas E. Meck is reported to have secured the contract for paving a portion of Elm St., at $15,700.

Camden, N. J.—Bids will be received until Nov. 11 by the Stone Road Com. the Court House, Camden, for furnishing about 10,000 tons of stone for and resurfacing Camden, Ellisburg and Marlton Turnpike in Camden County. J. J. Albertson, Co. Engr.

Belleville (Newark), N. J.—Bids will be received until Nov. 5 by the Township Com. of the Township of Belleville, Academy and Cortlandt Sts., Belleville, for furnishing material and constructing sidewalks and crosswalks on the east and west sides of a portion of Belmont Ave.

Atlantic City, N. J.—Bids will be received by the City Clerk until Nov. 11 for repaving Pacific Ave. and constructing drainage conduits, to include 23,500 sq. yds. asphalt paving, 1,040 lin. ft. bluestone heading, stone and a drainage system complete, consisting of 25 lines of conduits, including new vitr. fire clay block gutters upon concrete around 50 curved corners at end of conduits, as advertised in The Engineering Record.

Long Island City, L. I., N. Y.—Bids will be received until Nov. 11 by Jos. Bermel, Boro. Pres.. for paving portions of Onderdonk Ave. and Academy St. Engineer's estimate 6,865 sq. yds. asphalt black pavt., 1,700 lin. ft. concrete curb., etc.

Albany, N. Y.—Bids will be received until Nov. 18 and Nov. 21 by Fredk. Skene, State Engr. and Surveyor, Albany, for constructing about 5 public highways as advertised in The Engineering Record; cost reported to be about $1,500,000.

M. F. Dollard is reported to have secured the contract for paving Sheridan Ave., at $10,793.

New York, N. Y.—Bids will be received until Nov. 7 by Henry S. Thompson, Acting Pres. Boro. Manhattan and Comr. Pub. Wks., for repaving portions of Cortlandt Alley, Waverly Pl., Central Park, S.; Bway., Jefferson, Broad, Chambers, Spring, Platt, Stanton, Perry, W. 10th, E. 91st., E. 118th, W. 151st, W. 152d, W. 153d and W. 154th Sts., Amsterdam, Edgecombe, Madison, 10th and 12th Aves.; grading, curbing and flagging portions of W. 139th, W. 140th and W. 160th Sts. Engineer's estimate: 11,144 sq. yds. asphalt blk. pavt., 52,516 sq. yds. asphalt pavt., including binder course; 22,0[illegible] sq. yds. granite blk. pavt, with paving cement joints; 3,800 sq. yds. blk. pavt., 67,269 sq. yds old stone blocks, to be pur

**Items marked thus give the names of parties awarded contracts.*

chased by contractor and removed, 14,409 cu. yds. concrete, 33,381 lin. ft. new bluestone curb., furnished and set, 2,405 lin. ft. old bluestone curb., redressed, re-jointed and reset; 3,020 lin. ft. new curb., furnished and set; 12,140 sq. ft. new flagging, furnished and laid; 180 noiseless covers, complete, for sewer manholes, furnished and set; 87 noiseless covers, complete, for water manholes, furnished and set, etc.

Bids will be received by the Park Bd. (Saml. Parsons, Jr., Pres.) until Nov. 7 for furnishing and delivering 2 12-ton 3-wheel steam road rollers for the Dept. Parks, Boro. Bronx. Also until Nov. 14 for furnishing material and constructing granolithic and brick sidewalks and the granite curbing of the concourse and approach to Baird Court in the New York Zoological Park, Bronx Park.

Brooklyn, N. Y.—The City Comptroller has been authorized to issue $100,000 bonds for maintenance and repair of streets in Boro. of Brooklyn.

*The following are the bids opened on Oct. 9 by Bird S. Coler, Pres. Brooklyn Boro., for regulating, grading, curbing and laying sidewalks on New York Ave., from Clarkson Ave. to Malbone St.: (Bidders all of Brooklyn) Builders' Trucking & Material Co., Bedford Ave. and Degraw St., $10,661 (awarded contract); F. J. Gallagher, 574 Park Pl., $12,440 Bracken McAveney Co., foot of 6th St., $12,005 J. J. Gannan, Gravesend Ave. and Neck Road, $13,590; Daniel Douglass, 122 Logan St., $14,377; Bonacci Vincelli C. Co., 220 4th Ave., $14,107; J. T. Rutan, 4 and 5 Court Sq., $10,120; Chas. Cranford, 44 Court St., $13,257; H. P. George, 49 Washington Ave., Richmond Hill, $17,222; Geo. F. Melvin, 1241 Sterling Pa., $11,935.

Jacksonville, Ill.—The following are the bids opened on Oct. 14 by the Bd. of Local Improv. for paving in Dists. 3 and 4 (Engineer, C. W. Brown, of Jacksonville): (*a*) Schirtz & Bates, Lincoln; (*b*) F. J. Traut and F. J. Schneer, Jacksonville (*c*) T. F. Layden, Davenport, Ia.; (*d*) P. H. Tiernan, Macomb; (*e*) A. F. Frank, Jacksonville; (*f*) John Bretz, Springfield (2 bids), $1.62 per sq. yd. for Culver block—total, $83,763—and $1.56 for Purington block; (*g*) J. E. Saltisbury & Co., Aurora; (*h*) Ora F. Dunlop, Edwards. (Engineer's estimate, $77,641.)

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1890 lin. ft. 4x16 Limestone Marginal curb set in sand	$ 0.45	$ 0.50	$ 0.56	$ 0.50	$ 0.56	$ 0.45	$ 0.54	$ 0.48
24,160 lin. ft. Concrete combined curb and gutter..	.67	.55	.72	.62	.65	.65	.60	.64
64 cast iron sewer inlets	25.00	25.00	30.00	27.00	26.00	22.00	25.00	26.00
38,460 8-9 sq. yds. brick pav. on 4-in. con. found.	1.515	1.58	1.67	1.66	1.05	1.50	1.68	1.60
38,460 8-9 sq. yds. sand fill	.025	.03	.25	.02	.03	.03	.03	.04
12,813 cu. yds. excav. and grade	.20	.16	.25	.16	.25	.16	.16	.26
12,813 cu. yds. (extra per cu. yd.) for handling and spreading earth on levee	.50	.51	.65	.55	1.00	.50	.75	1.00
Totals	$82,737	$79,805	$88,750	$84,306	$86,244	$81,155	$84,925	$83,287

*Bids were opened on Oct. 9 by Bird S. Coler, Pres. Brooklyn Boro., for regulating and repaving with asphalt on a concrete foundation Bedford Ave., from Division Ave. to Heyward St., and the Brooklyn Alcatraz Co., 12th St. and Gowanas Canal, Brooklyn, secured the contract at the following bid: 15,490 sq. yds. asphalt pavt., $1.30; 15,490 sq. yds. present pavt., to be removed, $1.25; 30 sq. yds. old stone pavt., relaid, 40 cts.; 2,150 cu. yds. concrete, $6; 4,660 lin. ft. new curb, set in concrete, $1.25; 650 lin. ft. old cub, reset in concrete, 70 cts.; 44 noiseless covers and heads complete, for sewer manholes, $18; total, $59,483. Totals of other bids: Cranford Co., 190 Montague St., Brooklyn, $69,240; Uvalde Asphalt Paving Co., 1 Bway., N. Y. City, $69,684, and Barber Asphalt Paving Co., 114 Liberty St., New York City, $61,083.

Bids will be received until Nov. 13 by Bird S. Coler, Boro. Pres., for paving portions of Kenilworth Pl., E. 5th, E. 19th, 11th, Lynch and Martense Sts., Newkirk, Prospect and Ovington Aves. Engineer's estimate: 20,630 sq. yds. asphalt pavt., 12,370 sq. ft. cement sidewalk, 2,395 cu. yds. concrete, 3,990 lin. ft. new curb., etc.

Rochester, N. Y.—The City Council is reported to have authorized the paving of Atkinson St, with trap rock and constructing cement walks.

Newburgh, N. Y. Local press reports state that bids will be received until Nov. 5 by the City Clk. for paving a portion of South St.

Salisbury, N. C.—Bids will be received until Nov. 7 by A. H. Boyden, Mayor, for $100,000 street and general improvement bonds. For further information address H J. Overman, City Clk.

Cincinnati, O. It is stated that all bids opened Oct. 24 for paving with asphalt a portion of Burgoyne St. have been rejected According to reports new bids will be received.

Sandusky, O.—Preliminary legislation for the paving of Washington St., about 14,000 sq. yds. on concrete foundation, has been passed by City Council. Jos. Sotn, Jr., City Auditor; A. C. Schultz, City Engr.

Dayton, O.—The City Council is reported to have passed an ordinance providing for the paving of a portion of Point St.

The Bd. of Pub. Service is reported to have opened bids, as followa, for paving Roberts Boule.: J. O. Shoup & Co., creosoted wood block $26,686, macadam $14,181; J. E. Conley Co., 15 N. St. Clair St., bituminous macadam $17,517, macadam $14,675, with wood block a portion of the boulevard, $20,089; Wm. J. Kernan, brick $18,442, macadam $14,788; Al. Wroe & Son, brick $18,442; Barber Asphalt Paving Co., asphalt $20,927; Kirchner Const. Co., of Cincinnati, O., asphalt $21,122, and Andrews Asphalt Paving Co., asphalt $21,208.

Lawton, Okla. The City Engineer is reported to have been directed to prepare plans and specifications for street improvements, at an estimated cost of $90,000.

Portland, Ore. The Executive Bd. is stated to have opened bids as follows for paving: Warren Constr. Co., Stark St, $15,708, Elizabeth St., $12,953; Northrup St., $5,731; Knott St., $11,200; Williams Ave., $17,527; First St., $18,435; Grand Ave., $1,502; Vaughn St., $17,739; Broadway, $13,784 Pacific Bridge Co., Elizabeth St., $12,158; E. 27th St, $6,987; Williams Ave., $16,708; Broadway, $14,067; E. 16th St., $5,793; E 14th St., $9,497; E. Washington St, $16,415; E. 22d St., $5,382. Stevens Bros., E. 21st St, $1,407; Frankfort St., $11,510. Bechill Bros., Page St., $1,773; Gladstone Ave., $14,694; Borthwick St., $1,402; Benton St, $2,175, Flint St., $3,310. Chas. E. Pottage, E. Morrison St., $3,981. Miller & Bauer, Denver Ave., $3,469; E. 9th St., $3,708; Tacoma Ave., $3,178; Nehalem Ave, $2,224 Concrete Constr. Co., Grand Ave, $3,014. Star Sand Co., Raleigh St., $2,084; Lewis St., $4,286; Dixon St., $1,835; Borthwick St., $1,370; Benton St., $2,138, Flint St, $3,255. O'Neill & Co., E. Madison St., $10,523; E. Flanders St., $1,803. Keenan Bros., Gladstone Ave., $14,255. R. J. Debuhr, Mallory Ave., $4,882; E. 6th St., $3,989; H. J. Ewing, Union Ave., $8,340; E. 13th St., $3,085. O. W. Olson & Co., E. 9th St., $3,835; Tacoma Ave., $3,361. Barber Asphalt Paving Co., 21st St., $11,428.

Philadelphia Pa.—Bids were opened by the Dept. of Pub. Wks. on Oct. 21 for repaving about 40 miles of streets, embracing about 27 miles of asphalt streets, 12 miles of vitrified or shale bricks and one mile of granite block at an estimated cost of $1,500,000, and the following are reported to be the bids received:

For asphalt paving: Filbert Paving Co., $1.63 to $1.99 per sq. yd.; Barber Asphalt Co., $1.62 to $2.11 per sq. yd.; W. S. P. Shields, $2.16 per sq. yd.

Fo asphalt paving the Filbert Paving Co. was the lowest bidder on 194,000 sq. yds., the Mack Paving Co. on 174,000 sq. yds.

For repaving brick streets, costing about $400,000, Cunningham & Murray were the lowest bidders in the majority of instances, at $2.14 to $2.37 per sq. yd. for vitr. brick and $2.04 to $2.25 per sq. yd. for shale brick. The Mack Paving Co. bid, respectively, $2.32 to $2.65 and $2.15 to $2.75 per sq. yd., while the Filbert Paving Co. bid $2.25 to $3.15 for vitr. brick. David McMahon was lowest bidder for two streets at $2.07 to $2.12 per sq. yd.

D. J. McNichol & Co. was lowest bidder for repaving about a mile with granite block at $2.73 per sq. yd., estimated altogether at about $100,000, while the Mack Paving Co. bid from $3 to $5.75 per sq. yd.; Cunningham & Murray, $2.84 to $3.83; Arthur McGinn ,$2.75 to $2.90; Michael O'Rourke, $3.30 to $3.97; Samuel S. Bader, $2.92 to $3.97, and W. A. Ryan, $2.88 to $3.73 per sq. yd.

**Harrisburg, Pa.*—The contract tor constructing 5,280 ft. of State Road in Londonderry Township is stated to have been awarded to W. H. Smith, at $7,029.

**Harrisburg, Pa.*—The contract for paving 2,800 yds. on Maclay St. is stated to have been awarded to Warner-Quinlan Co., 42 Broadway, New York, N. Y., at $1.93 per sq. yd.

*Barber Asphalt Paving Co., Philadelphia, is stated to have secured the contract for paving Chestnut St. for about $3,000.

The following bids are reported opened Oct. 14 for resurfacing 4,100 sq. yds. of Walnut St.: Warner-Quinlan Co., $2.46 and Barber Asphalt Paving Co. at $2.25 per sq. yd.

The Warner-Quinlan Paving Co., 42 Broadway, New York, N. Y., is reported to have submitted the lowest bid for paving Hummel St. at $1.93, and the Barber Asphalt Paving Co. the lowest bid for Moltke St., at $1.94.

Columbia, S. C.—Bids will be received by the Street Comn. until Nov. 25 for paving Main St. with either vitrified brick, wood block, asphalt or bitulithic about 65,000 sq. yds. and 17,000 lin. ft. combined concrete curb and gutter and 4,500 lin. ft. concrete storm drains, as advertised in The Engineering Record. Engineer, J. L. Ludlow, of Winston-Salem, N. C.

Knoxville, Tenn.—It is stated that contracts will soon be received for paving portions of Hill, Union, Asylum, Oak, Deaderick, 4th and 5th Aves., Locust, Arthur, Central Market, Central, Luttrell and Deery Sts. and Bway.

Memphis, Tenn.—Bids will be received until Nov. 7 at the office of Ennis M. Douglas, City Register, for paving with brick a portion of Orleans St.; also La Clede Ave. with gravel.

Ft. Worth, Tex.—The city of Ft. Worth expects to pave about 15 miles of streets with brick, asphalt or bitulithic. Specifications may be had on application to E. C. Woodward, City Engr.; J. I. Nunnally, City Aud.

**Olympia, Wash.*—The contract for grading and macadamizing State Road No. 2 is reported to have been awarded to C. H. Lansing, at $9,750. Bids opened by Jos. M. Snow, State Highway Bd., on Oct. 15.

**Chehalis, Wash.*—Anderson & Robinson are stated to have secured the contract for macadamizing Prindle St., at $8,498.

Bellingham, Wash. Bids will be received until Nov. 9 by the State Highway Bd. (Jos. M. Snow, Secy.), Olympia, for grading and graveling State Aid Road No. 3, near Bellingham.

* The Bd. Pub. Wks. is stated to have awarded the contract for improving a portion of Astor St. to K. Sauset for $4,781.

Seattle, Wash.—The only bid received on Oct. 12 by the Bd. of Pub. Wks. for grading, paving with asphalt and constructing sewers, etc., on 40th Ave. was submitted by Rich & Harris, of Seattle, as follows: Clearing and grubbing (lump sum), $5,000; 2,700 lin. ft. 8-in. pipe sewer, 95 cts.; 460 lin. ft. 10-in. pipe sewer, $1.25; 120 lin. ft. 8-in. wood pipe sewer, $2; 22 4½ ft. manholes, ea., $80; 5 4½ ft. manholes, to be remodeled, $80; 24 catch basins (1) inlet, ea., $75; 8 catch basins (2) inlet, ea., $85; 1,900 lin. ft. curb armored concrete, $1.10; 14,870 lin. ft. curb. standard concrete, 50 cts.; 2,420 lin. ft. curb, special concrete, 50 cts.; 100 sq. yds. sidewalk repair concrete, $1.50; 24,765 sq. yds. asphalt pave., $2.35; 3,225 sq. yds. brick gutters, $3.40; 420 lin. ft. wood stop, 50 cts.; 10 flush tanks, ea. $125; 2 catch basins to move, $25; 4 catch basins, no inlets, ea. $65; 2 single inlets, ea. $15; 8 inlets to be moved, ea. $5; 6 adjusting C. B. & M. H. covers, ea. $2.50; 26 monument cases, ea. $10; 680 sq. yds. concrete walks, $1.35; 150 lin. ft. tile drain, 20 cts.; 98 cu. yds. retaining wall, $10; 100 lin. ft. iron railing, $1.25; 3,210 lin. ft 8-in. C. I. pipe Class "A," $2; 3,123 lin. ft. 8-in. C. I. pipe Class "B," $2.10; 14 8-in. gates, ea. $45; 18 hydrants, ea. $100; 80 lin. ft. 6-in. C. I. pipes, hyd. conn. "A," $1.50; 80 lin. ft. 6-in. C. I. pipes, hyd. conn. "B," $1.60; 14 brick gate chambers, new, ea. $40; 4 brick gate chambers, exit gates, ea. $40; 7,500 cu. yds. subgrading, 60 cts. Total, $120,475.

The following are the bids opened on Oct, 12 by the Bd. of Pub. Wks. for maintenance of 24,765 sq. yds. asphalt pavt. on 40th Ave.: (*a*) price per sq. yd.; (*b*) totals: Rich & Harris, *a* 3 cts.; *b*, $7,429. Independent Asphalt Paving Co., Pioneer Bldg., *a* 2½ cts.; *b* $6,191. L. B. Loomis & Co., Western Ave. and Bell St., bid on Oct. 12 for improving 31st Ave. as follows: Fixed estimate, $1,500; clearing and grubbing (lump sum), $1,575; 59,000 cu. yds. earthwork, 37½ cts.; 16 manholes to be adjusted, ea. $20; 250 lin. ft. 10-in. pipe sewer, $1.85; 90 lin. ft. 12 in. pipe sewer, $2, and 120 lin. ft. 8-in. pipe sewer, $1.60. Total, $26,484. P. J. McHugh, 2228 7th Ave., bid for this work $27,873.

*The Bd. of Pub. Wks. on Oct. 14 awarded contracts as follows: Irving St., concrete sidewalks, to E. H. Rawle & Co., 313 Boston Blk., $5,976; 6th Ave. concrete sidewalks, Smith & Hall, Downs Blk., $10,806; Fuhman Ave., grading and constructing necessary bulkheads, International Contract Co., New York Blk., $41,465; Westlake Ave., planking, Holt & Jeffery, $10,352; Union St., paving with sandstone blocks, Sparger Concrete Co., 562 Colman Blk, $24,541.

We are informed that an ordinance has been passed by City Council authorizing the Bd. of Public Works to construct an asphalt plant capable of turning out 54,000 sq. yds. of asphalt per day, to be used in the maintenance of all future streets paved with asphalt. Estimated cost of plant, $60,000; 15 teams and wagons, $18,750, and stables and quarters for men, $22,500.

Bids will be received by the Bd. of Pub. Wks. (C. E. Bagley, Secy.) until Nov. 9 for the following improvements: Concrete sidewalks and wood crosswalks on Hanford and other streets, together with necessary drainage; estimated cost, $30,500; grading, curbing and constructing concrete sidewalks on 36th Ave., N.; estimated cost, $20,800; concrete sidewalks and wooden crosswalks on Meridian Ave., with necessary drainage; estimated cost, $72,000; concrete sidewalks and wood crosswalks on Brooklyn Ave., together with necessary drainage; estimated cost, $5,000, and grading and concrete sidewalks on Phinney Ave.; estimated cost, $5,600.

The lowest bid opened on Oct. 19 by the Bd. of Pub. Wks. for grading and constructing concrete walks on E. Olive St. was submitted by E. H. Rawle & Co., Arcade Annex, at the following bid: Fixed estimate, $900; cleaning and grubbing (lump sum), $175; 900 cu. yds. earthwork, 40 cts.; 3 M. ft. curbs and gutters, $26; 14 M. ft. crosswalks, $26; 5,457 sq. yds. concrete walks, $1.26; 2 catch basins, 2 inlets, ea., $85; 1,500 lin. ft. 3-in. sewer pipe, 15 cts.; 450 lin. ft. half tile gutter, 25 cts.; 658 lin. ft. 8-in. sewer pipe, $1.60; 5 manholes, ea., $78; total, $10,791. Hans Pederson, 511 7th Ave., S., bid for this work $11,476.

The only bid received and opened on Oct. 19 for grading, etc., Lakeside Ave., was submitted by S. Normile, New York Blk., at the following bid: Fixed estimate, $2,000; 5.5 acres cleaning and grubbing, $250; 35,000 cu. yds. earthwork, 43 cts.; 77 M. ft. curbs and gutters, $26; 260 lin. ft. box drain, 75 cts.; 36 M. ft. bulkhead lumber, $30; 210 bulkhead piles, ea., $7.50, and 1,500 lin. ft. bulkhead rail, 10 cts.; total, $23,427.

Milwaukee, Wis.—Chas. Poetsch, City Engr., is reported to have submitted a proposition to the Metropolitan Park Comm. for a boulevard system around the city.

**Ottawa, Ont.*—Newton J. Ker, City Engr., writes that the Iroquois Iron Wks., of Buffalo, N. Y., has secured the contract for constructing the asphalt and bituminous paving plant (bids opened Oct. 16) for $14,800.

Toronto, Ont.—Bids will be received until Nov. 5 by E. Coatsworth (Mayor), Chmn. Bd. Control, for paving with asphalt portions of Dewson St., Montrose, Ryerson and Barton Aves.; with bitulithic, Huron St. and Avenue Rd., and constructing concrete walks and curbs on portions of numerous streets.

*The Bd. of Control on Oct. 23 is reported to have awarded contracts as follows: Godson Contr. Co. paving Berkeley St., $3,724; Dutchess St., $5,496; Barber Asphalt Paving Co., Bloor St., $8,718; Warren Bituminous Paving Co., Lindsay Ave., $4,683.

Markham, Ont.—See "Power Plants, Gas and Elec-

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—The Montgomery Light & Water Power Co. (R J. Chambers, Mgr.), is reported to have decided to expend about $100,000 in. improvements to include the installation of a large amount of machinery for increasing the capacity of the plant, as well as improving the quality of gas furnished to Montgomery patrons. A complete new gas arch bench with 6 retorts for purifying the gas, in increasing the output, as well as the installation of additional scrubbers and exhausters; also the installation of an additional transmission line from Montgomery to the water power plant on the Tallapoosa river, 30 miles from here. In connection with this transmission line additional banks to step up and step down transformers, and the latest methods of lightning arresters will be installed.

**Arizona.*—The Secretary of the Interior at Washington, D. C., has awarded contracts for transformers and switchboard apparatus for use in connection with the Salt River irrigation project, Ariz., as follows: Transformers, the Wagner Electric Mfg. Co., of St. Louis, Mo., for $23,970; switchboard apparatus, the General Electric Co., of Schenectady, N. Y., for $37,671.

Calistoga, Cal.—Henry Brown is reported to have secured a franchise to furnish light, heat and power.

San Jose, Cal.—Chas. H. Pieper, City Engr., has completed and presented to the mayor and city council his report on the construction of a municipal electric light plant for the city, and recommends the selection of an electrical, steam driven unit of not less than 300-kw. capacity, arranged to permit future extension; the total

**Items marked thus give the names of parties awarded contracts.*

cost of the proposed plant together with pole lines, underground conduits, lamps, apparatus and appurtenances would cost about $200,000.

Colebrook, Conn.—See "New Industrial Plants."

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Nov. 12 to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y.: Sch. 449—Steam disinfecting plant. Pensacola, Fla.: Sch. 435—175 boxes metallic shingles and 300 ft. galvanized ridge rolls. Sch. 436—125 bbls. Portland cement in wood, 31,500 ft. yellow pine. Sch. 437—14,400 lbs. bolts and nuts. Sch. 438—7,834 lbs. rolled bronze; 8,000 lbs. ingot copper; 10,500 lbs. bar iron; 39,551 lbs. steel rivets; about 63,256 lbs. medium steel plates; sheet steel; 9,900 lbs. steel angles; 201,298 lbs. steel. New Orleans, La.: Sch. 435—Electrical supplies. Bids will also be received until Nov. 19 as follows: Pensacola, Fla.: Sch. 448—1 motor driven rotary or centrifugal pump; 4 transformers and 4 motor generator sets; erecting complete 1 hot water heating system. New Orleans, La.: Sch. 448—Supplying new roof for north wing of building No. 6. California City Point, Cal.: Sch. 450—50-kw. generating set. Boston, Mass.: Sch. 445—1 double angle and beam punch; 4 variable speed gears. Norfolk, Va.: Sch. 445—12 2-ton trolley hoists; 1 motor-driven drilling, boring and milling machine. Charleston, S. C.: Sch. 445—1 combination band saw and rip saw. Portsmouth, N. H.: Sch. 446—1 motor-driven pipe threading machine ;1 engine lathe. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Genl., U. S. N.

**Savannah, Ga.*—The Savannah Lighting Co. is reported to have secured the contract for city lighting (bids opened Oct. 15).

Macon, Ga.—E. W. Gould, W. T. Morgan and others, of Savannah, representing the Citizens Electric Co. of Savannah, are reported to have petitioned the City Council of Macon for a franchise.

Hagerstown, Ind.—The Town Bd. is reported to have passed an ordinance providing for the issue of bonds for the construction of the proposed electric light plant. Plans and specifications have been ordered.

Knightstown, Ind.—The City Council is stated to have passed an ordinance providing for the issue of $12,000 bonds for the purchase of new machinery, boilers and equipment for the electric light plant.

Gosport, Ind.—The Gosport Electric Light & Power Co. is reported incorporated, to construct and operate an electric light and power plant. Directors: W. A. Montgomery, J. S. Davis and J. C. Brown.

Latonia, Ky.—At a recent meeting of Council the Kentucky Electric Co. is reported to have secured a franchise for electric lighting of the streets at $60 per arc lamp per yr. for the first 3 yrs.

Eunice, La.—The City Council is reported to have granted a franchise to Chas. Lauve, of Franklin, for an electric light plant, to cost about $30,000. Warren B. Reid, of New Orleans, will be associated with Mr. Lauve in the construction.

St. Michaels, Md.—Walter L. Butler, of Philadelphia, Pa., is reported to have petitioned the Town Comrs. for a franchise for an electric light plant.

Baltimore, Md.—The Bd. of Awards on Oct. 18 rejected bids recently received for dynamo to be installed in Eastern High School, and will receive new bids.

Traverse City, Mich.—The Manistee River Power Co. is reported formed, with a capital of $1,000,000, to develop power in Manistee River. It will construct four dams on Manistee River with a capacity of 20,000 h.p. continually for 24 hours. The first dam, developing 5,000 h.p., will be built in Greenwood Township, Wexford County, and the lines from the first dam will run to Cadillac, Elk Rapids and Traverse City. D. J. Albertson, of Kalamazoo, is reported to be the chief promoter.

Iron River, Mich.—A. J. Lytle and F. A. Morirson are reported to have in contemplation the purchase of machinery for an electric light plant.

Corunna, Mich.—The Shiawassee Light & Power Co. (H. A. Sprague, Mgr., Corunna,) is reported to be preparing to raise its dam at Shiatown from 8 to 15 ft.

Manchester, Mich.—W. J. Hoffer, City Clk., writes that the citizens have voted to purchase the electric light plant owned by J. H. Kingsley.

Kandiyohi, Minn.—It is reported that C. E. Kroona may install an electric light plant.

**Duluth, Minn.*—The Water & Light Comrs. on Oct. 11 awarded to Thomas & McCoy the contract for laying gas pipes in 1st Alley, between 8th Ave. west and 7th Ave. east, connecting with and extending the old Prindle Gas Co.'s main in the alley mentioned, for about $10,500. They bid 50 cts. per foot for laying pipe, $1.10 per yd. for excav. and $9 per yd. for rock work. The contract for laying water and gas mains on London Road, from 19th to 21st Aves. east was awarded to Emile Engle, 931 E. 54th St., Duluth, at 67 cts. per ft. for laying the pipe, $1.10 a yd. for excav and $7.75 per yd. for rock work, and Fairbanks, Morse & Co., of St. Paul, secured contract for laying 4-in. gas main in Main St. from 53d to 56th Aves. west, at 20 cts. per ft. for laying pipes and 87 cts. per yd. for the excav.

Louisville, Miss.—The Louisville Light & Water Co. is reported incorporated, with a capital of $20,000, by W. L. Strong, J. L. McCracken and others.

Burlington Junction, Mo.—The Burlington Junction Electric Light & Power Co. is reported incorporated with a capital of $6,000 by T. D. Garrett, Jesse F. Robertson and others.

Helena, Mont.—At a recent meeting of the State Bd. of Land Comrs. upon application of the Collins Land Co., of Helena, the Board sold to the Capital City Power Co. the land on each side of Missouri River in Sec. 36, Township 13 north, Range 3 west and in Sec. 16, and these lands will be flooded by the new dam to be constructed below Hauserlake.

Wahoo, Neb.—Edw. Lehmkull, Mayor, writes that the proposed water works and electric light plant will cost bet. $50,000 and $60,000. Engineer not yet selected.

Central City, Neb.—The City Council is reported to have passed on second reading the ordinance granting L. S. Jenkins and H. D. Forest, of Omaha, a franchise for an electric light plant.

Arlington, Neb.—The Arlington Electric Light & Power Co. is reported to have decided to erect a brick building and install a 130-h.p. boiler and a 90-h.p. engine.

**Tekamah, Neb.*—Bortenlanger & Co., of Omaha, are reported to have secured contract for constructing electric light plant.

Plattsmouth, Neb.—Earl C. Westcott, of Plattsmouth, writes that he proposes building 8 miles transmission line to connect with the plant of the Omaha Electric Light & Power Co., at Omaha, but will only need substation equipment and transformers.

Glens Falls, N. Y.—The International Paper Co., of Glens Falls, is reported to be considering the construction of a dam on Spier Falls for the purpose of furnishing power for a pulp mill or electrical plant. The Construction Dept. of the International Paper Co. is at 30 Broad St., New York City.

Niagara Falls, N. Y.—A franchise is reported to have been granted to the Niagara Falls Lighting Co.

Yorktown, N. Y.—The municipal authorities, it is reported, have granted to the Northern Westchester Lighting Co. a franchise for both gas and electricity.

Castile, N. Y.—Jas. C. Horning, of Lamont, Wyoming County, N. Y., writes that the proposed dam to be constructed across East Koy Creek to develop power for electric lights to be used in Castile, Silver Springs and Gainesville, will cost about $15,000 to $20,000. The company has not yet been organized but it is hoped to get work completed by next spring.

**New York, N. Y.*—The following are the bids opened on Oct. 21 by C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment in addition to and alteration in School 59, Boro. of Manhattan, LeBaron B. Johnson, $7,738; Commercial Constr. Co., $7,589; T. Fred. Jackson, Inc., 592 Columbus Ave., $7,250 (awarded contract), and E. J. Duggen, $9,475.

The following are the bids opened on Oct. 24 at the office of the Superv. Archt., Treasury Dept., Washington, D. C., for the installation of a flashlight signal system for elevators in the U. S. Custom House Bldg., New York: Otis Elevator Co., N. Y. City, $7,280, and Electric Supply & Repair Co., N. Y. City, $7,280.

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 28 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in School 5, Boro. of Brooklyn: T. Fred. Jackson, Inc., 592 Columbus Ave., N. Y. City, $15,995 (awarded contract); Peet & Powers, $16,676, and Reis & O'Donovan, Inc., $16,439.

Hendersonville, N. C.—Bids are wanted for lighting the streets with electricity; at present 26 12,000-c.p. lamps are used; will increase to 30 or more. For further information address Michael Schenck, Mayor.

Smithfield, N. C.—We are informed that an engineer will probably be selected on Nov. 4 to prepare plans and specifications for water works, a sewerage system and electric light plant, and an election will the be called to vote on issuing bonds for the construction of same.

Thomasville, N. C.—B. F. W. Bryant, of Boston, Mass., is reported to have secured a franchise for an electric light plant. The company will be known as the Thomasville Light & Power Co., and proposed plant will cost $20,000.

Cincinnati, O.—Press reports state that contracts will probably soon be let for rewiring old City Hospital at a cost of $7,000. Architects, Elzner & Anderson.

Youngstown, O.—Press reports state that at a meeting of the Lighting Com. of City Council on Oct. 19 it was decided to report favorably on the proposition to construct an electric light plant.

Alliance, O.—J. G. White & Co., New York, N. Y., has contracted with the Alliance Gas & Power Co. to act as consulting engineers and supervise the purchase and installation of a large turbine generator and a battery of 350-h.p. boilers, with complete auxiliaries for both electrical and steam ends. The new equipment will be installed in the old plant of the Alliance Gas & Power Co. through the winter and will be transferred later to a new plant, the construction of which will be begun by the engineers early in the spring.

Newburgh Heights, O.—Bids will be received until Nov. 18 at the office of P. S. Ruggles, Village Clk., for lighting the village streets.

**Philadelphia, Pa.*—Director Stearns, of the Dept. of Pub. Wks., on Oct. 28 awarded contract for the elecrtical equipment at the Torresdale filter plant to the D'Olier Eng. Co. for $77,002.

Easton, Pa.—The Superintendent of Lighting is reported to have been authorized to prepare specifications and ask bids for 300 arc lamps.

Pittsburg, Pa.—Bids will be received until Nov. 7 by the Committee on High Schools (Chas. Reisfar, Jr.) for installing an electric lighting plant in the 5th Ave. High School; probable cost, $7,000.

**Womelsdorf, Pa.*—W. W. Lengel, Boro. Secy., writes that the contract for the construction of a municipal electric light plant (bids opened Oct. 15) has been awarded to the Reading Electric Co., of Reading, Pa., for $11,275. Engineer, F. W. Darlington, 1140 Real Estate Trust Bldg., Philadelphia.

Harrisburg, Pa.—Press reports state that the State Water Supply Comn. on Oct. 22 approved applications for charters for the Iroquois Power Co. and the Watts Power & Water Co.; also for the Mill Creek Water Co. to operate in Huntingdon County, and the Trevose-Manor Co., of Philadelphia.

Panama.—Bids will be received until Nov. 10 at the office of H. F. Hodges, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for electrical fixtures, conductor wire, car wheels, wrought iron, steel tubing, etc., as per circular, No. 399.

Nashville, Tenn.—Mayor Brown in his annual message recommends extending the light plant facilities, and also the better lighting of both suburbs and business districts.

Clifton Forge, Va.—At at meeting of City Council on Oct. 21 a bid for the electric light franchise was received from the Clifton Forge Ice & Bottling Wks. and referred to the Light and Water Com.

Richmond, Va.—Mayor McCarthy on Oct. 22 approved the ordinance providing for the issue of $100,000, the first instalment needed for rehabilitation of the city gas plant. To thoroughly improve the plant it will require about $350,000, and several contracts have already been awarded.

Big Stone Gap, Va.—The Powell Valley Light & Power Co. is reported incorporated, with a capital of $5,000, to construct electric light and power plant. P. A. Morrison, Pres., and J. B. Ayers, Secy and Treas.

**Spokane, Wash.*—The lighting contract is reported to have been signed between the city and the Washington Water Power Co., by means of which the latter company supplies 525 lights to the city for a period of 5 yrs. and at an annual rate of $48 ea.

Spokane, Wash.—See "New Industrial Plants."

Stevenson, Wash.—H. C. Eckensberger, of Portland, Ore., general freight agent of the New York Central lines, is reported to have filed with the County Clerk a petition for permission to appropriate water on Columbia River at the Upper Cascade Rapids, for power and manufacturing purposes.

Marinette, Wis.—It is reported that a survey is to be made at once for the Holmes Lighting & Power Co. for the development of the Grand Rapids for electric power purposes. The work of construction will be started in the spring and power brought to Marinette and Menominee.

Crandon, Wis.—Otto Eckhoff, of Wittenberg, is reported to have petitioned for a franchise to construct an electric light plant.

Penticton, B. C.—The ratepayers are reported to be considering the question of constructing an electric light plant.

Kelowna, B. C.—R. Morrison, City Clk., writes that the proposed $40,000 water and electric light bonds to be issued have not yet been sold.

**Brandon, Man.*—The International Lighting & Htg. Co., of Cleveland, O., will, it is reported, soon commence work on the construction of a gas-producing plant at Brandon, for which it has the contract.

**Toronto Junction, Ont.*—The Town Council is reported to have awarded contract for lighting the town for 3 years to the Stark T. L. & P. System, Ltd., of Toronto, at 9 cts. per light per night.

Markham, Ont.—The citizens are reported to have voted on Oct. 22 to issue $3,000 bonds for extending electric light plant, $3,000 for granolithic sidewalk, and $3,000 for completion of new bridge over the Rouge.

London, Ont.—At a meeting of City Council on Oct. 21 the engineer is reported to have been instructed to make estimates of cost of a distributing plant for Niagara Falls power.

Campbellford, Ont.—The citizens are reported to have voted to issue $60,000 bonds to develop a municipal electric power plant at Middle Falls.

Mille Roches, Ont.—At a meeting of the International Waterways Comn. at the Queen's Hotel on Oct. 24 a proposition for the construction of a power plant for the development of the water power on St. Lawrence River at Mille Roches, near Cornwall, was presented by the St. Lawrence River Co. of Canada (Geo. Foster, Pres., Montreal, Que.) and by the Long Sault Development Co. (represented by Arthur V. Davis, of Pittsburg, Pa.; W. F. Rickey, of Massena, N. Y., and E. B. Freeman, of Hartford, Conn.) The cost of the work is estimated at about $20,000,000. It is proposed to develop power at this lower end of Barnard Island, where both companies would work together, and it is said that the scheme would improve navigation, doing away with lock 21 in the canal and saving 4 hours to steamers on the round trip. The St. Lawrence Co. at present supplies Cornwall with light and power, and its capacity is 1,250 h.p., and the new plan provides for 50,000 h.p. The Canadian concern will invest $5,000,000 and the American $15,000,000 in the scheme. The commission decided that the Canadian section should meet in Montreal on Nov. 5 to further consider the matter, and the Bd. of Trade, Harbor Comn. and other bodies there will be asked to present their views.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Ventura, Cal.—It is stated that bids will be received Nov. 12 for an electric railway franchise, as applied for by F. M. Packard and Julian P. Jones, along certain highways and streets in Ventura County. J. B. McCloskey, Co. Clk.

Woodstock, Ill.—It is stated that arrangements are being made for the construction of the proposed Woodstock, Marengo, Genoa & Sycamore Electric Ry., which is to connect Woodstock and Sycamore. It is proposed to make Woodstock the north and Sycamore the south terminals. The promoters of the company: M. W. Powell, John A. Schmidt, Thos. Edward, Irwin D. Stevens, Chas. A. Spenny, T. H. Rhodes, E. C. Spinney and E. B. Harang.

Ishpeming, Mich.—It is reported that the Marquette County Gas & Electric Co. (W. J. McCorkindale, Gen. Mgr., Ishpeming), will soon place contracts for the construction of 3 miles of track.

Elyria, O.—The City Council is stated to have granted the Cleveland, Southwestern & Columbus St. Ry. Co. a franchise for a belt line.

Millersburg, O.—The Millersburg & Eastern R. R. Co. is reported incorporated by O. S. Olmstead, Dan M. Miller, of Millersburg, and J. A. Burke, of Cleveland. The line proposed is to extend from Millersburg to Beach City, a distance of 26 miles.

Portland, Ore.—It is stated that the United Railways Co. will soon apply for a franchise for an electric railway from Portland through Linton to the county line.

***Items marked thus give the names of parties awarded contracts.**

Ambridge, Pa.—The French Point St. Ry. Co. is stated to have increased its capital stock from $6,000 to $31,200, and intends extending its line from Merchant and Wagner Sts., Ambridge, Pa., to a point on the right of way of the Economy Belt Line Ry. Jas. D. Collery, Pres.

Reading, Pa.—It is reported that a company to be known as the Reading & Philadelphia Short Line, to be operated on the third rail system, has been projected to build a line between Reading and Philadelphia via Norristown.

Altoona, Pa.—The Altoona & Bedford Springs Ry. Co. (T. G. Patterson, Pres.), is reported to have announced that the work of grading the line will begin within a few weeks. The line will be built first between Altoona and Newry.

Parsons, Pa.—The Borough Council is stated to have passed an ordinance authorizing the Wilkesbarre & Plains St. Ry. Co. to construct, maintain and operate a railway along Main and Mill Sts.

Johnstown, Pa.—Mayor Chas. Young is stated to have signed the ordinance granting the Johnstown Passenger Ry. Co. the right to double-track Bedford St. from the B. & O. crossing to Cedar St.

Mauch Chunk, Pa.—J. G. White & Co., operating managers and purchasing agents for the Eastern Pennsylvania Rys. Co., has just ordered $200,000 worth of electric railway material for the Tamaqua and Middleport, connecting link between Mauch Chunk and Pottsville. The order includes all material required for the permanent way and overhead electrical work of a standard interurban railway. Considerable grading has already been done.

West Newton, Pa.—It is expected that the work of connecting West Newton with Herminie and Irwin will begin within a few weeks. The proposed line is a branch of the Pittsburg, McKeesport & Westmoreland Ry., and rights of way and other privileges have already been secured. Jas. Bryan, Ch. Engr., Pittsburg.

Pen Argyl, Pa.—It is stated that surveyors are mapping out a straight track for the Slate Belt Street Ry Co. Curves will be removed at Allen's Corner, West Pen Argyl and at Alpha, where the tracks will be laid through Keller's field.

Monongahela, Pa.—A franchise is stated to have been granted to the Monongahela & Carroll St. Ry. Co., which proposes to build an electric line up Pigeon Creek and on to Bentleyville, Ellsworth and Washington.

Brackenridge, Pa.—The Saxonburg, Tarentum & Butler St. Ry. Co. is stated to have accepted the franchise granted some time ago by the Council of Brackenridge for the right of way through the town.

Shamokin, Pa.—Governor Stuart is stated to have approved the extension of the Shamokin & Edgewood Electric Ry. Co. from Shamokin to Sunbury. M. H. Kulp, Pres.

Corry, Pa.—The Corry & Columbus St. Ry. Co. is reported to have announced that 15 miles of track will be constructed during the next season. C. P. Northrup, Gen. Mgr.

Hunkers, Pa.—The West Penn. Rys. Co., of Pittsburg, is reported to have secured right of way for an electric railway between Hunkers and Scott Haven connecting with West Newton. The line will connect with the McKeesport and Scott Haven Line at Scott Haven and run across the Youghiogheny River over a bridge to Hunker.

Tacoma, Wash.—Articles of incorporation of the Seattle-Tacoma Short Line, which proposes to build the interurban between Seattle and Tacoma are reported filed. Incorporators: Merle J. Wightman, C. E. Muckler and F. J. Eitel. Capital of the company is placed at $6,000,000. The new company will acquire the franchises obtained in Seattle, Tacoma, Pierce and King counties for the road by Merle J. Wightman and C. E. Muckler. Preliminary surveys are stated to have been made for the entire route and most of the private rights of way have been secured. Construction work has been begun in Pierce County, near Tacoma, by the building of about 200 ft. of trestle work. It is said that active construction work will begin as soon as the remaining rights of way have been secured and material can be purchased.

Olympia, Wash.—See "Railroads."

Chehalis, Wash.—The City Council is stated to have granted a franchise to the Centralia-Chehalis Electric Ry. & Power Co. to construct an interurban and local electric railway system in and between Centralia and Chehalis.

Anacortes, Wash.—It is reported that articles of incorporation will shortly be filed with the Secretary of State by the Anacortes Improving & Developing Co., which propose to build an electric railway to connect Anacortes and Sedro Wooley. Incorporators: E. S. Morton, W. W. Robinson and R. P. Ball, of Anacortes, and Benjamin F. Weeks and H. B. Spear, of Tacoma.

Vancouver, B. C.—The British Columbia Electric St. Ry. Co. (R. H. Sperling, Gen. Supt.) is reported to have decided to expend next season about $1,500,000 in improvements and extensions.

Brantford, Ont.—It is stated that the Brantford St. Ry. Co. will be overhauled, new rails laid, loop lines extended to Eagle Pl. and Terrace Hills. In addition the line will be run to Cainesville, 3 miles east. To the south a new line will be built 30 miles to Port Dover on Lake Erie. The road from Brantford and Galt will be reconstructed, shortened and new rails laid. A spur will be built to St. George. From Brantford a new line will also be built west via Burford and Cathcart to Woodstock, where the Thames Valley Road, which has been acquired, will be used to Ingersoll.

RAILROADS.

Notes Arranged Alphabetically by States.

Chicago, Ill.—A charter has been granted to the Chicago, Fox Lake & Geneva R. R. Co., with principal office in Chicago; capital stock, $2,000,000. The road is to be constructed from Chicago, through Leyden, Maine, Elk Grove and Palatine, in Cook County; Ela, Cuba, Fremont, Wauconda and Grant, in Lake County; and Nunda, McHenry and Richmond, in the County of McHenry, to a point on the line dividing Illinois and Wisconsin, with branch lines to Fox Lake and Woodstock. Incorporators: Geo. H. Soward, Maurice B. Louis, Harry R. Yaryan and others.

Waterloo, Ia.—The residents of Lake Prairie Township, near Pella, are reported to have voted a tax to aid in the construction of the proposed Waterloo, Pella & Southwestern steam railroad. The line is to extend 120 miles southwest from Waterloo through an undeveloped coal field to Chariton.

Press reports state that the Iowa & Northwestern R. R. Co. has been financed, and construction will comence this fall. The line will be 100 miles long, running southeast from Waterloo through Independence and Anamosa to Stanwood.

**Hyde Park, Mass.*—John Cashman, of Quincy, is reported to have secured contract for elimination of Fairmount Ave. grade crossings.

Mankato, Minn.—Press reports state that the Chicago, Milwaukee & St. Paul R. R. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) is to build from Mankato to Granite Falls.

St. Louis, Mo.—The Missouri & North Arkansas R. R. Co. has 650,000 cu. yds. of side barrow and 3 miles of pile trestle to let on 28 miles of their extension between Kensett and Cotton Plant, Ark. W. S. Dawley, Ch. Engr., 820 Security Bldg., St. Louis.

Gotebo, Okla.—The Gotebo & Southwestern R. R. Co., originally chartered to build from Gotebo south to Frederick, has filed an amendment providing for the construction of 125 miles of road from Clinton via Gotebo to Frederick, and increasing the capital stock to $1,000,000.

Lawton, Okla.—Press reports state that plans and specifications have been completed and bids will soon be asked for the construction of the Lawton, Wichita Falls & Northwestern R. R. Co. J. M. Bellamy, Pres., Lawton.

Erie, Pa.—A charter has been granted to the East Erie Connecting R. R. Co to construct a railroad 2½ miles long in the suburbs of Erie; capital, $25,000. Matthew C. Griswald, Pres., Erie.

Manila, P. I.—The Philippine Ry. Co. has just ordered through J. G. White & Co., of New York, N. Y., construction engineers for its lines, 80 box cars and 15 passenger coaches from the American Car & Fdry. Co. J. G. White & Co. are now in the market for combination parlor and first-class passenger coaches for the Philippine Rys. Construction on these lines, which are being built under Philippine Government concession and with government guarantee of bond interest under Act of Congress of the United States, is progressing rapidly, and 20 miles of track are already in operation. The contract includes a total of about 295 miles of track.

Waco, Tex.—It is reported that the Texas Midland R. R. is to be extended from Enis to Waco, a distance of 70 miles. L. W. Wells, Ch. Engr., Terrell, Tex.

Pecos, Tex.—The Pecos, Saragosa & Balmorhea R. R. Co. is reported formed here, with a capital of $40,000, to construct a railroad from Pecos to Balmorhea.

Morgantown, Va.—The Morgantown Interstate R. R. Co. is reported to be arranging to make improvements and extensions on its line.

Olympia, Wash.—C. D. Hillman, of Seattle, is reported to have applied to the County Comrs. for a franchise for a double track steam and electric road from Tumwater through Olympia and on to his new townsite of Boston Harbor, at Dolphmeyer's Point, and will also apply at the next meeting of Council for the necessary franchise within Olympia. According to Mr. Hillman this 9-mile road will be built and in operation between Boston Harbor and Olympia inside of 18 months, and the line will be extended south to connect with the Union Pacific road proposed to be built to Grays Harbor.

**Buckhorn, W. Va.*—The Baltimore & Ohio R. R. Co. is reported to have awarded to F. H. Clement & Co., of Philadelphia, Pa., the contract for building a third track, with quick-acting switches at the altitude of the grade and with connections elsewhere along the 17 miles of the hard pull, to be used as a precaution against accidents at the steep grade at Buckhorn, between Altamont and Piedmont.

Torreon, Mex.—It is reported that the plans of Jones & Franklin, of Torreon, for the new municipal hospital have been accepted and work on the structure will begin at once. The building is to be of brick and stone and is to cost approximately $75,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Los Angeles, Cal.—It is stated that bids will be received until Nov. 18 by the Bd. Co. Superv. for erecting a kitchen building and extension to nurse's home at the County Hospital; also until Nov. 11 for erecting a 1-story brick morgue at said hospital. C. G. Keyes, Co. Clk.

Oakland, Cal.—It is stated that a building permit has been issued for the Saml. B. Merritt Memorial Hospital which is to be eected at Hawthone Ave. and Webster St., 2 stories of steel and concrete and cost about $80,000.

The Bd. of Police and Fire Comrs. is said to have in contemplation the erection of a building on 51st St., at a cost of $22,500; rebuilding Engine House No. 4, at a cost of $22,500; erecting fire house on 25th St.; cost $25,000.

Ventura, Cal.—See "Sewerage and Sewage Disposal."

Denver, Colo.—The following are the bids opened on Oct. 18 by the Superv. Archt., Treas. Dept., Washington, D. C., for the extension, etc., to the U. S. Post Office and Court House at Denver: F. A. Adams, Denver, $14,250; Stockton & Fraser, Denver, $14,470; Philip Funke, Denver, $14,950; Frank Damascis, Denver, $14,444; Morrison Ceris Co., Denver, $15,115, and J. H. Wiese, S. Omaha, Neb., $17,621.

Washington, D. C.—Bids will be received until Nov. 12 by Bernard R. Green, Supt. of Constr., National Museum, Library of Congress, Washington, for red bricks for this building.

Peoria, Ill.—The following are the bids opened on Oct. 17 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of an extension, remodeling, etc., including mechanical equipment (except lift) to the U. S. Post Office and Court Houses at Peoria: W. M. Allens Sons Co., Peoria, $212,500; W. J. Jobst Co., Peoria, $201,400; General Constr. Co., Milwaukee, Wis., $176,623, and Peoria Stone & Marble Co., Peoria, $217,000.

Chicago, Ill.—Bids will be received until Nov. 6 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a 2-story and basement brick and stone fire engine house at 87th St. and Escanaba Ave. Bids to be submitted on the following: Cut stone, iron and steel work, masonry, etc.; carpentry, plumbing, etc.; steam heating.

Chicago, Ill.—The Lithuanian-Americans of Chicago, it is reported, have secured a site at 46th St. and Western Ave. on which it is proposed erecting a hospital costing about $500,000. Jos. J. Elias is Pres. of the Bd. of Control of the Trus.

**Canton, Ill.*—Thos. M. Mercer is reported to have secured the contract to erect the Graham Hospital at $24,797, exclusive of plumbing and heating.

South Bend, Ind.—Bids are about to be asked for the erection of a 2-story brick fire station. W. A. McInerney, Pres. Bd. Pub. Wks.

Marion, Ind.—It is stated that the Bd. Co. Comrs. will receive bids until Nov. 5 for erecting an electric light building at the county infirmary. Harry Goldthwaite, Co. Aud.

Auburn, Ind.—It is reported that the Comrs. of De-Kalb County have ordered plans prepared and will soon ask bids for erecting a county infirmary, estimated to cost $30,000.

Des Moines, Ia.—It is reported that a building is to be erected at the Iowa Methodist Hospital, at 12th St. and Callanan Court, at a cost of $35,000. The building is to be of pressed brick and cement, 4 stories high, and is to be used for the nurses and superintendents.

The following are the bids opened on Oct. 21 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (complete) of the U. S. Post Office at Des Moines: Geo. Weize, Des Moines, $398,507; Paul Riemer's Sons, Milwaukee, Wis., $367,793; Northern Cons. Co., Milwaukee, Wis., $374,890; C. G. Gindele Co., Chicago, Ill., $372,925; I. A. McGonigle, Leavenworth, Kan., $444,650; Jno. Peirce, New York, N. Y., $405,693; P. M. Hennessey, St. Paul, Minn., $395,973.

Parsons, Kan.—Bids will be received, it is stated, until Nov. 12 by the State Bd. Contral (E. B. Schermerhorn, Chmn.), Topeka, for erecting an administration building at the Parsons State Hospital. John F. Stanton, State Archt., Topeka.

Waldoboro, Me.—Bids will be received until Dec. 5 for the construction (except plumbing, electric wiring and conduits) of the extension to the U. S. Post Office and Custom House, at Waldoboro, by Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Baltimore, Md.—Competitive plans are to be received until Nov. 4 from architects of the City of Baltimore for Engine House No. 1, which is to be erected at 323 N. Paca St. Edw. D. Preston, Inspector of Bldgs.

Somerville, Mass.—The Bd. of Aldermen, it is stated, has decided to accept the offer of Andrew Carnegie to erect a library in West Somerville, at a cost of $25,000.

**Fall River, Mass.*—The contract to erect the shacks at the City Hospital, it is reported, has been awarded to Stewart Dacey & Co. at $11,871.

Salem, Mass.—It is stated that bids for erecting the State Armory here will probably be asked within 2 weeks.

**Malden, Mass.*—G. M. Cox, Armory Comr., writes that the contract for erecting the armory (bids opened Oct. 19) has been awarded to Whiton Haynes & Co., Devonshire St., Boston, for $45,000.

Detroit, Mich.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Dec. 17 for the construction, compelte (except lifts), of the extension to the U. S. Post Office and Court House, Detroit.

It is reported that a building costing about $12,000 and to be used as a dormitory and kitchen is to be erected at the Boys' Home on its farm near Farmington.

Lapeer, Mich.—The Bd. of Superv. is said to be considering the erection of a court house at a cost of about $100,000.

All bids opened on Oct. 24 by the Bd. Control, Michigan Home for the Feeble Minded and Epileptic, for erecting a new dormitory building, a new bakery and for additions and alterations to the farm house have been rejected. Clark & Munger, Archts., Bay City. G. L. Chamberlain, Medical Supt.

Holland, Mich.—It is reported that steps are being taken to erect a city hall at a cost of $50,000.

Faribault, Minn.—The German Evangelical Church of Minnesota is said to be planning the erection of a fireproof hospital, to cost $35,000.

St. Paul, Minn.—It is reported that the State Bd. of Control is considering the erection of an addition to the city hospital at a cost of about $120,000.

Duluth, Minn.—The State Bd. of Control, it is stated, has approved the plans for the police station which is to be erected in the west end of Superior St. and 20th Ave. C. W. Kelly, Pallidio Bldg., is the archt.

St. Louis, Mo.—The Bd. of Pub. Improv., it is stated, has rejected all the bids received Oct. 17 for the fireproofing of the east wing at the poor house. The lowest bid submitted was $24,800.

**Newark, N. J.*—Fredk. Kilgus, 13 S. 6th St., has secured the contract to erect the armory on Roseville Ave. for First Troop at $84,053 (bids received Oct. 21). Other bids received were Jas. W. Lanning, of Trenton, $89,879, and Jos. Pelletier, of Newark, $92,275. The building is to be of Jersey pink granite. Adj. Gen. Heber Brientnall is Secy. State Military Board, Trenton.

**Atlantic City, N. J.*—It is stated that the contract to erect a fireproof municipal hospital for contagious diseases,

**Items marked thus give the names of parties awarded contracts.*

comprising 3 buildings, has been awarded to Wm. Beaumont, of Atlantic City, at $92,000.

Central Islip, N. Y.—Bids will be received until Nov. 13 by State Comn. in Lunacy, at Albany (T. E. McGarr, Secy.), for erecting a tuberculosis pavilion at the Central Islip State Hospital, Central Islip, including heating, plumbing and electric work. Only a bid on the complete work, construction, heating, plumbing and electric wiring will be considered. Franklin B. Ware, State Archt., Capitol, Albany.

New York, N. Y.—The Bd. of Aldermen voted Oct. 28 to appropriate $25,000 for a shelter and comfort station in Van Cortlandt Park, and $75,000 for a site and construction of the Carmine St. bath.

Brooklyn, N. Y.—The following are the bids opened on Oct. 17 by the Park Board N. Y. City for the erection of shelter houses in Brooklyn Boro. parks as follows: (a) In Fulton Park; (b) Winthrop Park; (c) Prospect Park: Chauncey G. Cozine, 4241 Fulton St., (a) $11,777; George F. Driscoll (a) $12,900; (b) $32,000; (c) $65,998; Peter Guthy (a) $12,739; (c) $66,348 Wm. Horne Co. (a), $12,740 Wm. H. Luth Co., 6oth St., Bay Ridge, (a) $12,001; (b) $31,216; (c) $63,494; Richd E. Henningham (c) $64,000; Thompson & Kelsey (c) $63,989.

The following are bids opened on October 24 by the Comr. of Charities for (*a*) furnishing materials and remodelling present Annex Building on the grounds of the Kings County Hospital, Clarkson St. and Albany Ave., Boro. of Brooklyn, or (*b*) furnishing materials and remodelling present Annex Building and erecting two additions to said building: C. L. Dooley, *a* $170,500, *b* $188,870; C. H. Peckworth, 15 Hudson St., *a* $184,773, *b* $201,928; M. G. Kelsey, *a* $157,417, *b* $173,333; D. J. Ryan, 723 Third Ave., *a* $172,000, *b* $188,000; J. K. Moreland Co., 1910 Park Ave., *a* $164,950, *b* $184,279.

Buffalo, N. Y.—The Bd. of Governors of the Homeopathic Hospital, it is stated, has decided to erect a new hospital at Linwood and Lafayette Aves., to cost $100,000.

*The following are reported to be the bids received by the Bd. of Superv. recently for installing a ventilating system in the new armory: Chas. D. Foster, $8,498 (awarded contract). Rademacher Bros., $9,499; Buffalo Forge Co., $10,970, and J. H. Ruckel & Son, $14,500.

Winston-Salem, N. C.—Bids will be received until Nov. 7 (extension of date) by the Bd. Co. Comrs. (M. D. Bailey, Chmn.) for erecting a jail. Frank P. Milburn & Co., Archts., Washington, D. C.

Hillsboro, N. D.—It is stated that bids will be received until Nov. 12 by the Bldg. Com. (Fred. L. Goodman, Chmn.), for erecting an armory. Haxby & Gillespie, Archts, Fargo.

Devils Lake, N. D.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept. Washington, D. C., until Dec. 2 for the construction of foundations, etc., for U. S. Post Office and Court House at Devils Lake, as advertised in the Engineering Record.

Columbus, O.—Bids will be received until Nov. 20 by J. W. Jones, Secy. Bd. Trus. of the Ohio Inst. for the Education of the Deaf & Dumb, at Columbus, for furnishing material and installing a hot water heating system in the buildings of said institute.

Youngstown, O.—The Secy. Bd. of Co. Comrs. writes that plans are not yet ready for the proposed court house, and no bids have yet been called for its erection.

Norwood, O.—The erection of a municipal hospital, it is stated, is being considered.

Springfield, O.—The only bid opened on Oct. 16 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for construction complete of extension to U. S. Post Office at Springfield, was submitted by F. A. Graham, of Springfield, for $34,000.

**Philadelphia, Pa.*—Lynch Bros., Lippincott Bldg., are reported to have secured the contract to make alterations and additions to buildings Nos. 2 and 3 at the Schuylkill Arsenal, at $64,933 (bids opened Oct. 7).

Roland W. Boyle, 1626 Chestnut St., it is stated, has prepared plans for an addition to the St. Joseph Hospital, at 16th St. and Girard Ave., and bids for the construction are reported as now being received. The addition is to be 2 stories, 28 x 1112 ft., of brick and marble.

**Hazleton, Pa.*—Geo. W. Beard & Co., of Philadelphia, it is stated, have secured the contract to erect an addition to the State Hospital at Hazleton at a cost of about $60,000.

Ebensburg, Pa.—Boyd & Hall are said to be the archts. who are preparing plans for the addition which the Co. Comrs. intend erecting to the jail at Ebensburg at a cost of $50,000.

Holmesburg, Pa.—Included in next year's budget of the Inspectors of the County Prisons is an appropriation of $160,000 to erect 2 wings to the Holmesburg County Prison, as recommended by the Council's Com. on Prisons and Correction.

Pine Grove, Pa.—Bids will be received by the Armory Bd. (Benj. W. Deeming, Secy.), at the office of the Adjutant General at Harrisburg, until Nov. 14 (readvertisement), for constructing an armory at Pine Grove, McCormick & French, Archts., Wilkesbarre.

Wernersville, Pa.—Bids will be received until Dec. 9 by J. M. Shenk; Chmn. Bldg. Com., State Asylum for the Chronic Insane of Pennsylvania, at Wernersville, for the construction of 2 buildings, 1 an extension to the dining room and the other an infirmary. A. A. Ritcher, Archt., Reading and Lebanon.

Lancaster, Pa.—It is stated that Seymour & Paul A. Davis, 1,600 Chestnut St., Philadelphia, have prepared revised plans for the several buildings to be erected at the Thaddeus Stevens Orphan Home near Lancaster.

Danville, Pa.—It is reported that the contract for erecting buildings at the Hospital for the Insane at Danville, which was recently awarded, will probably be readvertised.

Polk, Pa.—Bids will be received until Nov. 6 (readvertisement) by J. A. Wiley, Secy. State Inst. for Feeble Minded of Western Pennsylvania, at Polk, for erecting the following buildings: One custodial group; industrial school; cow barn; machinery barn; placing 16 stone porches to present cottages; fireproofing connecting corridors of present buildings; bids to be submitted as a whole or separately on the above. F. J. Osterling, Archt., Commonwealth Bldg., Pittsburg.

Pittsburg, Pa.—Preliminary plans and specifications will be received until Nov. 7 at the office of the City Compt., for an engine house to be erected at Stanton Ave. and Hawthorn St.; also an engine house and police station at Virginia Ave. and Shiloh St. The cost of above buildings, including the Architect's fees, shall not exceed the sum of $30,000 and $40,000, respectively. Geo. W. Guthrie, Mayor; Frank Ridgway, Dir. Dept. Pub. Safety.

**Indiana, Pa.*—E. W. Webster, of Du Bois, is reported to have secured the contract for the heating and plumbing work in the Indian County jail and court house.

**Harrisburg, Pa.*—The Trus. of the State Hospital for the Insane at Harrisburg, it is reported, have awarded the contract to erect 2 new buildings for acute cases to G. A. Glen & Co., of Philadelphia, at $145,200. Other bids received are stated to have been as follows: F. T. Nesbit & Co., New York, $192,534; Milton W. Young, Overbrook, $172,185; G. W. Beard & Co., Reading, $160,900; H. E. Baton, Philadelphia, $167,703; Chas. McCaul & Co., Philadelphia, $167,879; W. O. Weaver & Son, Harrisburg, $152,993; Lynch Bros., Philadelphia, $155,440.

Aiken, S. C.—The Aiken County Medical Society, it is reported, intends erecting a hospital.

Greenville, Tenn.—Bids will be received until Nov. 21 by Maj. M. Gray Zalinski, Quarter Master, U. S. A., Washington, D. C., for constructing brick lodge and out building, concrete walls and sidewalks, grading, etc., at the Greenville (Tenn.) National Cemetery as advertised in The Engineering Record.

Pulaski, Tenn.—Benj. Bosworth Smith, of Montgomery, Ala., is preparing plans for the proposed court house, to cost about $75,000. G. H. McMillion, County Judge.

Galveston, Tex.—The Bd. of City Comrs. has passed an ordinance authorizing the erection of a bath house for negroes to cost $15,000.

Ft. Monroe, Va.—Bids will be received until Nov. 20 by Capt. Ernest R. Tilton, Constr. Q. M., U. S. A., for 25 bathrooms, including construction and plumbing repairs.

National Soldiers' Home, Va.—Bids will be received by John T. Hume, Treas., Southern branch, N. H. D. V. S., National Soldiers' Home, until Nov. 7, for furnishing material and constructing a green house.

Franklin, W. Va.—It is stated that bids will be received until Nov. 25 by W. M. Boggs, Pres., County Court, for erecting a brick jail and jailer's residence.

**Eau Claire, Wis.*—The C. W. Gindele Co., of Chicago, Ill., has secured the contract for the construction complete of U. S. Post Office at Eau Claire, including plumbing, gas piping, heating apparatus, electric conduits and wiring (bids opened Oct. 1 by the Superv. Archt., Treas. Dept., Washington, D. C.), for about $113,550.

Ft. D. A. Russell, Wyo.—Bids will be received until Nov. 15 by Capt. V. R. Hart, 15th Inf., Q. M., U. S. A., Cheyenne, for furnishing material and installing a heating plant in new hospital now under construction at Ft. D. A. Russell.

Calgary, Alta.—The joint committees of the Hospital Bd., the City Council and the Medical Bd., it is stated, have decided to accept the plans of Lawson & O'Gara, of Calgary, for the hospital, which is to cost about $140,000.

Toronto, Ont.—Bids will be received until Nov. 5 by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for alterations and additions to the Post Office Bldg. at Toronto.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—The Kansas City Southern R. R. (W. Coughlin, Gen. Mgr., Kansas City, Mo.), is said to be arranging to erect a passenger station here at a cost of about $80,000.

San Francisco, Cal.—Armitage & Rowell, 1427 Post St., are reported to have prepared plans for an 8-story steel frame building which is to be erected at Kearny and Sutter Sts. by the Jacob Z. Davis Estate Co. at a cost of about $400,000.

**Trinidad, Colo.*—The contract for the ventilating and heating apparatus in the opera house, it is stated, has been awarded to Barnes & Stephens, of Colorado Springs, at $5,000.

**Wilmington, Del.*—Wm. D. Haddock & Co., 804 Orange St., it is reported have the contract to make improvements to the Y. W. C. A. Bldg., at 906 King St., at a cost of $12,695.

Washington, D. C.—W. Sidney Pittman, 494 Louisiana Ave., n. w., is stated to have completed plans for the Y. M. C. A. Bldg. which is to be erected for the negroes at a cost of $60,000 at 12th and S Sts.

Daytona, Fla.—The Bd. of Trade is reported to have decided upon a site on which it is proposed erecting a building for the Chautauqua Society, costing about $20,000.

Jacksonville, Fla.—The Bldg. Com. of the Florida Grand Lodge of Masons (Geo. L. Drew, of Jacksonville, Secy.), it is reported will receive bids Dec. 10 (readvertisement), for erecting a 7-story reinforced concrete Masonic Temple on Main St. Ecstimated cost, $110,000. L. M. Weathers, of Memphis, Tenn., is the archt.

Macon, Ga.—The remodeling of the Masonic Temple on Cherry St., at a cost of $25,000, is reported under consideration.

**Ft. Wayne, Ind.*—Caldwell & Drake, of Columbus, it is reported, have secured the contract to erect a hotel here, at a cost of about $250,000, to be 8 stories high.

**Des Moines, Ia.*—W. H. Brereton is reported to have secured the contract for the masonry of the first 2 stories of the building at 8th and Walnut Sts. for $12,950. The building is to be 7 stories high, and the contract for the steel and iron work on 6 stories will probably be let in a few days. Proudfoot & Bird, Crocker Bldg., are the archts.; Hugh Pritchard is the owner.

Des Moines, Ia.—It is stated that bids received for erecting the Y. M. C. A. Bldg. are considered too high and the plans will be altered and the contractors asked to refigure.

**Davenport, Ia.*—The Tri-City Constr. Co., Masonic Temple, it is reported has secured the contract to erect a 1-story addition to the Davenport Foundry Locomotive Wks. at a cost of $25,000.

Louisville, Ky.—H. J. Scheirich, H. M. Johnson and others are reported to have purchased a site at Bway. and 5th St., on which it is proposed erecting a 7-story fireproof store and apartment house, costing about $200,000.

Leitchfield, Ky.—The Grayson Springs Hotel Co., which was recently destroyed by fire, it is reported, is to be rebuilt of brick and stone at a cost of $150,000. Plans and specifications are now being prepared.

Alexandria, La.—It is reported that a site at 10th, Jackson and Elliott Sts. has been decided upon for the erection of a depot at a cost of $70,000 by the Iron Mountain and Texas & Pacific railroads. L. T. Wright, Gen. Mgr., Iron Mountain R. R., Keswick, Cal.

Springfield, Mass.—D. C. Shea, 78 Alden St., is reported to have secured the contract for erecting 4-story brick building, 40x60 ft., fo ra factory at Harrison Ave. for L. F. Carr. Architects, Kirkham & Parlett, 25 Harrison Ave.

**Boston, Mass.*—It is reported that the contract to erect a factory for the Lovejoy Wharf Co. has been awarded to L. P. Soule & Co., 166 Devonshire St. Probable cost, $400,000.

Winthrop Adams, it is reported, contemplates erecting a theatre on the site of the old Park Sq. Hotel, to cost $250,000.

Athol, Mass.—It is stated that $15,000 and a site has been donated toward the erection of a Y. M. C. A. Bldg. on condition that an additional $15,000 is raised by the citizens.

St. Paul, Minn.—The members of the Town and Country Club are said to be considering the construction of an addition to the clubhouse, to cost $14,000.

Kansas City, Mo.—Albert Owens, Dwight Bldg., is preparing plans for an office building to be erected on Walnut and 10th Sts., to cost $50,000.

D. Sutter, 1214 Main St., is preparing plans for the Kansas City Skating Rink, to be erected on 15th and Lydia Sts., to cost $35,000.

Howe & Hoit, 315 E. 10th St., are preparing plans for a brick stable to be erected on 36th and Main Sts. for Chas. Campbell, to cost $10,000.

**Libby, Mont.*—W. B. Parker, of Spokane, Wash., is reported to have secured the contract to erect a 2-story concrete block building for the Odd Fellows to cost about $10,000.

Jersey City, N. J.—John Haas is reported interested in a company which is organized for the purpose of erecting a theatre on New York Ave. and Lewis St. at a cost of $100,000.

*The Turner Constr. Co., 11 Bway., New York, N. Y., is reported to have sublet the plumbing work which will be required in the construction of the 8-story reinforced concrete building on Bay and Provost Sts. for the Great Atlantic & Pacific Tea Co., 260 West St., New York, to the United Plumbing & Contrg. Co., 323 Smith St., Brooklyn.

Plans are reported completed by Wm. A. Tilton, 76 Montgomery St., for a storage and warehouse building for the D. E. Cleary Co., 28 Montgomery St. The building will be erected on Grand St. and Jersey Ave., of brick construction, 4 stories high, 38x113 ft. Estimated cost, $25,000.

**Buffalo, N. Y.*—Mosier & Summers, 1260 Seneca St., are reported to have the contract to erect a freight house at Exchange and Louisiana Sts. for the Erie R. R. To be of brick construction, fireproof, 200 x 32 ft.

Rome, N. Y.—The storehouse and paint shop of the Rome Metallic Bedstead Co. is reported to have been destroyed by fire.

**Toledo, O.*—The Hattersley Constr. Co., Gardner Bldg., it is stated, has secured the contract to erect the Y. W. C. A. Bldg., at Jefferson Ave. and 11th St.

**Columbus, O.*—It is stated that the contract to erect a 5-story brick and steel building with reinforced concrete floors for the F. & R. Lazarus Co., at High and Town Sts., will be let Nov. 15. Plans for the building were prepared by Richards, McCarthy & Bulford, Ruggerly Bldg.

Cleveland, O.—S. Kohn & Sons, it is reported, will erect a business building at St. Clair Ave. and E. 105th St., to cost $60,000.

Cincinnati, O.—The Reliance Eng. Co. is reported to have completed plans for the stable which is to be erected at Des Moines and Florence Ave., at a cost of $25,000, for the B. H. Kroger Grocery & Baking Co.

Hamilton, O.—The Hamilton Lodge, No. 93, of Elks, it is reported, has approved plans for an Elks Temple, estimated to cost $40,000.

Toledo, O.—The Trus. of the Newsboys' Assoc., it is stated, have decided to proceed with the erection of the newsboys' building without the auditorium feature. The Bldg. Com. has been authorized to secure plans for a building costing about $50,000.

Zanesville, O.—Bids are wanted, it is stated, until Nov. 6 for remodeling the I. O. O. F. Temple, Main St. H. C. Meyer, Archt., People's Savings Bank Bldg.

Steubenville, O.—Bids will be received, it is stated, until Nov. 12 by Briggs & Nelson, Archts., Cleveland, for erecting a building for the Y. M. C. A. Probable cost, $50,000.

Bellaire, O.—The Bellaire & Ohio R. R. Co. is reported to be planning many improvements in Bellaire, which will include the erection of a freight shed, to cost

**Items marked thus give the names of parties awarded contracts.*

ab at $25,[illegible], and a new depot, site for which has not yet been decided upon.

Lawton, Okla.—Bids are wanted, it is stated, until Nov. 10 for erecting a 3-story bank and office building at 3d St. and C Ave. for the First Natl. Bank. J. Ira Jones, Archt.

Enid, Okla.—It is reported that the Santa Fe R. R. (J. E. Hurley, Gen. Mgr., Topeka, Kan.), intends erecting a 2-story depot here to cost about $50,000.

Philadelphia, Pa.—It is stated that plans have been completed by Heacock & Hokanson, 931 Chestnut St., for a 5-story semi-fireproof 85x106-ft. warehouse, to be erected at 106 Broad St. for Berger Bros.

Johnstown, Pa.—The Johnstown Trust Co., it is stated, is planning the erection in the spring of an 8-story building, to cost $150,000.

**Wilkesbarre, Pa.*—The Engineering Contr. Co., of Baltimore, Md., it is reported, has secured the contract to erect the 5th Ave. Theatre at about $70,000.

Lancaster, Pa.—It is reported that a theatre costing about $25,000 is to be erected by the Pennsylvania Amusement Co.

Franklin, Pa.—Seymour & Paul A. Davis, 1,600 Chestnut St., Philadelphia, it is reported, are preparing working plans for the Y. M. C. A. Bldg. to be erected here.

Pittsburg, Pa.—It is reported that plans are being prepared for a 6-story fireproof building which is to be erected in Pittsburg for the lines of the Pennsylvania R. R. west of Pittsburg. S. C. Long, Genl. Supt., Pittsburg.

East Liberty, (P. O. Pittsburg), Pa.—The Pennsylvania R. R. (Alex. C. Shand, Ch. Engr., Philadelphia, Pa.), it is reported has had plans prepared for a freight station which it is proposed erecting in East Liberty at a cost of about $1,000,000.

Harrisburg, Pa.—C. H. Bernheisel, 5 N. 2d St., Harrisburg, has received first prize for his plans for the Masonic Temple, which is to be of granite, fireproof throughout and 5 stories high and cost about $90,000. M. I. Kast, of Harrisburg, received 2d prize, and Walter Smedley, of Philadelphia, 3d prize. D. W. Cox, Pres. Masonic Temple Assoc. W. L. Gorgas, Chmn. Bldg. Com.

Maitland, S. D.—Harry W. Jones, of Minneapolis, Minn., is reported to be preparing plans for a 3-story hotel to be erected at Maitland by F. E. Little, of Minneapolis, Minn.

Memphis, Tenn.—A. W. Gettingby is stated to have been granted a permit to erect a 4-story brick store building at Union Ave. and S. 3d St., at a cost of $23,000.

Chattanooga, Tenn.—Bids will probably be called for about Nov. 15 for the erection of a Y. M. C. A. building, to cost about $100,000. Architect, R. H. Hunt, of Chattanooga.

Knoxville, Tenn.—The Masons are reported to be planning the erection of a new building, to cost about $25,000.

Nashville, Tenn.—The Elks, it is stated, are planning the erection of a 5-story lodge building, to cost about $100,000.

Temple, Tex.—It is stated that the directors of the State National Bank propose erecting a 4-story building.

Beaumont, Tex.—The Trades Council, it is reported, intends erecting a labor temple, costing about $30,000.

Richmond, Va.—It is stated that plans have been submitted to the officers of the Mutual Assurance Society for the addition of 3 stories to the building at 9th and Main Sts., which will cost about $250,000.

**Spokane, Wash.*—It is reported that the contract to erect a 4-story department store for Kemp & Herbert has been awrded to M. C. Murphy, 1st and Howard Sts., at about $150,000.

B. L. Gordon & Co., it is stated, have taken out a permit to erect a 2-story brick building, costing about $40,000.

*M. C. Murphy is reported to have secured the contract to rebuild the Fraternal Hall at Sprague Ave. and Wall St. at a cost of about $20,000.

The erection of a labor temple at a cost of $75,000 is reported under consideration. The Structural Bldg. Trades Alliance is reported interested.

Tacoma, Wash.—The Ancient Order of Vikings is reported to be planning the erection of a building, costing about $50,000.

C. A. Darner, 111 C St., is reported to be preparing plans for a $100,000 hotel to be erected on C St.

Seattle, Wash.—J. F. Everett, Walker Bldg., is reported to be preparing plans for remodeling the building at First Ave. and Madison St., owned by F. K. Struve. Cost, $100,000.

Howell & Stokes, of New York, N. Y., it is stated, have been engaged to prepare plans for the Metropolitan Bldg. Co. for the two buildings which it is proposed erecting at Union, Seneca, 4th and 6th Aves.

It is reported that the building at First Ave. and Spring St. is to be remodeled by E. K. Struve, vice-pres. of the John Davis Co. Estimated cost $200,000.

J. H. McGraw is reported to have secured a permit to erect a brick building at 1524 2d Ave. at a cost of $28,000.

The Meteor Land Co. (R. W. Hill, Vice-Pres. and Mgr.), it is stated will erect a 2-story store and office building at 3d Ave and James St., to cost $25,000.

The Northern Pacific Ry. Co. is reported to have filed plans for alterations to its warehouse and dock by adding a 2d story. Estimated cost, $12,000.

Martinsburg, W. Va.—It is stated that the revised plans for the Y. M. C. A. Bldg. are completed and bids for the construction will soon be asked.

La Crosse, Wis.—Parkinson & Dockendorf, of La Crosse, assisted by F. H. Husse, of Lansing, Mich., it is reported, will prepare plans for the Y. M. C. A. Bldg., which is to be erected at a cost of $100,000.

**Winnipeg, Man.*—It is stated that the contract to excavate the site for the foundation for the union depot of the Grand Trunk Pacific R. R. has been awarded to S. Br[illegible], of Winnipeg. About 45,000 cu. yds. will be excavated.

Toronto, Ont.—D. Fitzgerald, it is reported, has announced that he intends erecting a hotel on Queen St., to cost $30,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Decatur, Ill.—Geo. Staudaher, of Rock Island, is stated to be preparing plans for an edifice to be erected for the members of the St. Patrick R. C. Church which is to cost about $100,000. Rev. J. Murphy, pastor.

Baltimore, Md.—It is reported that a site has been secured on Charles St. and University Parkway on which it is proposed erecting a cathedral for the Episcopal Church of Maryland.

Detroit, Mich.—It is stated that plans have been accepted for the new edifice which is to be erected for the North Baptist Church at Woodward and Pingree Aves., of brick and stone, 109x111 ft. C. M. Harmon, Chmn. Bldg. Com.

Brainerd, Minn.—The members of the St. Francis R. C. Church, it is stated, intend erecting a $12,000 edifice.

South River, N. J.—It is reported that bids will be received Nov. 6 for erecting a stone, 119x60-ft. edifice for St. Mary's R. C. Church, at South River. Henry D. Dagit, 435 Chestnut St., Philadelphia, Pa., is the archt.

Burlington, N. J.—It is reported that the members of the First Baptist Church are raising $40,000 with which it is proposed erecting a new edifice.

Buffalo, N. Y.—It is reported that the Central Presbyterian Church on W. Genesee St., which was recently damaged by fire, is to be repaired at a cost of $10,000.

New York, N. Y.—Plans have been filed for the following: Six-story brick and stone tenement at 171 2d Ave. for M. W. Folsom; cost, $31,000; Mills & Greenleaf, Archts.; 6-story brick and stone tenement at 13th St. and Ave. B for Louis Block; cost, $20,000; Sommerfeld & Steckler, Archt.; 6-story brick and stone apartment house at Bway. and 133d St. for Daily & Carlson; cost, $125,000; Neville & Bagge, Archts.; 3 5-story brick tenements at Brook Ave. and 162d St. for Williams & Scheibel; cost, $140,000; Harry F. Howell, Archt.; 14 3-story brick tenements at Whitlock Ave. and Tiffany St. for Albert Rothermel, Archt. and owner; cost, $126,000; alterations to 4-story brick and stone extension to 4-story brick and stone tenement at 314 E. 34th St. for Jos. Finger; cost, $20,000; David Stone, Archt.; 3-story brick synagogue at Forest Ave. and 160th St. for Congregation Beth Hamedrash Hagodel. cost, $75,000; Goldner & Godlberg, Archts.

Plans have been filed for the erection of the following buildings: 6-story brick and stone tenement at Delancey and Mott Sts., for Susswein & Herman, cost $40,000, J. H. Amsler, Archt.; 15 5-story brick tenements at Clay Ave. and 169 St. for Albert J. Schwarz, owner and archt., cost $390,000.

**Delphos, O.*—We are informed that the contract for erecting edifice for Presbyterian congregation has been awarded to J. G. Horshan & Son, of Delphas, O., for $17,000. Architect, F. E. Walker, 211 Main St., Toledo.

Philadelphia, Pa.—The members of the Roman Catholic Church of Our Lady of Mt. Carmel, it is reported, are planning the erection of a $20,000 edifice.

Bristol, Va.—The members of the M. E. Church, it is stated, are considering the erection of an edifice costing about $12,000.

Hamilton, Ont.—All Saints Church, it is reported, is to be improved at a cost of $10,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Ardmore, Ark.—The Trus. of the Hargrave College, it is reported, are considering the erection of a dormitory at a cost of $50,000.

Ft. Smith, Ark.—A. Klingensmith, 521 Gar. Ave., it is reported, is preparing plans for a $60,000 school.

New Britain, Conn.—It is stated that $15,000 has been appropriated with which it is proposed erecting an addition to Monroe St. School.

Washington, D. C.—It is stated that all bids recently received for erecting the administration building for the Carnegie Institution have been rejected by the Executive Com., and new bids will be received at the Nov. meeting of the Bd. The contract for the building, which is to cost about $200,000, will be let Dec. 10 at the meeting of the Executive Com., Long Bldg. Carrere & Hastings, of New York, N. Y., are the archts.

Greensboro, Ga.—Bids will be received until Nov. 12 by Jas. H. McWhorter, City Clk., for $15,000 school bonds.

Downs, Kan.—It is stated that bids will be received until Nov. 12 by W. H. Boughner, Clk. School Bd., Farmers State Bank, for erecting a brick and stone school.

Millersburg, Ky.—It is reported that the Female College here, which was recently destroyed by fire, is to be rebuilt at a cost of about $30,000.

**Sidell, La.*—C. D. Stewart, of Baton Rouge, is reported to have received the contract to erect a school here at $22,000.

**St. Paul, Minn.*—The State Bd. of Control, it is stated, has awarded the contract to erect a barn at the State Agricultural College to N. P. Fransen, of St. Paul, at $11,600.

Waterville, Minn.—The citizens are reported to have voted $30,000 bonds to erect a school.

St. Louis, Mo.—Jos. Stander & Sons, Archts., 210 Temple Bldg., St. Louis, writes that contracts will not be let before the spring for the proposed parochial school and hall for St. Agatha's Parish, to cost about $50,000.

Collaway, Neb.—It is stated that plans have been prepared for a $12,000 school.

Woodbury, N. J.—The City Council is stated to have passed a resolution appropriating $60,000 toward the erection of a high school. Probable total cost $75,000.

Prospect Park, N. J.—Bids will be received until Nov. 6 by the Bldg. Com. of the Bd. of Educ., of Prospect Park (Cornelius Hameetman, Chmn., 281 N. 6th St.) for furnishing material and erecting a school according to plans prepared by John F. Kelly and John S. Struyk, assoc. archts., Post Office Bldg., Passaic. Probable cost, $25,000.

Somerville, N. J.—W. H. Long has been made Chmn. and A. P. Sutphen Secy. of a committee which will have charge of the erection of a 4-room school in East Somerville, to cost $22,000.

Mescalero, N. M.—Bids will be received until Nov. 19 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and labor to construct and complete a school at Mescalero School, N. M. For further information apply to James A. Carroll, Supt., Mescalero, N. M.

Buffalo, N. Y.—The Trus. of the St. Mary's Academy & Industrial Female Seminary, of Lockport, it is reported, have purchased a site at Walden Ave. and Doat St., Buffalo, on which it is proposed erecting an academy to cost $400,000.

The following are reported to be the bids received recently for installing 2 boilers in the Central High School, Court and Franklin Sts.: J. H. Ruckel & Son, $3,000 (allowance for old boilers, $60); Danl. Burgmaster, $3,400; Frontier Plumbing & Htg. Co., $3,525.

Syracuse, N. Y.—Bids will be received until Nov. 9 by Andrew S. Draper, Comr. of Educ., Capitol, Albany, for erecting a school, including heating and plumbing, at the Onondaga Indian Reservation, near Syracuse. Only bids for the complete work of construction, heating and plumbing will be considered. Franklin B. Ware, State Archt., Albany.

Brooklyn, N. Y.—Bids will be received until Nov. 11 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing a ventilating and heating system in the additions to and alterations in School No. 140, Boro. Brooklyn.

**New Brighton, S. I., N. Y.*—Danl. J. Rice, 5 E. 42d St., N. Y. City, has secured the contract for installing ventilating and heating apparatus in School 19, Boro. of Richmond (bids opened Oct. 28), for $3,672.

*The following are the bids opened on Oct. 21 by C. B. J. Snyder, Supt. School Bldg., New York City, for installing ventilating and heating apparatus in the following schools: (a) School 41, Manhattan Boro.; (b) School 59, Manhattan Boro.; (c) School 80, Brooklyn Boro.; (d) School 129, Brooklyn Boro., and (e) for ventilating and heating apparatus and electric elevator in Parental School, Queens Boro.: E. Rutzler Co., 178 Centre St., a $11,320; b $26,033 (awarded contract); c $5,708 (awarded contract); d $21,046; e $91,622 (awarded contract); James Curran Mfg. Co., a $11,750; Frank Dobson Co., Inc., a $11,393; b $27,829; c $5,050, d $20,925; e $97,730; W. J. Olvany, a $12,197; b $33,364; d $22,250; Baldwin Eng. Co., a $12,440; Harry L. Philp, a $10,375 (awarded contract); c $5,862; Gillis & Geohegan, 537 W. B'way, b $26,965; d $20,865 (awarded contract); G. A. Suter & Co., b $26,444; d $22,893; e $104,279; Blake & Williams, d $20,892; e $94,981.

*Bids were opened on Oct. 21 by C. B. J. Snyder, Supt. School Bldgs., for the erection of outside iron stairs on schools, and the Eagle Iron Wks., 403 E. 117th St., secured contract for Schools 18 and 28 at $3,764 and $3,191, respectively, and John F. Kuhn, 348 E. 52d St., for School 67 for $5,847.

Springville, N. Y.—It is stated that the plans of E. E. Joralemon, of Niagara Falls, for the new school have been accepted. The cost is to be about $75,000.

Troy, N. Y.—Plans for the Russell Sage Laboratory of the Rensselaer Polytechnic Institute are about ready. This building will contain the mechanical and electrical engineering laboratories. It will be 240 x 80 ft. and 5 stories high. It will be completed in 1908. The boiler house, with a capacity of 800 h.p., is now under process of construction and will be finished this year.

Cincinnati, O.—School bonds amounting to $250,000, it is stated, have been sold.

Ford City, Pa.—F. Reisgen, Secy. Bd. Educ., writes that bids will probably be received in about a month for the erection of a school to cost about $70,000. Architect, W. G. Eckels, of New Castle.

Philadelphia, Pa.—It is reported that bids are being received by Rowland W. Boyle, 1626 Chestnut St., archt., for erecting a 2-story brick and stone parochial school at 63d St. and Lancaster Ave. for the Church of Our Lady of Lourdes.

**Stroudsburg, Pa.*—C. Webster Eilenberger, of Shawnee, it is stated, has secured the contract to erect the 3-story brick school at the State Normal School in East Stroudsburg at $36,412.

Pittsburg, Pa.—J. H. Gilsey, Supt of Construction of the Carnegie Technical Schools, writes, with regard to Applied Science bldgs of the Carnegie Technical Schools, that upon the opening of bids on Sept. 28 it was found that the cost of the buildings had exceeded the appropriation, and it was then decided to revise and reconstruct the plans. This work is now being done by the architects, Messrs. Palmer & Hornbostel, of New York, N. Y., and upon the completion of same, approximately about Nov. 15, the Building Com. will ask for revised estimates on certain portions of the work. The buildings complete will cost about $1,000,000.

Alpine, Tex.—It is stated that bids are wanted until Dec. 10 for erecting a 2-story brick, stone and concrete block school. H. T. Phelps, Archt., San Antonio.

Bids will be received until Nov. 18 by J. D. Jackson, Clk., Bd. Educ., it is stated, for $20,000 school bonds.

Coleman, Tex.—The Attorney-General has approved the issue of $30,000 Coleman school bonds.

Clarendon, Va.—It is stated that the building of a brick school here is under consideration.

Fond du Lac, Wis.—The erection of a brick school in the First Ward to cost $15,000 is reported under consideration.

**Items marked thus give the names of parties awarded contracts.*

La Crosse, Wis.—It is stated that about Nov. 5 the Executive Com. of the Bd. of Regents at Madison will ask bids for erecting the normal school at La Crosse.

Victoria, B. C.—It is reported that competitive plans are now being received for a 2-story 150 x 62 ft. building which is to be erected at Point Grey, Victoria, for the British Columbia Univ. at a cost of about $100,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

**Denver, Colo.*—A. Danielson is reported to have secured the contract to erect a 2-story ice cream plant for C. G. Carlson at Larimer and 13th Sts., which is to cost about $25,000. F. E. Edbrooke, 510 Opera House Blk., is the archt.

Las Animas, Colo.—Bids will be received at the Bureau of Yards and Docks (R. C. Hollyday, Ch.), Navy Dept., Washington, D. C., until Nov. 16 for furnishing and installing laundry equipment in the naval hospital, New Fort Lyon, Las Animas, Colo.

Colebrook, Conn.—The Colebrook Mfg. Co. (mail, telephone and telegraph address, Winsted), writes that it is in the market for a full steam and water power (electric transmission) equipment and woodworking machinery for light work and specialties.

Chicago, Ill.—Hackie & Lovejoy, it is reported, propose erecting at 589 S. Paulina St. a 3-story 56x124-ft. factroy, to cost $75,000.

Perry, Ia.—It is reported that the Van Camp Packing Co., of Indianapolis, Ind., has announced its intention of constructing a milk condensing plant at Perry, to cost about $100,000. Construction will not begin probably until spring.

Rosedale, Kansas City, Kan.—J. Oliver Hogg, 947 N. Y. Life Bldg., Kansas City, Mo., is preparing plans for a plant for the Bradley-Alderson Co., of Kansas City, Mo., to be erected on Hill St., Rosedale. Contracts for buildings will be let about Dec., and contracts for power plant in Feb. Two electric elevators will be installed. The building will be 3 stories high, 200x181 ft., of reinforced concrete construction and cost about $50,000.

Worcester, Mass.—The Crompton & Knowles Loom Wks., it is reported, intend doubling the capacity of its plant.

Three Forks, Mont.—We are informed that F. L. Smith & Co., 41 Cortlandt St., New York, N. Y., are the designing and consulting engineers for the Three Forks Portland Cement Co., ofThree Forks, and no contracts have been let or will be let until complete layout and preliminary estimates have been approved.

Newark, N. J.—Wilson, Harris & Richards, Drexel Bldg., Philadelphia, Pa., it is reported, have prepared plans for a brick 300x80-ft. manufacturing plant, which is to be erected in Newark for the General Electric Co.

West Albany, N. Y.—Geo. H. Haselton, Supt. of Motive Power of the West Albany yards of the N. Y. Central & Hudson River R. R. Co., is reported to have announced that plans have been prepared for the erection of 3 buildings, 1 of which is now under construction. A blacksmith shop and machine shop are the other 2 buildings, and it is not known yet whether the work will be done by the R. R. company or let out by contract.

Wilkesbarre, Pa.—Edw. H. Post, Pres. Wilkesbarre Const. Co., writes that the company is in the market for derricks, hoisting engines, hand hoists or crabs, new or second-hand.

Pittsburg, Pa.—We are informed that fire on Oct. 20 destroyed the pattern and carpenter shops, steel furnace department and stables of the Stove & Range Co., of Pittsburg. H. M. Baldwin, Sales Mgr. It has not yet been decided whether to rebuild or not.

Riverpoint, R. I.—The Warwick Lace Wks., it is reported, propose erecting a lace mill here to cost about $100,000. Henry T. White and Henry C. Dexter are reported interested.

**Woonsocket, R. I.*—The J. W. Bishop Co., of Worcester, it is reported, has secured the contract to erect a thread mill in the Privilege dist. of Woonsocket for the Lawton Spinning Co., of Woonsocket. Probable cost, $450,000.

Beaumont, Tex.—Kyle Ward, Secy. Beaumont Ice, Light & Refrigerating Co., writes that it has been decided to add additional machinery to the ice department, and the company is now asking bids on 150-ton ice-making compressor, dry gas machine, connected up to a compound condensing engine. The engines in the electric plant are to be made condensing and are to be used in connection with this equipment. This machinery will increase the capacity to a total of 380 tons ice making. All the improvements contemplated will cost probably $100,000.

El Paso, Tex.—L. D. Gilbert, Secy. of the Cement Eng. Co., Union Trust Bldg., Los Angeles, Cal., engrs. in charge of the construction for the cement plant for the Southwestern Portland Cement Co., to be erected here, writes under date of Oct. 12 that machinery has not been purchased at this date, but requests have been sent out for most of it. Regarding the size of the buildings there will be 14 buildings and departments, including the office and laboratory, with an aggregate floor space of 80,000 sq. ft. These buildings will be built of structural steel and reinforced concrete, whichever method of construction will suit the work best. Expect to let contracts for the machinery in about 4 weeks. Regarding the power plant, it is proposed to install two 750 kw. 440 volts, 25 cycle, 3 phase generators, either direct connected to cross compound Corliss engines or steam turbines, to operate on 175 lb. gauge steam pressure, and 125 degrees superheat. The plant will be motor driven throughout, motors being direct connected to all the large size grinding machines.

Spokane, Wash.—The Schade Brewing Co. is reported to have been granted a permit to erect a 2-story brick and cement addition to its brewery at a cost of $28,000.
Chas. B. Pride, 508 Columbia Bldg., Spokane, is in charge of the operation of a large survey in this territory for a paper and pulp mill, water power, etc., but it will be at least two or three months before any plans are completed in connection with construction work.

Milwaukee, Wis.—The Kurth Brewing Co., of Columbus, Wis., it is reported, intends removing its plant to Milwaukee and will erect, beside a brewery, several large steel elevators at Burnham St. and 37th Ave.
The Plankinton Packing Co. is reported to have filed plans for a refrigerating plant to be erected on Meinecke Ave. It is stated that modern machinery for cold storage plants is to be installed.
Plans are being prepared, according to reports, by the Fred. Rueping Leather Co. for a tannery, to be erected on the Kinnickinnic River near the flushing tunnel plant.

Lachine, Que.—The ratepayers, it is stated, have voted to grant a bonus of $50,000 to the Imperial Locomotive Wks., of London, Eng., to erect a plant here. Probable cost, $3,000,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Altoona, Pa.—Bids will be received by the Bd. of Health (Saml. B. Trees, Secy.) until Dec. 4 for the collection and sanitary disposal of all city garbage for a period of 1, 3, 5 or 10 years, as advertised in The Engineering Record.

**Spokane, Wash.*—The contract for erecting an 80-ton crematory to increase the capacity of the present plant is reported to have been awarded by the Bd. of Pub. Wks. to the Decarie Co., of Minneapolis, Minn., for $60,000.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Ft. Morgan, Ala.*—The U. S. Government is reported to have on Oct. 24 awarded contracts for materials to be used in building the sea wall at Ft. Morgan, as follows: To the Vinegar Bend Lumber Co., of Vinegar Bend., 2,500,000 ft. of lumber, for $50,000, and to the Southern Lime & Cement Co., of Demopolis, for 19,000 bbls. of cement, for $40,000.

Pine Bluff, Ark.—It is stated that bids wil be received until Nov. 12 by Benj. Franklin, Chmn. Bd. Inspectors, Levee Dist. No. 2, at office of Taylor & Jones, attorneys, Main and Barrque Sts., for constructing a levee.

Wilmington, Del.—The following are the bids opened on Oct. 21 by Maj. C. A. F. Flagler, Corps. Engrs., U. S. A., for dredging entrance to Broadkill River (price given per cu. yd.): River & Harbor Improv. Co., Philadelphia, Pa., 19.2 cts.; Pennsylvania Dredging Co., Camden, N. J., 23⅜ cts.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Lawrenceburg, Ind.—Bids will be received by Lieut. Col. Wm. T. Rossell, Corps Engrs., U. S. A., Cincinnati, O., until Nov. 12 for repairing and protecting Great Miami embankment, as advertised in The Engineering Record.

Louisville, Ky.—The following are the bids opened at the office of the U. S. Engrs. on Oct. 21 for 2 steel barges; (*a*) price for each, (*b*) time required for completion: Blaw Collapsible Steel Centering Co., Pittsburg, Pa., *a* $10,525, *b* 30 weeks; Howard Ship Yards Co., Jeffersonville, Ind., *a* $8,950, *b* 20 weeks; Chas. Hegewold Co., New Albany, Ind., *a* $8,999, *b* 6 mos.; American Bridge Co. of New York, Cincinnati, O., *a* $7,050, *b* 34 weeks.

New Orleans, La.—The Dock Board on Oct. 15 approved plans for building 1,600 ft. of steel sheds over the St. Andrew St. wharf, and extending the Celeste St. shed 480 ft., at a total cost of $140,000. Hugh McCloskey, Pres. J. F. Coleman, Consulting Engr.
Local press reports state that the Dock Bd. will shortly be made a loan of $200,000, with which to build dock facilities for the Austro-American Steamship Co.
*Michael Mitchell is reported to have secured the contract for about 13,000 cu. yds. of levee work from Egania to Andry Sts. (bids opened Oct. 22), at 82 cts per cu. yd.
*Bids were opened on Oct. 22 by the Executive Com., joint organization of the Atchafalaya Basin and Lafourche Levee Dists. (Jas. S. Brady, Chmn.), for the construction of the Cancienne Canal in the Parish of Assumption, to be about 8,500 ft. long and requiring about 250,000 cu. yds. excav., and the contract is reported to have been awarded to Johnston Armstrong, at 17.4 cts. per cu. yd.
T. S. McChesney, Asst. Secy. Dock Board, writes that the proposed steel sheds over St. Andrew St. wharf and for extending the Celeste St. shed will cost about $130,000. Bids have not yet been called for. Engineer, A. C. Bell, 606 Hibernian Bldg.

Boston, Mass.—Bids will be received until Nov. 18 by Maj. Edw. Burr, Corps. Engrs., U. S. A., for removing the wreck of the schooner "Phineas H. Gay," in Broad Sound, Boston Harbor.

**Manchester, Mass.*—The following are the bids opened on Oct. 18 by the Massachusetts Harbor & Land Comrs., at Boston, for dredging channel in Manchester, about 14,500 cu. yds. (price given per cu. yd.). W. H. Letteney, 101 Tremont St., Boston, 38 cts.; Bay State Dredge Co., 185 Summer St., Boston, 34.5 cts., and Eastern Dredging Co., 247 Atlantic Ave., Boston, 34 cts. (awarded contract).

Ludington, Mich.—Bids will be received until Nov. 20 by Col. M. B. Adams, Corps Engrs., Grand Rapids, Mich., for construction of breakwaters at Ludington, as advertised in The Engineering Record.

Muskegon, Mich.—Bids will be received until Nov. 20 by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, Mich., for dredging at Muskegon Harbor, Mich., as advertised in The Engineering Record.

**Detroit, Mich.*—Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., writes that the contract for dredging Section 1, Plan B, Detroit River (bids opened Oct 7) has been awarded to Great Lakes Dredge & Dock Co., of Chicago, Ill., for $673,200. The contract for rock and earth excav., Sect. 2, Plan B, Detroit River (bids opened Oct. 7) has been awarded to Grant Smith & Co. & Locker, of Thorice, Mich., for $1,578,440. The latter contract was awarded on combined sub-aqueous and cofferdam method. For detail bids received for this work, see issue of The Engineering Record of Oct. 19.

Blue Earth, Minn.—The Comrs. of Faribault County are reported to have decided to construct a steel dam at the outlet of Walnut Lake.

Minneapolis, Minn.—It is stated that bids will be received until Nov. 11 by Hugh R. Scott, Co. Aud., for constructing Ditch No. 9.
Local press reports state that bids will be received until Nov. 12 by the Municipal Bldg. Com. at the Court House for installing 4 passenger elevators in the court

Duluth, Minn.—The Pittsburg Coal Co., of Pittsburg, Pa., is reported to have decided to erect a coal dock of steel construction in Duluth, to cost about $1,000,000.

St. Peter, Minn.—H. W. Daniels, County Surveyor, writes that the proposed Rushmers ditch will cost about $25,000, but it will be about 6 months before all reports are in, or bids called for.

West Point, Miss.—Bids will be received until Nov. 12 by the Co. Houlka Drainage Comrs., West Point, for constructing a canal 12 miles long through Houlka Creek bottom, requiring 238,000 cu. yds. of dirt to be excavated. For further information address B. H. McFarland, Aberdeen.

**Lincoln, Neb.*—The Brodoesser Elevator Mfg. Co., 514 Commerce St., Milwaukee, Wis., is reported to have secured the contract for the installation of an elevator at the Orthopedic Hospital, for $3,040.

Newark, N. J.—The Common Council on Oct. 22 passed a resolution to submit to a vote of the people of this city the provisions of the Lane Dock Bill, under which the Bd. of Works proposes to expend $1,000,000 in the acquisition of water rights and the building of docks along Newark Bay, with a ship canal across the meadows to the uplands as part of the scheme.

Atlantic City, N. J.—See "Paving and Roadmaking."

Brooklyn, N. Y.—The following are the bids opened on Oct. 17 by the Park Board, N. Y. City, for furnishing material and constructing a rustic masonry boundary wall around Sunset Park, Boro. of Brooklyn: Bonacci & Vincelli Contrg. Co., $39,921; Chas. Cranford, $45,856; F. W. Carlin Contrg. Co., for 2,700 lin. ft. completed wall, $43,000; Danl. Douglass, $44,826; Bart Dunn, $42,398; John M. Fox, $39,571; Guidone & Galardi Co., $40,497; Richd. E. Heningham, $45,375; Haggerty Contrg. Co., $42,558; Kelly & Kelley, Inc., $48,642; Michael Marrone, $40,461; McHarg-Barton Co., 299 Bway., N. Y. City, $34,325; Thompson & Kelsey, $37,442, and J. M. Vosburgh, $52,020.

Buffalo, N. Y.—Seperate bids will be received until Nov. 14 by the Dept. Pub. Wks. (F. G. Ward, Com.), for the following: Constructing a dock at the stub end of the Clark & Skinner Canal, bet. Ohio St. and Buffalo River, as a berth for the fire boat. Constructing an overflow through Hertel Ave., 10 ft., 2-in. diam., from Cornelius Creek to Tonawanda St., and 9-ft., 10-in. from Tonawanda St. to Niagara River, passing through Erie Canal through a concrete culvert.

New York, N. Y.—The following are the bids opened on Oct. 24 by the Dept. of Parks for (*a*) 1,000 cu. yds. broken stone of trap rock, (*b*) 5,000 cu. yds. screenings of trap rock, (*c*) totals: Clinton Point Stone Co., *a* and *b* $2.33, c $13,980; Jacob E. Conklin, *a* and *b* $2.25, *c* $13,500.

New York, N. Y.—Bids will be received until Nov. 11 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for the general construction, etc., of a grandstand, etc., on the Athletic Field on Crotona Park North, Crotona Park, Boro. Bronx.
The only bid received and opened on Oct. 29 by Louis F. Haffen, Pres. Bronx Boro., for constructing anchorages for the concrete retaining walls and building drain at the Morris Heights approach to the bridge of the N. Y. C. & Hudson River R. R. was submitted by J. C. Rodgers at the following bid: 500 cu. yds. excav., $1; 500 cu. yds. fill., 30 cts.; 4,600 lin. ft. piles, 40 cts.; 7 cu. yds. Class "A" concrete, $10; 70 cu. yds. Class "B" concrete, $6; 6,200 lin. ft. ⅞-in. steel wire cable, $1; 110 lin. ft. 16-in. c. i. pipe, $6; 18 lin. ft. 8-in. c. i. pipe, $5; 2 M ft. lumber, $50; total, $10,030.

Cincinnati, O.—We are informed that the only bid received and opened on Sept. 30 by Maj. J. G. Warren, Corps Engr., U. S. A., for constructing a dredge was submitted by the Fairbanks Steam Shovel Co., of Marion, for $9,700.

**Reading, Pa.*—The City Council on Oct. 28 awarded to Hawman Bros., of Reading, the contract for constructing Spring St. subway (bids opened Oct. 17) for $110,480.

Valley Forge, Pa.—The State Water Supply Comn. is reported to have approved the application of the Philadelphia & Reading Ry. Co. (Wm. Hunter, Ch. Engr., Philadelphia) to construct embankments to straighten the banks of Schuylkill River at Valley Forge.

Panama.—See "Power Plants, Gas and Electricity."

Panama.—Bids will be received by H. F. Hodges, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., until Nov. 12 for furnishing track-laying cars, journal jacks, motor, drain tile, iron, steel, rivets, chain, wire rope, etc., as per Circular No. 398.

Philadelphia, Pa.—Council's Com. on Commerce and Navigation on Oct. 17 referred with a favorable recommendation to the Finance Com. a bill appropriating $50,000 for the redredging of the ship channel in the Schuylkill River.
Council's Com. on Fairmount Park on Oct. 24 approved estimates submitted by the Park Comrs. for 1908 and sent it, with a favorable recommendation, to the Finance Com. The estimate is $1,054,029. The new items include $300,000 for the further extension of the Wissahickon boundaries of the park; improvements in the vicinity of Falls of Schuylkill, $25,000; laying out tennis grounds, constructing lockers, etc., $5,000; conduits for electric lights, $10,000; music pavilion and dining room at Belmont, $20,000; improving grounds and improvement of Zoological Garden, $30,000, and dredging Schuylkill River, $25,000. etc.
*Director of Public Health and Charities Neff, on Oct. 28, awarded to J. R. Wiggins & Co., for $34,125, a contract for building a brick and concrete conduit 6 x 6 ft. 9 in., 525 ft. long from power plant of new Municipal Hospital building to the scarlet fever ward, and to Chas. E. Monday a contract for a 6 x 3 ft. 3 in. conduit 1,525 ft. long from the power plant to smallpox pavilion at a cost of $37,362.

**Items marked thus give the names of parties awarded contract.*

Providence, R. I.—J. S. Packard & Son are reported to have secured the contract for dredging 35,000 cu. yds. of mud from Providence River, to form a channel connecting main channel of stream with its extensive wharfage property on Allens Ave., newly acquired, and this is said to be but the preliminary step in an extensive scheme which the General Chemical Co., of New York, has in contemplation for the enlargement of its facilities in this city. The company has completed purchase of property on West Side water front, north of Wm. M. Harris Co.'s property on Allen's Ave., and it is intended to erect there a large wharf to accommodate its shipping. At the same time large receiving tanks for mineral acids and chemicals will be built, and the property will be connected with the N. Y., N. H. & H. R. R. by spur tracks.

Newport, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., until Nov. 22, for dredging in Newport Harbor, as advertised in The Engineering Record.

Ft. Sumter, S. C.—Bids will be received until Nov. 21 by J. M. Fulton, Q. M., U. S. A., Ft. Moultrie, S. C., for constructing a wharf at Ft. Sumter.

Charleston, S. C.—Bids will be received by the Bureau of Yards and Docks, Navy Dept. (R. C. Hollyday, Ch.), Washington, D. C., until Nov. 16 for constructing a reinforced concrete wooden pile and timber deck pier at the U. S. Navy Yard, Charleston, S. C., as per Specification No. 1,565.

The only bid received and opened on Oct. 25 at the office of Capt. E. R. Stuart, Corps Engrs., U. S. A., for the construction of the hydraulic dredge to be delivered at Georgetown for use in deepening Congaree River was submitted by the Ellicott Machine Co., of Baltimore, Md., for $47,900.

Memphis, Tenn.—Bids will be received by Capt. Wm. D. Connor, Corps Engrs., U. S. A., until Nov. 25 for about 190,000 cu. yds levee work and 40,000 cu. yds. drainage ditch in Upper St. Francis Levee Dist., as advertised in The Engineering Record.

Galveston, Tex.—Bids will be received until Nov. 21 by Capt. John C. Oakes, Corps Engrs., U. S. A., Galveston, for dredging through Turtle Cove between Aransas Pass and Corpus Christi Bay, as advertised in The Engineering Record.

Bids will be received until Nov. 21 by Capt. John C. Oakes, Corps Engrs., U. S. A., Galveston, for jetty work at Aransas Pass, Tex.

Spokane, Wash.—Bids will be received until Dec. 16 by Robt. Fairley, City Compt., for $100,000 park improvement bonds.

Wausau, Wis.—Bids will be received until Dec. 3 by the Comrs. of the Dancy Drainage Dist. (Geo. H. Reynolds, Chmn.), at the office of the Clk. of the Circuit Court, at Wausau, for constructing a main ditch and all its branches. Specifications, etc., may be procured from the Harman Eng. Co., 109 S. Jefferson Ave., Peoria, Ill.

Eau Claire, Wis.—Press reports state that the special committee appointed several months ago to look up and submit a report on the proposed Shawtown dam and bridge are about ready to report; the proposed bridge and dam will, it is said, cost between $50,000 and $60,000.

Toronto, Ont.—Local press reports that contract for extension of breakwater on south side of island has been cancelled and new bids will be called for. A new plan is reported to have been approved by which, instead of extending the breakwater 1,000 ft. further west, a series of groynes will be built about 100 ft. into the water and 300 ft. apart, extending as far west as the water works pumping station. E. Coatsworth, Mayor, is Chmn. Bd. of Control.

PROPOSALS OPEN.

For Proposals see pages 80, 82, 84 and 87.

WATER.

Bids Close. — See Eng. Record.

Nov. 4. Engine, etc., Philadelphia, Pa. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 5. System, Las Animas, Colo...........Oct. 12
Nov. 5. Boiler, etc., Oceanside, Cal...........Oct. 19
Nov. 7. Improv. water system, Chilocco, Okla..Oct. 19
Nov. 9. Water extension, Hobart, Okla. ......Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 10. Well, Huntington, Ore. ....Nov. 2
Nov. 11. Well, Ft. Terry, N. Y.................Oct. 19
Nov. 11. Pipe, etc., Lewiston, Idaho............Nov. 2
Nov. 11. Standpipe, Trenton, Neb. ....Nov. 2
Nov. 12. Pipe, Atlanta, Ga.....................Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 12. System, Velva, N. D. ....Oct. 26
Nov. 13. Improv. at pump. station, New York, N. Y...............................Nov. 2
Nov. 14 Pump house, Ft. Morgan, Ala........Oct. 20
Adv. Oct. 26, Nov. 2.
Nov. 14. Main, Ft. Mackenzie, Wyo. ....Nov. 2
Nov. 15. Pipe, Winnipeg, Man.................Oct. 5
Adv. Oct. 5 to 19 and Nov. 2.
Nov. 25. Pumps, Atlanta, Ga. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 25. Pumping engine, Atlanta, Ga.........Oct. 26
Adv. Oct. 26, Nov. 2
Nov. 28. Tank and trestle, Ft. Morgan..........Nov. 2
Adv. Nov. 2.
Dec. 1. **Water wks., Shelley, Idaho. ....Sep. 28**
Dec. 1. Pipe, etc., Phoenix, Ariz. ....Oct. 12
Adv. Oct. 5 to 26.
Dec. 17. Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19...............Oct. 12
—— Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Nov. 2.......Sep. 28
—— Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to Nov. 2........Oct. 12
——. Reservoir, etc., Blackstone, Va.........Oct. 19

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 5. Girard, O.......................Nov. 2
Nov. 5. Trenton, N. J. ....Oct. 26
Nov. 6. Brooklyn, N. Y. ....Nov. 2
Nov. 6. Akron, O. ....Nov. 2
Nov. 7. White Plains, N. Y. ....Oct. 19
Adv. Oct. 19 to Nov. 2.
Nov. 7. Hattiesburg, Miss. ....Oct. 26
Nov. 7. Youngstown, O. ....Oct. 26
Nov. 9. Chagrin Falls, O. ....Oct. 26
Nov. 9. Hobart, Okla. Adv. Oct. 26, Nov. 2...Oct. 26
Nov. 9. Des Moines, Ia. ....Nov. 2
Nov. 11. Pensacola, Fla......................Oct. 19
Nov. 11. Long Island City, N. Y...............Nov. 2
Nov. 11. North Milwaukee, Wis. ....Nov. 2
Nov. 11. Lancaster, Pa. Adv. Nov. 2..........Nov. 2
Nov. 15. Boston, Mass. Adv. Oct. 26..........Oct. 26
Nov. 20. Springfield, O. Adv. Nov. 2..........Nov. 2
Nov. 25. Canton, O. ....Nov. 2
Dec. 2. Cadillac Mich. Adv. Oct. 19, 26...Oct. 19
Dec. 3. Auburn, N. Y. Adv. Oct. 19 to Nov. 2.Oct. 19
Dec. —. Ventura, Cal. ....Nov. 2
Jan. 15. Manila, P. I. Adv. Oct. 26 to Nov. 2..Oct. 26

BRIDGES.

Nov. 5. Vincennes, Ind......................Oct. 19
Nov. 5. Sundance, Wyo. ....Oct. 26
Nov. 5. Marion, Ind. ....Nov. 2
Nov. 6. Muncie, Ind. ....Nov. 2
Nov. 6. Memphis, Tenn........................Nov. 2
Nov. 6. Thief River Falls, Minn..............Nov. 2
Nov. 7. Mauch Chunk, Pa......................Oct. 19
Nov. 8. Redding, Cal. ....Oct. 19
Nov. 8. Webster, Pa. ....Oct. 26
Nov. 8. Carman, Man. ....Oct. 26
Nov. 9. Richmond, Ind. ....Oct. 26
Nov. 9. Centralia, Wash. ....Nov. 2
Nov. 11. Wharton, Tex. Adv. Oct. 26, Nov. 2..Oct. 26
Nov. 12. Troy, O. ....Oct. 12
Nov. 15. **Glendive, Mont. Adv. Sep. 28 to Oct. 12.Sep. 28**
Nov. 15. Portland, Ore. ....Oct. 19
Nov. 15. Mill Run, Pa. ....Nov. 2
Nov. 20. Georgetown, S. C. ....Nov. 2
Nov. 29. West Bethlehem, Pa. ....Oct. 26
Nov. 29. Portland, Ore. ....Nov. 2
Dec. 31. Canton, China. Adv. Oct. 26, Nov. 2..Oct. 26
Dec. —. Ventura, Cal. ....Nov. 2

PAVING AND ROAD MAKING.

Nov. 5. Vincennes, Ind.......................Oct. 19
Nov. 5. Wilmington, Del. ....Nov. 2
Nov. 5. Toronto, Ont. ....Nov. 2
Nov. 5. Belleville, N. J. ....Nov. 2
Nov. 5. Newburgh, N. Y. ....Nov. 2
Nov. 5. Davenport, Ia. ....Nov. 2
Nov. 6. Cleveland, O.........................Oct. 12
Nov. 6. Brooklyn, N. Y.......................Oct. 26
Nov. 6. Kokomo, Ind. ....Oct. 26
Nov. 6. Ft. Wright, Wash. ....Oct. 26
Nov. 6. Wethersfield, Conn. ....Nov. 2
Nov. 6. Thief River Falls, Minn................Nov. 2
Nov. 7. Rockville, Ind.........................Oct. 19
Nov. 7. Redding, Cal. ....Oct. 19
Nov. 7. Youngstown, O. ....Oct. 26
Nov. 7. Memphis, Tenn. ....Nov. 2
Nov. 7. New York, N. Y.........................Nov. 2
Nov. 7. Chicago, Ill. ....Nov. 2
Nov. 9. Hobart, Okla. Adv. Oct. 26, Nov. 2....Oct. 26
Nov. 9. Bellingham, Wash. ....Nov. 2
Nov. 11. Atlantic City, N. J. Adv. Nov. 2........Nov. 2
Nov. 11. Camden, N. J. ....Nov. 2
Nov. 12. Troy, O. ....Oct. 12
Nov. 12. Denton, Md............................Oct. 26
Nov. 13. Brooklyn, N. Y. ....Nov. 2
Nov. 14. New York, N. Y. ....Nov. 2
Nov. 14. Cedar Rapids, Ia. ....Nov. 2
Nov. 15. Pensacola, Fla. Adv. Oct. 19, 26....Oct. 19
Nov. 15. Davenport, Ia. ....Oct. 26
Nov. 15. Cincinnati, O. ....Oct. 26
Nov. 18. Brookhaven, Miss. ....Oct. 26
Nov. 18. Albany, N. Y. Adv. Nov. 2.............Nov. 2
Nov. 20. Hot Springs, Ark. ....Nov. 2
Nov. 21. Greenville, Tenn. Adv. Oct. 26.......Oct. 26
Nov. 21. Albany, N. Y. Adv. Nov. 2.............Nov. 2
Nov. 25. Columbia, S. C. Adv. Nov. 2...........Nov. 2
Nov. —. Tacoma, Wash. ....Oct. 26
Dec. 3. Monticello, Ind. ....Nov. 2
Dec. 3. Palatka, Fla. ....Nov. 2
Dec. 6. Salt Lake City, Utah.................Oct. 19
Adv. Oct. 19 to Nov. 2.
Dec. 13. **Valparaiso, Ind. ....Sep. 7**
Dec. —. Ventura, Cal. ....Nov. 2
—— **York, Pa. ....Sep. 7**
—— Ithaca, N. Y. Adv. Oct. 19...........Oct. 12
—— Ft. Worth, Tex........................Nov. 2

POWER PLANTS, GAS AND ELECTRICITY.

Nov. 7. Pittsburg, Pa. ....Nov. 2
Nov. 8. **Kokomo, Ind. ....Oct. 5**
Nov. 8. Minneapolis, Minn. ....Oct. 26
Nov. 9. **Las Animas, Colo. ....Sep. 28**
Nov. 9. Key West Barracks, Fla. ....Oct. 26
Nov. 12. Panama ....Nov. 2
Nov. 12. Chico, Cal. ....Oct. 26
Nov. 12.—Washington, D. C. ....Nov. 2
Nov. 14. Cincinnati, O. ....Oct. 19
Nov. 15. **Charleston, S. C. ....Sep. 14**
Nov. 18. Newburg Heights, O....................Nov. 2
Nov. 19. Panama ....Nov. 2
Nov. 19. Washington, D. C. ....Nov. 2
Dec. 1. Montreal, Que.........................Oct. 26
—— Hendersonville, N. C. ....Nov. 2

BUILDINGS.

Nov. 5. **Court house plans, Houston, Tex......Aug. 31**
Adv. Sep. 14 to Oct. 26.
Nov. 5. **Barrack bldg., Portland, Me..........Oct. 5**
Adv. Oct. 5 to 26.
Nov. 5. **Post Office, Flint, Mich...............Oct. 5**
Adv. Oct. 5, 12.
Nov. 5. Barracks, etc., New Orleans, La......Oct. 19
Nov. 5. Pub. bldgs., Marion, Ind. ....Nov. 2
Nov. 5. Armory, Strathroy, Ont. ....Oct. 26
Nov. 5. P. O. alterations, Toronto, Ont........Nov. 2
Nov. 6. Jail, Luverne, Ala....................Oct. 26
Nov. 6. Painting pub. bldg., Chicago, Ill.......Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 6. Remodeling bus. bldgs., Zanesville, O...Nov. 2
Nov. 6. Pub. bldg., Chicago, Ill. ....Nov. 2
Nov. 6. Pub. bldg., Polk, Pa. ....Nov. 2
Nov. 6. School, Prospect Park N. J. ....Nov. 2
Nov. 6. Church, South River, N. J.............Nov. 2
Nov. 7. Pub. bldg., National Soldiers, Home, Va. ....Nov. 2
Nov. 7. Jail, Winston-Salem, N. C.............Nov. 2
Nov. 7. Plans for pub. bldg., Pittsburgh, Pa...Nov. 2
Nov. 8. Barracks, Ft. Stevens, Ore. ....Oct. 26
Nov. 9. School, Mansfield, La..................Oct. 26
Nov. 9. School, Syracuse, N. Y. ....Nov. 2
Nov. 10. Bus. bldg., La Grange, Ill.............Oct. 26
Nov. 11. Rest pavilion, etc., Atlantic City, N. J..Oct. 26
Adv. Oct. 26
Nov. 11. Plumbing, pub. bldg., Pensacola, Fla...Oct. 19
Nov. 11. School, Cincinnati, O. ....Oct. 19
Adv. Oct. 19 to Nov. 2.
Nov. 11. Pub. bldg., New Orleans, La..........Oct. 26
Nov. 11. Htg. school, Brooklyn, N. Y. ....Nov. 2
Nov. 12. School, Seattle, Wash. ....Oct. 12
Nov. 12. Schools, Pipestone, Minn.............Oct. 19
Nov. 12. Pub. bldg., Parsons, Kan. ....Nov. 2
Nov. 12. Y. M. C. A. bldg., Steubenville, O......Nov. 2
Nov. 12. Armory, Hillsboro, N. D. ....Nov. 2
Nov. 12. School, Down, Kan. ....Nov. 2
Nov. 12. Brick for pub. bldg., Washington, D. C.Nov. 2
Nov. 13. Pub. bldg., Central Islip, N. Y. ....Nov. 2
Nov. 14. School, Jersey City, N. J.............Oct. 19
Nov. 14. New industrial plants, Ft. Morgan, Ala.Oct. 26
Adv. Oct. 26.
Nov. 14. Armory Pine Grove, Pa. ....Nov. 2
Nov. 15. **Pub. bldg., Chippewa Falls, Wis.......Oct. 5**
Nov. 15. Y. M. C. A. bldg., Tampa, Fla.......Oct. 19
Nov. 15. School, Superior, Wis. ....Oct. 26
Nov. 15. Y. M. C. A. bldg., Chattanooga, Tenn..Nov. 2
Nov. 15. Htg. hospital, Ft. D. A. Russell, Wyo..Nov. 2
Nov. 15. Bus. bldgs., Columbus, O. ....Nov. 2
Nov. 16. New indus. plant, Washington, D. C...Oct. 26
Nov. 16. Indns. plant, Las Animas, Colo.........Nov. 2
Nov. 18. Add. to pub. bldg., Los Angeles, Cal..Nov. 2
Nov. 19. Post bldgs., Jefferson Barracks, Mo....Oct. 26
Nov. 19. Bus bldg., Lawton, Okla................Nov. 2
Nov. 19. School, Mescalero, N. M. ....Nov. 2
Nov. 20. Plumb. work, pub. bldg., Ft. Monroe, Va.Nov. 2
Nov. 20. Pub. bldg., Columbus, O. ....Nov. 2
Nov. 21. **Bus. bldg., Auburn, N. Y............Oct. 5**
Nov. 21. Pub. bldgs., Greenville, Tenn.........Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 22. Post office, Portsmouth, Va...........Oct. 19
Adv. Oct. 19, 26.
Nov. 25. Exten. to post office, Tyler, Tex.......Oct. 19
Nov. 25. Jail, Franklin, W. Va. ....Nov. 2
Nov. 29. Post Office, Marion, Ind...............Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. —. **University gymnasium, Madison, Wis...Oct. 5**
Nov. —. School, Allegheny, Pa..................Oct. 19
Nov. —. School, Washington, D. C. ....Nov. 2
Dec. 2. Foundations, etc., P. O. bldg., Devils Lake, N. D. Adv. Nov. 2................Nov. 2
Dec. 3. Post Office, Nevada, Mo...............Oct. 26
Dec. 5. Post Office, Waldoboro, Me............Nov. 2
Dec. 9. Pub. bldg., Wernersville, Pa. ....Nov. 2
Dec. 10. School, Alpine, Tex. ....Nov. 2
Dec. 10. Bus. bldg., Jacksonville, Fla. ....Nov. 2
Dec. 17. Exten. to post office, Detroit, Mich....Nov. 2
Dec. 31. Church, Falls City, Neb. ....Oct. 26
Dec. —. **Industrial plants, Ft. William, Ont...May 11**
Dec. —. **School, Anderson, Ind. ....Sep. 28**
Dec. —. Fire house, Ventura, Cal. ....Nov. 2
Feb. 1. **Plans for Capitol, San Juan, P. R.....Sep. 28**
Feb. 1. Court house and jail, Cairo, Ga.......Oct. 26
Feb. —. College, Agricultural College, Mich....Oct. 19
—— Industrial plant, Hubbard City, Tex...Oct. 26

MISCELLANEOUS.

Nov. 5. Supplies, Washington, D. C..........Oct. 26
Nov. 6. Dock, Rye, N. Y. ....Oct. 26
Nov. 6. Dredging, Brooklyn, N. Y.............Oct. 26
Nov. 7. Levee work, New Boston, Ill..........Oct. 19
Nov. 7. Fence, Ft. Des Moines, Ia. ....Oct. 26
Nov. 8. Cement, etc., Panama..................Oct. 19
Nov. 9. **Crematory, Las Animas, Colo..........Sep. 28**
Nov. 11. Torpedo Cases, Ft. Totten, N. Y.......Oct. 19
Adv. Oct. 19 to Nov. 2.
Nov. 11. Ditch, Prophetstown, Ill. ....Oct. 26
Nov. 11. Car wheels, etc., Panama..............Nov. 2
Nov. 11. Ditch, Minneapolis, Minn...............Nov. 2
Nov. 11. Drainage conduits, Atlantic City, N. J..Nov. 2
Adv. Nov. 2.
Nov. 11. Grandstand, New York, N. Y. ....Nov. 2
Nov. 12. Supplies, Washington, D. C............Nov. 2
Nov. 12. Track laying cars, etc., Panama.......Nov. 2
Nov. 12. El ry. franchise, Ventura, Cal.........Nov. 2
Nov. 12. Levee, Pine Bluff, Ark, ...Nov. 2
Nov. 12. Canal, West Point, Miss. ....Nov. 2
Nov. 12. Embankment wk., Lawrenceburg, Ind..Nov. 2
Adv. Nov. 2.
Nov. 12. Elevators, Minneapolis, Minn. ....Nov. 2
Nov. 14. Monument, Chalmette, La...............Oct. 12
Adv. Oct. 12 to Nov. 2.
Nov. 14. Docks, etc., Buffalo, N. Y............Nov. 2
Nov. 15. **Pub. bldg., Chippewa Falls, Wis.......Oct. 5**
Nov. 15. Dredging, Philadelphia, Pa...........Oct. 19
Adv. Oct. 19 to Nov. 2.
Nov. 16. Pier, Charleston, S. C. ....Nov. 2
Nov. 16. Levee work, Pine Bluff, Ark...........Oct. 19
Adv. Oct. 19 to Nov. 2.
Nov. 18. Locks and dams, Dallas, Tex...........Oct. 12
Adv. Oct. 12 to 26.
Nov. 18. Hoisting engines, etc., Portland, Ore..Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 18. Removal of wreck, Boston, Mass......Nov. 2
Nov. 19. Supplies, Washington, D. C. ....Nov. 2
Nov. 20. **Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 19.........Sep. 28**
Nov. 20. Rock and earth excavation, Detroit, Mich. Adv. Oct. 12, 19.................Oct. 12
Nov. 20. Breakwaters, Ludington, Mich. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 20. Dredging, Muskegon, Mich. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 21. Dredging, Galveston, Tex..............Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 21. Dredging, Mobile, Ala. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 21. Wharf, Ft. Sumter, S. C. ....Nov. 2
Nov. 21. Jetty work, Galveston, Tex. ....Nov. 2
Nov. 22. Dredging, Newport, R. I. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 25. **Locks, etc., Mobile, Ala...............Sep. 28**
Adv. Sep. 28 to Nov. 2.
Nov. 25. Dredging, Mattituck, N. Y. ....Oct. 26
Adv. Oct. 26, Nov. 2.
Nov. 25. Levee work, Memphis, Tenn........Nov. 2
Adv. Nov. 2.
Dec. 3. Ditch work, Wausau, Wis.............Nov. 2
Dec. 4. Garb. disp., Altoona, Pa. Adv. Nov. 2..Nov. 2
Dec. 11. El. ry franchise, New Orleans, La....Oct. 26
—— **Lease of limestone quarries, Newark, N. J. Adv. Oct. 5...........................Oct. 5**
—— R. R. work, St. Louis, Mo. ....Nov. 2

CURRENT NEWS SUPPLEMENT

NOVEMBER 9, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting November 20, 1907. Paper on the Reinforced Concrete Work of the McGraw Building.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York. Annual meeting, New York, Dec. 3-6, 1907. Next meeting November 12, 1907. Paper on Gearless Traction Electric Elevators.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

PROPOSED INVESTIGATION OF STEEL AND STRUCTURAL MEMBERS.

An increased appropriation has been made available for the current fiscal year for the extension of the work carried on in the past at the Watertown Arsenal in the investigation of the properties of materials of construction. It is proposed to conduct this investigation along lines of the greatest practical value to users as well as manufacturers of materials. In the experimental study of steel and steel products it is proposed to begin with the metal in the ingot and thence to follow it out to the finished sections and to built members.

By authority of the Ordnance Department, Mr. William R. Webster, Consulting Engineer, and Mr. Edgar Marburg, Professor of Civil Engineering at the University of Pennsylvania, have been engaged to co-operate in the preparation of the program of tests, and in the prosecution of the work. A meeting attended, at their invitation, by about twenty-five consulting engineers and representatives of leading consuming and manufacturing interests was recently held at the Engineers' Club, New York City, for the purpose of meeting Major C. L. H. Ruggles, Commanding Officer, Watertown Arsenal, and Mr. J. E. Howard, in charge of the Watertown Testing Laboratory, with a view of determining the most desirable program for the initiation of the proposed investigation. This meeting was held in two sessions.

One session, presided over by Dr. Charles E. Dudley, Chemist, Pennsylvania Railroad, was devoted to a discussion of metallurgical questions applying to ingot structure, blooms, billets, slabs and forgings, and it was the sense of the meeting that it was desirable to make a study of these questions a special feature of the proposed work.

The second session, at which Mr. J. V. W. Reynders, Vice-President, Pennsylvania Steel Company, presided, was devoted to the consideration of a preliminary program for tests of structural members, including columns, riveted tension members, riveted splices, riveted connections in building construction and the general subject of riveting.

At the opening of the meeting Major C. L. H. Ruggles, Commanding Officer, U. S. Watertown Arsenal, explained that the work was not to be regarded in any sense a government investigation of steel, but that it was the desire of the Ordnance Department to utilize the increased appropriation with a view not only to the needs of the Government, but also to making the results as valuable as possible to all persons interested in the subject of steel, whether as consulting engineers or as representatives of consuming or manufacturing interests.

Mr. J. E. Howard, in charge of the Testing Laboratory at Watertown Arsenal, presented in abstract his report to the Ordnance Department in which attention was drawn to the desirability of making provision for the extension of the usefulness of the Testing Laboratory, and indicating in detail numerous lines of research that might be taken up to advantage.

It was the sense of the meeting that the extension of the testing facilities in this country had not kept pace with the advance in engineering construction, and a resolution was adopted by unanimous vote that the enlargement of the present facilities at the U. S. Watertown Arsenal by the erection of a testing machine of at least 10,000,000 pounds capacity was desirable. It was also decided to authorize the Chairman, Dr. Charles B. Dudley, to appoint two committees, subject to the approval of the Watertown authorities, one on Ingot Structure, Billets, Blooms, Slabs and Forgings, and the other on Tests of Structural Materials. These committees have since been appointed and much preliminary work has already been accomplished, which will be submitted at an early date to the engineering profession for criticism and suggestions.

THE STANDARD RAIL REPORT OF THE AMERICAN RAILWAY ASSOCIATION.

At the fall session of the American Railway Association held in New York on Oct. 30, the Committee on Standard Rail and Wheel Sections presented a progress report which was referred back to the committee with instructions to investigate further, and with authority to employ experts for this investigation. The committee made no express recommendations though the suggestions which it made were, in the main, concurred in. Special attention was called by the committee to the disputed percentage of discard from the ingot, and it is understood that in the further investigations special attention will be given to this point in order to reach a specification satisfactory to the railroads and the manufacturers.

SEPTEMBER EXCAVATION, ISTHMIAN CANAL.

The grand total of all excavation during September was 1,517,412 cu. yd. For the first time since United States control the million and a half limit was passed. Of the 1,517,412 cu. yd., 1,481,307 were taken from the canal prism. The Auugst total from the prism was 1,274,404 cu. yd., or 206,903 cu. yd. less than the September total. There were three less working days in September than there were in August, and the rainfall at nearly all points along the line was heavier than last year. At Empire, Culebra, Rio Grande and La Boca the rainfall was very much heavier, ranging from a half greater to more than twice as great. The excavation in detail is appended:

EXCAVATION BY STEAM SHOVELS.

Locality.	From Canal Prism.	From Accessory Works.	Total Excavation.
Culebra Division	753,288 cu. yd.	180 cu. yd.	753,468 cu. yd.
Mindi	28,837	...	28,837
Chagres Division	21,546	2,200	23,746
Gatun, locks.	87,423	...	87,423
Gatun, spillway	36,315	...	36,315
La Boca, locks	5,431	...	5,431
Total ...	932,840	2,380	935,220

The accompanying table shows the work performed in the Culebra Cut during the month as compared with the month of September, 1906:

SUMMARY OF WORK ON CULEBRA CUT DURING SEPTEMRER.

Period.	Total Excavation by Steam Shovels. Cu. yd.	Classification. Rock.	Classification. Earth.	Shovels at Work.	Work'g Days.	Excavation per Shovel. Cu. yd.	Railfall During Month. In.
Sep., 1906.	291,452	64%	36%	21.33	24	13,664	6.82
Sep., 1907.	749,529	70%	30%	38.50	24	19.468	11.12

The steam shovels which made the highest record for the month of September, 24 working days were as follows:

Class.	No.	Earth.	Rock.	Total.
95-ton	207	11,284 cu. yd.	16,927 cu. yd.	28,211 cu. yd.
	202	13,485	13,486	26,971
70-ton	122	2,912	21,370	24,282
	110	......	17,497	17,497
		27,681	69,280	96,961

EXCAVATION BY DREDGES.

Locality.	Canal Prism.	Accessory Wks.	Total Excav.
Colon Division	403,842 cu. yd.	17,000 cu. yd.	420,842 cu. yd.
La Boca Division	144,625	9,350	153,975
Do. ..	....	7,375	7,375
Total ..	548,467	33,725	582,192

During the month four dredges were in operation on the Colon Division, three of which worked in the Canal prism and the fourth outside of the prism. The amount and character of material removed by each dredge are as follows:

Dredges.	Material.	Amout. Place Measurement.
1 5-yard dipper dredge.......	Soft	17,000 cu. yd.
1 old French ladder dredge...	....	132,101
1 16-in. suction dredge.......	Soft	10,968
1 sea-going suction dredge ("Ancon")	Soft	260,773
		420,842

ENTIRE CANAL.

How Excavated.	Canal Prism.	Accessory Works.	Total Excavation.
By steam shovels	932,840 cu. yd.	2,380 cu. yd.	935,220 cu. yd.
By dredges.	548,467	33,725	582,192
Total ..	1,481,307	36,105	1,517,412

A NEW YORK ENGINEERING LIBRARY TO OPEN EVENINGS.

Since Nov. 6, the reference libraries of The American Institute of Electrical Engineers, The American Society of Mechanical Enginees, and The American Institute of Mining Engineers, 29 West 39th St., New York, have been open evenings until nine o'clock, and this will continue to be the case on all week days except public holidays. These libraries, constituting practically one library of engineering, situated near the New York Library, in the new headquarters of the Engineering Societies are available to members of the above societies, engineers, and the public generally, subject to proper regulations. Strangers are requested to bring letters of introduction from members or to secure cards fom the secretaries of the respective societies.

PERSONAL NOTES.

Mr. J. B. Hodgdon has been appointed city engineer of Joplin, Mo.

Prof. William B. Clark, chief of the Maryland State Geological Survey, returned recently from a tour of Europe.

Mr. J. W. Budd, formerly city engineer of Des Moines, Ia., has opened an office for private practice in that city.

Mr. J. C. Newsom, architect, San Francisco, Cal., has been appointed a member of the California State Board of Architects.

Mr. Charles A. Ingersoll, of Medina, N. Y., has been appointed a resident engineer on the New York State barge canals, with headquarters at Medina.

Mr. John W. Young has resigned as general European manager of the Allis-Chalmers Co. and will return to the United States about the first of December.

The Municipal Civil Service Commission of New York will hold examinations Dec. 17 and 19 of candidates for positions as structural steel or topographical draftsmen.

Mr. Robert Lindenthal has resigned as manager of the Arthur Koppel Co., and will establish himself in Berlin, Germany, as a representative of American manufacturing firms.

Mr. Arthur F. Ballou has been appointed superintendent of water-works of Woonsocket, R. I., succeeding Mr. E. W. Kent, whose resignation was noted recently in these columns.

Mr. H. Holbert Porter, of the firm of Sanderson & Porter, engineers, New York City, has been appointed consulting engineer to the Interborough-Metropolitan Co. of the same city.

Civil Engineer P. L. Reed, U. S. N., has been transferred from the Bureau of Yards and Docks to the works of the General Electric Co., Schenectady, N. Y., for special temporary duty.

Mr. E. F. Robinson, assistant engineer of track of the Buffalo, Rochester & Pittsburg Ry., has been appointed chief engineer of the line, succeeding Mr. J. M. Floesch, who recently resigned.

The Board of Water Supply of New York City has appointed Messrs. York and Sawyer, of that city, as its consulting architects, and Mr. Charles W. Leavitt, Jr., as its consulting landscape architect.

At a meeting of the board of directors of the Pennsylvania R. R. Co., Oct. 23, Mr. Percival Roberts, Jr., formerly head of the Pencoyd Iron Works, was elected a director to succeed the late A. M. Fox.

Mr. W. D. Taylor, chief engineer of the Chicago & Alton R. R., has been appointed chief engineer of the Toledo, St. Louis & Western R. R. also, the two roads now being controlled by the same interests.

W. S. Whiting, a civil engineer, who in 1901 took part in the organization of the Brown-Corliss Engine Co., died Nov. 2, at Racine, Wis., as the result of a recent railroad accident in which he lost both legs.

Capt. Lytle Brown, Corps of Engineers, U. S. A., on temporary duty in the office of the Chief of Staff, has been ordered to join the second battalion of engineers, stationed at Washington Barracks, Washington, D. C.

Mr. John S. Henderson, Jr., formerly connected with the Westinghouse Electric & Manufacturing Co., in the Baltimore offices of that company, has opened an office at Salisbury, N. C., as a consulting electrical and mechanical engineer.

The Pittsburgh Automatic Vise & Tool Co., Pittsburgh, Pa., have under way a shipment of "Pittsburgh" vises amounting to $5,000, consigned to a large manufacturing plant in England. They report an extensive volume of export business.

The New York State Civil Service Commission will hold examinations Nov. 30, of candidates for positions as assistant civil engineer in the State Engineer's Department; and electrical engineer and gas engineer to the Public Service Commissions.

Messrs. James A. Fairleigh, George H. Cushman, L. B. Lockwood, H. C. Beck and D. W. Hughes have applied for a charter for the Cushman-Fairleigh Engineering Co., Chattanooga, Tenn. The firm will engage in a general engineering business.

Mr. C. F. Muralt, of the firm of Muralt & Co., consulting engineers, 114 Liberty St., New York City, has been appointed to fill the newly-created chair of applied electrical engineering at the University of Michigan. He will continue in active practice.

Mr. Felix F. Wiener has resigned as vice-president and treasurer of Messrs. Henry Pels & Co., importers and manufacturers of punching and shearing machines, to become a partner in the International Electric & Engineering Co., 150 Nassau St., New York.

Mr. E. Stanley Field, formerly connected with Mr. Lewis E. Kitchen, of Chicago, and Mr. Henry M. Lilly, of Albemarle, N. C., have formed a partnership to conduct a general practice as architects and engineers, with offices in the Garrell Bldg., Wilmington, N. C.

Messrs. Allen Hazen, New York; Frederick P. Stearns, Boston, and Minard L. Holman, St. Louis, have been selected to represent the City of Denver on the board of appraisal which is to determine the value of the plant of the Denver Union Water Co., which the city is to acquire.

Prof. C. L. DeMuralt, of the electrical engineering department at the University of Michigan, has been appointed consulting engineer to the state railways of Austria in connection with the electrification of the Arlberg tunnel under the Tyrolean Alps. The tunnel is 7 miles long.

Mr. Nathaniel P. Craighill has been appointed professor of electrical and mechanical engineering at the University of Montana, Missoula, Mont. Prof. Craighill has had wide experience in electrical and mechanical engineering. At one time he was associate editor of the American Electrician.

Messrs. C. F. Chism, E. J. Pickwick, W. H. Van Wie, T. R. Ripley, F. J. Wagner, C. A. Ingersoll, T. J. Morrison, O. F. Bellows, F. C. Davis, E. Styring, J. A. O'Connor, C. H. McCullough and Herbert Spencer have been appointed resident engineers in the department of the New York State Engineer and Surveyor.

Mr. Clyde T. Griswold, superintendent of the Green Hill mine of the Canadian Copper Co., has been appointed professor of mining and metallurgy at Colorado College, Colorado Springs, Colo., succeeding Dr. Thomas T. Read, who is to be professor of metallurgy at the Imperial University, Tientsin, China. Professor Griswold is a graduate of Amherst College and Columbia University.

Mr. George S. Rice has resigned the position of chief engineer of the New York City Public Service Commission and Mr. Henry B. Seaman, consulting engineer to the Department of Bridges of the same city, has been appointed to fill the vacancy. Mr. Rice will continue in the service of the commission in charge of subway construction, with which he has been identified since the work began.

An investigation of deep wells for furnishing water supplies to small towns in the Atlantic Coast region is now being carried on by Dr. G. McCarthy, biologist of the North Carolina Board of Health, whose offices are at Raleigh. He is particularly desirous of securing information concerning artesian or deep well waters polluted by sewage or other surface material liable to convey typhoid fever germs. Water works engineers who have information along this line are requested to communicate it to Dr. McCarthy.

Mr. Orville H. Ensign, electrical and mechanical engineer in charge of electrical and pumping problems on the Pacific Coast for the United States Reclamation Service, has been appointed to succeed Prof. Dugald C. Jackson as head of the department of electrical engineering at the University of Wisconsin. Prof. Ensign has had a wide experience in the electrical profession. His early training, subsequent to his college work, was had in the service of the General Electric Co. and other Eastern concerns. In 1893 he moved to the Pacific Coast where he has since maintained a practice largely of a consulting nature.

At the quarterly meeting of the Massachusetts Highway Association at the American House, Boston, on Nov. 12, papers will be read by Messrs. John A. Pettigrew, superintendent of parks of Boston; John R. Rablin, engineer of the Metropolitan Park Commission of Boston; Frank C. Pillsbury, division engineer of the Massachusetts Highway Commission; Charles W. Ross, of the Newton Street Commission; George Kimball, superintendent of streets of Manchester; Alm. D. Sohier, of Beverly; Benjamin P. Richardson, of Brookline, and A. B. Cowdery, of Boston.

Mr. Richard T. Laffin, vice-president and general manager of the Manila Electric Railroad & Light Co., has resigned, having completed the task of establishing the operating organization of this property. The management is now assumed by Mr. C. B. Graves, who has been Mr. Laffin's right-hand man since the property was placed in operation, three years ago, as manager of the lighting and power department. Mr. Laffin is still interested financially in the Manila properties. He resigns to take the management of another group of public utility properties in which Messrs. J. G. White & Co., Inc., are interested. Mr. Graves has had extended experience in the management of electrical properties in the tropics. Before becoming connected with the Manila Electric Railroad & Light Co., he was electrical engineer and assistant manager of the San Paulo Tramway Light & Power Co., San Paulo, Brazil.

BUSINESS NOTES.

The Hunt Engineering Co. has placed an order with the Lehigh Car Wheel & Axle Works, Catasauqau, Pa., for the necessary pulverizing machinery for the 2,000-bbl. plant (shale and limestone) being built at Chanute, Kan., for the Ash Grove Lime & Portland Cement. Co.

A small town in Southern Pennsylvania has a site which it will offer to a manufacturing industry employing from 50 to 75 men, and its citizens are prepared to raise at least $25,000 in financing an attractive project, a business already established being preferred. Full information can be obtained from Mr. Geo. W. Aubrey, attorney-at law, B. & B. Building, Allentown, Pa.

The Allis-Chalmers Co. has opened an office at Deadwood, S. D., with Mr. O. F. Purnell as district manager. Special attention will be given by Mr. Purnell and the members of his staff to the sale of mining, crushing, pumping, power and electrical machinery, many installations of which have been made by Allis-Chalmers Co. and its predecessors throughout that section of country.

The Expanded Metal & Corrugated Bar Co., Frisco Bldg., St. Louis, Mo., is furnishing the reinforcement required in the construction of the Pennsylvania Railway Terminal Station, Seventh to Ninth Aves. from 31st to 33d Sts., New York City. An order for one thousand tons of corrugated bars has been placed with the above company by the contractor, the National Fire Proofing Co. McKim, Mead & White are the architects for the station.

The Southwestern Bridge Co., Joplin, Mo., has received the following orders for structural steel work: Texas Central R. R., two through plate girder bridges for Waco, Tex.; structural steel for the Allen Bldg., Shreveport, La.; 100,000-gal. tank and tower for the St. Louis & San Francisco R. R., at Springfield, Mo.; four additional steel buildings for the Kansas Natural Gas Co., Independence, Kan.; bridges on the Joplin & Pittsburg Interurban R. R.

W. & B. Douglas, Middletown, Conn., have acquired the pump department of the Union Mfg. Co., of New Britain, Conn., and will continue the manufacture of the Union make of pumps at their Middletown plant. The two concerns have been competitors for about thirty years, but from now on the Union Mfg. Co. will confine its attention to lathe, planer and drill chucks. All of the patterns, tools and machinery for the pumps are in the hands of W. & B. Douglas, who can furnish all repair parts.

Mr. S. T. DeLaMater, formerly with the Standard Construction Co., Chicago, has been engaged by the General Fireproofing Co., and for the present is located at the home office in Youngstown, O. Mr. DeLaMater is a graduate of Cornell University, and through his connections with contracting firms has acquired a wide experience in reinforced concrete design and construction. Among his connections have been the Osborne Engineering Co., Cleveland, O., Paul F. P. Mueller, Falenau Construction Co., Standard Construction Co., Chicago, and L. P. & J. A. Smith Co., of Cleveland.

J. H. Wagenhorst & Co., manufacturers of electric blue printing machines, report the following partial list of recent sales: Eugene Dietzgen Co., Toronto, Canada; H. W. Caldwell & Son Co., Chicago, Ill.; Betts Machine Co., Wilmington, Del.; Green Fuel Economizer Co., Matteawan, N. Y.; Atlantic Terra Cotta Co., Tottenville, N. Y.; Kansas City Structural Steel Co., Argentine, Kan.; Sawyer & Garstin, Colorado Springs, Colo.; H. Vogt Machine Co., Louisville, Ky.; Toledo Machine & Tool Co., Toledo, O.; S. G. Fetterman Engineering Co., Johnstown, Pa.; American Locomotive Works, Schenectady, N. Y.; H. L. Sprague, Springfield, Mass.; R. M. Jones Co., Muscogee, I. T.; Ajax Forge Co., Chicago, Ill.

Among the noteworthy features of the textile industry, this fall, has been the ordering of steam turbines, of the improved type built by Allis-Chalmers Co., for installation in some of the large mills of New England and the Central and Southern States. Contracts recently awarded by textile manufacturers include three turbines for the new 10,000-h.-p. plant of the Pacific Mills, Lawrence, Mass., one of 2,200 h.-p. for the American Thread Company's Watuppa Mills, one of 3,000 h.-p. for the Tremont & Suffolk Mills, and machines of 800 h.-p. each for the Jamestown Worsted Mills and Cherry Cotton Mills. These turbines are of the same general type as the machines installed on the new liners "Lusitania" and "Mauritania."

The Sandusky Portland Cement Co., Sandusky, O., reports that Medusa waterproof compound was used in the following work: By the Atchison, Topeka & Santa Fe Ry. Co. in the concrete depot at Las Animas, Colo., and by the same railroad in their tie and timber treating plant at Albuquerque; in the Owen Office Building and Peninsular Bank Building, both in Detroit, Mich.; in the roof of the North Chicago Hardware Co.; in a concrete reservoir for the Knickerbocker Ice Co.; in the Chicago Junction Ry. Co. and Chicago & Northwestern Ry. Co. track elevation at Chicago. The compound has also been recommended by the engineer in charge for the new Phipps Natatorium being constructed in Pittsburg, this recommendation having been made after a series of tests.

The B. F. Sturtevant Co., through Mr. F. R. Chinnock, manager of the New York office, 114 Liberty St., reports the following sales of electric generating sets: Kiernan & Hughes Co., Jersey City, N. J., one 9 x 8 vertical engine, 30-kw. generator; Millard & McLean, New York City, one 4½ x 4½ vertical engine, 5-kw. generator; Henry Steers, Inc., New York City, one 4½ x 4½ vertical engine, 5-kw. generator, two 6 x 5 vertical engines, 7½-kw. generators; Sonora Co., New York City, three 10-h.-p. motors; Washburn Brothers Co., Saugerties, N. Y., 13 x 12 horizontal engine, 50-kw. generator, 20-h.-p. motor; Eberhard Faber Pencil Co., Brooklyn, N. Y., 16 x 14 horizontal engine, 100-kw. generator; Department of Water Supply, Babylon, L. I., 9 x 8 vertical engine, 40-kw. generator; Samuel Smith & Sons Co., Paterson, N. J., 16 x 14 horizontal engine, 100-kw. generator; Isidor Fajans, New York, 9 x 8 vertical engine, 30-kw. generator; Charles Hakemeyer Co., Paterson, N. J., 17½-kw. generator, three 5-h.-p. motors. The above are a few of the recent orders and illustrate the class of clientele using Sturtevant generating sets.

CONTRACTING NEWS
OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

**Los Angeles Cal.*—G. O. Newman, 226 Mercantile Pl., Consulting Engr., Beaumont Land & Water Co., writes that K. Simonds Co. have secured the contract for constructing irrigation plant, for $25,000. Engineer in charge, L. S. Preston, of Beaumont.

**Atlanta, Ga.*—The Water Bd. is reported to have on Oct. 29 awarded to the New York Continental Jewell Filtration Co., of New York, N. Y., the contract for a filter plant for $26,000 (bids opened Oct. 23).

Ashland, Ga.—This city is reported to have voted to issue $20,000 water works bonds.

Hazelhurst, Ga.—It is reported that the Council is preparing to establish a water system, estimated to cost $25,000.

Chicago, Ill.—Bids will be received until Nov. 12 by John J. Hanberg, Comr. Pub. Wks., for furnishing and delivering at the city pipe yards about 178 tons special castings.

Coweta, Ind. Ter.—It is reported that arrangements are being made to establish water works, estimated to cost $20,000.

Sapulpa, Ind. Ter.—J. A. Fulp, City Recorder, writes that engineer has not yet been selected to prepare plans for water works, for which it is proposed to issue $50,000 bonds.

Waterloo, Ia.—The citizens on Oct. 28 voted to purchase present water works or construct a municipal plant.

Garrison, Ia.—Press reports state that it is proposed to construct water works here.

Mt. Washington, Baltimore, Md.—The Mt. Washington Water Co. is reported to have secured a franchise to lay mains from Rogers Station, in the Green Spring Valley, to Mt. Washington, a distance of about 9 miles.

Milan, Mich.—We are informed that bonds are now being printed, to be used for the construction of water works and sewers.

Hildreth, Neb.—It is stated that bids are wanted until Nov. 25 for $10,000 water works bonds. A. L. Beck, Village Clk.

Wood River, Neb.—See "Power Plants, Gas and Electricity."

Kearney, Neb.—The citizens are reported to have voted to issue bonds for the construction of water works.

Santa Fe, N. M.—Bids will be received until Nov. 21 by Maj. M. Gray Zalinski, Q. M., U. S. A., Washington, D. C., for repairs to water supply and improvements at the Santa Fe (N. M.) Natl. Cemetery.

Alcove, N. Y.—The State Water Supply Comn. at Albany is reported to have granted to the Hannicroix Water Co., of Ravenna, permission to construct a reservoir at Alcove.

Spencerport, N. Y.—The Village Trus. are reported to have granted Melville T. Page, Geo. M. Cole and Berton W. Brown, of Spencerport, and P. F. Coleman and Dr. H. M. Roberts, of Herkimer, representing the Spencerport Water Co., a franchise to lay water mains and furnish this village with water and also for sewerage system.

Mt. Olive, N. C.—It is reported that an issue of $25,000 in bonds has been voted for a water supply.

Wilmington, N. C.—C. R. Humphreys, City Engr., writes that the citizens have voted to issue $500,000 for water works and a sewerage system.

Local press reports state that the city has not yet definitely decided to purchase the present water works.

Grand Forks, N. D.—Bids will be received until Nov. 14 by the City Council for constructing water mains in portions of Pakenham and Ione Aves. W. V. O'Connor, City Aud.

Pleasant Ridge, O.—The City Council is reported to have decided to lay water mains to the city limits of Cincinnati.

Barnesville, O.—Bids will be received until Nov. 18 by the Bd. Co. Comrs. at the office of A. W. Beaty, Co. Aud., for furnishing material and installing a complete penumatic water system in the Co. Children's Home, near Barnesville.

Lakewood, O.—Bids will be received until Nov. 18 by B. M. Cook, Village Clk., for furnishing material and laying a water main in Nicholson Ave. Wm. H. Evers, Engr. Co., Engrs., 237 The Arcade.

**Philadelphia, Pa.*—We are informed that contracts have been awarded as follows (bids opened Oct. 22 by the Dept. of Pub. Wks., Bureau of Water, Fred C. Dunlap, Ch. Engr.):

*Contract 127.—Boilers for Torresdale pumping station to the D'Oliver Eng. Co., 121 S. 11th St., for 3 Heine boilers complete with Murphy stokers, Foster superheaters and Sturtevant economizers, for lump sum of $32,250.

*Contract 128.—For one centrifugal pump, driven by vertical cross compound steam engines, duty of 78,000,000 foot lbs. per 1,000 lb. steam consumed, to Allis-Chalmers Co., Milwaukee, Wis. (lump sum), $18,700.

*Contract 134.—For Magnesia covering at Lardners Point pumping station to H. W. Johns-Manville Co., 21 No. 2d St., at 8 cts. per lb. for furnishing Magnesia cement and for covering all steam piping at the station (lump sum), $4,933. John Jameson & Son, 2581 E. Huntington St., secured contract for painting 3 engines for $750.

The citizens on Nov. 5 voted to authorize Council to negotiate a loan of $10,000,000 to be apportioned as follows: Filtration, $800,000; for new school sites and buildings, $2,500,000; parkway, $1,000,000; mandamus, $1,000,000; high pressure fire system in the mill district, $500,000; police and fire stations and new fire apparatus, $500,000; League Island Park, $500,000; improvement of small parks, $150,000; bath houses, $100,000; South Broad St. boulevard, $400,000; Passyunk Ave. bridge, $300,000; new bridges, $300,000; main sewers, $600,000; branch sewers, $500,000; paving intersections, $200,000; grading, $300,000; surfacing unpaved streets, $150,000; house of detention for juvenile prisonrs, $200,000.

Bids were opened on Nov. 4 at the office of the Bd. of Pub. Wks., Bureau of Water for contracts as follows:

Contract 90.—For a 6,000,000-gal. pumping engine for Belmont high service pumping station; Snow Steam Pump Works, $39,000, to be completed in 270 days; Laidlaw Dunn Gordon Co., $36,500 (270 days); Bethlehem Steel Wks., $39,750 (260 days); Allis-Chalmers Co., $32,970 (240 days); Southwark Fdry. Machine Co., $44,385 (175 days).

Nos. 93 and 94.—Furnishing (*a*) pipe fittings and materials, and (*b*) excavating pipe trenches for high-pressure fire main system. John McMenomimy, *a*, 39 cts.; *b*, $160. Mack Paving Co., *a*, 60 to 70 cts.; *b*, $2.10. O. J. Evers, *a*, 35 cts.; *b*, $2.25. M. & J. B. McHugh, *a*, $1.30 to $1.90; *b*, $3.45. M. T. Quinn, *a*, $1.25 to $1.75; *b*, $2.37. Wm. C. Watson, *a*, $1.25 to 2; *b*, $.2.25.

Reading, Pa.—The citizens on Nov. 5 voted to issue $500,000 bonds for the filtration of the water supply.

Temple, Tex.—Bonds to the amount of $150,000 are reported to have been voted for the construction of water works.

Lufkin, Tex.—The citizens are reported to have voted on Oct. 24 to issue $5,000 bonds to drill an artesian well and improve water works.

Sweetwater, Tex.—Burns & McDonnell, 823 Scarritt Bldg., Kansas City, Mo., are preparing estimates for the construction of water works at Sweetwater. Bids will probably be called for in about 2 months.

Cisco, Tex.—It is stated that water works will be established at a cost of $16,000.

Norfolk, Va.—Bids will be received until Nov. 18 by the Bd. of Control (H. Hodges, Chmn.), for the following: Furnishing and installing 2,000 5-8 in. and 3-4 in. water meters and meter boxes; installing 2,000 5-8 in. and 3-4 in. meters and boxes; furnishing 2,000 5-8 in. and 3-4 in. water meters; furnishing 2,000 water meter boxes.

Alexandria, Va.—Bids are wanted by the Alexandria Electric Co., 502 King St., for furnishing material and extending the water suction line into the river at its plant, foot of Wolfe St.

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., until Nov. 26 for water mains in 11th Ave., N. W., together with necessary sewers; estimated cost, $8,075.

*The International Contract Co., New York Blk., has secured contract for laying water mains on 31st St., S., for $4,430.

**Tacoma, Wash.*—The Lister Constr. Co. is reported to have secured the contract for laying a 6 and 8 in. c. i. water main in Local Improv. Dist 524 (bids opened Oct. 26), for $20,075.

Spokane, Wash.—City Engr. Chas. McIntyre is reported to have recommended repairs to dam in Spokane River to prevent present leakage and that provision be made for widening the overflow and raising the crest of dam.

De Forest, Wis.—Fred Moeller, City Clk., writes that bids will probably be called for in Jan. or Feb. for the construction of water works, for which the National Constr. Co., of South Bend, Ind., is preparing plans; probable cost, $10,000.

Hamilton, Ont.—We are informed that the citizens will in Jan. vote on issuing $50,000 bonds for purchasing electric pumps to supply city with water.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Redondo, Cal.—Olmsted & Gillelen, 616 Grand Bldg., Los Angeles, are compelting plans for the construction of a sewerage system for Redondo, to cost about $80,000.

Fairfield, Cal.—F. L. Morrill, Town Clk., writes that bids will be received on Dec. 4 for the purchase of $20,000 bonds, to be used for the construction of a sewerage system.

**Plainville, Conn.*—A. B. Griswold, of New Britain, is reported to have secured the contract for constructing a surface water sewer in Whiting St. for $2,885.

Ft. Du Pont, Delaware City, Del.—Bids will be received by Capt. J. L. Knowlton, Constr. Q. M., U. S. A., until Nov. 25 for remodeling sewer system and installing two sewage ejectors and ejector chamber at Ft. Du Pont, as advertised in The Engineering Record.

Forsyth, Ga.—H. F. Wilder, City Clk. and Treas., writes that bids will be received on Dec. 6 for the construction of a sewerage system, to cost about $15,000.

**Nampa, Idaho.*—E. P. Bigelow, City Engr., writes that the contract for constructing gravity sewer (bids opened Sept. 18) has been awarded to Jos. Goggins & Co., of Nampa as follows: 1,920 ft. 15-in. pipe, main sewer pipe, $1.20; 5,140 ft. 8-in. laterals, 60 cts.; 1,438 ft. under 6 ft., 58 cts.; 2,433 ft 6 to 8 ft., 60 cts.; 1,606 ft. 8 to 10 ft., 63 cts.; 1,373 ft. 10 to 12 ft., 68 cts.; 210 ft. 12 to 14 ft. 71 cts.; 14 manholes (brick), each, $65; 5 flush tanks (automatic siphon), each $88; total, $9,958.

Belleville, Ill.—This city has in contemplation the extension of Town Grove sewer system. Fred Deutschman, Jr., City Engr.

Glencoe, Ill.—The Village Council is reported to be considering plans for the construction of a disposal plant and for drains leading away from the lake.

Elgin, Ill.—The City Engineer is reported to be preparing plans for a complete system of combination sewers for the 6th Ward.

Richmond, Ind.—Local press reports state that new bids will soon be asked, for the construction of two sections of the Northwest 2d St. sewer, to cost about $23,000.

Des Moines, Ia.—The following are reported to be the bids opened on Oct. 28 by the Bd. of Pub. Wks. for the construction of a septic tank: Cook Constr. Co., Des Moines, $5,000; J. L. & F. A. Hansman, $6,100; Jas. Horrabin, $6,450; O. P. Herrick, $6,900; Geo. M. King Constr. Co., $6,250, and Chas. Weitz, $8,361.

Sioux City, Ia.—Bids will be received until Nov. 12 at the office of the City Clk. for furnishing material and constructing an 8-in., vitrified tile pipe sanitary sewer in portions of Jennings, 20th, 22d and Jones Sts., Park Ave. and Higman's Park addition, and an 8-in. pipe sewer in a portion of W 2d St. T. W. Bayne, Chmn. Com. on Sewers.

Shelbyville, Ky.—The citizens are reported to have voted to issue $30,000 bonds for the construction of a sewerage system.

Louisville, Ky.—Local press reports state that work will start at once on the construction of an 18-in. sewer in Central Ave., from 7th to Jones St. Jos. Claybrook, City Engr.

Paducah, Ky.—L. A. Washington, City Engr., writes that all bids opened on Oct. 1 for the construction of 14 miles of 6-in. vitr. pipe sewer laterals, ranging from 12 to 6 ft., have been rejected, all being too high. No further steps have been taken as yet to procure new bids.

Springfield, Moss.—The City Council on Oct. 28 authorized the issue of $20,000 for sewers and $62,000 for constructing the Abbe Ave. crossover.

Southbridge, Mass.—Bids will be received until Nov. 12 by the Bd. Sewer Comrs. (Wilfred J. Lamoreux, Clk.) for constructing sewage purification works. John A. Whittaker, Engr., Southbridge.

Wyandotte, Mich.—R. Winthrop Pratt, of Columbus, O., has completed plans for a slow sand filtration system for Wyandotte, and is stated to have estimated its cost, with a capacity of 1,000,000 gals. daily, at $30,000.

Port Huron, Mich.—The City Engineer is reported to be preparing plans for a system of sewers for the 9th Ward.

Milan, Mich.—See "Water."

Sturgis, Mich.—Geo. S. Pierson, of Kalamazoo, is reported to have been selected to assist in preparing plans for a sanitary sewer system. This city is also said to be considering the advisability of installing a purification plant.

**St. Paul, Minn.*—The General Contr. Co. is reported to have secured contract for a sewer across the Soo Line's right-of-way on York St., for $11,490.

Paterson, N. J.—Governor Stokes has signed the bill authorizing Paterson to construct a sewage disposal plant, a companion measure to the trunk sewer bill passed at last session of Legislature. The law authorizes any municipality to issue bonds for the erection of a plant for sewage disposal, which may be located either within or without boundaries of municipality under certain restrictions.

Madison, N. J.—We are informed that a special election will be held on Dec. 2 to vote on issuing bonds for constructing sewerage system and disposal plant. Engineers, Hering & Fuller, of New York, N. Y.

Morristown, N. J.—The Bd. of Aldermen is reported to have on Nov. 1 decided to issue $400,000 sewer bonds.

Buffalo, N. Y.—Bids will be received until Nov. 16 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for constructing a 10-in. tile sewer in Barton St.

Cornwall, N. Y.—It is reported that plans have been completed for the construction of a sewerage system.

Brooklyn, N. Y.—Bids will be received until Nov. 20 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in 44th and E 4th Sts. Engineer's estimate: 3,951 lin. ft. 15 and 12 in. pipe, 762 lin. ft. brick sewer, 5,100 lin. ft. 6-in. house connection drain, 45 manholes, 30 M. ft. sheeting and bracing, etc.

Spencerport, N. Y.—See "Water."

White Plains, N. Y.—Bids will be received by the Bronx Valley Sewer Comn. (Frank N. Glover, Secy., 2 Grand St.) until Nov. 27 (extension of date from Nov. 7) for the construction of about 12 miles of circular sewer from 3 1-3 to 6 ft. in diam. and about 3 miles of circular lined tunnel, mostly 6½ ft. and 8½ ft. diam., as advertised in The Engineering Record. The material for construction to be either monolithic reinforced concrete, reinforced concrete block or brick masonry.

**Rochester, N. Y.*—The contract for building the substructure for a pumping station in connection with the new sewer in the 12th Ward and partially in the 23d Ward, is reported to have been awarded on Oct. 30 to Houston Barnard for about $6,000.

The Bd. of Contract and Supply on Oct. 31 awarded contract to Wm. Summerhays & Son for building the ventilating tower for the East Side sewer at Norton and St. Paul Sts., for $3,760.

Wilmington, N. C.—See "Water."

**Cleveland, O.*—At the meeting of the County Bldg. Com. on Oct. 30 it was decided to award contract for constructing sewer on court house site to Andrew Dall & Son, Euclid Ave. and Erie St.; cost, about $30,000.

Youngstown, O.—It is stated that bids are wanted until Nov. 14 for $25,000 Riverview sewer bonds. Wm. J. Davies, City Clk.

Bids will be received until Nov. 21 by Bd. Pub. Service (W. H. McMillin, Clk.), for furnishing material and constructing sewers in portions of Fairview and Ridge Aves. and Regent St.

Orrville, O.—We are informed that bids will be received on Dec. 9 by S. W. Jackson, Village Clk., for the construction of a sewerage system and sewage disposal plant for Orrville, to cost about $70,000. Engineer, L. E. Chapin, of Chapin & Knowles, Canton, O.

Philadelphia, Pa.—See "Water."

**Ardmore, Pa.*—R. A. Warner, Supt. of Health and Drainage, writes the the contract for constructing 1,575 ft. 8-in. terra cotta sewer on Lehigh Ave. (bids opened Oct. 31), has been awarded to Brubaker & Co., of Philadelphia, for $2,225.

**Items marked thus give the names of parties awarded contracts.*

Reading, Pa.—Bids will be received until Nov. 20 by the Bd. Pub. Wks., care Caleb Weidner, City Clk., for constructing and laying about 27,600 lin. ft. 10-in. and 32,500 lin. ft. 5-in. pipe sewer, together with Y's and manholes also same date for constructing storm water sewers as follows: Northeastern Intercepting Sewer; Canal St. sewer; Rose Valley sewer, as advertised in The Engineering Record.

Florence, S. C.—Wm. W. Lyon, of Sumter, is reported to have been selected to prepare plans and estimates for a sewerage system.

Buffalo, N. Y.—See "Miscellaneous."

Cincinnati, O.—Bids will not be called for until next year by the Bd. of Pub. Service for a lift bridge over canar at 14th St., to cost about $28,000. P. N. Jonte, Engr. of Bridges.

Bids will be received until Nov. 15 by Bd. Co. Comrs. (Fred Dreihs, Clk.), at Cincinnati, for repairing bridge over Big Miami River near New Baltimore, Crosby Township.

**Allentown, Pa.*—Ex-Mayor Fred E. Lewis, of Allentown, and other local capitalists are reported to have accepted the proposition of Brown Bros. & Co. and E. B. Smith & Co., of Philadelphia, to complete the erection of the $400,000 steel bridge to span the 118-ft. ravine between Allentown and South Allentown. The local company has expended about $100,000 on the substructure. This bridge is to form a connecting link in the system of electric railways owned or leased by the Lehigh Valley Transit Co.

or other corporations occupy the lake front the boulevard will be constructed on made ground out in the lake.

Salem, Ind.—Sam'l. G. Ellis, Co. Aud., writes that no bids were received on Nov. 4 for the construction of the following gravel roads: Salem and Martinsville road, 10,046 ft.; Borden and Martinsburg road, 9,738 ft.; Martinsburg and Greenville road, 10,363 ft.; Martinsburg and Palmyra road, 9,000 ft.; Old Grade road, 18,639 ft.; Livonia and Mt. Pleasant road, 24,845 ft.; Millsport gravel road, 24,220 ft.

Tecumseh, Mich.—The following are the bids opened on Oct. 29 by the Bd. of Village Trus. for furnishing material and constructing sewers (Engineers, Riggs & Sherman Co., of Toledo, O.): (*a*) F. M. Benner, Marion, Ind.; (*b*) Gould & Maybach, Collingwood, O.; (*c*) Ferdinand M. Porath, Detroit, Mich.; (*d*) Geo. W. Winterhalter, Detroit, Mich.; (*e*) J. A. Mercier, Detroit, Mich.; (*f*) A. P. Southworth, Adrian, Mich.; (*g*) Theo. W. Hill, Bellefontaine, O.; (*h*) Shoup & Baird, Dayton, O.; (*i*) D. W. J. Townsend Construction Co., Cleveland, O.; (*j*) Williams & McRitchie, Chicago, Ill.; (*k*) Emanuel Schneider, Ann Arbor, Mich.; (*l*) Algate & Johnson, Lansing Mich.; (*m*) Weage & Swonk, Coldwater, Mich.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
14,674 lin. ft. 6-in. sewer pipe	$0.11	$0.13	$0.15	$0.12	$0.13	$0.14	$0.17	$0.15	$0.12	$0.18	$0.11	$0.14	$0.12
28,227 lin. ft. 8-in. sewer pipe	.17	.18	.20	.18	.20	.22	.22	.20	.17	.27	.17	.195	.17
11,348 lin. ft. 10-in. sewer pipe	.25	.28	.26	.26	.29	.31	.34	.26	.25	.37	.19	.27	.23
500 lin. ft. 12-in. sewer pipe	.31	.365	.35	.35	.41	.40	.46	.33	.33	.48	.32	.375	.30
1,020 lin. ft. 15-in. sewer pipe	.40	.45	.50	.48	.58	.515	.65	.45	.45	.56	.47	.52	.45
3,914 lin. ft. excav. and back fill, under 6 ft	.20	.38	.28	.30	.30	.30	.24	.23	.35	.24	.25	.30	.18
22,137 lin. ft. excav. and back fill, 6 to 8 ft	.30	.525	.33	.37	.43	.45	.29	.31	.35	.33	.40	.40	.26
20,345 lin. ft. excav. and back fill, 8 to 10 ft	.45	.72	.48	.50	.60	.60	.44	.38	.35	.42	.50	.68	.37
7,431 lin. ft. excav. and back fill, 10 to 12 ft	.75	1.15	.65	.65	.80	.83	.68	.70	.75	.52	.65	.90	.62
1,742 lin. ft. excav. and back fill, 12 to 14 ft	1.00	1.26	.78	.85	1.20	1.10	1.30	1.20	.75	.62	.85	1.30	.90
200 lin. ft. excav. and back fill, 14 to 16 ft	1.50	1.65	.95	1.00	1.50	1.35	2.50	1.80	1.00	.75	1.00	1.60	1.40
80 manholes	50.00	32.00	35.00	45.00	35.00	38.00	40.00	35.00	34.00	50.00	32.00	35.00	32.00
7 drop manholes	60.00	30.00	45.00	55.00	45.00	40.00	55.00	50.00	42.00	50.00	40.00	50.00	37.00
36 inspection holes	43.00	20.00	28.00	38.00	28.00	31.00	36.00	20.00	28.00	43.00	30.00	25.00	25.00
17 flush tanks	75.00	65.00	65.00	90.00	70.00	62.00	60.00	60.00	65.00	80.00	60.00	75.00	60.00
15 cu. yds. bulkhead masry.	7.50	10.00	5.00	7.50	7.00	5.00	8.00	7.00	10.00	8.00	4.50	5.00	5.00
Totals	$41,373	$54,381	$41,331	$43,500	$48,294	$49,735	$43,605	$39,562	$37,608	$44,534	$40,532	$50,104	$35,035

Seattle, Wash.—Bids will be received on Nov. 26 by C. B. Eagley, Secy. Bd. of Pub. Wks., for constructing sewers and altering existing water mains in Elliott Ave.; estimated cost, $6,200, and sewers in W. 54th St.; estimated cost, $5,000.

*E. H. Rawle & Co., 313 Boston Blk., has secured contract for concrete walks on E. Olive St. and extending existing sewer, for $10,791; Stirral & Goetz, Pioneer Blk., for relief sewer on E. Denny Way, for $7,234, and to Rich-Harris Constr. Co. for sewer on Fremont Ave., for $3,047.

McMechen, W. Va.—Bonds to the amount of $25,000 are reported sold, to be issued for the construction of a sewerage system.

BRIDGES.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—It is stated that bids will be received until Nov. 25, by the Bd. of Public Works, for the construction of a reinforced concrete bridge across Arroyo de los Posos at Macy St. (Horace B. Ferris, Secy.).

Denver, Colo.—It is stated that T. W. Jaycox, State Engr., Denver, will receive bids until Nov. 13, for constructing the following bridges: 30-ft. reinforced concrete bridge across South Clear Creek, near Georgetown; 200-ft. steel highway bridge across the Gunnison River at Iola; reinforced concrete bridge, 50 ft. span, across the Rio La Jara River, at Capulin; 80-ft. steel bridge and approaches across the White River, about 1 mile east of the State line, Rio Blanco Co.

South Bend, Ind.—Bids will be received until Nov. 22 by the Bd. of Co. Comrs., at South Bend for constructing a concrete steel girder bridge at La Salle Ave., South Bend, to be 80 ft. long and 80 ft. wide. John W. Harbow, Co. Aud.; Alonzo J. Hammond, of South Bend, Engr in charge.

Indianapolis, Ind.—Plans for approaches to the bridge over the canal at 29th St. are reported under consideration.

Erie, Kan.—It is stated that bids will be received until Nov. 19 by the Bd. Co. Comrs. for constructing 3 all-steel or iron bridges across the Neosho River; also 1 40-ft. span, concrete piers, 8½ ft. high. O. M. Johnson, Co. Clk.

Williamsport, Md.—E. W. Byron, Secy. Williamsport & Berkeley Bridge Co., writes with regard to bids which were to have been opened on Oct. 30 for a reinforced concrete arch bridge, 15 spans, total length 1,570 ft., over Potomac River, that the matter has been deferred for two weeks. Mason D. Pratt, Consulting Engr., Harrisburg, Pa.

Baltimore, Md.—The City Council is stated to have passed an ordinance appropriating $11,500 toward the construction of a bridge over Gwynn's Falls, at Hollins St.

Mankato, Minn.—The construction of a bridge over the Minnesota River is reported contemplated, at a cost of $30,000.

Philadelphia, Pa.—See "Water."

Uniontown, Pa.—The construction of a bridge over the Monongahela River is reported contemplated.

**Philadelphia, Pa.*—The following are the bids opened Oct. 23 by Geo. R. Stearns, Dir. Dept. Pub. Wks., for *a* constructing a 4-track railroad bridge at 12th St. and *b* a highway bridge containing 2 concrete arches at Wyoming Ave.: Thos. F. Riley, *a* $51,897, *b* $124,975; J. F. Stanley & Co., *a* $52,000; Armstrong & Latta, *a* $53,500; Eastburn & Chiles, *a* $54,700, *b* $132,000; Jas. McGraw Co., *a* $57,197, *b* $157,000; Richard Walsh, *a* $58,000, *b* $102,000 (awarded contract); McGaw & Gray, *a* $58,-200, *b* $107,900; Mack Co., *a* $61,462, *b* $139,636; M. & J. B. McHugh, *a* $63,891; J. A. Kelly Co., *a* $63,900, *b* $134,500; Filbert Co., *a* $84,416, *b* $149,900; David Peoples, *b* $100,300; John McMenamy, *b* $113,500, and Riley and Riddle, *b* $124,975.

Eau Claire, Wis.—See "Miscellaneous."

Wailuku, Hawaii.—It is stated that bids will be received until Dec. 11 by the Bd. of Superv. at Wailuka, Maui County, for constructing three steel bridges. W. F. Kaae, Co. Clk.

Toronto, Ont.—Bids will be received until Nov. 12 by E. Coatsworth, Chm. Bd. Control, for the erection of the superstructure of Riverdale Park steel foot bridge.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Stamford, Conn.*—O'Connor Bros., of Stamford are stated to have secured the contract for macadamizing 5,450 ft. of the Bedford Road, at $1.96 per ft., and 3,547 ft. on Summer St., at $1.69 per ft.

Washington, D. C.—Bids will be received at the office of the Comrs., D. C. until Nov. 16 for furnishing the District government during the fiscal year ending June 30, 1908, granite curbing as advertised in The Engineering Record.

Atlanta, Ga.—Bids will be received until Nov. 18 by the Mayor and General Council for repaving Broad St. with creosote blocks, about 13,000 sq. yds. R. M. Clayton, City Engr.

Chicago, Ill.—Bids will be received until Nov. 12 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and paving with No. 2 granite blocks and constructing retaining walls on portions of W. Harrison and S. Canal Sts.

A boulevard which will completely encircle Lake Michigan, traversing the shores of the lake bordering on Michigan, Indiana, Illinois and Wisconsin, is reported contemplated. The first sketches of the proposed boulevard and parkway have been prepared by D. H. Burnham. The boulevard will keep close to the shore line wherever possible. In places where railroads

Jasper, Ind.—M. A. Sweeney, Co. Aud., writes that no contract was let on Nov. 4 for improving Holland and Huntingsburg Road No. 2, as all were higher than estimate.

Bluffton, Ind.—The Bo. Co. Comrs., it is reported, will receive bids until Nov. 16, for the construction of several gravel roads in each of the following townships: Rockcreek, Lancaster, Chester and Notingham.

Winchester, Ind.—The City Council is stated to have directed the City Engineer to prepare plans and specifications for paving with brick all the streets in the mile square north of Main and east of Mandian Sts.; also for the improvement of Washington, Franklin and North Sts.

**Ft. Wayne, Ind.*—Geo. W. Lindemuth, Co. Aud., writes that the contract for constructing 9,563 ft. macadamized road in Madison Township (bids opened Nov. 2) has been awarded to Wm. Busching, of Ft. Wayne, for $7,650.

**Greencastle, Ind.*—C. C. Hurst, Co. Aud., writes that the contract for construcing 16,340 ft. gravel road in Russell Township (bids opened Nov. 2) has been awarded to Shannon & Sutherlin, of Russellville, for $6,112.

Des Moines, Ia.—Bids will be received until Nov. 23 by the Bd. Pubfl Wks. (W. W. Wise, Chm.) for paving Elm, School, W. 2d. Center and W. 3d Sts. and an alley with vitrified paving blocks, in all about 11,067 sq. yds.

**Des Moines, Ia.*—J. L. & T. A. Hansman Constr. Co. is stated to have secured the contract for paving and curbing, as follows(bids opened Oct. 30 by Bd. Pub. Wks): W. 2d and W. 4th St., at $2, and W. 28th and W. 29th Sts., at $2.14½ per sq. yd.

**Iola, Kan.*—R. S. Gilfilian, of Iola, is reported to have secured the contract for paving portions of Lincoln, S. Walnut and S. Kentucky Sts., at $1.32 per sq. yd.

Baltimore, Md.—The Com. on Highways is stated to have approved ordinances for the following paving: Payson, Richmond, Lanyale, Wolfe, Chase, Pine Sts.; Woodbrook, North, Fremont, Lakewood Aves. and numerous other streets, at a probable cost of $500,000.

St. Paul, Minn.—The resurfacing of a portion of 4th St. is reported contemplated, at a cost of $108,215.

Gulfport, Miss.—See "Schools."

**Kansas City, Mo.*—The Economic Paving Co. is reported to have secured the contract for repairing asphalt pavements, at 93 cts. per sq. yd.

St. Louis, Mo.—Bids will be received until Nov. 19 by the Bd. Pub. Improv. (And. J. O'Reilly, Pres.) for paving portions of numerous alleys with vitrified paving brick blocks; est. cost, $90,000.

Woodbury, N. J.—Bids will be received until Nov. 16 by the Com. Bd. Chosen Freeholders for constructing with gravel about 6 miles of the Malaga and Downtown Rd. Wm. C. Cattell, Engr., Wenonah.

Brooklyn, N. Y.—Bids will be received until Nov. 20 by Bird S. Coler, Boro. Pres., for repaving with asphalt a portion of Classon Ave., and with granite on a concrete foundation, Columbia St. Engineer's estimate: 3,620 sq. yds. asphalt pavt., 3,300 sq. yds. granite block pavt., 3,270 lin. ft. new curb, to be set in concrete, etc.

Los Angeles, Cal.—The following are the bids opened on Oct. 14 by Bd. of Pub Wks. (Horace B. Ferris, Secy.) for constructing bridge across Los Angeles River at 7th St.: (*a*) Robt. Beyrle, (*b*) Union Iron Wks., (*c*) C. Leonardt, (*d*) Atlantic Gulf & Pacific Co., (*e*) Mercereau Bridge & Construction Co., (*f*) Burrell Bridge & Construction Co., (*g*) Cotton Bros. & Co., (*h*) Thomson Bridge Co., (*i*) Pacific Construction Co., (*j*) Melville Sheldon.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
Breaking up old piers (lump sum)	$450.00	$150.00	$1,256.00	$2,500.00	$2,000.00	$1,200.00	$3,180.00	$1,150.00	$1,200.00	$1,655.00
510 tons rock furnished and placed at west bank	2.25	2.00	1.00	1.75	2.20	2.00	3.00	2.25	2.35	2,984.00
Removing and placing rock at east bank (lump sum)	300.00	150.00	2,400.00	2,000.00	5,000.00	2,370.00	6,480.00	1,095.00	1,150.00	2,859.00
474 piles furnished and driven	12.00	11.50	19.00	20.00	20.00	20.00	15.20	23.25	23.00	26.60
661 cu. yds. concrete, Class A	11.50	11.62	10.00	12.00	9.00	14.00	11.50	14.10	15.10	15.48
2,000 cu. yds. concrete, Class B	10.25	10.72	9.50	10.00	9.00	12.00	8.00	13.25	14.10	13.92
2,780 cu. yds. concrete, Class C	9.50	9.62	9.00	9.00	10.00	12.00	12.90	11.60	12.10	12.52
Steel rods in place (lump sum)	7,000.00	8,890.00	8,650.00	8,500.00	16,000.00	7,332.00	9,676.00	8,437.00	8,750.00	9,143.00
Arch centers (lump sum)	6,100.00	4,054.00	12,150.00	12,000.00	6,000.00	7,080.00	8,290.00	11,500.00	12,000.00	11,650.00
281 sq. yds. surface wash, finished	.20	.25	.55	.50	.90	.25	1.20	.30	.30	.47
234 sq. yds. surface tool, finished	.50	.70	.75	.80	1.35	.60	2.00	1.60	1.75	.91
7,944 cu. yds fill	.25	.40	.50	.60	.35	.40	.40	.38	.41	.55
338 lin. ft. bridge, surfaced	2.50	1.00	2.00	2.50	1.50	5.00	4.32	5.00	5.10	2.45
676 lin. ft. curb	.30	.30	.30	.40	.35	1.50	1.20	.42	.40	.55
Total	$78,404	$79,532	$89,782	$94,534	$95,444	$101,188	$102,078	$107,869	$112,765	$119,691

**Items marked thus give the names of parties awarded contracts.*

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 30 by Bird S. Coler, Pres. Brooklyn Boro., for regulating, grading, paving and repaving with asphalt on concrete foundation Roebling St. from 4th St. to Union Ave. (*a*) Cranford Co., 9th St., Brooklyn (awarded contract); (*b*) Uvalde Asphalt Paving Co., 1 Bway., N. Y. City; (*c*) Barber Asphalt Paving Co., 114 Liberty St., N. Y. City.

	**a*	*b*	*c*
18,620 sq. yds. asphalt pavt.....	$1.34	$1.35	$1.44
2,590 cu. yds. concrete..........	5.95	6.10	6.00
5,600 lin. ft. new curb, set in concrete	1.30	1.30	1.27
600 lin. ft. old curb, reset in concrete	.75	.80	.77
1,470 cu. yds. earth excav......	19.00	20.00	20.00
71,530 sq. ft. cement sidewalk...	1.00	.75	.95
35 noiseless covers and heads, complete, for sewer manholes	.19	.22	.22
Totals	$63,817	$66,235	$67,760

**Concord, N. C.*—John A. Cline, Chmn. Co. Comrs., writes that the contract for grading and macadamizing about 10 miles of public road from Concord to Kannapolis, also about one mile on the Concord and Charlotte road (bids opened Oct. 24), has been awarded to J. Thos. Bennett, of Danville, Va.

Wilmington, N. C.—C. R. Humphreys, City Engr., writes that the citizens have voted to issue $400,000 bonds for street improvements.

Lakewood, O.—Bids will be received until Nov. 18 by B. M. Cook, Village Clk., for furnishing material and paving portions of five streets. Mm. H. Evers, Engr. Co., Engrs., 237 The Arcade.

Youngstown, O.—The City Council is reported to have passed a resolution providing for the paving of a portion of Marshall St.

Norwood, O.—It is stated that bids will be received until Nov. 16 by the Bd. Pub. Service (L. H. Gebhart, Clk.) for grading, macadamizing and constructing concrete curb and gutters in a portion of Warren Ave. J. B. Stewart, Engr., 712 Traction Bldg., Cincinnati.

Lima, O.—It is stated that bids will be received until Nov. 12 by the Bd. Pub. Service (L. L. Crumrine, Secy.), for sewering, curbing and macadamizing a portion of N. Jefferson St.

Bids will be received, it is stated, by Fred. C. Beam, City Aud., until Nov. 25 for $25,000 N. Main and S. Metcalf St. paving bonds.

**Cincinnati, O.*—The Kirchner Constr. Co. 8th and Plum Sts., is reported to have secured the contract for repairing asphalt pavements, at $7,500.

Ashley, Pa.—The Wilkes-Barre Constr. Co. is reported to have submitted the only bid for paving with brick a portion of Main St., at $11,850.

Philadelphia, Pa.—See "Water."

Lancaster, Pa.—Bids will be received until Nov. 21 by Jos. Hunter, State Highway Comr., Harrisburg, for constructing 2 sections of road in East Hempfield Township, Lancaster County, one 14,315 ft. long and the other 5,287 ft. long.

Media, Pa.—Bids will be received until Nov. 12 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 6,427 ft. road between Chester and Aston Township, Media.

El Pasa, Tex.—The Texas Bitulithic Co. is reported to have secured the contract for paving a portion of Magoffin Ave., at $1.87½ per sq. yd.

Manassas, Va.—O. E. Newman, Chmn. Improv. Com. of Council, writes that the Street Com. will macadamize the streets by day's work, at a cost of $5,000.

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Constr. Q. M., U. S. A., until Nov. 25 for the construction of a roadway leading to quartermaster's shop, as advertised in The Engineering Record.

Bellingham, Wash.—Geo. Gerhard, City Engineer, is reported to have estimated the cost of improving a portion of 14th St., at $8,512.

Ft. Flagler, Wash.—Bids will be received until Nov. 26 by Lieut. John C. Henderson, Q. M., U. S. A., for clearing and grading a roadway 3,575 ft. long to connect with county road, at this post.

Seattle, Wash.—Bids will be received by the Bd. of Pub. Wks. (C. B. Bagley, Secy.) until Nov. 26 for paving alley in Block 21, C. D. Boren's addition, with sandstone blocks; estimated cost, $2,800; grading and concrete walks on 19th Ave., N. W.; estimated cost, $8,654; grading and regrading Roanoke St. and constructing concrete sidewalks with necessary sewers; estimated cost, $15,000, and grading, curbing and constructing concrete walks on W. 85th St.; estimated cost, $8,400.

The only bid received and opened on Oct. 29 for grading, etc., Lakeside Ave., was submitted by Holt & Jeffery, as follows: Fixed estimate, $500; celaring and grubbing, sum, $3,000; earthwork, 45,000 cu. yds., 15 cts.; curbs and gutters, 22 M. ft., $24; catch basins, 2 inlets, ea., $80; 3 catch basins, 1 inlet, ea., $70; inlet, $30; 6 manholes to be constructed, ea., $50; total cost, $11,398.

The lowest bid opened on Oct. 29 for paving Madison St. with sandstone block was submitted by Hans Pedusa, 501 Fairview Ave., for $5,794.

*Contracts have been awarded as follows: To Rich-Harris Constr. Co., Seattle, for concrete walks on Kilbourne St., for $13,533, and to the Independent Asphalt Paving Co., Pioneer Blk., paving Boylston Ave. with asphalt, $7,234.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Jackson, Ala.—B. H. Warren, of Jackson, Pres. Jackson Light & Power Co., writes that bids will probably be received about Dec. 1 for the construction of dam across creek near Jackson. The company was recently formed to construct water works, electric light plant and street railway. Engineer, T. W. Nicol, of Mobile.

Imboden, Ark.—The Arbuckle Mining & Milling Co. is reported to have decided to construct a dam to develop 800 h. p. for electric purposes.

San Rafael, Cal.—It is reported that petitions will soon be filed by the Snow Mountain Power Co., with the Trus. of San Rafael, Mill Valley, San Anslemo, Sausalito and Belvedere for a franchise to construct power lines. The plan is to construct a sub-power plant in Marin County to supply the various towns. Ex-Senator Chas. N. Felton is one of the principal stockholders in the new concern.

Oakland, Cal.—E. M. Downer, of Pinole, Cal., is reported to have petitioned the Supervisors of Alamedo County for a franchise to construct an electric light plant and supply electricity in Alamedo County.

Sonora, Cal.—The Consolidated Stanislaus Water & Power Co. is reported incorporated, with a capital of $1,000,000. Directors: C. T. Tullock, R. R. Bigelow, W. B. Cadman and others, all of San Francisco.

**Savannah, Ga.*—Later reports state that the Savannah Electric Co. (M. L. Sperry, Mgr., Savannah) secured the contract for lighting the city (bids opened Oct. 15).

Columbus, Ga.—Charles E. Main and John E. Porter, consulting engineers of the Stone-Webster syndicate of Boston have been here and made an inspection of the power house at the City Mills, with a view to making improvements to increase the capacity of that plant, which is leased by the Columbus R. R. Co. They also inspected the water power plant at the Eagle and Phenix Mills, which are also to be greatly improved.

Moscow, Idaho.—H. H. Robinson, City Clk., writes that the question of constructing municipal power and lighting plant has been discussed by City Council, but nothing definite has yet been done.

Pocatello, Idaho.—The Idaho Consolidated Power Co., of Pocatello, Idaho, with a capital of $2,000,000, is reported to have absorbed the American Falls Power, Light & Water Co., the Pocatello Electric Light & Power Co., and the Blackfoot Power & Water Co. The plans include development of 50,000 h. p. at American Falls and transmission of electrical energy to surrounding towns; 2,500 h. p. is now being generated at American Falls, and an additional 4,000 can be placed on the wires inside of 60 days. Jas. H. Brady, of Pocatello, will be president of the new comuany.

Ft. Wayne, Ind.—Articles of incorporation are reported filed by the Ft. Wayne Power Co. for the purpose of establishing and equipping a plant to manufacture and distribute electric current for mechanical power and commercial purposes. Fred H. Schmidt, F. H. Cutshall, L. M. Morris and others, Directors.

Indianapolis, Ind.—The Citizens Gas Co. recently organized, is reported to have purchased mains of the Consumers' Gas Trust Co., and will proceed at once to construct and equip an artificial gas plant. Geo. Vonegut, Pres.; J. D. Forest, Secy.

Evansville, Ind.—It is reported that bids will be received until Nov. 16 (readvertisement) by the Bd. of Co. Comrs. for wiring the new County Infirmary building. Harry Stinson, Co. Aud.

Davenport, Ia.—The J. C. Settle Constr. Co., of St. Louis, Mo., are reported to have secured the contract for constructing a power building for the Independent Light Co. It will be of concrete block, 100x118 ft.

**Leavenworth, Kan.*—F. E. Newherry & Co., St. Louis, Mo., are reported to have secured the contract for the addition to the electric plant at the Federal Prison, at $8,126.

Grand Haven, Mich.—This city will shortly ask for bids for furnishing one 150-kw., 2-phase, 2300-volt alternator; one 220-h.-p. engine for direct connection to this alternator; a series alternating-current series enclosed type arc lighting system, complete with switchboard and 100 alternating-current series enclosed type arc lamps. F. W. Weber, Supt.

Calumet, Mich.—The stockholders of the Calumet Gas Co. are reported to have decided to increase its capital from $1,000,000 to $1,500,000, and propose making additions to the plant.

Allegan, Mich.—Fred. Littlejohn and associates are reported to be asking for a franchise to construct and operate an electric power plant here.

Columbia, Miss.—The Columbia Ice & Power Co. is reported incorporated, with a capital of $60,000, by G. W. Grayson and Lee Elder, both of Biloxi; L. A. Lundy, of Ocean Springs, and others.

Maysville, Mo.—Burns & McDonnell, Scarritt Bldg., Kansas City, have prepared preliminary estimates for the construction of an electric light plant for Maysville, to cost about $10,000. Bonds have not yet been sold.

Scotts Bluff, Neb.—L. L. Raymond, City Secy. and Attorney, writes that J. C. Cain is interested in the construction of an electric light plant here, to cost abont $10,000.

St. Paul, Neb.—The citizens are reported to have voted to establish an electric light plant.

Wood River, Neb.—D. D. O. Kane, Village Clk., writes that bids will be received about Jan. 15 for the construction of water works and an electric light plant, to cost $17,000. Engineer not yet selected.

Newark, N. J.—The citizens on Nov. 5 voted in favor of constructing a municipal electric light plant for lighting the streets; probable cost, $1,000,000.

Alpha, N. J.—The Alpha Cement Co., with main offices in Easton, Pa., is reported to be arranging to construct a power plant along the Pennsylvania side of Delaware River, near Foulrift, next spring. The plans are for the building of a canal 40 or 50 ft. wide and 3 miles in length, for the generation of electricity for the operation of its mills.

Atlantic City, N. J.—The City Council, on Oct. 29, passed the bill appropriating $35,000 for the installation of a new system of illumination for Atlantic Ave.

Fulton, N. Y.—The Fulton Light, Heat & Power Co. will install immediately generators, switchboard and belts. L. W. Emerick, Vice-Pres. and Gen. Mgr.

Holley, N. Y.—The franchise for laying pipe in Holley for the purpose of furnishing gas for light, fuel and power purposes is reported to have been granted by the Village Bd. to John F. Brush and Wm. McBain. The gas is to be manufactured at Brockport and supplied to Holley either from a gasometer, which will be erected here, into which the gas will be forced and stored, or direct from Brockport under high pressure, a pressure registering device being supplied with each service. The work of laying the pipes must begin not later than July 1, 1908.

Brocsport, N. Y.—See "Public Buildings."

Newport, N. Y.—The Public Service Com. at Albany is reported to have authorized the Newport Electric Light & Power Co. to construct lines in the Town of Newport and in the village of Poland. It also authorizes the company to issue a mortgage to secure the payment of 30-year bonds, amounting to $75,000, the proceeds to be used for retiring $15,000 of bonds outstanding and the balance for construction and equipment.

Utica, N. Y.—The Public Service Comn. at Albany is reported to have granted permission to the Utica Gas & Electric Co. to operate the franchises granted by the village of Frankfort and the towns of Frankfort, German Flatts and Little Falls, and to commence construction under them.

Pittsburg, Pa.—The Select Council is reported to have adopted a resolution authorizing the Dir. of Pub. Wks. to prepare an estimate of cost of establishing a system of conduits in the principal thoroughfare of the city for telegraph, telephone and electric wires.

Cresson, Pa.—The Cresson Electric Light Co. is planning to install a 60-kw., alternating-current, 1100-volt, 133-cycle generator in its plant, and is also contemplating the establishment of a day service beginning Jan. 1. J. F. Marsteller, Gen. Mgr.

**Philadelphia, Pa.*—We are informed that the following is the detailed bid of the D'Olier Eng. Co. 121 S. 11th St., the successful bidder for the electrical equipment for the Torresdale filter plant, bids for which were opened on Oct. 22 by the Dept. of Pub. Wks., Bureau of Water: 3,000 cu. yds. excav., 60 cts.; 17 manholes, ea., $140; 45,000 duct. ft. terra-cotta conduits, 6 cts.; laying 47,275 duct. ft. terra-cotta conduits, 15 cts.; 500 lin. ft. sewer connection to manholes, 30 cts.; underground cable equipment, complete, lump sum, $24,322; incandescent lighting equipment, complete, lump sum, $27,465; arc lamp equipment, complete, lump sum, $7,324; watchman's signal system, complete, lump sum, $2,250; total, $77,002. Totals of other bids: Penna. Electric Equipment Co., 1202 Race St., $85,346; the Mack Paving Co., 2032 Land Title Bldg., $83,327; Walker & Kepler, 531 Chestnut St., $85,275, and J. F. Buchanan & Co., 36 No. 4th St., $90,802.

Spartanburg, S. C.—The Southern Power Co. (W. S. Lee, Jr., Ch. Engr., Charlotte, N. C.) is reported to be preparing plans for a steam-electric plant, to be constructed near Spartanburg, to have a capacity of about 50,000 h. p. and cost about $2,000,000. It is stated it will be built in sections, work to commence next year.

Sioux Falls, S. D.—The Sioux Falls Light & Power Co. contemplates rebuilding its entire plant, developing water power to the extent of 1,200 h.-p. H. M. Byllesby & Co., of Chicago, Ill., are the engineers.

Charlotte, Tenn.—This city is reported to be considering the issue of $5,000 bonds for the construction of an electric light plant.

Alexandria, Va.—See "Water."

Richmond, Va.—Local press reports state that new bids will probably be asked for the rehabilitation of the city gas plant.

Roanoke, Va.—The Roanoke Water Power Co. is planning to install a 1000-kw. steam turbine to be used as an auxiliary to its water power plant next spring. R. E. Camp, mgr.

Tacoma, Wash.—Beall Foster, of the Foster Lumber Co. proposes installing electrical machinery to supply electric light for a community of about 1,000 houses, and would like to receive estimates for cost of furnishing equipment.

Pardeeville, Wis.—The Fox River Milling & Power Co. is planning to extend its lines and establish a 24-hour service. Myron L. Aldrich, mgr.

**Winnipeg, Man.*—The following contracts are reported recommended for award in connection with the construction of the general works, and for the supply and erection of the various portions of the equipments for the Hydro-Electric Works and station at Point du Bois, for a transmission line between Point du Bois and Winnipeg, and for a receiving transformer station in Winnipeg (bids for which were opened by the Bd. of Control on Oct. 1): Telephone system, J. Y. Hyland & Co., $24,840; general work at Point du Bois, Robinson, Pratt & Ryckman, including possible contingencies, $862,000; generators, exciters and induction motors, Swedish General Electric Co., $145,000; low and high tension electric equipment, Canadian Westinghouse Co., $382,000; steel towers, Naylor Bros., $99,000; insulators, Lima Insulator Co., including estimated cost of inside insulators, $18,500; transmission cable, Northern Aluminum Co., $180,000; auxiliary appliances, Canadian Fdy. Co., Allis-Chalmers-Bullock Co., Canadian Fairbanks Co., including estimated cost of oiling system, $35,000; repair shop equipments, Canadian-Fairbanks Co., $6,715. Total, $1,753,055.

It is further reported that bids received on the turbines, terminal station, protective appliances, electric cranes, turbine generators and governors were not recommended for award, and will probably be readvertised. No bids were received on the erection of the line, estimated to cost $104,400; clearing of remainder of transmission line, estimated cost, $12,500, and bridge, estimated cost, $15,000. M. Peterson is Secy. Bd. of Control.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

San Diego, Cal.—It is stated that the San Diego Electric Ry. Co. contemplates erecting machine shops, car shops and extending the trackage.

Merced, Cal.—Articles of incorporation of the Sierra Nevada Electric Co. are reported filed by H. E. Huntington, Wm. Kerckhoff, A. C. Balch, of Los Angeles, and J. S. Eastwood and Frank H. Short. Capital, $1,000,000.

Trinidad, Colo.—It is stated that Trinidad Electric

**Items marked thus give the names of parties awarded contracts.*

R. R. Co. proposes constructing an extension from Sparis to Cokedale. G. L. Horton, Gen. Mgr.

Bristol, Conn.—The Railroad Comrs. are stated to have approved the extension of the line of the Bristol & Plainville Tramway Co. to Terryville.

Chicago, Ill.—The Chicago, Fox Lake & Lake Geneva R. R. is reported incorporated to construct an interurban electric railroad from Chicago to Lake Geneva, with branches to Fox Lake and Woodstock. Capital, $2,000,000. Incorporators: Geo. M. Seward, Sidney F. Malette, Lewis E. Starr, Maurice B. Louis and others.

Belleville, Ill.—The Belleville & Interurban Ry Co. is reported incorporated to construct an electric railway from Belleville to Smithton. Capital, $100,000. Incorporators: Jacob Gundlach, Jr., Benj. H. Gundlach, R. W. Hofsommer, Geo. Hippard and Thos. A. Bell.

Murphysboro, Ill.—The Murphysboro & Interurban Ry. Co. is reported organized to build in and around Murphysboro and to Carbondale. A. B. Minton, Willard Wall, W. C. Alexander and others are reported interested.

Evansville, Ind.—It is said that the Evansville & Southern Indiana Traction Co. is to build an electric railway in the northeastern part of Evansville. R. H. Cole, Ch. Engr.

Indianapolis, Ind.—The Grand Central Traction Co. is reported to have petitioned for a franchise to construct an electric railway from Indianapolis to Evansville, with a branch from Terre Haute to Bloomington. G. C. M. Shanks is reported interested.

Plymouth, Ind.—It is stated that the Logansport & South Bend Traction Co. has secured a franchise to enter Plymouth. According to reports contracts will soon be let for constructing the line from Plymouth to Logansport.

Muncie, Ind.—The Logansport & Marion Traction Co. (A. J. Jenkins, Ch. Engr.) is reported to have announced that contract will soon be let for constructing an electric railway from Muncie to Logansport.

Cedar Rapids, Ia.—The construction of an interurban railway from Cedar Rapids to Tipton and Davenport via Muscatine is reported contemplated. Jas. H. Collins is said to be interested.

Sioux City, Ia.—Articles of incorporation of the Sioux City & Spirit Lake Ry. Co. are reported filed with the Secy. of State. Capital stock, $50,000. The object is the construction, equipment and operation of a line of railroad from Sioux City in a northeasterly direction via Hartley to Spirit Lake, Ia.; the said line may be operated either by electric, gasoline or steam power. Incorporators: J. F. Conn, G. E. Kusack, D. A. Fletcher, Geo. Coleman and Frank Patch.

Negaunee, Mich.—The Marquette County Traction Co., of Ishpeming, is reported to have in contemplation the expenditure of $20,000 for the improvement of tracks and new power machinery.

Moorehead, Minn.—The Northwestern Interurban Ry. Co. is reported incorporated, with a capital of $1,500,000, to construct an electric line from Moorehead to Detroit Lake. Incorporators: H. O. Coughlan, S. A. Anderson and John R. Turner.

St. Louis, Mo.—The Carondeles & Western Groves R. R. Co. is reported incorporated with a capital of $200,000 to construct a line from St. Louis to Webster Groves, a distance of 8 miles. Willard E. Winner and J. G. Hughes are reported interested.

Hamilton, N. Y.—F. K. Baxter, of Utica, is now at work on map and profile of an electric railway proposed between Hamilton and Norwich.

Asheville, N. C.—It is said that preliminary surveys have been made and the right-of-way secured for the proposed electric railway between Asheville and Hendersonvill. J. D. Murphy, Pres.; C. F. White, Treas.

Oklahoma, Okla.—The Oklahoma-Southwestern Interurban R. R. Co. is reported chartered to build 190 miles of road from Oklahoma City to Hollis, at a cost of about $10,000 per mile. Incorporators: M. W. Curry, of Eaton, O., and J. N. Street, of Bloomington, Ill.

Donora, Pa.—It is stated that the Donora & El Dorado St. Ry. Co. has secured right-of-way for an electric line to connect Donora and El Dorado. Incorporators: B. Allen, Monongahela, and J. A. Sprowls, of Donora.

Sykesville, Pa.—A charter is stated to have been granted the United Traction Extension Co., with a capital of $100,000. The company has decided to construct a line from Sykesville to Big Run. Directors: Austin Blakeslee, J. D. Sykes, Frank Hahne, J. E. Merris and others.

Tarentum, Pa.—The Butler, Saxonburg & Tarentum Ry. Co. is reported chartered to construct an electric railway 24 miles long, extending from Allegheny through Tarentum to Saxonburg and Butler. Capital, $50,000. Directors: Jos. Cirigliano, Emil T. Rudert, E. C. Rudert, all of Saxonburg, and others.

Harrisburg, Pa.—The Lewisberry & Strinestown St. Ry. Co. it reported to have secured the right to build an extension from near New Market to Harrisburg via New Cumberland. The Susquehanna River will be bridged at New Cumberland. This will be the final link in the proposed system connecting Harrisburg and York by electric railway, the new company connecting below New Market with the York County system and at Harrisburg with the Central Pennsylvania Traction and Valley Traction systems of over 100 miles of line. The surveys have been completed and the plans call for a high-speed line. David Pepper, Jr., of Philadelphia, Pres.

Covington, Tenn.—The Memphis, Covington & Northern Electric Ry. Co. is stated to have applied for a charter to construct an electric railway between Memphis and Covington. Capital $14,000. G. B. Gillespie and John F. Garner are reported interested.

Houston, Tex.—The Commissioners are stated to have granted the Houston Electric Co. a franchise, permitting the company to extend its lines to a point near Harrisburg.

Onalaska, Wis.—The La Crosse & Winona Electric Ry. Co., of La Crosse, is stated to have applied to Onalaska for a franchise for a street railway through the city.

Appleton, Wis.—The Fox River Valley Interurban Co. is reported to have announced that all surveys for the interurban line from Fond du Lac around the east shore of Lake Winnebago to Kaukauna and Appleton have been completed and that construction work will be begun early next spring. The cost of the new line will be $600,000. John S. Seaman, of Sheboygan, Pres.

Port Colborne, Ont.—It is stated that plans of the proposed Niagara Peninsula Ry. Co. have been filed with the Ontario Ry. and Municipal Bd. and certified by that body. The line will run from Port Colborne through the Townships of Humberstone and Wainfleet.

RAILROADS.

Notes Arranged Alphabetically by States.

Chicago, Ill.—The Chicago & East St. Louis Short Line Ry. is reported incorporated, with a capital of $50,000, and with principal offices at Chicago, to construct a steam railway between Chicago and East St. Louis, and the incorporation papers state that the road is to run through Madison, Montgomery, Christian, Macon, DeWitt, McLean, Livingston, Kankakee and Will Counties. It was also stated that construction would be begun at the Chicago end of the line. The Osterman Company, of West Pullman, is deeply interested in the project. Incorporators: H. C. Osterman, Wm. M. Drennan, Treas. of the Osterman Mfg. Co.; H. C. Dolph, of B. Nicoll & Co., iron merchants; Thomas W. Flynn, attorney, and Wm. Anderson, in charge of the lumber department of the Pullman Co.

Coffeyville, Kan.—The promoters of the Coffeyville & Memphis R. R. Co. are reported to have signed a contract with the citizens of Vinita, I. T., by which the citizens agree to pay a $25,000 bonus if the road builds through that city. The Coffeyville & Memphis was chartered early this year to build southeast from Coffeyville, Kan., through the coal fields of Ind. Ter. and Arkansas to Memphis, Tenn. A branch line is provided in the charter to build from Coffeyville south to Shawnee, Okla.

Stockbridge, Mass.—The New York, New Haven & Hartford R. R. Co. (E. Gagel, Ch. Eng., New Haven, Conn.), is reported to have decided to abolish the grade crossing south of the railroad station in Stockbridge; total cost of the changes to be bet. $50,000 and $60,000.

Rochester, N. Y.—The Buffalo, Rochester & Eastern R. R. Co. is reported incorporated and is making preparations to apply for a certificate and charter from the Public Service Comn. The route selected parallels the New York Central lines at an average distance of 20 miles, passing from Troy, through the city limits of Albany, thence south of Schenectady, through Rome, Utica, Syracuse, Rochester, Batavia, to Buffalo, Tonawanda and Suspension Bridge. The motive power of the road will be steam and it will be double track all the way. Incorporators: Jas. A. Bryan, Westfield, Mass.; Fred T. Ley, Springfield, Mass.; A. W. Eaton, Pittsfield, Mass.; Franklin Weston, Dalton, Mass.; Jos. Skinner, Holyoke, Mass., and others.

Asheville, N. C.—The citizens of Buncombe County are reported to have voted Oct. 29 to issue $200,000 bonds in aid in constructing the new Appalachian R. R.

Oklahoma City, Okla.—A charter has been granted to the Oklahoma, Mexico & Pacific R. R. Co., with headquarters at Oklahoma City, and with $500,000 capital stock, to build a 200-mile line southwest from Oklahoma City across the counties of Oklahoma, Canadian, Caddo, Washita, Kiowa and Greer to Hollis, at an estimated cost of $35,000 per mile. Incorporators: Jos. E. Kirkes, T. H. Lindley and O. S. Rice, of Oklahoma City; J. M. and F. D. Kroeger, of Guthrie.

Lawton, Okla.—J. M. Bellamy, of Lawton, Pres. Lawton, Wichita Falls & Northwestern R. R. Co., writes that bids will be received until Nov. 10 for grading 7 miles of road; cost, about $8,000 per mile. Engineer, A. J. Robinson, of Frederick.

Nashville, Tenn.—At a meeting of local capitalists on Oct. 25 it was decided to at once charter the Tennessee Western R. R. Co., with a capital of $3,000,000, and put engineers in the field to make a preliminary survey. The road is planned to connect with the Nashville & Huntsville at some point in Giles County and then run through Giles, Lawrence, Wayne, Harding, McNairy and Hardeman Counties to a connection with Illinois Central at Bolivar, Tenn.

Bristol, Tenn.—Application has been filed with the Secy. of State for the Bristol & Kingsport Ry. Co., which proposes constructing a line. The route is from Bristol to Blountville and Kingsport; Ex-Gov. John I. Cox, Jas. B. Cox, F. Percell, all of Bristol, are the incorporators. The new line will connect with the Southwestern at Kingsport and the Holston River Railway and the Virginia & Southwestern Railway at Moccasin Gap, Va.

Radford, Va.—A charter has been granted to the Radford & Carolina Ry. Co. to build and operate a steam railroad from Radford, Va., to the North Carolina line, through the counties of Patrick, Floyd, Carroll, Pulaski and Montgomery. Incorporators: J. Hoge Tyler, of Radford; J. J. Mott, Statesville, N. C.; R. L. Jordan, Radford, and others.

Guernsey, Wyo.—The Chicago, Burlington & Quincy R. R. Co. (G. W. Holdredge, Gen. Mgr., Omaha, Neb.), is reported to have decided to build across the State of Wyoming to connect its Guernsey line with the line recently built from Frannie to Worland, near the Yellowstone National Park. The surveys have been completed and the reports of the engineers received, but it has not yet been decided when the work will begin. The line will be 170 miles long.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The Bd. of Directors of the Methodist Orphanage, it is reported, proposes erecting a $20,000 building.

Napa, Cal.—An appropriation of $35,000 has been made by the legislature with which, it is stated, a treatment ward building is to be erected at the Napa State Hospital.

**Redondo, Cal.*—J. T. Atkinson, of Los Angeles, it is reported, has secured the contract to erect the city hall at $25,787.

Colorado Springs, Colo.—The Woodmen of the World, it is reported, have secured a site near Colorado Springs on which it is proposed erecting a tuberculosis hospital.

**Denver, Colo.*—F. F. Adams, of Denver, has secured contract for an extension to the U. S. Post Office (bids opened Oct. 18) for $13,250.

Washington, D. C.—Bids will be received until Nov. 27 by Elliott Woods, Supt. U. S. Capitol Bldgs. and Grounds, for steel framing for roof of office building, U. S. Senate. Plans and specifications may be had upon a deposit of $25.

Atlanta, Ga.—The following are the bids opened on Oct. 30 at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction, including plumbing, of U. S. Post Office and Court House at Atlanta, Ga.; (*a*) for marble, (*b*) deduct if granite is used, (*c*) deduct if limestone is used: Chas. McCane Co., Philadelphia, Pa., *a* $869,000, *b* $31,000, *c* $85,000; Miles & Bradt, Atlanta, *a* $992,000, *b* $59,000, *c* $170,000; Conners Bros. Co., Lowell, Mass., *a* $936,241, *b* $29,800 *c* $139,000; Gude & Walker, Atlanta, *a* $997,000 *b* $29,000, *c* $150,000; Cramp & Co., Philadelphia, Pa., *a* $954,000, *b* $37,300, *c* $149,400; F. F. Nesbit, New York, N. Y., *a* $1,032,000, *b* $37,490, *c* $143,800; Henry Smith's Sons, Baltimore, Md., *a* $988,100, *b* $49,000, *c* $130,000.

East St. Louis, Ill.—The following are the bids opened on Oct. 28 at the office of the Super. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of U. S. Post Office and Court House at East St. Louis: Hiram Floyd Bldg. Co., St. Louis, Mo., $213,305; C. L. Grey Const. Co., St. Louis, Mo., $239,300; Gedney Lumber & Mfg. Co., E. St. Louis, $238,791; A. B. Stannard, New York, N. Y., $227,000; I. H. Wiese, S. Omaha, Neb., $221,890, and Cramp & Co., Philadelphia, Pa., $222,960.

Chicago, Ill.—The lowest bid opened on Nov. 6 at the office of the Superv. Archt. Treas Dept., Washington, D. C., for painting U. S. Post Office was submitted by O'Brien Bros., of Chicago, for $22,000.

Chicago, Ill.—Bids are wanted until Nov. 12 for erecting a boathouse for the Illinois Naval Reserve, at Chicago. W. Carbys Zimmerman, State Archt., 1101 Steinway Hall.

South Bend, Ind.—Bids will be received until Nov. 15 by the Bd. Pub. Wks. (W. A. McInerney, Pres.) for erecting a brick hose house.

Terre Haute, Ind.—It is reported that all bids received Oct. 30 for erecting a jail have been rejected, as they exceeded the amount available, which is $75,000. The County Council, according to later reports, has appropriated an additional $50,000, making $125,000 available.

**Pittsfield, Mass.*—The contract to erect the armory on Summer St. is reported awarded by the State Armory Comrs. at Boston, as follows: Construction to Richardson & Burgess, of Boston, at $43,997; plumbing to Sullivan & Carnody, of Holyoke, at $1,725, and heating to Robbins & Gamwell, of Pittsfield, at $2,722.

Lowell, Mass.—The Council, it is reported, has appropriated $20,000 for fire station in the Centerville suburb.

Worcester, Mass.—The following are reported to be the bids opened on Oct. 30 for the erection of the Worcester Armory: Central Bldg. Co., $48,950; A. T. Robbins, $46,800; J. M. & C. J. Buckley, $46,150; J. D. O'Brien, $45,980; E. D. Ward, $44,940; Ed. J. Cross, $37,629; Jas. Miles & Son, 33 Merrick St., $37,277; F. W. Mark, 1 Benefit Terrace, $36,719. Reports state that new specifications are to be drawn and new bids asked.

Ann Arbor, Mich.—Bids will be received until Dec. 23 by Jas. Knox Taylor, Superv. Arch., Washington, D. C., for the construction (complete) of the U. S. Post Office at Ann Arbor.

Saginaw, Mich.—W. S. Linton, John L. Jackson and E. L. Hardwick are reported appointed as trustees for the auditorium which is to be erected at a cost of about $100,000.

Flint, Mich.—The following are the bids opened on Nov. 5 at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for the construction (complete) of the U. S. Post Office at Flint: Chas. Hoertz & Son, Grand Rapids, $85,423; Geo. Richmond's Sons, Kalamazoo, $74,900; Ed. Henry, Tipton, Ind., $73,000; W. I. McAlpine, Dixon, Ill., $72,700; Gen'l. Constr. Co., Milwaukee, Wis., $87,000; Northern Constr. Co., Milwaukee, Mo., $82,000; E. W. Reid & Co., Detroit, $82,900; Trunchtel & Schurman, Saginaw, $73,839.

St. Paul, Minn.—The erecting of a new wing at the City and County Hospital (Dr. A. B. Decker, Supt.), to cost about $120,000, is reported under consideration. Clarence H. Johnston, Manhattan Bldg., is the archt.

**Warren, Minn.*—The Co. Comrs. it is stated have authorized the Co. Comrs. to accept the bid of the Pauly Jail Bldg. Co., St. Louis, Mo., for jail cells, at $3,217.

Faribault, Minn.—Albert Schippel, of Mankato, is reported to have been engaged to prepare plans for a hospital which is to be erected here by the German Evangelical Synod of North America. Probable cost, $40,000.

Houston, Miss.—The Bd. of Superv. of Chickasaw Co., it is stated, has ordered an issue of $65,000 bonds to erect a court house and will consider plans at its Nov. meeting.

St. Louis, Mo.—Bids will be received until Nov. 15 (re-advertisement) by the Bd. Pub. Improv. (A. J. O'Reilly, Pres.) for furnishing material and rebuilding the east wing of the main building of the City Poorhouse, known as Bldg. No. 1; estimated cost, $25,000.

Leeds, Mo.—It is reported that at the meeting of Dr. Robt. O. Cross, Pres. of Jackson County Society for the Prevention of Tuberculosis, Mayor Beardsley, City Physician Sanders and the Council Sanitary Com. it was decided to erect at Leeds the tuberculosis hospital which Kansas City intends building. The cost of the building is to be about $20,000, of which the Jackson County Society will contribute $10,000.

Breesport, N. Y.—Bids will be received until Nov. 12 by Frank J. Gordon, Clk. Bd. Superv., at Elmira, for additions and alterations at the County Farm Buildings, at Breesport, including steam heating, electric light

**Items marked thus give the names of parties awarded contracts.*

plant and gas lighting. J. H. Considine, Archt., 323 Carroll St., Elmira.

Remsen, N. Y.—Bids will be received until Dec. 7 at the office of Walter G. Frank, Archt., 17 Clarendon Bldg., Utica, for erecting the Didymas Thomas Library at Remsen.

**Watervliet, N. Y.*—It is stated that the contract to erect a shop and stock room at the Arsenal has been awarded to Elmer H. Havens, of Albany. The building is to be of concrete and brick, 50x80 ft.

**Raleigh, N. C.*—W. A. Erwin, of West Durham, Chmn. Bldg. Co. State Hospital, writes that M. Underwood, of Durham, N. C., has secured contract for erecting addition to State Hospital (bids opened Oct. 25).

**Fayetteville, N. C.*—W. Lee Harvey, of Greensboro, is reported to have secured the contract to erect the $35,000 auditorium and market house.

Defiance, O.—Mahurin & Mahurin, of Ft. Wayne, are reported to be preppariug plans for an infirmary to be erected here at an estimated cost of $35,000.

Cleveland, O.—The following are the bids opened on Oct. 31 at the office of the Superv. Archt. Treas. Dept., Washington, D. C., for the Mechanical Equipment (except Elevators) of the U. S. Post Office Custom House and Court House at Cleveland: John Pierce, New York, N. Y., $129,000; L. H. Niehaus, Pittsburg, Pa., $142,550; S. Faith & Co., Philadelphia, Pa., $165,000; E. H. Alodie Co., St. Louis, Mo., $193,974; the Chafer Co., Cleveland, O., $179,162, and John Gill & Co., Cleveland, O., $172,460.
The following are the bids opened same time and place for interior partitions and mason work of U. S. Post Office at Cleveland: John Gill & Co., Cleveland, O., $63,968; John Pierce, New York, N. Y., $59,000, and A. B. Stannard, New York, N. Y., $92,867.

Philadelphia, Pa.—The Lutheran Hospital is reported organized, with Rev. S. D. Daugherty, Pres., and Dr. Luther C. Peters, Secy., for the purpose of erecting a hospital.

Pittsburg, Pa.—The improving of the Municipal Hospital, at a cost of about $150,000, is reported under consideration.

Philadelphia, Pa.—See "Water."

**Knoxville, Tenn.*—Brinner & England Bros., of Knoxville, are reported to have secured the contract to erect the city stables, 2-story brick, at a cost of $12,000.

Nashville, Tenn.—Bids will be received until Nov. 27 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including heating apparatus, electric conduits and wiring), of a new mailing platform and for miscellaneous betterments at the U. S. Custom House and Post Office at Nashville.

Wichita Falls, Tex.—It is reported that plans are being prepared for a city hall and jail, to cost $12,000.

Seattle, Wash.—The Sisters of Providence, according to reports, will erect a hospital at 17th Ave. and Jefferson St., at a cost including site of about $800,000.

Madison, Wis.—The Capitol Bldg. Com., it is reported, decided on Oct. 29 to build the separate heating plant for the State House next year. It is stated that bids will be asked at once for the tunnel which is to be constructed between the heating plant and the capitol, a distance of 5 blocks, and will award the contract Dec. 18. Geo. B. Post, of New York, N. Y., is reported to be preparing plans for the heating plant and as soon as plans are completed contract for the construction will be let. Storm Bull of the State Univ. is preparing specifications for the boilers and machinery to be used and these plans will be ready for bidders, according to reports, early next year.

Green Bay, Wis.—The Bldg. Com. of the Bd. of Superv., it is reported, has decided to recommend to the Bd. of Superv. at its meeting on Nov. 12 the plans of C. E. Bell, of Minneapolis, Minn., for the Court House, and those of Foeller & Schober, Fox Blk., for the jail.

Ft. Mackenzie, Wyo.—Bids will be received by Capt. Wm. D. Davis, Q. M., U. S. A., until Nov. 27 for the construction of brick quartermaster storehouse, brick quartermaster stable, brick fire station, frame coal shed, steel-clad magazine and for the installation of plumbing, heating, electric wiring and electric fixtures in buildings where specified at this post.

Toronto, Ont.—Bids will be received until Nov. 21 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for erecting an astronomical observatory here. Burke & Horwood, Archts., 28 Toronto St.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—Olivzer & Foulkes, of Oakland, it is reported, have completed plans for a 7-story concrete and brick building which is to be erected for doctors and dentists at Jackson and 13th Sts., at a cost of about $300,000.

Berkeley, Cal.—A permit has been issued for the Berkeley Natl. Bank, an 8-story structure, which is to be erected at Center St. and Shattuck Ave., at a cost of $140,000.

Los Angeles, Cal.—It is stated that Mulvihill & McInerney intend erecting on 15th and Main Sts. a 3-story hotel, according to plans prepeared by A. C. Smith, 307 S. Bway. The hotel is to be managed by W. C. Deister.
*The Machinery & Electric Co., it is stated, has secured the contract for the ventilating and heating system in the Majestic Theatre, at Bway. and 9th St.

Burlington, Colo.—A. W. Reynolds, of Denver, is said to be preparing plans for a 2-story bank building, to be erected here by A. W. Winegar, of Denver, at a cost of $20,000.

**Wilmington, Del.*—The contract for the steam heating apparatus for the Y. W. C. A. Bldg. is reported awarded to Geo. B. Ward, 1,003 Market St., and that for the electrical fixtures to Higgins & Co.

Washington, D. C.—The directors of the Washington Mechanics Savings Bank are said to be preparing to erect a bank and office building at 8th and G sts, estimated to cost $25,000.

Macon, Ga.—It is reported that the erection of an entirely new building for the Masons, instead of remodeling the old building, is contemplated. Probable cost, $100,000.
*The contract to erect a $18,000 store, it is reported, has been awarded to Wilder & Paulin, of Macon.

Aurora, Ill.—Bids will probably be received in Dec. or Jan. for the erection of a Y. M. C. A. building for Aurora, to cost about $75,000. John Mackimmie, of Aurora, has contract for the concrete foundations for this building. W. M. Mercer, Chm. Bldg. Com. Architects, Patton & Miller, of Chicago.

Ingleside, Ill.—The members of the Fox Lake Yacht Club, it is stated, have secured a site at Stanton Point on Fox Lake on which it is proposed erecting a club house next spring at a cost of $30,000.

Galesburg, Ill.—The Elks are reported to be planning the erection of a building at a cost of $20,000.

Chicago, Ill.—The 5-story building at State and Quincy Sts., is reported to have been badly damaged by fire on Oct. 31.

Peoria, Ill.—It is reported that bids are to be asked for erecting an 8-story warehouse at Harrison and Water Sts. for the Larkin Soap Co. as soon as switching facilities are secured. W. E. Parsons, of Peoria, Mgr.

Ft. Wayne, Ind.—Louis F. Curdes, Secy. Ft. Wayne Hotel Co., writes that plans for the new hotel are about complete and would be ready for contractors about Nov. 8, and contract will be let for its erection about 10 days after; probable cost, $300,000. Architects, Weatherhogg & Crocker, of Ft. Wayne.

Tipton, Ind.—The car barns of the Indiana Traction Co. are reported destroyed by fire.

**Roachdale, Ind.*—Thos. Hill & Co., are reported to have secured the contract to erect a saw mill for Cutsin Sons & Co. at a cost of $15,000.

East Chicago, Ind.—G. J. Bader, Pres. of the First Natl. Bank, is reported to be agitating the proposition to erect an office building, costing about $60,000.

Council Bluffs, Ia.—Harry Curtis, Gen. Secy. Y. M. C. A., writes that Cox & Schoentzen, of Council Bluffs, are preparing plans for a Y. M. C. A. building, to cost about $40,000.

Des Moines, Ia.—Proudfoot & Bird, Crocker Bldg., it reported, have completed plans for the 7-story cut-stone and terra cotta building which is to be erected for the Bankers' Life Insurance Co. at 6th and High Sts.

Belle Plaine, Ia.—Josselyn & Taylor Co., 213 S. 3d St., Cedar Rapids, it is reported, are preparing plans for a 2-story lodge building for the Odd Fellows, to cost $10,000.

Cedar Rapids, Ia.—The Bohemian Western Benevolent Assoc., it is reported, intends erecting at 12th Ave. and 3d St. at $20,000 building.

**Madisonville, Ky.*—Hall & Reynolds, of Madisonville, it is reported, have secured the contract to erect a hotel at Centre and Union Sts., estimated to cost $45,000.

Bowling Green, Ky.—L. J. Darter, Gen. Secy. Y. M. C. A., writes that it is proposed to erect a Y. M. C. A. building, at a cost of $30,000. Architect not yet selected and will probably not be for about 2 months.

Somerset, Ky.—It is reported that the Cincinnati, New Orleans & Texas Pacific R. R. Co. (F. Wrampelmeier, Res. Engr., Somerset), will erect a passenger station here to cost about $100,000.

Louisville, Ky.—Mrs. Virginia Sale, it is stated, has taken out a permit to remodel the building on 4th Ave., recently damaged by fire. The cost is to be about $25,000.

**New Orleans, La.*—The American Can Co., according to reports, has awarded the contract to erect a 3-story brick addition to its plant at Cortez and Toulouse Sts., to Geo. J. Glover, of New Orleans, at about $50,000.
*The contract for the steel and iron work on the new Monteleon Hotel is reported awarded to Milliken Bros., of New York, N. Y., at $76,000.

**Baltimore, Md.*—Jas. J. Duggan, 1121 W. Franklin St., is reported to have secured the contract to erect for the St. Stanislaus R. C. Church, at 1727 Alice Anne St., a brick hall, 47x179 ft., to cost about $35,000.

New Bedford, Mass.—Wm. J. Dunn, of Fall River, is reported to be considering the erection of a department store here for J. V. Spare Dry Goods Co., of which J. Fuller is president.

Duluth, Minn.—Plans and specifications for the warehouse to be erected by the Standard Oil Co., on Oneota St., have been submitted to the Bldg. Dept. W. T. Lang, local manager.
The Northwest Land & Loan Co. (T. A. Sloan, Mgr.), it is stated intends erecting another story to the Sloan Block, on 20th Ave. W., to cost about $10,000.

Minneapolis, Minn.—A permit is reported granted to John W. Thomas & Co. to erect a brick, tile and steel building at Nicollet Ave. and 8th St., to cost $175,000.
A permit has been issued for a 4-story warehouse and office building, to be erected for the City Sash & Door Co., at 305 5th St., S., to cost $40,000.

Kansas City, Mo.—H. E. Huselton is reported to have accepted plans prepared by Jas. Oliver Hogg, N. Y. Life Bldg., for a 6-story music hall and business building estiamted to cost $200,000.
The following buildings are to be erected: Brick store at 2201 E. 12th St., at a cost of $15,000, owner, Park Metter; brick society building at 718 W. 23d St., cost $29,000, owner, Swedish N. N. & E. Society; brick store at Bway. and Belt Line, cost $25,000, owner, American Linseed Oil Co.
Chas. Campbell, it is reported, has been granted a permit to erect at 10 W. 36th St., a business building costing about $50,000.

Omaha, Neb.—The managers of the Henshaw Hotel, according to reports, intend expending about $250,000 enlarging the hotel.

Bayonne, N. J.—It is stated that plans are being prepared by Tuthill & Higgins of Jamaica, L. I., N. Y., for a 2-story 72x224 ft. office building, to be erected at the plant of the Babcock & Wilcox Co. in Bayonne at a cost of $75,000.

Dover, N. H.—J. Edw. Richardson, 56 Grove St., is preparing plans for rebuilding the American House, recently burned; cost about $25,000.

Buffalo, N. Y.—A. Hoefner & Sons, according to reports, propose erecting a 3-story office building at 156 Van Rensselaer St.

Poughkeepsie, N. Y.—Jackson & Rosencranz, of Brooklyn, are reported to have been commissioned to prepare plans and obtain estimates for a new Y. M. C. A. building, to cost $100,000, to be erected on Market St.

Gouveneur, N. Y.—The erection of a Y. M. C. A. bldg. costing about $20,000 is reported under consideration.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 1-story brick freight shed at 11 Wooster St. for Adams Express Co.; cost, $20,000; Geo. K. Hooper, Archt.; 6-story brick and stone stores and tenements at 450 W. 41st St. for Hugh King; cost, $35,000; Bernstein & Bernstein, Archts.; 6-story brick and stone store and loft building at 439 W. 41st St. for Sharlow Bros.; costfi $30,000; J. H. Eames, Archt.; 6-story brick and stone loft building at 381 5th Ave. for I. H. Peller; cost, $60,000; S. Sass, Archt.; 2-six story brick and stone tenements at 112th St. and Madison Ave. for Saml. Michelson; cost, $70,000; Chas. M. Straub, Archt.; alterations to 6-story brick and stone bank and office building at 328 5th Ave. for J. J. Astor Estate; cost, $25,000; Augustus N. Allen, Archt.
Plans for the Lotus Club, a 7-story building to be erected at 110 W. 57th St., have been filed. Probable cost, $350,000. Dean Barber, 24 E. 23d St., is the Archt.
Plans have been prepared for the erection of the following buildings: 7 story brick and stone stores and office building, at 43 2d Ave., for Minsky & Engel; cost, $50,000; Fred Ebeling, Archt.; 6-story brick and stone store and tenement, at St. Nicholas Ave. and 173d St., for A. B. Kight, Owner and Archt.; cost, $125,000; 2-story brick storehouse, at 587 Brook Ave., for Jos. & John E. Couron; cost, $25,000; Jas. E. Maher, Archt.; alterations to 4-story brick and stone store and office building at 714 5th Ave. for Chas. A. Gould; cost, $41,000; Woodruff Leeming, Archt.
Plans have been filed for the erection of a 3-story addition to the State Bank at 376 Grand St., to cost $25,000.

Minot, N. D.—The Lodge of Elks, it is stated, intends erecting a $60,000 building here.

Enid, Okla.—The Denver, Enid & Gulf R. R. (R. J. Parker, Gen. Supt. Central Grand Division, Newton, Kan.), it is reported, will erect a depot here at a cost of about $50,000.

Pittsburg, Pa.—The members of the American Republican Club, it is stated, are planning the erection of a new clubhouse on Grant Boule., at a cost of about $175,000, exclusive of site.
*It is stated that the contract for the bathhouses to be erected for the Civic Club on Penn Ave. and 20th St. has been awarded to T. J. Williams, Ferguson Blk.
J. H. Craig, it is reported, intends erecting a 12-story brick business building on Burchfield St.

**Philadelphia, Pa.*—John Wanamaker is reported to have awarded to the Thompson-Starrett Co., New York, N. Y., the contract for the brick and steel work on the second half of the department store on Chestnut and 13th Sts. The building when completed is to be a 12-story structure.

Scranton, Pa.—The clubhouse of the Scranton Country Club is reported destroyed by fire.

Brookings, S. D.—The directors of the First Natl. Bank, it is stated, propose erecting a 2-story office building.

Memphis, Tenn.—It is reported that A. W. Gettingby is having plans prepared for a $23,000 business building.

Memphis, Tenn.—It is reported that the Weber Concrete Co., Randolph Bldg., will soon erect a 6 or 8 story building, to cost $150,000.
The Bd. of Directors of the Y. M. C. A. is reported to have secured a site at Madison Ave. and 4th St., and will have plans prepared at once for a building.

Ft. Worth, Tex.—The Ft. Worth Stock Yards Co., according to reports, will erect a $150,000 coliseum.

**Houston, Tex.*—Frank Heidelberg, 1417 Pease Ave., it is stated, has secured the contract to erect a 3-story brick family hotel, at $50,340.

Globe, Tex.—It is stated that a $25,000 building is to be erected by the Lodge of Elks.

**Seattle, Wash.*—It is stated that the contract to erect the 7-story steel and concrete fireproof building on Pike Pl. for the Pike Pl. Natatorium Co. has been awarded to A. E. White.
Edelsvard & Sankey are said to be preparing plans for a reinforced concrete building, to be erected at 8th Ave. and Virginia St., by Chas. Hultin, at a cost of $40,000; also plans for a $22,000 building, to be erected by P. A. Hallberg, at Boren Ave. and Denny Way.
It is reported that plans are being prepared for a hotel, which Chas. Hultin will erect, at an estimated cost of $75,000.
W. D. Hofius is stated to have filed plans for a 1-story brick market to be erected at 1503 First Ave., to cost $17,000, and Beck & Brill, 101 Pike St., for 2 additional stories to be erected to their building, the cost to be $25,000.

Bluefield, W. Va.—It is stated that bids will be received until Nov. 30 for constructing a reinforced concrete hotel, 8 stories high, 116x92 ft., and to cost $200,000. W. E. & E. L. Shufflebarger, Archts., Graham, Va.

Menasha, Wis.—Miss E. Bierman, of Appleton, it is reported, intends erecting on Main St., Menasha, a $15,000 3-story brick business building.

**Ottawa, Ont.*—The contract for excavating the site and the construction of foundation for the Grand Trunk station, hotel and other buildings, it is reported, has been awarded to John Quinlan & Co., of Montreal, Que., at about $60,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received until Dec. 10 by Maj. W. E. Craighill, Corps Engrs., U. S. A., Mobile, for furnishing material and constructing 3 keeper's

**Items marked thus give the names of parties awarded contracts.*

dwelling, with wharves, cisterns and privies, for Southwest Pass Light Station, La.

Pasadena, Cal.—It is stated that a site has been selected on which the members of the Christian Science Church propose erecting a $100,000 edifice.

Los Angeles, Cal.—S. N. Kornblum, it is reported, has secured a site at 11th and Hoover Sts. on which he intends erecting a $25,000 residence.

Sparta Ga.—The members of the Methodist Church, it is stated, are planning the erection of a $25,000 edifice.

Coeur d'Alene, Idaho.—It is reported that plans have been completed for a $50,000 edifice to be erected for the members of the Roman Catholic Church (Rev. Father Purrell, Pastor).

Decatur, Ill.—The members of St. Patrick R. C. Church, it is reported, are planning the erection of a $100,000 edifice.

Chicago, Ill.—John C. Updegrove, it is stated, will erect a 3-story apartment house at 1985 Sheridan Road to cost $25,000.

The members of Sheridan Park Methodist Church, it is stated, intend erecting an edifice at Wilson Ave. and Sheridan Park, estimated to cost $75,000.

Des Moines, Ia.—It is stated that plans are being prepared for a residence, to be erected at 696 18th St., for M. Rosenfield.

**Keokuk, Ia.*—Dollery & Woolley of Keokuk, it is reported have secured the contract to erect an edifice for the First Congregational Church to cost about $20,000.

**Galena, Kan.*—The contract to erect the Methodist Church, it is stated, has been awarded to Lillard & Helm, of Galena, at $18,000.

Hutchinson, Kan.—It is reported that the members of the Prebyterian Church propose making improvements at a cost of $15,000.

Baltimore, Md.—Rev. Edw. M. Weigel, Rector of the Sacred Heart R. C. Church, it is stated, is planning the erection of an edifice costing $150,00 at 3d St. and Foster Ave.

St. Joseph, Mo.—It is reported that the members of the First Christian Congregation are planning the erection of an edifice at 10th and Edmond Sts., to cost $75,000.

Kansas City, Mo.—Howe & Hoit, 315 E. 10th St., are preparing plans for a brick dwelling to be erected on 36th and Main St., for Chas. Campbell, to cost $40,000.

J. W. McKecknie, N. Y. Life Bldg., is preparing plans for stone dwelling to be erected on 36th and Locust St. for W. A. Henchman, to cost $13,000; also for an apartment house for Guy Cooper to be erected at 35th St. and Broadway.

H. Felt, Shukert Bldg., is preparing plans for the Jackson Ave. Christian Church, to be erected on 17th St. and Jackson Ave., to cost $35,000.

C. A. Smith, Dwight Bldg., is preparing plans for an apartment house for T. B. Tomb, to be erected at 414 Wabash Ave., to cost $11,000.

The following buildings are to be erected: Brick apartment house at 2600 E. 28th St., cost $35,000, J. A. Rowe owner; brick dwelling at 2600 31st St., cost $16,000, F. M. Rounx owner; brick dwelling at 3643 Vine St., cost $14,600; John Ravens, owner; brick dwelling at Benton Boule. and 6th St., cost $12,000, W. L. Morrow owner.

Lincoln, Neb.—It is reported that the East Side Baptist Church is to be remodeled at a cost of $12,000.

Omaha, Neb.—Saml. Adler, it is reported, has secured a site at 38th and Farnam Sts., on which he intends erecting a $20,000 apartment house.

North Platte, Neb.—It is reported that plans have been prepared for an edifice for the members of the Presbyterian Church which is to cost $17,500.

Jersey City, N. J.—The congregation of Mount Sinai of Hudson City is reported to be planning the erection of a synagogue costing about $30,000.

Orange, N. J.—The members of the North Orange Baptist Church, it is reported, propose making improvements to the edifice costing about $40,000.

Ocean City, N. J.—It is stated that plans are being prepared by Geo. E. Savage, Provident Bldg., Philadelphia, Pa., for a 1-story stone church for the members of the Methodist Church, to cost about $30,000.

Atlantic City, N. J.—Geo. E. Savage, Provident Bldg., Philadelphia, Pa., is reported to be preparing plans for a 2-story stone parsonage and tabernacle, to be erected for the Atlantic City Methodist Church. Probable cost, $30,000.

Jersey City, N. J.—The New Jersey Constr. Co., it is stated, has had plans prepared by Jos. Lugosh for a apartment houses, which are to be erected at a cost of $36,000 at Morgan St. and the Hudson Boule.

New York, N. Y.—Plans have been filed for the erection of 5-story brick and stone dwelling at 5th Ave. and 76th St. for Mrs. J. J. Wysong; cost, $80,000; Hoppin & Koen, Archts.; 6-story brick and stone apartment house at Bway. and 127th St. for Charter Constr. Co.; cost, $125,000; Schwartz & Gross, Archts.

Plans have been filed for a 3-story residence to be erected for M. Schinasi at Riverside Drive and 170th St., to cost $118,000.

Astoria, L. I., N. Y.—Plans have been filed for an edifice which is to be erected for the First Methodist Episcopal Church at a cost of about $55,000 at Temple and Crescent Sts.

Wilson, N. C.—It is reported that the members of the Baptist Church propose erecting a $25,000 edifice.

Cincinnati, O.—The congregation of the Bene Israel of Avondale is staid to be planning the erection of a synagogue costing about $200,000. Simon Greenbaum, Pres. of the congregation.

Columbus, O.—It is reported that the Eastwood Congregation has had plans prepared for a $30,00 edifice.

**Corey, O.*—John Burhart, of Kenton, according to reports, has secured the contract to erect the edifice for Our Lady of Consolation Church at a cost of $80,000.

**Philadelphia, Pa.*—The contract to erect a residence at [illegible] DeLancey St. for Prof. John Bach McMaster of the Univ. of Pennsylvania, it is stated, has been awarded to Henry C. Dahl, 241 S. 6th St., at $12,800.

**Pittsburg, Pa.*—J. H. Trimble & Son, of Allegheny, it is stated, has secured the contract to erect the Mary S. Brown Memorial Church, at Hazlewood Ave. and Beechwood Boule., Squirrel Hill, at a cost of $55,000.

D. A. Crone, 134 Stafford Ave., is reported to be preparing plans for a synagogue which is to be erected by the congrgeation of the Gates of Wisdom at Townsend St. and Colwell Sts. of gray brick with terra cotta trimmings and cost about $40,000.

Sumter, S. C.—The Bldg. Com. of the First Methodist Church, it is stated, has adopted the plans of A. W. Todd of Charleston for an edifice costing about $30,000.

Nashville, Tenn.—It is reported that an edifice costing about $12,000 is to be erected at First St. and 3d Ave. for the Moore Memorial Baptist Church.

Abilene, Tex.—It is reported that bids are wanted until Nov. 29 for erecting an edifice for the First Baptist Church. For further information address L. A. Scarborough. C. W. Bulger & Sons, Archts., Flateau Bldg., Dallas.

Uvolde, Tex.—Wm. Hagy, of San Antonio, it is reported, has completed plans for a $15,000 edifice, to be erected for the members of the Methodist Church.

Salt Lake City, Utah.—The members of the First Baptist Church, it is reported, have accepted plans for an edifice costing about $40,000. A. Bong, Clk. Bldg. Com.

A. W. Mibgley is reported to be arranging for the erection of a $20,000 apartment house.

Norfolk, Va.—It is reported that East & Hobbs are planning the erection of a $65,000 apartment house.

Spokane, Wash.—H. Bloch, it is stated, will erect a 3-story brick apartment house at Pacific Ave. and Hemlock St., to cost $16,00.

Seattle, Wash.—It is reported that the members of the Methodist Episcopal Church South are planning the erection of a $75,000 edifice.

Oshkosh, Wis.—Wilmot H. Miller, of Winneconne, it is stated, has secured a site at Algoma St. and New York Ave., on which he intends erecting a $25,000 residence.

Ashland, Wis.—It is reported that John V. Farwell & Co., of Chicago, Ill., contemplate erecting in the spring a 3-story flat building to cost about $60,000.

Reedsburg, Wis.—O. C. Uehling, of Milwaukee, is reported to be preparing plans for St. Peters Church, which is to be erected of brick and stone at a cost of $25,000.

Milwaukee, Wis.—A permit has been issued for an apartment house to be erected at 32d St. and Grand Ave. for A. A. Esbenschade at a cost of $27,000. Leiser & Holst, Germania Bldg., are the archts.

Torreon, Mex.—The Methodists are said to be planning the erection of a $35,000 church.

SCHOOLS.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—A. Klingensmith, 521 Gar. Ave., is reported to have prepared plans for a $50,000 school to be erected here, contract for which will soon be let.

Little Rock, Ark.—Gibb & Sands, of Little Rock, it is reported, have completed plans for the 5-story dormitory which is to be erected at the Philander-Smith Methodist College.

San Francisco, Cal.—The Bd. of Educ., it is stated, has approved plans and specifications for the Laguna Honda and Golden Gate schools.

The Bd. of Superv., it is stated, has directed the Bd. of Pub. Wks. to contract for the erection of the Monroe St., School, the cost not to exceed $81,000.

**San Diego, Cal.*—The Bd. of Educ. is reported to have awarded the contract to erect a brick school on Florence Heights to John Engebretson, at $55,000.

It is stated that the Bd. of Educ. has decided to erect a brick school at 12th and E Sts.

**New Britain, Conn.*—The contract to erect an addition to the Monroe St. School, it is reported, has been awarded to John W. Allen & Son, 209 Enst St., at $9,473.

Washington, D. C.—Marsh & Peter, 520 13th St., N. W., are preparing plans for a school of 16 classrooms and an assembly hall, to be erected at Mt. Pleasant, to cost about $100,000. Bids will probably be called for in Jan. by the District Comrs.

Cornelia, Ga.—The School Bd., according to reports, has decided to erect a $10,000 school.

Charleston, Ill.—J. H. Marshall, Trus. State Normal School, writes that W. Carby Zimmerman, State Archt., Chicago, is preparing plans for the erection of a dormitory at Charleston for the State Normal School, to cost about $100,000.

**Desoto, Ind.*—J. E. Hager, of Muncie, is reported to have secured the contract to erect an 8-room school at Desoto at about $15,000.

Atchison, Kan.—Nathan T. Veath, Supt. City. Schools, writes that it is proposed to erect a high school to cost, including site, $75,000. Architect not yet selected.

Lexington, Ky.—The School Bd., it is stated, is arranging to erect a new school and make improvements to other buildings at a total cost of $55,000.

**Slidell, La.*—It is stated that the contract to erect a 2-story high school has been awarded to C. D. Stuart of Baton Rouge, at an estimated cost of $22,000.

New Bedford, Mass.—The following are the bids opened on Oct. 22 by the City Council Com. on City Property for the construction of a high school on 2 plans—(*a*) large building, (*b*) smaller building: Henry T. Bulman, New Bedford, *a* $707,000, *b* $574,408; J. W. Bishop Co., Worcester, *a* $729,024, *b* $574,408; Woodbury & Leighton, Boston, *a* $731,840, *b* $597,836; Maguire Penniman Co., Providence, R. I., *a* $781,150, *b* $612,000; Z. B. Davis, New Bedford, *a* $853,350, *b* $678,758, and J. B. Sullivan & Son, of New Bedford, *b* $617,777.

Springfield, Mass.—The City Council has authorized a bond issue of $125,000, $43,000 to be used for school sites.

Coopersville, Mich.—F. E. Payne, Secy. Bd. of Educ., writes that bids will probably be received Jan. 6 for the erection of a school, to cost about $16,000.

Detroit, Mich.—The Washington Normal School on Beaubien St., it is stated, is to be replaced by the School Bd. with a new structure containing 24 rooms.

The following are reported to be the lowest bids received Oct. 22 by the School Bd. for erecting the Wm. A. Moore School: Masonry, W. D. Travers, 335 5th St., $25,970; carpenter work, Harcus & Lange, 770 Russell St., $21,780; plumbing and heating, Jacob Zerga, 78 Larned St. W., $11,394.

Coopersville, Mich.—It is stated that competitive plans are being received for a school to cost about $25,000.

Faribault, Minn.—All bids recently received for erecting a farm cottage dining hall at the School for Feeble Minded at Faribault, it is reported, have been rejected by the Bd. of Control at St. Paul.

Waterville, Minn.—The Pres. Bd. of Educ. writes that architect has not yet been selected for the new high school, for which the citizens recently voted to issue $30,000 bonds.

South St. Paul, Minn.—John J. O'Brien, Secy. Bd. of Educ., writes that the citizens on Oct. 29 voted to issue $45,000 school bonds.

Mankato, Minn.—The Bd. of Control at St. Paul, it is stated, has rejected all bids recently received for erecting the State Normal School at Mankato, as they exceeded the appropriation, which is $65,000.

Newfolden, Minn.—It is reported that plans are being prepared for a 2-story brick school to be erected here.

Gulfport, Miss.—The City Council, it is stated, has decided to sell $52,000 bonds, the proceeds to be used for street paving and for school buildings.

Phillipsburg, N. J.—It is stated that Seymour & Paul A. Davis, 3d., 1600 Chestnut St., Philadelphia, Pa., will invite estimates soon for a 3-story brick and stone high school, 65x90 ft., at Phillipsburg.

**Dover, N. J.*—The citizens have voted an additional $30,000 for erecting the high school and contracts for its construction are reported awarded as follows: (Bidders of Dover unless otherwise stated): O'Donnell & McManiman, Newton. masonry, $23,000; A. L. Shoemaker, carpenter work, $22,412; J. T. Kerr & Co., heating and ventilating, $12,995; J. T. Kerr & Co., plumbing, $3,095; Rich. P. Ward, electrical work, $1,400. J. J. Vreeland, Jr., of Dover, Archt.

Jersey City, N. J.—Bids will be received until Nov. 14 by the Bd. Educ. (Fred Ege, Secy.) for furnishing material and erecting a school on the plot adjacent to School No. 14, on Union St. Bids to be submitted, as a whole or separately, on the following: Masonry, carpentry, plumbing, ventilating and heating, etc.; also erecting fire escapes on Schools Nos. 1, 9, 13, 17, 18, 19, 20, 21, 22, 23 and 26. John T. Rowland, Jr., Archt., 15 Exchange Pl.

El Rito, N. M.—It is stated that bids will be received until Nov. 15 by the Bd. Trus. New Mexico Reform School (Venceslao Jaramillo, Secy.) for the completion of the basement, 2-story and attic of the administration building for above school. I. H. and W. M. Rapp, archts., Trinidad, Colo.

Cincinnati, O.—Bids will be received until Nov. 25 (readvertisement) by Wm. Grautman, Clk. Bd. Educ., for $250,000 school bonds.

New Wilmington, Pa.—It is stated that plans are being prepared for a musical auditorium which is to be erected for Westminster College at a cost of $15,000.

Philadelphia, Pa.—See "Water."

Philadelphia, Pa.—Cope & Stewardson, Achts., 320 Walnut St., according to reports, will invite estimates in a few days on the new building for the College of Physicians, at 22d and Ludlow Sts. The structure will cost about $300,000. They are also said to be preparing plans for an extension to the veterinary college of the University of Pennsylvania at 39th and Spruce Sts.

The directors of the Academy of Science, it is stated, have engaged Wilson, Harris & Richards, Drexel Bldg., to prepare plans for a 3-story 50x130 ft. white marble addition, which it is proposed erecting at a cost of about $125,000.

Jas. H. Windrim, Commonwealth Trust Bldg., is reported to have completed plans for a gymnasium 124x118 ft., to be erected at Girard College. The building is to be of steel, brick, granite and marble 1 story high.

**Lenoir City, Tenn.*—It is reported that the contract to erect a high school has been awarded to Baumann Bros., at $13,500.

Morrison, Tenn.—An administration building, estimated to cost $25,000, it is reported, is to be erected for the Normal and Industrial School. Dr. Judson S. Hill, Pres. Bd. Trus.

Eagle Pass, Tex.—The Attorney General is reported to have approved the issue of $30,000 Independent school dist. bonds.

**San Diego, Tex.*—The School Bd., it is stated, has awarded the contract to erect a school to Albert & Fuess, of Cuero, at an estimated cost of $12,000.

San Angelo, Tex.—The Bd. of Educ., it is stated, proposes erecting a school to cost $30,000.

Cleburne, Tex.—It is stated that bids will be received by John L. Cleveland, Chmn. School Bd., until Nov. 14, for installation of central heating plant for school buildings. Plans on file at office of Sanguinet & Staats, Archts., Wilson Bldg., Dallas.

**Spokane, Wash.*—The following are reported to be the bids received by the Bd. of Educ. Oct. 24 for erecting the North Central High School: J. C. Cunningham, $63,056 (awarded contract); J. B. Sweatt, $72,878, and N. Norman, $77,138.

Milwaukee, Wis.—Frank M. Harbach, Secy. Bd. School Dirs., writes that all bids opened on Oct. 31 for erecting school on Forest Home and 11th Avs. have been re-

****Items marked thus give the names of parties awarded contracts.***

jected and new bids will be called for. Amount available, $100,000.

Galesville, Wis.—The following are reported to be the lowest bids received Oct. 25 for erecting the high school: Construction, G. H. Smith, Viroqua, $29,800; heating, Baker-Niebuhr, of La Crosse, $5,560, and plumbing, $1,597.

Wauwatosa, Wis.—The Bd. of Educ., it is reported, has appropriated $5,000 for a heating plant for the high school.

Toronto, Ont.—It is reported that a site has been secured on which it is proposed erecting new buildings for the Knox College, the cost of site and buildings to be about $500,000. Rev. Dr. John Gray may be able to give further information.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Sheffield, Ala.—We are informed that the Stanford Steel Range Co., of Sheffield, will in the near future erect a plant to manufacture ranges of the Stanford patent, to cost from $100,000 to $250,000, but location of plant has not yet been decided upon.

St. Stephens, Ala.—John R. Markley, of Markley & Miller, of Chicago, Ill., is reported to be interested in a company which proposes constructing a cement plant in St. Stephens. Probable cost, $2,000,000.

Hartford, Conn.—The Hoag Rapid Press Co., 32 Union Pl., are reported to have decided to erect new factory building on Bartholomew Ave.

**Sioux City, Ia.*—Benj. E. Short, of Sioux City, is reported to have secured the contract to erect the main building for the Interstate Brewing Co., at $82,000. The building is to be 5 stories of steel, brick and fire-proof construction. The contract for the bottling house, office building, loading sheds, barns and other small buildings will be let soon. The machinery for the buildings will probably cost $100,000.

Des Moines, Ia.—It is reported that Cohen Bros., 307 E. 3d St., iron and metal dealers, have secured a site on which they propose erecting a steel roller mill costing about $100,0000.

Iola, Kan.—The Iola Portland Cement Co., incorporated in W. Va., is reported to have secured a charter in the State of Kansas on Nov. 1; the company has a capital stock of $4,500,000 and is incorporated to build a cement plant in Iola.

Charlotte, Mich.—F. S. Beach, Gen. Supt. Beach Mfg. Co., mfgrs. of everything for roads, writes that the company has broken ground for a new building of steel construction, 80x200 ft., to be used for structural iron work, and fitted with latest machinery for this class of work, the greaest portion of which is already on hand. Will do its own work and their engineer is drawing plans.

Minneapolis, Minn.—Wm. M. Kenyon, Guaranty Bldg., it is stated, has prepared plans for an addition which it is proposed erecting to the Soo machine shops in Northeast Miineapolis. The addition is to be of brick and stone, 123 x 180 ft. and cost about $65,000. Bids are being received. Thos. Green, Ch. Engr., Minneapolis, St. Paul & Sault Ste. Marie Ry., Minneapolis.

Laurel, Miss.—The Wausau Southern Lumber Co., of Wausau, Wis., is reported to have decided to erect a lumber mill in Laurel to have a capacity of 60,000,000 to 65,000,000 ft. per annum.

Wellsville, Mo.—The International Screen Door Co. is reported to have secured the plant of Burheu & Finley and intends enlarging and erecting new buildings.

Newberry, N. C.—F. N. Martin, Geo. S. Mower and others are reported to have filed articles of incorporation with a capital of $300,000 for the purpose of constructing the Highland Cotton Mill. Edw. R. Hipp and others, it is stated, are considering the erection of another cotton mill.

Cincinnati, O.—It is reported that the Jos. Joseph & Bros. Co., Harrison Ave., dealers in metals, contemplate making extensive improvements at its plant at a cost of about $40,000. The company, it is stated, has retained the Reliance Eng. Co. to prepare plans and supervise the erection of a new power house and installation of new power equipments. The capacity of the plant is to be greatly increased, with the addition of a battery of boilers of 1,000 h. p., new engines, generators and motors for the operation of a direct-drive system. The work will completely modernize the plant and increase its facilities.

The Reliance Eng. Co., according to reports, has been engaged by the Cincinnati Soap Co. to prepare plans for a plant to cost about $150,000.

**Riverpoint, R. I.*—It is stated that the contract to erect the building at Riverpoint for the Warwick Lace Wks. has been awarded to E. K. Watson & Co., of Warren. It is reported that the machinery has been ordered.

Hartsville, S. C.—The Hartsville Cotton Mills will add to its equipment spindles and looms.

Newport, Tenn.—We are informed that the proposed addition of the Crescent Eng. Co. will have about 25,000 sq. ft. of floor space, and it will be built of concrete with steel con. roof. The power plant will have a capacity of 200 to 300 h.p. None of the material has been ordered yet. Plans are not yet ready, but the company will be glad to hear from manufacturers and dealers.

Memphis, Tenn.—See "Miscellaneous."

Spokane, Wash.—Reinhart Martin, John Schnoor and Chas. J. Martin, according to reports, have filed plans in Olympia for the incorporation of the Schnoor Cooperage & Box Mfg. Co., which proposes erecting a general cooperage and box manufacturing plant in Spokane. It is also reported that the company has secured land in Bonners Ferry, Idaho, on which it is proposed erecting a similar plant.

Milwaukee, Wis.—We are informed that the Kurth Brewing Co., of Columbus, Wis., will erect a new plant at Milwaukee, to include a 600,000 bushel malting plant and a 250,000 bushel storage elevator, two 150-h.p. boilers and one 200-h.p. generator.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Baltimore, Md.—All bids opened on Oct. 16 by the Bd. Awards (J. Barry Mahool, Pres.), for the removal and final disposition of garbage, dead aniamls and market refuse of this city from Jan. 1. 1908, until Jan. 1, 1918, have been rejected, and new bids will be received until Nov. 20. J. L. Wickes, Comr. Street Cleaning.

Pittsburg, Pa.—The Council is reported to have on Oct. 28 passed an ordinance providing for the appointment of a consulting engineer in the Bureau of Health to prepare palns for collection and disposal of ashes, rubbish, etc.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—See "Churches and Dwellings."

Mobile, Ala.—The following are the bids opened on Oct. 5 by Maj. H. Jervey, Corps Engrs., U. S. A., for constructing locks and dams Nos. 2 and 3 and lock tender's house on Tombigbee River, Ala.: (*a*) P. H. O'Brien, Anniston; (*b*) Lane Bros. Co., Lynchburg, Va.; (*c*) Engineer's estimate:

Lock and Dam No. 2—

	a	*b*	*c*
11 acres grubbing and cleaning	$200.00	$100.00	$100.00
100,400 cu. yds. common excav.	.40	.55	.45
8,400 cu. yds. found. excav.	1.40	2.75	4.00
12,600 cu. yds. stone fill.	5.00	4.50	4.00
17,200 cu. yds. concrete	8.45	10.00	8.00
1,000 cu. yds. gravel fill	2.00	4.50	2.25
5,400 cu. yds. riprap, hand placed	5.50	5.00	4.50
3.6 M ft. miter sills	100.00	100.00	100.00
352 M ft. framed timber, square edged, sound	45.00	45.00	45.00
473 M. ft. framed timber, heart	47.00	55.00	50.00
309 M. ft. cofferdam timber	37.50	50.00	45.00
40 M. ft. sheathing	35.00	40.00	35.00
400 lin. ft. drain pipe	1.50	.90	.40
94,000 lbs. placing valves and special irons	.04	.01½	.01½
Totals	$350,275	$400,655	$368,155

Lock and Dam No. 3—

	a	*b*	*c*
8 acres grubbing and cleaning	$200.00	$100.00	$100.00
109,000 cu. yds. common excav.	.40	.55	.45
16,000 cu. yds. found. exc.	1.25	2.75	4.00
10,200 cu. yds. stone fill.	4.50	4.25	4.00
18,700 cu. yds. concrete	8.45	9.00	8.00
1,000 cu. yds. gravel fill	2.00	4.00	2.25
2,900 cu. yds. riprap, hand placed	5.00	5.00	4.50
3.6 M ft. miter sills	100.00	100.00	100.00
507 M ft. framed timber, equare edged, sound	45.00	45.00	45.00
477 M ft. framed timber, heart	47.50	55.00	50.00
320 M ft. cofferdam timber	37.50	50.00	45.00
40 M ft. sheathing	35.00	40.00	35.00
400 lin. ft. drain pipe	1.50	.90	.40
94,000 lbs. placing valves and special irons	.04	.01½	.01½
Totals	$389,725	$441,955	$440,967
Lock tender's house, at Lock No. 3	2,500	3,000	.....

Harrisburg, Ark.—The Comrs. of Poinsett County are reported to be considering the draining of the entire county at a cost of $595,000.

Paragould, Ark.—Press reports state that there are five drainage projects now on foot in Greene County, which, if carried out, will cost about $250,000.

Oakland, Cal.—The City Council has under consideration estimates presented by City Eng. Turner for new wharves, which the city proposes to build by means of a bond issue. Three estimates of cost are furnished for two wharves, 1¼ miles long and 200 ft. wide. The expense for ordinary construction, with creosoted piles and lumber superstructure, will be $1,425,000, for piles protected by concrete cylinders, timber stringers and floor, $5,702,400; for, protected piles and concrete floor, reenforced concrete superstructure, $6,336,000. The cost of dredging, buildings or railroads is not included in the estimate. The bulkhead would cost $54,900. To dredge a slip 300 feet wide to a depth of 25 ft. below water and to dredge a fan-shaped approach to the same depth out of the channel would require approximately the removal of 2,205,000 cu. yds., at a cost of $330,000.

Pesotum, Ill.—It is stated that bids will be received until Nov. 23, by the State Drainage Comrs., of Dist. No. 1 at the office of B. A. Hyatt, Town Clerk, for the construction of a tile drain, the work to be done to consist of the following: 4,200 ft. 16-in.; 3,480 ft. 15-in.; 980 ft. 14-in.; 1,445 ft. 12-in.; 600 ft. 10-in. tile, together with the necessary connections.

Chicago, Ill.—Bids will be received until Nov. 12 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and removing about 5,500 cu. yds. material from the bed of the Chicago River at the south end of Oakley Ave., and to construct about 75 ft. new dock across the south end of Oakley Ave. on the north branch of the Chicago River.

Logansport, Ind.—It is stated that bids will be received until Nov. 12, by the Surv. for the construction of the Jas. T. Braun ditch, in Jackson Township, Cass County.

Ft. Dodge, Ia.—Bids will be received, it is stated, until Nov. 19 by the County Auditor for constructing drainage works in Drainage Dist. No. 30. C. Anderson, Lake City, Engr.

Emmetsburg, Ia.—Bids will be received until Dec. 11 by the Bd. of Superv., at the office of Sim R. Stedman, Co. Aud., Emmetsburg, for constructing work in drainage districts Nos. 6, 12, 16, 18, 19 and 28, for which G. D. McNabb is the engineer, and also for work in Drainage Dists. Nos. 15, 23 and 25, of which Guy. R. Campbell is the engineer. The work includes excavating and tile work.

New Orleans, La.—Bids will be received at the Bureau of Yards and Docks, Navy Dept., Washington, D. C. (Wm. M. Smith, Acting Ch.), until Nov. 23 for an electric freight elevator in Bldg. 6, naval station, New Orleans, La, as per specification No. 1568; est. cost, $4,100.

Springfield, Mass.—See "Sewerage and Sewerage Disposal."

Blue Earth, Minn.—Jesse L. Herring, Co. Aud., writes that J. A. Bachtel, of Easton, Minn.; B. Bieri, of Wells, Minn., and C. H. Garnsey, of Winnebago, have been appointed to arrange plans for the construction of a steel dam at outlet of Walnut Lake.

**Minneapolis, Minn.*—The contract for the dredging at Lake of the Isles is reported to have been awarded to the La Crosse Dredging Co. at 12¾ cts. per cu. ft.

Wheaton, Minn.—Bids will be received, it is stated, until Dec. 3, N. F. Schroeder, Co. Aud., for constructing Sec. 1 of Ditch No. 2.

Madison, Minn.—It is stated that bids will be received until Nov. 18 by A. G. Shogren, Aud., Lac qui Parle Co., at Madison, for constructing judicial ditch No. 1 in Lac qui Parle and Yellow Medicine Counties.

Newark, N. J.—The citizens on Nov. 5 voted in favor of the Lane Dock Bill, under which the Bd. of Works proposes to expend $1,000,000 in the acquisition of water rights and the building of docks along Newark Bay, with a ship canal across the meadows to the uplands as part of the scheme.

New York, N. Y.—A. V. Porter, Archt. for the New York City Ry. Co., has filed plans with Supt. of Pub. Bldgs. of N. Y. City, for protecting against fire the two East Side and West Side car houses of the Metropolitan system, on Lexington ave. and 129 st., and on Amsterdam ave. and 128th st., by equipping them with sprinkler extinguishing plants. Each plant will be supplied with two storage tanks of 25,000 gals. capacity ea. and five pressure tanks, ea. of 7,500 gals. capacity. Large roof houses will be erected to shelter the plants; the improvements are to cost $9,500.

We are informed that all bids opened on Oct. 31 by J. A. Bensel, Com. of Docks, N. Y. City, for furnishing material and preparing for and building a new ferry house for the Staten Island Ferry, at the Manhattan terminal, foot of Whiteball St., Boro. of Manhattan, have been reiected. The following are the bids received: John J. Hopper, $666,333; Phoenix Constr. Co., $714,679, and Post & McCord, $524,900.

**Reading, Pa.*—The following are the bids opened on Oct. 18 by the Bd. of Pub. Wks. for the construction of a subway under the P. & R. tracks at Spring St.: (*a*) Howard E. Ahrens Co., Reading; (*b*) L. H. Focht & Son, Reading; (*c*) Hawman Bros, Reading (awarded contract); (*d*) David Peoples, Philadelphia; (*e*) Mack Paving Co., Philadelphia; (*f*) Jacob Meyer, Reading; (*g*) Jos. O'Reilly, Reading; (*h*) Eastburns & Childs, Philadelphia.

	a	*b*	**c*	*d*	*e*	*f*	*g*	*h*
324 lin. ft. 10-in. c. i. pipe	$1.50	$1.25	$1.15	$1.50	$1.85	$0.98	$1.30	$1.15
60 lin. ft. 8-in. c. i. pipe	1.10	1.00	1.07	1.50	1.35	.73	1.09	.87
220 lin. ft. 12-in. terra cotta pipe	1.00	.45	.43	.60	1.05	1.23	.46	.35
1,100 lin. ft. 10-in. terra cotta pipe	.90	.38	.48	.40	1.71	1.08	.34	.32
142 lin. ft. 8-in. terra cotta pipe	.80	.30	.30	.25	.90	.56	.24	.23
Concrete for 10-in. c. i. pipe, per lin. ft.	.50	.35	2.00	1.00	.25	.33	.60	.90
Concrete for 12-in. terra cotta pipe, per lin. ft.	.60	.38	2.00	1.00	.25	.53	.60	.90
73 concrete manholes with cover for pipe sewer, per vertical ft.	3.75	4.25	4.00	4.25	4.00	4.30	4.00	3.75
2,300 sq. yds. concrete sidewalk	1.00	1.25	.60	.90	1.50	.54	.52	1.54
2,600 lin. ft. Granolithic curb, 6x24-in.	.75	1.15	.40	.50	1.25	.38	.55	.30
2,100 lin. ft. reinforced cement coping (9-in. thick)	2.25	1.25	1.00	.60	.50	1.17	1.60	.40
4 plate "I" basins, ea.	80.00	79.00	40.00	100.00	35.00	48.00	60.00	30.00
4,450 sq. yds. plaster coat	.25	.18	.20	.10	.30	.38	.39	.50
All lumber, per M, B. M.	40.00	29.00	40.00	60.00	50.00	30.00	50.00	75.00
Brick masonry, per cu. yd.	8.50	9.00	15.00	9.00	15.00	9.60	22.00	12.00
Vitr. brick masry., per cu. yd.	10.00	18.00	20.00	16.00	20.00	14.20	30.00	20.00
Rubble stone masonry, per cu. yd.	4.90	3.00	7.50	6.00	6.00	5.70	9.00	9.00
4,375 cu. yds. concrete in place, 1-2-4	5.55	5.37	5.71	5.40	7.00	6.50	6.93	5.33
2,597 cu. yds. concrete in place, 1-2½-5	5.40	4.86	4.74	4.40	6.00	5.50	4.69	4.68
3,830 cu. yds. concrete in place, 1-3-6	5.25	4.83	4.58	4.25	7.00	4.72	3.37½	4.85
Maintenance of railroad traffic during construction, complete (lump sum)	13,250	11,750	11,750	14,300	19,350	11,750	11,750	13,750
3,100 sq. yds. water-proofing material, 1-in. thick	1.75	1.65	1.25	1.40	.60	1.62	1.62	.50
44,400 cu. yds. excavation without classification	.55	.55	.42	.44	1.10	.45	.47¾	1.03
Totals	$131,174	$122,982	$110,480	$110,945	$178,830	$122,284	$122,434	$142,310

*Items marked thus give the names of parties awarded contracts.

Canton, N. Y.—Bids will be received by the Indian Creek Drainage Comrs. until Dec. 6 for deepening the Van Rensselaer ditch at and near village of Rensselaer Falls, in the town of Canton, as advertised in The Engineering Record. E. M. Townsley, Engr.

Buffalo, N. Y.—Bids will be received until Nov. 19 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for furnishing and installing 2 vertical high-pressure double cylinder, 8 in. x 8 in. reversing engines at the Michigan St. Bridge over Buffalo River.

Ft. Caswell, N. C.—Bids will be received by L. Cravens, Q. M., U. S. A., until Nov. 30 for building creosoted bulkhead here, as advertised in The Engineering Record.

•*Panama.*—The Isthmian Canal Comn. has awarded to the Marion Steam Shovel Co., of Marion, O., the contract for supply 12 steam shovels, at $13,180 each, a total of $158,160 (bids opened Sept. 25). A contract has also been awarded to the Davenport Locomotive Co., of Davenport, Ia., for supplying 4 locomotives at $3,163, a total of $12,652.

•The Newport News Shipbuilding Co., of Newport News, Va., has secured the contract for building 6 steel barges for use in construction work on Panama Canal for $120,000.

Philadelphia, Pa.—See "Water."

Yankton, S. D.—The Comrs. of Yankton and Clay counties are reported to have voted to levy an assessment to raise $20,000 needed to construct the Turkey Valley ditch, near Irene, which will be 4½ miles in length.

Memphis, Tenn.—The Mississippi River Terminal Co. is reported organized by Columbus Beiree, W. J. Crawford, C. C. Hanson and others, stockholders of the Gulf Compress Co. It will erect and maintain a terminal, consisting of docks and elevators, at the foot of Livermore Ave., and handle the river cotton for the Gulf Compress Co.

Bay City, Tex.—The citizens are reported to have voted on Oct. 19 to create a drainage district to be known as Matagorda County Drainage Dist. No. 1; estimated cost $146,000.

•*Austin, Tex.*—John O. Johnson, City Clk., writes that R. V. Dixon has secured the contract for constructing retaining wall and embankment at Congress Ave., for $6,493.

Bremerton, Wash.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Nov. 26 to furnish at the navy yard, Puget Sound, Bremerton, Wash., the following supplies: Sch. 462—11 M. ft. white ash and 109 M. ft. white ash No. 1, 38 M. ft. fir; 31,400 ft. white oak, 44 M. ft. sugar pine, 17 M. ft. spruce lumber and 31 M. ft. spruce No. 1. Sch. 464—Standard iron pipe sets. Sch. 465—Brass rod, 25,000 lbs. ingot copper, round and square bar iron, 75 tons pig iron, 15,000 lbs. sheet lead, 3,000 lbs. ingot tin, medium bar steel, about 210,000 lbs. galvanized sheet steel, 124,000 lbs. mild steel billets, 4,000 lbs. slab zinc. Sch. 468—Seamless drawn brass pipe, wrought iron pipe, bushings, couplings, elbows, plugs, tees, crosses and unions, 70 doz. globe and angle valves and 1 doz. gate valves, etc.

•*Marinette, Wis.*—The contract for constructing drainage canal in Marinette County is reported to have been awarded on Oct. 26 to Hanson & Krienbring, of Peshtigo, at 10 cts. per cu. yd. for dirt, 30 cts. for hardpan and 70 cts. for rock.

Eau Claire, Wis.—Wm. Danforth, City Engr., writes that there is a committee to consider the construction of a dam and bridge at Shawtown, but nothing definite has yet been done.

Madison, Wis.—See "Public Buildings."

Toronto, Ont.—At a meeting of the Cabinet at Ottawa on Oct. 22 plans for the construction of a new western entrance to Toronto barbor were ratified, on recommendation of Hon. Mr. Pugsley, Minister of Pub. Wks. The work contemplated will involve an expenditure of between $300,000 and $400,000. A new western entrance is to be dredged out through the sand strip just south of the present channel; it will be 400 ft. wide and 18 ft. deep. Long piers will be built.

Trenton, Ont.—Bids will be received until Dec. 2 by the Central Ontario Ry. at its General Offices in Trenton (Geo. Collins, Mgr.) for the clearing, grading track laying, ballasting and other work required in the construction of the Whitney Extension between the 24th mile near Lake St. and Whitney, a distance of about 18 miles.

Peterboro, Ont.—Bids will be received until Nov. 21 Alex. J. Grant, Supt. Engr., Trent Canal, Peterboro, for the works connected with the construction of the Rosedale section of the canal.

•*Colborne, Ont.*—Kastier & Porter, of Wiarton, are reported to have secured the contract for constructing dock at Colborne (bids opened Oct. 24, by the Dept. of Pub. Wks. at Ottawa).

PROPOSALS OPEN.

For Proposals see pages 60, 61 and 63.

WATER.

Bids Close.		See Eng. Record.
Nov. 12.	Pipe, Atlanta, Ga. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 12.	System, Velva, N. D.	Oct. 26
Nov. 12.	Castings, Chicago, Ill.	Nov. 9
Nov. 13.	Improv. at pump. station, New York, N. Y.	Nov. 2
Nov. 14.	Pump house, Ft. Morgan, Ala. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 14.	Main, Ft. Mackenzie, Wyo.	Nov. 2
Nov. 14.	Mains, Grand Forks, N. D.	Nov. 9
Nov. 15.	Pipe, Winnipeg, Man. Adv. Oct. 5 to 19 and Nov. 2.	Oct. 5
Nov. 18.	Meters and meter boxes, Norfolk, Va.	Nov. 9
Nov. 18.	System in pub. bldg., Barnesville, O.	Nov. 9
Nov. 18.	Mains, Lakewood, O.	Nov. 9
Nov. 21.	Water supply improv. at National Cemetery, Santa Fe, N. M.	Nov. 9
Nov. 25.	Pumps, Atlanta, Ga. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 25.	Pumping engine, Atlanta, Ga. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 26.	Mains, Seattle, Wash.	Nov. 9
Nov. 28.	Tank and trestle, Ft. Morgan. Adv. Nov. 2, 9.	Nov. 2
Dec. 1.	Water wks., Shelley, Idaho.	Sep. 28
Dec. 1.	Pipe, etc., Phoenix, Ariz. Adv. Oct. 5 to 26.	Oct. 12
Dec. 17.	Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19.	Oct. 12
——	Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Nov. 2.	Sep. 28
——	Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to Nov. 9.	Oct. 12
——	Reservoir, etc., Blackstone, Va.	Oct. 19
——	Suction line, Alexandria, Va.	Nov. 9

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 12.	Southbridge, Mass.	Nov. 9
Nov. 12.	Sioux City, Ia.	Nov. 9
Nov. 12.	Lima, O.	Nov. 9
Nov. 15.	Boston, Mass. Adv. Oct. 26.	Oct. 26
Nov. 16.	Buffalo, N. Y.	Nov. 9
Nov. 20.	Springfield, O. Adv. Nov. 2, 9.	Nov. 2
Nov. 20.	Brooklyn, N. Y.	Nov. 9
Nov. 20.	Reading, Pa. Adv. Nov. 9.	Nov. 9
Nov. 21.	Youngstown, O.	Nov. 9
Nov. 25.	Canton, O.	Nov. 2
Nov. 25.	Ft. Du Pont, Del. Adv. Nov. 9.	Nov. 9
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 27.	White Plains, N. Y. Adv. Nov. 9.	Nov. 9
Dec. 2.	Cadillac Mich. Adv. Oct. 19, 26.	Oct. 19
Dec. 3.	Auburn, N. Y. Adv. Oct. 19 to Nov. 9.	Oct. 19
Dec. 6.	Forsyth, Ga.	Nov. 9
Dec. 9.	Orrville, O.	Nov. 9
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 9.	Oct. 26

BRIDGES.

Nov. 12.	Troy, O.	Oct. 12
Nov. 12.	Toronto, Ont.	Nov. 9
Nov. 13.	Denver, Colo.	Nov. 9
Nov. 15.	Glendive, Mont. Adv. Sep. 28 to Oct. 12.	Sep. 28
Nov. 15.	Portland, Ore.	Oct. 19
Nov. 15.	Mill Run, Pa.	Nov. 2
Nov. 15.	Cincinnati, O.	Nov. 9
Nov. 19.	Erie, Kan.	Nov. 9
Nov. 20.	Georgetown, S. C.	Nov. 2
Nov. 22.	South Bend, Ind.	Nov. 9
Nov. 25.	Los Angeles, Cal.	Nov. 9
Nov. 29.	West Bethlehem, Pa.	Oct. 26
Nov. 29.	Portland, Ore.	Nov. 2
Dec. 11.	Wailuka, H. I.	Nov. 9
Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. —.	Ventura, Cal.	Nov. 2

PAVING AND ROAD MAKING.

Nov. 11.	Atlantic City, N. J. Adv. Nov. 2.	Nov. 2
Nov. 12.	Troy, O.	Oct. 12
Nov. 12.	Denton, Md.	Oct. 26
Nov. 12.	Chicago, Ill.	Nov. 9
Nov. 12.	Media, Pa.	Nov. 9
Nov. 12.	Lima, O.	Nov. 9
Nov. 12.	Woodbury, N. J.	Nov. 9
Nov. 13.	Brooklyn, N. Y.	Nov. 2
Nov. 14.	New York, N. Y.	Nov. 2
Nov. 14.	Cedar Rapids, Ia.	Nov. 2
Nov. 15.	Pensacola, Fla. Adv. Oct. 19, 26.	Oct. 19
Nov. 15.	Davenport, Ia.	Oct. 26
Nov. 15.	Cincinnati, O.	Oct. 26
Nov. 16.	Bluffton, Ind.	Nov. 9
Nov. 16.	Norwood, O.	Nov. 9
Nov. 16.	Washington, D. C. Adv. Nov. 9.	Nov. 9
Nov. 18.	Brookhaven, Miss.	Oct. 26
Nov. 18.	Albany, N. Y. Adv. Nov. 2, 9.	Nov. 2
Nov. 18.	Atlanta, Ga.	Nov. 9
Nov. 18.	Lakewood, O.	Nov. 9
Nov. 19.	St. Louis, Mo.	Nov. 9
Nov. 20.	Brooklyn, N. Y.	Nov. 9
Nov. 20.	Hot Springs, Ark.	Nov. 2
Nov. 21.	Greenville, Tenn. Adv. Oct. 26.	Oct. 26
Nov. 21.	Albany, N. Y. Adv. Nov. 2, 9.	Nov. 2
Nov. 21.	Lancaster, Pa.	Nov. 9
Nov. 23.	Des Moines, Ia.	Nov. 9
Nov. 25.	Columbia, S. C. Adv. Nov. 2, 9.	Nov. 2
Nov. 25.	Ft. Myer, Va. Adv. Nov. 9.	Nov. 9
Nov. 25.	Lima, O.	Nov. 9
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 26.	Ft. Flagler, Wash.	Nov. 9
Nov. —.	Tacoma, Wash.	Oct. 26
Dec. 3.	Monticello, Ind.	Nov. 2
Dec. 3.	Palatka, Fla.	Nov. 2
Dec. 6.	Salt Lake City, Utah. Adv. Oct. 19 to Nov. 9.	Oct. 19
Dec. 13.	Valparaiso, Ind.	Sep. 7
Dec. —.	Ventura, Cal.	Nov. 2
——	York, Pa.	Sep. 7
——	Ithaca, N. Y. Adv. Oct. 19.	Oct. 12
——	Ft. Worth, Tex.	Nov. 2

POWER PLANTS, GAS AND ELECTRICITY.

Nov. 12.	Panama	Nov. 2
Nov. 12.	Chico, Cal.	Oct. 26
Nov. 12.	Washington, D. C.	Nov. 2
Nov. 14.	Cincinnati, O.	Oct. 19
Nov. 15.	Charleston, S. C.	Sep. 14
Nov. 16.	Evansville, Ind.	Nov. 9
Nov. 18.	Newburg Heights, O.	Nov. 2
Nov. 19.	Panama	Nov. 2
Nov. 19.	Washington, D. C.	Nov. 2
Dec. 1.	Montreal, Que.	Oct. 26
——	Hendersonville, N. C.	Nov. 2
——	Alexandria, Va.	Nov. 9

BUILDINGS.

Nov. 11.	Rest pavilion, etc., Atlantic City, N. J. Adv. Oct. 26	Oct. 26
Nov. 12.	School, Seattle, Wash.	Oct. 12
Nov. 12.	Schools, Pipestone, Minn.	Oct. 19
Nov. 12.	Pub. bldg., Parsons, Kan.	Nov. 2
Nov. 12.	Y. M. C. A. bldg., Steubenville, O.	Nov. 2
Nov. 12.	Armory, Hillsboro, N. D.	Nov. 2
Nov. 12.	School, Down, Kan.	Nov. 2
Nov. 12.	Brick for pub. bldg., Washington, D. C.	Nov. 2
Nov. 12.	Pub. bldg., Chicago, Ill.	Nov. 9
Nov. 12.	Pub. bldg., Breeseport, N. Y.	Nov. 9
Nov. 13.	Pub. bldg., Central Islip, N. Y.	Nov. 2
Nov. 14.	New industrial plants, Ft. Morgan, Ala. Adv. Oct. 26.	Oct. 26
Nov. 14.	Armory, Pine Grove, Pa.	Nov. 2
Nov. 14.	School, Jersey City, N. J.	Nov. 9
Nov. 14.	Htg. school, Cleburne, Tex.	Nov. 9
Nov. 15.	Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 15.	Y. M. C. A. bldg., Tampa, Fla.	Oct. 19
Nov. 15.	School, Superior, Wis.	Oct. 26
Nov. 15.	Y. M. C. A. bldg., Chattanooga, Tenn.	Nov. 2
Nov. 15.	Pub. bldg., Chippewa Falls, Wis.	Oct. 5
Nov. 15.	Pub. bldg., South Bend, Ind.	Nov. 9
Nov. 15.	Schools, El Rito, N. M.	Nov. 9
Nov. 15.	Pub. bldg., St. Louis, Mo.	Nov. 9
Nov. 15.	Htg. hospital, Ft. D. A. Russell, Wyo.	Nov. 2
Nov. 15.	Bus. bldgs., Columbus, O.	Nov. 2
Nov. 16.	New indus. plant, Washington, D. C.	Oct. 26
Nov. 16.	Indus. plant, Las Animas, Colo.	Nov. 2
Nov. 18.	Hotel, Ft. Wayne, Ind.	Nov. 9
Nov. 18.	Add. to pub. bldg., Los Angeles, Cal.	Nov. 2
Nov. 19.	Post bldgs., Jefferson Barracks, Mo.	Oct. 26
Nov. 19.	Bus bldg., Lawton, Okla.	Nov. 2
Nov. 19.	School, Mescalero, N. M.	Nov. 2
Nov. 20.	Plumb. work, pub. bldg., Ft. Monroe, Va.	Nov. 2
Nov. 20.	Pub. bldg., Columbus, O.	Nov. 2
Nov. 21.	Bus. bldg., Auburn, N. Y.	Oct. 5
Nov. 21.	Pub. bldgs., Greenville, Tenn. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 21.	Pub. bldg., Toronto, Ont.	Nov. 9
Nov. 22.	Post office, Portsmouth, Va. Adv. Oct. 19, 26.	Oct. 19
Nov. 25.	Exten. to post office, Tyler, Tex.	Oct. 19
Nov. 25.	Jail, Franklin, W. Va.	Nov. 2
Nov. 27.	Post office improv., Nashville, Tenn.	Nov. 9
Nov. 27.	Steel framing for roof of Senate Bldg., Washington, D. C.	Nov. 9
Nov. 27.	Post bldg., Ft. Mackenzie, Wyo.	Nov. 9
Nov. 29.	Post Office, Marion, Ind. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 29.	Church, Abilene, Tex.	Nov. 9
Nov. 30.	Hotel, Bluefield, W. Va.	Nov. 9
Nov. —.	University gymnasium, Madison, Wis.	Oct. 5
Nov. —.	School, Allegheny, Pa.	Oct. 19
Nov. —.	School, Washington, D. C.	Nov. 2
Dec. 2.	Foundations, etc., P. O. bldg., Devils Lake, N. D. Adv. Nov. 2, 9.	Nov. 2
Dec. 3.	Post Office, Nevada, Mo.	Oct. 26
Dec. 5.	Post Office, Waldoboro, Me.	Nov. 2
Dec. 7.	Pub. bldg., Remsen, N. Y.	Nov. 9
Dec. 9.	Pub. bldg., Wernersville, Pa.	Nov. 2
Dec. 10.	School, Alpine, Tex.	Nov. 2
Dec. 10.	Bus. bldg., Jacksonville, Fla.	Nov. 2
Dec. 10.	Dwelling, Mobile, Ala.	Nov. 9
Dec. 17.	Exten. to post office, Detroit, Mich.	Nov. 2
Dec. 18.	Tunnel to htg. pub. bldg., Madison, Wis.	Nov. 9
Dec. 23.	Post office, Ann Arbor, Mich.	Nov. 9
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
Dec. —.	School, Anderson, Ind.	Sep. 28
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. —.	School, Washington, D. C.	Nov. 9
Feb. 1.	Plans for Capitol, San Juan, P. R.	Sep. 28
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. —.	College, Agricultural College, Mich.	Oct. 19
——	Industrial plant, Hubbard City, Tex.	Oct. 26

MISCELLANEOUS.

Nov. 11.	Torpedo Cases, Ft. Totten, N. Y. Adv. Oct. 19 to Nov. 2.	Oct. 19
Nov. 11.	Drainage conduits, Atlantic City, N. J. Adv. Nov. 2.	Nov. 2
Nov. 11.	Grandstand, New York, N. Y.	Nov. 2
Nov. 12.	Supplies, Washington, D. C.	Nov. 2
Nov. 12.	Docks, etc., Chicago, Ill.	Nov. 9
Nov. 12.	Track laying cars, etc., Panama	Nov. 2
Nov. 12.	El ry. franchise, Ventura, Cal.	Nov. 2
Nov. 12.	Levee, Pine Bluff, Ark.	Nov. 2
Nov. 12.	Canal, West Point, Miss.	Nov. 2
Nov. 12.	Embankment wk., Lawrenceburg, Ind. Adv. Nov. 2, 9.	Nov. 2
Nov. 12.	Elevators, Minneapolis, Minn.	Nov. 2
Nov. 12.	Ditch, Logansport, Ind.	Nov. 9
Nov. 14.	Monument, Chalmette, La. Adv. Oct. 12 to Nov. 2.	Oct. 12
Nov. 14.	Docks, etc., Buffalo, N. Y.	Nov. 2
Nov. 15.	Dredging, Philadelphia, Pa. Adv. Oct. 19 to Nov. 9.	Oct. 19
Nov. 16.	Pier, Charleston, S. C.	Nov. 2
Nov. 16.	Levee work, Pine Bluff, Ark. Adv. Oct. 19 to Nov. 9.	Oct. 19
Nov. 18.	Locks and dams, Dallas, Tex. Adv. Oct. 12 to Nov. 9.	Oct. 12
Nov. 18.	Hoisting engines, etc., Portland, Ore. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 18.	Removal of wreck, Boston, Mass.	Nov. 2
Nov. 18.	Ditch, Madison, Minn.	Nov. 9
Nov. 19.	Ditch, Ft. Dodge, Ia.	Nov. 9
Nov. 19.	Supplies, Washington, D. C.	Nov. 2
Nov. 19.	Boiler, Buffalo, N. Y.	Nov. 9
Nov. 20.	Garb. disp., Baltimore, Md.	Nov. 9
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 19.	Sep. 28
Nov. 20.	Rock and earth excavation, Detroit, Mich. Adv. Oct. 12, 19, Nov. 9.	Oct. 12
Nov. 20.	Breakwaters, Ludington, Mich. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 20.	Dredging, Muskegon, Mich. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 21.	Dredging, Galveston, Tex. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 21.	Dredging, Mobile, Ala. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 21.	Wharf, Ft. Sumter, S. C.	Nov. 2
Nov. 21.	Jetty work, Galveston, Tex.	Nov. 2
Nov. 21.	Canal work, Peterboro, Ont.	Nov. 9
Nov. 22.	Dredging, Newport, R. I. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 23.	Tile drain, Pesotum, Ill.	Nov. 9
Nov. 23.	Elevator, New Orleans, La.	Nov. 9
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28 to Nov. 9.	Sep. 28
Nov. 25.	Dredging, Mattituck, N. Y. Adv. Oct. 26 to Nov. 9.	Oct. 26
Nov. 25.	Levee work, Memphis, Tenn. Adv. Nov. 2, 9.	Nov. 2
Nov. 26.	Supplies, Bremerton, Wash.	Nov. 9
Dec. 2.	R. R. work, Trenton, Ont.	Nov. 9
Nov. 30.	Bulkhead, Ft. Caswell, N. C. Adv. Nov. 9.	Nov. 9
Dec. 3.	Ditch work, Wausau, Wis.	Nov. 2
Dec. 3.	Ditch, Wheaton, Minn.	Nov. 9
Dec. 4.	Garb. disp., Altoona, Pa. Adv. Nov. 2, 9.	Nov. 2
Dec. 6.	Ditch work, Canton, N. Y. Adv. Nov. 9.	Nov. 9
Dec. 10.	Wharves, Mobile, Ala.	Nov. 9
Dec. 11.	El. ry franchise, New Orleans, La.	Oct. 26
Dec. 11.	Ditch, Emmetsburg, Ia.	Nov. 9
——	Lease of limestone quarries, Newark, N. J. Adv. Oct. 5.	Oct. 5
——	R. R. work, St. Louis, Mo.	Nov. 2

•*Items marked thus give the names of parties awarded contracts.*

CURRENT NEWS SUPPLEMENT

NOVEMBER 16, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting November 20, 1907. Paper on the Reinforced Concrete Work of the McGraw Building.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York. Annual meeting, New York, Dec. 3-6, 1907.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, 831 Ocean Ave., Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O

The Johnson system of fireproof floor construction has now been used in 131 buildings in 53 different cities, although it is comparatively new. These buildings are used for manufacturing, warehouse, office and public purposes, and several modifications of the flooring have been made in them to answer different requirements. The system has a bottom course of concrete containing a reinforcement of metal fabric, a middle course of rows of hollow terracotta blocks separated by 1-in. strips of concrete, and a top course of concrete. These floors are built by the National Fire Proofing Co., New York and Chicago, which has issued a pamphlet illustrating them and containing reports of tests.

THE HENRY HUDSON MEMORIAL BRIDGE.

The New York City Department of Bridges has just submitted for the approval of the Municipal Art Commission a design for the Henry Hudson Memorial Bridge across the Harlem River at Spuytenduyvil at a point about equivalent to the location of what would be 220th St., if the present system of streets were extended so far. It is proposed to create a public park at this point and to extend Riverside Drive to connect with it, thus making the bridge not only a memorial of the great discoverer, but also an important element in the magnificent river-front improvements of the metropolis.

The bridge will carry the driveway, promenade and four lines of car tracks across the river and valley at a maximum height of about 217 ft. above mean high water and will have extreme dimensions of about 2,840 ft. in length and 80 ft. in clear width. It will have a center span of 710 ft. in the clear with massive ornamental abutment piers flanked on one side by three and on the other side by four 100-ft. full-centered arches with wide piers and approaches terminating at each end in elaborate grand stairways. The construction will be mainly of concrete containing steel members and faced in some places with cut-stone masonry. The design is essentially monumental and has been carefully developed in strict conformity with the latest theories and structural practice and to present a beautiful appearance.

The axis of the bridge is on a tangent and is fortunately located at a point where the gneiss and dolomite rock rises nearly to the surface of the ground at the abutment and, according to the indications of numerous diamond drill exploration borings, will afford satisfactory footings at a depth probably not greater than about 20 ft. below datum, which is taken at mean high water, thus enabling the substructure to be advantageously constructed entirely in open excavation. Between the abutments the maximum depth of the water is about 25 ft. and the surface of the rock dips in both directions at a maximum angle of about 34 deg. toward the center of the river, where it is about 125 ft. below the datum.

The main span crosses the full width of the Harlem River and four tracks of the New York Central R. R. The center line of the arch ring has a span of 725 ft. and a rise of 177 ft. and the arch itself is a single continuous mass of concrete 70 ft. wide increasing in radial thickness from 15 ft. at the crown to 28 ft. at the skewbacks. It carries longitudinal spandrel walls at the crown and vertical piers and arches on the rest of the span. These piers form 8x22-ft. columns supporting on each side of the center line five pairs of spandrel arches of 31 ft. 7 in. clear span. Above them steel columns, girders, floor beams and stringers carry the concrete arches of the 50-ft. roadway and the reinforced concrete slabs of the 15-ft. cantilever sidewalks forming the upper or main deck. Below this is a second deck providing for the future installation of four car tracks in an arcade over and between the spandrel arches.

The character of the structure is designated by the designer, Prof. Wm. H. Burr, as articulated concrete construction calculated to concentrate definite stresses and to provide the requisite strength and rigidity for the large concrete surfaces without involving additional dead load from large masses of concrete not necessary to resist the working stresses, results which are attained by the system of embedded steel members and by the use of counterforts, ribs and flanges extended from the main body of the concrete.

The arch ring is reinforced by forty-eight full length 30x30-in. rectangular steel ribs each made of four 8x8-in. corner angles latticed together with inside bars. The ribs are arranged in twelve vertical planes and are thoroughly braced together by struts in vertical, longitudinal and transverse planes. The ends are seated on skewback footings and are thoroughly anchored to the masonry, and the ribs together form a complete span which will be erected on falsework before the commencement of the concreting. At each abutment the main ribs are supplemented by three intermediate I-shape auxiliary ribs, two panels long.

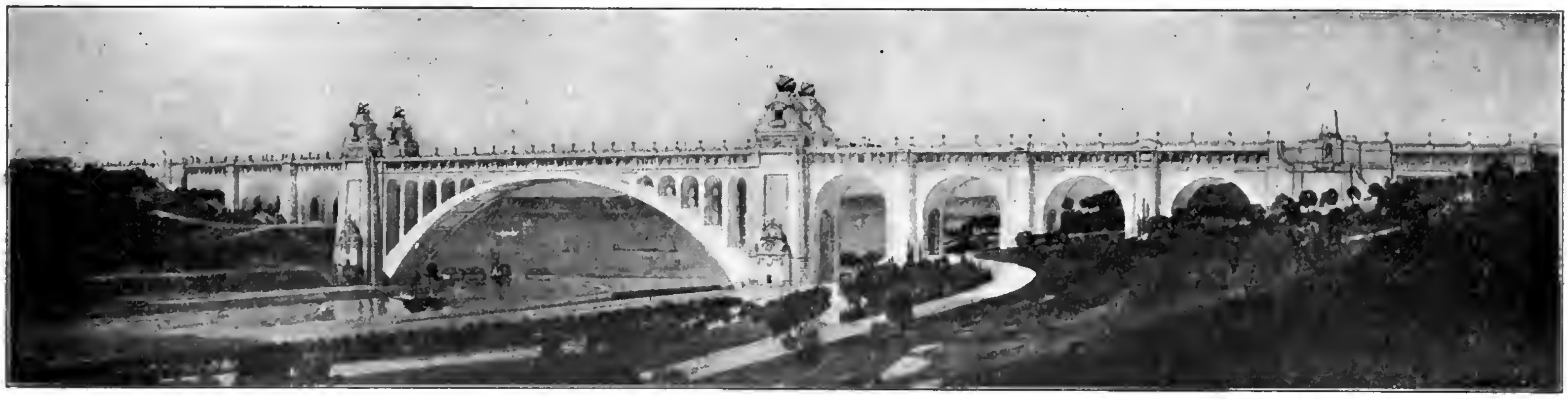
Groups of six rectangular vertical posts, each 2 ft. square and composed of four 6x6-in. angles latticed, are supported on the arch ribs and are riveted to all of them at intersections, thus forming an additional connection between the ribs. They are also riveted to horizontal transverse distributing plate girders connecting them just above the tops of the ribs, distributing the stresses and securing perfect alignment in the members. The vertical posts as well as the arch ribs are filled with concrete, and the former, in groups of six, are enclosed by concrete curtain walls which form the 8x22-ft. hollow spandrel posts.

The function of the steel is to strengthen the concrete by semi-hooping effects, to carry its proportion of the compressive stresses, and to resist the shrinkage stresses developed as the wet concrete becomes hardened. Great care is taken to avoid seating principal steel members on the concrete and to provide steel bearings for them in every case.

The calculations are made by two independent methods, first, the arch curve was determined by the approximate graphic method; second, the least work method was used analytically with the Cain graphic method and all principal dimensions were computed, not scaled. The results of both methods checked satisfactorily. The live load is assumed at 15,000 lb. per lineal foot and the position of maximum strain at all points is determined by the influence line method combined with reaction locus curves. In addition to direct dead and live load stresses, the calculations were made for stresses due to temperature changes, shrinkage during setting, deformation of arch curves by deflection and axial strain. The location of the curve is so near the center of gravity of the arch ring that under no possible condition can the unit compression in the concrete fall below 400 lb., the maximum compression under no condition exceeding 750 lb. The exact proportions of the concrete have not yet been determined, but it is expected that a rich concrete will be specified which will develop a strength of about 3,000 lb. for 12x12-in. test cubes. It is estimated that there will be in the main span, including the roadway platform, about 12,000 tons of structural steel and 47,000 cu. yd. of concrete.

The skewback piers are very prominent and important features of the design. They are 115x155-ft. hollow towers with concrete walls faced with granite and rise above the roadway to a total height of 300 ft. above mean high water. They are richly ornamented and have in the lower portions carvings in high relief representing portions of the hulls of Hudson's ancient ships.

The structure is being designed under the direction of Prof. Wm. H. Burr, who prepared a general outline of it for Commissioner Stevenson, of the Department of



THE PROPOSED HENRY HUDSON MEMORIAL BRIDGE, WITH A 710-FOOT REINFORCED CONCRETE CENTER SPAN.

Bridges more than a year ago. Since that time Mr. L. S. Moisseiff, of the Department's engineering staff has been in direct charge of the computations under Professor Burr's supervision and the approval of Mr. C. M. Ingersoll, chief engineer. Mr. Whitney Warren, of Warren & Wetmore, is the associated architect.

THE BOSTON TERMINAL PROBLEM.

In a long report to the Massachusetts Railroad Commission on the traffic and equipment conditions of the Boston & Albany R. R., Vice-President A. H. Smith, of the New York Central Lines, throws some interesting light on the terminal problem in Boston with reference to its present capacity and future improvement of electrification. Mr. Smith states that there has been no abatement of the interest taken to find a solution of the passenger terminal problem in Boston, but further study and investigation tend to create grave doubt as to the wisdom of abandoning, in such a short time, without abundant reasons, the commodious South Station, which was provided at great cost and after long and comprehensive studies by the best experts obtainable; especially when all the facilities originally contemplated and partially provided have not yet been fully utilized. This abandonment, if it happens, means the severance of union facilities for the convenient transfer of passengers, and the discommoding to some extent of certain commercial relations which the station has created, irrespective of the consideration of the great expense involved. Mr. Smith emphasizes the fact that if a serious error was committed in the building of this terminal for the special purpose for which it is now being used, which conclusion he hesitates to accept, it affords a monumental illustration of the necessity of conservative action.

During the period of densest traffic, the South Station is now handling about 88 trains per hour or approximately one train per track in the station every 20 minutes. During the rush hours of the holiday season, it has handled 97 trains per hour, or a train per track every 17 minutes. Considering the time required to load baggage, mail and express, this compares favorably with any terminal in the world in efficiency.

The plans which have thus far been evolved in the Park Square site to handle the present train service of the Boston & Albany would require the handling of four trains per track per hour, or the equivalent of a train per track per 15 minutes, requiring greater efficiency than the service now given at the South Station. The business now handled at the South Station, aggregating 850 trains per day, includes about 50 per cent. suburban trains, for the major portion of which electric operation was anticipated and double-track subways provided with an estimated capacity of 10,000 passengers per hour in each direction. If this subway operation of the suburban service may be realized in the future, it will permit a corresponding increase in the through train service on the main track level. This involves, according to Mr. Smith, a system of electric traction which will be entirely reliable at all times under the peculiar tidal and climatic conditions which prevail in that section, and for which there is now no precedent as a guide. It is hoped that the electric service at New York, with different kinds of construction, may indicate a satisfactory solution of the problem.

THE FORBES STERILIZER.

Some of our San Francisco readers will doubtless recognize that the apparatus shown in the accompanying illustration is the same in principle as the sterilizers sent to that city by the War Department eighteen months ago to furnish pure drinking water to the people of the afflicted city. For some eight or ten years the Forbes Company's shop at 1234 Callowhill St., Philadelphia, has been kept busy furnishing apparatus of this nature to various federal departments, and aside from supplying a few sterilizers to large companies which urgently requested them for thorough trial, the company has not been selling the appliances outside of government circles. The reason for this unusual condition is worth mentioning. The army in the Philippines during the early days of the occupation of the islands had much trouble in securing suitable drinking water and Drs. Walter Reed, E. O. Shakespeare and Victor C. Vaughn were appointed a board to ascertain the best method of obtaining it. Over thirty appliances for the purpose were thoroughly tested and the Forbes sterilizer was judged to be superior to all others submitted for trial, a decision that led to the steady government demand for the apparatus in various forms, from a little portable apparatus supplying hourly 10 or 12 gal. to the large plant in the State, War and Navy Building at Washington. It might be added that the company is now prepared to furnish plants having capacities of 500,000 gal. of sterilized water per hour, employing a number of units for the purpose.

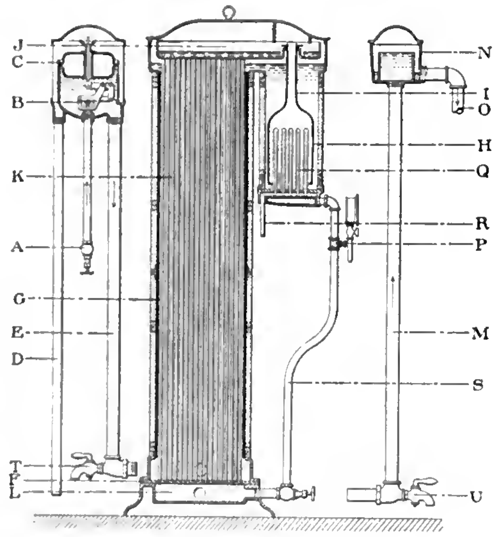
The object of the sterilizer is to boil the water in a closed receptacle for just sufficient time to sterilize it enough for all potable purposes and then cool the boiled water by making it give up its heat to the fresh supply which is about to be treated. In this way none of the natural gases in the water, which make it palatable, is lost, and the utmost use is made of the applied heat.

The illustration shows the type of apparatus operated by exhaust steam, which need not have a pressure exceeding 1 lb. The water passes through a raw-water valve A and its riser pipe to a level-regulating chamber, which it enters through a valve B controlled by a float. When the water reaches the desired level the valve is closed automatically, but should the water rise slightly above the operating level the excess passes over the little weir, C, into the overflow pipe, D. From the regulating chamber the raw water passes down the pipe, E, into G, the so-called "heat exchange." This is much like a surface condenser, the raw water entering above the tube sheet, F, while the hot sterilized water is circulated within the tubes. The raw water is warmed and the hot water cooled in this part of the apparatus, which, when working under ordinary good conditions furnishes sterilized water at a temperature of 5° to 8° above that of the raw supply.

The water from G enters the heater, H, containing steam pipes, Q, which raise its temperature to the boiling point. When it arrivers at this condition, it boils over like a full kettle on a hot stove, except that the water boils up through a fountain tube, I, into a hot-water pan, J, from which it enters the tubes of the heat exchange. These tubes end in a sterile water chamber, L, from which the water rises in the pipe, M, into a chamber containing a cup weir, N, for maintaining the correct level in J. The sterile water is drawn off through the pipe, O. Steam for sterilizing is admitted at P, and the condensed steam is drawn off at R; the apparatus itself can be sterilized by sending steam through the pipe, S.

The makers state that very little sediment or scale is found in the apparatus, but as all parts are readily reached for cleaning it is not believed that trouble will ever arise from this cause. The raw and sterilized water compartments can be flushed out at any time through the washout cocks, T and U.

The apparatus is made of copper and brass thoroughly protected by tin coatings. It is provided in many



THE FORBES WATER STERILIZER.

forms and sizes, including special patterns that can be transported to the most remote camp without special difficulty. The heating may be done with gas, kerosene, gasoline, electricity, coal or wood, and the makers will provide apparatus which will work below or above the atmospheric boiling point if it is desired.

The efficiency of the apparatus may be indicated by repeating some of the statements of the army board previously mentioned. Three styles of the apparatus were tested, and were found to rid water of all living germs except a few spore-bearing bacteria, without causing any loss of the natural gases or any flat taste. The bacteria which passed through the apparatus were considered of no significance by the board. The temperature of the sterilized water was 4½° above that of the raw supply.

TURBINES FOR THE UTILIZATION OF EXHAUST STEAM.

The firm of Willans & Robinson, of Rugby, England, builders of high-speed turbines and steam engines, has been recently engaged on the construction of turbines for the utilization of exhaust steam. They have at present under construction at their Rugby Works, two machines of the normal output of 1350 kw. with an overload capacity of 2000 kw. These are the largest exhaust turbines constructed in Europe. These machines are for the works of Sir Bernard Samuelson & Co., of Middlesbrough, and have been arranged to take steam from a number of non-condensing blowing engines used for supplying air to a number of blast furnaces.

The turbines are coupled to three-phase generators working with a periodicity of 40 with a pressure of 3000 volts and running at a speed of 2400 r.p.m. This is a very high speed for the output developed. The machines will work in parallel with a number of other turbines working in the same district, and will supply power to iron works and also power in bulk to the local power distribution company. Each steam turbine exhausts into a surface condenser of Messrs. Willans & Robinson's type, each condenser being designed to give a vacuum of 29 in. with a temperature of circulating water of 60° F., the quantity of steam to be dealt with at normal load being 45,000 lb. and about 70,000 lb. at the overload.

One special feature of the plant is the arrangement of relief valves, all low pressure steam that is not required for doing work in the turbine being by-passed direct into the condenser, so that all the steam output of the blowing engine is returned to the boilers as condensed water. The condensing plant is fitted with Edwards type, three-throw air pumps, driven by means of three-phase induction motors through machine cut gearing. The circulating pumps are of the centrifugal type and are driven by low-tension induction motors. The water for circulating is pumped from the river and forced through 27-in. cast-iron mains to the turbine house, a distance of some 250 yards, the amount of circulating water being about 4500 imp. gal. per minute.

Messrs. Willans & Robinson have also on hand 2000-kw. exhaust turbines for the South Wales District, the machines being arranged to work in conjunction with heat accumulators, the exhaust steam in this case being furnished by colliery winding engines. Amongst other sets on hand at Rugby, there is a 500-kw. exhaust turbo-alternator for supplying power to an ironworks and colliery in the Staffordshire district, working in conjunction with a vertical non-condensing blowing engine. The Willans & Robinson exhaust turbine is suitable not only for driving electric generators, but also for driving blowers, exhausters, ventilators and also high lift centrifugal pumps.

Messrs. Willans & Robinson also supply high-pressure steam turbines of all outputs from 2,000 to 10,000 h.-p. and have supplied or have on order within the last three years near one-quarter million horse-power in steam turbines, the machines being exported to all parts of the world.

AUTOBIOGRAPHICAL STATEMENTS OF AN EMINENT ENGINEER.

A few months ago the new Welfare Building of the Westinghouse Air Brake Co. was dedicated, and in an address at that time Mr. Walter C. Kerr made some very interesting statements concerning his early engineering experiences. These statements are here quoted verbatim:

When I look at the opportunities, comforts and pleasures afforded by an institution of this character, which you have justified by being a body of men banded together so firmly and with such good motives as to warrant the creation of this structure, I cannot help think of the contrast all this presents to the conditions under which I worked when I was as young as the youngest boy here and continued to work until I was as old as the average apprentice; how at the age of twelve I was shingling roofs and tacking on laths for the plasterers in a town buried so far in the middle of a far western state that I had never seen a railroad. Then working at several things until I landed at one end of a surveyor's chain, tramping the Western prairies, often wading waist deep in the waters of the marshes, sleeping in a tent, eating what I could get, and drinking water so bad that it would not make tea nor coffee, but would turn into something like ink. The best school I had was not as good as your worst one, and I did not have much time to attend it either. Such a thing as a night school was never heard of. The night was the time to sleep, and we did not have electric lights, gas, nor much of anything brighter than moonshine. No one was thinking about organized welfare, and the world, with its facilities, as you know it, was very far away.

It happened, however, that I got hold of a catalogue, from which I selected about half a dozen drawing instruments and a book called "Gillespie's Land Surveying," another on "Elementary Projection," and another on "Shades, Shadows and Perspective," scarcely knowing what these books were about, except that I thought from their titles that they would teach drawing and surveying. From the pictures in the books, I made a drawing board, a T-square, and two triangles, and I well remember mortising the T-square blade into the head, which prevented the triangles running over the left hand edge of the board. Notwithstanding such ignorance of the things you always knew all about, I learned to draw the kind of things these books taught, studied land surveying until I understood it, studied the surveying instruments from the pictures in the books and it was shortly after this that, when working as chainman, the head surveyor found that—although I had never had a transit in my hands—I could run one from what I had dreamed about it, and so I was promoted to transitman. It thus came that I ran a transit on the Western prairie when I was only sixteen years old and got a man's wages for doing it. It was

then that I learned for the first time that if any one would learn something that no one expected him to do, some one would soon want it done and want him to do it. I also learned in a good many ways what a day's work was and it was a good deal longer than anything we know of now.

I mention these things, not to tell the story of my life, but just that little piece of it which is necessary to show some of the younger men who live in this land of plenty, surrounded on every hand by things that help them, something I know personally of what a boy can do when his lot is cast so far away from everything that he has to even use his imagination to believe that the things of the world exist.

In the course of time a small foundry grew up in the neighborhood and I used to get the job of running the engine and boiler, fired with wood, Saturday afternoons while the engineer went into the foundry to help pour. Then I got a chance to mold waffle irons and bob sled shoes. In the winter, when the snow was several feet deep on the ground, I used to go to a little grist mill and help the engineer and the miller until I knew every nut and bolt in the engine, the condition of the piston rings, and every step of the process of milling flour. I would walk five or ten miles back into the woods to get a chance to work for a day without pay in a saw mill. When a steamboat landed at the levee, perhaps once or twice a week, I would always run from wherever I was at the first blow of the whistle, get there as soon as the boat, and stay on board, generally with the engineer, as long as the boat was tied up. To have a steamboat go up or down the river was a much bigger day to me than a day's holiday would now be to any of you. Even a corn sheller, a mowing machine, a piano, or a door lock was food for investigation. I lost no opportunity to get them apart and together again and well remember as a boy of fifteen repairing the action of a disabled piano on which most of the hammers stuck.

Now there is a lot of talk about opportunities, and lots of money is being spent in and about Pittsburgh to provide opportunities for young people, all the way from welfare buildings to libraries and technical schools, but I want to tell you that you have a thousand times as many opportunities around you every day as anybody can ever intentionally provide you with, and it is these opportunities that you must see and grasp. As a boy I would have walked a hundred miles to have spent one week in any shop that any of you have ever worked in, and I would have walked from Minnesota to Pittsburgh to have had a tenth part of the opportunities many throw away every day. The real trouble is that you have so many in this dense civilization that by familiarity they are likely to seem commonplace and be overlooked.

DOUBLE LOCK FOR STEEL SHEETING.

Some time ago, details were printed in this journal of a lock for steel sheet piling, by means of which the driving of such piles was materially facilitated. This device has proved entirely successful, and a modification of it has recently been placed on the market for use where double piles are considered necessary. In this system standard steel channels without bolts or rivets are used, and the salvage is thereby materially increased. The channels are held at the top and the bottom by locks, which differ only in a cutting edge being used on the bottom lock instead of the flat top adopted for the top lock, of which a diagram is given in the accompanying illustration. The double lock holds the pair of piles at a uniform distance apart and thus leaves a space into which any kind of water-tight material may be poured or rammed. The National Interlocking Steel Sheeting Co., 70 West Washington St., Chicago, are the makers of the lock.

PUMPING IN THE WILLISTON IRRIGATION PROJECT.

The actual pumping of water from the Missouri River into the canal system of the Williston irrigation project in western North Dakota has begun, and until cold weather prevents, tests of the apparatus and the gradual filling and priming of the main canals and pressure pipes will continue in order that the system may be in good condition to deliver water for next season's crops. A great deal of interest attaches to this project by reason of the fact that it is the first to be undertaken in North Dakota, and also because of the unique engineering features in connection with it.

The Missouri River has a habit of constantly cutting its banks and changing its channel, so that it was found impossible to locate any structure for the diversion of water by gravity without incurring enormous expense to protect it from the scour of the stream, moreover its grade was so flat that any gravity canal would be of prohibitive length. Fortunately large beds of lignite were discovered in the vicinity, affording cheap fuel, and the engineers conceived the plan of building a station at the coal mines and transmitting power electrically to the river. The pumps are placed on floating barges which will accommodate themselves to changes in the river channel and in the water level. The water is delivered through pipes with flexible joints into several basins located at a sufficient distance from the shore to be safe from encroachment by the shifting river. From these basins the water will be pumped into canals to cover the irrigable lands. The basins also serve for the purpose of settling silt, large quantities of which are carried in suspension by the Missouri River. During the winter the barges will be drawn out of the water to points where they will be safe from ice gorges and sudden freshets.

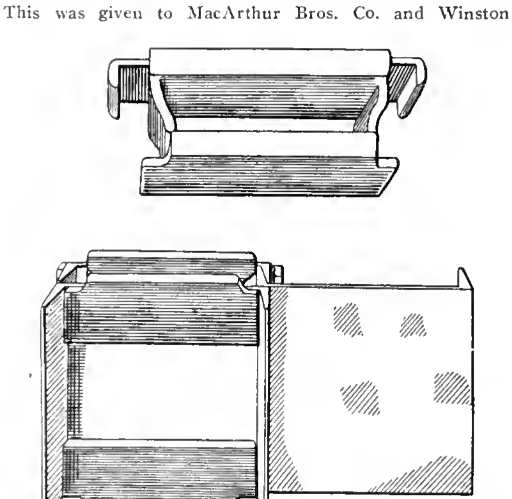
On Sept. 25 the steam turbine generating machinery was started up for the first time, and on the following day the electric current at 22,000 volts was turned on the transmission line to the intake pumping station. On Sept. 27 the two pumping units located on the barge were started. During the present month the pumping system has been operated at various times, raising the water gradually in the settling basin so that the banks could be puddled wherever there was any indication of weakness.

A producer designed for burning lignite coal is used. As the mine is carried farther into the vein the quality of the coal improves, and the little difficulties experienced in starting the plant are being overcome. It is expected that 5,000 acres will be irrigated during 1908.

The Williston power house will also supply power for the Buford-Trenton project, transmitting it by wire 22 miles. The installation of the electrical apparatus and the four pumping units in the station which receives the power from Williston has been completed at Buford, and the pumping machinery is now about mounted on the barge. The wires will be manufactured this winter, and it is hoped to have them placed on the poles early in the spring, so that power may be transmitted in time for supplying water as anticipated. It is expected that more than 3,500 acres can be supplied with water under the Buford-Trenton project in 1908.

AN ASHOKAN DAM INQUIRY.

The Commissioners of Accounts of New York City have been ordered by Mayor McClellan to investigate the recent award by the Board of Water Supply of the contract for the construction of the Ashokan dam. This was given to MacArthur Bros. Co. and Winston



DOUBLE LOCK FOR STEEL PILES.

& Co. at a tender of considerably higher than that of the lowest bidder, the John Peirce Co. The latter company's bid was very low, due to certain estimates regarding earthworks, which apparently did not allow for the difference between railway and dam construction. Mr. Peirce is understood to have stated that while he would lose money on the contract, he would take it if the Board of Water Supply insisted. This Board and its engineers recognized the many dangers to the public interests which arise when a great contract is let at a figure that will make it a source of loss rather than profit, and accordingly the contract went to the next bidder. This decision has received the hearty approval of all engineers who have had experience in the construction of large dams. It was urged by Messrs. John R. Freeman, F. P. Stearns. Wm. H. Burr and J. Waldo Smith, whose collective opinion on such a subect cannot be excelled professionally. The Commissioners of Accounts oppose to that testimony a statement by Col. T. W. Symons, H. P. Gillette, D. J. Hauer and Otto H. Klein, to the effect that the Peirce bid was large enough to give the contractor a profit.

FAST TURBINE INSTALLATION.

What is probably a record in furnishing and installing steam turbines was made by Allis-Chalmers Co. in connection with two 1,000-kw. units and accessories which that company built for the South Works of the Illinois Steel Co., at South Chicago, Ill. The contract was signed on May 13, 1907; shipment commenced from factory on May 25, and was finished on May 31; the erection of both units was completed July 16, and commercial load was put on the machines July 22. Since that time they have operated almost continuously, carrying loads up to 1,500 kw. each; that is, loads 50 per cent. above their rated capacity. At one stretch the turbines ran over three weeks day and night without being stopped. The turbines are installed in a temporary wooden building, and no crane nor the usual facilities were available during the erection. Since starting, the turbines have given no trouble whatsoever, and the manufacturer's engineers left them in charge of the Illinois Steel Co.'s operators within a few days after load was first carried.

The installation consists of two units, each comprising a 1,000-kw. Allis-Chalmers steam turbine coupled to a 1,000-kw., 25-cycle, 3-phase, 2,300-volt, Allis-Chalmers turbo-alternator; together with necessary surface condensing apparatus, pipe connections, and switchboard. The speed of the turbines is 1,500 r.p.m.; each is provided with a direct-connected exciter.

THE WAINWRIGHT PROTECTED CURB PATENTS.

The United States Circuit Court for the Eastern District of Louisiana has rendered the following decision in the case of the Steel Protected Concrete Co. et al. v. Central Improvement & Contracting Co., the opinion being written by Judge Saunders.

1. The bill herein alleges that one of the complainants, the Steel Protected Concrete Co., is the owner, and that the other complainant, the Grasser Contracting Co., is the exclusive licensee of three certain patents, taken out by one H. H. Wainwright, for improvements in concrete curb and gutter work; and that the defendant is infringing said patents. The relief prayed for is an injunction, restraining the defendant from further infringements and a decree ordering an accounting by defendant of profits realized from past infringements and payment to complainants of the sum so found to be due. The defendant denies the validity of the Wainwright patent and claims to be constructing metal protected curbs under a valid patent issued to one Gustave Soniat du Fossat.

2. The Wainwright patents are as follows:

(1) Patent No. 428,432, issued May 20, 1890. Application filed August 21, 1889.

In this patent Mr. Wainwright asserts that he "has invented a new and useful improvement in street curbs. . . . My invention consists of a curb for pavements, roads, lots, etc., embodying a frame for holding a filling, such as artificial stone, or pavement, etc., and an anchor for said frame; the novel features being hereinafter fully set forth and definitely claimed." The claims allowed in this patent are five in number. The first four describe the particular frame and anchor, and the corner bar shown in the drawings. The fifth claim is general:

"5. In a curb, a frame having a corner bar with a tongue on its inner face, substantially as and for the purpose set forth."

The general object of the entire device described in this patent seems to have been to construct a frame in which a concrete curb could be built in situ, and, as one of the incidents of this construction, it was proposed to place a metal bar on or imbedded in the upper outer edge of the curb so as to protect that edge from being chipped and broken by the impact of wheels backed against the curb. "It will be noticed," the patent sets forth, "that the frame, excepting the outer face of the corner bar, is embedded in the composition or filling; said frame thus preventing disintegration of the filling and materially adding to the strength of the curb. The (corner) bar protects the corner of the curb from contact with the wheels of the vehicles, and the curb is firmly supported and sustained, owing to the anchors. . . . It will be seen that I produce a superior curb, the same possessing strength and durability, rendering good service, and avoiding the heavy stone heretofore in use."

The claimed utility of the device is thus seen to consist: (1) In strengthening the entire structure of a curb made of artificial stone or cement; and (2) in protecting the outer upper edge of such a curb from being chipped and broken. The protection of the upper outer edge of the curb is not the sole nor even the special and prominent utility claimed to be effected by the combination. The patentee seems to have imagined that the principal utility of his invention consisted in the supposed strengthening of the mass of the curb by the frame in which it was formed, or the anchors holding that frame. The function of the corner bar is mentioned only in one sentence, and then inexactly.

That the patentee believed that the chief value of his device was due to the frame and anchors, which he described minutely and carefully, becomes more evident on reference to the claims made in his first application. These claims were also five in number, and all of them were concerned solely with the frame, and the corner bar is mentioned only once, and that brief reference is comprised in eight words. The claims in the first application are as follows:

"1. A frame for a curb consisting of uprights, a bar

or rod connecting the same, and pieces at the base of said uprights, substantially as described.

"2. A frame for a curb adapted to be filled, substantially as described, provided with a protecting corner piece as stated.

"3. A frame for a curb, adapted to be filled, substantially as described in combination with a supporting anchor as stated.

"4. A curb, consisting of a frame, an anchor supporting the same, and filling material embedding said frame; the parts being combined and substantially as described.

"5. A frame consisting of uprights, a rod or bar connecting the same, base pieces for said uprights and anchors supporting said frame, in combination with filling for said frame, resting on said base pieces and embedding the uprights, substantially as described.

"HENRY H. WAINWRIGHT."

It is obvious, I think, both from the claims as first made, and from the claims as allowed in the patent, and from the language of the body of the patent, that Mr. Wainwright's idea was that the frame and anchors described in his patent was the feature which gave it value. The corner bar is only on incident. His chief object was to strengthen the mass of the curb, not to protect its outer upper edge. While this fact does not disentitle him to the benefit of any invention he may have made incidentally and as a minor part of his main purpose, it is a material fact in determining the real meaning and extent of his claims.

The patent gives no verbal description of the corner bar used to protect the upper outer edge of the curb, except that it has a tongue at the back of it to enter certain slots or recesses in the arms of the frame. This does not state or imply that the tongue is continuous from one end of the bar to the other. Nor does the description in the patent indicate whether the corner bar is flat or curved. The drawings show a curved corner bar, with a flat tongue between parallel faces, from the point where it leaves the bar. A cross-section of the bar in the drawings shows that it is a section of a pipe. The entire bar as shown in the drawings might be obtained by splitting a small iron pipe and fastening an iron sheet at the middle point of the segment taken and extending to or beyond the center. The only function which is stated to be subserved by the tongue is that it rests in the slots of the arms of the frame. There is no suggestion that more tongue is required than enough to rest in these slots, nor that the tongue helps in any way to hold the corner bar in place.

(2) Patent No. 614,587, issued Nov. 22, 1898. Application filed January 26, 1898.

On January 26, 1898, Mr. Wainwright filed an application for a patent for "Improvements in the means for protecting projecting edges of concrete work." This application was eventually changed so as to read: "Improvements in the construction of concrete curb and gutter work." The first clause in this application as filed read: "This invention relates to improvements in means for protecting projecting edges of concrete work." This clause was also finally changed so as to read: "This invention relates to improvements in the construction of curbing, guttering and similar concrete work." Under this application, Mr. Wainwright made seven claims, as follows:

"1. The combination in concrete work, of a continuous metal bar for protecting the corner of the work, guides for temporarily supporting said bar during construction of the work, and concrete backing laid against said bar, whereby amalgamation of the concrete and metal surfaces fixes the bar in place, substantially as described.

"2. The combination in concrete work of a continuous metal bar for protecting the corner of the work, adjustable guides for temporarily supporting said bar during construction of the work and concrete backing laid against said bar, whereby amalgamation between the concrete and metal surfaces fixes the bar in place, substantially as described.

"3. The combination in concrete work of a continuous galvanized metal bar for protecting the corner of the work and concrete backing laid against the bar, whereby amalgamation of the cement and concrete surfaces fixes the bar in place, substantially as described.

"4. The combination in concrete work of a continuous galvanized metal bar for protecting the corner of the work, guides for the bar consisting of a support and an adjustable bracket thereon, and concrete backing placed around said guides and against said bar, substantially as and for the purpose described.

"5. The combination in concrete work of a concrete curb and gutter, and a continuous metal bar at the front edge of the gutter and between it and the street paving, substantially as described.

"6. The combination in concrete work of a continuous galvanized metal bar for protecting the corner of the work, temporary guides for said bar consisting of supports, j, and brackets, k, adjustably secured to said supports and recessed to receive said bar, substantially as described.

"7. The combination in curbing and guttering of a continuous galvanized metal bar, E, for protecting the corner of the curb, temporary guides for said bar consisting of supports, j, and brackets, k, adjustably secured to said supports and recessed to receive said bar, E, and continuous metal bars, G, at the front edge of the gutter and between it and the street paving, substantially as described."

All the above claims as made were finally rejected by the Patent Office and tacitly abandoned by Mr. Wainwright, who substituted in lieu thereof the following three claims, which were allowed, after considerable time and discussion, viz.:

"1. The combination in curb and gutter work of a continuous galvanized metal T-bar at the exposed corner of the work, brackets adapted to support said bar during the progress of the work, and concrete backing laid against the said bar and embedding said brackets, substantially as and for the purpose described.

"2. The combination in curb and gutter work of a continuous metal T-bar at the exposed corner of the work, brackets recessed to receive the rib of said bar and support the bar during the progress of the work, and concrete laid against said bar and embedding said brackets, whereby the union between the set concrete and the bar holds said bar in place, substantially as described.

"3. The combination in curb and gutter work of adjustable recessed brackets, a continuous metal T-bar provided with a rib adapted to fit said brackets, and concrete laid against said bar and embedding said brackets substantially as described."

In his specifications in this patent, Mr. Wainwright says:

"When curbs and similar work are constructed of concrete, it is indispensable that the corners of the curbs, etc., shall be protected from breakages due to the collision of vehicles and other objects therewith, and I have devised a system of protecting such corners by practically continuous bars of iron or steel. This system is not broadly herein claimed, since it is the subject of my earlier patent; but I do claim the improvements thereon, hereinafter particularly described. Said improvements, in general terms, comprise the following principles and mechanical elements: The protection of the corners of the work consists of a bar of galvanized iron or steel of peculiar shape (hereinafter described)

A T-bar, the sections of which are laid with closely abutting ends so that the sections together form a continuous bar. Now, I have discovered that, when a surface of iron or steel is backed with concrete, such an adhesion or union takes place that the iron or steel is held to the concrete with great tenacity, even when the iron or steel is not embedded in but merely laid firmly against the concrete backing. I have made a highly useful application of this discovery in my present invention, wherein I first set up brackets containing guide ways. These brackets support the protecting bars, while the cement or concrete backing which forms the curb is being laid, shaped and set. When set, the union between the cement or concrete and the bars has taken place and said bars are held most firmly in position practically as a part of the structure itself. It is to be particularly noticed here that the structure mentioned presents a very different condition from that existing in a bar of iron or steel, as a stay-bolt or tie rod is embedded in a mass of concrete. The present case is merely a superficial contact on only the back and tongue of the protecting bar and embedding the whole bar in the concrete is impossible, since that would defeat the purpose of the structure, which is that the bar should project or show at the front of the work."

He then goes on to claim the use of galvanized iron bars as part of this combination. Now, obviously, no weight can be given to Mr. Wainwright's statement that he had discovered that concrete adheres with great tenacity to an iron or steel surface on which it is laid, since that fact has been observed and known for centuries. Practically the claimed improvement consists, then, simply in this: That Mr. Wainwright devised a very simple frame to hold in place a bar having a tongue and a convex surface while the cement was hardening on the inner surface of the bar. There was no invention in remarking that the upper outer corner of the curb was liable to be chipped and broken by the impact of wheels against it. There was no invention in the general idea that this upper corner might be protected by a metal covering or bar of some kind. The only question, then, is whether there could be an invention in suggesting that the metal protection for the corner should consist in a solid galvanized iron bar having a convex surface on the outside, with a tongue extending into the cement, and held in position by a frame until the cement hardened. The convex surface of the bar had already been suggested for this very purpose in a patent issued to I. L. Landis for a pavement curb on July 8, 1890, and it had also appeared in the drawings in the first patent issued to Mr. Wainwright, and no invention was claimed. The general idea that the protecting bar should have a tongue set into the concrete also appears, though not clearly, in the drawings to Mr. Wainwright's first patent. As neither the idea of a protecting bar, nor the convex surface of that bar, nor the existence of a tongue extending from it diagonally into the mass of the cement were patentable, it seems to me that there was nothing patentable in the protecting bar shown in Mr. Wainwright's patent, No. 614,587, issued November 22, 1898.

The general idea of protecting with metal pieces the edges and corners of blocks of artificial stone dates back to a patent issued on December 21, 1869, to Francois Coignet. Coignet claimed that his invention consisted in:

"Protecting the exposed corners, sides, edges or angles of artificial stones by means and with the use of metallic shields fastened thereto in the process of manufacturing said stone, substantially in the manner herein set forth."

The drawings accompanying and showing the Coignet patent show that his proposed edge protector consisted of two metal planes at right angles and held in place by bolts or rods extending diagonally from the corner into the mass of the concrete. Coignet, it is true, proposed to form the artificial stones in which the corner was protected in molds, from which the stones would be taken and carried to the place where they were to be used. Mr. Wainwright, on the other hand, builds up the stones in the very place and position in which they are used, so that they do not require to be moved, but remain where they set and harden. But the present litigation is not concerned with this aspect of the two inventions. The only matter now under consideration is the feature of the two patents which relates to the protection of the edges of artificial stone with a metal shield or guard of some shape. Clearly Coignet was the first to conceive the general idea of this invention. The only difference between his metal protector and that of Wainwright was that Coignet's metal protector was square-edged and held in place by bolts or rods with expanded ends, and running diagonally from the corner into the concrete, while Wainwright's metal protector was convex, and was held in place by a continuous tongue extending into the concrete in the same direction as the bolts. Mr. Wainwright's first patent in 1890 shows, but does not claim any invention for, the convex surface of the corner metal protector. This feature of the bar was, therefore, not patentable in the second patent, that of 1898. Besides the Landis patent, No. 431,898, issued July 8, 1890, shows a metallic edge-protecting bar, having a convex surface at the edge. The use of a galvanized iron bar, instead of a plain iron bar, was certainly not patentable. The use of a continuous expanding tongue to hold the metallic edge protector in place while the concrete is hardening, and to help hold it in place after the concrete has set, is shown in a patent issued to R. S. Griffin on April 16, 1872, for holding a corner head of wood on the edge of a body of plaster. In any case it does not seem to me that the substitution of a continuous tongue in place of the bolts and stays shown in Coignet's patent presents patentable novelty.

(3) Patent No. 727,233, issued May 5, 1903. Application filed March 8, 1900.

In this patent Mr. Wainwright claimed invention for the form of the corner bar and tongue. The only difference between the corner bar and tongue described in this patent and the corner bar and tongue described in the patent of 1898 is that the tongue in the 1903 patent is spread out or enlarged at the inner end. I can see no invention in this change of the form of the tongue. The function of the tongue being to help hold the corner bar tight to the curb, it was so obvious that this function would be better performed if the end of the tongue were enlarged that it would occur to any mechanic of the most ordinary capacity and skill to enlarge it. Nor would any mechanic, so enlarging the tongue, dream that he had thereby invented anything worth patenting.

So far as concerns the metal protecting corner bar, all three of the patents taken out by Mr. Wainwright seem to me to be merely slight modifications of Coignet's construction. The only features in the Wainwright construction of the corner bar for which patentability could ever have been claimed—and the claim for them would have been of very doubtful validity—were the substitution of the convex corner bar for the square-edged corner bar and the continuous tongue for the bolts and stays of the Coignet bar. But these features appeared for many years in Wainwright's patents before he attempted in the 1903 patent to patent them. It was then too late. They had become common property. In Coignet's patent the drawings exhibit the bolts enlarged at the end to hold them more firmly in the concrete. It was inevitable almost to adopt the same construction, when a continuous tongue was substituted for the separate bolts. The imbedded end of the tongue would be enlarged to make it more difficult to draw the tongue out of the concrete, just as the imbedded end of the bolt had been enlarged for precisely the same purpose. As regards the corner bar, my conclusion therefore is that none of the patents issued to Mr. Wainwright show invention or novelty, and that they are all void.

This conclusion necessarily results in the rejection of plaintiff's demand. I was strongly inclined to hold that the defendants were estopped from contesting the validity of the plaintiff's patents by reason of the fact that the defendants set up a patent which is nothing more

than a copy, with immaterial variations, of the 1903 Wainwright patent. This patent of defendants is that issued to Soniat Du Fossat on November 22, 1904, under application filed on November 13, 1903. The Du Fossat patent was applied for more than six months after the issuance of Mr. Wainwright's last patent. Du Fossat's construction is so obviously copied from the last Wainwright patent that its nullity is beyond question. But can the defendants deny patentability in the Wainwright patent, when they claim patentability for an illegal imitation of that patent? I am strongly inclined to hold that they cannot. I would so hold if there were authority for thus deciding this controversy as between plaintiffs and defendant. On reflection, however, I have concluded that the evidence does not necessarily implicate the defendant in fraud. They took advice of reputable patent lawyers as to their rights and seem to have acted in good faith. Mr. Mioton, who was instrumental in procuring the Du Fossat patent, says he never examined the Wainwright corner bar until he had filed application for the Du Fossat patent.

On the whole, I have concluded that the only judgment I can render is one based on the invalidity of the Wainwright patents. There must then, be a decree in favor of defendants, rejecting plaintiff's demands.

PERSONAL NOTES.

Mr. J. L. Elder has been elected county surveyor of Cambria County, Pa.

Mr. Bailey Morledge was recently elected city engineer of Newport, Ohio.

H. W. Scott, principal assistant city engineer of Seattle, Wash., died recently.

Mr. H. B. Melat was recently elected county surveyor of Vernango County, Pa.

Mr. Charles H. Moon has been elected county surveyor of Bucks County, Pa.

Mr. Charles J. Maddox has been elected county surveyor of Montgomery county, Md.

Mr. Frederick Young was recently elected county surveyor of Luzerne County, Pa.

C. W. Sanders, chief engineer of the Copper Range R. R., Houghton, Mich., died recently, aged 51 years.

Charles E. Perkins, formerly president of the Chicago, Burlington & Quincy R. R., died at his home in Westwood, near Boston, Nov. 9, aged 67 years.

C. D. Wyman, managing director for the Stone & Webster Engineering Corporation in the Puget Sound region, died recently in Boston, aged 57 years.

Mr. Thomas Wheeler, who recently resigned as assistant state superintendent of public works of New York, has been elected mayor of Utica, N. Y.

Frank H. Earle, senior member of the firm of Earle & Harrison, civil engineers, Jersey City, N. J., died at his home in Newark, N. J., Nov. 7, aged 56 years.

Messrs. H. S. Gwin, M. W. Jenkins and J. C. Webster were recently elected county surveyors of Blair, Mercer, and Greene counties, respectively, Pennsylvania.

Mr. E. E. E. Piper has been elected county surveyor of Washington County, Md., and Mr. C. C. Billott was recently elected county surveyor of Prince George County, Md.

James F. Jones, a well-known civil and mining engineer, for many years consulting engineer to the Reading R. R. system, died Nov. 6, at his home in Philadelphia, aged 69 years.

William R. Kellogg, one of the oldest civil engineers in Chicago, died recently. He was prominently connected with the construction of the Kansas City extension of the Chicago & Alton R. R.

Mr. A. Buckel has resigned as sales manager of the Hodge Electric & Mfg. Co., and is now identified as contract manager with the Freeborn Engineering & Construction Co., Scarritt Building, Kansas City, Mo.

Mr. M. L. Hohman, of the firm of Hohman & Laird, consulting engineer, St. Louis, Mo., has been nominated as the next president of the American Society of Mechanical Engineers by the nominating committee of that society.

Mr. H. L. Hibbard, electrical expert to the Bureau of Construction and Repair, U. S. Navy Department, has resigned to enter the employ of The Cutler-Hammer Mfg. Co., Milwaukee, Wis., makers of electric controlling devices.

Col. Charles Bromwell, Corps of Engineers, U. S. A., in charge of public buildings and grounds in the District of Columbia, has returned to his duties after two months' absence most of which time he spent in Athens inspecting the army of Greece.

Mr. F. B. Freeman, designing engineer of the New York Central & Hudson River R. R., has been appointed engineer of construction in charge of the electric zone of the New York Central, with headquarters at the Grand Central Station, New York.

Mr. W. J. Wilgus, formerly vice-president of the New York Central & Hudson River R. R., has been retained as consulting engineer by the Detroit River Tunnel Co., a subsidiary company of the New York Central Lines, which is building the tunnel for the Michigan Central tracks under the Detroit River.

The Meade Testing Laboratories have recently been established in the Young Bros. Building, Nazareth, Pa., for the inspection and testing of Portland cement. The laboratories, which are fully equipped, are under the direction of Mr. Richard K. Meade, chemist and cement expert, and Mr. Clarence E. Kline is engineer of tests. A specialty will be made of the inspection of cement at the mill for which the laboratories are very favorably located.

The American Dittler Sewage Disposal Co., 1123 Broadway, New York, has elected to its board of directors the following members of its engineering staff: Mr. Richard Godeffrey, consulting engineer, president; Mr. Augustus G. Hepp, Chief engineer, vice president; Mr. William H. Schaladitz, mechanical engineer, secretary and treasurer. Mr. Schaladitz recently sailed for Germany to study present sewage disposal practice in Europe. During his absence Mr. Hepp will be the executive officer of the company.

Mr. W. Edgar Reed, electrical engineer, formerly with the Westinghouse interests, for some time in Paris, and for a considerable time at East Pittsburg, has opened an office for general consulting work in the Machesney Building, Pittsburg. Mr. Reed entered the employ of the Westinghouse Electric & Mfg. Co. in 1891 as an engineering apprentice. Upon finishing his apprenticeship course in the Westinghouse works he took a course in the Massachusetts Institute of Technology, from which he was graduated in 1897. Later he took a post-graduate course in Paris at the laboratory of the late Prof. Henri Moissan, the well-known chemist and metallurgist. Following this Mr. Reed became connected with the French Westinghouse Co., at Havre, France, filling the position of chief designing engineer of that company from 1898 to 1903. In 1903 Mr. Reed came to Pittsburg, filling the position of designing engineer for the French and American Westinghouse companies, which position he has filled up to this time. He has had long experience in designing both continuous and alternating current machinery, and has had direct charge of induction motor designing for several years. He has also had much experience in the practical application of direct and alternating current motors and generators, and is thoroughly familiar with their characteristics and applications.

The following candidates for membership in the American Society of Civil Engineers were elected Nov. 6: As members—A. M. Byers, Chf. Engr., The Southern Eng. & Constr. Co., City of Mexico, Mex.; T. W. Clayton, Engr., Internal Improvement Comm. of Illinois, Shawneetown, Ill.; G. R. Field, Contr. Engr., Risdon Iron & Locomotive Works, San Francisco, Cal.; F. C. Herrmann, Chf. Engr., California Development Co. and Sociedad de Riego y Terrenos de la Baja California, Calexico, Cal.; C. H. Kendall, Asst. Director Bureau of Public Works, Philippine Islands, Manila, P. I.; G. A. McCarthy, Chf. Engr., Temiskaming & Northern Ontario Ry. Comm., North Bay, Ont., Canada; Hood McKay, Div. Supt., Eastern Div., The Lehigh Coal & Navigation Co., Lansford, Pa.; J. B. Rohrer, Asst. Mgr., American-Hawaiian Eng. & Const. Co., Ltd., San Francisco, Cal.; H. E. Smith, Asst. Engr., Computing and Designing Dept., Barge Canal Office, Albany, N. Y. As associate members—F. W. Altstaetter, Capt. of Engrs., U. S. Army, Pittsburg, Pa.; Emanuel Anderson, Chf. of Eng. Dept., Mexican Light & Power Co., Ltd., Mexico, D. F., Mexico; F. H. Bass, Asst. Prof. of Municipal and San. Eng., Univ. of Minnesota, also Engr., Minnesota State Board of Health, Minneapolis, Minn.; W. B. Bates, City Engr., Roanoke, Va.; P. A. Beatty, Asst. Engr., Connellsville and Pittsburg Divs., Baltimore & Ohio R. R., Baltimore, Md.; E. C. Bebb, Engr., U. S. Reclamation Service, Glendive, Mont.; M. O. Bellingrodt, Asst. Engr., Atlanta, Birmingham & Atlantic R. R. Co., Atlanta, Ga.; W. H. Broughton, Head of Dept. of Civ. Eng., West Virginia Univ., and Cons. Engr. to County Court of Monongahela Co., W. Va., Morgantown, W. Va.; Charles Bradshaw, Hydrographic Engr., Arrowhead Reservoir & Power Co., San Bernardino, Cal.; L. D. Brownell, Asst. Engr., Dept. of New York State Engr. and Surv., Syracuse, N. Y.; R. G. Dieck, Portland, Ore.; S. D. Dodge, Asst. Engr., Board of Water Supply, New York City; E. B. Espenshade, Res. Engr., Chicago, Milwaukee & St. Paul Ry. Co., Roundup, Mont.; Wager Fisher, Engr. and Supt. for David Pepper, Jr., Engr. and Gen. Contr., Philadelphia, Pa.; P. M. Fogg, Asst. Engr., U. S. Reclamation Service, Newlon, Mont.; Philip Guise, Asst. Engr., Dept. of Docks and Ferries, New York City; W. C. Hattan, Res. Engr., South & Western R. R., Altapass, N. C.; G. F. Hosmer, with O. Perry Sarle, Providence, R. I.; F. M. Hough, Engr. of Track and Bridges, Saratoga & Encampment Ry., Saratoga, Wyo.; Anders Jordahl, Reinforced Concrete Specialist, W. S. Barstow & Co., Engrs. and Contrs., New York City; G. I. Oakley, Asst. Engr., New York State Barge Canal, Little Falls, N. Y.; J. M. Obreiter, Asst. Engr. with Earle & Harrison, Civ. Engrs., Jersey City, N. J.; H. G. Perring, Engr., Keystone Fireproofing Co., Philadelphia, Pa.; E. H. Ravenscroft, Cons. Engr., Chicago, Ill.; W. F. Rugg, Asst. Engr., New York Board of Water Supply, Peekskill, N. Y.; G. M. Stevens, Asst. Engr., Boston Street Dept., Boston, Mass.; T. P. Stevenson, Stevenson & Headman, Engrs. and Contrs., Rio de Janeiro, Brazil; Garfield Stubblefield, Office Assist. to Project Engr., Umatilla Project, U. S. Reclamation Service, Hermiston, Ore.; H. E. Wagner, Asst. Engr., with H. W. Edwards, Cons. Engr., Providence, R. I.; Ralph Whitman, with Isthmian Canal Comn., Washington, D. C.; H. B. Wrigley, Chf. Engr., R. H. Beaumont Co., Philadelphia, Pa. As associates—Robert Anderson, Vice-Pres., The Ferro-Concrete Construction Co., Cincinnati, O.; Henry McBurney, Stockbridge, Mass.; D. H. Morris, member of firm, The Dayton Hydraulic Machinery Co., Dayton, O.

BUSINESS NOTES.

In order to take care of its rapid increase in business The Bruner Steel Wagon Co., Wapakoneta, O., has increased its capital stock of $50,000 to $100,000.

The receivers of Milliken Brothers (Inc.), 11 Broadway, New York City, have been awarded the contract for the 2,500 tons of structural steel for the new 18-story Masonic Temple, at 24th St. and 6th Ave., New York City, another contract for the steelwork of a British Columbia paper mill, and the steel frame for an extension of the grandstand of the Sheepshead Bay race track in Brooklyn.

The Tremont & Suffolk Mills, of Lowell, Mass., will add to the present power equipment, recently purchased, a 1,500 kw. Allis-Chalmers turbine direct coupled to a 2,000 kw. generator, wound for 60 cycles 3-phase, to operate at a speed of 1,800 r. p. m. The new equipment includes, in addition to the main unit, two exciter units, one motor and the other engine-driven.

J. G. White & Co. recently shipped railway equipment to the value of $250,000 from New York to Manila. The consignment included locomotives, rolling stock, and construction plant of nearly every description. The material goes to the Islands of Cebu and Panay, upon which the construction of the lines of the Philippine Railway Co. is now well advanced.

Mr. Reginald Trautschold, formerly with the Robins Conveying Belt Co., has become manager of the Intercontinental Engineering Co., 126 Liberty St., New York City. The latter company will conduct a general engineering business, and act as manufacturers' agent. In the engineering line the design and equipment of power and industrial plants with particular attention to the economical handling of materials, will be made a specialty. In the agency department the company has received the American agency for Unic and Aries automobiles of France. The European agencies obtained from manufacturers in the United States include the Chester B. Albree Iron Works Co., the Dayton Pneumatic Tool Co., and the H. M. Richardson Steel & Iron Co. The company wishes to make arrangements to represent American manufacturers of shoe making machinery and machine tools of merit, as it has received inquiries for these. The European branch, which is located in Paris, has connections in every country of Europe, and is in a position to place American machinery before the trade of the continent.

The Pittsburgh Automatic Vise & Tool Co., general offices Pittsburgh, Pa., has been awarded the gold medal for vises, the highest honor obtainable, by the Jury of Awards of the Jamestown Exposition. The company reports that it has recently furnished equipment to the shops of the New York Central, the Pennsylvania, Louisville & Nashville, Atlantic Sea Coast, Seaboard Air Line, Norfolk & Western, Grand Trunk, and the St. Louis & Southwestern.

Mr. W. J. Roseberry, Jr., has resigned as manager of the Chicago Concrete Machinery Co., to become associated with the Chicago Builders' Specialties Co., 1118 Chamber of Commerce Bldg., Chicago, as manager of the machinery department. The latter company has made arrangements with the Koehring Machine Co., Milwaukee, Wis., to handle their entire output of Koehring concrete mixers in the United States.

Sixty-nine Curtis turbines, aggregating 60,000 hp. capacity, have been delivered to Japanese purchasers by the General Electric Co. These have been installed in textile mills, steel mills, railway shops, arsenals, dockyards, electric light stations and the power plants of tramways. The largest units so far shipped there are rated at 1,500 kw.

The contract for the three large skylights for the new National Museum at Washington has been awarded to Arthur E. Rendle, who will use his Paradigm system on the work. This was used to the extent of 80,000 sq. ft. on the new Union Depot buildings in that city.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—Bids will be received until Dec. 2 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing an addition to the water system at the Phoenix School. For further information apply to C. W. Goodman, Supt. School.

Tucson, Ariz.—Chas. F. Slack, Mayor, writes that the date of opening of bids for the construction of water works has been extended from Nov. 4 to Jan. 6. Frank S. Treat, City Recorder.

El Dorado, Ark.—The question of constructing water works at a cost of $35,000 is reported under consideration.

Oakland, Cal.—The City Council on Nov. 4 passed an ordinance appropriating $40,000 for the construction of a salt water pumping plant.

The Peoples Water Co., under direction of L. D. Adams, Constructing Engr., is reported to be carrying out plans for the development of water sources to supply Oakland, Alameda and Berkeley. The work includes the construction of a second reservoir near Lake Chabot, and a tunnel from Cull Canyon north of Hayward, work on which is reported to have already commenced. The development will extend to San Pablo and Pinole Creeks in the northern part of the county, the waters of which will be utilized.

Grand Junction, Colo.—J. F. O'Malley, City Engr., writes that the question of issuing $400,000 bonds for the construction of a mountain water system to supply the city was defeated at the election on Nov. 2. A petition is being circulated asking Council to call another election.

Paonia, Colo.—E. P. Martin, of Paonia, Ch. Engr. Mt. Lamborn Canal & Reservoir Co., writes that all bids opened on Oct. 6 for constructing reservoir, etc., have been rejected, and the matter has been postponed until spring.

Pensacola, Fla.—Bonds to the amount of $350,000 are reported sold to be used for water works and sewers. It is stated that the plant of the Pensacola Water Co. will probably be purchased and improved.

Sparks, Ga.—See "Power Plants, Gas and Electricity."

Bloomington, Ill.—Bids are wanted until Nov. 28 for furnishing all material for 4,000 ft. 10-in. c. i. water main. C. F. Fauntz, City Engr.

Anamosa, Ia.—The citizens are reported to have voted on Oct. 28 to issue $30,000 bonds to purchase present water works or construct a municipal plant.

Lamoni, Ia.—The W. K. Palmer Co., 718 Dwight Bldg., Kansas City, Mo., is preparing plans for water works for Lamoni.

Marion, Kan.—Thos. W. Bown, City Clk., writes with regard to the proposed water works, that the plan is now to purchase the present water works and put it in good repair. Engineers, Burns & McDonnell, Dwight Bldg., Kansas City, Mo.

Beloit, Kan.—The city is reported to have purchased the water works owned by E. E. Stevens, of Chicago, Ill.

Versailles, Ky.—The citizens are reported to have voted Nov. 5 to issue $60,000 bonds for water works and sewers.

Norway, Me.—Bids will be received until Jan. 1 by the Norway Water Co. (S. D. Andrews, Pres.) for constructing a 1,000,000-gal. reservoir.

Grand Rapids, Mich.—The Gen. Mgr. of the water works is reported to have decided to recommend to Council the purchase of a new steam pump, the repair of old pumps, repairing and rebuilding of pumping station, etc.

Thief River Falls, Minn.—Lars Backe, City Clerk, writes that the citizens on Nov. 6 voted to issue $10,000 bonds for water works.

St. Cloud, Minn.—The Great Northern R. R. Co. is reported to be considering the construction of a new pumping station, also new water mains from the yards on 1[illegible]th Ave. to the river.

Harrisonville, Mo.—The citizens are reported to have voted to issue $30,000 bonds for the construction of municipal water works.

Kearney, Neb.—Geo. E. Ford, City Clk., writes that the proposed water works will cost about $100,000; no time yet set for the receiving of bids. Engineer, C. A. Edwards, of Kearney.

**Chatham, N. J.*—W. F. Inman, of New York, N. Y., is reported to have secured the contract for extending the water mains here, for about $2,000.

Alcove, N. Y.—E. W. Moxley, of Ravenna, Supt. Harrtcroix Water Co., writes with regard to the reservoir proposed to be constructed at Alcove, that the company will in the spring hire men and do the work under the supervision of its superintendent. Cost not yet estimated.

Madison Barracks, N. Y.—Bids will be received until Nov. 27 by 2d Lieut. R. W. Drury, Constr. Q. M., Madison Barracks, N. Y., for constructing a 300,000-gal. steel tank, quarter master stable, one set quarters, wagon shed and remodeling old mess building, as advertised in The Engineering Record.

Rome, N. Y.—A blue print of the general plan for the proposed contracts to be advertised during the winter months is now on file at the office of The Engineering Record, 239 West 39th St., N. Y. City, to consist of the dam on Fish Creek, tunnel aqueduct and reservoir, as stated in the advertising columns of The Engineering Record. The city also expects to let a contract early next year for furnishing and laying about 6 miles of gravity main from Stokes reservoir to connect with the distributing systems in the city. The general plans of all of the above work are completed, and contractors can now see practically everything relating to the extent and conditions of the contemplated work, as it would be to the advantage of contemplating bidders to visit the site of this proposed work during the month of November or early December as later the ground is likely to be frozen and obscured by snow. The engineers on this work will go over it any day with those wishing to bid. Engineers, Knight & Hopkins, of Rome. Harvey S. Bedell, Chmn.

Smithfield, N. C.—See "Power Plants, Gas and Electricity."

Hamlet, N. C.—W. R. Bonsal and J. M. Jamison are reported to have secured franchises for water works.

Bowbells, N. D.—J. P. McCusker, City Aud., writes the proposed water works and system of fire protection will cost about $12,000. Engineer not yet selected.

Swanton, O.—It is stated that bids will be received until Nov. 25 by the Bd. Trus. Public Affairs (A. B. Lathrop, Secy.) for furnishing a deep well pump, together with an electrically driven pump head, motor and the necessary switches and controlling devices; also one elevated tank and tower having an approximate capacity of 22,000 gals. Wm. G. Clark, Consulting Engr., 1050 Spitzer Bldg., Toledo.

Rockport, O.—Bids will be received until Dec. 2 by W. L. Nichols, Village Clk., for $13,000 bonds, to be issued for the purpose of extending the water mains of said village.

Reading, Pa.—Caleb Weidner, City Clk., writes that bids for the proposed filtration plant, for which the citizens voted Nov. 5 to issue $500,000 bonds, will not be called for until about July, 1908. Engineer, E. L. Nebling, of Reading.

**Philadelphia, Pa.*—Local press reports state that the Holly Mfg. Co., of Buffalo, was on Nov. 5 awarded contract for the construction and installation of two 20,000,000-gal. pumps at Lardner's Point pumping station for $268,769 (time of completion 360 and 420 days.) (Bids opened Oct. 22.)

Cambridge Springs, Pa.—Bids will be received until Dec. 12 by A. H. Drake, Boro. Clk., for constructing a mechanical filter plant as advertised in The Engineering Record.

Mountville, Pa.—The citizens are reported to have voted Nov. 5 to issue $22,800 bonds for the construction and equipment of water works.

Florence, S. C.—See "Power Plants, Gas and Electricity."

Temple, Tex.—This city is reported to have purchased the plant of the Temple Water Works Co. F. P. Hamill, Mayor.

Wheeling, W. Va.—The City Council is reported to be considering the question of issuing bonds for water works improvements.

**Union, W. Va.*—This town is reported to have awarded a contract to John R. Shanklin, Gen. Mgr. of the West Virginia Htg. & Plumbing Co., of Charleston, W. Va., for installation of water works. Water will flow by gravity from a reservoir with capacity of 250,000 gal., to be constructed on site about 115 ft. above level of town.

La Crosse, Wis.—H. J. Beckwith, Pres. Bd. of Pub. Wks., is reported to have recommended the construction of a filter plant.

Cheyenne, Wyo.—C. C. Carlisle, City Engr., writes that the citizens on Nov. 5 voted to issue $160,000 bonds to improve the city water works, which is a gravity system.

Kelowna, B. C.—See "Power Plants, Gas and Electricity."

Chesley, Ont.—The citizens are reported to have voted to expend $38,000 for a system of water works.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Ft. Morgan, Colo.—The City Council is reported to have selected B. H. Meeker, of McCook, Neb., to prepare plans for a sewerage system.

Washington, D. C.—Bids will be received by the Coms. D. C. until Nov. 25 for constructing sewers in the Dist. of Columbia as advertised in The Engineering Record.

Pensacola, Fla.—See "Water."

Tampa, Fla.—The City Council on Oct. 31 passed on second reading the ordinance providing for an issue of $50,000 bonds for storm and sanitary sewers.

**Springfield, Ill.*—John Spence, has secured the contract for constructing sewer in Miller St. at 72 cts. per sq. ft. 18 in. sewer, 30 cts. per ft. for 12-in. inlet pipe and $24 ea. for manholes.

**Duquoin, Ill.*—Rech Bros., of Belleville, are reported to have secured contract for the construction of a sewerage system, for $24,500.

Indianapolis, Ind.—Plans for the 26th St. sewer are reported to have been completed by Chas. A. Brown, Asst. City Engr.; it will cost $25,000 and will be 2⅓ miles long.

Richmond, Ind.—C. W. Merrill, Pres. Bd. Pub. Wks., writes that bids will be received on Nov. 20 for the construction of the Northwest 2d St. sewer; it will be built in two sections and cost about $23,000. Fred R. Charles, City Engr.

Kendallville, Ind.—The City Council, it is reported, will receive bids until Nov. 22 for constructing a sewer in Richmond St.; probable cost, $7,000.

Lafayette, Ind.—It is reported that the Bd. of Pub. Wks. is preparing plans for the construction of a sanitary sewer system from Kossuth to Elliott St. with laterals in Central Ave., 9th, 10th and 11th Sts.

Churubusco, Ind.—The Town Board is reported to be receiving bids for the construction of an addition to Deckers addition sewer, about 2,500 ft.

Wapello, Ia.—Press reports state that all bids opened on Oct. 10 for the construction of the Van Buren St. sewer have been rejected as being too high, and new bids will be received until Dec. 19; probable cost, $6,000. E. T. Christie, City Recorder; W. S. Kremer, Engr., Wapello.

Des Moines, Ia.—Plans are reported to have been completed and approved for the Woodland Ave. sewer. The improvement contemplates a network of 10-in. pipe in the northwestern part of the city and will cost from $20,000 to $25,000; total length will be 12,325 ft. According to local press reports bids will be received by the Bd. of Pub. Wks. for this improvement on Nov. 20.

Fredonia, Kan.—The question of constructing a sewerage system is reported under consideration.

Louisville, Ky.—J. P. Claybrook, City Eng., writes that the proposed sewer on Central Ave. will be of 18-in. vitr. pipe and cost $3,650. The work is being done by city with its own force of labor.

Dayton, Ky.—Chas. A. Bird, City Clk., writes that the citizens on Nov. 5 voted to issue $28,000 bonds for the construction of trunk sewers on Vine, McKinney and Main Sts. Bids for construction will be called for next year. Engineer, Geo. G. Lindsey, of Dayton.

Versailles, Ky.—See "Water."

Baltimore, Md.—The Sewerage Comn. on Nov. 4 approved specifications for the superstructure of the pumping station on East Falls Ave.

Grand Rapids, Mich.—City Engr. Anderson is reported to be preparing plans and specifications for a trunk sewer which will form a continuation of the B'way sewer, to cost about $90,000.

Norway, Mich.—The City Council is reported to be considering the construction of a sewerage system to cost about $25,000.

St. Paul, Minn.—Bids will be received by the Bd. of Pub. Wks. (John S. Grode, Pres.) until 2 P. M. on Nov. 18 for constructing St. Anthony sewer extension No. 2, which includes about 12 miles of sewers.

Meridian, Miss.—The City Council is reported to have requested the Sewer Com. to procure estimates for the construction of sewers in the cotton mill district; probable cost, $7,000.

Kansas City, Mo.—Bids will be received until Nov. 21 by E. A. Harper, City Engr., for constructing sewers in joint Sewer Districts Nos. 200, 202, 2 and 3, in Sewer Div. No. 5.

**Butte, Mont.*—Alex. Leggat, City Engr., writes that Peter Oren has secured the contract for the construction of a cement pipe storm drain on Nevada, Maryland and California Aves., and Second St. at the following bid: 3-ft. trench, excav. and back fill., 35 cts. per lin. ft.; 80 ft. of 4-ft. trench, 45 cts.; 1,490 ft. 5-ft. trench, 60 cts.; 990 ft. 6-ft. trench, 65 cts.; 995 ft. 13 x 18 in. pipe, in place, 86 cts. per lin. ft.; 1,071 ft. 12-in. pipe, 55 cts.; 302 ft. 10-in. pipe, in place, 44 cts.; 197 ft. 8-in. pipe, in place, 34 cts. and 15 catch-basins, from $35 to $50.

Summerville, N. Y.—Bids will be received until Nov. 25 by the Sewer Comrs. (Chas. Salmon, Chmn.), 330 Powers Bldg., Rochester, for constructing a system of sanitary sewers at Summerville.

Richmond Hill (Jamaica, L. I.), N. Y.—The Board of Estimate of N. Y. City is reported to have adopted the plans for house sewerage for Richmond Hill as proposed by President Bermel, of Queens Boro., and revised and approved by Chief Engineer Nelson P. Lewis, of the Bd. of Estimate of N. Y. City. Work will soon be commenced by the Boro. Dept.

Rochester, N. Y.—Henry W. Taylor, Asst. City Egr., is reported to be completing surveys for a conduit system to carry the sewage of Rochester out into Lake Ontario for more than a mile near Summerville.

Smithfield, N. C.—See "Power Plants, Gas and Electricity."

Steubenville, O.—Bids will be received, it is stated, by the Bd. Pub. Service until Nov. 25 for constructing a sewer in a portion of 3d St.

Easton, Pa.—A. Prescott Folwell, of New York, N. Y., has submitted to the Mayor and Council a report on the separation of the sewerage system construction and location of a sewage plant and a garbage disposal plant for Easton, and estimates the cost at $240,000. F. A. March, Jr., Mayor.

**Washington, Pa.*—The Coryell Constr. Co., of Williamsport, is reported to have secured the contract for constructing sewer in bed of Grafin's run from Court St. to 4th St. for $10,250.

Norristown, Pa.—Harry P. Hiltner, Clk. of Council, writes that the citizens voted Nov. 5 to issue $300,000 bonds for sewers and street improvements, enlargement and extension of electric light plant, improvement of parks etc. S. Cameron Corson, City Engr.

**Lancaster, Pa.*—We are informed that the contract for finishing Water St. sewer, about 2,200 ft. of 108-in. concrete sewer (bids opened Nov. 11) has been awarded to Reilly & Riddle, of Philadelphia.

Allegheny, Pa.—Director Simon Kirschler, of the Department of Charities, is reported to have secured a permit from Dr. Sam. G. Dixon, State Health Comr., to install a sewage disposal plant at the Allegheny City Home at Claremont; probable cost, $10,000.

Providence, R. I.—The Bd. of Aldermen has adopted a resolution providing for the construction of sewers in Academy and Fairmount Aves., Blackstone Boule., Dodge, Clarence, Langdon and Corliss Sts.

Charleston, S. C.—The Sewerage Comrs. are reported to have decided to install an electric pump at the sewage plant.

Florence, S. C.—See "Power Plants, Gas and Electricity."

Norfolk, Va.—Bids will be received until Nov. 28 by J. D. Hank, Jr., Secy. Local Bd., 7th Ward, Norfolk, for constructing a portion of the sewerage system in said ward consisting of 1,000 lin. ft. 10-in. and 24,000

** Items marked thus give the names of parties awarded contracts.*

lin. ft. 8-in. terra cotta pipe lateral sewer and 24,000 lin. ft. terra cotta pipe house connections, 50 manholes and 35 flush tanks. W. T. Brooke, City Engr.

*Spokane, Wash.—Julian V. Costello is reported to have secured the contract for the 1st Ward sub-trunk sewer, Dist. No. 8; for $22,650. Jas. C. Broad bid $27,665 for this work.

Seattle, Wash.—The only bid received and opened on Nov. 2 by the Bd. of Pub. Wks. for constructing sewers in N. 39th St. was submitted by H. F. Jahn, 571 Coleman Bldg., at the following bid: Fixed estimate, $2,400; 330 lin. ft. 24 in. x 36 in., oviform brick sewer, $14; 430 lin. ft. 30 in. x 45 in., oviform brick sewer, $16; 760 lin. ft. 30-in. pipe sewer (alternative) $9.50; 624 lin. ft. 21-in. pipe sewer, $5.50; 196 lin. ft. 18-in. pipe sewer, $4.50; 216 lin. ft. 12-in. pipe sewer, $3.50; 1,140 lin. ft. 10-in. pipe sewer, $3; 9,170 lin. ft. 8-in. pipe sewer, $2.40; 250 lin. ft. 18 x 30 in. wooden box sewer, $2.25; 298 lin. ft. 18 x 24 in. wooden box sewer, $2.10; 5 flush tanks, each, $130; 43 4½ ft. manholes, each, $90; 1 wooden manhole, $40; 1 manhole to be rebuilt, $70; 51 catch basins, 1 inlet, each, $90; 15 catch basins, 2 inlets, each, $100; 2 sand boxes, each, $100; 150 lin. ft. 6-in. pipe connections, $2. Total for brick sewer, $56,943; total for pipe sewer, $52,663.30.

Hamilton, Ont.—Bonds to the amount of $120,000 have been sold to be used for the new annex sewer and disposal works.

BRIDGES.

Notes Arranged Alphabetically by States.

*Greeley, Colo.—G. N. Houston, of Denver, Deputy State Engr., writes that the contract for constructing reinforced concrete bridge at Greeley (bids opened Sept. 20) has been awarded to C. G. Sheely, of Denver, for $6,000.

Tampa, Fla.—The construction of a bridge at Lafayette St. is reported contemplated at a cost of $150,000.

Chicago, Ill.—It is stated that plans are being prepared by Thos. G. Pihlfeldt, Bridge Engr., for a bascule bridge to be constructed at Lake St. at an estimated cost of $1,000,000.

Iowa City, Ia.—The Bd. of Supervisors are stated to have decided to proceed with the construction of the bridge over the Iowa River near northwest city limits, at a cost of $25,000.

*Ida Grove, Ia.—R. J. Lundgren Co., of Des Moines, is reported to have been awarded the contract for constructing a steel bridge over Maple River near Ida Grove for $3,450.

Topeka, Kan.—It is stated that the Topeka Ry. Co. and the Atchison, Topeka & Santa Fe Ry. Co. contemplates constructing a viaduct over the tracks at Branner St. The structure to be of steel, 1,344 ft. long and cost about $60,000. C. A. Morse, Ch. Engr.

Baltimore, Md.—The Municipal Art Comn. is stated to have accepted plans prepared by D. B. Banks for a reinforced concrete bridge with three 120 ft. arches over Gwynn's Falls at Edmonson Ave. to cost about $130,000.

*Thief River Falls, Minn.—Lars Backe, City Clk., writes that the contract for constructing an iron bridge over Red Lake River (bids opened Nov. 6) has been awarded to the Hennepin Bridge Co., of Minneapolis, Minn., for $15,950.

Portsmouth, N. H.—See "Railroads."

*New York, N. Y.—The Manhattan Supply Co., 127 Franklin St., is reported to have secured the contract for furnishing and delivering steel and hardware supplies to Harlem River Bridges during the year 1907 for $5,425 (bids opened by Dept. Bridges Oct. 29).

Wilmington, N. C.—Bids, including plans and specifications, will be received until Jan. 7 by the Comrs. of New Hanover and Pender counties for constructing a steel highway bridge, approximately 400 ft., including draw span, over Northeast River at Castle Haynes, as advertised in The Engineering Record. Bids are to include foundations; depth of water, about 32 ft. Bridge to have 15-ft. road clearance and to carry 15-ton road roller. For further information apply to D. McEachern, Chmn. of Comrs., Wilmington, N. C.

Cincinnati, O.—A. J. Henkel, 621 Main St., is reported to have submitted the lowest bid for constructing the approaches to the Brighton Bridge, at $6,389.

Newark, O.—Bids will be received, it is stated, until Nov. 25 by the Bd. Co. Comrs. for constructing the superstructure of the Fallsburg Bridge, 105 ft. span, pin connected truss. H. L. Maddox, Co. Engr.

Mauch Chunk, Pa.—Bids were opened on Nov. 7 by the Bd. Co. Comrs. (D. O. Straup, Chmn.) for constructing a new span in place of the eastern span on the East Mauch Chunk Bridge over the Lehigh River at Mauch Chunk, and the lowest bid was submitted by the York Bridge Co., of York, for $16,850.

Salem, S. D.—C. J. Brach, Co. Aud., writes that bids will be received Jan. 7 for bridge work in McCook County. Engineer, A. Lindgren, of Bridgewater.

Graham, Tex.—The Comrs. Court will receive bids until Nov. 20 for constructing 2 bridges across Brazos River in this county; probable cost, $40,000. Geo. H. McLaren, Co. Judge.

*Texas.—The Union Bridge Co., of Kansas City, Mo., has secured a contract from the Colorado Southern, New Orleans & Pacific R. R. Co. for building the substructure of the Trinity River Bridge. There will be 4 piers, 2, and probably 3, will be sunk by the pneumatic process, and the other will be open work.

*New Haven, Vt.—The United Constr. Co., of Albany, N. Y., has secured the contract for constructing a 150 x 16 ft. span bridge for $3,000. (Bids opened on Nov. 7 by the officials of the towns of New Haven and Weybridge.)

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Evergreen, Ala.—The citizens of Conecuh County are reported to have voted to issue $100,000 bonds for road improvements.

Corona, Cal.—H. Alvord, City Clk., writes that it is proposed to issue $70,000 bonds. It is stated that $50,000 is for street improvements and $20,000 for a city hall.

*Ft. Collins, Colo.—G. N. Houston, of Denver, Deputy State Engr., writes that the contract for repair and improvement of 3½ miles wagon road between Ft. Collins and Loveland (bids opened Oct. 14) has been awarded to Jas. Ross, of Ft. Collins, for $3,850.

Lajara, Colo.—It is stated that bids will be received until Nov. 25 by T. W. Jaycox, State Engr., Denver, for constructing about 12 miles of wagon road from Lajara to Sandford and Manassa.

*Sterling, Conn.—Ahern Bros., of North Stonington, are stated to have secured the contract for constructnig 6,635 ft. gravel road in Sterling for $7,978.

*Groton, Conn.—The contract for constructing 7,208 ft. of macadam road in Groton is reported to have been awarded to F. Arrigoni & Bros., of Durham, at $1.58 per ft.

Wilmington, Del.—Bids will be received until Nov. 26 (readvertisement) by Francis A. Price, New Castle Co., State Highway Comr., Wilmington, for constructing a road in New Castle Hundred, leading from Wilmington to the town limits of New Castle, a distance of 2⅔ miles.

*Washington, D. C.—R. J. Beall Constr. Co., of Washington, is reported to have secured the contract for constructing cement sidewalks on both sides of Rhode Island Ave., at $1.27½ per sq. yd.

Tampa, Fla.—It is stated that $89,500 will be expended in street improvements.

*Springfield, Ill.—Henry Nelch on Nov. 10 secured contract for paving Park Ave. at $1.48 per sq. yard and Lawrence St. at $1.49, and for curb 55 cts. per lin. ft.

Monticello, Ind.—It is stated that bids will be received at the office of J. L. Ackerman, Co. Aud., until Nov. 25 for $47,700 bonds, to be issued for the purpose of constructing a macadam road in Monon Township.

*Columbus, Ind.—John M. Davis, Co. Aud., writes that the contract for constructing 4,761 ft. gravel road in Columbus Township (bids opened Nov. 4) has been awarded to Thomas Fiveeoats and Blaine Henry, of Ogilville, for $2,784.

Peru, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Dec. 7 for the construction of 23½ miles of gravel roads in Richland Township. Charles Griswold, Co. Aud.

Knox, Ind.—The Bd. of Co. Comrs., it is reported, will receive bids until Nov. 23 for the improvement by macadamizing roads in Oregon Township. L. M. Ransbottom, Co. Aud.

Green Castle, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Nov. 30 for the improvement of 16,371 ft. macadamized road in Jackson Township. C. C. Hurst, Co. Aud.

Lebanon, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Dec. 2 for constructing gravel roads as follows: 10,598 ft. in Marion Township; 10,580 ft. in Marion and Clinton Townships; 12,066 ft. in Eagle Township. B. F. Simmons, Co. Aud.

Logansport, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Dec. 4 for the construction of 3 gravel roads in Clinton Township. George W. Cann, Co. Aud.

Jasper, Ind.—M. A. Sweeney, Co. Aud., writes that new bids will not be called for until about March for the broken stone pavement on Holland and Huntingsburg Road, all bids received on Nov. 4 being considered too high.

Indianapolis, Ind.—It is stated that bids will be received by the Bd. of Pub. Wks. for paving with brick first alley west of Misson St., Pine St. and Ritter Ave.

Anderson, Ind.—The Bd. of Comrs. will soon ask for bids, according to reports, for the construction of a gravel road in Monroe Township known as the Schwin Road.

Decatur, Ind.—The Comrs. of Adams County are asking for bids for the improvement and repair of the Peffert Macadamized Road.

Terre Haute, Ind.—The City and the County Comrs. are reported to be preparing to ask for bids for the paving with asphalt the highway connecting the city with West Terre Haute; estimated cost, $30,000.

Crawfordsville, Ind.—The Comrs. of Montgomery County are stated to have decided to receive new bids for the constructon of a macadamzed road from Crawfordsville to Oak Hill Cemetery.

Des Moines, Ia.—Bids will be received until Dec. 4 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for paving W. 16th St. with vitrified blocks and Washington Ave. with asphalt, about 3,026 and 962 sq. yds., respectively; also combined curb and gutter on 14th St. and Prospect Ave., in all about 3,802 lin. ft.

New Orleans, La.—Plans and specifications are reported completed for the paving of portions of University Pl., Pierce, Scott, Cortez Sts., Tulane Ave. and several other streets and avenues.

Baltimore, Md.—Plans are stated to have been prepared for the extension of Broadway to the city limits, probable cost of improvement, $100,000.

*St. Louis, Mo.—The Bd. Pub. Improvements is stated to have awarded contracts for paving as follows (bids opened Oct. 29): Rueckling Constr. Co., Idaho Ave., $13,693, and Loughborough St., $6,284; Wm. H. Rademeyer Constr. Co., Columbia Ave., $11,487.

Kansas City, Mo.—Plans are stated to have been presented to the Bd. of Park Comrs. for a speedway to be constructed on Gilham Road; estimated cost, $5,040.

Kansas City, Mo.—Bids will be received until Nov. 21 by E. A. Harper, City Engr., for furnishing material and constructing a macadam pavement on 36th St., brick pavement on 2 alleys and artificial stone sidewalks on portions of numerous streets.

Woodbury, N. J.—Bids will be received until Nov. 25 by John E. Estell, City Clk., for paving about 2,950 sq. yds. on S. Broad St. with Warren's bitulithic pavement. Wm. M. Carter, City Engr., Woodbury.

*Belleville (Newark), N. J.—The Township Com. of Township of Belleville is reported to have awarded the contracts (bids opened Nov. 5) for constructing sidewalks and crosswalks on east and west sides of a portion of Belmont Ave. to John Doriety, 168 Ridge St., at $5,087.

Flemington, N. J.—Bids will be received until Dec. 12 by the Bd. of Chosen Freeholders (John H. De Mott, Dir.) for macadamizing the public road between the counties of Hunterdon and Somerset on the New Brunswick and Easton Turnpike, and continuing over course of said road through White House, White House Station to Sta. 342, near Pleasant Run, a distance of 34,200 ft., as advertised in The Engineering Record. Grant Davis, Co. Engr.

Buffalo, N. Y.—Separate bids will be received until Nov. 21 by the Dept. Pub. Wks. (F. G. Ward, Comr.) for paving portions of Custer St., Crowley and Woodward Aves. and repaving Hudson St.

Mineola, L. I., N. Y.—Road improvement bonds amounting to $200,000 are reported sold.

Ft. H. G. Wright, N. Y.—Bids will be received until Dec. 11 by Capt. Wm. E. Horton, Q. M., U. S. A., New London, Conn., for constructing macadam roads and sidewalks and for grading at Ft. H. G. Wright.

*Rochester, N. Y.—The Bd. of Contract is stated to have awarded the contract for paving with asphalt Dean St. to Whitmore, Rauber & Vicinus, 279 South Ave., at $3,124.

Hillsboro, O.—Bids are wanted, it is stated, until Nov. 30 for $5,400 road improvement bonds. John G. Roads, Co. Aud.

*Cleveland, O.—The County Comrs. are reported to have awarded to Moses F. Condo the contract for paving a portion of Miles Ave. Road for $21,890 (bids opened Nov. 6).

Toledo, O.—The citizens are stated to have voted to issue $150,000 bonds for the improvements of Grand Boulevard.

Lima, O.—It is stated that bids will be received until Nov. 19 by the Bd. Pub. Service (L. L. Crumrine, Secy.) for grading and paving with vitrified brick portions of 2 alleys.

Marysville, O.—It is stated that bids will be received until Dec. 3 by the Village Council for paving with vitrified brick portions of 6th and 7th Sts. J. C. Kennedy, Village Engr.

Youngstown, O.—The following are reported to be the lowest bids opened Nov. 7 by Bd. Pub. Service for paving with brick: S. H. De Groodt, Wick Ave., $10,068; Summit Ave., $8,079, and John Grady, E. Federal St., $8,850.

*Philadelphia, Pa.—Contracts were awarded by Director Stearns of Bd. Pub. Wks. on Nov. 6 for the repaving of about 40 miles of streets not occupied by the Rapid Transit Co., representing in the aggregate an expenditude of more than $1,000,000. The Barber Asphalt Co., Land Title Bldg., contract for repaving about 20 miles of asphalt streets at prices ranging from $1.69 to $2.01 a square yd.; the Filbert Paving Co., 15th and Chestnut Sts., a contract for about 5 miles of repaving, at $1.63 to $1.99 sq. yd. Estimated cost of the entire asphalt repaving, embracing 267 streets covered by the specifications, is about $750,000. Cunningham & Murray were awarded a contract for repaving 138 street with vitr. brick at an average price of $2.14 a sq. yd. For repaving with granite blocks about 5 miles of streets D. J. McNichols & Co., 704 Betz Bldg., a contract for 24 streets at $2.73 a sq. yd.; while the Mack Paving Co., a contract for 2 streets at $3.29 and $3.62 a sq. yd., respectively; Cunningham & Murray, German-American Bldg., 4 streets at $2.95 to $3.20 sq. yd., and W. A. Ryan, 6 streets at $2.88 to $3.03 sq. yd.

Philadelphia, Pa.—Plans are stated to have been approved by the Mayor for the widening of the parkway between Logan Sq. and Fairmount Park.

Pittsburg, Pa.—The resurfacing of Grant Boule. with asphalt is reported contemplated.

Harrisburg, Pa.—Bids will be received, it is stated, until Nov. 19 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing the following State roads: Loyalhaima Township, 3,000 ft.; North Bellevernon Boro., 1,112 ft.; Rostrover Township, 1,585 ft., all in Westmoreland Co.; Logan Township, Blair Co., 13,088 ft.; Tionesta, Forest Co., 1,523 ft. brick and 5,725 ft. macadam road; Swatara Township, Dauphin Co., two roads, one 3,200 ft., the other 10,000 ft.; also Nov. 20, Waterford Boro., Erie Co., 8,160 ft.; Waterford Township, Erie Co., 3,670 ft.; Clearfield Boro., Clearfield Co., 1,882 ft.; Bensinger Township, Elk Co., 5,300 ft.; also until Nov. 21, Crescent Boro., Cambria Co., 2,582 ft. brick and 1,681 ft. macadam road; Cresson Township, Cambria Co., 10,952 ft. macadam and 250 ft. brick road; Richland Township, Clarion Co., 16,500 ft.

Norristown, Pa.—See "Sewerage and Sewage Disposal."

*Washington, Pa.—The County Comrs. are stated to have awarded the contract for constructing the Taylorstown Station-Taylorstown Road to Hallam Constr. Co. for about $10,000.

Galveston, Tex.—Bids will be received until Nov. 21 by the Bd. City Comrs., at the office of John D. Kelley, City Secy., for paving with vitrified brick and curbing Ave. B and Ave. D, requiring 10,201 sq. yds. pavt. and 3,710 lin. ft. curb. A. T. Dickey, City Engr.

Ft. Myer, Va.—Bids will be received by Capt. B. B. Hyer, Constr. Q. M., U. S. A., until Nov. 23 for the construction of a roadway leading to quartermaster's shop, as advertised in The Engineering Record.

*Seattle, Wash.—The Rich & Harris Constr. Co. is reported to have secured the contract for asphalt paving in Denny-Blaine Park Addition at $2.35 per yd., or a total of $116,049.

All bids opened Oct. 29 for paving with sandstone block a portion of Madison St. are reported rejected. According to reports new bids will be received.

*Smith & Hall, 516 Downs Blk., have secured the contract for constructing concrete walks on Phinney Ave. and N. 50th St., for $5,592, and on Brooklyn Ave., E. 45th to E. 50th Sts., for $3,556.

Items marked thus give the names of parties awarded contracts.

**Seattle, Wash.*—The following are the bids opened on Nov. 2 by the Bd. of Pub. Wks. for improvement of Meridian Ave. by constructing concrete walks: (*a*) Hans Pederson, 501 Fairview Ave. (awarded contract); (*b*) Andrew Pederson, 410 Washington Bldg.; (*c*) MacAdam & Co., Grand Union Hotel.

	a	*b*	*c*
Fixed estimate	$3,400.00	$3,400.00	$3,400.00
6,500 cu. yds. earthwork.	.25	.01	.30
47,790 sq. yds. con. walks.	1.15	1.20	1.18
182 M ft. B. M. cross-walks	22.00	24.00	26.00
Con. 71 s. y. alley crossings	1.40	1.50	1.40
2 catch basins (2 inlets).	90.00	90.00	85.00
1 catch-basin (1 inlet)....	80.00	80.00	75.00
10,000 lin. ft. 3-in. pipe sewer	.15	.15	.14
Totals	$66,108.00	$67,311.50	$68,469.60

**Toronto, Ont.*—The Bd. of Control is stated to have awarded on Nov. 5 contracts as follows for paving: Contracting & Paving Co., Barton Ave., asphalt, $2,734; Godson Contr. Co., Montrose Ave., with asphalt, $4,292; Dewson St., with asphalt, $7,580; Warren Bituminous Paving Co., Huron St., with bitulithic, $2,442; C. H. Rust, Avenue Road, with bitulithic, $15,000.

Hamilton, Ont.—The construction of a road from the Jolley Cut to Victoria Ave. is reported contemplated.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Tuscaloosa, Ala.—See "Schools."

Birmingham, Ala.—The Muscle-Shoals Power Co. and the Hydro-Electric Co. propose, according to reports, to construct a series of 3 locks and dams across Tennessee River near Muscle Shoals in Alabama for the purpose of securing electric power therefrom.

The Birmingham Electric Light & Power Co. is reported incorporated with a capital of $196,000, and intends constructing a power plant on Village Creek for the purpose of supplying electricity for lighting purposes. The purpose of the company is to erect a building about 100 ft. square on Village Creek and install machinery of about 1,000 h.-p. All wires within the fire limits of Birmingham will be laid underground. The capacity of the plant at first will be 1,600 16-c.-p. incandescent lights, and franchises will be applied for in the various municipalities in the Birmingham district.

**Oakland, Cal.*—The Oakland Gas, Light & Heat Co. has been granted a permit to erect a steel gas storage tank to cost $162,000 near Market St. gas plant. Capacity, 2,000,000 cu. ft. It is reported that the contract for the work has been awarded to R. D. Wood & Co., of Philadelphia, Pa.

Las Animas, Colo.—Bids will be received until Nov. 23 (readvertisement) at the Bureau Yards and Docks, Navy Dept. (Wm. M. Smith, Acting Ch.), Washington, D. C., for power plant, building and machinery at U. S. Naval Hospital, New Ft. Lyon, Colo.

Branford, Conn.—The Connecticut Co. is said to be planning to install an alternating-current day service about June 1, 1908. E. T. Gilbert, Supt.

Jacksonville, Fla.—The following are reported to be the bids received by the Bd. of Bond Trus. on Nov. 4 for furnishing a 1,500-kw. steam turbo generator for the electric light plant: General Electric Co., Schenectady, N. Y., 900 revolution generator, $45,005; 1,800 revolution generator, $34,805. Allis-Chalmers Co., Milwaukee, Wis., $34,985. Westinghouse Machine Co., Atlanta branch, $36,509, for 1,800 revolution generator, and $49,172, for 1,200 revolution generator.

Sparks, Ga.—It is stated that the citizens have voted to issue $30,000 bonds to establish an electric light plant and a system of water works. It is reported that the bonds have been sold.

Centralia, Ill.—The Centralia Gas & Electric Co. is planning extensive improvements to its plant and will change its system from 2 to 3 wire and increase the boiler capacity. G. E. Fish, Supt.

Oregon, Ill.—Paul F. Shuster, of Rockford, writes that he, with Warren S. Stearns, of Rockford, have franchises and propose to erect gas plants at Marengo, Ill.; Oregon, Ill.; Harvard, Ill., and Platteville, Wis. The Platteville Gas Co. is fully organized; the others will be within a few days. No contracts have been made for construction work. All mail should be addressed to Paul F. Schuster, 424 Ashton Bldg., Rockford.

Princeton, Ill.—The Bureau County Light & Power Co. of Princeton is reported incorporated, with a capital of $50,000 to manufacture and sell electricity. Incorporators: R. R. Priestly, C. F. Sturtevant and B. C. Lindley.

Valley Junction, Ia.—The Valley Junction Water & Light Co. proposes increasing the capacity of its plant and will install new boilers and an engine. R. M. Lewis, Supt.

Cedar Rapids, Ia.—The Cedar Rapids & Iowa City Ry. & Light Co. contemplates the enlargement of its boiler room and equipment, including coal and ash handling apparatus, chain grates, conveyors and possibly economizers. W. J. Greene, Mgr.

Elkader, Ia.—The Turkey River Power Improv. Co., it is reported, will construct 3 water power dams and proposes an interurban line from Elkader to Oelwein and Dubuque.

Nevada, Ia.—M. A. Harrison and H. H. Caughlin are reported to have purchased the electric light plant and will make improvements.

Beloit, Kan.—This city is reported to have purchased the electric light plant owned by A. T. Rogers.

Lecompte, La.—Press reports state that the council will on Dec. 3 consider plans and specifications from electrical engineers for a complete electric light system.

Winchendon, Mass.—The Winchendon Electric Light & Power Co. is said to have in contemplation the installation of an auxiliary plant in connection with its present water-power plant. Frank W. Nourse, Mgr.

**Berrien Springs, Mich.*—We are informed that the C. L. Olds Constr. Co., of Ft. Wayne, Ind., on Nov. 7 secured the contract for 4¾ miles of wire, 25 street lights, regulator, transformer and erection of poles, wire, etc., for municipal lighting system for $3,220. Other bids received for this work were: W. Worth Bean, Jr., of Benton Harbor, $4,305, and Falkenau Electrical Constr. Co., Chicago, Ill., $3,895. Engineer, A. J. Hammond, of South Bend, Ind.

Onaway, Mich.—The Onaway Light & Power Co. proposes constructing a new dam next year to supply the increased demands made on its plant. W. W. Vaughn, Pres.

Bay City, Mich.—Wm. H. Fitzhugh, Supt. municipal electric light plant, writes that all bids opened on Oct. 30 for two 250-h.p. boilers for the electric light plant have been rejected, and new bids will be received on Nov. 27 on new specifications. The lowest bid amounted to $9,800. He further states that the following are the lowest bids received on other portions of the plant: Allis-Chalmers Co., Milwaukee, Wis., turbine and generator of 500 kw., $15,100, and exciters of 15 kw., $1,025; Westinghouse Electric Mfg. Co., Pittsburg, Pa., for 300 lamps, A. C. series, 6.6 ampere, $10,372, and the J. Lang Electric Co., Chicago, Ill., for a 5-panel switchboard, $1,085.

Nashwauk, Minn.—The Village Trustees contemplate increasing the capacity of the municipal electric light plant by the installation of an 80-kw alternator with engine and other necessary apparatus, and also the extension of lines to two miens. G. A. Lindsay, Supt.

Little Fork, Minn.—Jos E. Cummings, of Duluth, is reported to be contemplating the developing of Little Fork and Sturgeon Rivers for electrical power.

Stewartville, Minn.—The Stewartville Electric Light Co. is reported to have in contemplation improvements to its plant, including purchase of new boiler.

Virginia, Minn.—The Virginia Light & Water Co. is contemplating the installation of a 100-kw. alternating-current 2,300-volt direct-connected unit in its plant. O. H. Griggs, Mgr.

Canton, Miss.—It is proposed to purchase a 50-light transformer for the municipal arc lighting system and extend fire main to the corporate limits. John T. Sharp, Jr., Mgr.

Steelville, Mo.—A franchise is reported granted to Janus Bright for 20 years to furnish electric light for Steelville. The power house will be at Evans Mill, 1 mile east of the city, using water power.

Chinook, Mont.—Bids will be received until Dec. 21 by the Town Council for constructing an electric light system. John C. Duff, Town Clk.

Papillion, Neb.—The citizens are reported to be in favor of installing an electric light plant.

Stella, Neb.—It is reported that the Stella Electric Light Co. has closed a contract with the city for street lighting for a term of years and will begin at once to install the plant. The plant is to be in operation by Jan. 1, and John Brenner, of Humboldt, is to be the electrician.

North Platte, Neb.—Chas. F. Temple, City Clk., writes that City Council has granted the North Platte Electric Light & Power Co. (Lester W. Walker, Mgr., North Platte) a franchise for 20 years. The company will do considerable improving.

Reno, Nev.—The Lower Truckee Electric Co. is reported incorporated to construct a power plant to supply the mines of Fairview, Wonder and Olinghouse with power and lights, and probably run a line into Reno and the Carson valley. Capital, $50,000. Incorporators: T. W. Haines, of Oakland, Cal.; W. H. Hall, of Gridley, Cal., and Henry W. Esden, of Reno, Nev.

Alpha, N. J.—The Alpha Cement Co., of Easton, Pa., writes that it is not prepared to erect a power plant as recently reported.

Elmer, N. J.—The Elmer Gas Co. is reported to have secured a 50-year franchise from the Boro. Council.

Rhinebeck, N. Y.—R. Raymond Rikert, Secy. Dutchess Light, Heat & Power Co., of Rhinebeck, writes that plans for the proposed extension are not yet complete.

Smithfield, N. C.—The Holmboe Co., Lincoln Savings Bank Bldg., Louisville, Ky., has been selected to prepare plans and specifications for water works, sewers and an electric light plant at Smithfield. After estimates are ready an election will be held to vote bonds, and if bonds carry the work will be commenced at once.

Swanton, O.—See "Water."

McConnelsville, O.—The McConnelsville-Malta Electric Co. proposes installing gas engines of 150 h. p., to be used in case of emergencies. A. Durban, Supt.

Columbus, O.—Bids will be received until Nov. 25 by the Bd. Pub. Service (E. F. McGuire, Secy) for furnishing material and making the following improvements at the municipal electric light plant, Dublin Ave.: Boiler blow-off, tunnel foundation for additional boilers, continuation of ash pit tunnel, retaining wall and driveway, foundations for the 1,000-kw. steam turbine and exciter, watertight pit around foundations for turbine, etc. The bids for this work were recently rejected.

Oklahoma City, Okla.—The Citizens Electric Light & Power Co. is reported incorporated, with a capital of $50,000, by W. E. Grigsby, W. L. Peck and W. L. Bradford.

New Pine Creek, Ore.—The electric power plant of the California & Oregon Light & Power Co. at New Pine Creek is reported to have been destroyed by fire, and it is stated that plans for a new plant are being considered. E. Keller, Pres. & Mgr., New Pine Creek.

**Pittsburg, Pa.*—Chas. Reisfar, Jr., Secy. Central Bd. of Educ., writes that the contract for installing electric lighting plant in 5th Ave. School (bids opened Nov. 7) has been awarded to P. F. Magion & Co., 1025 Forbes Ave., Pittsburg, for $8,800.

A permit has been granted to St. Francis Hospital to erect a $100,000 5-story brick and stone power house to furnish heat and power to the Hospital.

Philadelphia, Pa.—See "New Industrial Plants."

**Delta, Pa.*—The Ambursen Hydraulic Constr. Co., of Boston, has secured contract from the Delta Electric Power Co., of Delta, Pa., for a reinforced concrete dam in Southeastern Pennsylvania for supplying power to the slate quarries and other industries in that district; it also received contract from the Big Horn Power Co., of Chicago, Ill., for a dam on the Big Horn River in Wyoming. These two dams are almost exactly similar in dimensios and characteristics. Each is situated in a deep, narrow gorge, where there is no possibility of a detached or independent power house. The Wyoming dam will create a head of 60 ft. and the Pennsylvania dam of 65 ft., and both structures are about 70 ft. high above foundations. The power houses in both cases will be under the rollway of the dam and protected by an inner shell. The great height of the dam allows ample space for a power house, together with traveling crane, switchboard, office, etc. Both dams will be of the half-apron type. Work has already been commenced and will be carried on throughout the winter. It is expected to complete both dams before the spring floods.

Norristown, Pa.—See "Sewerage and Sewage Disposal."

Rock Hill, S. C.—W. S. Lee and L. C. Harrison are reported to have petitioned City Council for a franchise to construct and operate a gas plant.

Charleston, S. C.—See "Sewerage and Sewage Disposal."

Florence, S. C.—The installing of a sewer system, costing $60,000, an electric light plant, costing $25,000 and additional water facilities costing $15,000, is reported under consideration.

Amarillo, Tex.—The Amarillo Water, Light & Power Co. contemplates the complete rearrangement of its system and doubling the capacity of its plant. Frank W. White, Manager.

Bristol, Va.-Tenn.—Engineers Chas. Hansel & Co., 43 Exchange Pl., New York, N. Y., are reported to represent a company which proposes constructing power plant and distribute electricity in Bristol. Harry Roberts, of Bristol, is attorney for the company.

Lynchburg, Va.—It is stated that C. W. Hancock & Sons, of Lynchburg, have secured a contract with the company owning the Natural Bridge property for the construction of a concrete dam 200 ft. long and 35 ft. high in Cedar Creek. The dam will be located about half a mile below the bridge, and the water will be used to develop 100 h.-p. which is for electric power purposes.

Buena Vista, Va.—The Buena Vista Light & Power Co. contemplates installing a new switchboard and making other improvements to its plant. E. C. Fowlkes, Supt.

Spokane, Wash.—H. C. Eckensberger, of Portland, Ore., general freight agent of the New York Central Lines, writes that it is proposed to harness the Columbia River, the power to be used for manufacturing and other purposes. Nothing definite has yet been done.

Wheeling, W. Va.—The City Council on Nov. 7 appropriated $150,000 for improvements to the gas and electric light plant.

North Milwaukee, Wis.—The North Milwaukee Light & Power Co. proposes changing part of its system to alternating current. Theodore Waech, Mgr.

Wauwatosa, Wis.—The question of constructing a municipal electric light plant is reported under consideration here.

Marinette, Wis.—It is reported that the Economic Light & Power Co. has been incorporated, with a capital of $25,000, by Theo. A. Pamnerin, Geo. Bever and others. A. W. Wilson, of Marinette, and A. L. Gillette, Oconto, representing Chicago, Ill., capitalists, have applied to City Council for a franchise to establish a new lighting system for the city. It is also proposed to build an interurban line in connection with the water power development. It is proposed to take power from Peshtigo River.

Eau Claire, Wis.—The City Council is reported to have decided to procure bids for lighting the streets and bridges for 5 years.

Madison, Wis.—Bids will be received until Nov. 22 by the Wisconsin Capitol Comn. (Lew F. Porter, Secy.), at Madison, for the following equipment for the heating and power plant for the Capitol Bldg., now under construction at Madison: Boilers, engines, electrical generators and motors, mechanical stokers, pumps (feed), pumps (building supply), storage tanks, conveying machinery, hoisting crane and open heaters, as advertised in The Engineering Record. Storm Bull, Consulting Engr., Madison.

West Bend, Wis.—The State R. R. Comn. is reported to have granted the West Bend Htg. & Lighting Co., of West Bend, permission to issue $25,000 additional stock and to purchase plant and to make certain improvements.

Big Horn, Wyo.—See "Delta, Pa."

Montreal, Que.—Official reports state that bids will be opened on Dec. 16 by the Fire and Light Com. of City Council for the supply of electrical energy for lighting the streets, squares and other real estate belonging to or under control of city; also for lighting, heating and industrial purposes for the citizens. Separate bids will also be received for the supply of gas, by burners, for lighting the streets, parks and squares; also gas to citizens for lighting, heating and industrial purposes, per 1,000 cu. ft. L. O. David, City Clk.

Kelowna, B. C.—R. Morrison, City Clk., writes that as soon as bonds are sold work will commence on the construction of water works and an electric light plant; probable cost, $40,000.

Toronto, Ont.—See "Schools."

Campbellford, Ont.—E. C. West, City Secy., writes that John S. Fielding, 15 Toronto St., Toronto, is engineer for the proposed power plant to be constructed at Middle Falls, to cost about $60,000.

Listowel, Ont.—Bids are wanted for lighting this town by electricity, arc and incandescent. For further information address C. A. Lee, Chmn. Light Com.

West Lorne, Ont.—The West Lorne Electric Light Co., Ltd., is contemplating the installation of a producer gas power plant soon. D. F. Webster, Secy.

* *Items marked thus give the names of parties awarded contracts.*

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Lakeport, Cal.—The Sonoma & Lake County Ry. Co. is stated to have announced that all the rights of way, terminals and franchises have been secured and that construction work is to begin next spring. The road is to be 30 miles long and will connect Cloverdale, Lakeport and Kelseyville. A. E. Dickinson, of Ukiah, Cal., Pres.; J. E. Fulton, of Lakeport, Gen. Manager; W. S. Fry, Lakeport, Secy.; J. R. Garner, of Upper Lake, Cal., Treas.

Murphysboro, Ill.—The Murphysboro Electric Ry., Light, Heat & Power Co., Murphysboro, is reported incorporated to operate electric railway and public utilities. Capital, $36,000. Incorporators: John G. Hardy, Walter C. Alexander and Philip H. Eisenmeyer.

Chicago, Ill.—The Chicago & East St. Louis Short Line Ry. Co., with principal offices at Chicago, is reported incorporated to construct an electric railway from East St. Louis through Christian, Macon, Dewitt, McLean, Livingston, Kankakee and Will Counties to a point in Chicago. Capital, $50,000. Incorporators: H. C. Osterman, Wm. M. Drennan, H. C. Dolph, Thos. W. Flynn and Wm. Anderson.

Edwardsville, Ill.—The St. Louis & Staunton Ry. Co. is reported incorporated by the McKinley Syndicate for the purpose of constructing an interurban railway from Edwardsville to Staunton. Incorporators: Geo. M. Mattis, W. H. Carnahan, C. Zilly, D. E. Brambel and R. H. Watson, all of Champaign.

Sycamore, Ill.—A charter is stated to have been granted to the Woodstock, Marengo & Sycamore Electric Ry. Co. to construct a road from Woodstock to Sycamore. Capital $25,000. Incorporators: Chas. A. Spenny, Edward B. Harang, M. W. Powell and others.

Tulsa, I. T.—The Tulsa Interurban Ry. Co. is reported to have petitioned for a charter to construct a line from Sapulpa to Tulsa. John O. Mitchell, L. D. Marr, H. R. Cline and others are reported interested.

Elkader, Ia.—See "Power Plants, Gas and Electricity."

Shreveport, La.—It is stated that a movement is uder way to extend the Shreveport Traction Co.'s lines to Centenary College, a distance of several mines.

**Boston, Mass.*—The contract for constructing open incline north of Boston City Hospital Relief Station (bids opened Oct. 31 by the Boston Transit Com.) has been awarded to C. R. Gow Co. for $27,771.

Manistee, Mich.—It is reported that the R. G. Peters Salt & Lumber Co., of Manistee, is considering the construction of an interurban electric railway between Manistee and Cadillac.

Mexico, Mo.—The Mexico & Perry Traction Co. is reported to have awarded the contract for grading the electric line from Mexico to Perry to J. M. Wolf, of Collinsville, Ill.

Canal Dover, O.—It is stated that the Tuscarawas Valley Transit & Power Co. will build its line from Canal Dover to Canton by way of Zoar and Bolivar, using a private right of way. The line will extend from Canton to Columbus, passing through Coshocton.

Upper Sandusky, O.—It is stated that Frank M. Ohl, of Toledo, contemplates constructing an electric railway through Upper Sandusky.

Oklahoma City, Okla.—The Red River Ry. Co., with $5,000,000 capital and headquarters at Oklahoma City and Durant, is reported chartered to build an electric line from a point on the Texas State line, just north of Bonham, Tex., to Oklahoma City, 200 miles. Incorporators: Geo. T. Robertson, of Atoka; E. M. Abernathy, S. C. Hawk and F. J. Hawk, Lexington; J. W. Hocker, of Purcell, and T. H. Bayless, of Durant.

La Plume, Pa.—Plans are stated to have been approved by the Governor for the extension of the Dalton St. Ry. from La Plume through Factoryville to the north side of Lake Winola.

Luzerne, Pa.—The Governor is reported to have approved plans of the Wilkesbarre & West Side Ry. Co. for the extension of the line on Courtdale Ave. through Courtdale Borough to Plymouth Township, a distance of about 1 mile.

East Conemaugh, Pa.—The Borough Council is stated to have passed an ordinance granting the Southern Cambria Street Ry Co. the right to lay tracks and operate an electric railway within East Conemaugh.

San Antonio, Tex.—A franchise is stated to have been granted the San Antonio Traction Co. to construct an extension to the Tobin Hill line. W. B. Tuttle, Gen, Mgr.

Buenos Aires, Argentina, S. A.—Bids are wanted and will be received before May, 1908, by the Municipal Intendente, Buenos Aires, for constructing two of the principal lines of the proposed system of th Metropolitan Subway Electric Railways; also for the lease of the two lines now under construction. Further information can be had by addressing the Argentine Legation, Washington, D. C.

RAILROADS.

Notes Arranged Alphabetically by States.

Champaign, Ill.—The St. Louis & Staunton Ry. Co. has been incorporated, with principal office at Champaign, and capital $2,500, to construct a railroad from Edwardsville to a point in or near Staunton. Incorporators: Geo. M. Mattis, W. H. Carnahan, C. Zilly and others.

Jefferson City, Mo.—The Jefferson City, Albuquerque & San Diego Valley R. R. Co. is reported chartered in Guthrie, Okla., with a capital of $7,000,000. It proposes to build a road from Jefferson City, through Missouri, Kansas and Beaver County, Okla., New Mexico and Arizona to San Diego, 1,600 miles. Incorporators: J. H. Langston and O. S. Jent, of Guymon, Okla.; W. F. Bort. of Wichita, Kan.; C. R. Wright, of Liberal, Kan., and others.

Hannibal, Mo.—The City Council is reported to have adopted an ordinance granting the Chicago, Burlington & Quincy R. R. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.), a franchise to lay double tracks on the levee. The company agrees to construct a good levee at a cost of about $300,000; it also proposes erecting a new depot, to cost about $100,000.

Portsmouth, N. H.—The Boston & Maine R. R. Co. (H. Bissell, Ch. Engr., Boston, Mass.), is reported to have decided to expend $1,250,000 on improvements to its property in this section. Of this amount between $50,000 and $75,000 will be used for a new railroad station on Maplewood Ave. and about $400,000 for a new steel bridge across Piscataqua River bet. New Hampshire and Maine. The remainder will be used in making the necessary changes that will result from placing the bridge a half-mile above present wooden structures.

Rochester, N. Y.—J. W. Dwyer, 875 Ellicott Sq., is reported to be the lowest bidder for excavating and masonry work of the Culver Road subway under the tracks of the New York Central R. R. at Rochester, for about $100,000. The total cost of the grade crossing improvement is estimated at $200,000. The New York Central is to pay one-half, the city of Rochester a quarter and New York State a quarter. The actual construction work will be in the hands of the railroad. It is estimated that a year will be required to complete the subway.

Columbus, O.—The citizens on Nov. 5 voted to issue $1,000,000 bonds for the abolition of railroad grade crossings in Columbus, about 25 in all. Henry Maetzel, City Engr., is reported to have completed the plans and the railroad companies interested have approved the plans.

Richmond, Va.—The survey for the extension of the Richmond & Chesapeake Ry. to deep water will be resumed in the early spring. J. M. McLure, Ch. Engr., Chester, S. C.

Spokane, Wash.—See "Business Buildings."

Winnipeg, Man.—The Saskatchewan, Peace River & Dawson R. R. Co. is reported to have petitioned Dominion Parliament for permission to construct a road from Winnipeg to Dawson City.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Whipple Barracks, Ariz.—Bids will be received until Dec. 12 (readvertisement) by Capt. Chas. C. Walcutt, Jr., Acting Q. M., Prescott, for construction, plumbing, hot water heating and electric wiring, hospital at Whipple Barracks, Ariz., as advertised in The Engineernig Record.

Clarendon, Ark.—We are informed that it is proposed to erect a court house, to cost about $50,000. Nothing definite will be done until about Feb .

Corona, Cal.—See "Paving and Roadmaking."

Las Animas, Colo.—See "Power Plants, Gas and Electricity."

Denver, Colo.—It is stated that plans for the new Franciscan Orphanage to be erected on Osceola St. and W. 26th St. have been completed and filed with the building inspector. The plans provide for several 3-story fireproof buildings, costing in all about $150,000.

Norwich, Conn.—It is stated that plans are now being prepared for the erection of an addition to the Hospital for the Insane, the cost to be $25,000.

**Wilmington, Del.*—A. S. Reed & Bro. Co., 85 Shipley St., it is stated, have secured the contract for the boiler house and coal bins at the new city pumping mill at 16th and Walnut Sts., at $13,747, and the contract for the laboratory in connection with same at $727.

Washington, D. C.—The five-story building at 321 C St., N. W., occupied by the seed distributing department of the Department of Agriculture, is reported destroyed by fire.

Bids for the erection of the building for the International Bureau of American Republics are to be submitted, according to reports, on Dec. 15. Amount available, $1,000,000. Elihu Root, Secy. of State, is a member of the Bd. of Governors.

Bids will be received until Nov. 20 by the Comrs. D. C. (Henry B. McFarland, Chmn.) for constructing an engine house on Lanier Pl. and Ontario St., Lanier Heights; also an engine house at 22d and Evarts Sts., Langdon, D. C.

The Comrs. D. C. opened bids on Nov. 9 for erecting a stable for the water dept. in the rear of the Bryant St. pumping station and for a storehouse at 14th and D Sts. Thos. Melton, 19 T St., n. w., submitted the lowest bid on both buildings, at $23,000 to construct the stable with concrete floors, or $21,300 with wood floors, and $7,095 for the cement storehouse. The other bids received for the stable (bids being on concrete and wood floors, respectively) were as follows: Robt. T. Humphrey, $26,500 and $25,300; and Jos. H. Gibbons, $31,700 and $29,700.

Tampa, Fla.—The Council has passed on second reading an ordinance providing for the issue of bonds, as follows: For a new city hall and its site, $245,000; city hospital, $35,000. An election is to be held Dec. 10 to confirm the Council's action in this matter.

Ocala, Fla.—Bids will be received until Dec. 19 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (includnig plumbing, gas piping, heating appartus, electric conduits and wiring) of the U. S. Post Office and Court House at Ocala, as advertised in The Engineering Record.

Great Lakes, North Chicago, Ill.—Bids will be received at the Bureau of Navigation, Navy Dept. (W. H. Brownson, Ch.), Washington, D. C., until Dec. 2 for the construction of a commandant's house, 6 officers' houses and a receiving guard house at the naval training station, Great Lakes, North Chicago.

**Peoria, Ill.*—The contract for constructing an extension, remodeling, etc., including mechanical equipment (except lift) to the U. S. Post Office and Court House at Peoria has been awarded by the Superv. Archt., at Washington, D. C., to the General Constr. Co., of Milwaukee, Wis., at $170,325 (bids opened Oct. 7).

Chicago, Ill.—It is reported that active work is to be started at once on the plans for the central police station, municipal court headquarters and city jail; probable cost, $600,000.

New Albany, Ind.—The Bd. Co. Comrs., it is stated, will receive bids until Nov. 29 for remodeling the county jail.

Michigan City, Ind.—The County Council of Laporte County is stated to have appropriated $125,000 for the erection of a superior court building at Michigan City.

Laporte, Ind.—The County Comrs. are reported to have appropriated $85,000 for a county jail to be erected at Laporte.

South Bend, Ind.—Bids will be received by Jas. Knox Taylor, Super. Arch., Washington, D. C., until Jan. 2, for the construction of an extension to and the remodeling, etc., of the U. S. Post Office at South Bend.

Princeton, Ind.—An appropriation of $20,000 is reported made by the County Bd. for the erection of a jail.

Des Moines, Ia.—The plans of Proudfoot & Bird, Crocker Bldg., are stated to have been accepted by the Bd. of Pub. Wks. for the City Hall.

**Des Moines, Ia.*—Paul Riemers & Sons, of Milwaukee, Wis., have secured the contract to erect, complete, the U. S. Post Office at Des Moines (bids for which were opened by the Superv. Archt., at Washington, D. C., on Oct. 21), at $367,793.

**Muscatine, Ia.*—The Superv. Archt. at Washington, D. C., awarded the contract to erect, complete, the U. S. Post Office at Muscatine to W. J. McAlpine, of Dixon, Ill., at $65,232.

**Louisville, Ky.*—The contract to erect a fire engine house at Frankfort and Frank Aves. is reported awarded to Geo. H. Rommel, 1014 E. Bway., at $21,174.

**Leesville, La.*—C. K. Oakes, Clk. Police Jury, writes that the contract for erecting a county building (bids opened Nov. 4) has been awarded to W. C. Whitney, of Beaumont, Tex., for $88,000.

Grand Rapids, Mich.—The erection of a new armory for the batallion is reported contemplated; probable cost, $125,000.

St. Peter, Minn.—J. D. Mills, Secy. State Bd. of Control, St. Paul, writes that all bids opened on Oct. 26 for erecting, plumbing and heating tuberculosis building at State Hospital have been rejected. Architect, C. H. Johnston, 712 Manhattan Bldg., St. Paul.

Rochester, Minn.—The bids received recently for erecting a wing at the Rochester Hospital, it is reported, have been rejected.

**Hastings, Minn.*—It is stated that the contract to erect a cottage for men at the Hastings Asylum for the Insane has been awarded to C. Ash & Co., of Hastings, at $42,800.

Minnehaha, Minn.—It is reported that bids will be opened Nov. 20 for improvements to the old hospital building at the Soldiers' Home at Minnehaha. The work includes carpenter and brick work, electric wiring, new plumbing fixtures, etc. A. F. Gauger, Scandinavian-American Bank Bldg., St. Paul, is the archt.

Houston, Miss.—The Bd. of Superv., it is reported, has adopted the plans of R. H. Hunt, of Chattanooga, Tenn., for the court house, which is to cost, exclusive of furnishings, about $65,000.

Paris, Mo.—The Co. Bd. is reported to have accepted plans for an infirmary estimated to cost $25,000. J. N. Magruder, Co. Clk.

Rockport, Mo.—The citizens are stated to have voted in favor of issuing bonds to erect a county infirmary to cost $30,000.

Kansas City, Mo.—The following are reported to be the bids received by the County Clerk Oct. 31 for the walls, roof, floors and windows of the 3-story brick 55x310-ft. county home for the poor (bidders of Kansas City unless otherwise stated): T. H. Ludlow, $148,920; Taylor & Winn, 121 W. 8th St., $148,208; Andrew Mathers, $149,100; Urban Constr. Co., $177,000; Geo. W. Huggins, $170,492; G. E. Strickler, $177,793; W. H. Mapes and Jos. Overly, $184, 977; J. H. Stone, $175,500; Chris Yetter, Independence, Mo., $201,800, and W. R. Atkinson, Colorado Springs, Colo., $183,000. Architects, Smith & Rea, 722 Dwight Bldg.

Omaha, Neb.—Dan B. Butler, City Clk., writes that the citizens on Nov. 2 voted to issue $30,000 bonds for the erection of a fire house on 24th St. Bids will probably be called for in the spring.

Ely, Nev.—It is reported that bids are wanted until Dec. 2 for erecting a courthouse and jail. J. W. Miles, Co. Clk.

Secaucus, N. J.—Bids will be received until Nov. 26 by the Bd. Chosen Freeholders (Walter O'Mara, Clk.), Jersey City, for erecting a tuberculosis hospital at Secaucus. Plans and specifications may be had from the Clk., Bd. Chosen Freeholders, upon a deposit of $25. Fredk. Hensel, Archt., 246 Summit Ave., Hoboken.

Newark, N. J.—Bids will be received until Nov. 19 by the Co. Park Comn. (A. Church, Secy.) for erecting a stable in Weequahic Reservoir, Newark.

Madison Barracks, N. Y.—See "Water."

Binghamton, N. Y.—It is stated that improvements and alterations to the Binghamton State Hospital are being considered by the State Comn. in Lunacy, at Albany, which include the erection of a surgical and chemical laboratory, to cost $15,000; a nurses' home, for which there is an appropriation of $81,000, and the complete reconstruction of the light, heat and power plants, for which there is an appropriation of $60,000.

Buffalo, N. Y.—The Police Headquarters, on Franklin St., according to reports, has been badly damaged by fire.

New York, N. Y.—The Municipal Art Comn. on Nov. 12, according to reports, approved the plans for the administration building to be erected in the Zoological Park, Boro. of Bronx, which is to cost $80,000.

Brooklyn, N. Y.—The Municipal Art Comn. of New York City, is reported to have on Nov. 12 approved the plans of D'Oench & Yost, 289 4th Ave., N. Y. City., for the extension to Raymond St. jail, Boro. of Brooklyn, which is to cost $350,000. Bird S. Coler, Boro. Pres., has also approved the plans. The Comn. also approved the preliminary plans for the nurses' home and training school for the Kings County Hospital, which is to be 5 stories high, of Harvard brick, terra cotta and white stone, and is to cost about $250,000.

Wapakoneta, O.—It is stated that the Co. Comrs. have authorized plans prepared for the county infirmary to cost about $55,000.

**Columbus, O.*—B. F. Smith, 1351 Mt. Vernon Ave., it is reported has secured the contract to erect a 2-story

** Items marked thus give the names of parties awarded contracts.*

hospital of brick and stone on Champion Ave., estimated to cost $10,000. Dr. Henry L. Bowen, owner.

Bainbridge, O.—N. H. High, Township Clk., writes that the citizens have voted to issue $12,000 bonds for the erection of a town hall.

Lisbon, O.—The Columbiana County Bd. (M. P. Carnes, Chmn.) is reported to be considering the erection of a $50,000 jail.

New Philadelphia, O.—It is stated that bids will be received until Nov. 25 by the Bd. Co. Comrs., for erecting an administration building at the Co. Infirmary. A. V. Donahey, Co. Aud.

Sandusky, O.—Bids will be received, it is stated, until Nov. 25 by the Bd. Co. Comrs., for erecting a barn at the Co. Infirmary. S. H. Shively & Son, Archts., 12 Cable Blk., Chas. Kubach, Co. Aud.

Mangum, Okla.—Floyd McNeill, County Clk., writes that all bids opened on Nov. 1 for the erection of a jail have been rejected; probable cost, $25,000.

Pittsburg, Pa.—Bids will be received until Nov. 25 (readvertisement) by F. P. Booth, Co. Compt., Pittsburg, for erecting the Allegheny County Soldiers' Memorial building. Bids will be received on sandstone, limestone or granite and terra cotta. Plans and specifications can be obtained at the office of the County Engr., Rm. 25, Court House, Pittsburg.

Lancaster, Pa.—Bids will be received until Dec. 30 for the construction of an extension, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring) to the U. S. Post Office at Lancaster by James Knox Taylor, Superv. Arch., Washington, D. C.

Philadelphia, Pa.—Magazine & Potter are reported to have completed plans and will soon ask bids for the erection of a 4-story nurses' home at the Jewish Hospital, at York and Tabor Roads. The buidling is to be of brick and stone and contain 35 rooms.
*W. R. Dougherty, 1604 Sansom St., it is stated, has secured the contract to erect an addition to the servants' dormitory at the Jewish Hospital, at a cost of $10,000.

Mt. Pleasant, Pa.—R. M. Trimble, Ferguson Bldg., Pittsburg, it is stated, has been selected to prepare plans for an addition which it is proposed erecting to the Mt. Pleasant Memorial Hospital.

Danville, Pa.—Bids will be received until Nov. 26 (readvertisement) by the Bldg. Com. (Dr. L. I. Shoemaker, Chmn.) at the office of H. B. Merdeith, Supt. State Hospital for the Insane, at Danville, for erecting a female infirmary building, a building for the acute insane male patients and a building for the acute insane female patients, as advertised in The Engineering Record.

Seguin, Tex.—The erection of a city hall and fire department building, to cost $20,000, is reported contemplated.

Bristol, Va.—John H. Gose, City Clk., writes that at a meeting of City Council Nov. 7 the Building Com. was instructed to ascertain cost of erecting a city jail. Any person interested in jail building or furnishings can address the City Clk.

Walla Walla, Wash.—The Trus. of St. Mary's Hospital, it is stated, intend erecting a new building, to cost about $100,000.

Milwaukee, Wis.—It is stated that as soon as plans are completed by Ferry & Clas, 419 Bway., bids will be asked by the Bd. Pub. Wks. for the construction of the museum, of which Henry L. Ward is Director.
*The Bd. of Directors of the Milwaukee Auditorium Assoc., it is reported, awarded on Nov. 7 the contract to erect the auditorium to the Northern Constr. Co., of Milwaukee, at $449,000.

Green Bay, Wis.—Ferry & Clas, of Milwaukee, it is stated, are preparing plans for an administration building to be erected at the reformatory at a cost of $100,000. The building is to be of granite, fireproof throughout, and the work will probably be done by day labor.

**Watertown, Wis.*—W. H. Fissel, New York, N. Y., has secured the contract to erect the U. S. Post Office at Watertown (bids for which were opened by the Superv. Archt., at Washington, D. C.), at $64,900.

Madison, Wis.—See "Power Plants, Gas and Electricity."

**Racine, Wis.*—A. C. Kappel is reported to have secured the contract to erect the fire engine house at Wisconsin and 4th Sts., to cost $14,333.

La Crosse, Wis.—It is reported that the Governor's Guard Assoc. will erect an armory, to cost $30,000.

Hamilton, Ont.—It is stated that $30,000 bonds have been sold, the proceeds to be used to erect the east end fire station.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—The Santa Fe R. R. (H. C. Phillips, of Los Angeles, Ch. Engr.), it is stated, is planning the erection of a freight depot on 21st and Adeline Sts.

[illegible]—The Bd. of Trade, according to reports, has decided upon a site on City Island on which it is proposed erecting an assembly hall to cost $20,000.

Hawkinsville, Ga.—The Chamber of Commerce and the citizens are said to be agitating the question of constructing a brick hotel at a cost of $30,000.

Savannah, Ga.—B. Dub, proprietor of the Seerdens Hotel, it is stated, intends making improvements to the hotel at a cost of about $20,000.

Lake Forest, Ill.—It is reported that the members of the Young Men's Club propose erecting a clubhouse, to cost $30,000.

Evanston, Ill.—W. A. P[illegible], it is reported, will erect a store and flat building at [illegible] and Foster Aves., to cost $50,000.

Waukegan, Ill.—Jos. Howard is reported to be planning the erection of a theatre, to cost about $30,000.

Chicago, Ill.—Fritz Foltz, 132 Dearborn St., is said to be preparing plans for a 7-story warehouse, to be erected by the Dupont Powder Co., of Wilmington, Del., at 22d St. and Union Pl., to cost $200,000. The building is to be of brick, 125x150 ft.

The 5-story building at State and Quincy Sts., occupied by the Holden Shoe Co., is reported to have been badly damaged by fire on Oct. 31.
Marshall & Fox, 164 Dearborn St., are said to be preparing plans for a 6-story warehouse to be erected at Ohio and St. Clair Sts. for A. C. McClurg & Co., at a cost of $250,000.

Tipton, Ind.—It is reported that the Indiana Union Traction Co. (H. A. Nicholl, Gen. Mgr., Anderson) will soon ask bids for erecting car barns in this city to replace structures which were recently destroyed by fire.

Terre Haute, Ind.—H. A. Condit, Secy., Lodge 86 B. P. O. Elks, writes that bids will be received on Nov. 30 for the erection of a lodge building, to cost about $75,000. Architect, Martin C. Miller, Mutual Life Bldg, Buffalo, N. Y.

Sioux City, Ia.—The Farmers & Trust Co., it is stated, is preparing to erect a 7-story building at 4th and Nebraska Sts.

Louisville, Ky.—Buildings in the Bourbon Stock Yards, at Johnson and Market Sts., it is reported, have been seriously damaged by fire.

Louisville, Ky.—The Elks Lodge (W. O. Parsons, Secy.), it is reported, is arranging to erect a $30,000 building.

**Covington, La.*—The contract to erect for the Covington Bank & Trust Co. a 2-story bank building is reported awarded to C. D. Stewart Co., of Baton Rouge.

Baltimore, Md.—The J. G. Valiant Co. has secured a site on which it is proposed erecting a 5-story building to cost $35,000, plans for which are being prepared by E. H. Glidden, 301 N. Charles St.

**Boston, Mass.*—J. M. & C. J. Buckley, of Worcester, it is stated, have secured the contract to erect a 5-story buidling at 26 Pittsburg St. for the Rowe's Wharf Co.; cost, $43,000.

**St. Paul, Minn.*—E. F. Romer & Sons, according to reports, have secured the contract to erect a warehouse for the Illinois Steel Co., at $37,000.

Duluth, Minn.—North Star Lodge, No. 35, K. of P., it is stated, is planning the erection of a building 4 stories high.

Hannibal, Mo.—See "Railroads."

**Helena, Mont.*—The contract to erect a granite and marble mausoleum in Helena for Mrs. Peter Lawson, it is stated, has been awarded to the P. N. Peterson Granite Co., of St. Paul, Minn.; probable cost, $35,000.

Lincoln, Neb.—The Y. W. C. A. is about to erect a 3-story brick building on N Street, to cost about $25,000.

Portsmouth, N. H.—See "Railroads."

Atlantic City, N. J.—Milligan & Webber, Archts., 520 Walnut St., Philadelphia, Pa., it is stated, are receiving bids for erecting a 3-story 50x140-ft. addition to Green Hotel, Ocean Ave. and the Boardwalk; probable cost, $80,000.

Newark, N. J.—It is stated that plans have been completed by Hyman Rosensohn, 188 Market St., for a store and apartment house, 4 stories high, to be erected at Baldwin St. for Abraham Khin, at a cost of $18,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 2 six-story brick stores and tenemnets at Arthur Ave. and Belmont Pl. for Pasquale Garginlo; cost, $120,000; Lorenz F. J. Weiher, Archt.; alterations to 3-story brick and stone stores and hall for Walter J. Salomon; cost, $30,000; Hedman & Schoen, Archts.

St. George, S. I., N. Y.—The Hotel Castleton is reported to have been destroyed by fire on Nov. 12.

Oakes, N. D.—It is stated that plans are being prepared by Haxby & Gillispie, of Fargo, for a 2-story brick hotel and business building, estimated to cost $25,000.

Marietta, O.—Mills Pruitt & Co., of Columbus, it is reported, have compelted plans for a department store, to be erected for the Gracey Co., at an estimated cost of $40,000.

Columbus, O.—The Central Market Bldg. Co. is reported incorporated by Wilbur T. Mills, Edwin E. Pruitt and others for the purpose of erecting a market arcade on 4th St.; capital, $30,000.

Cincinnati, O.—The Reliance Eng. Co. is reported to have been engaged to prepare plans for a 2-story fireproof office and warehouse building, 200 ft. square, to cost about $100,000, for the Seinsheimer Paper Co.

Ashtabula, O.—Chas. G. Laughlin, Gen. Secy. Y. M. C. A., writes that Briggs & Nelson, of Cleveland, are preparing plans for the proposed Y. M. C. A., bids for which will be called for early next summer.

**Lancaster, Pa.*—B. D. Zook & Son are reported to have secured the contract to erect for Chas. B. Buchong, at Chester and Christian Sts., a 3-story brick hotel.

East Liberty (Pittsburg P. O.), Pa.—It is reported that a $300,000 building is to be erected for the East Liberty Branch of the Y. M. C. A. (Harry Baldwin, Gen. Secy.).

Pittsburg, Pa.—It is reported that fire on Nov. 1 badly damaged the Shannon Bldg.

Philadelphia, Pa.—The Bd. of Directors of the Philadelphia Turngemeinde, according to reports, has decided to erect a Turner's Hall, to cost about $150,000.
*Jas. Reilly is reported to have secured the contract to erect a parish house for the R. C. Church of Our Lady of Lourdes, to cost $28,000.

Newport, R. I.—Alfred G. Vanderbilt is reported to have offered to the Y. M. C. A., of Newport, a building as a memorial to his father, to cost about $100,000.

Charleston, S. C.—It is stated that the 4-story building occupied by the Ruffner Bros., wholesale grocers, has been destroyed by fire.

**Greenwood, S. C.*—Grandy & Jordan, of Columbus, it it stated, have secured the contract to erect the Masonic Temple, at about $17,000.

Knoxville, Tenn.—Wm. Caswell is reported to be having plans prepared for a 4-story hotel building.

Dallas, Tex.—The 3-story building occupied by the Dennis O. Wigley Furniture Co., it is stated, has been destroyed by fire.

Huntsville, Tex.—It is reported that a Masonic Temple is to be erected at a cost of $10,000.

Mineral Wells, Tex.—It is stated that Sidney Webb, of Bellevue, intends erecting a pavilion here, to cost about $55,000.

**Houston, Tex.*—H. H. Vorty, 174 Milam St., it is stated, has secured the contract to erect a $35,000 store building.

**Ft. Worth, Tex.*—Buchanan & Gilder, of Ft. Worth, it is stated, have secured the contract to erect a 4-story hotel, estimated to cost $85,000.

Tacoma, Wash.—The Northern Pacific R. R. (T. H. Croswell, Prin. Asst. Engr., Spokane), it is reported, is preparing to erect an 8-story building, estimated to cost $150,000.
F. S. Harmon & Co., it is reported, intends erecting on 21st St. and Pacific Ave. a warehouse to cost about $150,000.

Seattle, Wash.—It is stated that plans have been filed for alterations to the 2-story building at 1101 3d Ave., owned by W. A. Peters; cost, $17,000.
C. Alfred Breitung, of Seattle, is preparing plans for a 3-story brick building with stone or tile trimmings for the Odd Fellows, to be erected on Pine St. and 10th Ave., to cost about $70,000. Bids for construction have not yet been asked.

Spokane, Wash.—It is stated that plans are being prepared in the office of W. L. Darling, Ch. Engr., St. Paul, Minn., for the $300,000 passenger depot which the Northern Pacific R. R. intends erecting in Spokane. The elevation of the tracks at an estimated cost of $2,000,000 is also reported contemplated in the improvements in this city.
The Polson Improvement Co. will erect at once a 4-story warehouse, 75 x 80 ft. of brick and mill construction; cost about $25,000.

**Hinton, W. Va.*—The contract to erect a lodge building for the Brotherhood of Railway Trainmen is reported to have been awarded to J. B. Stuart, of Huntington, at $68,000.

Toronto, Ont.—The building of a Y. M. C. A. bldg. at Toronto Junction, to cost $35,000, is reported under consideration.
The Anderson & Macbeth office building in Bay St. is reported to have been destroyed by fire.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—The Jewish people are said to be planning the erection of a synagogue in Oakland, to cost $300,000.

Berkeley, Cal.—It is stated that a Roman Catholic Church, costing about $35,000, is to be erected at Alcatraz and Dana Sts.

Washington, D. C.—Stone & Averill, are said to be preparing plans for a Sunday school building and church to be erected by the members of the Immanuel Baptist Church (Rev. G. E. Whitehouse, pastor).

Rockford, Ill.—The Bldg. Com. of the Swedish Baptist Church, it is stated, has accepted plans for an $18,000 edifice.

Evanston, Ill.—Harvey T. Weeks & Co., it is reported, are planning the erection of an apartment house at Hudson Ave. and Davis St., estimated to cost $250,000.

Crowley, La.—It is stated that the members of the Methodist Church (Rev. W. Winans Drake, pastor) propose erecting an edifice, costing about $25,000.

Minneapolis, Minn.—Edwin H. Hewitt, 15 N. 4th St., is said to be preparing plans for a brick and stone residence, to be erected on Lake Minneteonka for Chas. S. Pillsbury, at a cost of $75,000.
*Emil M. Johnson, Kasota Bldg., it is reported, has the general contract to erect the Bethel Swedish Baptist Church, at 24th St. and 28th Ave., to cost $18,000.

St. Louis, Mo.—The members of the Episcopal Church of the Ascension, it is stated, are considering the erection of a new edifice to cost $60,000.

Kansas City, Mo.—Plans have been filed for the following buildings: Brick apartment house at 1222 Benton Boule., to cost $15,000, Carl Stuebenrach owner; brick dwelling at 3421 Holmes St., cost $10,000, Geo. Fowler owner; brick dwelling at 4312 Main St., cost $13,000, J. A. Robinson owner; brick apartment house at 1822 Morton St., cost $16,000, L. F. Hartman owner.

David City, Neb.—The members of St. Mary's R. C. Church, it is stated, have decided to erect an edifice, costing about $25,000.

New York, N. Y.—Plans have been filed for 3 five-story brick tenements, to be erected at Prospect Ave. and 163 St. for Gaines & Roberts Co.; cost $90,000. Harry F. Howell, Archt.

El Reno, Okla.—It is reported that the members of the Christian Church propose erecting a $40,000 edifice.

**Ardmore, Pa.*—The contract to erect a 2½-story stone and brick residence here for Dr. Jos. M. Reeves, it is stated, has been awarded to Watson & Huckle, of Philadelphia, Pa., for $20,000.

Runge, Tex.—Bids will be received until Nov. 20 by O. P. Airhart, Chmn. Bldg. Com., for erecting a concrete block church.

Seattle, Wash.—F. A. Sexton, Lumber Exchange, is said to be the archt. for an apartment house which is to be erected at Spruce St. and 9th Ave., at an approximate cost of $25,000.

North Yakima, Wash.—The plans of N. C. Gauntt, People's Savings Bank, Seattle, for the Baptist Church, to be erected at Yakima Ave. and 6th St., have been accepted; cost, $25,000.

Milwaukee, Wis.—Emil Blatz has taken out a permit to build a residence on Lake drive and Ivanhoe pl. of brick and stone, 3 stories high, 44 x 65 ft. Ferry & Clas, 419 B'way, are the archts.

** Items marked thus give the names of parties awarded contracts.*

Kenosha, Wis.—The Lithuanian Catholic Church members, it is reported, have accepted plans for a $40,000 edifice.

Langue Pointe, Que.—The Roman Catholic Church here is reported destroyed by fire.

Peterborough, Ont.—The congregation of the Charlotte St. Methodist Church (Rev. H. M. Manning, pastor), it is stated, has decided to erect a $30,000 edifice.

SCHOOLS.

Notes Arranged Alphabetically by States.

Auburn, Ala.—Prof. N. C. Curtis, of the Polytechnic Institute, writes that bids will be received about Dec. 15 for the erection of a library, to cost about $30,000. C. C. Thach, Pres.

Tuscaloosa, Ala.—It is stated that bids will be received until Nov. 23 for constructing proposed Engineering Buliding and geological and biological laboratories for the Univ. of Alabama. The engineering building is to be of reinforced concrete or concrete with brick or stucco finish. The new equipment will include two 100-kw. generators, direct connected; 25-kw. generator; 500-h. p. water tube boilers, with coal weighing and ash removal plant; complete equipment for physical, cement testing and road materials laboratories; mining and hydraulic equipment and heating plant. The Legislature appropriated $500,000 for equipment and buildings, which appropriation is now available. Frank Lockwood, Adams St., Montgomery, Ala., is archt. Edgar B. Kay is Dean, Dept. Engineering.

Little Rock, Ark.—The School Bd. is said to be preparing to erect 2 schools, estimated to cost $78,000.

Ft .Smith, Ark.—The Supt. of Schools writes that bids will be received about Dec. 1 for the erection of a school to cost about $65,000. Architect, A. Klingensmith ,of Ft .Smith.

San Bernardino, Cal.—School bonds amounting to $30,000 are reported sold.

Washington, D. C.—The following are reported to be the bids received Nov. 2 by the Comrs. D. C. for erecting an extension to the McKinley Manual Training School: Geo. A. Fuller Const. Co., $82,500; Thompson-Starrett, $84,329; Pavarini & Wyne, $87,800; Thos. H. Milton, $91,484; Milton H. Davis, $90,962, and J. M. Dunn, $96,288.

Carbondale, Ill.—The Bd. of Trus. Southern Illinois State Normal University (Hugh Lauder, Secy.) will receive bids until Dec. 5 for the erection of a model school.

Jeffersonville, Ind.—Thos. H. Stradley, of Jeffersonville Township, Jeffersonville, it is reported, has announced that he will receive bids until Nov. 26 for erecting a brick school at Claysburg.

Reliance, Ia.—The Bd. of Educ., according to reports, will receive bids until Nov. 22 for erecting a school.

Reinbeck, Ia.—O. A. Houghland of Chariton is reported to have been engaged to prepare plans for a $30,000 school.

Winfield, Kan.—Bids will be received, it is reported, by he State Bd. Control (E. B. Schemerhorn, Chmn.) Topeka, until Nov. 30 for furnishing material and erecting a custodial building at the School for Feeble Minded Youths, Winfield.

Ft. Scott, Kan.—The Academy of the Notre Dame de Lourde, it is reported, is to be enlarged, at an estimated cost of $20,000. Rev. Father McKernen may be able to give further information.

Lexington, Ky.—The Trus. of Berea College, it is stated, are considering the erection of a school for negroes similar to Tuskegee Inst.

**Franklin, La.*—The contract to erect the 2-story school is reported awarded to the Gulf Constr. Co. of Houston, Tex., at about $50,000. C. H. Page, Jr., of Austin, Tex., is the archt.

Houma, La.—It is stated that a site has been secured on which it is proposed erecting a high school.

Bossier, La.—The School Bd., it is reported, has decided to erect a school at a cost of $15,000.

**Mansfield, La.*—The contract to erect a 2-story brick school is reported awarded to Randolph & Goslin, of Ruston, at $17,461.

Bath, Me.—It is stated that $70,000 has been bequeathed by Miss L. Bailey for the establishment of an industrial school for boys and girls.

Baltimore, Md.—The School Bd. has decided to appropriate $109,000 to start work on the proposed Polytechnic Inst. The School Bd. also decided to recommend to the Bd. of Estimates that of the balance remaining for school purposes for next year, $125,000 to be used for an addition to the Western High School; $66,000 for a new school to take the place of School 22; $50,000 for a new lot and a school to take the place of School 6, and $50,000 for an addition to School 3.
Morrow Bros., 212 Clay St., it is stated, have applied for a permit to erect a power house and nurses' home for the Univ. of Maryland on King St. Cost $25,000.
An ordinance has passed the Second Branch of Council appropriating $64,000 for a public school on Baltimore and Payson Sts.

Madison, Minn.—Obert R. Nelson, Secy. Bd. Educ., writes that bids will probably be received in January for a high school to cost about $55,000. Architects, Wm. Elliott & Son, of St. Paul.

Helena, Mont.—The Bldg. Com. of the Roman Catholic Church on Nov. 1 decided, according to reports, to reject all bids recently received for the excavation of the foundation for the high school and to ask bids on the construction of the new cathedral, high school and college collectively. Work on the 3 structures will be started in the spring.

Columbia, Mo.—J. G. Babb, of Columbia, Secy. State Univ., writes that it is proposed to erect an agricultural college at the State University, to cost about $100,000. Architects, Cope & Stewardson, 800 Security Bldg., St. Louis.

St. Louis, Mo.—Wm. B. Ittner, Comr. of Pub. Bldgs., is reported to have completed plans for the high school which it is proposed erecting at Union and Kensington Aves. at a cost of $750,000.

Elizabeth, N. J.—The Bd. of School Estimates and the Bd. of Educ. are reported to have decided to erect a school to take the place of School No. 3, on High St.; estimated cost, $65,000. The erection of a new high school, to cost $150,000, is also reported under consideration.

Rockville Centre, L. I., N. Y.—It is reported that it has been voted to erect an addition to primary school No. 2 at a cost of $30,000.

**Brooklyn, N. Y.*—Thos. Reilly, of Philadelphia, Pa., is reported to have secured the contract to erect in Brooklyn for the Jesuit College a brick fireproof building, to cost $350,000.

**Hudson, N. Y.*—The contract to erect a cottage at the N. Y. State Training School for Girls at Hudson, it is stated, has been awarded by Frank E. Ware, State Archt., at Albany, to Peter Keeler Bldg. Co., of Albany, at about $30,000.

LeRoy, N. Y.—The Bd. of Educ. is said to be considering the repairing of the high school.

Utica, N. Y.—It is stated that the citizens voted to issue $100,000 bonds to complete and equip 2 grammar schools.

Sheyenne, N. D.—Haxby & Gillispie, of Fargo, it is stated, have been engaged to prepare plans for an 8-room brick school, to be erected here, at a cost of $12,000.

Hamilton, O.—John A. Keller, Clk. Bd. Educ., writes that Geo. Barkmar, of Hamilton, is preparing plans for a new school.

Westerville, O.—The citizens are reported to have voted in favor of issuing bonds amounting to $16,000 for the erection of a school.

Akron, O.—C. R. Olin, Secy. Buchtel College, writes that Briggs & Nelson, of Cleveland, have prepared plans for the erection of a chemical laboratory, to cost about $25,000.

Defiance, O.—J. R. Weston, Pres. Biblical Institute, writes that bids will be received about Nov. 25 for the erection of a college building, to cost about $27,000. Architect, J. J. Hale, 655 Perry St., Defiance.

Pawnee, Okla.—Bids will be received until Dec. 17 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing a dormitory at the Pawnee School. For further information address Geo. W. Nellis, Supt. School, Pawnee.

Philadelphia, Pa.—E. F. Durang, 1,200 Chestnut St., is reported to have completed plans for a 5-story marble addition which is to be erected to the R. C. High School at Vine and Broad Sts. at a cost of $150,000.
Watson & Huckel, 1211 Walnut St., are reported to have been engaged to prepare plans for a 3-story brick school to replace St. Anthony parochial school, at 23d and Carpenter Sts., which was recently destroyed by fire.
It is reported that site has been purchased on Broad and York Sts. on which it is proposed erecting the Dropsie College for Hebrew and Cognate Learning, for the establishment of which the late Moses A. Dropsie bequeathed $1,000,000.

Pittston, Pa.—Owen McGlynn of Wilkesbarre, is reported to be preparing plans for a 3-story high school, which it is proposed erecting at a cost of about $100,000.

Edgewood, Pa.—It is stated that plans are being prepared by E. J. Carlisle, Westinghouse Bldg., Pittsburg, for a brick and stone school to be erected at a cost of $35,000.

Canton, S. D.—See "New Industrial Plants."

Franklin, Tenn.—According to reports, arrangements are being made to erect a $50,000 school.

Seattle, Wash.—The Seattle Bd. of School Directors, it is stated, has decided to erect 3 new schools, and has directed Jas. Stephen, New York Blk., to prepare plans for the structures, which are to be a 12-room school on Columbia Heights, to cost $40,000; an 8-room school, on N. 78th St., to cost $25,000, and a school at Ft. Lawton, to cost probably $25,000.

**Galesville, Wis.*—E. F. Clark, Clk. School Bd., writes that the contract for erecting brick and stone high school (bids opened Oct. 23) has been awarded to Geo. L. Smith Co., of South Kaukauna, for $29,800.

Milwaukee, Wis.—The Bd. School Directors (Frank M. Harbach, Secy.) will open bids Nov. 25 for erecting a 9-room addition to 21st Dist. School No. 2, 9th and Ring Sts. Bids to include heating, plumbing, etc.

**Toronto, Ont.*—Contracts for the installation of heating and ventilating apparatus and plumbing in the 4 new Normal schools at Hamilton, Stratford, Peterborough and North Bay, it is stated (bids for which were received Nov. 4), have been awarded by the Provincial Pub. Wks. Dept. at Toronto to Purdy, Mansell & Co., of Toronto. The electric wiring of the new buildings was awarded to Fred Armstrong & Co., of Toronto. The work involved will entail an expenditure of about $62,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Thomson, Ga.—The erection of another mill is reported decided upon by the John E. Smith Cotton Mfg. Co. of Thomson, to have 6,000 spindles and 200 looms. The enlargement will cost about $100,000.

Wallace, Idaho.—The Buffalo Mining Co. is reported to have decided to increase its capital stock from $1,000,000 to $1,500,000, and has awarded the contract to construct 1,300 ft. of the lower tunnel to O. H. Linn, of Wallace. Three drill compressors with motive power for same, will be installed at once by the contractor.

Muskogee, Ind Ter.—A. L. Holtom, of Muskogee, Secy. Union Machine & Fdy. Co., writes that this company proposes manufacturing the King hydro carbon engine and the King alcohol motor for mine haulage and will expend about $40,000 for buildings and equipment.

Marshalltown, Ia.—We are informed that the Iowa Central Ry. Co. (L. F. Day, Gen. Mgr., Minneapolis, Minn.) will rebuild car shop, 75x500 ft., and paint shop, 30x16 ft., which were recently burned; probable cost of building, $40,000; no power plant will be installed; 150-h. p. engine will run mill.

Buffalo, N. Y.—Hazard, Coates & Bennett, of Rochester, dealers in scrap iron, it is reported, have purchased a site for a plant on the line of the South Buffalo Railway, near the Lackawanna steel plant. Machinery for handling of heavy metals will be installed. The yards will have a storage capacity of about 75,000 tons.

DeKalb Junction, N. Y.—The Mutual Milk & Cream Co., of New York, N. Y., according to reports, is planning the erection of a milk condensary next spring at DeKalb Junction; probable cost, $100,000.

Youngstown, O.—It is reported that the Wm. B. Pollock Co. intends making additions to its plant next year. A shop and new machinery will be needed.

Cincinnati, O.—We are informed that contracts will probably be let in the spring for the construction of the proposed plant of the Cincinnati Soap Co. for which the Reliance Eng. Co., of Cincinnati, is preparing plans; the building will be 100 x 100 ft., and the power plant have a capacity of 100 kw.; probable cost of work, $55,000.

Philadelphia, Pa.—The Spreckels Sugar Refining Co., it is stated, has been granted a permit to build a 3-story steam generating plant on Meadow St., south of Reed St. The building will be 84 x57 ft., of steel, concrete and brick construction, and cost $60,000.

Philadelphia, Pa.—The A. Schoenhut Co., toy manufacturers, it is stated, is having plans prepared by Ballinger & Perrot, 102 S. 12th St., for a 5-story brick reinforced concrete addition to its plant at 2215 Adams St.

Nesquehoning, Pa.—W. B. Lovatt, who was manager of the Read-Lovatt Silk Mill at Weatherly, is reported to have procured a site from the Lehigh Coal & Navigation Co. and will erect a silk mill at Nesquehoning. Recorder of Deeds Van Dyke, of Weatherly, is associated with Mr. Lovatt. The plans for the structure are now being made.

Canton, S. D.—Bids will be received until Dec. 10 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing a laundry building with equipment at the Indian Insane Asylum, Canton. For further information apply to Oscar S. Gifford, Supt. Sschool, Canton.

Superior, Wis.—See "Miscellaneous."

Hamilton, Ont.—The Dominion Power & Transmission Co., it is reported, has announced its intention of building a car factory in the east end of the city.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Tampa, Fla.—The City Council on Oct. 31 passed on second reading the ordinance providing for an issue of $23,000 bonds for crematory improvements.

Evansville, Ind.—The Bd. Pub. Wks., it is reported, will receive bids until Nov. 26 for sweeping and cleaning brick and asphalt streets from Jan. 1, 1908, to Dec. 31, 1908. W. F. Wunderlick, City Clk.

Dover, N. J.—The Town Clk. writes that the conference committee of the Bd. of Health has been directed to confer with Common Council on the question of garbage disposal. The matter of cremating the garbage has been suggested, but nothing definite has yet been done.

Columbus, O.—Mayor Badger on Nov. 8 signed the ordinance passed by Council appropriating $150,000 for the construction of a garbage disposal plant.

Easton, Pa.—See "Sewerage and Sewage Disposal."

Wheeling, W. Va.—The City Council on Nov. 7 appropriated $35,000 for a new crematory.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—The Atlas Gas Engine Co. is reported to have decided to construct 3 or 4 wharves and dredge its 1,800-ft. frontage to a depth of 25 ft. and a width of 500 ft.; about $200,000 will be expended.

**Stockton, Cal.*—A. C. Russell, City Clk., writes that the contract for constructing a bulkhead on the north side of the Stockton channel (bids opened Oct. 17) has been awarded to Clark & Henery Constr. Co. at $44.50 per lin. ft.

Berkeley, Cal.—All bids opened on Oct. 28 by the Town Trus. for the construction of the municipal wharf are reported to have been rejected. The lowest bid received amounted to about $49,000.

Wallace, Idaho.—See "New Industrial Plants."

Danville, Ill.—Bids will be received until Dec. 4 by M. J. Barger, Treas. Danville Branch N. H. D. V. S., at Danville, for furnishing material and installing a telephone system at the branch, as advertised in The Engineering Record.

**Prophetstown, Ill.*—F. W. Sears, Engr. Big Slough Special Drainage Dist., writes that contract for enlarging the ditch (bids opened Nov. 11) has been awarded to G. A. McWilliams, of Walnut, at 6¼ cts. per cu. yd.

Lagrange, Ind.—The County Comrs. are reported to be preparing to ask for bids for the construction of drains in Lagrange County.

Portland, Ind.—The Comrs. of Jay County are reported to have ordered plans and specifications prepared for the dredging of Salamonia River through Knox and Penn. Townships.

**New Orleans, La.*—The Orleans Levee Bd. is reported to have awarded to the Columbia General Const. Co. the contract for filing in behind bulkhead erected by the Port Comrs. bet. Jackson Ave. and St. Andrew St. at 65 cts. per cu. yd..

Hannibal, Mo.—See "Railroads."

Jersey City, N. J.—Bids will be received until Nov. 26 by the Bd. Chosen Freeholders (Walter O'Mara, Clk.) for $140,000 Park bonds.

* *Items marked thus give the names of parties awarded contracts.*

Murray, Minn.—Bids will be received, it is stated, by I. E. Ware, Co. Aud., until Nov. 19 for constructing Ditch No. 3, requiring about 10,000 cu. yds. excav.; probable cost $...

Kyr. N. Y.—Geo. L. Henderson, Village Clk., writes that all bids received Nov. 6 for constructing a dock or bulkhead at Milton, Kys., N. Y., were returned to bidders unopened, as no bids were received for bonds which were to cover work. Chas. S. Fowle, Village Engr., 5 E. 42d St., N. Y. City.

Ft. H. G. Wright, N. Y.—Bids will be received until Dec. 11 by Capt. Wm. E. Horton, Q. M., U. S. A., New London, Conn., for constructing a timber retaining wall and for filling and grading around wharf at Ft. H. G. Wright.

New York, N. Y.—The Committee on Design of the Robert Fulton Memorial Assoc. has decided in favor of site selected at 114th to 116th St. on Hudson River for the proposed water gate and memorial, and at a meeting of the association at the office of Isaac. Guggenheim, 71 Bway, a committee was selected, including Saml. G. Clemens, Col. H. O. S. Heistand and others to determine upon a definite plan as to the form that the water gate and memorial shall take.

Albany, N. Y.—F. C. Stevens, State Supt. Dept. of Pub. Wks., is reported to have canceled contract of the Scofield Co. for construction of dams in Mohawk River and other incidental barge canal work in the vicinity of Amsterdam, the company being financially embarrassed. The Supt. of Pub. Wks., under provisions of contract, has taken charge of plant of company, in order to do such work as is necessary to insure safety of structure of present canal, and also to do what can be done to protect uncompleted structures. It is expected that the balance of the work will be readvertised and a new contract let.

Hamilton, O.—The contract for arching the Hamilton and Rossville hydraulic bet. 4th and Water Sts. is reported to have been let by the Bd. of Pub. Service to the Thos. Bridges Son's Co. for $17,000.

Minerva, O.—Bids will be received, it is stated, until Dec. 4 by the Bd. Public Affairs (L. E. Weber, Secy.) for a 150 h. p. boiler, 150 lbs. steam pressure.

Panama.—Bids will be received until Dec. 6 by H. F. Hodges, Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for pumps, engine lathe, pneumatic tools, steel plates and angles, iron roofing, copper tubing, iron pipe and fittings, valves, screw jacks, anvils, forges, etc., as per circular 402.

Norristown, Pa.—See "Sewerage and Sewage Disposal."

Ft. Adams, R. I.—Bids will be received until Nov. 22 by Capt. Willis C. Metcalf, Q. M., U. S. A., 200 Thames St., Newport, for constructing coal bin, sea wall and railway at the power house, Ft. Adams.

Providence, R. I.—The following bids for dredging Long Bed, Providence River, were opened Oct. 30 by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., at Newport (about 36,000 cu. yds.); price given per cu. yd.: R. G. Packard Co., New York, N. Y., 43 cts.; J. S. Packard Dredging Co. and Chas. M. Cole, Providence, R. I., 25 cts.; Morris & Cumings Dredging Co., New York, N. Y., 26 2/11 cts.; International Contrg. Co., New York, N. Y., 24 cts.; Columbia Dredging Co., New York, N. Y., 22 cts.; Maritime Dredging Co., New York, N. Y., 61 cts.; John A. Seeley, New York, N. Y., 48 cts., and Atlantic Dredging Co., New York, N. Y., 29 cts.

Bids will be received until Nov. 26 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for elevator equipment for the U. S. Post Office, Court House and Custom House at Providence.

Port Royal, S. C.—Bids will be received until Nov. 26 by Col. J. W. Pope, Ch. Q. M., U. S. A., Atlanta, for supply f. o. b. cars, Port Royal, one 30-h. p. boiler.

Nashville, Tenn.—Bids will be received by Maj. Wm. W. Harts, Corps Engrs., U. S. A., until Dec. 14 for 1,258,605 ft. B. M. long leaf yellow pine lumber, as advertised in The Engineering Record.

Bremerton, Wash.—Bids will be received until Dec. 3 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the navy yard, Puget Sound, Wash., the following supplies: Sch. 439—One Universal radial drill, two 32-in. and two 24-in. upright drills, two 14-in. x 12-ft. engine lathes, one 16-in new model engine and tool room lathe, two 18x8-ft., two 36-in. x24 ft., two 24x18 ft. and two 18-ftx12-in. screw cutting engine lathes. Applications for proposals should designate the schedules desired by number. C. B. Rogers, Paymaster Genl., U. S. N., Washington, D. C.

Wheeling, W. Va.—The City Council on Nov. 7 appropriated $2,000 for repairing Caldwells Run.

Superior, Wis.—The Pittsburg Coal Co. is reported to have awarded contracts to the Barnett-Record Co., of Superior, and the Great Lakes Dredging Co. for work on its big coal dock at Allouez Bay, Superior, preparatory to the enlargement and rebuilding of that structure; a sum of $100,000 will be expended. Complete new steel machinery is to be one of the improvements.

North Erced, Ont.—It is stated that bids will be received until Nov. 29 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for constructing a wharf and stone approach at White Cloud Island, Georgian Bay. J. G. Sing, Engr., Confederation Life Bldg., Toronto.

Port ..., Ont.—Bids will be received, it is stated, until Nov. 26 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for constructing a wharf and stone approach at R... J. G. Sing, Engr., Confederation Life Bldg., Toronto.

PROPOSALS OPEN.

For Proposals see pages 74, 76, 77 and 78.

WATER.

Bids Close.		See Eng. Record.
Nov. 21.	Water supply improv. at National Cemetery, Santa Fe, N. M.	Nov. 9
Nov. 25.	Pumps, Swanton, O.	Nov. 16
Nov. 25.	Pumps, Atlanta, Ga. Adv. Oct. 26, Nov. 2	Oct. 26
Nov. 25.	Pumping engine, Atlanta, Ga. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 26.	Mains, Seattle, Wash.	Nov. 9
Nov. 27.	Tank, Madison Barracks, N. Y. Adv. Nov. 16.	Nov. 16
Nov. 28.	Tank and trestle, Ft. Morgan. Adv. Nov. 2 to 16.	Nov. 2
Nov. 28.	Pipe, Bloomington, Ill.	Nov. 16
Dec. 1.	Water wks., Shelley, Idaho.	Sep. 28
Dec. 1.	Pipe, etc., Phoenix, Ariz. Adv. Oct. 5 to 26.	Oct. 12
Dec. 2.	Add. to system, Phoenix, Ariz.	Nov. 16
Dec. 12.	Filter plant, Cambridge Springs, Pa. Adv. Nov. 16.	Nov. 16
Dec. 17.	Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19.	Oct. 12
Jan. 1.	Reservoir, Norway, Me.	Nov. 16
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
——	Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Nov. 2.	Sep. 28
——	Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to Nov. 16.	Oct. 12
——	Suction line, Alexandria, Va.	Nov. 9

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 20.	Springfield, O. Adv. Nov. 2, 9.	Nov. 2
Nov. 20.	Brooklyn, N. Y.	Nov. 9
Nov. 20.	Reading, Pa. Adv. Nov. 9.	Nov. 9
Nov. 20.	Richmond, Ind.	Nov. 16
Nov. 20.	Des Moines, Ia.	Nov. 16
Nov. 21.	Youngstown, O.	Nov. 9
Nov. 21.	Kansas City, Mo.	Nov. 16
Nov. 22.	Kendalville, Ind.	Nov. 16
Nov. 25.	Canton, O.	Nov. 2
Nov. 25.	Ft. Du Pont, Del. Adv. Nov. 9, 16.	Nov. 9
Nov. 25.	Washington, D. C. Adv. Nov. 16.	Nov. 16
Nov. 25.	Steubenville, O.	Nov. 16
Nov. 25.	Summerville, N. Y.	Nov. 16
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 27.	White Plains, N. Y. Adv. Nov. 9, 16.	Nov. 9
Nov. 28.	Norfolk, Va.	Nov. 16
Dec. 2.	Cadillac, Mich. Adv. Oct. 19, 26.	Oct. 19
Dec. 3.	Auburn, N. Y. Adv. Oct. 19 to Nov. 16.	Oct. 19
Dec. 6.	Forsyth, Ga.	Nov. 9
Dec. 9.	Orrville, O.	Nov. 9
Dec. 10.	Wapello, Ia.	Nov. 16
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 16.	Oct. 26

BRIDGES.

Nov. 19.	Erie, Kan.	Nov. 9
Nov. 20.	Georgetown, S. C.	Nov. 2
Nov. 20.	Graham, Tex.	Nov. 16
Nov. 22.	South Bend, Ind.	Nov. 9
Nov. 25.	Los Angeles, Cal.	Nov. 9
Nov. 25.	Newark, O.	Nov. 16
Nov. 29.	West Bethlehem, Pa.	Oct. 26
Nov. 20.	Portland, Ore.	Nov. 2
Dec. 11.	Wailuka, H. I.	Nov. 9
Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 7.	Wilmington, N. C. Adv. Nov. 16.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16

PAVING AND ROAD MAKING.

Nov. 18.	Albany, N. Y. Adv. Nov. 2 to 16.	Nov. 2
Nov. 19.	St. Louis, Mo.	Nov. 9
Nov. 19.	Harrisburg, Pa.	Nov. 16
Nov. 19.	Lima, O.	Nov. 16
Nov. 20.	Brooklyn, N. Y.	Nov. 9
Nov. 20.	Hot Springs, Ark.	Nov. 2
Nov. 20.	Harrisburg, Pa.	Nov. 16
Nov. 21.	Greenville, Tenn. Adv. Oct. 26	Oct. 26
Nov. 21.	Albany, N. Y. Adv. Nov. 2 to 16.	Nov. 2
Nov. 21.	Lancaster, Pa.	Nov. 9
Nov. 21.	Harrisburg, Pa.	Nov. 16
Nov. 21.	Buffalo, N. Y.	Nov. 16
Nov. 21.	Galveston, Tex.	Nov. 16
Nov. 21.	Kansas City, Mo.	Nov. 16
Nov. 23.	Ft. Myer, Va. Adv. Nov. 9, 16.	Nov. 9
Nov. 23.	Des Moines, Ia.	Nov. 9
Nov. 23.	Knox, Ind.	Nov. 16
Nov. 25.	Columbia, S. C. Adv. Nov. 2 to 16.	Nov. 2
Nov. 25.	Lima, O.	Nov. 9
Nov. 25.	Lajara, Colo.	Nov. 16
Nov. 25.	Woodbury, N. J.	Nov. 16
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 26.	Ft. Flagler, Wash.	Nov. 9
Nov. 26.	Wilmington, Del.	Nov. 16
Nov. 30.	Greencastle, Ind.	Nov. 16
Nov. 30.	Hillsboro, O.	Nov. 16
Nov. —.	Tacoma, Wash.	Oct. 26
Dec. 2.	Lebanon, Ind.	Nov. 16
Dec. 3.	Monticello, Ind.	Nov. 2
Dec. 3.	Palatka, Fla.	Nov. 2
Dec. 3.	Marysville, O.	Nov. 16
Dec. 4.	Logansport, Ind.	Nov. 16
Dec. 4.	Des Moines, Ia.	Nov. 16
Dec. 6.	Salt Lake City, Utah. Adv. Oct. 19 to Nov. 9.	Oct. 19
Dec. 7.	Peru, Ind.	Nov. 16
Dec. 11.	Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 12.	Flemington, N. J. Adv. Nov. 16.	Nov. 16
Dec. 13.	Valparaiso, Ind.	Sep. 7
Dec —.	Ventura, Cal.	Nov. 2
——	York, Pa.	Sep. 7
——	Ithaca, N. Y. Adv. Oct. 19.	Oct. 12
——	Ft. Worth, Tex.	Nov. 2

POWER PLANTS, GAS AND ELECTRICITY.

Nov. 19.	Panama	Nov. 2
Nov. 20.	Washington, D. C.	Nov. 2
Nov. 22.	Madison, Wis. Adv. Nov. 16.	Nov. 16
Nov. 23.	Las Animas, Colo.	Nov. 16
Nov. 23.	Tuscaloosa, Ala.	Nov. 16
Nov. 25.	Columbus, O.	Nov. 16
Nov. 25.	Swanton, O.	Nov. 16
Nov. 27.	Bay City, Mich.	Nov. 16
Dec. 2.	Lacomote, La.	Nov. 16
Dec. 16.	Montreal, Que.	Nov. 16
Dec. 21.	Chinook, Mont.	Nov. 16
——	Hendersonville, N. C.	Nov. 2
——	Alexandria, Va.	Nov. 9
——	Listowel, Ont.	Nov. 16

BUILDINGS.

Nov. 19.	Post bldgs., Jefferson Barracks, Mo.	Oct. 26
Nov. 19.	Bus. bldg., Lawton, Okla.	Nov. 2
Nov. 19.	School, Mescalero, N. M.	Nov. 2
Nov. 19.	Pub. bldg., Newark, N. J.	Nov. 16
Nov. 20.	Plumb. work, pub. bldg., Ft. Monroe, Va.	Nov. 2
Nov. 20.	Pub. bldg., Columbus, O.	Nov. 2
Nov. 20.	Church, Runge, Tex.	Nov. 16
Nov. 20.	Pub. bldg., Minnehaha, Minn.	Nov. 16
Nov. 20.	Pub. bldg., Washington, D. C.	Nov. 16
Nov. 21.	Bus. bldg., Auburn, N. Y.	Oct. 5
Nov. 21.	Pub. bldgs., Greenville, Tenn. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 21.	Pub. bldg., Toronto, Ont.	Nov. 9
Nov. 22.	Post office, Portsmouth, Va. Adv. Oct. 19, 26.	Oct. 19
Nov. 22.	School, Reliance, Ia.	Nov. 16
Nov. 23.	Pub. bldg., Las Animas, Colo.	Nov. 16
Nov. 23.	School, Tuscaloosa, Ala.	Nov. 16
Nov. 25.	Exten. to post office, Tyler, Tex.	Oct. 19
Nov. 25.	Jail, Franklin, W. Va.	Nov. 2
Nov. 25.	Pub. bldg., Pittsburg, Pa.	Nov. 16
Nov. 25.	Pub. bldg., New Philadelphia, O.	Nov. 16
Nov. 25.	School, Defiance, O.	Nov. 16
Nov. 25.	Pub. bldg., Sandusky, O.	Nov. 16
Nov. 25.	School, Milwaukee, Wis.	Nov. 16
Nov. 26.	School, Jeffersonville, Ind.	Nov. 16
Nov. 26.	Pub. bldg., Danville, Pa. Adv. Nov. 16.	Nov. 16
Nov. 26.	Hospital, Secaucus, N. J.	Nov. 16
Nov. 27.	Post office improv., Nashville, Tenn.	Nov. 9
Nov. 27.	Steel framing for roof of Senate Bldg., Washington, D. C.	Nov. 9
Nov. 27.	Post bldg., Ft. Mackenzie, Wyo.	Nov. 9
Nov. 27.	Pub. bldg., Madison Barracks, N. Y. Adv. Nov. 16.	Nov. 16
Nov. 29.	Post Office, Marion, Ind. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 29.	Church, Abilene, Tex.	Nov. 9
Nov. 29.	Jail, New Albany, Ind.	Nov. 16
Nov. 30.	Hotel, Bluefield, W. Va.	Nov. 9
Nov. 30.	School, Winfield, Kan.	Nov. 16
Nov. 30.	Lodge bldg., Terre Haute, Ind.	Nov. 16
Nov. —.	University gymnasium, Madison, Wis.	Oct. 5
Nov. —.	School, Allegheny, Pa.	Oct. 19
Nov. —.	School, Washington, D. C.	Nov. 2
Dec. 1.	School, Ft. Smith, Ark.	Nov. 16
Dec. 2.	Foundations, etc., P. O. bldg., Devils Lake, N. D. Adv. Nov. 2, 9.	Nov. 2
Dec. 2.	Post bldgs., Great Lakes, North Chicago, Ill.	Nov. 16
Dec. 2.	Court house, etc., Ely, Nev.	Nov. 16
Dec. 3.	Post Office, Nevada, Mo.	Oct. 20
Dec. 5.	Post Office, Waldoboro, Me.	Nov. 2
Dec. 5.	School, Carbondale, Ill.	Nov. 16
Dec. 7.	Pub. bldg., Remsen, N. Y.	Nov. 9
Dec. 9.	Pub. bldg., Wernersville, Pa.	Nov. 2
Dec. 10.	School, Alpine, Tex.	Nov. 2
Dec. 10.	Bus. bldg., Jacksonville, Fla.	Nov. 2
Dec. 10.	Dwelling, Mobile, Ala.	Nov. 9
Dec. 10.	New indus. plant, Canton, S. D.	Nov. 16
Dec. 10.	School, Canton, S. D.	Nov. 16
Dec. 12.	Hospital, Whipple Barracks, Ariz. Adv. Nov. 16.	Nov. 16
Dec. 15.	School, Auburn, Ala.	Nov. 16
Dec. 15.	Pub. bldg., Washington, D. C.	Nov. 16
Dec. 17.	Exten. to post office, Detroit, Mich.	Nov. 2
Dec. 17.	School, Pawnee, Okla.	Nov. 16
Dec. 18.	Tunnel to htg. pub. bldg., Madison, Wis.	Nov. 9
Dec. 19.	Pub. bldg., Ocala, Fla. Adv. Nov. 16.	Nov. 16
Dec. 23.	Post office, Ann Arbor, Mich.	Nov. 9
Dec. 30.	Post office, Lancaster, Pa.	Nov. 16
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
Dec. —.	School, Anderson, Ind.	Sep. 28
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 12.	Post office, South Bend, Ind.	Nov. 16
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Feb. 1.	Plans for Capitol, San Juan, P. R.	Sep. 28
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. —.	College, Agricultural College, Mich.	Oct. 19

MISCELLANEOUS.

Nov. 18.	Hoisting engines, etc., Portland, Ore. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 19.	Ditch, Ft. Dodge, Ia.	Nov. 9
Nov. 19.	Supplies, Washington, D. C.	Nov. 2
Nov. 19.	Boiler, Buffalo, N. Y.	Nov. 9
Nov. 19.	Ditch, Morris, Minn.	Nov. 16
Nov. 20.	Garb. disp., Baltimore, Md.	Nov. 9
Nov. 20.	Dredge and snag boat, New Orleans, La. Adv. Sep. 28 to Oct. 19.	Sep. 28
Nov. 20.	Rock and earth excavation, Detroit, Mich. Adv. Oct. 12, 19, Nov. 9, 16.	Oct. 12
Nov. 20.	Breakwaters, Ludington, Mich. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 20.	Dredging, Muskegon, Mich. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 21.	Dredging, Galveston, Tex. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 21.	Dredging, Mobile, Ala. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 21.	Wharf, Ft. Sumter, S. C.	Nov. 2
Nov. 21.	Jetty work, Galveston, Tex.	Nov. 2
Nov. 21.	Canal work, Peterboro, Ont.	Nov. 9
Nov. 22.	Dredging, Newport, R. I. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 22.	Sea wall, etc., Ft. Adams, R. I.	Nov. 16
Nov. 23.	Tile drain, Pesotum, Ill.	Nov. 9
Nov. 23.	Elevator, New Orleans, La.	Nov. 9
Nov. 25.	Locks, etc., Mobile, Ala. Adv. Sep. 28 to Nov. 16.	Sep. 28
Nov. 25.	Dredging, Mattituck, N. Y. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 25.	Levee work, Memphis, Tenn. Adv. Nov. 2, 9.	Nov. 2
Nov. 26.	Supplies, Bremerton, Wash.	Nov. 9
Nov. 26.	Elevator equipment, Providence, R. I.	Nov. 16
Nov. 26.	Street cleaning, Evansville, Ind.	Nov. 16
Nov. 26.	Boiler, Port Royal, S. C.	Nov. 16
Nov. 26.	Wharf, Rossport, Ont.	Nov. 16
Nov. 29.	Wharf, North Keppel, Ont.	Nov. 16
Nov. 30.	Bulkhead, Ft. Caswell, N. C. Adv. Nov. 9, 16.	Nov. 9
Dec. 2.	R. R. work, Trenton, Ont.	Nov. 9
Dec. 2.	Breakwater extension, Meadford, Ont.	Nov. 16
Dec. 3.	Ditch work, Wausau, Wis.	Nov. 2
Dec. 3.	Ditch, Wheaton, Minn.	Nov. 9
Dec. 3.	Drills, etc., Bremerton, Wash.	Nov. 16
Dec. 4.	Garb. disp., Altoona, Pa. Adv. Nov. 2 to 16.	Nov. 2
Dec. 4.	Telephone system, Danville, Ill. Adv. Nov. 16.	Nov. 16
Dec. 4.	Boiler, Minerva, O.	Nov. 16
Dec. 6.	Ditch work, Canton, N. Y. Adv. Nov. 9, 16.	Nov. 9
Dec. 6.	Engine, lathe, etc., Panama	Nov. 16
Dec. 10.	Wharves, Mobile, Ala.	Nov. 9
Dec. 11.	El. ry. franchise, New Orleans, La.	Oct. 26
Dec. 11.	Ditch, Emmetsburg, Ia.	Nov. 9
Dec. 11.	Wall, etc., Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 14.	Lumber, Nashville, Tenn. Adv. Nov. 16.	Nov. 16
May —.	El. ry., Buenos Aires, S. A.	Nov. 16
——	Lease of limestone quarries, Newark, N. J. Adv. Oct. 5.	Oct. 5
——	R. R. work, St. Louis, Mo.	Nov. 2

CURRENT NEWS SUPPLEMENT

NOVEMBER 23, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting, December 4, 1907. Paper, "Invar (Nickel-Steel) Tapes on the Measurement of Six Primary Base Lines."

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York. Annual meeting, New York, Dec. 3-6, 1907.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York. Next meeting, December 13, 1907. Paper on Duplex Stoker Boiler and Results of Tests.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia

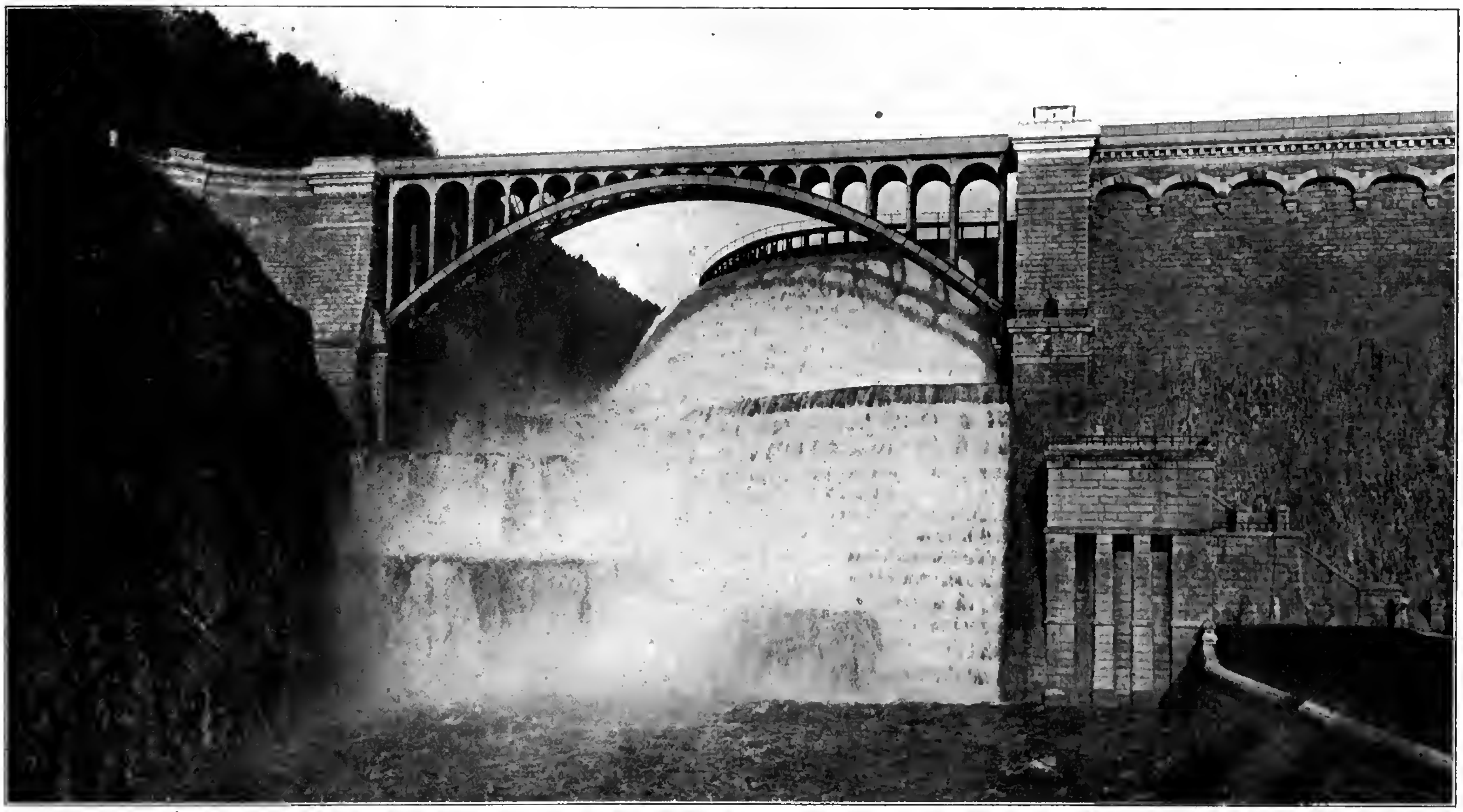
American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O

THE FILLING OF THE NEW CROTON RESERVOIR.

The 38,000,000,000-gal. reservoir formed by the new Croton dam has recently been filled and water ran down the spillway for the first time on Nov. 6. This reservoir impounds the water that overflows from the ten dams in the Croton valley above it and is a lake having a maximum length of nearly 20 miles. During last month it has supplied a daily average of 314,000,000 gal. of water to New York City.

The dam now presents a beautiful appearance on account of the large volume of water pouring over the waste weir, falling in cascades down the spillway to the channel at the foot of the dam through which it finds its way to the original bed of the river. The overflow sweeps around the end of the main structure and, passing under the 200-ft. arch roadway span, makes a total descent of about 150 ft. The fall is broken by curved steps which, although intended to diminish the impact of the falling mass, add greatly to the beautiful effect.



NORTH END OF NEW CROTON DAM, SHOWING WATER DISCHARGING OVER WASTE WEIR INTO SPILLWAY FOR FIRST TIME.

It will be remembered that this dam, which has been fully described in many articles in these columns, was commenced in 1892 and was officially completed Jan. 17, 1906, at a total cost of about $7,500,000. It is notable for being the highest and largest dam yet constructed and contains about 850,000 cu. yd. of masonry, which extends about 150 ft. above the surface of the ground at the foot of the dam and to a nearly equal depth below it, where it has an extreme width of about 206 ft. At the top there is an ornamental cornice and balustrade along the roadway crossing it, the width being about 26 ft. over all, while the minimum width of the dam is 18 ft. The dam is built entirely of granite masonry faced with ashlar, and has at one end a waste weir 1,000 ft. long nearly at right angles with the axis of the dam and 16 ft. below its crest. The water flows over the crest of the waste weir into a spillway 40 ft. wide at the upper end and 200 ft. wide at the lower end, which was formed by excavating about 400,000 cu. yd. of rock out of the side of the valley.

Cast-iron brackets 12 ft. high are set about 8 ft. apart on the large granite coping blocks on the crest of the waste weir and are provided with two vertical grooves 8 in. apart. The brackets carry a reinforced concrete platform 3 ft. wide, provided with a hand-rail on one side and a track for a small car for handling the flash boards. This platform serves as a sidewalk and enables the attendants to place 4x12-in. horizontal planks in the vertical grooves and fill the space between them, if necessary, with puddle. At the end of the platform a reinforced concrete house is built on the bastion for the storage of the planks and of necessary tools.

During September the average rain-fall recorded at ten stations in the Croton valley was 10.82 in. During October it was 8.43 in., including a 4-in. fall for Oct. 27, 28 and 29. On Nov. 2 there was a fall of from 1 to 1½ in., and on Nov. 6 a fall of 1½ to 1¾ in. This large precipitation caused so great a run-off that the water in the reservoir rose rapidly, until on Nov. 7 it was about 1 ft. above the crest of the waste weir. The remarkable rapidity with which this water was stored was indicated by the difference in capacity of the reservoir at the different levels during the week, which amounts to 1,586,000,000 gal.

Observations have been made on the tightness of the dam, and no important percolation through it has been observed. A slight seepage does, of course, take place through the masonry, but it is only on dark or cloudy weather that moisture can be observed on the downstream face. This has been noticed to maintain a distance of about 30 ft. below the water level on the upper side of the dam as the latter fluctuates. A very careful examination below the dam fails to show as yet the appearance of any new springs or evidences of leakage through or around its foundations. No indications of change in the ground water level in the adjacent country have yet been observed above the dam, but it is possible that these may later appear.

The dam was built under the direction of the Croton Aqueduct Commission during the administration of several successive chief engineers, commencing with the late Mr. Alphonse Fteley and succeeded by Messrs. W. R. Hill, J. Waldo Smith, and Walter H. Sears. Messrs. Coleman, Breuchaud & Coleman were the contractors.

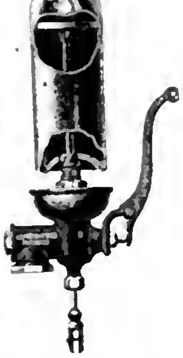
THE FIRST ANNUAL CEMENT SHOW AT CHICAGO.

The First Annual Cement Show will be held in Chicago at the Coliseum, Dec. 17 to 21. The Exposition will be held under the auspices of the Cement Products Exhibition Co., incorporated under the laws of the State of Illinois for the purpose of holding annual expositions of cement products. The enterprise is being promoted by Portland cement manufacturing interests of the Middle West. The Exposition will be of marked educational importance, and will accomplish a good work in advancing the interests of the concrete industry. The scope of the Exposition may be judged from the outline of the various divisions of exhibits as follows. Cement, concrete mixers, block machines, brick machines, cement pipe machines, cement tile machines, cement post machines, cement coloring mixtures, reinforcing metal, cement publications, testing machinery, sheet piling, aggregates, sand, technical institutions, etc. The management of the show has been placed in the hands of Mr. L. L. Fest, an experienced manager of great trade exhibitions of this nature. His connection with the affair is an assurance of its energetic and competent supervision.

The time of the Exposition is opportune, coming as it does during the holiday season, when the cement men from all over the West come to Chicago. It is hoped by those in charge that everybody directly or indirectly interested in the cement industry will do something to contribute to the success of this great demonstration intended to exploit cement as a leading building material of the future.

A NEW FIRE ALARM WHISTLE.

The cut herewith illustrates an improved form of whistle manufactured by The Lunkenheimer Co., of Cincinnati, Ohio, and known as a combination or fire alarm whistle. It answers the purpose of an ordinary whistle, as well as of a fire-alarm, and is provided with a piston, to be worked up or down within the bell, thus changing the length, and consequently, also the tone. When the piston is not operated, the whistle gives but one tone like any plain whistle, but when pulled up or down, a howling, penetrating noise is produced. An extension rod is connected to the fork at the bottom of the piston rod, when the whistle is placed above the roof of a building, and a rope or wire is attached to the valve lever for the purpose of operating it.



At its upper end the bell is dome-shaped, and its lower end is securely supported by a three-arm spider, the stem of which is adjustably screwed into the whistle base and fastened by a lock-nut. This construction keeps the lower edge of the bell always in line with the slot in the base, through which the steam escapes, thereby insuring best results by the production of a perfectly clear and loud tone.

THE DEVELOPMENT OF SMALL CURTIS TURBINES.

Mr. R. H. Rice contributed the following account of the development of small Curtis turbines to a recent number of the "General Electric Review."

The first small Curtis turbines produced by the General Electric Co. were constructed and installed some four years ago. These first units, which were designed for 160 lb. steam and 80 volts, had a capacity of 15 kw. and were used for train lighting. They were of the square type, so-called on account of the cross section of the generator frame, and were originally placed on pilots of locomotives, a location extremely exposed to dust, cinders, rain and extremes of temperature. In order to avoid any possible detriment from this exposure, these sets were removed later to the baggage car, where they gave very satisfactory service. The present machines of this size, "round type," embody the results of all the experience gained with the old type, and are designed both for installation in baggage cars and for mounting on the top of the locomotive boilers. In this latter type the generator is so perfectly enclosed that no moisture or dust can gain access to the commutator or windings.

A particularly inviting field presents itself in the use of these sets mounted on the locomotive boiler, for use in lighting suburban trains; in which case the turbine is used without battery or other complicated and expensive apparatus, and the necessity for the employment of a flexible steam coupling is entirely eliminated. A number of sets are being installed in this way, and this use is undoubtedly destined to increase in popularity as its simplicity and reliability become demonstrated.

Beginning with these train lighting sets, many sizes have been developed, all of the horizontal type, up to 300 kw. These machines have until recently been of the direct current type, and for voltages varying from 80 to 250. All the generators are connected to the turbines directly without gearing and consequently run at turbine speeds. The Curtis principle renders this possible, and permits the attainment of excellent results with great simplicity of mechanism. In order, however, to attain good operation at turbine speeds, special methods of commutator construction had to be devised which would be capable of maintaining the commutator bars in absolutely fixed relationship against the influence of considerable centrifugal forces. In fact, this relationship has to be maintained more perfectly than is necessary in case of slower running machines on account of the increased liability to mechanical sparking present at high speeds. As might be expected, however, commutators constructed to meet these conditions are more rigid and more perfect than those made in the old way; they possess greater wearing depth and are therefore capable of longer life.

The construction of the turbine and of these sets has been so planned as to obtain the greatest possible simplicity. Naturally, there are differences in design in machines varying as widely in capacity as 300 kw. and 15 kw. In the larger unit economy in the use of steam is perhaps the most important consideration; while in the smaller one simplicity and small bulk are the prime requisites. These, and similar considerations, will be found to have influenced the development consistently.

In the smallest sizes plain throttling has been used for governor control, since this method is the simplest possible; and as the size of the unit increases, the governing methods are increased in perfection from an economical standpoint, with the necessary accompaniment of a larger number of parts. So also in the construction of the turbine itself; the smaller sets have only a single stage, while as the capacity is increased, stages are added in order to increase the efficiency.

In this connection it may be noted that the Curtis type of turbine permits extreme of simplicity in the support of the shaft in these smaller sizes. These machines are provided with two bearings only, one of which does all the work, while the other simply maintains the shaft alignment. Machines with a multiplicity of stages, or of the reaction type, which require long drums and many rows of buckets, necessarily have to have a number of bearings. Some of the Curtis machines now have four bearings, but the tendency in recent designs is toward the use of two, or three at the most. In the latter case, the form of flexible coupling used ensures perfect operation, without the necessity of maintaining absolute alignment of bearings.

A surprising perfection of speed control has been attained in this apparatus, due to the use of governors working on knife edges and therefore without friction; to the valve gears instantly responding to the action of the governor; and to the fact that action of the valve gear makes itself felt in the control of the turbine speed without any lag. In governing an engine no effect can be produced on the speed except at one point in each stroke (the point of cut-off), and consequently there is frequently considerable lag between governor action and speed control. In the turbine, however, where the steam flow can be varied at any instant, no lag occurs and speed control is more prompt.

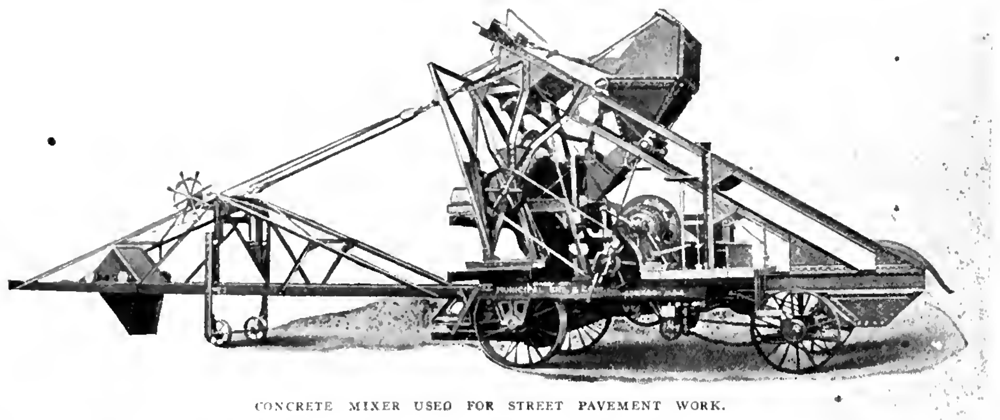
In these machines every effort has been made to reduce the amount of attention required to a minimum. Lubrication is as nearly automatic as possible; the packings are non-adjustable and durable; the polished surfaces are small in extent; and the oil is confined to the inside of bearings and does not escape, therefore the machines are readily kept clean. Furthermore the generators are of open construction, so that brushes may be readily attended to and windings kept clean. Additional safety governors are always provided which act to stop the apparatus when the speed, for any reason, reaches a certain predetermined maximum in excess of normal.

The New York Cableway & Engineering Co., a Rector St., New York, has issued a folder illustrating a typical cableway system of its design, and also the hoisting engine built for operating the cableway.

A SPECIAL CONCRETE MIXER FOR STREET WORK.

Most paving contractors have at one time or another experimented with some kind of a concrete mixer, and while a great saving in labor can be realized with mechanical mixers on every other kind of work, the laying of concrete base for street pavements involves conditions that have not, until very recently, been overcome. In other words, the work of setting up and taking down a mixer, building platforms, runways, etc., for each block of work, conveying the mixed concrete from the mixer to the work in wheelbarrows or carts, for which runways are usually necessary, bring the cost so high that the small saving in labor over hand work would not justify the purchase of a machine, a better quality of concrete being practically the only inducement.

The Municipal Engineering & Contracting Co., Railway Exchange, Chicago, recogizing that some special machine for reducing the cost of handling materials on this kind of work must be devised, and looking at the matter from the contractor's standpoint, have been experimenting with that end in view. The accompanying illustration shows a machine brought out by them some months ago, which has been in operation during the past season by one of the largest street paving concerns in the East, with results so satisfactory that the manufacturers have decided to place the machine on the market next season along with their regular "Chicago Improved Cube" mixer. Recently the machine referred to mixed and put in place 1,000



CONCRETE MIXER USED FOR STREET PAVEMENT WORK.

sq. yd. of concrete base 6 in. thick in less than 8 hours, with 17 laborers, which reduces the labor cost to about one-half that of hand work.

The machine consists of one of their standard cube mixers mounted on an extra heavy truck frame, discharging from the rear into a specially-designed bucket which receives the whole batch and travels rearward on a truck which is 25 ft. long and pivoted to swing either way 80 to 85 degrees, permitting the placing of the concrete just where wanted on a street 50 ft. wide. There is also a device for quickly and economically elevating the material and charging the mixer, which consists of an elevating hopper traveling on an inclined track and dropping down to the ground in front of the machine, where the entire batch of ingredients can be dumped in from wheelbarrows, or materials can be shoveled in directly from the piles which have been previously distributed along the street. There is an automatic water-measuring supply tank mounted in the upper part of frame, which insures a uniform supply of water at all times.

The machine has a substantial self-propelling device with both go-ahead and back-up motion and complete steering gear. Future machines will be equipped with steam power. The manufacturers aim to carry these machines in stock next season, but at present delivery can be made, it is understood, in about six weeks.

PERSONAL NOTES.

Messrs. Chester Stevens and Harry Keerl will open an office for civil engineering work at Mason City, Ia.

Mr. Glenn D. Holmes has been appointed chief engineer of the Intercepting Sewer Board, of Syracuse, N. Y.

Richard D. Hurley, manager of the Pittsburg office of the Independent Pneumatic Tool Co., died at Chicago, Ill., Nov. 5, of heart disease, aged 39 years.

Mr. H. H. Russell, supervisor of the Maryland division of the Pennsylvania R. R., has been made assistant engineer of the Allegheny division at Pittsburg, succeeding Mr. J. R. McGraw.

Mr. Charles E. Phelps, Jr., and Mr. Charles G. Edwards, have been re-elected chief engineer and assistant engineer, respectively, of the Baltimore Electrical Commission.

President Roosevelt recently reappointed Rear Admirals Charles W. Rae and W. L. Camps, U. S. N., to be chief of the Bureau of Steam Engineering and chief of the Bureau of Construction and Repairs of the Navy Department, respectively.

Mr. H. B. Ayers, for the past two years in charge of the Canadian Locomotive Works and prior to that general manager of the Pittsburg Locomotive Works, has become general manager of the locomotive works of the H. K. Porter Co., Pittsburg, Pa.

Mr. William H. Ford, for several years sales manager of the Kosmos Portland Cement Co., has been elected vice-president of the William G. Hartranft Cement Co., of Philadelphia, and first vice-president and general manager of the William G. Hartranft Cement Co. of Canada, with general sales offices in Montreal.

Col. Garrett J. Lydecker, Corps of Engineers, U. S. A., division engineer of the Central Division, with headquarters in Detroit, Mich., has been placed on the retired list, having reached the age limit of 64 years. He was retired with the rank of brigadier general, the advance in rank being in recognition of his service in the civil war.

Capt. George M. Hoffman, Corps of Engineers, U. S. A., in charge of river and harbor work in the vicinity of Vicksburg, Miss., has been detailed for duty with the Isthmian Canal Commission. He will be relieved at Vicksburg by Capt. Clarke S. Smith, commanding Company G, Second Battalion of Engineers, on duty connected with road construction in Cuba.

The United States Civil Service Commission will hold an examination, Dec. 11, in the large cities of the country, of candidates for the position of assistant superintendent of construction in the Quartermaster's Department at Large. On Dec. 11 and 12 the Commission will also examine candidates for the following positions: Engineer draftsman, in the office of the Supervising Architect, Treasury Department mechanical draftsman and topographic draftsman, in the service of the Isthmian Canal Commission.

Storm Bull, professor of steam engineering at the Univercity of Wisconsin, died, Nov. 18, at his home in Madison. He was born in Bergen, Norway, in 1856, and was graduated from the Federal Swiss Polytechnic Institute in 1877, receiving the degree of Engineer of Mines. After two years of professional work in America, he became an instructor in the University of Wisconsin in 1879, and was made a full professor five years later. He was a member of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, and the Western Society of Engineers.

The Secretary of Agriculture has divided into two sections the irrigation and drainage investigation work of the Office of Experiment Stations, formerly managed by Dr. Elwood Mead, who recently resigned to assume direction of government irrigation work in Australia. Dr. Samuel Fortier, irrigation engineer in charge of the Pacific district of the irrigation and drainage investigations, and stationed at the University of California, Berkeley, Cal., has been made chief of irrigation investigations. Mr. C. G. Elliott, for several years past engineer in charge of the drainage investigations of the Office, has been made chief of drainage investigations.

H. W. Scott, principal assistant city engineer of Seattle, Wash., whose death was noted in these columns Nov. 16, had been in the service of the city continuously since 1888. One of his most important pieces of work before entering its employ was the location of the Seattle, Lake Shore & Eastern R. R., now the Seattle & International. His first important work for the city was the direction of the construction of the Cedar River water system. After the completion of this project he was made principal assistant city engineer, with general supervision of all city work. He continued in this capacity until three years ago, since when he has been in charge of the construction of all water system extensions. He was the treasurer of the Pacific Northwest Society of Engineers for several years.

BUSINESS NOTES.

The General Fireproofing Co. announces the removal of its Washington offices from 420 Colorado Building and 501 Fourteenth St., to 725 Fourteenth St., N. W., corner of New York Ave. Samples of Allsteel furniture, and materials for reinforcing concrete and for fireproofing are kept on hand. Mr. W. A. Kennedy is district manager, and Mr. C. A. Hamilton is in charge of the Allsteel furniture department.

The Birmingham branch office of the Sullivan Machinery Co. is now located at 1 Twentieth St., South, where additional space is provided for rock drills and their parts and the other mining and quarrying machinery carried in stock.

The Northern Engineering Works, Detroit, Mich., reports the following recent sales: The Hilgartner Marble Co., Baltimore, 3-ton crane; Erie Foundry Co., Erie, Pa., 3-motor 10-ton electric traveling crane; Peninsular Motor Co., Grand Rapids, Mich., No. 54 Newten cupola; the Modern Iron Works, Quincy, Ill., No. 66 Newten cupola.

The New York offices of the Raymond Concrete Pile Co. have recently been moved to 140 Cedar St., in the new West Street Building, where more commodious quarters have been secured than those previously occupied. The company has been carrying out a number of contracts for concrete pile foundations lately and has recently secured one for the pile supports of the electric wiring conduit in the Long Island R. R. terminal at Long Island City, probably the first use made of concrete piles for such a purpose. Another contract which is of special engineering interest is for the footings of the Cuyahoga viaduct of the Cleveland Short Line.

The past year has been a busy one for the Artesian Well & Supply Co., Banigan Bldg., Providence, R. I., which has sunk about eighty wells and is now at work on about a dozen more. Two of the wells were 13-in. holes for elevators, but most of the work was sinking 8-in. wells for water. A number of the wells were for the Citizens Water Supply Co., Douglaston and Little Neck, N. Y., which contracted with the Providence company about two years ago; up to date 53 wells have been sunk, all flowing, which yield 9,000,000 gal. of water daily.

It is understood that the report for the last quarter of the Union Switch & Signal Co. will show very favorable returns. Net earnings for the year are estimated at $1,100,000 on a total capital stock of $2,500,000 and bonds of $243,000. There are $1,250,000 of accounts receivable and enough money in the bank to meet pay rolls for two months if no more money is collected within that time.

The Steel Protected Concrete Co., Philadelphia, states that it has appealed from the recent decision of Judge Saunders of the U. S. District Court holding three of the six Wainwright curb patents to be void.

Mr. George A. Gallinger has been appointed manager of the Pittsburg office of the Independent Pneumatic Tool Co., of Chicago. The office is at the Farmers Bank Bldg., and a complete line of Thor tools and spare parts will be carried there.

The New Jersey Zinc Co., Franklin Junction, N. J., has ordered two 22x48-in. Allis-Chalmers duplex direct-acting Corliss hoisting engines, with double drums. They will handle a total load of 19,600 lb. up an incline of 47½ deg. from a vertical depth of 1,050 ft.

Mr. C. W. Whitney has resigned as manager of the Publicity Department of Abner Doble Co. and accepted a position as purchasing agent with the Ransome Concrete Co., of California, whose main offices are in the Crocker Building, San Francisco. In addition to the regular duties of his new office, Mr. Whitney will have charge as well of publicity matters, for which his previous experience well qualifies him.

The Berger Mfg. Co., Canton, Ohio, has constructed at 11th Ave. and 22d St., New York, a building in which the visitor has an opportunity of seeing metal ceiling work of satisfactory workmanship. The company manufactures a great variety of such ceilings and wall coverings, and its purpose in fitting up the building mentioned is to show how to avoid butchering this material in putting it in place.

TRADE PUBLICATIONS.

Slip-drum electric winches for hauling car floats are described in bulletin 21, just issued by the Lidgerwood Mfg. Co., 96 Liberty St., New York. These winches are designed to place the entire control of hauling in a car float in the hands of one man, the frictional drive of the winding drum exerting full power without danger to the hawsers, but permitting slippage if the proper strain is exceeded or the float is clear into its berth. It also facilitates control of the float if the mooring gear should part, pulling it steadily back into place until moored again, slippage of the drum occurring in case there may be a tendency to back away. This winch mechanism was designed for the transfer terminals of the Pennsylvania R. R. at its new freight yards at Greenville, N. J., and South Brooklyn, N. Y., using the type of slipping friction drum developed for maintaining a constant tension on the cables of the Lidgerwood cableways for coaling war ships at sea. The friction can be adjusted at will, those above referred to being set to exert a pulling strain of 11,000 lb. on the hawser before it begins to slip, reducing then to 9,000 lbs., which is maintained as long as slippage occurs.

A 55 per cent. saving in current consumption through the use of roller bearings on street car journals is announced by the Standard Roller Bearing Co., 5003 Lancaster St., Philadelphia, in a folder recently issued. The folder reprints an article that was published in the Street Railway Journal giving the results of a series of tests on an electric car at Syracuse, N. Y., in which roller bearings supplied by this company were used. Details of the tests and a description of the bearings are given.

The C. O. Bartlett & Snow Co., Cleveland, Ohio, has issued its 1908 catalogue of elevating, conveying, mining and milling machinery and supplies. It is a 325 page book, containing in the first portion illustrations of special coal-loading machines, coal carriers, fueling scows, coal and ore elevators and other labor-saving machinery. Following this are listed a variety of milling machinery for oatmeal and other food stuffs, and grain elevator equipment, and also machinery for other industries, such as cement machinery, gypsum machinery, phosphate machinery and paint mills. A large stock of millwright supplies which are kept on hand is also listed.

The North Star Ash Can Co., 167 Chrystie St., New York, has issued a folder relative to its extensive line of ash and stable cans and masons' salamanders. The latter are made with grates of angle iron that cannot be broken. Special engineers' ash cans are offered for use in office building plants where large quantities of ashes are handled, the body of the can being protected by four heavy bars and having a removable malleable iron bottom.

The October bulletin of the Barriett Electric Mfg. Co., Cincinnati, describes the company's polyphase induction motors, which are made in all sizes from ½ to 50 h. p. for two and three phase circuits and all standard voltages. The leading details of the design are explained.

The economical heating of water and air in breweries and malt houses is the subject of a bulletin of The Green Fuel Economizer Co., Matteawan, N. Y. Half of the bulletin consists of a study of hot water and boiling by steam for breweries, reprinted from the proceedings of one of the German steam engineers' societies. The methods and results obtained in utilizing the furnace gases before allowing them to escape are studied at length and an ideal arrangement for the hot water and boiling-steam supplies for a brewery are presented. The second half of the bulletin treats of the blower and exhaust systems for malt houses and breweries, and describes the company's apparatus for this work.

Some interesting data and pictures relating to dredging and harbor improvements are brought together in a booklet descriptive of the work of the North American Dredging Co., engineers and contractors, main office, Merchants' Exchange Bldg., San Francisco, Cal. The company has dredging plants of the sea-going self-propelling type capable of steaming to any part of the world, and acts as consulting engineer on all kinds of river and harbor work, levees, earth dams, canals and similar works. Among the interesting views are one of the sea-going, self-propelling hydraulic dredge "Pacific" discharging through 6,000 ft. of pipe and elevating material 16 ft. at Tacoma, Wash., a number of views of large fills made by the same dredge at Honolulu, one of the dredge "Galveston" discharging through 10,500 ft. of pipe with a vertical lift of 17 ft. at Galveston, Tex., and one of a levee building dredge with a 155-ft. boom having a 6-yd. clam-shell bucket at its end. The capacity of the large dredges is given between 200,000 and 300,000 cu. yd. of earth each per month, when discharging through 6,000 ft. of pipe. The indicated horse-power in 1,600, 1,200 for the pumps and 400 for auxiliary machinery. They are capable of dredging a channel 50 ft. deep and 200 ft. wide at one operation.

Two publications recently received relate to Smith concrete mixers made by The T. L. Smith Co., Milwaukee, Wis., and sold by the Contractor's Supply and Equipment Co., Old Colony Bldg., Chicago. The first of these publications is a catalogue, No. 13, stating the increases in plant equipment made by the manufacturers to keep pace with the growth of business, and describing the Smith mixer, the various methods of mounting it with steam and gasoline engines, side loading cars, self-contained side loaders and batch feeding hoppers. A list at the end gives full data on Smith mixers of various sizes. The second publication is a mixer manual for the use of salesmen and operators of Smith mixers, which in addition to the data of the first publication, contains many things of value to the contractor who is operating concrete mixers. A series of questions and answers makes plain the requisites of good concrete, and suggests the way of best complying with these requisites. Data on ordering mixers fitted with hoists, on friction clutches, cart pullers for inclines, setting up mixers, and their proper care, as well as illustrations and descriptions of various parts for convenience in ordering repairs, are certain to be of value to contractors and mixer operators.

Economy drawing tables in great variety from simple tables without any drawers to elaborate outfits with conveniences for a great quantity of drawing materials and for storing tracings and blue prints, are shown in a catalogue of the Economy Drawing Table Co., 1303 Utah St., Toledo, O. Sectional filing cases for drawings are also listed and described.

Symons crushers, made by the Smith & Post Co., Merrill Bldg., Milwaukee, Wis., and sold by the Contractor's Supply and Equipment Co., Old Colony Bldg., Chicago, are described in a small folder recently received. Both the gyratory and jaw crushers are shown mounted on trucks so as to be readily moved about.

A recent bulletin of the General Electric Co., Schenectady, N. Y., is devoted to catenary line material. The details of the equipment which are fully described and illustrations are presented of the various forms of construction for single and double track, curves, anchorages, etc. Another new bulletin is devoted to direct-current motor starting rheostats types SA and SO.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Bay Minnette, Ala.—See "Public Buildings."

Ft. Morgan, Ala.—We are informed that the following are the bids which were opened in Sept. at the office of the Quartermaster for a 150,000-gal. elevated tank and a 75-ft. tower, and which were rejected: R. D. Cole Mfg. Co., Newnan, Ga., $20,150, and the Chicago Bridge & Iron Wks., Chicago, Ill., $19,250. New bids will be received on Nov. 28 by Capt. L. F. Garrard, Q. M., U. S. A.

**Oceanside, Cal.*—H. D. Brodie, City Clk., writes that the contract for one horizontal return tubular boiler 48 in. in diam. and 16. ft. long, and one cross-compound, high-duty pumping engine of 1,000 gals. capacity (bids opened Nov. 5) has been awarded to the Pacific Coast Mfg. Co., of Los Angeles, for $16,862.

Denver, Colo.—The Antero & Lost Park Reservoir & Canal Co. is reported incorporated, with a capital of $2,000,000, by Horace G. Clark, clerk of the Supreme Court; E. J. Riethmann and Geo. A. Starbird, of Denver; S. J. Perry and D. A. Camfield, of Greeley, and others. The company will build two dams. The larger, at Antero, will cover 4,000 acres and have a capacity of 3,000,000,000 cu. ft. of water. One branch of South Platte River will supply water to this reservoir. The other will be at the middle fork of the South Platte. The reservoir will be fed by the Four-Mile, High and Goose Creeks. The company will supply the High Line ditch lands and the irrigable land under the Burlington ditch. Work upon the project is said to have already been commenced.

**Atlanta, Ga.*—Bids were opened on Nov. 12, by the Bd. of Water Comrs. for 13,000 ft. of 36-in. water pipe, and the contract is reported to have been awarded to the U. S. Cast Iron Pipe & Fdy. Co., of Chattanooga, Tenn., at $24.97 per ton for c. i. pipe.

Elgin, Ill.—The City Council is reported to be considering the question of erecting a stand pipe on N. Spring St., to cost about $10,000.

Elkhart, Ind.—The City Council is reported to have selected C. A. Maltby of Chicago, Ill., to prepare plans and specifications for water works.

Evansville, Ind.—The City Council is reported to have decided to construct a mechanical filtration plant.

Claremore, Ind Ter.—The citizens are reported to have voted to expend $40,000 to extend the water works.

Russell, Mass.—T. H. Clark is reported to have been selected to investigate the question of installing municipal water works.

**Baudette, Minn.*—M. D. Stoner, of Bemidji, and C. W. Jewett, of Blackduck, are reported to have secured the contract for constructing water works at Baudette.

Stevensville, Mont.—The Town Council is reported to be considering the question of constructing water works.

Benson, Neb.—The citizens are reported to have voted to issue $9,000 bonds for the improvement of the water system.

Jersey City, N. J.—Bids will be received until Nov. 25 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for furnishing and delivering special castings; also water gate boxes and covers and manhole heads and covers.

Verona, N. J.—T. E. Brooks, Boro. Clk., writes that the citizens on Nov. 14 voted in favor of constructing water works. Another election will be held to vote on amount to be raised by bonds, the date of which has not yet been decided upon. Engineer not yet appointed.

Roswell, N. M.—Fred J. Beck, City Clk., writes that an election will be held on Jan. 15, to vote on issuing $155,000 bonds for water works and sewer extensions. If the election is successful, bids will be invited and work will be in charge of a commission, consisting of John W. Poe, J. F. Hinkle and R. D. Bill.

Syracuse, N. Y.—We are informed that the question of constructing high service reservoir and conduit line to Skaneateles Lake will not be definitely decided until after official state canvass of returns in Dec. If it is found that the amendment to the constitution carried on Nov. 5, plans will be prepared and contracts let soon after Jan. 1. Henry C. Allen is City Engr.

Durhamville, N. Y.—Bids will be receievd until Nov. 26 by F. C. Stevens, Supt. Pub. Wks., Albany, for constructing a new aqueduct under the Erie Canal at Durhamville on the line between the counties of Madison and Oneida.

New Brighton, S. I., N. Y.—The Mayor of the City of New York, on Nov. 11, approved the ordinance passed by the Bd. of Aldermen on Oct. 29, providing for an issue of corporate stock in the sum of $1,100,000 to provide means for the purchase of the property and franchises of the Staten Island Water Supply Co.

Wilmington, N. C.—The Bd. of Aldermen is stated to have adopted the recommendation of the special committee that a contract be entered into with the Clarendon Water Works Co., for the purchase of its plant for $140,000.

Grand Forks, N. D.—It is reported that bids are wanted for extending water mains in several streets. W. V. O'Connor, City Aud.

Ironton, O.—It is stated that bids will be received until Dec. 10 by F. A. Ross, City Aud., for $10,000 water and street improvement bonds, also until Nov. 26 for $20,000 water works bonds.

Wilmington, O.—The Village Council is reported to have passed on second reading, an ordinance granting [illegible] Neff a franchise for water works.

[illegible] *Okla.*—C. F. Dunham, City Clk., writes that Burns & McDonnell, Dwight Bldg., Kansas City, Mo., are preparing plans for water works to cost about $50,000.

Pawhuska, Okla.—See "Power Plants, Gas and Electricity."

Eugene, Ore.—It is stated that bids will be received until Jan. 6 by B. F. Dorris, Recorder, for $300,000 water bonds.

**Philadelphia, Pa.*—We are informed that the following are the bids opened on Oct. 22 by the Dept. of Pub. Wks., Bureau of Filtration (Fred C. Dunlap, Ch. Engr.) for Contract 126, two pumping engines of 20,000,000-gal. capacity, for Lardner's Point pumping station: Walter Wood, 400 Chestnut St., Philadelphia, $294,000; Holly Mfg. Co., Buffalo, N. Y., $268,769 (awarded contract); Southwork Fdry. & Mch. Co., Washington Ave. & 5th St., Philadelphia, $272,000; Allis-Chalmers Co., Milwaukee, Wis., $284,000, and Bethlehem Steel Co., So. Bethlehem, $244,800. Each engine of the Holly Mfg. Co., the successful bidder, will perform a duty of not less than 172,000,000-ft. lbs. per 1,000 lbs. of dry steam, the first engine to be installed in 360 days and the second in 420 days.

Bids will be received until Nov. 27 by the Dept. Pub. Wks. (Geo. R. Stearns, Dir.), for Sch. A—Restoring burnt portion of testing station, cast iron force main, etc.

Ridgeville, S. C.—See "Power Plants, Gas and Electricity."

Temple, Tex.—This city is reported to have decided to purchase the plant of the Temple Water Works Co., and will make improvements to same.

Roanoke, Va.—The Roanoke Gas & Water Co. is reported to be preparing to lay 4 miles of 10-in. to 4-in. water mains. It is stated that a new pumping station will be installed in the spring. H. H. Baughman, Supt.

Spokane, Wash.—The City Council on Nov. 12, acting on recommendations from Mayor Moore and the Bd. of Health, with which were submitted reports of experts, ordered the Bd. of Pb. Wks. to proceed at once with the installation of the necessary machinery for the development of the underground flow.

**Seattle, Wash.*—The International Contract Co., 636 New York Block, has secured the contract for constructing water mains on E. 65th St. and on 3d Ave. S. for $6,475.

The City Council on Nov. 11, ordered the laying of salt water mains on 1st, 2d and 3d Aves., from Pipe St. to Jackson St., about 10,067 lin. ft. of 20-in. C. I. pipe, and 9,438 lin. ft. of 16-in. C. I. pipe. There will also be built, at the foot of Madison St., an auxiliary pumping station of concrete and brick, 20 x 40 x 60 ft. with eight 5-stage centrifugal pumps, direct connected electric motor. Capacity of motor, 2,600 H. P., plant to be capable of pumping 12,000 gal. per minute; total estimated cost of mains and plant, $340,000. Bids will be called for within a short time.

Manitowoc, Wis.—Press reports state that if this city will agree to improvements contemplated by company, providing it purchases plant, the Manitowoc Water Works Co. will install an additional boiler and also sink another well, the improvements being estimated at bet. $25,000 and $35,000.

Hamilton, Ont.—The Fire & Water Com. of Council on Nov. 12 decided to recommend that a by-law for $50,000 for electric pumps for the Beach pumping house be submitted to the rate payers, and the Council passed same on second reading. The specifications call for bids on both hydro-electric and cataract power.

Collingwood, Ont.—It is stated that it is proposed to extend the water system, at a cost of $3,800.

London Ont.—The City Council on Nov. 17 passed on second reading the ordinance providing for an expenditure of $393,500 for water works extension.

Weyburn, Sask.—Edgar A. Chappell, City Secy., writes that the bids for constructing the proposed water works will not be called for until the spring. It is intended, however, to construct a dam this fall by day's work under direction of the Town Engineer, so that the spring flow will be available for next summer.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Monica, Cal.—Bonds to the amount of $160,000 are reported sold, the proceeds to be used for sewers, street improvements and a large pier.

It is reported that plans and specifications are wanted by Dec. 21 by Thomas H. James, City Engr., for constructing a septic tank, also a pier 1,600 ft. long, from the medium tide line of the Pacic Ocean, extending into the Pacic Ocean, for the purpose of carrying an outfall pipe from the septic tank; also estimates for construction of improvements either separately or combined.

Waterbury, Conn.—Bids are wanted, it is stated, until Dec 16, for $125,000 sewerage bonds. Wm. E. Thomas, Mayor.

Tampa, Fla. The City Clk. writes that about $50,000 will be expended for sewer work if approved by the voters. Election will be held Jan. 7. G. P. Sullivan, City Engr.

Bloomington, Ill.—Bids will be received by Bd. of Local Improv. at the office of Chas. F. Fauntz, City Engr. until Nov. 29, for 3,147 ft. of 12-in. pipe sewer, 1,478 ft. of 12 in. pipe sewer and 580 ft. of 18-in. pipe sewer.

Canton, Ill.—The Special Sewer Committee is stated to have presented to council its report on the construction of a sewerage system. Two new systems are planned, one to drain the south and east portions of city, the other the north and northwest portions. No action has yet been taken.

Indianapolis, Ind.—Chas. A. Brown, Asst. City Engr., is reported to be preparing plans for the Fulton St. sewer to extend from Ohio St. to St. Clair St., with a branch on Spring St.

Lafayette, Ind.—E. H. Andress, City Clk., writes that bids will be received on Nov. 27 for the construction of sanitary sewers in several streets.

Aurora, Ind.—Frank D. Johnson, City Clk., writes that bids for sewer construction were rejected on Nov. 11, and the matter will be laid over until Feb. or March, when new bids will be called for.

South Bend, Ind.—Specifications have been adopted for about 22,880 lin. ft. 6 to 30 in. pipe sewers, with manholes, flush tanks, etc. Bids will be called for in Dec. A. J. Hammand, City Engr. W. A. McInerney, Pres. Bd. Pub. Wks.

Fredonia, Kan.—R. S. Spencer, City Clk., writes that Burns & McDonnel, Dwight Bldg., Kansas City, Mo., are preparing plans for a sewerage system to cost between $40,000 and $50,000. Nothing definite has yet been done.

Louisville, Ky.—Bids will be received at the office of the Comrs. of Sewerage (P. L. Atherton, Chmn.), until Dec. 17, for constructing Sect. B of the Southern Outfall Sewer, Contract No. 2, to consist of a sewer 3,322 ft. long, 15 ft. 2 in. x 15 ft. 6 in. diam.; 1,820 ft. of 14 ft. 5 in. x 15 ft., and 970 ft. 13 ft. 11 in. x 14 ft. 3 in.; 17,000 cu. yds. concrete, 6,143 lin. ft. excav., 22 to 42 ft. deep; 1,200,000 lbs. steel bars, 21,000 bbls. Portland cement, as advertised in The Engineering Record. Harrison B. Eddy, Consulting Engr., 14 Beacon St., Boston, Mass. J. B. F. Breed, Ch. Engr.

Baltimore, Md.—The Sewerage Committee is reporetd to have decided to increase its expenditure for storm water drains to $100,000 next year.

Boston, Mass.—Bids were opened at the office of the Metropolitan Water and Sewerage Bd., Boston, Mass., on Nov. 15, for constructing in rock and earth trench and tunnel Sec. 81 and parts of Secs. 83 and 85 of the Extension of the High Level Sewer, South Metropolitan System, in Brookline and Brighton, and the following are the bids received (Wm. M. Brown, Ch. Engr. Sewerage Wks.):

Contract 60—Sect. 81 Chestnut and Kendall Sts., Brookline: (*a*) 2,140 ft. trench; inside diam. of sewer, 78 x 84 in.; (*b*) 50 cu. yds. Portland brick masonry; (*c*) 3,400 cu. yds. concrete masonry in trench; (d) 2,000 cu. yds. rock excav. in trench; sewer invert, 13 ft. to 29 ft. below street surfaces; (*e*) totals): Falvey & Kelly, 15 Intervale Park, Dorchester, *a*, $20; *b*, $20; *c*, $9; *d*, $7; *e*, $88,400. Geo. J. Regan, 92 Stoughton St., Dorchester, *a* $18.90; *b*, $18.50; *c*, $8.25; *d*, $5.50; *e*, $80,421. Jas. Driscoll & Son, Brookline, *a*, $12.50; *b*, $18; *c*, $7.90; *d*, $5; *e*, $64,510. Geo. M. Bryne Co., 7 Water St., *a*, $13; *b*, $16; *c*, $7.50; *d*, $4.50; *e*, $63,120. T. J. O'Connell, 158 Adams St., Dorchester, *a*, $10; *b*, $16; *c*, $8; *d*, $6; *e*, $61,400. Donavon & Phillips, 87 Border St., E. Boston, *a*, $9.75; *b* $15; *c*, $8.50; *d*, $4.50; *e*, $59,515. Donovan & Doyle, 22 Weld Ave., *a*, $8.20; *b*, $13.50; *c*, $8; d, $7; *e*, $59,423. Hugh Nawn Cont. Co., 82 Savin St., *a*, $10; *b*, $17; *c*, $8; *d*, $4; *e*, $57,450. Bruno & Petitti, 23 Court St., *a*, $9.50; *b*, $15; *c*, $8.50; *d*, $3.50; *e*, $56,980.

Contract 61, Sect. 83, Cypress St., Brookline; (*a*) 920 ft. rock and earth tunnel; (*b*) 355 ft. trench, inside diameter of sewer, 78 x 84 in.; (*c*) 50 cu. yd. Portland brick masonry; (*d*) 600 cu. yd. conerete masonry in trench; (*e*) 1,200 cu. yd. concrete masonry in tunnel; (*f*) 1,000 cu. yd. rock excavation in trench, sewer invert, 24 ft. to 34 ft. below street surfaces; (*g*) total. Jas. Driscoll & Son, *a*, $46; *b*, $15; *c*, $18; *d*, $8.50; *e*, $12; *f*, $6; *g*, $74,045. T. J. O'Connell, *a*, $33; *b*, $15; *c*, $16; *d*, $8; *e*, $10; *f*, $6; *g*, $59,285. Pat. McGovern, 6 Beacon St., *a*, $31.50; *b*, $15; *c*, $16; d, $9; *e*, $11; *f*, $4.75; *g*, $58,455. Bruno & Petitti *a*, $25; *b*, $18; c, $16; *d*, $9.50; *e*, $14; *f*, $4; *g*, $56,690. Hugh Nawn Cont. Co., *a*, $29.50; *b*, $12; *c*, $18; *d*, $8; *e*, $10; *f*, $4, *g*, $53,100.

Contract 62, Sect. 83, Winchester St., Brookline. (*a*) 1,664 ft. earth tunnel, inside diameter of sewer, 69 x 72 in.; (*b*) 50 cu. yd. Portland brick masonry; (*c*) 2,500 cu. yd. concrete masonry; (*d*) 100 cu. yd. rock excavation, sewer invert of the tunnel, 28 ft. to 43 ft. below street surfaces; (*e*) totals. Pat. McGovern, 6 Beacon St., Boston, *a*, $24; *b*, $17; *c*, $12; *d*, $7; *e*, $71,486. James Driscoll & Son, *a*, $22.50; *b*, $18; *c*, $12; *e*, $69,540. Hugh Naun Cont. Co., *a*, $27; *b*, $18; *c*, $9; *d*, $4; *e*, $68,728. John E. Palmer, 79 Journal Bldg., *a*, $19; *b*, $15; *c*, $12; *d*, $8; *e* $63,166. Chas. G. Craib & Co., 249 Pleasant St., Winthrop, *a*, $20; *b*, $14; *c*, $10; *d*, $10; *e*, $59,980. T. J. O'Connell, *a*, $16.75; *b*, $16; *c*, $10; *d*, $10; *e*, $54,672.

Contract 63, Sect. 85, Warren St., Brighton, (*a*) 1,252 ft. rock in tunnel, inside diameter of sewer, 69 x 72 in; (*b*) 50 cu. yd. Portland brick masonry; (*c*) 1,500 cu. yd. concrete masonry, sewer invert of the tunnel 53 to 63 ft. below street surfaces; (*d*) totals. Jas. Driscoll & Son, *a*, $40; *b*, $20; *c*, $11; *d*, $67,580. Falvey & Kelly, *a*, $32; *b*, $20; *c*, $10; *d*, $56,064. Coughlin & Shiels Co., Boston, *a*, $28; *b*, $20; *c*, $12; *d*, $54,056. Bruno & Petitte, *a*, $25; *b*, $16; *c*, $14; *d*, $53,100. Pat. McGovern, *a*, $27.50; *b*, $17; *c*, $11 50; *d*, $52,530. Hugh Nawn Cont. Co., *a*, $30; *b*, $17; *c*, $9; *d*, $51,910. D. F. O'Connell Co., *a*, $28; *b*, $20; *c*, $10; *d*, $51,056. Geo. M. Byrne Co., *a*, $28; b, $16; *c*, $10; *d*, $50,856.

Contract 64, Sect. 85, Warren, Cambridge and Washington Sts., Brighton; (*a*) 2,300 ft. rock in tunnel, inside diameter of sewer, 69 x 72 in.; (*b*) 50 cu. yd. Portland brick masonry; (*c*) 2,700 cu. yd. concrete masonry, sewer invert of the tunnel, 54 ft. to 64 ft. below street surfaces; (*d*) totals. Falvey & Kelly, *a*, $48; *b*, $20; *c*, $12; *d*, $143,800. Bruno & Petitti, *a*, $30; *b*, $16; *c*, $14; *d*, $107,600. Coughlan & Sheils Co., 104 Hanover St., *a*, $28; *b*, $20; *c*, $12; d, $97,800. Patrick McGovern, *a*, $27.50; *b*, $17; *c*, $11.50; *d*, $95,150. Hugh Nawn Cont. Co., *a*, $30; *b*, $17; *c*, $9; *d*, $94,150. D. F. O'Connell Co., *a*, $28; *b*, $20; *c*, $10; *d*, $92,400.

Contract 65, Sect. 85, Washington St., Brighton, (*a*) 1,650 ft. rock and earth tunnel, inside diameter of sewer, 69 x 72 in.; (*b*) 50 cu. yd. Portland brick masonry; (*c*) 1,900 cu. yd. concrete masonry, sewer invert of the tunnel, 27 to 62 ft. below street surfaces; (*d*) total. Patrick McGovern, *a*, $30; *b*, $17; *c*, $11.50; *d*, $72,200. D. F. O'Connell Co., *a*, $30; *b*, $20; *c*, $20; *d*, $71,400. Hugh Nawn Cont. Co., *a*, $30; *b*, $17; *c*, $9; *d*, 67,450.

Southbridge, Mass.—The lowest bid on Nov. 12, by the Bd. of Sewer Comrs. for constructing sewage purification works, is stated to have been submitted by C. E. Trumbull, of Boston, at the following bid: Grubbing, 42 cts. per cu. yd.; excavat. 29½ cts. per cu. yd.; trenching, 29½ cts. per cu. yd.; rock excavat, $2 per cu. yd.; for 8-inch main pipe, 30 cts. per lin. ft.; 10-inch, 40 cts.; 12-inch, 50 cts.; 18-in., 70 cts.; 20-in., 75 cts.; 4-in. distributing pipe, 30 cts. per lin. ft.; 6-in. 35 cts.; 8-in., 40 cts.; masonry, $8 per cu. yd; woodwork $50 per m. ft.; total, $30,582. Total of other bids: $50 per m. ft.; total, $30,582. Totals of other bids: Geo. M. Byrne Co., Boston, $31,811; John F. Gill & Co., Somerville, $35,689; John E. Palmer, Boston, $38,546; Bruno & Petetti, Boston, $39,484; Hassam Paving Co., Worcester, $45,935; Frank Williams, Boston, $51,213, and Donovan & Doyle, Boston, $71,023.

**Items marked thus give the names of parties awarded contracts.*

*Luverne, Minn.—The City Council on Nov. 5, awarded contract for sewers to Greene & Delate, at 65 cts. lin. ft. for sewer, manholes ea. $60 and flush tanks, ea. $90.

St. Paul, Minn.—The Bd. of Pub. Wks. is reported to have received from the City Engr. preliminary estimate of cost of a new sewer to be constructed on Prior Ave., from Feronia to Chelton; probable cost $30,536.

Forsyth, Mont.—The citizens are reported to have voted to issue $10,000 bonds for sewers.

*Pitman, N. J.—John Hanlon & Co., of Philadelphia, Pa., are reported to have secured the contract for constructing sewers for $4,283.

Woodbury, N. J.—The citizens are reported to have voted to issue $7,000 bonds for a surface drainage system west of Park Ave. in the meadow section.

Roswell, N. M.—See "Water."

Stittville, N. Y.—Bids will be received until Dec. 7 by the Sewer Comrs. of the First Sewer Dist. of the Town of Marcy (W. S. Pentland, Stittville, Chmn.), for the construction of about 1,500 lin. ft. of vitrified pipe sewer in the unincorporated village of Stittville, W. G. Stone, Engr., Mann Bldg., Utica.

Valley City, N. D.—Bids will be received until Dec. 2, by the City Council for constructing sewers in two alleys. H. F. Halverson, City Aud.

Trenton, O.—It is stated that bids will be received until Dec. 2 by Armstrong Ashbrook, City Aud., for $20,000 sewer and street improvement bonds.

*Girard, O.—E. L. Hauser, City Clk., writes that the contract for constructing portion of main sewer (bids opened Nov. 5), has been awarded to C. L. Allen, of Marion, O., for $19,329.

Cincinnati, O.—The following are the bids opened on Nov. 8 by the Bd. of Pub. Service for constructing sewers on Western Ave. and Bridge St.: M. J. Connelly Constr. Co., $8,031; Kirchner Constr. Co., $9,062; A. J. Henkel, $9,142, and J. E. Mahoney, $9,523.

Warren, O.—It is stated that bids will be received until Nov. 28 by the Bd. Co. Infirmary Dirs. (John B. Lewis, Chmn.) for constructing a tile drain system.

Xenia, O.—See "Power Plants, Gas and Electricity."

Dayton, O.—Bids will be received until Dec. 4 by the Bd. Pub. Service (T. M. Pexton, Pres.), for constructing sanitary sewers in part of Dist. No. 3, North Dayton, requiring 70,050 ft., 6 to 15-in. vitrified pipe sewers, 68,250 ft. trench and back fill 6 to 28 ft. deep, 80 lamp holes, 75 flush tanks, flush tank connections, repaving 1,500 sq. yds. brick pavement, 100 sq. yds. asphalt, 6,000 lin. ft. boulder repaving, c. i. pipe and specials, etc.

Stillwater, Okla.—It is stated that bids will be received until Dec. 3 by the City Clk. for $60,000 sewer bonds.

Pawhuska, Okla.—See "Power Plants, Gas and Electricity."

Norristown, Pa.—We are informed that $60,000 will be expended for pipe and concrete sewers. S. Cameron Corson, Boro. Engr.

New Cumberland, Pa.—The Town Council is reported to be considering the question of constructing a sanitary sewerage system.

Prairie View, Tex.—Press reports state that the Bd. of Directors of the Agricultural and Mechanical College will soon receive bids for a sewer system at the Prairie View Normal School, to cost about $5,000. C. E. Andrew, of College Station, Tex., is Secy. Bd. of Directors.

Cameron, Tex.—The City Council is reported to have selected N. Werenskiold, of Dallas, to prepare plans for a system of sewers.

Seattle, Wash.—Rich & Harris Constr. Co., Mutual Life Bldg., has secured the contract for constructing sewer in Kilbourne St. for $13,533. Smith & Hall, Downs Blk., bid for this work $15,947, and Hans Federson, 501 Fairview Pl., $17,045.

Bids will be received by the Bd. of Pub. Wks. (C. B. Bagley, Secy.) until Nov. 23 for constructing a sewer in Railroad Ave., estimated to cost $2,900, and a sewer in Columbia St., at a cost of $9,000.

The Bd. of Pub. Wks. is reported to have on Nov. 9 received bids on the North trunk sewer, lowest bidder being Jas. Black Masonry & Con. Co., $993,036, and North 39th St. sewer, lowest bidder H. F. John & Co., $56,943, both being considered too high.

Green Bay, Wis.—It is reported that bids will be received until Nov. 27, by the Com. on Sewers and Plumbing of Common Council, for construction of a 12-in. vitr. pipe sewer in Grignon St. W. W. Reed, City Engr.

*North Milwaukee, Wis.—E. H. Klamp, Village Clk., writes that all bids opened on Nov. 11, for constructing septic tank 42-ft. diam., and 16 ft. deep, have been rejected. Engineer, W. G. Kirchoffer, of Madison.

Vancouver, B. C.—Wm. McQueen, City Clk., writes that it is proposed to extend the sewerage system to the unsewered districts of city. W. A. Clement, City Engr.

BRIDGES.

Notes Arranged Alphabetically by States.

*San Luis Obispo, Cal.—The County Bd. of Supervisors on Nov. 5, is stated to have awarded the contract for constructing a steel and concrete bridge over the Arroyo Grande Creek at Bridge St., to Atlantic Gulf & Pacific Co., 220 Market St., San Francisco, at $10,589.

Council Bluffs, Ia.—It is reported that bids will be received until Dec. 3, by W. C. Cheyne, Co. Aud., for constructing all bridges required by this county for one year, from April 1, 1908.

*Lehigh, Ia.—The contract for constructing a bridge over Des Moines River at Lehigh is reported to have been awarded to the N. M. Stark Bridge Co., of Des Monies, for $11,300. The structure to be 375 ft. long.

Wichita, Kan.—It is stated that bids were received for the construction of a concrete bridge across the drainage canal on Douglas Ave., as follows: Topeka Bridge & Iron Co., $11,975 and $10,975; Topeka Carthage Bridge Co., $11,890, and the Cement Stone & Supply Co., $11,850.

*Williamsport, Md.—We are informed that Coder & Miller, of Harrisburg, Pa., have secured the contract for constructing a reinforced concrete arch bridge of 15 spans over Potomac River for the Washington & Berkeley Bridge Co., (bids opened Nov. 13), for $123,660. Other bids received were: McGaw & Gray, Philadelphia, Pa., $186,940; Meigs & Hanford, Washington, D. C., $160,712; H. H. Geist, Baltimore, Md., $151,130; Alsop & Pierce, Newport News, Va., $136,376; E. G. Nave Bros., Portsmouth, O., $127,000. Engineer Mason D. Pratt, of Harrisburg.

Jackson, Minn.—It is stated that bids will be received until Dec. 10, by P. D. McKellar, Co. Aud., for constructing a 100-ft. steel bridge with approaches.

*Athens, Minn.—The County Comrs. are stated to have awarded the contract for constructing a bridge over the Rum between Stanford and Athens, to A. Y. Bayne & Co., of Minneapolis, at $5,235.

Ft. Benton, Mont.—It is reported that bids will be received until Dec. 2, by W. R. Leet, Co. Clk., for the construction of two bridges across Highwood Creek, near Bucklands.

Cincinnati, O.—Bids will be received until Nov. 29, by the Bd. Co. Comrs. (Fred Dreihs, Clk.), for repairing the suspension bridge over Whitewater River, Whitewater Township.

Cincinnati, O.—The City Council is reported to have instructed the City Engineer to prepare estimates for the construction of lift bridges over the Miami Canal at Elm, Vine, Main, Findlay and Liberty Sts.

Toledo, O.—F. I. Consaul, City Engr., is reported to have estimated the cost of repairing Cherry St. Bridge at a cost of $22,000.

Norwood, O.—Bids will be received at the office of the Bd. of Pub. Service (L. H. Gebhart, Clk., until Dec. 14, for furnishing material and constructing substructure of viaduct over the B. & O. S. W. Ry. and Section Ave., as advertised in The Engineering Record. Engineer, Jas. A. Stewart, 712 Traction Bldg., Cincinnati.

Bethlehem, Pa.—The construction of a bridge at Broad St. is reported contemplated.

Webster, Pa.—The following bids are reported opened Nov. 8 by the Comrs. of Westmoreland County and the County Comrs. of Washington County at Greensburg for the construction of a joint bridge over Mohongahela River between Webster and Donora. The superstructure to have 5 truss spans, 2 viaduct approaches with a roadway 25 ft. wide and length of structure 1,550 ft.: Franklin Bridge Co., $189,000; Toledo-Massillon Co., $190,000; American Bridge Co., $193,000; Chambersburg Bridge Co., $292,000.

Philadelphia, Pa.—See "Railroads."

Beaver, Pa.—The War Dept. is stated to have approved the plans for the Pittsburg & Lake Erie R. R. bridge to be constructed over the Ohio River, between Monaca and Beaver.

*Uniontown, Pa.—We are informed that the Penn. Bridge Co., of Beaver Falls, has secured the contract for constructing bridge over Monongahela River at Uniontown.

River Falls, Wis.—Bids will be received until Dec. 5, by Allen P. Weld, City Clk., for constructing a steel truss bridge at the Cedar St. crossing of the Kinnickinnic River, to be 140-ft. long, concrete floor 20-ft. wide, cement sidewalks, 5-ft. wide and abutments.

Menominee, Wis.—The Special Bridge Committee is reported to have submitted a favorable report to Common Council for the construction of a bridge over the Red Creek River below the dam.

Superior, Wis.—The Northern Pacific Ry. bridge located at Superior, is reported destroyed by fire. W. L. Darling, Ch. Engr., St. Paul, Minn.

Brandon, Man.—W. H. Shillinglaw, City Engr., writes that it is proposed to construct reinforced concrete bridge of three 90-ft. spans, and two 60-ft. spans, with 24-ft. clear roadway and provision will be made for street car traffic.

Carman, Man.—A. Malcomson, City Secy.-Treas., writes that all bids opened on Nov. 8, by the Bd. of Pub. Wks. for the construction of a 90-ft. Pratt truss steel bridge with 18-ft. roadway, concrete abutments, across Boyne River, near Carman, have been rejected, all being above the estimate.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Decatur, Ala.—The City Council is reported to have passed an ordinance providing for the construction of about 7 miles of concrete sidewalks on Pon, Oak Canal, Cain, Market and Cherry Sts.

*San Francisco, Cal.—C. L. Harney is reported to have secured the contract for repairing a portion of East St. with asphalt blocks for $12,625.

*The contract for repairing the roadway on Center St. is reported to have been awarded to Eureka Constr. Co. at $7,302.

Santa Monica, Cal.—See "Sewerage and Sewage Disposal."

Denver, Colo.—The Park Comrs. are stated to have decided to construct a boulevard from William to High St., connecting Congress Park and the Country Club.

Ansonia, Conn.—The macadamizing of a portion of N. Main St. is reported contemplated.

Collinsville, Ill.—The Council is reported to have under consideration the paving of certain streets, probably with brick. Jas. E. Simpson, City Clk; J. L. R. Wadsworth, Mayor.

Ottawa, Ill.—It is stated that bids will be received until Nov. 27, by the Bd. Local Improv., for constructing 41,000 sq. yds. brick pavement, with granitoid curbs, etc.

Peoria, Ill.—The Bd. of Local Improvements is stated to have recommended that Glen Oak and S. Glendale Aves. be paved with brick.

Rock Island, Ill.—The Tri-City Constr. Co., 2422 7th Ave., is reported to have secured the contract for paving portion of 25th St. with brick and asphalt at $5,600.

Edwardsville, Ill.—The paving of S. Fillmore St. with brick is reported contemplated at a cost of $15,000.

Lebanon, Ill.—The paving of St. Louis St. is reported contemplated.

Crawfordsville, Ind.—Plans and specifications are stated to have been completed and bids will soon be received for the paving of Walnut, College and Water Sts. with brick.

Bedford, Ind.—The citizens of Mitchel Township are stated to have voted to issue a tax of $30,000 for the construction of a macadamized road. According to reports bids will be received by Bd. of Comrs.

Anderson, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Dec. 12, for the constructing 9,140 ft. free gravel road. Jas. Kinnard, Co. Aud.

Martinsville, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Dec. 2, for the constructing 8,165 ft. gravel road, known as the Jones Rd., Jackson Township. E. E. Thornburg, Co. Aud.

Columbus, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Dec. 2, for constructing 7,942 ft. free gravel road in Clifty Township. John M. Davis, Co. Aud.

Hartford City, Ind.—It is reported that bids will be received until Dec. 4, by the Comrs. of Blackford County for the construction of the Bugh macadam road in Washington Township, about 15,810 ft. in length. L. W. Daugherty, Co. Aud.

Portland, Ind.—Bids will be received until Dec. 3 by the Bd. Co. Comrs., for grading, draining and graveling 2 roads in Noble Township, to be 10,333 and 5,280 ft., respectively. W. Lea Smith, Co. Aud.

New Orleans, La.—Specifications are reported prepared for the paving of a portion of Soniat St., with asphalt.

Providence, La.—Bids will be received until Dec. 17 at the office of T. J. Powell, Mayor, for paving and curbing about 4 miles of sidewalks.

Jackson, Mich.—We are informed that bids will probably be received in Jan. for paving W. Main and 1st Sts. A. W. D. Hall, City Engr.

Cadillac, Mich.—The City Clerk is reported to have been instructed to receive bids for paving with brick, bitulithic and concrete 23,888 sq. yds.

St. Peter, Minn.—Bids will be received until Nov. 29 by the Bd. Co. Comrs., for grading and graveling the State Road in the towns of Traverse, Bernadotte and Lake Prairie. A. H. Freeman, Co. Aud.

Bemidji, Minn.—It is reported that bids will be received until Dec. 3, by John Hillmann Co. Aud., for constructing a county road.

Kansas City, Mo.—Bids will be received until Nov. 27, by the Bd. of Pub. Wks., for constructing asphalt pavements on portions of numerous streets. E. A. Harper, City Engr.

Billings, Mont.—Bids will be received by the City Council until Feb. 4, for paving with slate brick certain streets in Special Improv. Dist. No. 21; also same date for macadamizing, draining and building cement gutters in Special Improv. Dist. 20; both proposals advertised in The Engineering Record. J. D. Matheson, City Clk.

Atlantic City, N. J.—Bids will be received by the City Clk., until Nov. 25 (change of date from Nov. 11), for repaving Pacific Ave. and constructing drainage conduits, to include 23,500 sq. yds. asphalt paving, 1,040 lin. ft. bluestone heading, stone and a drainage system complete, consisting of 25 lines of conduits, including new vitr. fire clay block gutters upon concrete around 50 curved corners at end of conduits, as advertised in The Engineering Record.

Falconer, N. Y.—The Bd. of Supervisors of Chautauqua County is stated to have passed a resolution providing for the construction of a state road from Falconer to Levant, at a cost of $11,500.

Riverhead, L. I., N. Y.—The Bd. of Supervisors on Nov. 13, is stated to have adopted a resolution favoring the improvement of the Onogue-Riverhead Road under the state aid plan. This road is 7.69 miles long and will cost $81,600. It was also voted to proceed with the work of having the Amityville-Babylon road improved under the same plan. This road is 3.82 miles long, and will cost $37,700.

*Long Island City, L. I., N. Y.—The Barber Asphalt Paving Co., 114 Liberty St., New York City, is reported to have secured the contract for paving with asphalt block Onderdonk Ave., Ridgewood Heights, for $10,661.

Brooklyn, N. Y.—Bids will be received until Dec. 4 by Bird S. Coler, Boro Pres., for regulating and repaving with asphalt portions of several streets, including Engert, Irving, Morgan and Prospect Aves., Kossuth Pl., Skillman and Ten Eyck Sts. Engineer's estimate, 35,650 sq. yds. asphalt, 13,365 lin. ft. new curb, set in concrete, etc.

New York, N. Y.—The lowest bid opened on Nov. 7 at the office of the Pres. of Manhattan Boro. for regulating and repaving with asphalt on concrete foundation Madison Ave. from 23d to 32d St., was submitted by the Sicilian Asphalt Co., 41 Park Row, as follows: 11,000 sq. yds. asphalt pave. including binder course, $1.35; 1,000 cu. yds. concrete, $5.50; 1,750 lin. ft. new bluestone curb, 90 cts.; 200 lin. curb, 40 cts.; 37 noiseless covers, complete, for sewer and water manholes, ea. $20; total, $22,745. Totals of other bids: Barber Asphalt Co., 114 Liberty St., $24,465, and Uvalde Asphalt Co., 1 Broadway, $29,295.

Items marked thus give the names of parties awarded contracts.

The lowest bid opened on Nov. 7, at the office of the Pres. of Manhattan Boro. for regulating and repaving with granite block on concrete foundation roadway of 10th Ave., from Little W. 12th St., to 23d St., was submitted by John E. Quinn, of Brooklyn, at the following bid: 15,914 sq. yds. granite block pave, with paving cement joints, $2.44; 15,914 sq. yds. old stone blocks, to be purchased by contractor and removed, 7 cts.; 3,054 cu. yds. concrete, $5.10; 4,770 lin. ft. new bluestone curb, 78 cts.; 100 lin. ft. old bluestone curb, reset, 50 cts.; 17 new sewer manhole heads and covers, $14; 13 new water manhole heads and covers, $20; 7,130 sq. ft. new granite bridgestone, 70 cts.; total, $62,540. Totals of other bids: Sheehan Constr. Co., $63,570; Republic Constr. Co., 180 Broadway, $64,977; George & Farrell, Brooklyn, $65,617; Atlanta Constr. Co., 432 E. 91st St., $64,370; Jas. Quinn, Jr., $62,825.

The following are the bids opened on Nov. 14, by the Park Board for furnishing and constructing material, granolithic and brick sidewalks and granite curb on concourse and approach to Baird Court, in the New York Zoological Park, in Bronx Park: Bart Dunn, $17,254; Kelly & Kelley, Inc., $15,933; John B. Malatesta, $13,699; Michael Marrone, $17,975; W. H. Masterson, $18,427; McHarg-Barton Co., $17,700; Murray Contr. Co., Inc., $17,484; John V. Schaefer, Jr., & Co., $15,360; Thompson & Kelsey, $18,400.

Steubenville, O.—Bids will be received, it is reported by the Bd. Pub. Service (T. W. Vance, Clk.), until Dec. 16, for paving a portion of Market St.

Cincinnati, O.—The Bd. of Pub. Service is reported to have passed resolutions providing for the paving of Glendora Ave. and Lyons St. with brick and York St. with asphalt; probable cost, $28,918.

Portsmouth, O.—It is stated that bids will be received until Dec. 2 by Filmore Musser, City Clk., for $7,000 street improvement bonds.

Ironton, O.—See "Water."

Trenton, O.—See "Sewerage and Sewage Disposal."

**Canton, O.*—W. E. Sarver, City Engr., writes that the contract for paving Navarre St., 22,800 sq. yds. (bids opened Sept. 3), has been awarded to Wise, Wise, Smith & Sbekels, of Canton, O., for $37,459.

Boyertown, Pa.—The Town Board is stated to have directed that plans and estimates be prepared for paving several streets, at a cost of $28,000.

Norristown, Pa.—We are informed that about $140,000 will be expended for paving. S. Cameron Corson, Boro. Engr.

**Memphis, Tenn.*—M. Larkin is reported to have secured the contract for paving with brick, Orleans St., at $23,030.

Seattle, Wash.—The Bd. of Pub. Wks. is stated to have rejected all bids opened for grading 31st Ave. and 40th St., paving Madison St., and constructing concrete walks on 2d Ave., north and 23d St. north.

*The Bd. of Pub. Wks. on Nov. 12, awarded contracts as follows: To E. H. Rawle & Co., for concrete walks on E. Olive St., $10,791; Smith & Hall, Downs Blk., concrete walks, sewers, etc., on Phinney Ave., $5,592; also same contractors for concrete walks on Brooklyn Ave., $3,556; and to Hans Pederson, 501 Fairview Ave., concrete walks on Meridian Ave., at the following bid: Fixed estimate, $3,400; earthwork, 6,500 cu. yds., at 25 cts. per cu. yd.; crosswalks, 183 M. ft. $22; concrete walks, 47,790 sq. yds. $1.15; alley crossings, concrete, 71 sq. yds. $1.40; 2 catch basins, 2 inlets, $90 ea.; 4 catch basins, 1 inlet, $80 ea.; 3-in. sewer pipe, 10,000 lin. ft., 15 cts.; total, $66,109. Andrew Peterson, 410 Washington Bldg. bid for this work, $67,311, and MacAdam & Co., Grand Union Hotel, $68,460.

Bids will be received by the Bd. of Pub. Wks. (C. B. Bagley, Secy.), until Nov. 23, for grading and regrading 15th Ave. W., and planking same; estimated cost $89,000.

West Salem, Wis.—The County Bd. of Supervisors at La Crosse, is stated to have passed a resolution appropriating $8,500 toward the construction of a highway between West Salem and Mindoro.

Hamilton, Ont.—We are informed that the proposed road to be constructed from the Jolley Cut to head of Victoria Ave. will cost about $50,000. Plans and estimates not yet made. E. E. Barrow, is City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Coosa River Electric Power Co. (Roswell H. Cobb, Pres., Birmingham), is reported to have under consideration the development of power at Ten Island Shoals on Coosa River about 48 miles from Birmingham.

Hot Springs, Ark.—Press reports state that Atwood Benton, of Kansas City, Mo., will construct an electric light plant here to be complete April 1.

Vallejo, Cal.—See "Miscellaneous."

Needles, Cal.—Carl F. Schrader is reported to have petitioned the Bd. of Super. at San Bernardino, for a franchise for an electric light system and gas plant for Needles. It is stated that he will obtain electric power from the Victor & Virgin Mining Co. and will construct a gas plant.

Moscow, Idaho.—The City Council is reported to be considering the question of constructing a municipal electric light plant.

Marengo, Ill.—Stearns & Schuster, of Rockford, are reported to have received franchise for an electric light plant.

Vincennes, Ind.—It is reported that the Black Hawk Light, Heat & Power Co., recently incorporated with a capital of $1,000,000, will soon ask for bids for the construction and equipment of gas and electric light plants; also for laying gas mains. H. C. Bauer and H. M. Gentry, are among the directors.

Lafayette, Ind.—Bids will be received by the Bd. of Pub. Wks. at the office of L. H. Andress, Jr., City Clk., until Dec. 20, for the electrical lighting of the streets, alleys and other places of the city for a period of 10 years from Sept. 1, 1908, as advertised in The Engineering Record. R. H. McGrath, Chairman Bd. Pub. Wks.

**Kokomo, Ind.*—W. T. Meck, City Clk., writes that the contract for lighting the city (bids opened Nov. 8) has been awarded to the Kokomo, Marion & Western Traction Co., of Kokomo.

Baltimore, Md.—Local press reports state that all bids opened on Oct. 23 by the Bd. Awards, care J. Sewell Thomas, City Register, for furnishing, installing, equipping, maintaining and operating gasoline or naptha street or outdoor lamps, with the use of incandescent mantle fixtures have been rejected and new bids will probably be called for.

Newtonville, Mass.—See "Schools."

Owosso, Mich.—The Owosso Light & Power Co. is reported organized with E. M. Hopkins, of Detroit, Pres., and Frank Wescott, of Owosso, Treas. The company proposes to build a dam 500 ft. long and 30 ft. high at a point on Shiawassee River, 2½ miles north of city. The dam will close the outlet of a body of water containing about 10 acres and this head of water will be used to generate electricity, for the proposed Grand Rapids-Pontiac electric line, and for light and power in Owosso.

Glenwood, Mich.—The owners of the Glenwood electric light plant contemplate installing a new 220-h-p. engine. H. Peterson, secy.

Faribault, Minn.—F. C. Nelson, of St. Paul, is reported to have purchased the plant of the Polar Star Electric Co., and will make improvements to same.

Sauk Rapids, Minn.—The city is reported to considering the installation of a pole line for a street lighting system and securing power from the water works plant of John M. Brown.

Natchez, Miss.—An ordinance is reported to have been introduced in Council authorizing the Municipal Water Works Comn. to get figures on cost of adding an electric light plant to the water works for street lighting.

Chinook, Mont.—Bids will be received until Dec. 21 by John C. Duff, Town Clk., for constructing a system of electric lights.

Elmer, N. J.—We are informed that the Union Railway Constr. Co., of Philadelphia, Pa., proposes installing a gas plant at Elmer.

Lockport, N. Y.—At a meeting of Common Council on Nov. 11 a petition was received from the International Power & Transmission Co., by W. W. Higgs, as secy., applying for permission to enter the city with its power lines from the west side and furnishing several industries in the corporation with light, heat and power.

Xenia, O.—The Trus. of the Ohio Soldiers' and Sailors' Home at Xenia, in their annual report filed with the Governor on Nov. 17, ask for an appropriation of $100,000, with which to install a complete new power plant and sewage system.

Newburgh, O.—Bids will be received until Dec. 5 by the Bd. Pub. Service (Wm. H. Jentzen, Clk.), for furnishing, lighting, extinguishing and keeping in repair, including the furnishing of gas and gasoline, and all material necessary therefore, 140 street lights for a period of 1 year.

Cleveland, O.—Local press reports state that as soon as the franchises pending before Council are ratified the Cuyahoga Light Co. will proceed to erect four more power plants in downtown sections of the city. John C. Keys, Pres.

New Bremen, O.—A. M. Steinebrey, Village Clk., writes that the citizens on Nov. 12, voted to issue $20,000 bonds for an electric light plant. Engineer, A. W. Fischbaugh, of Celina.

**Pawhuska, Okla.*—W. W. Cook & Son, of Muskogee, Ind. Ter., are reported to have secured the contract for constructing water works, sewers and an electric plant, for about $100,000.

Norristown, Pa.—We are informed that about $20,000 will be expended for the improvements to the electric light plant. Geo. W. Kite, Secy. Electric Comn.

Panama.—Bids will be received until Dec. 13 at the office of Lieut. Col. H. F. Hodges, Corps Engrs. U. S. A., Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing motor generator sets, switchboard, electric switches and fuse block, electric fans, steel plates and angles, lumber, repair parts for steam shovels, driving wheel tires and centers for locomotives, etc., as per circular, No. 403.

Philadelphia, Pa.—It is reported that the Equitable Electric Power Co. has secured a charter for the lighting of houses by electricity. It also hopes to enter the Pittsburg field. Jas. Collins Jones, Bullitt Bldg., is counsel for the company. I. C. Splane, of Pittsburg, and Geo. R. Sheldon, of New York, N. Y., are also reported to be interested. It is said that the power plant of the Philadelphia & Western R. R. Co., at Cobb's Creek may be used in connection with the Equitable Co.

Ridgeville, S. C.—There is reported to be a movement on foot here looking to the construction of water works, also an acetylene gas plant.

Anderson, S. C.—The stockholders of the Savannah Power Co., which company owns several shoals and power plants on Savannah River, is reported to have passed resolutions authorizing the directors of the company to transfer all property over to the Georgia-Carolina Power Co. The latter company was formed several months ago with a capital of $8,500,000, and is merging many companies on the Savannah and Tugaloo Rivers. The company will develop between 125,000 and 150,000 h. p. H. A. Orr, of Anderson, is president.

Aberdeen, S. D.—The Wagner, Lake Shore & Armour Traction Co. is reported to have secured a franchise in this city and intends to organize a new company to carry on the operations here. It will be known as the Aberdeen Light and Power Co. and will have a capital of $200,000. Representatives expect to begin building operations before the close of the present year.

Mitchell, S. D.—The Mitchell Illuminating & Power Co. is reported incorporated with a capital of $100,000 and will put in a water gas plant to supplant the acetylene plant. The electric light plant will be overhauled. The company agrees to furnish incandescent lights at 10 cts. per thousand watts.

Bristol, Va., Tenn.—We are informed that the Fish dam development, near Bristol, Tenn., of which Chas. Hansel, 43 Exchange Pl., New York, N. Y., is engineer, has not yet been financed. The matter of construction has also been deferred for the present.

South Pittsburg, Tenn.—D. A. Tate is reported to have purchased the city electric light plant, and will make improvements to same.

Chattanooga, Tenn.—The Chattanooga Electric Co. is reported to have decided to install a 1,500-kw. turbine generator.

Beaumont, Tex.—See "New Industrial Plants."

Ft. Worden, Wash.—See "Public Buildings."

Toronto, Ont.—Local press reports state that various plnas and estimates for a municipal plant for the distribution of electric power were submitted at a conference at the Mayor's office on Nov. 15 between the city officials, the Hydro-Electric Power Comn. and the engineering experts. There were seven schemes presented at the conference, ranging from $1,775,000 to $5,250,000. Three plans were presented by W. G. Chase, of the engineering firm of Smith, Kerry & Chase; the other plans were from the engineers of the Hydro-Electric Power Comn. If one of these estimates is selected the citizens will be asked to vote on Jan. 1 on the question of issuing bonds for same.

Woodstock, Ont.—Chief Engineer Richards is reported to have forwarded his estimate of cost of distributing power in Woodstock, which he figures will cost about $18,000.

Galt, Ont.—Chief Engineer Richards, of the Hydro-Electric Power Comn. is reported to have estimated the total cost of a distributing plant for manufacturers of this city at $46,195; cost of plant for street lighting $16,583 and for a private service, giving 500 lights, $18,000 to $19,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—The Nelson Investment Co. is reported organized, with a capital of $100,000, to build an interurban electric line between Ft. Smith and West Fort Smith, a distance of about 10 miles.

San Mateo, Cal.—The right-of-way for the Peninsular Electric R. R. is reported secured from San Mateo to Stanford Univ. A. W. Bell, of Palo Alto, is reported interested.

Denver, Colo.—The Intermountain Ry. Co. is reported incorporated and contemplates electrifying the recently purchased Denver & Intermountain R. R. between Denver, Lakewood and Golden: Capital, $1,000,000. Incorporators: T. J. Milner, Caldwell Yeaman, Frank Loveland and Thos. B. Doran, all of Denver. At present the road uses electric power as far as Denver city limits and steam power for the remainder of the distance to Golden.

Smyrna, Del.—The Smyrna, Kent County & Delaware Bay Traction Co. is stated to have secured the right-of-way through New Castle County with 1½ miles of Delaware City, and they expect in a short while to begin the construction of an electric railway. A power house will soon be constructed at St. George's.

Albia, Ia.—The Albia Electric Light & Power Co. is contemplating the installation of a 200-kw. General Electric generator, for railway service, a 200-hp. Ball engine, and the construction of 4½ miles of track; also the purchase of four cars, 25-hp. motors and two trailers. W. E. Gant, mgr.

Minneapolis, Minn.—The Minneapolis, Rochester & Dubuque Traction Co., F. G. L. Hunt, Ch. Engr., is reported taking bids for grading between Savage and Northfield.

Forest City, Mo.—An application is stated to have been made to Secretary of State Swanger for a certificate of incorporation by the Oregon Interurban Ry. Co., of Oregon, with a capital of $60,000. The company proposes to build a standard-gauge road, operated by electricity, from Oregon to Forest City, a point on the Kansas City, St. Joseph & Council Bluffs Road, a distance of 6 miles. Incorporators: Benj. F. Morgan, Lewis L. Moore, Chas. D. Zook, Wm. Derr, Henry C. Cook, Wm. H. Richards and Daniel Zachmann.

Kansas City, Mo.—The County Court is stated to have confirmed the granting of the right-of-way of the Blue Valley Railroad to operate an electric line on the Blue Ridge Road, 49th and Swope Park highway, to a point east of the Blue River. Alex Massey, Pres.; Jos. S. Chick, Secy. and Treas.; D. W. Pike, Ch. Engr.

Kansas City, Mo.—The City Council is stated to have approved an ordinance authorizing the Metropolitan St. Ry. Co. to extend its 27th St. line from Cleveland St. to Jackson Ave.

Ely, Nev.—William B. Thompson is reported to have petitioned for a franchise to construct and equip an electric railway between the depot at Ely City to the town of Ely.

East Las Vegas, N. M.—The first long-distance electric railway in New Mexico is stated to have been decided upon and location will be started soon. W. A. Buddecke, of Las Vegas, promoted the enterprise, and $80,000 of the $100,000 necessary has been raised. The line will be the Las Vegas-Mora-Taos Electric Ry.

Port Chester, N. Y.—The Public Service Comn. is stated to have granted permission to the New York & Stamford Ry. Co. to double track its line in Larchmont, Rye and Port Chester.

Winston-Salem, N. C.—The Carolina Valley Ry. Co. (Dee Allen, Pres.), which proposes to build an electric railway between High Point and Winston-Salem, is stated to have made an application for a franchise to construct its lines in Winston-Salem. The line will enter the city from East Winston.

**Columbus, O.*—J. T. Adams, of Columbus, is reported to have been awarded the contract for rail laying and ballasting on the Lima-Bellefontaine Division of the Shoepf traction lines.

**Items marked thus give the names of parties awarded contracts.*

Tecumseh, Okla.—A charter is stated to have been granted the Rapid Transit Interurban Co., with headquarters in Tecumseh and with $2,500,000 capital, to build an electric interurban line from Muskogee southwest 137 miles, via Tecumseh to Chickasha, with a cross line provided northwest from Tecumseh 55 miles to Guthrie, and south from Tecumseh 55 miles to Sulphur, a total distance of 277 miles, to be constructed at an estimated cost of $2,500,000. Incorporators: John A. Clark, S. B. Mitchell, J. W. Saxon, G. M. Cissna, T. J. Ray and M. H. Tennison, all of Tecumseh.

Philadelphia, Pa.—The agreement of consolidation and merger of the French Point St. Ry. Co., the Ecobridge St. Ry. Co. and the Ambridge & Baden St. Ry. Co. into the Ambridge & Baden Ry. Co., with a capital of $48,000 has been filed at the State Department, Harrisburg. James D. Callery, pres.; W. B. Carson, sec.; C. J. Brun, Jr., treas. The line will extend from the Pittsburg, Ft. Wayne & Chicago R. R. on Marchant St., Ambridge, over certain streets in Ambridge, to the Allegheny County line and to Baden, and will be 6.05 miles long.

Johnstown, Pa.—The Johnstown Electric Ry. Co., of Johnstown, is reported incorporated with a capital of $50,000 by John B. Morgret, E. V. Remington, Chas. M. Moses, of Johnstown, Pa.

**Wolla Walla, Wash.*—Articles of incorporation of the Washington-Oregon Traction Co. are reported filed. Capital, $1,500,000. The company is to operate in Oregon and Washington and Idaho, and in addition own and operate steamships and control water rights. The incorporators are Max Baumeister, Allen H. Reynolds, Samuel Drumbelier, C. K. Holloway, John Smith, W. A. Ritz, E. S. Isaach and J. L. Sharpstein. The construction will be commenced within a year on at least 75 miles of electric line operating out of Walla Walla. Power will be secured from the Wenaha River about 25 miles from Walla Walla. Power will also be furnished for manufacturing enterprises.

Cobalt, Ont.—C. M. Stone, M. J. O'Brien, Frank Latchford and others are stated to have secured a franchise from the municipalities for an electric line from Cobalt to Haileybury.

RAILROADS.

Notes Arranged Alphabetically by States.

Denver, Colo.—See "Electric Railways."

Kansas City, Kan.—The Gulf Short Line R. R. Co. is reported chartered at Guthrie, Okla., to build a railroad from Kansas City, Kan., to Port Lavaca, Tex., about 1,500 miles. Incorporators: J. P. Byrne and Louis E. Potts, of Oklahoma City, Okla., Fred A. Jeran, La Junta, Colo., and others.

Ashland, O.—Press reports state that work will probably be started in the spring on the construction and extension of the Lorain & Ashland R. R., 63 miles south from Ashland. Jos. Ramsay, Jr., formerly president of the Wabash R. R. Co. is reported interested.

Oklahoma City, Okla.—The International & Great Southern R. R. Co. is reported incorporated, with $60,000 capital, and headquarters at Oklahoma City, to build southwest from Joplin, Mo., via Webber Falls, Ind. Ter., to Galveston, Tex., and with branch lines provided from Webber Falls to Ft. Worth, Tex., and to El Paso, Tex., a total mileage of 2,000 miles. Incorporators: Geo. Silsby, of Saginaw, Mich.; L. E. Patterson, C. T. Williams and S. C. Glasgow, of Oklahoma City, and others.

Guymon, Okla.—The Oklahoma, Colorado & Pacific Ry. Co. is reported incorporated, with headquarters at Oklahoma City and Guymon, with $18,000,000 capital stock, to build a distance of 600 miles northwest from Oklahoma City to Trinidad, Colo., and crossing the Oklahoma Counties of Oklahoma, Logan, Canadian, Kingfisher, Garfield, Woods, Woodward and Beaver; across Union County in New Mexico, and the Counties of Las Animas and Pueblo in Colo. Incorporators: Edgar Turner, of Turney, Okla.; M. G. Wiley, of Guymon; H. P. Ladd, of Oklahoma City, and others.

Lawton, Okla.—The Kansas, Lawton & Gulf R. R. Co. is reported incorporated, with a capital of $5,000,000 and principal office in Lawton; the company proposes to construct a line 250 miles in length from the northern boundary of Woods County, terminating near the southeast corner of Comanche County. Incorporators: J. Robinson, of Frederick; J. M. Belamy, Chas. G. Shade and F. P. Cease, of Lawton.

Philadelphia, Pa.—Bids will be received until Dec. 17 by W. Hunter, Ch. Engr., Phila. & Reading R. R. Co., 520 Reading Terminal, Philadelphia, for the construction of the work appurtenant to the abolishment of grade crossings on the P., G. & N. R. R. as follows: Contract No. 5—Masonry, trestle and embankment from south side of Berks St. to south side of Susquehanna Ave. Contract No. 7—Masonry, trestle and embankment from south side of Susquehanna Ave. to Broad St. Contract No. 8—Bridges from Berks St. to Broad St. Contract No. 14—Masonry, embankment and paving for yards bet. York St. and Cumberland St., and Contract No. 26—Temporary engine yard at Wayne Junction.

Fairmount, W. Va.—A charter has been granted to the Alleghany Coal R. R. Co. to construct a railroad from Fairmont or some point near Fairmont, on the Baltimore & Ohio R. R., which road will be used as an outlet, through Marion, Harrison, Lewis and Gilmer Counties, W. Va. The road will be built as a coal road; capital $5,000,000. Principal office of the company is at 1 Bway, New York, N. Y. Incorporators: Granville M. Dodge, Adolph Leirinshon and Uriah Herman, all of New York, N. Y., and Fairfax S. Landstreet and Harry Smith, of Baltimore.

Big Horn, Wyo.—The Wyoming Short Line R. R. Co. is reported incorporated with a capital of $2,500,000 to build a standard railway from Wiley in the Big Horn basin through Greybull and Germania to the eastern boundary of Yellowstone Park, about 50 miles. It is reported as being backed by the Big Horn Development Co.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Bay Minette, Ala.—Bids will be received until Dec. 9, by the Bd. Co. Comrs., at Dapline, for constructing water works and closets for the county court house and building fence around said court house. J. H. H. Smith, Judge of Probate.

Alaska.—Bids will be received at the office of the Light House Engineer at Portland, Ore., until Jan. 14 for furnishing material and erecting Hinchinbrook entrance light station, Alaska, as advertised in The Engineering Record.

Berkeley, Cal.—J. V. Mendenhall, Town Clk., writes that bids will be received until Dec. 9, for the erection of a town hall; it will be of concrete and steel and cost about $100,000. Architects, Bakewell & Brown, 417 Montgomery St., San Francisco.

Anaheim, Cal.—It isreported that competitive plans are being prepared for a Carnegie Library.

Oakland, Cal.—The City Council is reported to be in favor of calling an election to vote on issuing $1,450,000 bonds for the erection of a city hall.

Los Angeles, Cal.—Bids will be received, it is stated, until Dec. 9 by the Bd. Co. Superv., for remodeling steam heating plant of the physicians' residence, administration building, wards 5 and 6, surgical and insane and consumption wards at the county hospital. C. G. Keyes, Co. Clk.

Colorado Springs, Colo.—T. P. Barber, Bank Bldg., is said to be preparing plans for the Deaconess Hospital to be erected on E. Boulder St., of brick, 4 stories high, and cost about $50,000.

Atlanta, Ga.—Whitfield & King of New York, N. Y., are reported to have been engaged to prepare plans for the branch library which is to be erected in the 5th Ward.

Chicago, Ill.—Bids will be received until Dec. 9 at the office of the Comdg. Officer, 16th St. and Michigan Ave., for erecting an armory for the 7th Regt., I. N. G., probable cost $300,000. W. Carbys Zimmerman, State Archt., 1101 Steinway Hall.

Peoria, Ill.—The Secy. Trus. of Illinois General Hospital for Insane writes that Wm. Allen, Son & Co., of Peoria, have secured the contract for erecting two buildings (bids opened Nov. 6), for $82,452.

Josonville, Ind.—The Local Miner's Assoc., it is reported, is planning the erection of a union hospital here.

Richmond, Ind.—The Co. Bd. is said to be arranging to erect a jail.

Terre Haute, Ind.—The Co. Comrs., it is reported, will receive bids until Dec. 14 (readvertisement) for erecting the jail, for which there is available $125,000.

**Parsons, Kan.*—The State Bd. of Control at Topeka, it is reported, awarded the contract for erecting the administration building at the Parsons Hospital for Epileptics at Parsons (bids for which were received Nov. 11), to J. W. Prince, of Parsons, at $56,308.

Wichita, Kan.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., until Jan. 6, 1908, for the construction (complete) of the extension to the U. S. Post Office and Court House, at Wichita.

**New Orleans, La.*—The following are reported to be the bids received by the Finance Com. Nov. 11, for erecting an annex to the City Hall: Jefferson Constr. Co., $286,000; and $5,000 additional for a passenger elevator (recommended for award), and W. T. Carey & Bro., $276,000 and $5,000 additional for a passenger elevator.

New Roads, La.—Bids will be received until Nov. 26, by N. P. Phillips, Pres. Police Jury, Torras, for erecting a parish jail at New Roads. E. J. Hull, Archt., Alexandria.

**Portland, Me.*—The following are reported to be the bids received Nov. 5 by Capt. F. J. Morrow, Quartermaster, U. S. A., Portland, for the construction, plumbing, heating, electric wiring, electric fixtures, etc., of a double barrack building at Ft. Williams, and for a single barrack building at Ft. McKinley:

*Double barrack at Ft. Williams: Construction, Kennedy & Patterson, $77,035 (awarded contract); Smith & Rumery, $78,646; Charles B. Currier, $87,837. Plumbing: M. C. Hutchinson, 183½ Brackett St., $9,600 (awarded contract); A. L. Dow & Co., $10,394. Heating: A. H. Moulton, 75 Union St., $5,134 (awarded contract); Wm. A. Bowers, $5,566; Walworth Constr. & Supply Co., $2,585; M. C. Hutchinson, $6,200; English & Fleet, $6,792; Hurley & Co., $7,150. Electric wiring: T. W. Byrne, $1,209 (awarded contract); Lowell & Lowell, $1,400; York & Boothby, $1,403; LeBaron B. Johnson, $1,634. Electric fixtures: Lowell & Lowell, $525 (awarded contract); York & Boothby, $560; T. W. Byrne, $815; LeBaron B. Johnson, $1,006.

*Barrack at Ft. McKinley: Construction: Richd. D. Shanahan, 221 Franklin St., $40,007 (awarded contract); Smith & Rumery, $43,870; Chas. E. Currier Co., $48,963. Plumbing: M. C. Hutchinson, 183½ Brackett St., $4,200; A. L. Dow & Co., $4,606. Heating: A. H. Moulton, 75 Union St., $3,534 (awarded contract); Wm. A. Bowers, $3,575; Walworth Constr. & Supply Co., $3,992; M. C. Hutchinson, $4,000; English & Fleet, $4,287. Electric wiring: Thos. W. Byrne, $672 (awarded contract); York & Boothby Co., $780; Lowell & Lowell, $850; LeBaron B. Johnson, $1,178. Electric fixtures: Thos. W. Byrne, $330 (awarded contract); York & Boothby, $360; Lowell & Lowell, $400; LeBaron B. Johnson, $534.

Baltimore, Md.—Victor G. Bloede is reported to have offered to give $25,000 to erect an addition to the Eudowood Sanitarium for Consumptives provided the management of the inst. will raise a fund of $15,000 per year for its maintenance for 5 years.

*Thos. P. Johns, 405 McCulloh St., is reported to have secured the contract to erect a Jewish Home for consumptives near Reisterstown. Probable cost, $35,000.

The Bd. of Estimates, it is stated, has decided to remodel the Colored High & Training School into temporary quarters for the Central Police Station, the cost of the improvements to be about $15,000.

**Pittsfield, Mass.*—Later reports state that the contract to erect the armory on Summer St. has been awarded to Osteyee Bros. of Pittsfield at $44,655. It is reported that a number of sub-contracts will be let by the contractors this month.

Boston, Mass.—The erection of an immigrant station on Governor's Island to cost about $250,000 is reported under consideration by the Immigrant Dept. at Washington, D. C.

Flint, Mich.—D. E. Newcombe, City Clk., writes that bids will be received on Jan. 2 for the erection of a city hall, not including heating and lighting; cost between $65,000 and $75,000. Architects, Van Leyen & Schilling, Union Trust Bldg., Detroit.

**Collins, Miss.*—It is reported that the contract for the heating system for the court house has been awarded to Carr & Co., at $1,797.

Havre, Mont.—It is stated that W. R. Leet, Co. Clk., will receive bids until Dec. 2 at Chinook, for erecting a county poor house near Havre.

**Albion, Neb.*—The contract to erect the Carnegie Library, is reported awarded to Roberts & Parker, at $61,050.

Asbury Park, N. J.—We are informed that no bids were opened on Nov. 20 by the Public Grounds Com. (W. P. Sherman, Secy.) for the erection of a bathhouse, as the date of opening has been postponed for about 60 days or until the bonds are sold. Architect Clarence W. Brazer, 1133 Bway., New York, N. Y.

Albuquerque, N. M.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 3 for the construction of U. S. Post Office at Albuquerque, including plumbing, gas piping, heating apparatus, electric wiring and conduits, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received until Nov. 27, by Theo. A. Bingham, Police Comr., for furnishing material and making repairs to the heating systems of numerous police station houses in the Boros. of Manhattan, Bronx, Brooklyn and Queens.

The Bd. of Aldermen Nov. 20 passed a resolution appropriating $40,000 for a temporary eight and one-half story brick structure on the site of the old fire house, Center and Chambers Sts., in City Hall Park, for housing the additional City Court justices.

*J. H. Carl, 510 First Ave., has secured the contract for finishing certain rooms in the new Custom House, for $18,834.

The Mayor on Nov. 11 approved the ordinance appropriating $25,000 for the erection of a shelter house and comfort station in Van Cortlandt Park and erection of comfort station and shelter house in Macomb's Dam Park, Boro. of Bronx; also $75,000 for sites and construction of interior public baths in Boro. of Manhattan.

**Fulton, N. Y.*—Buell Bros., of Fulton, it is stated, have secured the contract to install a steam heating system in the City Hall.

Riker's Island, N. Y.—An ordinance providing an issue of $200,000 for securing an architect to prepare plans and specifications for new penitentiary buildings on Riker's Island was approved by the Mayor of New York City Nov. 11.

Cleveland, O.—It is stated that steps will be taken in the spring by the City of Cleveland to erect the workhouse at Warrensville. Probable cost of building $250,000. Chas. P. O'Reilly, Supt.

Youngstown, O.—Bids will be received until Nov. 25 by Will B. Jones, Co. Aud., for excavating the basement of the new court house to be erected at Market and Boardman Sts. Bids to be per yd.

Columbus, O.—Bids will be received until Dec. 4 by the Bd. Pub. Service (Edw. F. McGuire, Secy.), for furnishing material and enlarging and repairing the West Side Market house.

Columbus Barracks, O.—Bids received by Capt. H. J. Hirsch, Constr. Q. M., U. S. A., until Nov. 30, (readvertisement), for construction 2 double sets lieutenants' quarters (including electric wiring and fixtures), 1 quartermaster's storehouse, and 1 wagon shed at this post.

Oklahoma City, Okla.—It is reported that a home for the Confederate Soldiers of the State, to cost about $40,000, is reported under consideration. The location of the building has not yet been decided upon. Division Commander Brant H. Kirk may be able to give further information.

Claremont, Pa.—F. C. Sauer, 804 Penn. Ave., Pittsburg, is reported to be preparing plans for remodeling the present building and erecting an addition to the workhouse at Claremont.

Wilkesbarre, Pa.—The following are reported to be the bids received by the Co. Comrs. Nov. 11, for erecting a boiler house and prison wall at the Court House: John E. James, $24,937; Reese D. Isaacs & Son, $25,142; Geo. T. Dickover, $24,400; Carlucci Stone Co., $27,700; Standard Constr. Co., $26,770; Kehoe & Mowrey, $25,260; John A. Schmidtt, $22,544; E. T. Long, $27,853.

Ashland, Pa.—Competitive plans will be received until Dec. 4, by E. C. Wagner, of Girardville, Secy. State Hospital, for a Nurses Home to be adjacent to the hospital, near Ashland, cost not to exceed $10,000. A premium of $150 will be paid for the plans accepted.

Fairview, Pa.—The State Lunacy Comn. at Harrisburg, it is reported, has approved the plans for the State Hospital for the Insane to be erected at Fairview. Marshall Sherk of Philadelphia is the archt.

Homestead, Pa.—Bids will be received until Dec. 2, by Aud. Hill, Boro. Clk., for erecting a building at the garbage furnace, to have concrete foundations and steel frame covered with corrugated iron. Plans and specifications may be obtained from the Borough Engineer in Municipal Bldg.

Allentown, Pa.—Bids will be received until Dec. 3, by the Bd. Co. Comrs. (Adam E. Bittner, Chmn.), for erecting an addition to the Co. jail.

Pine Grove, Pa.—Benj. W. Demming, of Harrisburg, Secy. State Armory Bd., writes that all bids opened by the Armory Bd. at its meeting at Wilkesbarre on Nov. 14 for the erection of the Pine Grove Armory have been rejected, all being considered too high. The following are the totals of bids received: J. N. Bastress & Co., Harrisburg, $15,500; C. F. Seaman, Hamburg, $16,375; David Buffamoyer & Son, Lebanon, $14,875; Chas. Batdorf, Williamstown, $15,602, and Geo. W. Beard & Co., Reading, $16,111.

Pittsburg, Pa.—J. P. Shaw, Dir. Charities and Correction writes that the contract for erecting a kitchen and repairing a chapel at Marshalsea Station (bids opened Oct. 31) has been awarded to Wineland Constr. Co., Park Bldg., Pittsburg, for $11,850.

Items marked thus give the names of parties awarded contracts.

Philadelphia, Pa.—Philip H. Johnson, Land Title Bldg., is stated to have been engaged as the archt. for the House of Detention to be erected by the Co. Comrs. at 22d and Arch Sts. The cost of the building will be about $150,000 and about $20,000 additional will be needed for the equipment.

Pulaski, Tenn.—Bids will be received until Dec. 9, by the Co. Courthouse Bldg. Comn., for erecting a 2-story and basement, brick and stone, fireproof courthouse, probable cost $75,000. B. B. Smith, Archt., 22½ Perry St., Montgomery, Ala. G. H. McMillon, Co. Judge.

Austin, Tex.—Dr. B. M. Worsbam, Supt. State Insane Asylum, writes that the plans of C. H. Page, Jr., of Austin, have been selected for an addition to the asylum.

Tacoma, Wash.—It is stated that bids will be received until Dec. 2, by I. Jay Knapp, Archt. for construction of a steel frame conservatory to be built for the Metropolitan Park Dist., in Wright Park.

Ft. Worden, Wash.—Bids will be received until Dec. 2, by Lieut. Chas. C. Burt, C. A. C., Constr. Q. M. U. S. A., for constructing a 2-company barrack building at this post, and furnishing and installing fixtures and watt meters in the building for electric lighting.

Green Bay, Wis.—The County Bd. of Superv., it is stated, has adopted the report of the special building committee to accept the designs of C. E. Bell of Minneapolis, on the Court House and the designs of Soeller & Schoeber of this city on the jail. The Court House is to cost $230,000, and the jail $50,000. The jail will be built at once and the Court House later.

Barron, Wis.—The Co. Bd. of Superv., it is stated, has secured a site and intends erecting a brick county insane asylum adjoining the poor farm.

Chippewa Falls, Wis.—The following are the bids opened on Nov. 15 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Chippewa Falls: Hiram Ferge, Milwaukee, $73,098; Wm. Lister, Chippewa Falls, $70,409; Chippewa Falls Constr. Co., $67,506; Hanson Bros., Chicago, Ill., $84,688; C. W. Guidele Co., Chicago, Ill., $66,646; P. M. Hennessy Constr. Co., St. Paul, Minn., $66,300; J. W. Miller, St. Paul, Minn., $67,972.

**Casper, Wyo.*—It is stated that the contract to erect Natrona County Courthouse has been let to Schmidt & Esmay at $44,270.

Medicine Hat, Alta.—P. Burns, of Medicine Hat, is reported to have secured the contract to erect a 2-story red pressed brick and Calgary sandstone armory on Esplanade and 3d Ave. at $16,600.

Simcoe, Ont.—Bids will be received until Dec. 6 by Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, for erecting a public building at Simcoe.

Toronto, Ont.—R. McCallum, City Archt., City Hall, writes that bids will probably be received in Dec. for the erection of bath houses on Stephaine Pl.; probable cost, $40,000.

**Strathroy, Ont.*—It is reported that the contract to erect the armory at Strathroy (bids for which were received Nov. 5 by Fred Gelinas, Secy. Dept. Pub. Wks., at Ottawa), has been awarded to Nagle & Mills of Ingersoll, at $13,000.

Portage la Prairie, Man.—The Deputy Minister of Pub. Wks. at Winnipeg writes that nothing will probably be done before 1908 on the erection of a reformatory at Portage la Prairie. Saml Hooper, of Winnipeg, is Provincial Archt.

Montreal, Que.—It is stated that a site has been purchased on which the Government buildings for Montreal are to be erected at a cost of about $3,000,000.

**Saskatoon, Sask.*—Architects Storey & Van Egmond, of Regina, write that the Saskatchewan Bldg. Co. has secured the contract for erecting a court house for Saskatoon, for about $50,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Ft. Smith, Ark.—W. W. Bailey is reported to have decided to expend about $35,000 in rebuilding the hotel Main.

**Los Angeles, Cal.*—Newell Bros., 218 W. 1st St., are reported to have secured the contract to install the plumbing and steam heating system in the 10-story office building of Wm. K. Kerchoff at 6th and Main Sts.

San Francisco, Cal.—It is stated that steps are being taken to erect the Y. M. C. A. Building at a cost of $800,000.

According to local press reports, steps will be taken at once to erect the following buildings: A 12-story building at Post and Montgomery Sts. by the First National Bank directors; cost, $1,250,000; D. H. Burnham & Co., Merchants' Exchange Bldg., are the archts.; a 10-story brick building at Bush and Battery Sts., to cost $275,000, by Miss J. E. Crocker.

Pueblo, Colo.—The German-American Society (Dr. A. J. Kauffman, Secy.) is reported to be preparing to erect a $20,000 clubhouse.

Denver, Colo.—C. D. Griffith, Pres. of the Manufacturers' Assoc., is reported interested in the erection of an office building to cost about $300,000.

Wilmington, Del.—Patk. Fahey, it is stated, will erect a 4-story brick warehouse on French St. for Mundy Bros., to cost $10,000.

Gainesville, Fla.—It is stated that plans are being prepared for the Masonic Temple, which is to cost about $[illegible].

**[illegible], Ga.*—Miles & Brandt, of Atlanta, it is re[illegible] secured the contract to erect a 5-story 98x[illegible] to cost $110,000. A. Ten Eyck Browne, of A[illegible] archt.

At[illegible]—It is reported that A. G. Rhodes has se[illegible] Marietta St., on which he intends erecting [illegible] building.

[illegible] W. J. Gilbert, it is stated, will erect in [illegible] and DuPage Sts., a new building.

Chicago, Ill.—It is stated that Sidney Adler is contemplating the erection of an 8-story building at 292 5th Ave., to cost $40,000.

**Kankakee, Ill.*—The contract for the Y. M. C. A. Building is reported awarded to Kaufman & Wallheier, of Kankakee, at $33,155, exclusive of heating system.

Belleville, Ill.—Frank N. Piester, owner of the Piester Park & Cafe, it is reported, will expend $20,000 in improvements.

Ft. Wayne, Ind.—It is reported that bids will be received by Weatherhogg & Crocker, Hamilton Bank Bldg., until Dec. 2, for erecting a 9-story hotel, 120 x 150 ft., for the Ft. Wayne Hotel Co. It will be of hard brick, Bedford stone, terra cotta and reinforced concrete; probable cost, $300,000.

Indianapolis, Ind.—The Northwestern Amusement Co. (Wm. J. Neukom, Director), it is reported will erect two skating rinks here.

It is reported that plans have been ordered by Wm. B. Burford for a 3-story steel, stone and brick business building to be erected on S. Meridian St.

Terre Haute, Ind.—It is reported that the Virgo Temple of Labor Assoc. has approved plans and will soon ask bids for erecting a $75,000 temple.

Sioux City, Ia.—The 5-story building occupied by the Sioux City "Journal" is reported to have been destroyed by fire.

Portland, Me.—The buildings occupied by H. H. Hays & Sons and the Jas. Bailey Co., at Middle and Free Sts., it is stated, have been destroyed by fire.

Baltimore, Md.—Wm. C. Baker is reported to have secured a site at 635 W. Lombard St., on which it is proposed erecting a 6-story fireproof warehouse, costing about $40,000.

Frederick, Md.—It is reported that Chas. Wertheimer will expend $25,000 improving City Hotel.

**Detroit, Mich.*—It is stated that contracts for erecting the brick and stone car barns and freight shed at Arthur St. and Glengary Ave. have been awarded as follows: Masonry, Thompson Bros., 614 Fort St., W.; carpentry work, Wm. Walker; iron and roof work, Pennington-Brider Co.; painting and glazing, Thos. Brooke; hardware and finishings, Neveaux, Clinton & Baxter.

Grand Rapids, Mich.—Daisy Lodge of Elks, No. 48, it is stated, has had plans prepared for a 7-story brick, stone and steel temple, which it is proposed erecting on Ottawa St., at a cost of $100,000.

Minneapolis, Minn.—Jas. S. Roddy is reported to have decided to erect a 5-story brick and concrete warehouse at 319 1st Ave., to cost about $35,000.

Collins, Miss.—Almost the entire business section of the city is reported destroyed by fire.

St. Louis, Mo.—It is stated that the Planters' Hotel (Lyman T. Hay, Pres.) is to be improved at a cost of $20,000.

Jersey City, N. J.—It is stated that the contract to erect a 5-story brick 50x85-ft. factory at Wayne and Varick Sts. for the Dixon Crucible Co. has been awarded to Wm. Robertson, Jr., 15 Exchange Pl., at about $45,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 3-story brick and stone store and office building at Trinity Pl. and Rector St. for United States Express Co.; cost, $75,000; Clinton & Russell, Archts.; 12-story brick and stone stores and office building at 364 Bway. for Louis M. Jones & Co.; cost, $500,000; F. C. Browne, Archt.; alterations to 4 4-story brick and stone offices and dwellings at 149 E. 34th St. for Geo. G. Moore; cost, $30,000; Ludlow & Valentine, Archts.; alterations to 6-story brick and stone office building at Delancey and Suffolk Sts. for Delancey-Suffolk Co.; cost, $20,000; S. Sass, Archt.

Syracuse, N. Y.—The Directors of the Chamber of Commerce, it is stated, have voted in favor of organizing a company for the purpose of erecting a hotel, to cost about $800,000.

Rockingham, N. C.—The Rockingham Development Co., it is reported has secured a site, on which it is proposed erecting a $25,000 opera house.

Ellendale, N. D.—Plans are reported as being prepared for a $25,000 hotel, to be erected by R. W. Dickey.

Tiffin, O.—The Bd. of Trus. of the National Junior Order of United American Mechanics is stated to have decided to erect a $12,000 building here as an orphans' home.

Cincinnati, O.—The members of the Price Hill M. E. Church, it is stated, propose erecting a parish house, to cost $25,000.

Pittsburg, Pa.—A permit has been issued to the Pittsburg Brewing Co. to erect a 4-story brick stable on 33d St., to cost $150,000.

**Easton, Pa.*—Geo. B. Ruch is reported to have been awarded the contract for the erection of the new silk mill on the Ingersoll tract for the Continental Silk Co. The main building is to be 103x60 ft.

Reading, Pa.—It is reported that Camp 163, Patriotic Order of Sons of America (H. C. Marcks, Secy.) has accepted plans for a clubhouse, estimated to cost $30,000.

Mitchell, S. D.—The Elks are reported to be planning the erection of a $25,000 lodge building.

Chattanooga, Tenn.—Geo. Fritcher is stated to have had plans prepared by Bearden & Foreman, Chamberlain Bldg., for a 2-story store and apartment building, to be erected at 6th and Cherry Sts., at a cost of $12,000.

Dallas, Tex.—John G. Hunter, Chmn. Bldg. Com. Mystic Shriners, writes that it is proposed to erect a temple and auditorium, to cost about $150,000. Contract will probably not be let until Feb. Architect not yet selected.

Salt Lake City, Utah.—The barn and warehouse of the Redman Van & Storage Co., it is reported, have been destroyed by fire.

Aberdeen, Wash.—The erection of a temple, costing about $15,000, it is reported, is contemplated by the Knights of Pythias.

Beloit, Wis.—The Sigma Chi and Beta Theta Pi, two Beloit College fraternities, it is reported, are planning the erection of a chapter house, to cost $20,000.

Toronto, Ont.—A permit has been issued for a $65,000 factory, to be erected by I. H. Ller & Co. on Stirling Road.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—It is reported that Garrett & Bixby, 310 Currier Bldg. have prepared plans for a 3-story apartment house to be erected at Grand Ave. and 4th St. for D. H. Steele and Bernard A. Vollmer at an estimated cost of $75,000.

Berkeley, Cal.—T. O. Newson, 906 Bway, it is stated, is preparing plans for an apartment house to be erected at Channing Way and Shattuck Ave., at a cost of $20,000.

Denver, Colo.—A. W. Reynolds, Majestic Bldg., is reported to have prepared plans for a 2-story apartment house, to be erected at 26th and Stout Sts., at a cost of $17,000.

It is stated that plans have been prepared by Frank S. Snell, 1517 Tremont St., for an apartment house to be erected at Washington and Pearl Sts., and 13th and 14th Aves., at a cost of $400,000.

**Washington, D. C.*—Mrs. Norman Williams, it is stated, has been granted a permit to erect a 4-story brick dwelling at 1227 16th St., N. W., to cost $60,000. Wyeth & Cresson, 1517 H St., N. W., are the archts.; John H. Nolan, 1413 G St., N. W., is the builder.

*A permit has been issued to Leo Simmons to erect two 3-story brick apartment houses at 1840 V. St., at a cost of $30,000. Merrel S. Vaughn, Archt.; Wm. A. Vaughn, builder.

Atlanta, Ga.—It is reported that the plans of R. H. Hunt of Chattanooga, Tenn., for the Baptist Tabernacle and institution, which is to be erected at Luckie and Spring Sts., have been accepted. The plans provide for 4 buildings, which are to cost $250,000. Dr. Len G. Broughton is the pastor.

Marshall, Ill.—It is reported that the members of the Congregational Church are contemplating the erection of a $16,000 edifice. Rev. Arthur Miles, pastor.

Chicago, Ill.—Edw. Benson, 1779 N. Clark St., is reported to be preparing plans for a 3-story apartment house to be erected on N. Paulina St., to cost $130,000.

Delphi, Ind.—The members of the Christian Church, it is reported, propose erecting a $12,000 building.

Russiaville, Ind.—It is stated that the Trustees of the Friends Church will soon ask bids for installing a heating plant in the church.

**Baltimore, Md.*—A. K. Boteler is reported to have secured the contract to erect an edifice costing about $30,000 for the Garrett Ave. Methodist Episcopal Church at Lexington and Monroe Sts.

The Rev. Edw. M. Weigel, Rector Sacred Heart R. C. Church, is said to be planning the erection in the spring of a $150,000 edifice at 3d St. and Foster Ave., Highlandtown.

Detroit, Mich.—Malcomson, Higginbotham & Clement, Moffat Bldg., are reported to have prepared plans for a brick residence to be erected for Bert Lambert, 200 Horton Ave., at a cost of $10,000.

Bay St. Louis, Miss.—Among the buildings destroyed by fire here on Nov. 16 are reported to be the St. Joseph Convent, the Roman Catholic Church and parsonage and several business buildings.

Hastings, Neb.—The members of the First Congregational Church, it is reported, are planning the erection of an edifice costing about $16,000.

Bayonne, N. J.—Bishop John J. O'Connor, it is stated, has approved the plans prepared by Jas. F. Bagnell, of Bayonne, for the edifice which is to be erected for the St. Joseph Slavish R. C. Church at Ave. E and 25th St., at a cost of $50,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 2 5-story brick tenements at 149th St., and St. Anns Ave., for Moorehead Realty & Constr. Co., cost $80,000, Edward J. Byrne, Archt.; 5-story brick tenement at 205th St., and Villa Ave., for Angelo Guazzo, cost $25,000, Moore & Landsiedel, Archts.; 2 5-story brick tenements at Anderson and Jerome Aves., for J. H. Jones, cost $40,000, Lloyd J. Phyfe, Archt.

Buffalo, N. Y.—Plans have been filed for the brick addition to the chapel of the Church of the Blessed Sacrament. Estimated cost, $12,000.

Lumberton, N. C.—The erection of a $25,000 edifice for the members of the Baptist Church (Rev. C. H. Durham, Pastor) is reported contemplated.

Cleveland, O.—The West Side Methodists are said to be planning the erection of a new deaconesses' cottage to cost about $25,000.

Toledo, O.—The Congregation B'Nai Israel, it is stated, has accepted the plans prepared by Sidney E. Aftel, Spitzer Bldg., for the brick and terra cotta synagogue which is to be erected at Woodruff Ave. and Union St., at a cost of $50,000.

Pittsburg, Pa.—A permit has been issued to Geo. H. Shickler to erect two 3-story brick apartment houses on McKee Pl., to cost in all $40,000.

Philadelphia, Pa.—It is stated that a new edifice costing about $100,000 is contemplated by the members of the Calvary Methodist Episcopal Church (Rev. G. W. Izer, pastor).

Plans are reported filed for a bachelor apartment house which is to be erected by the Richardson Estate at 1722 Walnut St., at a cost of $200,000. The structure is to be 7 stories, 42 x 169 ft. of fireproof construction, white marble and brick and terra cotta trimmings. Denby & Nute of New York, N. Y., are the architects.

Sumter, S. C.—The Bldg. Com., it is stated, has adopted the plans of A. W. Todd, of Charleston, for the First Methodist Church, to be erected at a cost of $30,000.

**Items marked thus give the names of parties awarded contracts.*

Dallas, Tex.—C. Weishel, it is reported, will erect a modern $20,000 residence at this place in the near future.

Richmond, Va.—The plans of D. Wiley Anderson, 920 E. Main St., for the brick edifice which is to be erected for the West End Christian Church on Allen and Hanover Aves., at a cost of $25,000, have been accepted by the congregation.

Winnipeg, Man.——John Atchison & Co., 51 Merchants' Bank Bldg., it is stated, is preparing plans for an apartment block, to be erected at Maryland St. and Portage Ave.

SCHOOLS.

Notes Arranged Alphabetically by States.

Conway, Ark.—The State Normal Bd. of Trus., Little Rock, according to reports, has approved plans for a school to be erected at Conway at a cost of $40,000.

Tempe, Ariz.—It is stated that bids, including plans and specifications, will be received until Dec. 3 by Alfred J. Peters, Secy. Bd. Educ. for erecting a science building, and gymnasium and auditorium building. Probable total cost, $60,000. L. W. Millard, Archt., Fleming Bldg., Phoenix.

Berkeley, Cal.—It is reported that the plans for the first section of the Doe Memorial Library at the State Univ. have been definitely settled and work is to be started at once. This section will cost about $2,500,000. John Galen Howard, of the Univ., is the archt.

Monmouth, Ill.—The main building at Monmouth College is reported destroyed by fire. Loss said to be $40,000.

Bloomington, Ill.—The following bids were opened Nov. 9 at the Illinois State Normal Univ. by the State Bd. Educ. (Chas. L. Capen, Bloomington, Chmn.) for erecting the manual of arts building: J. L. Simmons, 2150 W. Madison St., Chicago, $87,650; English Bros., of Champaign, $88,593; J. W. Evans Son's Co., of Bloomington, $100,984, and R. B. Watson Co., of Chicago, $105,080. The building is to be fireproof, 143x131 ft., of brick and reinforced concrete.

Shirley, Ind.—It is reported that J. S. Mooney, Township Trus., will receive bids until Dec. 12 for erecting a school. Probable cost, $10,000.

Baltimore, Md.—Mayor Mahool has signed the ordinance appropriating $54,000 from the $1,000,000 loan for the erection of a school at Mulberry and Payson Sts., also an ordinance appropriating $10,000 to erect an addition to School No. 6 on S. Ann St.

Newtonville, Mass.—Bids will be received until Dec. 2 by Geo. H. Elder, Pub. Bldgs. Comr., City Hall, West Newton, for furnishing material and erecting a technical training high school at Walnut St. and Elm Rd., Newtonville. Bids to be submitted separately on the following: Ventilating and heating plant, electric plant. Geo. F. Newton, Archt., 6 Beacon St., Boston; French & Hubbard, Engrs., 85 Beach St., Boston.

Quincy, Mass.—The City Council has appropriated $70,000 for a school in Ward 1. Architect, Chas. A. Brigham, 8 Exchange Pl., Boston.

Mankato, Minn.—We are informed that bids will probably be called for in Jan. for the erection of a building at the State Normal School at Mankato; probable cost, $65,000. Architect, Clarence H. Johnston, of St. Paul.

Slayton, Minn.—Bids will be received until Jan. 7, by B. H. Whitney, Clk., School Bd., for furnishing material and erecting a brick addition to school for Independent School Dist. No. 52. Thori Alban & Fisber, Archts., 508 Chamber of Commerce Bldg., St. Paul.

Farmington, Mo.—Riester & Rubach, of East St. Louis, Ill., it is reported, are preparing plans for a $75,000 school.

Bayonne, N. J.—The School Bd. is reported to have approved plans for School No. 10.

Montclair, N. J.—Hale & Rogers of New York, N. Y., it is stated, have been engaged to prepare plans for a $50,000 school to be erected in place of the present building on Cedar Ave.

Atlantic City, N. J.—Henry D. Dagit, 435 Chestnut St., Philadelphia, Pa., it is stated, has completed plans for a 3-story parochial school, 60x100 ft. which is to be erected at California and North Atlantic Aves. for the R. C. Church of Our Lady Star of the Sea.

Nework, N. J.—Bids will be received until Nov. 26 by the Com. on Schoolhouses, Bd. Educ. (R. D. Argue, Secy.), for furnishing material and erecting an addition to the Warren St. School. Estimated cost, $104,000. Bids may be submitted as a whole or separately on the following: Masonry, iron and steel work; carpentry, plumbing; roofing and metal work; electrical work. Separate bids must be submitted on ventilating and heating system and motor and motor wiring. Henry J. King, Archt., 22 Clinton St.; Runyon & Carey, Engrs., 122 Market St.

Far Rockaway, L. I., N. Y.—Jos. D. Sulsona, Pres. Latin-American Institute of Far Rockaway, is stated to have secured a site on which he intends erecting a building costing about $60,000.

Ossining, N. Y.—Frank G. Wood, Clk. Bd. Educ. writes that the contract for erecting a high school has been awarded to John V. Schaefer, Jr., & Co., 9 to 13 E. 59th St., New York City, for $53,815. Archt., Wilson Potter, 3 Union Sq., New York City. Bids opened Nov. 11.

Cincinnati, O.—Bids will be received until Dec. 9 by Dr. J. M. Withrow, Chmn. Bldg. Com., Bd. Educ., for erecting a high school on Clifton Ave., McMillan and Guy St. Bids may be submitted as a whole or separately on all branches of the work.

Cincinnati, O.—Saml. Hannaford & Sons, Hulbert Blk., it is stated are preparing plans for a building for St. Xavier College to cost about $200,000.

**Philadelphia, Pa.*—The Com. on Property of the Bd. of Educ., it is stated, has awarded the contract to erect a 12 division brick school at Montgomery Ave. and Wildey St. to Lynch Bros., Lippincott Bldg., at $124,116. (Bids received Nov. 11.)
The lowest bid received at the same time and place as the above for erecting the 12 division Feltonville School at Rockland St. and Rising Sun Ave., is stated to have been submitted by Cramp & Co., Commonwealth Bldg., at $117,248.
It is is stated that bids will be received until Nov. 27 for erecting a 2-story building for the College of Physicians at 22d and Ludlow Sts.; probable cost, $300,000. Architects, Cope & Stewardson, 320 Walnut St.

Allegheny, Pa.—It is reported that bids will be received until Dec. 3 for erecteing a 2-story school for 10th Ward. It will be of brick, terra-cotta and concrete, 176 x 99.6 ft., and cost about $175,000. C. M. Bathberger & Son, archts., Westinghouse Bldg., Pittsburg.

West Pittsburg, Pa.—Robinson, Winkler & Mac Donald, House Bldg., Pittsburg, it is stated have been engaged to prepare plans for an 8-room addition which it is proposed erecting to the school, bids for which will probably be asked by Jan. 1.

**Pontiac, R. I.*—David A. Barry, of Providence, is reported to have secured the contract to erect the school at $18,787.

Nashville, Tenn.—It is stated that at the next meeting of the Peabody Fund a grant of $1,000,000 will be made for the establishment of a teachers' college in Nashville in connection with the Peabody Normal School in that city.

Athens, Tenn.—It is reported that a $15,000 school is to be erected. W. Z. Long, Chmn. Bldg. Com.

Beaumont, Tex.—The Bd. of Trus. of the City Schools, it is reported, will receive bids until Dec. 6 for erecting a ward school in the North End.

Arp, Tex.—The Attorney-General, it is stated, has approved the $15,000 independent school district bonds.

**San Antonio, Tex.*—Stevenson-Kenyon Contract Co., of Dallas, is stated to have secured the contract to erect the dormitory at the Agricultural & Mechanical College, at about $50,000, and the contract for the natatorium and veterinary hospital has been secured by C. E. Jenkins, of Dallas, at about $10,000.

**Seattle, Wash.*—Wm. Markham, Secy. Bd. Regents, State Univ. of Washington, writes that the Westlake Constr. Co., of St. Louis, Mo., has secured the contract for the auditorium, engineering and chemistry buildings (bids opened Nov. 12) at a total for 3 buildings of $421,810.

Chehalis, Wash.—G. W. Bullard of Tacoma, it is stated, has prepared plans for an 8-room addition which it is proposed erecting to the school at a cost of about $16,000.

Superior, Wis.—All bids received Nov. 15, by the State Bd. of Normal School Regents at Madison (Wm. Kittle, Secy.), for erecting an addition to the Normal School at Superior, were above the appropriation which is $45,000. Plans will probably be modified and contract let to lowest bidder.

Benton, Wis.—Bids will be received on Nov. 26 for erecting a high school, to cost about $23,000. Architect, H. Kleinhammer, of Platteville. M. E. Cottman, Clk. School Bd.

Madison, Wis.—M. E. McCaffrey, of Madison, Acting Secy. Regents of the University of Wisconsin, writes that bids have not yet been asked for the proposed women's gymnasium building. The Regents will meet on Dec. 17, when some action will probably be taken on matter; cost reported to be about $150,000.

Kincardie, Ont.—Bids will be received until Dec. 1, by J. H. Scougall, Secy. Bd. Educ., for remodeling the Central School. Bids to be submitted as a whole or separately on the following: Excavation, masonry, carpentry, heating, plumbing, etc. N. R. Darrach, Archt., St. Thomas.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Oakland, Cal.——It is reported that the Southwestern Broom Co. has secured a site at 20th Ave. and E. 14th St., on which it is proposed erecting a 4-story factory.

**Los Angeles, Cal.*—Ballinger Bros., of Pittsburg, Pa., are reported to have secured the contract to erect and equip a brewery at Albion and E. Main Sts. for the Duquesne Brewing Co. (Ralph Muss, Secy., Germain Bldg.); probable cost, $250,000. The buildings are to be of brick, steel, stone and reinforced concrete. The brewery equipment will include one 175-bbl. copper strain brewing kettle, a steel wash tub, steel hot-water tanks, steel cold-water tanks, steel rice and grain tank, steel malt bins of 2,000 bu. capacity, with a closed beer cooler, 2 ice-making machines and additional machinery driven by directly connected motors. These motors will be furnished with power from 2 generators driven by automatic engines. In addition to the brewery buildings there will be a bottling house and office buildings, stables and ice plant, with a daily capacity of 25 tons. The bottling house capacity will be 36,000 bottles per day.

Gary, Ill.—The Combined Liquid Tank & Freight Car Co., it is reported, has secured a site in Gary on which it is proposed erecting ten brick buildings for the manufacture of refrigerator and stock cars. The cost of the plant is to be about $250,000.

Logansport, Ind.—A. R. Durkee, of Chicago, it is stated, is preparing plans for additions which it is proposed making to the plant of the Routh Packing House Co. Plans are being prepared for a 2-story 116x114-ft. packing house building and a power house, 30x56 ft. The buildings are to be of brick and reinforced concrete, with gravel roofs and calked floors and electric fixtures.
The Logansport Radiator Equipment Co. is reported incorporated for the purpose of establishing and equipping a radiator factory in this city; capital $50,000. J. F. Digan and A. D. Benson are among the directors.

Oxford, Md.—The American Ice Co., of Talbot Co. (Jerry Valiant, Pres.), is asking bids on ice-manufacturing machinery, both new and second-hand; 10-ton capacity.

Jersey City, N. J.—Plans have been completed according to reports, by John T. Rowland, Jr., and Frank Eurich, Jr., both of 15 Exchange Pl., for the erection of a factory building for Jabez Burns & Sons, manufacturers of machinery at 542 Greenwich St., Manhattan, on Claremont Ave. and Halstead St. It will be of brick construction, one story high, 200 x 150 ft. Specifications will call for all modern improvements, and plans are now said to be ready for figures.
*The general contract for the construction of a factory building on West Side Ave. and the Pennsylvania Railroad, it is stated, has been awarded by H. G. Kotten & Co, manufacturers of pneumatic tools, of 120 Liberty St., New York, to Jas. J. O'Leary, 39 Cortlandt St., New York, N. Y. The new building will be of brick construction, 2 stories high and equipped with all modern factory improvements.

Hillsboro, N. C.—It is stated that the Eno Cotton Mills is to be enlarged, the improvement including the erection of an addition to the weave shed, 100x125 ft., which will provide for the installation of 200 additional looms.

High Point, N. C.—The High Point Hosiery Mills Co., according to reports, is said to be planning the erection of another mill. Work will probably begin about Jan. 1.

Brevard, N. C.—The Brevard Light & Power Co. contemplates adding a 5-ton ice plant to its system next season. J. W. Chapman, mgr.

Sandusky, O.—The Osborne Eng. Co., of Cleveland, is said to be preparing plans for a new plant for the Bay View Foundry Co., of this city, to be erected next spring.

**Philadelphia, Pa.*—Plans have been filed for a 3-story brewery, 80 x 80 ft., to be built at Trenton Ave. and Adams St. for Jos. Straubmuller. Philip Haibach & Co., 2530 Thompson St., are reported to have the contract. The cost will be about $50,000.

New Kensington, Pa.—It is stated that plans are being prepared by F. A. Rider for a brick cold storage plant to be erected at New Kensington, for the New Kensington Ice & Cold Storage Co. Cost $40,000.

Blacksburg, S. C.—G. Lang Anderson, of Williamston, is reported interested in the organizing of a company, with a capital of $250,000, for the purpose of erecting a cotton factory at Blacksburg.

Nashville, Tenn.—The Nashville Bridge Co., according to reports, contemplates enlarging its plant.

Beaumont, Tex.—Kyle Ward, Secy. Beaumont Ice, Light & Refrigerating Co., writes under date of Nov. 15, that the Bd. of Directors has decided not to purchase the proposed additional machinery this season.

Superior, Wis.—The Webster Mfg. Co., mfgrs. of chairs, will expend about $70,000 in rebuilding plant recently damaged by fire. Two new buildings will be erected, one 80 x 200 ft., the other 81 x 225 ft. The power plant was not damaged.

Hamilton, Ont.—The Dominion Power & Transmission Co. writes that it is not proposed at the present time to erect a car factory.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabeticolly by States.

Oakland, Cal.—The Council is reported to be in favor of voting $100,000 bonds for a garbage crematory.

Ft. Hancock, N. J.—Bids will be received until Dec. 17 by Capt. M. N. Falls, Constr. Q. M., Ft. Hancock, for constructing a garbage crematory at this post.

New York, N. Y.—Bids will be received by W. Bensel, Comr. Street Cleaning, until Nov. 29, for furnishing all the labor and materials required for the removal of snow and ice in the Boros. of Manhattan, Bronx and Brooklyn, for the period ending April 15, 1908. Bids will also be received same place until Nov. 27 for furnishing material and building 15 scows.

Homestead, Pa.—See "Public Buildings."

Johnstown, Pa.—The garbage plant owned by the People's Garbage Co. and operated by the Bd. of Health, is reported to have been destroyed by fire.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—Bids will be received until Dec. 11, by Capt. H. B. Ferguson, Corps Engrs., U. S. A., Montgomery, Ala., for constructing bulkhead at mouth of Apalachicola River, Fla.

**Los Angeles, Cal.*—The Bd. of Supv. is reported to have awarded to the Mercereau Bridge & Constr. Co. the contract to construct 3 concrete culverts in the Cahuenga road district, at a cost of $4,257; also for a concrete culvert across Griffin Ave., near the County Hospital, for $1,070.

Santa Monica, Cal.—See "Sewerage and Sewerage Disposal."

Vallejo, Cal.—Bids will be received until Dec. 3, at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the navy yard, Mare Island, Cal., the following supplies: Sch 481—17,900 lbs. beams, 2,700 lbs. trails, 23,600 lbs. medium bar steel, 8,300 ft. leather belting. Sch. 485—41,500 lbs. commercial brass rod, 98,700 lbs. seamless brass pipe, 65 doz. gate valves, brushings, bends, couplings, elbows, etc. Sch. 448—5 induction motors. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster Genl., U. S. A., Washington, D. C.

Washington, D. C.—Bids will be received until Dec. 11 by Elliott Woods, Supt. U. S. Bldgs. & Grounds, Washington, for furnishing and delivering, only, at the office of the building, U. S. Senate, Washington, of the quantities of sheet copper called for: 6,250 sheets, 24 x 96 in. equivalent to 100,000 sq. ft. of material.

Hawaii.—Bids will be received until Dec. 16 by the Lighthouse Engineer at Tompkinsville, N. Y., for furnishing two 4th order lanterns for Honolulu Range Light Stations, Hawaii.

Anderson, Ind.—It is stated that bids will be received until Nov. 27 by Edwin J. Wilcox, Supt. Constr., for constructing a ditch.

Lawrenceburg, Ind.—The following are the bids opened on Nov. 12 by Lieut. Col. Wm. T. Rossell, Corps Engrs. U. S. A., Cincinnati, O., for repairing and protecting Great Miami embankment at Lawrenceburg, Ind.: (*a*) 13,400 cu. yd. earth fill; (*b*) 19,000 sq. yd. concrete; (*c*) total. John W. Scott, Aurora, Ind., and George P. Walker, Cincinnati, O., *a*, 58 cts.; *b*, 60 cts; *c*, $19,172. Thos. J. McKim, Lawrenceburg, Ind., *a*, 35¾ cts.; *b*,

**Items marked thus give the names of parties awarded contracts.*

50½ cts.; c. $15,478. Albert T. Gridley, Aurora, Ind., and Wm. J. Abraham, Lawrenceburg, a. 84 cts.; b. 79 cts.; c. $20,200. L. Eid Concrete Steel Co., Cincinnati, O., a. 48½ cts.; b. $1.10; c. $27,399.

Marion, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Dec. 2, for constructing the Brewer Ditch, Mill Township.

New Orleans, La.—Gen. Arsene Perilliat, of the State Bd. of Engrs. is reported to be completing a report for Bd. of Comrs. of the Point Coupee Drainage Dist. No. 2 on its proposed large drainage project. He finds that 38 miles of main canal will be necessary, involving the excavation of 1,500,000 cu. yds. of earth. In addition to this main canal it will be necessary to excavate lateral canals which entail the removal of 500,000 more cu. yds. of earth.

Bids will be received until Dec. 16, at the office of the Mississippi River Comn., 1539 Louisiana Ave., New Orleans, for constructing 771,600 cu. yds. levee work in the lower Tensas, Atchafalaya and Pontchartrain Levee Dists. Maj. J. F. McIndoe, Corps Engrs., U. S. A.

Ft. Howard, Md.—Bids will be received until Dec. 9 by the Quartermaster at Ft. Howard, for repairs to government wharf at this post.

Scituate, Mass.—Bids will be received at the office of the Harbor and Land Comrs. at Boston, until Nov. 29 for riprap work at the Third Cliff in the town of Scituate, as advertised in The Engineering Record.

Boston, Mass.—Bids will be received until Dec. 14 by The Bureau of Yards & Docks, Washington, D. C. (R. C. Hollyday, Ch. of Bureau), for dredging in the slip at the Navy Yard, Boston. Appropriation available, $4,500.

Adrian, Mich.—It is reported that bids will be received until Nov. 27, by Hope Welch, County Drain. Comr., for the construction of the Stoddard tile drain.

Minneapolis, Minn.—Park bonds to the amount of $50,000 are reported sold.

Ft. Stanton, N. M.—Bids will be received until Nov. 27, by P. M. Carrington, Surgeon, Public Health and Marine Hospital Service, for furnishing lumber, engineer's supplies, hardware, etc.

Brooklyn, N. Y.—The contract for the construction of the concrete drydock at the Brooklyn Navy Yard, known as Contract No. 4, which was awarded in Feb., 1905, has been declared forfeited, and new bids will probably be called for.

In his coming report to Congress, Sec. of the Navy Metcalf will ask for about $1,000,000 with which to rebuild dry docks Nos. 2 and 3, at the Brooklyn Navy Yard.

Buffalo, N. Y.—We are informed that bids were opened by the Bd. Pub. Wks. on Nov. 14 for constructing dock at Ohio St. and Buffalo River along the Clark and Skinner Canal, and it has been recommended to award contract to Geo. Parks & Son, 217 15th St., Buffalo, for $3,396. C. M. Morse, Deputy Eng. Comr.

Steubenville, O.—It is reported that bids will be received by T. W. Vance, Clk. Bd. Public Service, until Dec. 2, for constructing a cement retaining wall along Fisher's Run.

Portland, Ore.—Bids will be received by Lieut.-Col. S. W. Roessler, Corps Engrs., U. S. A., until Dec. 20, for one stern wheel steamboat, as advertised in The Engineering Record.

Charleston, S. C.—We are informed that the following are the bids on Nov. 16 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for a pile and timber wharf at the Navy Yard, Charleston: (a) For pier complete, in accordance with plans and specification; (b) for pier complete, length to be 570 ft. instead of 650 ft.; (c) for complete work with modifications: Grant Wilkins, 23½ Whitehall St., Atlanta, Ga., a. $153,000; b. $134,000 c (2 bids), $123,000 and $96,000. Alsop & Peirce, 138 28th St., Newport News, Va., a. $123,000; b. $18,500; c (2 bids), $98,000 and $87,358. Simons-Mayrant Co., 16 Broad St., Charleston, S. C., a. $139,365; b. $15,353 (to deduct); c. (8 bids) deduct $8,000 to $57,000. Raymond Concrete Pile Co., 140 Cedar St., New York, N. Y., c (2 bids), $139,875 and $129,963. New York Continental Jewell Filtration Co., 15 Broad St., New York, N. Y., a, $139,840; b $124,890; c $89,885. A. F. Chapman & Co., 20 Breckenridge St., Buffalo, N. Y., a, $103,400; b, $93,000; c. (2 bids), $80,000 and $75,000. Bernard Rolf, 39 Cortlandt St., New York, N. Y., a, $109,333; b. $96,333. William L. Miller, 19 Milk St., Boston, Mass., a, $99,900; b, $90,000; c (two bids), $79,600 and $78,430. General Contracting & Eng. Co., 15-25 Whitehall St., New York, N. Y., c (2 bids), $73,630 and $64,840. The Foundation Co., 115 Bway, New York, N. Y., a, $126,676; b, $113,054.

**Galveston, Tex.*—The grade raising contractors, Goehart & Bates, are reported to have sublet to the North American Dredging Co., of San Francisco, Cal., a contract for about 1,000,000 cu. yd. of fill.

**National Soldiers' Home, Va.*—John T. Hume, Treas. Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., writes that the contract for dredging channel extension, Jones' Creek, about 4,800 cu. yds. (bids opened Nov. 1) has been awarded to W. H. French, of Norfolk, at 35 cts. per cu. yd.

Meaford, Ont.—Bids will be received until Dec. 2 by the Dept. Pub. Wks. (Fred Gelinas, Secy.), Toronto, for the construction of an extension to breakwater, the removal of portion of landing pier, the construction of a pile and concrete revetment wall, and a line of tongued and grooved sheet piling, at the town of Meaford. J. G. Sing, Resident Engr., Confederation Life Bldg., Toronto

PROPOSALS OPEN.

For Proposals see pages 64, 65, 66 and 67.

WATER.

Bids Close.		See Eng. Record.
Nov. 26.	Mains Seattle, Wash.	Nov. 9
Nov. 26.	Aqueduct, Durhamville, N. Y.	Nov. 23
Nov. 27.	Tank, Madison Barracks, N. Y. Adv. Nov. 16-23.	Nov. 16
Nov. 27.	Main, Philadelphia, Pa.	Nov. 23
Nov. 28.	Tank and trestle, Ft. Morgan. Adv. Nov. 2 to 16.	Nov. 2
Nov. 28.	Pipe, Bloomington, Ill.	Nov. 16
Dec. 1.	**Water wks., Shelley, Idaho.**	**Sep. 28**
Dec. 1.	**Pipe, etc., Phoenix, Ariz.** Adv. Oct. 5 to 26.	**Oct. 12**
Dec. 2.	Add. to system, Phoenix, Ariz.	Nov. 16
Dec. 9.	Water works, Minnette, Ala.	Nov. 23
Dec. 12.	Filter plant, Cambridge Springs, Pa. Adv. No. 16-23.	Nov. 16
Dec. 17.	**Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19.**	**Oct. 12**
Jan. 1.	Reservoir, Norway,* Me.	Nov. 16
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
———	Mains, Grand Forks, N. D.	Nov. 23
———	**Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Nov. 2.**	**Sep. 28**
———	**Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to Nov. 16.**	**Oct. 12**
———	Suction line, Alexandria, Va.	Nov. 9

SEWERAGE AND SEWAGE DISPOSAL.

Nov. 25.	Washington, D. C. Adv. Nov. 16-23.	Nov. 16
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 27.	White Plains, N. Y. Adv. Nov. 9 to 23.	Nov. 9
Nov. 27.	Green Bay, Wis.	Nov. 23
Nov. 27.	Adrian, Mich.	Nov. 23
Nov. 27.	Lafayette, Ind.	Nov. 23
Nov. 28.	Norfolk, Va.	Nov. 16
Nov. 28.	Warren, O.	Nov. 23
Nov. 29.	Bloomington, Ill.	Nov. 23
Dec. 2.	**Cadillac Mich. Adv. Oct. 19, 26.**	**Oct. 19**
Dec. 2.	Valley City, N. D.	Nov. 23
Dec. 3.	Auburn, N. Y. Adv. Oct. 19 to Nov. 23.	Oct. 19
Dec. 4.	Dayton, O.	Nov. 23
Dec. 6.	Forsyth, Ga.	Nov. 9
Dec. 7.	Stittville, N. Y.	Nov. 23
Dec. 9.	Orrville, O.	Nov. 9
Dec. 17.	Louisville, Ky. Adv. Nov. 23.	Nov. 23
Dec. 19.	Wapello, Ia.	Nov. 16
Dec. 21.	Santa Monica, Cal.	Nov. 23
Dec. —.	Ventura, Cal.	Nov. 2
Dec. —.	South Bend, Ind.	Nov. 23
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 16.	Oct. 26

BRIDGES.

Nov. 29.	West Bethlehem, Pa.	Oct. 26
Nov. 29.	Portland, Ore.	Nov. 2
Nov. 29.	Cincinnati, O.	Nov. 23
Dec. 2.	Ft. Benton, Mont.	Nov. 23
Dec. 3.	Council Bluffs, Ia.	Nov. 23
Dec. 5.	River Falls, Wis.	Nov. 23
Dec. 10.	Jackson, Minn.	Nov. 23
Dec. 11.	Wailuka, H. I.	Nov. 9
Dec. 14.	Norwood, O. Adv. Nov. 23.	Nov. 23
Dec. 17.	Philadelphia, Pa.	Nov. 23
Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 7.	Wilmington, N. C. Adv. Nov. 16-23.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16

PAVING AND ROAD MAKING.

Nov. 25.	Atlantic City, N. J. Adv. Nov. 23.	Nov. 23
Nov. 26.	Seattle, Wash.	Nov. 9
Nov. 26.	Ft. Flagler, Wash.	Nov. 9
Nov. 26.	Wilmington, Del.	Nov. 16
Nov. 27.	Kansas City, Mo.	Nov. 23
Nov. 27.	Ottawa, Ill.	Nov. 23
Nov. 29.	St. Peter, Minn.	Nov. 23
Nov. 30.	Greencastle, Ind.	Nov. 16
Nov. 30.	Hillsboro, O.	Nov. 16
Nov. —.	Tacoma, Wash.	Oct. 26
Dec. 2.	Lebanon, Ind.	Nov. 16
Dec. 2.	Columbus, Ind.	Nov. 23
Dec. 2.	Martinsville, Ind.	Nov. 23
Dec. 3.	Monticello, Ind.	Nov. 2
Dec. 3.	Palatka, Fla.	Nov. 2
Dec. 3.	Marysville, O.	Nov. 16
Dec. 3.	Bemidji, Minn.	Nov. 23
Dec. 3.	Portland, Ind.	Nov. 23
Dec. 4.	Logansport, Ind.	Nov. 16
Dec. 4.	Des Moines, Ia.	Nov. 16
Dec. 4.	Hartford City, Ind.	Nov. 23
Dec. 4.	Brooklyn, N. Y.	Nov. 23
Dec. 6.	Salt Lake City, Utah. Adv. Oct. 19 to Nov. 9.	Oct. 19
Dec. 7.	Peru, Ind.	Nov. 16
Dec. 11.	Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 12.	Flemington, N. J. Adv. Nov. 16-23.	Nov. 16
Dec. 12.	Anderson, Ind.	Nov. 23
Dec. 13.	**Valparaiso, Ind.**	**Sep. 7**
Dec. 16.	Steubenville, O.	Nov. 23
Dec. 17.	Providence, La.	Nov. 23
Dec. —.	Ventura, Cal.	Nov. 2
Jan. —.	Jackson, Mich.	Nov. 23
Feb. 4.	Brick paving, Billings, Mont. Adv. Nov. 23.	Nov. 23
Feb. 4.	Macadam, Billings, Mont. Adv. Nov. 23.	Nov. 23

POWER PLANTS, GAS AND ELECTRICITY.

Nov. 27.	Bay City, Mich.	Nov. 16
Nov. 29.	Newtonville, Mass.	Nov. 23
Dec. 2.	Ft. Worden, Wash.	Nov. 23
Dec. 3.	Vallejo, Cal.	Nov. 23
Dec. 3.	Lacompte, La.	Nov. 16
Dec. 5.	Newburgh, O.	Nov. 23
Dec. 13.	Panama	Nov. 23
Dec. 16.	Montreal, Que.	Nov. 16
Dec. 20.	Lafayette, Ind. Adv. Nov. 23.	Nov. 23
Dec. 21.	Chinook, Mont.	Nov. 16
———	Hendersonville, N. C.	Nov. 2
———	Alexandria, Va.	Nov. 9
———	Listowel, Ont.	Nov. 16

BUILDINGS.

Nov. 26.	School, Jeffersonville, Ind.	Nov. 16
Nov. 26.	Pub. bldg., Danville, Pa. Adv. Nov. 16-23.	Nov. 16.
Nov. 26.	Hospital, Secaucus, N. J.	Nov. 16
Nov. 26.	School, Benton, Wis.	Nov. 23
Nov. 26.	Jail, New Roads, La.	Nov. 23
Nov. 26.	Schools, Newark, N. J.	Nov. 23
Nov. 27.	Post office improv., Nashville, Tenn.	Nov. 9
Nov. 27.	Steel framing for roof of Senate Bldg., Washington, D. C.	Nov. 9
Nov. 27.	Post bldg., Ft. Mackenzie, Wyo.	Nov. 9
Nov. 27.	Pub. bldg., Madison Barracks, N. Y. Adv. Nov. 16.	Nov. 16
Nov. 27.	School, Philadelphia, Pa.	Nov. 23
Nov. 27.	Htg. system at pub. bldgs., New York, N. Y.	Nov. 23
Nov. 29.	Post Office, Marion, Ind. Adv. Oct. 26, Nov. 2.	Oct. 26
Nov. 29.	Church, Abilene, Tex.	Nov. 9
Nov. 29.	Jail, New Albany, Ind.	Nov. 16
Nov. 30.	Hotel, Bluefield, W. Va.	Nov. 9
Nov. 30.	School, Winfield, Kan.	Nov. 16
Nov. 30.	Lodge bldg., Terre Haute, Ind.	Nov. 16
Nov. 30.	Pub. bldg., Columbus Barracks, O.	Nov. 23
Dec. 1.	School, Ft. Smith, Ark.	Nov. 16
Dec. 1.	School, Kincardie, Ont.	Nov. 23
Dec. 2.	Foundations, etc., P. O. bldg., Devils Lake, N. D. Adv. Nov. 2, 9.	Nov. 2
Dec. 2.	Post bldgs., Great Lakes, North Chicago, Ill.	Nov. 16
Dec. 2.	Court house, etc., Ely, Nev.	Nov. 16
Dec. 2.	Hotel, Ft. Wayne, Ind.	Nov. 23
Dec. 2.	Pub. bldg., Tacoma, Wash.	Nov. 23
Dec. 2.	Pub. bldg., Havre, Mont.	Nov. 23
Dec. 2.	Pub. bldg., Homestead, Pa.	Nov. 23
Dec. 2.	Post bldgs.; Ft. Worden, Wash.	Nov. 23
Dec. 3.	Post Office, Nevada, Mo.	Oct. 26
Dec. 3.	School, Allegheny, Pa.	Nov. 23
Dec. 3.	School, Temple, Ariz.	Nov. 23
Dec. 3.	Add. to jail, Allentown, Pa.	Nov. 23
Dec. 4.	Pub. bldg., Columbus, O.	Nov. 23
Dec. 4.	Pub. bldgs., Ashland, Pa.	Nov. 23
Dec. 5.	Post Office, Waldoboro, Me.	Nov. 2
Dec. 5.	School, Carbondale, Ill.	Nov. 16
Dec. 6.	School, Beaumont, Tex.	Nov. 23
Dec. 6.	Pub. bldgs., Simcoe, Ont.	Nov. 23
Dec. 7.	Pub. bldg., Remsen, N. Y.	Nov. 9
Dec. 9.	Pub. bldg., Wernersville, Pa.	Nov. 2
Dec. 9.	Remodeling Hospital bldgs., Los Angeles, Cal.	Nov. 23
Dec. 9.	Armory, Chicago, Ill.	Nov. 23
Dec. 9.	Pub. bldg., Bay Minette, Ala.	Nov. 23
Dec. 9.	Town hall, Berkeley, Cal.	Nov. 23
Dec. 9.	Court house, Pulaski, Tenn.	Nov. 23
Dec. 9.	School, Cincinnati, O.	Nov. 23
Dec. 10.	School, Alpine, Tex.	Nov. 2
Dec. 10.	Bus. bldg., Jacksonville, Fla.	Nov. 2
Dec. 10.	Dwelling, Mobile, Ala.	Nov. 9
Dec. 10.	New indus. plant., Canton, S. D.	Nov. 16
Dec. 10.	School, Canton, S. D.	Nov. 16
Dec. 12.	Hospital, Whipple Barracks, Ariz. Adv. Nov. 16-23.	Nov. 16
Dec. 12.	School, Shirley, Ind.	Nov. 23
Dec. 14.	Jail, Terre Haute, Ind.	Nov. 23
Dec. 15.	School, Auburn, Ala.	Nov. 16
Dec. 15.	Pub. bldg., Washington, D. C.	Nov. 16
Dec. 17.	Exten. to post office, Detroit, Mich.	Nov. 2
Dec. 17.	School, Pawnee, Okla.	Nov. 16
Dec. 18.	Tunnel to htg. pub. bldg., Madison, Wis.	Nov. 9
Dec. 19.	Pub. bldg., Ocala, Fla. Adv. Nov. 16-23.	Nov. 16
Dec. 20.	Steamboat, Portland, Ore. Adv. Nov. 23.	Nov. 23
Dec. 23.	Post office, Ann Arbor, Mich.	Nov. 9
Dec. 30.	Post office, Lancaster, Pa.	Nov. 16
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
Dec. —.	School, Anderson, Ind.	Sep. 28
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Dec. —.	Bath houses, Toronto, Ont.	Nov. 23
Jan. 2.	Pub. bldg., Flint, Mich.	Nov. 23
Jan. 2.	Post office, South Bend, Ind.	Nov. 16
Jan. 3.	Post office bldg., Albuquerque, N. M. Adv. Nov. 23.	Nov. 23
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 6.	Post office exten., Wichita, Kan.	Nov. 23
Jan. 7.	Add. to school, Slayton, Minn.	Nov. 23
Jan. 14.	Light station, Alaska. Adv. Nov. 23.	Nov. 23
Jan. 14.	Indus. plant, Oxford, Md.	Nov. 23
Jan. ...	School, Mankato, Minn.	Nov. 23
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Feb. 1.	**Plans for Capitol, San Juan, P. R.**	**Sep. 28**
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. —.	College, Agricultural College, Mich.	Oct. 19

MISCELLANEOUS.

Nov. 25.	**Locks, etc., Mobile, Ala.** Adv. Sep. 28 to Nov. 23.	**Sep. 28**
Nov. 25.	Dredging, Mattituck, N. Y. Adv. Oct. 26 to Nov. 16.	Oct. 26
Nov. 26.	Supplies, Bremerton, Wash.	Nov. 9
Nov. 26.	Elevator equipment, Providence, R. I.	Nov. 16
Nov. 26.	Street cleaning, Evansville, Ind.	Nov. 16
Nov. 26.	Boiler, Port Royal, S. C.	Nov. 16
Nov. 26.	Wharf, Rossport, Ont.	Nov. 16
Nov. 27.	Ditch, Anderson, Ind.	Nov. 23
Nov. 27.	Lumber, etc., Ft. Stanton, N. M.	Nov. 23
Nov. 27.	Scows, New York, N. Y.	Nov. 23
Nov. 29.	Wharf, North Keppel, Ont.	Nov. 16
Nov. 29.	Rep. rap. work, Scituate, Mass. Adv. Nov. 23.	Nov. 23
Nov. 29.	St. cleaning, New York, N. Y.	Nov. 23
Nov. 30.	Bulkhead, Ft. Caswell, N. C. Adv. Nov. 9 to 23.	Nov. 9
Dec. 2.	R. R. work, Trenton, Ont.	Nov. 9
Dec. 2.	Breakwater extension, Meadford, Ont.	Nov. 23
Dec. 2.	Retaining wall, Steubenville, O.	Nov. 23
Dec. 2.	Garbage disp., Homestead, Pa.	Nov. 23
Dec. 2.	Ditch, Marion, Ind.	Nov. 23
Dec. 3.	Ditch work, Wausau, Wis.	Nov. 2
Dec. 3.	Ditch, Wheaton, Minn.	Nov. 9
Dec. 3.	Drills, etc., Bremerton, Wash.	Nov. 16
Dec. 3.	Supplies, Vallejo, Cal.	Nov. 23
Dec. 3.	Lumber, etc., New York, N. Y.	Nov. 23
Dec. 4.	Garb. disp., Altoona, Pa. Adv. Nov. 2 to 16.	Nov. 2
Dec. 4.	Telephone system, Danville, Ill. Adv. Nov. 16-23.	Nov. 16
Dec. 4.	Boiler, Minerva, O.	Nov. 16
Dec. 6.	Ditch work, Canton, N. Y. Adv. Nov. 9 to 23.	Nov. 9
Dec. 6.	Engine, lathe, etc., Panama	Nov. 16
Dec. 9.	Wharf repairs, Ft. Howard, Md.	Nov. 23
Dec. 10.	Wharves, Mobile, Ala.	Nov. 9
Dec. 11.	El. ry franchise, New Orleans, La.	Oct. 26
Dec. 11.	Ditch, Emmetsburg, Ia.	Nov. 9
Dec. 11.	Wall, etc., Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 11.	Bulkhead, Montgomery, Ala.	Nov. 23
Dec. 11.	Copper, Washington, D. C.	Nov. 23
Dec. 14	Lumber, Nashville, Tenn. Adv. Nov. 16-23.	Nov. 16
Dec. 14.	Dredging, Boston, Mass.	Nov. 23
Dec. 16.	Levee work, New Orleans, La.	Nov. 23
Dec. 16.	Lanterns, Hawaii	Nov. 23
Dec. 17.	Garbage crematory, Ft. Hancock, N. J.	Nov. 23
Dec. 17.	R. R. work, Philadelphia, Pa.	Nov. 23
May —.	El. ry., Buenos Aires, S. A.	Nov. 16

*Items marked thus give the names of parties awarded contracts.

CURRENT NEWS SUPPLEMENT

NOVEMBER 30, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Next meeting, December 4, 1907. Paper, "Invar (Nickel-Steel) Tapes on the Measurement of Six Primary Base Lines."

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, 29 West 39th St., New York. Annual meeting, New York, Dec. 3-6, 1907.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 29 West 39th St., New York. Next meeting, December 13, 1907. Paper on Duplex Stoker Boiler and Results of Tests.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 29 West 39th St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 113 Beekman St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Railway Engineering and Maintenance of Way Association. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago

American Water Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia. Annual convention, Buffalo, N. Y., Jan. 20-25, 1908.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O

Association of Railway Superintendents of Bridges and Buildings. Secretary. S. F. Patterson, Concord, N. H.

American Street and Interurban Railway Association. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

PERSONAL NOTES.

Mr. Howard R. Smart has been appointed town engineer of Lincoln, R. I.

Mr. Leopold Mercader, formerly an assistant engineer in the United States highway work, has been appointed bridge inspector of the Department of the Interior of Porto Rico.

Mr. W. T. Dorrance has been appointed designing engineer of the Exterior Zone of the New York Central & Hudson River R. R., with headquarters in the Grand Central Station, New York.

Mr. Charles P. Hart, building inspector in the Bureau of Buildings, Philadelphia, Pa., has been appointed engineer of construction in the same bureau, succeeding Mr. F. G. Myhlertz, resigned.

Prof. Robert Sibley, formerly associated with Mr. T. L. Greenough and the University of Montana, has established The Engineering Offices, at Missoula, Montana, for the practice of civil, mechanical and mining engineering.

Mr. W. A. Cornelius has been appointed general manager of the National Tube Co., of McKeesport, Pa., succeeding Mr. G. G. Crawford, who recently resigned to become president of the Tennessee Coal, Iron & Railroad Co.

Mr. Foster Crowell, the well-known New York consulting engineer, has been appointed Commissioner of Street Cleaning of that city, to succeed Dr. Walter Bensel, who has resigned to resume his former position as sanitary superintendent of the Department of Health.

Charles S. Magowan, professor of municipal and sanitary engineering in the College of Applied Science in the State University of Iowa, died Nov. 14, 1907. Professor Magowan had been a member of the faculty of the University of Iowa for twenty-one years.

Mr. C. F. Maitland, formerly resident engineer of the Wyoming Division of the Union Pacific R. R., has been appointed engineer of the Utah division of that railroad. Mr. S. W. Rano becomes resident engineer of the Utah division and Mr. W. C. Ferguson is in charge of the resident engineer's office on the Wyoming division.

In addition to the regular civil engineering courses of Columbia University, arrangements have been made for a series of supplementary lectures by prominent specialists. Among those who will lecture on sanitary engineering and allied subjects are Mr. George C. Whipple, Dr. Daniel D. Jackson, Prof. G. N. Calkins and Mr. Allen Hazen.

The following appointments are announced in the engineering department of the Boston & Albany R. R.: Mr. L. G. Morphy to be assistant engineer of maintenance of way and construction, with headquarters in Boston; Mr. E. A. Haskell to be division engineer of the Boston division, with headquarters in Boston; Mr. W. F. Barclay to be division engineer of the Albany division, with headquarters in Pittsfield.

Mr. George J. Roberts, chief engineer of the United Gas Improvement Co., of Philadelphia, has been appointed first vice-president of the Public Service Corporation of New Jersey, in charge of the operation of all its gas, electric and railway properties. This is one of the most difficult positions that American public-service companies can present, and Mr. Roberts has the hearty good wishes of those who are acquainted with his past successes as he assumes these for more trying burdens.

Edward A. Handy, general manager of the Lake Shore & Michigan Southern Ry., died on Nov. 21, in a Chicago hospital from pneumonia, after a three days' illness. He was graduated from the Massachusetts Institute of Technology and entered railroad work in 1878 as an assistant engineer of construction of the Atchison, Topeka & Sante Fe R. R. After several promotions, he left the Sante Fe and for a year was locating engineer of the Mexican National R. R. In 1881 he became principal assistant engineer of its Northern division and in 1883 chief engineer of the same road, holding the latter position about five years. In 1888 he was appointed engineer of the Lake Shore division of the Lake Shore & Michigan Southern Ry., and in 1891 chief engineer of the same road. He held this position five years and was then promoted to the executive department.

The members of the American Society of Civil Engineers and of the American Society of Mechanical Engineers in Denver and vicinity entertained the appraisers of the Denver Union Water Works, Messrs. John R. Freeman, Charles L. Harrison, Allen Hazen, M. L. Holman and Frederic P. Stearns, at a formal dinner at the University Club in Denver on Thursday evening, Nov. 21. The thirty engineers in attendance were seated at one large circular table. After dinner the five guests responded extemporaneously to subjects suggested by Mr. T. B. Stearns, as toastmaster. Mr. George G. Anderson, as a local member of the American Society of Civil Engineers, and Mr. F. E. Shepard, as a local member of the American Society of Mechanical Engineers, spoke as representatives of their respective societies. Mr. C. W. Comstock and Mr. Thos L. Wilkinson, to whom the idea and the success of the dinner were due, replied to the remarks of the toastmaster made in recognition of their efforts to bring the local members of the two societies together and thus promote the professional interests of the individuals, as well as of the Societies. In addition to those mentioned, the following were also present: H. C. Crocker, T. W. Jaycox, J. M. Houston, L. B. Curtis, H. A. Summer, H. J. Burt, M. S. Ketchum, Y. A. Kauffman, F. C. Finkle, G. T. Prince, L. E. Ashbaugh, E. C. Jansen, J. H. Matthes, Albert Carr, John B. Harper, E. A. Lee, J. A. Beeler, C. A. Yont and R. S. Sumner. Practically the same party was also entertained on Nov. 24 by a trip over the Moffat Road from Denver to the Continental Divide and return by Mr. H. A. Sumner, chief engineer of that railroad.

BUSINESS NOTES.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., is furnishing the reinforcement for three circular reservoirs, 100 meters in diameter, for the Potable Water Commission, City of Mexico. The order calls for 2,600 tons of corrugated bars. The latter product has been awarded a gold medal by the Jury of Awards of the Jamestown Exposition. This is the fourth medal awarded to the corrugated bar, the last one being given at the International Exhibition in New Zealand.

The U. S. District Court for the Southern District of New York has decided in favor of the plaintiff in the suit of Jules Breuchaud vs. the Mutual Life Insurance Co. and Arthur McMullen. This action was brought for infringement of Mr. Breuchaud's patent, No. 563,130, issued June 30, 1906, for the system of underpinning called by his name and involving the sinking of piers through soft strata to a firm support in the plane of the wall to be underpinned.

The Ball & Wood Co. announces the addition to its well-known engine business of a line of high grade air compressors, designed to meet the modern requirements for air compressing machinery equal in material and workmanship to the highest class of steam engine construction. These compressors are the product of long experience in the design and manufacture of high grade engines, combined with important improvements in the air compressing elements. They are designed, with large bearings and wearing surfaces, rigid frames, effective lubrication, ample valve areas and intercooling capacities. The main office and works of the company are in Elizabethport, N. J., and the New York office at 17 Battery place.

The Northern Engineering Works, Detroit, Mich., have sold a 50-ton 3-motor traveling crane to the Columbia Improvement Co., Seattle, Wash., for its new power station, and a 10-ton 60-ft. span crane to the Pittsburg plant of the United Engineering & Foundry Co. The Northern Engineering Works also reports the following sales of Newten cupolas: The Hilgartner Marble Co., Baltimore; Noyes Stove Co., Waterville, Me.; Progressive Stove Co., Colorado City; Pocahontas Iron Works, South Norfolk, Va.; Mississippi Seating Co., Jackson, Miss.; Chickasaw Iron Works, Memphis, Tenn.

The Pittsburgh Automatic Vise & Tool Co., Pittsburgh, Pa., has just completed a large shipment of double and single swivel vises to the Brazilian Government, Rio Janeiro. The order is a direct outcome of an inspection and test made by the Brazilian Government at the Jamestown Exposition. The company reports that its plant is running double time to fill orders promptly, and that despite the financial scare the business of October was over twice that of any previous month.

Concrete piles are being extensively used at present for the foundations of buildings in localities where the soil is of an extremely poor character, the extent of their use being shown by the large number of contracts which are at present calling for the use of such foundations. Simplex concrete piles have been used for foundations of the Fruit Auction Exchange Bldg., corner of Franklin and Washington Sts., New York City; Isaac G. Johnson Steel Castings Foundry on Spuyten Duyvil Creek, Spuyten Duyvil, New York City; the refuse destructor for the Borough of Richmond, City of New York, foot of Taylor St., West New Brighton, S. I.; and the addition to the plant of the Standard Oil Co., at Claremont Ave., Jersey City. The Foundation Co., 115 Broadway, New York City, has just been awarded the contract for borings and for placing Simplex concrete piles in the foundations of a new refining plant for the S. T. Baker Oil Co., of New York City, at Bay Way, Elizabeth, N. J. These piles are to be used in the foundations of the tanks, and the walls of the filling, storage and tank houses.

QUEBEC BRIDGE TESTIMONY.

Last month the Canadian Commission of Inquiry concerning the Quebec bridge made public the testimony of Mr. Cooper concerning the structure, and last week it gave out copies of the testimony of the Phœenix Bridge Co.

Mr. Cooper testified that he corrected the original specifications to provide for a smaller wind load and larger vertical loading than was required at first. In order to keep the weight of the structure designed to meet these requirements within the original estimated

[illegible] made modifications in the unit working strains in various members. The floor system proposed for the structure he considered excessively heavy and advised reducing its weight to that of the floors of first-class railroad bridges in the United States. The preparation of the plans by the Phœnix Bridge Co. was not given sufficient time, he testified. As a result of the rush with which they were pushed through after work was begun on them, and his own frail health, he was forced to rely upon others concerning many parts of the design.

The workmanship on the bridge material was perfectly satisfactory to Mr. Cooper in many respects, he testified, but he nevertheless had to make frequent complaints of the mechanical department, especially regarding the facing of the compression members and the boring of the pin-holes. The material in the bridge he considered most excellent. He did not consider that the Phœnix Bridge Co. had on the work at all times, in charge of the erection, an engineer fully cognizant of the details of the structure, the action of the different members under the different strains and camber movements, and the steps to take in case the theoretical expectations were not fulfilled. He judged that there was not due care in handling bridge members at all times.

In September, 1906, the anchor arm did not work itself free from the falsework near chords 8, 9 and 10, as it should have done, but showed a tendency to lift at the shore end. This Mr. Cooper believed to be due to a failure to consider the compression of the main center post under the additional load of the cantilever arm; it threw an undue load on the bents near point 9 of the anchor arm. An undue strain was thus probably produced near lower chord 9, for at that time the splices, the weakest portion of the structure, were not riveted and perhaps not fully bolted.

On Aug. 6, 1907, a condition in chords 7 and 8 in the cantilever arm was reported to Mr. Cooper which he considered unsatisfactory and subsequent correspondence convinced him that "the Phœnix Bridge Co. did not desire to make any corrections of importance or to put this chord in a safe condition." Before he could take final action, the more serious problem of the bending of chord 9 in the anchor arm was reported to him. Mr. Cooper testified that when the condition of lower chord 7-8 of the cantilever arm was reported to him, he first became uneasy about the lower chord members. When an inspector personally reported to him on the morning of Aug. 29 a 2¼-in. deflection of the west member of lower chord 9 in the anchor arm, he at once telegraphed to the Phœnix Bridge Co. to put no more load on the bridge until after due consideration of the facts. The inspector who made the report took the first train to the bridge shops, but on the evening of the same day telegraphed that the bridge was in the river. Mr. Cooper testified that such a deflection in an important member would indicate to any intelligent mind that the chord was less capable of doing the duty it should have done than were it in a perfectly straight condition. He considered that if prompt action had been taken to protect west lower chord 9 of the anchor arm, which could have been done by three hours' work and $100 worth of timber and bolts, the bridge could have been made perfectly safe and sufficient for its intended purpose.

Long before the large traveler had passed to the cantilever span, according to Mr. Cooper's testimony, he called the attention of the designing engineer of the Phœnix Bridge Co. to the undesirability of using it for erecting the suspended plan. A small traveler was accordingly designed for this erection, and Mr. Cooper consented to the use of the large traveler to erect it, on the understanding that as soon as the small traveler was completed the large one should be removed. He did not know until after the collapse of the bridge that this large traveler remained on the structure after the erection of the suspended span had commenced.

The testimony of the officers and engineers of the Phœnix Bridge Co. is to the effect that Mr. Cooper ordered the main span increased from 1,600 to 1,800 ft. and raised some of the unit stresses to an unprecedented amount in order to keep the weight of the bridge down. The Phœnix Bridge Co., being paid on a pound basis, would naturally have been glad to use lower unit stresses and more metal. The fall of the bridge is directly attributed by President Reeves of the company to this change in the unit stresses by Mr. Cooper. The company's designing engineer testified that when the first deflection was noticed in the lower chord he immediately prepared a plan for remedying it, which was submitted to Mr. Cooper and was in his possession when the bridge fell. One of the company's representatives testified that when engineers of the Phœnix Bridge Co. reported a deflection of the chords, Mr. Cooper had replied that there was no danger.

Leadite, a composition for making bell and spigot pipe joints, is the subject of a pamphlet from The Leadite Co. of America, 1215 Filbert St., Philadelphia. Tests of Leadite joints to determine their resistance to injury by expansion and contraction, unequal settlement, oxidation, frost, shock and vibration, are described. Pressure tests as high as 450 lb. per square inch are said to have been made without causing leakage of the joints.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Washington, D. C.—See "Public Buildings."

**Wilmington, Del.*—The Water Comrs. on Nov. 25 contracted with P. H. & F. Root of New York, N. Y., for a 75-h.-p. motor and blower, which will have a capacity of 3,000 ft. of cubic air per minute, for use in connection with the preliminary filter plant.

Palmetto, Fla.—T. D. Pollard, Town Clk., writes that the citizens on Nov. 12 voted to issue $25,000 bonds for water works improvements. Engineer not yet selected.

Leesburg, Fla.—Mayor Dozier is reported to be in favor of bonding the town for the construction of municipal water works.

Ft. Dade, Fla.—Bids will be received until Dec. 19 by the Constructing Quartermaster at Ft. Dade, for constructing 3 cypress cisterns at this post.

Savannah, Ga.—The Water Com. of Council (Alderman Wilkinson, Chmn.), is reported to be considering the general improvement of the water works, to include new mains, new wells and improvements at pumping station.

Dallas, Ga.—The citizens are reported to have voted to issue $30,000 bonds for the construction of water works.

Aurora, Ill.—It is stated that bids will be received until Jan. 17 for furnishing an air compressor for the pumping station.

Rockton, Ill.—There is reported to be a movement on foot here looking to the construction of water works.

Rock Island, Ill.—The City Clerk is asking for prices for twenty-five ⅝-in. meters and three ¾-in. meters. W. Treichler, City Engr.

Atlantic, Ia.—Bids will be received until Dec. 7 by T. E. Nichols, City Clk., for furnishing material and drilling 2 wells 8 or 10 in. in diam. and 50 ft. or deeper as the supply of water warrants, casing, valves and fittings for 8 or 10-in. wells and 8 or 10-in. c. i. pipe to connect wells with suction main; 1,000 or less water meters from ⅝ to 2-in. in size; a high duty pumping engine capable of lifting water from a depth of 26 ft. and against a head of 90 to 160 lbs., and pump 700,000 gals. in 24 hours; a triplex or power pump to be driven either by steam engine or operating under 80 lbs. boiler pressure or by electric motor and capable of performing the service from a depth of 26 ft. and against a head of 90 to 160 lbs. and pump 700,000 gals. in 24 hours.

Hancock, Md.—Henry P. Bridges, 1,119 Calvert Bldg., Baltimore, writes that the proposed water works reservoir and sewerage system will cost between $35,000 and $40,000. Engineer Arthur Giesler, 29 B'way, New York, N. Y.

Benson, Neb.—E. A. Steiger, City Clk., writes that it is proposed to extend the water mains, at a cost of $9,000. Nothing definite will probably be done until spring.

Fremont, Neb.—See "Power Plants, Gas and Electricity.

Atlantic City, N. J.—Water Supt. Van Gilder is reported to favor the building of new pumping stations and laying new mains across the 5-mile stretch of meadows from Absecon; about $250,000 will be expended.

Ogdensburg, N. Y.—The question of procuring a pure supply of water is reported under consideration by the Water Board.

New York, N. Y.—Bids will be received until Dec. 11 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing, delivering and erecting a system of water curtains, with all piping, valves, manifolds, sprinkler heads, brackets, supports and all other appurtenances, complete in place and ready for operation in the high-pressure pumping stations at Oliver and South Sts. and at Gansevoort and West Sts., Bor. of Manhattan.

Lenoir, N. C.—It is stated that bids will be received until Dec. 15 by J. C. Seagle, Town Secy. and Treas., for $80,000 water and $20,000 street bonds.

Sulphur Springs, N. C.—See Power Plants, Gas and Electricity.

Fargo, N. D.—Bids will be received until Dec. 2 by N. C. Morgan, City Recorder, for making connections with the sewer and water main on Northern Pacific Ave.

Minerva, O.—See "Power Plants, Gas and Electricity."

Cincinnati, O.—The Bd. of Water Works Comrs. is reported to have decided to make some changes in settling reservoir No. 2 of the new water works at a cost of about $43,000.

East Stroudsburg, Pa.—The Boro' Council is reported to be considering the construction of a new reservoir, also the procuring of a better water supply for the town.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Pittsburg, Pa.—Controller John B. Larkin is reported to have submitted to Mayor Guthrie estimates for work proposed for the Greater Pittsburg as follows: Preliminary filtration plant, $600,000; free bridges, $3,000,000; subway tunnel for traction purposes, with 2 spurs, $8,000,000; new city hall, $3,000,000, and new market house, $3,000,00.

Ft. Pierre, S. D.—Bids are wanted, it is stated, until Jan. 21, for the $9,000 water works bonds. M. A. MacMillen, City Aud.

Elgin, Tex.—See "Power Plants, Gas and Electricity."

Mineral Wells, Tex.—The State Attorney General has approved an issue of $10,000 water bonds and $15,000 sewer bonds.

Puyallup, Wash.—The City Council is reported to be considering the matter of utilizing the five springs owned by the city in connection with the Salmon Creek spring at Sumner, to furnish a water supply for Puyallup. City Engr. Wheeler is reported to have suggested the construction of a concrete reservoir to hold about 24 hours' flow.

**Seattle, Wash.*—Sanfield & Gifford, of Seattle, secured contract on Nov. 16 for furnishing and laying water mains in 6th Ave. N. W., as follows: 3,874 lin. ft. 12 in. wood water pipe, $2; 13,100 lin. ft. 8 in. wood water pipe, $1.35; 230 lin. ft. 6 in. c. i. pipe hydrant connections, $1.50; 100 cu. yd. extra excav., 10 cets.; total, $32,668, including valves, hydrants, etc. They also secured contract for water mains on Ewing St., $2,148.

Marinette, Wis.—The City Council is reported to have voted to purchase the local water plant.

Winnepeg, Man.—Magnus Peterson, Secy. Bd. of Control, writes that the date of opening of bids for the supply of approximately 15 miles of assorted pipe has been extended from Nov. 15 to Jan. 15. Specifications and forms of tender may be obtained at the office of H. N. Ruttan, City Engr.

Hamilton, Ont.—The Fire and Water Com. of Council is reported to have decided to procure bids for electric pumps, and competition, it is said, will be open to foreign as well as Canadian manufacturers.

City Engr. Barrow is reported to have estimated the cost of laying a 12-in. pipe to supply the town of Dundas with water at $38,000, but nothing will be done in this matter until after pumps are purchased.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Washington, D. C.—See "Public Buildings."

Vienna, Ga.—Surveys and estimates are being prepared to determine the cost of constructing a sewerage system.

Galva, Ill.—The Bd. of Local Improv. is reported to have decided to construct sewer system, to cost $30,000.

Anna, Ill.—J. L. Hammond, Secy. Bd. Local Improv., writes that Chas. W. Brown, of Jacksonville, is preparing plans for a sewerage system, to cost about $12,000.

Elgin, Ill.—Local press reports state that plans have been completed for the proposed sewer system for the 6th Ward.

Evansville, Ind.—We are informed that bids will be received on Dec. 7 by the Bd. of Pub. Wks. (W. F. Wunderlich Clk.) for constructing pipe sewers on 7th and 4th Aves., and in an alley east of Main St.

**Kendallville, Ind.*—Wm. P. Myers, City Clk., writes that the contract for constructing sewer in Richmond St. (bids opened Nov. 22) has been awarded to Moellering Constr. Co., of Ft. Wayne, for $4,945.

Sterling, Kan.—Mayor D. J. Fair, Jr., is reported to favor the construction of a sewerage system for the town.

Paola, Kan.—E. D. McLaughlin, City Clk., it is stated will receive bids until Dec. 3 for constructing lateral sewers.

Shelbyville, Ky.—The citizens are reported to have voted to construct a system of sewers.

Lexington, Ky.—E. G. Katenhuber, Jr., Asst. Engr. on Sewers, writes that bids will probably be called for early in Jan. for about one-half mile of 12-in. sewer in heavy rock cut. He further states that bonds to the amount of $25,000 will be sold about Jan. 1 to be used for main sewer work now under construction.

Hancock, Md.—See "Water."

Gloucester, Mass.—The citizens will on Dec. 3 vote on the question of establishing a sewerage system. Winslow L. Webber, City Engr.

Boston, Mass.—See "Power Plants, Gas and Electricity."

Minneapolis, Minn.—Local press reports state that work is about to commence on the construction of a tunnel and drop-shaft on 38th St. at the Mississippi River in connection with the proposed construction of a new sewerage system throughout the extreme southern part of the city, to include Linden Hills and Cottage City.

St. Louis, Mo.—A bill has been introduced in Council providing for the extension of the Glaise Creek sewer through Carondelet Park to Kansas St., to cost about $140,000.

Holdrege, Neb.—N. Nelson, City Clk., writes that about $20,000 will be expended for sewers.

Portsmouth, N. H.—See "Power Plants, Gas and Electricity."

Albuquerque, N. M.—Jas. N. Gladding, City Engr., writes that plans are being prepared for a sewerage system; probable cost $375,000.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

Rochester, N. Y.—The Bd. of Contract has rejected bids received Sept. 25 for 500 ft. of riveted steel pipe for a part of the new 21st ward sewer; the lowest bid amounted to $3,543. The plans will be changed and longer lengths of pipe used.

Fargo, N. D.—See "Water."

Springfield, O.—All bids opened by the Bd. of Pub. Wks. (F. A. Crothers, clk.) Nov. 20 for furnishing material and constructing a portion of the high level intercepting sewer to include 9,816 lin. ft. vitri. pipe, plain or reinforced concrete sewer, 9,376 lin. ft. 6 in. pipe house connections, Y branches, manholes, 17,875 cu. yds. rock excav., 115 cu. yds. Class A concrete, etc., have been rejected and new bids will be received on Dec. 18 as advertised in THE ENGINEERING RECORD. W. H. Sieverling, City Eng.

Norwood P. O., Cincinnati, O.—It is stated that the Bd. Pub. Service (L. H. Gebhart, Clk.) will receive bids until Dec. 14 for constructing a sanitary sewer in a portion of Sherman Ave. Jas. A. Stewart, Engr., 712 Traction Bldg., Cincinnati.

Items marked thus give the names of parties awarded contracts.

Brooklyn, N. Y.—Bids will be received until Dec. 11 by Bird S. Coler, Boro. Pres., for furnishing material and constructing sewers in E. 4th and 44th Sts. Engineer's estimate; 762 lin. ft. 36-in. brick sewer; 3,965 lin. ft. 12-in., 981 lin. ft. 15-in pipe; 5,100 lin. ft. 6-in. house connection drain; 45 manholes; 30 M. ft. sheeting and bracing. etc.

Eaton, O.—Bids are wanted, it is stated, until Dec. 16 for $10,000 sewer bonds. R. F. Craig, Mayor.

**Lancastetr, Pa.*—The detail bid of Reilly & Riddle, of Philadelphia, the successful bidder for completing Water St. sewer (bids opened Nov. 11), is as follows: Nine thousand cu. yd. earth excavated, classes A and B, 90 cents; 3,700 cu. yd. rock excavation, $2.80; laying 2,200 ft. 6-in. rock underdrain, 62 cents; 1,000 ft. 108 in. concrete sewer in earth, $12.50; 1,200 ft. 108 in. concrete sewer in rock, $12.50; 75 ft. 72 in. concrete sewer in earth or rock, $8.75; 60 in. concrete sewer in earth or rock, $7.10 48 in. concrets sewer in earth or rock, $5.60; 36 in. concrete sewer in earth or rock, $5; 30 in. concrete sewer in earth or rock, $4.35; 20 ft. 30 in. pipe sewer, $3.75; 300 ft. 24 in., $2.15; 900 ft. 18 in., $1.25; 15 in., 94 cents; 100 ft. 12 in., 60 cents; 300 ft. 10 in., 62 cents; 8 in., 38 cents; 300 ft. 6 in., 30 cents; 5M. ft. timber cradle, $56.25; 10M. ft. sheeting left in trench, $37.50; 60 cu. yd. earth excavated below grade filled with crushed stone, $3.10; 25 cu. yd. earth excavated below grade filled with Port. cem. con., $11.25; 40 cu. yd. brick masonry laid in Port. cem. mortar, $12.50; brick masonry laid in Nat. cem. mortar, $10; 50 cu. yd. Portland cement concrete, $10; 50 cu. yd. rubble masonry laid in Nat. cem. mortar, $6.25; 3,000 lbs. iron castings, 5 cents; 2,000 lbs. wrought iron fittings, 5 cents; 25 cu. yd. rip rap, $2.50; total, $52,842, to be completed Sept. 1, 1908. Totals of other bids: E. G. Gummel, Washington, D. C., $54,226 (300 days); R. A. Malone, Lancaster, $55,655 (200 days).

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

McKeesport, Pa.—It is stated that bids will be received until Dec. 5 by C. E. Soles, City Compt., for constructing a 15-in. terra cotta sewer in Jim Crow Alley.

Kane, Pa.—The Borough Council (Dr. J. Baher, Pres.) is reported to be making preparations for the disposal of the sewage of Kane.

Scranton, Pa.—The City Council is reported to be considering the construction of a septic tank and contract bed system for sewage disposal in the 10th Ward to cost about $33,000.

Yorkville, S. C.—The citizens are reported to have voted to issue $25,000 bonds for the construction of a sewerage system.

Chattanooga, Tenn.—Local press reports state that bids will be received until Dec. 3 by Robt. Hooke, City Engr., for constructing 1½ miles of sanitary sewers in Grand View Hotel Dist., known as No. 12. Estimated cost, $28,000.

Cameron, Tex.—C. B. Beatty, City Secy., writes that the proposed sewerage system will cost about $12,000. Bonds have not yet been sold. Engr., N. Werenskiold, of Dallas.

Seattle, Wash.—We are informed that new bids will probably be called for in about 6 weeks for constructing the Green Lake section of the north trunk sewer. The lowest bid recently received for the sewer amounted to $993,036 and was rejected as being too high. C. B. Bagley, Secy. Bd. of Pub. Wks.

Chester, W. Va.—We are informed that Engineer John A. George, of East Liverpool, O., is constructing a sewerage system here for the Chester Improvement Co.

Cashton, Wis.—It is reported that surveys are being made for a sewerage system.

BRIDGES.

Notes Arranged Alphabetically by States.

Newport, Ind.—It is stated that bids will be received until Dec. 4 by the Co. Comrs. at Newport for constructing the superstructure of the bridge across Wabash River.

Muncie, Ind.—It is stated that bids will be received until Dec. 4 by the Co. Comrs. at Muncie for constructing 3 bridges, 2 across Mississinewa River and the other across White River.

Pooli, Ind.—It is stated that bids will be received until Dec. 3 by the Bd. Co. Comrs. for constructing a new floor system for the Finley bridge. Alvin B. Ham, Co. Aud.

**Iowa City, Ia.*—The Bd. of Supervisors is stated to have awarded the contract for constructing a bridge over Iowa River to the Iowa Bridge Co., of Des Moines, for about $26,500.

Topeka, Kan.—Bids will be received any time prior to Jan. 1 for the construction of a steel viaduct at Branner St. for Topeka St. Ry. Co. (A. M. Patten, Gen. Supt., Topeka) and the Atchison, Topeka & Santa Fe Ry. Co. (C. A. Morse, Ch. Engr., Topeka); cost reported to be $60,000.

Girard, Kan.—It is stated that bids will be received until Dec. 10 for constructing the iron superstructure for 4 I-beam and a 70-ft. truss bridges.
It is stated that bids will be received until Dec. 9 by Fred. A. Gerren, Co. Clk., Girard, for constructing the stone superstructure for the following bridges: Vehlow Bridge in Walnut Township; Dunlop Bridge in Baker Township; Devlin Bridge in Washington Township; stone arch bridge consisting of 2 10-ft. arches in Sherman Township.

**Chanute, Kan.*—The Southwestern Bridge Co., of Joplin, Mo., has secured the contract to build a bridge across Neosho River, near Chanute. The crossing consists of one 200-ft. span, one 70-ft. span, and two 30-ft. steel approaches, the roadway being 20 ft.; contract price, $11,573. Work will be completed about June 1, 1908.

Sunrise, Minn.—Bids will be received until Dec. 15 by G. E. Deming, Town Clk., for $4,000 bridge bonds.

Kansas City, Mo.—We are informed that a reinforced concrete bridge is to be constructed over Gooseneck Creek at Independence Ave. in the spring, at a cost of about $12,000. E. A. Harper, City Engr.

St. Louis, Mo.—The City Council is stated to have passed the bill pending for the construction of a free bridge over the Mississippi River at Chouteau Ave., for which the citizens voted to issue $3,500,000 bonds.

Niagara Falls, N. Y.—See "Railroads."

New York, N. Y.—Bids will be received until Dec. 9 by Jas. W. Stevenson, Comr. of Bridges, New York City, for the construction of the masonry piers, surface and sub-surface changes, and steel super-structure of the Manhattan and Brooklyn approaches of the Manhattan bridge, over East River, between the Boroughs of Manhattan and Brooklyn. Security, $800,000.

Fargo, N. D.—It is stated that Arthur G. Lewis, Co. Aud., will receive bids until Dec. 4 for replanking or paving Front St. bridge and approach thereto; also repairing bridge in Barnes Township over Sheyenne River.

Tiffin, O.—The County Surveyor has completed plans and specifications for repairing and painting Washington St. bridge; estimated cost, $2,960.

Toledo, O.—The Bd. of Pub. Service is stated to have approved plans for the construction of the Lake Shore's bridge to cross Swan Creek from Monroe St. to Goose Point. The bridge will be a rolling lift, and cost approximately $85,000. S. Rockwell, Ch. Engr., Cleveland.

Cleveland, O.—Wm. J. Carter, City Engr., is stated to have been authorized to prepare plans for high level bridges to be constructed over Cuyahoga River.

Celina, O.—It is reported that bids will be received until Dec. 4 by the Co. Comrs. at Celina, for constructing the superstructure of John Bridge, Blackcreek Township, also a steel bridge, known as Tickle Bridge in Blackcreek Township, each bridge to have a 64-ft. span and 16-ft. roadway. T. A. Weis, Co. Aud.

Pittsburg, Pa.—See "Water."

Etna, Pa.—Bids will be received at the office of A. R. Dunbar, Boro. Clk., for constructing 2 bridges; a steel girder bridge with the necessary abutments, over Pine Creek on Grant Ave.; also a bridge over Little Pine Creek on Dewey St. Bids to be submitted on 3 different plans: 1st, a steel girder bridge with necessary abutments: 2d, reinforced concrete arch bridge; 3d, a masonry ribbed arch bridge.

**Spokane, Wash.*—The County Comrs. are stated to have awarded the contract for constructing the Le Pray Bridge over Spokane River about 26 miles below the city, to Mm. Oliver, of Spokane, for $8,500.

Mt. Vernon, Wash.—John W. Meehan, County Engr., is reported to have been authorized to secure plans and specifications for a 262-ft. steel span, 20 ft. wide, for the Mt. Vernon Bridge.

Wheeling, W. Va.—The City Council is reported to have decided to issue $25,000 bonds for the Market St. Bridge.

La Crosse, Wis.—It is stated that bids will be received until Dec. 6 at the office of C. H. Rawlinson, Co. Clk., for constructing a steel bridge over Black River; also laying new girders and flooring in the McGillivrary bridge.

Menominie, Wis.—Bids will probably be received about Dec. 6 by F. W. Rowe, City Clk., for the construction of a bridge over Red Cedar River; cost about $30,000.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The construction of a road from Los Angeles to Yuma via San Diego is reported contemplated.

Oakland, Cal.—The City Council is reported to be considering the construction of a boulevard around Lake Meritt.

Boulder, Colo.—It is stated that bids will be received until Dec. 7 by T. W. Jaycox, State Engr., Denver, for constructing and repaving 1 2-3 miles of county wagon road from Jamestown to Allen Park.

Washington, D. C.—See "Public Buildings."

**Wilmington, Del.*—Francis A. Price, State Highway Comr., writes that the contract for constructing a macadam road 2 64-100 miles long in New Castle (bids opened Nov. 26), has been awarded to Amies Asphalt Co., of Wilmington, Del., for $20,498.

Pensacola, Fla.—We are informed that the time of receiving of bids for approximately 170,700 sq. yds. of clay or shale blocks, sheet asphalt, bitulithic, wood block or macadam pavement, and 115,950 lin. ft. of concrete curb, which were to have been opened on Nov. 15, has been postponed until after Jan. 1st. L. Hilton Green, Chmn. Bd. Bond Trus.; T. Chalkley Hatton, Consulting Engr., Wilmington, Del.

Clarksville, Ga.—J. H. Asbury, Mayor, writes that it is proposed to macadamize about 1¼ miles of streets with crushed stone, at a cost of about $5,000.

Atlanta, Ga.—The City Council is reported to have opened bids Nov. 18 for paving with creosoted blocks Broad St. as follows: Venable Bros., Atlanta, $3.29, small granite blocks, between double car tracks, at $2.65. Georgia Granite Co., $3.49. Creosoting Co., of Ficklin, Ga., $3.61. Price given per sq. yd.

Chicago, Ill.—Plans are stated to have been prepared by the South Park Bd. for the widening of Michigan Ave.

Rock Island, Ill.—We are informed that bids will be received on Dec. 2 for 2 blocks of asphalt paving on 19th St.; estimated cost, $6,300. W. Treichler, City Engr.

Peoria, Ill.—The Bd. of Local Improv. has recommended the paving of Lincoln Ave. with brick; estimated cost, $28,600.

Danville, Ind.—It is stated that bids will be received until Dec. 5 by the Co. Comrs., at Danville for constructing 1¼ miles of gravel road in Marion Township. David D. Mills, Co. Aud.

**Crawfordsville, Ind.*—It is proposed to pave College and Walter Sts., about 20 blocks in all, with brick, cement curb and gutter. B. R. Johnston, City Engr.; Henry B. Hulett, City Clk.

Baltimore, Md.—Bids will be received until Dec. 4 by the Bd. of Awards (J. Barry Mahool, Pres.), to curb, regutter and resurface with bitulithic a portion of 22d St.

Boston, Mass.—See "Power Plants, Gas and Electricity."

St. Louis, Mo.—Bids will be received until Dec. 10 by the Bd. Pub. Improv. (J. J. O'Reilly, Pres.) for improving portions of numerous alleys by paving with vitri. paving brick blocks.

Portsmouth, N. H.—See "Power Plants, Gas and Electricity."

**Woodbury, N. J.*—The Bd. Chosen Freeholders is stated to have awarded the contract for constructing about 6 miles of the Malaga and Downstown road to J. S. Fisler, for $12,911.

**Malaga, N. J.*—The contract for the construction of the Malaga and Downstown Road is stated to have been awarded to J. Sheppard Fisler, of Clayton, for $12,911.

Newark, N. J.—Plans and specifications are reported completed for the paving of Clay St. at an estimated cost of $85,000.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—Bids will be received until Dec. 11 by Bird S. Coler, Boro. Pres., for paving with asphalt portions of Throop Ave., Grafton and 80th Sts., and with granite Wolcott St. Engineer's estimate 6,451 sq. yds. asphalt pavt.; 400 sq yds. granite block pavt, with tar and gravel joints; 830 cu. yds. concrete, etc.

Buffalo, N. Y.—Separate bids will be received until Dec. 16 by F. G. Ward, Comr. Pub. Wks., for paving portions of Detroit, Holt and Pine Sts., repaving Lafayette Ave. and Beau Alley.

New York, N. Y.—The following are the bids opened by the Dept. of Parks, Nov. 7, for furnishing and delivering two 12-ton, 3-wheel, steam road rollers for Dept. of Parks, Borough of Bronx: Buffalo Steam Roller Co., Buffalo, for Pitts-Niagara Rollers, each $1,595; total, $3,190; for Pitts Standard Rollers, each $3,175; total, $6,350; Iroquois Iron Works, Land Title Bldg., Philadelphia, Pa., each $2,338; total, $4,677; The Kelly-Springfield Road Roller Co., Springfield, O., each $3,050; total, $6,100; Chas. Longenecker & Co., each $2,650; total, $5,300.

Lenoir, N. C.—See "Water."

Fargo, N. D.—See "Bridges."

Hamilton, O.—Bids are wanted, it is stated, until Dec. 11 for $40,000 street bonds. John A. Keller, City Clk.

Toledo, O.—It is stated that bids will be received until Dec. 5 by Reynold Voit, Secy., Bd. Pub. Service, for constructing sidewalks on several streets.

Conneaut, O.—It is stated that H. G. Culp, City Aud., will receive bids until Dec. 14, for $20,000 Washington St. sidewalk bonds, also $2,000 street improvement bonds.

Washington, Pa.—Bids will be received until Dec. 20 by Wm. Wylie, Co. Road Engr., Washington, for repairing the roadway and culverts and cleaning out the side ditches in the sections of the Laboratory, Zollarsville, Beallsville and Claysville Roads.

Allentown, Pa.—The City Council is reported to have passed ordinances providing for the paving of Fulton and 12th Sts., also the opening and grading of a portion of Fairview Ave.

Altoona, Pa.—An ordinance is reported passed by City Council providing for the paving with brick a portion of 9th St.

Pittsburg, Pa.—Bids were opened as follows for macadamizing extension of Lovedale Road according to reports: McLaughlin Constr. Co., $3,186; Collins Garden Co., $2,379; Pitts Constr. Co., $3,597, and Albert G. Rathey, $2,821.

Williamsport, Pa.—The City Council is reported to have passed an ordinance providing for the paving of a portion of Washington St.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Memphis, Tenn.—Bids will be received until Dec. 5 by Ennis M. Douglass, City Register, for paving with gravel on a portion of La Clede Ave. Jas. H. Malone, Mayor.

Salt Lake City, Utah.—Bids will be received at the office of the Bd. of Pub. Wks. (F. J. Leonard, Chmn.) until Jan. 3 (extension of date from Dec. 6), for grading, curbing and paving First South St., to include 60,000 cu. yds. grading, 17,000 lin. ft. curb and 41,000 sq. yds. asphalt, as advertised in The Engineering Record. Louis C. Kelsey, City Engr.

Spokane, Wash.—Bids are wanted until Dec. 15, it is stated, for $400,000 street bonds. Robert Fairley, City Comptr.

**Seattle, Wash.*—H. F. Jahn & Co. have secured the contract for paving Jackson St. with brick for $6,102.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Columbiana, Ala.—The Columbiana Light & Power Co. is reported to have selected E. N. Cunningham, of New Orleans, La., to prepare plans for the installation of an electric light plant. After plans are completed bids will be received on equipment for complete plant.

**Arizona.*—The Secretary of the Interior at Washington, D. C., has executed contract with Roeblings Sons & Co., of Trenton, N. J., for furnishing approximately 685,000 lbs. of copper wire required for the transmission line and other purposes in connection with the Salt River irrigaton project, Arizona, at 15 1-4 cents per lb.

Chico, Cal.—The City Council is reported to have on Nov. 13 sold to L. D. Macy, a franchise to construct and operate an electric light, heat and power system in Chico.

Long Beach, Cal.—The Edison Electric Light Co. will expend about $100,000 to $150,000 for a new plant at Long Beach.

**Items marked thus give the names of parties awarded contracts.*

Berkeley, Cal.—At a recent meeting of the Chamber of Commerce, C. S. Forney is reported to have submitted a proposition for the establishment of an electric light plant.

**Pasadena, Cal.*—The City Council has voted to enter into a contract with the Ft. Wayne Electric Co., of Ft. Wayne, Ind., for the needed supply of electric transformers.

**Denver, Colo.*—The Northwestern Electric Equipment Co. of St. Paul, Minn., is reported to have secured the contract for the electrical equipment for the Auditorium for about $40,000.

Las Animas, Colo.—The following are the bids opened on Nov. 23 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for power plant for naval hospital (new) Ft. Lyon. (a) Price for the entire work, complete, in accordance with plans and specification; (b) amount to be deducted if garbage crematory and stack are omitted; (c) price for garbage crematory and stake; (d) for complete work in accordance with the spirit of specification, but with modifications: Lewis & Kitchen, 1,200 Michigan Ave., Chicago, Ill., (a) $90,728, (b) $2,150, (c) $2,150; Evans, Almirall & Co., 281 Water St., New York, N. Y. (a) (two bids) $91,472 and $98,750, (b) $2,285, (c) $2,285, (d) $85,582, $90,935 to $96,840; Stearns Rodger Mfg. Co., 1,720 California St., Denver, Colo., (a) $90,800; Dixon Eng. & Constru. Co., 323 1-2 Huron St., Toledo, O., (c) $2,850; D'Olier Eng. Co., 121 South 11th St., Philadelphia, Pa., (a) $77,800, (b) $2,090, (d) (3 bids) $77,000 to $77,500; Joseph S. Sweigard, Betz Bldg., Philadelphia, Pa., (d) $1 058; C. L. de Muralt, 114 Liberty St., New York, N. Y., (a) $72,000, (b) $2,600, (c) $2,600, (d) $62,250.

Washington, D. C.—R. C. Hollyday, Chief of the Bureau of Yards and Docks, in his annual report recommends an appropriation of $985,047 for the Washington Navy Yard, of which $300,000 will be expended for purchase of land and change of railroad system; rewiring certain yard buildings, $21,500; machinery for power plant extension, $12,000; night watch time detector system, $10,000; underground conduit system, to extend, $10,000; electric light plant extension, $5,000; extension and improvement of electric fire alarm and telephone systems, $4,000; completing switchboard in power plant building No. 118, $2,500; locomotive and locomotive crane house, $61,747; new foundry (to cost $300,000), $100,000; fireproof general storehouse for supplies and accounts, $200,000; quay wall, to complete, $25,000; new floors in north and south gun shops, east and west gun carriage, and other shops, $25,000; quay wall in front of old part of yard, $85,800, etc.

Washington, D. C.—See "Public Buildings."

Washington, D. C.—See "Miscellaneous."

Leesburg, Fla.—The question of holding an election to vote on issuing electric light bonds is reported to be under consideration.

Lagrange, Ga.—The Mayor writes that about $20,000 will be expended for electric light improvements. Bids will probably be called for in February. J. R. Black is Supt. and Ch. Engr. municipal plant.

Albany, Ga.—The Albany Power & Mfg. Co. is reported to have selected J. B. Sirrine, of Greenville, S. C., to prepare plans for the development of about 10,000 h. p. at Porter Shoals, on Flint River, where a dam and power house will be constructed.

Americus, Ga.—See "Electric Railways."

Muldoon, Idaho.—R. T. Tusten is reported to have decided to install an electric light plant to furnish light and power to the mills.

Clinton, Ill.—The Clinton Gas & Electric Co., of Clinton, is reported incorporated with a capital of $10,000, to manufacture and sell gas and electricity. Incorporators: Jas. M. Surdam, John W. Smith, Rolla T. Ingham, and others.

Harvard, Ill.—The City Council is reported to have granted Warren S. Stearns, of Rockford, a franchise for a gas plant.

Bedford, Ind.—See "Electric Railways."

Pella, Ia.—W. H. Fowler is reported to have petitioned Council for a franchise for an electric light plant.

Boston, Mass.—An appropriation of $435,800 has been asked for by the Bureau of Yards and Docks for the Boston Navy Yard to be divided as follows: Power plant extensions, $205,000; electric elevators, $17,000; underground conduit system, $30,800; repairs to pier No. 8, $15,000; repairs to pier No. 1, $5,000; dredging, $5,000; paving, $10,000; railroad system extensions, $7,000; railway rolling stock and new locomotive, $3,000; telephone system extensions, $2,000; water system extensions, $2,500; sewers, $2,500; rebuilding pier No. 9, $28,000; additional oil storehouse, $10,000, and removal of wall and chimney of the steam engineer foundry, building No. 42, $3,000.

Ft. Revere, Mass.—Bids will be received until Dec. .. by Capt. C. O. Zollars, C. A. C., Quartermaster, Ft. Revere, for furnishing and installing electric light fixtures in hospital at Ft. Revere.

Fowlerville, Mich.—The Fowlerville Light Co. is reported organized with a capital of $15,000. Incorporators: Lewis P. Cody, Amazon Antisdel and others.

Hermantown, Minn.—It is reported that improvements are contemplated at the city electric light plant.

Stewartville, Minn.—J. S. Dannerk, Mgr. Stewartville Electric Light Co., writes that between $1,200 and $1,500 will be expended for improvements. He is now considering the merits of a generator engine of 50 h. p.

Billings, Mont.—J. D. Losekamp is reported to have petitioned for a franchise for a gas plant.

[illegible], Neb.—Frank Hammond, Secy. Bd. of Pub. Wks., writes that former bids received for water works and electric light station have been rejected, and new bids are not yet called for. Probable cost of work, [illegible] Engineer, C. A. Chapman, of Chicago, Ill.

[illegible], N. H.—An appropriation of $871,350 has [illegible] the Bureau of Yards and Docks for [illegible] Portsmouth Navy Yard during the [illegible] Electric plant extension, $20,- [illegible] wall, $30,000; pattern shop for [illegible] $20,250; quay wall, extension (to cost $448,000), $50,000; streets and grading $15,000; naval prison extension (to cost $380,000), $250,000; marine barracks, naval prison, $130,000; quarters for commanding officer naval prison, $15,000; junior officers' quarters naval prison, six sets, $42,000; store house for combustibles, $30,100; sewer extension, $6,500; railroad extension, $15,000; paving, $20,000; cranes for boiler shop No. 96, $20,000; purchase of water supply system, $170,000; steam main, central power plant to steam engineer plant, $9,000; plumbers' shop improvements, $3,300; improvement to building No. 29, $4,900.

New York, N. Y.—Bids will be received until Dec. 10 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, New York City, to furnish the following to the Boroughs of Manhattan, Bronx, Queens and Richmond from Jan. 1 to Dec. 31, 1908, inclusive: Gas for and to the public lamps on the streets, supplying gas, etc., for new lamps when required, for making certain repairs to lamp-posts, and for furnishing gas to public buildings; gas lamps, etc., on the streets, and so on, and for connecting, lighting, extinguishing, cleaning, repairing and maintaining same, and also lamps belonging to city, supplying new lamps when required and furnishing burners and appliances for improved system of lighting on streets, avenues, parks and public places; also a bid on naphtha or similar illuminating material under conditions similar to gas lamps; furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places; furnishing, putting in place and maintaining 635 gas regulators; furnishing steam for heating or power purposes to certain public buildings.

Bay Shore, L. I., N. Y.—The Bay Shore Gas & Electric Light Co. (A. M. Hallock, Supt., Bay Shore) is reported to have decided to expend about $35,000 in improvements to its plant to include a 100,000 ft. storage holder, a 200 h. p. steam engine, 150 h. p. boiler, 110 kw generator, 8 in. exhauster, 8 in. station meter and laying of 1 1-2 miles of 12 in. pipe to supplement present system of mains.

Brooklyn, N. Y.—Bids will be received until Dec. 6 by John H. O'Brien, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing and delivering special cross heads for lamp posts in the Boro. of Brooklyn.

Bids will be received until Dec. 10 by John H. O'Brien, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing from Jan. 1 to Dec. 31, 1908, the following in the Boro. of Brooklyn: Gas for and to public lamps on streets, supplying gas, etc., for new lamps when required, for making certain repairs to lamp-posts, and for furnishing gas to public buildings; gas lamps, etc., on streets, and so on, and for connecting, lighting, extinguishing, cleaning, repairing and maintaining same, and also lamps belonging to city, supplying new lamps when required, and furnishing burners and appliances for improved system of lighting on streets, avenues, parks and public places; also a bid on naphtha or similar illuminating material under conditions similar to gas lamps; furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places.

Press reports state that R. C. Hollyday, Chief of the Bureau of Yards and Docks, Washington, D. C., in his annual report recommends the following improvements for the Brooklyn Navy Yard: Central power plant, $231,000; electric plant, extensions, $40,000; underground conduits, extensions, $25,000; railroad equipment, additional, $10,000; railroad system, extensions, $30,000; paving and grading, to continue, $15,000; sewers and drains, $15,000; dry dock No. 3, $20,000; tools for yards and docks, $2,000; repairs to roofs of buildings, $20,000; telephone system, extensions, $12,000; administration building (to cost $536,000), $100,000; traveling crane track, $50,000; extending garbage crematory, $5,000; reconstructing roof power house No. 41, $33,000; surveys and maps of yard improvements, $8,000; extending chemical laboratory, $6,000; fireproofing girders, building No. 127, $6,000; total, $628,000.

Sulphur Springs, N. C.—Smith & Powers are reported to be preparing plans for water works and an electric light plant.

Cleveland, O.—The Council Committee on Nov. 20 approved the franchise of the Cuyahoga Heat & Light Co., by which the company promises to furnish light within the city at a charge not greater than 5½ cts. per kw. hour. The company will accept the franchise and will within 2 years build a $2,000,000 plant. John C. Keyes, Pres.

Minerva, O.—Bids will be received until Dec. 4 by the Bd. of Pub. Affairs, (L. E. Weber, Secy), for furnishing for the municipal electric light and water plant a 150 h. p. boiler; 150 lbs. steam pressure.

Asheville, O.—It is stated that W. P. Powell, Village Clk., will receive bids until Dec. 20 for furnishing all material, copper wire and arc lamps and constructing a system of electric street lighting to be operated in connection with the substation of the Scioto Valley Traction Co. Plans and specifications may be obtained from R. Fullerton, care Scioto Valley Traction Co., Columbus.

Clinton, Okla.—F. Murch, of Hennessey, is reported to have secured a franchise for an electric light and gas plant.

Philadelphia, Pa.—In his annual report R. C. Hollyday, Chief of Bureau of Yards and Docks, Washington, D. C., asks for an appropriation of $903,000 for League Island Navy Yard to be expended as follows: Extension to central power plant, $322,500; extension to electric conduit system, $8,000; electric elevators, $8,000; electric motors for Dry Dock No. 1, $35,000; to continue retaining wall about reserve basin, $50,000; repairs to fenders on sea wall of Delaware water front, $8,000; repairs to shore ends of piers 2 and 3, Delaware water front, $10,000; grading and paving to continue, $25,000; sewer system, extensions, $11,000; hydraulic dredge for Dept. of Yards and Docks, $125,000; locomotive crane track extension, $30,000; extension to railroad system, $18,000; extension of artesian water system, $4,250; extension of fire protection system, $20,000; central heating system for yard, $50,000; intermediate keel blocks for Dry Dock No. 2, $5,675; equipment for railroad, $5,000; intermediate keel blocks for Dry Dock No. 1, $6,800; dredging and filling Delaware water front, $75,000; sawmill, boat and joiner shop (to cost $300,000), $100,000, etc.

Panama.—Bids will be received at the office of Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Comm., Washington, D. C., until [illegible], for furnishing electrical material, consisting of cable, wire, flexible conduit, wire attachments, switches, push buttons, shade holders, annunciators, bells, lamp shades, electroliers, incandescent globes, dry cells, wire grips, etc.

Sumter, S. C.—See "Electric Railways."

Freeman, S. D.—The citizens and business men are reported to have petitioned City Council to construct an electric light plant.

Elgin, Tex.—B. H. Graham, of Smithville, writes that a stock company is about to be formed, to construct electric light plant, water works and an ice plant, to cost between $50,000 and $60,000. Will be ready for plans about Jan. 1. No engineer yet selected.

Ft. Worth, Tex.—Bids will be received at the office of Jas. Knox Taylor, super Treas. Dept., Washington, D. C., until Dec. 20 for the installation of a conduit and electric wiring system for extension to U. S. Postoffice, as advertised in THE ENGINEERING RECORD.

Amherst, Va.—The Amherst Electric Light & Power Co. is reported incorporated, with a capital of $15,000, for the purpose of establishing plant for furnishing electric light and power. H. L. Page, Pres.

Tulalip, Wash.—See "Schools."

Fayetteville, W. Va.—The Fayetteville Water & Light Co. is reported incorporated with a capital of $25,000, and has secured franchise; will soon begin construction of plant. Jos. Hawkins is one of the incorporators.

Woodstock, Ont.—At the coming municipal election, it is stated that a by-law will be submitted for the expenditure of $27,000 for a distributing plant for Niagara power, and to provide a new motor and an electric pump.

London, Ont.—The City Council is reported to have passed on first reading, the Niagara power by-law, and the Special Com. of Council was authorized to instruct the engineer to prepare a statement of estimated cost of distribution, and prepare plans showing area proposed to be covered.

Hamilton, Ont.—See "Water."

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—It is stated that the Los Angeles & Owens Valley R. R. Co. will begin construction work in the spring on the line to connect Los Angeles, Randsburg, Independence and Bishop, which will be about 325 miles long. S. P. Jewett, Pres.; A. M. Chaffey, Secy. and Treas.

Hayward, Cal.—It is stated that bids will be received Dec. 4 for a franchise as applied for by the Oakland Traction Co.

Washington, D. C.—It is reported that the Washington, Spa Springs & Gretta Electric Ry. Co., which is to connect Washington, Bladensburg and Branchville by an electric railway will begin construction work in January. The line will be about 8 miles long. Capital, $100,000. Benj. D. Stephens, Hyattsville, Md., Pres., and S. S. Yoder, Gen. Mgr.

Americus, Ga.—It is stated that the Americus Ry. & Lighting Co. is planning to begin construction of the electric railways within 60 days. The company contemplates building 4 miles of track. The power house and repair shop will be located at Americus. A. N. Walker, Scranton, Pa., Pres.

**Atlanta, Ga.*—The contract for constructing the Atlanta-Augusta Interurban Electric Ry. is stated to have been awarded to Cook & Laurie Co., of Montgomery.

Marietta, Ga.—It is stated that a charter for the Marietta-Macland Ry. Co., which will build an electric railway from Marietta to Powder Springs, will be secured next month, and as soon as the financial situation becomes more settled the company will be financed and work pursued to completion on the road. John N. McEachern is reported interested. Capital, $500,000.

Bedford, Ind.—The City Council is reported to have granted the Grand Central Traction Co. a franchise for the construction of an interurban line through the city and also operate an electric light plant.

New Orleans, La.—J. W. I. Stephens is reported organizing a company to construct an electric railway between New Orleans and Grand Isle.

Calumet, Mich.—It is stated that Calumet & Lac la Belle Traction & Power Co. will soon be organized for building an electric railway between Calumet and Lac la Belle. S. M. Wells, of Chicago, is promoting the scheme.

Manchester, N. H.—See "Business Buildings."

New York, N. Y.—Bids were opened at the office of Jas. W. Stevenson, Comr. Bridges, N. Y. City, on Oct. 24, for the construction of train spacing signals for the elevated railway tracks of the Brooklyn Bridge and the contract was awarded to the Union Switch & Signal Co., 143 Liberty st., for $39,950.

Defiance, O.—The Toledo & Defiance Ry. Co. and the Defiance, Hicksville & Ft. Wayne Ry. Co. have been granted franchises to construct electric railways in Defiance, according to reports.

Oklahoma City, Okla.—A charter is stated to have granted to the Oklahoma Interurban Traction Co., of Oklahoma City, with $500,000 capital to build an electric interurban line in Oklahoma City and Capitol Hill to El Reno. Incorporators: L. E. Patterson, S. C. Glasgow, G. F. Benz and others.

Hershey, Pa.—It is reported that the extension of the Hershey & Campbellstown Elecrtc Ry. to Elizabethtown, is contemplated.

Morrellville, Pa.—The City Council is reported to have passed an ordinance granting the Johnstown Passenger Ry. Co. the right to operate on certain streets in Morrellville. C. N. Smith, Ch. Engr., Johnstown.

Linesville, Pa.—The Meadville & Conneaut Lake Traction Co. (H. L. Kellenbaugh, of Meadville, Supt.) is reported to have announced that the extension of the line from Linesville to Greenville, a distance of 21 miles, is contemplated.

Smithfield, Pa.—The Borough Council is reported to have granted the Brownsville, Masontown and Smithfield

*Items marked thus give the names of parties awarded contracts.

St. Ry. Co. a franchise on Geneva, Masontown, Church Morgantown and Water sts. E. M. Wilkins, Ch. Eng.

Pittsburg, Pa.—See "Water."

Sumter, S. C.—It is reported that J. L. Alnut has petitioned the Council for a franchise for a street railway and gas works.

Memphis, Tenn.—See "Business Buildings."

Spokane, Wash.—It is stated that the work of clearing the right of way of the Panhandle Electric Ry. & Power Co. is proceeding rapidly, and in a short time the grading of the road will be started. The company will at once proceed to erect a large power plant on Priest River to furnish power for the road, and will also sell power to the mines in the Priest Lake district. Terminals for the road have been purchased at the town of Priest Lake, on the Great Northern, and at the foot of the lake itself.

Prosser, Wash.—The Prosser Traction Co. is reported organized to construct an electric railway. The company announces that a power site has been selected 7 miles below Prosser. In case it secures the site the company will construct a dam and build a power plant at that place, transmitting its power to Prosser. It is proposed to construct a line south into Horse Heaven County as far as the Columbia River and another east to connect with the North Coast R. R. in case that road builds its line, as now proposed, through Kiona and up the Yakima Valley.

North Yakima, Wash.—It is stated that surveys have been completed for the Hanford Electric R. R., which is to connect the Hanford irrigation tract on the Columbia River with the Milwaukee and also with the Northern Pacific at this point. Grading work will be commenced either this winter or early in the spring and power to operate the road will be generated at the power plant of the irrigation company at Priest Rapids. The line from the town of Hanford to North Yakima will run straight through the Moxee Valley to North Yakima, traversing the Black Rock and Cold Springs districts.

Bluefield, W. Va.—The Bluestone Traction Co. is reported to have been granted a franchise to extend its line over So. Bland St., and into South Bluefield.

Niagara Falls, Ont.—The Buffalo, Niagara & Toronto Ry. Co. is stated to have secured the right of way from Falls View to a point on the Niagara, St. Catharines and Toronto line.

St. Vital, Man.—The Town Council is reported to have decided to construct a municipal street railway system in St. Vital.

RAILROADS.

Notes Arranged Alphabetically by States.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Eunice, La.—The Eunice, Lafayette & Abbeville Ry. Co. (Mr. Clarke, Mgr., 1st Natl. Bank Bldg.) is reported to be completing surveys for its new line.

Boston, Mass.—See "Power Plants, Gas and Electricity."

Biloxi, Miss.—It is reported that surveys have been made for the Biloxi Great Northern R. R., which it is proposed to build from Biloxi to a connection with the Mobile & Ohio R. R. It is stated that surveys have been made to Bucatunna, making the distance about 100 miles. W. L. Covell, Ch. Engr., Biloxi.

Portsmouth, N. H.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—The East River Terminal Co. is reported incorporated to build and operate a standard gauge steam railroad, to be used exclusively for freight purposes, in the Boro. of Brooklyn. The road is to begin at the East River, bet. No. 3d and No. 4th Sts., and run easterly about half a mile to a point east of Wythe Ave., bet. No. 3d and No. 4th Sts. Capital, $10,000. Directors: H. O. Havemeyer, Jr.; B. E. Martin, J. H. McCafferty and others, of New York City; John Unger, of Morristown, N. J., and Wm. B. Duncan, Jr., of Port Washington, L. I.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

Albany, N. Y.—Press reports state that the Boston & Albany R. R. Co. (Walter Shepard, Ch. Engr., Boston, Mass.) is having plans and specifications prepared for installing a signaling system on its road, at an estimated cost of $900,000. This work will be completed in 2 to 3 years and will be started in the spring. It will entail replacing signals on ¾ of the length of the system.

Niagara Falls, N. Y.—At a session of the Grade Crossings Comn. on Nov. 14 Engr. John L. Harper, of the Niagara Falls Hydraulic Power & Mfg. Co., and Engr. Wm. D. Robins, of the Niagara Falls Power Co., were selected to prepare a complete set of plans for the elimination of all grade crossings in the city. The board also took under consideration the resolution of the Common Council recently passed directing the Comn. to take necessary steps to eliminate the No. Main St. crossing by means of a viaduct from Ontario Ave. to Bellevue Ave. This proposition will also be looked into by the engineers of the Comn.

Bellaire, O.—The officials of the Northwest system of the Pennsylvania Co. and those of the Southwest system, which operates the Pan Handle R. R. are reported to have decided to construct during 1908 a second track on the Cleveland & Pittsburg division from Bellaire to Mingo Junction, O., and also build a large freight yard at New Cumberland Junction, W. Va., 6 miles east from Steubenville, O. Thos. Rodd, Ch. Engr., Pittsburg, Pa.

Philadelphia, Pa.—Geo. S. Webster, Chief of the Bureau of Surveys, on Nov. 21 reported to the Special Joint Committee appointed by Councils to consider the removal of grade crossings in the downtown district that the estimated cost would be for an elevated steel structure along Washington Ave. $4,650,000, and a partly elevated, partly subway track for the Oregon and Shunk street lines $4,000,000. A subcommittee was appointed to confer with the Mayor, the Bureau of Surveys and the officials of the Pennsylvania and Baltimore & Ohio R. R. Companies as to the most practicable plans for the accomplishment of this work. The subcommittee consists of Charles R. Campbell, Select Councilman from the 39th Ward; Wm. A. Miller, Common Councilman from the same ward, and Wm. J. Crawford, Select Councilman from 30th Ward.

Wilkesbarre, Pa.—Local press reports state that the Grade Crossing Comn. of Council have adopted plans for abolishing the grade crossings as amended, which will permit Market and Northampton Sts. remaining open. E. B. Morgan, Chmn. Hollenback Bldg.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Stamford, Tex.—The Stamford & Northwestern Ry. Co. has completed the location of its proposed new line. The line starts at Stamford and runs through Jones, Haskell, Stonewall, Kent and Dickens Counties; total length of line, 100 4/10 miles. It is expected that work will commence on construction before end of year. L. M. Buie, Pres., and W. E. Bogart, Ch. Engr., both of Stamford.

Cheyenne, Wyo.—The Wyoming Short Line R. R. Co. is reported incorporated to construct a line in the Big Horn country, to be 50 miles in length, extending from Wiley and reaching the eastern border of Yellowstone National Park. The road will pass through Germania, Grey Bull and other towns. The new enterprise is financed by the Big Horn Development Co., which has capitalized the new railroad at $2,500,000.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—Geo. F. Tilton, of New York, N. Y., is reported engaged to prepare plans for the Carnegie Library to be erected at 7th and Louisiana Sts.

Wilmington, Cal.—The plans of C. H. Russell, of Wilmington, for the city hall provide for a 2-story building to be erected at 8th and Canal Sts., at a cost of $10,000.

Bridgeport, Conn.—It is stated that improvements to the Bridgeport Hospital, including the erection of an additional story to the west ward and improving the west wing at a cost of $16,000 are contemplated.

Stamford, Conn.—Nelson E. Emmons is reported to be preparing plans for two new fire engine houses.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received at the office of Bernard R. Green, Supt. of Construction, National Museum, Library of Congress, until Dec. 10 for furnishing and delivering c. i. radiators for hot water heating for the new national museum, as advertised in The Engineering Record.

The Comrs. D. C. on Nov. 20 opened the following bids for (*a*) erecting fire truck house at Lanier Heights and (*b*) chemical fire engine house in Langdon: Burgess & Parsons, *a* $28,700; *b* $16,400; Jas. M. Dunn, *a* $25,460; *b* $16,400; Robt. T. Humphrey, *b* $16,900; Thos. H. Melton, *a* $23,547.

Among the estimates for local improvements to be submitted to Congress at its coming session by the Secretary of War is reported to be one of $770,000 for additional buildings for the engineer post and school at the Washington barracks reservation, as follows: A building or buildings for post headquarters, engineer school, engineer library, engineer museum, etc., $150,000; barrack No. 2 (completing), $35,000; 6 additional double sets of quarters for non-commissioned officers' quarters, $60,000; new post hospital, $60,000; bachelor officers' quarters, $65,000; one new stable, $17,500; engineer school power house, $20,000; engineer school trade shops, $20,000; quartermaster's coal shed, $8,000; timber shed, $3,000; quarters for chaplain, $17,000; extending and completing the system of roads, sidewalks, sewers, water supply, gas and electrical distribution to serve these new buildings, $25,000; storage shed for ponton wagons, $12,500.

Ocilla, Ga.—The Comrs. of Roads and Revenues are reported to have secured a site, on which it is proposed erecting a jail costing about $18,000.

Chicago, Ill.—It is stated that the Cribside Society will erect a hospital at 481 Orchard St., to cost $30,000. Plans to be prepared by Holabird & Roche, 1618 Monadnock Bldg., for a 2-story 37x41-ft. structure.

Lincoln, Ill.—W. Carbys Zimmerman, 1101 Steinway Hall, Chicago, has prepared plans for a gymnasium for the Illinois Asylum for Feeble Minded Children at Lincoln; cost about $20,000. Dr. Hardt, of Lincoln, Supt.

Auburn, Ind.—It is stated that bids will be received until Dec. 4 for $30,000 County Asylum bonds.

Ft. Des Moines, Ia.—Bids will be received by Capt. John J. Boniface, Constr. Q. M., U. S. A., until Dec. 23 for constructing plumbing, steam heating and electric wiring certain buildings at this post, as advertised in The Engineering Record.

Lakeland, Ky.—Bids will be received until Dec. 4 for erecting a laundry building at the Central Kentucky Asylum for the Insane at Lakeland. Further information can be obtained from Kenneth McDonald & W. J. Dodd, Archts., Lincoln Savings Bank Bldg., Louisville.

Ft. Thomas, Ky.—Bids will be received until Dec. 5 by Capt. J. C. Castner, Q. M. 4th Infantry Constr. Q. M., U. S. A., for constructing a brick stable and a frame wagon shed at this post.

New Orleans, La.—It is reported that the Treas. Dept. at Washington, D. C., has asked competitive plans for the Federal Building at New Orleans, which is to cost about $400,000.

Marksville, La.—The grand jury has recommended the erection of a new parish courthouse.

Boston, Mass.—Bids will be received until Dec. 6, by the Trus. of the City Hospital, for additions to and alterations in the Relief Station of the City Hospital. Bids to be submitted separately on plumbing, heating and electric work. Kendall, Taylor & Co., Archts., 93 Federal St.; Geo. M. Rowe, Supt.

Fall River, Mass.—The proposed contagious disease hospital, for which L. G. Destremps, Bennett Blk., is preparing plans, will cost about $125,000.

Boston, Mass.—See "Power Plants, Gas and Electricity."

**Worcester, Mass.*—Eli Beliale, 19 Portland St., is reported to have secured the contract at $22,450 for the erection of a 4-story brick workshop. Geo. H. Halcott, Supt. of Pub. Bldgs.

**Flint, Mich.*—H. J. McAlpine, of Dixon, Ill., has secured the contract for constructing complete U. S. Post Office at Flint, for $71,100 (bids opened Nov. 5 at office of Superv. Archt., Treas. Dept., Washington, D. C.).

Houston, Miss.—It is stated that T. W. Hamilton, Co. Clk., will receive bids until Dec. 17 for $65,000 courthouse bonds.

Ellisville, Miss.—We are informed that bids will be received on Dec. 16 by W. H. Bufkin, Chancery Clk., for the erection of two jails, one at Ellisville, the other at Laurel.

**St. Louis, Mo.*—The Bd. of Pub. Improv., it is reported, has awarded the contract for the construction and fireproofing of the east wing of the poorhouse to the McCully Constr. Co., 509 Chestnut St., at $24,084 (bids received Nov. 15).

**Kansas City, Mo.*—The contract to erect the poor farm building is reported awarded to Taylor & Winn, of Kansas City, at $148,208 (bids received Oct. 31). This bid includes excavation and enclosing of building. Contracts for finishing and electric wiring are to be let separately.

Cassville, Mo.—The Co. Board, it is reported, has under consideration the issuing $60,000 bonds for the construction of a court house.

Potosi, Mo.—Bids will be received until Dec. 21 by N. F. Robinson, County Treas., Potosi, for $30,000 bonds issued for the purpose of erecting a court house.

Portsmouth, N. H.—See "Power Plants, Gas and Electricity."

**Atlantic City, N. J.*—Wm. Riddle, Chmn. Com. on Streets, Walks and Drives, writes that the contract for a public rest pavilion and comfort station on Boardwalk at New York Ave. (bids opened Nov. 11), has been awarded to P. E. Lane, Bartlett Bldg., Atlantic City, for $10,800.

Utica, N. Y.—Bids will be received until Dec. 11 by Henry W. Roberts, County Treas., Utica, for $55,000 county court house bonds.

The Special Com. of the State Fair Comn., it is stated, has adopted the plans of Green & Wicks, of Buffalo, for developing the fair grounds, which include the erection of the manufacturers' and liberal arts building, provided for in the accepted plans. The cost of the building alone is reported at $200,000.

Canandaigua N. Y.—J. Foster Warner, of Rochester, it is stated, has submitted a report to the Bd. of Superv. of Ontario County, in which he estimated the cost of erecting 2 small wings and a 3-story to the court house at $31,500, and the erection of a separate fireproof building at $47,250.

New York, N. Y.—It is stated that Asst. Secy. Winthrop, of the Treas. Dept. at Washington, D. C., in charge of public buildings, has designated a number of architects of New York to submit competitive plans for the new post office building in New York. the plans to be opened on March 25. The architects are Carrere & Hastings, Heins & LaFarge, McKim, Mead & White, Geo. B. Post, H. Van Buren, Magonigle, Whitfield & King, Kenneth M. Murchison and Cass Gilbert.

At the hearing on Nov. 26 on the ordinance passed by the Bd. of Aldermen, Nov. 19, appropriating $40,000 for a temporary building to be erected in City Hall Park, at Centre and Chambers Sts., for city court purposes, action was taken against the ordinance.

Brooklyn, N. Y.—The Trus. of the Public Library, it is stated, adopted a resolution recently approving the plans submitted by R. F. Almirall, 51 Chambers St., Manhattan, for the Central Library.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

Ellis Island, N. Y. Harbor.—Bids will be received until Dec. 5 by Robt. Watchorn, Comr. of Immigration, Ellis Island, N. Y. Harbor, for furnishing material and making alterations to provide for dining hall, second floor, kitchen and laundry building at the U. S. Immigration Station, Ellis Island.

Columbus, O.—The Comrs. of the county, it is reported, are considering the erection of a cottage for women at the Longview Hospital, to cost $150,000.

Cincinnati, O.—The Co. Comrs. are reported to have adopted a resolution for plans and specifications for repairs to an armory of the O. N. G., which will include heating, fire escapes, fireproofing and electric wiring.

Youngstown, O.—Bids will be received until Dec. 21 by the Co. Courthouse Comrs. (John Stambaugh, Chmn.) for ventilating and heating the new Co. Courthouse. Owsley & Boucherle & Co., Archts.; Maloney Blk.

Pittsburg, Pa.—See "Water."

McKeesport, Pa.—It is reported that the Council is contemplating the erection of an infirmary, to cost $50,000.

Philadelphia, Pa.—Director Dixon, Comr. of Health, Academy of Natural Sciences, 19th and Race Sts., it is stated, has asked bids for erecting a State sanitarium for consumptives at Belle Alto, for which the State has appropriated $1,000,000. Bids are now asked, according to reports, on 50 frame cottages and pavilions. Other buildings are to be erected in connection with this sanitarium, which include infirmary building, central dining hall, buildings for employees and a central laundry and bath houses. The number of cottages will eventually be increased to 100. Wilson, Harris & Richards, Drexel Bldg., are the archts.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Philadelphia, Pa.—The Trus. of the Northwest General Hospital, 2019 N. 22d St., it is stated, are ahving plans

Items marked thus give the names of parties awarded contracts.

prepared for a hospital to be erected at a cost of $75,000, of brick and limestone trimming and 4 stories high.

Pittsburg, Pa.—P. W. Finn, 163 Columbus Ave., New York, N. Y., is reported to have secured from the Co. Comrs. the contract to erect the Allegheny County Soldiers' Memorial Hall (bids for which were received Nov. 23), at $753,134. Sandstone is the material to be used.

Local press reports state that the Bldg. Com. of the proposed Oliver Memorial Annex of the Southside Hospital will receive bids on Dec. 4 for erecting said annex.

Columbia, S. C.—The erection of a building to provide offices for the Supreme Court, State Supt. of Educ. and others, it is reported, is under consideration.

Chattanooga, Tenn.—Local press reports state that bids will be received until Dec. 10 by Robt. Hooke, City Engr., for erecting the City Hall. R. H. Hunt, 8th and Broad Sts., is the archt.

Canyon, Tex.—The Co. Bd., it is reported, is considering the issuing of $60,000 bonds to erect a court house.

Ft. Worth, Tex.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Dec. 20 for a low-pressure steam heating apparatus for the U. S. Post Office and Court House and extension thereto, as advertised in The Engineering Record.

Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Dec. 21 for installation of plumbing, gas-piping, etc., in extension to U. S. Post Office and Court House at Ft. Worth.

Tyler, Tex.—The following are the bids opened on Nov. 25 at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction, including plumbing, gas piping, heating, apparatus, electric conduits and wiring, of an extension, etc., to the U. S. Post Office and Court House at Tyler, Tex.: John J. Ports & Co., Tyler, $38,763; Tom Lovells Sons, Denton, $43,677; L. R. Wright, Dallas, $41,900, and Bell & Ainsworth, Waco, $30,875.

Abilene, Tex.—It is reported that bids will be received Dec. 6 by the Secy. Bd. Comrs. for erecting 2 buildings at the Epileptic Colony, Abilene; also bids for lighting and plumbing same.

Portsmouth, Va.—The following are the bids opened on Nov. 22 at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Custom House at Portsmouth: E. Hart, Norfolk, $76,152; King Lumber Co., Charlotteville, $76,440; W. H. Fissell, New York, N. Y., $78,954; H. A. Bishop, Chicago, Ill., $79,775; Richardson & Son, Hampton $64,734; A. B. Stannard, New York, N. Y., $79,328; D. N. Andrew Co., Baltimore, Md., $68,031, and G. A. Fuller Co., Washington, D. C., $77,500.

Montpelier, Vt.—It is stated that the plans for the new city hall provide for a 2-story brick, terra cotta and granite building.

Green Bay, Wis.—The Bd. of Superv., it is stated, has passed a resolution authorizing a $50,000 bond issue to cover the cost of erecting a jail and sheriff's residence.

**Toronto, Ont.*—A contract for the alterations to the Toronto Post Office (bids received Nov. 5 at Ottawa), it is reported, has been awarded to Geo. Henry, Russell Road, Toronto, for about $20,000.

Ottawa, Ont.—It is reported that a drill hall costing about $100,000 is to be erected here.

Kingston, Ont.—Bids will be received until Dec. 6 by Dept. Pub. Wks. at Ottawa (Fred Gelinas, Secy.) for servants' quarters, R. M. C., Kingston.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Batesville, Ark.—The Masonic Grand Lodge has authorized the Bd. of Control of the Orphans' Home to begin at once the erection of a building in Batesville. Probable cost, $40,000.

Red Bluff, Cal.—The following are reported to be the lowest bids recently received for erecting an opera house: Brick work, O'Connor Bros., $14,495; carpenter work, J. G. Fritz, $16,000; plumbing, A. H. Schaffer, $1,495; electrical work, Robinson & Stringer, Redding, $1,403; plastering, G. M. Dalrymple, Chico, $1,684 (bidders of Red Bluff unless otherwise stated).

Denver, Colo.—J. K. Mullen and M. Marceau are reported interested in the erection of a 3-story restaurant building on Glenarm St., to cost about $400,000.

Gainesville, Fla.—S. H. Dempsey is reported to be preparing plans for a Masonic Temple for Gainesville to cost about $20,000.

Chicago, Ill.—It is stated that Tyler & Hippach has purchased a site at Ohio and Orleans Sts., and will erect a 5-story building to cost $100,000.

The Y. M. C. Assoc., it is stated, is considering the erection of a boys' clubhouse on the North Side with the Albert Keep bequest of $100,000. The building will probably cost $150,000.

Chicago, Ill.—It is stated that the Kuntz-Remmier Co. will add 4 stories to their 2-story building at 305 Wabash Ave. It will be of fireproof construction and cost about $50,000. Wm. J. Brinkman, 163 Randolph St., is the archt.

Peoria, Ill.—The Louthner Bldg., occupied by Browie & Bros., and the buildings adjoining are reported destroyed by fire.

**Des Moines, Ia.*—H. A. Maine is reported to have secured the contract for the erection of a building on [illegible] St., which F. M. Hubbell & Sons will erect for the [illegible] Electric Co., at a cost of $25,000.

Des Moines, Ia.—It is stated that a citadel will be erected [illegible] for the Des Moines Div. of the Salvation Army, at a cost of $40,000.

**[illegible], Ky.*—The Bd. of Directors of the Y. M. C. A., it is reported, has awarded the contract to erect the Y. M. C. A. Bldg. at Main and Green Sts. to Porter [illegible].

South Braintree, Mass.—Aaron H. Gould, Archt., 17 [illegible] St., Boston, writes that bids will be received about Apr. 1 for the erection of a hotel at South Braintree, to cost about $100,000.

St. Paul, Minn.—It is stated that Kennedy, McLeod & McArthur Co. are preparing to erect a $250,000 business building.

Minneapolis, Minn.—A. Guthrie & Co., of St. Paul, are stated to have decided to erect an addition to the Golden West Hotel, at Washington Ave. and 3d St. south, Minneapolis, to cost about $25,000.

Crookston, Minn.—Harry Ives, prop. of the St. Hilaire Spectator, is said to be interested in the erection of an opera house here, to cost about $30,000.

Collins, Miss.—It is reported that F. L. Crump will erect a brick hotel replacing the Collins Hotel, recently destroyed.

Kansas City, Mo.—The Wells-Fargo Express Co. is reported to have under consideration the erection of a 5-story brick building at Central and Goodrich Pl., to be used as a supply house.

Manchester, N. H.—The Manchester S. Ry. Co is reported to have decided to erect car barns at West Central and Franklin Sts. J. B. Smith, Gen. Mgr.

**White Plains, N. Y.*—It is stated that the contract to erect a 3-story brick garage for Wm. G. Barrett has been awarded to Freeman H. Merritt, at about $30,000.

Brooklyn, N. Y.—The Belmont Ave. Peddlers Assoc., it is reported, intends erecting a market in Brownsville at Belmont Ave. and Christopher St., at a cost of about $75,000.

W. H. McElfatrick, of New York, N. Y., it is stated, has prepared plans for a theatre to be ereectd at Manhattan Ave. and Calyer St., of stone and steel and concrete, by Percy G. Williams.

Plattsburg, N. Y.—The General Secretary of the Y. M. C. A. writes that bids will probably be received the latter part of December for the erection of a Y. M. C. A. building, to cost about $55,000. Architects, Jackson & Rosencrans, 31 Union Sq., New York City.

Buffalo, N. Y.—The New York Central R. R. Co. is reported to have decided to erect a round house on Bailey Ave., East Buffalo, at a cost of $120,000. L. H. Van Allen, of Buffalo, Division Supt.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 3-story brick and stone stores and dwellings at 113th St. and Lenox Ave. for Jos. Roberts cost $20,000. Geo. F. Pelham, archt.; 6 story brick and stone tenement at Amsterdam Ave. and 178th St., for T. J. McGuire Constr. Co., cost, $175,000, Geo. R. Euell, Archt.; one-story brick substation at Baychester R. R. Yard on Main St., for N. Y., N. H. & H. R. R. Co., cost, $18,000, A. L. Fowler, Archt.; 2-story brick and stone extension to 4-story brick and stone stores and studios at 15 W. 31st St., for Robt. Smith, cost, $30,000, B. W. Levitan, Archt.

Plans prepared by Carrere & Hastings, 28 E. 41st St. for the New Theatre are reported accepted by the Bd. Directors (W. K. Vanderbilt, Pres.) Nov. 10.

W. H. Knowlton, engineer of the New York Central Rail Road Co., has filed plans for equipping the train platforms of 8 groups of railroad tracks east of Vanderbilt Ave., and just north of the Grand Central Station, with long canopies, supported by large posts, the improvements being made at a cost of $50,500, to shelter passengers.

Fargo, N. D.—The warehouse and office building of J. I. Case Co. is reported destroyed by fire.

Oklahoma City, Okla.—Plans are stated to have been prepared for a $1,000,000 hotel to be erected at Grand Ave. and Robert St., by Chas. T. Colcord and Robert Galbreath.

**Philadelphia, Pa.*—A. Raymond Raff, 1635 Thompson St., is reported to have secured the contract to repair the fire damage to the tobacco warehouse of A. E. Cunnungham on N. Second St. Cost, $14,000.

Memphis, Tenn.—The Lake View Traction Co. is reported to have purchased the old building and site of the Y. M. C. Association and will erect thereon depot and terminals.

Seattle, Wash.—It is stated that plans are under consideration by the Arctic Brotherhood for the erection of a building for the Alaska-Yukon-Pacific Exposition; probable cost of structure, $20,000.

Green Bay, Wis.—H. C. Koch & Co., 120 Wisconsin St., Milwaukee, are said to be preparing plans for a 6-story white enameled building to be known as Minahan Block.

Milwaukee, Wis.—Parkinson & Dockendorf are stated to have been selected to prepare plans for the Y. M. C. A. building, to cost $100,000. F. H. Hussey, of Lansing, Mich., has been engaged as consulting archt. for the interior plans.

Chas. L. Lesser, 321 Grove St., is reported to be preparing plans for a lodge hall, to be erected at Kinnickinnic and Otjen Aves. for Lake Lodge, F. and A. M. The building will be of solid brick construction, with stone facings and 3 stories in height. Cost about $25,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—Wm. Cowe, 510 Mack Bldg., it is stated, is preparing plans for an edifice to be erected for the East Side Christian Church, at 13th Ave. and Williams St., at a cost of $20,000.

W. E. Fisher & Bros., Ferguson Bldg., it is reported, are preparing plans for an edifice to be erected by the members of the Capitol Hill Methodist Church, at a cost of $25,000.

Atlanta, Ga.—It is stated that a stone edifice costing about $20,000 is to be erected for the Read St. Baptist Church (Rev. E. P. Johnstone, pastor).

Chicago, Ill.—J. M. Dubach, it is stated, will erect a 3-story brick and stone apartment house at Prairie Ave. and 47th St., to cost $50,000.

It is stated that a 3-story apartment house is to be erected at Princeton Ave. and 73d St. by Arthur Foster, at a cost of $10,000.

Cullom, Ill.—The erection of an edifice costing about $25,000 for the members of the Roman Catholic Church is reported contemplated. Rev. Father White, pastor.

Baltimore, Md.—Jacob F. Gerwig, 111 E. Lexington St., it is stated, has been commissioned by Israel Silberstein to prepare plans for 4 3-story apartment houses to be erected at Whitelock St. and Bolton Ave., to cost a total of $60,000.

Detroit, Mich.——E. H. Zeigen, manager of the Zeigen Real Estate Exchange, is reported to be having plans prepared for a modern $18,000 residence.

St. Louis, Mo.—It is reported that the Mount Auburn Methodist Society South, has purchased a site, and will erect a $40,000 edifice.

Hastings, Neb.—The members of the Congregational Church, it is stated, are planning the erection of a brick edifice costing about $16,000.

Newark, N. J.—Peter Charles, 15 Clinton St., is reported to have completed plans for a 4-story brick apartment house to be erected for Theo. G. Gibson at an estimated cost of $40,000.

Ocean City, N. J.—Chas. A. Doe, of Philadelphia, Pa., it is stated, is having plans prepared for a $15,000 apartment house and 2 cottages, which are to cost $35,000 each, to be erected in Ocean City.

Wilmington, N. C.—It is reported that the members of the Baptist Church are having plans prepared for a $20,000 edifice. Rev. C. H. Durham, pastor.

Pemberville, O.—It is stated that bids will be received until Jan. 15 by Rev. E. H. D. Winterhoff, Chmn. Bldg. Com., for erecting a 1-story 73x120-ft. brick and stone edifice for the Evangelical Lutheran congregation. Bids to be submitted separately on roofing and sheet metal work. R. C. Gotwald, Archt., Springfield.

Enola, Pa.—It is stated that the Trus. of the Presbytery of the Dist. of Carlisle propose erecting a $30,000 Presbyterian Church in Enola.

Philadelphia, Pa.—Abel Bottoms, of West Philadelphia, it is stated, has secured a site at Walnut and 36th Sts. on which, it is said, he intends erecting a 6 or 8-story apartment house to cost $100,000.

Carrere & Hastings, of New York, N. Y., are reported to be the archts. engaged to prepare plans for the edifice which is to be erected for the First Church of Christ (Scientist), at Walnut and 39th Sts.

It is stated that Wilson, Harris & Richards, Drexel Bldg., have prepared plans for a $100,000 edifice and Sunday school building to be erected at Wayne Ave. and Queen St., Germantown, for the M. E. Church of the Advocate.

Greenville, Pa.—The Bd. of Directors of St. Paul's Orphans' Home of Pittsburg Synod Reformed Church of the United States, it is stated, has voted to erect a new $65,000 home near Greenville, changing the present location from Butler. Plans for the building as prepared by Milligan & Miller, of Wilkinsburg, have been accepted. It is stated that bids for the construction will be received early in Jan.

Milwaukee, Wis.—Leenhouts & Guthrie, 102 Wisconsin St., according to reports, have completed plans for a $60,000 apartment house to be 4 story, brick and stone, and erected by John Bennett, Secy., General Constr. Co., at 13th and Well Sts.

Oshkosh, Wis.—The members of the Christian Science Church, it is stated, have secured a site on Washington St. and Jefferson Ave., on which it is proposed next spring erecting an edifice costing about $25,000.

Kiel, Wis.—It is stated that plans are being prepared for an edifice which is to be erected for the members of Sts. Peter and Paul R. C. Church at a cost of $20,000. Rev. Father R. W. Nickle, pastor.

SCHOOLS.

Notes Arranged Alphabetically by States.

Cullman, Ala.—The directors of St. Bernard's College, it is stated, are planning to expend $20,000 in improvements.

Montgomery, Ala.—It is stated that work will soon commence on the erecting of buildings for the Methodist College for Women, probable cost of proposed structures, $50,000.

Pasadena, Cal.—Pres. A. H. Chamberlain, of Throop Institute, is reported to have announced that plans are being prepared for new buildings which it is proposed erecting at E. California and San Pasqual Sts., at a cost of about $2,000,000.

Washington, D. C.—The following are the bids opened on Nov. 16 by the Comrs. D. C. for (*a*) erecting McCormick School, an 8-room building; (*b*) 6-room addition to the Langdon School: R. T. Humphrey, *a* $45,600; *b* $25,300; J. M. Dunn, *a* $47,220; S. J. Brinkley, *a* $49,000; Burgess & Parsons, *a* 49,420; Pavarini & Wyne, *a* $49,900; *b* $23,800; T. H. Melton, *a* 50,900; W. E. Mooney, *a* $51,975; J. H. Gibbons, *b* $22,933; M. Haclison, *b* $23,583; W. T. Davis, *b* $24,660.

The following are reported to be the bids opened Nov. 23 by the Comrs. D. C. for erecting a public school at Lincoln Ave. and Prospect St.: J. M. Dunn, $21,533; Pavarini & Wyne, $23,700; B. B. Knell, $21,644; R. B. Humphrey, $21,800; S. J. Brinkley, $23,700; T. H. Melton, $25,450, and Burgess & Parsons, $22,965.

Paris, Ill.—Bids will probably be received about Jan. 1 for the erection of a high school, to cost about $60,000. Architects, Reeves & Baillie, of Peoria; J. C. Risser, Chmn. Bldg. Com.

Anderson, Ind.—The School Bd., it is stated, has accepted the plans of R. P. Daggett-Dunlap Co., of Indianapolis, for the high school, which is to cost about $125,000.

Lexington, Ky.—J. O. H. Simrall, Clk. Bd. of Educ., writes that the citizens on Nov. 5 voted to issue $75,000 bonds for the erection of schools. No architect yet selected.

Ann Arbor, Mich.—The Bd. of Regents of the Univ. of Michigan, it is stated, has decided to erect a chemistry building. Probably $300,000 will be appropriated for the erection of said building.

Grand Rapids, Mich.—Plans and specifications have been approved for the boiler and heating plant for the Coit Ave. School. According to reports bids will soon be received for installing the same.

*Items marked thus give the names of parties awarded contracts.

Northfield, Minn.—It is stated that preliminary plans will be received until Dec. 15 by Paul G. Schmidt, for a ladies' dormitory at St. Olaf College.

Vicksburg, Miss.—It is stated that the Mississippi Episcopal Girls' College is to be situated in the National Park addition to this city. The main building will be erected at once, at a cost of $75,000. Philip S. Garnder, of Laurel, Miss., can be addressed.

St. Louis, Mo.—Plans are stated to have been approved for a high school to be erected at Union Boule. and Fairmount Ave. The building to contain 92 rooms and cost about $750,000. According to reports the contract will soon be let.

Omaha, Neb.—It is reported that the Mount St. Mary's Seminary, Fifteenth and Castellan Sts., will be enlarged at a cost of $20,000.

Bayonne, N. J.—Bids will be received until Dec. 10 by the Bd. Educ. (J. F. Desmond, Secy.) for furnishing material and erecting School No. 10. Bids to be submitted separately on plumbing and gas fitting and the Warren Webster ventilating and heating system. S. Edson Gage and Donald G. Anderson, Archts., 3 Union Sq W., New York, N. Y.

**Jersey City, N. J.*—Jos. H. Cutley, 508 Pavonia Ave., is reported to have secured the contract to construct the granite approach to the High School grounds, at $43,045.
*The contract for furnishing and erecting fire escapes at schools Nos. 1, 9, 13, 17, 18, 19, 20, 21, 22, 23 and 26 (bids received Nov. 14) is reported awarded by the Bd. Educ. to the Oltmer Iron Wks., at a total of $16,485.
The following are reported to be the bids received by the Bd. Educ. on Nov. 14 for erecting an annex to school No. 14: Mason work—M. T. Connolly, $49,738; Gavin & Doris, $54,000; Wm. L. Crow, $55,129; also a bid for the whole job for $113,000; W. H. & F. W. Cain, mason and carpentry work, $86,312, and P. S. Van Kirke for the same work, $92,632. Carpenter work—Jos. Jewkes & Sons Co., $26,490; John Hansen, $28,972; Herman Brugel, $26,775; Robt. Cook, $30,415; J. Ditmar & Son, $32,000. Plumbing—F. T. Keleher, $5,595; Crescent Co., $10,000. Painting—M. A. H. Miller, $2,164; A. Lemon, $2,230; Chas. Rabe, $1,942; Jas. Treasner, $2,558. Heating and ventilating—Storms & Co., $15,968; Baldwin Eng. Co., $15,940; T. P. Schroeder, $19,500; John F. McLaughlin, $10,479.

East Orange, N. J.—The erection of an addition to the High School to cost $75,000, is reported under consideration.

Dayton, O.—Bids will be received until Dec. 19 by Wm. G. Haenssler, Clk. Bd. Educ., for furnishing material and erecting the west wing of the Manual Training High School, on E. 5th St. Bids on labor and material to be stated separately.

Springfield, O.—W. H. Holmes, Clk. Bd. of Educ., writes that the citizens have voted to issue $200,000 bonds for the erection of a school. Nothing definite has yet been done.

Cincinnati, O.—Bids will be received at the office of the Clerk, Bd. of Educ., until Jan. 6 for the erection of a high school at Clifton Ave. and McMilan St. as advertised in The Engineering Record. Henry Klein, Supt. of Bldgs., 910 Main St.

Philadelphia, Pa.—Mitchell Bros. are stated to have been granted a permit to erect 2 three-story 26x36-ft. stone additions to the Kenderton School, at a cost of $20,986.

Cheyenne, S. D.—Bids will be received until Jan. 10 by Commissioner of Indian Affairs, at Washington, D. C. (C. F. Larrabee, Acting Comr.) for furnishing material and constructing a building for employers' quarters at the school at Cheyenne River Agency, S. D.

Cisco, Tex.—Te Attorney-General has approved the issue of $30,000 independent school district bonds.

Emory, Va.—The directors of Emory & Henry College, it is reported, have decided to expend $100,000 in improvements.

**Williamsburg, Va.*—Geo. C. Ware, of Newport News, is reported to have been awarded the contract for erecting a building for the Female Seminary.

Colville, Wash.—Bids will be receeived until Jan. 8 by Comr. of Indian Affairs, at Washington, D. C. (C. F. Larrabee, Acting Comr.) for furnishing material and constructing 2 day school buildings at Nespelem and Barnaby, Colville Agency, Wash. For further information apply to Capt. J. McA. Webster, U. S. Indian Agent, Ft. Spokane (Miles P. O.), Wash.

Tulalip, Wash.—Bids will be received until Dec. 27 by Comr. of Indian Affairs at Washington, D. C. (C. F. Larrabee, Acting Comr.) for furnishing material and constructing a dormitory, hospital, power house and electric lighting system at Tulalip School, Washington. For further information apply to Chas. M. Buchanan, Supt., Tulalip.

LeCrosse, Wis.—The Bd. of Normal Regents, it is stated, has decided to postpone the awarding of the contract to erect the Normal School here until early in 1908. Van Ryn & De Gelleke, of Milwaukee, are the archts., and have completed the plans for the school.

Belleville, Ont.—The Convent School is reported destroyed by fire.

NEW INDUSTRIAL PLANTS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Miller & Lux have applied for a permit to build an abattoir and packing house on Kentucky St. and Second Ave., South. Only about one-fourth of the structure finally to be built will be erected at once at an estimated cost of $150,000.

Wilmington, Del.—The Harlan & Hollingsworth Corporation, is said to be planning the erection of modern car shops.

Washington, D. C.—See "Power Plants, Gas and Electricity."

**Eastport, Me.*—It is stated that the contract to erect the 2-story reinforced concrete and brick canning factory for the Seacoast Canning Co. at Eastport has been awarded to Frank B. Gilbreth, of New York, N. Y.

Waterville, Me.—The Central Maine Potato & Starch Co. is reported organized with Jacob Hedmann, of Aroostook, Pres., and Simon P. Hedman, Secy., and a capital of $100,000. Headquarters of the company to be in Waterville. It is stated that a starch mill will be erected in Waterville, and others in several towns in central Maine.

Jersey City, N. J.—The Levinson Mfg. Co., 171 Canal St., New York, N. Y., is reported to have purchased a site in West Bergen on which it is proposed erecting a factory for the manufacture of chairs.

**Harrison, N. J.*—The contract to erect a 3-story 62x121-ft. reinforced concrete building for the General Electric Co. at Sussex and 4th Sts., it is reported, has been awarded to Salmond Bros. Co., of Kearny. The cost of the building, including equipment, it is stated, will be about $32,000.

Buffalo, N. Y.—The International Eng. Co., at a meeting in Buffalo Nov. 16, it is reported authorized the erection of a plant for the manufacture of high-grade engines and boilers. The location of the plant has not yet been decided upon. H. S. Jeffrey, of Scranton, is Pres. of the company, and C. W. Limstrom, of Galesburg, Ill., Secy. and Treas.

Sandusky, O.—The plant of the Bay Bay View Fdy. Co., for which the Osborne Eng. Co., of Cleveland, is preparing plans, will cost about $35,000. The building will be 80x150 ft. and the power plant will have a capacity of 75 h. p. with foundry equipment. Contracts will be let in the spring.

**Reading, Pa.*—The Brown Engineering Co. is reported to have secured the contract for the electric light and power equipment for the plant of the Nolde & Horst Co., at 9th and Douglass Sts. Individual electric motors will be placed under the several tables, together with specially designed motors placed in the elevator towers to operate the cars.

Girard, Pa.—The U. S. Steel Corporation, 71 B'way, N. Y. City, it is reported, has had tentative plans prepared for an ore harbor to be established on Lake Erie near Girard, for the care and shipment of ore from the Northwest to the lower lakes and the furnaces in the Pittsburg district. The improvements, it is stated, will be started soon, and extensive machinery will be installed and the total cost will be several millions.

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

Erie, Pa.—The Erie City Iron Works has under consideration the erection of a 75x400-ft. storage building, in one bay, with a 30-ton crane. It has not been decided whether to use steel or concrete construction.

Morristown, Tenn.—H. G. Gildard, of the Brookside Mills, Knoxville, is said to be planning the organization of a company to establish a cotton cloth mill at Morristown. It will have a capital stock of $150,000 and a mill of 9,000 spindles and 200 looms will be erected. The product will be cloth used by the linoleum and rubber trades.

Elgin, Tex.—See "Power Plants, Gas and Electricity."

Milwaukee, Wis.—It is reported that C. H. Stehling is preparing plans for a tannery to be erected next spring by the Fred. Rueping Leather Co., of Fond du Lac, on Kinnickinnic Ave. and Lincoln St. To protect the establishment from the river a concrete wall 1,200 ft. long and 30 ft. high will be built. Two 6-story buildings 60x120 ft., will be used for the currying and finishing departments. In addition to these there will be hide trimming, glue storage, beam hair drying, lime and boiler houses and a pattern and machine shop. The boilers will be of 4,500 h. p. each, and the machinery of the plant will be operated by motors. A water tower, storage house and heater house will also be erected. All of the buildings will be built of steel and concrete.

STREET CLEANING AND GARBAGE DISPOSAL.

See also "Business Buildings."

Las Animas, Colo.—See "Power Plants, Gas and Electricity."

Baltimore, Md.—Bids were opened on Nov. 20 by the Bd. of Awards for the removal and final disposal of garbage, dead animals and market refuse of this city from Jan. 1, 1908, until Jan. 1, 1918, and the Baltimore Products Co., of which Michael T. Horner is president is reported to have secured the contract; for the first year the company agrees to dispose of the garbage for $45,000, and $1,800 additional will be charged yearly, so that for the 10th year it will cost the city $61,200. In addition, the company agrees to pay to the city $100,000 for the disposal plant in South Baltimore; total amount of contract for 10 years is $531,000 less $100,000 for city plant. The company is to remove the reduction plant to a distance of 10 miles from city. The collection of garbage is to be done under supervision of J. L. Wickes, Street Cleaning Comr., and carried to central points, and will be scowed to the reduction plant. The same system of reducing refuse will be used as is now employed by the Baltimore Sanitary Contr. Co. The only other bid received was that of the Southern Products Co., whose aggregate bid was $587,500. Both companies agreed to pay the city $100,000 for its plant.

St. Louis, Mo.—Local press reports state that the Bd. of Pub. Improv. is about to let contract for garbage disposal. It will receive bids for the privilege of disposing of garbage, and if no one offers to pay for privilege, the contract will be let to lowest bidder.

West Orange, N. J.—The Town Council is reported to have on Nov. 19 rejected all bids for the removal of ashes and garbage and will receive new bids.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

New York, N. Y.—Bids will be received by W. Bensel, Comr. Street Cleaning, until Dec. 2 (extension of date) for furnishing all the labor and material required for the removal of snow and ice in the Boros. of Manhattan, Bronx and Brooklyn, for the period ending April 15, 1908.

Columbus, O.—Bids will be received by the Bd. of Pub. Service (E. F. McGurre, Secy.) until Jan. 14, for the construction of garbage reduction works of 100 tons capacity per 24 hours, as advertised in The Engineering Record; probable cost, $150,000. John H. Gregory, Engr. in charge.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—P. H. O'Brien, of Anniston, is reported to have secured contracts for constructing locks and dams Nos. 2 and 3, on Tombigbee River (bids opened Oct. 5)at $350,275 and $389,725, respectively. For detail bids received for this work see issue of The Engineering Record of Nov. 9.

Washington, D. C.—Bids will be received at the office of the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., until Dec. 3 for furnishing at navy yards and naval stations the following supplies: Boston, Mass. Sch. 521, generators, etc.; Sch. 524, wire rope; Sch. 527, 8 doz. ratchets; Sch. 529, 75,000 lb. rivet steel; Sch. 530, 1 motor controller; Sch. 531, 5,400 lb. brass pipe, 10,500 lbs. bronze, 2,800 lbs. sheet brass, 1,600 lbs. sheet copper; Sch. 532, bar steel, 4,590 lbs. sheet lead, 36,200 lbs. sheet zinc; Sch. 533, valves, 33 doz. gate valves, bushings, elbos, pinions, etc. League Island, Pa., Sch. 521, 17,000 ft. conduit steel, 12,500 ft. wire junction boxes, etc.; terminal boxes, switches, etc.; fuses and fuse wire batteries and cells, 12 ventilating sets; Sch. 527, drill chucks, drills, etc.; Sch. 528, 11,750 ft. white oak, 21M. ft. white pine, 225M ft. yellow pine; Sch. 531, 6,500 lbs. brass pipe, sheet brass, sheet copper and copper rod; Sch. 532, 15,000 lbs. sheet zinc; Sch. 533, 192 gate valves, pipe fittings. Portsmouth, N. H., Sch. 521, generating set, etc., 5,000 ft. wire. Brooklyn, N. Y., Sch. 521, 6,500 ft. interior cable, 25,000 ft. lighting wire, etc., about 56,000 ft. rubber covered wire, elbow, nipples, couplings, etc.; Sch. 528, 26M. ft. white oak; 110M. ft. white pine, 30M. ft. North Carolina pine, etc.; Sch. 533, 156 gate valves. Washington, D. C., Sch. 526, motor, 5,790 lbs. waterproof stranded copper cable, 65M. ft. white pine, 1 air pump, 84,000 lbs. machine steel; Sch. 529, 19,400 lbs. structural steel beams. Bids will also be received same place until Dec. 17, as follows: Puget Sound, Wash., Sch. 513, 4,800 ft. conduit, 4,800 ft. rubber covered wire, 3 switchboard cabinets; Sch. 515, 7,000 ft. flexible steel wire cable, about 14,000 lbs., copper pipe; Sch. 516, 60M. ft. teak, 15,500 ft. mahogany; Sch. 518, 28,200 lbs. steel angles, 121,500 lbs. mild steel. Mare Island, Cal., Sch. 515, 1,400 bronze plates, 1,000 lbs. brass metal, 36 gate valves; Sch. 5-- lavatories, showers, water heaters, plumber's supplies, etc.; Sch. 518, 25,000 lbs. rolled sheet zinc boiler plates, 15,000 lbs. rolled sheet zinc. Boston, Mass., Sch. 538, centering machine, crank shaper, rod and double machine, steam hammer, etc. Brooklyn, N. Y., Sch. 537, engine lathe, boring and turning mill, etc. League Island, Pa., Sch. 538, 1 gear generator. Washington, D. C., Sch. 538, 1 milling machine. Pensacola, Fla., Sch. 537, engine lathe, crank shaping machine. Applications for proposals should designate the schedules desired by number. H. B. Rogers, Paymaster Genl., U. S. N.

New Boston, Ill.—Bids were opened on Nov. 7 by the Comrs. of the Bay Island Drainage and Levee Dist. for constructing about 50,000 cu. yds. muck ditch and 724,700 cu. yds. levee work and F. B. Stevens, of Geneseo, Ill., bid for portions of muck ditch 22 cts. per cu. yd. and for portions of levee work 16 and 15 cts. per cu. yd. R. J. Phelps & Co., muck ditch 18 cts. and levee work 14 cts. G. A. McWilliams, Walnut, muck ditch and levee work 13.45 cts.; R. H. McWilliams, of Mattoon, muck ditch and levee work 10.75 cts.; Peoples' Constr. Co., Davenport, Ia., muck ditch and levee work, 16.5 cts. Grand, Smith & Co. and C. H. Locker, Northern Trust Co., Chicago, Ill., muck ditch and levee work, 10.25 cts., and Havemeyer, Contr. Co. & C. A. Denham, C. E., Chicago, for muck ditch and levee work 12¼ and for levee work 12¾ and 15¾ cts.; R. H. McWilliams, of Walnut, bid also for 138,000 cu. yds. ditch 10 cts. and 165,000 cu. yds. ditch 9.75 cts., and J. E. Rogers, of Forrest City, for same work 10 cts.

Webster City, Ia.—Bids will be received until Dec. 14 by the Bd. Superv. (Geo. S. Neel, Chmn.) for constructing the Robbins Drainage Ditch No. 32; also the Brandrup Drainage Ditch No. 31. O. A. Cragwich, Co. Aud.

Sac City, Ia.—It is stated that bids will be received until Dec. 10 by J. J. Harter, Co. Aud., at Sac City, for constructing Ditch No. 10, Sac Co., and Ditch No. 69, Calhoun Co.

Annapolis, Md.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Dec. 10, to furnish at the Naval Academy, Annapolis, Md., a quantity of pipe fittings and forge. Applications for proposals should refer to Schedule 570. E. B. Rogers, Paymaster Genl., U. S. N.

Boston, Mass.—See "Power Plants, Gas and Electricity."

Boston, Mass.—Bids will be received by Maj. Edw. Burr, Corps Engrs., U. S. A., until Dec. 27, for removal of wreck of steamship "City of Birmingham" lying in Upper Main Ship Channel of Boston Harbor, as advertised in The Engineering Record.

Grand Rapids, Mich.—City Engr. L. W. Anderson is reported to have presented to the Bd. of Pub. Wks. his report on the construction of a flood wall on west side of river from 6th St., south to the gates at the power dam, which he estimates at $19,317.

Detroit, Mich.—The following are the bids opened on Nov. 20 by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., for rock and earth excavation at Sect. 3, Plan B, Detroit River: (*a*) 1,465,000 cu. yds. earth excav. (full rate); (*b*) 145,000 cu. yds. earth excav. (half rate); (*c*) 560,000 cu. yds. rock excav. (full rate); (*d*) 260,000 cu. yds. rock excav. (half rate); (*e*) total: P. B. McNaughton & O. E. Dunbar, Buffalo, N. Y., *a* 50 cts, *b* $25, *c* $2.80, *d* $1.40, *e* $2,700,750; Great Lakes Dredge & Dock Co., Chicago, Ill., *a* 58 cts., *b* $29, *c* $3.22, *d* $1.61, *e* $3,113,550.

Olivia, Minn.—It is stated that H. J. Lee, Co. Aud., will receive bids until Dec. 5 for constructing Ditch No. 37.

Ivanhoe, Minn.—It is stated that bids will be received until Dec. 3 by R. H. Sisson, Co. Aud., for $6,000 bonds for the construction of Ditch No. 6, and $4,500 bonds for Ditch No. 8.

**Morris, Minn.*—F. E. Ware, Co. Aud., writes that the contract for constructing ditch No. 3 (bids opened Nov. 19) has been awarded to Brown & Sutcliff, of Benson, at 13½ cts. per cu. yd.; total, $10,341.

**West Point, Miss.*—B. H. McFarland, of Aberdeen, Secy. and Attorney for the County Houlka Creek Drainage Comrs., writes that G. A. McWilliams, of Walnut,

Items marked thus give the names of parties awarded contracts.

La., has secured the contract for constructing a canal 12 miles long, 25 ft. wide and 5 ft. deep through Houlka Creek and through timbered sandy loam creek bottom, about 230,000 cu. yds. (bids opened Nov. 12), at 12.7 cts. per cu. yd. Other bids received were: Woolman Constr. Co., Sandusky, Mich., 12.75 cts.; R. L. Brand, Prairie, Miss., 14.5 cts.; Northern Alabama Constr. Co., Riverton, Ala., 15.7 cts.; E. C. Spencer, Vandalia, Ill., 10 cts.

Portsmouth, N. H.—See "Power Plants, Gas and Electricity."

New York, N. Y.—Bids will be received until Dec. 2 by Col. Wm. S. Patten, Depot Q. M., 30 Whitehall St., New York, for furnishing and delivering at either the Philadelphia, Boston, New York, Chicago or St. Louis depots of the Q. M. Department, U. S. Army, 400 enameled recruiting signs, subject to increase or decrease in quantity of 25 per cent., if desired by this department.

Bids will be received until Dec. 5 by John V. Coggey, Comr. of Correction, N. Y. City, for furnishing and delivering iron, steam fittings, lumber and miscellaneous articles.

Bids will be received Dec. 5 by W. Bensel, Comr. Street Cleaning, N. Y. City, for furnishing and delivering 10,000 North River bricks (red), 8,000 sq. fire bricks, 5,000 end wedge fire bricks, 50 barrels fire clay, 30 cu. yds. Cow Bay sand.

Brooklyn, N. Y.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—Bids will be received until Dec. 10 by the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C. (E. B. Rogers, Paymaster Gen.), to furnish at the Navy Yard, New York, a quantity of naval supplies as follows: Schedule 667—bolt and pipe threading and drilling machines, lathes, emery grinders; Schedule 567—Portland cement, etc.; Schedule 569—insulating tape, steel rope, brass, etc.; Schedule 572—lumber; Schedule 574—bolts and nuts, steel iron, etc.; Schedule 575—brass bronze, etc.; Schedule 576—bolts and nuts, jacks, cement compound, copper tubing, valves, thermometers; Schedule 577—bolts and nuts, wire, etc. Applications for proposals should designate the schedule desired by number.

Albany, N. Y.—At a meeting of the State Canal Board on Nov. 26 plans are reported to have been approved for contract No. 20, Sections 2 and 3 of the barge canal. This work includes the dredging of the Mohawk River from Rexford Flats to Mindville, involving an expenditure of $4,000,000.

Grand Forks, N. D.—It is stated that Hans Anderson, Co. Aud., will receive bids until Dec. 10 for $15,500 drainage bonds.

Cleveland, O.—W. A. Stinchcomb, Engr. of the Park Dept., is reported to be making plans for new docks to be built at foot of E. 9th St. to accommodate the intercity steamship lines. Two schemes of construction are under consideration by the steamship companies, one temporary and the other permanent.

Portland, Ore.—Bids will be received by Lieut. Col. S. W. Roessler, Corps Engrs., U. S. A., until Dec. 23 for the construction of one wooden hull hydraulic dredge, as advertised in The Engineering Record.

**Philadelphia, Pa.*—The following are the bids opened on Nov. 15 at the office of Maj. J. C. Sanford, Corps Engrs., U. S. A., for dredging in Delaware River: (a) 694,400 cu. yd. excav. scow meas. Sect. 4; (b) 716,800 cu. yd. Sub-Sect. 5A; (c) 716,800 cu. yd. Sub-Sect. 5B; (d) totals: P. Sanford Ross, Inc., Jersey City, N. J., a, 18¾ cts.; b, 19¼ cts.; c, 20¼ cts; d, $409,864. Morris & Cumings Dredging Co., New York, N. Y., a, 20.5 cts.; b, 21.3 cts; c, 26 cts.; d, $481,398. American Dredging Co., Philadelphia, Pa., a and b, 16 cts.; c, 17.5 cts.; d, $351,232 (recommended for award).

Girard, Pa.—See "New Industrial Plants."

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

McKees Rocks, Pa.—Press reports state that a brick lined tunnel 461 ft. long and 36 ft. wide, will be constructed in West Park, of which the Comrs. of Stowe Township will pay $25,000 for its construction, and the West End Land Co. $25,000.

Newport, R. I.—The following are the bids opened on Nov. 22 by Col. J. H. Willard, Corps Engrs., U. S. A., for dredging in Newport harbor (price given per cu. yd.): John P. Randerson, Albany, N. Y., 40 cts., W. H. Beard Dredging Co., New York, N. Y., 29 cts.; the International Contracting Co., New York, N. Y., 22 cts., and Chas. M. Cole & J. S. Packard Dredging Co., Fall River, Mass., and Providence, R. I., 22 8-9 cts. (Approximate amount to be expended under this contract, $171,-000.)

Providence, R. I.—The following are the bids opened on Nov. 26 at the office of Jas. Knox Taylor, Superv. Archt. Treas. Depart., Washington, D. C., for elevator equipment for U. S. Post Office, Court House and Custom House at Providence: Otis Elevator Co., New York, N. Y., $17,975; Standard Plunger Elevator Co., New York, N. Y., $20,235.

Desmet, S. D.—Bids will be received it is stated until Jan. 7 by P. A. Carroll, Co. Aud., for constructing Drainage Ditch No. 1, Baker Township.

Superior, Wis.—C. P. White, of Pittsburg, Pa., Gen. Mgr. Pittsburg Coal Co., writes that bids will be received on Dec. 10 for the construction of a dock in Superior. C. J. A. Morris, of Superior, is Consulting Engr.

PROPOSALS OPEN.

For Proposals see pages 66, 67 and 68.

WATER.

Bids Close.		See Eng. Record.
Dec. 4.	Boiler, Minerva, O.	Nov. 30
Dec. 7.	Water works material, Atlantic, Ia.	Nov. 30
Dec. 7.	Water works, Minnette, Ala.	Nov. 23
Dec. [illegible]	Water curtains, New York, N. Y.	Nov. 30
Dec. [illegible]	Filter plant, Cambridge Springs, Pa. Adv. Nov. 16-23.	Nov. 16
[illegible]	Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19.	Oct. 12
Dec. 19.	Cisterns, Ft. Dade, Fla.	Nov. 30
Jan. 1.	Reservoir, Norway, Me.	Nov. 16
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
Jan. 15.	Pipe, Winnipeg, Man.	Nov. 30
Jan. 17.	Air compressor, Aurora, Ill.	Nov. 30
——	Mains, Grand Forks, N. D.	Nov. 23
——	**Attention to Contractors, New York, N. Y.** Adv. Sep. 28 to Nov. 2.	Sep. 28
——	**Attention to Contractors, etc., Rome, N. Y.** Adv. Oct. 12 to Nov. 16.	Oct. 12
——	Suction line, Alexandria, Va.	Nov. 9

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 2.	Valley City, N. D.	Nov. 23
Dec. 3.	Auburn, N. Y. Adv. Oct. 19 to Nov. 30.	Oct. 19
Dec. 3.	Paola, Kan.	Nov. 30
Dec. 3.	Chattanooga, Tenn.	Nov. 30
Dec. 4.	Dayton, O.	Nov. 23
Dec. 5.	McKeesport, Pa.	Nov. 30
Dec. 6.	Forsyth, Ga.	Nov. 9
Dec. 7.	Stittville, N. Y.	Nov. 23
Dec. 7.	Evansville, Ind.	Nov. 30
Dec. 9.	Orrville, O.	Nov. 0
Dec. 11.	Brooklyn, N. Y.	Nov. 30
Dec. 14.	Norwood, O.	Nov. 30
Dec. 17.	Louisville, Ky. Adv. Nov. 23, 30.	Nov. 23
Dec. 18.	Springfield, O. Adv. Nov. 30.	Nov. 30
Dec. 19.	Wapello, Ia.	Nov. 16
Dec. 21.	Santa Monica, Cal.	Nov. 23
Dec. —.	Ventura, Cal.	Nov. 2
Dec. —.	South Bend, Ind.	Nov. 23
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 16.	Oct. 26
Jan. —.	Lexington, Ky.	Nov. 30

BRIDGES.

Dec. 3.	Council Bluffs, Ia.	Nov. 23
Dec. 3.	Paoli, Ind.	Nov. 30
Dec. 4.	Muncie, Ind.	Nov. 30
Dec. 4.	Newport, Ind.	Nov. 30
Dec. 4.	Fargo, N. D.	Nov. 30
Dec. 5.	River Falls, Wis.	Nov. 23
Dec. 6.	Menominie, Wis.	Nov. 30
Dec. 6.	La Crosse, Wis.	Nov. 30
Dec. 9.	Girard, Kan.	Nov. 30
Dec. 9.	New York, N. Y.	Nov. 30
Dec. 9.	Etna, Pa.	Nov. 30
Dec. 10.	Jackson, Minn.	Nov. 23
Dec. 10.	Girard, Kan.	Nov. 30
Dec. 11.	Wailuka, H. I.	Nov. 9
Dec. 13.	Celina, O.	Nov. 30
Dec. 14.	Norwood, O. Adv. Nov. 23, 30.	Nov. 23
Dec. 17.	Philadelphia, Pa.	Nov. 23
Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 1.	Topeka, Kan.	Nov. 30
Jan. 7.	Wilmington, N. C. Adv. Nov. 16 to 30.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16

PAVING AND ROAD MAKING.

Dec. 3.	Monticello, Ind.	Nov. 2
Dec. 3.	Palatka, Fla.	Nov. 2
Dec. 3.	Marysville, O.	Nov. 16
Dec. 3.	Bemidji, Minn.	Nov. 23
Dec. 3.	Portland, Ind.	Nov. 23
Dec. 4.	Logansport, Ind.	Nov. 16
Dec. 4.	Des Moines, Ia.	Nov. 16
Dec. 4.	Hartford City, Ind.	Nov. 23
Dec. 4.	Brooklyn, N. Y.	Nov. 23
Dec. 4.	Baltimore, Md.	Nov. 30
Dec. 4.	Fargo, N. D.	Nov. 30
Dec. 5.	Danville, Ind.	Nov. 30
Dec. 5.	Memphis, Tenn.	Nov. 30
Dec. 5.	Boulder, Colo.	Nov. 30
Dec. 7.	Peru, Ind.	Nov. 16
Dec. 10.	St. Louis, Mo.	Nov. 30
Dec. 11.	Brooklyn, N. Y.	Nov. 30
Dec. 11.	Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 12.	Flemington, N. J. Adv. Nov. 16 to 30.	Nov. 16
Dec. 12.	Anderson, Ind.	Nov. 23
Dec. 13.	Valparaiso, Ind.	Sep. 7
Dec. 16.	Steubenville, O.	Nov. 23
Dec. 16.	Buffalo, N. Y.	Nov. 30
Dec. 17.	Providence, La.	Nov. 23
Dec. 20.	Washington, Pa.	Nov. 30
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 3.	Salt Lake City, Utah. Adv. Oct. 19 to Nov. 9 and 30.	Oct. 19
Jan. —.	Jackson, Mich.	Nov. 23
Feb. 4.	Brick paving, Billings, Mont. Adv. Nov. 23, 30.	Nov. 23
Feb. 4.	Macadam, Billings, Mont. Adv. Nov. 23, 30.	Nov. 23

POWER PLANTS, GAS AND ELECTRICITY.

Dec. 3.	Vallejo, Cal.	Nov. 23
Dec. 3.	Lacompte, La.	Nov. 16
Dec. 3.	Washington, D. C.	Nov. 30
Dec. 4.	Minerva, O.	Nov. 30
Dec. 5.	Newburgh, O.	Nov. 23
Dec. 6.	Brooklyn, N. Y.	Nov. 30
Dec. 10.	Ft. Revere, Mass.	Nov. 30
Dec. 10.	Brooklyn, N. Y.	Nov. 30
Dec. 10.	New York, N. Y.	Nov. 30
Dec. 13.	Panama	Nov. 23
Dec. 16.	Montreal, Que.	Nov. 16
Dec. 17.	Washington, D. C.	Nov. 30
Dec. 20.	Lafayette, Ind. Adv. Nov. 23, 30.	Nov. 23
Dec. 20.	Ft. Worth, Tex. Adv. Nov. 30.	Nov. 30
Dec. 20.	Ashville, O.	Nov. 30
Dec. 21.	Chinook, Mont.	Nov. 16
Dec. 23.	Panama	Nov. 30
Feb. —.	Lagrange, Ga.	Nov. 30
——	Hendersonville, N. C.	Nov. 2
——	Alexandria, Va.	Nov. 9
——	Listowel, Ont.	Nov. 16

BUILDINGS.

Dec. 3.	Post Office, Nevada, Mo.	Oct. 26
Dec. 3.	School, Allegheny, Pa.	Nov. 23
Dec. 3.	School, Temple, Ariz.	Nov. 23
Dec. 3.	Add. to jail, Allentown, Pa.	Nov. 23
Dec. 4.	Pub. bldg., Columbus, O.	Nov. 23
Dec. 4.	Pub. bldgs., Ashland, Pa.	Nov. 23
Dec. 4.	Pub. bldg improv., Lakeland, Ky.	Nov. 30
Dec. 4.	Hospital, Pittsburg, Pa.	Nov. 30
Dec. 5.	Post Office, Waldoboro, Me.	Nov. 2
Dec. 5.	School, Carbondale, Ill.	Nov. 16
Dec. 5.	Pub. bldg. improv., Ellis Island, N. Y. Harbor	Nov. 30
Dec. 5.	Post bldgs., Ft. Thomas, Ky.	Nov. 30
Dec. 6.	School, Beaumont, Tex.	Nov. 23
Dec. 6.	Pub. bldgs., Simcoe, Ont.	Nov. 23
Dec. 6.	Pub. bldg., Abilene, Tex.	Nov. 30
Dec. 6.	Pub. bldg., Kingston, Ont.	Nov. 30
Dec. 6.	Pub. bldgs., Boston, Mass.	Nov. 30
Dec. 7.	Pub. bldg., Remsen, N. Y.	Nov. 9
Dec. 9.	Pub. bldg., Wernersville, Pa.	Nov. 2
Dec. 9.	Remodeling Hospital bldgs., Los Angeles, Cal.	Nov. 23
Dec. 9.	Armory, Chicago, Ill.	Nov. 23
Dec. 9.	Pub. bldg., Bay Minette, Ala.	Nov. 23
Dec. 9.	Town hall, Berkeley, Cal.	Nov. 23
Dec. 9.	Court house, Pulaski, Tenn.	Nov. 23
Dec. 10.	School, Alpine, Tex.	Nov. 2
Dec. 10.	Bus. bldg., Jacksonville, Fla.	Nov. 2
Dec. 10.	Dwelling, Mobile, Ala.	Nov. 9
Dec. 10.	City Hall, Chattanooga, Tenn.	Nov. 30
Dec. 10.	New indus. plant., Canton, S. D.	Nov. 16
Dec. 10.	School, Canton, S. D.	Nov. 16
Dec. 10.	Radiators for National Museum, Washington, D. C. Adv. Nov. 30.	Nov. 30
Dec. 10.	School, Bayonne, N. J.	Nov. 30
Dec. 12.	Hospital, Whipple Barracks, Ariz. Adv. Nov. 16 to 30.	Nov. 16
Dec. 12.	School, Shirley, Ind.	Nov. 23
Dec. 14.	Jail, Terre Haute, Ind.	Nov. 23
Dec. 15.	School, Auburn, Ala.	Nov. 16
Dec. 15.	Pub. bldg., Washington, D. C.	Nov. 16
Dec. 15.	School, Northfield, Minn.	Nov. 30
Dec. 16.	Jails, Ellisville, Miss.	Nov. 30
Dec. 17.	Exten. to post office, Detroit, Mich.	Nov. 2
Dec. 17.	School, Pawnee, Okla.	Nov. 16
Dec. 18.	Tunnel to htg. pub. bldg., Madison, Wis.	Nov. 9
Dec. 19.	Pub. bldg., Ocala, Fla. Adv. Nov. 16-23.	Nov. 16
Dec. 19.	School, Dayton, Ohio	Nov. 30
Dec. 20.	Htg. post office bldg., Ft. Worth, Tex. Adv. Nov. 30.	Nov. 30
Dec. 21	Plumbing at post office bldg, Ft. Worth, Tex.	Nov. 30
Dec. 21.	Htg. court house, Yougstown, O.	Nov. 30
Dec. 23.	Post office, Ann Arbor, Mich.	Nov. 9
Dec. 23.	Post bldgs., Ft. Des Moines, Ia. Adv. Nov. 30.	Nov. 30
Dec. 27.	School, Tulalip, Wash.	Nov. 30
Dec. 30.	Post office, Lancaster, Pa.	Nov. 16
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
Dec. —.	**School, Anderson, Ind.**	**Sep. 28**
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Dec. —.	Bath houses, Toronto, Ont.	Nov. 23
Dec. —.	Y. M. C. A. bldg., Plattsburg, N. Y.	Nov. 30
Jan. 1.	Dwellings, Greenville, Pa.	Nov. 30
Jan. 1.	School, Paris, Ill.	Nov. 30
Jan. 2.	Pub. bldg., Flint, Mich.	Nov. 23
Jan. 2.	Post office, South Bend, Ind.	Nov. 16
Jan. 3.	Post office bldg., Albuquerque, N. M. Adv. Nov. 23, 30.	Nov. 23
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 6.	Post office exten., Wichita, Kan.	Nov. 23
Jan. 6.	School, Cincinnati, O. Adv. Nov. 30.	Nov. 30
Jan. 7.	Add. to school, Slayton, Minn.	Nov. 23
Jan. 8.	Schools, Colville, Wash.	Nov. 30
Jan. 10.	School, Cheyenne, S. D.	Nov. 30
Jan. 14.	Light station, Alaska. Adv. Nov. 23, 30.	Nov. 23
Jan. 14.	Indus. plant, Oxford, Md.	Nov. 23
Jan. 15.	Church, Pemberville, O.	Nov. 30
Jan. —.	School, Mankato, Minn.	Nov. 23
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Feb. 1.	**Plans for Capitol, San Juan, P. R.**	**Sep. 28**
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. —.	College, Agricultural College, Mich.	Oct. 19
Mar. 25.	P. O. plans, New York, N. Y.	Nov. 30
Apr. 1.	Hotel, South Braintree, Mass.	Nov. 30

MISCELLANEOUS.

Dec. 2.	Signs, New York, N. Y.	Nov. 30
Dec. 2.	Street cleaning, New York, N. Y.	Nov. 30
Dec. 3.	Ditch work, Wausau, Wis.	Nov. 2
Dec. 3.	Ditch, Wheaton, Minn.	Nov. 9
Dec. 3.	Drills, etc., Bremerton, Wash.	Nov. 16
Dec. 3.	Supplies, Vallejo, Cal.	Nov. 23
Dec. 3.	Lumber, etc., New York, N. Y.	Nov. 23
Dec. 3.	Ditch, Ivanhoe, Minn.	Nov. 30
Dec. 3.	Supplies, Washington, D. C.	Nov. 30
Dec. 4.	Garb. disp., Altoona, Pa. Adv. Nov. 2 to 16.	Nov. 2
Dec. 4.	Telephone system, Danville, Ill. Adv. Nov. 16 to 30.	Nov. 16
Dec. 4.	El ry. franchise, Hayward, Cal.	Nov. 30
Dec. 5.	Ditch, Olivia, Minn.	Nov. 30
Dec. 5.	Bricks, etc., New York, N. Y.	Nov. 30
Dec. 6.	Ditch work, Canton, N. Y. Adv. Nov. 9 to 30.	Nov. 9
Dec. 6.	Engine, lathe, etc., Panama	Nov. 16
Dec. 9.	Wharf repairs, Ft. Howard, Md.	Nov. 23
Dec. 10.	Wharves, Mobile, Ala.	Nov. 9
Dec. 10.	Supplies, Brooklyn, N. Y.	Nov. 30
Dec. 10.	Dock, Pittsburg, Pa.	Nov. 30
Dec. 10.	Ditch, Sac City, Ia.	Nov. 30
Dec. 10.	Supplies, Annapolis, Md.	Nov. 30
Dec. 11.	El. ry franchise, New Orleans, La.	Oct. 26
Dec. 11.	Ditch, Emmetsburg, Ia.	Nov. 9
Dec. 11.	Wall, etc., Ft. H. G. Wright, N. Y.	Nov. 16
Dec. 11.	Bulkhead, Montgomery, Ala.	Nov. 23
Dec. 11.	Copper, Washington, D. C.	Nov. 23
Dec. 14.	Lumber, Nashville, Tenn. Adv. Nov. 16 to 30.	Nov. 16
Dec. 14.	Dredging, Boston, Mass.	Nov. 23
Dec. 14.	Ditch, Webster City, Ia.	Nov. 30
Dec. 16.	Levee work, New Orleans, La.	Nov. 23
Dec. 16.	Lanterns, Hawaii	Nov. 23
Dec. 17.	Garbage crematory, Ft. Hancock, N. J.	Nov. 23
Dec. 17.	R. R. work, Philadelphia, Pa.	Nov. 23
Dec. 17.	Supplies, Washington, D. C.	Nov. 30
Dec. 20.	Steamboat, Portland, Ore. Adv. Nov. 23, 30.	Nov. 23
Dec. 21.	Metal lions, Washington, D. C. Adv. Nov. 30.	Nov. 30
Dec. 23.	Dredge, Portland, Ore. Adv. Nov. 30.	Nov. 30
Dec. 27.	Removal of wreck, Boston, Mass. Adv. Nov. 30.	Nov. 30
Jan. 7.	Ditch, Desmet, S. D.	Nov. 30
Jan. 14.	Garbage plant, Columbus, O. Adv. Nov. 30.	Nov. 30
May —.	El. ry., Buenos Aires, S. A.	Nov. 16

**Items marked thus give the names of parties awarded contracts.*

CURRENT NEWS SUPPLEMENT

DECEMBER 7, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, Jan. 15-16, 1908. Next meeting, December 18, 1907. Paper, "Municipal Sewage Disposal—an Investigation."

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York. Next meeting, December 13, 1907. Paper on Duplex Stoker Boiler and Results of Tests.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building. Annual meeting in New York, Dec. 10.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia. Annual convention, Buffalo, N. Y., Jan. 20-25, 1908.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

THE PROPOSED BUILDING CODE FOR NEW YORK CITY.

The Building Code Revision Committee of the City of New York has completed its labors and submitted to the Board of Aldermen a draft of a code which is to apply to all boroughs. No public hearings concerning the proposed text of the code, as submitted, have been held, and as the composition of the Board of Aldermen will change before a reasonable opportunity for criticizing the multifarious regulations can be given by the present Board, it is generally considered that there is no immediate prospect of the adoption of the regulations. Very strong criticism from real estate interests and others has already been heard regarding some sections of the proposed code, and these criticisms are increasing in number and vigor as the time for study of the regulations grows. Apart from critics whose interests are injuriously affected by some of the suggested rules, a number of engineers and architects whose work makes them familiar with the conditions in New York have expressed the opinion that while the proposed code as a whole is a distinct advance, there are some sections in it, notably that relating to fireproofing, which on no account should receive aldermanic approval, and there are isolated clauses in other sections that would become powerful aids to favoritism and even graft in the hands of an unscrupulous superintendent of buildings.

The opportunity for displaying partiality or for grafting which the proposed code offers is illustrated, according to one architect of long experience, by several clauses scattered through the regulations, whose full significance is only appreciated when they are brought together and considered as a whole. The office of Superintendent of Buildings is one defined in the New York city charter and the Board of Aldermen cannot, of course, change any of the charter provisions. His judgment is final on certain subjects, and one of these subjects, according to the proposed code, would be the classifications of buildings coming under two types, known as Classes D and E and defined as follows:

"Class D—Mercantile Buildings shall be construed to mean and include all structures used for, or adapted to, the transaction of business, the operation of machinery, or the manufacture or storage of machinery or materials, the housing of horses or live stock, or other industrial purposes. This class shall include office buildings, restaurants, markets, refrigerating plants, stables, carriage houses, laboratories and observatories.

"Class E—Special Hazard Buildings shall be construed to mean and include all mercantile buildings which are used for the manufacture, storage or sale of inflammable products, goods and materials, that is to say, materials that will readily ignite by the application of a flame, or in which heavy machinery is used. Factories, workshops, lofts, printing houses, stores, warehouses, slaughter houses, rendering plants, light and power stations, smoke houses, and garages shall be included in this class."

It is asserted by critics of the code that, in view of the very inflammable nature of office furniture and the use or display of machinery in many office buildings, notably such as the World Building or the Times Building, coupled with the peculiar working of the clauses, the Superintendent of Buildings is practically left without any very strong code control in determining in what class a proposed structure shall be officially placed. The full value of this power of selection to an unscrupulous official will be seen, according to the critics, only when other provisions are examined.

According to Section 105 every building of these two classes which is more than 60 ft. high must be fireproof, and according to Section 106 all Class E buildings must be of so-called first-class construction, while all others may be of so-called second-class construction. These two classes are defined at considerable length in clauses which are quoted not only to show the extent of the power placed in the hands of the Superintendent of Buildings but also because the same clauses are held by some critics to show unwarranted favor toward certain types of concrete floor construction, and to be prejudicial to hollow-tile of equal architectural merit in the opinion of experienced structural designers.

First Class Construction.—"The fireproof floor and roof construction between the steel beams shall be in the form of segmental arches consisting of Portland cement concrete, brick, or hollow tile of hard burned clay, or semi-porous or porous terra cotta. Such arches shall be designed to carry safely the imposed loads, and shall have a rise of not less than 1 in. for each foot of span between the beams. [Section 130 says that the ground and lower floors of Class D buildings must be figured for not less than 150 lb. per square foot and the upper floors for not less than 75 lb.; all floors of Class E buildings must be figured for not less than 150 lb.].

"Arches of Portland cement concrete shall be not less than 4 in. in thickness at the crown of the arch, and shall be mixed in the proportions of 1 part of Portland cement, 2 parts of clean sharp sand, and 5 parts of steam boiler cinders or crushed slag, brick, tile or stone passing a 1-in. ring. These arches shall in all cases be reinforced and protected with steel rods or bars, reticulated or meshed steel, or similar metal weighing not less than 1 lb. per square foot of superficial floor area. If the metal is in the form of rods or bars they shall be spaced not over 16 in. center to center.

"Brick arches shall have a thickness of not less than 4 in. for spans of 5 ft. or less, and 8 in. for spans over 5 ft. and up to 8 ft. [The code makes 8-ft. the maximum span between beams.] Said brick arches shall be composed of good hard common brick or porous terra cotta without cellular spaces, the brick to be laid to a line on the centers, and properly and solidly bonded. Each longitudinal line of brick breaking joints with the adjoining line in the same ring and with the ring under it when the arches are 8 in. thick. The arches shall spring from suitably designed, solid skewbacks made from the same material as the arches and properly keyed. The brick shall be well wetted before laying, and the joints filled in solid with Portland cement mortar, mixed in the proportions of 1 part cement to 3 parts of sand.

"Hollow tile arches or hard burned clay or semi-porous or porous terra cotta shall be of uniform density and hardness of burn and shall have sufficient depth between the top and bottom surfaces of the arch to carry the load to be imposed thereon without stressing the material beyond its safe working load, but such depth shall in no case be less than 6 in. for spans of 5 ft. or less than 8 in. for greater spans, and all blocks shall have at least two cellular spaces in said minimum depth. The shells and webs of all arch blocks shall be not less than 1 in. in thickness. Skewbacks of side construction shall be used with all forms of hollow tile arches. They shall be of such form and section as to accurately fit the beams and properly receive the thrust of the arches, and shall have shells and webs not less than 1¼ in. in thickness. The arches shall be laid in Portland cement mortar as required for brick arches and shall be built with the key in the center of the arch. The shells and webs of all end construction arch blocks shall abut one against the other.

"All metal structural members supporting loads or resisting stresses, and which are not covered with brickwork to a minimum thickness of 4 in. or of stone masonry to a thickness of 8 in., shall be fireproofed as follows: The protection of the columns shall consist of concrete as defined for floors filled solidly around them, or of brick as defined for floors laid in Portland cement with Portland cement concrete filled in solidly so as to leave no voids or spaces between the brick and the columns. [This clause has come in for severe criticism from structural designers as a particularly unjust discrimination against certain forms of terra cotta fireproofing that are largely used in important buildings.] In every case this protection to cover the columns at all points to a thickness of not less than 4 in. and to be continuous from the base to the top of the column. The extreme outer edges of lugs, brackets and similar supporting metal may project to within 2 in. of the outer surface of the protection. The protection of the girders shall be of the same material as the columns and shall not be less than 3 in. thick at all points. The protection of the webs and soffits of beams, lintels and other lesser structural members supporting loads or resisting strains shall be not less than 2 in. in thickness at any point.

"The fireproof protection of all the above structural members shall be held in position by suitably designed interior steel anchors hooked rigidly around the flanges or angles of the structural members and spaced not over 16 in. apart, horizontally and vertically. These anchors to be made with hooked ends from steel stock weighing not less than ½ lb. per linear foot and extending to within 1 in. of the outside surface of the concrete or brick protection."

Second Class Construction.—"The fireproof floor and roof construction between the steel beams may be in the form of flat arches or slabs with horizontal surfaces. Such flat arches shall consist of Portland cement concrete, or hollow tile of hard burned clay or semi-porous or porous terra cotta.

"Flat arches of Portland cement concrete shall be not less than 4 in. in thickness and shall consist of the same materials and mixed in the same proportions as specified in First Class Construction. These arches shall in all cases be reinforced with steel rods or bars, reticulated or meshed steel, or similar metal, designed so as to secure the required strength, but in no case shall such reinforcing metal weigh less than 1 lb. per square foot of superficial floor area. The center of the section of such reinforcing metal shall in no case be less than 1¼ in. from the under side of the concrete slab. If the reinforcing metal is in the form of rods or bars, they shall be spaced not more than 16 in. center to center, and if in the form of mesh it shall have no openings smaller than 16 sq. in.

"All flat hollow tile arches of hard burned clay and semi-porous and porous terra cotta shall have the arch blocks and skewbacks complying with the requirements of First Class Construction, except that the depth shall be not less than 1¾ in. for each foot of span, between the beams, not including any portion of the depth of the tile projecting below the under side of the beams, the total depth in no case to be less than 8 in.

"All metal structural members supporting loads or resisting strains and which are not covered by brick or stone masonry to a thickness of 4 in. shall be fireproofed as follows: The columns and girders shall be protected in the same manner as specified in First Class Construction, except that the thickness of the concrete or brick protection at all points of the columns and girders may be reduced to 2 in. and at the extreme outer edges of lugs, brackets and similar supporting metal to 1 in. Columns may also be protected by hollow tile blocks not

less than 4 in. in thickness, with shells and webs not less than 1 in. in thickness, with the space between the blocks and the columns filled solidly with Portland cement concrete. The concrete and the blocks to be anchored with interior steel anchors as specified in First Class Construction. Columns may also be protected by a double layer of metal lath and plaster as follows: The columns to be wrapped with metal lath weighing not less than 5 oz. per square foot, corrugated or with metal furring so as to offset the metal lath at least ¾ in. from the surface to be protected, the ends of the lath to be thoroughly secured by lapping and lacing with No. 18 galvanized steel wire. Plaster gauged with 25 per cent. of Portland cement shall then be applied to a minimum thickness of 1 in., filling the space solidly between the metal lath and the column. Over this first layer of metal lath and plaster shall be constructed a second layer of metal lath and plaster, similar in every respect to the first layer except that the corrugations or metal furring shall offset the metal lath at least 1½ in. from the outside surface of the first layer, and that the first coat of cement plaster of the second layer shall be not less than ¾ in. in thickness. The brown coat and finishing coat may be of similar material as is used in the finishing of other portions of the building.

"The members of all metal trusses and the webs of all floor beams projecting above or below the arches shall be protected by not less than 2 in. of the arch material. The soffits of all floor beams shall be protected by not less than 1 in. of the arch material. Said soffit protection, if of concrete, shall be secured in place by interior steel anchors, as defined under First Class Construction, or by meshed metal or metal in other forms weighing not less than ½ lb. per square foot, the said metal to be anchored by extending the ends at least 2 in. in the fireproof protection of the webs above.

"If of tile the protection shall consist of lugs forming part of the skewbacks and extending around the lower flange of the beam and meeting at the center; or of tile slabs held in position by dovetailed lugs projecting from the skewbacks.

"The soffits of floor beams may be protected with metal lath and plaster to a thickness of 1 in. as follows: The metal lath shall weigh not less than 5 oz. per square foot and shall be wrapped around the soffits of the beams so as to be offset ¾ in. from the surface to be protected, with the ends of the lath secured by extending them at least 2 in. in the concrete protection of the webs above. Plaster gauged with 25 per cent. of Portland cement shall then be applied to a thickness of 1 in. in a single coat, filling the space solidly between the metal lath and the soffit of the beam. No exposed metal clips or clamps of any character shall be used to support the soffit protection. Lintels and other lesser structural members supporting loads shall be protected in the same manner as the soffits of the the floor beams."

Another section which makes Second Class Construction less expensive than the First Class Construction relates to metal lath and plaster ceilings, in which this provision occurs: "Metal lath ceilings as herein specified, when covered with plaster to a thickness of 1 in., will be considered equivalent to 1 in. of protection to the steel beams supporting the floor arches above it in fireproof buildings of Second Class Construction only, and the protection of said floorbeams may be reduced by 1 in. wherever such ceilings are erected underneath them in Second Class Construction."

Still another clause which has been criticized as enabling an unscrupulous Superintendent to show favoritism to certain methods of fireproofing is found in Section 120 and reads as follows: 'In the construction of fireproof floors and roofs, tie-rods [between floorbeams] can be omitted if the weight of steel called for in Section 106 is incorporated in the construction of the floor, unless specifically ordered to the contrary by the Superintendent of Buildings, in which case he may designate tie-rods shall be used in accordance with this Section."

Height of Buildings.—A feature of the proposed code which has aroused real estate interests relates to the height of buildings. The more important clauses read as follows:

"The height of fireproof buildings, except such buildings as are occupied for office or hotel purposes, shall not exceed 100 ft. unless such buildings are of First Class Construction in accordance with Section 106 of this Code and are provided with a standard equipment of automatic sprinklers, in which case the height shall not exceed 150 ft. Fireproof buildings to be occupied for office or hotel purposes over 100 ft. in height shall be of First Class Construction in accordance with Section 106 of this Code, but the height of such buildings shall not exceed 200 ft. except in case the building shall have such offsets, yards or courts in excess of those required in Section — of this Code that the cubage of the building measured above the mean street grade level shall not exceed 174 times the area of the lot.

"The height of buildings with either walls, columns or girders constructed of reinforced concrete shall be limited not to exceed 75 ft." This requirement places reinforced concrete and mill construction in the sameclass, according to the views expressed this week.

INSPECTION OF THE EAST RIVER TUNNEL.

The Interborough Rapid Transit Co.'s directors, engineers and officials, together with a number of New York City officers and guests, started from Bowling Green on Nov. 27 and passed down through the north tube under the East River to Brooklyn as far as Borough Hall station, riding in a train of Interborough standard cars, consisting of two motor cars and one trailer. The distance from Bowling Green to Borough Hall is 1.6 miles, and the length of the tube proper is 1.2 miles. The distance from center to center of the two tubes is 28 ft. The inside diameter of the tubes is 15 ft. 6 in. The lowest part of the tubes is 95 ft. below mean high water. The lowest part of the tube in the center is 40 ft. below the bottom of the river. The grades down from New York to the bottom of the tube and from the bottom of the tube up to Brooklyn is 3.1 per cent., which is the same grade as that under the Harlem River, under which cars have been operated for upwards of two years.

Ventilating shafts have been provided on the New York shore and on the Brooklyn shore, which will be equipped with very large capacity ventilating machinery. The ventilating shafts will also be equipped with emergency stairways.

The tube is lighted by an independent lighting system which is not in any way connected with the third rail. Therefore, should at any time the power or current go off the third rail, the lights in the cars will be extinguished, but the lamps lighting the tunnel, which are arranged on each side wall, will still continue to burn. This independent lighting circuit is arranged on two separate circuits, so that if a short-circuit occurs on one of the lighting mains, the other one will still continue to burn.

Chief Engineer Geo. H. Pegram explained that while the alignment of the tunnel had necessarily been made to a very large degree with considerable curvature, great care had been exercised in its construction and the elevation of the tracks to suit the curvatures, which had been accomplished to such a degree of perfection that a passenger riding in the car could scarcely perceive that the track was curved.

There are three sumps equipped with air lifts and pumps sufficient to handle a very large volume of water. Each is connected from one tube to the other, which makes it possible for workmen to pass from one tube to the other in the performance of their duty. Each of these tubes is equipped with a 3-in. city water main running the entire length of the tube, with connections for hose at about every 300 ft.

The trolley rail is of special section, rolled in an umbrella shape, secured from the bottom section of the rail by means of insulators to the track ties and protected above the top by means of an insulating board. The trolley shoes pass under the bottom of board and on top of the rail.

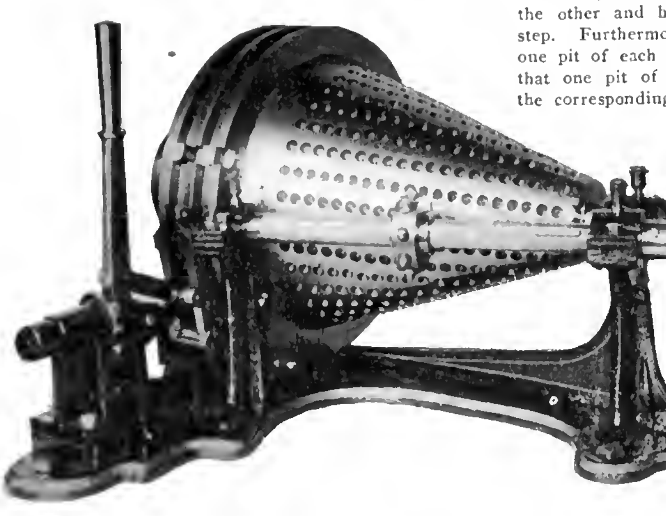
On each side of the track is constructed a bench wall made of concrete. In this bench wall the cable ducts are located. A large number of these cables have already been installed. The signalling system through the tubes is being rapidly installed and through the tubes will be of the type known as the track circuit over-lapping block signals. The tubes will be equipped with automatic train stops.

In the office at the south end of the Bowling Green station on Manhattan Island there are a number of ingenious safety devices for the purpose of controlling the movement of trains and the ventilation of the tube. The man in charge in this office will have a miniature track model with the signals on it, which will indicate by means of colored lights the exact location of each train at all times through the tube. There is also arranged a system of wiring running to this office, which will enable the operator to cut the power on or off the third rail or lighting system. A separate telephone system has been installed through these tubes in to the same office at Bowling Green on Manhattan Island. These telephones are arranged all through the tubes every 300 ft. and at the same points 300 ft. apart are devices for automatically tripping the circuit breakers in the power houses. These circuit breakers can either be tripped at every 300 ft. through each tube or tripped by the man in charge in the Bowling Green office.

A NEW VARIABLE SPEED DRIVE.

The "R-W. Speed Variator," for deriving variable speeds from a constant speed motor, is based on the gear-and-cone principle, consisting of a gear cone provided with a number of circumferential rows of gear pits, and, parallel with the slant of the cone, a shaft on which is feathered a spur gear having pin teeth of a general conoidal form. This gear is adjustable longitudinally on its shaft so as to be brought into mesh with any desired row of gear pits on the cone, thereby causing the driven element, which of course may be either the gear or the cone, to rotate at a corresponding speed.

If the number of pits in the successive rows differ in arithmetical progression the rows themselves must be equidistant from each other. For example, if the row nearest the apex has 11 pits, the next row 12, the next 13, and so on, the distance from the first row to the second, from the second to the third, and so on, is, and must be, the same. Hence the gear can be shifted by equal steps from either end of the cone to the other and be in mesh with a row of pits at each step. Furthermore, the rows can be so arranged that one pit of each row will lie in the same axial plane, so that one pit of each row will be exactly in line with the correspondingly located pits on all other rows. This



SPEED-CHANGE DEVICE FOR POWER TRANSMISSION.

straight or longitudinal series of pits is formed on a sliding bar capable of movement in both directions a distance equal to the space between successive circular rows of pits. The speed changes are accomplished by shifting the pin tooth gear to other rows of pits by means of this bar, which is accomplished at the instant in the cone's rotation when the slide is parallel with the gear shaft; if the slide is then quickly shifted, it will carry the gear to the next row of pits.

At the base of the cone are two grooves, which the slide crosses, and projecting from the slide into the grooves are two studs, the arrangement and proportioning of the parts being such that the studs, when the slide is in its normal position, are spaced slightly from the rib between the grooves. Adjacent to the grooves are two oppositely inclined vertical cams, operated by a controlling handle, each cam equal in width to the distance which the slide must move to transfer the gear from one row of pits to the next, so that either cam, engaging the stud in its slide, will shift the slide the proper distance either way. Thus, suppose the left-hand cam is thrown into the corresponding groove; then, with the cone rotating forward, as the stud strikes the cam the slide will be carried toward the base of the cone, thus carrying the pin tooth gear in the same direction. Similarly, the other cam shifts the slide, and with it the gear, in the opposite direction.

The cams are mounted on the upper ends of two arms pivoted at their lower ends, which are actuated by links to a controlling lever on opposite sides of the pivot of the latter. This method of connecting the cam-arms with the controller makes it impossible to throw both the cams into the grooves at once. Normally both cams are retracted to the inoperative position, and to produce this retraction instantly when the operator releases the control handle, a spring-pressed plunger is provided on the outer side, having a flat face bearing against the controller on both sides of its pivot. Oscillation of the handle in either direction compresses the plunger spring; which will, on release of the lever, throw the latter immediately to its inoperative position with both cams retracted. To restore the slide to its normal position after each actuation, an inclined guide is provided at each side of the flanges at the

base of the cone, against one or the other of which one of the slide lugs, projecting beyond the flange, strikes after passing the gear, and is thereby thrown back to the normal position.

It will be seen that as long as one of the cams is held in its grooves, each revolution of the cone will produce an actuation of the slide and a corresponding shifting of the pin tooth gear, so that the latter will move step by step up or down the cone, according to which cam is operating. When this gear arrives at the end of its shaft and can, of course, go no farther, the cam shifting it is retracted before the next succeeding revolution of the cone brings the slide again into position for actuation; this retraction is effected automatically by mechanism inside the cone, which acts to throw the cam out of its groove, against the force exerted by the operator, just before the slide-lugs reach the position of the cam. This mechanism is controlled by the R-W Speed Variator Co., Singer Bldg., New York.

A NEW NARROW-GAUGE CAR.

A short while ago an order was placed with the Arthur Koppel Co., manufacturers of industrial railway materials, for 200 mine cars by the New River Pocahontas Consolidated Coal Co. The first sample car of the order was ready for inspection about Nov. 15, and a committee consisting of several of the best mine superintendents in the vicinity went to Koppel to inspect the car. The committee examined the car in minute detail and an additional order for 200 cars was immediately placed with the Koppel Co.

This car is of all-steel construction, and is a very low car for its capacity, the overall height from top of rail being only 30 in. and the capacity 57½ cu. ft. The gauge is 44 in. A special feature in the design is embodied in the round buffer, which is built of a special steel channel having a small depth and very wide flanges. At the ends, this channel is bent to a semi-circular shape and projects beyond the car, so as to give clearance between the corners of the cars on curves. Between the ends this bumper channel is continued clear through the car, making a continuous buffing column capable of carrying the end shocks met in service, from car to car, without transmitting the whole strain to any particular car. This feature secures the desirable results obtained with the draft gear of ordinary standard freight cars.

The large over-hang of the sides, which gives the car its large capacity, has been well stiffened, and its shape, composed of large radial corners, facilitates the discharge of the load. The door at one end is of the lift type, and is also well stiffened to give it the necessary rigidity. The wheels, axles and bearings are of a special patented self-oiling type, the wheels being 16 in. in diameter.

A MISLEADING CALL FOR ENGINEERS.

A Pacific Coast correspondent answers a recent letter from this journal as follows: "Some time ago you forwarded to me a letter evidently written by a young man in Kansas or that vicinity asking for information in regard to work for the Los Angeles aqueduct and referring to advertisements in an 'Engineering Journal' of Inglewood, Cal. I replied to the young man's letter that I questioned very much the legitimacy of this publication and advised him to write directly to the Aqueduct Commission in Los Angeles, with which I was acquainted. That my suspicions were well founded, you may judge by the enclosed despatch from Los Angles to the San Francisco 'Call.' It might be advisable to make some mention of this matter in the Record."

The article in the "Call" is as follows:

"Los Angeles, Nov. 23.—The post office authorities, at the request of Chief Engineer Mulholland of the Los Angeles Aqueduct Commission, has promptly put a stop to a scheme for defrauding thousands of men throughout the United States out of various sums which in the aggregate would have amounted to many thousands of dollars. The so-called 'Engineering Journal' of Inglewood, this county, has been obliged to cease its shady existence, and, although no arrests have been made, criminal prosecutions will follow any attempt to revive the swindle. The mail of the concern has been stopped and hundreds of letters, nearly all of them containing money orders, have been returned to their senders. The 'Engineering Journal' should not be confused with a legitimate publication of that name, for it exists in name only and was used only to further the scheme of the sharpers. Advertisements appeared in newspapers throughout the country announcing that 5,000 men and 1,000 teams were needed in the construction of the Owens River aqueduct, on which Los Angeles is about to expend millions of dollars. The 'ads' said that upon payment of from $1 to $5 registration fees positions paying from $100 to $500 a month could be secured through the agency of the 'Journal.' Another part of the swindle was to induce persons to pay various sums for reservations of land along the line of the aqueduct, water from which, the circulars said, would insure abundant crops. Tempting bait was offered engineers for big fees and several eastern engineers took the bait and paid the fees demanded. The truth is that there is no scarcity of laborers on the aqueduct work, that the work of construction has not reached a stage where an army of men is needed. There is no registration bureau here and no person has authority to offer positions on the work, much less collect fees for such a service. When the matter was called to the attention of the postal authorities a fraud order was issued and the swindle stopped."

PERSONAL NOTES.

Mr. John C. McMynn has resigned his connection with Robert W. Hunt & Co.

Mr. J. Clyde Power has resigned as superintendent and engineer to the Board of Park Commissioners of Indianapolis, Ind.

Everett B. Webster, president of the National Steel & Wire Co., New York, died, Nov. 29, at Jacksonville, Fla., aged 38 years.

Mr. Allen R. Boudinot has opened an office in the Lane Building, Davenport, Ia., where he will engage in a general civil engineering practice.

Mr. Stephen E. Kieffer has opened offices for the practice of civil and hydraulic engineering in the First National Bank Building, Berkeley, Cal.

Mr. Richard L. Humphrey, consulting engineer, Philadelphia, Pa., and president of the National Association of Cement Users, has been elected a member of the Société des Ingenieurs de France.

E. M. Collins, formerly chief engineer of Quincy, Omaha & Kansas City R. R., died recently as the result of a stroke of paralysis, which occurred in December, 1905, and caused him to retire from the service of the road.

Civil Engineer A. C. Lewerenz, U. S. N., has been transferred from the navy yard at Puget Sound to the Bureau of Yards and Docks, at Washington, and Civil Engineer P. L. Reed has been ordered from Schenectady, N. Y., to Puget Sound.

Mr. W. R. C. Corson, consulting engineer, Hartford, Conn., has entered the service of the Hartford Steam Boiler Inspection and Insurance Co., as assistant to Mr. Frank S. Allen in the mechanical engineering department.

Mr. Theodore P. Shonts, head of the Interborough-Metropolitan Co., New York, was recently elected president of the Chicago & Alton R. R., succeeding Mr. Samuel M. Felton, who resigned to become president of the Mexican Central Ry. Co., Ltd. Mr. Shonts has long been president of the Toledo, St. Louis & Western R. R., which recently gained control of the Chicago & Alton.

The United States Civil Service Commission will hold an examination in the large cities of the country, on Jan. 8-9, of candidates for the position of civil engineer and superintendent of construction in the Quartermaster's Department at Large, at $1,500 per year. Examinations will also be held on Jan. 8, 9 and 10 to fill vacancies in the position of mechanical and electrical draftsman in the Ordnance Bureau, War Department.

BUSINESS NOTES.

Mr. Carl G. A. Schmidt, Jr., 265 Broadway, New York, has made arrangements for manufacturing a detachable silent chain for driving machinery which has been tested for some time in several installations.

An important reorganization has taken place in the Whitney Power Co., now engaged in completing a large hydro-electric enterprise in North Carolina. Mr. George I. Whitney has resigned the presidency and been succeeded by Mr. Edward F. Buchanan, of the New York brokerage firm of A. O. Brown & Co. A number of directors resigned and Messrs. G. L. Stout, L. G. Young, W. D. Sargent, J. S. Henderson and A. O. Brown have been elected their successors.

The Alpha Portland Cement Co. at a meeting in Easton, Pa., last week, voted to increase the capital stock of the company from $2,000,000 to $6,000,000. The increased stock will be held in the treasury to be used in the business as required.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., has just completed a shipment of 1,000 tons of open hearth steel corrugated bars for the irrigation works of the Tieton project of the U. S. Reclamation Service. This order is one of several received by the above company for bars for irrigation works.

Owing to the increased demand for its cement in the South, the Edison Portland Cement Co., Arcade Building, Philadelphia, has opened an office in the National Bank Bldg., Savannah, Ga., in order to supply the trade better than can be done from New York. Arrangements are being made to carry stocks of cement at various Southern seaports so as to enable the company to give prompt deliveries.

Mr. A. Borlido Maia, the surviving partner of the late firm of Borlido Moniz & Co., Rio de Janeiro, Brazil, has established a new firm to be known as Borlido Maia & Co., to continue the original business in lubricating oils, greases, paints, hardware and railroad supplies. The new partners are Mr. C. H. de Niemeyer and Mr. F. X. G. Flores, both of whom were employees of the original firm.

Paradigm skylights to the extent of 55,000 sq. ft. are to be installed on the new locomotive shops at Stratford, Ont., for the Grand Trunk Ry. by Arthur E. Rendle, of Montreal, New York and Chicago. The Arnold Co., Chicago, are the engineers. Mr. Rendle has also the contract for about 17,000 sq. ft. of skylights for the Grand Trunk car shops at London, Ont.

The Carbolineum Wood Preserving Co., of New York, announces that it has secured the services of Mr. George S. Blanchard, who until recently was interested in lumber, and more particularly treated lumber on the Pacific Coast. Mr. Blanchard will make his headquarters in New York City, and will also be actively engaged in supervising the treating operations of the Carbolineum Timber Treating Co.

Allis-Chalmers Co. has engaged for its offices in St. Louis, Mo., a new suite of rooms at 1302-1304 Third National Bank Bldg., where the company's district manager, Mr. F. L. Bunton, and his staff, will be prepared to receive visitors after Jan. 1, 1908.

J. G. White & Co., of New York, engineers and constructors for the Philippine Railways, have contracted with the American Car & Foundry Co. for four combination first-class and parlor coaches. The cars will be furnished with easy chairs in the parlor compartment in addition to the regulation seats, and will have fully equipped buffets and commodious lavatories. This class of rolling stock has become very necessary for the accommodation of foreigners and the better class of natives, and will be used on the lines terminating in the southern ports of Cebu and Iloilo, the construction of these lines being now well advanced.

At the recent annual meeting of the stockholders of the Independent Pneumatic Tool Co., held at Jersey City, N. J., the following directors were re-elected for the ensuing year: Messrs. J. B. Brady and W. O. Jacquette, of New York; John P. Hopkins, J. D. Hurley, J. J. McCarthy, J. M. Glenn, M. S. Rosenwald and Simon Florsheim, of Chicago; and J. R. Turner, of Jersey City. At the annual meeting of the board of directors held at Chicago all of the present officers were re-elected for the ensuing year as follows: Mr. J. B. Brady, Pres.; Mr. W. O. Jacquette, first V. Pres.; Mr. J. D. Hurley, second V. Pres.; Mr. A. B. Holmes, Secy. and Treas. The annual statement shows a very gratifying increase in business over the previous year. The company has recently greatly enlarged its plant at Aurora, Ill., installing a large amount of new machinery and now has facilities for practically doubling its output. The company reports that the outlook for business during the coming year is very promising, notwithstanding the present financial stringency.

The Pittsburg Automatic Vise & Tool Co., Pittsburg, has made a simple but useful improvement in its vises by cutting a groove in one of the jaws, which enables a firm hold to be secured on small round work.

TRADE PUBLICATIONS.

Recent bulletins issued by the Fort Wayne Electric Works, Fort Wayne, Ind., describe a multiple system of street arc lighting, enclosed direct-current multiple arc lamps, and portable wattmeter calibrators that are built by this company and have recently been considerably improved. The multiple street lighting system was especially designed to permit of both street and commercial lighting from one set of street mains, particularly desirable in small towns, while the wattmeter calibrators are portable instruments for testing the accuracy of service current meters.

A pamphlet on the subject of the concentration and briquetting of iron ores has recently been issued by the American Gröndal Kjellin Co., New York, which has the sale of the American rights of Mr. Gustaf Gröndal's process of treating low-grade iron ores. The process is well described and the necessary machinery illustrated, representative plants in both Norway and Sweden being explained and reference made to tests with ores from other countries. It is claimed that ores may be profitably treated by the crushing process for poor magnetites containing down to 25 per cent. of metallic iron and those high in phosphorus or copper, while by concentration, nearly all iron ores with a high percentage of sulphur and nearly all small ores, such as fine concentrates and iron sand, may be successfully treated.

A supplement to Catalogue 17 of the Marine Iron Works, Chicago, Ill., illustrates a number of improvements in steam machinery of all classes for use in marine service. Surface condensers, engine-driven centrifugal pumps, deck and freight hoists, triple and compound propellor engines, stern paddle-wheel engines and boilers, are among the equipment discussed.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Harrison, Ark.—Geo. W. O'Neal is stated to have petitioned Town Council for a franchise to lay and maintain water mains.

Denver, Colo.—The Agricultural Ditch Co. at the Chamber of Commerce Bldg. on Nov. 20 indorsed the project of constructing a tunnel through the mountain 3 miles long, and to bring water from Williams Fork on western slope to a point near Georgetown; the work will cost about $1,500,000. After determining to form an irrigation district the stockholders appointed a committee to arrange details and report to the annual meeting of the stockholders next January, including F. J. Chamberlin, W. W. Garwood, George J. Bancroft, and others.

Palatka, Fla.—The city is reported to have voted to issue $10,000 water works bonds.

Jacksonville, Fla.—See "Power Plants, Gas and Electricity."

Savannah, Ga.—We are informed that the city of Savannah has selected H. S. Jaudon, of Thomasville, to go over its water works, with a view of reinforcing and bettering the service.

Blue Ridge, Ga.—See "Power Plants, Gas and Electricity."

Atlanta, Ga.—Local press reports state that the following are the bids opened on Nov. 25 by the Bd. of Water Comrs. and Special Com. of Council for furnishing and erecting one vertical triple expansion high-duty pumping engine of the self-contained type, to have a capacity to deliver 20,000,000 U. S. gal. of water in 24 hours against a varying pressure of from 120 to 160 lbs. per square in., at Hemphill Sta.: (*a*) 20,000,000-gal, vert. triple expansion pump, (*b*) 20,000,000 centrifugal pump, (*c*) 25,000,000 centrifugal: Wisconsin Engine Co., of Corliss, Wis., *a* $139,500; Bethlehem Steel Co., of South Bethlehem, Pa., *a* $132,000, *b* $68,000, *c* $74,000; Holly Mfg. Co., Lockport, N. Y., *a* $156,000; Wm. Todd Co., Youngstown, O., *a* (2 bids) $157,400 or $165,000; General Electric Co., Atlanta, *b* $56,000, *c* $61,930; Camden Iron Wks., Philadelphia, Pa., *a* $147,000; Dolin Eng. Co., Philadelphia, Pa., *b* $39,900, *c* $42,500; Allis-Chalmers Co., Milwaukee, Wis., *a* (2 bids) $134,700 and $149,300, *b* $43,700, *c* $48,200.

Chicago, Ill.—Separate bids will be received until Dec. 11 by the Bd. Local Improv. (H. S. Dietrich, Pres.) for constructing water service pipes in 37th St., Normal and Parnell Aves., and drains in W. 37th St.

Spirit Lake, Ia.—A. W. Osborne, City Clk., writes that $17,000 will probably be expended for water works, but no steps have yet been taken to issue bonds.

Owensboro, Ky.—The question of sinking wells to procure an increased water supply, is reported under consideration.

Murray, Ky.—See "Power Plants, Gas and Electricity."

Peabody, Mass.—The citizens are reported to have voted Dec. 2 to appropriate $12,000 for new water pipe.

**Cloquet, Minn.*—The contract for erecting steel pressure tank for the city water works, to be located on south side of E Ave., bet. Market and Arch Sts., is reported to have been awarded to the Des Moines Bridge & Iron Co., of Des Moines, Ia., at $8,718 (bids opened Nov. 18). The tower will be 166 ft. high and the tank 41 ft., with a diam. of 24 ft., and will have a capacity of 125,000 gal.

McComb City, Miss.—Bids will be received until Dec. 17 by the Bd. Mayor and Selectmen for sinking an artesian well at the water plant. J. Dock Darrell, City Clk.

**Newton, Miss.*—The Board of Mayor and Aldermen is reported to have awarded contracts for water works as follows: To Ahrens & Ott Mfg. Co., New Orleans, La., pipe and specials, valves, boxes and hydrants, $13,365; A. M. Lockett & Co., New Orleans, La., pumps, connections and valves for same, erection of all machinery except deep well and pump; furnishing feed water heater and wrought iron pipe and valves for boiler and pump connections and asbestos cover for same, $3,865; P. H. Porter, Clinton, Ky., foundation for tank and tower, construction reservoir, construction of pipe line, $7,153; L. R. Sperry, New Mexico, furnishing and installing deep well and pumping outfit, $1,600. Enberg Electro & Chemical Works, St. Joseph, Mich., Enberg electro hydraulic, $175, and J. F. Mercer, erecting building for the plant, $5,339.

Atlantic City, N. J.—There is reported to be a movement on foot here to install a high-pressure salt water main system in the hotel district between Pacific Ave. and the beach front; estimated cost, $475,000.

Lockport, N. Y.—The Council on Nov. 25 accepted the grant of the Common Council of North Tonawanda, giving this city the right to go through the streets of that city with Lockport's new water supply.

* *Velva, N. D.*—The Des Moines Bridge & Iron Wks., Des Moines, Ia., is reported to have secured the contract for constructing water works, for $15,027.

Claremore, Okla.—Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are preparing plans and specifications for the new water supply and remodeling of the water works. The new plant recently completed is without water, and the proposed improvements contemplate securing water supply from the Verdigris River.

Hermiston, Ore.—It is reported that arrangements are being made to establish water works.

East Stroudsburg, Pa.—H. B. Bush, Secy. Boro Council, writes that $10,000 to $15,000 will be expended for water works improvements. Engineer, Harry A. Kent, of Stroudsburg.

**Philadelphia, Pa.*—Bids were opened on Nov. 4 by the Dept. of Pub. Works, Bureau of Water (F. C. Dunlap, Chief of Bureau) for one 6,000,000-gal. pumping engine for Belmont high-service pumping station (Contract No. 90), and the Allis-Chalmers Co., of Milwaukee, Wis., secured the contract at $32,070, to be completed in 240 working days. Other bids received were: The Snow Steam Pump Works, 114 Liberty St., New York, N. Y., $39,000, 250 days; the Laidlaw, Dunn, Gordon Co., 114 Liberty St., New York, N. Y., $36,500, 270 days; Bethlehem Steel Co., So. Bethlehem, Pa., $30,750, 260 days; Southwark Fdry. & Mchy. Co., 5th and Washington Ave., $44,385, 175 days.

Reading, Pa.—The Water Board is reported to be considering the covering of the reservoirs at the head of Penn St., at a cost of $25,000, and that of Hampden, to cost $80,000.

Yorkville, S. C.—The citizens are reported to have voted to issue $25,000 bonds for water works and sewers.

Platte, S. D.—It is reported that arrangements are being made to issue $10,000 bonds for water works extension.

Estelline, S. D.—The City Council is reported to be considering the question of constructing water works.

Lebanon, Tenn.—The citizens are reported to have voted to issue $10,000 bonds for water works.

Victoria, Tex.—The State Attorney General is reported to have approved plans for the issue of $415,000 water works bonds.

Childress, Tex.—The citizens are reported to have voted on Nov. 20 to construct water works.

Seattle, Wash.—City Engr. R. H. Thomson estimates the cost of laying water mains on 36th Ave. for $7 300. The City Council has passed an ordinance providing for the laying of water mains on Hella St., at a cost of $7,700.

Odessa, Wash.—The citizens are reported to have voted to expend $11,500 in improvements, to include the replacing of the wooden mains with iron pipe.

New Westminster, B. C.—W. A. Duncan, City Clk., writes that the building of an additional reservoir is being talked of, but has not been decided upon finally. If done, it will most likely be by day's work under supervision of City Engr. and Supt. of Water Wks.

Hamilton, Ont.—Local press reports state that bids will be received until Dec. 21 by the Fire and Water Com. of Council, for electric pumps to be installed at the beach.

Hamilton, Ont.—See "Power Plants, Gas and Electricity."

Chesley, Ont.—Wm. McDonald, City Clk., writes that it is proposed to construct water works, at a cost of $38,000.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Santa Monica, Cal.—Thos. H. James, City Engr., writes that about $35,000 will be expended for main and outfall sewer, a portion of which has been let. The balance will be let in about 60 days.

Santa Monica, Cal.—See "Miscellaneous."

Sacramento, Cal.—M. J. Desmond, City Clk., writes that the citizens on Nov. 19 voted to issue $300,000 bonds for the construction of sewers.

Stockton, Cal.—The lowest bid recently received for constructing the east side sewer extension from E. 11th St., to E. 8th St. is reported to have been submitted by C. D. Vincent for $8,800.

Washington, D. C.—The lowest bid opened on Nov. 25 by the Comrs. D. C., for constructing sewers, was submitted by E. G. Gummel, at the following bid: 3,400 cu. yd. sewer excavation, 70 cts.; 62 cu. yd. brick masonry, $15; 115 cu. yd. vitr. brick masonry, $21; 450 cu. yd. concrete "B," $8, and 450 cu. yd. concrete "C," $8; total cost, $12,025. Totals of other bids: W. F. Brenizer Co., $13,481, and R. L. Beall Const'n Co., $15,991. D. E. McComb, Engr. of Sewers.

Belleville, Ill.—Bids will be received until Dec. 14 by the Bd. Local Improv. for constructing sewers in portions of 6 streets; estimated cost, $15,000.

**Bloomington, Ill.*—E. F. Fauntz, City Engr., writes that the contract for constructing pipe sewers (bids opened Nov. 29) has been awarded to D. H. Rider, of Bloomington, for $3,939.

**Summit, Ill.*—The Corns Products Mfg. Co. has awarded contract for a system of sewers at its new plant at Summit, to the Federal Improvement Co., of which Wm. Lorimer is president. Offices 949 to 959 Rookery, Chicago. Contract price, $75,000.

Cicero, Ill.—The citizens are reported to be in favor of co-operating with the city of Chicago in building the 52d Ave. sewer.

**Springfield, Ill.*—The contract to lay an 18-in. pipe sewer in Osburn Ave. from Dorlan Ave. to No. Grand Ave. has been awarded to John Spence, of Springfield, at 98 cts. per lin. ft. for 18-in. pipe, 40 cts. for 12-in. inlet pipe, and $25 for each manhole, complete.

Richmond, Ind.—Fred. R. Charles, City Engr., writes that Philip Hipskind & Sons, of Wabash, bid on Nov. 20 a total of $11,700 for constructing Northwest 2d St. sewer, to consist of 2,660 yd. rock excavation; 610 yd. earth excavation; 7 manholes, 3 inlets, 1,100 ft. 48 in. sewer, 1,100 ft. 6 in. subdrain pipe, 60 ft. 12 in. sewer pipe, 3 12-in. elbows and 30 squares repaving.

The Bd. of Pub. Wks. is reported to have ordered plans for the construction of a trunk sewer in E. Madison St., and pipe sewers in Niles Ave. and Edward, Webster, Howard and other streets.

South Bend, Ind.—The Bd. of Pub. Wks. is reported to have decided to construct a sewer in Pennsylvania Ave. from Wenger St. to Michigan St.

Greenfield, Ind.—O. O. Beaver, City Clk., is reported to be receiving bids for the construction of a sanitary sewer in and along Grant St.

Muncie, Ind.—The Bd. of Pub. Wks. is reported to have decided to construct a sewer in Kilgore Ave. and Jackson St.

Evansville, Ind.—The Bd. Pub. Wks., it is reported, will receive bids until Dec. 28, for the construction of a large sewer in a portion of 7th Ave. W. F. Wunderlick, City Clk.

Evart, Mich.—Bids will be received at the office of Irvin Chase, Village Clk., until Dec. 13, for the construction of a sanitary district sewer system, requiring 4,766 lin. ft. of 10, 15 and 18-in. pipe sewer, with necessary Y's and manholes, as advertised in The Engineering Record.

St. Paul, Minn.—Bids were opened by the Bd. of Pub. Wks (John S. Grode, Pres.) on Nov. 18 for constructing St. Anthony sewer extension No. 2, which includes about 12 miles of sewers, and the lowest bid submitted was that of the General Constr. Co., at $317,000. Other bids were: Fielding & Shepley, $330,575; Feyen & Keough Bros., $349,993; Green & Sons Co., $365,000, and O'Neil & Preston, $369,000.

St. Louis, Mo.—The Bd. of Pub. Improv. is reported to be considering the extension of Glaze Creek sewer through Carondelet Park to Kansas St.; probable cost of work, $140,000.

**Omaha, Neb.*—McCar & Cathrol are reported to have secured the contract for constructing a sewer on 33d St. from Taylor to Ames St., for about $5,478.

Riverside, N. J.—We are informed with regard to sewerage system bids for which were to have been opened on Nov. 1 at the office of Irven Kollo, Township Clk., that the award of contract is withheld for present. The system consists of approximately 10 miles of sewers 8 to 24 in. in diam., pump house, engines, pumps, pump well and disposal works. Engineer, Wm. H. Boardman, 426 Walnut St., Philadelphia, Pa.

Madison, N. J.—Bonds to the amount of $125,000 were voted Dec. 2 for the construction of sewerage and sewage disposal works, from plans of Hering & Fuller, of New York, N. Y. Jas. H. McGraw, Chmn. Sewer Com.

**Buffalo, N. Y.*—The following are the bids recently received by the Bd. of Pub. Wks. for constructing a 9-ft. 10-in. overflow and 10-ft. 2-in. overflow drain through Hertel Ave., bet. Cornelius Creek and Niagara River (biders all of Buffalo): Jos. F. Stabell Co., $156,000 (bid informal); Dark & Co., $159,200 (recommended for award); Miller & Franklin, $168,000.

The following bids have been received for constructing sewer in Military Road from Cornelius Creek to Hertel Ave. (bidders all of Buffalo): Miller & Franklin, $5,800 (recommended for award); Jos. F. Stabell Co., $6,000, and Dark & Co., $6,300.

Mt. Vernon, N. Y.—The officials of Mt. Vernon, North Pelham and Pelham Manor are reported to have decided to construct at once reduction works for the treating of the sewerage and the pumping of the residue into the sound.

Mt. Kisco, N. Y.—The citizens are reported to have voted on Nov. 23 to issue $59,000 bonds and raise $40,200 by a tax for the construction of sewers, to take care of the refuse, the city having decided to construct a sewage disposal plant if the village would construct the sewers. Engineer, J. M. Farley, of White Plains. F. J. Carpenter, Village Clk.

White Plains, N. Y.—Press reports state that the lowest bids opened on Nov. 27 at the office of the Bronx Valley Sewer Comn., 2 Grand St., White Plains, for constructing the Bronx Valley sewer is stated to have been submitted by Frank E. Gore, of New York City, at a cost of about $1,500,000. The bids called for furnishing work and materials necessary for the watertight and enduring construction of each one of the seven sections

**Reading, Pa.*—The following are the bids opened on Nov. 20 by the Bd. of Pub. Wks. for the construction of house sewer in Dist. 12: (*a*) Jos. O'Reilly, Reading (awarded contract); (*b*) David Peoples, 1200 Betz Bldg., Philadelphia; (*c*) Hawman Bros., Reading; (*d*) John F. Albrecht & Co., Reading; (*e*) Hawman Constr. Co., Reading. (Elmer H. Beard, City Engr.)

Furnishing and Laying 27,600 Lin. Ft. Pipe—	**a*	*b*	*c*	*d*	*e*
10-in pipe	$0.28	$0.26	$0.33	$0.34	$0.29
8-in. pipe	.22	.36	.40	.32	.25
6-in. pipe	.20	.25	.35	.18	.19
32,500 lin ft. 5-in. pipe	.10½	.13	.11	.15	.12
Concrete Cradle in Place—					
For 10-in. pipe	.29	.35	2.50	.60	.70
For 8-in. pipe	.29	.30	2.25	.60	.65
For 6-in. pipe	.25	.30	2.25	.60	.65
For 5-in. pipe	.25	.25	2.00	.60	.60
Each extra "Y" branch	1.45	1.00	3.40	3.00	1.35
1,270 *Manholes—*					
Concrete manhole, complete, per vertical ft.	3.80	4.25	4.00	4.40	4.40
Brick manhole, complete, per vertical ft.	4.00	4.25	4.50	4.60	4.75
30,000 cu. yds. earth excav.	.37	.64	.48	.90	.58
6,000 cu. yds. loose rock excav.	.73½	1.50	1.00	1.40	.84
36,000 cu. yds. rock excav.	.73½	.65	.85	.70	1.15
Lumber left in place, per M ft.	26.00	25.00	23.00	28.00	28.00
Brick masonry, per cu. yd.	15.00	16.00	15.00	16.50	14.00
Vitr. brick masry., per cu. yd.	25.00	20.00	20.00	18.50	20.00
Rubble stone masry., per cu. yd.	10.00	6.00	7.50	6.30	5.00
Concrete in place, per cu. yd.	9.00	7.00	12.50	9.40	7.00
Lumber left in place, per M ft.	40.00	25.00	60.00	28.00	28.00
Totals	$74,102	$85,846	$85,690	$100,564	$101,592

**Items marked thus give the names of parties awarded contracts.*

which together comprise about 12 miles of circular sewer from 3⅓ to 6 ft. diam. and about 3 miles of circular lined tunnel mostly 6½ ft. and 8½ ft. diam. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry.

Cincinnati, O.—The Bd. of Public Service is reported to be considering the construction of a sewer system in the annexed territory, which was formerly the village of Westwood.

Upper Sandusky, O.—The Council is reported to have passed an ordinance providing for the issue of $15,000 bonds for the construction of sewers in Sub-Dist. No. 2. John T. Carey, Mayor.

Mingo Junction, O.—It is stated that bids will be received until Dec. 23 by Frank McIlster, Village Clk., for $50,000 sewer bonds.

Wapakoneta, O.—It is stated that Chas. E. Fisher, Village Clk., will receive bids until Dec. 13 for constructing sewers in several streets.

**Reading, Pa.*—David Peoples, 1200 Betz Bldg., Philadelphia, has secured the contract for constructing intercepting storm water sewer from 11th and Greenwich St. to 12th and Walnut St. (bids opened by Bd. Pub. Wks. on Nov. 20), at the following bid: 1,072 lin. ft 4x6-ft. concrete, plain, $6.15; 1,062 lin. ft. 3-ft. 6-in. x 5-ft. 3-in. concrete, plain, $5.25; 580 lin. ft. 2-ft. 10-in. x 4-ft. 3-in. concrete, $4.45; 760 lin. ft. 24-in. pipe, $2.10; 110 lin. ft. 18-in. pipe, $1.90; 150 vertical ft. concrete manhole, with cover, concrete sewer, $4.25; 100 vert. ft. concrete manhole, with cover, for pipe sewer, $4.25; 20 plate "C" basin, including connection, ea., $90; 5 plate "I" basins, including connection, ea., $80; 50 M ft. lumber, $25; brick masonry, per cu, yd., $16; vitr. brick masonry, per cu. yd., $20; rubble stone masonry, per cu. yd., $6; concrete in place, complete, per cu. yd., $8; lumber in place, per 1,000 B. M., $30. Extra work: For earth excav., $1.50 per cu. yd.; loose rock excav., $1.60 per cu. yd.; rock excav., $1.60 per cu. yd. Total, $18,602. Totals of other bids: Fehr & O'Rourke, Reading, $23,043; Hawman Constr. Co., Reading, $24,895; Jos. P. O'Reilly, Reading, $26,617.

*Jos. P. O'Reilly, of Reading, has secured the contract for constructing Rose Valley Creek sewer from Neversink St. to river, at $17,935. Totals of other bids: Fehr & O'Rourke, Reading, $24,894; David Peoples, 1200 Betz Bldg., Philadelphia, $22,739; and Hawman Constr. Co., Reading, $36,253.

Yorkville, S. C.—See "Water."

Seattle, Wash.—The City Council has passed an ordinance providing for the laying of a sewer in 3d Ave. N., for $5,600.

BRIDGES.

Notes Arranged Alphabetically by States.

Red Bluff, Cal.—Plans are stated to have been completed for a 360-ft. I-beam bridge, to be constructed over Peynes Creek Slough on the Cone Road. The plans provide for twelve 30-ft. spans.

**Sacramento, Cal.*—We are informed that the Bd. of County Superv. recently awarded contract to Jenkins & Wells for repairs to American River bridge at 12th St. for $5,388; also to McDougall & Kennedy, for repairs to 2,800 ft. of trestle north of American River on 12th St. road for $13,795.

San Francisco, Cal.—The Bd. of City Superv. on Nov. 25 passed an ordinance setting aside $10,000, and the state to build an overhead bridge for foot passengers, from Market St. crossing east of the ferry.

Denver, Colo.—G. W. Houston, Deputy State Engr., writes that the following are the bids opened on Nov. 13: (*a*) Gunnison County bridge, a 125-ft. steel span, 80-ft. pile approaches; (*b*) Rio Blanco County bridge, 80-ft. steel span, including grading approaches; (*c*) 50 ft. reinforced concrete slab and girder type bridge in Capulin Conejos County; (*d*) 30-ft. arch type reinforced concrete bridge at Empire, Clear Creek County: South Western Bridge Co., Joplin, Mo., *a* $4,350 (awarded contract), *b* $3,940; Denver Bridge Co., Denver, *b* $4,700; Midland Bridge Co., Kansas City, Mo., *a* $4,800, *b* $4,767; Pueblo Bridge Co., Pueblo, *a* $4,650, *c* $2,800; C. G. Sheelly, *d* $1,949 (rejected); Walter Sharp Bridge Co., *a* $2,400.

Hartford, Conn.—Bids will be received by Morgan G. Bulkeley, Pres. Connecticut River Bridge and Highway Dist., until Dec. 16 for the sale of the superstructure of the present temporary highway bridge across the Connecticut River at Hartford, as advertised in The Engineering Record.

Colona, Ill.—The Joint Bridge Com. of Rock Island and Henry Counties is stated to have selected Colona as a site for the erection of a bridge over Rock River, the structure to consist of three 200-ft. spans, and cost $26,000.

Lafayette, Ind.—Bids will be received by the Comrs. of Tippecanoe County until Dec. 18 for the construction of a bridge near Granville, between Wayne and Shelby Townships, as advertised in The Engineering Record.

South Bend, Ind.—We are informed that all bids opened on Nov. 22 by the Bd. of Co. Comrs., at South Bend for constructing a concrete steel girder bridge at La Salle Ave., South Bend, to be 80 ft. long and 80 ft. wide, have been rejected and new bids will be called for about Mar. 1. The following are the bids received: C. L. Copp, Osceola, $13,234; Falkenau Electric Constr. Co., Chicago, Ill., $14,248; Marsh Bridge Co., Des Moines, Ia., $16,764; and Elkhart Bridge Co., Elkhart, $17,500. John W. Harbow, Co. Aud.; Alonzo J. Hammond, of South Bend, Engr. in charge.

Colfax, La.—It is stated that bids will be received until Jan. 6 by the Police Jury (J. B. Roberts, Clk.) at Colfax for constructing 2 steel bridges, one across Big Creek at Fishville, and the other across Fish Creek on the Pollock and Rochelle Rd.

New Orleans, La.—Bids will be received by Chas. R. Kennedy, Compt., until Jan. 2, for constructing a bascule trunnion bridge over Bayou St. John at intersection of Esplanade Ave.

Mankato, Minn.—The following bids are reported opened Nov. 14 for the construction of a steel highway bridge over the Minnesota River at A St.: A. Y. Bayne & Co., complete with wood floor, $25,800, with concrete floor, $2,100 extra Minneapolis Steel & Machinery Co., of Minneapolis, plan A, $27,800; B, $26,300, and C, $23,500. The Hennepin Bridge Co., plan A, $23,530; B, $22,265; C, $20,968, and D, $18,968. The Minneapolis Bridge & Iron Co., $27,485, complete with concrete floor; $26,000, with wood floor.

Red Wing, Minn.—Bids will be received until Dec. 20 by the Co. Bd. and the Bd. of the Town of Hay Creek at the Co. Auditor's office, Red Wing, for constructing a steel or reinforced concrete bridge over Bullid Creek, Town of Hay Creek, to be 60 ft. long between the two end walls.

Duluth, Minn.—The City Council is reported to have under consideration the construction of a steel viaduct over the railway tracks at Banks Ave. and 3d St., probable cost $20,000.

Kansas City, Mo.—The Commercial Improvement Co. is stated to have accepted the ordinance which authorizes it to build a viaduct on Main St. from 20th to 23d; estimated cost, $135,000.

New York, N. Y.—Plans are stated to have been approved by the Art Commission for the bridge to be constructed at Mott Ave. and tracks of Spuyten Duyvil & Port Morris Branch of the New York Central & Hudson River R. R.

Wilmington, N. C.—Blueprints are now on file at the office of The Engineering Record, 239 West 39th St., New York, N. Y., showing location of proposed bridge over Northeast River at Castle Haynes, bids for which will be received until Jan. 7 by the counties of New Hanover and Pender, as advertised in The Engineering Record. It will be a steel highway bridge approximating 400 ft., including draw span, and the bids are to include foundations; depth of water, about 32 ft. Bridge to have 16-ft. road clearance, and to carry 15-ton road roller. Design of bridge and details to be submitted by the bidders, and bidders must take their own measurements and soundings. D. McEachern, Chmn. Com.

**Newark, O.*—H. L. Maddocks, Co. Engr., writes that the contract for constructing superstructure Fallsburg Bridge (bids opened Nov. 25) has been awarded to Columbus Bridge & Iron Co., of Columbus, for $2,295.

Dayton, O.—Bids will be received until Dec. 17 by the Bd. Pub. Service (W. A. Maynes, Clk.), for re-erecting 2 of the old spans of the Stratford Ave. bridge at the mouth of Wolf Creek, including all necessary oak plank and joists for new floor and guard railing complete; also cleaning and repainting said 2 spans; also 730 cu. yds. steel reinforced concrete for the abutment piers and wing walls, including excavations. The contractor will be required to haul said 2 old spans from the present place of storage and furnish new material in place of all the missing or defective members of said 2 spans.

Meadville, Pa.—The construction of a bridge over French Creek at Mead Ave. replacing present structure is reported contemplated.

**Graham, Tex.*—Geo. H. McLaren, Co. Judge, writes that Mitchell & Pigg, of Weatherford, have secured the contract for building two suspension bridges across Brazos River (bids opened Nov. 20), for $37,280.

Houston, Tex.—Bids will be received until Dec. 11 by John B. Asbe, Co. Aud., for constructing 4 bridges on the Webster Ave. Line Co. Road.

Ogden, Utah.—The Oregon Short Line R. R. Co. is reported to have decided to construct a viaduct over the railroad yards at 24th St.

Ft. Monroe, Va.—Bids will be received at the office of Capt. Ernest R. Tilton, Constr. Q. M., until Jan. 6 for the reconstruction of Mill Creek Bridge, as advertised in The Engineering Record.

**Curlew, Wash.*—William Oliver, of Spokane, is stated to have secured the contract for constructing a steel bridge over Kettle River at Curlew, for $9,000.

Wheeling, W. Va.—Preliminary plans are stated to have been prepared for the construction of a bridge over the creek at Market St.

Lake Mills, Wis.—The County Bd. and citizens of Milford are stated to have appropriated $14,000 toward the construction of a bridge over Crawfish River, replacing Hubbleton Bridge.

Milwaukee, Wis.—The Bd. of Pub. Wks. is stated to have been authorized to receive bids for the construction of a bascule bridge over Kinnickinnic River, also for the Highland Boulevard Viaduct.

Eau Claire, Wis.—Wm. Danforth, City Engr., writes that a committee of City Council has arranged with Lang & McAnulty to prepare plans for a bridge and dam across Chippewa River near the southerly city limits.

Walkerton, Ont.—Bids will be received until Dec. 11 by P. A. Malcomson, Co. Clk., for $20,000 bridge bonds.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—Southern Bitulithic Co., of Nashville, Tenn., has received an additional contract for 2,500 sq. yds. of bitulithic.

San Francisco, Cal.—The Bd. of City Supervs. on Nov. 25 passed the ordinance providing for an appropriation of $50,000 for the repair of bituminous and asphalt streets.

Santa Monica, Cal.—Thos. H. James, City Engr., writes that bids will probably be received about Feb. 15 for paving about 2,000 sq. yds. asphaltum, with concrete base, including grading and cement curb; cost about $6,000.

Creede, Colo.—Bids will be received, it is stated, until Dec. 23 (re-advertisement) by T. W. Jaycox, State Engr., Denver, for the construction and repairs of a flume and wagon road on Willow Creek near Creede

Ridgefield, Conn.—Bids will be received until Jan. 2, by the Bd. Selectmen (Geo. H. Whitlock, Chmn.) for grading and graveling a section of road.

**Christiania, Del.*—The Levy Court at Wilmington is reported to have awarded the contract for constructing a portion of Christiana Road between Christiana and the bridge across White Clay Creek near Stanton, to Theobold Harsch, for $8,500.

Atlanta, Ga.—Venable Bros., Temple Court, are stated to have secured the contract for repaving 13,000 sq. yds. of Broad St. with creosoted wood block at $3.98 per sq. yd. and granite block at $2.65 per sq. yd., to be used between car tracks.

Augusta, Ga.—This city proposes installing new rock crusher for street improvements.

**Springfield, Ill.*—The contract for paving Rutledge St. from Carpenter St. to Miller St. has been awarded to John Bretz, of Springfield, at $1.67 per sq. yd. for paving, and 54 cts. per lin. ft. for stone curb.

**Greencastle, Ind.*—C. C. Hurst, Co. Aud., writes that the contract for improving 16,371 ft. of road in Jackson Township (bids opened Nov. 30) has been awarded to James M. Stewart, Roachdale, for $9,500.

Indianapolis, Ind.—It is stated that bids will soon be received for paving with brick Ray St.

Greenfield, Ind.—The Comrs. of Hancock and Marion Counties will soon let the contract for constructing 15,840 ft. of gravel road on the county line.

Columbus, Ind.—The City Council, it is reported, will receive bids until Dec. 16 for the construction of cement curbs, gutters and cement walks on 4th and Brown Sts. and cement walks on 11th and 12th Sts. L. F. Orr, City Clk.

Donville, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Dec. 15 for constructing a gravel road in Marion Township, 6,600 ft. in length. D. D. Mills, Co. Aud.

Des Moines, Ia.—The following bids are reported opened Nov. 23 by Bd. Pub. Wks., for paving about 11,067 sq. yds. on *a*, Enos Ave.; *b*, Alley between 5th and 6th, Clark and State St.; *c*, Alley between 1st and 2d, Postal and Court St.; *d*, 2d and 3d Sts.; *e*, School St.; *f*, Centre St.; *g*, Postal St., and *h*, Elm St. Flint Brick Co., *a* and *e*, $1.95; *b*, $2.05; *c*, $2.15; *d*, $1.38; *f*, $2.04½; *g*, $2.01; *h*, $2.06. Hausman Improvement Co., *a*, *g* and *h*, $2.05; *b*, $2.13; *c*, $2.08; *d*, $1.40; *e*, $2.19; *f*, $2.17. Jas. Horrabin, *a* and *b*, $2.15; *c*, $2.19; *d*, $1.42. O. P. Herrick, *e*, *f* and *g*, $2.09.

New Orleans, La.—The Com. on Buget and Assessment is stated to have reported favorably on the ordinance providing for the paving with bitulithic a portion of Roberts St., and with asphalt a portion of Octavia St.

The Streets and Landings Com. is stated to have reported favorably on the paving with bitulithic Walnut St., with asphalt Soniat St. and Carondelet St., also the paving of portion Bell and Pine Sts., and sidewalks on Audubon St.

Long Beach, Miss.—The Citizens are stated to have voted to issue $10,000 bonds for street improvements.

**Kansas City, Mo.*—The Engineering & Constr. Co. is reported to have secured the contract for repairing asphalt paving on Brooklyn St. at $1.09 per sq. yd.

Omaha, Neb.—It is stated that $150,000 will be expended in improving Douglas County Roads.

**Woodbury, N. J.*—The contract for paving about 2,950 sq. yds. on S. Broad St. with bitulithic is reported to have been awarded to the Standard Bitulithic Co., at $2.25 per sq. yd. Bids opened Nov. 25 by John E. Estell, City Clerk.

Albany, N. Y.—Fredk. Skene, State Engr., is reported to have opened bids Nov. 18 for the following improvements: Road No. 345, Canajobarie-Sprout Brook, Montgomery County—Brown & Lane, Schenectady, $41,278; Stewart, Kerbaugh, Shanley Co., New York City, $38,611. Road No. 462, Old-Forge-McKeever, Herkimer County—Pennell & Hern, Yonkers, $71,210; Brown & Lane, $99,839; P. A. Herliby, Glens Falls, $110,307; Casey & Murray, Rochester, $70,664; D. Moynohan, Herkimer, $74,979. Road No. 477, Valley Falls Road, Rensselaer County—Patrick A. Lillis, Troy, $43,371; Thos. H. Karr, Troy, $43,596; M. F. Dollard, Albany, $49,405; Stewart, Kerbaugh, Shanley Co., $47,500. Road No. 478, Haynerville-Raynertown, Rensselaer County—Croliss Constr. Co., Troy, $27,226; Patrick A. Lillis, Troy, $25,279; Brown & Lane, $29,362; Martin Murray, $27,067; Thos. H. Karr, $25,716; M. Kantrowitz, Albany, $25,969; Stewart, Kerbaugh, Shanley Co., $28,132. Road No. 490, Hoosick-NorthHoosick, Rensselaer County—M. Fitzgerald, Hoosick Falls, $24,127: Thos. H. Karr, $24,969; P. A. Lillis, $24,106; Brown & Lane, $34,311; Stewart, Kerbaugh, Shanley Co., $25,778.

Other bids opened at the same time are reported to be as follows: Road No. 273, Seneca River, North Side, Chambers & Brady, Rochester, $14,886.

Road No. 308, New Paltz-Rifton, Joseph Walker, Stone Ridge, $43,009; Stewart Kerbaugh Shanley Co., New York City, $45,560.

Road No. 355, Wellsburg, Bennett & Ryan, Silver Creek, $32,923.

Road No. 358, Horseheads-Corning, Bennett & Ryan, Silver Creek, $79,537; Casey & Murray, Rochester, $77,954. Road No. 382, Walden-Pine Bush, De Graff & Hogaboom, Bloomington, N. Y., $59,943; Orange County Road Constr. Co., New York City, $57,609; D. Moynehan, Herkimer, $58,358; Stewart Kerbaugh Shanley Co., $57,546.

Road No. 391, Clarendon-Holly, Sec. 1, Greece Constr. Co., Rochester, $25,136; Chambers & Grady, $31,832; Henry P. Burgard Co., Buffalo, $30,368; Stewart Kerbaugh Shanley Co., $28,631.

Road No. 398, County Line, Orleans and Monroe counties, Greece Constr. Co., $30,809; Stewart Kerbaugh Shanley Co., $30,342.

Road No. 401, Rapids, Jeremiah T. Finch, Glens Falls, $32,586; Whitmore Rauber Vicennes Co., $27,170.

Road No. 402, Buffalo Sec. 3, Greece Constr. Co., $24,805; Gantz-Wilson Constr. Co., Buffalo, $29,796; Chambers & Grady, $30,274; Whitmore-Rauber-Vicennes Co., $29,696.

Road No. 403, Churchville-Riga, Patrick A. Lillis, Troy, $17,412; Greece Constr. Co., $17,551; Chambers & Grady, $20,036.

Road No. 408, Rich's Dugway-Penfield, Monroe County, Monroe Roads Co., $24,398; Whitemore-Rauber-Vicennes Co., $27,179; Patrick A. Lillis, Troy, $23,790.

Road No. 421, Conklin, Casey & Murray, $58,766; A. D. Bridge's Sons, Hazzardville, Conn., $58,852.

Road No. 426, State Road, Sec. 2, Wm. J. Semper, $48,231.

*Items marked thus give the names of parties awarded contracts.

Road No. 428, Watertown-Carthage, Sec. 3, Wm. J. Semper, Watertown, $35,862; Burns Bros. & Haley, Watertown, $37,972; Stuart Kerbaugh Shanley Co., $32,047.

Road No. 445, Lisle Center Lisle, J. McCormick, East Providence, R. I., $20,144.

Road No. 474, Clover St. Road, Sec. 2, Monroe Roads Co., $14,735; Patrick A. Lillis, Troy, $14,695; Whitmore Rauber-Vicennes Co., $16,034.

Road No. 479, Fairport, Sec. 2, Monroe Roads Co., Rochester, $3,301; Whitmore-Rauber-Vicennes Co., $3,434; Patrick A. Lillis, Troy, $3,376.

Road No. 485, West Bloomfield, Honeoye Falls, Bert Warren, Honeoye Falls, $26,416; Henry P. Burgard Co., Buffalo, $30,013.

Road 480, Tully Roads, Chambers & Grady, Rochester, $36,305.49; Stewart Kerbaugh Shanley Co., New York City, $30,269.

Road No. 531, Base Line, Sec. 2, Gantz, Wilson Constr. Co., Buffalo, $23,150; Stewart Kerbaugh Shanley Co., $18,194.

Road No. 532, Base Line, Sec. 3, Gantz-Wilson Constr. Co., $14,891; Stewart Kerbaugh Shanley Co., $10,425.

**Rochester, N. Y.*—The contract for paving with brick Shepard St. is stated to have been awarded to Whitmore, Rauber & Vicinus, for $14,861.

**Winston, N. C.*—A contract for 72,000 sq. yds. of bitulithic has been awarded to the Atlantic Bitulithic Co., of Richmond, Va.

**Toledo, O.*—H. P. Streicher & Co., of Toledo, will lay 6,325 sq. yds. of bitulithic in this city.

Cleveland Heights, O.—It is stated that bids will be received until Dec. 10 by Wm. G. Phare, Village Clk., for $9,669 sidewalk bonds.

Cincinnati, O.—The City Council is reported to have passed the following resolutions for paving with granite Lawrence and Griffin Sts., with brick Bishop St., with asphalt Winchell Ave., and macadamizing Edwards Road.

Struthers, O.—Bids will be received until Dec. 30 at the office of L. S. Creed, Village Clk., for $5,000 bonds, to be issued for the purpose of resurfacing and improving streets.

Columbus, O.—Bids will be received until Dec. 11 by the Bd. Pub. Service (Edwd. F. McGuire, Secy.) for improving portions of 13 streets.

Ashtabula, O.—It is reported that bids will be received until Dec. 10 by the Bd. Pub. Service (A. J. Richardson, Clk.) for paving with brick portions of several streets.

Dayton, O.—The City Council is reported to have passed resolutions providing for the paving of portions of Grand Ave. and Jackson St.

Guthrie, Okla.—W. W. Miller, City Engr., is now preparing plans for paving Noble Ave., about 24 blocks, and 1st St. for 3 blocks.

**Portland, Ore.*—An additional contract for 15,802 sq. yds. of bitulithic has been awarded to the Warren Constr. Co.

**Eugene, Ore.*—2,834 sq. yds. of bitulithic will be laid by the Warren Constr. Co., of Portland, Ore., in Eugene.

**Salem, Ore.*—An additional contract for 14,429 sq. yds. of bitulithic has been awarded to the Warren Constr. Co., of Portland, Ore.

**Harrisburg, Pa.*—The County Comrs. are stated to have awarded the contract for constructing the Paxtang Pike along the Reading Road to McCormick & Co., of Philadelphia, at $18,000.

Bids will be received until Dec. 16 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 5,280 ft. of road, 16 ft. wide, in Londonderry Township, Dauphin County.

Altoona, Pa.—The lowest bid opened Nov. 19 by State Highway Dept. at Harrisburg for constructing a portion of the state road from Young's Crossing along Logan Valley St. Railway is stated to have been submitted by John Vipond, of Altoona, at $26,238.

Erie, Pa.—The County Comrs. on Nov. 23 are stated to have received from State Highway Dept. at Harrisburg bids, as follows, for constructing *a* 8,158 ft. of road in Waterford Borough and *b* 3,670 ft. in Waterford Township: W. C. McIntyre & Son, of Sharon, *a* (3 bids) $21,597 to $28,424, *b* (3 bids) $9,597 to $12,818; John L. Hanna, Jr., of Franklin, *a* (2 bids) $31,936 and $34,667, *b* (2 bids) $11,378 and $14,853; Franklin Constr. Co., of Franklin, *a* (3 bids) $14,448 to $29,404, *b* (2 bids) $10,045 and $10,509; E. M. Love & Son, of Corry, *a* (4 bids) $21,741 to $36,147, *b* (2 bids) $9,988 and $16,779; South Shore Constr. Co. *a* (3 bids) $19,175 to $30,170, *b* (4 bids) $8,811 to $14,395, and C. B. McCray and M. J. Crowell, of Corry, *a* (2 bids) $19,960 and $30,416, *b* (2 bids) $8,725 and $13,611.

Carlisle, Pa.—It is stated that bids will be received until Dec. 11 by the State Highway Dept. (Jos. W. Hunter, Comr.), Harrisburg, for constructing 2 roads, 2,700 ft. and 6,932 ft. long, respectively, in Lower Mifflin Township; also until Dec. 13 a road 600 ft. long in Mechanicsburg Boro. and 2 roads in Hampden Township, 5,730 ft. and 1,520 ft. long, respectively.

**Columbia, S. C.*—The Georgia Engineering Co., of Augusta, Ga., is reported to have secured the contract for paving a portion of Main St., for $173,559. Bids opened Nov. 25 by Street Comn. Other bidders were as follows: W. F. Bowe, Augusta, $174,780; John J. Cain, Columbia, $225,808; Atlantic Bitulithic Co., Richmond, $203,592; Southern Paving & Constr. Co., Chattanooga, $237,873.

Greenville, Tenn.—See "Public Buildings."

**Ft. Worth, Tex.*—The Texas Bitulithic Co., of Dallas, Tex., has been awarded contract for 114,940 sq. yds. of bitulithic.

**Vancouver, Wash.*—A contract for 36,987 sq. yds. of bitulithic is being constructed by the Warren Constr. Co., of Portland, Ore.

Seattle, Wash.—City Engr. R. H. Thomson has submitted the following estimates on proposed street improvements: [illegible] and W. 70th St., grading, estimated cost, [illegible]; [illegible] Ave., concrete walks, $9,900; Madison St., [illegible] $21,500; Virginia St., planking, $4,760; [illegible] St., paving, $16,200.

The [illegible] has passed ordinances for grading [illegible] 4th S. and 34th Aves., at a cost of $92,640; grading and concrete walks on 37th and 3d Aves., cost $27,100; concrete walks on Fremont Ave., cost $32,650; and paving Columbia and Cherry Sts., cost $15,100.

Janesville, Wis.—The County Board is stated to have voted to expend $15,000 for road improvements.

Vancouver, B. C.—W. A. Clement, City Engr., writes that about $100,000 will be expended for concrete sidewalks and $400,000 for wood block, stone block and asphalt pavement.

**Port Arthur, Ont.*—The Warren Bituminous Paving Co., of Toronto, has been awarded contract for 6,593 sq. yds. of bitulithic.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Sulphur Springs, Ark.—The Kihiberg Co. (E. B. Guthrey, Secy.) is reported to have decided to install an electric light and power plant.

Booneville, Ark.—The Booneville Ice, Light & Storage Co. is reported incorporated, with a capital of $50,000, by C. G. Yates, S. P. McConnell, and others.

Denver, Colo.—A. E. Wilson, of Denver, is reported to have decided to construct a power plant on South Platte River, a short distance from Denver, to cost about $1,000,000. It will permit the generation of 20,000 h.-p.

Washington, D. C.—Bids will be received at the office of Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, until Jan. 15, for equipment for the heating, lighting and power plant for the U. S. Capitol and Congressional Buildings, including boiler feed pumps, barometric condensers, centrifugal pumps, motors, cranes and chimneys, as advertised in The Engineering Record.

Jacksonville, Fla.—The A. A. Kind Electric Co. is planning to install an ice plant, water works and gas plant next summer. A. A. Kind, Mgr.

Leesburg, Fla.—Mayor Dozier is reported to favor the construction of an electric light plant.

Walkersville, Ga.—A committee is reported to have been formed, with Dr. J. D. Nicodemus as chairman, to form a stock company to furnish this city with electric lighting.

Blue Ridge, Ga.—The citizens are reported to have voted to issue $35,000 bonds for water works and an electric light plant.

Elk City, Idaho.—Jacob Schlosser, of Chicago, Ill., Pres. Umatilla Mining Co., is reported interested in a new company about to be formed, to develop the water power of the south fork of Clearwater River near the mouth of Ten Mile Creek, near the Elk City and Orogrande mining districts, to furnish power to run the Umatilla mine and also supply the Buffalo Hump, Orogrande and Elk City mining districts.

Hailey, Idaho.—The Idaho Consolidated Mines is reported to have decided to install an electric light and power plant for the mines, to cost about $50,000. Work is reported to have been started on the construction of a power dam across Wood River.

Chicago, Ill.—See "New Industrial Plants."

Cairo, Ill.—See "Electric Railways."

Fisher, Ill.—The Village Trus. are reported to have decided to purchase the electric light plant and will make improvements to same.

Winchester, Ind.—The Citizens Water & Light Co. will start a day service May 1, 1908, and will be in the market for motors and all equipment for power use.

Shelbyville, Ind.—The Shelbyville Gas Co. is reported formed, to take over the property of the Shelbyville Gas & Light Co. and to enlarge and re-equip the plant.

Ligonier, Ind.—The question of constructing a municipal electric light plant is reported under consideration.

**South Bend, Ind.*—The South Bend Fuel & Gas Co. is reported to have awarded a contract to H. G. Christman & Co., for the construction of gas holder on Pennsylvania Ave.

Keosauqua, Ia.—A. W. Carpenter, Box 315, Memphis, Mo., writes that J. W. Andrews, 7 Pine St., New York, N. Y., is engineer for two dams to be constructed over Des Moines River for power purposes, to cost about $500,000. D. Fitzgerald, 80 Wall St., New York, N. Y., is also interested.

Jefferson, Ia.—Percy Gray, Mgr. Jefferson Light, Heat, Power & Water Co., writes that among the improvements contemplated are the installation of one 150-kw., 3-phase alternator, 100 to 200 kw. new 3-phase set, 100 to 200 h.-p. boilers and possibly a heating plant.

Ida Grove, Ia.—The citizens are reported to have voted to grant a 15-year franchise to the Ida Grove Electric Co. to maintain a light and heating plant. The company is said to have in contemplation many new extensions and improvements.

Alma, Kan.—The Alma Light & Ice Co. is making arrangements to install an ice and light plant and give a 24-hour service. W. B. Wilson, Mgr.

Wichita, Kan.—The Wichita Heat, Power & Space Co. is reported formed, with a capital of $250,000, to construct a heat, power and lighting plant for the purpose of encouraging and aiding small manufacturers.

Murray, Ky.—It is stated that bids are wanted for $20,000 water and light bonds. W. D. Wear, City Clk.

Ponchatoula, La.—The Ponchatoula Electric Light Co. expects to be ready to install a new plant in January, the equipment of which will consist of a 60-kw. alternator, a 125-h.p. engine and a boiler of 150 h. p.; also transformers and arc lamps. S. Bowling, Mgr.

Grand Rapids, Mich.—The Grand Rapids-Muskegon Power Co. (A. J. Bemis, Gen. Mgr., Grand Rapids), is reported to have decided to construct a dam at Ox Bow, on Muskegon River, 8 miles north of Croton dam. It will have a 54-ft. head and develop about 15,000 h.-p.

Winona, Minn.—The Winona Ry. & Light Co. is reported to have decided to install a 450-hp. boiler at the power plant.

Minneapolis, Minn.—Archibald S. White, of New York, N. Y., is reported to be owner of the Minnesota Power & Trolley Co., which was formed to utilize the Mississippi River at Otsego and Monticello for the generation of electricity to be conveyed to Minneapolis for commercial purposes. It is said that work on the development will probably be started in the spring.

Houston, Miss.—The citizens are considering increasing the capacity of the municipal electric light plant and will install a 120-kw., 60-cycle, 2,200-volt alternator direct connected. J. C. Arnold, Mgr.

Neosho, Mo.—The Neosho Electric Light Co. is planning to install a 400 or 500-h.p. water tube boiler in its plant. S. W. Carver, Mgr.

Nebraska City, Neb.—The Citizens Gas Co. is reported to have decided to expend $15,000 in improvements.

Grand Island, Neb.—The Grand Island Electric Co. (T. H. Fritts, Mgr.) contemplates increasing the capacity of its plant by the installation of a 300-kw. steam turbo-generator set, cooling tower and pumps complete.

Waynesville, N. C.—The Waynesville Electric Power Co. contemplates developing other water powers and installing more equipment. Engineer, Geo. E. Ladshaw, of Spartanburg, S. C.

Kenmare, N. D.—The Kenmare Light & Power Co. is making arrangements to install a 100-kw. generator and perhaps another boiler. F. W. Amster, Mgr.

**Columbus, O.*—The Bd. of Pub. Service (E. F. McGuire, Secy.) on Nov. 27 awarded to D. W. McGrath, of Columbus, the contract for putting in foundations for boilers and turbines and other work incident to the installation of new machinery in the municipal electric light plant for $11,680.

New Bremen, O.—A. M. Steinebrey, Village Clk., writes that it is proposed to purchase the present lighting plant and transfer same to water works plant.

Cincinnati, O.—The Bd. of Pub. Service is reported to have awarded to the Sun Vapor St. Light Co. the contract for new mantles for the natural gas lamps in the Hyde Park Dist. at 55 cts. for 1,700 single burner lamps and $1.35 for 98 double burners.

**Lebanon, Pa.*—The City Council is reported to have on Nov. 25 awarded contract to the Edison Electric Illuminating Co. of Lebanon for lighting the city for 5 years at $79.92 per year for each arc lamp, and $16.80 for incandescents.

Madison, S. D.—Plans are being considered for increasing the capacity of the municipal electric light plant, which will include the installation of two 80-h.-p. boilers carrying 130 lbs. working pressure, one 65-kw. alternating-current generator with exciter, and also changes on switchboard.

Flandreau, S. D.—We are informed that the Flandreau Water Power Co., with the city, are considering the question of constructing an electric light plant to be run by water power. It is proposed to organize a stock company, and a practical electrical man is wanted to take stock and look over field and estimate probable cost of plant.

Limestone, Tenn.—W. N. Mitchell is reported interested in the construction of an electric light plant.

McKinney, Tex.—R. F. Dowell, City Secy., writes that the citizens on Nov. 26 voted to issue $26,000 bonds for water and electric light extension and park work.

San Saba, Tex.—The San Saba Light, Ice & Bottling Co. (Frank Hall, Mgr.), contemplates installing a gas producer or oil engine to operate the lighting plant.

Amherst, Va.—O. V. Hauger, Secy. Amherst Electric Light & Power Co., writes that the company has been organized, and will in about 10 days decide on size of plant, etc.; propose, if possible, to run plant by water power.

Monroe, Wash.—The Monroe Water & Light Co. proposes making improvements and extensions to its plant and will install a new engine, boiler and generator, and about 4½ miles of line. R. V. Greene, Mgr.

Waterloo, Wis.—Jackson & Jackson, of Madison, are reported to be preparing plans for an extension to the municipal electric light plant, to cost about $10,000.

Hamilton, Ont.—See "Water."

Hamilton, Ont.—The City Council on Nov. 25 passed on second reading two by-laws, one to issue $225,000 bonds for an electric light distribution system, and the other $50,000 for electric pumps for the water works, to be submitted to the ratepayers on Jan. 1 for approval.

Toronto, Ont.—The citizens will on Jan. 1 vote on the question of issuing bonds to the amount of $2,750,000 for a plant to distribute electric power to be supplied by the Hydro-Electric Power Commission of Ontario from Niagara Falls.

Parry Sound, Ont.—The Ontario Ry. and Municipal Board has been asked to approve a by-law of the Town of Parry Sound, providing for the issuance of $20,000 bonds for the purpose of extending and improving the electric light and water works system.

St. Thomas, Ont.—Estimates submitted to City Council on Nov. 26, by Engineer Richards of the Hydro-Electric Power Comn. are said to provide for a distribution plant costing $42,493, making a total annual charge of $4.46 per h.-p., and provides for the construction of two branch lines through the city.

Minnedosa, Man.—We are informed that Jos. Barrett, 573 Dufferin St., Toronto, Ont., is manager of the Minnedosa Power Co., which proposes constructing a water power plant at Minnedosa.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Vallejo, Cal.—The Vallejo & Northern Ry. Co. is reported to have decided to begin construction work in the spring of an electric railway which is to connect Vallejo, Napa Junction, Creston, Cordelia, Suisun, Fairfield, Clement, Vacaville, Winters, Woodland and Sacramento. All franchises and terminal sites together with a large portion of the right of way have been secured. The railway will be standard gauge and about 130 miles long. Power will be obtained from Bay Counties Power Co., and both third rail and trolley will be used. Melville Dozier, Jr., Oakland, Pres. and Engr.; T. T. C. Gregory, Fairfield, Secy., and Geo. S. Lackie, Oakland, Treas.

**Items marked thus give the names of parties awarded contracts.*

Red Bluff, Cal.—The Bd. of Supervisors is stated to have passed the electric railway franchise ordinance applied for by F. S. Granger.

Milner, Idaho.—The Milner & North Side R. R. Co. is reported to have under consideration the construction of an electric railway which, when completed, will connect Milner, Jerome, Wendell and Gooding. It is announced that considerable grading has been done on the line, which is to be 65 miles long. It is planned to erect the power station at Shoshone Falls. Capital, $250,000. D. C. McWatters, Pres.; Fentress Hill, Secy., and Paul S. A. Bickel, Ch. Engr.

Cairo, Ill.—O. C. Macy, Mgr. Cairo Electric & Traction Co., writes that about $150,000 will be expended on improvements, but nothing will be done for the present.

**Gary, Ind.*—The Co-operative Constr. Co., of Chicago, Ill., is stated to hae been awarded the contract to construct the Gary & Interurban Ry.

Keokuk, Ia.—Articles of incorporation of the Keokuk & Columbus Junction Transit Co. are reported filed at office of County Recorder. Capital, $10,000. Directors, J. E. Peterson, Ira W. Wills, W. J. Francey and others.

Dodge Center, Minn.—It is stated that the Dean Patch Electric R. R. Co. contemplates constructing an electric railway through Dodge County.

Goldfield, Nev.—H. G. Merry is reported to be interested in a company which proposes constructing a standard-gauge electric railway from Bonnie Claire station on Tonopah & Goldfield R. R. to their mines, a distance of 50 miles.

Akron, O.—The Akron-Youngstown Electric R. R. Co. is stated to have applied for a charter to construct a line between Youngstown and Akron. Capital, $100,000. Thos. L. Childs, of Akron, is reported interested.

Toledo, O.—The Toledo Railways & Light Co. is stated to have been granted a franchise for a line of tracks on Holland St. and Oakdale Ave. in East Toledo. It will connect the East Broadway and Woodville St. lines of the company and also provide an entrance into Toledo for the Toledo, Tiffen & Fostoria Electric Ry.

Portland, Ore.—The Portland, Eugene & Eastern Ry. Co. is reported incorporated with a capital of $1,000,000, for the purpose of building an electric railway from Portland to Salem, Eugene, Yaquina, Prineville and Ontario, with branches to numerous towns. The total mileage contemplated is more than 800 miles. It is proposed to develop from the Mackenzie, the Santiam and the Deschutes rivers and streams in central Oregon the power necessary for operating the system planned. Incorporators: J. O. Story, J. C. Bracher, Geo. A. Welch, E. M. Hall and John McNary. According to the incorporation papers the following lines of electric road will be built: From Portland to Salem, to Eugene, from which point they will branch out in several directions. A line from Eugene via Springfield and the Mackenzie River valley will extend to Prineville and across the State to Ontario, Ont. Another line from Eugene will tap Yaquina Bay points and lines will also connect Eugene with Florence, Cottage Grove, Corvallis, Wendling, Mehana and Dallas, passing through Lane, Polk and Lincoln counties.

Westchester, Pa.—The Westchester & Wilmington Electric Ry. Co. is reported to have applied to the State Dept. at Harrisburg for the extension of the line along the Westchester and Wilmington turnpike between these two cities, a distance of about 18 miles. Thos. E. O'Connell, of Westchester, Pres.

Huntington, Pa.—It is stated that surveys have been made and all rights of ways secured for the Big Valley Electric Ry. Co., which is building an electric railway to connect Huntingdon Mill Creek, Allenville, Belleville, White Hall, Reedsville and Lewistown, a distance of 32 miles in all. The company is owned and controlled by the Juniata Valley Electric St. Ry. Co., of which R. W. Jacobs is Gen. Mgr.

Greenville, S. C.—The Greenville Interurban Co. is stated to have begun a survey of its proposed electric railway from Williamston to Greenville and is now engaged in securing rights of way for another line, which it proposes to build from Greenville to Spantanburg. John C. Carey, Pres.; C. C. Good, Secy. and Treas.; H. H. Prince, Gen. Man.

Haileybury, Ont.—The Silver Belt Electric Ry. Co. is reported to have been granted a charter for the construction of an electric railway from Latchford north to Cache River, passing through Cobalt, North Cobalt, Haileybury and New Liskeard. The first portion of the road constructed will be between Cobalt and Haileybury. Arrangements are now being made for the granting of a right of way and all necessary preliminaries.

RAILROADS.

Notes Arranged Alphabetically by States.

Washington, Ga.—A petition for charter has been filed with the clerk of Wilkes Superior Court for the Washington & Elberton Constr. Co., with a capital of $75,000, for the purpose of constructing the projected line between Washington and Elberton, Ga., and ultimately to be extended to Hartwell. Incorporators: J. J. Wilkinson, W. J. Adams, J. A. Moss and others.

Shelbyville, Ind.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. (W. M. Duane, Ch. Engr., Cincinnati, O.) is reported to have made a survey between this city and Batesville, and will let a contract for the grading and bridging of an additional track.

Barnstable, Mass.—The Bd. of State R. R. Comrs. at Boston are reported to have decided in favor of the petition to abolish the Pond Village road grade crossing in the town of Barnstable by doing away with the present way and the building of a new way on the easterly side of the present way. The Comn. requires that of the actual cost of abolition, the New York, New Haven & Hartford R. R. Co. (E. Gagel, Ch. Engr., New Haven, Conn.) shall be required to pay 65 per cent., the Commonwealth 25 per cent., and the town of Barnstable 10 per cent.

Toronto, Ont.—The Canadian Pacific R. R. Co. (J. G. Sullivan, Mgr. of Construction Dept., Toronto) is reported to be making arrangements to double track its line from Smiths Falls to Toronto next spring.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Bids will be received until Dec. 27 at the office of the Light House Engr., San Francisco, for constructing 2 single dwellings at Humboldt Bay Fog Signal Station (North Spit), Cal.

Denver, Colo.—Dr. Chas. Hendricks, of New York, N. Y., founder of the sanitarium at Ardmore, L. I., is reported to be planning the erection of a sanitarium in Denver, to cost about $150,000.

Denver, Colo.—The County Bd. is reported to be preparing to expend $25,000 in building an addition to county hospital.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received at the office of Jas. Knox Taylor, Super. Archt. Treas. Dept., until Jan. 7 for the construction (including plumbing, heating apparatus, electric wiring and conduits) of an extension to and remodeling of the hygenic laboratory of the U. S. Marine Hospital Service at Washington.

The following are the bids opened at office of the Supt. U. S. Capitol Building and Grounds, Washington, D. C., on Nov. 27, for structural steel work for the roof of the office building, U. S. Senate: The Phœnix Iron Co., 410 Walnut St., Philadelphia, Pa., $24,339; Brown-Ketcham Iron Wks., Indianapolis, Ind., $24,750; The American Bridge Co., Baltimore, Md., $24,950; Baltimore Bridge Co., Baltimore, Md., $27,400; McClintic-Marshall Constr. Co., Pottstown, Pa., $27,460; Strobel Steel Constr. Co., Chicago, Ill., $28,000; I. B. & J. M. Cornell Co., New York, N. Y., $28,800; Heckcher, Ward & Olcott, Receivers for Milliken Bros., Inc., New York, N. Y., $31,700, and Belmont Iron Wks., Philadelphia, Pa., $34,124.

Ocilla, Ga.—L. R. Tucker, Co. Comr., writes that bids will probably be called for in Feb. for the erection of a jail, to cost about $10,000.

St. Charles, Ill.—Architects, Rogers & Woodyatt, 59 Clark St., write that bids are now being received for the erection of a Carnegie Library, to cost about $14,000.

**Chicago, Ill.*—O'Brien Bros., of Chicago, has secured the contract for painting the Post Office (bids opened Nov. 6, by Jas. Knox Taylor, Superv. Archt., Washington, D. C.) at $22,000.

Worthmann & Steinbach, cor. W. Chicago Ave. and Lincoln St., write that bids will be received on Jan. 15 for erecting 2 wing additions to the House of Good Shepherd, on Racine Ave. and Grace St.; probable cost, $125,000.

Bids will be received until Dec. 12 by John J. Hanberg, Comr. Pub. Wks., for erecting a bath house at 12th Pl. and Union St. Bids to be submitted on cut stone, masonry, sheet metal and gravel roofing, carpentry, plumbing, heating, etc.

Great Lakes, North Chicago, Ill.—The following are the bids received Dec. 2 by the Bureau of Navigation at Washington, D. C. (Wm. H. Brownson, Ch.), for (*a*) constructing commandant's house; (*b*) 6 officers' houses; (*c*) guard house: C. E. Barquit, Chicago, *a*, $51,517; *b*, $94,821; *c*, $7,075. J. Corse, Racine, Wis., *a*, $47,106; *b*, $77,000; *c*, $18,635. J. E. Hull, Chicago, *b*, $89,970.

Anderson, Ind.—The Co. Comrs., according to reports, are receiving bids for erecting a county infirmary, to cost $30,000.

Marion, Ind.—The following bids were opened Nov. 29 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring of the U. S. Post Office, at Marion: J. G. Schumaker Co., Indianapolis, $94,500; F. M. Roode, Tipton, $80,921; Edw. Henry, Tipton, $83,000; Bedford Stone & Constr. Co., Indianapolis, $91,494; Chas. Hoertz & Sons, Grand Rapids, Mich., $83,277; Selden Brick Co., St. Louis, Mo., $93,000; The Warren Co., Chicago, Ill., $84,990; C. W. Gindele Co., Chicago, Ill., $79,250; B. W. Waltrous Co., Chicago, Ill., $89,400; J. M. Bishop, Crawfordville, $105,850; Moore & Danner, Kokomo, $77,628.

Mason City, Ia.—Mayor McConlogue in his message to the City Council recommends the erection of a new city hall.

Des Moines, Ia.—The Seventh Day Adventists, it is stated, propose erecting a sanitarium at 42d St. and Grand Ave.

Springfield, Mass.—It is stated that only architects of Springfield are to be asked to submit competitive plans for the Indian Orchard Branch Library, for which there is available $50,000.

New Bedford, Mass.—Nat. C. Smith, Archt., New Bedford, writes that bids will be received until Dec. 16 for remodeling city hall into a library; cost about $150,000.

**Cedar Rapids, Mich.*—W. J. McAlpine, of Dixon, Ill., has secured the contract to erect the Court House at $134,600.

Detroit, Mich.—It is stated that the plans prepared by Stratton & Baldwin, Union Trust Bldg., for the bath house to be erected on Belle Isle have been approved, and bids for the construction will soon be asked.

Nevada, Mo.—Bids opened Dec. 3 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. Post Office at Nevada were as follows: F. H. Latimer, Kansas City, $39,452; Hiram Lloyd Bldg. & Constr. Co., St. Louis, $45,857; J. W. Bishop, Crawfordville, Ind., $45,889; Bartlett & Kleng, Cedar Rapids, Ia., $38,980; Northern Constr. Co., Milwaukee, Wis., $34,600; J. A. Daly, Nevada, $41,578; A. Anderson, Co., St. Louis, $44,163.

**Lincoln, Neb.*—W. G. Merton is reported to have secured the contract to erect the hospital cottage and storehouse at Norfolk Asylum, at $77,782, and F. H. Wheeler the contract for the electric wiring of same, at $1,640.

York, Neb.—Bids will be received at the office of Jas. Knox Taylor, Super. Archt. Treas. Dept., Washington, D. C., until Jan. 14 for the construction (including plumbing, gas piping, heating apparatus and electric wiring) of U. S. Post Office at York, as advertised in The Engineering Record.

Orange, N. J.—It is stated that the enlarging and improving of St. Mary's Hospital, at a cost of $250,000, is under consideration.

Secaucus, N. J.—Only 2 bids are reported received by the Bd. of Freeholders at Jersey City on Nov. 26 for erecting the tuberculosis hospital at Secaucus. They are stated to have been Geo. H. Becker, $56,600, and Dennis Mullins, $69,000. Estimated cost was $40,000.

Lockport, N. Y.—Gertrude E. Hall, State Charities Inspector on the Niagara County Almshouse, has submitted a report to the Bd. of Superv., in which she recommends the erection of new buildings, a better water supply, a new pavilion hospital for isolation cases, electric lights, cold storage, metal lining for drying racks, better drainage for the farm, etc.

Syracuse, N. Y.—F. X. Wood, County Purchasing Agent, writes that it is proposed to erect a women's dormitory at the County Home, at a cost of about $50,000. Contract will probably be let in the spring. Architect, Archimedes Russell, Barnstable Bldg., Syracuse.

Rochester, N. Y.—Bids will be received until Dec. 11 at the office of F. X. Pifer, Clk. Bd. Contract and Supply, for constructing the superstructure of by-pass house at Cobbs Hill. J. Foster Warner, Archt., 1036 Granite Bldg.

Buffalo, N. Y.—The Comr. of Pub. Wks., it is stated, has been directed by the City Council to ask for erecting Hook and Ladder House No. 11 at Fillmore Ave. and Lovejoy St., and Engine House No. 33 at Kehr St. and Winslow Ave.

Devils Lake, N. D.—The following bids were opened Dec. 2 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing foundations, etc., for the U. S. Post Office and Court House at Devils Lake: Berge & Hodson, Grand Forks, $19,870; J. M. Miller, St. Paul, Minn., $17,027; J. H. Mickel, St. Paul, Minn., $20,920; Chas. Hoertz & Sons, Grand Rapids, Mich., $22,700; Valdeman Gram, Devils Lake, $24,656.

**New Philadelphia, O.*—A. V. Danohey, Co. Aud., writes that the contract for erecting an administration building for County Infirmary (bids opened Nov. 25) has been awarded to The Union Lumber Co., of New Philadelphia, for $9,922.

Painesville, O.—It it stated that bids will be received until Dec. 16 by the Court House and Jail Bldg. Comn. (C. H. Stocking, Chmn.) for the construction of the cell work for the jail now being erected. J. Milton Dyer, Archt., Cleveland.

**Youngstown, O.*—W. B. Jones, Co. Aud., writes that the contract for excavating basement of court house (bids opened Nov. 25) has been awarded to Joe, John and Ben Bullock, General Delivery, Youngstown, at 38 cts. per cub. yd.; estimate of 5,850 cub. yds. to be removed.

Columbus, O.—The Franklin County Bd., it is stated, is considering the erection of a hospital for crippled children.

Wyoming, O.—The Com. on Bldg. of the new Town Hall, it is stated, has rejected the plans formerly prepared for the town hall, and new plans are being prepared by Garber & Woodward, Neave Bldg., Cincinnati. Cost to be $28,000.

Oklahoma City, Okla.—E. P. Phelps, Librarian, writes that bids will be received on Jan. 3 for the erection of a library, to cost about $25,000.

**Pittsburg, Pa.*—The following are reported to be the bids received Nov. 25 by the Co. Comrs. for erecting the Allegheny County Soldiers' Hall: (*a*) sandstone, (*b*) buff limestone, and (*c*) granite and terra cotta: P. W. Finn, *a* $753,134 (awarded contract), *b* $733,000, *c* $873,000; Wm. Miller & Sons, *a* $874,744, *b* $856,974, *c* $968,574; A. & S. Wilson Co., *a* $857,643, *b* $822,193, *c* $943,912; H. Shenk & Co., *a* $874,971, *b* $843,971, *c* $974,371; Wm. Kerr's Sons, *a* $918,391, *b* $913,808, *c* $1,052,133; C. H. Kerr, *a* $939,525, *b* $929,525, *c* $1,054,595; J. C. Robinson & Son, *a* $829,817, *b* $794,717, *c* $924,817; J. E. & A. L. Pennock, *a* $868,866, *b* $798,865, *c* $928,866; J. Gill & Sons, *a* $839,500, *b* $829,800, *c* $944,000; Norcross Bros., *a* $1,020,000, *b* $929,000, *c* $1,037,000; A. B. Stannard, *a* $926,000, *b* $906,000, *c* $1,034,000.

*The Jones & Laughlin Co., of Pittsburg, it is reported, has secured the contract for the structural steel to be used in the Soldiers' Memorial Hall, which will require about 1,850 tons, also the light steel frame for the new addition to the Southside Hospital, which will require about 250 tons of structural shapes.

Danville, Pa.—The following are reported to be the bids received by Bldg. Com. on Nov. 26 for erecting 3 buildings at the Hospital for the Insane at Danville: Mosier & Summers, Buffalo, N. Y., $252,290; Steinbach & Billmeyer, Lewistown, $286,000; Metzger & Wells, Philadelphia, $255,000; A. L. Weaver, Harrisburg, $259,997; M. P. Wells, Philadelphia, $255,000; Geo. W. Beard & Co., Reading, $282,200; Lynch Bros., Philadelphia, $256,822; J. E. & A. L. Pennock, Philadelphia, $260,447; C. H. Focht & Son, Reading, $263,596; Bennett & Woodnut, Williamsport, $269,000.

**Philadelphia, Pa.*—Jos. Hand, it is reported, has secured the contract to make alterations and additions to the Frankford Hospital at Frankford Ave. and Wakeling St. and the Vulcanite Paving Co. Land Title Bldg. the contract for paving the roadways, walks, etc., around the hospital.

Bids were opened Dec. 2, according to reports, by the Department of Pub. Safety for the erection of a 2 story and basement fire station at 82d St. and Tinicum Ave., as follows: Abel Bottonis, $12,800; J. E. & A. L. Pennock, $13,347; Lynch Bros., $13,662; Edw. Fay & Son, $13,750; Wm. J. Smith, $13,907; H. B. Shoemaker & Co., $14,600; Mitchell Bros., $14,700, and P. J. Hurley, $15,930.

Nashville, Tenn.—Bids opened Nov. 27 by Jas. Knox Taylor, superv. archt., Washington, D. C., for constructing (including heating apparatus, electric conduits and wiring) a new mailing platform and vestibule, and for miscellaneous betterments at the U. S. Custom House and Post Office at Nashville were as follows (bidders of Nashville): Geo. Moore & Sons, $8,258; Edgeeld & Nashville Mfg. Co., $8,633.

**Items marked thus give the names of parties awarded contracts.*

Pulaski, Tenn.—Bids will be received until Dec. 16, by the Co. Courthouse Bldg. Comn., for erecting a 2-story and basement, brick and stone, fireproof courthouse; probable cost, $75,000. B. B. Smith, Archt., 22½ Perry St., Montgomery, Ala. G. H. McMillon, Co. Judge.

Greeneville, Tenn.—Bids will be received by Maj. M. Gray Zalinski, Q. M., U. S. A., Washington, D. C., until Dec. 16 for constructing lodge and outbuilding, concrete wall and sidewalks, grading, etc., at the Greenville, Tenn., national cemetery, as advertised in The Engineering Record.

**Seattle, Wash.*—It is stated that the contract to erect the manufacturers' building at the Alaska-Yukon-Pacific Exposition has been awarded to Strehlow, Freese & Peterson, of Seattle, at $79,999.

Tacoma, Wash.—It is stated that an armory costing about $95,000 is to be erected on 11th St.

Milwaukee, Wis.—The Co. Bd., it is stated, has appointed a committee, of which S. R. Bell is Chmn., to investigate a site and plans for the new Juvenile Court and detention home building. Appropriation available, $60,000.

It is stated that the erection of a bonded warehouse for the Government, to cost about $50,000, is under consideration.

It is reported that bids will soon be asked for erecting the northside natatorium; probable cost, $45,000. H. Messmer & Son, 473 E. Water St., are the archts.

Green Bay, Wis.—Elmer S. Hall, Co. Clk., writes that Foeller & Scholber, of Green Bay, have plans for a jail, to cost about $50,000, bids for which will be received about Feb. 1st. He further states that C. E. Bell, of Minneapolis, Minn., is the architect for the court house, to cost about $230,000, bids for which will be called for about 6 months later.

Ladysmith, Ont.—It is stated that bids will be received until Dec. 11 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for erecting a public building at Ladysmith.

**Battleford, Sask.*—Storey & Van Egmond, of Regina, Archts., write that the contract for erecting court house at Battleford (bids opened Nov. 16) has been awarded to Saskatchewan Bldg. Co., of Regina, for $42,900.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Marysville, Cal.—It is reported that the erection of a $12,000 lodge building is being considered by the Masons.

San Francisco, Cal.—Sarah Rosenstock and H. B. Nutal, it is stated, have applied for a permit to erect a 7-story office building on Geary and Kearny Sts., at a cost of $160,000, and A. Roullier an 8-story office building on Kearny and Post Sts., at a cost of $56,000.

Los Angeles, Cal.—Neher & Skilling, of Los Angeles, it is reported, have completed plans for the superstructure of the hotel and apartment building to be erected at 4th and Grand Ave. for Mrs. Mira Hershey. It will be of reinforced concrete, contain over 300 rooms, have 4 passenger elevators, and will have 3 stories below the grade line and 8 stories above. The concrete foundation work is completed.

Oakland, Cal.—A permit has been issued for the partial construction of the Taft & Pennoyer Bldg., at Clay and 14th Sts. This portion of the work is to cost $125,000. The total cost of the building is to be $325,000.

Denver, Colo.—The German-American Indemnity Assoc., according to reports, is having plans prepared for a $100,000 office building which it is proposed erecting, but no definite location has yet been decided upon.

It is stated that plans are being prepared for a 9-story building which is to be erected next spring at 15th and Champa Sts. by a company in which H. M. Porter and Chas. Boettcher are interested. Cost, $500,000.

Peoria, Ill.—The Leisley Brewing Co., according to reports, has directed Reeves & Baillie, Y. M. C. A. Bldg., to prepare plans for a 6-story building to be used for business and hotel purposes. Probable cost, $300,000.

Springfield, Ill.—The Knights of Pythias, it is reported, are preparing to erect a $30,000 lodge building.

Mattoon, Ill.—It is reported that plans have been accepted for a $100,000 addition to the Odd Fellows Old Folks' Home.

**Clinton, Ia.*—The contract to erect the John Gund Brewing Co.'s cold storage house is reported awarded to John Lake & Son, 634 5th Ave., at $10,000.

Baltimore, Md.—E. H. Glidden, 301 N. Charles St., is preparing plans for an addition 100 x 75 ft. to the plant of the Crane Co. to cost about $30,000. No new power plant to be installed.

Cambridge, Mass.—The Boston & Albany R. R. (W. Shepard, Ch. Engr., Boston, Mass.), according to reports, has secured a site on Binney St., in Cambridge, on which it is proposed erecting next spring a freight station. About $100,000 will be expended in the site and building.

New Bedford, Mass.—The Dartmouth & Westport St. Ry. Co. is stated to have purchased a site at N. Water St. for the erection of an express station. H. H. Crapo, Pres.

Duluth, Minn.—Plans have been filed for the 8-story Sellwood Bldg. which is to be erected on Superior St. at a cost of about $200,000.

**Minneapolis, Minn.*—Theo. F. Curtis, it is stated, has taken out a permit to erect a 4-story brick addition to Curtis Court on 10th St., to cost $50,000. Barclay Cooper, 1114 Yale Pl., is the contractor.

Kansas City, Mo.—Curtice Throing is reported to have decided to erect a concrete barn at 1600 Baltimore Ave., to cost $45,000.

Saylor & Seddon are reported to have prepared plans for a brick garage, to be erected at 1616 Grand Ave., to cost $10,000.

Omaha, Neb.—M. J. Sturn, of Chicago, Ill., according to reports, has prepared plans for a 3-story brick, stone and terra cotta, 44 x 100 ft. building to be erected on 16th and Harney Sts., for Tolf Hanson.

**Collingswood, N. J.*—J. A. Quinto, 524 Pine St., Philadelphia, Pa., according to reports has secured the contract to erect a 2-story factory building for the Enterprise Wall Paper Co., at a cost of $30,000.

Trenton, N. J.—The Executive Com. of the Junior Order of Mechanics, it is stated, has decided to spend $125,000 in the erection of a 10-story building at 137 E. State St.

Schenectady, N. Y.—C. J. Harvey is said to be planning the erection of a 3-story business building on Phoenix Ave. and Rugby Road, at an estimated cost of $14,000.

New York, N. Y.—Plans have been filed for the following buildings: 21-story brick and stone manufacturing and office building at Park Ave. and 33d St. for Alfred G. Vanderbilt, cost $1,000,000, Warren & Wetmore, Archt., 3 E. 33d St.; 3-story brick stores and tenements at Belmont Ave. and 180th St. for Pasquale D'Auria, cost $38,000, Arthur Boehmer, Archt.; alterations to 4-story brick and stone sub-station and shops at 146th St. and Lenox Ave. for New York City Ry. Co., cost $25,000, A. V. Porter, Archt.

Plans have been filed for a 5-story loft building, with stable, to be erected in 108th St. and 8th Ave., at a cost of $80,000, for Israel Lippman, a real estate operator.

Fargo, N. D.—The J. I. Case Co., of Racine, Wis., it is reported, proposes rebuilding the offices and warehouses in this city which were recently destroyed by fire.

Cincinnati, O.—The 6-story brick building occupied by the Wm. Windgorst Co. is reported to have been seriously damaged by fire on Nov. 29.

Oakmont, Pa.—The Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Philadelphia) had plans prepared for a $12,000 depot which is to be erected at Oakmont on the Buffalo & Allegheny Valley Division.

Hazleton, Pa.—Milligan & Webber, 520 Walnut St., Philadelphia, it is stated, are preparing plans for a granite building to be erected for the First National Bank of Hazleton, at a cost of $100,000. Bids for the construction will probably be asked in about 3 weeks.

Philadelphia, Pa.—Watson & Huckel, 1211 Walnut St., it is stated, have completed plans for a 3-story, 122x120-ft. garage which is to be erected at 229 N. Broad St. by Henry G. Lea, of brick and terra cotta, and cost, including ground, $400,000.

Memphis, Tenn.—A. A. Chighizola, Scimitar Bldg., it is stated, is preparing plans for a warehouse to be erected for Webb & Maury at a cost of $17,000.

Amarillo, Tex.—J. M. Neely, it is reported, will erect an $80,000 business building.

Norfolk, Va.—The 5-story building of the Willis-Smith-Creel Co., furniture dealers, is reported to have been badly damaged by fire on Nov. 18.

**Seattle, Wash.*—Rasmus Hansen & Co. are reported to have secured the contract to erect the Danish Brotherhood Bldg. at 14th Ave. and Fir St., at $25,000. V. W. Voorhees, Eitel Bldg., is the archt.

Spokane, Wash.—It is reported that Jacob S. Haye is arranging to erect a $50,000 business building at Front Ave. and Barnard St.

Tacoma, Wash.—It is stated that the plans for the 6-story Y. M. C. A. Bldg. to be erected on D St. have been completed, and as soon as approved bids for the construction will be asked.

Milwaukee, Wis.—It is reported that the Knights of Columbus are preparing to erect a club house at a cost of $30,000.

Kirchhoff & Rose, 201 Grand Ave., it is reported, have prepared plans for a brick garage which is to be erected by the Solliday Motor Co., at Grand Ave. and 8th St. at a cost of $20,000.

*P. Riesen's Sons, 111 Mason St., it is reported, have secured the contract for the masonry work on the plant of the Bay View Tanning Co., at Hillbert and Alice Sts. The building is to be 2-story, brick and steel, and cost $45,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Pasadena, Cal.—Franklin P. Burnham, Pacific Electric Bldg., it is stated, has been appointed architect of the proposed new Christian Science church to be built in Pasadena at a cost of $100,000.

San Jose, Cal.—Norman F. Marsh and C. H. Russell, Stimson Bldg., Los Angeles, it is stated, have in preparation plans for a new edifice for the First Christian Church of San Jose. It is estimated to cost $20,000.

Long Beach, Cal.—It is stated that plans have been completed by C. F. McDonald, of Los Angeles, for an apartment house, to be erected on Magnolia Ave. at Long Beach, for Geo. Ward, of Long Beach.

Denver, Colo.—Wm. Cowe, 510 Mack Blk., it is stated, is preparing plans for an apartment house to be erected at Grant and 14th Aves. at a cost of $20,000.

New Haven, Conn.—Brown & Von Berne, Exchange Bldg., according to reports, are preparing plans for a 2-story brick and stone residence to be erected for W. Edw. Zwingman, of the Marlin Fire Arms Co.

Chicago, Ill.—It is stated that plans are being prepared by Marshall & Fox, 164 Dearborn St., for an apartment house to be erected on Lake Shore Drive at a cost of $100,000.

Tipton, Ind.—Bids will be received until Dec. 23, for erecting an edifice 57x72 ft. for First Baptist Church at Tipton. It will be of brick, Bedford stone and have tile roof, with gas and electric fixtures, steam heat, plumbing, art glass; cost $15,000. J. T. Johnson & Co., Archts., Indianapolis, Ind.

Indianapolis, Ind.—G. A. Greathouse, it is reported, intends erecting a residence at Pennsylvania and 32d Sts., to cost $15,000.

**Lyons, Ia.*—Anton Zwack, of Dubuque, it is stated, has secured the contract to erect an edifice for the St. Boniface R. C. Church at $26,617. Rev. Jos. M. Tritz, pastor.

St. Marys, Kan.—According to reports, a chapel costing about $40,000 is to be erected at St. Mary's College.

Mayfield, Ky.—The Presbyterians are said to be preparing to erect a $40,000 church.

Covington, La.—St. Joseph academy, convent, monastery and church are reported seriously damaged by fire.

Lake Charles, La.—The members of the First Presbyterian Church are said to be considering plans for a $20,000 edifice. Dr. Allison, Pastor.

Baltimore, Md.—Thos. B. Stanfield Co., according to reports, intends erecting 7 dwellings at a total cost of $60,000.

Jacob F. Corwig, it is reported, is preparing plans for a $60,000 flat to be erected by Israel Silberstein.

Minneapolis, Minn.—A building permit has been issued for the construction of the foundation for the new Church of the Immaculate Conception, Minneapolis, Minn., at Hennepin Ave. and 16th St. The foundation will cost $65,000.

St. Paul, Minn.—Plans have been filed for a brick edifice to be erected on Ashland Ave. for the St. Paul Universalist Church at a cost of $15,000; Emil Peterson, contractor; and for a 2-story brick and cement flat to be erected on Central Park Place East and Summit Ave. at a cost of $10,000. Dr. W. J. Hurd, owner; John Moline, contractor.

*F. J. Wickens & Co., 228 McBoal St., are reported to have secured the contract for erecting brick residence on Dayton and Farmington Sts., for F. P. Shepard; cost about $16,000.

**Kansas City, Mo.*—Taylor & Winn, 121 W. 8th St., it is reported, have the contract for the erection of a 75x84 ft. stone synagogue for the Buia Jehudah Congregation, cost $105,000. Howe & Holt, 315 E. 10 St., are the archts.

John A. Eaton is reported to be having plans prepared for a $125,000 residence by Howe & Holt, 315 E. 10th St.

C. A. Smith, Dwight Bldg., is reported to be preparing plans for a stone edifice for the Bway M. E. Church, to be erected on 74th St. and Bway, to cost about $12,000.

Hastings, Neb.—It is stated that the members of the Congregational Church contemplate erecting a $16,000 edifice.

Atlantic City, N. J.—The members of the First Presbyterian Church, it is stated, have decided to erect an $80,000 steel and stone edifice.

New York, N. Y.—Paterno Bros. are reported to have secured a site on 116th St. and Riverside Drive, on which it is proposed erecting a 12-story elevator apartment house.

Grand Forks, N. D.—The Trus. of the Presbyterian Church, it is stated, have decided to erect an edifice costing about $50,000 to replace present church.

Philadelphia, Pa.—Stearns & Castro, Stephen Girard Bldg., according to reports, are preparing plans for a church and Sunday school, to cost $50,000.

Jamestown, Pa.—It is reported that the Christian Society has purchased a site and intends erecting a $20,000 church. Adress pastor.

Spokane, Wash.—H. Schallaske is reported to be planning the erection of a $16,000 flat.

The members of the Jefferson St. M. E. Church, it is stated, propose erecting an edifice costing about $50,000 at August Ave. and Monroe St. Rev. E. M. Hill, pastor.

The members of the Centenary Presbyterian Church, it is reported, are arranging to erect an edifice costing about $50,000.

Seattle, Wash.—It is stated that plans have been prepared by V. W. Voorhees, Eitel Bldg., for a 3-story flat to be erected at 13th Ave. and Harrison St. at a cost of $25,000.

Milwaukee, Wis.—It is stated that a 4-story apartment house is to be erected at 13th and Wells Sts. at a cost of $60,000 by John F. Bonnett; Leenbouts & Guthrie, 102 Wisconsin St., are the archts.

Madison, Wis.—The members of the Roman Catholic Church, it is reported, are having plans prepared for a $20,000 edifice.

West Allis, Wis.—It is stated that plans have been prepared for a $12,000 church to be erected for the Slavonia Catholic Congregation of West Allis.

Reedsburg, Wis.—It is stated that bids will be received until Dec. 12 by the Bldg. Com. of St. Peters R. C. Church for erecting an edifice; probable cost, $35,000. O. C. Uehling, Archt., Milwaukee.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Athena, Ala.*—Glidewell Bros., of Fayetteville, Tenn., according to reports, have secured the contract to erect Westmoreland Hall, the new state Normal School, at an estimated cost of $15,000.

Ft. Smith, Ark.—We are informed that bids will be opened on Jan. 11 for the erection of a school to cost about $65,000. Architect, A. Klingensmith, of Ft. Smith.

San Diego, Cal.—It is reported that plans and specifications have been prepared for a school estimated to cost $75,000.

Upland, Cal.—The plans submitted by A. C. Smith, 307 S. Bway., Los Angeles, for a new grammar school, it is reported, have been accepted by the School Trustees. The plans call for a one-story and basement brick structure 148x148 ft. The estimated cost is $35,000.

Stamford, Conn.—Boring & Tilton, 32 Bway., New York, N. Y., are reported to be preparing plans for the West Side School, and bids for same will soon be received.

Brunswick, Ga.—The Secy. Bd. of Educ. writes that a committee has been appointed to obtain details to submit to architects for plans for a new school for Glynn County.

Chicago, Ill.—Bids will be received until Dec. 13 at the office of the Business Manager, Bd. Educ., for erecting the Jackson School addition. Bids to be submitted on masonry, cut stone, terra cotta, sheet metal, composition roofing, structural iron, iron stairs, carpentry, steel ceilings, fireproofing, concrete floors, asphalt floors, marble

*Items marked thus give the names of parties awarded contracts.

and tile work, steam heating ventilation, plumbing and gas-fitting, sewerage, electric work, etc. D. H. Perkins, Archt., Rm. 714, Tribune Bldg.

Terre Haute, Ind.—The City School Bd., it is stated, has decided to spend $54,000 at once in building additions to district schools.

Bardstown, Ky.—R. C. Cherry, Secy. Bd. Trus. Graded Common School Dist., writes that bids will probably be called for in Jan. for a school to cost about $20,000. Architect not yet selected.

Paris, Ky.—Bids are wanted until Dec. 12, it is stated, for 45,000 public high school bonds. D. C. Parrisch, Chmn. Finance Com.

Cheneyville, La.—The citizens are reported to have voted in favor of issuing bonds to erect a school.

New Orleans, La.—It is reported that the following are the bids recently received for erecting the school for negroes at Claiborne, Iberville, Derbigny and Bienville Sts: Michel Chesse & Co., $28,220; John O. Chisholm & Co., $27,000; Thos. Brown, $28,987.

Housatonic, Mass.—The Bldg. Com., it is stated, is considering plans for a school.

**Boston, Mass.*—Wm. J. Crane, 7 Water St., is stated to have secured the contract to erect an addition to the Mechanic Arts High School and also the contract to remodel the old building at $305,431 and $40,760, respectively. The contract for the ventilating and heating of the new building is reported awarded to Albert B. Franklin, 62 High St., at $53,400.

**Ishpeming, Mich.*—It is stated that the contract for the plumbing, sewerage and gas fitting of the high school has been awarded to C. H. Norton, of Marquette, at $4,646.

Minneapolis, Minn.—E. S. Stebbins, Masonic Temple, is said to be preparing plans for an eight-room addition to the Webster school, on Summer and Monroe Sts., NE. It will be of brick and cut stone, 2-story and basement, with plumbing and steam heating. Plans will be ready for figures, according to reports, about Dec. 10.

Hallock, Minn.—Bids will be received, it is stated, until Dec. 27 by the Bd. Educ., Independent School Dist. No. 1, for erecting a 2-story brick and concrete school.

Newton, Miss.—The General Baptist Assoc., it is reported, has decided to erect the Clarke Memorial College in Newton. $35,000 and 40 acres of land have been given by the town.

Columbia, Mo.—The Executive Com. of the Bd. of Curators of the Univ. of Missouri at its meeting in St. Joseph on Nov. 26, it is reported, approved plans for the 3-story cut-stone agricultural building to be erected on the horticultural grounds at the Univ. in Columbia, the cost to be about $100,000. The contract for the construction will be let, according to reports, Dec. 10.

Winneoago, Neb.—Bids will be received until Jan. 15 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing an employees mess building at the Winnebago School. For further information apply to Oscar M. Waddell, Sutp. School.

Hanover, N. H.—The Bd. of Trus. of Dartmouth College, it is stated, has decided to erect a new dormitory between Hallgarten Hall and Wilson Library.

Atlantic City, N. J.—Mayor Stoy has signed the ordinance authorizing the issue of $70,000 bonds to erect a school on the Ohio Ave. site and for completing the New Jersey Ave. school and purchasing the site on Ohio Ave.

Belleville, N. J.—The Bd. of Educ., it is stated, has decided to have plans prepared by Chas. Granville Jones, for a 3-story brick school to be erected at Hornblower Ave. and Rutgers St.

White Plains, N. Y.—Bids will be received until Dec. 10 by the Bd. Educ., Union Free School, Dist. No. 1 (Guy H. Baskerville, Clk.), for $190,000 bonds.

**Cincinnati, O.*—The Bd. of Educ. Nov. 25, it is stated, awarded the contracts for erecting the Westwood School to the following: Excavating, subgrading, masonry, concrete footings, brick work, cut stone, ornamental terra cotta work, carpenter work and lumber and plastering, to H. Harig & Co., 31 E. 4th St., $132,000; electric wiring, to Al Becker & Son, 8 W. 6th St., $3,558; plumbing and gasfitting, to Wm. Attlesey, 819 Vine St., $5,137; painting and glazing, to Beach & Methven, $5,868; sheet-metal work and roofing, to the Harkness & Fowler Co., $2,210; structural iron work, to Columbus Iron Wks., $5,164; marble and tilework, to the Great Western Marble Wks., 1602 Reading Road, $7,300.

Easton, Pa.—The Bldg. Com. of the Bd. of Educ., it is stated, has the following bids under consideration for erecting the Firth School: Wenzleberger & Anderson, of Phillipsburg, N. J., $23,872; J. S. Rogers Co., of Stanwick, $23,962; G. W. Beard & Co., of Easton, $23,778; Phillipsburg Supply & Constr. Co., of Phillipsburg, N. J., $24,319.

Manning, S. C.—The issuing of $30,000 bonds to erect a graded school is reported under consideration.

Pine Ridge Agency, S. D.—Bids will be received until Jan. 17 by C. F. Larrabee, Acting Comr. Indian Affairs, Washington, D. C., for furnishing material and constructing a dairy barn at the school at Pine Ridge.

Madison, S. D.—Bids will be received as a whole or separately by E. C. Ericson, Pres. Regents of Educ., at Elk Point, until Dec. 10, for heating and plumbing new addition to the ladies' dormitory, at the Madison Normal School, Madison.

Tulia, Tex.—The Attorney General has approved the issue of $15,000 bonds for the Tulia Independent School Dist.

**Sherman, Tex.*—E. J. Bender, of Sherman, it is reported, has secured the contract to erect a $50,000 high school.

College Station, Tex.—It is stated that the Bldg. Com. of the Agricultural & Mechanical College has adopted the plans of W. S. Smith, of Ft. Worth, for buildings at College Station and for cottages and a sewerage system at Prairie View, and will soon ask for the construction of same. Cost about $30,000 at each school.

**San Marcos, Tex.*—It is stated that the contract to erect a wing to the Science Bldg. at the State Normal School has been awarded to Otto Berkner, of San Marcos, at about $10,000.

Groveton, Tex.—The citizens are reported to have voted in favor of issuing $25,000 bonds to erect a free brick school.

Rosebud, Tex.—S. J. Ward, Secy. Rosebud Independent School Dist., writes that it is proposed to erect a school, to cost about $25,000.

**North Yakima, Wash.*—Jas. Gobson, of North Yakima, it is reported, has secured the contract to erect the high school at about $75,000.

Genoa Junction, Wis.—The public school building is reported destroyed by fire, and a new building costing about $20,000 is to be erected.

Coloma Station, Wis.—Bids will be received until Jan. 10 by W. A. Roblier, Dist. Clk., for erecting a school. C. H. Williams, Archt., Portage.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Denver, Colo.—It is stated that the Fleischman Yeast Co., of Cincinnati, O., intends erecting a plant here.

Jacksonville, Fla.—See "Power Plants, Gas and Electricity."

Dalton, Ga.—It is reported that the Elk Spinning Mill Co., of Dalton, has decided to double the capacity of its plant.

Chicago, Ill.—Raeder & Wood, Engrs. and Archts., 77 Jackson Boule., Chicago, write that they have designed a machine shop (not a power house) for the Chicago House Wrecking Co., of Chicago. It will be 60 x 300 ft. and so constructed as to admit carrying 3 additional floors above for warehouse purposes. The bids for this work have been received and opened.

Alma, Kan.—See "Power Plants, Gas and Electricity."

Vidalia, La.—This town has donated a site on which the St. Paul Mill & Elevator Co., of St. Paul, Minn., (S. J. McKenzie, Pres.), according to reports, will erect a plant to cost $25,000.

**Fort Caswell (P. O., Southport), N. C.*—A. J. Robbins, of Southport, is reported to have secured the contract for the erection of an ice and cold storage plant at Ft. Caswell, bids for which were opened Nov. 6.

Newton, N. C.—Plans are reported completed for the mill to be erected by the Ridgeview Cotton Mills, of Newton. A one-story building, 164 x 80 ft., will be built with one end of wood to permit of extension. Its equipment will consist of 2,800 spindles for manufacturing two-ply 30 to 40 cotton yarns. The plant will cost about $60,000. H. F. Smith, Gen. Mgr.

Gastonia, N. C.—According to reports, an equipment of 5,000 spindles for the manufacture of cotton yarns will be installed in the plant of the Dunn Mfg. Co. (C. B. Armstrong, Pres.) and electricity will be used.

Cincinnati, O.—The Triumph Electric Co., it is stated, has secured a site in Oakley and is having plans prepared by Bert. L. Baldwin & Co., Perin Bldg., for several factory buildings.

Chattanooga, Tenn.—It is reported that plans are being prepared for the $200,000 plant which is to be erected here by the Southern Car & Supply Mfg. Co. (Jas. M. Wiggs, Pres.). The plant is to be moved from Beaumont, Tex., where it is at present located.

Ft. Worth, Tex.—The American Casket Mfg. Co. (J. H. Ballard, Pres.) will expend about $50,000 on improvements, and have let contracts for the buildings, generator and motors; the other equipment necessary includes an electric belt d. c. 220 volt freight elevator 5,000 lbs. capacity; 2 dry kilns, brick constructed drying system; one shaving collecting system for 18 machines; one fire pump and a duplex feed pump for two 150 h. p. boilers. Architect, B. A. Mueller, of East St. Louis, Ill.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Oakland, Cal.—Frank R. Thompson, City Clk., writes that the Council Com., with Oliver Ellsworth as Chairman, is investigating the matter of constructing a garbage crematory. Walter B. Fawcett is Secy. Bd. of Pub. Wks.

San Francisco, Cal.—The Bd. of City Superv. on Nov. 25 passed the ordinance providing for an appropriation of $120,000 for street sweeping.

**Newport, Ky.*—The Council is reported to have on Nov. 20 awarded to Sewell & Pardington, the contract for the disposal of the city garbage for one year at $166 per month.

Brooklyn, N. Y.—The following are the bids opened at the office of W. Bensel, Comr. Street Cleaning, New York City, for removal of snow and ice in Brooklyn Boro: (a) Dist. 1; (b) Dist. 2; (c) Dist. 3; (d) Dist. 4; (e) Dist. 5; (f) Dist. 6; (g) Dist. 7; (h) Dist. 8. (Price given per cu. yd.) John Monihan, 106 Manhattan Ave., a, 29 cts.; b, c and f, 35 cts.; d, 18 cts.; e, 29 cts.; g and h, 33 cts. Jas. Riley, 401 De Graw St., b, 40 cts. Hill & Hayes, 165 Rutledge St., d, 39 cts. Norton & Gorman Contr. Co., 303 Douglas St., a, b and h, 37½ cts.; c, d, e, f and g, 47½ cts. Henry Newman, 1127 Willoughby Ave., d, 29.9 cts.; e and g, 39.9 cts. Chas. Cranford, Foster Ave., a and c, 35 cts.; b, 40 cts.; d, e, f and g, 55 cts.; h, 40 cts. Donlon Cont. Co., 84 Broadway, Brooklyn, a and b, 53 cts.; c and e, 79 cts.; d, 50 cts.; f, 85 cts.; g and h, 47 cts. Wm. Nolan, b, 29 cts. Bracken, MacAveney Co., foot 6th St., a and c, 40 cts.; b, 34 cts.; d, g, and h, 30 cts.; e and f, 48 cts. Hugh K. Starr, 208 Bay 8th St., b, 28¾ cts. J. M. Fox, f, 49 cts.

New York, N. Y.—The following are the bids opened on Dec. 2 at the office of W. Bensel, Comr. of Street Cleaning, for removal of snow and ice, according to districts: (a) Dist. 1; (b) Dist. 2; (c) Dist. 3; (d) Dist. 4; (e) Dist. 5; (f) Dist. 6; (g) Dist. 7; (h) Dist. 8; (i) Dist. 9; (j) Dist. 10; (k) Dist. 11; (l) Bronx. (Price given per cu. yd.) Canavan Bros., 518 W. 156th St., a, 58 cts.; b and c, 57 cts.; d, 55 cts.; e, 48 cts.; f, 52 cts.; g, 42 cts.; h and i, 49 cts.; j and k, 51 cts. T. T. Milligan, l, 33¼ cts. Chas. Schneider, Teller Ave. and 167th St., l, 28 cts. C. Conforti Co., k, 46 cts. Thos. Crimmins Contr. Co., 444 E. 69th St., a, b, c and d, 47 cts.; e and f, 45 cts.; g, 46 cts.; h, 54 cts.; i, 35 cts.; j, 32 cts.; k, 33 cts.; l, 37 cts. P. J. Kane, 53 E. 15th St., i, 55 cts.; k, 40 cts.; l, 50 cts. L. Worthington & Sons, e, 70 cts. John W. Duncan, 523 E. 134th St., k, 30 cts.; l, 25 cts. Thompson Bros., i, 36 cts.; k, 32 cts. Wm. H. Masterson, l, 28 cts. C. Du Marco, 80 Mulberry St., k, 29 cts.; l, 25½ cts.

Reading, Pa.—Elmer H. Beard, City Engr., writes that bids will be received on Jan. 7 for the collection and disposal of garbage, for periods of 1, 2, 3 and 5 years.

Johnstown, Pa.—Dr. Geo. Hay, Health Officer, writes that the recent fire only damaged the building of the garbage disposal plant, which is now being repaired.

Altoona, Pa.—Saml. B. Trees, Secy. Bd. of Health, writss that the date of opening of bids for collection and sanitary disposal of all city garbage for a period of 1, 3, 5 or 10 years, has been extended from Dec. 4 to Dec. 31.

Philadelphia, Pa.—Bids will be receved by Geo. R. Stearns, Dir. Dept. Pub. Wks., until Dec. 16 for cleaning streets, inlets, public markets and alleys, and for removal of ashes, household waste, rubbish, etc., during the year 1908, as advertised in The Engineering Record.

*Local press reports state that the following are the totals of bids opened on Nov. 20 by the Dept. of Pub. Wks. for collection and disposal of garbage during 1908: The Penn Reduction Co., $488,988 (awarded contract) and the American Product Co., $505,145.

Providence, R. I.—Bids will be received until Dec. 10 by the Com. on Health Dept. (Henry Fletcher, Chmn.) for the removal of swill, house offal and garbage for a period of 5 years from May 1, 1908.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—The following are the bids opened on Nov. 21 by Maj. H. Jervey, Corps Engrs., U. S. A., for dredging at the mouths of Wolf and Jordan Rivers (price given per cu. yd.): Southern Dredging Co., Mobile, 16 cts. (recommended for award); Home Dredging Co., Mobile, 16½ cts.; and Jancke Navigation Co., New Orleans, La., 17 cts.

Santa Monica, Cal.—Thos. H. James, City Engr., writes that bids will be received about Jan. 15 for the construction of a new pier, including new outfall sewer pipe; probable cost, $100,000. The plans and specifications for this work will be received until Dec. 21.

**Berkeley, Cal.*—The Atlantic, Gulf & Pacific Co. is reported to have secured the contract for the construction of the new municipal wharf at West Berkeley for $74,550.

Washington, D. C.—R. C. Hollyday, Chief of the Bureau of Yards and Docks, in his annual report is stated to have made the following recommendation: A larger appropriation for a new dock at Puget Sound; for the continuance of the appropriation for that at Guantanamo, Cuba, and for enlarging the entrance of dock at Norfolk yard; establishment of a drydock at Pearl Harbor, Hawaii, where necessary land has been acquired; this harbor is near Honolulu, and the dock will cost $2,000,000, and an estimate of $500,000 to begin work is submitted. Another estimate of $555,500 for the naval station at Olongapo, in the Philippines, is submitted. The estimates for the various yards include the following: Boston, $435,800; naval station at Cavite, $59,700; navy yard, Charleston, S. C., $402,500; naval station, Guantanamo, $425,000, of which $400,000 is to begin a drydock; League Island, $993,255; Mare Island, $786,800; New Orleans naval station, $75,000; Norfolk, $1,950,500; Pensacola, $157,800; Portsmouth, $871,350; Puget Sound, $1,491,500, $100,000 of which is to begin the construction of a drydock, and Washington, $985,047; also an appropriation of $360,000 for two storehouses for material to be held in reserve in case of special emergency, one on the Atlantic Coast and another at Olongapo.

Bids will be received by the Comrs., D. C., until Dec. 21, for furnishing 4 metal lions, as advertised in The Engineering Record.

Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Dec. 10, to furnish at the navy yard, Washington, D. C., etc., quantity of naval supplies, as follows: Portland cement, brass, tubes, shield plate steel, etc. Applications for proposals should refer to schedule 571. E. B. Rogers, Paymaster Genl. U. S. N.

Ft. Wayne, Ind.—Perry Randal is reported interested in the construction of a ship canal from Lake Michigan to Lake Erie.

**Laporte, Ind.*—H. G. Harding, of Laporte, is reported to have secured the contract for constructing a complete system of drainage.

Boston, Mass.—Bids will be received at the office of the Charles River Basin Comn. (Henry S. Pritchett, Chmn.), 367 Boylston St., until Jan. 6, for building Sect. 6 of the Boston marginal conduit and Sect. 4 of the Boston embankment requiring about 18,000 cu. yds. earth fill, 29,000 lin. ft. piles, 3,000 cu. yds. concrete masonry, 240 cu. yds. stone masonry, 400 tons riprap, construction of 3 coffer dams, etc., as advertised in The Engineering Record.

Muskegon, Mich.—The following are the bids opened on Nov. 20 by Col. M. E. Adams, Corps Engrs., U. S. A., Grand Rapids, for dredging in Muskegon Harbor: (a) 101,750 cu. yds., (b) totals: Greiling Bros., Green Bay, Wis., a 17¾ cts., b $34,391; Samuel O. Dixon, Milwaukee, Wis., a 22 9/10 cts., b $44,369; Great Lakes Dredge & Dock Co., Chicago, Ill., a 26¾ cts., b $51,586; Graves & Stephens, Cleveland, O., a 29½ cts., b $57,156; the Fitzsimons & Connell Co., Chicago, Ill., a 39 cts., b $75,562.

**Minneapolis, Minn.*—M. F. Hufty, Clk. Municipal Building Comn., writes that the contract for installing passenger elevators in court house (bids opened Nov. 11) has been awarded to Otis Elevator Co., of Minneapolis, for $14,400.

It is stated that bids will be received until Dec. 13 by H. R. Scott, Co. Aud., for constructing Ditch No. 11.

**Morris, Minn.*—Brown & Sutcliffe, Benson, Minn., are reported to have secured the contract for the construction of county ditch No. 3, at 13½ cts per cu. yd.; total cost about $12,000.

**Items marked thus give the names of parties awarded contracts.*

Craig Mont.—The W. C. Gillette Co., of Craig, writes that all bids opened on Nov. 10 for the construction of about 6 miles of ditch on Upper Dearborn River have been rejected.

Cold Spring N. J.—The Seacoast Constr. Co. of New York, N. Y., is reported to have secured the contract to build stone jetties at Cold Spring Inlet, Cape May, N. J., for a total of $614,000 (bids opened Oct. 3 by Maj. C. A. Flagler, Corps Engrs., U. S. A., at Wilmington, Del.).

Atlantic City, N. J.—Bids will be received by the Streets, Walks and Drives Com. (Wm. Riddle, Chmn.) until Dec. 9 for the construction of a boardwalk along ocean front between Pacific Ave. and Connecticut Ave., to be about 2,000 ft. in length, to be constructed with a wood floor upon wood or reinforced concrete joists supported by reinforced concrete girders and columns, as advertised in The Engineering Record. J. W. Hacknay, City Engr.

New York, N. Y.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Dec. 27, for the installation of a vacuum cleaning system for U. S. Custom Building at New York, as advertised in The Engineering Record.

Mattituck, N. Y.—The following are the bids opened on Nov. 25 by Col. John G. D. Knight, Corps Engrs., Army Bldg., N. Y. City for dredging Mattituck Harbor (price given per cu. yd.), John P. Randerson, Albany, 35 cents; Atlantic Dredging Co., 15 Whitehall St., N. Y. City, 43.3 cents; J. Marvin Briggs, 154 Nassau St., N. Y. City, 28.4 cents; J. S. Packard Dredging Co., 425 Angell St., Providence, R. I., 49 cents, and Maritime Dredging Co., 78 Broad St., N. Y., City, 23 2-3 cents (recommended for award). There is $36000 available for this work.

Durhamville, N. Y.—We are informed that Theo. F. Kalbfleisch, of Glens Falls, has secured the contract for constructing aqueduct under Erie Canal near Durhamville (bids opened Nov. 28 by F. C. Stevens, State Supt. Pub. Wks., Albany), at the following bid: Bailing and draining (lump sum), $4,000; removal of spillway, wastegates, etc. (lump sum), $220; 12,000 cu. yds. excav., 85 cts.; 1,340 cu. yds. 2d-class reinforced concrete, $11.75; 1,050 cu. yds. 3d-class reinforced concrete, $9.70; 860 sq. yds. stone paving, $1.35; 180 sq. yds. stone paving, relaid, 60 cts.; 210 cu. yds. lining, $2; 950 cu. yds. puddle, $1.80; 100 cu. yds. riprap, 60 cts.; 8,800 lin. ft. foundation piles, 30 cts.; 64 M ft. wooden sheet piling, $46; 120,000 lbs. metal reinforcement, 4 cts.; 11,000 lbs. metal in wastegates, 12 cts.; 400 lin. ft. wrought-iron pipe railing, $1.45; total, $56,093. Totals of other bids: N. D. Peters, Utica, $60,532; The Foundation Co., 115 Bway., New York, $63,-316; Casey & Murray, Rochester, $60,389; Marcellus & Ballard, Oneida, $69,530; Engineer's estimate, $46,455.

Ludington Mich.—The following are the bids opened on Nov. 20 by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, for construction of breakwater at Ludington harbor: (*a*) L. E. Schnorbach & Co., Muskegon; (*b*) Great Lakes Dredge & Dock Co., Chicago, Ill.; (*c*) Burk, Smith & Nelson, Muskegon, Mich.; (*d*) Greiling Bros., Green Bay, Wis.; (*e*) Patk. Keobane, Fayettville, N. Y.; (*f*) Wm. H. Gillen, Milwaukee, Wis.

	a	*b*	*c*	*d*	*e*	*f*
3,000 cu. yds. dredging for crib foundations	$0.50	$0.60	$0.90	$0.60	$0.97	$0.90
61,908 lin. ft. foundation piles	.75	.65	.70	.75	.70	.90
1,224 lin. ft. oak guard piles	.40	.45	.50	.50	.70	.90
167,232 M. ft. oak timber	60.00	60.00	65.00	65.00	53.00	80.00
2,094,012 M ft. white, Norway or Southern pine or Douglas fir timber	45.00	44.00	46.00	50.00	55.00	50.00
5,738.392 M ft. hemlock timber	30.20	35.00	35.00	39.00	38.00	40.00
545.76 M ft. white, Norway or Southern pine or Douglas fir planks for decking	45.00	41.50	42.00	50.00	55.00	50.00
887,727 lbs. drift bolts	.04	.04½	.04	.06	.04	.05
259,841 lbs. screw bolts	.04	.04¾	.05	.06	.04	.05
49,536 lbs. spikes	.05	.04¼	.05	.06	.04	.05
118,132 tons stone, 50 to 100 lbs	1.59	1.65	1.60	1.40	1.69	1.70
18,153 tons stone, 500 lbs. or more	1.89	1.90	1.90	1.95	2.00	2.25
Totals	$621,063	$652,059	$652,088	$688,109	$703,046	$735,946

Buffalo, N. Y.—See "Sewerage and Sewage Disposal."

Cleveland, O.—Bids will be received until Dec. 18 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for constructing a standard guard railing on the Brecksville Rd., Brecksville Township. A. B. Lea, Co. Surv.

McKinney, Tex.—See "Power Plants, Gas and Electricity."

Panama—Bids will be received unt.. Dec. 21 by Lieut. Col. H. F. Hodges, Corps Engrs., U. S. A., Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing 4 steel dump barges as per circular 404.

*The Star Drilling Machine Co., of Akron, O., is reported to have secured the contract to furnish 50 drilling machines to the Government for use on the Panama Canal, for about $75,000.

Panama—Bids will be received until Dec. 27 at the office of Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., Purchasing Officer Isthmian Canal Comn., Washington, D. C., for furnishing sanitary fixtures, valves, wrought-iron pipe, copper tubing, conductor pipe, unloaders and dump cars, rail braces, wheeled scrapers, steel, bar iron, copper, wire rope, etc., as per circular No. 406.

PROPOSALS OPEN.

For Proposals see pages 84, 86 and 88.

WATER.

Bids Close. — See Eng. Record.
Dec. 11. Water curtains, New York, N. Y. ......Nov. 30
Dec. 11. Pipe, Chicago, Ill ....Dec. 7
Dec. 12. Filter plant, Cambridge Springs, Pa...Nov. 16
Adv. No. 16-23.
Dec. 17. Water supply improv., etc. Camden,
Dec. —. Well, McComb City, Miss. ....Dec. 7
[illegible] Cisterns, Ft. Dade, Fla. ....Nov. 30
[illegible] Electric [illegible] Hamilton, Ont. ....Dec. 7
Jan. 1. Reservoir, Norway, Me. ....Nov. 16
Jan. 6. Water wks., Tucson, Ariz. ....Nov. 16
Jan. 11. Pipe, Winnipeg, Man. ....Nov. 30
Jan. 17. Air compressor, Aurora, Ill. ....Nov. 30
——— Attention to Contractors, New York, N. Y. Adv. Sep. 28 to Nov. 2......Sep. 28
——— Attention to Contractors, etc., Rome, N. Y. Adv. Oct. 12 to Nov. 16......Oct. 12

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 11. Brooklyn, N. Y. ....Nov. 30
Dec. 13. Wapakoneta, O. ....Dec. 7
Dec. 13. Evart, Mich. Adv. Dec. 7..........Dec. 7
Dec. 14. Norwood, O. ....Nov. 30
Dec. 14. Belleville, Ill. ....Dec. 7
Dec. 17. Louisville, Ky. Adv. Nov. 23 to Dec. 7.Nov. 23
Dec. 18. Springfield, O. Adv. Nov. 30, Dec. 7...Nov. 30
Dec. 19. Wapello, Ia. ....Nov. 16
Dec. 21. Santa Monica, Cal. ....Nov. 23
Dec. 28. Evansville, Ind. ....Dec. 7
Dec. —. Ventura, Cal. ....Nov. 2
Dec. —. South Bend, Ind. ....Nov. 23
Jan. 15. Manila, P. I. Adv. Oct. 26 to Nov. 16.Oct. 26
Jan. 15. Santa Monica, Cal. ....Dec. 7
Jan. —. Lexington, Ky. ....Nov. 30

BRIDGES.

Dec. 10. Jackson, Minn. ....Nov. 23
Dec. 10. Girard, Kan. ....Nov. 30
Dec. 11. Wailuka, H. I. ....Nov. 9
Dec. 11. Houston, Tex. ....Dec. 7
Dec. 13. Celina, O. ....Nov. 30
Dec. 14. Norwood, O. Adv. Nov. 23, 30.......Nov. 23
Dec. 16. Sale of superstructure, Hartford, Conn. Adv. Dec. 7..............Dec. 7
Dec. 17. Philadelphia, Pa. ....Nov. 23
Dec. 17. Dayton, O. ....Dec. 7
Dec. 18. Lafayette, Ind. Adv. Dec. 7..........Dec. 7
Dec. 20. Red Wing, Minn. ....Dec. 7
Dec. 31. Canton, China. Adv. Oct. 26, Nov. 2..Oct. 26
Dec. —. Ventura, Cal. ....Nov. 2
Jan. 1. Topeka, Kan. ....Nov. 30
Jan. 2. New Orleans, La. ....Dec. 7
Jan. 6. Colfax, La. ....Dec. 7
Jan. 6. Ft. Monroe, Va. ....Dec. 7
Adv. Dec. 7.
Jan. 7. Wilmington, N. C. ....Nov. 16
Adv. Nov. 16 to Dec. 7.
Jan. 7. Salem, S. D. ....Nov. 16
Mar. 1. South Bend, Ind. ....Dec. 7

PAVING AND ROAD MAKING.

Dec. 10. St. Louis, Mo. ....Nov. 30
Dec. 10. Ashtabula, O. ....Dec. 7
Dec. 11. Brooklyn, N. Y. ....Nov. 30
Dec. 11. Ft. H. G. Wright, N. Y. ....Nov. 16
Dec. 11. Carlisle, Pa. ....Dec. 7
Dec. 11. Columbus, O. ....Dec. 7
Dec. 12. Flemington, N. J. ....Nov. 16
Adv. Nov. 16 to Dec. 7.
Dec. 12. Anderson, Ind. ....Nov. 23
Dec. 13. Carlisle, Pa. ....Dec. 7
Dec. 13. Valparaiso, Ind. ....Sep. 7
Dec. 15. Danville, Ind. ....Dec. 7
Dec. 16. Steubenville, O. ....Nov. 23
Dec. 16. Buffalo, N. Y. ....Nov. 30
Dec. 16. Columbus, Ind. ....Dec. 7
Dec. 16. Harrisburg, Pa. ....Dec. 7
Dec. 17. Providence, La. ....Nov. 23
Dec. 20. Washington, Pa. ....Nov. 30
Dec. 23. Creede, Colo. ....Dec. 7
Dec. —. Ventura, Cal. ....Nov. 2
Jan. 2. Ridgefield, Conn. ....Dec. 7
Jan. 3. Salt Lake City, Utah ....Oct. 19
Adv. Oct. 19 to Nov. 9 and 30, Dec. 7.
Jan. —. Jackson, Mich. ....Nov. 23
Feb. 4. Brick paving, Billings, Mont. ....Nov. 23
Adv. Nov. 23, 30.
Feb. 4. Macadam, Billings, Mont. ....Nov. 23
Adv. Nov. 23, 30.
Feb. 15. Santa Monica, Cal. ....Dec. 7

POWER PLANTS, GAS AND ELECTRICITY.

Dec. 10. Ft. Revere, Mass. ....Nov. 30
Dec. 10. Brooklyn, N. Y. ....Nov. 30
Dec. 10. New York, N. Y. ....Nov. 30
Dec. 13. Panama ....Nov. 23
Jan. 15. Washington, D. C. Adv. Dec. 7.....Dec. 7
Dec. 16. Montreal, Que. ....Nov. 16
Dec. 17. Washington, D. C. ....Nov. 30
Dec. 20. Lafayette, Ind. Adv. Nov. 23, 30.....Nov. 23
Dec. 20. Ft. Worth, Tex. Adv. Nov. 30, Dec. 7..Nov. 30
Dec. 20. Ashville, O. ....Nov. 30
Dec. 21. Chinook, Mont. ....Nov. 16
Dec. 23. Panama ....Nov. 30
Feb. —. Lagrange, Ga. ....Nov. 30

BUILDINGS.

Dec. 10. School, Alpine, Tex. ....Nov. 2
Dec. 10. Bus. bldg., Jacksonville, Fla. ....Nov. 2
Dec. 10. Dwelling, Mobile, Ala. ....Nov. 9
Dec. 10. City Hall, Chattanooga, Tenn. ....Nov. 30
Dec. 10. New indus. plant., Canton, S. D. ......Nov. 16
Dec. 10. School, Canton, S. D. ....Nov. 16
Dec. 10. Radiators for National Museum, Washington, D. C. Adv. Nov. 30..........Nov. 30
Dec. 10. School, Bayonne, N. J. ....Nov. 30
Dec. 10. School, Madison, S. D. ....Dec. 7
Dec. 11. Pub. bldg., Rochester, N. Y. ....Dec. 7
Dec. 11. Pub. bldg., Ladysmith, Ont. ....Dec. 7
Dec. 12. Hospital, Whipple Barracks, Ariz. ......Nov. 16
Adv. Nov. 16 to 30.
Dec. 12. School, Shirley, Ind. ....Nov. 23
Dec. 12. Church, Reedsburg, Wis. ....Dec. 7
Dec. 12. Bath house, Chicago, Ill. ....Dec. 7
Dec. 13. School, Chicago, Ill. ....Dec. 7
Dec. 14. Jail, Terre Haute, Ind. ....Nov. 23
Dec. 15. School, Auburn, Ala. ....Nov. 16
Dec. 15. Pub. bldg., Washington, D. C. ....Nov. 16
Dec. 15. School, Northfield, Minn. ....Nov. 30
Dec. 16. Jails, Ellisville, Miss. ....Nov. 30
Dec. 16. Lodge bldg. for U. S. Cemetery, Greenville, Tenn. Adv. Dec. 7..........Dec. 7
Dec. 16. Remodeling pub. bldg., New Bedford, Mass. ....Dec. 7
Dec. 16. Court house, Pulaski, Tenn. ....Dec. 7
Dec. 16. Cell wk. at jail, Painesville, O. ....Dec. 7
Dec. 17. Exten. to post office, Detroit, Mich....Nov. 2
Dec. 17. School, Pawnee, Okla. ....Nov. 16
Dec. 18. Tunnel to htg. pub. bldg., Madison, Wis. ....Nov. 9
Dec. 19. Pub. bldg., Ocala, Fla. ....Nov. 16
Adv. Nov. 16-23.
Dec. 19. School, Dayton, Ohio ....Nov. 30
Dec. 20. Htg. post office bldg., Ft. Worth, Tex..Nov. 30
Adv. Nov. 30, Dec. 7.
Dec. 21 Plumbing at post office bldg, Ft. Worth, Tex. ....Nov. 30
Dec. 21. Htg. court house, Youngstown, O. ....Nov. 30
Dec. 23. Post office, Ann Arbor, Mich. ....Nov. 9
Dec. 23. Post bldgs., Ft. Des Moines, Ia. ......Nov. 30
Adv. Nov. 30, Dec. 7.
Dec. 23. Church, Tipton, Ind. ....Dec. 7
Dec. 27. Pub. bldg., San Francisco, Cal. ....Dec. 7
Dec. 27. School, Hallock, Minn. ....Dec. 7
Dec. 27. School, Tulalip, Wash. ....Nov. 30
Dec. 30. Post office, Lancaster, Pa. ....Nov. 16
Dec. 31. Church, Falls City, Neb. ....Oct. 26
Dec. —. Industrial plants, Ft. William, Ont...May 11
Dec. —. School, Anderson, Ind. ....Sep. 28
Dec. —. Fire house, Ventura, Cal. ....Nov. 2
Dec. —. Y. M. C. A., Aurora, Ill. ....Nov. 9
Dec. —. Bath houses, Toronto, Ont. ....Nov. 23
Dec. —. Y. M. C. A. bldg., Plattsburg, N. Y....Nov. 30
Jan. 1. Dwellings, Greenville, Pa. ....Nov. 30
Jan. 1. School, Paris, Ill. ....Nov. 30
Jan. 2. Pub. bldg., Flint, Mich. ....Nov. 23
Jan. 2. Post office, South Bend, Ind. ....Nov. 16
Jan. 3. Post office bldg., Albuquerque, N. M....Nov. 23
Adv. Nov. 23, 30.
Jan. 3. Library, Oklahoma City, Okla. ....Dec. 7
Jan. 6. School, Coopersville, Mich. ....Nov. 9
Jan. 6. Post office exten., Wichita, Kan. ....Nov. 23
Jan. 6. School, Cincinnati, O. ....Nov. 30
Adv. Nov. 30, Dec. 7.
Jan. 7. Add. to school, Slayton, Minn. ....Nov. 23
Jan. 7. Laboratory, Washington, D. C. ....Dec. 7
Jan. 8. Schools, Colville, Wash. ....Nov. 30
Jan. 10. School, Cheyenne, S. D. ....Nov. 30
Jan. 10. Schools, Colma Sta., Wis. ....Dec. 7
Jan. 11. School, Ft. Smith, Ark. ....Dec. 7
Jan. 14. Light station, Alaska ....Nov. 23
Adv. Nov. 23 to Dec. 7.
Jan. 14. Indus. plant, Oxford, Md. ....Nov. 23
Jan. 14. Post Office, York, Neb. Adv. Dec. 7..Dec. 7
Jan. 15. Church, Pemberville, O. ....Nov. 30
Jan. 15. School, Winnebago, Neb. ....Dec. 7
Jan. 15. Pub. bldg., Chicago, Ill. ....Dec. 7
Jan. 15. Heating Capitol, Washington, D. C..Dec. 7
Adv. Dec. 7.
Jan. 17. School, Pine Ridge Agency, S. D. ....Dec. 7
Jan. —. School, Mankato, Minn. ....Nov. 23
Jan. —. School, Washington, D. C. ....Nov. 9
Jan. —. School, Madison, Minn. ....Nov. 16
Jan. —. School, Bardstown, Ky. ....Dec. 7
Feb. 1. Plans for Capitol, San Juan, P. R.....Sep. 28
Feb. 1. Court house and jail, Cairo, Ga. ....Oct. 26
Feb. 1. Jail, Green Bay, Wis. ....Dec. 7
Feb. —. College, Agricultural College, Mich....Oct. 19
Feb. —. Jail, Ocilla, Ga. ....Dec. 7
Mar. 25. P. O. plans, New York, N. Y. ....Nov. 30
Apr. 1. Hotel, South Braintree, Mass. ....Nov. 30

MISCELLANEOUS.

Dec. 9. Boardwalk, Atlantic City, N. J. ......Dec. 7
Adv. Dec. 7.
Dec. 10. Wharves, Mobile, Ala. ....Nov. 9
Dec. 10. Supplies, Brooklyn, N. Y. ....Nov. 30
Dec. 10. Dock, Superior, Wis. ....Nov. 30
Dec. 10. Ditch, Sac City, Ia. ....Nov. 30
Dec. 10. Supplies, Annapolis, Md. ....Nov. 30
Dec. 10. Garb. disp., Providence, R. I. ....Dec. 7
Dec. 10. Supplies, Washington, D. C. ....Dec. 7
Dec. 11. El. ry franchise, New Orleans, La....Oct. 26
Dec. 11. Ditch, Emmetsburg, Ia. ....Nov. 9
Dec. 11. Wall, etc., Ft. H. G. Wright, N. Y....Nov. 16
Dec. 11. Bulkhead, Montgomery, Ala. ....Nov. 23
Dec. 11. Copper, Washington, D. C. ....Nov. 23
Dec. 13. Ditch, Minneapolis, Minn. ....Dec. 7
Dec. 14. Lumber, Nashville, Tenn. ....Nov. 16
Adv. Nov. 16 to Dec. 7.
Dec. 14. Dredging, Boston, Mass. ....Nov. 23
Dec. 14. Ditch, Webster City, Ia. ....Nov. 30
Dec. 16. Levee work, New Orleans, La. ....Nov. 23
Dec. 16. Lanterns, Hawaii ....Nov. 23
Dec. 16. St. cleaning, etc., Philadelphia, Pa....Dec. 7
Adv. Dec. 7.
Dec. 17. Garbage crematory, Ft. Hancock, N. J...Nov. 23
Dec. 17. R. R. work, Philadelphia, Pa. ....Nov. 23
Dec. 17. Supplies, Washington, D. C. ....Nov. 30
Dec. 18. Guard rail, Cleveland, O. ....Dec. 7
Dec. 20. Steamboat, Portland, Ore. ....Nov. 23
Adv. Nov. 23 to Dec. 7.
Dec. 21. Metal lions, Washington, D. C. ....Nov. 30
Adv. Nov. 30.
Dec. 21. Dump barges, Panama ....Dec. 7
Dec. 23. Dredge, Portland, Ore. ....Nov. 30
Adv. Nov. 30, Dec. 7.
Dec. 27. Removal of wreck, Boston, Mass. ....Nov. 30
Adv. Nov. 30, Dec. 7.
Dec. 27. Sanitary fixtures, etc., Panama........Dec. 7
Dec. 27. Vacuum clean. system, New York, N. Y. Adv. Dec. 7..........................Dec. 7
Dec. 31. Garb. disposal, Altoona, Pa. ....Dec. 7
Jan. 6. Conduit and embankment, Boston, Mass. Adv. Dec. 7......................Dec. 7
Jan. 7. Ditch, Desmet, S. D. ....Nov. 30
Jan. 7. Garb. disposal, Reading, Pa. ....Dec. 7
Jan. 14. Garbage plant, Columbus, O. ....Nov. 30
Adv. Nov. 30, Dec. 7.
Jan. 15. Pier, Santa Monica, Cal. ....Dec. 7
May —. El. ry., Buenos Aires, S. A. ....Nov. 16

*Items marked thus give the names of parties awarded contracts.

CURRENT NEWS SUPPLEMENT

DECEMBER 14, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary Charles Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, Jan. 15-16, 1908. Next meeting, December 18, 1907. Paper, "Municipal Sewage Disposal—An Investigation."

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary J. M. Diven, Charleston, S. C.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia. Annual convention, Buffalo, N. Y., Jan. 20-25, 1908.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

THE ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.

The annual meeting of the Association of American Portland Cement Manufacturers was held at the Hotel Astor, New York, on Dec. 10 and 11. Mr. John B. Lober, who has been president for several years, presided. One new member was admitted, making the list as follows: Aetna Portland Cement Co., Detroit, Mich.; Alabama Portland Cement Co., Demopolis, Ala.; Alma Cement Co., Wellston, O.; American Cement Co., Philadelphia; Alpena Portland Cement Co., Alpena, Mich.; Alpha Portland Cement Co., Easton, Pa.; Alsens American Portland Cement Works, Alsen, N. Y.; Atlas Portland Cement Co., New York; Bath Portland Cement Co., Bath, Pa.; Bonneville Portland Cement Co., Philadelphia; Buckeye Portland Cement Co., Bellefontaine, O.; Buckhorn Portland Cement Co., Philadelphia; Castalia Portland Cement Co., Pittsburg; Catskill Cement Co., Cementon, N. Y.; Chicago Portland Cement Co., Chicago, Ill.; Coplay Cement Mfg. Co., Philadelphia; Dexter Portland Cement Co., Nazareth, Pa.; Diamond Portland Cement Co., Cleveland, O.; Edison Portland Cement Co., Stewardsville, N. J.; Elk Cement & Lime Co., Petoskey, Mich.; Empire Portland Cement Co., Warners, N. Y.; German-American Portland Cement Works, La Salle, Ill.; Glens Falls Portland Cement Co., Glens Falls, N. Y.; Helderberg Cement Co., Albany, N. Y.; Hudson Portland Cement Co., Hudson, N. Y.; Iola Portland Cement Co., St. Louis, Mo.; Ironton Portland Cement Co., Ironton, O.; Kansas Portland Cement Co., Iola, Kan.; Lawrence Cement Co., New York; Lehigh Portland Cement Co., Allentown, Pa.; Louisville Cement Co., Louisville, Ky.; Marquette Cement Mfg. Co., La Salle, Ill.; Thomas Millen Co., Wayland, N. Y.; Nazareth Cement Co., Nazareth, Pa.; Newaygo Portland Cement Co., Newaygo, Mich.; Northampton Portland Cement Co., Stockertown, Pa.; Omega Portland Cement Co., Jonesville, Mich.; Peerless Portland Cement Co., Union City, Mich.; Peninsular Portland Cement Co., Jackson, Mich.; Penn-Allen Portland Cement Co., Allentown, Pa.; Pennsylvania Cement Co., New York, N. Y.; Phoenix Cement Co., Nazareth, Pa.; The Portland Cement Co., Denver, Colo.; Portland Cement Co. of Utah, Salt Lake City; St. Louis Portland Cement Co., St. Louis, Mo.; Standard Portland Cement Co., Napa Junction, Cal.; Sandusky Portland Cement Co., Sandusky, O.; United States Cement Co., Bedford, Ind.; Universal Portland Cement Co., Chicago, Ill.; Virginia Portland Cement Co., Fordwick, Va.; Vulcanite Portland Cement Co., Philadelphia; Wabash Portland Cement Co., Detroit, Mich.; Western Portland Cement Co., Milwaukee; Western States Portland Cement Co., Independence, Kan.; Whitehall Portland Cement Co., Philadelphia; Wolverine Portland Cement Co., Coldwater, Mich.; Superior Portland Cement Co., Charleston, W. Va.; Kosmos Portland Cement Co., Louisville, Ky.

The Association was formed but a few years ago for the purpose of bringing together the manufacturers of

TUCKER & VINTON PANEL, CONCRETE EXHIBITION.

Portland cement for the discussion of problems affecting the entire industry. Prior to its organization there was a feeling of deep distrust by many cement manufacturers concerning their competitors, largely due to a lack of real personal acquaintance. The demand for the material was advancing by leaps and bounds, and those who had been engaged longest in the industry recognized that unless something was done to form the same kind of a trade association that existed in other lines of manufacture conditions would go backward rather than advance. It was also felt that something should be done to spread a knowledge of the rational uses of Portland cement, so as to encourage its legitimate use and discourage any attempts to accomplish the impossible with it. Accordingly the Association has two distinct sides, one for the investigation and discussion of business and technical subjects of interest only to those engaged in the industry, and the collection of statistics after the fashion long followed by the American Steel & Iron Association, and the other for the collection and distribution of information regarding the uses of concrete.

The Association has already issued from its headquarters at 1232 Land Title Bldg., Philadelphia, a large number of bulletins of much value to users of cement. These cover a great variety of subjects, and some of them are complete monographs. It also publishes a small monthly containing a survey of important articles on concrete that have appeared in other journals, along with original contributions. This feature of the Association's work is to be further developed, and Mr. Percy H. Wilson, Assoc. M. Am. Soc. C. E., has been elected secretary of the Association in order to further this purpose as well as to relieve Mr. Lober of much of the detail work he has been carrying. It should be added that those who desire copies of this monthly publication or the bulletins can obtain them by writing to the Association or to any one of its members.

At the convention this week three papers were presented of technical interest. The first of these, by Mr. Wm. A. Aiken, general inspector of materials of the Public Service Commission of New York, First District, was a discussion of the effect of chemical composition and other properties on the strength of Portland cement, continuing the discussions of the same subject which he has contributed to the Society for Testing Materials and other Bodies. The second paper was a report of some investigations made by Mr. Robert W. Lesley and the Henry S. Spackman Engineering Co. These investigations were made to determine the effect of regrinding on set cement and to ascertain what proportion of the total amount of cement was actually affected in the setting process. The paper is one of the most surprising nature, and the investigation, which was made at Mr. Lesley's initiative, seems likely to arouse wide interest. The third paper was an abstract of a detailed report which Mr. Sanford E. Thompson was retained by the Association to make on the design, construction and serviceability of reinforced concrete chimneys. As a result of his examination of many such stacks and a study of their design and construction, Mr. Thompson reports favorably on them, provided they are carefully built and of proper proportions. All these papers will be issued by the Association as soon as practicable.

During the meeting of the Association an important step was taken in the organization of the "Sales Managers' Section" of that body, which has been formed for "the elevation of salesmanship." The officers of the Association are: President, Albert Moyer, Vulcanite Portland Cement Co.; vice-president, J. U. C. McDaniel, Chicago Portland Cement Co.; secretary and treasurer, C. L. Johnson, Castalia Portland Cement Co.; executive committee, R. E. Griffith, Lesley & Trinkle; L. V. Clarke, Lawrence Cement Co.; C. H. Wood, Wolverine Portland Cement Co.; B. F. Affleck, Universal Portland Cement Co.; E. R. Stapleton, Iola Portland Cement Co.; W. P. Corbett, Alsens Portland Cement Co.; P. B. Beery, Sandusky Portland Cement Co.; W. G. Hartranft, Virginia, Buckhorn and Phoenix Portland Cement Companies; Mr. McVay, Western Portland Cement Co.; A. H. Craney, Jr., St. Louis Portland Cement Co., and George G. Sykes, Lehigh Portland Cement Co.

THE PERMANENT EXHIBITION OF THE CONCRETE ASSOCIATION OF AMERICA.

The Concrete Association of America is composed of those who are desirous of encouraging and developing the intelligent and scientific use of concrete, to standardize methods of construction, to promote social intercourse among those engaged in concrete construction and its allied fields, to secure an exchange of views upon subjects of interest, and to collect and circulate accurate and reliable data and information relating to all matters pertaining to and affecting the concrete industry. The work of the Association is largely to be devoted to educating the investing public, architects, engineers and concrete contractors in the scientific, practical and proper use of Portland cement concrete. The members of the Association realized that the very best method of obtaining this end and of advancing the concrete and fireproof building construction was to show those interested what can and has been done.

To follow out this plan the Executive Committee of the Association, some months ago, leased part of the eleventh floor of the Brunswick Building, located in the heart of the building centre of New York City, at Fifth Ave., 26th and 27th Sts. Here it is now installing a permanent exhibition of the various products of concrete, reinforcements, methods of construction, and materials which are closely allied with the concrete and fireproof building industries. It is the first exhibition of its kind in the United States and enough of the exhibits are already in place to make it well worth visiting. Those who have already taken space are: Alpha Portland Cement Co., New York; Whitehall Portland Cement

Co., Philadelphia; Keasbey & Mattison Co., New York; Dillman Fireproof Construction Co., New York; Webber Construction Co., New York; J. W. Rapp, New York; Tucker & Vinton, Inc., New York; M. L. Freeman, New York; Albert Oliver, New York; Turner Construction Co., New York; The American Machinery Co., New York; The N. Y. Concrete Block Co., New York; J. F. Blanchard Co., New York; Dr. Chas. F. McKenna, New York; The American Concrete Steel Co., Newark, N. J.; Voigtmann & Co., New York; Vulcanite Portland Cement Co., Philadelphia; The Expanded Metal & Corrugated Bar Co., St. Louis; Barrett Mfg. Co., New York; The Expanded Metal Engineering Co., New York; Herringbone Metal Lath Co., New York; Toch Bros., New York; Automatic Door & Gate Co., New York; American Mason Safety Tread Co., New York; Pennsylvania Cement Co., New York; Alsens American Portland Cement Works, New York; Engineering News Publishing Co., New York.

The informal opening of the exhibition was on the afternoon of Dec. 11, a date fixed to enable the members of the Association of American Portland Cement Manufacturers to see what the Concrete Association was doing in an educational way. As before mentioned all the exhibits are not yet in place, but enough are installed to form a very interesting collection. A complete description is hardly in order at this time, owing to the unfinished condition of some displays, but a few notes concerning some of the exhibits will indicate the variety of things to be seen.

The Expanded Metal Engineering Co. has arranged its space as indicated in one of the accompanying illustrations. Here the applications of expanded metal can be studied and some excellent concrete works examined. An associated company, the Expanded Metal & Corrugated Bar Co., of St. Louis, exhibits among other things a long bar of concrete containing one of its corrugated bars; this has been cut longitudinally and the bond of the concrete and steel is finely demonstrated.

The Turner Construction Co. displays a large model of the Robert Gair Building in Brooklyn, one of the first large reinforced structures to be erected in Greater New York, which, it might be added, has been so satisfactory that another building like it is now being erected by the same company for Mr. Gair. The model is a fine piece of work, made to scale and so arranged that the inside can be examined with the help of small electric lights. The roof is shown in all stages of construction, and this part of the model is particularly instructive as showing how a reinforced concrete floor is constructed.

Tucker & Vinton, Inc., show some large models of reinforcement in place, together with excellent examples of admirable concrete art work. The accompanying illustration gives a rather poor idea of a beautiful panel, demonstrating what can be done in concrete by the proper co-operation of artist and artisan. The artist who modeled this panel made a careful study of the eagles at the New York Zoological Gardens, and the finished work is vigorous and effective. Attention should also be drawn to some remarkable specimens of color effects in concrete shown by the Vulcanite Portland Cement Co.

Another exhibit that will attract immediate attention is the display of the American Concrete Steel Co. In addition to numerous photographs of structures erected by the company, there are models of its system of floor construction for steel frame buildings and of the built-up frames employed for the reinforcement of beams and girders. The system of floor construction does away with floor beams, and requires only steel girders, an end attained by a special type of reinforcement.

The Barrett Mfg. Co. has on exhibition a number of models showing many types of waterproofing in different stages of construction. The company has been engaged in such work for two generations and in the course of its long experience has evolved certain types of construction which the test of time shows to yield the best results, which are exhibited here.

Mr. Albert Oliver makes a good display in the form of a small structure showing Clinton wire fabric applied to various structural purposes and the General Fireproofing Co. has a similar exhibit.

An entirely different type of exhibit is that made by Dr. Charles F. McKenna, who has made arrangements to instruct the visitor concerning the various testing methods employed to insure the use of nothing but proper cement in a structure. It was a particularly happy thought to have such a display in an educational exhibition, and it was noticeable on the opening day that there was always a group of interested visitors about it.

The secretary of the Association is in constant attendance and from him visitors can always get authentic information regarding any of the exhibits.

The Pond rigid turret lathe, a new design of heavy duty turret lathe, recently designed by the Pond works of the Niles-Bement-Pond Co., is illustrated and described in an attractive catalogue recently issued by this company. The details of the new machine are well illustrated, and the great variety of work for which it is adapted is well shown by illustrations of the lathe engaged in various machining operations.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The fifty-sixth convention of the American Society of Mechanical Engineers was held in New York, from Dec. 3 to 6, inclusive. It was the first annual meeting of the society at its new headquarters in the Engineering Societies' Building, at 29 West 39th St., and was the largest meeting in the history of the organization. The total registered attendance was 1,332, of which 727 were members and 605 guests. Features of the meeting were a well-attended excursion to the terminals of the Hudson Companies and a trip through their recently completed tunnels under the Hudson River; visits to a new 300-h.p. gas producer power plant at the works of the Watson-Stillman Co., Aldene, N. J., and a lecture on color photography. The last was given by Mr. F. E. Ives, of New York, and included a complete account of the progress of the art to date, and the development of the Lumiere process, with illustrations by stereopticon.

The technical papers presented at the meeting included symposiums on gas engine power development, on foundry practice and on superheated steam, all of which received much attention and aroused considerable discussion. A paper calling forth animated comment was that by Mr. W. B. Russell on "The Apprentice System of the New York Central Lines," which described the lately developed system now in use on this railroad, in which the apprentices are given thorough educational advantages while fully under the shop discipline and environment. The methods and experiences obtaining there elicited numerous references to similar systems in industrial establishments in which satisfactory results have been obtained. The papers on other subjects included one by Prof. W. F. M. Goss of the University of Illinois on "Power Transmission by Friction Driving," in which the results of an extensive series of tests on friction wheels of various compositions are presented, and another by Mr. Jacob H. Wallace, of the University of Colorado on "Cylinder Port Velocities," in which studies of cylinder port proportions for steam engines by valve diagrams were discussed.

The papers on gas power development included: "The Rational Utilization of Low Grade Fuels in Gas Producers," by E. F. Junge, Berlin, Germany; "Duty Test on Gas Power Plant," by Messrs J. R. Bibbins and G. I. Alden; "Control of Internal Combustion in Gas Engines," by Prof. C. E. Lucke, of Columbia University, and "The Evolution of the Internal Combustion Engine," by Sidney A. Reeve. The second was a report on a duty test of a 300-kw. producer gas engine generating unit at the works of the Norton Co., Worcester, Mass., in which bituminous coal is used in the producer, and throws considerable light on the question of operating efficiency and character of service of this type of equipment. The paper attracted much attention and was liberally discussed.

The papers on foundry practice included "The Foundry Department and Department of Engineering Design," by Mr. W. A. Bole, Pittsburg, Pa.; "Moulding Sand," by Mr. A. E. Outerbridge, Philadelphia, Pa.; "Power Service in the Foundry," by Mr. A. D. Williams, Pittsburg, Pa.; "A Foundry for Bench Work," (the new foundry of the Michigan Stove Co.), by Mr. W. J. Keep and Mr. Emmet Dwyer, Detroit, Mich.; "A Volumetric Study of Cast Iron," by H. M. Lane, Cleveland, O.; "Specifications for Iron and Fuel, and Method of Testing Foundry Output," by Mr. R. Moldenke; "The Foundry Cupola and Iron Mixtures," by Mr. W. J. Keep, Detroit, Mich.; "Foundry Blower Practice," by Mr. W. B. Snow, Boston, Mass.; "Patterns for Repetition Work," by Mr. E. H. Berry, New York, and "Some Limitations of Molding Machines," by Mr. E. H. Mumford, Philadelphia, Pa. The first of the papers was of particular interest in showing the interdependence between the foundry and drafting room, and pointed out many classes of design work in which difficulties in obtaining satisfactory castings may be avoided by observance of elementary principles of foundry practice.

The papers on superheated steam were "The Specific Heat of Superheated Steam," by Prof. C. C. Thomas, of Cornell University, and "Engine Design as Adapted for Use of Superheated Steam," by Mr. Max E. R. Toltz, St. Paul, Minn. The former presented the most recent data regarding the specific heat of superheated steam, which have recently been determined by elaborate tests with improved apparatus. The paper by Mr. Toltz was a resume of superheater practice upon locomotives and the tendencies in future designs. Both of these papers elicited extended discussion on topics of all sorts in connection with use of superheated steam, in which numerous favorable and adverse opinions were expressed.

EXHIBIT OF EXPANDED METAL ENGINEERING CO. AT CONCRETE EXHIBITION.

THE NEW BUILDING FOR THE AMERICAN SCHOOL OF CORRESPONDENCE.

The building recently erected for the American School of Correspondence, Chicago, partakes to some extent of the nature of an office building as well as a school. It stands in the immediate vicinity of Washington Park and the Midway Plaisance, of World's Fair fame, now an essential link in Chicago's great boulevard system. In conjunction with the University of Chicago, whose administration offices stand only two blocks away, the school is to be instrumental in making this the educational center of the city. This location dictated for the school a design that would combine in the exterior the picturesqueness appropriate to collegiate architecture and the solidity required in an office building. This scheme has been worked out in the utmost simplicity by the architects, Messrs Pond & Pond, Chicago.

The building contains four stories and basement. The general interior plan is that of the letter E; the return of the east and west wings encloses on two sides an open court, 60 ft. square, walled in at the rear and entered through an arched driveway.

The administrative offices are on the second floor; the remainder of the building is used for the accommodation of the large staff of instructors, editors, and other employees in charge of the various details of the work of the school. An interior telephone system connects all departments. To facilitate the work of the business office and mailing room, several of the latest electrical appliances have been installed, including adding ma-

chines, folding machines, and envelope sealers, all operated by electric power. In the basement are the stock room, the shipping room and the steam heating plant. Electricity is used throughout for lighting purposes. The corridors and larger rooms are equipped with Nernst lamps, the other parts of the building with incandescent lamps. Lavatories with hot and cold water are located on each floor.

On the second floor are the lecture room and the rest room for employees. The lecture room is used as a meeting place for the clubs that have been formed at the works of the Crane Co., the McCormick Harvester Co., and other large manufacturing plants in and near Chicago. At these plants students of the American School have organized, appointed leaders from their own number, and found mutual assistance in studying together. From time to time they meet in the lecture room of the school, where they are provided with instructors, apparatus, and—since most of them come direct from the shop to the school—with a substantial lunch, all for the usual tuition. The school also provides its employees with free coffee and lunch at noon time.

ANOTHER MANUFACTURER OF BIG GAS ENGINES.

As an indication of the rapid development in the manufacture of big gas engines and the importance of the field occupied by this type of prime mover, it is of interest to note that another manufacturer of large Corliss steam engines has actively taken up the manufacture of gas engines, and is bidding strongly for engines in medium and large sizes.

The Wisconsin Engine Co., with works at Corliss, Wis., which has built some very large and successful Corliss steam engines, is building gas engines for all services in sizes from 400 to 5.000 b.h.p. The engines utilize natural gas, producer gas, coke-oven gas or blast-furnace gas in the Otto cycle (four-cycle), and are of the horizontal tandem and twin-tandem double-acting type. This company controls the Sargent patents on internal combustion engines, and has employed Mr. Charles E. Sargent as the engineer of its gas engine department. Mr. Sargent has a wide reputation as an engineer, and in 1898 designed a horizontal tandem double-acting gas engine, which was probably the first of the type, and was a wide departure from the accepted practice of those days, when the most prominent manufacturers of gas engines declared such a type was impracticable and doomed to failure. However, the largest gas engines are of the horizontal, twin-tandem, double-acting, four-cycle type, and with one exception this is the only type in which large units are being built in this country to-day.

The gas engines built by the Wisconsin Engine Co. bear some of the distinctive features of their large Corliss engines, and utilize in design most of the Sargent patents. The design is remarkably simple and embodies features which are of considerable interest to the engineer and power user. There is but one poppet valve for each explosion chamber, and as this is located on the bottom of the cylinder the cumbersome and unsightly air and gas pipes, as well as the stairs, galleries and railings found on most horizontal tandem engines, are entirely eliminated; provision is made for preventing the dangerous pressures caused by possible pre-ignitions, and the engines are started automatically.

Tests of even small Sargent engines show a heat consumption of less than 9,000 B.t.u. per brake horse power hour.

This company has recently shipped some large steam engines to such concerns as the Illinois Steel Co., Jones & Laughlin Steel Co., Packard Motor Car Co., American Sheet & Tin Plate Co., Amoskeag Mfg. Co., New Hampshire Spinning Mills, National Tube Co., City of Milwaukee. Carnegie Steel Co., American Woolen Co., United States Envelope Co., and the Carnegie Natural Gas Co. It takes pride in its reputation for shipping on time, and promises to do as well on gas engine orders.

The air-brake department of the Allis-Chalmers Co., Milwaukee, has recently issued two bulletins, one descriptive of its new type OB pneumatic governor for the control of pressure delivered from motor-operated air compressors, and the other explaining the new type J emergency valve for straight air-brake equipments. The pneumatic governor contains important improvements in general design and arrangement, facilitating inspection and care.

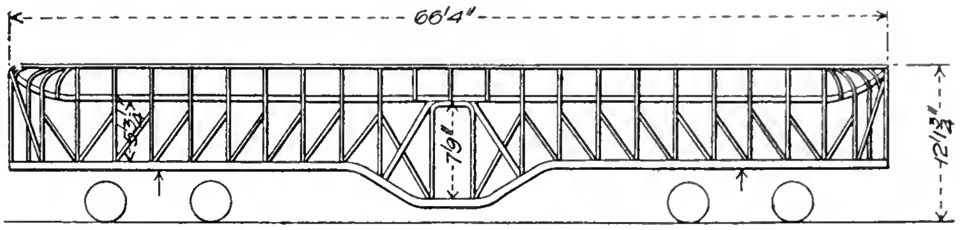
AN UNUSUAL BLUE PRINT.

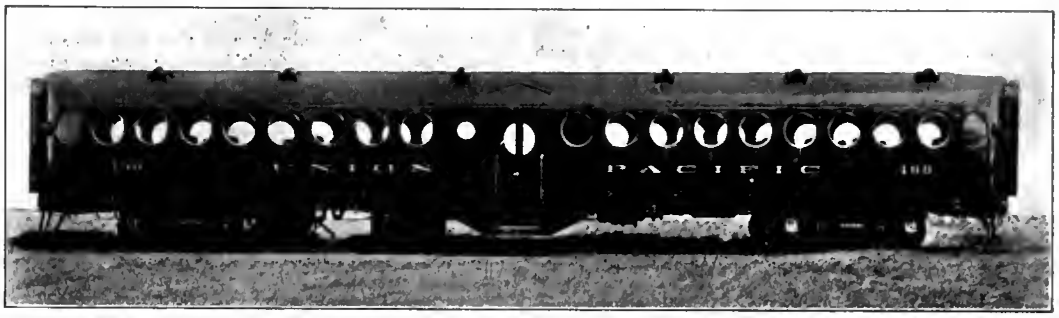
The blue print shown in the accompanying illustration is probably the longest single-piece print that has ever been made. It is 54 in. wide and 120 ft. long and shows the arrangement of offices in the extension of the Capitol at Washington. The 540 sq. ft. of paper in this print is surprisingly uniform in tone, without streaks or other defects. It was made on one of the six Everett-McAdam machines used by the Federal Government and was printed by one man, although it took two men to handle the wet paper during the washing and drying processes. The print was run through a 10-ft. tank, where it was sprayed with water from a hose, and was then hung up in long loops over sticks to dry.

A SINGLE-SHEET BLUE PRINT, 120 FEET LONG.

The machine has also been used to make some very large Van Dyke negatives from which prints having blue lines on a white field are prepared. The machine has a rotating transparent cylinder containing two mercury vapor lamps longer than the cylinder, so as to secure a uniform distribution of the light. The cylinder lies in a series of narrow belts surrounding three-fourths of its circumference; the paper and tracings are fed in between the belts and the glass cylinder, and rotate with the latter. After passing once around they are delivered into a box in the front of the machine. The glass cylinder is 8¼ in. in diameter and 45 in. long for a 42-in. print or 60 in. for a 54-in. print. The machines are made by the Revolute Machine Co., of New York.

THE UNION PACIFIC STEEL CARS.





THE ALL-STEEL CARS OF THE UNION PACIFIC RAILROAD.

With the idea of bettering its present passenger coach equipment and providing greater safety for its passengers and trainmen, the Union Pacific R. R. Co. has designed and constructed at its Omaha shops an all-steel passenger coach that marks a wide departure from the familiar car. The length over vestibule diaphragms is the same as the present standard coach, and only in this respect does the new coach bear any similarity to equipment now in service. A decrease in height from rail to roof of 24 in. marks a very noticeable change from the regular equipment.

The underframing is composed of two 12-in. I-beam center sills, 16 in. apart on centers, and 6x3½-in. angle iron side sills, all securely fastened by cross ties, needle beams and diagonal bracing. The 12-in. center sills are intended chiefly for the buffing and pulling stresses, and do not carry any load, as they themselves are carried by the sides of the car, which are of girder construction. The double-body bolsters, end sills and end bracing of the underframe are made of a one-piece steel casting, 11 ft. long by 9 ft. 9 in. wide, weighing 3,700 lb. each.

On top of the underframing is riveted a course of 1/16-in. sheet steel, forming a fire protection from below. On these steel sheets is a layer of ¾ in. of hair-felt, and on top of this is a flooring of fireproof composition in 3x4-ft. pressed sheets, ½ in. thick, laid on 2x¾-in. nailing strips embedded in the hair-felt. The whole floor construction is securely bolted together by small stove bolts, the heads being let in flush with the top of the floor.

The side posts and carlines are of one continuous piece of 3-in. channel iron, bent in the form of an inverted U, extending from side sill to side sill, forming the contour of the half-oval roof, and extending down to the side sill on the opposite side of car from whence it started.

To these channel-iron posts, which are formed with

flat side outward, is riveted the 15-in. steel side sheathing, which with the posts is riveted to the angle-iron side sills. The steel sheathing extends from the bottom of the side sills to the top of the 4-in. channel side plate, forming a deep substantial girder, which is additionally stiffened by diagonal braces placed below the windows and riveted to the sheathing. Holes 25 in. diameter are cut out of the sheathing to accommodate the circular aluminum window frames.

The interior arrangement differs widely from any present coach. The four entrances, steps, and end vestibules, found in the ordinary coach, have been discarded and a single vestibule at the center of car, with an entrance on each side, has been adopted. This style of entrance proved to be extremely satisfactory in all the gasoline motor cars recently described in this journal. Both ends of the coach are rounded in order to lessen wind and air resistance.

One of the most noticeable features of this new type of car is the system of ventilation. Cottier suction ventilators are placed at intervals on the roof, along each side of the center line. In the fresh air system, air is admitted at the circular ends of the car, about 8 ft. from the rail, at each side of the end train-line doors, through intakes 12 in. in diameter, covered with a fine brass netting; thence downward to an air-tight galvanized sheet iron box beneath car which contains two sets of removable dust-collecting screens, set vertically. After passing through these screens, the air is admitted upward to the inside of car through a galvanized sheet duct having perforations at each seat. Along the outside of this fresh air duct are placed the steam heating pipes, which warm the incoming fresh air to the desired temperature. The amount of fresh air admitted to car is regulated by dampers in the intakes.

The lighting equipment consists of an electric generator on one of the trucks, belted to a pulley on the truck axle. An auxiliary storage battery has been placed in steel boots below the car floor. At each seat is placed an 8-c.-p. lamp, with frosted globe, located slightly above a seated passenger's head, and at the side of the car.

In regard to weight, this 78-passenger coach is lighter than any all-steel coach, with an equal seating capacity or length, ever built. It has a weight per passenger of only 1,145 lb., or 89,300 lb. in all.

The above information has been supplied by Mr. W. R. McKeen, Jr., superintendent of motive power and machinery, under whose personal supervision the coach was designed and built.

THE TATA STEEL PLANT IN INDIA.

It has long been known that valuable deposits of hematite iron ore exist in India, and the late J. N. Tata, a leading merchant and manufacturer of Bombay, spent a large sum in investigations of them. He employed Mr. C. P. Perin, an American engineer, who for two years made extensive examinations and located two distinct fields of superior value. One field, in the state of Majurbang, has large deposits of ore containing from 60 to 62 per cent. of iron. The other field, in the Central Provinces, contains ore yielding from 67 to 68 per cent. of iron. The Hierria coal fields, about 200 miles northwest of Calcutta, are the most important in India and produce coal low in sulphur, suitable for coking. Coke from this field has already been used in the blast furnaces at Barakar, which for several years have been established on a paying basis.

The 28,000-mile railroad system of British India is considerably larger than that of Great Britain, and all of its supplies are now imported from England at a high cost and great inconvenience. Besides the large amount of supplies required for this system, there is now in India a considerable market for structural shapes and other steel products, which was considered sufficient to justify Mr. Tata in the establishment of a local iron and steel industry. The preparations for it were interrupted by his death two years ago. Since then his sons have continued the preliminary work and last year unsuccessfully endeavored to raise the required $7,500,000 capital in England. On this account the enterprise was temporarily delayed, but during the past summer the native Indian capitalists became so much interested that they have subscribed the entire amount of capital required, and the Tata Iron & Steel Co., Ltd., has been formed to construct and operate a large iron and steel plant designed on the most modern lines.

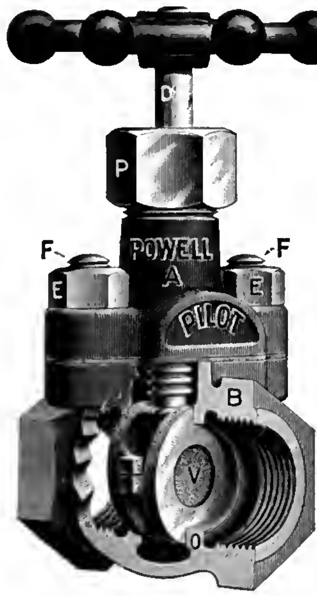
Strenuous efforts were made by English and European engineers to secure the design and construction of these important works, a contract which was, however, awarded to the engineering firm of Julian Kennedy, Sahlin & Co., who have been retained to make all designs and to purchase and inspect machinery and materials, and to supervise the erection of a complete iron and steel plant of a capacity of 120,000 tons a year, which will be located at Sini Junction, on the Bengal and Nagpur Railway, 171 miles west of Calcutta.

The plant will include two blast furnaces, each of a capacity of 200 tons per day, basic open hearth steel furnaces, blooming mills, rail mills, merchant bar mills, foundries and shops, in addition to extensive water-works and coke ovens. The distinctive features will be the use of standard well-tried plans modified to meet difficult local and climatic conditions. The machinery and plant will, of course, be mainly purchased in America and Europe.

The work of constructing an industrial village and suitable bungalows for engineers and foremen is already under way. The Indian Government has undertaken to give to the new plant favorable freight rates for incoming and outgoing material and to construct and equip at its own expense a broad gauge railroad from the iron mines to the works, the latter being already connected by rail with the coal mines. The Indian Government has also guaranteed an order of 200,000 tons of rails distributed over a ten-year period.

Labor in this district is plentiful and exceedingly cheap and is sufficiently intelligent to be trained to operate this plant, as is demonstrated by the fact that for several years Tata & Co. have operated what is said to be the largest cotton factory in the world, the Empress mills, at Nagpur, exclusively with native labor, staff and officers. These mills have proved to be exceedingly profitable and are well organized. The native workmen are, however, very weak physically, and every effort will be made to substitute machinery for manual labor. As the cost of raw materials assembled in the plant is very low, the project will be started under very favorable auspices.

The project is of great importance, both for its intrinsic magnitude and as the commencement of what will probably be a large Oriental development, making it specially gratifying that it should be executed and controlled by American engineers, especially by a firm of such wide experience. Mr. Julian Kennedy, it is hardly necessary to say, has been connected with much of the most important iron and steel work in Pittsburg and throughout this country.



A NEW PILOT GATE VALVE.

Mr. Axel Sahlin, who has been for several years the head of the firm in Europe, was formerly superintendent of the Maryland Steel Co., and afterward consulting engineer for the Brown Hoisting & Conveying Co., Cleveland. He is now in this country in conference with Mr. Kennedy for the organization of the plant.

THE PILOT GATE VALVE.

The Pilot iron-body gate valve is another addition to the long list of steam specialties manufactured by the Wm. Powell Co., Cincinnati. The body has heavy lugs on either side of the neck, carrying stud bolts *F*. The bonnet cap *A* has corresponding lugs drilled to template, which insures constant alignment at all times and also allows the bonnet to be replaced without unusual care after taking apart. The semi-finished hexagon nuts *E* large enough to admit wrenching down hard, with a joint of the best packing material between the faces of bonnet and body, make a joint which the makers state is tight for all pressures up to 100 lb. The large brass packing nut *P* affords room for packing material to prevent leakage around the stem. The brass steam *D* and bonnet are chased and cut to a true Acme thread of unusual length, which is considered the best for wear. The long thread has been provided to keep the steam in a true axial position at all times whether open or closed. The knobby hand wheel is furnished to give a firm grip, even when the hand is oily.

The discs are double, with ball and socket back, making them adjustable, and are hung in recesses to the collar on the bottom of the stem. The discs, working in a tapering seat, expand or collapse in opening or closing, in order that the valve may close tight without straining or open easily, no matter what the conditions may be.

The Pilot gate valve is also made wholly of iron without any brass used in its construction anywhere. This all-iron valve is intended for controlling ammonia, cyanide solutions, acids and other liquids or gases that attack brass.

BUSINESS NOTES.

The marble and monument works of Benisch Bros., New York, have recently purchased a Northern crane of 71-ft. span, 15-tons capacity, with 5-ton high-speed auxiliary hoist. This crane was furnished by the Northern Engineering Works, of Detroit.

The Bury Compressor Co., Erie, Pa., has recently shipped to the Navy Yard at Brooklyn a steam-driven air compressor for the "Panther," which is to sail with the Pacific squadron. The company has also received orders from the Japanese navy for one 350-ft. belt-driven compressor, and from the Navy Department of France for a direct connected motor-driven compressor.

Goff, Horner & Co., Ltd., Frick Bldg., Pittsburg, Pa., have taken over the sole sales agency in the United States of the Cummings system of concrete reinforcement, and are looking for agents in the large cities. Mr. A. C. Kuester, formerly with The Scofield Co., contractors, Philadelphia, has recently taken charge of agencies, his office being in the Frick Bldg., Pittsburg.

The new electric generating units in the addition to the Lincoln Wharf station of the Boston Elevated Ry. Co., are two Allis-Chalmers direct current railway type of 2,700 kw. each. They are multi-polar compound-wound and are driven by 42 and 90x60-in. engines, which run at 72 r.p.m.

In 1900 the Tonawanda Iron & Steel Co., of North Tonawanda, N. Y., installed a 4,000-h.p. We-Fu-Go water softening and purifying system. Since that time it has been necessary to open the boilers only once a year for washing out and inspection. They have just placed a second order with Wm. B. Scaife & Sons Co., of Pittsburg, Pa., for an addition to their present system, to take care of increased boiler capacity of 4,000-h.p., making a total of 8,000 h. p. Among the recent orders taken by Wm. B. Scaife & Sons Co. for We-Fu-Go water softening and purifying systems are the following: Rochester & Pittsburg Coal & Iron Co., Walston, Pa., 1,250 h.p., (fourth order); Clearfield Bituminous Coal Corporation, Rossiter, Pa., 1,800 h.p.; Wickwire Steel Co., Buffalo, N. Y., 4,000 h.p.; Union Brewing Co., Sharon, Pa.., 500 h.p.; Saratoga Textile Co., Saratoga Springs, N Y., 2,400 gal. per hour; American Sheet & Tin Plate Co., Cambridge, O., 2,000 h.p.; People's Brewing Co., Terre Haute, Ind., 700 h.p.; and a 500-h.p. Scaife system for George J. Renner, Jr. Brewery, Youngstown, O.

PERSONAL NOTES.

Mr. Julian Kendrick has been re-elected city engineer of Birmingham, Ala.

Mr. Arthur O'Brien, a member of the Fort Orange Construction Co., of Troy, N. Y., has been apppointed city engineer of Utica, N. Y.

Mr. L. M. Muzzy has been appointed an assistant division engineer in the maintenance of way department of the Boston & Albany R. R.

William H. Ward, a well-known contractor of Lowell, Mass., was struck by a derrick boom and instantly killed, recently. He was 78 years old.

Robert Augst, chief engineer of the Duluth & Iron Range R. R., Duluth, Minn., and an authority on iron ore dock construction, died recently aged 60 years.

All offices connected with the Stone & Webster organization in Boston have been collected in the company's building at 147 Milk St. corner of Batterymarch St.

Prof. J. P. Jackson, who has charge of instruction in electrical engineering at the Pennsylvania State College, has been appointed dean of the School of Engineering there.

Mr. R. O. Jones, formerly chief engineer of the Jeanesville Iron Works, Hazleton, Pa., has become chief engineer of The Dayton Hydraulic Machinery Co., Dayton, Ohio.

One of the new members of Congress, Mr. George W. Gordon, of the Tenth district of Tennessee, is a civil engineer. He rose to the rank of brigadier-general in the Confederate army.

Mr. Carl C. Witt has resigned as assistant engineer of the Pierre & Fort Pierre Bridge Ry., to become chief engineer of the South Dakota R. R. Commission, with headquarters in Sioux Falls, S. D.

Mr. James Logan, one of the most active trustees of the Worcester Polytechnic Institute, has been elected mayor of Worcester, Mass., He is the first vice-president and general manager of the United States Envelope Co.

Mr. William J. Moore, assistant professor of electrical engineering at Stevens Institute, Hoboken, N. J., has resigned to accept a professorship in the North Carolina State College of Agriculture and Mechanical Arts.

Mr. Thomas Appleton, superintendent of construction, U. S. Public Buildings, Supervising Architect's Office, has been transferred from Evanston, Wyo., to the supervision of the new post-office and court house building at East St. Louis, Ill.

Mr. James Douglas, vice-president of the American Institute of Mining Engineers, has given to the United

States Government four acres of land on the Palisades of the Hudson, including the site occupied by Fort Lee in Revolutionary times.

Capt. Robert R. Raymond, Corps of Engineers, U. S. A., in command of Company K, third battalion of Engineers, has been ordered to Denver, Col., as chief engineer officer of the Department of the Colorado, to relieve First Lieut. George R. Spalding.

Gen. Cyrus B. Comstock, Corps of Engineers, U. S. A., has given to the National Academy of Sciences, of which he is a member, the sum of $10,000, the income from which is to be devoted to the advancement of knowledge in magnetism, electricity and radiant energy.

Mr. Austin Lord Bowman, consulting civil engineer, has been appointed consulting engineer to the Department of Bridges of New York City, succeeding Mr. Henry B. Seaman, who recently resigned to become chief engineer of the New York Public Service Commission, First district.

Mr. L. D. Hadwen, assistant engineer, Chicago, Milwaukee & St. Paul Ry. Co., bridge and building department, has been appointed acting engineer of masonry construction in place of Mr. J. J. Harding, who has been assigned to other duties in connection with the Pacific Coast extension.

Prof. Wm. H. Burr and the engineers of the Department of Bridges of New York City, are being congratulated on the approval this week by the Municipal Art Commission of the plans for the Henry Hudson Memorial bridge described at length in the current news supplemen of this journal for Nov. 16.

The fortieth annual convention of the American Society of Civil Engineers, will be held in Denver, Col., beginning on Tuesday, June 30, and ending Friday, July 3, 1908. The first meeting of the society for 1908 was scheduled to be held on New Year's Day. By action of the board of direction that meeting will be held one week later on Wednesday, Jan. 8, 1908.

Charles Philo Matthews, professor of electrical engineering and director of the electrical laboratory at Purdue University, Lafayette, Ind., died at Phœnix, Ariz., Nov. 23, aged 40 years. He was widely known for his contributions to scientific knowledge, his chief work being an investigation of photometric standards for arc lights. He was collaborator in the production of text books in physics and electricity with Professors Nichols and Shearer, of Cornell University, and with Prof. Esterline, of Purdue University, and he also published a number of papers on electrical subjects.

At the meeting of the American Society of Civil Engineers Dec. 4 the following were elected to membership: As members—A. L. Black, Engr., New Orleans Ry. & Light Co., New Orleans, La.; Francis Blossom, member of firm of Sanderson & Porter, Engrs. and Contrs., New York City; W. C. Boyd, Asst. Engr., Pittsburg Railways Co., Pittsburg, Pa.; G. R. G. Conway, Chf. Engr., Monterey Water Works and Sewer Co., Ltd., and Monterey Ry., Light & Power Co., Ltd., Monterey, Mex.; S. F. Crecelius, U. S. Engr. Office, Louisville, Ky.; L. N. Farnum, Gen. Mgr. of Constr., J. G. White & Co., New York City; James B. Goodwin, senior Asst. Res. Engr. of Constr., McCall Ferry Power Co., McCall Ferry, Pa.; R. H. Ober, Engr. of Columbia River Bridge at Beverly, Wash., Chicago, Milwaukee & St. Paul Ry. Co., Vulcan, Wash.; Umesaburo Ogawa, Prof. of Civil Engineering, Kyoto Imperial Univ., and private practice, Kyoto, Japan; E. J. Pearson, Chf. Engr. Chicago, Milwaukee & St. Paul Ry., Pacific Extension, west of Butte; Julius Pitzman, Surv. and Civ. Engr., St. Louis, Mo.; Henry Souther, Pres. and Treas. The Henry Souther Eng. Corporation, Hartford, Conn.; C. C. Wilson, Wilson Sompayrac & Urquhart, Engrs. and Archts., Columbia, S. C. As associate members—M. A. Ananthalwar, Asst. Engr., Channapatna Sub. Div. of Bangalore Div., Mysore Public Works Dept., Channapatna, Mysore, India; C. N. Bennet, Chf. Engr. and Supt. of Constr., Webster, Monessen, Belle Vernon & Fayette City Street Ry. Co. and West Side Electric Street Railway Co., Charleroi, Pa.; J. A. Donahey, Res. Engr., Lake Shore & Michigan Southern R. R., Darrowville, Ohio: T. C. Fischer, Asst. Engr., Central R. R. Co. of New Jersey, Elizabeth, N. J.; J. C. Fruit, Asst. Mgr. American Plant, American Bridge Co., of New York, Chicago, Ill.; H. T. Griswold, in office of Gen. Mgr. of Constr. J. G. White & Co., New York City; A. F. Hartman, Asst. Engr. and Chf. Draftsman for Geo. F. Hardy, Mill Archt. and Hydr. Engr., New York City; H. P. Hoyt, Draftsman and Asst. Engr., with H. S. Ferguson, Millinocket, Me.; C. W. Killam, Chf. Engr., Peabody & Stearns, Archts., Boston, Mass.; E. K. Knight, with Cuban Govt. as Engr. in charge of constr. of water supply system for city of Camaguey, Cuba; M. J. Leahy, Engr. in charge of construction, Champion Coated Paper Co., Hamilton, Ohio; R. J. Middleton, Asst. Engr., Bridges and Buildings, Chicago, Milwaukee & St. Paul Ry., Ottumwa, Ia.; Ray Murray, Res. Engr. Poughkeepsie Bridge, Poughkeepsie, N. Y.; C. H. Quimby, Jr., Res. Engr., New York, Westchester & Boston Ry. Co., Mt. Vernon, N. Y.; J. P. Richmond, First Asst. to Prin. Asst. Engr., Executive Div. Board of Water Supply, New York City; R. H. Stearns, Asst. Engr. Designer, New York Board of Water Supply, New York City; George Sykes, Civ. Engr. and Building Contr., New York City; H. E. Van Ness, Asst. Engr., Central R. R. Co. of New Jersey, Little Falls, N. J.; S. J. Van Ornum, City Engr., Pasadena, Cal.; E. B. Wardle, Asst. Engr. for Geo. F. Hardy, Mill and Hydr. Engr., New York City; H. W. Woodcock, Civ. Engr. and City Surv., Brooklyn, N. Y.; A. M. Zabriskie, Asst. Engr., Central R. R. of New Jersey, Plainfield, N. J.

TRADE PUBLICATIONS.

The Berger Mfg. Co., Canton, O., has recently issued a pamphlet on sheet metal building material which it manufactures from the ore to the storehouse. The variety of materials supplied is very extensive, including all kinds of metal roofing, eaves troughs, conductor pipes, cornices, ridging, finials and other exterior metal work, and all kinds of interior metal finish such as metal ceilings, wall covering, metal lath and construction materials. A specialty is also made of metal window frame and sash, skylights, and steel filing devices, lockers and other fireproof furniture for offices.

A well-prepared catalogue of the truss method of reinforcement has just been published by the Truss Metal Lath Co., 147 Fourth Ave., New York. The truss metal lath and Kuhne's clinch lath are referred to in considerable detail and simple and economical methods of construction of partitions and hanging ceilings, by the use of these forms of lath are suggested. A set of specifications is included in the catalogue and instructions are presented for the use of temporary studding in erecting partitions, the insertion of gas pipes and conduits in the center of thin partitions, fastening to door and window bucks, forming corners and similar work. A report is given of fire and water tests made of this partition construction, which has been approved by the New York building department, and there are illustrations of a large number of installations in which the lath is used, including concrete fencing reinforced with the truss lath.

The use of lifting magnets for the rapid handling of materials is discussed in a 32-page pamphlet just issued by the Cutler-Hammer Clutch Co., of Milwaukee, which contains a number of full-page illustrations showing lifting magnets handling pig iron, steel stampings, castings, scrap and other material, together with diagrams, data on current consumption, and information on lifting capacity of magnets. A new cable take-up device is also described and reference is made to the Cutler-Hammer system of control by which the strong kick which occurs when the circuit is suddenly opened on a magnet coil, is automatically shunted to a discharge resistance, thus protecting the magnet insulation by dissipating the energy of the induced voltage outside of the coil itself.

The General Electric Co., Schenectady, N. Y., has recently issued two bulletins of particular interest on heavy electric traction, one concerning the electrification of the West Shore R. R. between Utica and Syracuse, and the other on the electric locomotive in heavy passenger and freight work. The former is a well-illustrated pamphlet of 24 pages describing the entire electrification equipment and shows typical third rail and overhead line construction, trains, substations and operating train sheets that well indicate the increase in traffic over steam operation with the same track capacity. The pamphlet on electric locomotives illustrates a number built by this company and several proposed types, the entire group embracing a series ranging from 17 to 150 ton units and adapted for all classes of service.

Recent bulletins of the Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia, Pa., explain the use of the storage battery in connection with alternating-current power transmission, one describing an installation of 275 type R-33 chloride cells at one of the substations of the Spokane & Inland Empire System in Washington, and the other describing apparatus furnished for use in alternating current regulation. The operation of the split-pole variable ratio convertor and of the carbon regulator are explained. As a result of the installation on the Inland Empire System, it is stated that the bills for power, which is purchased from the Washington Water Power Co., have been reduced by one-half.

The Ashcroft prismatic water gauge for indicating boiler water levels is described in a recent pamphlet issued by the Ashcroft Mfg. Co., 85 Liberty St., New York. The gauge utilizes a special flat glass of peculiar quality, little affected by changes of temperature, which is enclosed in a metal chamber so designed as to appear black in the portion below the water level, while taking on a silvery appearance above. The water level indications are stated to be exceptionally clear and this design ensures almost entire freedom from glass breakages.

The Oswego Boiler & Engine Co., Oswego, N. Y., has issued a revised edition of its catalogue on the Oswego-McNaull water-tube boilers. This is of the steel header type with straight tubes and longitudinal drums, and is so designed that it may be shipped in sections and erected in the field without driving rivets. The details of construction and the advantages of the principal features are explained, and data added relative to the horse power and principal dimensions of the various sizes of units built. It is stated that nearly 200,000 h.p. of these boilers are now in operation.

Power pumps and paper mill machinery are listed in a catalogue lately issued by the Sandusky Foundry & Machine Co., Sandusky, Ohio. The line of pumps embraces single-acting types ranging in capacity from 3 to 1,000 gal. per minute and for pressures from 50 to 5,000 lb., and double-acting pumps of 500 to 2,500-gal. capacity and for pressures from 40 to 350 lb. In this line are also included vacuum pumps and stuff and sewage pumps and a series of low-pressure multiple-cylinder pumps for tank purposes. In paper machinery revolving suction rolls, centrifugal screens and the Millspaugh shower pipe system are shown.

A booklet on slag and its uses has been published by Emanuel & Co., Catasauqua, Pa., in which there is an extended discussion of the use of slag for concrete. The properties necessary in slag for successful use in concrete are pointed out and a large number of slag concrete works are referred to. The use of slag for fireproofing is explained, and underwriters' tests of structures constructed of this material are quoted. Other uses of slag mentioned are for paving, road making and roofing, it being considered preferable in many ways to gravel for covering. The pamphlet is profusely illustrated.

A catalogue of valves and fittings for ammonia has been issued by the Crane Co., Chicago, Ill., embracing an extensive line of special equipment for use in connection with refrigerating machinery. There are included globe angle and cross valves, expansion valves, check valves and all types of fittings and flanges, including the special return bends for condenser construction. A specialty is made of Boyle unions and brine cocks. Forty pages of the book are devoted to tables of properties of ammonia and other data used in connection with the design and operation of ammonia refrigerating equipments.

The eighth edition of the catalogue of the Eugene Dietzgen Co., 181 Monroe St., Chicago, is a well bound volume of 473 pages, measuring 5¼ x 8¼ in. Drawing materials and surveying instruments in great variety to suit all conditions and tastes are described and illustrated. Gem Union and Richter drawing and Dietzgen surveying instruments receive especially good attention. The excellent illustrations and full descriptions will make the book of value to those who are selecting drafting room equipment and engineers' supplies.

The Ferro-Concrete Construction Co., Cincinnati, has sent out a cover for binding the bulletins which it issues from time to time, describing its work. Separate bulletins are issued for different classes of work. Among the bulletins received are those on office buildings, theatres and hotels, factory buildings, footings, piers, retaining walls, stacks and tanks, tests of floors, and a reprint of an article on the 16-story reinforced concrete Ingalls Building in Cincinnati

The Gould Storage Battery Co., New York, has recently issued two bulletins, referring to the use of storage batteries in electric railway systems. One contains a comprehensive description of an installation of two 240-ampere-hour batteries on the line of the Dayton & Western Ry. for use in connection with the railway's power distribution system, and the other a 400-ampere-hour battery in connection with the alternating current distribution of the Rutland Railway, Light & Power Co.

A pamphlet has been issued of the Liberty Manufacturing Co., 6.910 Susquehanna St., Pittsburg, Pa., describing the flue cleaners, water strainers, oil purifier, and the blow-off valve manufactured by this company. The flue cleaners include a heavy-duty type for use in tubes carrying heavy scale, the Liberty standard cleaner, the Liberty pneumatic cleaner and the Niagara cleaner of the turbine type. The Faber blow-off valve has a steam jet for cleaning the seat of the valve of scale and sediment before the disc seats itself firmly.

Bruner steel wagons, all parts of which, including the wheels and the box, are made of cold pressed steel, are described in a small folder from The Bruner Steel Wagon Co. Wapakoneta, O. They are used for farm work, trucking, logging and general purposes, and not only present a neat appearance, but are said to be lighter than wagons of similar size made of wood. The wheels are made of two circular cone-shaped discs with flanged edges which are forced into the tire under great pressure by a hydraulic press. Holes are punched through the tire and the flanges of the discs and the parts riveted together, the rivets being countersunk on the outside of the tire.

The Rathbun vertical gas engines are described in a well-illustrated catalog recently issued by the S. M. Jones Co., Toledo, O. This company has built engines for use with producer or natural gas since 1896. It has developed many refinements of details in two or three cylinder vertical types and has recently perfected a six-cylinder engine which it especially recommends for use with 60-cycle alternating current electrical generators to be operated in parallel.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—New bids will be received on Jan. 10 by Robt. A. Craig, Supt. Water Dept., for laying c. i. water pipe, as advertised in The Engineering Record.

*Bids were opened on Dec. 1 for furnishing material for water works construction, and contracts are reported to have been awarded as follows: For pipe, to the American Cast Iron Pipe Co., Birmingham, Ala., $86,747; specials, same company, at $65 per ton; hydrants, R. D. Wood & Co., Chicago, Ill., $4,512, and valves and boxes, the Ludlow Valve Mfg. Co., Troy, N. Y., $5,748.

Los Angeles, Cal.—This city is reported to have purchased property at head of San Fernando Valley as a site for the twin storage reservoirs for the waters of the Owens River. At this end a dam half a mile long and 130 ft. high will be built; 4,000,000 ft. of earth must be removed, at an expense of $500,000. The volume of water stored will be 10,000,000,000 gal.

Oakland, Cal.—Mayor Mott has signed the ordinance appropriating $40,000 toward the construction of a salt water plant for auxiliary fire protection. The system as projected contemplates mains through the business section of the city and the utilization of the main lake sewer, a 6-ft. aqueduct connecting Lake Merritt with San Francisco Bay, traversing 22d St., and a reservoir for salt water. The whole plant is to cost about $100,000. The $40,000 appropriated is placed at the disposal of the Bd. of Public Works, with which to commence the construction of the pumping plant at the Willows, on the shore of Lake Merritt. Any surplus is to be used for the laying of mains.

Mokelumne Hill, Cal.—A. E. Shaw, of Berkeley, is reported interested in the organization of the Mokelumne Water Co., recently formed, to take over a plant in Calaveras County. The company is said to have a capital of $1,500,000 and will expend a large sum in refitting and repairing the property, building dams and making other improvements.

Johnstown, Colo.—The citizens are reported to have voted to issue $20,000 bonds for the construction of water works.

Las Animas, Colo.—W. R. Murphy, City Engr., writes that bids will be called for about Feb. 1 for the construction of water works, to cost about $67,000.

Macon, Ga.—C. K. Lawrence, of Savannah, Ch. Engr. of the Central of Georgia Ry., is reported to have prepared plans for the construction of a water plant at the railway shops; estimated cost, $30,000.

Twin Falls, Idaho.—The Twin Falls Salmon River Irrigation Co. is reported incorporated with a capital of $500,000, by I. B. Perrine, H. L. Hollister, Robt. McCullom and others, to construct a reservoir system to cost about $2,500,000. The water is taken from Salmon River after being stored in a reservoir that will hold 350,000 acre feet. The dam will be 70 ft. across at the bottom and will be 200 ft. high; a tunnel will be driven from the lava wall of the river, located at a point 75 ft. below top of the dam, a distance of 3,000 ft. The tunnel will open directly upon the land to be irrigated and will require no canals other than for distribution of water. Near the head of the river a reinforcing reservoir is to be installed. Title to a section of land has been secured 17 miles southwest of Twin Falls near center of new tract, upon which the town of Hollister will be located. A telephone and power line has been surveyed from Twin Falls and work on the same will begin at once. J. E. Hayes, the engr. who laid out Twin Falls, will begin at once the work of laying out the town of Hollister.

**Chicago, Ill.*—We are informed that the contract for furnishing 5,300 tons c. i. water pipe (bids opened Dec. 7) has been awarded to U. S. Cast Iron Pipe & Fdry. Co. at $27.20 per ton.

Rockton, Ill.—Geo. C. Morgan, of Chicago, is reported to be preparing plans and estimates for water works; probable cost, $17,000.

Evanston, Ill.—The Bd. of Local Improv. has ordered ordinance prepared for laying 6-in. water main in Milburn St.; estimated cost, $2,772. Ready for letting about April 1, if confirmation is had in court.

Claremore, Ind. Ter.—G. W. Chalfant, who will be Supt. in charge of construction of proposed water works improvements, writes that bids will probably be called for in about 2 weeks from plans of Burns & McDonnell, Scarritt Bldg., Kansas City, Mo.; probable cost, $35,000. W. P. Johnson, City Recorder.

Baltimore, Md.—Bids will be received until Dec. 18 by the Bd. Awards (J. Barry Mahool, Pres.) for furnishing and delivering to the Water Bd. supplies for the year ending Dec. 31, 1908, including lumber, brick, cement, c. i. work, lead-lined iron pipe, c. i. pipe and fittings, brass castings, water meters, hauling pipe, pipe fittings, etc. Alf. M. Quick, Water Engr.

**Cumberland, Md.*—Fred M. Prescott, of Milwaukee, Wis., is reported to have secured the contract for furnishing and installing complete at the water works a 5,000,000-gal. pumping engine for $23,410.

Boston, Mass.—See "Miscellaneous."

Belchertown, Mass.—The Bd. of Selectmen and the Water Supply Com. are reported to be considering the question of procuring a water supply for fire and domestic purposes.

Marion, Mass.—Louis E. Hawes, 101 Tremont St., Boston, is reported to have been appointed as engineer of construction of the proposed water-works, and is now making surveys for same.

Blandford, Mass.—C. A. Tinker, of Springfield, has been selected to make surveys and estimates looking to the construction of water works. It is proposed to petition State Legislature for permission to issue $20,000 bonds for the purpose. Rev. S. G. Wood, Secy. Water Com.

St. Paul Park, Minn.—Bids will be received by W. H. [illegible], Village Recorder, until Dec. 27 for the construction of water works, consisting of about 2 miles of c. i. distribution pipe line system and 75,000-gal. steel tank and steel tower; probable cost, $22,500. Engineer, Oscar Claussen, German-American Bank Bldg., of St. Paul.

St. Louis, Mo.—The question of constructing a water system for fire protection is under consideration; probable cost $2,000,000. Benj. C. Adkins, Water Comrs., 312 City Hall.

Harlowton, Mont.—See "Power Plants, Gas and Electricity."

Lincoln, Neb.—The Water Com. is reported to be considering the question of an improved water supply.

Orange, N. J.—Bids will be received until Jan. 1 by the Common Council for suction and delivery pipe connections of pumping engine at the Chestnut St. Pumping Station; also bids for steam and feed water piping at the Chestnut St. Pumping Station. Willet B. Gano, City Clk.

Jersey City, N. J.—C. H. Van Keuren, Ch. Engr. Street and Water Comrs., is reported to have been authorized to prepare plans and specifications for two 36-in. pipes under Hackensack and Passaic Rivers; estimated cost $100,000.

Albany, N. Y.—City Comptroller Howard N. Fuller will receive bids until Dec. 11 for $100,000 water bonds.

New York, N. Y.—Bids will be received by the Comr. Water Supply, Gas and Electricity until Dec. 18 for furnishing, delivering and constructing gate vaults for the high-pressure pumping stations located at Gansevoort and West Sts. and at Oliver and South Sts., Boro. Manhattan.

Albion, N. Y.—The taxpayers are reported to have voted in favor of appropriating $500 to locate a pure and adequate water supply.

Mt. Olive, N. C.—See "Sewerage and Sewage Disposal."

Burlington, N. C.—A. F. Barrett, Mayor, writes that the citizens on Dec. 3 voted to issue $100,000 bonds for constructing water works and a sewerage system.

Worthington, O.—Bond S. Neff, of Powell, who was recently granted a franchise for water works at Worthington, writes that bids will be received about Apr. 1 for construction, to cost about $35,000.

Anadarko, Okla.—See "Power Plants, Gas and Electricity."

Enid, Okla.—See "Sewerage and Sewage Disposal Plants."

Philadelphia, Pa.—The Council's Water Com. on Dec. 5 approved the Water Bureau's budget for next year, calling for an appropriation of $3,420,667. Included in that amount was $1,700,000 for improvement, extension and filtration of the water supply.

According to local press reports, it is proposed to supply the entire city with filtered water by the spring of 1909. Only three contracts are yet to be let before every unit will be in working order. These are for coal handling machinery at the Lardner's Point pumping station, the preliminary filter wash pumps and the shelter houses and administration building at Torresdale. Fred C. Dunlap, Ch. Engr., Water Bureau.

**Manila, P. I.*—J. F. Case, Ch. Engr., Dept. Sewer and Water Works Construction, writes that the following are the totals of bids opened on Sept. 14 for valves and sluice gate for use in gravity system of water works: Findlay & Co., of Kilmarnock, Scotland, with office at Manila, $5,417 (awarded contract); Manuel Earnshaw & Co., $6,646; Fred Wilson & Co., $6,804; Frank Strong, $5,699, and Henry W. Peabody & Co., $6,253 (bidders all of Manila).

Columbia, S. C.—It is proposed to lay a double 8-in. main along Main St. from Richland to Gervais St., at a cost of about $12,000.

Teague, Tex.—W. R. Boyd, Jr., Mayor, writes that an election will be held on Jan. 2 to vote on issuing bonds for the construction of water works.

Childress, Tex.—Jos. H. Aynesworth, City Secy., writes that the proposed water works will cost about $15,000. Plans and specifications have not yet been prepared.

Bronte, Tex.—It is reported that plans and specifications are being prepared for the construction of water works.

Salt Lake City, Utah.—City Engr. L. C. Kelsey is reported to have recommended that a 5,000,000-gal. reservoir be built at the intake in the City Creek Canyon.

Puyallup, Wash.—See "Sewerage and Sewage Disposal."

Odessa, Wash.—W. M. Nevins, Town Clk., writes that about $15,000 will be expended for water-works improvements. Engr., W. M. Schoonover, of Odessa.

Seattle, Wash.—R. H. Thomson, City Engr., has made the following estimates: Phinney Ave., connecting fire hydrants to existing mains, $20,200; East Olive St., water mains, $19,700, and Bagley Ave., grading, $27,400.

An ordinance has been passed providing for the construction of a salt water fire protection system and pumping plant, to cost about $340,000.

Lethbridge, Alta.—The question of constructing waterworks is reported under consideration.

Winnipeg, Man.—It is stated that bids will be received by the Bd. Control (M. Peterson, Secy.) until Jan. 2 for supplying and installing pumping and air compressing machinery for well No. 7.

Brantford, Ont.—This city is reported to have petitioned the Ontario Ry. and Municipal Board for permission to issue bonds to extend the water works.

Aylmer, Ont.—J. Bradley, Town Clk., writes that contract has not yet been let for water conduit, and the city is still open for bids; probable cost, $8,000. Engineer, Jas. A. Bell, of St. Thomas.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

East Lake (P. O. Birmingham), Ala.—The question of constructing a sewerage system is being considered; probable cost, $25,000.

Los Angeles, Cal.—The Bd. of Pub. Wks. on Nov. 22 authorized City Council to construct Arroyo de las Posas sewer, at a cost of $18,000; Boyle Heights sewer, at a cost of $10,000, and West Boyle Heights main sewer, at a cost of $15,000.

Durango, Colo.—Bids will be received until Jan. 6 by Herman Berndt, Mayor, for furnishing material and constructing 3 sanitary sewers in Sewer Dist. No. 1, said sewers to be known as Sewers Nos. 1, 2 and 3, as advertised in The Engineering Record.

Hartford, Conn.—Local press reports state that bids will probably soon be asked for the construction of tunnel Sec. B, of the Homestead Ave. intercepting sewer system. F. L. Ford, City Engr.

**Washington, D. C.*—E. G. Gummel, 612 F St., N. W., is reported to have secured the contract for constructing sewers in Arkansas Ave. (bids opened Nov. 25) for $12,925.

Ft. Du Pont, Delaware City, Del.—The following are the bids opened at the office of Capt. J. L. Knowlton, Q. M., on Nov. 25 for (*a*) remodeling sewer system, (*b*) 2 sewage ejectors and ejector chamber, at Ft. Du Pont: Jos. Anderson, Delaware City, *a* $4,924; Harry A. Miller, Wilmington, *a* $7,780, *b* $7,195; M. B. Bunyear, Chester, Pa., *a* $4,300, *b* $7,900.

Forsyth, Ga.—We are informed that the Mayor and Aldermen on Dec. 6 rejected all bids received for $15,000 sewer bonds, and the city will not install any sewers for the present. H. F. Wilder, City Clk.

Pekin, Ill.—It is reported that specifications are being prepared for a sewer system for the North Dist.

Moline, Ill.—There is reported to be a movement on foot by the citizens of the 6th Ward to secure sewerage system for that portion of the city.

Ft. Dodge, Ia.—K. E. Beal, City Clk., writes that it is proposed to construct new pipe sewers. Engineer, C. H. Reynolds, of Ft. Dodge.

Traer, Ia.—The City Council is reported to be considering the construction of a sewerage system.

Sterling, Kan.—D. J. Fair, Mayor, writes that no engineer has yet been selected for the proposed sewerage system; if constructed it will cost about $43,000.

**Baton Rouge, La.*—Krumbhaar & Aiken, of New Orleans, are reported to have secured the contract for the construction of an electrical sewerage station for Baton Rouge, at $3,200.

**St. Paul, Minn.*—The contract for constructing St. Anthony Park sewer system, about 12 miles in length, was awarded by Bd. of Pub. Wks. on Dec. 2 to the General Contracting Co., 430 Temple Court, Minneapolis, for $317,000.

Specifications are reported to have been completed for a sewer on Armstrong Ave. from View St. to Chatsworth St., 4 blocks long, to have 900 ft. tunneled in the sand rock.

Specifications for a sewer on the West Side to cover 13 blocks have been completed and presented to the Board of Pub. Wks. The sewer is in three parts. It will extend on Stickney St. from south city limits to Concord and Curtice Sts. and to the Chicago Great Western right-of-way. Another section on Andrew St. will connect with the Concord sewer, and another branch on Page St. from Andrew will make similar connection. It will be constructed in the spring.

Duluth, Minn.—It is reported that it is proposed to construct a trunk line or outlet sewer for West Duluth.

Minneapolis, Minn.—Local press reports state that the city engineer's office will commence at once plans for a tunnel and drop-shaft on 38th St. at the Mississippi River as a preliminary step to establish a new sewer system throughout the extreme southern portion of city, including Linden Hills and Cottage City. L. A. Lydiard, City Clk.

St. Louis, Mo.—We are informed that an ordinance is now under consideration providing for the construction of sewers in Wyoming Street, Dist. No. 21, to be known as Glaze Creek sewer, to cost about $140,000. A. J. O'Reilly, Pres. Bd. Pub. Improv.

Elizabeth, N. J.—Bids will be received until Dec. 16 by the City Council, for furnishing material and constructing 1,710 lin. ft., 10, 12 and 15-in. pipe sewer, 1,596 lin. ft. 6-in. pipe, 26 6x15-in., 32 6x12-in., 56 6x10-in. connections, 12 manholes, etc.

Niagara Falls, N. Y.—The Bd. of Pub. Wks. is reported to have approved the plans of City Engr. Read for a tunnel trunk sewer on Royal Ave. for the relief of the factories to the east of Echota. Estimated cost, $67,000.

Troy, N. Y.—See "Street Cleaning and Garbage Disposal."

Albion, N. Y.—The Village Trus. are reported to be considering the question of establishing a system of sewage disposal for the village.

**White Plains, N. Y.*—Bids were opened on Nov. 27 at the office of the Bronx Valley Sewer Comn., 2 Grand St., White Plains, for constructing the Bronx Valley sewer, and we are informed that the contract has been awarded to the Mack Paving & Constr. Co., of Philadelphia, Pa.; contract price reported to be $1,800,000. The bids called for furnishing work and materials necessary for the watertight and enduring construction of each one of the seven sections, which together comprise about 12 miles of circular sewer from 3⅓ to 6 ft diam. and about 3 miles of circular lined tunnel mostly 6½ ft. and 8½ ft. diam. The material to be either monolithic reinforced concrete, reinforced concrete blocks or brick masonry. Geo. R. Byrne is Ch. Engr. in charge of the sewer. Frank N. Glover, Secy.

New Rochelle, N. Y.—Bids will be received until Dec. 19 by the Bd. Pub. Wks. (Jas. K. Wilkes, Ch. Engr.) for constructing sewers in Glen and Colonial Pl. and drains in Lockwood Ave. and Hickory St.

Burlington, N. C.—See "Water."

Mt. Olive, N. C.—Albert S. Grady, Mayor, P. O. Box 105, writes that bids will probably be called for in the spring for the proposed sewerage system, to be constructed inconnection with the establishment of water works; probable cost, $25,000. Engineer not yet selected.

Ashtabula, O.—Plans for sewerage for Dist. No. 3 have been submitted to the State Bd. of Health for approval.

**Items marked thus give the names of parties awarded contracts.*

**Canton, O.*—We are informed that contracts for pipe sewers (bids opened Dec. 3) have been awarded as follows: Bridge St., to John Skeeles, for $3,000, and Short St., to S. A. Haskell $1,900.

Dayton, O.—Bids were opened on Dec. 4 by the Bd. Pub. Service (T. M. Pexton, Pres.), for constructing sanitary sewers in part of Dist. No. 3, North Dayton, requiring 70,050 ft., 6 to 15-in. vitrified pipe sewers, 68,250 ft. trench and back fill 6 to 28 ft. deep, 80 lamp holes, 75 flush tanks, flush tank connections, repaving 1,500 sq. yds. brick pavement, 100 sq. yds. asphatl, 6,000 lin. ft. boulder repaving, c. i. pipe and specials, etc., and the following are reported to be the totals of bids received: John T. Reese, $72,856.36; Shafor and Dill, $75,860.; C. F. Sullivan, $75,960; T. J. Backus Constr. Co., $77,532, and Wm. Hilt, $77,850.

Youngstown, O.—It is stated that bids will be received until Dec. 16 for $14,485 sewer bonds and $10,285 sidewalk bonds.

Upper Sandusky, O.—It is stated that bids will be received until Dec. 28 by W. C. Ruopp, Village Clk., for $15,000 sewer bonds.

**Mingo, O.*—Ferry & Neville are reported to have secured the contract for constructing trunk sewer for $42,400.

Enid, Okla.—It is stated that bids are wanted until Dec. 19 for $285,000 sanitary sewer, $10,000 septic sewer and $15,000 water extension bonds. E. R. Lee, City Clk.

Lancaster, Pa.—The State Health Comr. at Harrisburg is reported to have approved plans for the new sewer system for the northern section of city.

Philadelphia, Pa.—The budget of the Survey Bureau for the year 1908 is reported to contain $500,000 for main sewers, $300,000 for branch sewers and $500,000 for bridges.

Salt Lake City, Utah.—It is stated that bids will be received by Bd. of Pub. Wks. (F. J. Leonard, Chmn.) until Jan. 3, for constructing pipe sewers in sewer extension No. 191. Louis C. Kelsey, City Engr.

**Norfolk, Va.*—Duffy & Co. are reported to have secured the contract for constructing lateral sewers in the 7th ward for $34.075.

Puyallup, Wash.—The City Council is stated to have authorized City Engr. Wheeler to prepare plans and specifications for sewer and water service for the South Hill Dist., to cost about $3,000.

Aberdeen, Wash.—It is stated that bids will be received until Jan. 8, by P. F. Clarke, City Aud., for $30,628 sewer bonds.

North Milwaukee, Wis.—We are informed that all bids have been rejected for constructing a concrete septic tank, 42 ft. diam. by 16 ft. deep, and the work will be done by the day. Engineer, W. G. Kirchoffer, of Madison. E. H. Klamp, Village Clk.

Fond du Lac, Wis.—The City Council is reported to have ordered the construction of a 12-in. sewer on W. 1st St. from Union St. to east branch of Fond du Lac River.

BRIDGES.

Notes Arranged Alphabetically by States.

Madison, Ark.—Bids will be received until Jan. 2 by the Bd. Co. Comrs., at the office of T. C. Merwin, Co. Clk., Forrest City, for constructing a 700-ft. steel highway drawbridge over the St. Francis River at Madison. H. M. Pharr, Consulting Engr., 216 Randolph Bldg., Memphis, Tenn.

**Los Angeles, Cal.*—Horace P. Ferris, Secy. Bd. of Pub. Wks., writes that the contract for constructing reinforced concrete bridge over Arroyo de los Posos at Macy St. (bids opened Nov. 25) has been awarded to Union Iron Works of Los Angeles, for $51,787.

Washington, D. C.—The construction of a bridge over Rock Creek at Q St. is reported contemplated.

Waycross, Ga.—The construction of a steel bridge over the Satilla River is reported contemplated.

King's Ferry, Ga.—Bids will be received until Dec. 30 by the Bd. Co. Comrs. and Ex-Officio Judges (G. Reuben Butler, Clk.) at Savannah for furnishing material and constructing a steel highway drawbridge over the Great Ogeechee River at King's Ferry.

Muncie, Ind.—The Commrs. of Delaware County are stated to have awarded a contract for the construction of two bridges to the Indiana Bridge Co., of Muncie, for $35,000. All bids opened for the construction of the White River Bridge at Albany were rejected, and according to reports news bids will be received.

Hammond, Ind.—It is reported that bids will be received until Jan. 6 by the Bd. Co. Comrs. at Crown Point, for furnishing material and constructing the substructure and superstructure and installing machinery of a swing bridge over the Calumet River, at Columbia Ave., Hammond.

Greenfield, Ind.—It is reported that bids will be received until Dec. 24 by the Bd. Co. Comrs. for constructing two steel bridges, with concrete abutments, over Sugar Creek, one in Center Township, to have a 112-ft. span, and the other in Brown Township, to have a 75-ft. span; also a 12-ft. span steel and concrete bridge, with concrete abutments, in Brandywine Township. W. I. Garriott, Co. Aud.

Des Moines, Ia.—Surveys have been made, and plans will be completed this winter, for placing old Locust St. Bridge at North St. One extra span will be required and some pile bridge approach.

Randolph, Kan.—Bids will be received until Dec. 28 by the Bd. Jackson Township (J. H. Johnson, Clk.) for constructing a 30-ft. concrete arch bridge across Walnut Creek, between Sections 19 and 20.

Louisville, Ky.—The construction of a railway bridge over the Ohio River to connect Jeffersonville and Louisville is reported contemplated.

Baltimore, Md.—B. T. Fendall,, City Engr., writes that bids will be received until Dec. 27 for the construction of a bridge over Gwynns Falls on Edmondson Ave.; probable cost, $180,000. Address J. Barry Mahool, Pres. Bd. of Awards.

Frederick, Md.—See "Electric Railways."

Waseca, Minn.—It is stated that bids will be received until Jan. 8 by the Bd. Co. Comrs., for constructing 7 steel bridges. C. H. Bailer, Co. Aud.

St. Charles, Mo.—It is stated that bids will be received until Feb. 1, by the St. Charles Co. Comrs. for constructing a bridge. Estimated cost, $8,000.

Kansas City, Mo.—The Park Bd. is reported to be preparing plans for the construction of two bridges over Blue River in Swope Park.

Doniphan, Mo.—It is stated that bids will be received until Dec. 19 by Jas. McKenzie, Road and Bridge Comr., for constructing 3 bridges.

St. Louis, Mo.—See "Railroads."

Glendive, Mont.—The following are the totals of bids opened on Nov. 15 at the office of the U. S. Reclamation Service at Glendive, for the erection of 34 steel highway bridges in connection with the Lower Yellowstone project, North Dak.-Mont.: (*a*) heavy bridges, (*b*) light bridges: A. Y. Bayne & Co., Minneapolis, Minn, *a* $16,714, *b* $17,389; Skobis Bros. Co., Milwaukee, Wis., *a* $17,211.40; the Midland Bridge Co., Kansas City, Mo., *a* $17,844, *b* $18,041; Minneapolis Steel & Machinery Co., Minneapolis, Minn., *a* $17,885, *b* $18,080; Penn. Bridge Co., Beaver Falls, Pa., *a* $18,622, *b* $18,018; Strobel Steel Constr. Co., Chicago, Ill., *a* $18,705, *b* $20,443; W. D. Lovell, Minneapolis, Minn., *a* $22,511, *b* $19,947; the Interstate Eng. Co., Bedford, O., *a* $25,032, *b* $27,363; and New Jersey Foundry & Machine Co., 915 Murray St., New York, N. Y., *a* $45,185, *b* $50,860.

Lincoln, Neb.—The City Council is reported to have on Dec. 6 notified the Burlington & Northwestern R. R. (H. E. Bryan, Gen. Supt., Lincoln) and the Missouri Pacific R. R. (E. F. Mitchell, Engr. of Constr., St. Louis, Mo.) to begin within 30 days the construction of a viaduct over their tracks on N. 10th St. According to plans drawn and submitted by Wm. Grant, City Engr., the viaduct will be of reinforced concrete throughout and of especial strength; 892 ft. long reaching from the south line of Vine St. at grade level to the alley north of Y St. at grade level; a roadway 40 ft. wide, and shall have in addition 5 sidewalks 5 ft. wide on each side of the roadway. Over main lines of two railroads the height of the viaduct shall be 22 ft., and over the switches it shall be 20 ft; probable cost, $75,000.

Fremont, Neb.—Bids will be received until Jan. 15 by the Bd. Co. Superv. at the office of C. O. Boe, Co. Clk., for furnishing material and constructing all bridges required in this county during the year 1908.

Silver City, N. M.—The American Bridge Co., of El Paso, Tex., is reported to have submitted plans to City Council for the construction of a bridge over the arroya on Broadway.

New York, N. Y.—The Municipal Art Commission on Dec. 10 approved plans for the Hudson Memorial bridge to be constructed over Harlem River.

New York, N. Y.—Bids were opened on Dec. 9 at the office of Jas. W. Stevenson, Comr. of Bridges, for the construction of the masonry piers, surface and subsurface changes, and steel superstructure of the Manhattan and Brooklyn approaches of the Manhattan bridge, over East River, between the boroughs of Manhattan and Brooklyn, and the following are the totals of bids received: John C. Rodgers, 1929 Amsterdam Ave., $2,167,304; Maryland Steel Co., 71 Broadway, $2,179,724; Williams Eng. & Constr. Co., 21 Park Row, $2,410,682, and McClintic-Marshall Constr. Co., 21 Park Row, and Pittsburg, Pa., $2,367,978.

Guymon, Okla.—Bids will be received until Dec. 20 by the Bd. Co. Comrs. (J. C. Grasham, Chmn.) for constructing a 24-ft. span, 5-panel steel bridge across Goff Creek; bids may be submitted as a whole or separately on labor and material.

Portland, Ore.—Bids were opened on Nov. 15 at the office of A. L. Barbour, City Aud., for constructing bridges, as follows:

Union Ave. steel bridge across Sullivan Gulch, 408 ft. in length, 40-ft. roadway, 10-ft. sidewalks on each side—Minneapolis Steel & Machinery Co., Minneapolis, Minn., $74,985; International Contract Co., $74,530, and Robt. Wakefield, $73,137.

E. 28th St. reinforced concrete bridge, 558 ft. long, with 40-ft. roadway, sidewalks 10 ft. on each side, double-track street railway— (*a*) 558 lin. ft. bridge complete, (*b*) excav. not called for in plans, per cu. yd., (*c*) concrete not called for in plans, per cu. yd: Robt Wakefield, *a* $93,975, *b* 50 cts., *c* $8; Orrin Backus, A. Giebisch and F. Joplin (2 bids on their own plans), *a* $77,000 and $87,000, *b* 50 cts., *c* $12 and $10.

Grants Pass, Ore.—It is stated that bids will be received until Jan. 2 by the County Court for the construction of a steel bridge 400 ft. long and 22 ft. wide across the Rogue River.

West Bethlehem, Pa.—We are informed that no contract was let by the Comrs. of Lehigh and Northampton Counties at Easton, on Nov. 29, for the construction of a reinforced concrete bridge over Broad St., West Bethlehem. It will be 60 ft. wide with 5 spans, 2 of 75 ft., 2 of 90 ft., and 1 of 100 ft. New bids will be called for. L. A. Francisco, Co. Engr., Easton.

Philadelphia, Pa.—The appropriation available for bridges is reported to be as follows:

Woodland Ave., over Cobbs Creek, $18,000.
Belfield Ave., under the Philadelphia & Reading Ry., $50,000.
Large St., under the Frankford branch of the Philadelphia & Reading Ry., $20,000.
Boulevard Ave., over the P. & W. R. R., $60,000.
Boulevard Ave., over the Philadelphia & Frankford R. R., $50,000.
Hunting Park Ave., over the Philadelphia & Newtown R. R., $40,000.
Rockland St., over the North Penn, $40,000.
Sixty-first St., over the Baltimore & Philadelphia R. R., $15,000.
Sedgwick St., under the Chestnut Hill branch of the Philadelphia & Reading, $35,000.
Ontario St., over Richmond branch of the Philadelphia & Reading, $40,000.
Roberts Ave., under the Philadelphia & Reading, $20,000.
Fifty-fourth St., over the Philadelphia, Baltimore & Washington R. R., $22,000.
Sixty second St., over the Philadelphia, Baltimore & Washington R. R., $32,000.
Forty-second St., over Pennsylvania R. R., $112,000.
Passyunk Ave. Bridge over the Schuylkill River, $200,000.

**East Mauch Chunk, Pa.*—The Comrs. of Carbon County are stated to have awarded the contract for constructing a 10-ft. span bridge over Lehigh River to Horn & Neff, of Slatington, at $15,432.

Seattle, Wash.—It is stated that plans for overhead steel bridges at Holgate and Stacy Sts., to be constructed by the Columbia & Puget Sound and the Northern Pacific Rys., have been submitted to the engineering departments in order that the necessary approaches may be worked out. Each of the structures will cost $75,000. Jas. Anderson, Ch. Engr. the former company.

Spokane, Wash.—See "Paving and Roadmaking."

**Memomonie, Wis.*—F. W. Rowe, City Clk., writes that the following are the bids opened on Dec. 6 for constructing a bridge over Red Cedar River: Minneapolis Bridge & Iron Co., Minneapolis, Minn., $29,900; Security Bridge Co., Minneapolis, Minn., $27,800; Jinks & Dresser, Port Huron, Mich., $29,464; A. Y. Bayne & Co., Minneapolis, Minn. (3 bids), $26,999, $26,497 and $26,000; Hewitt Bridge Co., Minneapolis, Minn., $27,870; The Hennepin Bridge Co., Minneapolis, Minn., $26,900; Contracting Hydraulic Bridge Co., Eau Claire, Wis., $24,465; and Minneapolis Steel & Machinery Co., Minneapolis, Minn., $24,290 (awarded contract).

Victoria, B. C.—It is stated that bids will be received until Dec. 31 by the Ch. Comr. Lands and Works, for furnishing and delivering f. o. b. scow at Vancouver or New Westminster, all the metal work required for the superstructure of a steel swing span; also, same time and place, for furnishing and delivering fir and cedar piles, at the bridge site on the north arm of the Fraser River. F. C. Gamble, Pub. Wks. Engr.

**Toronto, Ont.*—The Provincial Pub. Works Dept. is stated to have awarded contracts for constructing 2 bridges over Spanish River, as follows: The Algoma Steel Bridge Co., of Sault Ste. Marie, a structure at Massey, and to Dixon Bros., of Campbellford, the bridge at Espanola, at a cost of about $25,000 for both.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—It is stated that $125,000 will be expended in street improvements.

Little Rock, Ark.—It is stated that bids will be received until Jan. 2 by Gerhard Morgner, Engr. in charge of road improv., Dist. No. 1, at the office of the Co. Road and Bridge Comrs., for improving W. 12th St.

**Fresno, Cal.*—The Pacific Co. of San Francisco is stated to have secured the contract for paving Tulare St. for $14,983.

**Palatka, Fla.*—Jos. E. Craig, City Engr., writes that the Graves-Matthews Paving Co., of Birmingham, Ala., has secured the contract for 22,805 sq. yds. vitr. brick paving, to be placed on sand of street at $1.54 per sq. yd., and 9,800 ft. 4x18-in. granite curb at 40 cts. (bids opened Dec. 3). The other bids received were: J. B. Chambers, Youngstown, O., $1.49 per sq. yd. for paving and 47 cts. per lin. ft. for curb.; Southern Clay & Mfg. Co., Chattanooga, Tenn., $1.58 and 41 cts., and Georgia Eng. Co., Augusta, Ga., $1.61 and 41 cts.

Savannah, Ga.—The Bd. of Pub. Wks. is stated to have directed that specifications be prepared for improving McDoogle St. with asphalt block.

**Atlanta, Ga.*—H. L. Collier, Comr. of Pub. Wks., writes that contract for paving Broad St. has been awarded to Venable Bros. at $3.29 per sq. yd., and the pavement will be creosoted wood blocks, from curb to curb, No belgian block will be used.

Ottawa, Ill.—It is stated that all bids recently opened for paving in the east side have been rejected. According to reports new bids will be received soon.

**Springeld, Ill.*—The contract for laying a brick pavement with asphalt fill. in No. Grand Ave. from 1st St. to W. Grand Ave. (bids opened Dec. 6.) has been awarded to John E. Bretz, of Springfield, at $1.69 per sq. yd. for pavement and 55 cts. per lin. ft. for curb.

**Monticello, Ind.*—J. L. Ackerman, Co. Aud., writes that the contract for constructing gravel roads in Prairie Township (bids opened Dec. 3.) has been awarded to L. T. Kent, of Brookston, for $15,119.

**Logansport, Ind.*—The Comrs. of Case and Carroll counties are stated to have awarded the contract for constructing 7 miles of gravel roads to Daniel Mahoney for $20,650.

*The Comrs. are stated to have awarded contracts to build gravel roads in Cass County, as follows: McClain Road, in Washington Township, 2½ miles in length to Carney & Wilburn, $7,500; Nos. 1 and 3 divs. of the Briggs Road to Frank Justice, $4,809 and $3,373. respectively. No. 2 div. to Smith & Palmer, $2,650.

**Peru, Ind.*—Chas. Griswold, Co. Aud., writes that the contract for constructing 23½ miles of gravel road in Rockland Township (bids opened Dec. 7) has been awarded to Mees, Carney & Wilburn, of Logansport, for $37,622.

Georgetown, Ind.—The citizens are stated to have voted to construct the turnpike from Edwardsville to the Harrison County line, a distance of 7 miles, at an estimated cost of $18,000.

Columbus, Ind.—A petition is stated to have been filed with the Comrs. for the construction of a macadamized road in Hope township.

Knox, Ind.—It is stated that bids will be received until Jan. 10 by the Bd. Co. Comrs., for constructing 14 miles of gravel roads. Lee M. Ransbottom, Co. Aud.

Danville, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Jan. 6 for the construction of a gravel road, 14,598 ft. long, on the line between Center and Middle Townships. David S. Mills, Co. Aud.

Lebanon, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Jan. 6 for the construction of the

**Items marked thus give the names of parties awarded contracts.*

Martin gravel road in Clinton Township. Total length, 9,234 ft.

Terre Haute, Ind.—The improvement of Ohio St. from E. & T. H. Ry. to the eastern corporate limits is proposed by paving and parking same.

Logansport, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Jan. 6 for furnishing material and constructing a gravel road in Deer Creek Township. Geo. W. Cann, Co. Aud.

**Des Moines, Ia.*—The Bd. of Pub. Wks. on Dec. 6 is stated to have awarded the contract for paving W. Sixth, Seventh and Mulberry Sts. with creosoted wood block to J. W. Campbell for $19,000.

The following are reported to be the lowest bids opened for paving: Flint Brick Co., 10th St. with brick, at $2.15; W. A. Bryant & Sons Co., asphalt Eleventh St., at $2.15; The Hausman Co., brick on W. Sixteenth St. at $2. (Prices given per sq. yd.).

Baltimore, Md.—The lowest bid opened Dec. 4 by the Bd. of Award for paving with bitulithic 22d St. is stated to have been submitted by John L. Robertson, 9 E. Lexington St., cost $2.03 per sq. yd.

Cadillac, Mich.—Geo. Johnston, City Clk., writes that bids will be received on Dec. 17 for paving to cost about $45,000. Bids to be received on brick, bitulithic and concrete.

Manistee, Mich.—The Superv. of Manistee County have appropriated $17,740 for the grading and graveling of 10 1-2 miles of highway to be constructed under the county road system. E. W. Muenscher, Co. Engr.

Duluth, Minn.—The City Engineer is reported to have estimated the cost of regrading and paving 3d St. at $108,004.

**St. Paul, Minn.*—The Park Board is stated to have awarded the contract for grading Como Ave. to Ryan & Johnson at $2,850.

**Joplin, Mo.*—The contract for paving a portion of Joplin St. is reported to have been awarded to E. J. Overly, of Joplin, at $1.68 per sq. yd.

New Brunswick, N. J.—Bids will be received by the Bd. of Chosen Freeholders of Middlesex County (Frank H. Pownall, Dir.) until Dec. 27 for the construction of stone and gravel roads, according to plans on file in the office of Morgan F. Larson, County Engr., 121 Smith St., Perth Amboy, as advertised in The Engineering Record.

**Woodbury, N. J.*—J. E. Estell, City Clk., writes that the contract for paving with bitulithic 2,950 sq. yds. in S. Broad St. (bids opened Nov. 25) has been awarded to Standard Bitulithic Co., of New York, N. Y.

**Syracuse, N. Y.*—The Bd. of Contract and Supply is stated to have awarded contracts on Nov. 25 as follows: F. J. Baker, University Blk.—Court St. at $40,446. Central City Paving Co., Kirk Bldg.—Grape St. with asphalt, $8,620. Saml. Bonn, 654 Burnett Ave.—Solar St. with Syracuse block, $4,000. Hill & Van Wagner—Sidewalks on 1st Ave., 13 cts. per sq. ft. Albert Gaffey—Sidewalks on Emma St. at 12½ cts. per sq. ft. Salt City Paving Co.—Sidewalks on Walnut Ave., 11 9-10 cts. per sq. ft.

Bids for paving portions of *a* Salt St. and *b* Columbus Ave. are reported opened, as follows: Warner-Quinlan Asphalt Paving Co., *a* (2 bids), $4,203 and $4,254, *b* (4 bids), $2,962 to $3,365; Guy B. Dickinson, *a* (2 bids), $3,955 and $3,821, *b* (4 bids), $2,862 to $3,270.

**Syracuse, N. Y.*—The Stewart, Kerbaugh & Shanley Co., New York City, are stated to have secured the contract for constructing the following roads in Onondaga County: Fly Road, from Dewitt to Collamer, $21,598; Fabius Road, $45,282, and East Syracuse and Chittenango Road, $88,593.

Coxsackie, N. Y.—A resolution is reported to have been adopted by Bd. Supervisors providing for the building of a State road from Coxsackie through New Baltimore to the line of Greenville, surveys of which have been made. The road will be 5.14 miles in Coxsackie and .42 in New Baltimore. The cost of building the road is estimated at $52,600.

Buffalo, N. Y.—Separate bids will be received until Dec. 24 by Francis G. Ward, Comr. Pub. Wks., for paving portions of Oberlin St., repaving Franklin, Babcock, N. Division, and 15th Sts.

Albany, N. Y.—The following are reported to be additional bids opened recently by Frederick Skene, State Engr., for constructing roads: Road 539, Fulton-Volney, Chambers & Grady, Rochester, N. Y., $16,782; John H. Gordon, Albany, N. Y., $18,852; Stewart, Kerbaugh-Shanley Co., New York City, $17,765; Barnett Contracting Co., Oswego, N. Y., $16,850. Road 553, Fly Road—John H. Gordon, Albany, N. Y., $22,596; Stewart, Kerbaugh-Shanley Co., $21,539. Road 554, Fabius Road—Stewart, Kerbaugh-Shanley Co., $45,282. Road 555, East Syracuse-Chittenango—Stewart, Kerbaugh-Shanley Co., $88,593. Road 568, Milbrook-Lithgaw—General Constr. Co., Bridgeport, Conn., $37,416; Stewart, Kerbaugh-Shanley Co., $38,761; Saml. Beskin, Fishkill, N. Y., $37,398. Road 587, Mt. Kisco-Millwood—T. E. Vermilyea, New York City, $40,232; Wm. F. McCabe, White Plains, N. Y., $36,775; Frank J. Fowler Constr. Co., Mt. Kisco, N. Y., $41,011; Bellew & Merritt Co., Tuckahoe, N. Y., $36,841; Latta & Terry Constr. Co., Philadelphia, Pa., $63,969; Stewart, Kerbaugh-Shanley Co., $44,258. Road 595, Homer-Tully Section 2—Chambers & Grady, $43,327; Patrick A. Lillis, Troy, N. Y., $42,427; Stewart, Kerbaugh-Shanley Co., $43,764. Road 598, Norwich-Preston—Stewart, Kerbaugh-Shanley Co., $52,664. Road 607, Manchester-Clifton Springs—Mosier & Summers, Buffalo, N. Y., $27,159; Gantz-Wilson Constr. Co., $26,487; Chambers & Grady, $26,[illegible]. Road 566, Wolf Hill-Berne—Brown & Lowe, $6[illegible]; M. Krantrowitz, Albany, N. Y., $66,797; Jeremiah T. Finch, Glens Falls, N. Y., $67,425; Stewart, Kerbaugh-Shanley Co., $67,849. Road 608, Phelps-Clifton Springs—Gantz-Wilson Constr. Co., Buffalo, $14,975; Mosier & Summers, $15,278; Chambers & Grady, $15,400. [illegible] Washington Hollow-Milbrook—Stewart, Kerbaugh-Shanley Co., $13,648; General Constr. Co., $12,787; [illegible] Beskin, $12,776. Road 613, Catskill-South Cairo—[illegible] E. Consalus, $57,086; M. Kantrowitz, $57,138; [illegible], $59,072; Stewart, Kerbaugh-Shanley Co., [illegible]. Road 6[illegible], Geneseo-Avon—Stewart, Kerbaugh-[illegible] Co., $56,314. Road 643, North Tonawanda [illegible] Sections 1 and 2—Stewart, Kerbaugh-Shanley Co., $3[illegible]. Road 649, Hudson-Stottsville—Stewart, Kerbaugh-Shanley Co., $[illegible],932. Road 651, Clintonville-Keeseville—Jeremiah T. Finch, Glens Falls, N. Y., $55,750; Buckley Constr. Co., Plattsburg, N. Y., $55,764. Road 653, Granby Roads—Stewart, Kerbaugh-Shanley Co., $57,586. Road 657, Croton River-Peekskill—Bellew & Merritt Co., Tuckahoe, N. Y., $71,200; Wm. F. McCabe, White Plains, N. Y., $71,087; A. W. Canney, Croton, N. Y., $82,880; Stewart, Kerbaugh-Shanley Co., New York City $76,990. Road 660, Griswold-St. Bratts Bridge—Akron Constr. Co., Akron, N. Y., $65,551; Stewart, Kerbaugh-Shanley Co., $65,286. Road 674, Milford Center-Milford—Berkley Constr. Co., Plattsburg, N. Y., $70,547; J. K. Palmer & Co., Clearfield, Pa., $70,050; M. L. Seiver & Co., Sidney, N. Y., $76,016. Road 765, Otsego-Onconta—Buckley Constr. Co., $43,575; J. K. Palmer & Co., Clearfield, Pa., $43,179; M. L. Seiver & Co., Sidney, N. Y., $46,002. Road 676, Otsego-Wilsey's Cor.—M. L. Seiver & Co., $10,576; J. K. Palmer & Co., Clearfield, Pa., $17,038; S. B. Van Wagoner, Rondout, N. Y., $17,163. Road 677, Edmeston-West Burlington-Kelsey Cor.—M. L. Seiver & Co., Sidney, N. Y., $43,255. Road 678, Morris-Gilbertsville—M. L. Seiver & Co., $24,621; S. B. Van Wagoner, Rondout, N. Y., $24,577. Road 684, Cato-Meridan-Baldwinsville—Stewart, Kerbaugh-Shanley Co., $55,752.

Reading, O.—The City Council is stated to have approved plans for the resurfacing of the principal streets of the village.

Toledo, O.—The lowest bids opened Dec. 5 for constructing sidewalks by Bd. Pub. Service is stated to have been as follows: East District, cement, O. A. Schroeder, $1,796; stone, the Knopp Bros. Co., $6,282; South District, cement, J. H. Horen, $1,796; stone, C. Peck & Sons, $7,437; North District, cement, Chas. Neuendorf, $1,708; stone, C. Peck & Son, $6,262.

**Cincinnati, O.*—T. Strack, 518 Walnut St., is reported to have secured the contract for paving a portion of St. Lawrence St. for $9,686.

Bluffton, O.—It is stated that bids will be received until Dec. 21 by B. G. Biery, Village Clk., for $37,107 Main St. improvement bonds.

Youngstown, O.—See "Sewerage and Sewage Disposal."

Cleveland, O.—Bids will be received until Jan. 4 by the Bd. Co. Comrs. (Julius C. Dorn, Clk.) for grading, draining and paving Fisher and Dillie Roads. A. B. Lea, Co. Engr.

Pittsburg, Pa.—The City Council is reported to have passed an ordinance providing for the grading and paving of a portion of Howley St.

Chester, Pa.—The City Council is reported to have approved the ordinance providing for the paving of 2d St.

Norristown, Pa.—It is proposed to expend about $130,000 for street paving; material not yet decided upon. S. Cameron Corson, City Engr.

Pottsville, Pa.—Bids will be received until Dec. 26 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 3,300 ft. road in Pine Grove Township; also 22,800 ft. road in Wayne Township, both in Schuylkill Co.

Reading, Pa.—Bids will be received until Dec. 27 by Jos. W. Hunter, State Highway Comr., Harrisburg, for constructing 11,000 ft. road between Exeter and Amity Townships, Berks Co.

Dorranceton, Pa.—Bids will be received until Dec. 23 by the Town Council, for grading, curbing and paving a portion of James St. with U. S. creo-resinate wood block on concrete foundation; also Dorrance St., with vitrified fire clay paving block upon a concrete foundation.

Allentown, Pa.—The City Council is reported to have passed an ordinance providing for the paving of portions of Fulton and 12th Sts.

Dallas, Tex.—The City Secy. is reported to have been authorized to receive bids for bituminous paving with concrete base on a portion of Griffin St.

Salt Lake City, Utah.—Specifications are on file at the office of the The Engineering Record, 239 West 39th St., New York City, for the paving First South St. to consist of 60,000 cu. yd. grading, 17,000 lin. ft. curb and 41,000 sq. yd. of asphalt, and bids for this work will be received at the office of the Bd. of Pub. Wks. (F. J. Leonard, Chmn.) until Jan. 3, Louis C. Kelsey, City Engr.

Richmond, Va.—The Committee on Annexed Territory is stated to have decided to open and grade 34th St. from the old corporate lines to Oakwood Ave. at a cost of $25,000.

Tacoma, Wash.—The paving of St. Helens Ave. is reported contemplated.

Spokane, Wash.—Bids will be received until Dec. 23 by the Bd. Pub. Wks. (J. T. O'Brien, Secy.) for constructing a roadway across E. Sprague Ave., to consist of an earthen fill, with proper masonry, retaining walls, or of a concrete viaduct.

Seattle, Wash.—See "Water."

Seattle, Wash.—An ordinance has been passed providing for concrete walks on 33d Ave. N. W. to cost $4,191.

Neenah, Wis.—The Bd. Pub. Wks. is reported to be preparing plans for the paving of a portion of Wisconsin Ave. with brick.

Racine, Wis.—It is stated that bids will be received until Dec. 28 by the Bd. Pub. Wks. (P. H. Connolly, Chmn.), for grading and paving a portion of 5th St.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Oakland, Cal.—It is reported that the Great Western Power Co., of Richmond, Cal., has purchased property on Brooklyn basin, south of 5th Ave., in East Oakland, to be used as a site for a power plant.

South San Francisco, Cal.—The Bd. of Superv. at Redwood City, is stated to have granted a franchise to W. J. Martin, of the South San Francisco Land and Improv. Co. to erect poles and wires for furnishing electricity for power and light purposes in South San Francisco.

Monterey, Cal.—Bids will be received until Dec. 30 by John L. Clem, Ch. Q. M., U. S. A., at the Presidio of San Francisco, for furnishing and installing electric lighting fixtures in a double set of non-commissioned officers' quarters for sergeant 1st class hospital corps at the Presidio of Monterey.

Aguilar, Colo.—Hawkins & Barnett, of Pueblo, are reported to have secured an electric light franchise and will immediately commence construction of a $25,000 electric light and power plant. They will furnish light and power to several coal mines adjacent to Aguilar.

**Las Animas, Colo.*—C. L. de Muralt, 114 Liberty St., New York, N. Y., has secured the contract for constructing power plant for the U. S. Naval Hospital at (new) Ft. Lyon (bids opened Nov. 23) for $72,000.

**Glastonbury, Conn.*—The Glastonbury Power Co. is reported to have awarded contract for its entire plant to the Ley Constr. Co., of Springfield, Mass. The work of construction will begin early in the spring. The entire plant will cost about $200,000. The power-house will be equipped with one dynamo, also a spare one and will have at the beginning 3 water wheels and 3 generators. The whole equipment of the power-house will be capable of furnishing 1,300 h.-p., all by water. The power will be used partly for electric lighting on Main St., Glastonbury, Rocky Hill and Manchester. The company will run about 25 miles of primary line.

Dover, Del.—The city contemplates installing a 90-kw. generator in the municipal electric light plant. Harvey B. Roop, Mgr.

Jacksonville, Fla.—The following are reported to be the bids opened on Dec. 4 by the Bd. of Pub. Wks. for furnishing, complete, f. o. b. Jacksonville, one surface condenser, with separate circulating and vacuum pumps: Wheeler Condenser & Eng. Co., of Atlanta, Ga., $12,238; C. H. Wheeler Mfg. Co., of Philadelphia, Pa., $11,495; Alberger Condenser Co., of New York, N. Y., $9,890, or condenser with ¾-in. tubes instead of 1-in. tubes for $9,540; J. G. Christopher (2 bids), $10,792 and $10,000.

Lagrange, Ga.—The citizens are contemplating doubling the capacity of the municipal electric light plant, increasing the number of city lamps and making other extensions. J. R. Black is Supt.

Twin Falls, Idaho.—See "Water."

Pella, Ia.—Henry Rhynsberger and Walter Fowler, of Pella, are reported to have purchased the electric light plant and will make improvements to same.

Griswold, Ia.—Dan Eppelsheimer, City Clk., writes that the Griswold Light & Power Co., composed of R. C. Prather and J. M. McAvoy, both of Griswold, has received franchise for electric light plant; probable cost of plant proposed, $3,000.

Guthrie Center, Ia.—The Guthrie Center Electric Light Co. is planning to install another unit in its plant next year. C. T. Harney is Mgr.

Lecompte, La.—The Mayor and Bd. of Aldermen on Dec. 5 adopted the plans of C. Scott Yaeger, of Alexandria, for an electric light plant.

Lake Charles, La.—F. S. Price, of Hannibal, Mo., is reported interested in the construction of a gas plant.

**Kirksville, Mo.*—The Ft. Wayne Electric Wks., of Ft. Wayne, Ind., is reported to have secured the contract to install dynamos and other electrical machinery and equipment in the new power house.

Harlowton, Mont.—A. C. Graves and Benj. Turner are reported interested in the construction of water works and an electric light plant.

Pender, Neb.—The Village Board is reported to be considering a proposition from M. M. Neumann to install an electric light plant.

Omaha, Neb.—H. E. Babcock and F. Jaeggi are reported interested in the organization of a company which proposes to develop Loup River for power purposes. The cost of a 40,000 h. p. plant has been estimated by Geo. Sturtevant, 279 Dearborn St., Chicago, Ill., at $4,250,000.

Atlantic City, N. J.—Plans for the burial of overhead electric lighting wires in the city were submitted to City Council on Dec. 9 by the Electric Light and Power Co. It is proposed to start wire removal on the Boardwalk and place the entire system in conduits within two years. The operation will cost about $400,000. Council approved the plan and it is said that the company will probably receive a renewal of a 10-year contract to light the city.

**New York, N. Y.*—Comr. O'Brien, of the Dept. of Water Supply, Gas and Electricity, on Dec. 10 opened bids for supplying the city with electricity for 1908, and contracts were awarded as follows: To the Edison Electric Light & Power Co. and the New York Edison Co., for electric lights in Manhattan, the Westchester Lighting Co. in The Bronx, the Edison Electric Illuminating Co. in Brooklyn, the Queens Borough Gas & Electric Co. in Queens, and the Richmond Light & R. R. Co. in Richmond. The city's lighting bill for this year will amount to between $3,500,000 and $4,000,000. Electric arc lights will cost about the same this year as last. The city will pay $100 a lamp a year for 5,000 arc lights of 450 kilowatts. All lamps over that number, $95. When the city has 7,500 of these arc lights the cost will be $95 each. Incandescent lights will cost the same as this year—$22.50 a lamp a year. Current for public buildings for heat and other purposes wil lcost from 7½ to 10 cts., while power current will cost 6 cts. The only increase was in the cost of mantles for Queens.

**Dunkirk, N. Y.*—The Water Bd. on Dec. 2 awarded contract for connecting up condenser and doing necessary steam fitting at city's electric light plant to the John W. Danforth Co., of Buffalo, for $2,492.

Newburg Heights, O.—Bids will be received until Jan. 7 by P. S. Ruggles, Village Clk., for furnishing material and supplying this village with street lighting. Bids will be received as a whole or separately on material and labor.

Bergholz, O.—The Bergholz Electric Light & Power Co. is reported incorporated with a capital of $10,000 by E. Steinetz, James B. Marshall and others.

New Bremen, O.—It is stated that bids will be received until Dec. 30 by A. M. Steinbray, Village Clk., for $20,000 electric light bonds.

Anadarko, Okla.—The City Council is reported to be considering the question of issuing $75,000 bonds for improving the electric light plant and water works.

*Items marked thus give the names of parties awarded contracts.

Erie, Pa.—Bids were opened on Dec. 9 by City Council for lighting the city, and the Erie County Electric Co. secured the contract for lighting the city by electricity at $65.70 per lamp per year and the Erie Gas Co. for gas lighting for 5 years at 5 1-2 cts. per lamp per night.

Easton, Pa.—The Clymer Power Co. is reported incorporated to manufacture gas, electricity or heat. Leo S. Clymer and B. F. Feckenthal are the incorporators.

Mt. Pleasant, Tex.—The Mt. Pleasant Electric Co. contemplates installing a 75-kw. generator direct connected in its plant. C. S. Johnson is Supt.

Salt Lake City, Utah.—D. M. Griffiths, of Salt Lake City, is reported to have filed application to appropriate 10 cu. ft. of water per second from Stairs Gulch Creek, a branch of Big Cottonwood Creek. The power produced will be used for electric lighting and propelling machinery.

Colton, Wash.—The City Council has passed the ordinance granting the Idaho-Washington Light & Power Co., of Moscow, Idaho, a franchise to construct and operate an electric light plant in Colton.

Elkins, W. Va.—The Valley Improvement Co. (C. C. Bosworth, Supt.) will reorganize under the name of the Elkins Power Co. and will build an entirely new plant, reconstruct its lines, etc. The company has secured a new franchise for 50 years, and the city contract for street lighting has been extended for a term of 10 years. A new arc lighting system for street lighting will be installed as soon as the plant is ready to furnish the current. The present 1,100-volt, single-phase, 60-cycle system will be replaced with a 2,200-volt, 3-phase system.

**Minnedosa, Man.*—Jos. Barrett, 573 Dufferin St., Toronto, Ont., writes that the Minnedosa Power Co. has awarded to the Hydro-Electrical Constr. Co., of Toronto, Ont., the contract for constructing its plant at Minnedosa, for about $80,000.

Sherbrooke, Que.—F. J. Griffith, City Secy.-Treas., writes that Ross & Holgate, of Montreal, are preparing plans for an eletric light and power plant for Sherbrooke.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The Ocean Shore Ry. Co. has let a contract to Geo. Pratchner for grading its branch from the coast up Seattle Creek to Swanton, and there is every indication that this line will later be extended to the State Park.

**Jerseyville, Ill.*—The certificate of incorporation of the Improved Electric Ry. Co. is reported filed with a capital of $200,000. Directors: S. H. Bowman, S. L. Hill, Dr. A. A. Shobe, Wm. J. Herman and others.

Centralia, Ill.—The Centralia & Sandoval Ry. Co. is reported formed by the owners of the Centralia & Central City Traction Co., for the purpose of building a four-mile extension from the present terminus of the line to Sandoval, Ill. Construction work probably will begin about April 1. E. R. List, pres., and G. E. Hubbard, Gen. Engr. of the Centralia & Central City Traction Co.

Gillespie, Ill.—The Gillespie Electric R. R. is reported incorporated with a capital stock of $30,000 to construct and operate an electric railway in Macoupin County. Incorporators: J. M. Rodiner, H. T. Bycroft and R. H. Isaacs, of Gillespie.

Indianapolis, Ind.—It is reported that the Grand Central Traction Co. will soon be in the market for all kinds of material necessary for the construction of its line. The surveys and estimates have just been completed for this railway, which is to connect Indianapolis and Evansville. A branch line will also be built from Bloomington, Ill., to Terre Haute, Ind. W. Duncan, Ch. Engr.

Logansport, Ind.—The Ft. Wayne & Wabash Valley Traction is said to be asking for a franchise to lay a double track on Erie Avenue.

Frederick, Md.—T. J. King, of Washington, D. C., consulting engineer and superintendent of transportation of the Great Falls & Old Dominion Ry., is reported to be arranging for a preliminary survey for the proposed connecting line between that railway and the Washington, Frederick & Gettysburg Ry., now being built northward from Frederick. The survey for the line from Frederick to Great Falls, where it will connect with the Great Falls & Old Dominion Ry. will be run through Buckeystown and Park Mills, thence on the west side of Sugar Loaf Mountain to Deckerson Station, thence to the east of Beallsville, through Poolesville to Seneca and thence to Great Falls, a distance of 31 miles. At Great Falls it will be necessary to bridge the Potomac River to reach the present terminus of the Great Falls and Old Dominion Ry., which runs along the Virginia side of the river to Rosslyn, where it crosses to Washington.

Manitou, Minn.—It is reported that the Twin City Rapid Transit Co. (E. H. Scofield, Ch. Engr., Minneapolis) will electrify and operate that portion of the Minneapolis & St. Louis line between Manitou and Tonka Bay, Lake Minnetonka. The company will build a mile and a half of line from its present terminus at Excelsior to Manitou and will improve the mile and a half of the Minneapolis & St. Louis track from that point to Tonka Bay. There will be one station at Manitou and one at Wildhurst on the extension.

**Excelsior Springs, Mo.*—J. S. Berger is reported to have applied to the City Council for a franchise to build an electric railway to the Milwaukee depot.

Brooklyn, N. Y.—Chief Engr. Seaman, of the Public Service Comm., and Geo. S. Rice, Engr. of Subway Construction, are reported to be making alterations in plans for the construction of 4th Ave. subway to Coney Island; as soon as changes are completed, bids for construction will be called for by the Public Service Comm., office in Tribune Bldg., N. Y. City (Wm. R. Wilcox, Chmn.).

Patchogue, N. Y. The South Shore Traction Co., it is stated, has filed with the Secy. of State a certificate of extension of route, as follows: Beginning at the junction of Railroad Ave. with the westerly limits of the town of Brookhaven, thence east along Railroad Ave. to Blue Point Ave., thence south to the South Country road, and thence easterly to the west corporate limits of the village of Patchogue; also beginning at the intersection of Blue Point Ave. and the South Country road, in Brookhaven, thence easterly over private right-of-way to the corporate limits of the village of Patchogue.

Mineola, N. Y.—Application is stated to have been made to the Nassau County Supervisors by the New York & North Shore Traction Co., formerly the Mineola, Roslyn & Port Washington Traction Co., for a franchise to build an electric street railway on the North Hempstead and Flushing Turnpike at its intersection with the Middle Neck road.

Burlington, N. C.—A charter is stated to have been issued to the Burgrahaw Traction Co., of Burlington, which proposes to equip, operate and maintain a line of street railway in Burlington, Graham and Haw River. Capital, $250,000. Junius N. Harden, John M. Cook and J. W. Murray are said to be interested.

Lidgerwood, N. D.—E. A. and J. H. Movius are reported interested in a company which has been organized to construct an electric railway from Veblen to Lidgerwood. Capital, $500,000. Arrangements are now being made to survey the route, also estimate the cost of the road.

Findlay, O.—It is stated that an interurban line that will connect Prairie Depot with Bradner on the new extension of the Toledo, Fostoria & Findlay Ry. to Toledo, is being planned. M. R. Black, of Toledo, is taking the right of way.

Donora, Pa.—It is stated that bids will be received by the Donora & Eldora St. Ry. Co. (B. M. Hanna, Pres., 718 Pennsylvania Ave., Pittsburg), until Jan. 15, for constructing overhead line from Donora to Eldora.

Sayre, Pa.—Gov. Stuart, it is stated, has approved the extension of the line of the Sayre Ry. Co. from South and Loder Sts. in So. Waverly, Bradford County, along South and Fulton Sts. to the new station of the Delaware, Lackawanna & Western Ry.

South Bethlehem, Pa.—It is reported that the South Bethlehem & Saucon St. Ry. Co. has begun operations on its new line between South Bethlehem and Colesville, a distance of eight miles. Next spring the line will be extended from Colesville to Center Valley, where it will connect with the Philadelphia division of the Lehigh Valley Transit Co.

Erie, Pa.—It is stated that the Conneaut & Erie Traction Co. is planning to make a number of improvements on its line. All bad curves will be eliminated and some parts of the road will be re-ballasted. A. B. Nelson will have charge of the reconstruction work.

Johnstown, Pa.—The City Council, it is stated, has passed over Mayor Young's veto the ordinance granting the Johnstown Passenger Railway Company the right to operate in Morrellville.

Phoenixville, Pa.—The Philadelphia Interurban Railway Co. (Chas. H. Detwiler, Pres.), formerly the Roysersford St. Ry. Co., it is stated, has accepted the ordinance from the borough of Phoenixville, permitting the company to construct, maintain and operate an electric railway upon certain streets and avenues in Phoenixville.

Beaver Falls, Pa.—The Beaver Falls & Koppel Ry. and Beaver & Lawrence St. Ry. Co., it is reported, have been chartered in the Beaver County courts. The Beaver & Lawrence line begins in North Sewickley, just on the boundary between Beaver and Lawrence Counties, and will be built as far as Beaver Falls. The other system will extend from Beaver Falls to Koppel, a distance of about 10 miles. T. P. Simpson, S. L. Tone and others are the incorporators.

Colfax, Wash.—According to reports the line of the Inland Electric Ry. Co. will be extended from Colfax, its present terminus, to Walla Walla, in the near future. Jay P. Graves, of Spokane, Pres.

RAILROADS.

Notes Arranged Alphabetically by States.

Stockton, Cal.—The Southern Pacific R. R. Co. (Wm. Hood, Ch. Engr., San Francisco) is reported to have filed an application with the City Council for perimssion to install another track alongside of the main line through Stockton, and also for additional spurs at various points along the road.

Denver, Colo.—The Rock Island system is reported to be planning to enter Denver on its own tracks from Limon Junction, to build from Denver to Colorado Springs, and to secure terminal facilities at Denver. The surveys for the line to Colorado Springs have been completed. The engineering department is now engaged in locating a route into Denver from Limon and the company is engaged in taking options on land in Denver which can be used as terminals. A. T. Abbott, of Colorado Springs, Supt. Colorado Div.

Ft. Wayne, Ind.—The Bd. of Pub. Wks. is reported to have ordered plans and specifications and will soon ask for bids for the elevation of the tracks in Calhoun St.

Indianapolis, Ind.—A resolution to elevate tracks of Union Ry. Co. at E. Washington St. has been prepared and will be submitted to the Bd. of Pub. Wks. The plans approved by Blaine H. Miller, City Engr., provide that tracks shall be elevated 12 ft. above present grade of street and the street depressed 6 ft. There is to be a vertical clearance of 15 ft. 9 in. The plans provide for 4 railway tracks over the street.

Bartlesville, Ind. Ter.—The St. Louis, Bartlesville & Pacific R. R. Co. is reported formed and is surveyed to run west from Webb City, Mo., through Joplin and the Quapaw Reservation into Bartlesville, where it will deliver zinc ore, and on through the Osage Reservation to a connection with the Kansas City, Mexico & Orient R. R.. The new road will be practically a belt line and will connect at Webb City, the eastern terminus, with the Iron Mountain, Missouri Pacific and Frisco; with the Frisco at Joplin and the Kansas City Southern; will cross the Katy at Welch, the Iron Mountain at Delafare, the Katy and Santa Fe at Bartlesville, the Midland Valley at Pawhuska, and will have connection in Oklahoma with the Frisco at two points; crossing the main line of the Santa Fe at Ponca City and the Rock Island at Pond Creek. The shops and general offices are to be located at Bartlesville.

Huron, Mich.—The State R. R. Comn., at Madison, is reported to have granted the Lake Superior & Southern Ry. Co permission to issue bonds to the extent of $9,000,000. The company proposes to build a line from Huron to Champion.

St. Louis, Mo.—The Terminal Railroad Assoc. is reported to have notified the Municipal Bridge and Terminals Comn. of its intention to provide depot and yard facilities in practically the entire area between Ewing, Grand and Manchester Aves. on the north side of the Mill Creek Valley tracks. The improvements will cost about $4 000,000, including the viaduct, depot, etc.

Cleveland, O.—Bids will be received, it is stated, until Dec. 17 by A. R. Callow, Secy. Pub. Wks., for track special work, consisting of curves, switches, turnouts, etc., needed for track construction. The work involves finishing special work for 22 different places and separate bids will be received on the material for each place. Bidders will be required to name in their bids the place of delivering f. o. b. Cleveland of material for each job.

Ashland, O.—Jos. Ramsey, Jr., and associates are reported to have completed negotiations to buy the Ashland & Western R. R. from C. V. Davis, of Canton, O., which is to be consolidated with the Industrial R. R. of Lorain and the Lorain & Ashland, now owned by them. It is said that work will begin next spring in extensions, additional terminals and equipment, entailing an expenditure of $1,000,000.

Pittsburg, Pa.—Press reports state that at a meeting of the directors of the New York, Pittsburg & Chicago R. R. Co., in Pittsburg on Dec. 4, Jos. Ramsey, Jr., was elected president. This railroad is the short line from New York to Chicago through the State of Pennsylvania. It was also decided to send out five corps of engineers to revise the survey between this city and the summit of the Allegheny Mountains. This will be done in the early spring. The total distance on the New York, Pittsburg & Chicago to Sunbury, on the Susquehanna River is 193 miles, and if the Reading system is used from that point to New York the total distance from Pittsburg to New York will be 383 miles.

Janesville, Wis.—Plans are reported to be on foot for the extension of the Chicago & Lake Superior R. R. (B. L. Delamater, Pres., Cambridge, Wis.) between Cambridge and London, a distance of 4 miles, to Janesville, passing through Rockdale, Albion and Edgerton and making the total length of the road 29 miles. It is expected that the construction of the extension will begin in the spring.

Edmonton, Alta.—It is stated that bids are wanted until Dec. 23 for construction work for the Grand Trunk Pacific Ry., 120 miles west of Edmonton. B. B. Kelliher, Ch. Engr., Montreal, Que.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Selma, Ala.*—The contract to construct, including heating apparatus, plumbing, gas piping, electric conduits and wiring the U. S. Post Office at Selma (bids for which were opened recently at the office of the Superv. Archt., Washington, D. C.) has been awarded to the King Lumber Co. of Charlottsville, Va., at $108,775.

Washington, D. C.—Cramp & Co., Philadelphia, Pa., it is reported, submitted the lowest bid on the proposed addition to the mess hall for the U. S. Soldiers' Home, at Washington, at $25,000.

Pensacola, Fla.—The Bd. Co. Comrs. has decided to call an election to vote on the issuing of $75,000 bonds to erect a jail.

Chicago, Ill.—Bids will be received until Dec. 18 by John J. Hanberg, Comr. Pub. Wks., for furnishing material and erecting a 3-story and basement brick and stone police station at 39th St. and California Ave. Bids to be submitted on the following: Cut stone, iron work, plumbing, etc.; sheet metal, etc.; cell work, heating, electric work, etc. Also until Dec. 19 for erecting a 3-story and basement brick and stone police station at 75th St. and Jackson Ave. Bids to be submitted on work as given above.

**Lincoln, Ill.*—V. Johst & Sons, of Peoria, Ill., according to reports, have secured the contract for the erection of a gymnasium building at the asylum for feeble minded, at $19,974.

Terre Haute, Ind.—It is stated that bids will be received until Dec. 18 by the Co. Aud. for erecting a 3-story jail, to cost about $125,000. W. H. Floyd, Archt., 656½ Wabash Ave.

Auburn, Ind.—It is reported that plans have been prepared by C. H. Griffiths, of Ft. Wayne, Ind., for a $30,000 infirmary to be erected in Auburn.

It is stated that plans are being prepared for a Carnegie Library. Bids will be invited, according to reports, about Jan. 1.

Indianapolis, Ind.—The Bd. of Pub. Wks. is said to be preparing to receive bids for the furnishing and installation of a heating plant in the city hospital.

Brazil, Ind.—The taxpayers have petitioned the Commissioners to construct a new $200,000 court house in this city.

Kokomo, Ind.—The County Council, it is stated, has appropriated $10,000 additional, making $16,000, for the construction of an orphan home. Bids will be solicited, according to reports, as soon as modified plans are prepared.

Waldoboro, Me.—W. H. Glover, of Rockland, submitted the only bid Dec. 5 to the Superv. Archt. at Washington, D. C., for the construction, except plumbing, electric wiring and conduits) of the extension to the U. S. Post Office and Custom House at Waldoboro at $4.775.

Baltimore, Md.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Dec. 18 for iron window guards and gates for the U. S. Custom House, Baltimore.

Clinton, Mass.—The Town Hall is reported destroyed by fire.

Chicopee, Mass.—Mrs. Sarah E. Spaulding has bequeathed $20,000 to the city of Chicopee to erect a library.

Boston, Mass.—The following are reported to be the bids opened Dec. 6 by the Trus. of the Boston City Hospital for erecting an addition to the Relief Hospital in Haymarket Sq. and for plumbing, heating and electric

**Items marked thus give the names of parties awarded contracts.*

wiring the same. Construction—Mack & Moore, $45,900; Central Bldg. Co., $47,950; Henry A. Root, $41,738; McGahey & O'Connor, $40,421; Geo. W. Harvey Co., $41,970; Connors Bros. Co., $48,533; Mead, Mason & Co., $44,480; Whitcomb & Cavanagh, $41,240. Heating—Ingalls & Kendricken, $3,960; Alex. Duncan Co., $5,129; Albert B. Franklin, $4,037; Burkel & Co., $5,079; Pierce & Cox, $4,503; Lynch & Woodward, $4,629; Isaac Coffin Co., $4,410; J. J. Hurley & Co., $4,800; Huey Bros. & Co., $4,667. Plumbing—Bresnahan Bros., $3,852; John Manning, $4,030; Burkel & Co., $4,715; Pierce & Cox, $5,043; W. H. Mitchell & Son Co., $3,590; W. F. Arkinson & Co., $4,782; Robertson & Browning, $4,400; K. Palmer, $4,848; David Craig, $4,250. Electric wiring—J. W. Wilkinson & Son, $1,417; John R. Bowker, $1,459; T. T. Kelly & Co., $1,342.

Menominee, Mich.—It is stated that the Co. Bd. is considering the erection of a court house.

Detroit, Mich.—Bids will be received until Dec. 14 by Philip Breitmeyer, Comr. Parks and Boulevards, for erecting a shelter house on Belle Isle Park, just north of the aquarium. Mildner & Eisen, Archts., 1018 Hammond Bldg.

Fergus Falls, Minn.—The State Bd. of Control at St. Paul is said to be considering the location of two buildings at the State Insane Hospital Grounds at Fergus Falls. One building is to be a detention hospital, which is to cost $65,000, and the other a contagious ward, to cost $10,000. It is also proposed to erect an addition to the hospital kitchen and employees' dining room, which will cost $25,000.

Duluth, Minn.—E. H. Burnham & Co., of Chicago, Ill., it is stated, are preparing plans for remodeling and erecting additions to the Bd. of Trade Bldg.; probable cost, $100,000.

St. Louis, Mo.—The Directors of the St. Louis Coliseum Co., it is stated, have decided to have new steel used in the framework of the Coliseum to be erected at 13th and Locust, instead of using the steel framework of the old Coliseum. Plans are now being prepared by F. C. Bonsack, 8th and Locust Sts.

It is stated that an addition, costing $10,000, is to be erected to the Children's Home Society for Missouri. Dr. T. H. Hagerty, Secy.

Trenton, N. J.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 8 for the steam heating apparatus, etc., for U. S. Post Office and Court House and extension thereto at Trenton, as advertised in The Engineering Record.

Bids will be received until Jan. 9 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the plumbing and marble finish in toilet rooms, etc., for the U. S. Post Office and Court House building and extension thereto at Trenton.

Newark, N. J.—The Bd. of Freeholders Nov. 29 decided to have J. O'Rourke & Sons, 756 Broad St., modify plans for the House of Detention. The building is to cost about $25,000.

Jersey City, N. J.—Bids will be received until Dec. 23 by the Bd. Finance (Oliver H. Perry, Chmn.) for erecting a public bath at 14th and Erie Sts. Appropriation, $80,000. Geo. W. Van Arx, Archt., 15 Exchange Pl.

Brooklyn, N. Y.—Bids will be received until Dec. 24 by Theo. A. Bingham, Police Comr., New York City, for furnishing material, completing alterations, general repairs and improvements to the 49th, 54th, 59th and 62d Prect. Station Houses, Boro. Brooklyn, and the 74th Prect. Station House, Boro. Queens.

Ft. Wood, N. Y. H., N. Y.—Bids will be received by D. C. Burnell, Constr. Q. M., U. S. A., until Jan. 13 for the construction, including plumbing, heating, electric wiring and electric light fixtures for one double set of captains' quarters at this post, as advertised in The Engineering Record.

Bids will be received by Lieut. Wm. W. Bessell, Signal Corps, until Jan. 13, for the purchase and removal of 4 buildings at this post, as advertised in The Engineering Record.

Syracuse, N. Y.—The House of Providence, an orphan asylum west of this city for boys, under the direction of the Sisters of Charity of the Roman Catholic Church, is reported destroyed by fire, and it is stated will be replaced as soon as possible.

New York, N. Y.—Fire Comr. Lantry has filed plans for enlarging and modernizing the station houses of Engine Companies 17 and 37, at 91 Ludlow St. and 83 Lawrence St. The present wooden floors for the apparatus will be replaced with floors of steel and concrete. The improvements are to cost $38,000.

The Municipal Art Comn., it is reported, has approved designs for a building for dormitories for men and women for the City Poor Farm, on Staten Island, for a building for hospital nurses on Randall's Island; for a tuberculosis infirmary on Blackwell's Island, and for a building for the medical staff of the City Hospital on Blackwell's Island.

Cincinnati, O.—It is stated that bids will be received until Dec. 27 by the Bd. Co. Comrs. (Fred Dreibs, Clk.) for remodeling the steam heating building on Freeman Ave. Saml. Hannaford & Sons, Archts., Hulbert Blk.

**Cleveland, O.*—John Peirce, of New York, has secured the contract for the mechanical equipment (except elevators) at the U. S. Post Office, Custom House and Court House at Cleveland (bids for which were received Oct. 31 by the Superv. Archt. at Washington, D. C.), at $129,000.

Columbus Barracks, O.—Francis Bros., of Columbus, according to reports, submitted the lowest bid on Nov. 30 for erecting buildings at this post, as follows: Three new sets of officers' quarters, $49,590; quartermaster's storehouse, $11,891; wagon shed, $2,324.

East Liverpool, O.—Bids will be received until Jan. 17 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (complete of the U. S. Post Office at East Liverpool.

Akron, O.—It is reported that the erection of a city hall to cost about $125,000 is under consideration.

Portland, Ore.—The Bldg. Com. of the Council, it is reported, recommends the erection of a 4-story building for council and municipal court.

Pittsburg, Pa.—Andrew Carnegie, it is stated, has given this city $[illegible] with which to erect a library in the Homewood District at Lang and Hamilton Aves.

*W. J. [illegible] & Sons Co., Beechwood Boule., are stated to have secured the contract to erect the Carnegie Branch Library at Carson and S. 22d Sts., South Side.

**Danville, Pa.*—Mosier & Summers, of Buffalo, N. Y., it is reported, have secured the contract to erect the 3 buildings at the Hospital for the Insane, at $252,290. (Bids received Nov. 26.)

Uniontown, Pa.—The Governor has approved the site near Uniontown for the erection of a State Hospital for Injured Miners in the coal fields near Shamokin. An appropriation of $30,000 has been made for the structure.

**Mont Alto, Pa.*—Chas. W. Denny, of Philadelphia, it is stated, has a contract to build 40 frame cottages and 2 pavilions for the State Hospital for Consumptives at Mont Alto. The contract price is $56,368.

**Braddock, Pa.*—Geo. Moore, Pres. Bd. Mgrs. of the Braddock General Hospital, writes that the contract for erecting a building for the Braddock General Hospital (bids opened Dec. 6) has been awarded to The Geo. Hogg Co., of Braddock, for $29,500.

Homestead, Pa.—Bids will be received until Dec. 16 by And. Hill, Boro. Clk., for erecting a building at the garbage furnace, to be of concrete foundation, and steel frame covered with corrugated iron.

Allentown, Pa.—The following are reported to be the bids received Dec. 3 by the Co. Comrs. for erecting an addition to the jail: The Van Dorn Iron Wks., Cleveland, O. (3 bids), to erect the addition complete with the old locking system, for $142,000; including a new and improved locking system to be installed, $148,000; to build the jail alone, omitting the receiving buildings, $132,000. Robt. S. Rathbun, of Allentown, only for the construction of the building, $48,000.

Philadelphia, Pa.—Mayor Reyburn is reported to have decided to recommend to the Council the appropriating of $20,000 for the establishment of an aquarium at the Philadelphia Museum.

Columbia, S. C.—The City Council has adopted a resolution authorizing the Columbia Hospital Assoc. to place a first mortgage on their property, amounting to $30,000, said sum to be used to erect a public ward building at the hospital, plans for which have been prepared.

Big Springs, Tex.—The Co. Comrs., it is reported, have authorized the issue of $46,000 bonds for the erection of a jail.

Houston, Tex.—Bids will be received until Jan. 15 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (including plumbing, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at Houston.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—It is stated that bids will be received until Jan. 10 by J. W. Dorris, Chmn. Bldg. Com., for erecting a Y. M. C. A. Bldg.; probable cost, $60,000. Frost & Creighton, archts., 412 Fleming Blk.

**Los Angeles, Cal.*—The contract to erect a building at Main and 6th Sts., it is reported, has been awarded to W. P. Fuller & Co. at about $20,000.

San Francisco, Cal.—The Royal Insurance Co., of Liverpool, has decided to erect a 10-story Class A building on Pine and Sansome Sts.

Denver, Colo.—T. Robt. Wieger, 628 14th St., is said to be preparing plans for a summer hotel, to be erected by F. O. Stanley at Estes Park at a cost of $150,000.

Savannah, Ga.—A site has been purchased at Bull and Charlton Sts. on which it is proposed erecting a Masonic Temple. The Masonic Temple Assoc. has the matter in charge.

Boise, Idaho.—J. W. Smith, it is reported, has accepted plans prepared by A. Johnson, for a $12,000 livery stable.

Indianapolis, Ind.—Wm. B. Burford has filed plans for a 3-sory business building to be erected at 38 S. Meridian St. and cost $20,000.

**Terre Haute, Ind.*—It is reported that the contract to erect the Elks Lodge Bldg. has been secured by the Modern Constr. Co., of Terre Haute; estimated cost, $80,000.

Plans for the Y. W. C. A. building, to be erected on 7th St., it is reported have been completed by Foltz & Parker, of Indianapolis. The building will be constructed of light-colored brick and terra cotta and Indiana stone, 3 stories, with finished basement; estimated cost, $65,000.

Somerset, Ky.—The passenger station of the Cincinnati, New Orleans & Texas Pacific R. R. (F. Wrampelmeier, Res. Engr., Somerset), at Somerset, is reported destroyed by fire.

**Baltimore, Md.*—The Noel Constr. Co., McCulloh and Eutaw Sts., is reported to have secured the contract to erect a 5-story reinforced concrete and brick, 28x84-ft. building on Pratt St., for the United Railways Co., to cost $30,000.

Boston, Mass.—Clarence H. Blackall, 20 Beacon St., it is reported, is the archt. who is preparing plans for the $300,000 theatre to be erected at Pleasant and Eliot Sts. and Park Sq. for Winthrop Ames.

**Mt. Clemens, Mich.*—Geo. A. Slocum, of Mt. Clemens, it is stated, has received the general contract to erect the $25,000 addition to the Olympia baths. Thos. E. Mathewson, Pres.

**Bay City, Mich.*—The C. A. Moses Constr. Co., Commerce Bldg., Chicago, Ill., is reported to have secured the general contract to erect the 7-story hotel for the Wenonah Hotel Co., which is estimated to cost $150,000. Smith-Hinchman & Co., of Detroit, Mich., are the archts.

St. Paul, Minn.—Anton Weinholzer, former occupant of the Empire Theatre, which was recently destroyed by fire, it is stated, is considering the rebuilding of the building; probable cost, $25,000.

$335,000 of the $350,000 needed to erect the Y. M. C. A. building is reported secured.

**Minneapolis, Minn.*—R. B. Pelton, 418 Sixth St., it is stated has secured the general contract to erect the Transit Thresher Co. building at 2723 University Ave. S. E. It will be of brick and cut stone, 80x130 ft., with truss roof, and cost $14,000, and Pike & Cook, 416 S. Fifth St., are reported to have secured the general contract for repairing and rebuilding the 5-story brick warehouse lately damaged by fire at 428 First St. N. Cost about $24,000.

*A permit has been issued for an addition to the Soo line shops at 29th Ave. N. E. and Quincy St. Cost, $55,000. M. Schumacher, contractor; W. M. Kenyon, Guaranty Bldg., archt.

St. Louis, Mo.—See "Railroads."

Kenwood, Mo.—A. F. Haeussler, 514 Roe Bldg., St. Louis, is preparing plans for a 3-story clubhouse, to be erected at Kenwood, to cost about $250,000. Bids for construction will be received about Feb. 1.

**Omaha, Neb.*—The Forbes Green Constr. Co. is reported to have the contract to erect the Y. W. C. A. bldg. at 17th and St. Mary's Ave., which is to be 5 stories high and cost about $100,000. Thos. R. Kimball, McCague Bldg., is the archt.

Dover, N. H.—J. Edw. Richardson, Archt., 56 Grove St., has completed plans for rebuilding the American House, recently burned, and is ready for figures; probable cost, $20,000.

**Paterson, N. J.*—H. W. Mills & Co. are reported to have filed plans for a 3-story 25x100-ft. warehouse, to be erected at a cost of $15,000 and for which the David Henry Bldg. Co., 6 Smith St., has the contract.

Buffalo, N. Y.—Plans have been filed for a garage and private stable to be erected at 827 Delaware Ave. for Willis K. Jackson, at a cost of $12,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 12-story brick and stone store and loft building at 19 W. 21st St. for David Spero, cost $350,000, Robert D. Kahn, Archt.; 6-story brick and stone tenement and store at 66th St. and 2d Ave., for David Leuten, cost $48,000. Geo. F. Pelham, Archt.; 5-story brick and stone loft and stable building at 108th St. and 1st Ave. for Israel Lippman, cost $80,000, Chas. B. Meyers, Archt.; 2 3-story brick stores and dwellings at Westchester Ave. and 172d St. for Jos. J. Gleason, cost $20,000. B. Ebeling, Archt.

Pawnee, Okla.—Fire here Dec. 9, it is reported, destroyed a block of buildings, including the O. P. C. H. department store and the Globe Hotel.

Easton, Pa.—It is stated that bids will be received until Jan. 3 by A. A. Ritcher, Archt., Lebanon, for erecting a fireproof granite and concrete bank and office building, 32x158 ft., estimated to cost $180,000.

Homestead, Pa.—Emil Schmid, of Knoxville, is said to be preparing plans for a $30,000 hall building, to be erected on 5th Ave., Homestead, for the Eintracht Turn & Gesang Verein Society.

**Pittsburg, Pa.*—Jas. Stewart, Westinghouse Bldg., it is reported, has secured the contract to erect for the H. W. Oliver estate a 7-story fireproof building at Liberty and Oliver Aves.

Reading, Pa.—We are informed that the Hotel Reading Co. is being formed at Reading for the purpose of raising all the money required for a hotel not to exceed in cost $240,000. It is to be a popular subscription, with at least 200 stockholders. The organization will be effected Feb. 1, 1908, until which time no consideration will be given to plans or for the furnishing of material.

Wm. A. Fink, of Reading, is preparing plans for a 4-story brick store building, 60x230 ft., for Kline Bros.; cost, about $39,000.

J. O. Hatt & Co. will erect a 4-story factory to cost about $11,500. Architect, Wm. A. Fink, of Reading.

Philadelphia, Pa.—It is stated that plans have been completed by Edgar V. Seeler, Real Estate Trust Co. Bldg., for an 8-story printing house to be erected by the Curtis Publishing Co. at 6th, 7th, Walnut and Sansom Sts., at a cost of about $1,000,000.

West Chester, Pa.—Chas. Barton Keen, of Philadelphia, it is stated, has been chosen by the directors of the Y. M. C. A. to prepare plans for the proposed $25,000 building to be erected here in the near future.

Newport, R. I.—Ewing & Chappell, 345 5th Ave., New York, N. Y., are preparing plans for a Y. M. C. A. building to be erected at Newport.

West Rutland, Vt.—Noah LaRose, of Rutland, is reported to have secured the contract to erect a 1-story 50x24-ft. solid concrete depot for the Delaware & Hudson R. R. at West Rutland.

Spokane, Wash.—Cutter & Malmgren, Exchange Bldg., are said to be preparing plans for a 3-story brick hotel to be erected at Main Ave. and Division St. at a cost of $80,000.

Seattle, Wash.—Plans are being drawn, it is reported by A. Warren Gould, Arcade Bldg., for the complete remodeling of the MacDougal & Southwick store, on 1st Ave. and Columbia St.; probable cost, $15,000.

Martinsburg, W. Va.—Bids will be received until Jan. 15 by the Bldg. Com. (Lewis H. Thompson, Chmn.) for erecting a Y. M. C. A. Bldg. Plans and specifications can be obtained until Dec. 15.

Janesville, Wis.—Hilton & Sadler, it is stated, have completed plans for the 2-story 32x80-ft. brick hotel which is to be erected by the South Janesville Hotel Co., at a cost of $10,000.

Winnipeg, Man.—The Imperial Theatre Co., of Winnipeg, is reported incorporated by Thos. B. Campbell, prop. of the Mariaggi Hotel, Danl. Bruce Flagg, of Buffalo, N. Y., and others for the purpose of erecting a theatre on Notre Dame Ave.; capital, $100,000.

Lima, Peru.—Jose M. Mendoza, 530 Carabaya St., Lima, writes that it proposed to erect a market house here: Floor space, 30 meters by 40 meters, building to be divided in three sections; construction to be made of iron, steel and galvanized iron; building to be open on all sides and protected by iron fences which extend from the base to roof. Proposal must contain complete plans with details, specifications, list of material, weight of it and price of some, material placed on board steamer, New York. Material in such a way so as to be ready to be installed upon its arrival with all the holes ready to receive rivets, etc. Pieces marked, so any engineer following plans could erect building. Concerns wishing to undertake this work will submit bids at once.

Alameda, Sask.—The entire business section of the town is reported destroyed by fire.

**Items marked thus give the names of parties awarded contracts.*

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Enterprise, Ala.—The Baptist Congregation is said to be arranging to erect a church. Estimated cost, $16,000. Rev. A. G. Mosely, pastor.

Los Angeles, Cal.—F. M. Tylor, Laughlin Bldg., according to reports, has completed plans for a 17-room residence which is to be erected at Hollywood for R. E. Bowden.

Denver, Colo.—W. E. Fisher, Ferguson Bldg., it is stated, is having plans prepared for an apartment house, which H. K. Brown, of the J. F. Brown Investment Co., has announced that he intends erecting at Grant and 14th Sts.; probable cost, $75,000.

Chicago, Ill.—J. F. Knudson, 133 La Salle St., is preparing plans for an apartment house to be erected on Humboldt Boule. and No. Whipple St. for O. Kohlreth, to cost about $45,000.

Du Bois, Ill.—The members of the Roman Catholic Church, according to reports, propose erecting a new edifice costing about $30,000.

Gary, Ind.—It is reported that plans have been ordered for an edifice for the Episcopal Church to be erected in Gary. Bishop J. H. White, of Michigan City, has the matter in charge.

*Iowa City, Ia.—The contract to erect the residence for the president of the State Univ. of Iowa, it is reported, has been awarded to B. A. Wickham, of Iowa City, at about $18,000.

Eunice, La.—It is stated that the erection of a new edifice for the members of the Roman Catholic Church to cost about $20,000 is contemplated. Rev. Father La Roche, Pastor.

Covington, La.—See "Schools."

Annapolis, Md.—The contract for erecting a residence at Annapolis for Rear Admiral Knox, of the Naval Academy, has been awarded to E. D. Skipper, of Annapolis. Wyatt & Nolting, of Baltimore, are the archts.

Boston, Mass.—P. J. Cantwell, it is reported, will erect a 6-story $18,000 apartment house on Perry St. in Brookline.

Detroit, Mich.—Malcolmson & Higginbotham, Moffat Bldg., it is reported, have prepared plans for an edifice to be erected for the members of the North Congregational Church at Woodward and Blaine Aves. at an estimated cost of $50,000. Rev. Carl S. Jones, Pastor.

Minneapolis, Minn.—Chas. S. Pillsbury, according to reports, has announced that he intends erecting a $75,000 residence, at Ferndale, Lake Minnetonka, next spring. Plans are being prepared by Edwin H. Hewitt, 15 N. 4th St.

St. Paul, Minn.—It is stated that Frank P. Shepard is preparing to erect a 2-story brick residence on Dayton and Virginia Aves. to cost $16,000.

Greenwood, Miss.—The members of the First Baptist Church, it is reported, are arranging to erect a $20,000 edifice. Rev. S. S. E. Till, pastor.

St. Louis, Mo.—A. L. Beltinger is reported to have purchased a site on which it is proposed erecting a $16,000 residence.

Schenectady, N. Y.—The members of the African M. E. Church, it is reported, psopose erecting an edifice costing about $14,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: Two 6-story brick tenements at 149th St. and St. Ann's Ave. for Dacorn Realty Co., cost $100,000, Moore & Landseidel, Archts.; 5-story brick tenemnt at Arthur Ave. and 179th St. for John McNulty, cost $45,000, Chas. Schaefer, Jr., Archt.; 5-story brick tenement at Belmont Ave. and 181st St. for Levin & Sampson, cost $40,000, Goldner & Goldberg, Archts.; 5-story brick tenement at Bathgate Ave. and 182d St. for H. J. Schwarzler, cost $30,000, Chas. Schaefer, Archt.; five 4-story brick tenements at Southern Boule. and Freeman St. for John Leo, owner and archt., cost $75,000.

Philipsburg, Pa.—It is reported that the members of the Presbyterian Church are preparing to erect an edifice estimated to cost $20,000.

Oakland, Pa.—It is stated that plans are being prepared by G. H. Schwan, 326 4th Ave., Pittsburg, for a 3-story brick apartment house, to be built in Oakland by W. J. McCutcheon.

Philadelphia, Pa.—It is reported that the Richardson estate is planning the erection of a $300,000 apartment house at 1722 Walnut St.

Nashville, Tenn.—It is reported that plans have been prepared by Warner & Adkins, of Cincinnati, O., for an 8-story stone and brick apartment house to be erected at West End Ave. and Church St., to be known as Ellison Court and cost about $250,000. Geo. W. Wilson, of Cincinnati, O., is reported interested, and W. R. Ellison ,of Nashville, is the local representative.

Richmond, Va.—W. A. Chesterman, it is reported, is preparing to erect a $60,000 apartment house at W. Franklin and Harrison Sts.

Milwaukee, Wis.—It is reported that the members of the Baptist Church will erect a $35,000 edifice.

SCHOOLS.

Notes Arranged Alphabetically by States.

*North Birmingham (Birmingham P. O.), Ala.—The Southern Constr. Co., of Birmingham, is reported to have been awarded the contract for the erection of a high school at a cost of $25,000.

Conway, Ark.—J. J. Doyne, of Little Rock, Pres. State Normal School, writes that bids will be called for about Feb. 15 for the erection of a school at Conway, to cost about $40,000. Architect, C. L. Thompson, of Little Rock.

Oakland, Cal.—The Trus. of St. Mary's College, on Bway., it is stated, are contemplating the erection of 2 buildings, one 3 story, 60x160 ft. structure.

San Francisco, Cal.—The Bd. of Superv. has passed a resolution authorizing the construction of the Winfield School. Appropriation, $39,000.

Pueblo, Colo.—The School Bd. of Dist. No. 1, it is reported, is about to ask plans for a high school to cost about $150,000.

New Haven, Conn.—Bids will be received until Dec. 27 by the Bd. Educ. (G. T. Hewlett, Secy.) for erecting a school at 111 Greene St. Bids may be submitted as a whole or separately on the following: Carpentry, etc.; masonry; plumbing; gas fitting; ventilating and heating. Brown & Von Beren, archts., 865 Chapel St.

Washington, D. C.—Andrew Carnegie, it is stated, has given $50,000 to Howard Univ. to erect a library.

Atlanta, Ga.—Bids will be received by the Bd. of Educ. on Dec. 21 for the erection of the 5th Ward grammar school, to cost about $70,000. Architect, Haralson Bleckley, 619 Empire Bldg. Frank Orme, Chmn. Bldg. Com.

East St. Louis, Ill.—J. S. Pidgeon, Secy. Bd. of Educ., writes that Reister & Rubach, Insurance Bldg., are preparing plans for a new school.

Topeka, Kan.—Rice Hall at Washburn College, a 4-story structure, is reported destroyed by fire.

Covington, La.—The buildings at St. Joseph College, which included an academy, convent, monastery and church and which were recently destroyed by fire, it is reported, are to be replaced with brick and concrete structures.

Newtonville, Mass.—The lowest bids received Dec. 2 for erecting the Technical High School at Newtonville, it is stated, were as follows: Construction, C. T. Fellows, $252,546; plumbing, W. H. Mitchell & Son, Boston, $18,225; ventilating, C. H. Sanborn, $44,682. The electrical construction is to cost about $40,000.

Westfield, Mass.—The erection of an 8-room addition to the Walnut St. School, to cost $46,000, is reported contemplated.

Battle Creek, Mich.—It is stated that the erection of a high school, to cost about $250,000, is contemplated.

Minneapolis, Minn.—It is stated that bids are wanted until Dec. 31 for $441,000 school and $100,000 park improvement bonds. Danl. C. Brown, City Compt.

St. Paul, Minn.—The School Bd. has decided to ask the City Council to authorize the issue of $75,000 bonds to erect additions to the Hill, Ramsey, Hancock and Murray schools.

Quitman, Miss.—P. J. Krouse, of Meridian, has prepared plans for a brick school, and bids will be called for about Feb. 1. For further information address S. H. Terrall, of Quitman.

Saml. H. Terrall, Chmn. School Com., would like to correspond with bond buyers regarding sale of $12,500 school bonds.

Webster Grove, Mo.—Bids will be received until Jan. 2 by F. B. Miller, Secy. Bd. Dirs. of the School Dist., for $60,000 School bonds.

Chadron, Neb.—The members of St. Patrick's Church, it is reported, are planning the erection of a parochial school to cost $15,000.

Phillipsburg, N. J.—J. S. Rogers & Co., of Stanwick, N. J., are reported to have secured the contract to erect the 3-story brick and stone high school. Seymour and Paul A. Davis, 3d., of Philadelphia, Pa., are the archts.

Montclair, N. J.—The Bd. of Educ. on Dec. 3 decided to reject all bids recently received for erecting a school and to defer indefinitely entering into any further contracts for the erection of schools.

*Newark, N. J.—The Com. on Schoolhouses of the Bd. of Educ. Nov. 26 opened bids for erecting an addition to Warren St. School and for making alterations to present school building, and awarded contracts Nov. 30, as follows: Mason work, Jos. Oschwald, $44,543; work, Trivett & Walters Co., $20,236; painting work, Chas. Stopper, $1,214; roofing and metal work, Jacob Sternberg, $5,260; plumbing work, Jaehnig & Peoples, $4,817; electrical work, Browe Co., $1,784; heating and ventilating, David C. Seymour, $14,261; motor and motor wiring, General Electrical Equippers, $534; total, $103,409.

Far Rockaway, L. I., N. Y.—Prof. J. D. Sulsona, Director of the American Collegiate Inst., it is stated, intends erecting on Mott Ave. a 3-story brick, stone and steel school, lighted by gas and electricity and heated by steam; estimated cost, $75,000.

Lawrence, L. I., N. Y.—The Committee of Taxpayers representing Inwood, Lawrence and Cedarhurst, to confer with the Bd. of Educ. of Union Free School Dist. No. 15 on the proposition to assess the district for $75,000 for the purpose of repairing and enlarging the Lawrence High School, has decided that the building is too old to spend so much money on and will report at a special meeting of the school district on Dec. 17 that it approves a proposition to sell the present high school property in Central Ave. and to purchase a new site at some point north of the railroad tracks on which to erect a new and modern brick and stone building.

Weedsport, N. Y.—J. Mills Platt, 921 Chamber of Commerce Bldg., Rochester, is completing plans for a district high school to be erected at Weedsport, to cost $30,000.

Poughkeepsie, N. Y.—Ewing & Chappell, 345 5th Ave., N. Y. City, are preparing plans for a 3-story chemical laboratory for Vassar College.

Greensboro, N. C.—J. I. Faust, Pres. State Normal & Industrial College, writes that C. C. Hook, of Charlotte, is preparing plans for a science building to cost about $50,000.

Cincinnati, O.—It is reported that a donation of $250,000 has been made to the Hebrew Union College (Isaac Broom, Secy.) for the erection of a building.

Edw. H. Dornette, Pickering Bldg., it is stated, has been authorized to prepare plans for an annex to the 22d Dist. School, cost not to exceed $45,000.

Madisonville, O.—Plans and specifications will be received until Jan. 6 by the Bd. Educ. (J. F. Klein, Clk.) for a school to be erected here at a cost of $100,000.

Lorain, O.—It is stated that bids will be received until Dec. 23 by E. Bruell, Clk., Bd. Educ., 1730 Penfield Ave., for erecting fire escapes on schools.

Tulsa ,Okla.—A. Grant Evans, Pres. Henry Kendall College, writes that W. Avelett Cann, 1023 Missouri Trust Bldg., St. Louis, Mos., is preparing plans for the proposed buildings for the college. The first building will cost $35,000.

Newport, R. I.—The citizens, it is stated, have authorized the appropriation of $50,000 to erect a school for the children of the lower grades.

Richmond, Va.—Bids will be received until Jan. 20 by the Chmn. School Bd. for erecting a high school. Chas. K. Bryant, Archt., 1014 E. Main St.

Milwaukee, Wis.—It is stated that bids will soon be asked by F. M. Harbach, Secy. School Bd., for erecting the 10th Dist. School, and as soon as alterations are completed in the plans for the 11th Dist. School new bids will be asked.

Edgerton, Wis.—It is stated that all bids recently received for erecting the Florence Childs Memorial High School have been rejected, as they were too high. The plans are being revised and new bids will be asked. Appropriation, $40,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Montbrook, Fla.—We are informed that the Florida Lumber Co., of Monthrook, will erect its own plant, but is in the market for one 150-h.-p. plain balanced valve engine. Architect, J. M. Parker, of Floral City, Fla.

Danville, Ill.—J. Scully, of Chicago, Ill., is reported to have secured a site near the plant of the Danville Car Co., on which he intends erecting a plant, to cost $150,000. J. O. Gordon, of the firm of Gordon & Ganor, contractors of Danville, is reported interested.

Jersey City, N. J.—Jabez Burns & Sons, dealers in machinery at 542 Greenwich St., N. Y. City, according to reports, will erect a $50,000 2-story factory building, 157x275 ft. at Claremont Ave. and Halsey St., for which Architect John T. Rowland, Jr., 15 Exchange Pl., Jersey City, has prepared plans. It is reported that no awards have yet been made.

Marinette, Wis.—The Pike River Granite Co., now located at Amberg, it is reported, intends removing its plant to Marinette.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Troy, N. Y.—Bids will be received until Dec. 17 by Bd. Conrtact & Supply (Jas. M. Riley, Clk.) for the following for the year 1908: Furnishing necessary grounds for dumping garbage, ashes, loose stones, street dirt, filth and rubbish collected by carters in 15th, 16th and 17th Wards; labor and services required in sweeping, cleaning and caring for public streets, avenues, alleys and highways; labor, services and teams required in removing garbage, street dirt and other refuse from the streets, avenues, alleys, highways and public places, and removing silt from catchbasins and silt and other deposits from public sewers.

New York, N. Y.—Bids will be received until Dec. 18 (readvertisement) by Foster Crowell, Comr. St. Cleaning, for furnishing material and removing the snow and ice in the Boros. of Manhattan and Bronx for the period ending April 15, 1908.

*Brooklyn, N. Y.—The Bd. of Estimate of N. Y. City on Dec. 6 awarded contracts for removal of snow in Brooklyn Boro. to Hugh Starr, 208 Bay 8th St.; Chas. Cranford, Foster Ave. and Bracken-MacAveney Co., foot of 6th St. (bids opened Dec. 2).

East Liverpool, O.—The question of constructing a garbage reduction plant is reported under consideration here.

Pittsburg, Pa.—Rudolph Hering, of New York, N. Y., is reported to have been selected to prepare plans for collection and disposal of ashes, rubbish, etc. Dr. J. F. Edwards, Supt. Bureau of Health.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Woodland, Cal.—State Engineer Ellery, of Sacramento, is stated to have submitted to Governor Gillett plans for closing the Kripp break in the levee on the Yolo side of the Sacramento River. Engineer Ellery estimates the expenditure at about $8,000, half of which to be paid by the property owners and Yolo County, the balance by the State.

San Francisco, Cal.—The Mercer-Frazer Co. is reported to have submitted the lowest bid to the Bd. of Harbor Comrs. on Nov. 29 for the construction of a wharf on Illinois St. for $56,786. The lowest bid received, same time and place, for laying new rails for Belt Line R. R. was submitted by Flynn & Treacy, for $7,905.

The Bd. of Harbor Comrs. is reported to have completed plans for harbor improvements under the first $2,000,000 bond issue authorized by State Legislature. The improvements as projected will consist of 2 sections of sea wall and 7 large concrete piers. The work is to be done in the vicinity of the mail dock.

Washington, D. C.—Bids will be received by Maj. Spencer Cosby, Corps Engrs., U. S. A., Washington, until Jan. 11 for dredging in Rappahannock River, Va., as advertised in The Engineering Record.

Havana, Ill.—Press reports state that plans are being considered for the improvement of the Spring Lake Drainage Dist.; it will be necessary to construct 15 miles of levee along Illinois River, dig 50 miles of ditches inside of district and erect a pumping station; it is also planned to build a lock at the lower end of the district.

Ft. Wayne, Ind.—W. H. L. Weber, Ch. Engr. of the Ft. Wayne & Wabash Valley Traction Co. is reported to be preparing plans for the improvement of Robison Park. A new combined concrete dam and bridge will be constructed in St. Joe River, also 3 new aqueducts

*Items marked thus give the names of parties awarded contracts.

Princeton, Ind.—The Comrs. of Gibson and Posey Counties are reported to be preparing to ask for bids for the construction of a ditch 75 miles in length; estimated cost $75,000.

Evansville, Ind. The Comrs.* of Vanderburg County are reported to have decided to construct a large drain in Knights Township. Harry Stinson, Co. Aud.

Danville, Ind. A petition is reported to have been filed with the Comrs. of Hendricks County for the construction of a tile ditch, known as the Lee and Hogan ditch.

Columbus, Ind.—The Comrs. of Bartholomew County are reported to have ordered plans and specifications prepared for the construction of a drain in Columbus Township.

Mt. Vernon, Ind.—It is stated that bids will be received until Dec. 20 by the Co. Drainage Comrs., for constructing a ditch and drain.

Anderson, Ind.—It is stated that bids will be received until Dec. 28 by Edwin J. Wilcox, Supt. Constr., for constructing the Chas. Baxter tile ditch.

Estherville, Ia.—Bids will be received, it is stated, by R. J. Ridley, Co. Aud., until Jan. 16, for constructing county drain No. 24.

Jefferson, Ia.—Bids will be received until Dec. 27 by E. S. Gose, Co. Aud. Jefferson, for furnishing material and constructing county drains No. 33 and 10. C. P. Walker, Chmn. Bd. Superv.

Boston, Mass.—Rear Admiral Wm. S. Cowles, Chf. of the Bureau of Equipment for the Navy, in his annual report asks an appropriation of $100,000 for the installation of three chain-making machines at the Boston Navy Yard; also for a building for use as a wireless telegraph station, $5,000; tower on coaling plant and system of fire protection improved, cost $40,000; installation of efficient water system for fire protection of ropewalk, $10,000.

St. Louis, Mo.—See "Railroads."

Ada, Minn.—It is stated that D. E. Fulton, Co. Aud., will receive bids until Dec. 20 for constructing Ditch No. 33; probable cost, $12,096.

Aitkin, Minn.—It is stated that bids will be received until Jan. 7 by Fred Stearns, Co. Aud., for constructing Ditch No. 4.

Minneapolis, Minn.—See "Schools."

New Jersey.—In his estimates of appropriations needed for the year ending June 30, 1909, and which Congress is expected to appropriate at the present session, Secy. of the Treasury Cortelyou asks for the following amounts for New Jersey: For improving Passaic River, $100,000; for completion of improvements to public building at Trenton, $25,000; for various improvements at Sandy Hook proving grounds, $175,700; for improving Arthur Kill, $100,000; for completing the improvements at Cold Spring Inlet, with a view to securing a depth of 25 ft., $900,000, and for improving Delaware River, $50,000.

Canton, N. Y.—H. M. Townsley, Engr. Indian Creek Drainage Comn., writes that all bids opened on Dec. 6 for widening and deepening Van Rensselaer ditch have been rejected, and new bids will be called for.

Brooklyn, N. Y.—Press reports state that new bids will be received by the Bureau of Yards and Docks at Washington, D. C., until Jan. 18, for the completion of the new dry dock at the Brooklyn Navy Yard, Contract No. 4.

Long Island City, L. I., N. Y.—Dock Comr. J. A. Bensel, of N. Y. City, is reported to favor the construction of a public dock at foot of Nott Ave. in the Hunter's Point section.

Albany, N. Y.—Press reports state that at a recent meeting of the advisory board of consulting engineers in charge of the barge canal work it was voted to recommend to the State Canal Board the building of a harbor near Lockport, to cost between $50,000 and $100,000. The board also discussed the proposed work on the Champlain Canal and the Erie Canal near St. Johnsville.

At a recent conference of the State Barge Canal engineers, held in Albany, it was decided that the route of the canal will follow through Genesee Valley Park in Rochester. Contract drawings will be prepared and bids for construction will be received during the year 1908.

It is stated that contract No. 9 of the barge canal near Medina will probably be awarded within the next two months.

The Advisory Board of Consulting Engineers in charge of the barge canal work is reported to have decided to recommend to the State Canal Board that the dam over Oswego River at Phoenix be a fixed, circular dam, with openings admitting two gates, each 9 ft. deep and 40 ft. wide. The new dam will cost about $50,000. The height of it will govern the water surface for about 30 miles.

Wilmington, N. C.—Bids will be received by Capt. Earl I. Brown, Corps Engrs. U. S. A., until Jan. 10 for two 6-pocket bottom dump scows, as advertised in The Engineering Record.

Portsmouth, O.—It is stated that Filmore Musser, City Aud., will receive bids until Dec. 27 for $20,000 Kendal Ave. subway bonds.

**Cincinnati, O.*—The Bd. of Pub. Service is reported to have on Dec. 6 awarded to C. H. Glandorf, 8th and Plum Sts., the contract for building a retaining wall and restoring street at McMicken Ave. and Borden St. for $7,070, and to Edw. Meier, 3846 Colerain Ave., for retaining walls on Duckcreek Road for $2,876.

Panama.—Bids will be received until Jan. 2 by Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing steam gauges, valves, inspirators, sight-feed lubricators, injectors, etc., and repair parts for above fittings, as per circular, No. 407.

The Secretary of the U. S. Treasury at Washington, D. C., has accepted bids for the Panama Canal bonds to the amount of $2[illegible].

**Ottawa, Ont.*—The Dept. of Rys. and Canals is reported to have awarded contract for Sect. 1 of the Ontario-Rice Lake division of the Trent Canal to Lewis P. Nott, of Montreal, Que.

PROPOSALS OPEN.

For Proposals see pages 62, 63 and 64.

WATER.

Bids Close.		See Eng. Record.
Dec. 17.	**Water supply improv., etc. Camden, N. J. Adv. Oct. 12, 19**	**Oct. 12**
Dec. 17.	Well, McComb City, Miss.	Dec. 7
Dec. 18.	Gate vaults, New York, N. Y.	Dec. 14
Dec. 18.	C. i. pipe, etc., Baltimore, Md.	Dec. 14
Dec. 19.	Cisterns, Ft. Dade, Fla.	Nov. 30
Dec. 21.	Electric pumps, Hamilton, Ont.	Dec. 7
Dec. 27.	Water wks., Sauk Rapids, Minn.	Dec. 14
Jan. 1.	Reservoir, Norway, Me.	Nov. 16
Jan. 1.	Piping, Orange, N. J.	Dec. 14
Jan. 2.	Machinery for well, Winnipeg, Man.	Dec. 14
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
Jan. 10.	Laying pipe, Phoenix, Ariz. Adv. Dec. 14.	Dec. 14
Jan. 15.	Pipe, Winnipeg, Man.	Nov. 30
Jan. 17.	Air compressor, Aurora, Ill.	Nov. 30
Feb. 1.	Water works, Las Animas, Colo.	Dec. 14
Apr. 1.	Water wks., Worthington, O.	Dec. 14

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 17.	Louisville, Ky. Adv. Nov. 23 to Dec. 7.	Nov. 23
Dec. 17.	Troy, N. Y.	Dec. 14
Dec. 18.	Springfield, O. Adv. Nov. 30, Dec. 7	Nov. 30
Dec. 19.	Wapello, Ia.	Nov. 16
Dec. 19.	New Rochelle, N. Y.	Dec. 14
Dec. 21.	Santa Monica, Cal.	Nov. 23
Dec. 28.	Evansville, Ind.	Dec. 7
Dec. —.	Ventura, Cal.	Nov. 2
Dec. —.	South Bend, Ind.	Nov. 23
Jan. 3.	Salt Lake City, Utah	Dec. 14
Jan. 6.	Durango, Colo. Adv. Dec. 14.	Dec. 14
Jan. 15.	**Manila, P. I. Adv. Oct. 26 to Nov. 16.**	**Oct. 26**
Jan. 15.	Santa Monica, Cal.	Dec. 7
Jan. —.	Lexington, Ky.	Nov. 30

BRIDGES.

Dec. 16.	Sale of superstructure, Hartford, Conn. Adv. Dec. 7, 14	Dec. 7
Dec. 17.	Philadelphia, Pa.	Nov. 23
Dec. 17.	Dayton, O.	Dec. 7
Dec. 18.	Lafayette, Ind. Adv. Dec. 7	Dec. 7
Dec. 19.	Doniphan, Mo.	Dec. 14
Dec. 20.	Red Wing, Minn.	Dec. 7
Dec. 20.	Guymon, Okla.	Dec. 14
Dec. 23.	Spokane, Wash.	Dec. 14
Dec. 24.	Greefield, Ind.	Dec. 14
Dec. 27.	Baltimore, Md.	Dec. 14
Dec. 28.	Randolph, Kan.	Dec. 14
Dec. 30.	Kings Ferry, Ga.	Dec. 14
Dec. 31.	**Canton, China. Adv. Oct. 26, Nov. 2.**	**Oct. 26**
Dec. 31.	Victoria, B. C.	Dec. 14
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 1.	Topeka, Kan.	Nov. 30
Jan. 2.	New Orleans, La.	Dec. 7
Jan. 2.	Madison, Ark.	Dec. 14
Jan. 2.	Grants Pass, Ore	Dec. 14
Jan. 6.	Colfax, La.	Dec. 7
Jan. 6.	Ft. Monroe, Va. Adv. Dec. 7, 14.	Dec. 7
Jan. 6.	Hammond, Ind.	Dec. 14
Jan. 7.	Wilmington, N. C. Adv. Nov. 16 to Dec. 14.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16
Jan. 8.	Waseca, Minn.	Dec. 14
Jan. 15.	Fremont, Neb.	Dec. 14
Feb. 1.	St. Charles, Mo.	Dec. 14
Mar. 1.	South Bend, Ind.	Dec. 7

PAVING AND ROAD MAKING.

Dec. 17.	Providence, La.	Nov. 23
Dec. 17.	Cadillac, Mich.	Dec. 14
Dec. 20.	Washington, Pa.	Nov. 30
Dec. 23.	Creede, Colo.	Dec. 7
Dec. 23.	Spokane, Wash.	Dec. 14
Dec. 23.	Dorranceton, Pa.	Dec. 14
Dec. 24.	Buffalo, N. Y.	Dec. 14
Dec. 26.	Pottsville, Pa.	Dec. 14
Dec. 27.	New Brunswick, N. J. Adv. Dec. 14	Dec. 14
Dec. 27.	Reading, Pa.	Dec. 14
Dec. 28.	Racine, Wis.	Dec. 14
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 2.	Ridgefield, Conn.	Dec. 7
Jan. 2.	Little Rock, Ark.	Dec. 14
Jan. 3.	Salt Lake City, Utah. Adv. Oct. 10 to Nov. 9 and 30, Dec. 7.	Oct. 19
Jan. 4.	Cleveland, O.	Dec. 14
Jan. 6.	Logansport, Ind.	Dec. 14
Jan. 6.	Lebanon, Ind.	Dec. 14
Jan. 6.	Danville, Ind.	Dec. 14
Jan. 10.	Knox, Ind.	Dec. 14
Jan. —.	Jackson, Mich.	Nov. 23
Feb. 4.	Brick paving, Billings, Mont. Adv. Nov. 23, 30, Dec. 14.	Nov. 23
Feb. 4.	Macadam, Billings, Mont. Adv. Nov. 23, 30, Dec. 14.	Nov. 23
Feb. 15.	Santa Monica, Cal.	Dec. 7

POWER PLANTS, GAS AND ELECTRICITY.

Dec. 17.	Washington, D. C.	Nov. 30
Dec. 20.	Lafayette, Ind. Adv. Nov. 23, 30	Nov. 23
Dec. 20.	Ft. Worth, Tex. Adv. Nov. 30, Dec. 7	Nov. 30
Dec. 20.	Ashville, O.	Nov. 30
Dec. 21.	Chinook, Mont.	Nov. 16
Dec. 23.	Panama	Nov. 30
Dec. 30.	Monterey, Cal.	Dec. 14
Jan. 7.	Newburg Heights, O.	Dec. 14
Jan. 15.	Washington, D. C. Adv. Dec. 7, 14	Dec. 7
Feb. —.	Lagrange, Ga.	Nov. 30

BUILDINGS.

Dec. 16.	Lodge bldg. for U. S. Cemetery, Greenville, Tenn. Adv. Dec. 7, 14	Dec. 7
Dec. 16.	Pub. bldg., Homestead, Pa	Dec. 14
Dec. 17.	Exten. to post office, Detroit, Mich.	Nov. 2
Dec. 17.	School, Pawnee, Okla.	Nov. 16
Dec. 17.	Pub. bldg., Detroit, Mich.	Dec. 14
Dec. 18.	Tunnel to htg. pub. bldg., Madison, Wis.	Nov. 9
Dec. 18.	Guards and gates for U. S. bldg., Baltimore, Md.	Dec. 14
Dec. 18.	Jail, Terre Haute, Ind.	Dec. 14
Dec. 18.	Pub. bldg., Chicago, Ill.	Dec. 14
Dec. 19.	Pub. bldg., Ocala, Fla. Adv. Nov. 16-23.	Nov. 16
Dec. 19.	School, Dayton, Ohio	Nov. 30
Dec. 19.	Pub. bldg., Chicago, Ill.	Dec. 14
Dec. 20.	Htg. post office bldg., Ft. Worth, Tex. Adv. Nov. 30, Dec. 7.	Nov. 30
Dec. 21	Plumbing at post office bldg, Ft. Worth, Tex.	Nov. 30
Dec. 21.	Htg. court house, Yougstown, O.	Nov. 30
Dec. 21.	School, Atlanta, Ga.	Dec. 14
Dec. 23.	Post office, Ann Arbor, Mich.	Nov. 9
Dec. 23.	Post bldgs., Ft. Des Moines, Ia. Adv. Nov. 30 to Dec. 14.	Nov. 30
Dec. 23.	Church, Tipton, Ind.	Dec. 7
Dec. 23.	Pub. bldg., Jersey City, N. J.	Dec. 14
Dec. 23.	Fire escapes on School, Lorain, O.	Dec. 14
Dec. 24.	Station house improv., Brooklyn, N. Y.	Dec. 14
Dec. 27.	Pub. bldg., San Francisco, Cal.	Dec. 7
Dec. 27.	School, Hallock, Minn.	Dec. 7
Dec. 27.	School, Tulalip, Wash.	Nov. 30
Dec. 27.	Htg. armory, Cincinnati, O.	Dec. 14
Dec. 27.	School, New Haven, Conn.	Dec. 14
Dec. 30.	Post office, Lancaster, Pa.	Nov. 16
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. —.	**Industrial plants, Ft. William, Ont.**	**May 11**
Dec. —.	**School, Anderson, Ind.**	**Sep. 28**
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Dec. —.	Bath houses, Toronto, Ont.	Nov. 23
Dec. —.	Y. M. C. A. bldg., Plattsburg, N. Y.	Nov. 30
Jan. 1.	Dwellings, Greenville, Pa.	Nov. 30
Jan. 1.	School, Paris, Ill.	Nov. 30
Jan. 2.	Pub. bldg., Flint, Mich.	Nov. 23
Jan. 2.	Post office, South Bend, Ind.	Nov. 16
Jan. 3.	Post office bldg., Albuquerque, N. M. Adv. Nov. 23, 30.	Nov. 23
Jan. 3.	Library, Oklahoma City, Okla.	Dec. 7
Jan. 3.	Bank, Easton, Pa.	Dec. 14
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 6.	Post office exten., Wichita, Kan.	Nov. 23
Jan. 6.	School, Cincinnati, O. Adv. Nov. 30 to Dec. 14.	Nov. 30
Jan. 6.	School plans, Madisonville, O.	Dec. 14
Jan. 7.	Add. to school, Slayton, Minn.	Nov. 23
Jan. 7.	Laboratory, Washington D. C.	Dec. 7
Jan. 8.	Htg., etc., Post Office bldg., Trenton, N. J. Adv. Dec. 14	Dec. 14
Jan. 8.	Schools, Colville, Wash.	Nov. 30
Jan. 9.	Plumb., etc., Post Office, Trenton, N. J.	Dec. 14
Jan. 10.	School, Cheyenne, S. D.	Nov. 30
Jan. 10.	Schools, Colma Sta., Wis.	Dec. 7
Jan. 10.	Y. M. C. A. bldg., Phoenix, Ariz.	Dec. 14
Jan. 11.	School, Ft. Smith, Ark.	Dec. 7
Jan. 13.	Post bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14	Dec. 14
Jan. 13.	Sale and removal of bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14	Dec. 14
Jan. 14.	Light station, Alaska. Adv. Nov. 23 to Dec. 14.	Nov. 23
Jan. 14.	Indus. plant, Oxford, Md.	Nov. 23
Jan. 14.	Post Office, York, Neb. Adv. Dec. 7, 14.	Dec. 7
Jan. 15.	Church, Pemberville, O.	Nov. 30
Jan. 15.	School, Winnebago, Neb.	Dec. 7
Jan. 15.	Pub. bldg., Chicago, Ill.	Dec. 7
Jan. 15.	Heating Capitol, Washington, D. C. Adv. Dec. 7, 14.	Dec. 7
Jan. 15.	Y. M. C. A. bldg., Martinsburg, W. Va.	Dec. 14
Jan. 15.	Post Office, Houston, Tex.	Dec. 14
Jan. 17.	School, Pine Ridge Agency, S. D.	Dec. 7
Jan. 17.	Post Office, East Liverpool, O.	Dec. 14
Jan. 20.	School, Richmond, Va.	Dec. 14
Jan. —	School, Mankato, Minn.	Nov. 23.
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Jan. —.	School, Bardstown, Ky.	Dec. 7
Feb. 1.	**Plans for Capitol, San Juan, P. R.**	**Sep. 28**
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. 1.	Jail, Green Bay, Wis.	Dec. 7
Feb. 1.	School, Quitman, Miss.	Dec. 14
Feb. 1.	Club house, Kenwood, Mo.	Dec. 14
Feb. 15.	School, Conway, Ark.	Dec. 14
Feb. —.	College, Agricultural College, Mich.	Oct. 10
Feb. —.	Jail, Ocilla, Ga.	Dec. 7
Mar. 25.	P. O. plans, New York, N. Y.	Nov. 30
Apr. 1.	Hotel, South Braintree, Mass.	Nov. 30

MISCELLANEOUS.

Dec. 17.	Garbage crematory, Ft. Hancock, N. J.	Nov. 23
Dec. 17.	R. R. work, Philadelphia, Pa.	Nov. 23
Dec. 17.	Supplies, Washington, D. C.	Nov. 30
Dec. 17.	R. R. work, Cleveland, O.	Dec. 14
Dec. 17.	Carting garbage, Troy, N. Y.	Dec. 14
Dec. 18.	Guard rail, Cleveland, O.	Dec. 7
Dec. 18.	Removal of snow, New York, N. Y.	Dec. 14
Dec. 20.	Steamboat, Portland, Ore. Adv. Nov. 23 to Dec. 14.	Nov. 23
Dec. 20.	Ditch, Mt. Vernon, Ind.	Dec. 14
Dec. 20.	Ditch, Ada, Mich.	Dec. 14
Dec. 21.	Metal lions, Washington, D. C. Adv. Nov. 30.	Nov. 30
Dec. 21.	Dump barges, Panama	Dec. 7
Dec. 23.	Dredge, Portland, Ore. Adv. Nov. 30 to Dec. 14.	Nov. 30
Dec. 23.	R. R. work, Edmonton, Alta.	Dec. 14
Dec. 27.	Removal of wreck, Boston, Mass. Adv. Nov. 30 to Dec. 14.	Nov. 30
Dec. 27.	Sanitary fixtures, etc., Panama	Dec. 7
Dec. 27.	Vacuum clean. system, New York, N. Y. Adv. Dec. 7, 14	Dec. 7
Dec. 27.	Ditch, Jefferson, Ia.	Dec. 14
Dec. 28.	Ditch, Anderson, Ind.	Dec. 14
Dec. 31.	Garb. disposal, Altoona, Pa.	Dec. 7
Jan. 2.	Steam gauges, etc., Panama	Dec. 14
Jan. 6.	Conduit and embankment, Boston, Mass. Adv. Dec. 7, 14	Dec. 7
Jan. 7.	Ditch, Desmet, S. D.	Nov. 30
Jan. 7.	Garb. disposal, Reading, Pa.	Dec. 7
Jan. 7.	Ditch, Aitken, Minn.	Dec. 14
Jan. 10.	Dump scows, Wilmington, N. C. Adv. Dec. 14.	Dec. 14
Jan. 11.	Dredging, Washington, D. C. Adv. Dec. 14.	Dec. 14
Jan. 14.	Garbage plant, Columbus, O. Adv. Nov. 30, Dec. 7.	Nov. 30
Jan. 15.	Pier, Santa Monica, Cal.	Dec. 7
Jan. 15.	El. ry. work, Donora, Pa.	Dec. 14
Jan. 16.	Ditch, Estherville, Ia.	Dec. 14
Jan. 18.	Dry dock, Brooklyn, N. Y.	Dec. 14
May —.	El. ry., Buenos Aires, S. A.	Nov. 16

*Items marked thus give the names of parties awarded contracts.

CURRENT NEWS SUPPLEMENT

DECEMBER 21, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary Charles Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, Jan. 15-16, 1908. Next meeting, Jan. 8, 1908.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 413 Dorchester St., West, Montreal. Annual meeting, Montreal, Jan. 28, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary J. M. Diven, Charleston, S. C.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia. Annual convention, Buffalo, N. Y., Jan. 20-25, 1908.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

LORD KELVIN.

William Thompson, first Lord Kelvin, who died in Glasgow on Dec. 17, was known the world over as the possessor in an extraordinary degree of great scientific ability and also of attainments enabling him to use his scientific knowledge for direct practical purposes. He inherited his talents from his father, a man of Scotch-Irish descent, who was professor of mathematics at a Belfast institution for many years. His son William was born there on June 25, 1824. In 1832 his father became professor of mathematics at the old College of Glasgow, and from that time until the close of his life the distinguished son was a resident of that city. His early education was obtained mainly from his father, although he attended the college at Glasgow, and his later education was obtained at Cambridge, where he was graduated in 1845 with high honors. It may be added that in addition to achieving success as a student he found time to take part in various athletic sports and rowed in the winning boat in a race with Oxford. In fact, throughout his long life, Lord Kelvin was noted for his keen interest in everything going on about him, and had none of the petulant disregard for human affairs which is currently assumed to be an inevitable part of the character of an eminent scientist.

The scientific achievements of Lord Kelvin are altogether too numerous to be enumerated here. Many of them were due to his extraordinary mathematical ability and that peculiar quality which has been termed a mathematical imagination. He showed a great deal of interest from the earliest days of his career as a physicist in the causes of things, particularly in theories regarding the more important phenomena of physics. The ultimate nature of matter, the relations between heat and mechanical power, the basic facts of electricity, all received a great deal of attention from him and his writings on the subject have received international recognition as statements by high authority.

To the engineer, his career has been particularly interesting on account of the deep interest he has shown in the development of apparatus for utilizing the facts discovered by himself and other physicists. The part he played in the development of the Atlantic cable service was of the utmost importance, in fact it is safe to say that he made submarine telegraphy a practical art. He also took a great deal of interest in the development of wireless telegraphy, although he did not contribute personally to its practical development. It should be added that he was knighted in 1866 on account of his work in submarine telegraphy.

Just as important was his work for navigation. Until he investigated the mariner's compass, ascertained the cause of its numerous defects, and devised means for remedying them, navigators were subjected to all kinds of hazards on account of a ship's magnetism, after iron hulls came into use. Lord Kelvin found a method of overcoming these troubles, and the practical value of his invention was probably as great as his achievements in submarine telegraphy. Another of his inventions which

LORD KELVIN.

played an important part in the development of electric measurements was the quadrant electrometer. From his early days Lord Kelvin was accustomed to tell his students that their knowledge was not good for much until it was sufficiently accurate to enable them to measure things by it. It was this belief in the desirability of measuring things that probably led to his making so many improvements in electrical apparatus. His machine for automatically computing the courses of tides in any part of the world is another interesting example of his ability to harness the laws of science in an unusual way for the service of man. All his inventions of an important nature did not prevent him from improving a great many little things with the same care; for example he devised a form of faucet for plumping that has had a wide use in Great Britain.

RECLAMATION SERVICE WORK, 1907.

A summation of the work of the Reclamation Service for 1907 shows that it has dug 1,815 miles of canals, or nearly the distance from Washington to Idaho. Some of these canals carry whole rivers, like the Truckee River in Nevada, and the North Platte in Wyoming. The tunnels excavated are 56 in number, and have an aggregate length of 10¾ miles. The Service has erected 214 large structures, including the great dams in Nevada and the Minidoka dam in Idaho 80 ft. high and 650 ft. long. It has completed 670 headworks, flumes, etc. It has built 611 miles of wagon road in mountainous country and into heretofore inaccessible regions. It has erected and placed in operation 830 miles of telephone lines. Its own cement mill has manufactured 80,000 bbl. of cement, and the purchased amount is 403,000 bbl. Its own saw mills have cut 3,036,000 ft. B. M. of lumber, and 23,685,000 ft. have been purchased. The surveying parties of the Service have completed topographic surveys covering 10,970 square miles, an area greater than the combined areas of Massachusetts and Rhode Island. The transit lines had a length of 18,900 miles, while the level lines run amount to 24,218 miles, or nearly sufficient to go around the earth.

The diamond drillings for dam sites and canals amount to 66,749 ft., or more than 12 miles. To-day the Service owns and has at work 1,500 horses and mules. It operates 9 locomotives, 611 cars and 23 miles of railroad, 84 gasoline engines and 70 steam engines. It has constructed and is operating 5 electric light plants. There have been excavated 35,419,222 cu. yd. of earth and 4,745,000 cu. yd. of rock. The equipment now operated by the Service on force account work represents an investment of a million dollars.

This work has been carried on with the following force: Classified and registered service, including Washington office, 1,126. Laborers employed directly by the Government, 4,448; laborers employed by contractors, 10,789, or a total of all forces of 16,363. The expenditures now total nearly $1,000,000 per month. As a result of the operations of the Reclamation Service eight new towns have been established, 100 miles of branch railroads have been constructed, and 14,000 people have taken up their residence in the desert.

The Corbett Tunnel, one of the main features of the Shoshone irrigation project in Wyoming, has just been completed by the Reclamation Service under force account, the work having been turned over to the United States by the contractor on Aug. 10, 1906. The tunnel is 3½ miles long, and has a cross-section of 102 sq. ft., and a carrying capacity sufficient to irrigate 100,000 acres of land. Notwithstanding the scarcity of labor and the difficulty of obtaining materials for construction, the work progressed steadily and rapidly under Government supervision and was completed without any serious delays or casualties other than those incident to works of this magnitude. The structure is lined with concrete throughout, and with the Corbett diversion dam, which is now nearing completion, will be one of the most permanent and satisfactory pieces of work now under way by the Service.

The Gunnison Tunnel in Colorado, which is under construction by the Service by force account, has now been excavated a distance of 22,000 ft., of which nearly 2,000 ft. is headings in advance of the full section of the tunnel. The distance between the headings is in round numbers 8,000 ft., and the rate of progress is 20 ft. per day. If nothing happens to delay the work it will probably be possible to receive water through the tunnel by the irrigating season of 1909.

This work is being watched with a great deal of interest by engineers throughout the country by reason of the fact that it is the longest and largest underground waterway of its kind in the world. Its total length will be over 30,000 ft., its cross section 10½ x 11½ ft., and its capacity 1,300 cu. ft. per second. It will be cement lined throughout.

Both ends of the tunnel are now in very hard granite, which sustains itself without any timbering. The chief difficulty in the past has been that the rock has been so soft that expensive timbering had to be inserted to hold the roof and sides in place. This timbering in turn necessitated the placing of concrete lining in order to render the work permanent. In the granite section, as lining is not necessary immediately, it has been decided to reduce the size of the tunnel temporarily and run headings in advance of the full-size portion of the tunnel. By so doing it will be possible to connect the two ends of the tunnel and allow a portion of the water supply to come through during each irrigating season until final completion. During the remainder of the year, when the water is shut off, work on the tunnel can be resumed to complete it the full size in the granite.

The wisdom of rejecting excessive bids on the work under the Reclamation Service has been strikingly exemplified in the results obtained by force account work on the Tieton irrigation project in Washington. The tunnel work is costing a third less than the lowest bid received, while on open canal excavation the saving is still greater, the actual work costing 80 per cent. less than the lowest bid. This construction was carried on under very unfavorable conditions, the price of labor being extremely high and the men continually shifting.

STEEL PILING FOR PITS.

The accompanying illustration shows the first of a series of eight pits which are being built for the Pittsburgh Plate Glass Co., at Crystal City, Mo., by Mr. S. Caspar's, the well known contractor of Columbus, Ohio. The steel cofferdam used in this pit is interesting on account of its tightness and the rapidity with which it was put down. The pit illustrated is about 22x26 ft. in plan and 40 ft deep. About 20 ft. below the surface there is a 12-in. vein of quicksand, the material penetrated elsewhere, both above and below the quicksand, being clay. This work was started with wooden sheeting carried down horizontally to a depth of 18 ft., and the lower part of this sheeting on one side of the pit can be seen in the engraving. The work proceeded rather slowly at first and the superintendent in charge, Mr. J. T. Nealon, decided to use interlocking steel sheeting of the Nye type. A line of steel waling of I-beams was constructed, the beams having holes bored in them every 2-in for a distance of about 2 ft. from all the ends, so that the dimensions of the waling could be adjusted from about 22x26 ft. to a foot less if necessary. It will be seen in the illustration that there are two courses of waling of this sort. The steel sheeting was driven with an ordinary pile driver, using an 1,800-lb. hammer. The piling was held in position in the leads of the driver with a follower cap made by the Curtis Steel Foundry of St. Louis. After this sheeting was driven, very little water entered the pit; a 2-in. siphon could empty the pit in the morning and there would be no more pumping necessary during the day. The channels used for the sheeting on this work were 15-in. 33-lb. 40 ft. long. It is understood that Mr. Nealon will follow the same method in sinking the remaining seven pits.

DEEP SHAFTS ON THE CATSKILL AQUEDUCT.

The engineers of the Board of Water Supply of New York City have discovered that to drive the Catskill aqueduct tunnel through solid rock under the Rondout Creek and Wallkill River south of Kingston, they will have to drive deep tunnels, the first to cost about $5,500,000, and the one under the Wallkill to cost about $4,500,000. These valleys are so far below the natural level at which the water would flow in the ordinary aqueduct that the water will have to be carried across them under pressure.

Leaving Ashokan reservoir in a deep trench near the middle of the chain of dams across the Esopus Creek and Beaverkill, the aqueduct crosses Esopus Creek and Tongore Brook, then 6 miles further pierces a nose of the mountains in a tunnel about one mile long, then runs 1¼ miles to the northerly side of the Rondout Valley. Here the water will drop down a shaft 750 ft. deep and flow for about 4½ miles to another shaft, where it will rise 750 ft. and pierce Bonticou Crag in the Shawangunk Mountains, passing through the ridge 2⅓ miles northest of Lake Mohonk.

Emerging onto the hillsides of the Wallkill Valley, the aqueduct follows the side of the valley for about 4 miles and then drops into a shaft 480 ft. deep and proceeds in a direct line across this broad valley for a distance of about 4 ½ miles to the little hamlet of Ireland Corners, where it rises through another shaft 410 ft., and proceeds southward in a trench along the hillside for many miles toward the Hudson River, crossing at Storm King, tunnelling under the Moodna Creek Valley on the way.

These deep siphon tunnels, because of the uncertainties of all work at great depths, must be undertaken at the earliest possible day. The work will take several years.

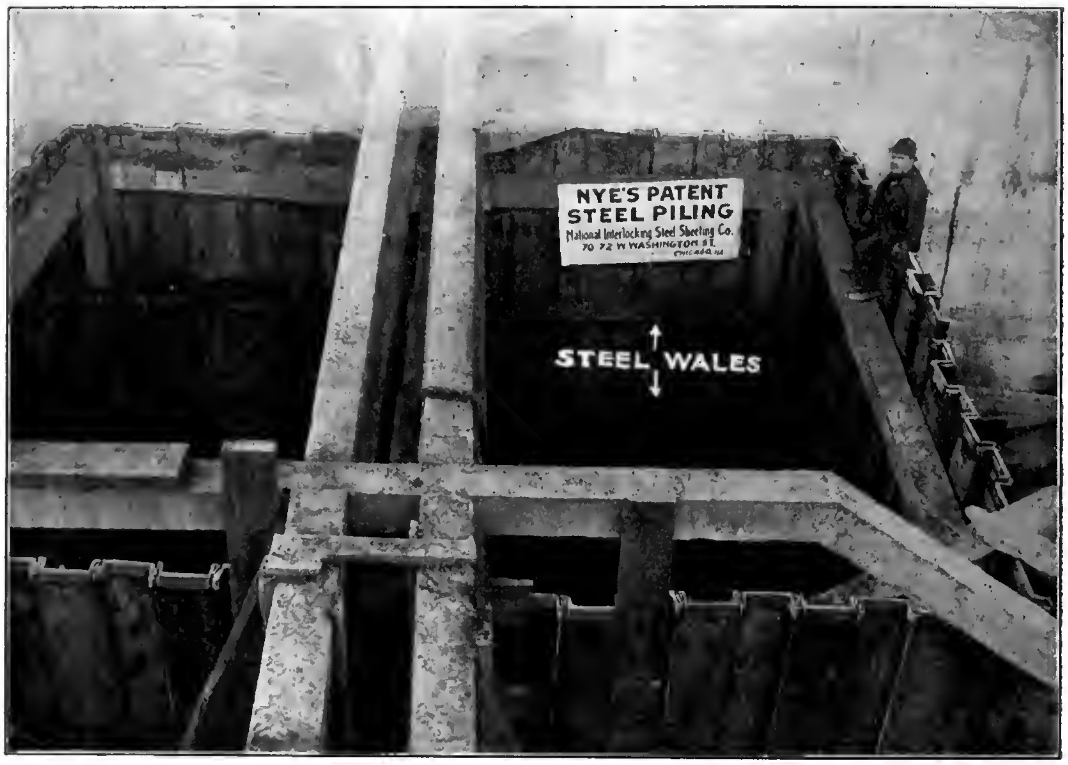
IMPORTANT HYDRO-ELECTRIC AND RAILWAY PLANS IN VIRGINIA.

On Dec. 13, an interesting engineering program for the development of Eastern Virginia was explained when Judge Alvin T. Embrey appeared before the Corporation Commission of the State and applied for a charter for the Fredericksburg & Southern Ry. Co. to build a railroad (to use any motive power) from at or near Fredericksburg, Spotsylvania Co., to Doswell, Hanover Co., with the privilege of extending the line 50 miles in any direction, together with the right to buy, lease, or merge with any other railway and water power companies. This line will practically parallel the Richmond, Fredericksburg & Potomac R. R. from Fredericksburg to Doswell When the latter was built the State Legislature, in order to encourage subscriptions, enacted a prohibition against paralleling this line for 35 years, and at the expiration of this time the act was renewed. The State took about one-third of the capital stock of this road, and owns it at present. On Dec. 16, the Corporation Commission listened to arguments concerning the granting of the charter, and of course the Richmond, Fredericksburg & Potomac R. R., as well as the State proxies, opposed it. The Commission reserved their decision. Should it refuse to grant this charter the case will immediately be taken to the State Supreme Court, and this tribunal will be asked to decide, as it did by what is known as the [illegible] case, by which the Richmond & Chesapeake Bay Ry. Co. received its charter, whether or not it is unlawful for the Corporation Commission to refuse to grant a charter for a line paralleling the Richmond, Fredericksburg & Potomac R. R. for a portion of its distance. Should the Supreme Court in January turn the company down, it will make a fight before the next Legislature to have the law against paralleling repealed.

All the water power in the Rappahannock River and most of the power in the James and Appomattox Rivers, together with all lighting, power and street railway, both urban and interurban, in Richmond, Manchester and Petersburg, are controlled by Mr. Frank J. Gould and Miss Helen Gould, of New York City. Mr. Gould also owns the Richmond & Chesapeake Bay Ry. Co., which in turn owns the Fredericksburg Power Co., and the latter is to own the Fredericksburg & Southern.

The Fredericksburg Power Co. has purchased more than 4,000 acres of land on the Rappahannock River, and is preparing to develop more than 30,000 h.p., which is more than the power furnished by both the James and the Appomattox Rivers. This power will be an inducement to new industries to locate at or near Fredericksburg and it will be used to operate the street railway in Fredericksburg and furnish power to the Fredericksburg & Southern road. Preparations are being made for a complete hydraulic electrical development on the Rappahannock River at and above Fredericksburg, and an application is soon to be made to the City Council of Fredericksburg for a franchise to sell light, heating and power. The Fredericksburg & Southern R. R. will be built along the same high-grade lines as the Richmond & Chesapeake Bay line, which, although only 17 miles long, cost $760,000. Its construction will give Richmond a much closer business connection with the country for a distance of 62 miles north of it. A line from Fredericksburg to Doswell, with the Richmond & Chesapeake Bay Ry. extending its line from Ashland to Doswell, will give Mr. Gould control of an electric line from Fredericksburg to Petersburg, a distance of 85 miles, together with street railways in the cities of Fredericksburg, Richmond, Manchester and Petersburg.

The officers and incorporators of the Fredericksburg & Southern are: Wm. C. Whitner, President; E. J. Smith, Vice President; Alvin T. Embrey, Secretary and Treasurer, and these gentlemen, together with A. P. Rowe, A. W. Embrey, C. W. Jones, and J. T. Lowrey of Fredericksburg, Va., form the incorporators and directors. The officers of the Fredericksburg Power Co. are: Wm. C. Whitner, President; Alvin T. Embrey, Secretary and Treasurer, and they, together with A. W. Embrey, A. P. Rowe, of Fredericksburg, Va., and W. L. Roddey, of Rock Hill, S. C., are the Directors. Mr. Whitner is chief engineer of hydraulics for Mr. Gould in all of his enterprises in Virginia.



STEEL COFFER DAM USED AT CRYSTAL CITY, MO.

Cement Manufacturers will find much to interest them in an unusually attractive book just issued by the Lehigh Car, Wheel & Axle Co., Fullerton, Pa. After an introduction on the development and processes of the Portland cement industry, the Fuller-Lehigh pulverizer mill is described in detail, with excellent illustrations, and plans are given for an "ideal" clinker department in a 3,000-bbl. mill. Illustrations and descriptions are then given of the installations of Fuller Lehigh pulverizer mills for different purposes in several cement works.

PERSONAL NOTES.

Mr. J. P. Claybrook has been reappointed city engineer of Louisville, Ky.

Mr. John Chambers, a civil engineer, has been appointed Building Inspector of Louisville, Ky.

Mr. G. H. Hazelhurst has been appointed chief engineer of the Georgia & Florida Ry. System.

Mr. E. Y. Allen has been appointed village engineer of South Orange, N. J., succeeding Mr. E. R. Halsey, resigned.

John E. Haight, city engineer of Shelbyville, Ky., was run down and killed by a railway train near Independence, Ky., Dec. 13.

Mr. Charles E. Wells, White Plains, N. Y., has been appointed a division engineer in the service of the Board of Water Supply of New York City.

Mr. W. H. Balch, engineer for the Aberthaw Construction Co., Boston, Mass., is now engaged on special work in Philadelphia for Mr. J. C. Trautwine, Jr.

The firm of Benedict & Sturgeon, mining engineers, Denver, Colo., has been dissolved. Mr. H. B. Benedict is continuing the business, engaging in general engineering. Mr. E. A. Sperry is associated with Mr. Benedict.

Mr. C. W. Dyott has resigned his position with the Westinghouse Electric & Mfg. Co., and has opened an office in the Westinghouse Building, Pittsburg, Pa., as engineer, making a specialty of electric motors and electrical mining machinery.

Mr. Howard Egleston, in charge of the construction of the eastern end of the Del Rio and Nogales branch of the Cananea, Yaqui River & Pacific R. R., has been transferred to Mazattan, where he will have charge of track laying and bridge work.

Mr. Vincent Salomone has retired from the contracting firm of Bruno, Salomone & Petitti, Boston, and the business will hereafter be carried on under the name of Bruno & Petitti in the Kimball Bldg., instead of at the former address of 23 Court St.

Lieut.-Col. George W. Goethals, Corps of Engineers, U. S. A., chairman and chief engineer of the Isthmian Canal Commission, and Mr. J. C. S. Blackburn, governor of the Panama Canal Zone and member of the Canal Commission, arrived in New York, Dec. 16, on a six-weeks' leave of absence.

The firm of Dow & Smith, chemical engineers, New York, have been retained by the City of Philadelphia to organize and carry on their inspection system covering all the asphalt pavements to be laid in that city during the coming year, about 1,000,000 sq. yd. Many other cities have already retained them in a similar capacity, recognizing that their services, by insuring the proper character of the workmanship and materials used, tend to eliminate many of the unsatisfactory features of the present much discussed system of guarantees.

The following have recently been appointed resident engineers in the office of the New York State Engineer and Surveyor: G. R. Winslow, Utica; H. E. Smith, Albany; Perry Filkins, Brewster; James Burden, Troy; R. S. Greenman, Albany; O. C. Richards, Sandy Hill; L. C. Hurlbard, Albany; O. J. Dempster, Herkimer; T. M. Ripley, Albany; and C. H. Hoyt, Albany. George

W. Bradley, Marcy, has been apponited an assistant engineer in the same office.

Thomas Fitch Rowland, one of the leading engineers this country has produced, died at his home in New York on Dec. 13. His greatest fame came to him as the financial backer of John Ericsson and the builder of the first monitor, but the construction of that famous vessel was but one achievement that made his Continental Iron Works noted among engineers. Mr. Rowland was born in New Haven, Conn., March 15, 1831. His early education was obtained at Lovel's School and at the Collegiate Preparatory School at New Haven. Instead of entering college he accepted employment with the New Haven & Farmington Railroad. Later he became associated with the New York, New Haven & Hartford Railroad, where he was employed as fireman and engineer. Subsequently he left this position to become second assistant engineer on the steamboat Connecticut, plying between Hartford and New York. In 1852 he accepted a position as draftsman with the Allaire works, in New York City, which he left in 1853 to become general superintendent of the Atlantic Dock Iron Co., in Brooklyn. In 1859 he established a business of his own at Greenpoint, which subsequently became the Continental Iron Works. Among his more important achievements was the construction of a quarter of a mile of wrought iron tube, 7½ ft. in diameter, which was placed on the top of the High Bridge to carry water from the Croton Aqueduct to the new reservoir in Central Park. At the outbreak of the Civil War the government gave him several contracts, and he constructed the gun carriages and mortar beds for the Navy Department and fitted out some of the steamers purchased of the merchant service, which took part in the capture of Port Royal. He also constructed all the vessels composing the Port Royal mortar fleet. In October, 1861, John Ericsson and his associates gave Mr. Rowland the contract to build an iron floating battery in accordance with Ericsson's plans, and the vessel was launched Jan. 30, 1862. In 1887 the business was incorporated as the Continental Iron Works, of which Mr. Rowland was president and general manager. Mr. Rowland was granted over fifty patents for machinery which he used in his own factory. Mr. Rowland became a member of the American Society of Civil Engineers in 1867 and was elected an honorary member in 1899. He was a director in 1871-73, vice-president in 1886-87, and established the Rowland prize in 1884. In 1882 he became a member of the American Society of Mechanical Engineers, and for many years took an active interest in its work.

BUSINESS NOTES.

J. G. White & Co., New York, engineers, constructors and purchasers for the Porto Rico Railways Co., Ltd., have ordered three Mogul locomotives from the Baldwin Locomotive Works for use on the San Juan-Caguas line and over the Caguas extension, which is now nearing completion. The locomotives are of one-meter gauge, have 44-in. drivers and have a total weight of 90,000 lb. The tender weighs 60,000 lb. They are intended principally for freight traffic, Caguas being the collecting center of the richest tobacco raising center of the island. The locomotives will be finished next month.

On account of the increase in business, the San Francisco office of the Independent Pneumatic Tool Co. has been moved to larger quarters at 61 Fremont St., in the machinery district, where a complete line of Thor air tools and spare parts will be carried in stock.

The Sandusky Portland Cement Co., of Sandusky, O., has started its new mill for "white" Portland cement for the highest grades of artificial stone objects. It is made from a vein of limestone having barely a trace of iron and by a process which is the result of many experiments and long study by Mr. S. B. Newberry, general manager of the company.

The plant of the Blanc Stainless Cement Co., Allentown, Pa., is now in operation, and Mr. J. Maxwell Carrere, treasurer and general manager of the company, has attained his long held ambition to make a strong cement of perfect color.

The Navy Bulletin, a booklet which should prove useful to everyone who sells motor-driven machinery to the U. S. Navy Department, has just been issued by the Cutler-Hammer Mfg. Co., of Milwaukee, makers of electric controlling devices. This company for many years has made a special study of Navy Department requirements, and in the booklet just issued, illustrations, descriptions, dimension diagrams and shipping weights are given on all Cutler-Hammer standard starting panels, speed regulating panels, machine tool controllers, resistances, circuit breaker panels, etc. Attention is called to the fact that Navy specifications preclude in nearly all instances the use of ordinary controlling panels and, furthermore, that apparatus acceptable for use in navy yards will not always be acceptable if supplied for use on shipboard. How to select the proper piece of apparatus in each case is explained, and numerous illustrations are presented of electric controlling appliances conforming to Bureau of Construction and Repair and Bureau of Equipment specifications.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Carbon Hill, Ala.—See "Power Plants, Gas and Electricity."

Eldorado, Ark.—Bids will probably be called for in the spring for the construction of water-works to cost about $30,000. Engineer, M. P. Jackson, of Eldorado.

Hope, Ark.—See "Power Plants, Gas and Electricity."

Vallejo, Cal.—The Bd. of Works is stated to have passed favorably on the report of City Engr. Noyes in which he asked for a new reservoir site and lake, to enlarge the local water system. An election will probably soon be held to vote on issuing $60,000 bonds to enlarge the system.

San Francisco, Cal.—At a meeting of the Public Utilities Com. of the Bd. of Superv. on Dec. 3, plans are reported to have been presented by City Engr. Woodward for an auxiliary water system for fighting fires in the district bounded by Devisadero, the Bay, Channel St. Treat Ave. and 20th St., and with a zone for the Potrero and part of North Beach; estimated cost of work $5,250,000.

Salida, Colo.—See "Power Plants, Gas and Electricity."

Madison, Ga.—Bids will be received by E. W. Butler, Mayor, until Dec. 31 for $50,000 water works, sewerage and electric light bonds.

Waycross, Ga.—A. M. Knight, Mayor, writes that the citizens on Dec. 13 voted to issue $20,000 bonds for water-works extension.

**Atlanta, Ga.*—We are informed that the Wisconsin Engine Co., of Corliss, Wis., has secured the contract for a 20,000,000-gal. vertical triple expansion pump; cost about $139,500 (bids opened Nov. 25).

Cottonwood, Idaho.—The Cottonwood Water & Light Co. is reported to have secured a franchise to establish a water system.

**Batavia, Ill.*—The Henry R. Worthington Co., of New York, N. Y., is reported to have secured contract for auxiliary pump for water works at $1,400.

Ft. Wayne, Ind.—Bids will be received by the Bd. of Pub. Wks. until Jan. 6 for the purchase of 4 tubular boilers, now in service at the city water works station, on N. Clinton St., as advertised in The Engineering Record.

Weleetka, Ind. Ter.—See "Power Plants, Gas and Electricity."

Sapulpa, Ind. Ter.—J. O. Fulp, City Recorder, writes that the citizens on Dec. 9 voted to issue bonds for the construction of water works; probable cost, $50,000.

Ft. Leavenworth, Kan.—Bids will be received until Dec. 27 by Capt. J. E. Normoyle, Q. M., U. S. A., for constructing water mains at this post.

New Orleans, La.—The Executive Com. of the Sewerage and Water Bd. on Dec. 10 adopted specifications for a 4,000,000 gal. pump for the Algiers water purification station.

Marion, Mass.—Col. Harry E. Converse has been selected as chairman of the Bd. of Water Comrs. which will have charge of the construction of the proposed water works. It is proosed to petition the State Legislature for permission to issue bonds for the construction; probable cost of plant, $75,000. Engineer, Louis E. Hawes, of Boston.

Mentone, Mich.—The Town Bd. is reported to be considering the construction of water works.

Marquette, Mich.—The City Council is reported to be considering the question of employing a sanitary engineer to examine water supply with a view to improving same.

St. Paul, Minn.—Specifications are reported to have been presented to the Water Bd. for another extension to the Centerville conduit. It is proposed to construct about 1,400 ft. next year.

Speed Addition (Vicksburg Postoffice), Miss.—The citizens are reported to have voted to issue bonds for the construction of water-works.

Lincoln, Neb.—There is some talk here of constructing a separate fire protection system. Nothing definite has yet been done. Wm. Grant, City Engr.

Camden, N. J.—Local press reports state that bids were opened by the Water Com. of City Council on Dec. 17, for improving the present artesian water supply system and adding to present supply of 17,000,000 gals. at least 5,000,000 gals. daily, and two propositions were received, one from J. L. Sweigard & Co., and the other from M. P. Quinn, both of Philadelphia, Pa. No action was taken in the matter.

Morris Plains, N. J.—Bids will be received until Jan. 9 by the Com. on Supplies of the New Jersey State Hospital at Morris Plains (Geo. W. Jagle, Chmn.), for furnishing supplies including 1,500 ft. 6-in. c. i. water mains, 7 6x6-in. water main tees, run, hub and spigot, branch hub, 2 6x6x4-in. water main tees, etc., 6 6-in. Kennedy improved fire hydrants, etc., also lumber.

Livingston Manor, N. Y.—See "Power Plants, Gas and Electricity."

**Buffalo, N. Y.*—The U. S. Cast Iron Pipe & Fdry Co., Buffalo, N. Y., is reported to have secured the contract for c. i. pipe and special castings for the year ending July 1, 1908, as follows: Cast iron pipe, 3-in., $40 per net ton; 4-in., $38; 6-in. to 48-in., $32.50.; ordinary specials 3-in. to 30-in., $60 per net ton, and from 24-in. to 48-in., $85. Flanged specials, all sizes, $100.

Syracuse, N. Y.—We are informed that maps and plans are now being prepared for the proposed reservoir and conduit line from Skaneateles Lake to the city of Syracuse; probable cost of work, $1,500,000. Henry C. Allen, City Engr.

Albion, N. Y.—The Village Clk, writes that a committee of five has been appointed to locate a new water supply; no engineer selected as yet.

Albany, N. Y.—Water supply bonds to the amount of $100,000 are reported sold.

**Rochester, N. Y.*—The following are reported to be the bids opened on Dec. 11 by the Bd. of Contract and Supply for the construction of a by-pass gate house at Cobbs Hill Reservoir, on Monroe Ave.: Dennison & Co., $15,947 (awarded contract); R. T. Ford Co., $16,238; Gorsline, Swan & Rice, $16,315.

Bids will be received until Dec. 25 by the Bd. Contracts and Supply (F. X. Pifer, Clk.) for constructing a gate house at Cobbs Hill Reservoir. J. Foster Warner, Archt., 1036 Granite Bldg.

Maxton, N. C.—F. L. Black, City Clk. and Treas., writes that the citizens on Dec. 9 voted to construct water-works and a seewrage system; probable cost, $50,000. Bids for construction will be called for about Jan. 15. R. M. Williams, Mayor. Engineer, J. M. Bandy, of Laurinburg.

Burlington, N. C.—A. F. Barrett, Mayor, writes that Gilbert C. White, of Durham, has been selected to prepare plans for water-works and a sewerage system; cost about $100,000.

Dayton, O.—The question of extending the water mains to Ohmer Park, at a cost of $12,000, is reported under consideration.

Guthrie, Okla.—Plans and bids will be received at the office of C. M. Barnes, Mayor, until Jan. 7 for the establishment of a filtration system having a capacity of 1,000,000gal. of water per day; also for furnishing 8, 4 and 6-in. c. i. pipe for extension of water mains.

Panama.—Bids will be received until Dec. 30 by Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., Genl Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing c. i. pipe specials and gate valves as per circular No. 409-A.

Houston, Tex.—The Wm. A. Wilson Realty Co., is reported to have decided to lay about a mile of 8-in. water main, under supervision of its engineer, F. L. Dormant.

Sweetwater, Tex.—The proposed water works, for which Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are preparing plans, will cost about $75,000. Date not yet set for receiving of bids for construction.

Norfolk, Va.—See "Miscellaneous."

Spokane, Wash.—The lowest bid recently received for supplying the machinery required for the pumping station for the development of the underground flow, is stated to have been submitted by the Fairbanks-Morse Co., of Chicago, Ill., for $12,360.

Lynden, Wash.—D. W. Bender, Town Clk., writes that the citizens have voted to construct water-works. Bids will probably be called for in the spring.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

Berlin, Ont.—This city is reported to have in contemplation the issue of $6,000 bonds for extending and improving the water works.

Gravenhurst, Ont.—This city is stated to have petitioned the Ontario Ry. & Municipal Bd., for permission to issue $15,000 bonds for extending and improving the water works.

Toronto Junction, Ont.—The Supt. of Water Works is stated to have presented to Town Council a report on improvements contemplated to the water works, which he estimates at $100,000.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

East Lake (Birmingham Postoffice), Ala.—The City Clk. writes that the proposed sewerage system will cost bet. $12,000 and $15,000. Nothing will be done until bonds are sold. Engineer, L. D. Lea, of East Lake.

Hartford, Conn.—Bids will be received until Dec. 30 by the Bd. Contract and Supply (Chas. E. Parker, Secy. pro tem.) for constructing Sec. B of the Homestead Ave. intercepting sewerage system, consisting of about 2,800 lin. ft. concrete or brick conduit 4 ft. 9 in. diam.; probable cost $35,000 to $40,000. F. L. Ford, City Engr.

Madison, Ga.—See "Water."

Albany, Ga.—The City Council is reported to have decided to call an election to vote on issuing $25,000 bonds to be added to $18,077 already laid aside to be expended in 1908 for the perfection of the city's drainage system.

Waycross, Ga.—A. M. Knight, Mayor, writes that the citizens on Dec. 3 voted to issue $10,000 bonds for sewers.

Silvis, Ill.—It is stated that estimates are being prepared for a sewerage system.

Elgin, Ill.—Carl E. Plum, City Engr., writes that bids will be received by the Bd. of Local Improv. (Arwin E. Price, Pres.) until Dec. 26 for the construction of storm and sanitary sewers in the West Side Dist., to consist of 3,104 ft. of 18 to 6 in. vitr. pipe sewers, 7 manholes, 10 catch basins and 8 inlets; cost $3,200.

Riverside, Ind.—The Town Trus. are reported to have decided to construct two additional sewers, one from the Jersey St. sewer bet. Sutton and Jarrett Sts., and the other between Jarrett and North Sts.

Columbus, Ind.—Lawrence F. Orr, City Clk., writes that about $15,000 will be expended for main and lateral sewers. Engr., Wm. H. Rights, of Columbus.

Evansville, Ind.—The following are reported to be the bids opened on Dec. 7 by the Bd. of Pub. Wks. for constructing a 7-in. sewer in 7th Ave.: (a) sewer per lin. ft.; (b) inlets, ea.; (c) manholes, ea.; Lamasco. The Zeller-Hughes Co., (a) 93 cts.; (b) $29; (c) $23; The Newman-Vineyard Co., (a) 69 cts.; (b) $30; (c) $25.

Clinton, Ia.—This city will on Jan. 14 receive bids for about 3,500 ft. of 12 to 36-in. pipe sewers. Engineer Chas. P. Chase, of Clinton.

Traer, Ia.—Chas. P. Chase, of the Iowa Eng. Co., of Clinton, is preparing plans for a sewerage system for Traer; probable cost, $30,000. Bids for construction will be received about Mar. 1. T. F. Stoakes, Town Clk.

**Items marked thus give the names of parties awarded contracts.*

[illegible], Kan.—Bids will be received until Jan. 15 by R. S. Spencer, City Clk., for furnishing material and constructing a system of sewers, including a septic tank. Burns & McDonnell, Engrs., 821 Scarritt Bldg., Kansas City, Mo.

[illegible], Kan.—The City Council is reported to be considering the question of improving the sewerage system.

North Andover, Mass.—E. W. Bowditch, 62 Devonshire St., Boston, is reported to have completed plans and specifications for a sewerage system for North Andover to cost about $300,000.

Hanley Falls, Minn.—It is stated that bids will be received until Jan. 6 by J. M. Hardy, Village Recorder, for constructing sewers.

Springfield, Mo.—The City Council is reported to have authorized the City Engr. to prepare plans, profiles and estimates for the construction of a system of surface drainage or storm sewers, with a view to submitting question to vote on the issue of bonds for same.

Forsyth, Mont.—Bids are wanted, it is stated, until Jan. 4 for $10,000 sewer bonds. S. H. Irwin, Town Clk.

Auburn, N. Y.—J. Walter Ackerman, City Engr., writes that all bids opened on Dec. 3 for constructing sewers in the 4th, 5th, 6th and 7th Wards Sewer Dist., and for disposal works have been rejected. The following are the totals of bids received:

Constructing sewers (a) tile 24 in. long; (b) tile 36-in. long; (c) tile 24 in. long, including rock; (d) tile 36 in. long including rock: Syracuse Excavating Co., *a* $77,147; *b* $79,350. Brayer Bros., *a* $98,328; *b* $99,702; *c* $121,743; *d* $123,288. D. M. Rosser Eng. & Constr. Co., *a* $144,682; *b* $144,970; *c* $288,551; *d* $290,984.

Disposal works: Berch & Beebe, $47,036, and D. M. Rosser Eng. & Constr. Co., $42,329.

Syracuse, N. Y.—We are informed that bids will be called for this spring for the proposed intercepting sewers to cost about $500,000. Glenn D. Holmes, of Syracuse, is Ch. Engr. of Intercepting Sewer Bd.; Henry C. Allen, City Engr.

Rochester, N. Y.—The Council is reported to have adopted an ordinance, providing for the grading and construction of sewers in the Driving Park Ave. tract to cost about $45,000.

Burlington, N. C.—See "Water."

Marion, N. C.—See "Water."

**Dayton, O.*—C. P. De Weese, Asst. Clk. Bd. of Pub. Service, writes that J. T. Reese, 19 W. 2d St., has secured the contract for constructing sanitary sewers in a portion of Dist. 3, North Dayton (bids opened Dec. 4), for $72,856. The work consists of 70,050 ft., 6 to 15-in. vitri pipe sewers, 68,250 ft. trench and back fill 6 to 28 ft. deep, 80 lamp holes, 75 flush tanks, flush tank connections, repaving 1,500 sq. yds. brick pavement, 100 sq. yds. asphalt, 6,000 lin. ft. boulder repaving, c. i. pipe and specials, etc.

Springfield, O.—It is stated that bids will be received until noon, Dec. 26, by the Bd. of Pub. Service for the construction of a sewer in portions of Ludlow Ave., Sheridan Ave. and Burt St. F. A. Crothers, Clk. Bd.

Youngstown, O.—Local press reports state that bids will be received by the Bd. of Pub. Service until Dec. 27 for the construction of the Mahoning Ave. sewer.

Oberlin, O.—The Village Council is reported to have passed an ordinance providing for the construction of sewers in Dist. No. 14, on N. Prospect St. O. F. Carter, Mayor.

Canton, O.—Bids will be received until Jan. 3 by the Bd. Pub. Service (B. F. Faust, Clk.) for constructing storm sewers in a portion of E. 4th St., and branch sewers in portions of several other streets. Approximate quantities: 1,335 lin. ft. 36-in. brick sewer; 3,965 ft. 12 to 24-in. vitrified pipe sewers, 5 manholes for brick sewer, 13 manholes for pipe sewer, 46 catch basins. W. E. Sarver, City Engr.

Cincinnati, O.—Bids will be received until Jan. 3 by the Bd. Co. Comrs. (Fred Dreihs, Clk.) for constructing two culverts, one on Cooper Ave. and the other on Wyscarver R., Sycamore Township, as per specifications Nos 697 and 699, respectively.

Guthrie, Okla.—We are informed that W. W. Miller, City Engr., is preparing plans for a main sanitary sewer estimated to cost $10,000, and storm sewers in Dists. 1, 2 and 3, to cost about $30,000. C. M. Barnes, Mayor.

Bradford, Pa.—It is proposed to issue $76,000 bonds to be used for sewers, street paving, 3 bridges, a hose house, etc.

Hot Springs, S. D.—Bids will be received until Jan. 3 by W. A. Tucker, Treas., Battle Mountain Sanitarium, N. H. D. V. S., Hot Springs, for furnishing and delivering vitrified pipe.

Paris, Tex.—The State Attorney-General is reported to have approved the issue of $6,000 sewer bonds.

Spokane, Wash.—Chas. McIntyre, City Engr., is reported to be outlining plans for the improving of the sewage system of the business portion of the city. He will be ready to report plans to Council in about 2 or 3 months.

Seattle, Wash.—An ordinance has been passed providing for the construction of sewers in Fuhrman Ave. to cost $21,900.

The estimated cost has been reported on property owners' majority petition for the improvement of Thorndyke Ave. to consist of grading, constructing concrete sidewalks, sewers and water mains, at $124,000. R. H. Thomson, City Engr.

Chester, W. Va.—John A. George & Sons, of East Liverpool, O., are preparing plans for a sewerage system for the Chester Improvement Co., to cost about $[illegible]. Nothing further will be done until the spring.

McMechen, W. Va.—Press reports state that all bids recently received for constructing a sewerage system here have been rejected and new bids will be called for.

[illegible]ville, Wis.—It is proposed to construct the main [illegible] sewer the coming season at a cost of $60,000. C. [illegible], City Engr.

**Toronto, Ont.*—Rutherford Cumming, of Toronto, is reported to have secured the contract for the erection of a corrugated iron building, on Clifford St., in which will be installed a plant for the experimental treatment of sewage and the testing of water by the provincial staff of bacteriologists and chemists. About $4,500 will be expended for the purchase of equipment.

Toronto, Ont.—The Bd. of Control and City Council are reported to be considering the construction of 3 1-2 miles of sewers in Parkdale.

BRIDGES.

Notes Arranged Alphabetically by States.

Attalla, Ala.—It is reported that bids will be received until Jan. 6 by the Bd. Co. Comrs. at Gadsden for constructing a steel bridge to replace the Rhea Bridge over Willis Creek near Attalla. Cost not to exceed $10,000.

Ocola, Fla.—Bids will be received until Jan. 8 by the Bd. Co. Comrs. (S. T. Sistrunk, Clk.) for constructing steel bridges across Blue River, near Dunellon; also Withlocooche River at Stokes Ferry.

Indianapolis, Ind.—It is reported that the Comrs. of Marion Co. will receive bids until Dec. 30 for the construction of concrete abutments and pier for bridge over Eagle Creek; for a concrete steel culvert on road in Section 21, and for a concrete steel culvert over Pfaff's Branch in West Newton. C. J. Clark, Co. Aud.

Peru, Ind.—Bids will be received, it is stated, until Dec. 26 by the Bd. Co. Comrs., for erecting two concrete arches. Chas. Griswold, Co. Aud.

Evansville, Ind.—Plans are stated to have been approved for the improvement of the Louisville & Nashville R. R. bridge over Pigeon Creek at Water St., at a cost of $40,000. W. H. Courtenay, Ch. Engr., Louisville, Ky.

Cedar Rapids, Ia.—It is stated that an election will be held in the Spring on the issuing of bonds for the construction of a bridge at 16th St.

Creston, Ia.—Bids will be received until Jan. 7 at the office of W. F. Craig, Co. Aud., for furnishing material and erecting all bridges and for all steel pipe and cement work in this county during the year 1908.

Tipton, Ia.—Bids will be received until Jan. 3 by the Bd. Co. Superv., for steel bridges, bridge piling and bridge lumber for the year 1908. P. H. Schneider, Co. Aud.

Topeka, Kan.—A. M. Patton, of Topeka, Gen. Supt. Topeka Street Ry. Co., writes that he will receive bids for the proposed steel viaduct to be constructed at Branner St.; cost, about $35,000.

Fitchburg, Mass.—The first step toward connecting the Water and Summer St. sections of the city is reported taken by the City Council in the form of an order instructing the Mayor and Aldermen to petition the County Comrs. for a location of an extension of Fourth St. and bridges spanning the Nashua River and the tracks of the Boston & Maine and New York, New Haven & Hartford R. R. at an estimated cost of $81,000.

Mohawk, Mich.—It is stated that the Keweenaw Central R. R. Co. is planning the construction of a bridge over the Mineral Range tracks near Mohawk, the structure to be 200 ft. long. T. E. Simer, Ch. Engr., Hancock, Mich.

**Minneapolis, Minn.*—The Minneapolis Steel & Machinery Co., of Minneapolis, is stated to have secured the contract for constructing a steel bridge over Minnesota River, at $37,500.

**Arcadia, Mo.*—A. D. Burnett Bridge Co., of Galesville, is reported to have secured the contract for constructing a steel bridge with concrete abutments near here, at $6,800.

Bethany, Mo.—It is stated that bids are wanted until Jan. 8 for constructing several steel bridges in this county. J. C. Howe, Bridge Comr.

Wayne, Neb.—It is stated that bids will be received until Jan. 10 by Chas. W. Reynolds, Co. Clk., for erecting and repairing bridges in this county during the year 1908.

Geneva, Neb.—Bids will be received until Jan. 14 by the Bd. Superv. (W. C. Peterson, Clk.), for furnishing material and erecting all county bridges, both bent and pile, steel and wooden, required by this county, during the 12 months beginning Jan. 14, 1908.

Mt. Holly, N. J.—Bids will be received until Dec. 27 (readvertisement) by Boards of Chosen Freeholders of the Counties of Burlington and Mercer at the Court House, Mt. Holly, for furnishing material and constructing a bridge over Crosswicks Creek from North Crosswicks in the County of Mercer, to Crosswicks in the County of Burlington. Bids to be submitted on 4 propositions, as follows: 1. For the construction and completion of concrete abutements, wing-walls and pier, steel superstructure and the necessary grading of approaches for a bridge; 2. For the construction and completion of concrete abutments, wing-walls, pier and steel superstructure for a bridge; 3. For the necessary grading of approaches for a bridge; 4. For the construction and completion of a two-span concrete arch bridge and approaches.

Princeton, N. J.—Andrew Carnegie is reported to have given an additional $20,000 for the construction of wings at the approaches of stone bridges over Princeton Lake.

**New York, N. Y.*—Bids were opened on Dec. 9 at the office of Jas. W. Stevenson, Comr. of Bridges, for the construction of the masonry piers, surface and sub-surface changes, and steel superstructure of the Manhattan and Brooklyn approaches of the Manhattan bridge, over East River, between the boroughs of Manhattan and Brooklyn, and the contract was awarded to John C. Rodgers, 1929 Amsterdam Ave., for $2,168,304.

Cohoes, N. Y.—Bids will be received until Dec. 28 for $18,000 bonds issued for the purpose of constructing a bridge across the first branch of the Mohawk River at Ontario St. Rich. Bolton, City Chamberlain.

Le Roy, N. Y.—Plans and specifications will be received until Feb. 1 for a bridge over Oatka River in Le Roy, as advertised in The Engineering Record. For further information address, Philo J. Sperry, of Le Roy.

Fargo, N. D.—See "Paving and Roadmaking."

West Union, O.—It is stated that bids will be received until Jan. 3 by S. S. Jones, Co. Aud., for constructing the superstructure of 2 bridges, one a quarter of a mile from Dunkinsville, and the other two miles from North Liberty.

Troy, O.—It is stated that bids will be received until Dec. 27 by E. E. Pearson, Co. Aud., for furnishing material and constructing the superstructure of a hand-lift bridge over the Miami and Erie Canal on Water St., said bridge to be a skew of 60 degrees, one roadway 20 ft. in the clear and 6-ft. walks on each side; 150 lbs. live load capacity.

Guthrie, Okla.—The City Engineer is preparing plans and specifications for the construction of 2 steel bridges across Cottonwood River, one on 5th St. and the other on 9th, same to have 16-ft. roadway, with sidewalk on one side; also the building of a concrete bridge across Cottonwood River at 5th St. C. M. Barnes, Mayor.

Washington, Pa.—See "Paving and Roadmaking."

South Bethlehem, Pa.—H. R. Fehr, of Easton, Pres. and Gen. Mgr. of the Easton Transit Co., states that it is proposed to build a bridge across the P. & R. Ry. Co.'s tracks, Northampton Heights Borough, near South Bethlehem, Pa., and is prepared to receive estimates for the work. Upon application to R. E. Neumeyer, C. E., South Bethlehem, the necessary information will be furnished.

Bradford, Pa.—See "Sewerage and Sewage Disposal."

Redfield, S. D.—It is reported that W. Bingham, Co. Aud., will receive bids until Jan. 10 for furnishing material and constructing all bridges that may be ordered during the year 1908.

Beaumont, Tex.—It is stated that plans are being prepared for the construction of a bridge over Pine Island Bayou to connect Jefferson and Hardin Counties, at an estimated cost of $15,000. J. A. Harrison is reported interested.

**River Falls, Wis.*—Bids were opened on Dec. 5 by Allen P. Weld, City Clk., for constructing a steel truss bridge at the Cedar St. crossing of the Kinnickinnic River, to be 140 ft. long, concrete floor, 20 ft. wide, cement sidewalks, 5 ft. wide and abutments, and the contract for same was awarded to the Minneapolis Steel & Machinery Co., of Minneapolis, Minn., for $12,250.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

**Mesa City, Ariz.*—The City Council has let contract for concrete walks and gutters to M. L. Vieux, of Phoenix, for about $3,500.

Hot Springs, Ark.—F. V. P. Ellsworth, City Engr., writes that the paving of Dists. 21 and 26 (bids for which were to have been opened on Nov. 20) has been postponed indefinitely. Expect to ask for new bids in the spring. The work consists of approximately 10,000 sq. yds. of asphalt, bitulithic or vitrified paving block on 6-in. concrete base; also about 5,000 sq. yds. vitri brick between tracks of Street R. R.

Ft. Rosecrans, Cal.—Bids will be received until Dec. 31 by Lieut. B. H. L. Williams, Constr. Q. M., U. S. A., for constructing macadam roadways and gutters at this post.

Jamestown, Colo.—It is stated that bids will be received until Dec. 28 by T. W. Jaycox, State Engr., Denver, for the construction and repair of about 2 miles of county wagon road, from Jamestown to Allen's Park.

Washington, D. C.—Bids will be received until Dec. 26 by the Comrs. D. C. (Henry B. F. MacFarland, Comr.), for furnishing the District Government 6x20-in. granite curbing during the remaining portion of the fiscal year ending June 30, 1908.

Lewiston, Idaho.—It is stated that bids will be received by W. L. Gifford, City Clk., until Jan. 16, for the construction of the J. Roth Rd. in Road Dist. No. 8.

**Rock Island, Ill.*—The Bd. of Local Improvements on Dec. 2 is stated to have awarded the contract for paving with asphalt a portion of 19th St. to the McCarthy Improvement Co. of Davenport, at $1.99 1-2 per sq. yd., estimated cost of improvement, $6,300.

Gibson City, Ill.—The Council is stated to have decided to expend $75,000 for street improvements.

Peoria, Ill.—The Bd. of Local Improvement is stated to have in contemplation the resurfacing of a portion of Adams St. with asphalt.

**Danville, Ind.*—D. D. Mills, Co. Aud., writes that the contract for constructing gravel road in Marion Township (Bids opened Dec. 15) has been awarded to Hicks Curry, of Danville, for $3,170.

Noblesville, Ind.—It is stated that bids will be received until Jan. 11 by the Bd. Co. Comrs., of Hamilton and Boone Counties, at Noblesville, for grading, draining and graveling 2 highways. N. W. Cowgill, Co. Aud., Noblesville.

Versailles, Ind.—It is reported that bids will be received by the Bd. Co. Comrs., until Jan. 7 for constructing 2 miles of macadamized roads. Nicholas Volz, Co. Aud.

Vincennes, Ind.—It is reported that Comrs. of Knox County will receive bids until Jan. 7 for the construction of 6,536 ft. of gravel road in Vincennes Township known as the Newton Rd.; the construction of 104,602 ft. of gravel road in Decker Township and 2 miles of gravel road in Vincennes Township known as the Beal Rd. John T. Scott, Co. Aud.

Crownpoint, Ind.—It is reported that bids will be received by the Comrs. of Lake County until Jan. 6 for the construction of a gravel road known as the Ruff Rd. No. 2, and a gravel road known as the Ruff Rd. No. 1, both in North Township. Chas. A. Johnson, Co. Aud.

**Cedar Rapids, Ia.*—M. Ford, of Cedar Rapids, is reported to have secured the contract for paving a portion of 15th St. at $1.48 per sq. yd.

New Orleans, La.—The Budget and Assessment Com. is stated to have reported favorably on the repaving of Napoleon Ave. and Magazine St.

Baton Rouge, La.—A. Swart, City Engineer, is reported to have estimated the cost of repaving pavement on Main St. and North Boulevard, at $12,000.

Ft. Washington, Md.—Bids will be received until Jan. 10 by the Constr. Q. M., U. S. A., for resurfacing macadam roads at this post.

**Items marked thus give the names of parties awarded contracts.*

Baltimore, Md.—Bids will be received until Dec. 27 by J. Barry Mahool, Pres. Bd. Awards, to grade, curb, gutter and pave with bitulithic asphalt blocks, vitrified bricks or sheet asphalt, a portion of Konig St.
*The contract for resurfacing a portion of 22d St. with bitulithic is reported to have been awarded to J. L. Robertson, 9 E. Lexington St., at $35,314.

Fitchburg, Mass.—See "Bridges."

Boston, Mass.—Bids will be received until Dec. 24 by the Boston Transit Comn. (B. Leighton Beal, Secy.), for furnishing and placing a thin layer of concrete surfaced with granolithic, for platforms, landings, passageway floors to various stations of the Washington St. tunnel.

Virginia, Minn.—It is stated that bids will be received until Jan. 7 by W. A. James, Clk. Town of Buyck, for constructing 6 miles of roadway from Crane Lake, Portage to Pelican.

Duluth, Minn.—The paving of a portion of 4th St. is reported contemplated at a cost of about $70,000.

**St. Joseph, Mo.*—The contract for paving a portion of King Hill Ave. is reported to have been awarded to the Phoenix Brick & Constr. Co.

**Salem, N. J.*—The Salem County Bd. of Chosen Freeholders is stated to have awarded to B. L. Tuft and Firman H. Lloyd the contract to construct a State road in Mannington Township, for $10,700.

Jersey City, N. J.—It is stated that bids will be received by Boulevard Comrs. John C. Sweeney, Clk., 580 Newark Ave., until Jan. 2, for furnishing supplies, during fiscal year, among which are the following. 2,500 yds. broken stone, as may be required, in sizes 2 1-2 to 1 1-2; 1,000 yds. road gravel, Roa Hook, Shark River, or equivalent; 1,000 yds. Pike County shale; 5,000 ft. No. 6 R. C. electric line wire; 3,000 ft. No. 6 twin (duplex) R. C. wire braided, 2 color cores; 1,000 ft. 1-4-in. galvanized guy wire; 1,000 1-4-in. mast arm wire; 2,000 arc light globes; 50,000 elliptical copper coated carbons, 1x 11 3-4 in.; 50,000 elliptical copper coated carbons, 1x7 1-4 in.; 50,000 round coated carbons, 1-2x12 in.; 250 chestnut poles, straight, clean and sound, 35 ft. long, butt 12 to 14 in.

**Flemington, N. J.*—The Bd. of Chosen Freeholders on Dec. 12 is stated to have awarded the contract for macadamizing about 34,200 ft. of public road between Hunterdon and Somerset Counties on the New Brunswick and Easton Turnpike to Delaware River Quarry & Constr. Co., for $48,852.

**Brooklyn, N. Y.*—The Barber Asphalt Paving Co., 114 Liberty St., N.Y. City, has secured the contract for regulating and repaving with asphalt on concrete foundation Irving Ave., bet. Suydam St. and Harman St., and bet. Greene Ave. and Myrtle Ave. (bids opened Dec. 4 by Bird S. Coler, Boro. Pres.) at the following bid: 11,860 sq. yds. asphalt pavment, $1.25; 100 sq. yds. old stone pavement relaid, 40 cts.; 1,660 cu. yds. concrete, $5.85; 3,130 lin. ft. new curb in concrete, $1.33; 2,500 lin. ft. old curbs reset in concrete, 83 cts.; total, $31,516. Totals of other bids: Cranford Co., 190 Montague St., $32,438, and Uvalde Co., 1 B'way, N. Y. City, $33,312.
*The Brooklyn Alcatraz Co., 407 Hamilton Ave., secured contract for regulating and repaving with asphalt on a concrete foundation of Skillman St. (bids opened Dec. 4) at the following bid: 7,370 sq. yds. asphalt pavt., $1.25; 10 sq. yds. old stone pavt. to be relaid, 40 cts.; 1,020 cu. yds. of concrete, $5.90; 3,685 lin. ft. of new curb, set in concrete, $1.25; 1,840 lin. ft. old curb, reset in concrete, 75 cts.; 22 noiseless covers and heads, complete, for sewer manholes, ea., $18; total, $21,617. Totals of other bids: Cranford Co., $22,516; Uvalde Co., $23,126, and Barber A. P. Co., $22,308.
*The Uvalde Co., 1 B'way, N. Y. City, secured the contract on Dec. 4 for regulating and repaving with asphalt on concrete foundation roadway of Ten Eyck St., at the following bid: 8,400 sq. yds. asphalt pavt., $1.24; 30 sq. yds. old stone pavt. relaid, 40 cts.; 1,170 cu. yds. concrete, $5.90; 3,840 lin. ft. new curbs, set in concrete, $1.30; 1,200 lin. ft. old curbs, to be reset in concrete, 80 cts.; 24 noiseless covers and heads, complete, for sewer manholes, ea., $18; total $23,715. Total of other bids: Cranford Co., $24,511, and Barber Asphalt Paving Co., $24,235.

Freeport, L. I., N. Y.—The Bd. of Trustees is stated to have decided to expend $54,000 on street improvements.

Mineola, L. I., N. Y.—Press reports states that work will probably begin in the spring on the Long Island motor parkway to be constructed from Garden City, Mineola, Hempstead, Meadowbrook, Westbury, Hicksville, Central Park to Lake Ronkonkoma, a distance of 34 miles, and thence to Riverhead; estimated cost about $2,000,000. Wm. K. Vanderbilt, Jr., of New York; A. R. Pardington, Ralph Peters, of Garden City, and others are reported interested.

Gouverneur, N. Y.—The State Surveyor is stated to have forwarded to the clerk of the Bd. of Superv. of this county detailed plans and specifications for the construction of three pieces of road in the county as follows: From Canton to Ogdensburg, 16 miles in length, estimated to cost $155,650; from Potsdam to Parishville Center, through the town of Pierepont, 5.12 miles in length, estimated to cost $47,500; from Potsdam to Colton, through the town of Pierepont, 7.90 miles in length, estimated to cost $76,500.

Rochester, N. Y.—Wetmore, Rauher & Vincennes, 270 South Ave., are stated to have submitted the lowest bid for paving portions of Atkinson St., at $14,921.
The paving of Meigs St. is reported contemplated.

Patchogue, N. Y.—The Village Trustees are reported to have authorized the Village Clerk to receive bids for constructing a boulevard by the bay extending from Bay to Cedar Ave.

Wheatfield, N. Y.—The Bd. Supervisors at Lockport is stated to have approved the estimate for constructing the Shawnee-Cambria Road, the improvement to cost $28,500. According to reports bids will soon be received by the State Engineer.

**Fargo, N. D.*—Jas. Kennedy, of Fargo, is reported to have secured the contract for paving with creosoted blocks the approach to the South Bridge, at $3,263.

**Cincinnati, O.*—The L. Drach Constr. Co., 206 E. 4th St., is stated to have secured the contract for macadamizing a portion of 1st Ave., at $15,651; also for paving with brick Valencia St., at $4,148.

Cincinnati, O.—Chas. N. Danenbower, City Engr., is reported to have estimated the cost of improving a portion of Clifton Ave. at $80,270.
The Bd. of Pub. Service is reported to have been directed to receive bids for improving a portion of Beechmont Ave.

Columbus, O.—Bids will be received by the Bd. Pub. Service (E. F. McGuire, Secy.) until Dec. 30 for grading and paving with hard burned brick or block or other substantial material on portions of numerous streets.

Delaware, O.—Bids will be received, it is stated, until Jan. 2 by F. D. King, City Aud., for $10,013 paving bonds.

Washington, Pa.—Bids will be received until Jan. 17 by the Co. Comrs. at Washington for the construction of an improved roadbed, culverts, bridges, etc., on Dry Run Rd., leading from Monongahela to Gingerhill, about 3 miles to be improved. Wm. Wylie Co., Road Engr.

Towanda, Pa.—It is stated that bids will be received until Dec. 31 by Jos. W. Hunter, State Highways Comr., Harrisburg, for constructing road in Wyalusing Township, Bradford County.

Bradford, Pa.—See "Sewerage and Sewage Disposal."

**Chehalis, Wash.*—Anderson & Robinson are reported to have been awarded the contract for paving Park, School, Washington and Adams Sts. for $8,500.

**Spokane, Wash.*—The Bd. Pub. Wks. is stated to have awarded contracts as follows: Grading, curbing and parking Carlisle Ave., Cedar St. and 18th Ave., to Mitchell Bros., at $5,100, $10,000 and $6,995, respectively; grading, curbing and parking 7th Ave., to Julia V. Costello, $8,500; sidewalks on Carlisle Ave., to Foster & Gardin, $2,300; sidewalks on Cedar St. and 18th Ave., to L. B. Handley, $2,624 and $1,970, respectively.

Seattle, Wash.—R. H. Thomson, City Engr., has reported the estimated cost on the following work: Prospect St. concrete walks, $14,900; paving alley in block 20, Borai's Addition, $3,000, and planking W. Stacy St., $1,300.
Ordinances have been passed providing for grading Graham Ave. at a cost of $27,000 ,and Davis Pl., to cost $30,200, and brick paving on Main St. to cost $4,100. R. H. Thomson, City Engr.

Seattle, Wash.—See "Sewerage and Sewage Disposal."

La Crosse, Wis.—Wooley & Hanson, of La Crosse, are reported to be the lowest bidder for the macadamizing of the Onalaska-North La Crosse Rd., at $3,900.

Janesville, Wis.—This city will purchase a new road roller next month.
Bids will soon be asked for 3,194 sq. yds. brick paving on E. Milwaukee St.

Wausau, Wis.—The paving of a portion of Fulton St. with macadam is reported contemplated.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Carbon Hill, Ala.—Plans are being made to extend the transmission lines of the municipal electric lighting plant to the outskirts of the town. The water mains will also be extended. H. T. Butler, Supt.

Clanton, Ala.—The Clanton Light & Power Co. contemplates equipping its power house with new machinery. J. P. Van Derveer, Pres.

Dadeville, Ala.—The Mayor writes that the citizens on Dec. 9 voted to issue $10,000 bonds for improving electric light plant. Bids for bonds will be received on Jan. 1.

Argenta, Ark.—The managers of the municipal electric lighting plant propose establishing a commercial service and furnishing electricity for the street railway system. A. J. Trotier, Supt.

Hope, Ark.—Extensive additions and improvements are contemplated to the municipal electric light plant, which include the installation of 2 boilers, another engine and dynamo, and the construction of a new power house, and new water works system will also be built. Chas. M. Richards, Supt.

**Ft. Smith, Ark.*—The City Council is reported to have awarded to the Ft. Smith Light & Traction Co. a franchise to light the city with 181 lamps of 2,000 c. p., at $55 per lamp per year.

Sacramento, Cal.—Plans and specifications for a municipal underground conduit electric street lighting system have been presented to the City Trus. by Trustee Edw. J. Carragher, Chmn. of Com. having in charge the work of lighting the city streets. The plans have been prepared by C. L. Cory, of San Francisco, who estimates the cost as follows: Station building of fireproof construction, including foundation, $16,500; electrical machinery, $22,150; 600 arc lamps, $30,000; underground conduit system, $26,100; 184 cast iron posts, $18,600; copper wire, $39,350; engineer's plans and construction, $11,300; steam machinery installed complete, including 50,000-gal. oil tank, $73,200; total, $237,200.

Pasadena, Cal.—Early next year an election will probably be held to vote on issuing $200,000 bonds for an additional municipal and commercial lighting system. Heman Dyer, City Clk.

San Francisco, Cal.—The Northern California Power Co. is contemplating the construction of a hydro-electric station having an output of 20,500 h. p. E. V. D. Johnson, Mgr.

Fairfield, Cal.—E. D. N. Lehe, of Dixon, is reported to have decided to construct a transmission line up the valley from the substation near Cordelia.

Merced, Cal.—The Merced Falls Gas & Electric Co. contemplates constructing a new hydro-electric plant. H. H. Adams, Gen. Supt.

Oceanside, Cal.—The Oceanside Electric & Gas Co. contemplates extending its transmission line to San Luis Rey Valley to furnish electricity for pumping and irrigating purposes. Will furnish from 150 to 200 h. p. Eugene V. Griffes, Secry. and Mgr.

Salida, Colo.—The Salida Light, Power & Utility Co. is contemplating the construction of a hydro-electric plant, 10,000 ft. water pipe line, and installing a 750-kw unit. F. A. Sparks, Supt.

Durango, Colo.—The Standard Light, Power & Water Co. is planning to construct a 2,000 h. p. hydro-electric plant next year. M. Harrington, Mgr.

Berthoud, Colo.—The Northern Colorado Power Co. is planning to replace present direct-current street lighting system to alternating-current. Wm. J. Preston, Mgr.

Hartford, Conn.—The Hartford City Gas Light Co. is reported to be considering the advisability of construction of an electric light plant in connection with the gas works on Arch St. E. B. Bennett, Pres.

Washington, D. C.—See "Miscellaneous."

Washington, D. C.—Specifications are on file at the office of The Engineering Record, 239 West 39th St., New York, N. Y., calling for equipment for the heating, lighting and power plant for the U. S. Capitol and Congressional Buildings, bids for which will be received at the office of Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, until Jan. 15.

Quincy, Fla.—This city proposes to expend about $10,000 in the near future to improve the municipal electric plant. A new boiler of 150 h.p., one 75-kw. alternating-current, 2,300-volt generator and engine will probably be installed. J. B. Price, Supt.

Columbus, Ga.—Surveyors in the employ of the Columbus Power Co. are reported to have completed making a survey of the water power of Chattahoochee River between this city and West Point. In a distance of 35 miles the river falls 365 ft., affording an energy that is estimated to be over 100,000 h.-p. Most of this power is owned by the Columbus Power Co. It is said to be the policy of the company to develop these powers from time to time, to meet the demands from new industries being established in Columbus and vicinity. The company already has 3 plants in operation. Plans have been drawn for another dam and power house, 2 miles north of the city.

Caldwell, Idaho.—The Caldwell Power Co. contemplates installing three 100-kw. transformers in its plant. R. V. Sebree, Secy.

Emmett, Ida.—The Emmett Power & Water Co. is planning to change from steam to water power in the spring. W. A. Marshall, Mgr.

Delavan, Ill.—The Royal Light & Power Co. is said to be considering the installation of Tungsten lamps on its street lighting system. W. H. Few, Mgr.

Carterville, Ill.—H. C. Hope is owner of the Carterville electric light plant, and will probably purchase a 100-kw., alternating-current, 1,100-volt, 60-cycle generator, belted type.

La Harpe, Ill.—The La Harpe Electric Light & Power Co. is planning to increase the output of its plant by the installation of two direct-current generators having a rating of 40 kw. each. A. L. Blythe, Mgr.

Meredosia, Ill.—C. W. Skinner is owner of the Meredosia electric light plant and expects to install a complete new plant next spring.

Medora, Ill.—Frank Watson is owner of the Medora electric light plant, and expects to install a storage battery in his plant in the near future.

Harrisburg, Ill.—Chas. D. Stilwell, is Mgr. of the Peoples Water & Light Co., which is planning to make enlargements and extensions to its plant the coming year.

Sheffield, Ill.—The Sheffield Electric Light Co. contemplates making improvements to its plant during the year of 1908. H. W. Booth, Mgr.

Harvard, Ill.—The Harvard Electric Light & Power Co. contemplates the reconstruction of its entire overhead system. C. C. Condon, Mgr.

Ridgeville, Ind.—The Ridgeville Electric Light, Heat, Power & Water Co. contemplates the installation of a 30-kw. turbine in its plant. S. C. Lay, Mgr.

Decatur, Ind.—The city is said to be considering replacing the present street lighting system with alternating-current street lighting system in the spring. M. J. Mylott, Supt.

Winona Lake, Ind.—The Winona Electric Light & Water Co. is in the market for a 500-kw. turbo-generator set.

Crown Point, Ind.—The Crown Point Electric Co. is planning to increase the output of the plant by the installation of a 300-kw. turbine. F. H. Keeney, Mgr.

Farmersburg, Ind.—The Torr Electric Co. contemplates installing a larger engine in its plant in the near future. A. D. Torr, Mgr.

Ferdinand, Ind.—The Ferdinand Electric Light Co. contemplates installing a larger battery in its plant the latter part of next year. Wm. R. Sauer, Mgr.

Greencastle, Ind.—Paul H. White is reported to have petitioned Council for a franchise for furnishing light and power.

Garrett, Ind.—Plans are being prepared for extensive additions to the municipal electric lighting system, which include the installation of an engine, generator and a new arc lighting system.

Weleetka, Ind. Ter.—The Weleetka Light & Water Co. is planning to install another boiler having the same capacity of the present one, and either an 80,000-gal. tank or standpipe for city water works, or a second pump for direct pressure. D. F. Campbell, Mgr.

Des Moines, Ia.—The Des Moines Gas Co. (Jansen Haines, Mgr.) is reported to be preparing to enlarge and improve its plant; probable cost of work, $100,000.

Kansas City, Kan.—A company in which H. F. Wulf, Henry McGraw and others are interested, is reported to have applied to the City Council for a 30-year electric light franchise to do a general business in this city.

Morehead, Ky.—The Reliance Eng. Co., Cincinnati, O., is reported to have been selected to prepare plans for a municipal elctric light plant; cost about $10,000.

Flemingsburg, Ky.—O'Bannon & Son, owners of the electric lighting plant, are contemplating installing a storage battery to provide for a continuous service.

Lecompte, La.—W. H. Jones, City Clk., writes that bids will probably be received about Feb. 1 for the construction of an electric light plant to cost about $10,000. Baldwin Wood, of New Orleans, Engr. of construction.

Thibodaux, La.—The Improvement Committee is considering a proposition to do away with steam power and substitute gas producer outfits in the municipal electric

**Items marked thus give the names of parties awarded contracts.*

light plant, and changing the present system to alternating-current, installing larger units. A. R. Staunton, Supt.

[illegible], La.—The citizens are contemplating the installation of a new street lighting system to replace the system now in use. L. A. Larson, Mgr.

Fryeburg, Me.—The Fryeburg Electric Light Co. contemplates changing from steam to water power and building one mile of new line. C. E. Harris, Secy. and Mgr.

Ashland, Me.—C. A. Flint is owner of the Electric Light Co., and proposes changing plant from steam to water power; he also expects to build his own power plant.

Port Deposit, Md.—The Port Deposit Electric Co. contemplates replacing the present street lighting system with 40-c.p. Tungsten series street lamps. Walter Flint, Mgr.

Pocomoke City, Md.—The Stevenson Electric Light Co. will install a 100 h. p. boiler in its plant next summer. R. P. Stevenson, Owner and Mgr.

Winchendon, Mass.—The Winchendon Electric Light & Power Co. contemplates constructing an auxiliary water power plant. F. W. Nourse, Mgr.

Hyde Park, Mass.—The Hyde Park Electric Light Co. contemplates replacing its present street lighting system with enclosed arc lamps next spring. M. S. Rose, Supt.

Kalamazoo, Mich.—The Kalamazoo Power Co. is reported incorporated by Frank W. Armstrong, C. S. Smedley, and others with a capital of $50,000, to operate a power and steam heating plant in Kalamazoo, and furnish power to manufacturing plants. About 14 800-h. p. engines in pairs will be installed, ea. pair being directly connected to a 1,100 kw. generator making 7 in all, and equal to over 10,000 h. p. W. D. Ball, of Chicago, Ill., is the Elec. Engr. Active work is to begin in the spring.

Mt. Pleasant, Mich.—The Harris Electric Co. will install a new generator in its plant and change the system from single to the 3-phase system in about 6 weeks. E. O. Harris, Owner and Mgr.

Petoskey, Mich.—New boilers will be installed in the municipal lighting plant to take the place of the ones now in use. J. E. Niles, Supt.

Eaton Rapids, Mich.—Extensive additions and improvements are contemplated for the municipal electric light plant, which will include the installation of a 90-kw. dynamo, an 80-h.p. engine and a boiler of 125 h.p. W. H. Woodmausee, Supt.

Howard City, Mich.—The Howard City Electric Light & Power Co. contemplates making extensive improvements and additions to its plant, which will include the installation of new switchboard, possibly new generators and additional boiler capacity; also the rebuilding of its lines. L. W. Greene, Owner and Mgr.

Fenton, Mich.—The Fenton Electric Light & Power Co. is said to be contemplating extending its lines to the town of Linden. E. H. Bliss, Mgr.

Hobart, Mich.—The citizens are said to have in contemplation the installation of an additional engine and alternator in the municipal electric light plant. O. L. Shore, Mgr.

Holland, Mich.—The city is contemplating adding a 500-kw. directed unit to the municipal electric lighting plant. James De Young, Mgr.

White Pigeon, Mich.—It is reported that plans are being made, and bids will soon be asked, for rebuilding gas plant recently wrecked by an explosion.

Natchez, Miss.—Krumbhaar & Aiken, of New Orleans, La., are reported to be preparing estimates of cost of installing machinery at the water works, to generate electricity for public lighting, also lighting the municipal offices.

Sedalia, Mo.—The Sedalia Ice, Light & Fuel Co. contemplates the installation of a 700-h.p. water-tube boiler in its plant. E. R. Audler, Mgr.

Smithville, Mo.—Harry Gordon, owner of the Smithville electric light plant, contemplates replacing the present high-speed engine in his plant with a 14x36 Corliss engine.

Shelbina, Mo.—The citizens are said to be considering the installation of a new boiler in the municipal electric lighting plant next year. E. P. Weaver, Supt.

St. Louis, Mo.—The plant of The Laclede Power Co. is reported to have been sold by the Clark Syndicate of Philadelphia, to the Union Light & Power Co., for about $3,000,000. The plant will be operated as a branch of the plant of the Union Co. and will be under the management of W. U. N. Powelson, the new president of the Union Co.

Princeton, N. J.—R. M. Anderson, Asst. Treas., Princeton Theological Seminary, writes that it is proposed to install a central heating and lighting plant next year, and to have it ready in time for the opening in Sept. Contract will be let late this winter or in the early spring. The Richard D. Kimball Co., 6 Beacon St., Boston, Mass., has prepared the plans and will have charge of the work.

Newark, N. J.—Jas. M. Seymour, Jr., of Newark, is reported to have been selected by the Bldg. Com .of the Bd. of Freeholders to investigate conditions at the county jail and determine the advisability of establishing an electric light plant there.

Trenton, N. J.—Bids will be received until Dec. 31 by J. Williard Morgan, State Compt., for furnishing electric current needed for lighting and power purposes in and about the State House, W. State St., Trenton, for a period of 3 or 5 years. Maximum current required will be 1,500 amperes, 110 volts a. c. 60 cycle, single phase for lighting purposes, and desk fans motors; for elevators, motors, shops, blower fans, etc., a maximum current of 200 amperes 220 volts d. c. will be required. Bids must be submitted on a net flat meter rater per kw. hour for both classes of service. Current to be furnished by meter or meters furnished and maintained by the bidder.

Jersey City, N. J.—See "Paving and Roadmaking."

Falconer, N. Y.—E. W. Jordan, owner of the Falconer electric light plant, contemplates the installation of gas engines and furnishing a continuous service, and a direct-current service for power purposes. W. E. Cowden, Mgr.

Livingston Manor, N. Y.—The Livingston Manor Electric Co. is building a concrete dam, 1,400 ft. of pipe line 20 in. diam., and install two 60 h. p. impulse water wheels. W. R. Woolsey, Treas.

Bedford, N. Y.—The Pub. Service Comn. at Albany, on Dec. 12 granted permission to the Katonah Lighting Co. to construct an electric light line in the town of Bedford, and to issue $20,000 capital stock.

**Rochester, N. Y.*—The Bd. of Contract on Dec. 12 awarded contract for lighting the new convention hall to Jas. McDonnell at $2,163, and to R. T. Ford Co. for heating same, at $1,527.

**Buffalo, N. Y.*—Mayor Adam has sent to the Bd. of Aldermen a communication advocating a contract with the Welsbach Street Lighting Co. of America for the placing of incandescent gas burners throughout the city. The company will supply lampheads with the incandescent burners for 3 cts. per night per lamp, 5,000 or more heads to be installed, the contract to run 5 years.

Lamont, N. Y.—Jas. C. Horning, of Castile, will construct an electric light and power plant at Lamont to light Silver Springs, Castile and Gainesville; probable cost, $40,000. Bids will be called for about Apr. 1. Engineer, Chas. E. Collins, of Philadelphia, Pa.

**New York, N. Y.*—The Otis Elevator Co. of N. Y. City, has secured the contract for flash-light signals for the elevators at the N. Y. Custom House, for $7,280.

Salisbury, N. C.—The Salisbury & Spencer Ry. Co. has contracted with the Southern Power Co., of Charlotte, for three 100-kw. transformers, substation and motor generator set for operating the street railway system. The company will furnish electricity to city for commercial, lighting and power purposes. Work will commence on the construction of the substation in about 30 days. H. W. Frund, Mgr.

Salem, O.—The Salem Electric Light & Power Co. contemplates building a new plant next spring. D. L. Davis, Secry. and Mgr.

Fremont, O.—The Fremont Yaryan Co. contemplates the installation of a new engine, generator and boiler in its plant. B. J. Shockley, Supt.

Columbus, O.—Bids will be received until Dec. 30 by Edwd. F. McGuire, Secy. Bd. Pub. Service, for furnishing and delivering on or before Jan. 15, 1908, at the Municipal Electric Light plant, Dublin Ave., cable and wire for a 1,000 kw. generator and motor driven exciter.

Newton Falls, O.—The Electric Light & Power Co. is contemplating the construction of a new power house and boiler house. J. W. Carr, Mgr.

Portland, Ore.—A report and estimate of expenses of the city lighting department has been submitted to Mayor Lane by Thos. G. Greene, D. A. Pattulo and M. A. Fleischner, of the Executive Bd., and the report favors the establishment of a municipal lighting plant, from power furnished from Bull Run River. The present lighting contract expires on Dec. 31.

Panama.—Bids will be received until Jan. 6 by Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., purchasing officer, Isthmian Canal Comn., Washington, D. C., for furnishing engine and generator switchboard, boring and turning mill, journal boxes, brick, lumber, etc., as per circular No. 408.

McDonald, Pa.—The McDonald Electric Heat & Power Co. is reported organized with a capital of $100,000, by A. Valentour, W. H. Young, and others.

Pittsburg, Pa.—The Dept. of Pub. Wks. (A. B. Shepherd, Acting Dir.) is said to be considering the extending of the municipal light system on Braddock Ave.

Reading, Pa.—The Supply, Janitors & Repairs Com. of School Bd. is said to be considering the installing of an independent electric light plant in the administration building at 8th and Washington Sts., to furnish light for the two high schools. The cost of a plant of 150 h. p. is estimated at $5,000.

Trappe, Pa.—The Collegeville Gas Co., of Collegeville, is reported to have secured a gas franchise from Town Council to extend its service to this borough.

**Easton, Pa.*—The Common Council is reported to have awarded to the Westinghouse Electric Co., of Pittsburg, the contract for lamps, at about $13,000.

Richmond, Va.—Bids will be received until Dec. 30 by W. P. Knowles, Supt. City Gas Wks., address to Chmn. Com. on Light, for furnishing pipe and labor and material for constructing 6, 10, 12 and 20-in. gas mains to be installed in certain streets.

Tacoma, Wash.—Donald Fletcher has filed a petition with the County Comrs. for a franchise to run transmission lines along roads and highways of Pierce County for the conveyance of electric current to be brought from a proposed power plant on Cle Elum River above Cle Elum Lake. Mr. Fletcher stated in his petition that he proposed to furnish power for electric lights, running of mills and factories, etc., for Pierce, Kittitas and King Counties. He further states that he can furnish to the extent of 110,000 h. p. from the current of the Cle Elum River.

Colton, Wash.—E. S. Aldrich, of Moscow, Idaho, Mgr. Idaho-Washington Light & Power Co., writes that about $3,000 will be expended for work required in Colton. The company will do its own work.

Puyallup, Wash.—Fuller & Manley, of Boston, Mass., are reported to have been selected to prepare plans for a municipal power plant, for lighting the city of Puyallup.

Hatfield, Wis.—J. G. White & Co., of New York, N. Y., have finished the closing of a new dam for the La Crosse Water Power Co., of La Crosse, on Black River at Hatfield. This is a concrete structure 50 ft. high at center, by 400 ft. long, containing about 24,000 cu. yds. There are still under construction the power house, which is located 2 miles below the dam and the canal between the dam and the power house. The installation will have 16,000 h. p., ultimate capacity, and will supply La Crosse and Winona with current over 90 miles of transmission lines. The pressure will be 45,000 volts.

Iola, Wis.—The planing mill and electric light plant of Frogner Bros. & Sons, are reported to have been destroyed by fire.

Waterloo, Wis.—F. E. Peschel, Village Clk., writes that about $5,000 will be expended on electric light improvements, the work to be done by day labor. Engineers, D. C. and Wm. B. Jackson, Coml. National Bank Bldg., Chicago, Ill.

Charlestown, W. Va.—It is stated that bids are wanted until Jan. 1 for lighting the town for one year from Feb. 1, 1908, with privilege of renewal of contract at the expiration of the same. Geo. T. Light, Mayor.

Claresholm, Alta.—The question of constructing a municipal electric light plant is reported under consideration.

Port Arthur, Ont.—We are informed that the city of Port Arthur has commissioned Smith, Kerry & Chace, Confederation Life Bldg., Toronto, to make a survey for power development at Silver Falls on Kaministikura River, about 25 miles distant from Port Arthur.

Edmonton, Alta.—A site is reported to have been selected for a municipal power plant, 5 miles from city, and plans are now being prepared for the buildings and transmission line. R. R. Keeley, City Engr.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Woodland, Cal.—The Northern Electric Ry. Co. is stated to have been granted a franchise to operate an electric railway on Main St. C. S. Compton, Ch. Engr., Chico.

Riverside, Cal.—It is stated that construction will begin on the electric railway which is to connect Riverside and Colton. The contract for the grading has been let to Garnsey & Pitzer, of Los Angeles. The franchise was awarded a year ago to the San Bernardino Valley Interurban Ry. Co. under the name of A. C. Denman, Jr., but it is understood that the line will be a Huntington road and will be a connecting link in the Huntington system between Riverside and Los Angeles. The road will be about 9 miles in length.

Pasadena, Cal.—It is reported that surveyors are working on the line of a new electric railway, supposed to be the line which H. Potter, of La Canada, intends to bring into La Canada and to North Pasadena. Starting from the short electric line to Verdugo, owned by the Harriman interests, the survey has been run to LaCanada through the Cottonwood Canon. From the canon another line has been run almost directly north to Millard Canon. Another survey has been run from the northeast corner of Lincoln Ave. and Montana St. in North Pasadena, to the mountains.

East St. Louis, Ill.—Articles of incorporation of the Red Bud & Belleville Interurban R. R. Co. are stated to have been filed at Belleville. The incorporators are Conrad Becker, Herman Schreiber and Dr. C. G. Smith, of Red Bud; John Keller of Hecker, Ill., and Ben A. Gundlach, of Belleville. The company proposes to construct and operate an electric railway from Belleville to Smithton, thence southeast to Red Bud, Ill.

Quincy, Ill.—The St. Louis, Terre Haute & Quincy Traction Co. is stated to have decided to increase the capital from $25,000 to $50,000. The company proposes to build an electric interurban railway from Quincy, Ill., to Terre Haute, Ind., via Roodhouse, Virden and Taylorville. Edward Yates, Pittsfield, Pres.; F. W. Knollenberg, Quincy, Secy. and Treas. It was also decided to move the headquarters of the company from Springfield to Quincy.

South Bend, Ind.—The County Comrs. are stated to have granted a franchise to the Indianapolis, Logansport & South Bend Ry. Co. to construct and operate an electric railway running along Michigan Rd. from the southern border of the county to a point a short distance south of the city, where the line will enter a private right of way.

Decatur, Ind.—The Ft. Wayne & Springfield Traction Co. is stated to have decided to extend the line south to Berne early next year.

Boston, Mass.—It is reported that the Railroad Comrs. had given their approval to an order granting the Boston & Worcester Str. Ry. Co. the right to lay its tracks in Worcester, Bacon, Middle Harvard and Sawin Sts., and North Ave., in Natick. Under this order the street railway company will be able to run a branch line to Natick and give the citizens of that town more rapid transit to and from Boston. E. H. Rogers, Ch. Engr., So. Framingham.

Salisbury, N. C.—See "Power Plants, Gas and Electricity."

Chambersburg, Pa.—It is reported that the Cumberland Valley R. R. Co. will electrify the Waynesboro Branch.

Tacoma, Wash.—Deeds for the right of way of the Puget Sound Electric Ry.'s new line to Puyallup are being taken, according to reports. Since the decision to build through the valley to Puyallup the company's plans have been enlarged. It is reported that the new line is to become part of the through line betwen Tacoma and Seattle.

Sedro Wooley, Wash.—It is stated that construction work will soon start on the electric railway between Ainacortes and Sedro-Wooley, surveys having been completed. B. J. Weeks is reported interested.

Buenos Ayres, S. A.—Bids will be opened May 1 at 2 P. M. in the office of the Secretary of the Intendency, Buenos Ayres, for the construction of 2 of the lines of underground electric railways which form the metropolitan network projected and approved by that Corporation, and for the exploitation of those lines under a lease from the date of completion of their construction. Further information can be obtained by addressing the Argentine Legation, Washington, D. C.

RAILROADS.

Notes Arranged Alphabetically by States.

Decatur, Ala.—Press reports state that the Southern Ry. Co. (J. A. Dodson, Supt. of Constr., Atlanta, Ga), will expend about $500,000 in rebuilding and double-tracking the Tennessee River and Swan Lake bridges and double tracking its road from Decatur to Decatur Junction. Much of the work has already been commenced; it will take 8 or 9 months to complete the work.

West Point, Ga.—The Secy. of State has granted an amendment to the charter of the Chattahoochee Valley Ry. Co. (L. Lanier, Pres. & Mgr., West Point), which proposed to extend its line from West Point through

**Items marked thus give the names of parties awarded contracts.*

Troup County to a point near Standing Rock, Ala., thence through Chambers and Randolph Counties, Ala., to Texas.

Chicago, Ill.—The Chicago, Joliet & Central Illinois Ry. Co. is reported incorporated, with principal office in Chicago, to construct and operate a railway from Chicago southeasterly through Lyons, Downers Grove, Dupage and thence south through Lockport and Joliet to other points in the counties of Cook, Dupage, Will, Bureau, Peoria, Kendal, Grundy, Lasalle, Livingston, Putnam, Marshall, McLean and Woodford. Incorporators Josiah Burnham, Hugo De Loeb, Geo. L. Turnbull and others.

Ft. Standish, Mass.—Bids will be received until Jan. 15 by the Quartermaster, at Ft. Banks, Winthrop, Mass., for fushnishing material and constructing approximately 1,500 ft. narrow gauge railroad extending from end of Engineer's wharf to Battery Burbeck, at Ft. Standish.

Mize, Miss.—It is reported that Eastman, Gardiner & Co., of Laurel, Miss., are making preparations to begin work on a railroad from Mize, on the Gulf and Ship Island R. R., to Morton, on the Alabama & Vicksburg R. R., a distance of about 41 miles.

Omaha, Neb.—The Chicago & Rock Island R. R. Co. (J. B. Berry, Ch. Engr., Chicago, Ill.), is reported to have decided to double track and completely reballast its Omaha-Lincoln line.

The double tracking will eventually be continued through Nebraska to Denver. The Missouri Pacific R. R. Co. (Jas. W. Way, Consulting Engr., St. Louis, Mo.), as was announced, is reported to have decided to expend $1,000,000 in Nebraska in rebuilding its road and in installing new equipment and stations.

The Chicago & Northwestern R. R. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.) is said to be contemplating improvements on its lines through the State. The Webster St. Depot will either be rebuilt or all of the trains run out of the Union passenger station.

Niagara Falls, N. Y.—John L. Harper and Wm. D. Robbins, Engrs. of the Grand Crossing Comn., are reported to have been authorized to complete the details for an overhead crossing, on North Main St. over the tracks of the Central and the Erie Railroads.

Columbus, O.—The Sinking Fund Trustees are reported to have accepted the $1,000,000 issue of bonds to pay city's portion of expense of eliminating railroad grade crossings, which make it possible for the work of preparing for the elimination of these crossings to be continued.

Clearfield, Pa.—Press reports state that the New York Central R. R. (W. J. Wilgus, of New York, N. Y., Vice-Pres. Constr. Dept.) is reported to have completed surveys for a connecting line with the Lake Erie R. R. from Versailles to Clearfield.

Pittsburg, Pa.—Plans are reported to have been approved for continuing construction work on the Pittsburg, Binghamton & Eastern R. R. during 1908, and authority has been given to build the Oregon Hill branch, which will be 32.25 miles long. Extensions are also proposed from Powell to Binghamton, 60 miles, and from Cedar Lodge to Clearfield, 148.6 miles. H. A. Schwanecke, Vice-Pres. and Ch. Engr.

Philadelphia, Pa.—Mayor Reyburn, a sub-committee of the Special Committee on Grade Crossings, consisting of Chief Clerk Wm. J. Milligan, of Select Council; Geo. S. Webster, Ch. Engr., Bureau of Survey, and others, had a conference on Dec. 13 at the Broad St. Station with Chas. E. Pugh, 2d Vice-Pres., A. C. Shand, Chief Engr., and J. B. Baker, Supt. of the Philadelphia terminal division of the Pennsylvania R. R., with the object of having an understanding to serve as the basis of future negotiations for the abolition of grade crossings in South Philadelphia by the joint action of the city and the railway company especially the Washington Ave. crossings; it is estimated that it will cost about $4,000,000 to elevate the Washington Ave. tracks.

Chattanooga, Tenn.—The Louisville & Nashville R. R. Co. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) is reported to have decided to extend its line from Etowahton, Ala., to Chattanooga, a distance of 50 miles. The line will cost about $1,000,000.

Fredericksburg, Va.—The application is reported to have been made to the State Corporation Comn. at Richmond, for a charter for the Fredericksburg & Southern R. R. Co.

Berne, Switzerland.—See "Miscellaneous."

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—Evans Bros. Constr. Co., 2231 1st Ave., is reported to have secured the contract to make improvements to the county jail.

Berkeley, Cal.—J. V. Mendenhall, Town Clk., writes that all bids opened on Dec. 9 for the erection of a town hall of concrete and steel have been rejected, and plans will be revised; probable cost about $100,000. Architects, Bakewell & Brown, 417 Montgomery St., San Francisco.

San Francisco, Cal.—At the meeting of the Public Utilities Com. of the Bd. of Superv. Dec. 3, Jas. D. Phelan, a member of the Library Bd., recommended an appropriation of $1,000,000 for the new library building.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Jacksonville, Fla.—The State Bd. of Health (E. M. Hendry, of Tampa, Pres.) is said to be considering the erection of a 3-story building in Jacksonville suitable for headquarters and offices for the board, the cost to be about $25,000.

Punta Gorda, Fla.—Bids will be received until Jan 10 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing quarters and boat house at Boca Grande Quarantine Station, Punta Gorda, Fla.

Gainesville, Ga.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 21 for the construction (complete) of the U. S. Postoffice, at Gainesville.

Chicago, Ill.—John M. Schroeder, 99 Randolph St., is reported to have prepared plans for a 3-story 42x100 ft. building to be erected for the People's Hospital at 363 22d St., to cost $25,000.

Plans for a hospital and school building to be erected at Washington St. and 5th Ave., it is stated, are being prepared for the Chicago Eye, Ear, Nose and Throat Hospital, by Nimmons & Fellows, 204 Dearborn St. The building will be 12 stories, 40x80 ft.; estimated cost, $250,000.

Indianapolis, Ind.—The Finance Com. of the City Council, it is stated, has decided to allow the Bd. of Health about $60,000 for the needs of the City Hospital.

DesMoines, Ia.—Bids will probably be received in Feb. or Mar. by the Bd. of Pub. Wks. for the erection of the proposed City Hall to cost about $350,000. Architects Proudfoot & Bird, Crocker Bldg.

The State Bd. of Agriculture, it is stated, has ordered plans prepared for a $20,000 administration building to be erected at the State Fair Grounds.

Franklinton, La.—The Police Jury, it is stated, has decided to erect new jail, costing $10,500, according to plans submitted by the F. B. Hull Constr. Co., of Alexandria.

Baltimore, Md.—The Architectural Comn. is reported to have on Dec. 10 accepted the plans of Simonson & Pietsch, American Bldg., for the fire engine house to be erected at 323 N. Paca St. Estimated cost $25,000.

Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 3 (extension of date) for iron window guards and gates for the U. S. Custom House, Baltimore.

Springfield, Mass.—The Municipal Bldg. Comn., it is stated, has decided to ask competitive plans for the municipal building.

Ft. Andrews, Mass.—Bids will be received until Jan. 14 by Capt. Ira L. Fredendall, Constr. Q. M., U. S. A., 263 Sumner St., Boston, for the construction, plumbing, heating, electric wiring, and electric lighting fixtures of a brick barrack building at Ft. Andrews, Peddock's Island, Boston Harbor, Mass.

Detroit, Mich.—Smith, Hinchman & Grylls, Washington Arcade, it is reported, have completed plans for the Jas. G. Scripps branch library to be erected at Scripps Park, Trumbill and Grand River Aves., at a cost of $14,000.

The following are the bids opened on Dec. 17 at the office of Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction, complete, of extension to U. S. Post Office and Court House at Detroit: Paul Reimers Sons, Milwaukee, Wis., $236,000; Northern Constr. Co., Milwaukee, Wis., $233,793; Vinton Co., Detroit, $223,924; E. W. Reid Co., Detroit, $216,595; R. L. Robertson Detroit, $263,790; W. H. Maxwell, Spokane, Wash., $227,741; Conners Bros., Lowell, Mass., $215,000; J. H. Wiese, So. Omaha, Neb., $198,390; and A. B. Stannard, New York, N. Y., $213,831.

Maryville, Mo.—It is reported that A. A. Seary, of Maryville, has completed plans for an infirmary to be erected here at a cost of $33,000.

Kansas City, Mo.—Mayor Beardsley is said to be in favor of erecting a convenience station at 9th and Main Sts., to cost about $30,000.

**Overbrook, N. J.*—The Com. on Bldgs., of the Bd. of Freeholders, it is stated, decided on Dec. 11 in favor of the Standard system of thermostatic heating and ventilating in the new Hospital for the Insane at Overbrook, awarding the contract to Storms & Co., of Newark.

Rochester, N. Y.—See "Water."

New York, N. Y.—Certain architects have been engaged to prepare competitive plans for the municipal office building, of at least 20 stories, to be erected between City Hall Pl. and Chambers St., Centre St. and Park Row. The cost is to be about $9,000,000. Plans are to be submitted before Apr. 14, and bids for construction will probably be asked next fall. There will be 25 elevators installed.

Durham, N. C.—Kendall, Taylor & Stevens, 193 Federal St., Boston, Mass., Archts., will receive bids about Feb. 1 for a new hospital to be erected here, donated by Geo. W. Watts, of Durham; probable cost, $140,000.

Asheville, N. C.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C., until Jan. 20, for the construction (complete) of the extension to the U. S. Postoffice and Court House, Asheville.

Columbus, O.—Bids will be received until Jan. 10 by the Bd. Pub. Service (Edwd F. McGuire, Secy.) for furnishing material and erecting a greenhouse in Schiller Park. Excavations, concrete work, sewer, plumbing and cement walks excepted. Bids to be submitted as a whole or separately on labor and material.

**Columbus Barracks, O.*—Francis Bros., 120 N. Monroe Ave., have secured the contract to erect 3 double sets of officers' quarters, at $49,190; quartermaster's storehouse at $12,101, and wagon shed at $2,295. Bids opened Nov. 30. Capt. H. J. Hirsch, Q. M., U. S. A., is in charge of construction.

Pendleton, Ore.—It is stated that bids are wanted until Dec. 30 for $135,000 city hall bonds. Thos. Fitzgerald, City Clk.

Allentown, Pa.—Bids will be received until Dec. 27 (readvertisement) by the Co. Comrs. (Adam E. Bittner, Chmn.) for erecting an addition to the jail.

Mercer, Pa.—The Mercer County Courthouse at Mercer, is reported destroyed by fire Dec. 15.

**Erie, Pa.*—The following are reported to be the bids received Dec. 11 by the Bd. of Fire Comrs. for erecting the First Ward engine house: Constable Bros. Co., 5th and Sassafras Sts., $14,889 (awarded contract); Offerle & Smith, $14,940; Kirschner Bros., $15,768; Wm. Ackerman & Son, $15,871; Laird Bros., $15,850; A. Schroeck, $15,945; C. H. Schaper, $16,800; Henry Shenk Co., $17,000.

Bradford, Pa.—See "Sewerage and Sewage Disposal."

Columbia, S. C.—Shand & Lafaye, 1328 Main St., it is reported, have completed plans for a $30,000 hospital to be erected at the Univ. of South Carolina.

Mitchell, S. D.—Bids will be received at the office of Jas. Knox Taylor, Superv. Archt., Washington, D. C., until Jan. 22, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of U. S. Post Office at Mitchell, as advertised in The Engineering Record.

**Memphis, Tenn.*—J. Massey Rhind, of New York, N. Y., it is stated, has secured the contract for the sculptural work on the court house, at about $74,000.

El Paso, Tex.—It is stated that the Co. Bd. has appropriated $25,000 for erecting an addition to the court house.

Lynchburg, Va.—Plans have been accepted, according to reports, for a $15,000 market house and auditorium. J. T. Kinner, Chmn. Ed. Trus.

Ft. Monroe, Va.—Bids will be received until Jan. 13 by Capt. Ernest R. Tilton, Constr. Q. M., U. S. A., for remodeling bath house at quarters No. 84 at this post.

**Roanoke, Va.*—W. F. Baker, it is stated, has secured the contract to improve the city market at $36,950.

Tacoma, Wash.—Russell & Babcock, Provident Bldg., it is stated will have the plans completed in about a month for the armory which is to be erected on Yakima Ave. and 10th St. and the Armory Comrs. will probably ask bids for the construction soon thereafter. About $95,000 is available for the building. Adjutant Genl. Ortis Hamilton is a member of the Comrs.

Monongah, W. Va.—It is stated that the Fairmount Coal Co. intends erecting an orphan asylum here to cost $50,000.

La Crosse, Wis.—The Common Council has authorized the building of an auditorium at a cost of not more than $20,000.

Milwaukee, Wis.—Bids will be received until Dec 28 by the Milwaukee Auditorium Bd. Rm. 45, University Bldg. (Alvin P. Kletzsch, Pres. Bldg. Com.), for furnishing material and erecting an auditorium at State, 5th 6th and Cedar Sts. Bids may be submitted separately or as a whole on the following work: Entire work complete; mason and concrete work; cut stone; artificial stone; iron work; plaster and staff work; sheet metal and roofing; carpenter work and hardware; painting and glazing; plumbing and gas fitting; electric work; elevators; marble work; ventilating and heating. Duplicate sets of plans and specifications can be obtained from Ferry & Clas, Archts., 419 B'way, Milwaukee, on payment of $50.

The State Bd. of Control, it is stated, is agitating the erection of 2 cottages at the County Insane Asylum, to cost $60,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—The Sacramento Hotel Co. is reported to have had plans prepared by Chas. F. Whittlesey & Co., of Los Angeles, for a hotel estimated to cost $500,000.

Riverside, Cal.—It is stated that the Masons are considering the erection of a temple to cost about $15,000.

**Oakland, Cal.*—It is reported that L. Schreiber & Sons Co., have the contract for the ornamental iron work on the 6-story bank building to be erected for the Oakland Bank of Savings & Bankers' Trust Co. at about $30,426, and the Dahlstrom Metallic Door Co., Jamestown, N. Y., the contract for metallic doors, etc., at $10,050.

San Francisco, Cal.—Mary L. Phelan is reported to have applied for a permit to erect a 4-story brick building at Battery and Market Sts., to cost $80,000.

The erection of a $500,000 store building at Grant Ave. is reported contemplated by Frank J. Sullivan.

Mary L. Phelan has applied for a permit for the erection of a 4-story brick store and loft structure to cost $80,000, on Battery and Market Sts.

Bridgeport, Conn.—The Connecticut Ry. & Lighting Co. (Chas. H. Chapman, Supt., Bridgeport), it is reported intends erecting concrete car barns on Water and Congress Sts.

Wilmington, Del.—The Security Trust & Safe Deposit Co. is stated to have secured a site at 6th and Market Sts. on which it is intended erecting an addition to the bank building.

**Jacksonville, Fla.*—H. P. Heifner, of Atlanta, Ga., is reported to have secured on Dec. 14 the contract to erect the Masonic Temple to cost $125,000. L. M. Weathers & Co., of Memphis, Tenn., are the architects.

Chicago, Ill.—Cooper, Will & Nephews, makers of chemicals and dyes, it is reported, has secured a site at Fairbanks Court and Ontario St. on which it is proposed erecting a $70,000 building.

Ft. Wayne, Ind.—It is stated that bids will be received until Dec. 27 by Chas. McCullock, Pres., Ft. Wayne Hotel Co., for erecting the Anthony Hotel. Weatherbogg & Crocker, Archts., Hamilton Natl. Bank Bldg.

**Tipton, Ind.*—The Indiana Union Traction Co., it is reported, has awarded a contract to W. R. Hicks, of Elwood, for the construction of new car barns in Tipton.

Council Bluffs, Ia.—Bradley & Co., whose buildings here were recently damaged by fire, it is reported, are considering rebuilding.

**Baltimore, Md.*—John Cowan, 106 W. Madison St., is reported to have secured the contract for the general alterations to be made to the former residence of the late A. S. Abell, at Charles and Madison Sts., which, when completed, will be the home of the Baltimore Club. Probable cost of improvements, $30,000.

Duluth, Minn.—It is reported that the Bldg. Com. of the Y. W. C. A. is considering the enlarging of the building at a probable cost of $100,000.

St. Joseph, Mo.—Block Bros., according to reports, have accepted plans for a $100,000 building which it is proposed erecting at 6th and Felix Sts.

Kansas City, Mo.—Chas. A. Smith, Dwight Bldg., is said to be the archt. for the 3-story store and warehouse which is to be erected by F. H. Thwing.

Lincoln, Neb.—L. A. Lamoreaux, of Minneapolis, Minn., according to reports, is preparing plans for an office building and residence of brick, to be erected in Wyuka Cemetery for the Wyuka Cemetery Assoc., at a cost of about $18,000.

Newark, N. J.—A tentative plan of the proposed new Young Women's Christian Assoc. building, it is reported, has been made showing the administration building and the 2 dormitories to be built at 562 Broad St. The cost, including ground and furnishings, is to be about $200,000.

Lake George, N. Y.—It is reported that the officials of the Delaware & Hudson R. R. (L. F. Loree, Pres., 32 Nassau St., N. Y. City) intend making improvements to the Ft. William Henry Hotel at the head of Lake George.

**Items marked thus give the names of parties awarded contracts.*

New York, N. Y.—Stephen Ball, 3682 B'way, it is reported, has secured the contract to erect a 12-story brick and stone office building to cost $500,000. Milliken & Moeller, 7 W. 38th St., are the archts.

Harry Levey, it is stated, has completed his plans for the 12-story office and theatre building which he proposes erecting at 43d St. and B'way.

Plans have been filed for the erection of the following buildings: Six-story brick and stone store and tenement at 207 Madison St., for Harry Kay, cost $30,000; Chas. M. Straub, Archt.; 7-story brick and stone store and loft building at 247 W. 36th St., for F. A. Hill, cost $30,000; Chas. E. Birger, Archt.; 12-story brick and stone store and apartment building at 5th Ave. and 51st St., for T. R. A. Hall, cost $200,000; Alex. M. Welch, Archt.; 2-story brick and stone store and office building at Broadway and 11th St., for Moses Sahlein, cost $25,000, Arnold W. Brunner, Archt.; alterations to 6-story brick and stone store at 6th Ave. and 23d St. for subway for Jas. McCreery Realty Co., cost $35,000; J. J. F. Gavigan, Archt.

Valley City, N. D.—It is stated that C. E. Bell, of Minneapolis, is preparing plans for a brick, stone and granite building to be erected for the American National Bank, at a cost of about $25,000. Work will be done mostly by day labor.

Cincinnati, O.—Geo. E. MacDonald Co., 13 E. Lippencott St., according to reports, has secured the contract to erect a factory building for the Ault Wiborg Co. at an estimated cost of $75,000.

Findlay, O.—The Findlay Bldg. Co. is reported organized for the purpose of erecting a 7-story office building.

Newark, O.—Eli Hullit, it is reported, has accepted plans for a 6-story business building. It is reported that it is to be equipped with its own electric light plant.

Portland, Ore.—The Contracting Eng. Co., of Tacoma, Wash., it is stated, has secured the contract to erect an 8-story reinforced annex to the Portland Hotel at a cost of $175,000.

Philadelphia, Pa.—It is stated that the contract for erecting the 3-story, 125x120-ft. garage on Broad St. for Henry C. Lea has been awarded to Wm. Steele & Sons Co., 1600 Arch St., at about $100,000. Watson & Huckel, 1211 Walnut St., are the archts.

Pittsburg, Pa.—The members of Sheraden Lodge, No. 949, B. P. Order of Elks, it is stated, propose erecting a $30,000 club house.

Greenville, S. C.—The Chick Springs Hotel, a summer resort 10 miles from Greenville, it is reported was badly damaged by fire Dec. 14.

Silsbee, Tex.—C. F. W. Felt, of Galveston, Ch. Engr. Gulf, Colorado & Sante Fe. Ry. Co., writes that contract has not yet been let for the hotel to be erected at Silsbee.

Houston, Tex.—It is reported that the Houston Theatre in which were located the Federal office, was destroyed by fire recently.

Salt Lake City, Utah.—The Crane Co. of Chicago, Ill., is reported to have purchased a site here on which it is proposed erecting a 6-story office and warehouse building to cost $200,000.

Richmond, Va.—Competitive plans have been asked for the Y. M. C. A. Bldg.

Tacoma, Wash.—The erection of a 3-story 65x125 ft. brick and concrete building for the Scandinavian secret societies and organizations, is reported contemplated. The cost of the building, including site, is to be about $60,000. G. O. Gunderson and C. H. Skotheim are members of the committee having the matter in charge.

Seattle, Wash.—It is reported that bids will probably soon be asked for erecting the Metropolitan Bldg. Howell & Stokes, of New York, N. Y., are preparing the plans. J. F. Douglass is Secy. of the Metropolitan Bldg. Co.

Milwaukee, Wis.—The Sterling Eng. & Constr. Co., it is reported, has taken out a permit to erect a brick and stone store and office building at Grand Ave. and 5th St. to cost $25,000.

Racine, Wis.—August Uihlein, it is stated, intends erecting a hotel on 6th St. to cost about $20,000. Jos. Wagner, of Racine, is to be the Mgr.

Halifax, N. S.—We are informed that the Century Club, with quarters now at 100 Grafton St., Halifax, has purchased property at Water St. and Spring Garden Road, and intends erecting a 6-story building to cost about $135,000. Architect Nathan Stevens Bath, of Halifax. For further information address Roland Crocker or William Lawrence, members of the building committee.

Victoria, B. C.—It is reported that the Directors of the Northern Victoria Bank propose erecting a 5-story office and banking building.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Eufaula, Ala.—B. E. Hudson, of Atlanta, Ga., is reported to have secured the contract to erect an edifice for the First Baptist Church at about $30,000.

Redlands, Cal.—It is reported that plans are being prepared for a 16-room residence to be erected for H. O. T. Higgins at a cost of $26,000.

Denver, Colo.—A. W. Reynolds, Majestic Bldg., it is stated, is preparing plans for remodeling the building at 26th and Stout Sts. into an apartment house at a cost of about $20,000. Mrs. Jos. Gavin, owner.

Chicago, Ill.—J. Kolsetti, it is stated, intends erecting a 3-story apartment house at Humboldt Boule. and Whipple St. to cost $50,000.

Duluth, Minn.—Bray & Nystrom, Talladio Bldg., according to reports, have prepared plans for a 5-story apartment house which is to be erected on E. Superior St.

St. Louis, Mo.—O. R. S. Traber, Fullerton Bldg., according to reports, contemplates erecting a residence to cost $10,000.

It is reported that the members of the St. Francis De Sales R. C. Church are having plans prepared for an edifice which is to cost about $250,000. Rev. P. G. Holweck, pastor.

St. Louis, Mo.—Mariner La Beaume, Chemical Bldg., are preparing plans for an edifice for the congregation of the Episcopal Church of the Ascension. Contracts will probably be let in Jan.

New York, N. Y.—Plans have been filed for the erection of a 1-story brick church at Brook Ave. and 159th St. for R. C. Church of Sts. Peter-Paul, Rev. Wm. Murphy, pastor, to cost $20,000. M. J. Garvin, 3307 3d Ave., archt.

Columbus, O.—Alfred Linton, of E. 14th St., according to reports, intends erecting a brick residence on Indianola and 14th Aves., to cost about $20,000.

Piqua, O.—The congregations of Calvary Baptist and the First Baptist Churches, it is reported, propose consolidating and erecting an edifice to cost $50,000.

Philadelphia, Pa.—Watson & Huckel, 1211 Walnut St., are said to be preparing plans for a choir loft, sanctuary, pulpit, high altar and reredos for the Episcopal Church of St. Mark's, in Frankford. The work will all be in stone, richly decorated and carved. The cost of the work will be about $25,000.

Seattle, Wash.—It is stated that a 3-story apartment house is to be erected at Mercer St. and 15th Ave. N. at a cost of $40,000, according to plans prepared by H. Ryan, Globe Bldg. McCoy & Nonro, owners.

Spokane, Wash.—It is reported that the members of the Swedish Methodist Church propose erecting an edifice to cost $15,000. Rev. J. A. Williams, pastor.

The members of the Centenary Presbyterian Church, it is stated, have announced that they propose erecting an edifice, estimated to cost $50,000.

Sturgeon Bay, Wis.—The members of St. Joseph R. C. Church, it is stated, are planning the erection of an edifice costing about $25,000.

Rice Lake, Wis.—The members of St. Joseph R. C. Church, it is stated, are considering the erection of a new edifice costing about $25,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The erection of a high school in Jefferson County to cost $50,000, is reported under consideration.

Hoxie, Ark.—Moore & Ridgway, it is stated, have secured the contract to erect the school at about $18,000.

San Diego, Cal.—John C. Austin, of Los Angeles, is said to have completed plans for the 2-story school to be erected at 12th and E Sts., which is to cost about $85,000.

East St. Louis, Ill.—We are informed that bids will be called for by the School Board about Feb. 1 for the erection of a school, to cost about $65,000. Architects, Riester & Rubach, 412 Missouri Ave., East St. Louis.

Indianapolis, Ind.—The School Bd. is reported to be prearing for the construction of 2 new school buildings, one in Cerealinetown and one in Brightwood suburbs, each to cost about $50,000. Work to begin early next year.

Kirklin, Ind.—Amos L. Hiatt, Trustee Kirklin Township, it is reported has purchased a site and will soon ask for bids for the construction of a new High School, estimated cost $30,000.

Cedar Falls, Ia.—Proudfoot & Bird, Archts., write that the Des Moines Bridge & Iron Wks., of Des Moines, has secured the contract for the structural iron work for the library of the State Normal School (bids opened Dec. 10) for $7,350; and Arthur Watson, of Des Moines, the contract for the cut stone work for $24,500.

Viola, Kan.—It is stated that bids will be received until about Dec. 29 by Chas. J. Dalborn, Clk. Joint School Dist. No. 148-160, for erecting a 2-story 4-room brick school.

Orono, Me.—Bids will be received until Jan. 1 by Geo. E. Fellows, Univ. of Maine, Orono, for the construction, including plumbing, of an agricultural building at said univ. Wm. Hart Taylor, Archt., 50 Broomfield St., Boston, Mass.

Worcester, Mass.—The Joint Standing Com. of the City Council, it is stated, has decided to recommend the erection of a 12-room school on Meade St. to cost $60,000; 6-room addition to Dartmouth St. School, estimated to cost $25,000, and a 4-room and hall building to cost $25,000.

Melrose, Mass.—The citizens voted in favor of appropriating $75,000 to erect an addition to the high school.

Great Barrington, Mass.—Wm. D. Hill, Secy. School Com., writes that bids will probably be called for in the spring for the erection of a school to cost about $50,000.

Boston, Mass.—Bids will be received until Dec. 24 by the School House Comrs. (R. Clipston Sturgis, Chmn.) for installing a ventilating and heating apparatus in the extension to Francis Parkman School, Walk Hill St. Chas. F. Eveleth, 120 Boylston St., Htg. Engr.; Chas. B. Perkins, Archt., 15 Ashburton Pl.

South Hadley Falls, Mass.—The Special Com. appointed by the town to secure plans, has asked competitive plans to be submitted by Feb. 22 to M. J. Judge, Secy. The plans are to be of 2 kinds: One set to provide for a building containing 4 class rooms with a seating capacity of 48 ea., and an assembly room with a seating capacity of 200, lecture room, chemical laboratory, physical laboratory, principal's office, teachers' office, business room with adjoining typewriter room. The second plan calls for a combination town hall and school building. This building to contain town offices and committee rooms.

Flint, Mich.—It is reported that W. O. Lewis, Secy. Bd. Educ., will receive bids until Jan. 15 for erecting a 10-room grade school, complete, except ventilating and heating. Edward C. Van Leyen, Archt., 40 Fort St. W., Detroit.

Albert Lea, Minn.—The Bd. of Trus. of the Albert Lea Cottage, it is stated, is having plans prepared for a science hall and dormitory which they propose erecting next season.

Sydney, Neb.—It is stated that bids will be received until Jan. 1 by the School Bd. (Leroy Martin, Secy.) for $15,000 school bonds.

Superior, Neb.—The School Bd., it is reported, has decided to erect a $30,000 school.

Jersey City, N. J.—The Bd. of Educ. is stated to have awarded contracts recently for erecting an annex to School No. 14 (bids for which were received Nov. 14) as follows: Mason work, M. T. Connolly Constr. Co., $49,738; carpenter work, Jos. Jewkes & Sons Co., $26,490; painting, Chas. Rabe, $1,942; plumbing, F. T. Kelaher, $5,595; heating and ventilating, Baldwin Eng. Co., $15,940.

Ridgefield Park, N. J.—Bids will be received until Dec. 30 by Adolph Freud, Dist. Clk., Central Ave. and 2d St., for $50,000 school bonds.

Santa Fe, N. M.—Bids will be received until Jan. 13 by C. F. Larrabee, Acting Comn. Indian Affairs, Washington, D. C., for furnishing material and constructing an office building at the Santa Fe School. For further information apply to C. J. Crandall, Supt. school.

Dunkirk, N. Y.—The Bd. of Educ., it is stated, has decided to erect an addition to School No. 3.

Philmont, N. Y.—Bids will be received until Dec. 31 by J. F. Terrick, Clk. Bd. Educ., School Dist. 6, for erecting an addition to the school buildings.

New York, N. Y.—Bids will be received until Dec. 26 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for alterations of present auditorium on the 2d and 3d floors of the hall of the Bd. of Educ., Park Ave. and 59th St., Boro. Manhattan.

Ithaca, N. Y.—The members of Cornell Univ. Club of Northern New Jersey are said to be considering the erection of a dormitory at Cornell Univ. to cost about $36,000. It is to be known as "Jersey Hall."

Rolla, N. D.—J. W. Ross, of Grand Forks, it is stated, has about completed plans for a school to be erected here at a cost of $25,000, contract for construction will probably be let in January.

Bryn Mawr, Pa.—Edwin F. Durang & Son, 1200 Chestnut St., Philadelphia, are completing plans for a school to be erected at Bryn Mawr for the parish of the Church of Our Lady of Good Counsel. The building will be brick and stone, costing $40,000.

Pittsburg, Pa.—The Trus. of the Western Univ. of Pa., it is reported, has bought 43 acres of ground in the Schenley Farms property, opposite the Carnegie Institute, and work will be begun at once on the erection of a group of 10 building in which the university will be housed when completed.

Providence, R. I.—The State Grange at a meeting on Dec. 11 voted to recommend the appropriating of $80,000 for the erection of a new building at the Kingston Inst., and for new boilers at Lippitt Hall at the State College, and a building in which to install the heating plant.

Hallettsville, Tex.—The issuing of $18,000 bonds to erect a school is reported under consideration by the Trus. of the Independent School Dist.

Richmond, Va.—The proposed high school bids for which will be received until Jan 20, will cost bet. $350,000 and $400,000. Architect Chas. K. Byant, 1014 E. Main St., Richmond.

Williamstown, W. Va.—It is reported that arrangements are being made to erect a $25,000 school.

Brillion, Wis.—It is statd that bids are wanted until Jan. 15 for erecting a 2-story and basement press brick school; prob. cost, $12,000. C. H. Tegen, Archt., Manitowoc.

Milwaukee, Wis.—Bids will be received until Jan. 2 by the Bd. of School Directors (Frank M. Harbach, Secy.), for furnishing material and erecting a school at Forest Home and 11th Aves., in the 11th Ward, to cost about $75,000. Bids are to be stated separately on the following, also a total bid to be submitted for the entire work: Mason, concrete and cement work; cut stone work; lath and plastering work; structural steel and iron work; carpenter work, including composition roofing; hardware; galvanized iron and tin work; electric work; painting and glazing; plumbing, sewerage and gasfitting; ventilating and heating; heat regulation apparatus.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Streator, Ill.—The Streator Ice & Cold Storage Co. is reported organized, with a capital of $50,000, to manufacture ice; also erect a cold storage plant. H. H. Dicus, Secy.

Danville, Ill.—Jas. O. Gordon, general contractor, 31 N. Vermillion St., proposes erecting a structural shop here, but details are not yet complete. He is making his own plans and doing his own building; the shop will be 80x200 ft., using electric power. He further states that he is in the market for a 10-ton crane.

Salem, Ind.—L. D. Fouts, of New Albany, and others are reported to have purchased a large area of shale and will engage in the manufacture of paving brick.

Harbor Beach, Mich.—It is stated that Edw. C. Van Leyen and Edw. A. Schilling, archts., 40 Fort St. W., have prepared plans and specifications for the reconstruction of the Huron Milling Co.'s starch plant at Harbor Beach, Mich., of which Geo. J. Jenks, of Detroit, is the Pres. Plans are also reported being prepared for a reinforced concrete dock, 40x300 ft.; warehouse, 46x250 ft.; and coal bunkers, with crane tracks for unloading boats, 40x250 ft., 16 ft. in height, to carry a supply of 5,000 tons of coal. Plans for buildings for the manufacture of bi-products are also in contemplation.

Detroit, Mich.—Dinan Bros., it is reported, will erect a plant at Michigan Ave. and 15th St. under plans prepared by B. C. Wetzel & Co. The building will be a combination warehouse and cold storage plant, will have solid brick walls, concrete floors, concrete columns reinforced with cast iron, iron window frames and wired glass, making the structure strictly fireproof. The plans will be ready for figures, it is stated, about the middle of January.

Newton, N. C.—H. F. Smith, Gen. Mgr. Ridgeview Cotton Mills, writes that contract has not yet been let for the power plant for the mills, to cost about $4,000.

Weldon, N. C.—Arrangements are being completed by the Shaw Cotton Mills of Weldon for the construction of a yarn plant. A 2-story brick building, 50x150 ft., is to be erected and an equipment of 5,129 frame spindles will be installed to be run by gas power. Two-ply 24x36 cotton yarns will be manufactured. Capital, $100,000.

*Items marked thus give the names of parties awarded contracts.

Cincinnati, O.—Albert L. Allen, Secy. and Treas. Pfau Mfg. Co., writes that the plant was partially destroyed by fire on Dec. 11. It is proposed to repair same and resume operation at an early date. The loss on buildings, equipment, etc., is about $100,000.

Hennessey, Okla.—The Hennessey Electric Light, Power & Ice Co. expects to install an ice plant in connection with its electric plant. F. Murch, Mgr.

Portland, Ore.—The National Wood Pipe Co., 404 Equitable Bank Bldg., Los Angeles, Cal., will erect a factory at Portland, to cost about $100,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Indianapolis, Ind.—Bids will be received until Dec. 27 by the Bd. Pub. Wks. (Jos. T. Elliott, Pres.) for the collection, removal and disposal of ashes and sweepings in this city for a period of 10 yrs. as per Miscellaneous Specification, No. 38; also same time and place for the collection, removal and disposal of sweepings in this city for a period of 10 yrs. as per Miscellaneous Specification No. 39.

Paducah, Ky.—The question of constructing a garbage reduction plant is reported under consideration here.

Minneapolis, Minn.—The Council Com. of Health and Hospital, is reported to be considering the installation of a traveling crane at the garbage crematory.

St. Louis, Mo.—Bids will be received until Feb. 11 by the Bd. Pub. Improv. (A. J. O'Reilly, Pres.) for furnishing material, machinery and buildings for the reduction of garbage for a term ending Sept. 1, 1918. Bidders are to erect and maintain 2 receiving stations ea. having a capacity of 300 tons in ea. 8 hours, and to consist of approaches, drives and unloading platforms; also erect within a mile of the city on not less than 5 acres of ground a reduction plant having a capacity of reducing not less than 400 tons daily.

East Liverpool, O.—The City Auditor writes that it is not proposed to construct a garbage crematory, as recently reported.

Philadelphia, Pa.—Bids were opened on Dec. 16 at the office of Geo. R. Stearns, Dir. Dept. Pub. Wks., for cleaning streets, alleys, inlets, public market houses, and for the removal of ashes, household waste, rubbish, etc., during the year 1908, and the following are the bids received according to districts: (*a*) 1st Dist.; (*b*) 2d Dist.; (*c*) 3d; (*d*) 4th; (*e*) 5th; (*f*) 6th; (*g*) 7th; (*h*) 8th; (*i*) entire city: Edwin H. Vare, *a*, $149,000 *b*, $285,000;*e*, $133,999; *i*. $1,087,000. Mack Co., *a*, $170,000; *b*, $331,000; *c*, $185,200; *d*, $126,600; *e*, $160,500; *f*, $98,200; *g*, $101,500; *h*, $79,700; *i*, $1,240,700. Reiter, Peoples & Co., *a*, $230,000; *b*, $330,000; *c*, $220,000; *d*, $120,000; *e*, $160,000; *f*, $98,000; *g*, $98,000; *h*, $79,000; *i*, $1,400,000. Wm. H. Achuff, *f*, $98,000. Howard E. Rueb, *c*, $164,800. Jas. Curran, *d*, $133,800. Jas. A. Mullen, *g*, $113,300; *h*, $67,800. David McMahon, *f*, $86,950. Johnson & Co., *g*, $119,000; *h*, $74,000. Laughlin & Dorney, *c*, $159,974. Reiter, Peoples & Co., *b*, $280,000.

Pittsburg, Pa.—Dr. J. F. Edwards, Supt. Health Bureau, writes with regard to the disposal of ashes, rubbish, etc., that an investigation is to be made with a view to preparing a report on same. No plans, specification or recommendations yet made. Engineer, Rudolph Hering, of N. Y. City.

Providence, R. I.—Bids were opened on Dec. 10 by the Com. of Health Dept. (Henry Fletcher, Chmn.) for the removal of swill, house offal and garbage for a period of 5 years from May 1, 1908, and the following are the bids received: (a) 1st year; (b) 2d yr.; (c) 3d yr.; (d) 4th yr.; (e) 5th yr; (f) total: Chas. E. Clarke, Seekonk, Mass., (f) $120,000; payable in monthly installments of $2,000; T. A. Sampson, of Fall River, (a) $23,875, (b) and (c), $24,000; (d) $26,000 (e) $27,000; (f) $124,875; Jos. J. Nugent, of Providence and Seekonk, (a) $25,000; (b) $25,597; (c) $26,625; (d) $27,739; (e) $29,000; (f) $133,961; Oneco Granite Co., Providence, (a) $27,900; (b) $35,250; (f) $142,150; Jas. H. Dillon, $28,850 ea. yr., (f) $142,850; Herbert R. Durfee, of Cranston, (a) $27,000; (b) $28,000; (c) $29,000; (d) $30,000; (e) $31,000; (f) $145,000; Geo. A. Field & Son Co., Cranston, (f) $150,000 in monthly installments of $2,500.

Milwaukee, Wis.—Local press reports state that Rudolph Hering, of New York, N. Y., estimates the cost of a reduction plant, equipped to dispose of rubbish, would cost $375,000, while an incineration plant would cost $325,000. It is stated that the city will probably adopt the contract system, and not construct a municipal plant at this time.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—The following are the bids opened on Nov. 25 by Maj. H. Jewey, Corps Engrs., U. S. A., for constructing locks and dams in Black Warrior River, and lock tenders' houses: (*a*) Dravo Contr. Co., Pittsburg, Pa. (awarded contract) (*b*) Lane Bros. Co., Lynchburg, Va.

Lock No. 14—

	*a	b
3 acres grubbing and clearing	$100.00	$100.00
56,000 cu. yds. common excav	.70	.56
3,300 cu. yds. rock excavation	3.50	2.90
3,690 cu. yds. stone fill	2.50	2.90
29,850 cu. yds. concrete	7.50	8.30
1,890 cu. yds. riprap, hand placed	3.00	3.00
3.6 M ft. B. M. miter sills	100.00	125.00
91.7 M ft. B. M. framed timber, square edged, sound	65.00	45.00
90.4 M ft. B. M. framed timber, heart	70.00	50.00
471 M ft. B. M. cofferdam timber	55.00	45.00
20 M ft. B. M. sheathing	50.00	45.00
85,000 lbs. placing valves and special irons	.01	.04
Total	$330,223	$339,947

Lock No. 15—

	a	b
3 acres grubbing and clearing	$100.00	$100.00
46,300 cu. yds. common excav	.70	.56
2,600 cu. yds. rock excavation	3.75	2.90
3,890 cu. yds. stone filling	2.50	2.90
32,180 cu. yds. concrete	8.25	8.75
2,050 cu. yds. riprap, hand placed	3.00	3.00
3.6 M ft. B. M. miter sills	100.00	125.00
103 M ft. B. M. framed timber, square edged, sound	65.00	46.00
90.4 M ft. B. M. framed timber, heart	70.00	51.00
352 M ft. B. M. cofferdam timber	60.00	46.00
20 M. ft. B. M. sheathing	50.00	46.00
85,000 lbs. placing valves and special irons	.01	.04
Total	$360,173	$363,084
Lock tender's house at Lock No. 14	$3,000	$2,525
Lock tender's house at Lock No. 15	3,000	3,000

Ft. Huachuca, Ariz.—Bids will be received until Jan. 9 by C. A. H. McCauley, Ch. Q. M., U. S. A., Denver, Colo., for constructing a swimming pool at Ft. Huachuca.

**Berkeley, Cal.*—W. F. McClure, City Engr., writes that the Atlantic, Gulf & Pacific Co., Monadnock Bldg., San Francisco, has secured the contract for constructing the proposed municipal work at the following bid: Repair old wharf, 200 piles, per pile, $6; 100 M piles in place, per M, ft., $27; 760 ft. 3-pile bent, per ft., $6.80; 2,204 ft. concrete pile approach, per ft., $14.50; main wharf, 408x75 ft. (lump sum), $28,000; inner wharf, 4,040 sq. ft. (lump sum), $1,600; shed, 24x100 ft. (lump sum), $1,165; shed, 16x60 ft. (lump sum), $759, 4,400 ft. 4-in. water pipe, 50 cts total, $74.750. Totals of other bids: Burrell Constr. Co., San Francisco, $73,975; Cotton Bros. Co., Oakland, $80,115; Healey Tibbitts Constr. Co., San Francisco., $82,549; Mercer Frazier, $82,906; Pacific Constr. Co., San Francisco., $76,205.

**Greeley, Colo.*—I. L. Thompson, of Ft. Collins, is reported to have secured the contract for extending Eaton ditch, for $3,000.

Wilmington, Del.—At a meeting on Dec. 10 of the combined committees of City Council and the Bd. of Trade, appointed to look into the river front proposition, apppointed the six engineers who were to investigate conditions bearing upon selection of suitable location for terminal point and site for a pier, made their report. The report was signed by Chief Engineer Theo. A. Leisen, Water Dept.; Alex. T. Taylor and Harry L. Maier, of the Street & Sewer Dept.; Edw. R. Mack, of the Park Comn.; City Engr. Howard B. Griffith, and City Councilman Matthew L. Kyle. The plans as proposed showed a 1,000-ft. wharf at foot of 4th St. extended, and at base of pier a circular plot 1,000 ft. diam. which would be used as a terminus; along the entire river front extended a driveway 300 ft. wide, and from terminus extended to the north a 100-ft. boulevard, to be known as the North Boulevard, and connecting with Vandever Ave.; to the west extended another boulevard, known as 4th St. Boule., connecting with 7th St., and to the south, the South Boule., connecting with B St. extended to the Christiana River. No estimate of cost is given, nor is exact location recommended.

Washington, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Jan. 2, to furnish at the navy yards and naval stations the following supplies: Puget Sound, Wash.: Sch. 579—Single frame steam hammer, 1 pattern maker's lathe, 1 horizontal boring, drilling and milling machine. Sch. 600—A quantity of Sanderson's steel, Mare Island, Cal. Sch. 615—1 power punch, 1 motor driven emery grinder, 1 groover, 1 double seaming machine and 1 hand beading machtne, 1 fresh water pump, 20 tons crushed ganister and 6,000 ganister brick; 25,000 lbs. galvanized sheet steel. Applications for proposals should designate the schedule desired by number. E. B. Rogers, Paymaster-Genl., U. S. N.

Bids will be received same time and place as above for the following: Puget Sound, Wash.: Sch. 439—3 pipe-bending machines. Sch. 579—Drills and rachets. Newport News, Va., and Quincy, Mass.: Sch. 614—40 motors, 40 master controllers, 40 shunt motors, 20 series motors, 20 complete controllers. New Orleans, La.: Sch. 616—29 M. ft. clear and 21 M. ft. common cypress, 130 M. ft. white pine. Sch. 617—Bar iron in commercial lengths, 3,900 lbs. bolt iron, 13,000 lbs. bar steel, a quantity of tool steel. Sch. 620—Sheet brass, copper rod, sheet copper, etc.; 5,000 lbs. ingot copper, 9,000 lbs. pig lead. Sch. 622—2,800 ft. seamless drawn brass pipe, 2,200 ft. black wrought iron or steel pipe and 2,200 ft. galvanized wrought iron or steel pipe, 2,600 ft. black iron pipe, a quantity of brass globe valves, check valves and cross valves, etc. Pensacola, Fla.: Sch. 620—8,100 lbs. sheet lead. Sch. 624—Metal saw machine, sheet steel, tool steel, etc. Bids will also be received same place until Dec. 26 for the following: Boston, Mass.: Sch. 601—Electric supplies, 60 tons Albany sand and 80 tons molding sand. Sch. 609—6,600 lbs. round rolled bronze, 19,000 lbs. seamless brass pipe. Sch. 610—20 doz. brass gate valves, 8 doz. brass check valves and 50 doz. brass globe valves. Brooklyn, N. Y.: Sch. 602—625 lbs. magnet wire, 165 lbs. Advance resistance wire, platinum wire, 20-volt meters, 15 ammeters. Sch. 608—28,800 lbs. G. I. sheet steel, 18,100 ft. leather belting. Sch. 609—About 58,000 lbs. bronze rod, 78,000 lbs. seamless brass pipe. Sch. 610—Brass angle valves, 50 doz. brass gate valves. Sch. 611—50 doz. brass unions, bushings, couplings, tees, etc. Sch. 612—12,750 lbs. sheet lead, 32,000 ft. wrought iron or steel steam pipe. Sch. 644—50 M. ft. spruce, 23 M. ft. white hickory, 55 M. ft. white oak. Annapolis, Md.: Sch. 406—10,500 pieces opalite tile. Charleston, S. C.: Sch. 608—3,000 lbs. galvanized medium steel plates, 22,660 lbs. structural plates and 560 lbs. steel angles.

Paxton, Ill.—W. B. Flood, Co. Clk., writes that C. F. Helman, of Paxton, is engineer for the drainage ditch to be constructed in Sugar Creek Drainage Dist.

Monticello, Ill.—Bids will be received until Dec. 28 by the Comrs. of the Lake Fork Special Drainage Dist. Counties of Piatt, Champagn and Douglas (T. J. Tucker, Chmn.) at Monticello, for cleaning out and repairing the main ditch of Sub Dist. No. 21, Lake Fork Special Drainage Dist., requiring 37,228 cu. yds. excavation. Address communications to Harvey Fay, Co. Clk., Monticello.

Ft. Wayne, Ind.—It is reported that bids will be received by David Sprindler (Supt. of Drains) until Dec. 28, for the construction of a ditch in Perry Township.

Princeton, Ind.—Geo. W. Smith, of Owensville, and Thos. J. Johnson, of Mt. Vernon, are reported to have petitioned for the construction of a drain 75 miles in length through Gibson and Posey Counties.

Council Bluffs, Ia.—W. C. Cheyne, Co. Aud., writes that bids will be received on Jan. 9 for the construction of the Avoca drainage ditch, probable cost $2,914.

Creston, Ia.—See "Bridges."

Forest City, Ia.—L. J. Nelson, Co. Aud., writes that bids will be received on Jan. 7 for constructing ditches 3 and 11; probable cost $8,464. Engineer, E. W. Burgitt, of Britt.

Louisa, Ky.—Bids will be received by Lieut.-Col. J. G. Warren, Corps Engrs., U. S. A., Cincinnati, O., until Jan. 20 for raising crest of Lock and Dam 3, Big Sandy River, near Louisa, Ky., as advertised in The Engineering Record.

**New Orleans, La.*—The State Board of Engineers is reported to have on Dec. 10 awarded the contract for earthwork on Waltzer levee to Pat H. Lyons, at 24.48 cts. per cu. yd. and to B. W. Borne for revetment at the Old Quarantine Levee, $1.23 per lin. ft.

Saginaw, Mich.—Bids will be received by Col. Chas. E. L. B. Davis, Corps Engrs., U. S. A., Detroit, until Jan. 16, for dredging in Saginaw River, as advertised in The Engineering Record.

Menominee, Mich.—It is reported that surveys are now being made in Menominee County for a new section of drainage canal.

Keweenaw Bay Mich.—The Chief of Engineers is reported to have recommended to Congress the construction of a harbor at th eastern entrance to Keweenaw Canal at a cost of $210,000, provided land can be secured at reasonable cost. The object is to provide a harbor where vessels may lie in time of storm, and where eastbound boats going through Keweenaw Canal may wait for clearing weather before passing out into open water of Lake Superior.

Grand Rapids, Mich.—Bids will be received until Jan. 15 by Maj. Chas. Keller, Corps Engrs., U. S. A., 57 Park St., Grand Rapids, for furnishing stone for pier filling and rip-rap at various harbors on eastern shore Lake Michigan.

Greenwood, Miss.—Bids will be received until Dec. 31 by the Drainage Comrs. (G. W. Holmes, Pres.) at the Court House, Greenwood, for constructing main drains in the Jones-Walton Drainage Dist., requiring the clearing of the right of way and digging about 6 miles of ditches, including the removal of about 66,000 cu. yds. of dirt; also separate bids same time and place, main drains in Ellsberry Drainage Dist., including clearing right of way and digging about 11 miles of ditches, requiring removal of 178,000 cu. yds. of dirt.

Morris Plains, N. J.—See "Water."

Atlantic City, N. J.—Prof. Lewis M. Haupt, of Philadelphia, Pa., is reported to have prepared and submitted to the business men plans for improving and deepening the channel to the Atlantic City harbor; he estimates the cost about $500,000.

Atlantic City, N. J.—Bids were opened by the Streets, Walks and Drives Com. (Wm. Riddle, Chmn.) on Dec. 9 for the construction of a concrete boardwalk along ocean front between Pacific Ave. and Connecticut Ave., to be about 2,900 ft. in length, and the lowest bid received was that of the Raymond Concrete Tile Co., at $53,535.

Jersey City, N. J.—See "Paving and Roadmaking."

Jersey City, N. J.—A contract is reported to have been filed here providing for the erection by the Pennsylvania Railroad Co. of a pier for the Adams Express Co. north of its station in this city. The pier is to be of steel frame, 120 ft. wide and 510 ft. long, and 3 stories high. Cost, about $85,000.

Brooklyn, N. Y.—There is now on file at the office of The Engineering Record, 239 W. 39th St., N. Y. City, specification No. 1,571 calling for the completion of a dry dock at the Navy Yard, also an inventory of plant, machinery, tools and appliances of Geo. B. Spearin, in possession of the U. S. Government at the Navy Yard, for use in the construction of the granite and concrete dry dock, recently under contract with him, and material on hand for prosecuting the work of construction, and bids for furnishing material and completing same will be received at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until Jan. 18. R. C. Hollyday, of Washington, D. C., is Chief of Bureau.

Ft. Caswell, N. C.—Lieut. L. Cravens, Constr. Q. M., U. S. A., writes that the following are the bids opened on Nov. 30 for building creosoted bulkhead at Ft. Caswell: Alsop & Pierce, Newport News, Va., $12,000; A. J. Robbins, Southport, N. C., $8,640; Rich. Parrott, Newburgh, N. Y., $8,944.

Portsmouth, O.—It is stated that bids are wanted until Dec. 23 for $20,000 Kendall Ave. subway bonds. Filmore & Musser, City Aud.

Hamilton, O.—The Butler County Comrs. are reported to have decided to proceed at once with the diversion of Crawford Run. This will result in making it possible to sewer and pave the 4th Ward of the city; the cost will be about $75,000.

**Items marked thus give the names of parties awarded contracts.*

Cleveland, O.—Local press reports state that the city of Cleveland, the Detroit & Cleveland and the Cleveland & Buffalo steamship lines will expend jointly about $607,500 for new docks. Office buildings of brick and stone are to be built on the west pier, the land end, at a cost of $42,000. Adjoining the offices will be freight sheds, 600 ft. long, of iron and steel, and to cost $116,000. Improvements to the piers will cost $64,500.

Panama.—See "Power Plants, Gas and Electricity."

Erie, Pa.—Bids will be received until Feb. 4 by the Erie Dock Comn. (Clark Olds, Pres.) for furnishing material and constructing public steamboat landing at Port of Erie, about 548 ft. long and 100 ft. wide, as advertised in The Engineering Record.

Memphis, Tenn.—Capt. W. D. Connor, Corps Engrs., U. S. A., writes that no bids were opened on Nov. 25 by the Mississippi River Comn., 1st and 2d Districts, for about 190,000 cu. yds. levee work and 40,000 cu. yds. drainage ditch in Upper St. Francis Levee Dist., the advertisement having been withdrawn. New bids will probably be called for later.

Dallas, Tex.—Capt. W. P. Wooten, Corps. Engrs., U. S. A., writes that the following are the totals of bids opened on Nov. 18 for constructing locks and dams on Trinity River, Tex: (*a*) Lock and Dam No. 2, (*b*) No 4: D. C. McCord, Dallas, *a* $135,825; Ball-Carden Co., Dallas, *a* $125,482, *b* $126,330; Midland Bridge Co., Kansas City, Mo., *a* $232,842, *b* $236,448.

**Galveston, Tex.*—John D. Kelly, City Secy., writes that the contract for constructing concrete drain on 19th St. (bids opened Nov. 30) has been awarded to Kelso & Vantrell, of Galveston, for $17,735.

Galveston, Tex.—Local press reports state that the following are the bids opened on Nov. 21 by Capt. John C. Oakes, Corps Engrs., U. S. A., for jetty work at Aransas Pass, Tex.—(*a*) 80,000 tons riprap, per ton, (*b*) 23,000 tons stone, per ton; (*c*) track and trestle, per ft., (*d*) wharf, per ft.: Daniel M. Picton, *a* $3.50, *b* $4.37, *c* $6.25, *d* $2.10; Chas. Clarke & Co., *a* $4, *b* $5, *c* $6.75, *d* $2.20; Christie & Low, *a* $3.80, *b* $4.90, *c* $6, *d* $2.30.

Bids were opened same time and place for dredging through Turtle Cove, between Aransas Pass and Corpus Christi Bay, about 825,000 cu. yds. (price given per cu. yd.): Bowers Southern Dredging Co., 14 cts.; American Dredging Co., 14¼ cts., and the Home Dredging Co., of Mobile, Ala., 14⅞ cts.

Norfolk, Va.—Bids will be received until Dec. 26 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Norfolk, the following supplies: Sch. No. 601, boiler tubes; Sch. 607, yellow pine; Sch. 609, brass and copper pipe; Sch. 611, pipe ttings; Sch. 612, machine tools. Applications for proposals should designate the schedule desired by number. E. B. Rogers, Paymaster General, U. S. N.

**Wausau, Wis.*—Bids were opened Dec. 3 by the Comrs. of the Daucy Drainage Dist. (Geo. H. Reynolds, Chmn.), at the office of the Clk. of the Circuit Court, at Wausau for constructing a main ditch and all its branches, and the contract for constructing same is stated to have been awarded to Chas. Forrestal, of Milwaukee, at 6.9 cts. per cu. yd.; total, $83,000. Engrs., the Harman Eng. Co., 109 S. Jefferson Ave., Peoria, Ill.

Eau Claire, Wis.—Lang & McAnulty, of Eau Claire, are reported to have been selected to prepare plans for a dam to be constructed across Chippewa River, in the 5th Ward, to cost about $10,000.

Peterboro, Ont.—Bids will be received until Feb. 1 by L. K. Jones, Secy. Dept. Railways and Canals, Ottawa, for the works connected with the construction of Sec. 2, Ontario-Rice Lake Div., Trent Canal.

Berne, Switzerland.—The National Council has approved the project of paralleling Simplon tunnel, thus providing double track construction.

PROPOSALS OPEN.

For Proposals see pages 68 and 70.

WATER.

Bids Close.		See Eng. Record.
Dec. 21.	Electric pumps, Hamilton, Ont.	Dec. 7
Dec. 25.	Gate house, Rochester, N. Y.	Dec. 21
Dec. 27.	Water wks, Sauk Rapids, Minn.	Dec. 14
Dec. 27.	Mains, Ft. Leavenworth, Kan.	Dec. 21
Dec. 30.	C. i. pipe, etc., Panama	Dec. 21
Jan. 1.	**Reservoir, Norway, Me.**	**Nov. 16**
Jan. 1.	Piping, Orange, N. J.	Dec. 14
Jan. 2	Machinery for well, Winnipeg, Man.	Dec. 14
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
Jan. 6.	Boilers for sale, Ft. Wayne, Ind. Adv. Dec. 21.	Dec. 21
Jan. 7	Filter plant, pipe, etc., Guthrie, Okla.	Dec. 21
Jan. 9.	Pipe, Morris Plains, N. J.	Dec. 21
Jan. 10.	Laying pipe, Phoenix, Ariz. Adv. Dec. 14, 21.	Dec. 14
Jan. 15.	Pipe, Winnipeg, Man.	Nov. 30
Jan. 15.	Water works, Maxton, N. C.	Dec. 21
Jan. 17.	Air compressor, Aurora, Ill.	Nov. 30
Feb. 1.	Water works, Las Animas, Colo.	Dec. 14
Apr. 1.	Water wks., Worthington, O.	Dec. 14

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 26.	Elgin, Ill.	Dec. 21
Dec. 26.	Springfield, O.	Dec. 21
Dec. 27.	Youngstown, O.	Dec. 21
Dec. 28.	Evansville, Ind.	Dec. 7
Dec. 30.	Hartford, Conn.	Dec. 21
Dec. 31.	Madison, Ga.	Dec. 21
Dec. —.	Ventura, Cal.	Nov. 2
Dec. —.	South Bend, Ind.	Nov. 23
Jan. [illegible]	Salt Lake City, Utah	Dec. 14
Jan. [illegible]	Cincinnati, O.	Dec. 21
Jan. [illegible]	Hot Springs, S. D.	Dec. 21
Jan. 10.	Pub. bldg., Punta Gorda, Fla.	Dec. 21
Jan. 3.	Canton, O.	Dec. 21
Jan. 6.	Durango, Colo. Adv. Dec. 14	Dec. 14
Jan. 6.	Hanley Falls, Minn.	Dec. 21
Jan. 14.	Clinton, Ia.	Dec. 21
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 16.	Oct. 26
Jan. 15.	Santa Monica, Cal.	Dec. 7
Jan. 15.	Maxton, N. C.	Dec. 21
Jan. 15.	Fredonia, Kan.	Dec. 21
Jan. —.	Lexington, Ky.	Nov. 30
Mar. 1.	Traer, Ia.	Dec. 21

BRIDGES.

Dec. 24.	Greefield, Ind.	Dec. 14
Dec. 26.	Peru, Ind.	Dec. 21
Dec. 27.	Baltimore, Md.	Dec. 14
Dec. 27.	Mt. Holly, N. J.	Dec. 21
Dec. 27.	Troy, O.	Dec. 21
Dec. 28.	Randolph, Kan.	Dec. 14
Dec. 30.	Kings Ferry, Ga.	Dec. 14
Dec. 30.	Indianapolis, Ind.	Dec. 21
Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. 31.	Victoria, B. C.	Dec. 14
Dec. —.	Ventura, Cal.	Nov. 2
Jan. 1.	Topeka, Kan.	Nov. 30
Jan. 2.	New Orleans, La.	Dec. 7
Jan. 2.	Madison, Ark.	Dec. 14
Jan. 2.	Grants Pass, Ore.	Dec. 14
Jan. 3.	Tipton, Ia.	Dec. 21
Jan. 3.	West Union, O.	Dec. 21
Jan. 6.	Colfax, La.	Dec. 7
Jan. 6.	Ft. Monroe, Va. Adv. Dec. 7 to 21.	Dec. 7
Jan. 6.	Hammond, Ind.	Dec. 14
Jan. 6.	Attalla, Ala.	Dec. 21
Jan. 7.	Wilmington, N. C. Adv. Nov. 16 to Dec. 21.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16
Jan. 7.	Creston, Ia.	Dec. 21
Jan. 8.	Waseca, Minn.	Dec. 14
Jan. 8.	Bethany, Mo.	Dec. 21
Jan. 8.	Ocala, Fla.	Dec. 21
Jan. 10.	Redfield, S. D.	Dec. 21
Jan. 10.	Wayne, Neb.	Dec. 21
Jan. 14.	Geneva, Neb.	Dec. 21
Jan. 15.	Fremont, Neb.	Dec. 14
Jan. 17.	Washington, Pa.	Dec. 21
Feb. 1.	St. Charles, Mo.	Dec. 14
Feb. 1.	Le Roy, N. Y. Adv. Dec. 11	Dec. 21
Mar. 1.	South Bend, Ind.	Dec. 7

PAVING AND ROAD MAKING.

Dec. 24.	Buffalo, N. Y.	Dec. 14
Dec. 24.	Boston, Mass.	Dec. 21
Dec. 26.	Pottsville, Pa.	Dec. 14
Dec. 26.	Washington, D. C.	Dec. 21
Dec. 27.	New Brunswick, N. J. Adv. Dec. 14, 21.	Dec. 14
Dec. 27.	Reading, Pa.	Dec. 14
Dec. 27.	Baltimore, Md.	Dec. 21
Dec. 28.	Racine, Wis.	Dec. 14
Dec. 28.	Jamestown, Colo.	Dec. 21
Dec. 30.	Columbus, O.	Dec. 21
Dec. 31.	Towanda, Pa.	Dec. 21
Dec. 31.	Ft. Rosecrans, Cal.	Dec. 21
Dec. —.	**Ventura, Cal.**	**Nov. 2**
Jan. 2.	Ridgefield, Conn.	Dec. 7
Jan. 2.	Little Rock, Ark.	Dec. 14
Jan. 2.	Jersey City, N. J.	Dec. 21
Jan. 3.	Salt Lake City, Utah Adv. Oct. 10 to Nov. 9 and 30, Dec. 7.	Oct. 19
Jan. 4.	Cleveland, O.	Dec. 14
Jan. 6.	Logansport, Ind.	Dec. 14
Jan. 6.	Lebanon, Ind.	Dec. 14
Jan. 6.	Danville, Ind.	Dec. 14
Jan. 6.	Crownpoint, Ind.	Dec. 21
Jan. 7.	Vincennes, Ind.	Dec. 21
Jan. 7.	Virginia, Minn.	Dec. 21
Jan. 7.	Versailles, Ind.	Dec. 21
Jan. 10.	Knox, Ind.	Dec. 14
Jan. 10.	Ft. Washington, Md.	Dec. 21
Jan. 11.	Noblesville, Ind.	Dec. 21
Jan. 16.	Lewiston, Idaho	Dec. 21
Jan. 17.	Washington, Pa.	Dec. 21
Jan. —.	**Jackson, Mich.**	**Nov. 23**
Feb. 4.	Brick paving, Billings, Mont. Adv. Nov. 23, 30, Dec. 14, 21.	Nov. 23
Feb. 4.	Macadam, Billings, Mont. Adv. Nov. 23, 30, Dec. 14, 21.	Nov. 23
Feb. 15.	Santa Monica, Cal.	Dec. 7

POWER PLANTS, GAS AND ELECTRICITY.

Dec. 26.	Washington, D. C.	Dec. 21
Dec. 30.	Monterey, Cal.	Dec. 14
Dec. 30.	Columbus, O.	Dec. 21
Dec. 30.	Richmond, Va.	Dec. 21
Dec. 31.	Trenton, N. J.	Dec. 21
Jan. 1.	Charlestown, W. Va.	Dec. 21
Jan. 2.	Washington, D. C.	Dec. 21
Jan. 2.	Jersey City, N. J.	Dec. 21
Jan. 6.	Panama	Dec. 21
Jan. 7.	Newburg Heights, O.	Dec. 14
Jan. 15.	Washington, D. C. Adv. Dec. 7 to 21.	Dec. 7
Feb. 1.	Lecompte, La.	Dec. 21
Feb. —.	Lagrange, Ga.	Nov. 30
Apr. 1.	Lamont, N. Y.	Dec. 21

BUILDINGS.

Dec. 23.	Post bldgs., Ft. Des Moines, Ia. Adv. Nov. 30 to Dec. 21.	Nov. 30
Dec. 23.	Fire escapes on School, Lorain, O.	Dec. 14
Dec. 24.	Station house improv., Brooklyn, N. Y.	Dec. 14
Dec. 24.	Htg. school, Boston, Mass.	Dec. 21
Dec. 26.	Schools, New York, N. Y.	Dec. 21
Dec. 27.	Pub. bldg., San Francisco, Cal.	Dec. 7
Dec. 27.	School, Hallock, Minn.	Dec. 7
Dec. 27.	School, Tulalip, Wash.	Nov. 30
Dec. 27.	Htg. armory, Cincinnati, O.	Dec. 14
Dec. 27.	School, New Haven, Conn.	Dec. 14
Dec. 27.	Jail addition, Allentown, Pa.	Dec. 21
Dec. 27.	Hotel, Ft. Wayne, Ind.	Dec. 21
Dec. 29.	School, Viola, Kan.	Dec. 21
Dec. 30.	Post office, Lancaster, Pa.	Nov. 16
Dec. 31.	Church, Falls City, Neb.	Oct. 26
Dec. 31.	Addition to school, Philmont, N. Y.	Dec. 21
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
Dec. —.	School, Anderson, Ind.	Sep. 28
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Dec. —.	Bath houses, Toronto, Ont.	Nov. 23
Dec. —.	Y. M. C. A. bldg., Plattsburg, N. Y.	Nov. 30
Jan. 1.	Dwellings, Greenville, Pa.	Nov. 30
Jan. 1.	School, Paris, Ill.	Nov. 30
Jan. 1.	Schools, Orono, Me.	Dec. 21
Jan. 2.	Pub. bldg., Flint, Mich.	Nov. 23
Jan. 2.	Post office, South Bend, Ind.	Nov. 16
Jan. 2.	School, Milwaukee, Wis.	Dec. 21
Jan. 3.	Post office bldg., Albuquerque, N. M. Adv. Nov. 23, 30.	Nov. 23
Jan. 3.	Library, Oklahoma City, Okla.	Dec. 7
Jan. 3.	Bank, Easton, Pa.	Dec. 14
Jan. 3.	Guards and gates for U. S. Bldg., Baltimore, Md.	Dec. 21
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 6.	Post office exten., Wichita, Kan.	Nov. 23
Jan. 6.	School, Cincinnati, O. Adv. Nov. 30 to Dec. 21.	Nov. 30
Jan. 6.	School plans, Madisonville, O.	Dec. 14
Jan. 7.	Add. to school, Slayton, Minn.	Nov. 23
Jan. 7.	Laboratory, Washington, D. C.	Dec. 7
Jan. 8.	Htg., etc., Post Office bldg., Trenton, N. J. Adv. Dec. 14, 21	Dec. 14
Jan. 8.	Schools, Colville, Wash.	Nov. 30
Jan. 9.	Plumb., etc., Post Office, Trenton, N. J.	Dec. 14
Jan. 10.	School, Cheyenne, S. D.	Nov. 30
Jan. 10.	Schools, Colma Sta., Wis.	Dec. 7
Jan. 10.	Y. M. C. A. bldg., Phoenix, Ariz.	Dec. 14
Jan. 10.	Pub. bldg., Columbus, O.	Dec. 21
Jan. 11.	School, Ft. Smith, Ark.	Dec. 7
Jan. 13.	Post bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14, 21	Dec. 14
Jan. 13.	Sale and removal of bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14, 21.	Dec. 14
Jan. 13.	Post bldg. improv., Ft. Monroe, Va.	Dec. 21
Jan. 13.	School, Santa Fe, N. M.	Dec. 21
Jan. 14.	Light station, Alaska Adv. Nov. 23 to Dec. 14.	Nov. 23
Jan. 14.	Indus. plant, Oxford, Md.	Nov. 23
Jan. 14.	Pub. bldg., Ft. Andrews, Mass.	Dec. 21
Jan. 14.	Post Office, York, Neb. Adv. Dec. 7, 14.	Dec. 7
Jan. 15.	Church, Pemberville, O.	Nov. 30
Jan. 15.	School, Winnebago, Neb.	Dec. 7
Jan. 15.	Pub. bldg., Chicago, Ill.	Dec. 7
Jan. 15.	Heating Capitol, Washington, D. C. Adv. Dec. 7 to 21.	Dec. 7
Jan. 15.	Y. M. C. A. bldg., Martinsburg, W. Va.	Dec. 14
Jan. 15.	Post Office, Houston, Tex.	Dec. 14
Jan. 15.	School, Flint, Mich.	Dec. 21
Jan. 15.	School, Britton, Wis.	Dec. 21
Jan. 17.	School, Pine Ridge Agency, S. D.	Dec. 7
Jan. 17.	Post Office, East Liverpool, O.	Dec. 14
Jan. 20.	School, Richmond, Va.	Dec. 14
Jan. 20.	Post office, etc., Asheville, N. C.	Dec. 21
Jan. 21.	Post office, Gainesville, Ga.	Dec. 21
Jan. 22.	Post office, bldg., Mitchell, S. D. Adv. Dec. 21.	Dec. 21
Jan. —	School, Mankato, Minn.	Nov. 23.
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Jan. —.	School, Bardstown, Ky.	Dec. 7
Jan. —.	Church, St. Louis, Mo.	Dec. 21
Feb. 1.	**Plans for Capitol, San Juan, P. R.**	**Sep. 28**
Feb. 1.	**Court house and jail, Cairo, Ga.**	**Oct. 26**
Feb. 1.	Jail, Green Bay, Wis.	Dec. 7
Feb. 1.	School, Quitman, Miss.	Dec. 14
Feb. 1.	Club house, Kenwood, Mo.	Dec. 14
Feb. 1.	School, East St. Louis, Ill.	Dec. 21
Feb. 1.	Hospital, Durham, N. C.	Dec. 21
Feb. 15.	School, Conway, Ark.	Dec. 14
Feb. —.	**College, Agricultural College, Mich.**	**Oct. 19**
Feb. —.	Jail, Ocilla, Ga.	Dec. 7
Feb. —.	City Hall, Des Moines, Ia.	Dec. 21
Mar. 25.	P. O. plans, New York, N. Y.	Nov. 30
Apr. 1.	Hotel, South Braintree, Mass.	Nov. 30

MISCELLANEOUS.

Dec. 23.	Dredge, Portland, Ore. Adv. Nov. 30 to Dec. 21.	Nov. 30
Dec. 26.	Supplies, Norfolk, Va.	Dec. 21
Dec. 26.	Supplies, Washington, D. C.	Dec. 21
Dec. 27.	Removal of wreck, Boston, Mass. Adv. Nov. 30 to Dec. 21.	Nov. 30
Dec. 27.	Sanitary fixtures, etc., Panama	Dec. 7
Dec. 27.	Vacuum clean. system, New York, N. Y. Adv. Dec. 7, 14	Dec. 7
Dec. 27.	Ditch,, Jefferson, Ia.	Dec. 14
Dec. 27.	St. cleaning, Indianapolis, Ind.	Dec. 21
Dec. 28.	Ditch, Anderson, Ind.	Dec. 14
Dec. 28.	Drain, Ft. Wayne, Ind.	Dec. 21
Dec. 28.	Ditch, Montecello, Ill.	Dec. 21
Dec. 31.	Garb. disposal, Altoona, Pa.	Dec. 7
Dec. 31.	Ditch, Greenwood, Miss.	Dec. 21
Jan. 2.	Steam gauges, etc., Panama	Dec. 14
Jan. 2.	Hammer, lathe, etc., Washington, D. C.	Dec. 21
Jan. 2.	Wire, etc., Jersey City, N. J.	Dec. 21
Jan. 6.	Conduit and embankment, Boston, Mass. Adv. Dec. 7 to 21	Dec. 7
Jan. 6.	Lumber, etc., Panama	Dec. 21
Jan. 7.	Ditch, Desmet, S. D.	Nov. 30
Jan. 7.	Garb. disposal, Reading, Pa.	Dec. 7
Jan. 7.	Ditch, Aitken, Minn.	Dec. 14
Jan. 7.	Ditch work, Forest City, Ia.	Dec. 21
Jan. 7.	Pipe and Cement, Creston, Ia.	Dec. 21
Jan. 9.	Ditch work, Council Bluffs, Ia.	Dec. 21
Jan. 9.	Swimming pool, Ft. Huachuca, Ariz.	Dec. 21
Jan. 10.	Dump scows, Wilmington, N. C. Adv. Dec. 14, 21.	Dec. 14
Jan. 11.	Dredging, Washington, D. C. Adv. Dec. 14, 21.	Dec. 14
Jan. 14.	Garbage plant, Columbus, O. Adv. Nov. 30, Dec. 7.	Nov. 30
Jan. 15.	Pier, Santa Monica, Cal.	Dec. 7
Jan. 15.	El. ry. work, Donora, Pa.	Dec. 14
Jan. 15.	R. R. work, Ft. Standish, Mass.	Dec. 21
Jan. 16.	Ditch, Estherville, Ia.	Dec. 14
Jan. 16.	Dredging, Saginaw, Mich. Adv. Dec. 21.	Dec. 21
Jan. 18.	Dry dock, Brooklyn, N. Y.	Dec. 21
Jan. 20.	Dam work, Louisia, Ky. Adv. Dec. 21.	Dec. 21
Feb. 1.	Canal work, Peterboro, Ont.	Dec. 21
Feb. 4.	Steamboat landing, Erie, Pa. Adv. Dec. 21.	Dec. 21
Feb. 11.	Garb. reduction, St. Louis, Mo.	Dec. 21
May 1.	El. ry., Buenos Aires, S. A.	Dec. 21

**Items marked thus give the names of parties awarded contracts.*

CURRENT NEWS SUPPLEMENT

DECEMBER 28, 1907.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary Charles Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, Jan. 15-16, 1908. Next meeting, Jan. 8, 1908: Informal discussion on reinforced concrete, opened by E. P. Goodrich.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West 39th St., New York. Next meeting, Jan. 14, 1908. Paper on "Car Lighting," by R. M. Dixon.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West 39th St., New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 29 West 39th St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk St., Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 113 Beekman St., New York. Annual meeting, New York, Jan. 21-23, 1908.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 413 Dorchester St., West, Montreal. Annual meeting, Montreal, Jan. 28, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, E. H. Fritch, 962 Monadnock Block, Chicago.

AMERICAN WATER WORKS ASSOCIATION. Secretary J. M. Diven, Charleston, S. C.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, John B. Lober; Secretary, Percy H. Wilson. Omce, 1232 Land Title Bldg., Philadelphia.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia. Annual convention, Buffalo, N. Y., Jan. 20-25, 1908.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Patterson, Concord, N. H.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Bernard V. Swenson, 29 West 39th St., New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

ELECTRIC TRACTION ON THE GREAT NORTHERN RY.

The Great Northern Railway Co. has closed a contract with the General Electric Co. for electric equipments to take care of all passenger and freight trains traversing the Cascade tunnel. This tunnel is approximately 2¾ miles in length with no ventilating shaft and a uniform grade east of 1.6 per cent. in the tunnel section, making the difficulties of ventilation with steam locomotive operation a very serious factor, both from the standpoint of safety and operating efficiency. Aside from danger of poisonous gases of combustion, the interior of the tunnel has become so fouled with soot as to reduce the tractive effort of the steam locomotives now used by reason of the slippery condition of the rails. The introduction of electric locomotives will do away with many of the evils now encountered in steam operation.

The electric locomotives will weigh 100 tons each, all weight being on the drivers, each locomotive being equipped with four three-phase induction motors of 325 h.-p. capacity mounted on two articulated bogie trucks. Each locomotive will have a capacity of hauling a 500-ton trailing load up a 2 per cent. grade at 15 miles per hour, and, the motors being reversible, will control the speed of the train down grade by regeneration. It is hoped by this means to introduce an additional feature of safety and eliminate the possibility of breakdown due to overheated wheel tires and brake shoes.

The locomotives will receive their supply from two 6,600-volt conductors fed from a step-down transformer station located at the entrance of the tunnel. The generating station will be located on the Wenatchee River, 30 miles from the tunnel, and power will be transmitted over duplicate transmission lines at 33,000 volts. The generating station will contain two 2,000-kw., three-phase, water-wheel-driven generators, operating at twenty-five cycles, and arrangements are being made to take care of excess power of regeneration due to an unbalanced load up and down grade.

The entire installation is under the supervision of Dr. Cary T. Hutchinson, who acts as consulting engineer to the Great Northern Ry., and the entire apparatus is being supplied by the General Electric Co. It is expected to have the road in operation in about one year, and work is already well under way on the water-power development as well as the electrical apparatus.

THE INVESTIGATION OF THE NEW YORK BOARD OF WATER SUPPLY.

The Commissioners of Accounts of New York City reported this week to Mayor McClellan that within a few days they would prefer formal charges against the Board of Water Supply, charging the members with incompetency and misconduct in connection with the award of the contract for the Ashokan dam. The misconduct referred to is "a manifest waste of the city's money in awarding the contract for the Ashokan reservoir dam for a price of $2,354,425 more than that for which the lowest bidder was willing to do the work." The charges have to be made in this form, since the law of 1905, under which the Board of Water Supply was created, says that no member of the Board shall be removed except on charges of incompetency and misconduct. It should also be stated that the investigation made by the Commissioners of Accounts was an entirely one-sided affair, like the investigations made by a grand jury. The Commissioners of Accounts would not print the statement prepared by the Board of Water Supply in its defense, nor would they permit the Board to make any such defense of its methods as is customary in a legal action. In taking this position, the Commissioners have apparently acted on the opinion that the actual trial of the case would be held before the mayor, and that it was merely their duty to ascertain if there were sufficient grounds for holding such a trial. The Commissioners' report is, therefore, merely an indictment and an ex parte statement like the arguments of a district attorney. This should be borne in mind in reading the following notes concerning the report.

The Commissioners state that the one reason of the Board of Water Supply for the rejection of the lowest bid for this dam, the fear of delay, rested on two causes, according to the testimony of the members of the Board, inexperience and a losing price. The Commissioners report that the Board had before it absolutely nothing to justify the conclusion that such causes existed or were sufficient, except general statements of opinion and experience. The Commissioners accuse the Board of failing to take such steps to satisfy itself of the accuracy of the statements made by its chief engineer and consulting engineers, as would be expected of ordinary business men of experience. It further accuses them of neglecting to bring out the facts from the lowest bidder and of authorizing a large expense upon a record which, it is claimed, bears upon its face the evidence of its insufficiency.

The report of the Commissioners states that the president of the Board of Water Supply, Mr. J. Edward Simmons, testified that he knew nothing of the engineering problems or questions involved in the award of the contract, for he had not inquired into these matters, believing that they were of such a nature as to be intelligible in detail only to engineers. He was satisfied with the reports of the chief engineer and consulting engineers, relied absolutely on their advice, and did not consider that it was necessary to go beyond their advice, in passing upon this matter. According to the report of the Commissioners, the second member of the Board of Water Supply, Mr. Shaw, did not ask the chief engineer to explain how he had arrived at his estimates, although he had asked on what facts the opinion that the Peirce prices were too low was based. It was his opinion, the report states, that he had no way of determining that the Peirce bid was in error and the engineers correct, other than the unanimity of opinion on the part of the engineers, except that the other bidders named figures higher still. The Commissioners report that the third member of the Board of Water Supply, Mr. Chadwick, testified to a general understanding of the preliminary investigation and the nature of the tests made by the engineering department. When the tabulated bids were examined by him, the contrast between the figures in the Peirce bid and the others caused him to believe that the former should be closely scrutinized. He testified that upon the ques-

INTERIOR VIEW OF ONE OF THE TWIN TUBES OF THE BATTERY TUNNEL, NEW YORK.

The first train was run through this tunnel on Nov. 27 from Bowling Green, Manhattan to the Borough Hall station, in Brooklyn. The design and construction of the tunnel have been fully described in past issues of The Engineering Record.

tion of price, he considered that the various bids submitted were the best expert advice and evidence of which he could conceive, four out of five of these bids approximated, corroborated and endorsed the engineer's estimate, while the fifth, the lowest bid, differed widely from it. Mr. Peirce had told him that he was unwilling to perform the work under his bid, that the prices were too low, and that he (Peirce) could not get anyone to justify and protect him in this bid.

The report of the Commissioners of Accounts summarizes in detail the statements of the witnesses examined by it and then makes this comment: "It becomes a question whether the members of the Board took all the steps and precautionary measures which business men of experience might be expected to take in the conduct of their private business, for this we consider to be the fair measure of their duty. We are of the opinion that they did not. There was no evidence before the Board that the Peirce prices were below cost. Their conclusion that such was the case rested solely upon inference and opinion, inference from other conclusions unsupported by evidence, and opinion unexplained and unanalyzed. Their conclusion that delay must result from a losing price rested also upon opinion, though in this matter on opinion qualified and unpronounced and upon two cases cited. What an analysis of the facts in one of these cases would have brought out the testimony taken before us shows. What a thorough and searching investigation by the Board would have devolved upon the whole question that testimony also demonstrates. It seems to us that the measure of care and application given by the members of this Board to this problem was not that measure which the people of this city have the right to demand of their servants in office charged with the duty of wisely and economically administering their funds."

The Commissioners of Accounts make these comments on the testimony of the engineers of the Board of Water Supply:

"The chief engineer did not know the rate of wages prevailing at Ashokan or what the contractor was, at the time of this hearing, paying his men. He did not know and could not estimate the detailed cost of any particular sub-division of the work of constructing the dams. He believed that such information would serve no purpose. In general he held that the estimating of engineers was purely a speculative science; that between estimates there is no way of telling which is right until the work is carried out; that cost cannot be determined in advance by any mortal, and that the only way to determine it is for a contractor to do the work and keep a record. Not being able to tell the cost of the work projected, he yet considered it wise to award a contract at an advance of $2,500,000 over the lowest bid, under the conditions presented.

"Professor Burr, after a very lengthy and detailed examination, in which an earnest effort was made to draw from him specific statements and facts, added absolutely nothing to the evidence of price, with the exception of two costs which he cited. These were of a rolled embankment of the water works at Waterbury and of a dam at Farrington, Conn. He formed his judgment of the Peirce prices from his general experience as an engineer, particularly that in this class of work, and from the experience of others communicated to him. His actual experience in the construction of rolled earth embankments confined itself to a reservoir 400 ft. in diameter in the outskirts of the city of Newark, constructed under his direction 34 years ago, and to the Harlem River driveway. He could not remember the cost in the former case and considered the conditions were too dissimilar to allow of a comparison with the Ashokan dam. He did not know the cost in the case of the Harlem River Driveway, which, in any case, was a different character of embankment. The remainder of his experience was as a consultant.

"Mr. Stearns had but little experience in steam shovel work. They had been very little used in the hydraulic work with which he had been connected. He did not know the cost of running a steam shovel for one day or for any other period of time. He never kept costs of steam shovels. He could not name the number of shovels which would probably be used at Ashokan, or the probable daily output of cubic yards per shovel. He did not know the details of steam-shovel work. He thought the cost of loading on board cars by steam shovel would be 20 cents per cubic yard at Ashokan, but could not show how he arrived at that figure.

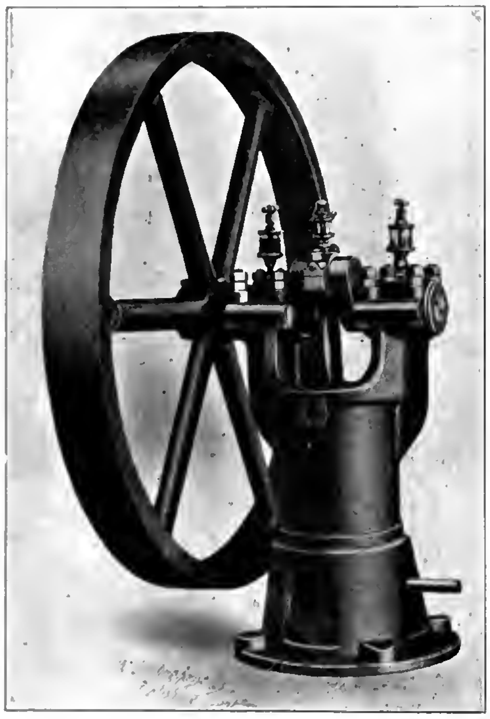
"Mr. Freeman's contributions to the evidence upon cost were exceedingly meagre. His judgment that Peirce's prices for earthwork were below cost were at one time during this testimony based mainly on the engineer's estimates, while at another it was based on his general experience, using former contract prices as a criterion, his judgment of the price for this work being a composite of his general experience. His judgment fixed the price for embankment at 60 cents per cubic yard."

"Mr. Freeman differs radically from his colleague, Mr. Stearns, and from Chief Engineer Smith, who were strongly of the opinion that the only safe guides in [illegible] were costs of former works and who con[illegible] earthwork [illegible] would serve as partial guides."

The Commissioners of Accounts make the following statements regarding the testimony by representatives of contracting companies:

"Of all the evidence submitted upon the questions of price and cost that contained in the testimony of Mr. John Peirce and his engineers was the most striking, because of the prevailing impression that Mr. Peirce believed his bid to be at losing figures. In explanation of his interview with Commissioner Chadwick Mr. Peirce stated that he had been invited to meet the chief engineer and the Commissioners. He had stated to the former that he considered that he was low on embankment, but had good prices on the masonry. The chief engineer agreed with him. His interview with Commissioner Chadwick occurred some three days later. He was not familiar with embankment work and was influenced in thinking his prices were too low partly by the other bids, partly by steam shovel people who were here at the time, partly by the opinion of the chief engineers and of the Commissioners. He did not remember that any one connected with the Board asked him how he expected to come out on the entire contract, or that he communicated his expectations to any one there.

"When called to the stand Mr. Peirce declared that his bid, in his own judgment, formed after his return from Europe, showed, as it stood, a net profit of 10 per cent. He stated that the figures from his engineers showed a profit of $2,000,000 to $2,500,000, and that his own judgment, independent of the engineers' figures, showed him a profit after he had gone over the matter. This profit was on the entire bid, but he saw none on the embankment item, viewed separately. He could not say that the embankment items at those



SMALL WESTINGHOUSE AIR COMPRESSOR.

prices would be done below cost, there being various opinions as to that. He did not consider that this profit of 10 per cent. was enough for a job extending over so long a time, and if the Commission was willing to pass his bid he was willing that it should do so. He had never abandoned a contract or refused to perform an obligation, and had the Commission held him to his bid it was his intention to perform the letter of his contract.

"W. J. Oliver, who had been associated with Mr. Peirce in the company organized to do work on the Panama Canal, considered that Peirce was too low on excavation, but wanted to become a partner and participate in the entire contract.

"Witness (Emil Deibitsch), the vice-president of the John Peirce Company, furnished the names of those who took part in the preparation of the Peirce bid. The cost estimate was prepared by Ernest C. Moore, an engineer in charge of certain contract work of the Peirce Company. That estimate amounted to about $8,000,000, and was submitted to Engineer Reed, of John B. McDonald's office, for his opinion. Mr. Deibitsch checked up this estimate.

"The only direct evidence upon the price of labor submitted was that given by James O. Winston, of the Winston Company, and Bruno Feder, the labor contractor. Mr. Winston stated that the MacArthur Company was paying $1.50 up a day of nine hours. Mr Feder testified that he was prepared to make an offer to the successful contractor to furnish labor up to the number of one thousand men, in a period of two weeks, at a rate of $1.35 a day of eight hours.

"The evidence submitted to prove that delay invariably results from a price below cost was inconclusive and meagre."

A NEW WESTINGHOUSE AIR COMPRESSOR.

The Westinghouse Air Brake Co. has been for some years supplying various industries using compressed air with its standard steam and motor-driven air compressors. In some industries, however, there is a demand for a compressor of smaller capacity and the company has therefore developed a small belt-driven compressor.

The compressor is of the vertical single-cylinder, single-acting, water-jacketed type, operated by power delivered to a 30-in. flywheel attached to a crank shaft, the rotation of which drives the piston in the cylinder by means of a connecting rod. The diameter of the air cylinder is 3 in., the stroke of the piston is 4 in., and the rated capacity of the pump is 4 cu. ft. of free air at 250 r. p. m. It is designed to operate if desired against any air pressure up to 250 lb. At 250 r. p. m. its speed of maximum efficiency, and against 200 lb. air pressure, approximately one brake horse power is required to operate the pump. Since the act of compressing air always raises its temperature, the cylinder is surrounded by a water jacket, through which a constant circulation of water is maintained.

THE WATER PURIFICATION WORKS AT PITTSBURGH.

It is generally known that the water purification works at Pittsburgh are so far advanced that in a few days water will probably be admitted to some of the filter beds, but there are some portions of the work which are still quite backward. In the pumping station which will supply water from the river to the sedimentation basins, half of the boilers, two of the three electric-generating units and two of the four main pumping engines are in service or ready for it. This will enable at least two shifts a day to be operated and plenty of water pumped to the settling basins. These basins have been filled and the conduits and pipe lines from them to the filters are now being tested. Twelve of the filters are entirely complete, with all their connections, and can be started as soon as water is delivered to them. Twelve more filters have all their filtering material in them and can be started as soon as a few connections are completed. The remaining filters are in various stages of progress; most of the concrete work is done, but only about half of the filtering material is in place and a good many adjustments will have to be made before the works as a whole are in a good state for use.

Connections have been made so that as soon as the filtered water reservoir is filled, at least two of the pumps at the Brilliant pumping station of the Pittsburg water-works can be supplied with filtered water, but it is impracticable to state at present just when the connections for the other pumps can be made, so that all of them will be in a position to receive filtered water. This work depends a good deal upon river conditions, and the length of time the pumps can be placed out of commission. It would not be surprising if this work remained incomplete until next fall.

A good deal of trouble is being experienced in securing good men for the maintenance of the works. The old ordinance governing such things prohibited the employment of men who had not lived six months in the city of Pittsburgh, prior to the time they received their appointment. This ordinance was not enforced during the construction of the filters, because the men were necessarily experts in their respective duties in one sense, but it is the desire of those at the head of the city's affairs to have the maintenance work done entirely by citizens. In order to ensure this, a new ordinance calls for preference to be given to those who have resided in the city for two years prior to the passage of the ordinance, which entirely prevents the appointment on the maintenance staff of men living in Aspinwall, where the filters are, who have been familiar with the construction of the work. Up to the present time it has been impossible to secure enough men through the local Civil Service Commission who had the technical qualifications for the places and could comply with the requirements as to residence.

The consolidation of Allegheny with Pittsburg is causing considerable discussion as to the water supply of the former place. At the present time there is a pumping station at Montrose which supplies Allegheny with about 40,000,000 gal. daily. To filter this amount of water will require from 22 to 24 more filters, at the present maximum rates, than the present plans for the Pittsburgh works contemplate. There is room for 10 more filters on land already owned by the city. It has been suggested by some that it would be best to build 10 additional filters for operation at the rate contemplated by the designers of the work and conduct a series of experiments to ascertain whether this rate can be increased by the use of preliminary filters or by coagulation. Inasmuch as no conclusive experiments have been undertaken to determine whether the Allegheny River water can be subjected to such preparatory processes with any economical success, it is manifest that the adoption of one of these methods without further trial would be at the risk of an expensive failure.

THE ACCIDENT AT THE VIRGINIA PORTLAND CEMENT WORKS.

The newspaper reports of the accident to the power house of the Virginia Portland Cement Co., at Fordwick, Va., have failed to state correctly the facts of this unusual occurrence. These mills were described in The Engineering Record of July 28, 1900. The power house is a 56x82-ft. building with a 43x78-ft. extension. It is a brick structure with heavy timber roof trusses, the latter made necessary by the impracticability of securing ironwork within any reasonable time when the plant was built. These trusses were carried on a plate girder 48 ft. long and 5 ft. deep, which had a 15x18-in. bearing at each end on a brick pilaster. The brickwork was laid in lime mortar and the 40-ton load on each bearing came directly on the brickwork, without a bearing plate or capstone.

For some weeks previous to the accident, blasting had been going on in the excavation for a condenser ditch outside the power-house, and it is believed that the series of shocks from the blasting weakened the brickwork until it failed, resulting in the wreck shown in the picture. The actual damage is much less than the picture would indicate. While the walls of the building are so badly cracked that they must be torn down, the machinery is undamaged. The girder fell on the transmission rope, which held it, and parts of the roof were held by the traveling crane. In reconstructing the building the girders will be supported on steel columns.

WRECK OF THE ROOF OF THE POWER HOUSE OF THE VIRGINIA PORTLAND CEMENT WORKS.

THE CHICAGO CEMENT SHOW.

The first annual cement show under the management of the Cement Products Exhibition Co., which was held in the Chicago Coliseum this week, was more largely attended than seemed probable a few weeks ago, when the flurry in the money market produced a feeling of unrest in the building trades. When the financial disturbance began, the directors of the company recognized that they would have to give their personal attention to the enterprise if it was to have the educational results desired, and the character and number of the exhibits demonstrated the hard work these men did. The company is an organization of manufacturers of Portland cement, with the following officers: President, Edward M. Hagar, Universal Portland Cement Co.; vice-president, Norman D. Fraser, Chicago Portland Cement Co.; secretary and treasurer, C. H. Wood, Wolverine Portland Cement Co.; directors, the gentlemen named above with A. St. J. Newberry of the Sandusky Portland Cement Co., Wm. Dickinson of the Marquette Cement Mfg. Co., Daniel McCool of the Newaygo Portland Cement Co., E. W. Shirk of the United States Cement Co., B. F. Affleck of the Universal Portland Cement Co., and J. U. C. McDaniel of the Chicago Portland Cement Co. The company is a permanent one, which proposes to hold a similar show every year for the purpose of enabling the manufacturers of materials and supplies for the concrete industry in the Chicago district to exhibit them under the most favorable circumstances. This year there were considerably over a hundred exhibits and the interest shown in them by the visitors was considered entirely satisfactory by those in charge and an indication of even greater success hereafter, for more time can be given to perfecting the arrangements for future shows and the experience gained in this first one will prove a guide to the work.

The exhibits made by the manufacturers of Portland cement were chiefly samples of art work. It is generally recognized at the present time that the architects are proving the main stumbling block in the way of a more extensive use of Portland cement in the better grade of residences. Their objection is not against the structural properties of the material, but rather against its alleged lack of artistic capabilities. This feeling is due to an absence of information concerning what can be accomplished with cement and concrete under proper treatment, and to furnish this information visitors to the show were given an opportunity to see some interesting and artistic samples of decorative concrete work. Naturally enough many present were particularly interested in the samples of the new white Portland cement for art work which the Sandusky Portland Cement Co. displayed. The Marquette Cement Mfg. Co. showed a model house of concrete blocks which was always surrounded by a number of visitors. Other cement manufacturers displayed pictures of their works which furnished a convincing proof of the extent and permanence of the manufacturing plants required in this industry.

The builders of machinery for cement mills took advantage of the show to be represented and to make known among the cement men present the advantages of their novelties and their standard apparatus. The makers of machines for moulding concrete building blocks were also in evidence, a special reason for their exhibits being the convention of the Northwestern Cement Products Association, which met during the week.

The exhibits of machinery for contractors' use were numerous. The Arthur Koppel Co. displayed a portable track and several cars. One of these was a 1-yd. steel dump car with a special fastener, roller bearings, and cast-steel wheels, which was designed particularly for conveying concrete from mixers to the forms where it is to be used. Another type of car shown is what is called a scoop car, made entirely of steel and used for charging a mixer. By the use of a fifth wheel or turntable, the box can be dumped to either side or end. The Continental Car & Equipment Co., of Louisville, showed a 6-yd. two-way diamond frame dump car for a standard-gauge road. This type of car is used in cement works and by contractors in handling the material excavated by steam shovels. The car weighs about 9,500 lb., and it was delivered at the show only with considerable difficulty, on account of the trouble in getting it transported quickly. The company reports that it is entirely satisfied with the results of its trouble, however, for a number of sales were made during the show. The Parker Hoist & Machine Co., of Chicago, exhibited its builder's derrick, which weighs only 450 lb. complete, with blocks and rope. The heaviest part of the machine weighs but 150 lb.

The manufacturers of cement mixers were naturally well represented. The Eureka Machine Co., of Lansing, displayed a steam power mixer and a gasoline engine outfit in actual operation. The McKelvey Machinery Co. not only showed contractors' machinery and tools, but also industrial cars and block machines. The Chicago Concrete Machinery Co. had one of its mixers in operation. The Chicago Builders' Specialty Co. showed the Koehring mixer. The various water-proofing methods were explained by representatives at the show, and the interest shown in this subject was decidedly marked.

The General Fireproofing Co., of Youngstown, showed its various types of reinforcement for beams and slabs by means of a model structure in which the manner of using these different materials was clearly indicated. The Expanded Metal & Corrugated Bar Co., of St. Louis, had a number of illuminated pictures of structures in which their materials had been used. The Inland Steel Co., of Chicago, displayed a collection of high-carbon twisted bars. The American Steel & Wire Co., of Chicago, displayed columns, beams and slabs reinforced by its new wire nettings. The American System of Concrete Reinforcing, of Chicago, exhibited its complete system of constructing beams, columns and slabs.

A feature of the show which caused considerable comment among visitors was the number of different types of concrete roof tiles which were to be seen. This is not a new cement product by any means, but its recent rapid strides into some prominence are noteworthy.

It is, of course, impracticable to give here a complete list of everything exhibited, but it can be gathered from what has been said that such a display of materials and products of the cement industry has a distinct educational value. There are many cement workers who are carrying on small undertakings successfully and wish to enlarge their operations, but hesitate to do so on account of unfamiliarity with some branches. The show furnished such visitors with much of the information they wished to obtain. In addition the architects and builders who saw the samples of artistic work in concrete were free to acknowledge their profit from an inspection of these things.

PERSONAL NOTES.

Mr. J. W. Wilcox has been appointed city engineer of Macon, Ga.

Mr. Charles W. Trumbull has been appointed city engineer of Schenectady, N. Y.

Col. William E. Cutshaw, city engineer of Richmond, Va., for the past 30 years, died Dec. 20, after an illness of several weeks.

Mr. W. P. Chrysler has been appointed superintendent of motive power of the Chicago Great Western Ry., a newly-created office.

Messrs. Kable & Kable, architects and engineers, Portland, Ore., announce the removal of their offices to the Chamber of Commerce Tower in that city.

Messrs H. C. Innes and E. A. Gast have been re-elected president and secretary and treasurer, respectively, of the Engineers' Club, of Cincinnati.

Mr. W. S. Menden, who has been acting superintendent as well as chief engineer of the Brooklyn Rapid Transit Co., has been appointed assistant general manager and chief engineer of that company.

At a recent meeting of the Washington Society of Engineers, the following were elected officers for the coming year: President, Arthur P. Davis; vice-president, D. S. Carll; secretary, John C. Hoyt; treasurer, John F. Hayford.

Col. William Crooks, assistant to the general manager of the Oregon R. R. & Navigation Co., at Portland, Ore., and one of the pioneer civil engineers in the Northwest, died recently at Portland, Ore., aged 76 years. Crookston, Minn., was named after him.

Mr. S. R. Fowler, formerly a resident engineer with the Kenefick-Hammond-Quigley Construction Co., Beaumont, Tex., has joined Mr. F. F. Kendall, of Houston, Tex., for the practice of general engineering. The name of the new firm is Kendall & Fowler.

Mr. J. W. Ager has resigned as electrical aide in the Bureau of Yards and Docks, United States Navy Department, to enter the employ of Muralt & Co., engineers, New York, as manager of that company's Southern office in the Title Guarantee Building, Birmingham, Ala.

Mr. J. C. Elliott, structural engineer and concrete-steel expert, has resigned as contracting engineer of the Berger Manufacturing Co., of Canton, Ohio, in the Chicago office of that concern, to accept a reappointment as superintendent of construction for the United States Treasury Department at Eau Claire, Wis.

At the nineteenth annual meeting of the Engineering Association of the South, held in Nashville, Tenn., Dec. 14, the following officers were elected: H. M. Jones, president; A. G. Gude, director. For the Nashville section: H. H. Trabue, president; W. M. Archibald, vice-president; S. M. McMurray, director. For the Atlanta section: Arthur Pew, president; R. H. Lawrence, vice-president; and T. P. Brant, director.

The Pennsylvania R. R. Co. has determined to continue its policy of furnishing to the public prompt and accurate information relative to its affairs, and for this purpose has engaged Mr. Ivy L. Lee to take charge of this work. Mr. Lee has been a member of the firm of Parker & Lee, who have acted as publicity managers for many of the largest interests in the country, including the Pennsylvania R. R. Co., so that there will be no interruption in the excellent methods of that company. Mr. Charles A. Bridge, manager of the firm of Parker & Lee, takes the place of Mr. Lee in it, the firm name becoming Parker & Bridge.

BUSINESS NOTES.

The Concrete Engineering & Supply Co. has moved to new offices at No. 1 Madison Ave., New York City.

The Artesian Well & Supply Co., of Providence, has been awarded the contract for sinking a well at Fort Terry, Plum Island, Long Island Sound, by the War department.

The Northern Engineeering Works, Detroit, Mich., has installed a No. 54 Newten cupola for the Standard Pulley Co., Cincinnati, O., and has also made shipments of Newten cupolas to Havre, France, and Genoa, Italy.

The Foos Gas Engine Co., of Springfield, O., have purchased the business of the Marinette Gas Engine Co., which comprises the line of Walrath multiple cylinder engines from 20 to 500 h.-p. for electric and power work. This engine has been on the market for over ten years, and with the company's horizontal engines from 2 to 90 h.-p. makes the Foos line very comprehensive.

B. F. Sturtevant Co., through Mr. F. R. Chinnock, manager of the New York office, reports the following sales of engines and electric generators: Board of Water Supply, Babylon, N. Y., one 9 x 8 vertical center crank engine, direct connected to a standard slow speed 25-kw. generator; Hanover National Bank, New York City, one 12 x 10 engine direct connected to 50-kw. generator; Eberhard Faber Pencil Co., Brooklyn, N. Y., one 16 x 14 horizontal automatic center crank engine direct connected to a 100-kw. generator; Booker Contracting Co., New York City, one 4½ x 4½ engine direct connected to 5-kw. generator; Central Union Gas Co., New York City, one 5 x 7 engine direct connected to 15-kw. generator; Vulcan Detinning Co., Sewaren, N. J., one 7 x 7 vertical engine; Hotel Takanassee, Long Branch, N. J., one 16 x 14 engine direct connected to 75-kw. generator, and one 13 x 12 horizontal engine direct connected to 50-kw. generator; H. J. McCoy, New York City, one 11 x 9 vertical engine; Washburn Bros., Saugerties, N. Y., one 25-h.-p. motor; N. Y. State Reformatory for Women, Bedford, N. Y., one 13 x 12 horizontal engine direct connected to 50-kw. generator; Isidor Fajans, New York City, one 6 x 6 engine direct connected to 10-kw. generator; Votey Organ Co., Garwood, N. J., one 3½ x 3 engine direct connected to 3-kw. generator; Johnson & Johnson, Steamer "Robert Johnson," one 10-kw. generator, direct connected to 6 x 6 vertical engine; Andrew McLean Co., Passaic, N. J., one 4 x 4 vertical engine; Royal Mfg. Co., Rahway, N. J., one 8 x 6 vertical engine direct connected to 6-kw. generator; New York Engineering Co., New York City, three 4½ x 4½ vertical engines direct connected to 5-kw. generators; Parker Engineering Co., one 14 x 14 engine direct connected to 75-kw. generator; Henry Steers, Inc., New York City, three 7½-kw. generators; Samuel Smith & Sons, Paterson, N. J., one 14 x 14 direct connected to two 50-kw. generators.

Ground has been broken for the enormous refinery to be constructed by the Standard Oil Co. on Staten Island Sound not far from Elizabeth, N. J.

The Wagner Water Still Co., 87 Washington St., Chicago, is pushing the sale of its water distilling apparatus for furnishing drinking water in places where the local supply is of questionable quality. The large stills, having a capacity of 2 to 15 gal. per hour are operated by steam, while the smaller sizes for laboratory and household purposes are operated by gas.

J. G. White & Co., New York, are buying freight cars for the Porto Rico Railways for carrying tobacco and sugar cane. The first order will include ten box and ten flat cars, all with steel underframes. This company has just ordered four 3½-ft. combination cars for the Philippine Ry. Co., making the seventh equipment contract for these lines placed by the company.

The Paterson oil eliminator, with make-up water softener, is described in a pamphlet recently issued by the Paterson Engineering Co., Ltd., Amberley House, Norfolk street, Strand, London, England. This apparatus is intended to free the condensation water from reciprocating engines from the emulsified oil which is found difficult to remove in the usual oil extractor in the exhaust mains. This is accomplished by a coagulation process which is fully described, the illustrations showing an equipment of 2,500 imp. gal. hourly capacity. Attached to the latter apparatus there is a water softener of 500 gal. hourly capacity for removing scale-forming substances from water which is added to the [illegible] for makeup purposes.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

ENGINEERING AND BUILDING SUPPLIES

WATER.

Notes Arranged Alphabetically by States.

Headland, Ala.—See "Power Plants, Gas and Electricity."

Brewton, Ala.—See "Power Plants, Gas and Electricity.

Hartord, Ala.—See "Power Plants, Gas and Electricity."

Tropico, Cal.—The Tropico Water Co. is reported to have decided to purchase the water plant of the Dwight Briswood Land Co. and will improve same.

Daytona, Fla.—The City Council is reported to be considering the question of issuing $50,000 bonds for the construction of water works, to include fire protection.

Albany, Ga.—Bids will be received until Jan. 6 by Y. C. Rust, Clk. City Council, for $15,000 bonds to be issued for the purpose of extending the water mains and city sanitary sewerage system into Arcadia and other portions of this city; also $15,000 bonds for improving the surface drainage system of said city.

Boise, Idaho.—The Custer Land & Irrigation Co., of Boise, is reported incorporated, with a capital stock of $150,000. Incorporators: L. L. Folsom, W. W. Lynch, S. E. Vance and others.

Rockford, Ill.—The Water Com. is reported to be planning an expenditure of $30,000 for an extension of the water mains.

Evanston, Ill.—See "Paving and Roadmaking."

Springfield, Ill.—The City Council has passed an ordinance authorizing the Mayor and Supt. of Water Wks., to procure bids for the constructon of a dam and the diversion of the course of Spring Creek; the work to be done under supervision of Water Works Supt. and City Engr. Frank H. Hamilton.

**Wesley, Ia.*—The National Constr. Co., of South Bend, Ind., is reported to have secured the contract for constructing water works for $8,000.

Rockwell City, Ia.—It is stated that bids will be received until Jan. 6 by I. E. Dougherty, Town Clk., for constructing a 4-in. water main.

Versailles, Ky.—The Holmboe Co., Lincoln Savings Bank Bldg., Louisville, has been selected to prepare plans and specifications for water works and sewers; probable cost of work, $60,000.

New Orleans, La.—Geo. G. Earl, Gen. Supt. Sewerage and Water Board, writes that bids are about to be asked for a 4,000,000-gal. direct acting compound condensing pumping horizontal engine for the Algiers water purification station.

Baltimore, Md.—The city and county authorities are discussing an agreement for the construction of a 20-billion gallon reservoir in the Gunpowder River Valley and the application to the legislature for permission to raise $5,000,000 for acquoring the water rights.

**Cumberland, Md.*—The Fred. M. Prescott Steam Pump Co., of Milwaukee, Wis., recently received contract for furnishing and installing a pumping engine here. This engine if the Prescott Corliss cross-compound crank and fly-wheel type, with a capacity of 5,000,000 gals. per day of 24-hours; contract price, $23,410.

**New Bedford, Mass.*—The U. S. Cast Iron Pipe & Foundry Co., of New York, N. Y., is reported to have secured the contract for 481 net tons of 12,10, 8 and 6 in. c. i. pipe at $27.25 per ton and 44 tons specials, $57.50; total, $15,637. Totals of other bids: Warren Foundry & Machine Co., New York, N. Y., $15,796; Camden Iron Works, Philadelphia, Pa., $18,127 and Lynchburg Fdy. Co., Lynchburg, Va., $15,703.

Columbia, Miss.—The citizens are reported to have voted on Dec. 13 to issue $50,000 bonds for water works and sewers. W. L. Simmons, Town Clk. E. Blanchard, Engr., Columbia.

St. Louis, Mo.—The West St. Louis Water & Light Co. which supplies water to St. Louis County, is reported to have completed arrangements for erecting 2 water towers and laying 13 miles of pipe in the country. One of the towers will be erected on Stratman Hill, on the Link and Olive St. roads in the southern part of the county; the other will be placed near Normandy. Each tower will have a diam. of 65 ft. and will stand over 125 ft. high, their capacity being 750,000 gals. The new pipe will be laid over the Olive St. and Denny roads, to give a more direct line to Kirkwood and Webster Groves.

Harlowton, Mont.—See "Power Plants, Gas and Electricity."

Molma, Neb.—See "Power Plants, Gas and Electricity."

Burlington, N. J.—The Bd. of Water Comrs. is reported to be considering the question of constructing a filtration plant, to cost about $100,000.

Rocky Mount, N. C.—See "Power Plants, Gas and Electricity.

Forgo, N. D.—It is stated that bids will be received until Jan. 6 by N. C. Morgan, City Aud., for constructing a 6-in. water main in 10th Ave., S., and 4th and 8th Sts., N.

Minot, N. D.—Local press reports state that bids will probably be called for at once for the construction of water works, to cost about $150,000.

**Zanesville, O.*—The Fred M. Prescott Steam Pump Co., of Milwaukee, Wis., recently received a contract from the City of Zanesville, for a horizontal triple expansion direct acting water works pumping engine, with a capacity of 6,000,000 gals. per day.

Toledo, O.—The city officials are reported to be considering the construction this winter of conduits from the filter plant to the water works pumping station

Fostorio, O.—The Riggs & Sherman Co. of Toledo, is preparing plans for preliminary filters for Fostoria.

Warren, Pa.—The American Water Works & Guarantee Co., of Pittsburg (J. H. Purdy, Mgr.) owner of the Warren Water Works Co., is reported to be considering the question of constructing a filtration plant at Gladerun, to cost about $100,000.

Fairchance, Pa.—Jas. Farrell, Clk., of Council, writes that bids will probably be called for in March for the construction of water works, to cost about $20,000. Engineer Geo. Scudder, of Uniontown.

Newberry, S. C.—See "Power Plants, Gas and Electricity."

**Bay City, Tex.*—We are iformed that the John W. Maxey Constr. Co., of Houston, has secured the contract for constructing water works for Bay City at about $25,000.

Seattle, Wash.—R. H. Thomson, city engr., estimates the cost of laying water mains on 20th Ave., n., at $3,750; also for water mains on e. 65th, 15th Ave., n. w., and 23d Ave., n. e. at $12,100.

Tacoma, Wash.—Owen Woods, Comr. of Pub. Wks., is reported to have been instructed to procure bids for a 2-stage, 10-in. turbine pump, capable of handling 6,000,000 gal. of water daily at Station A.

Kenosha, Wis.—The City Council is reported to be considering the building of a new intake for the municipal water plant. It is proposed to extend the intake into the lake about 6,000 ft.; estimated cost, $75,000.

Morietta, Wis.—The Marietta Water Co. is reported to be planing considerable extension work next spring.

Lethbridge, Alta.—C. M. Arnold, City Engr., writes that water works have been installed here since 1904, but further extensions are in view for the future.

Edmonton, Alta.—Bids will probably be called for in April for water work improvements, to cost about $40,000. R. R. Kelly, City Engr.

Toronto, Ont.—C. H. Rust, City Engr., writes that bids will be opened on Jan. 28 for a 15,000,000 and a 6,000,000 imperial gallon triple expansion vertical engine for the main and high level pumping station.

Weyburn, Sask.—Edgar A. Chappell, City Treas., writes that a dam to hold 100,000,000 gals. has been put in this fall to catch the spring's water, and as soon as the season opens next spring it is planned to go on with the 3½-mile water main to bring the water to town. There will be astand pipe needed, and between 5 and 6 miles of pipe for distribution. Final plans are awaiting the action of the coming Council.

Hamilton, Ont.—Bids are wanted until Jan. 1., as a whole or separately, for the water works system requlred on Burlington Beach, including motor, pumps, tanks, pipes, hydrants and valves. For further information apply at the Beach Comrs.' office, Rm. 59, Federal Life Bldg.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

University, Ala.—Bids are wanted until Dec. 31, for constructing a sewerage system for the University of Alabama, consisting of approximately 4,960 ft 8 in., 1,260 ft. 10 in., 1,110 ft. 12 in., and 2,160 ft. 15-in. sewer, and 25 manholes. John W. Abercrombie, Pres. of the University.

San Jose, Cal.—Bids will be received, it is stated, until Jan. 2 by the City Clk. for constructing an intercepting sewer in the 1st, 2d and 4th wards.

Bakersfield, Cal.—Bids will be received, it is stated, until Jan. 6 by the Bd. City Trus. for constructing a main land outfall sewerage system.

Albany, Ga.—See "Water."

**Belleville, Ill.*—We are informed that Reeb Bros. of Belleville has secured the contract for constructing sewers on Race, High and Church Sts. at 65 cts. per lin. ft. for 12 in., 80 cts. for 15 in.; $40 for manholes and $35 each for catch basins. The Stoltz Supply Co. of Belleville secured the contract for 12-in. pipe sewers on 2d Av. and D Sts., alley bet. High and Jackson Sts. and Jackson St. at 72 cts., 54 cts. and 57 cts; manholes, $36 and $35 and catch basins, $34.50.

Woodstock, Ill.—Lynn Richards, City Clk., writes that it is proposed to construct a sewerage system, to cost about $80,000. Engineer, W. S. Shields, 1201 Hartford Bldg., Chicago. Geo. H. Hoy, Mayor.

South Bend, Ind.—Bids will be received by the Bd. of Pub. Wks. until Jan. 7 for the construction of about 4 miles of pipe sewers up to 30-in. diam., with manholes, flush tanks, etc. A. J. Hammond, City Engr.

Indianopolis, Ind.—Chas. A. Brown, Asst. City Engr., is reported to have completed plans for the Spring St. sewer, to be about 4,800 ft. long, and cost about $6,500.

Ft. Wayne, Ind.—It is stated that bids will be received until Jan. 2 by the Bd. Pub. Service (Edw. J. Lennon, Chmn.) for constructing sundry sewers.

Charles City, Ia.—The City Council is reported to have decided to issue $14,000 sewer bonds.

Galena, Kan.—The City Council has authorized W. L. Ricksecker, City Engr., to prepare plans and specifications for lateral sewers, to cost about $30,000.

Caney, Kan.—It is stated that bids are wanted until Jan. 7 for $50,000 sewer bonds. W. E. McMillan, City Clk.

Versailles, Ky.—See "Water."

**Boston, Mass.*—John J. Leahy, Supt. of Sewers, writes that Timothy J. O'Connell, 158 Adams St., Dorchester, has secured the contract for rebuilding Stony Brook condnit in Bryant St., for $17,219.

**St. Paul, Minn.*—The Board of Public Works, on Dec. 16, awarded contracts for a sewer on Armstrong St. to Chatsworth St. to John Lind, 34 E. 2d St., for $7,600, and for sewers on Stickney, Gates and Page Sts. to O'Neill & Preston, for $12,457.

*H. Thornton Bros. are reported to have secured the contract on Dec. 10 for constructing about 2 miles of sewer on Dayton's Bluff, for $37,883.

Columbia, Miss.—See "Water."

**Items marked thus give the names of parties awarded contracts.*

Billings, Mont.—The city will probably let two contracts for sewers on Feb. 4, one to cost $14,000, the other about $17,000. Henry Gerharz, City Engr.

Morristown, N. J.—Mayor Alex. Bennett has signed the contract awarding to J. B. Salmon the contract for the erection of the disposal plants for the Morristown sewers on the Whithall tract.

Newark, N. J.—Press reports state that Edw. S. Rankin, Engr. Sewer Dept., is making surveys, etc., which will be presented to the Bd. of Wks. in Jan. for the construction of drains to carry off surface work in that section of the city south of S. Orange Ave and west of S. 12th St., taking in the Vailsburg Dist., probable cost, $250,000.

Millville, N. J.—The City Council is reported to be considering the question of constructing a sewage disposal plant.

Louisville, Ky.—The following are the bids opened on Dec. 7 at the office of the Comrs. of Sewerage (P. L. Atherton, Chmn.) for the construction of Sec. B of the Southern outfall sewer, Contract 2, of the comprehensive system of sewerage (J. B. F. Breed, Ch. Engr.): (*a*) T. B. Jones & Co., St. Louis; (*b*) Henry Bickel, Louisville; (*c*) E. H. Abadie Co., St. Louis; (*d*) Kirshener Const. Co., Cincinnati, O.; (*e*) Westwater & Casey, Columbus, O.; (*f*) N. Y. Continental Jewel Filtration Co., New York, N. Y.; (*g*) American Eng. & Constr. Co., Chicago, Ill.; (*h*) E. G. Nave Bro. & Co., Portsmouth, O.; (*i*) Irwin Bros., Greenville, O.; (*j*) Metropolitan Constr. Co., Boston, Mass.; (*k*) Luck Constr. Co., Roanoke, Va.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
1,100 lin. ft. earth excav. and backfill	$16.60	$28.36	$31.12	$30.26	$30.00	$34.00	$38.00	$37.05	$38.00	$57.00	$41.50
1,700 lin. ft. earth excav. and backfill	16.00	27.60	30.68	22.90	30.00	30.60	37.00	34.60	37.25	46.00	41.50
1,330 lin. ft. earth excav. and backfill, except Junction section	14.20	21.28	25.00	20.07	23.00	24.00	36.00	22.75	35.00	29.00	41.50
950 lin. ft. earth excav. and backfill	11.20	27.98	31.13	25.07	34.00	34.80	37.00	40.75	42.00	58.00	41.50
1,043 lin. ft. earth excav. and backfill	14.50	19.76	20.87	20.20	23.00	24.00	37.00	24.50	31.00	26.00	41.50
1,035 cu. yds. earth excav. and backfill for Junction section	10,091.00	1,135.00	1,106.00	621.00	1,550.00	1,500.00	4,000.00	2,175.00	2,500.00	1,700.00	1,542.50
17,000 cu. yds. concrete masonry, exclusive of cement	6.15	5.96	4.72	7.90	6.70	7.20	5.50	6.90	5.00	5.40	9.85
1,275,150 lbs. reinforcing metal in place, plain bars	.0357	.0325	.0333	.04	.039	.039	.0225	.04	.037	.0325	.035
1,194,280 lbs. reinforcing metal in place, corrugated bars	.0387	.035	.0375	.0425	.0425	.040	.025	.045	.043	.035	.040
500 cu. yds. earth excavation in trench below masonry	.50	.50	1.07	1.00	2.00	2.00	2.00	2.25	1.50	1.00	3.00
500 cu. yds. gravel refilling in trench below masonry	.90	.50	1.87	1.00	2.00	2.00	1.50	2.00	1.75	.50	2.00
85 cu. yds. concrete masonry, Junction section, exclusive of cement	9.60	18.75	9.39	18.00	20.00	14.00	15.00	18.00	7.50	10.00	13.00
21,000 bbls. Portland cement used in the work	1.60	1.58	2.20	1.40	1.80	1.80	1.60	1.70	2.00	1.75	1.75
266 lin. ft. manholes, complete	3.50	3.50	5.66	2.60	4.00	3.00	4.00	6.00	3.00	1.60	3.00
Cleaning up (lump sum)	2,400.00	375.00	1,600.00	3,000.00	2,000.00	1,000.00	1,000.00	3,000.00	3,000.00	1,500.00	1,000.00
1,000 lin. ft. 8-in. under drain	.20	.35	.60	.75	.55	.50	.52	.50	.80	.40	1.40
3,000 lin. ft. 10-in. under drain	.25	.40	.68	.85	.60	.60	.60	.70	.90	.45	1.60
2,000 lin. ft. 12-in. under drain	.30	.45	.80	1.00	.65	.70	.65	.80	1.10	.50	1.75
Totals	$296,524	$336,681	$352,674	$370,175	$385,070	$397,351	$404,627	$415,240	$416,393	$439,723	$522,306

Dunkirk, N. Y.—The Council is reported to have decided to construct 10-in. tile sewers on Beaver, Zebra and E. 2d Sts.

New York, N. Y.—Bids will be received until Jan. 7 by Louis F. Haffen, Pres. Bronx Boro., for furnishing material and constructing sewers in portions of Anderson Ave., E. 163d St., Grand Boule. and Concourse, E. 181st St., and Jerome Ave., repairing and extending a drain in White Plain Rd. and in Bartholdi Rd.; receiving basins inCreston Ave. at E. 193, E. 197, and E. 198 Sherman Ave. and E. 162d St., E. 164th St and Sherman Ave., and E. 160th St. and Trinity Ave. Engineer's estimate: 877 lin. ft. 15-in. and 3,764 lin. ft. 12-in pipe sewers; 1,270 lin. ft. 18-in. pipe drain; 6,350 cu. yds. rock to be excavated and removed; 9 M. ft. timber; 53 manholes, etc, also for constructing a sewer in a portion of Truston St., Leggett Ave., E. 156th St., Whitlock and Longwood Aves. Engineer's estimate: 1,025 lin. ft. of concrete sewer, 11 ft. 6 in. x 7 ft. 3 in. 1,678 lin. ft., 11 ft. x 7 ft. 2 in. 10 lin. ft., 11 ft. x 5 ft. 10 in. 1,584 lin. ft., 6 ft. 3 in. x 6 ft. 1½ in. 10 lin. ft., 6 ft. 3 in. x 5 ft. 10 in. 2,874 lin. ft., 6 ft. x 5 ft. 11 in. 626 lin. ft. of pipe sewer, 30, 24, 18, 15 and 12 in. Items given above include the furnishing and placing all materials entering into construction thereof, as shown by stanodard and typical sections of same on plan, together with all special construction at manhole openings, reducers, etc. 952 spurs for house connections, over and above the cost per lin. ft. of sewere. 38 manholes, complete. 8 receiving basins, complete. 15,300 cu. yd. of rock to be excavated and removed. 150 cu. yd. of Class "A" concrete, in place, additional to that shown on the plan. 1,800 cu. yd. of Class "B" concrete, in place. 5,900 cu. yd. of broken stone for foundations, in place. 100,000 lb. of steel bars; 5-8-in. and ¾-in., furnished and in place in foundations, and ½-in. to 1¼-in. furnished and placed in standard sections additional to those shown on the plan. 1,265 M. ft. timber, furnished and left in place. 85,000 lin. ft. of piles. 2,150 lin. ft. of 6-in. pipe, as risers for house connections, including the supporting and surrounding Class "A" concrete. 100 lin. ft. of 12 to 24 in. drain pipe, furnished and laid.

Charlotte, N. C.—R. Goodwyn Phett, Mayor, in his address to Council recommends the completion of the sewerage system; also the enlarging of the present city hall.

Canton, O.—Bids will be received, it is stated, by Armstrong Ashbrook, City Aud., until Jan. 6 for $10,000 storm water sewer bonds.

Canal Dover, O.—It is stated that bids will be received until Jan. 11 by J. F. Defenbacher, City Aud., for $14,500 sewer bonds.

Steubenville, O.—It is stated that bids will be received until Jan. 13 by the Bd. Pub. Service (T. W. Vance, Clk.) for constructing sewers in 5th St. and Alley E.

**Youngstown, O.*—John Grady is reported to have secured the contract to construct the E. Federal St. sewer for $8,850.

Wyoming, O.—The Riggs & Sherman Co. of Toledo, are engineers for the proposed sewerage system to be constructed here, to cost about $50,000.

Springfield, O.—The following are the totals of bids opened on Dec. 18 for furnishing material and constructing a portion of the high level intercepting sewer. to consist of the following approximate quantities: 2,096 ft., 24-in. vitr. pipe, plain or reinforced concrete sewer; 5,554 ft. 30-in. vitr. pipe, plain, or reinforced concrete sewer; 2,166 ft. 33-in. vitr. pipe, plain or reinforced concrete sewer; 9,376 ft. 6-in. pipe house connections, average depth 10 ft; 71 6-in. on 24-in. Y branches; 158 6-in. on 30-in. Y branches; 64 6-in. on 33-in. Y branches; 800 ft. 8-in. sanitary sewer; 50 ft. 18-in. sanitary sewer; 10 ft. 30-in. sanitary sewer; 32 round manholes 8 single drop manholes; 1 double drop manhole; 1 regulator; 41 manhole covers and frames; 475 manhole steps; 115 cu. yd. Class A concrete and 17,875 cu. yd. rock excav.: (*a*) plain concrete; (*b*) reinforced concrete; (*c*) vitr. pipe; (*d*) Jackson reinforced concrete; (*e*) pipe of Ohio Pipe Co. Paul & Kershner, Dayton (*a*), $53,993; (*b*) $53,993; (*c*) $60,546. Bowman & Co., McKeesport, Pa.; (*a*) $46,881; (*b*) $53,425; (*c*) $53,892; (*d*) 51,835; (*e*) $48,457. C. I. McCracken Co., Columbus, (*a*) $56,396; (*c*) $59,622; (*d*) $56,396. Danl. Doyle, Springfield, (*a*) $48,844, (*b*) $50,263, (*c*) $60,650. W. E. McHugh, Springfield, (*a*) $53,491; (*b*) $55,130; (*c*) 62,341; (*d*) 54,330; (*e*) $53,491. Cyrus M. Long, Springfield, (*a*) $37,208; (*b*) $38,620; (*c*) $46,110; (*d*) $43,370. Thos. P. Strack, Cincinnati, (*a*) $46,792; (*b*) $48,651; (*c*) $51,660. Huonker & Williams, Springfield, (*a*) $50,327; (*b*) $52,188; (*c*) $59,007; (*d*) $54,230; (*e*) $52,585. To each of the above grand totals for various materials bid upon add about $35,750 for about 17,875 cu. yd. stone. W. H. Sieverling, City Engr.

**Orrville, O.*—Bids were opened on Dec. 9 for constructing sewerage system and disposal plant, and the contract for constructing the sewerage system was awarded to John Skeels, of Canton, at the following bid: For 6-in. sewer, 50 cts.; 54,700 ft. 8-in. sewer, 38 cts.; 8,900 ft. 10-in., 44 cts.; 9,500 ft. 12-in., 49 cts.; 1,000 ft. 15-in., 61 cts.; 5,000 lin. ft. 6-in. drain tile, 3 cts.; 5,000 ft. 8-in. 4 cts.; 1,200 ft. manhole, per lin ft., $1.95; 52 flush tanks, $25; 100 cu. yds. rock excav., $5; 500 cu. yds. earth excav., 25 cts.; 50 cu. yds. concrete, $2; 10 M ft. lumber, $10 per M ft.; total, $34,683. Totals of other bids. Post E. Gibson, Cambridge, $54,458; H. J. Glover, Lorain, $46,551; L. D. Burd & J. A. Rippeth, Canton, $53,499; J. C. Beasley, Columbus, O., $58,965; Price & Hurley, Marion, $48,144; McGarry & McGowan, Akron, $49,845; Wm. N. Perry, Canton $56,831; Jas. Brown & Co., Akron, $74,370; Clifford & Co., Martins Ferry, $55,622; Nitschke & Gibbins, Cleveland, $53,712; Turnbull Bros., Canton, $52,768; Ralston & Blinn, Mt. Vernon, $56,476; Gubbins & Hayes, Muncie, Ind., $47,412; Beers & Lehman, Cleveland, $62,382; Wildes & Davidson, Akron, $47,227; S. W. Parshall, Akron, $51,315; Weage & Swonk, Coldwater, Mich., $55,480; C. T. McCracken & Co., Columbus, $62,755; John B. McLane & Co., Newport, Ky., $57,899; E. McShaffrey & Son, Akron, $50,858; Campbell & Haskell, Canton, $43,105; Wm. H. Hunt, Akron, $45,393.

*S. W. Parshall, of Akron, secured the contract for constructing the sewage disposal plant at the following bid: 7,500 cu. yds. earth embankment, 25 cts.; 330 cu. yds. concrete, $7; 400 lin. ft. 12-in. sewer pipe, 35 cts.; 376 ft. 10-in., 30 cts.; 108 ft. 8-in., 25 cts.; 600 ft. 6-in., 18 cts.; 350 ft. 4-in., 10 cts.; 1,300 ft. 3-in., 6 cts.; 5 manholes, each, $22; 4 lampholes to set, each 90 cts.; 4 siphons to set, lump sum, $700; 1 pump house complete, $300; 2,000 cu. yds. slag, $1,60; 400 cu. yds, cinders, 90 cts.; 5,000 cu. yds. sand, $1.60; 20 cu. yds. concrete, $7; total, $17,499. Total of other bids: J. C. Beasley, Columbus, $18,961; Jas. Brown & Co., Akron, $29,324; Nitschke & Gibbins, Cleveland, $18,523; Turnbull Bros., Canton, $30,799; Ralston & Blinn, Mt. Vernon, $22,546; Beers & Lehman, Cleveland, $17,971; E. McShaffrey & Son, Akron, $23,706; Fauver & Renick, Findlay, $21,045; Wm. E. McHugh, Springfield, $20,744; Pittsburg Constr. Co. Pittsburg, Pa., $21,894; W. I. Kennedy, Medina, $28,968. Chapin & Knowles of Canton, are Consulting Engrs.

McKeesport, Pa.—Bids will be received, it is stated, until Jan. 7 by C. E. Soles, City Compt., for constructing a 24-in. terra cotta sewer in W. 6th St. and a 15-in. terra cotta sewer in Beech St.; also a sewer at No. 4 fire station.

Camden, S. C.—Bids are wanted until Jan. 15 for $50,000 bonds, to be issued for installing a sewerage system. J. J. Goodale, City Clk.

**Galveston, Tex.*—A. T. Dickey, City Engr., writes that Kelso & Vantrim, of Galveston, on Dec. 12 secured the contract for constructing 66-in. reinforced concrete drain on 10th St., from Ave. D to water front at $17,735. M. D. Carr, of Galveston, bid for this work $17,934.

Seattle, Wash.—City Engr. R. H. Thomson, estimates that cost of constructing sewers on Atnaltis St. at $69,000 and W. 64th St. at $6,590.

Edmonton, Alta.—Bids will probably be called for in the spring for sewer work to cost about $200,000, and septic tank, to cost about $100,000. R. R. Kelly, City Engr.

BRIDGES.

Notes Arranged Alphabetically by States.

Dunnellon, Fla.—It is stated that bids will be received until Jan. 8 by the Bd. Co. Comrs. (S. F. Siptrunk, Clk.) at Ocala, for constructing a steel bridge across the Blue River near Dunnellon.

Rossville, Kan.—Bids will be received, it is stated until Jan. 3, by the Bd. Co. Comrs. at the office of L. G. Zimmerman, Co. Clk., at Topeka, for constructing a low truss steel bridge over Cross Wreck at Rossville, to consist of one span, 98 ft., between centers of piers, 14-ft approach and roadway 16 ft, in width.

Alexandria, La.—Bids will be received by the Police Jury, of Rapides Parish, at Alexandria, until Jan. 16, for constructing a steel highway bridge on concrete piers at the race track crossing of Bayou Rapides, as advertised in The Engineering Record. Ira W. Sylvester, Consulting Engr., Rapides Bank Bldg., Alexandria.

Minneapolis, Minn.—The City Council is stated to have appropriated $2,500 for the repair of the bridge over Minnehaha Creek at Nicollet Ave.

Crookston, Minn.—The construction of a steel structure replacing the Sampson's Addition Bridge is reported contemplated, at a cost of $10,000.

Gulfport, Miss.—Plans and specifications will be received by the Bd. Co. Superv. (F. S. Hewes, Clk.), until Jan. 6 for constructing a draw-bridge across the Tchontacaboriffa River.

Kansas City, Mo.—W. H. Dunn, Supt. of Parks, writes that preliminary plans have been ordered prepared for constructing 2 bridges over Blue River in Swope Park. No definite arrangement yet made for construction. F. R. Nossard, Secy. Park Bd.

Albany, N. Y.—The Common Council is stated to have passed an ordinance authorizing the construction of a viaduct over N. Lansing St.

Washington, N. C.—Bids will be received, it is stated by Gilbert Rumley, Clk., Bd. Co. Comrs., until Jan. 6, for $50,000 bridge bonds.

Logan, O.—It is stated that bids will be received until Jan. 11 by the Bd. Co. Comrs. for constructing a bridge across Heicking River in Green Township. Jas. L. Martin, Co. Aud.

Norwood, O.—Engineer Jas. A. Stewart, 712 Traction Bldg., Cincinnati, O., writes that the following are the bids opened on Dec. 14 by the Bd. of Pub. Service for furnishing material and constructing sub-structure of a viaduct over the B. & O. S. W. Ry. and Section Ave. to consist of 1,700 cu. yds. concrete (price given per cu. yd.): John Snyder, Norwood, $8.90; Jones Bros., Columbus, $12.50; L. Eid Concrete Steel Co., Cincinnati, $9.84; Thos. J. McRiver, $12; Concrete Steel Co., Cincinnati, $9.90; Frank Foley & Co., Cincinnati, $8.50; Tuppan & Son, Peru, Ind., $7; Ferro Concrete Co., Cincinnati, $9.19; J. B. McLane & Co., Newport, Ky., $8,50; C. D. Bennett, Cincinnati, $9.68; Louis Drach Constr. Co., Cincinnati, $8.70.

Nashville, Tenn.—Bids will be received by the Cumberland Bridge Com. (J. K. Rains, Chmn.) until Jan. 22 for furnishing material and manufacturing and erecting steel spans for two bridges across Cumberland River, as advertised in The Engineering Record.

Hudson, Wis.—Bids will be received by the Common Council until Jan. 6, for constructing a steel bridge and foundations, across Willow River, at the north end of 2d St. Loweth & Wolff, Engrs., First Natl. Bank Bldg., St. Paul, Minn.; A. Karbas, City Clk.

PAVING AND ROAD MAKING.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—Bids will be received by the City Treas. until Jan. 6, for paving sidewalks on a portion of Hull St. with hexagon blocks, and for all necessary granite curbing and storm water sewers in connection therewith.

Compton, Cal.—The Compton Electric Light & Power Co. contemplates extending its lines to Watts and Willow Brook. G. R. Fulton, Secy.

Albany, Ga.—Bids will be received until Jan. 6 by Y. C. Rust, Clk., Council for $10,000 bonds to be issued for the purpose of paving a portion of Broad St., also $5,000 bonds for reopening up and grading Davis St.

Rathdrum, Idaho.—The A. O. Skinner Electric Light & Power Co. contemplates constructing 5 miles of high-tension transmission line. H. R. Saunders, Secy.

Grangeville, Idaho.—The Grangeville Electric Light & Power Co. is planning to double its present output, and extend its transmission lines to Cottonwood, 20 miles distant. D. C. Van Buren, Mgr.

Evanston, Ill.—The City Council has passed an ordinance providing for paving with granite top macadam Colfax St. from Sheridan Road to Ridge Ave.; also for laying 6-in. water main in Milburn St.

Gibson City, Ill.—Wm. A. Davidson, City Clk., writes that it is preposed to lay about 36,087 sq. yds. brick pavement at a cost of $60,000 to $70,000. Engineer, C. F. Helman, of Paxton. C. W. Knapp, Mayor.

Chicago, Ill.—The Bd. Pub. Improvements is stated to have approved ordinances providing for the paving of portions of Wentworth, Greenwood, Lexington and Woodlawn Aves., Maxwell, Lock Sts.

Peoria, Ill.—The paving of a portion of Garden St. is reported contemplated, at a cost of about $30,000.

Champaign, Ill.—G. C. Fairclo, City Engr., writes that bids will be received by the Bd. of Local Improv. on Jan. 8 for improving Daniels St., to consist of the following: Excav., 5,950 cu. yds.; asphalt pavt. on concrete foundation, 8,320 sq. yds; combined curb and gutter, 5,700 lin. ft.; retaining and false curb, 442 lin. ft.; 40 gutter plates, 12 catch-basins, and 1,820 lin. ft. 8-in. vitr. pipe.

* *Items marked thus give the names of parties awarded contracts.*

Indianapolis, Ind.—The Union Asphalt Co. is stated to have secured the contract for paving E. 21st St. with asphalt, for $8,997.

Indianapolis, Ind.—The Bd. of Pub. Wks. will soon ask for bids for grading, graveling roadway, brick gutters, cement walks and curb in Sleete and Union Sts., for brick roadway in first alley north of 12th St.; and alley north of 12th St., and for cement walks in Butler Ave.

West Lafayette, Ind.—It is reported that the Town Trus. will receive bids until Jan. 20, for the paving of South St. and North Western Ave. Chas. T. Stalland, Town Clk.

Vevay, Ind.—The Bd. Co. Comrs., it is reported, will receive bids until Jan. 6, for the constructing of 3,870 ft. of gravel road in Cotton Township. L. J. Woolen, Co. Aud.

Paoli, Ind.—The Bd. Co. Comrs. it is reported will receive bids until Jan. 7, for the constructing of 9,971 ft. of gravel road.

Columbus, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until Jan. 7, for constructing 3 free gravel roads in Wayne Township as follows: Wright Rd., 8,317 ft. length; Thompson Rd., 7,160 ft.; Waynesville Rd., 10,621 ft. John M. Davis, Co. Aud.

Washington, Ind.—The Bd. Co. Comrs., it is reported will receive bids until Jan. 7, for the constructing of the Edwards gravel road in Steele Township. Thos. Nugent, Co. Aud.

Buffalo, N. Y.—The Common Council has ordered that Rhode Island St. be repaved, 30 ft. wide, from Niagara St. to Richmond Ave., and that F. G. Ward, Comr. of Pub. Wks., make plans and specifications for same.

Patchogue, L. I., N. Y.—It is stated that plans, specifications and bids will be received by the Bd. Trus. until Jan. 14 for the construction of a shore driveway along the bay front between Rider and Cedar Aves., the driveway to be about 1,425x6 ft. and about 4 ft. above high water mark. J. Fred Flugrath, Village Clk.

Lockport, N. Y.—The Bd. of Superv. is stated to have passed a resolution to improve the Pekin and Sanborn Rd. in Cambria and Lewistown, a distance of 3 miles, at a cast of $21,300.

New York, N. Y.—Bids will be received until Jan. 7 by Louis F. Haffen, Pres. Bronx Boro., for paving with granite block on a portion of Burnside Ave. and setting curb where necessary. Engineer's estimate: 18,200 sq. yd. of granite block pavement on a sand foundation, laid with sand joints, and keeping the pavement in repair for one year from date of acceptance. 1,400 lin. ft. curbstone; 4,850 lin. ft. of old curbstone, rejointed, recut on top and reset; 2,340 sq. ft. ofnew bridgestone for crosswalks, furnished and laid; 3,840 sq. ft. of old bridgestone, rejointed and relaid.

Elyria, O.—It is stated that Frank R. Fauver, Secy. Road Comrs., will receive bids until Jan. 14 for $100,000 road improvement bonds.

Sidney, O.—It is stated that bids will be received by Chas. Counts, Co. Surv., until Jan. 4, for constructing the Brandewe Pike, McLean Township; said pike is 23,216 ft. long.

Youngstown, O.—Bids will be received until Jan. 25, by North Newton, Secy. Bd. Co. Comrs., Special Rd. Dist. No. 1, Rm. 215, Dollar Bank Bldg., for $60,000 bonds, to be issued for the purpose for constructing and improving the roads in said district.

Hamilton, O.—The City Council is reported to have authorized L. A. Dillon, City Engr., to prepare plans and specifications for the paving of a portion of Market St.

McKeesport, Pa.—It is stated that C. E. Soles, City Comp., will receive bids until Jan. 7 for grading, curbing and paving portions of several streets with vitrified brick.

Titusville, Pa.—The City Council is reported to have passed a nordinance providing for the paving of S. Franklin St.

Memphis, Tenn.—Bids will be received until Jan. 8 by the Bd. of Fire & Police Comrs. for furnishing material and paving with vitrified brick on a concrete foundation on Mississippi Boule. from Iowa to Walker Aves. and from Walker Ave. south with cemented gravel and brick gutters, at a cost of about $10,000, Jas. H. Malone, Mayor.

**Dallas, Tex.*—The Coffeyville Brick Co. is reported to have received the contract for furnishing brick blocks for Main St., at $14,400.

Dallas, Tex.—The City Secretary is reported to have been instructed to receive bids for paving with brick a portion of Akard St.

**Galveston, Tex.*—A. T. Dickey, City Engr., writes that Kelso & Vantrin, of Galveston, have secured the contract for paving Ave. D with brick (bids opened Nov. 30) at the following bid: 3,516 sq. yds. vitr. brick on sand base, $1.50; 2,290 sq. yds. vitr. brick on 4-in. concrete base, $2.25, and 229 cu. yds. extra concrete, $8; total, $12,258.

Phoebus, Va.—It is stated that bids are wanted by L. P. Furness, Mayor, for $20,000 street improvement bonds.

**Tacoma, Wash.*—Owen Woods, Comr. of Pub. Wks., is stated to have awarded on Dec. 12 contracts as follows: S. 19th, 21st, S. 23d and 24th Sts., with sandstone blocks, to F. A. Keasal at $61,400. N. 7th, 9th, 10th, 11th, N. 13th, N. 1st, N. 21st and Steele Sts. with asphalt and sandstone to Barber Asphalt Paving Co., $146,200, cement sidewalks on S. 38th St., to Fred Essman, for $2,4[illegible].

Seattle, Wash.—Ordinances have been passed ordering the improvement of Washington St., by paving same with vitr. brick, at an estimated cost of $2,900, and for grading Depot St. at a cost of $5,510.

City Engr. R. H. Thomson estimates the cost of grading and planking W. Brandon St., at $8,600; and paving alleys in blocks E and F, 14, 107, 26 and 27, at $[illegible].

Wheeling, W. Va.—See "Miscellaneous."

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Dadeville, Ala.—Bids will be received until Jan. 10 by the Town Council for $8,500 bonds to pay for additional equipment and for the improvement of the municipal electric light and power plant. J. B. Rylance, Mayor.

Headland, Ala.—J. L. Kelly, Mayor, writes that the citizens on Dec. 16 voted to issue $23,500 bonds for the construction of water works and an electric light plant.

Hartford, Ala.—The citizens are contemplating making extensions to both the water and light plants during the next year. W. H. Whatley, Supt.

Troy, Ala.—The Pea River Power Co. is planning to develop water power on Pea River at this point and will erect a 3,000-h.p. plant. The company owns 7 miles of water rights and 100 ft. of right of way from its power site to Elba. H. D. Boyd, Secy.

Brewton, Ala.—The citizens are contemplating installing 2 new boilers of 150 h.p. each in the municipal electric light plant and water works, and erecting a 100,000-gal. stand pipe. G. E. McCants, Mgr.

De Queen, Ark.—The De Queen Light, Ice & Cold Storage Co. proposes establishing a day service and installing a meter system. Paul Coleman, Mgr.

Fordyce, Ark.—The Fordyce Light & Water Co. contemplates the construction of a new power station. C. A. Parsons, mgr.

Santa Rosa, Cal.—The Santa Rosa Lighting Co. contemplates changing its system from 2- to 3-phase and rewiring the town. R. Leo Van de Naillen, Mgr.

San Jose, Cal.—It is stated that bids will be received until Jan. 2 by the City Clk. for lighting the streets with either gas or electricity for 1, 3 and 5 years, beginning July 1, 1908.

Holtville, Cal.—The Holton Power Co. contemplates increasing the output of its plant by the installation of two 300-kw. alternating-current generators direct connected to water wheels. C. E. Paris, El Centro, Gen. Supt.

Delta, Colo.—The Delta Electric Light Co. is contemplating the installation of a 100-h.p. engine and an alternating-current generator. J. E. Shue, Treas. and Mgr.

Washington, D. C.—Bids will be received at the office of Bernard R. Green, Supt. of Constr. National Museum of Congress, until Jan. 21 for furnishing, delivering and installing in place, complete, the electric wiring required for the new building for the National Museum, as advertised in The Engineering Record.

Savannah, Ga.—The Savannah Lighting Co. contemplates installing a 500-kw. steam turbo-generator set in February or March. S. Brown, supt.

Carrolton, Ga.—The Carrolton Electric Co. is making estimates on cost of installing a 3-phase alternator and Corliss engine, also starting a day service some time next year. J. G. Cheney, Mgr.

Pocatello, Idaho.—The Idaho Consolidated Power Co. contemplates the installation of a 2,500-h.-p. horizontal turbine water wheel. F. C. Stanford, mgr.

Rexburg, Idaho.—The Falls Power, Light & Water Co. (J. H. Brady, Pres., Pocatello) is reported to have decided to extend the high-tension line from Blackfoot to Rexburg.

Monticello, Ind.—See "Electric Railways."

Frankfort, Ind.—The city is contemplating installing a 600-kw. generator direct connected to a cross-compound engine in the municipal electric light plant. W. H. Garter, Supt.

Tipton, Ind.—The Tipton Electric Light Co. is considering the question of installing a 500-h.-p. water tube boiler next year. J. H. Stewart, Mgr.

Osage, Ia.—The Osage Electric Light, Heat & Power Co. is planning to install an additional water wheel soon. Thomas Ferris, Mgr.

Humboldt, Kan.—The managers of the municipal electric light plant contemplate establishing a day service next spring. W. A. Moore, Supt.

Herington, Kan.—The Water and Light Com. contemplates rebuilding the electric lighting plant soon. C. E. Stromquist, Gen. Mgr.

Harper, Kan.—We are informed that the city contemplates the installation of an additional generator and 2 new boilers in the municipal electric light plant in the spring or summer. Horace A. Lee, Supt.

Richmond, Ky.—The Richmond Electric Power Co. will install an additional boiler next summer. The General Eng. Co. of Cleveland has charge of the plant.

Central City, Ky.—The Central City Light & Power Co. contemplates increasing the equipment of its plant for the purpose of furnishing a day service to operate fans. T. Q. Fortney, Mgr.

Midway, Ky.—The Versailles Electric Light Co. is making arrangements to extend its transmission line to Midway, a distance of 6 miles. The company has a franchise in Midway, and private right of way is nearly completed. Harry Reid, Pres.

Crowley, La.—An additional boiler will be installed in the municipal plant next summer. Armas Durio, Supt.

Crisfield, Md.—The Crisfield Ice Mfg. Co. will make extensive additions and improvements, which will include the installation of new engines, dynamos and boilers, and 10 miles of extension. C. O. Mills, Ch. Engr.

**Baltimore, Md.*—The Bd. of Awards is reported to have on Dec. 18 awarded the gas and naphtha lighting contracts to the American Street Lighting Co., of Baltimore, for one year at $10.85 per lamp per yr., for maintaining 7,200 gas lamps and for 1,100 naphtha lamps, $25 ea.

New Bedford, Mass.—The New Bedford Gas & Edison Light Co. contemplates making extensions to its electric lighting system. Chas. R. Price, treas.

Holyoke, Mass.—The Bd. of Aldermen is reported to have on Dec. 17 authorized the Lighting Dept. to secure a $160,000 loan for additions and improvements to the electric lighting station.

Bellaire, Mich.—It is proposed to increase the output of the municipal light plant; the dam will be raised next season, putting in cement core, cement flume and bulkhead. Chas. J. Evans, supt.

Gladwin, Mich.—Schulz & Brindle, owners of the local electric light plant, are contemplating establishing a day service. F. L. Prindle, Mgr.

Mancelona, Mich.—The Antrim Light & Power Co. proposes increasing the output of its plant. F. R. Joslin, Mgr.

Sault Ste. Marie, Mich.—We are informed that the Edison Sault Electric Co. is contemplating the installation of a new dynamo next spring. Alex. Dow, Mgr.

Osakis, Minn.—The Osakis Milling Co. contemplates increasing the output of its plant to meet the increased demand for electricity. About 75 h.-p. will be needed. Wm. A. Olen, Mgr.

Wadena, Minn.—The Trustees of the village electric light plant and water works system contemplate installing a district heating system, but nothing as yet has been decided. Geo. S. Chrysler, Supt.

Blackduck, Minn.—The Blackduck Electric & Telephone Co. is in the market for a 35-kw., 250-volt, direct-current outfit with compensating set, or outfit to work on 3-wire system of 125 and 250 volts. C. W. Jewett, Mgr.

New Prague, Minn.—The citizens contemplate putting in a 15-ampere storage battery in the municipal electric light plant next spring. A. K. Adams, Supt.

Princeton, Minn.—The village contemplates installing an air lift pump, fire pump and induced draft system in the electric light and water works system. C. A. Dow, Supt.

Nashwauk, Minn.—The Village Trus. are reported to be receiving bids for the installation of an engine, 80-kw. alternating-current generator, switchboard, etc. G. A. Lindsay, Mgr.

Waseca, Minn.—The Water and Light Board is contemplating changing the system of the municipal electric light plant from direct to alternating current in the spring. E. G. Guy, Supt.

St. Peter, Minn.—Plans are being made to change the system of the municipal electric light plant from single phase, 1,000-volt to 3-phase, 2,300-volt, and from belted to direct-connected machines. H. A. Hildebrandt, Supt.

Faribault, Minn.—The Faribault Gas & Electric Co. contemplates installing a producer gas engine plant. B. W. Cowperthwait, Secy. and Mgr.

Pontotoc, Miss.—The Pontotoc Light & Power Co. proposes increasing the output of its plant and will install an 85-h.-p. tubular boiler and establish a direct-current power service. R. L. Campbell, Mgr.

Magnolia, Miss.—The Magnolia Electric Light Co. proposes installing a 100-kw. generator and a 150-h.-p. high-speed engine in its plant. Xavier A. Kramer, Supt.

Brookfield, Mo.—The Brookfield Electric Light Co. proposes installing a 3-phase power service and will establish a 24-hour service in the spring. Percy W. Markham, supt.

Lees Summit, Mo.—L. Schreechfield & Son, owners of the electric light plant, are negotiating with the town of Greenfield, 4 miles distant, to furnish electricity for lighting in that town.

Higginville, Mo.—The citizens contemplate rebuilding the overhead system of the municipal electric light plant. Frank Monser, Supt.

Harlowton, Mont.—A. C. Graves, of Harlowton, proposes constructing water works and an electric light plant here, the cost about $20,000, and bids for construction will probably be called for in March. Engineer not yet selected.

Malmo, Neb.—The Village Trus. are reported to have appointed a committee to investigate cost, etc., of installing water works and an electric light plant.

Sparks, Nev.—Engineer E. Talbot, of Carson, writes that the proposed power plant to be constructed on Truckee River, 18 miles east of Reno, will cost about $250,000. The matter has been held up by litigation until July, 1908. Nothing definite will be done until after that time.

Hammonton, N. J.—The Hammonton Electric Light Co. is planning to remodel its street-lighting system in the spring. P. H. Garrison, Supt.

Roslyn, N. Y.—At a recent meeting of the stockholders of the Nassau Light, Heat & Power Co. the proposition to issue $1,000,000 of 5 per cent. bonds is reported to have been ratified and confirmed. L. A. Howland, Supt., Roslyn.

Glens Falls, N. Y.—The Public Service Comn. at Albany has approved the application of the Hudson River Electric Power Co. (E. A. Wakeman, Mgr. and Supt., Glens Falls) to extend its plant, and for authority to issue $3,232,000 bonds to cover the cost of the proposed improvements and extensions. This company proposes to construct and operate a storage dam, power dam, and electrical power plant on Sacandaga River. It also plans to construct and operate electrical transmission lines for the proposed plant to Saratoga, Ballston, Mechanicsville, Troy, Albany, Watervliet, Schenectady, and Amsterdam.

Croton Falls, N. Y.—Geo. Juengst & Sons, owners of the Croton Falls electric light plant, contemplate the reconstruction of its plant and its system at Brewster and Purdys. Geo. Juengst, Jr., Mgr.

Rhinebeck, N. Y.—The Dutchess Light & Power Co. proposes making some line extensions in the spring. R. Raymond Rikert, Mgr.

Oswego, N. Y.—The People's Gas & Electric Co. contemplates installing a 500-kw. steam unit in its plant. J. M. Dickenson, Mgr.

Gouverneur, N. Y.—The Hannawa Power Co. is reported to have purchased the Gardner property on the west side and will construct its transforming station upon that site.

** Items marked thus give the names of parties awarded contracts.*

Sodus, N. Y.—The Public Service Comn. is reported to have granted permission to the Sodus Gas & Electric Light Co. to extend its lines from Sodus to Webster and to Sodus Point and to increase its capital stock from $15,000 to $90,000 for this work.

Rocky Mount, N. C.—The city has voted bonds to the extent of $80,000 for the construction of an entire new electric light plant and improvements to water works. When bonds are sold the city will be in the market for electrical machinery, engines and boilers. A. S. Lyon, Supt.

Hendersonville, N. C.—The Hendersonville Light & Power Co. will develop water power not far distant from its present plant, which will practically double the present output. Orders have been placed with S. Morgan Smith, of York, Pa., for water wheels. W. H. Bangs, Supt.

Enderlin, N. D.—The Enderlin Electric Light & Power Co. contemplates installing a gas producer and extending its lines to Sheldon. M. A. Abbott, Mgr.

Edgeley, N. D.—There is reported to be a movement on foot here for the installation of an electric light plant in connection with the proposed water pumping plant.

Wauseon, O.—H. H. Williams & Co., owners of the Wauseon electric light plant, contemplate installing new boilers in their plant to take the place of the ones now in use. W. F. Hubbell, Mgr.

Cherokee, Okla.—The Cherokee Ice & Power Co. contemplates the installation of a 90-kw. alternating-current generator in its plant. Robert T. Lyon, Mgr.

Homestead, Pa.—Bids will be received until Feb. 3 by And. Hill, Boro. Clk., for lighting the streets of this borough for a period of 1, 3 and 5 years.

**Franklin, Pa.*—The Allis-Chalmers Co., of Milwaukee, Wis., is reported to have secured the contract for installing an additional engine and generator for the borough electric light plant, for $8,600.

Blairsville, Pa.—The Citizens' Heat, Light & Power Co. contemplates the installation of an 80-arc dynamo. R. H. Wiggins, Secy.

Olyphant, Pa.—The borough electric light committee contemplates establishing a day service and will install a new engine, generator and boilers in the municipal electric plant. W. J. Lynott, Ch. Engr.

Titusville, Pa.—The Titusville Electric Light & Power Co. contemplates rebuilding its entire plant next spring. Fred. Woodring, Mgr.

Gettysburg, Pa.—The Keystone Electric Light, Heat & Power Co. contemplates constructing suburban transmission lines in the spring, taking in two towns. T. P. Turner, Mgr.

Danville, Pa.—Plans are being made by the Standard Electric Light Co. to increase the output of generators and to change its system from 133 to 60 cycles. Geo. M. West, Supt.

Newberry, S. C.—Plans are being considered for enlarging and improving the electric light plant and water works system, which will include the installation of a new 200-kw. generator and a well pump. H. W. Schumpert, Supt.

Summerville, S. C.—The Crystal Ice Co. is planning to install a 125-kw. generator and a 175-h.p. engine and boiler in its plant next fall. Milton P. Skinner, Pres.

Yankton, S. D.—A new gas company has been organized by Isaac Piles, Fred Schnauber, John Holman, Mr. Springer and F. L. Van Tassel. It has taken over the old plant and will, according to reports, erect a new plant in the spring.

Beresford, S. D.—Extensive additions and improvements are being made to the local electric light plant. Another generator will be added to the plant next summer. L. Wagner, Owner and Mgr.

Hartford, S. D.—The Hartford Electric Light & Telephone Co. contemplates the installation of a storage battery in its plant. Fred E. Harris, Mgr.

Jefferson City, Tenn.—The Jefferson City Electric Co. contemplates installing a compound engine, a three-phase, direct-current generator to furnish power for a large woolen mill, and installing a street arc lighting system. I. M. Coile, Supt.

Ft. Worth, Tex.—The following are the 3 lowest bids opened on Dec. 20 at the office of the Superv. Archt., Washington, D. C., for the installation of a conduit and electric wiring system in the extension to the U. S. Post Office and Court House at Ft. Worth: Roberts Electric Co., Sherman, $1,795; W. A. Conrad, St. Louis, Co., $1,664, and L. H. Melson, Pittsburg, Pa., $1,900.

Ft. Covington, Vt.—The Ft. Covington Light, Heat & Power Co. is considering the question of building a new dam and establishing a day service next summer. W. S. H. Keefe, Mgr.

Roanoke, Va.—The Roanoke Water Power Co. contemplates the installation of a 1,000-kw. Allis-Chalmers generator as an auxiliary to its present plant. R. C. Camp, Gen. Mgr.

Medicine Hat, Alta.—The Red Cliff Realty Co. is contemplating enlarging its plant next summer and increasing the equipment to 400 kw. C. W. Jewett, of Blackduck, Minn., can give further information.

Toronto, Ont.—Bids will be received until Jan. 9, by H. F. McNaughton, Secy., Pub. Wks. Dept., Toronto, for rewiring the Parliament Bldgs., Toronto.

**St. Catherines, Ont.*—The City Council is reported to have on Dec. 19 accepted the bid of the Falls Power Co. to light the streets for the next 20 years at $30.50 per lamp per yr. The company also accepts all the liabilities here against the defunct Stark Co.

Campbellford, Ont.—John S. Fielding, 15 Toronto St., Toronto, Ont., writes with regard to the proposed municipal power plant for Campbellford, that bids are wanted for turbine wheels, 1,350 h.p., at 25 ft. head. He further states that Bogue & Buchanan, of Peterboro, have secured contract for head race, power house and tail race, and th Allis-Chalmers-Bullock Co. the contract for electric equipment; total cost of proposed plant, $60,000. E. C. West, City Secy.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The construction of an electric railway to connect Ontario, Pomona, Chino and Newport is reported under consideration. The proposed new line is said to be the project of the Ontario Land & Improvement Co. of Ontario, of which Chas. Frankish is president.

Ventura, Cal.—J. B. McCloskey, County Clk., writes that Julian P. Jones and F. M. Packard, 506 Citizens Natl. Bank Bldg., Los Angeles, have secured a franchise for an electric railway (bids opened Dec. 5).

Los Angeles, Cal.—Chas. Frankish, of Ontario, Cal., is reported to be promoting a new electric railway to run from Ontario, through Pomona and Chino, to Newport Beach, where it will connect with the present terminus of the Pacific Electric Ry. Co., a distance of 35 miles. Rights of way are now being secured. At Ontario the Ontario Interurban Ry. Co. is being organized with a capital of $500,000 to carry out the project.

Pueblo, Colo.—The Pueblo & Arkansas Electric R. R. Co. is reported incorporated to build an electric railway from Pueblo to Fowler down the Arkansas Valley. The line will pass through Avondale and Vineland. Capital, $300,000. Incorporators: M. J. Varnar, Lester Wolf and others.

Colorado Springs, Colo.—It is reported that work on the Manitou-Crystal Park Electric Ry. Co.'s line will begin in a few weeks. The proposed electric railway will be built from Manitou to Crystal Park at a cost of $500,000. J. K. Vannatta, Pres.

Atlanta, Ga.—It is stated that the Georgia Railway & Electric Co. is preparing to begin in the near future the extension of its lines to Buckhead.

Danville, Ill.—The Danville & Southern Ry. Co. is stated to have filed an application for a franchise from the public square to the city limits on the Perryville Road. The Danville & Southern Railway Company is part of the Illinois Traction System.

Monticello, Ind.—The Tippecanoe Electric Power Co. is reported incorporated with a capital of $75,000 to improve a power dam in the Tippecanoe River, erect and equip a modern power plant for the manufacture and distribution of electric light and power, and also to furnish a portion of the power for the operation of an electric railway to be constructed between Frankfort, Ind., and Chicago, by way of Monticello. A. S. Strauss and Henry Meyer, of Chicago, and J. G. Smith, of Monticello, are directors of both the Tippecanoe Co. and the Frankfort & Chicago Electric R. R. Co.

**Terre Haute, Ind.*—The contract for the building of the line of the Terre Haute & Merom Traction Co. has been awarded to the Central States Constr. Co. of Chicago, according to reports. It is expected to begin construction work this month. The road will extend from Terre Haute to Merom, Ind., also to Robinson, Ill., and will be about 10 miles in length. L. Brown, Terre Haute, Pres.; J. Warren Brown, Terre Haute, Secy.; and H. L. Bartlett, St. Louis, Mo., Treas.

Ft. Dodge, Ia.—The Spirit Lake, Emmetsburg & Fort Dodge Ry. Co. expects to begin construction work in the near future according to reports. Practically all of the right of way has been secured. The railway, which it is estimated will be 110 miles long, will connect and run through Ft. Dodge, Clare, Lizzerd, Pocohontas, Havelock, Mallard, Emmetsburg, Spirit Lake, Grottinger, Terrill and Milford. The repair shops are to be located at Emmetsburg. T. F. McCartan, Pocohontas, Pres.; M. H. Miller, Ft. Dodge, Vice-Pres. and Acting Gen. Mgr.; P. O. Refsell, Emmetsburg, Secy., and D. O. Johnson, Emmetsburg, Treas. Capital, $500,000.

Paducah, Ky.—It is stated that C. A. Harrington, of the American Engineering Company, of Indianapolis, Ind., and a corps of engineers, have been surveying a route out of Paducah to Mayfield, a distance of 25 miles, for the Paducah Southern Electric Ry. The corps will survey routes and work of building the road will be pushed rapidly.

Minden, La.—H. A. Davis and J. B. Story have applied to the Town Council for a street railway franchise.

Lewiston, Me.—The Lewiston, Augusta & Waterville St. Ry. Co. (E. D. Reed, Gen. Mgr.) expects to place contracts during the next two months for the construction of two sub-stations, according to reports.

**Boston, Mass.*—Coleman Bros., 15 Court Sq., Boston, have secured the contract for concrete and granolithic platforms, landing, etc., in Washington St. tunnel, bet. Lagrange St. and Haymarket Sq. (bids opened Dec. 24 by the Boston Transit Comn.), at the following bid: Furnishing and putting in place 750 cu. yds. concrete masonry for base, 2 in. or more deep, $8.40; 9,200 sq. yds. granolithic wearing surface, 1 in. deep, 53 cts.; 2 tons ⅜ in. square twisted steel rods, furnished by Comn., $15; and furnishing and placing 170 reinforced granolithic covers, 12 in. x 7¾ in., over drains, 20 cts.; total, $11,240. Totals of other bids: Coughlan & Sheils Co., 104 Hanover St., $17,464; Thos. J. Hind, 19 Milk St., $17,101; John F. Gill Co., Winter Hill, Mass., $15,240; W. A. Murtfeldt Co., 161 Devonshire St., $15,155; Peter F. Connolly, 70 Perkins St., Jamaica Plain, $14,939.70; Frank Williams Co., 19 Willard St., $14,459; Aberthaw Constr. Co., 8 Beacon St., $14,059.50; Simpson Bros. Corpn., 166 Devonshire St., $12,534.30; Chas. R. Gow Co., 79 Milk St., $12,405.

Corinth, Miss.—It is stated that the Corinth & Shiloh Electric Ry. Co. plans building an electric railway from Corinth to the National Park at Shiloh. The total length of the road will be 22 miles and the overhead trolley system will be installed. The power station and repair shops will be at Corinth. Capital, $250,000. A. Rubel, Corinth, Pres.; S. H. Rubel, Vice-Pres. and Treas.; M. T. Bynum, Secy.; and W. J. Lamb, Gen. Mgr.

Nevada, Mo.—Report states that all the surveys have been made for the Kansas City & Sprinfield Southern Ry., to build an electric railway between Nevada and Springfield with a branch line to Carthage. Capital, $3,750,000. The total length of the line, including sidings, will be 140 miles and cars will be operated by electricity. The necessary current will be furnished from a power station which is to be built near Arcola, Mo. In addition, the company will also own and control an amusement park near the Sac River. The officials of the Kansas City & Springfield Southern Ry are as follows: W. B. Forsyth, Pres.; S. A. Wight, Secy.; J. W. Creekman, Treas.; C. C. McFann, of Nevada, Mo., Gen. Mgr.

Burlington, N. C.—The Bd. of Aldermen is stated to have granted a franchise to the Burgrahaw Traction Co. to construct and operate a street car system over any or all of the streets of Burlington. J. N. Harden, J. M. Cook and J. W. Murray are reported interested.

**Asheville, N. C.*—It is reported that the Carolina Constr. Co. has been awarded the contract to build and equip the electric railway which is to connect Asheville and Hendersonville. J. D. Murphy, C. F. White and J. H. Tucker are interested in the interurban railway.

Minot, N. D.—It is reported that P. O. Dowd, of Kansas City, Mo., will soon apply for a street railway franchise in Minot.

Gibsonburg, O.—It is reported that the Toledo, Fostoria & Findlay Electric Ry C., T. W. Adams, Gen. Mgr., Fostoria, is behind a plan to build an electric railway from Gibsonburg to Jersey City by way of Bradnor and Prairie Depot. This would open up a lot of new territory for the company and would probably prove a good feeder. It is said that the road will be built the coming summer.

Portland, Ore.—It is reported that a large plan of electric railway development in the Willamette Valley and Central Oregon is being launched by A. Welch and the Willamette Valley Co., owners of the electric light plant at various points, and builders of the Eugene Street Ry. and other projects. With a capital of $1,000,000 they will incorporate the Portland, Eugene and Eastern Ry. Co. for the purpose of building an electric railway from Portland to Salem, Eugene, Prineville, Yaquina and Ontario, with branches to numerous towns.

Pittsburg, Pa.—It is stated that the Hebron Street Ry. Co. will soon ask the city for a franchise to construct a traction line through the 41st Ward and a portion of the 37th Ward.

Newtown, Pa.—The Bucks County Electric Ry. Co. is contemplating the entire reconstruction of the street railway line and installing modern equipment. W. H. Janney, Mgr.

**Fredericksburg, Va.*—A charter is stated to have been prepared for the Fredericksburg & Southern Ry. to be presented to the State Corporation Commission. The charter authorizes the company to construct and operate an electric railway from some point in Hanover County to Fredericksburg and northwestwardly and also authorize the running of a street railway in the city of Fredericksburg. W. C. Whitner, Pres.; Alvin T. Embrey, Secy. and Treas.

Cobalt, Ont.—The Municipal Council is stated to have granted a franchise for an electric railway to the Central Ry. Co. A start on the construction of the Cobalt-Liskead section will probably be made next spring. This section will cost about $250,000.

London, Ont.—The City Engr. is reported to have been instructed by the Bd. of Wks. to prepare plans for a new electric belt line in the north end of the city.

Montreal, Que.—Announcement is reported made to the effect that a large English concern will expend $10,000,000 in the development of Canadian electrical railways. The company will assist in developing the plants of the Montreal Light, Heat & Power Co., the Quebec Railway, Light & Power Co. and the Electric Development Co. Electric railways will be constructed in the rural districts of Ontario and Quebec, and engineers have already completed a tour of inspection.

RAILROADS.

Notes Arranged Alphabetically by States.

Philadelphia, Pa.—The following are reported to be the bids opened on Dec. 17 at the office of W. Hunter, Ch. Engr., Philadelphia & Reading Ry Co., for contract 26 for temporary engine yard at Wayne Junction: F. M. Nolan, $63,500; Edw. Fay & Son, $47,500; Kelly & Co., $47,400; F. J. Boas, $44,460; Henry E. Baton, $43,790; W. Steele & Sons Co., $43,034; Jas. McGraw Co., $41,034; Fred. A. Havens & Co., $39,991, and Armstrong & Latta, $39,900.

Fredericksburg, Va.—The City Council is reported to have adopted a resolution in favor of the granting of a charter by the Corporation Comn. to the Fredericksburg-Southern R. R. Co.

Spokane, Wash.—The Spokane & Inland Empire Ry. Co. is reported to be considering the construction of a branch line from Spokane to Nine Mile bridge, to be oprated by steam or electric power.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Washington, D. C.—The following are the bids opened on Dec. 11 at the office of the Supt. U. S. Capitol Bldgs. and Grounds for about 100,000 lbs. of 16-oz. cold rolled, annealed sheet roofing copper required for the roof covering of the Office Building, U. S. Senate, Washington, D. C. (price given per lb): C. G. Hussey & Co., Pittsburg, Pa., 15.9 cts.; Rome Brass & Copper Co., Rome, N. Y., 16.04 cts.; Clendenin Brothers, Baltimore, Md., 17.05 cts.; U. T. Hungerford Brass & Copper Co., New York, N. Y., 17.1 cts.; Merchant & Evans Company, Philadelphia, Pa., 17.2 cts.; Lewis H. Jones, Detroit, Mich., 17.5 cts.; Taunton-New Bedford Copper Co., New Bedford, Mass., 17.5 cts.; Crucible Steel Co. of America, Pittsburg, Pa., 17.75 cts.

The Chief of Staff of the Army, it is stated, has recommended the construction of officers' quarters at the Army War College at an expense of $100,000. He also asks $197,000 for the construction of necessary buildings for 2 companies of the Signal Corps at Forts Riley and Leavenworth.

Albany, Ga.—Bids will be received until Jan. 6 by T. C. Rust, Clk. City Council, for $30,000 bonds, issued for the purpose of erecting and equipping a city hall.

Augusta, Ga.—The erection of a $50,000 hospital is reported under consideration. Jos. R. Lamar, Chmn. Bd. Trus. Medical College, may be able to give further information.

Chicago, Ill.—The Comrs. of Cook County, it is stated, are planning the erection of a $500,000 infirmary.

* *Items marked thus give the names of parties awarded contracts.*

Kankakee, Ill.—It is stated that a $70,000 building is to be erected at the Illinois Eastern Hospital.

Connersville, Ind.—According to reports, bids will soon be asked by the Library Assoc. for erecting a library, for which there is $17,000 available.

**Terre Haute, Ind.*—It is reported that the contract to erect an addition, 4 story, 46x118 ft., to the St. Anthony Hospital has been awarded to John A. Schumacher Co., of Indianapolis, at about $70,000.

Sioux City, Ia.—The Directors of the German Lutheran Hospital, it is stated, are considering the erection next year of a new building.

**New Orleans, La.*—The Jefferson Constr. Co. is reported to have secured the contract to erect the City Hall annex at $273,000.

Ft. McKinley, Me.—Bids will be received until Jan. 2 by Capt. F. J. Morrow, Q. M., U. S. A., 478½ Congress St., Portland, for constructing a boat house at Ft. McKinley.

Ft. Revere, Hull, Mass.—Bids will be received until Jan. 2 by Capt. Ira L. Fredendall Constr. Y. M., U. S. A., 203 Summer St., Boston, for making alterations to hot water heating system in post hospital at Ft. Revere.

Ionia, Mich.—It is stated that in the spring a city hall costing about $20,000 is to be erected.

St. Louis, Mo.—Bids will be received, it is stated, until Dec. 31 by the Bd. Pub. Improv. (And. J. O'Reilly, Pres.) for furnishing material and installing certain plumbing at City Insane Asylum on Arsenal St.

Jefferson City, Mo.—Bids will be received until Jan. 10 by Miller & Opel, Archts., Southern Hotel, St. Louis, for remodeling and reconstruction of the Hall of the House of Representatives in the State Capitol, Jefferson City. The bidders will be required to visit the work and to consult with the archts. regarding same. No plans and specifications will be sent by mail.

Missoula, Mont.—The Missoula County Comrs. at Missoula, it is reported, have asked competitive plans to be submitted Jan. 27 for a fireproof sandstone court house, to cost, including heating and plumbing, $150,000.

David City, Neb.—The David City Library & Gymnasium Assoc. is reported organized for the purpose of erecting a library and gymnasium and raising $20,000 for the purpose. C. H. Aldrich is pres. and R. C. Roper, secy.

Hackettstown, N. J.—The Warren County Bd. of Freeholders (Belvidere, Court House), it is stated, has decided to erect an isolation hospital on the county almshouse farm, near here. Most of the work will be done by the inmates of the poor farm. The county will purchase machinery for making concrete blocks, and work will begin early in the spring.

**Secaucus, N. J.*—Geo. H. Decker is reported to have secured the contract to erect the tuberculosis hospital at $56,600.

Brooklyn, N. Y.—The Municipal Art Comn. has approved the plans for the 4-story and attic steel, limestone and granite building to be erected for the Brooklyn Public Library as a central library building at Prospect Park Plaza, Eastern Parkway and Flatbush Ave., and to cost $4,500,000.

Geneva, N. Y.—A. P. Rose, Mayor, writes with regard to the erection of the city hall, that the plans are now in the hands of several prospective bidders. Architect, Arthur C. Nash, 27 E. 22d St., N. Y. City.

Ft. Totten, N. Y.—Bids will be received until Jan. 3 by Chas. A. Clark, Constr. Q. M., U. S. A., for furnishing and installing metal ceilings in 3 barrack buildings, Nos. 107, 108 and 110, at this post.

Remsen, N. Y.—Walter G. Frank, Archt., Utica, writes that bids will be opened by the Bd. of Library Trus. (Judge J. E. Pritchard, Chmn.) about Dec. 30, for the erection of a library, to cost about $30,000.

Wampsville, N. Y.—W. E. Lounsbury, of Morrisville, Clk. Bd. of Superv., writes that it is proposed to erect a jail and court house at Wampsville, to cost about $250,000. Architect not yet selected.

LaMoure, N. D.—It is stated that plans have been accepted for the Court House.

Dayton, O.—It is stated that the Co. Comrs. at its Feb. meeting will consider plans for a court house.

Youngstown, O.—Bids will be received until Feb. 8 by the Co. Courthouse Comn. (John Stambaugh, Chmn.) for erecting a complete building, excluding ventilation and heating. Owsley, Boucherle & Co., Archts., Maloney Block.

Sidney, O.—It is stated that bids will be received by the Bd. Co. Comrs. until Jan. 11 for furnishing and delivering at the heating plant for the county buildings, 2 horizontal tubular boilers, also for setting and completion of said boilers and heating plant. J. C. Rosser, Co. Aud.

Tulsa, Okla.—The erection of a court house and jail costing about $100,000 is reported under consideration.

Ft. Adams, R. I.—Plans are now on file at the office of The Engineering Record, 239 W. 39th St., New York, N. Y., and bids will be received by Capt. Willis C. Metcalf, Q. M., U. S. A., 209 Thames St., Newport, until Jan. 22 for converting casemates and building thereon barracks at Ft. Adams, as advertised in The Engineering Record.

**Chattanooga, Tenn.*—We are informed that contracts have been awarded as follows for the construction of city hall (bids opened Dec. 10): General contract, to Jos. Trimby, $157,750; heating, to Lookout Htg. & Supply Co., $5,935; plumbing, to T. S. Wilcox Plumbing Co., $1,680; and wiring, to Terrell-Hedges Co, $1,593; successful bidders all of Chattanooga. Architect, R. H. Hunt, 8th and Broad Sts., Chattanooga.

Houston, Tex.—Geo. F. Horton, County Engr., writes that plans for the new Harris County Court House, as prepared by Lang & Witchell, Wilson Building, Dallas, have been accepted (bids opened Nov. 5). The second prize, consisting of $1,000 in cash, was awarded to F. S. [illegible] & Son, of Houston, and the third price, $500, to [illegible] & Co., Houston and Stone Bros., New Orleans, La. [illegible]. The building consists of basement, 4 stories and dome and is of fireproof construction throughout. It will be built of concrete to base line, Texas granite to second story, and from there to roof line of pressed brick; total cost, $500,000.

Clarksville, Tex.—It is stated that bids will be received until Jan. 14 by the Comr's Court, for erecting a 2-story addition to the courthouse. Glenn Bros., archts, Hugo, Okla.

Ogden, Utah.—Bids will be received by James Knox Taylor, Superv. Arch., Washington, D. C., until Feb. 17, for the construction (except heating apparatus, and conduit and wiring) of an extension to the U. S. Post Office and Court House at Ogden.

Richmond, Va.—It is reported that the plans for the Blues Armory have been rejected.

Walla Walla, Wash.—The State Supreme Court, it is stated, has decided that the $100,000 bond issue by this city for a city hall and fire station is valid.

Seattle, Wash.—Somervell & Cote, Walker Bldg., it is stated, have completed plans for the hospital which the Sisters of Providence propose erecting at 17th and 18th Aves. and Cherry and Jefferson Sts., at a cost of about $800,000.

Beloit, Wis.—The city has purchased a site for the erection of a city hall, also a site for a detention hospital. Robt. Caldwell, City Engr.

Milwaukee, Wis.—It is stated that competitive plans are to be asked soon for the new court house. Carl F. Busacker, Chmn. Com. having matter in charge.

Madison, Wis.—See "Miscellaneous."

Appleton, Wis.—The erection of an addition to Elizabeth Hospital is reported contemplated.

Kamloops, B. C.—It is stated that bids will be received until Dec. 31 by the Ch. Comr., at the Dept. Lands and Works, Victoria, for erecting a court house at Kamloops. Honeyman & Curtis, Archts., Molson Bank Bldg., Vancouver, B. C.; F. C. Gamble, Public Wks. Engr., Land and Wks. Dept., Victoria.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Manager J. H. Wilson, it is stated, has announced that the Mobile Light & R. R. Co. expects to erect a fireproof car house accommodating about 75 cars.

**Gadsden, Ala.*—The Vulcan Constr. Co., of St. Louis, Mo., it is stated, has secured the contract to erect the Hayden-Packe Theatre, at about $35,000.

Argenta, Ark.—The officials of the Cotton Belt, according to reports, have accepted plans for a 1½-story brick passenger depot, 100x140 ft., and a 2-story freight depot, 50x200 ft., to be erected here. M. L. Lynch, Ch. Engr., Tyler, Tex.

**Riverside, Cal.*—D. Irvine is reported to have secured the contract to erect a Masonic Temple for Evergreen Lodge, to cost $15,000.

Oakland, Cal.—It is stated that revised plans have been prepared by J. Galen Howard, 456 Montgomery St., San Francisco, for the Y. M. C. A. Bldg., which is to be erected at a cost of $250,000.

Trinidad, Colo.—John Aiello, Pres. of the Southern Colorado Mercantile Co., it is stated, has secured plans for a 5-story brick warehouse to be erected at a cost of about $75,000.

Stratford, Conn.—It is stated that plans are being prepared for a 3-story building to be erected for the Cupheags Club.

**Wilmington, Del.*—It is stated that the contract to make alterations to the factory building at 9th and Walnut Sts. has been awarded to the Union Improv. Co., at about $12,000.

Springfield, Ill.—Fire on Dec. 21, it is stated, destroyed the 4-story building occupied by Johnson, Hatcher Co., at 7th and Adams Sts.; the 4-story building occupied by J. L. Jones, furniture store, and two 3-story brick buildings owned by M. J. Bartel and John Bressmer.

Chicago, Ill.—The Monarch Electric & Wire Co., it is stated, intends erecting a 6 or 10 story reinforced concrete building on Adams and Desplaines Sts., to cost about $100,000.

Des Moines, Ia.—The Red Men are reported to be planning the erection of a $25,000 building in Des Moines. Onawa Tribe, I. O. R. M., may be able to give further information.

**Baltimore, Md.*—The Baltimore Ferro-Concrete Co., Baltimore, is reported to have secured the contract to erect a 4-story warehouse and stable on King St., the total cost to be about $23,000. The stable is to be of reinforced concrete and the warehouse of brick. Edward H. Glidden, Archt., 301 N. Charles St.

The 5-story buildings at 325 and 327 W. Baltimore St. occupied by Wilenzig Bros. & Co. and Reinhard, Meyer & Co. are reported seriously damaged by fire on Dec. 21.

Minneapolis, Minn.—Gamble & Ludwig, it is stated, propose erecting on Hennepin Ave. a 3-story building.

**Newark, N. J.*—The W. L. Crow Constr. Co., of New York, N. Y., it is reported, has been awarded the contract for the erection of a power house for the Celluloid Co. on Fillmore St., which will cost about $75,000.

**Jersey City, N. J.*—The Turner Constr. Co., 11 Bway., N. Y. City, it is stated, has secured the contract to erect a power house for the Great Atlantic & Pacific Tea Co. at Bay and Henderson Sts. of reinforced concrete, 2 stories, 63x100 ft., costing about $28,000.

**Syracuse, N. Y.*—Henry Reichel, 106 Oberst St., it is reported, has secured the contract to erect a storehouse for the Haverle Brewing Co. on Butternut St at $12,000.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 2-story brick stable and wagon house at Webster Ave. and 181st St. for City of New York, cost $50,000, M. J. Garvin, archt.; 2-story brick shop at Webster Ave. and 181st St. for City of New York, cost $30,000, M. J. Garvin, archoitect; alteration to 1-story brick and stone stable at Ave. C. and 16th St. for Dept. Street Cleaning, cost $60,000, Westervelt & Austin and Lederle & Provost, Archts.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 5-story brick and stone assembly and meeting hall at 595 E. 79th St. for John King, cost $60,000, Edwin C. Georgi, Archt.; 6-story brick tenement and stores at 151st St. and Morris Ave. for Bartolomeo Zunino, cost $50,000, Moore & Landsiedel, Archt.; alterations to 7 5-story brick and stone loft buildings at 9 Park Pl. for American News Co., cost $100,000, Fay Kellogg, Archt.; alterations to 5-story brick and stone store and loft building at 122 W. 20th St. for Frederick Sackett, cost $23,000, Richard R. Davis, Archt.

Auburn, N. Y.—E. M. Ryder, of Syracuse, is said to be seeking a site here, on which it is proposed erecting a theatre.

Devil's Lake, N. D.—J. M. Thompson, Fred P. Mann and others have been apointed as a committee to secure a site and consider the erection of a theatre, costing about $35,000.

**Steubenville, O.*—Archts. Briggs & Nelson, 669 Rose Bldg., Cleveland, write that the contract for erecting Y. M. C. A. building (bids opened Nov. 12) has been awarded to Elliot-Winchell Constr. Co., 304 Reilly Bldg., Wheeling, W. Va., for $80,000. Sub-contracts have been awarded as follows: Marble and tile work, Vermont Marble Co., Cleveland; steel, T. H. Brooks & Co., Cleveland; heating and plumbing, Huffman-Conklin Co., Columbus; terra cotta, to the Atlantic Terra Cotta Co., Pittsburg, Pa.; electric work, to Pittsburg Electric Constr. Co., Pittsburg, Pa., and plastering, to D. W. Taibet, of Cleveland.

Gettysburg, Pa.—Henry L. Reinhold, Jr., 1004 Chestnut St., it is stated, has completed plans for a hotel building to be erected at Gettysburg, to be known as the Battlefield Hotel. The structure will be of brick and terra cotta, 7 stories high, and contain 125 rooms and 50 baths.

Scranton, Pa.—Edw. H. Davis, 713 Connell Bldg., has prepared plans for alterations and additions to the store building of Samter Bros., to cost about $30,000.

Seattle, Wash.—H. Ryan, Globe Bldg., it is stated, has prepared plans for a 3-story brick hotel to be erected at 1723 Summit Ave. at a cost of $40,000.

Spokane, Wash.—It is stated that plans are being prepared for a store and apartment house which is to be erected by K. G. Malmgren and Chas. Jasper at Division St. and Liberty Ave. at a cost of $25,000.

Toronto, Ont.—G. W. Gouinlock, Temple Bldg., it is stated, has prepared plans for a 2-story summer hotel to be erected on the shore of Lake of Bays, opposite Bigman's Island, at a cost of $50,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Oakland, Cal.—It is stated that plans have been prepared by Henry F. Starbuck for a 4-story apartment house to be erected at Oak and 13th Sts. by W. F. Mercier, of Bangor, Me.

J. Cather Newson is said to be preparing plans for a 5-story apartment house which is to be erected at Telegraph Ave. and Sycamore St. at a cost of $150,000.

Denver, Colo.—Fallis & Stein, Colorado Bldg., according to reports, are preparing plans for an apartment house to be erected at Grant and Colfax Aves. by a syndicate headed by N. C. Merrill.

Chicago, Ill.—Sherman T. Cooper, it is reported, has secured a site on Wabash Ave. and 50th St., on which it is proposed erecting 4 3-story apartment houses, to cost a total of $75,000.

Albert H. Wolf, it is stated, has secured a site at Woodlawn Ave. and 49th St., on which he intends erecting a residence to cost $50,000.

Glenwood, Ia.—It is stated that a gift of $25,000 has been bequeathed to the Glenwood Baptist Church by the late Mrs. J. V. Hinchman, to be used to erect a new edifice.

**Meyer, Ia.*—Robt. Stock, of Cedar Rapids, is reported to have secured the contract to erect an edifice for the members of the Roman Catholic Church, to cost about $22,000.

Leavenworth, Kan.—Wm. P. Feth, of Leavenworth, according to reports, is preparing plans for a residence to cost $35,000 to be erected for D. H. Pike, of Denver.

Baltimore, Md.—Certain architects have been engaged, according to reports, to prepare plans for a 7-story apartment house to be erected at Eutaw Pl. and Dolphin St. at a cost of about $175,000. Harry Brown, 109 Clay St., is to superintend the construction. Alonzo M. Hurlock and E. J. W. Revell are the owners.

Springfield, Mass.—It is stated that plans have been completed by W. B. Reid, of Holyoke, for a 4-story apartment house to be erected by Gagnier & Angers, real estate dealers, on Pearl St.

North Platte, Neb.—It is stated that plans have been accepted and bids will soon be asked by the Bldg. Com. for the erection of an edifice for the members of the Presbyterian Church; cost not to exceed $17,500.

Ocean City, N. J.—Heavley & Adams, according to reports, intend erecting a 3-story apartment house.

Rochester, N. Y.—It is stated that bids are being received for a 4-story apartment house which is to be erected on East Ave. according to plans prepared by Leon Stern, Chamber of Commerce Bldg. Estimated cost, $225,000. J. S. Quicke, Mgr. of the Security Bldg. Co., may be able to give further information.

New York, N. Y.—Plans have been filed for the erection of the following buildings: 5-story brick tenement at Dongan and Fox Sts. for American Real Estate Co., cost $120,000, Herbert H. Morrison, Archt.; two 5-story brick tenements at Dongan and Simpson Sts. for American Real Estate Co., cost $145,000, Herbert H. Morrison, Archt.; 1-story concrete and stone synagogue at 11th St. and St. Nicholas Ave. for Congregation of Ansch Chesed, cost $75,000, Edward I. Shire, Archt.

Providence, R. I.—The members of the Christian Science Church, it is reported, contemplate erecting a $250,000 edifice on the East Side.

Dallas, Tex.—The members of Oak Lawn Methodist Church, it is stated, are planning the erection of an edifice costing about $30,000. Rev. J. H. Griffin, pastor.

* *Items marked thus give the names of parties awarded contracts.*

Wytheville, Va.—It is stated that bids are wanted until Feb. 1 for remodeling edifice for St. John's congregation (W. H. K. Pendleton, Rector). A. H. Ellwood & Sons, Archts., Elkhart, Ind.

Spokane, Wash.—The Trus. of the All Saints' Episcopal Cathedral (Dr. C. K. Merriman, Chmn.), it is reported, are considering plans for an edifice costing about $100,000.

Madison, Wis.—H. C. Hengell, Chaplain, St. Paul's University, writes that it is proposed to erect a new chapel, to cost about $20,000.

**Reedsburg, Wis.*—O. C. Uehling, Archt., Milwaukee, writes that the contract for erecting an edifice for St. Peter's R. C. Church (bids opened Dec. 12) has been awarded to Wm. Gutzke, of La Crosse, for $33,500. Bids on the following items will be received by the architect: Pipe organ, seating, altar and pulpit, interior decoration, bells and tower clock, also art glass.

**Milwaukee, Wis.*—Bennet & Michi, of Milwaukee, it is reported, have secured the general contract to erect a 4-story brick flat, estimated to cost $60,000, and for which Leenhouts & Guthrie, 102 Wisconsin St., are the archts.

SCHOOLS.

Notes Arranged Alphabetically by States.

University, Ala.—It is stated that the Bd. of Trus. of the Univ. of Alabama on Dec. 16 rejected all bids received for erecting the engineering building and a chemical and geological laboratory building. It is reported that new bids will be asked in about 60 days, to be submitted on the following: Stucco; pressed brick; stone. The 2 buildings are estimated to cost $165,000.

Tempe, Ariz.—It is stated that plans, specifications and estimate of cost will be received by Alf. J. Peters, Secy. Normal School grounds; a separate bid will also be received for the construction of above building, according to tentative plans and specifications on exhibition in the office of D. W. Millard, Archt., Fleming Bldg.; cost not to exceed $30,000.

Conway, Ark.—Bids will be received until Jan. 15 by the Bd. of Trus. of the Arkansas State Normal School (E. W. Torreyson, of Little Rock, Secy.) for erecting a normal school at Conway. Separate bids will be received for plumbing, heating and wiring.

San Francisco, Cal.—The Bd. of Educ. is said to be planning the expenditure of about $8,000,000 in school improvements.

Sacramento, Cal.—The School Bd., it is reported, is preparing to erect a school in the Oak Park Dist. to cost $32,000.

New London, Conn.—The Bd. of School Visitors on Dec. 4, it is stated, opened the following bids for a heating plant in Harbor School: (a) according to architects plans; (b) plans submitted by bidder: M. J. Daly & Sons, Waterbury (a), $10,111; Alfred B. Franklin, Boston, Mass., (a) $10,110; (b) $9,987, $9,925 and $9,---; Merrill Co., Boston Mass. (a) $8,018; Isaac Coffin Co., Boston, Mass. (a) $8,580; Aetna Heating Co., New Britain, (b) $8,475, or with fans and controller outfit complete, $9,416; Wm. D. Ahern, New London, (a) $9,087; Hopson & Chapin Co., New London, (a) $8,250; (b) 10 per cent. above actual cost of material and labor with guarantee that price will not be more than $7,500; Jas. T. Murray, Hartford, (a) $8,959.

Thomaston, Ga.—It is stated that bids are wanted until Jan. 7 for $50,000 school bonds. Claude Worrill, Clk. School Bd.

Springfield, Ill.—It is reported that the Academy of Our Lady of the Sacred Heart is to be enlarged at a cost of $75,000, according to plans prepared by W. H. Conway, 104 East Side Sq.

Urbana, Ill.—Jas. M. White, of Urbana, Superv. Archt. University of Illinois, writes that plans are now being prepared for the erection of a physics laboratory and addition to the Natural History Dept. Bldg., to cost about $400,000. W. Carbys Zimmerman, of Chicago, is State Archt.

Charleston, Ill.—L. G. Lord, of Charleston, Pres. State Normal School, writes that bids will be received until Jan. 21 for the erection of a dormitory, to cost about $100,000. Architect, W. Carbys Zimmerman, 1101 Steinway Hall, Chicago.

Petersburg, Ind.—The School Bd., it is stated, will soon ask bids for erecting a school with the $40,000 given by Mrs. Thornton.

Des Moines, Ia.—It is reported that Rev. Father Winfried Schmidt, pastor of St. Mary's R. C. Church, has made arrangements for the erection of a $25,000 parochial school.

The Directors of the Dept. of Agriculture are said to be investigating the cost of erecting an administration building.

New Orleans, La.—The City Engr., it is reported, has recommended the acceptance of the bid of John Chisholm & Co., 223 S. White St., for the erection of the school at Bienville, Iberville, and Claiborne Sts., at $27,000.

Springfield, Mass.—The City Property Com. is said to be considering plans submitted by B. Hammet Seabury, 21 Besse Pl., for a 16-room school to be erected on Kensington Ave. at Forest Park.

Boston, Mass.—It is reported that the Trus of Boston College have secured additional grounds and will soon ask competitive plans for 6 or 7 building which it is proposed erecting. Father Gasson is Pres. of the college.

Amherst, Mass.—It is stated that bids are now being received for erecting the biological and geological laboratory at Amherst College, which is to cost about $100,000. McKim, Mead & White, of New York, N. Y., are the archts.

Mt. Pleasant, Mich.—Bids will be received until Jan. 30 by Luther L. Wright, Secy. State Bd. Educ., Lansing, for erecting a physical training building at the Central Michigan Normal School at Mt. Pleasant. E. W. Arnold, Archt., 278 Garfield Ave., Battle Creek.

Lansing, Mich.—The School Bd. is reported to be preparing to erect a $12,000 school.

Detroit, Mich.—Bids will be received until Jan. 6 by Frank E. Doremus, City Compt., for $250,000 school bonds.

River Rouge, Mich.—Baxter & O'Dell, Hammond Bldg., Detroit, are reported to have prepared plans for a school to be erected here, at a cost of $65,000.

Columbia, Mo.—The State Bd. of Agriculture (Geo. B. Ellis, Secy.) is said to be planning the erection at Columbia of an agricultural high school.

Passaic, N. J.—Seymour & Paul A Davis, 3d, of Philadelphia, Pa., and John F. Kelly, of Passaic, N. J., according to reports, are the assoc. archts. who will prepare plans for a high school to be erected in Passaic.

Middletown, O.—It is reported that the School Bd. has decided to erect a $20,000 school.

Newark, O.—It is stated that bids will be received until Jan. 9 by the Bd. Educ. for plumbing, sewerage and electric wiring annex to the High School. Vernon Redding, Archt., Mansfield.

Norman, Okla.—The main building at the Univ. of Oklahoma is reported destroyed by fire.

**Braddock, Pa.*—The School Bd. of North Braddock, it is stated, has awarded the contract to erect a brick and stone high school at Bell Ave. and Verona St. to Geo. M. Hogg, 541 Braddock Ave., Braddock, at $69,908.

York, Pa.—The erection of a school in the West End to cost about $56,000 is reported contemplated by the School Bd.

Kane, Pa.—The Plans of Seymour & Paul A. Davis, 3d, of Philadelphia, it is reported, have been accepted for the high school to be erected here at a cost of $90,000.

Manning, S. C.—The citizens are stated to have voted in favor of issuing $30,000 bonds for erecting a school in School Dist. No. 9.

Manila, Tex.—Bids are wanted until Jan. 1 for erecting a 2-story brick school. Lee Tidwell, Manila, may be able to give further information.

Hallettsville, Tex.—T. Y. Hill, Secy. Independent School Bd., will receive plans until Jan. 10 for erecting a 2-story and basement 8-room brick school; probable cost $15,000.

Seattle, Wash.—The citizens are reported to have voted in favor of issuing $500,000 school improvement bonds.

The School Bd. Dec. 11 ordered plans prepared for a high school to be erected on Queen Anne Hill.

The School Bd., it is stated, has adopted plans for a parental school to be erected on Mercer Island at a cost of $15,000.

La Crosse, Wis.—Wm. Kittle, of Madison, Secy. Bd. Normal Regents, writes that bids will be received about Feb. 1 for the erection of a normal school at La Crosse, to cost about $200,000. Architects, Van Ryn & De Gelleke, 211 Grand Ave., Milwaukee.

Milwaukee, Wis.—Bids will be received until Jan. 2 by the Bd. of School Directors (Frank M. Harbach, Secy.) for furnishing material and erecting a 20-room school at Lloyd and 13th Sts., in the 10th Ward. Bids are to be stated separately on the following, also a total bid to be submitted for the entire work: Mason, concrete and cement work; cut stone work; lath and plastering work; structural steel and iron work; carpenter work, including composition roofing; hardware; galvanized iron and tin work; electric work; painting and glazing; plumbing, sewerage and gasfitting; ventilating and heating; heat regulation apparatus.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

New York, N. Y.—The following are the bids opened on Dec. 18 by Foster Crowell, Comr. Street Cleaning, for removal of snow and ice in Manhattan and Bronx Boroughs, according to sections (price given per cu. yd.): (*a*) Sect. 1, (*b*) Sect. 2, (*c*) Sect. 3, (*d*) Sect. 4, (*e*) Sect. 5, (*f*) Sect. 6, (*g*) Sect. 7, (*h*) Sect. 8, (*i*) Sect. 9, (*j*) Sect. 10, (*k*) Sect. 11, (*l*) Bronx: E. J. Duggan, W. 159 th St., *a* 33¾ cts., *b* 37 cts.; *c* 37¼ cts., *d* 36¾ cts., *e* and *f* 34¾., *g* 34¼ cts., *h* 39¼ cts.; Thompson Bros. Co., 141st St. and 5th Ave., *k* 28 cts.; J. T. Shaughnessy, 636 W. 131st St., *a*, *b* and *c* 36.9 cts., *d* and *e* 35.9 cts. *f* 36.9 cts., *g* and *h* 37.9 cts *i* 31.9 cts., *j* and *k* 32.9 cts., *l* 35.9 cts.; Wm. Bradley, 68th St. and North River, *b* 38 cts., *d* 39 cts.; J. J. Dooley & Co., 157th St. and Amsterdam Ave., *g* and *h* 37 cts., *j* 31 cts., *k* 32 cts.; Williams Eng. & Cont. Co., 21 Park Row, *a*, *b*, *c* and *d* 42 cts., *e*, *f*, *g* and *h* 41 cts., *i* 34 cts., *j* 32 cts., *k* 30 cts., *l* 25 cts.; Atlanta Cont. Co., 432 E. 91st St., *j* 37 cts.; P. Reddy, Lenox Ave. and 111 St., *h* 42 cts., *i* and *j* 35 cts., *k* 32 cts.; J. W. Dunican, 285 E. 134th St., *l* 19 cts.; Canavan Bros. Co., 518 W. 56th St., *a* 63 cts., *b* and *d* 57 cts., *c* 64 cts., *e* and *i*, 45 cts., *f* 55 cts., *g* 42 cts., *h* 57 cts., *j* and *k* 51 cts.; Estate of P. H. Keabon, 108 10th Ave., *c* 49 cts.; Thos. Crimmins Contr. Co., 444 E. 69th St., *a* 64 cts., *b*, *d* and *f* 53 cts., *c* 72 cts., *e* 54 cts., *g* and *h* 50 cts., *i* and *j* 39 cts., *l* 42 cts.; T. Du Marco, 80 Mulberry St., *e* 37 cts., *h* and *k* 30 cts, *l* 26 cts.; W. W. Masterson, 187 St. and Washington Ave., *a* and *b* 43 cts.; O'Grady Bros., Brooklyn, *a* 49.9 cts.; P. J. Kane, 933 E. 150th St., *h* 32½ cts.; T. T. Willigan, 1037 Fox St., *l* 24 cts.; Chas. Schneider, 167th St. and Findlay Ave., *l* 22 cts.; Indelli & Conforti Co., 507 E. 119th St., *j* 41 cts.

**Philadelphia, Pa.*—Geo. R. Stearns, Dir. of Pub. Wks., on Dec. 18 awarded to Edwin H. Vare, 710 Betz Bldg., the contract for cleaning streets, alleys, inlets, public market houses and for the removal of ashes, household waste, rubbish, etc., during the year 1908 throughout the entire city for $1,087,000. W. R. Benson, Chief Bureau of Highways.

Reading, Pa.—Bids will be received at the office of Caleb Weidner, City Clk., until Jan. 7 for the collection, removal and disposal of all garbage and offal in this city for the period of 1, 2, 3, 4 and 5 years, as advertised in The Engineering Record. Elmer H. Beard, City Engr.

Milwaukee, Wis.—Rudolph Hering, of New York, N. Y., in his report to Council on Dec. 23 recommends the construction of a garbage incineration plant, capable of destroying 300 tons of garbage daily, to cost about $200,000.

NEW INDUSTRIAL PLANTS.

See also "Business Buildings."

Ft. Smith, Ark.—C. W. L. Armour, of Ft. Smith, writes that nothing definite has yet been done toward the construction of a cement plant at Ft. Smith.

Calhoun, Ga.—It is stated that plans have been completed by the Echota Cotton Mills, of Calhoun (T. W. Harbison, Pres.), for the plant to be erected, and a factory of 10,000 spindles and 300 looms has been decided upon. The product will be 41-inch print cloths, and about 14,000 yards will be the daily output. Steam power will be used.

Kosciusko, Miss.—J. O. Ashworth, of Kosciusko, is architect for the rebuilding of the plant of the Kosciusko Oil Mill & Fertilizer Co., recently burned. Building to be of brick and steel. 40 x 140 ft. Will likely need 20 x 48 Corliss-engine; no boilers required.

St. Louis, Mo.—The American Fdy. & Mfg. Co., 10th, Herbert and Wright Sts., will on Jan. 5 let contract for the power plant work, needed in connection with repair of plant, recently damaged by fire. The contract for repair of buildings was to have been let on Dec. 27; probable cost of improvements, $30,000.

Hackettstown, N. J.—See "Public Buildings."

Charlotte, N. C.—It is reported that the cotton mill company recently proposed for organization here by Sumner B. Sargent will be incorporated in January. He has planned a concern with $100,000 capital stock to build a plant which will be equipped with 5,000 spindles.

Tulsa, Okla.—P. De C. Ball, 3003 N. Broadway St., St. Louis, Mo., is engineer of the Tulsa Corporation which is said to have in contemplation the installation of a cold storage plant in Tulsa.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Colorado Springs, Colo.—Bids will be received until Jan. 15 by E. D. Marr, Secy. Cripple Creek Drainage & Tunnel Co., Mining Exchange Bldg., Colorado Springs, for driving about 14,000 ft. of deep drainage tunnel, 7x10 ft.; also sinking about 600 ft. of shaft, 5x10 ft. in the clear, in Cripple Creek Mining Dist.

Springfield, Ill.—The City Council has passed on ordinance appropriating $6,000 as the city's share of the expense of constructing Eastman Ave. subway.

Ft. Wayne, Ind.—The Ft. Wayne & Wabash Traction Co. (H. L. Weber, Ch. Engr., Ft. Wayne) is completing plans for a dam in St. Joseph River and Robson Park, to be of reinforced concrete; also controlling works and three concrete culverts; estimated cost, $38,000.

Kokomo, Ind.—Thet Comrs. of Howard County are reported to be planning to let a contract for the construction of the Cook and Butler ditch, 8 miles in length.

Princeton, Ind.—Geo. W. Smith, Drainage Comr., writes that only a preliminary report has been filed for the construction of a drainage ditch, about 75 miles in length, through Gibson and Posey Counties; nothing definite will be done for about 4 or 5 months.

Burlington, Ia.—The Des Moines Co. Bd. of Superv. at Burlington, are reported to be considering the construction of a drainage system in the eastern sections of Burlington, Benton and Huron townships.

Clarion, Ia.—Bids will be received until Jan. 7 at the office of E. M. Callender, Aud. Wright County, at Clarion, for constructing a joint ditch and drain, known in Humboldt County as Humboldt-Wright Joint No. 1 and in Wright County as No. 27, to be divided into 4 sections requiring 14,466 ft. 14, 16, 20 and 24-in. tile.

Jefferson, Ia.—Bids will be received until Jan. 3, it is stated, by E. S. Gose, Co. Aud., for furnishing and laying vitrified tile drain from 6 to 22-in.

Rockwell City, Ia.—It is stated that bids will be received by B. E. Stonebreaker, Co. Aud., until Jan. 2 for constructing a tile drain in Dist. No. 25.

Ft. Dodge, Ia.—It is stated that H. S. Holm, Co. Aud., will receive bids until Jan. 14 for constructing drainage Ditch No. 40.

Benson, Mich.—It is stated that Michael Romstad, Co. Aud., will receive bids until Jan. 21 for constructing Ditch No. 9.

**Ada, Minn.*—D. E. Fulton, County Aud., writes that the contract for constructing Ditch No. 33 (bids opened Dec. 20) has been awarded to J. L. Baker, of Willmar, for $15,222.

Redwood Falls, Minn.—Bids will be received until Jan. 10 at the office of L. P. Larson, Co. Aud., for constructing Ditch No. 3, requiring 6,518 ft. 10-in., 14,907 ft. 8-in., 25,123 ft. 6-in. tile; est. cost, $7,700; also Ditch No. 4, requiring 7,100 ft. 15-in., 5,054 ft. 12-in., 7,230 ft. 10-in., 23,600 ft. 8-in., and 50,720 ft. 6-in. tile; est. cost, $16,180.

Ellis Island, N. Y. H., N. Y.—Bids will be received at office of Comr. of Immigration, Robt. Watchorn, until Jan. 4, for furnishing material and repairing fender piles, shocks, etc., at southwest face of dock, Barge Office, U. S. Immigrant Station, Ellis Island.

Buffalo, N. Y.—It is reported that bids will soon be called for by Col. Henry Adams, Corps Engrs., U. S. A., 540 Federal Bldg., Buffalo, for the construction of locks, cofferdams, etc., to be built at foot of Bridge St.; probable cost, $1,750,000.

Ft. Hamilton, Brooklyn, N. Y.—Bids will be received until Jan. 15 by Capt. Chas. T. Baker, Constr. Q. M., U. S. A., for grading and removing stonewall at this post.

Hamilton, O.—L. A. Dillon, County Surveyor, writes that bids will probably be received about Mar. 1 for the diversion of Crawfords Run, to cost about $70,000. It will be constructed jointly by Hamilton and Butler Counties.

Cincinnati, O.—Bids will be received until Jan. 21 by Lieut.-Col. Wm. T. Rossell, Corps Engrs., U. S. A., for building cabin and upper works on steel dredge.

** Items marked thus give the names of parties awarded contracts.*

Coshocton, O.—It is stated that bids will be received until Jan. 16 by the Bd. Pub. Service (W. S. Hutchinson, Secy.) for furnishing f. o. b. Coshocton, and setting up, a horizontal tubular boiler, 18 ft. long, 72 in. diam.

Panama.—Bids will be received until Jan. 17 by Lieut. Col. H. F. Hodges, Corps Engrs., U. S. A., Genl. Purchasing Officer, Isthmian Canal Comn., Washington, D. C., for furnishing Portland cement as per circular No. 410; also until Jan. 13 for sanitary fixtures, pipe fittings, flexible joints, valves, etc., as per circular No. 411.

Panama.—The lowest bid opened on Dec. 21 by the Isthmian Canal Comn. at Washington, D. C., for furnishing 4 steel dump barges is reported to have been submitted by the Maryland Steel Co., of Sparrows Point, Md., at $19,800 each.

Coraopolis, Pa.—Bids will be received until Jan. 3, by F. J. Booth, Co. Compt., Pittsburg, for furnishing material and building 2,300 lin. ft. of fencing along the improved road between Coraopolis and Stoops Ferry. Geo. T. Barnsley, Co. Rd. Engr., Rm., 26 Court House, Pittsburg.

Providence, R. I.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Jan. 18 for the installation of a vacuum cleaning system for the U. S. Post Office, Court House and Custom House, Providence. Clark & Howe, Archts., 72 Weybosset St., Providence.

**Providence, R. I.*—Walter F. Slade, Com. of Pub. Wks., on Dec. 18 opened bids for dredging about 20,000 cu. yd. on west side of Providence harbor, bet. Sassafras and Field's Points, and awarded contract to the Packard Dredging Co.

**Galveston, Tex.*—Kelso & Vantrin, of Galveston, are reported to have secured the contract for constructing reinforced concrete drain on 19th St. from Av. D to wharf front at the following bid: 1,323 lin. ft. of regular section A, at $10.46; 112 lin. ft. of special section B, at $12.50; 16 catch basins and connections, complete, $29 ea.; 2 manholes, complete, $20 ea.; 50 cu. yd. extra concrete, $7.45 and 60 m. ft. B. M. lumber, at $27; total, $17,735. M. D. Carr, of Galveston, bid for this work $17,934.

Wheeling, W. Va.—Bids will be received by Capt. F. C. Boggs, Corps Engr., U. S. A., until Jan. 25, for constructing guide walls, grading, paving, etc., at Dam 13, Ohio River, as advertised in The Engineering Record.

**Madison, Wis.*—Jos. W. Mitchell, of Madison, is reported to have secured the contract from the Wisconsin Capitol Comn. for the construction of the tunnel between the separate heating and storage plant and the state house, and the razing of the east wing of the old capitol, for $42,800.

Mills Point, N. B.—It is stated that bids will be received until Jan. 10 by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing a wharf at Mill Point. E. T. P. Shewen, Res. Engr., St. John, N. B.

Piche Point, Que.—Bids will be received, it is stated, by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont., until Jan. 8 for constructing a wharf at Piche Point, Que. J. L. Michaud, Res. Engr., Merchants Bank Bldg., Montreal, Que.

PROPOSALS OPEN.

For Proposals see pages 66 and 68.

WATER.

Bids Close.		See Eng. Record.
Jan. 1.	Reservoir, Norway, Me.	Nov. 16
Jan. 1.	Piping, Orange, N. J.	Dec. 14
Jan. 1.	Water works, Hamilton, Ont.	Dec. 28
Jan. 6.	Main, Fargo, N. D.	Dec. 28
Jan. 6.	Water wks., Tucson, Ariz.	Nov. 16
Jan. 6.	Boilers for sale, Ft. Wayne, Ind. Adv. Dec. 21.	Dec. 21
Jan. 6.	Main, Rockwell City, Ia.	Dec. 28
Jan. 7.	Filter plant, pipe, etc., Guthrie, Okla.	Dec. 21
Jan. 9.	Pipe, Morris Plains, N. J.	Dec. 21
Jan. 10.	Laying pipe, Phoenix, Ariz. Adv. Dec. 14, 21.	Dec. 14
Jan. 15.	Pipe, Winnipeg, Man.	Nov. 30
Jan. 15.	Water works, Maxton, N. C.	Dec. 21
Jan. 17.	Air compressor, Aurora, Ill.	Nov. 30
Jan. 28.	Engines, Toronto, Ont.	Dec. 28
Feb. 1.	Water works, Las Animas, Colo.	Dec. 14
Mar. —.	Water wks., Fairchance, Pa.	Dec. 28
Mar. —.	Water wks., Harlowton, Mont.	Dec. 28
Apr. 1.	Water wks., Worthington, O.	Dec. 14
Apr. 1.	Improvements, Edmonton, Alta.	Dec. 28

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 31.	University, Ala.	Dec. 28
Jan. 2.	Ft. Wayne, Ind.	Dec. 28
Jan. 2.	San Jose, Cal.	Dec. 28
Jan. 3.	Salt Lake City, Utah	Dec. 14
Jan. 3.	Cincinnati, O.	Dec. 21
Jan. 3.	Hot Springs, S. D.	Dec. 21
Jan. 3.	Canton, O.	Dec. 21
Jan. 6.	Durango, Colo. Adv. Dec. 14	Dec. 14
Jan. 6.	Hanley Falls, Minn.	Dec. 21
Jan. 6.	Bakersfield, Cal.	Dec. 28
Jan. 7.	South Bend, Ind.	Dec. 28
Jan. 7.	New York, N. Y.	Dec. 28
Jan. 7.	McKeesport, Pa.	Dec. 28
Jan. 10.	Pub. bldg., Punta Gorda, Fla.	Dec. 21
Jan. 13.	Steubenville, O.	Dec. 28
Jan. 14.	Clinton, Ia.	Dec. 21
Jan. 15.	Manila, P. I. Adv. Oct. 26 to Nov. 16.	Oct. 26
Jan. 15.	Santa Monica, Cal.	Dec. 7
Jan. 15.	Maxton, N. C.	Dec. 21
Jan. 15.	Fredonia, Kan.	Dec. 21
Jan. —.	Lexington, Ky.	Nov. 30
Feb. 4.	Billings, Mont.	Dec. 28
Mar. 1.	Traer, Ia.	Dec. 21

BRIDGES.

Dec. 31.	Canton, China. Adv. Oct. 26, Nov. 2.	Oct. 26
Dec. 31.	Victoria, B. C.	Dec. 14
Jan. 1.	Topeka, Kan.	Nov. 30
Jan. 2.	Madison, Ark.	Dec. 14
Jan. 2.	Grants Pass, Ore.	Dec. 14
Jan. 3.	Tipton, Ia.	Dec. 21
Jan. 3.	West Union, O.	Dec. 21
Jan. 3.	Rossville, Kan.	Dec. 28
Jan. 6.	Colfax, La.	Dec. 7
Jan. 6.	Ft. Monroe, Va. Adv. Dec. 7 to 28.	Dec. 7
Jan. 6.	Hammond, Ind.	Dec. 14
Jan. 6.	Attalla, Ala.	Dec. 21
Jan. 6.	Plans, Gulfport, Miss.	Dec. 28
Jan. 6.	Hudson, Wis.	Dec. 28
Jan. 7.	Wilmington, N. C. Adv. Nov. 16 to Dec. 28.	Nov. 16
Jan. 7.	Salem, S. D.	Nov. 16
Jan. 7.	Creston, Ia.	Dec. 21
Jan. 8.	Waseca, Minn.	Dec. 14
Jan. 8.	Bethany, Mo.	Dec. 21
Jan. 8.	Ocala, Fla.	Dec. 21
Jan. 8.	Dunnellon, Fla.	Dec. 28
Jan. 10.	Redfield, S. D.	Dec. 21
Jan. 10.	Wayne, Neb.	Dec. 21
Jan. 11.	Logan, O.	Dec. 28
Jan. 14.	Geneva, Neb.	Dec. 21
Jan. 15.	Fremont, Neb.	Dec. 14
Jan. 16.	Alexandria, La. Adv. Dec. 28.	Dec. 28
Jan. 17.	Washington, Pa.	Dec. 21
Jan. 22.	Nashville, Tenn. Adv. Dec. 28.	Dec. 28
Feb. 1.	St. Charles, Mo.	Dec. 14
Feb. 1.	Le Roy, N. Y. Adv. Dec. 21, 28.	Dec. 21
Mar. 1.	South Bend, Ind.	Dec. 7

PAVING AND ROAD MAKING.

Dec. 31.	Towanda, Pa.	Dec. 21
Dec. 31.	Ft. Rosecrans, Cal.	Dec. 21
Jan. 2.	Ridgefield, Conn.	Dec. 7
Jan. 2.	Little Rock, Ark.	Dec. 14
Jan. 2.	Jersey City, N. J.	Dec. 21
Jan. 3.	Salt Lake City, Utah. Adv. Oct. 19 to Nov. 9 and 30, Dec. 7.	Oct. 19
Jan. 4.	Cleveland, O.	Dec. 14
Jan. 4.	Sidney, O.	Dec. 28
Jan. 6.	Logansport, Ind.	Dec. 14
Jan. 6.	Lebanon, Ind.	Dec. 14
Jan. 6.	Danville, Ind.	Dec. 14
Jan. 6.	Crownpoint, Ind.	Dec. 21
Jan. 6.	Vevay, Ind.	Dec. 28
Jan. 6.	Montgomery, Ala.	Dec. 28
Jan. 7.	Vincennes, Ind.	Dec. 21
Jan. 7.	Virginia, Minn.	Dec. 21
Jan. 7.	Versailles, Ind.	Dec. 21
Jan. 7.	Columbus, Ind.	Dec. 28
Jan. 7.	Washington, Ind.	Dec. 28
Jan. 7.	Paoli, Ind.	Dec. 28
Jan. 7.	New York, N. Y.	Dec. 28
Jan. 7.	McKeesport, Pa.	Dec. 28
Jan. 8.	Memphis, Tenn.	Dec. 28
Jan. 8.	Champaign, Ill.	Dec. 28
Jan. 10.	Knox, Ind.	Dec. 14
Jan. 10.	Ft. Washington, Md.	Dec. 21
Jan. 11.	Noblesville, Ind.	Dec. 21
Jan. 14.	Patchogue, L. I., N. Y.	Dec. 28
Jan. 16.	Lewiston, Idaho	Dec. 21
Jan. 17.	Washington, Pa.	Dec. 21
Jan. 20.	West Lafayette, Ind.	Dec. 28
Jan. —.	Jackson, Mich.	Nov. 23
Feb. 4.	Brick paving, Billings, Mont. Adv. Nov. 23, 30, Dec. 14, 21.	Nov. 23
Feb. 4.	Macadam, Billings, Mont. Adv. Nov. 23, 30, Dec. 14, 21.	Nov. 23
Feb. 15.	Santa Monica, Cal.	Dec. 7

POWER PLANTS, GAS AND ELECTRICITY.

Dec. 31.	Trenton, N. J.	Dec. 21
Jan. 1.	Charlestown, W. Va.	Dec. 21
Jan. 2.	Washington, D. C.	Dec. 21
Jan. 2.	San Jose, Cal.	Dec. 28
Jan. 2.	Jersey City, N. J.	Dec. 21
Jan. 6.	Panama	Dec. 21
Jan. 7.	Newburg Heights, O.	Dec. 14
Jan. 9.	Toronto, Ont.	Dec. 28
Jan. 10.	Dadeville, Ala.	Dec. 28
Jan. 15.	Washington, D. C. Adv. Dec. 7 to 28.	Dec. 7
Jan. 21.	Washington, D. C. Adv. Dec. 28.	Dec. 28
Feb. 1.	Lecompte, La.	Dec. 21
Feb. 3.	Homestead, Pa.	Dec. 28
Feb. —.	Lagrange, Ga.	Nov. 30
Mar. —.	Harlowton, Mont.	Dec. 28
Apr. 1.	Lamont, N. Y.	Dec. 21
——	Campbellford, Ont.	Dec. 28

BUILDINGS.

Dec. 30.	Library, Remsen, N. Y.	Dec. 28
Dec. 31.	Church, Falls City, Neb.	Oct. 20
Dec. 31.	Addition to school, Philmont, N. Y.	Dec. 21
Dec. 31.	Pub. bldg., St. Louis, Mo.	Dec. 28
Dec. 31.	Court house, Kamloops, B. C.	Dec. 28
Dec. —.	Industrial plants, Ft. William, Ont.	May 11
Dec. —.	School, Anderson, Ind.	Sep. 28
Dec. —.	Fire house, Ventura, Cal.	Nov. 2
Dec. —.	Y. M. C. A., Aurora, Ill.	Nov. 9
Dec. —.	Bath houses, Toronto, Ont.	Nov. 23
Dec. —.	Y. M. C. A. bldg., Plattsburg, N. Y.	Nov. 30
Jan. 1.	Dwellings, Greenville, Pa.	Nov. 30
Jan. 1.	School, Paris, Ill.	Nov. 30
Jan. 1.	Schools, Orono, Me.	Dec. 21
Jan. 1.	School, Manila, Tex.	Dec. 28
Jan. 2.	Pub. bldg., Flint, Mich.	Nov. 23
Jan. 2.	Post office, South Bend, Ind.	Nov. 16
Jan. 2.	School, Milwaukee, Wis.	Dec. 21
Jan. 2.	School, Milwaukee, Wis.	Dec. 28
Jan. 2.	School, Tempe, Ariz.	Dec. 28
Jan. 2.	Pub. bldg., Ft. Revere, Mass.	Dec. 28
Jan. 2.	Pub. bldg., Ft. McKinley, Me.	Dec. 28
Jan. 3.	Post office bldg., Albuquerque, N. M. Adv. Nov. 23, 30.	Nov. 23
Jan. 3.	Library, Oklahoma City, Okla.	Dec. 7
Jan. 3.	Bank, Easton, Pa.	Dec. 14
Jan. 3.	Ceilings in post bldgs., Ft. Totten, N. Y.	Dec. 28
Jan. 3.	Guards and gates for U. S. Bldg., Baltimore, Md.	Dec. 21
Jan. 6.	School, Coopersville, Mich.	Nov. 9
Jan. 6.	Post office exten., Wichita, Kan.	Nov. 23
Jan. 6.	School, Cincinnati, O. Adv. Nov. 30 to Dec. 21.	Nov. 30
Jan. 6.	School plans, Madisonville, O.	Dec. 14
Jan. 7.	Add. to school, Slayton, Minn.	Nov. 23
Jan. 2.	New Orleans, La.	Dec. 7
Jan. 7.	Laboratory, Washington, D. C.	Dec. 7
Jan. 8.	Htg., etc., Post Office bldg., Trenton, N. J. Adv. Dec. 14, 21.	Dec. 14
Jan. 8.	Schools, Colville, Wash.	Nov. 30
Jan. 9.	Plumb., etc., Post Office, Trenton, N. J.	Dec. 14
Jan. 9.	School, Newark, O.	Dec. 28
Jan. 10.	School, Cheyenne, S. D.	Nov. 30
Jan. 10.	Schools, Colma Sta., Wis.	Dec. 7
Jan. 10.	Y. M. C. A. bldg., Phoenix, Ariz.	Dec. 14
Jan. 10.	Pub. bldg., Columbus, O.	Dec. 21
Jan. 10.	School, Halletsville, Tex.	Dec. 28
Jan. 10.	Remodeling post bldg., Jefferson City, Ia.	Dec. 28
Jan. 11.	School, Ft. Smith, Ark.	Dec. 7
Jan. 11.	Htg. pub. bldg., Sidney, O.	Dec. 28
Jan. 13.	Post bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14 to 28.	Dec. 14
Jan. 13.	Sale and removal of bldgs., Ft. Wood, N. Y. Harbor, N. Y. Adv. Dec. 14 to 28.	Dec. 14
Jan. 13.	Post bldg. improv., Ft. Monroe, Va.	Dec. 21
Jan 13.	School, Santa Fe, N. M.	Dec. 21
Jan. 14.	Light station, Alaska. Adv. Nov. 23 to Dec. 14.	Nov. 23
Jan. 14.	Indus. plant, Oxford, Md.	Nov. 23
Jan. 14.	Pub. bldg., Ft. Andrews, Mass.	Dec. 21
Jan. 14.	Post Office, York, Neb. Adv. Dec. 7, 14.	Dec. 7
Jan. 14.	Court house addition, Clarksville, Tex.	Dec. 28
Jan. 15.	Church, Pemberville, O.	Nov. 30
Jan. 15.	School, Winnebago, Neb.	Dec. 7
Jan. 15.	Pub. bldg., Chicago, Ill.	Dec. 7
Jan. 15.	Heating Capitol, Washington, D. C. Adv. Dec. 7 to 28.	Dec. 7
Jan. 15.	Y. M. C. A. bldg., Martinsburg, W. Va.	Dec. 14
Jan. 15.	Post Office, Houston, Tex.	Dec. 14
Jan. 15.	School, Flint, Mich.	Dec. 21
Jan. 15.	School, Britton, Wis.	Dec. 21
Jan. 15.	School, Conway, Ark.	Dec. 28
Jan. 17.	School, Pine Ridge Agency, S. D.	Dec. 7
Jan. 17.	Post Office, East Liverpool, O.	Dec. 14
Jan. 20.	School, Richmond, Va.	Dec. 14
Jan. 20.	Post office, etc., Asheville, N. C.	Dec. 21
Jan. 21.	Post office, Gainesville, Ga.	Dec. 21
Jan. 21.	Dormitory, Charleston, Ill.	Dec. 28
Jan. 22.	Post office, bldg., Mitchell, S. D. Adv. Dec. 21, 28.	Dec. 21
Jan. 22.	Barracks, etc., Ft. Adams, R. I. Adv. Dec. 28.	Dec. 28
Jan. 30.	School, Mt. Pleasant, Mich.	Dec. 28
Jan. —	School, Mankato, Minn.	Nov. 23.
Jan. —.	School, Washington, D. C.	Nov. 9
Jan. —.	School, Madison, Minn.	Nov. 16
Jan. —.	School, Bardstown, Ky.	Dec. 7
Jan. —.	Church, St. Louis, Mo.	Dec. 21
Feb. 1.	Plans for Capitol, San Juan, P. R.	Sep. 28
Feb. 1.	Court house and jail, Cairo, Ga.	Oct. 26
Feb. 1.	Jail, Green Bay, Wis.	Dec. 7
Feb. 1.	School, Quitman, Miss.	Dec. 14
Feb. 1.	Club house, Kenwood, Mo.	Dec. 14
Feb. 1.	School, East St. Louis, Ill.	Dec. 21
Feb. 1.	Hospital, Durham, N. C.	Dec. 21
Feb. 1.	Church, Wytheville, Va.	Dec. 28
Feb. 1.	School, La Crosse, Wis.	Dec. 28
Feb. 8.	Court house, Youngstown, O.	Dec. 28
Feb. 17.	Exten. to post office, Ogden, Utah	Dec. 28
Feb. —.	College, Agricultural College, Mich.	Oct. 19
Feb. —.	Jail, Ocilla, Ga.	Dec. 7
Feb. —.	City Hall, Des Moines, Ia.	Dec. 21
Mar. 25.	P. O. plans, New York, N. Y.	Nov. 30
Apr. 1.	Hotel, South Braintree, Mass.	Nov. 30

MISCELLANEOUS.

Dec. 31.	Garb. disposal, Altoona, Pa.	Dec. 7
Dec. 31.	Ditch, Greenwood, Miss.	Dec. 21
Jan. 2.	Steam gauges, etc., Panama	Dec. 14
Jan. 2.	Hammer, lathe, etc., Washington, D. C.	Dec. 21
Jan. 2.	Wire, etc., Jersey City, N. J.	Dec. 21
Jan. 2.	Drain, Rockwell City, Ia.	Dec. 28
Jan. 3.	Drain, Jefferson, Ia.	Dec. 28
Jan. 3.	Fence, Coraopolis, Pa.	Dec. 28
Jan. 4.	Repairing tender piles, Ellis Island, N. Y.	Dec. 28
Jan. 6.	Conduit and embankment, Boston, Mass. Adv. Dec. 7 to 21.	Dec. 7
Jan. 6.	Lumber, etc., Panama	Dec. 21
Jan. 7.	Ditch, Desmet, S. D.	Nov. 30
Jan. 7.	Garb. disposal, Reading, Pa.	Dec. 7
Jan. 7.	Ditch, Aitken, Minn.	Dec. 14
Jan. 7.	Ditch work, Forest City, Ia.	Dec. 21
Jan. 7.	Pipe and Cement, Creston, Ia.	Dec. 21
Jan. 7.	Garbage disposal, Reading, Pa. Adv. Dec. 28.	Dec. 28
Jan. 7.	Cement, Panama	Dec. 28
Jan. 7.	Ditch, Clarion, Ia.	Dec. 28
Jan. 8.	Wharf, Piche Point, Que.	Dec. 28
Jan. 9.	Ditch work, Council Bluffs, Ia.	Dec. 21
Jan. 9.	Swimming pool, Ft. Huachuca, Ariz.	Dec. 21
Jan. 10.	Pump scows, Wilmington, N. C. Adv. Dec. 14 to 28.	Dec. 14
Jan. 10.	Wharf, Mills Point, N. B.	Dec. 28
Jan. 10.	Ditch, Redwood Falls, Minn.	Dec. 28
Jan. 11.	Dredging, Washington, D. C. Adv. Dec. 14 to 28.	Dec. 14
Jan. 13.	Sanitary fixtures, etc., Panama	Dec. 28
Jan. 14.	Garbage plant, Columbus, O. Adv. Nov. 30, Dec. 7.	Nov. 30
Jan. 14.	Ditch, Ft. Dodge, Ia.	Dec. 28
Jan. 15.	Pier, Santa Monica, Cal.	Dec. 7
Jan. 15.	El. ry. work, Donora, Pa.	Dec. 14
Jan. 15.	R. R. work, Ft. Standish, Mass.	Dec. 21
Jan. 15.	Wall, Ft. Hamilton, N. Y.	Dec. 28
Jan. 15.	Tunnel, Colorado Springs, Colo.	Dec. 28
Jan. 16.	Ditch, Estherville, Ia.	Dec. 14
Jan. 16.	Dredging, Saginaw, Mich. Adv. Dec. 21, 28.	Dec. 21
Jan. 16.	Boilders, Coshocton, O.	Dec. 28
Jan. 18.	Dry dock, Brooklyn, N. Y.	Dec. 21
Jan. 18.	Cleaning system in post office, Providence, R. I.	Dec. 28
Jan. 20.	Dam work, Louisia, Ky. Adv. Dec. 21, 28.	Dec. 21
Jan. 21.	Ditch, Benson, Minn.	Dec. 28
Jan. 21.	Dredge, Cincinnati, O.	Dec. 28
Jan. 25.	Guide walls, etc., Wheeling, W. Va. Adv. Dec. 28.	Dec. 28
Feb. 1.	Canal work, Peterboro, Ont.	Dec. 21
Feb. 4.	Steamboat landing, Erie, Pa. Adv. Dec. 21, 28.	Dec. 21
Feb. 11.	Garb. reduction, St. Louis, Mo.	Dec. 21
Mar. 1.	Crawford's Run Diversion, Hamilton, O.	Dec. 28
May 1.	El. ry., Buenos Aires, S. A.	Dec. 21

* *Items marked thus give the names of parties awarded contracts.*